11 31 505 Adjusting the timing of the camshaft (s) (for work no. 11 31 005/508)

WARNING

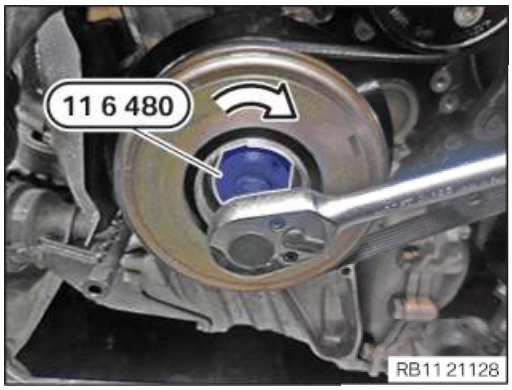
Hot surfaces.

Risk of burning!

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

PRELIMINARY WORK

1 – Block the crankshaft in he TDC firing position of cylinder 1



RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

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- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

  The engine is in the TDC firing position of cylinder 1.

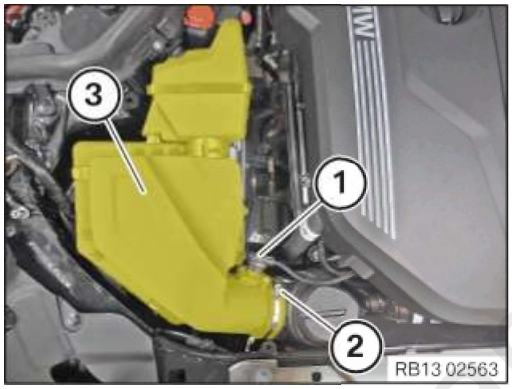
2 – Removing intake silencer housing

RISK OF DAMAGE

Damage to the clean air line. Damage to the air filter.

For changing the air filter insert, if the upper section of intake filter housing is only raised and not completely removed, the clean air line and the air filter insert may be damaged.

- Do not lift upper section of intake filter housing by force.
- Unfasten clamp.
- Remove upper section of intake filter housing completely.

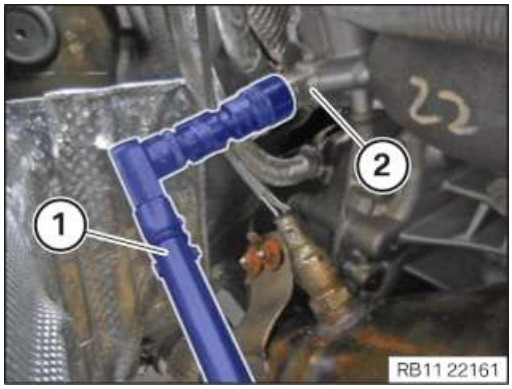


- Unlock plug connection (1) and disconnect.
- Unfasten clamp (2).
- Pull out and remove the intake silencer housing (3) from the rubber mounts towards the top.

3 – Removing chain tensioner

TECHNICAL INFORMATION

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



- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).

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- Feed out and remove the chain tensioner (1).

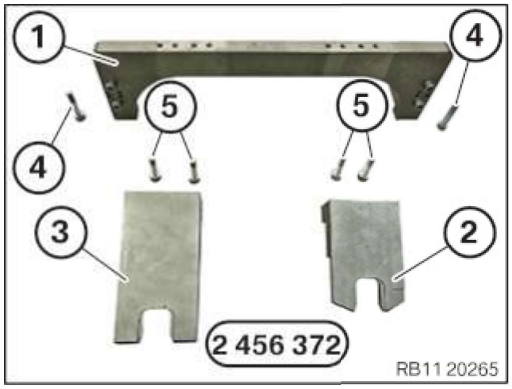
MAIN WORK

4 – Adjust the timing of the camshaft

Prerequisite

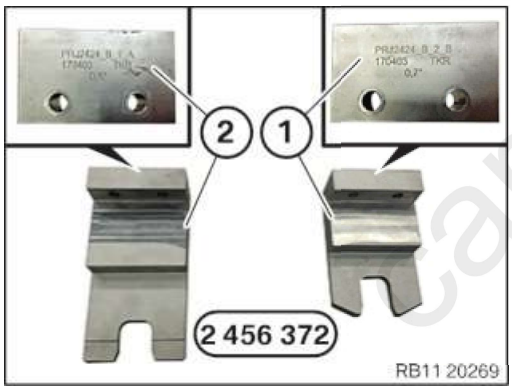
Crankshaft is disconnected and blocked.

The engine is in the TDC firing position of cylinder 1.



- Have the set of special tools 2 456 372 ready.

Number	Description
1	Basic carrier
2	0.7° setting gauge to adjust the intake camshaft
3	0.5° setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Use the setting gauge 0.7 ° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.

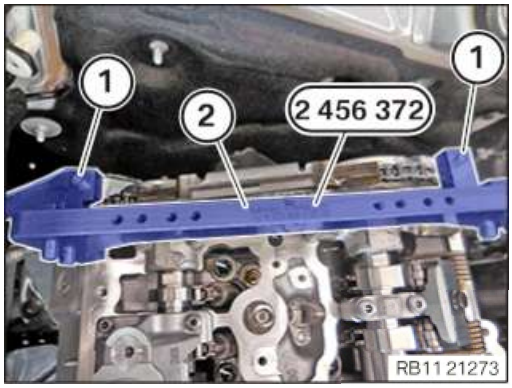


- To release the VANOS central valve (1) use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

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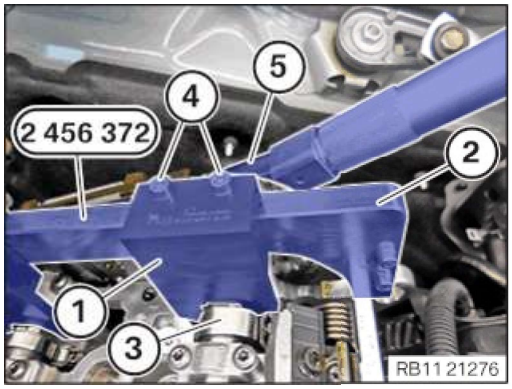
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm

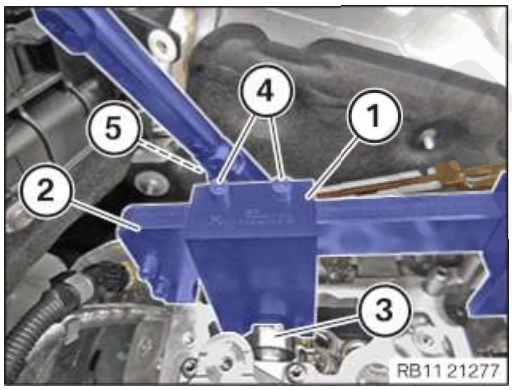


- Position setting gauge 0.7° (1) from the set of special tools 2 456 372 between basic carrier (2) from the set of special tools 2 456 372 and intake camshaft (3).
- If necessary, crank the engine at the crankshaft using special tool 0 493 380 (11 6 480).
- Tighten the screws (4) from the set of special tools 2 456 372.

Test gauge to basic carrier

M6		Tightening torque	8 Nm

- Release the VANOS central valve (5) of the intake adjuster.

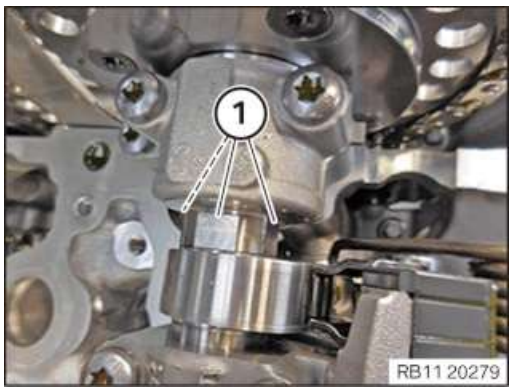


- Position setting gauge 0.5° (1) from the set of special tools 2 456 372 between basic carrier (2) from the set of special tools 2 456 372 and exhaust camshaft (3).
- If necessary, crank the engine at the crankshaft using special tool 0 493 380 (11 6 480).
- Tighten the screws (4) from the set of special tools 2 456 372.

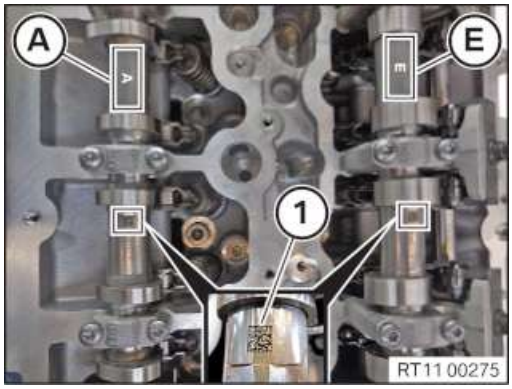
Test gauge to basic carrier

M6		Tightening torque	8 Nm

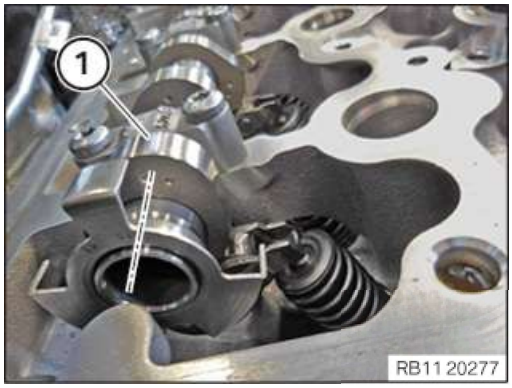
- Release the VANOS central valve (5) of the exhaust camshaft adjuster.



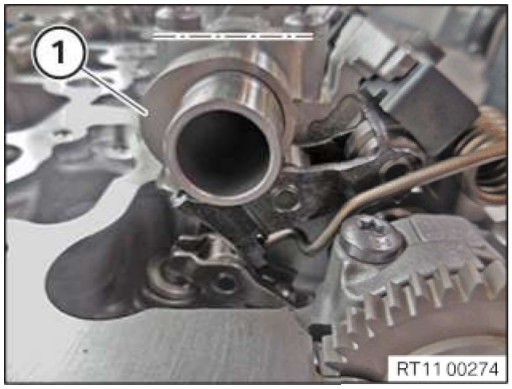
- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



- Turn the intake camshaft (E) and the exhaust camshaft (A) such that the marks (1) can be read from the top.

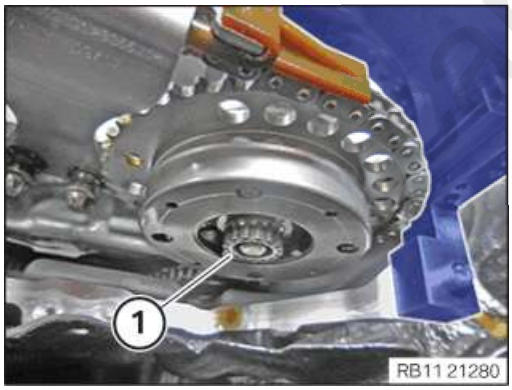


- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.

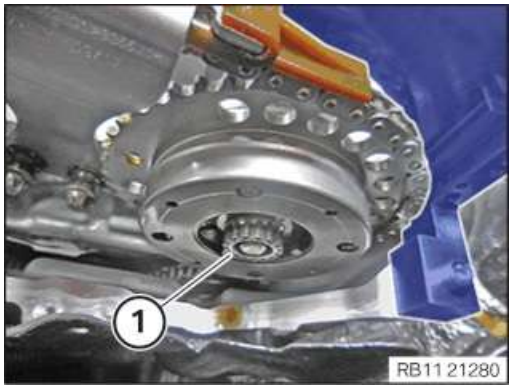


- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.

5 – Installing the VANOS central valve of the exhaust camshaft adjuster

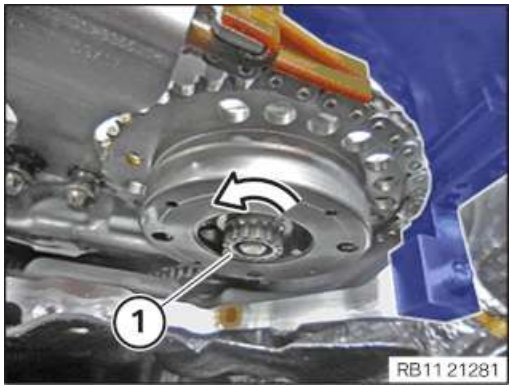


- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.



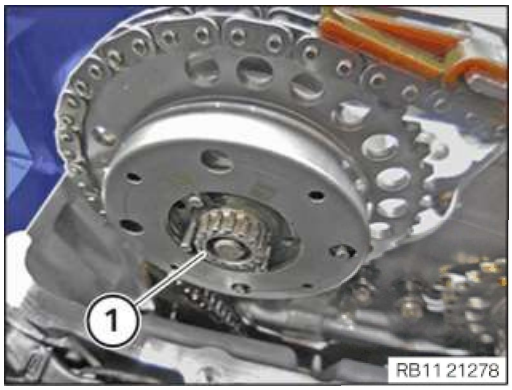
- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

ardiagn.com

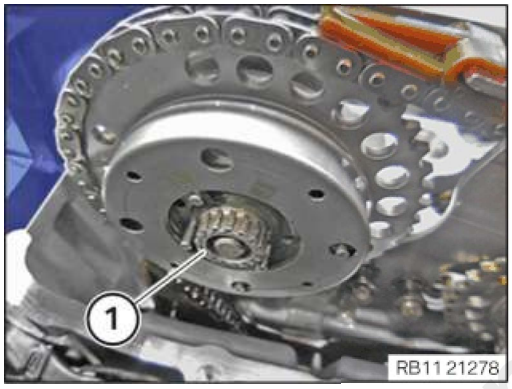


- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

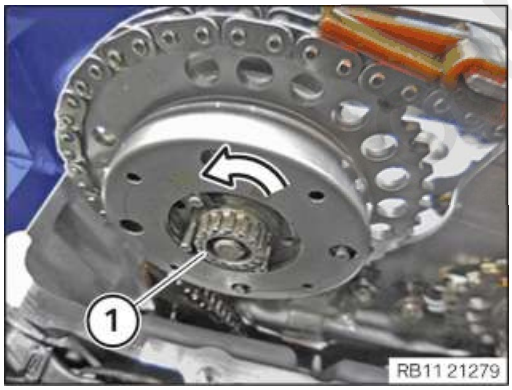
6 – Install the VANOS central valve of the intake adjuster



- Guide in the VANOS central valve (1) of the intake adjuster and install.

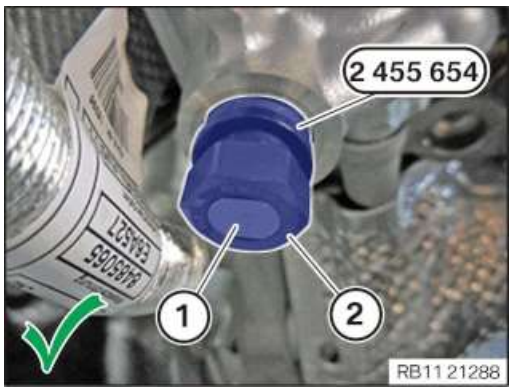


- Hand-tighten the VANOS central valve (1) of the intake adjuster.



- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

7 – Pretension the timing chain with the special tool



- Make sure that the timing chain is **correctly** pre-tensioned with the special tool 2 455 654.

  The pin (1) must align **precisely** with housing (2).

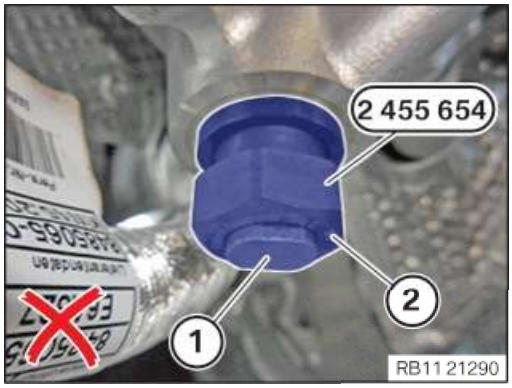
bmwdiagn.com



- Make sure that the preload of the timing chain is no **insufficient**.

  The preload is insufficient when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.



- Make sure that the preload of the timing chain is not **too high**.

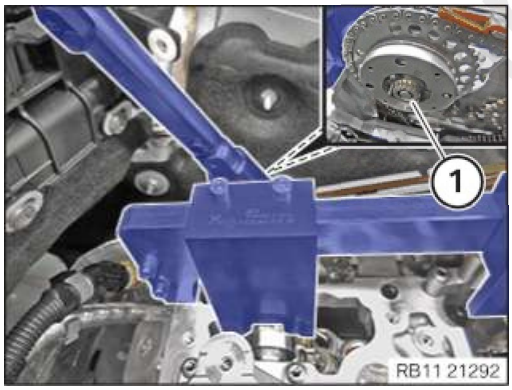
  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

8 – Tightening the VANOS central valve of the exhaust camshaft adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



- Tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

9 – Tightening the VANOS central valve of the intake adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



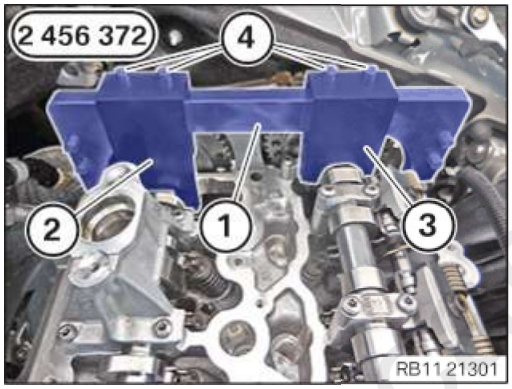
- Tighten the VANOS central valve (1) of the intake adjuster.

VANOS central valve to camshaft

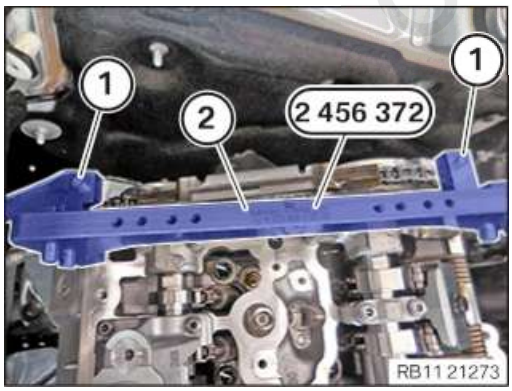
M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

POSTPROCESSES

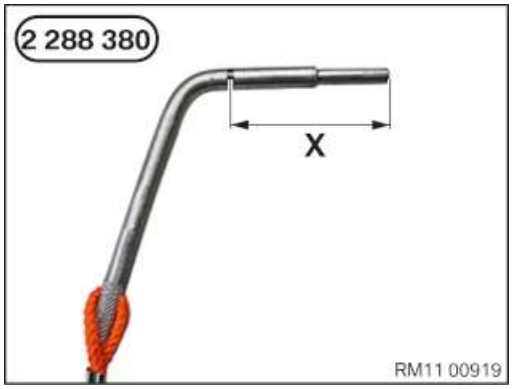
10 – Disassembling all special tools



- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) and remove.



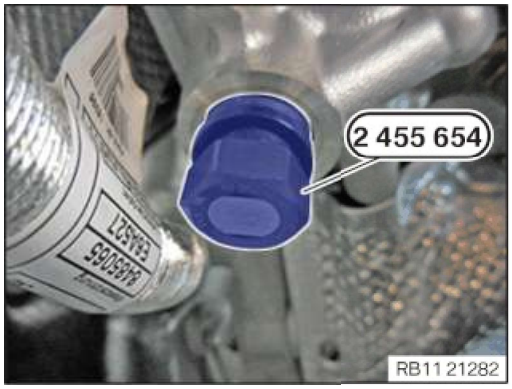
- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.



- Guide the special tool 2 288 380 out and remove.



- Guide the special tool 0 493 380 (11 6 480) out and remove.



- Guide the special tool (1)2 455 654 out and remove.

11 – Install chain tensioner

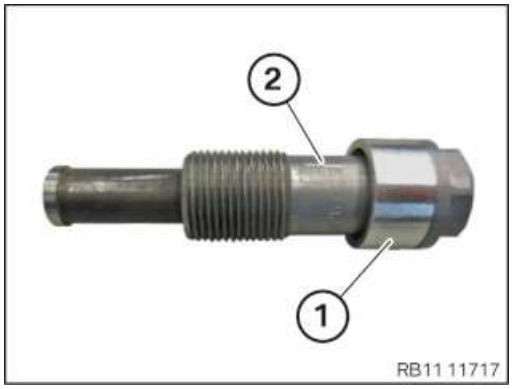
TECHNICAL INFORMATION

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



- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.

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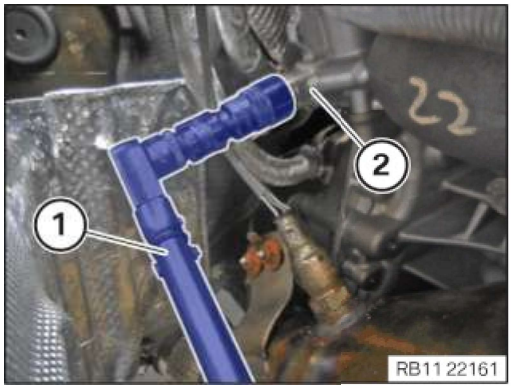


- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.



- Insert and install the chain tensioner (1).

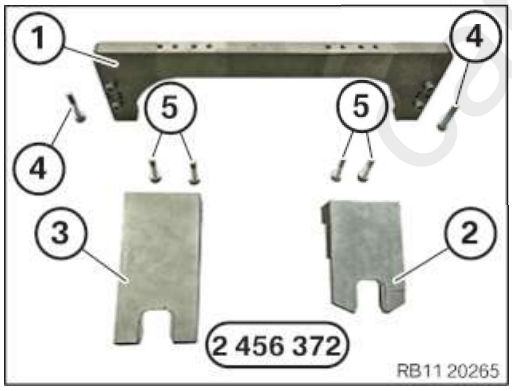


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

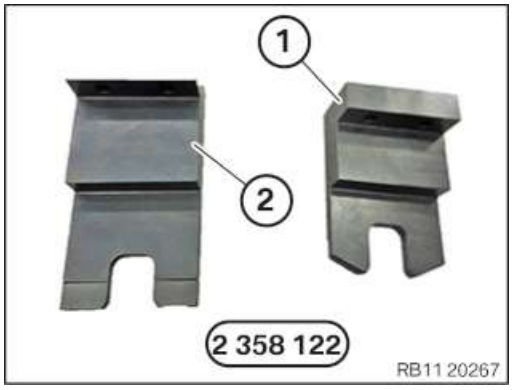
Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

12 – Checking camshaft timing



- Have the set of special tools 2 456 372 ready.

Number	Description
1	Basic carrier
2	0.7° setting gauge to adjust the intake camshaft
3	0.5° setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Keep the test gauge from the set of special tools 2 358 122 ready.

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft

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- Have the special tool 2 288 380 ready.

Number	Description
1	Locating stud



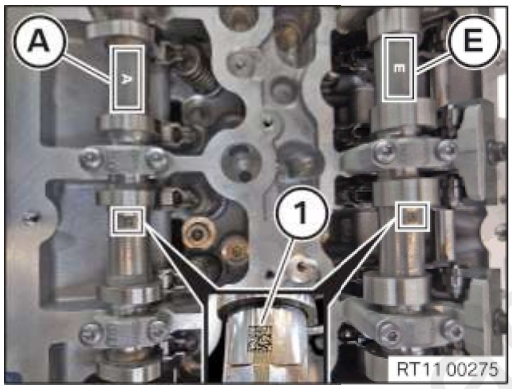
RISK OF DAMAGE

Damage to the engine.

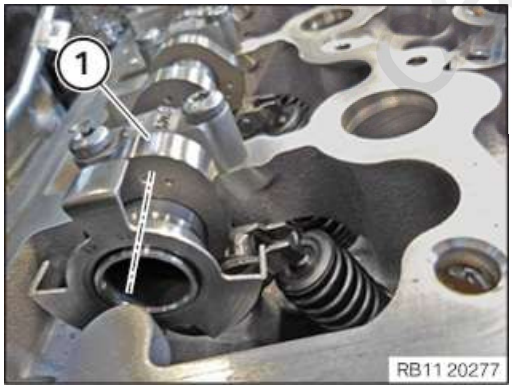
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.

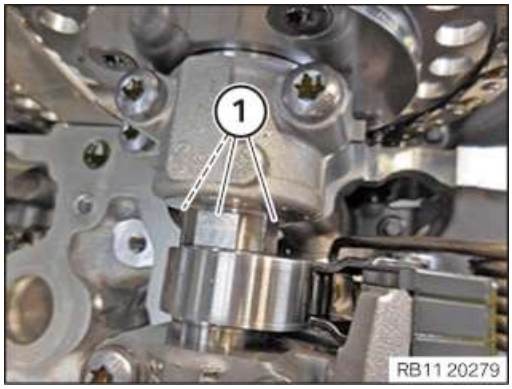


- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.

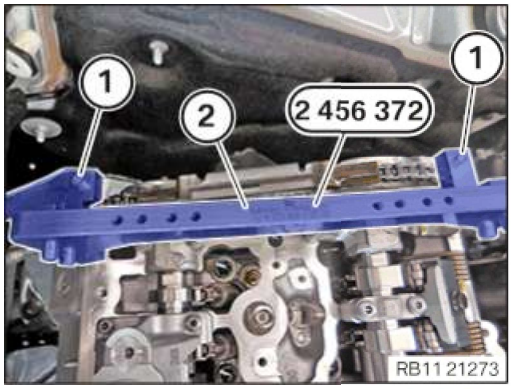
carfdiag.com



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



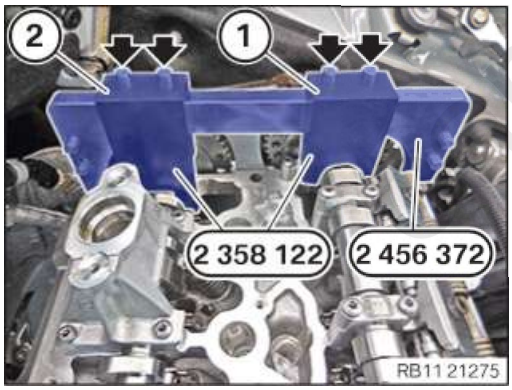
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

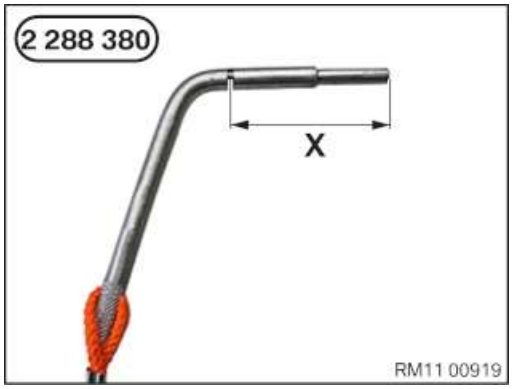
Test gauge to basic carrier

M6		Tightening torque	8 Nm



- Thread the sealing cap (1) out and remove.

rdiagn.com



- **Vehicles with automatic transmission:**

  Dimensions (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

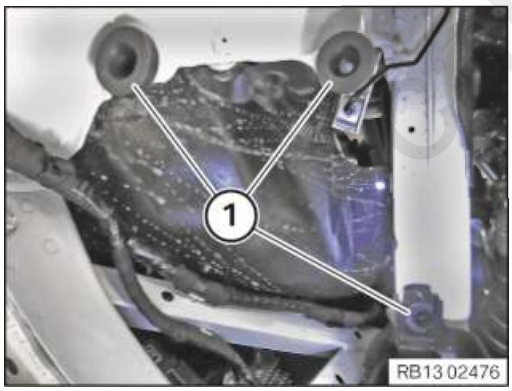


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

  The engine **is in the** TDC firing position of cylinder 1.

13 – Installing intake silencer housing



- Check the rubber mount (1) for correct fit.



- Feed the intake filter housing (3) in and engage it in the rubber mounts.
- Tighten clamp (2).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

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Additional Information

Overview of Tightening Torques

Basic carrier to cylinder head — Used in step 412

M6		Tightening torque	8 Nm

Test gauge to basic carrier — Used in step 412

M6		Tightening torque	8 Nm

VANOS central valve to camshaft — Used in step 89

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

Chain tensioner to cylinder head — Used in step 11

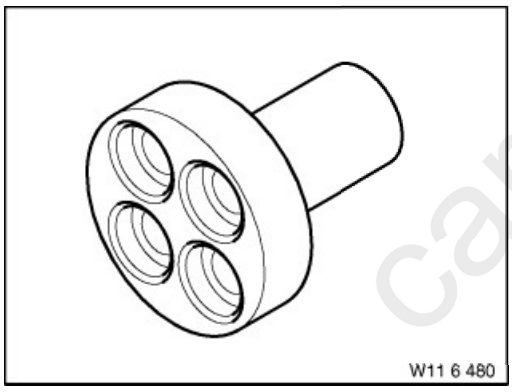
Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Clean air pipe to upper section of intake filter housing — Used in step 13

Clamp		Tightening torque	3 Nm

Overview of Special Tools

0 493 380 (11 6 480) Connector



Common — Used in step 141012

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

2 288 380 Locating stud

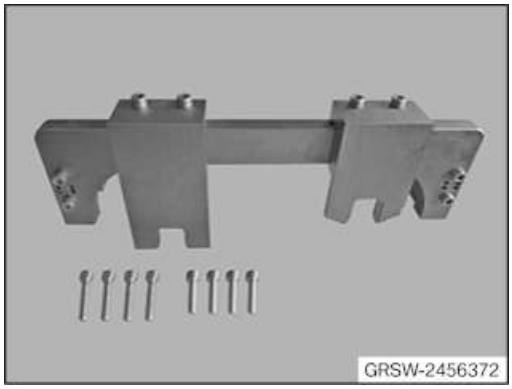


Common — Used in step 11012

Usage	For disconnecting the crankshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 04 14 (071)

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2 456 372 Gauge



Common	Used in step 41012
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

0 496 855 Ratchet handle



Common	Used in step 489
Usage	Insert reversible ratchet with nut for installation and disassembly of the VANOS- SW22. (only in longitudinal installation). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A55
Replaced by	
In connection with	
SI-Number	01 34 15 (306)

2 450 487 Socket



Common	Used in step 489
Usage	For removing and installing the VANOS adjuster. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	0496855
SI-Number	01 07 17 (487)

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2 455 654 Tensioning tool



Common	Used in step 710
Usage	To pretension the timing chain when adjusting the timings. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 122 Gauge



Common	Used in step 12
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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11 31 005 Check the timing of the camshaft (s)

WARNING

Hot surfaces.

Risk of burning!

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

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

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

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

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

CAUTION

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

Danger of injury!

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

RISK OF DAMAGE

Damage to battery terminal, the safety battery terminal or the intelligent battery sensor (IBS).

Damaged battery terminals can lead to malfunctions or vehicle electrical system faults.

- Pull off battery terminal from battery pole by carefully moving to and fro. Do not pry off using a tool.

TECHNICAL INFORMATION

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

PRELIMINARY WORK

1 – Disconnecting all battery earth leads

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- See additional information.

2 – Bring front compartment lid in the service position

Prerequisite

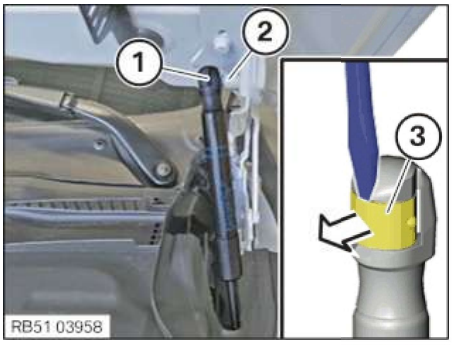
Engine compartment lid is open.

CAUTION

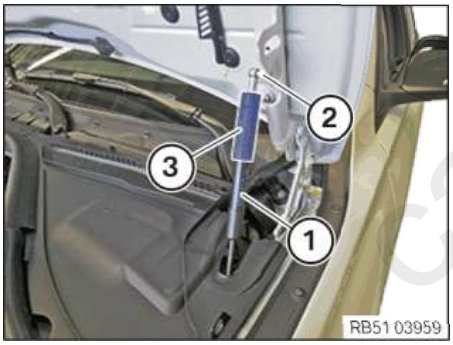
Shutting bonnet or tailgate.

Danger of injury!

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



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



TECHNICAL INFORMATION

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

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

3 – Remove the seal for the rear bonnet



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

4 – Removing the acoustic cover

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WARNING

Hot surfaces.

Risk of burning!

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

RISK OF DAMAGE

Damage to the acoustic cover.

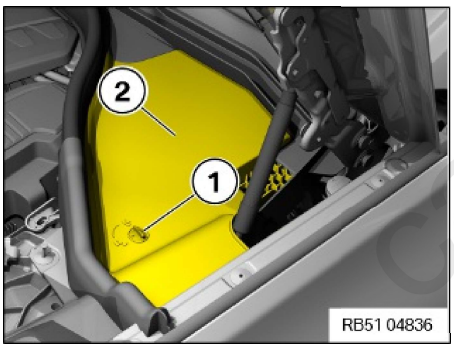
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

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



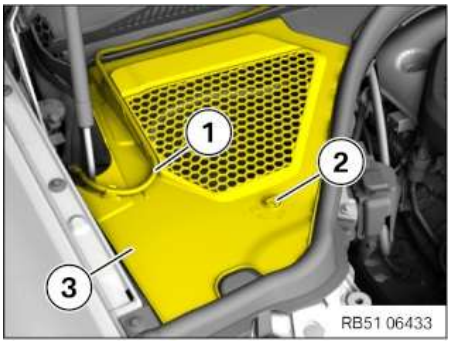
- Release the acoustic cover (1) towards the top from the rubber mounts (marks).

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



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

6 – Remove the cover of the rear right engine compartment



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

7 – Removing both wiper arms

NOTICE

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

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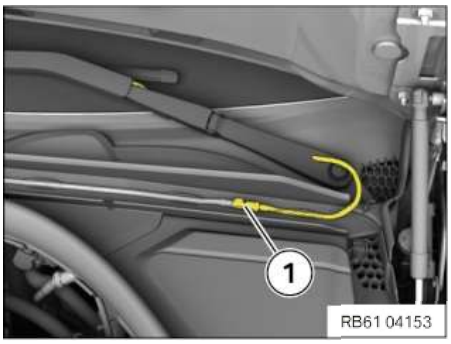
▸ **Remove the wiper arm**

RISK OF DAMAGE

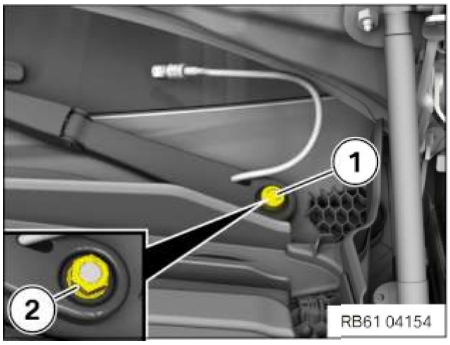
Damage to wiper console

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

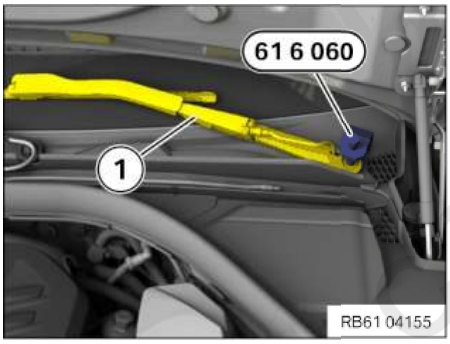
- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.



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

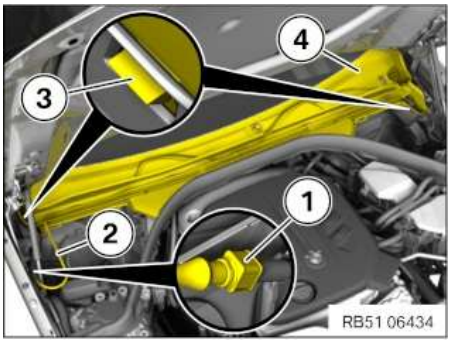


- Remove the protective cap (1).
- Loosen nut (2).



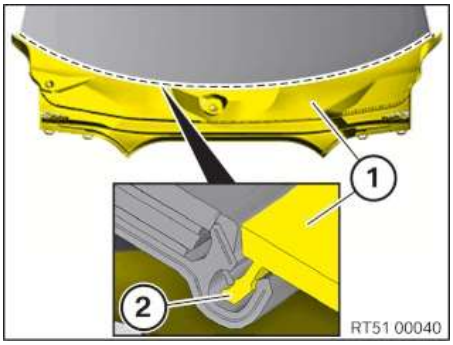
- Pull off the wiper arm (1) using special tool .

8 – Remove cowl panel cover



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

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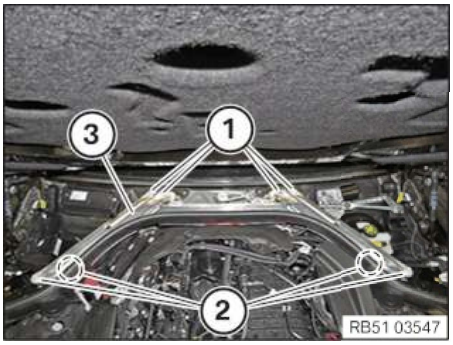


- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

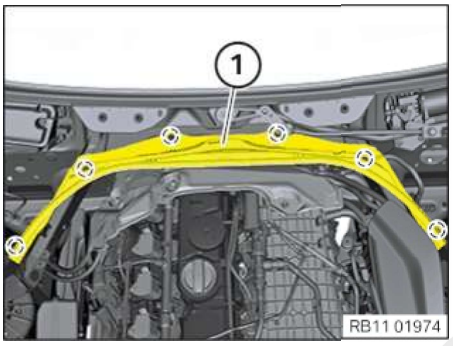
9 – Removing the centre bulkhead upper part

TECHNICAL INFORMATION

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



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



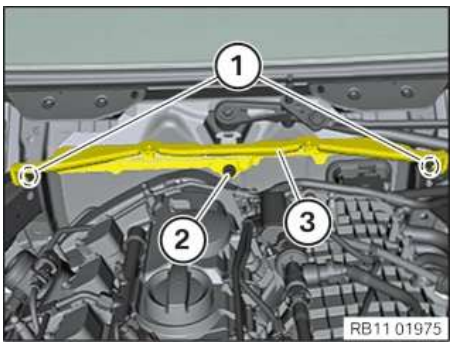
- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

10 – Removing acoustic cover at rear



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

11 – Removing the centre bulkhead lower section



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

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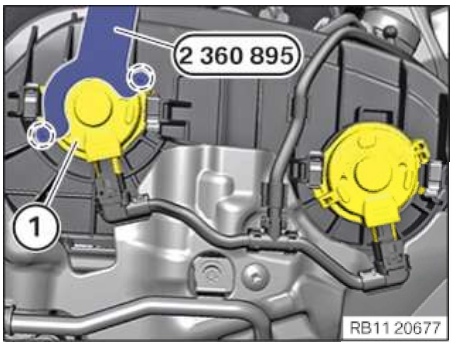
12 – Removing both actuators

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

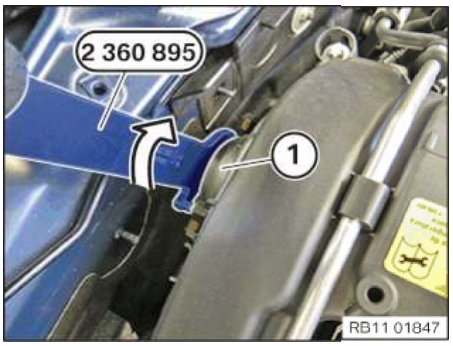
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the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



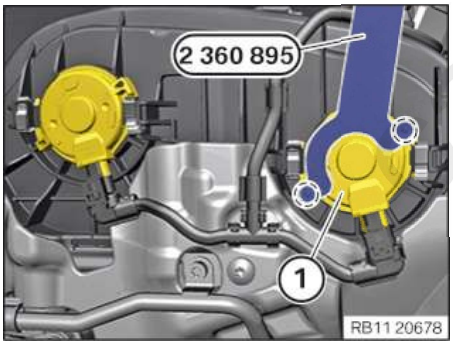
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



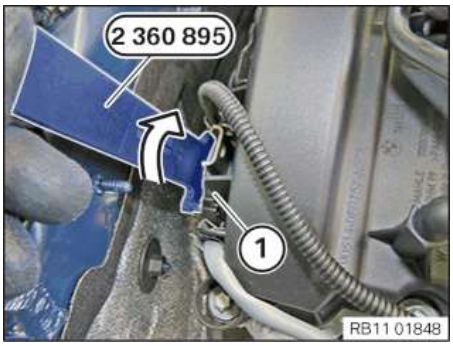
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



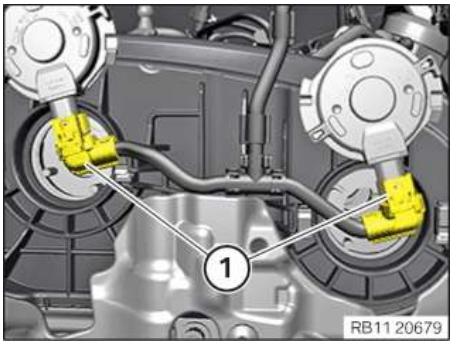
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.

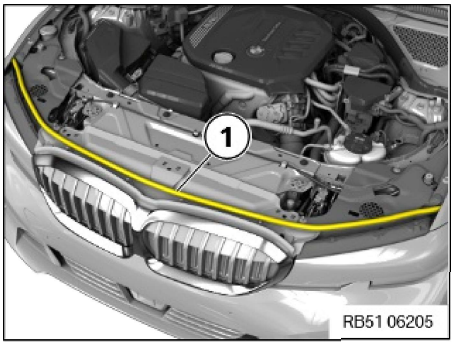


NOTICE

The figure shows the rear side of the engine.

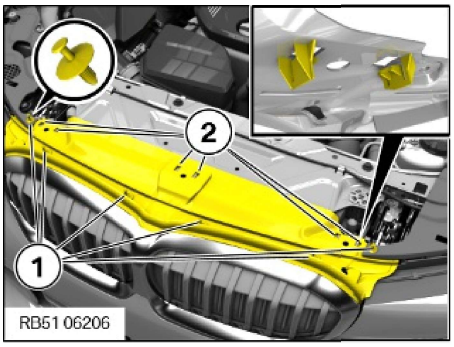
- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

13 – Remove the seal for the bonnet in front



- Pull off front bonnet seal (1) upwards.

14 – Removing the centre engine compartment cover



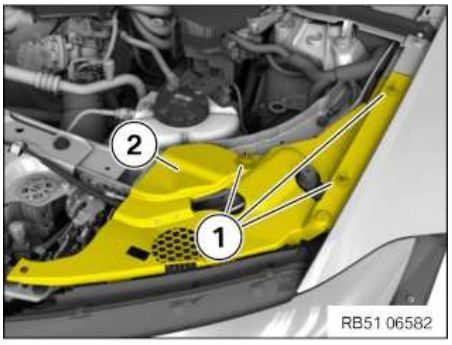
- Detach all expanding rivets (1).
- Release the cover of the centre engine compartment with the latch mechanisms (2) .
- Feed the cover for the centre engine compartment out to the rear.

15 – Partially remove the top left and right cover in the engine compartment

NOTICE

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

▶ **Removing the cover in the engine compartment on top partially**



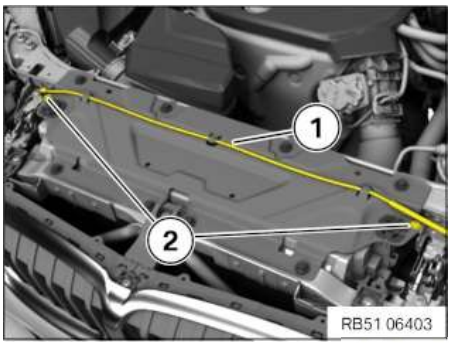
- Loosen the expanding rivet (1).
- Remove the cover in the engine compartment on top (2) partially.

16 – Removing the top cross connection

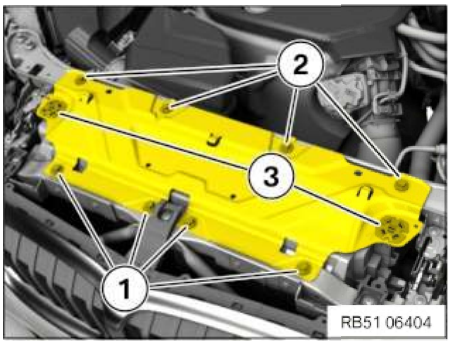
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- Release the housing for the coupling of the Bowden cables (1) from the body.

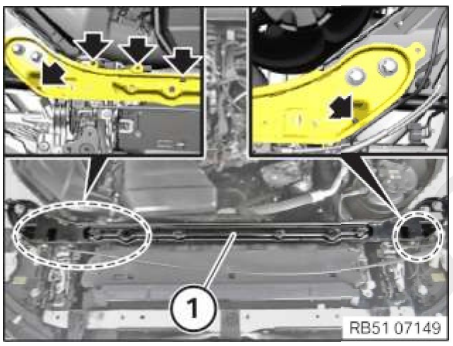


- Detach Bowden cable (1) at the top cross connection.
- Loosen screws (2).

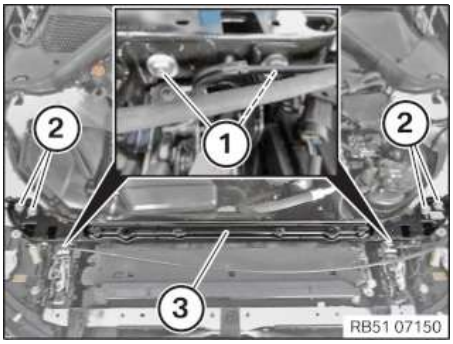


- Loosen screws (1) and (2).
- Remove the top cross connection with the holders(3) towards the top.

17 – Remove the rear top cross connection



- Release the clips (arrows) in the marked areas from the top rear cross connection (1).



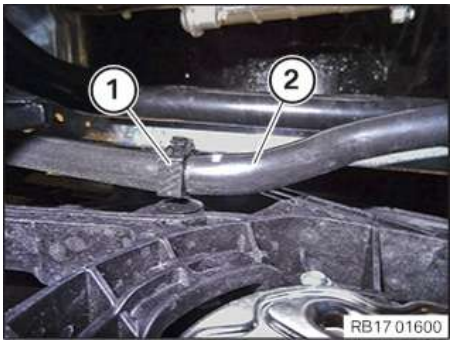
- Loosen screws (1).
- Loosen screws (2).
- Guide out and remove top rear cross connection (3).

18 – Remove fan cowl.

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TECHNICAL INFORMATION

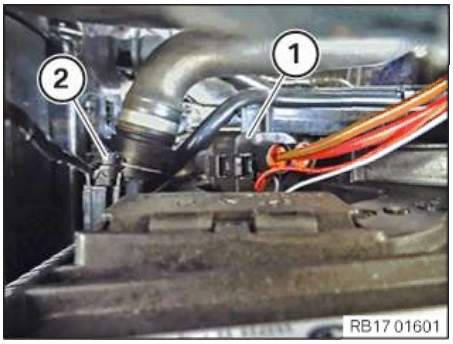
- When the engine is stopped after the end of the journey, it may be necessary to run the electric fan. In rare cases, operation of the electric fan can last up to 11 min. This protects the components. In this case, replacing the electric fan will not remedy the problem!



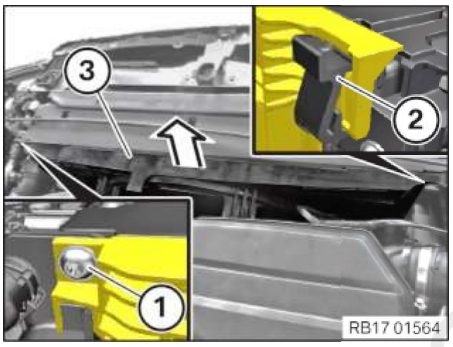
- **If installed:** Release transmission oil line (2).

  Unlock the holder (1).

  Thread out transmission oil line (2) and set aside.



- Unlock plug connection (1) and disconnect.
- Unlock plug connection (2) and disconnect.



- Loosen screw (1).
- Unlock lock (2).
- Guide out and remove fan cowl (3) **carefully** in the direction of the arrow.

19 – Remove all ignition coils.

NOTICE

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

▸ **Removing the ignition coil**

WARNING

Hot surfaces.

Risk of burning!

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

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RISK OF DAMAGE

Damage to the ignition coil.

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

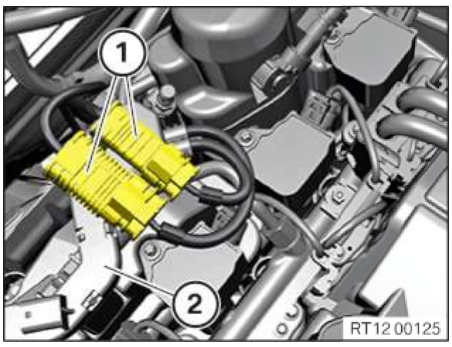
- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

RISK OF DAMAGE

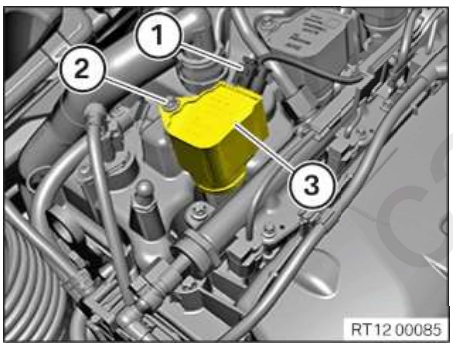
Electrostatic discharge.

Damage to or destruction of electrical components.

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



- Disconnect the connector (1) of the front oxygen sensor and the monitoring oxygen sensor from the cable channel (2) and set aside.



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

20 – Removing all spark plugs

WARNING

Hot surfaces.

Risk of burning!

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

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CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

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

- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

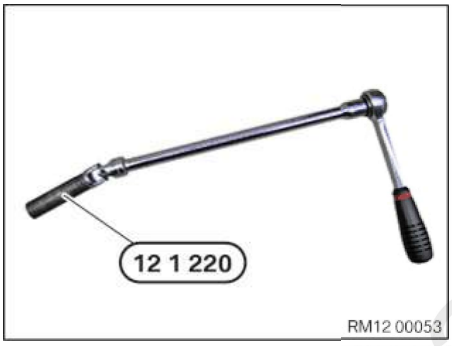
The spark plug shaft must be cleaned using compressed air after having removed the ignition coils and before removing the spark plugs. After having removed the spark plugs, once again check the sealing surface for contamination and (if necessary) clean using a moist cloth or clean using compressed air.

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

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

NOTICE

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



TECHNICAL INFORMATION

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

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



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

21 – Remove the high pressure line between the high pressure pump and the rail

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

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

CAUTION

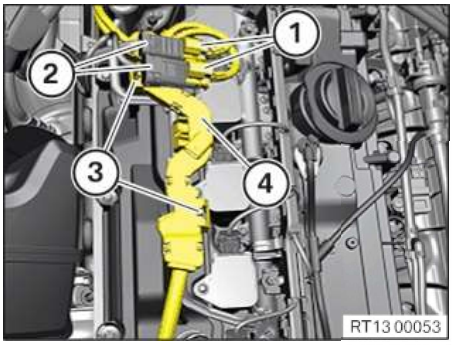
On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

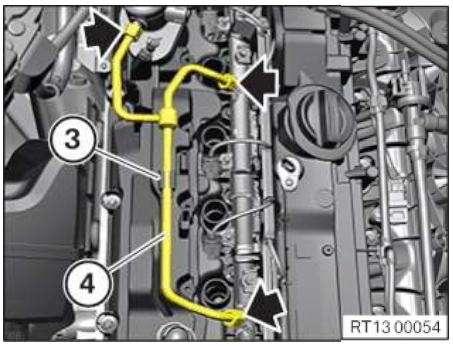
- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

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



- Unlock and disconnect the plug connections (1) and (2).
- Unlock the locks (3).
- Guide out the wiring harness section of the engine wiring harness (4) and set it aside.



- Position a lint-free rag under the union nuts.
- Unscrew union nuts (arrows) with the special tool .
- Catch and dispose of escaping fuel.
- Thread out the high pressure line (4) from the bracket (3) and remove it.
- Feed out and dispose of the lint-free cleaning clothes .

22 – Remove fuel delivery line

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

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

CAUTION

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

Danger of injury!

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

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RISK OF DAMAGE

Damage to the ignition coil.

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

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

RISK OF DAMAGE

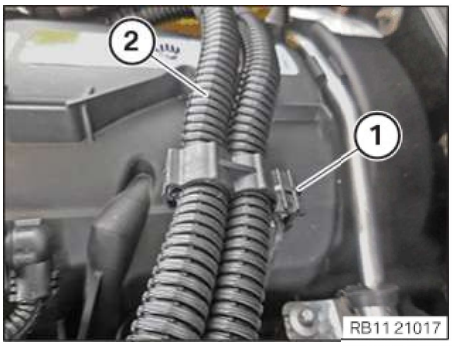
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

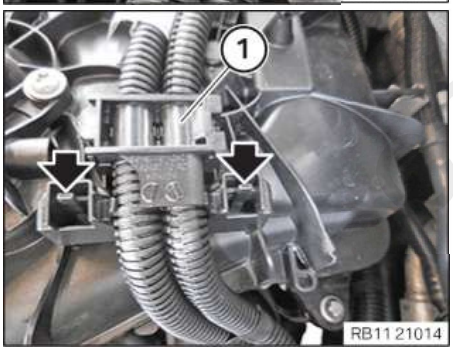
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

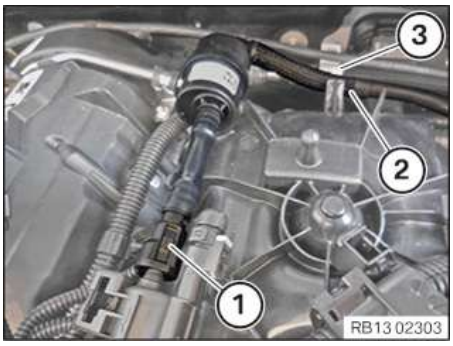
Reset special tool in early to avoid bending pressure lines.



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

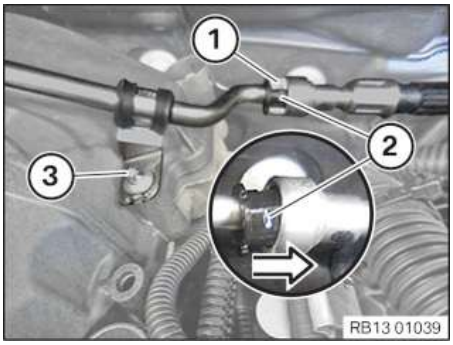


- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.

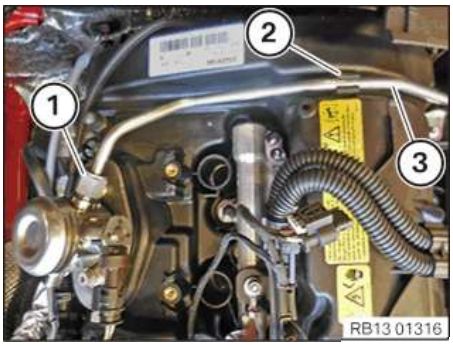


- Unlock and loosen lock (1).
- Guide tank ventilation line (2) out of clamp (3) and place it aside.

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



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

23 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

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

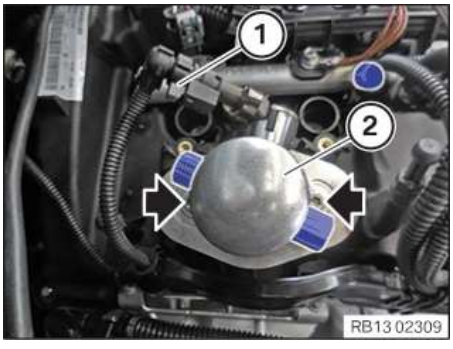
TECHNICAL INFORMATION

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

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

24 – Removing rail with injectors of cylinders 1 to 3

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RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

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

RISK OF DAMAGE

Damage to the ignition coil.

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

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

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

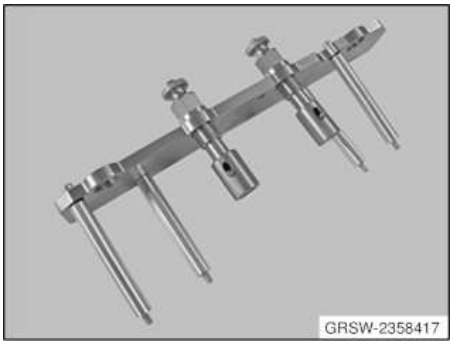
Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.



- Prepare special tool .

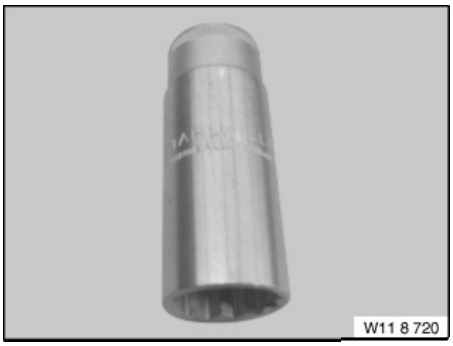


- Prepare special tool 2 358 417.

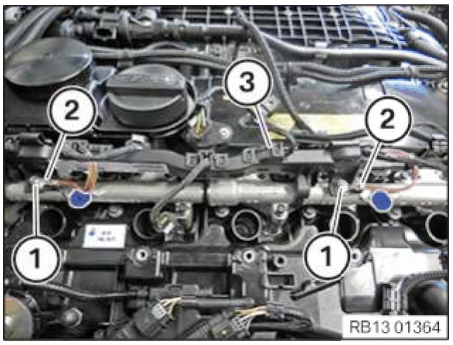
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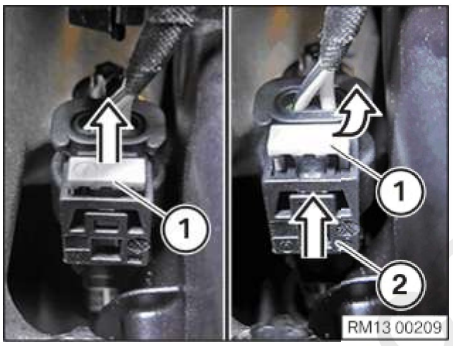
- Prepare special tool .



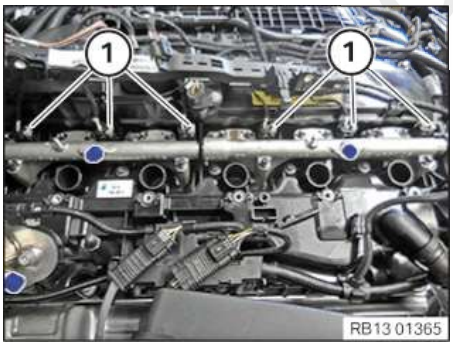
- Prepare special tool 0 496 106 (11 8 720).



- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.

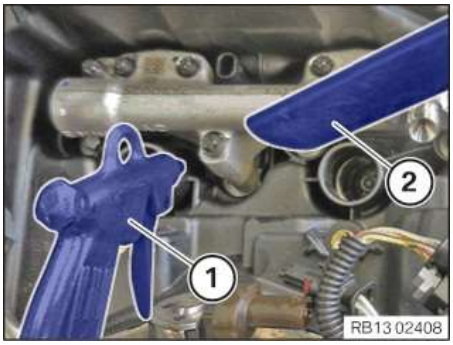


- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull out the connector (2) from the injectors.



- Unlock and release all connectors (1) of the injectors.

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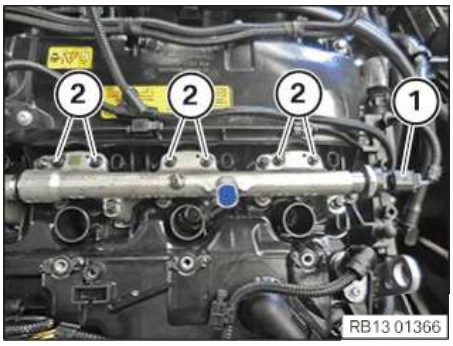


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

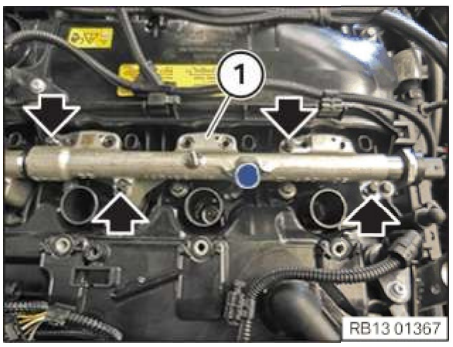
- Before releasing the high pressure lines: Blow out the injector shafts with an air gun(1) with less pressure.
- Simultaneously, draw off the dirt particles with an **explosion proof** vacuum cleaner (2).



- Unlock and loosen connector (1).
- Release screws (M5x30) (2).
- Remove screws (2).

  Do not reuse the bolts (2).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.

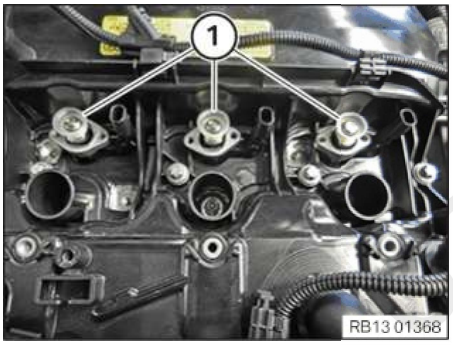


- Unscrew the screws (M6x30) (arrows).

  The screws may not be reused!
- Renew screws.

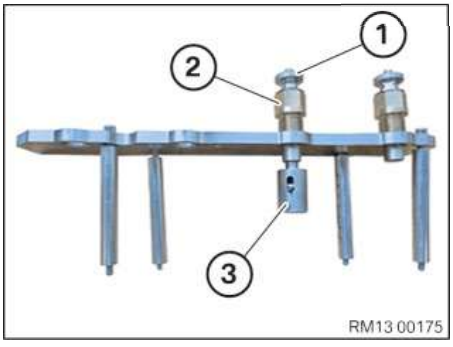
  Parts: Screws (M6x30)
- Remove rail (1) in upward direction.

  The injectors remain in the cylinder head.



- Remove the gaskets (1).

  The seals (1) are only required during the initial assembly at the plant and will not be installed again.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.

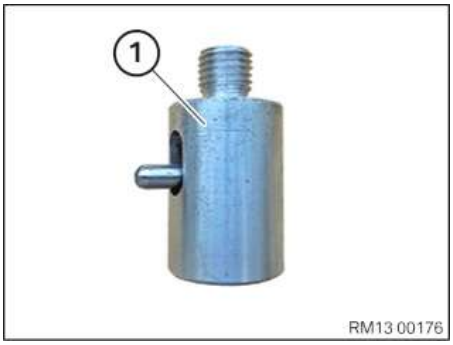
- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use the special tool 2 358 417to remove the injectors.

  The special tool 2 358 417 is used to ensure that the tensile force is not exceeded.

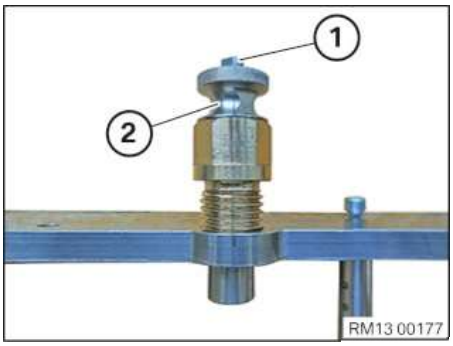
  Special tool 2 358 417 consists of:

  - **(1)** Threaded sleeves
  - **(2)** Pull-out thread (left-hand thread)
  - **(3)** Mounting for the injectors

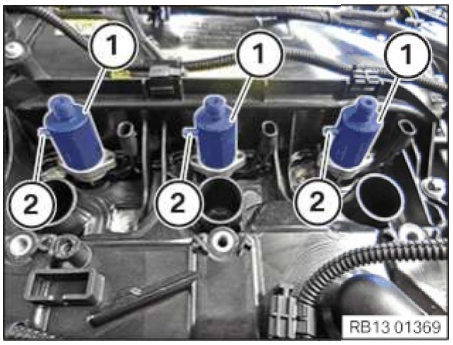
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- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.

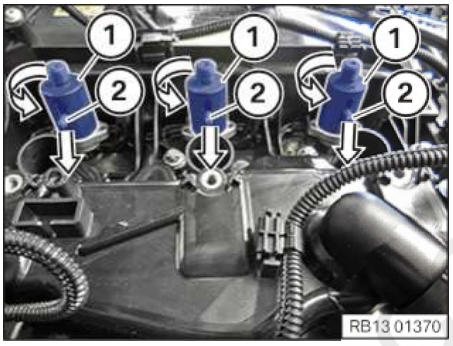


- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.

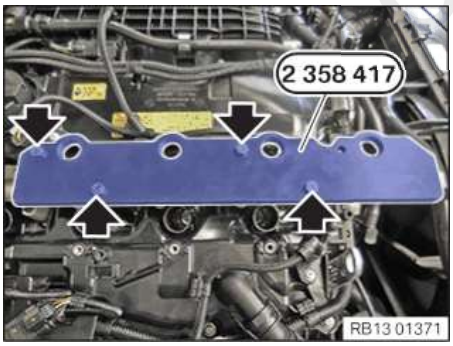


- Install all fixtures (1) for the injectors.

  The fixture (1) is not locked if the lever (2) is on the top.



- Turn fixtures (1) by 90° and lock the lever (2) downwards.



RISK OF DAMAGE

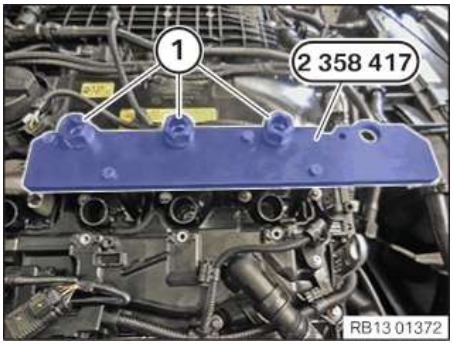
Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

- Attach special tool 2 358 417 to cylinder head.
- Hand-tighten the bolts (arrows).

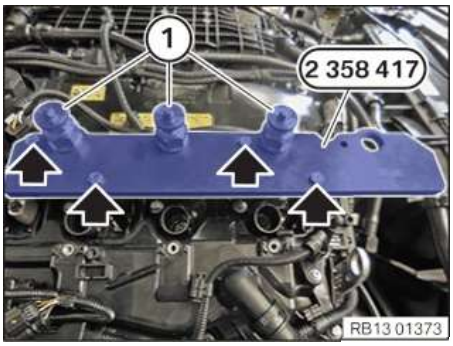
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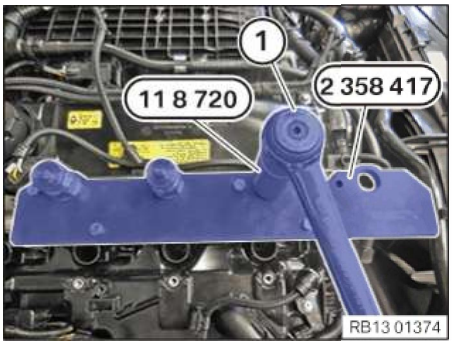
TECHNICAL INFORMATION

The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.



- Insert threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for injectors.
- Then tighten screws (arrows) on special tool 2 358 417 to 5 Nm.

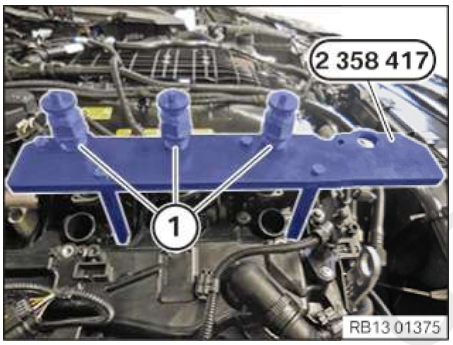


- Adjust torque wrench to 13 Nm **clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720)until the injector is pulled out.

TECHNICAL INFORMATION

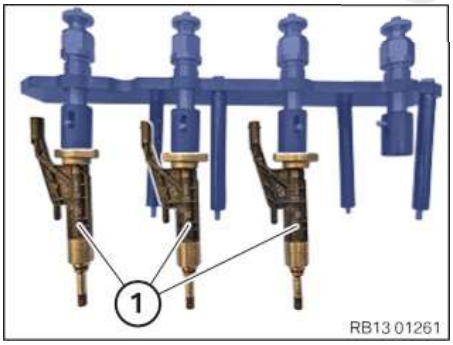
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

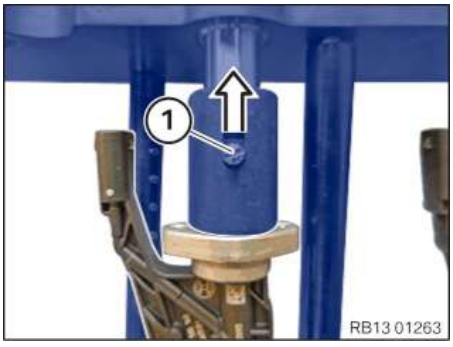


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  This can be recognised on the completely visible threads of the sleeves (1).
- Loosen screws on special tool 2 358 417.



- Carefully remove the special tool 2 358 417with injectors (1) from the cylinder head vertically upwards.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat on a clean table.

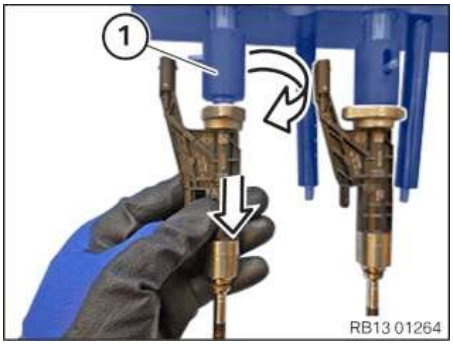


NOTICE

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

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture (1) by 90°.
- Release and remove the injector downwards.

25 – Removing rail with injectors of cylinders 4 to 6

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

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

RISK OF DAMAGE

Damage to the ignition coil.

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

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

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

Damage to injectors.

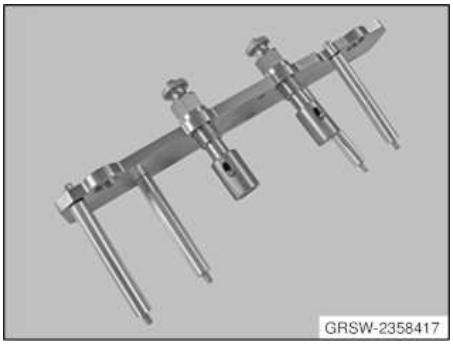
Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.



- Prepare special tool .

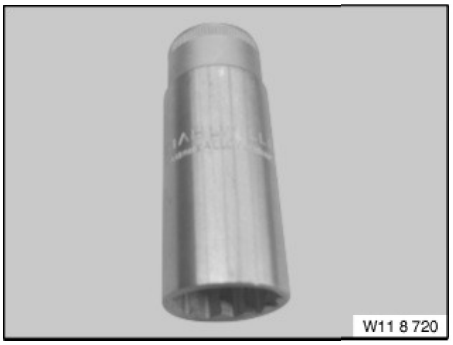
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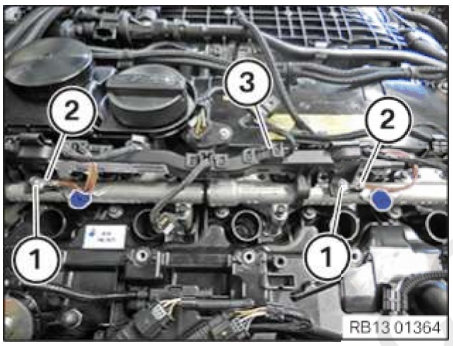
- Prepare special tool 2 358 417.



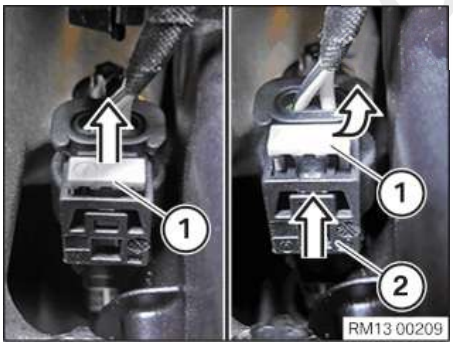
- Prepare special tool .



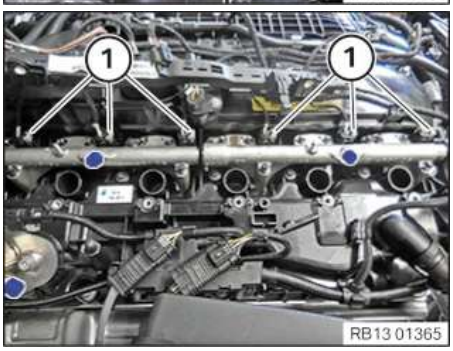
- Prepare special tool 0 496 106 (11 8 720).



- Release nuts (1) .
- Feed out ground cable (2) and set aside.
- Feed out cable channel (3) and set it aside.

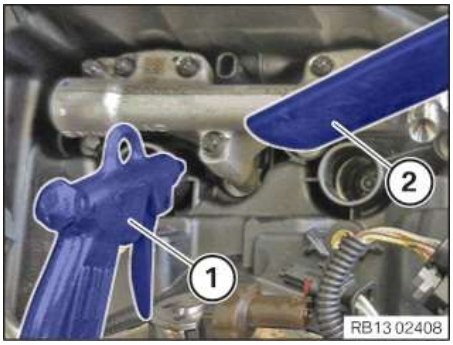


- Unlock lock (1) in direction of arrow upwards.
- Press lock (1) together and release.
- Disconnect the connector (2) from the injectors in the direction of the arrow.



- Unlock and release all connectors (1) of the injectors.

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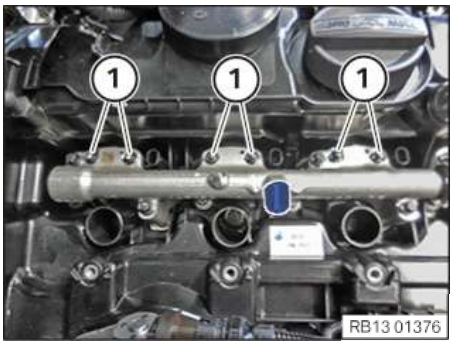


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

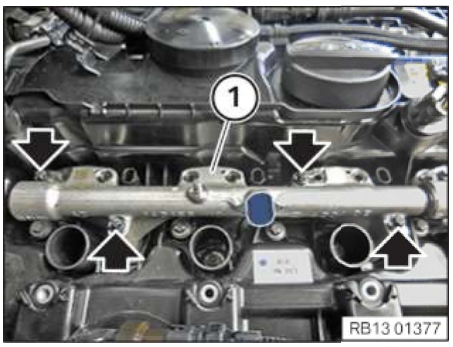
For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

- Before releasing the high pressure lines: Blow out the injector shaft with an air gun (1) with less pressure.
- Simultaneously, draw the dirt particles off **using an** explosion proof (2) vacuum cleaner.



- Release screws (M5x30) (1).
- Remove screws (M5x30) (1) .

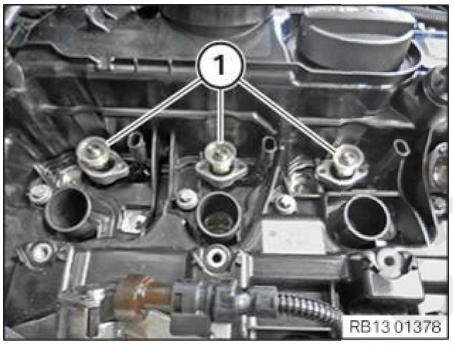
  Do **not** reuse screws (M5x30) (1).
- Catch and dispose of escaping fuel with suitable materials.



- Release screws (M6x30) (arrow).
- Remove screws (M6x30) (arrows).

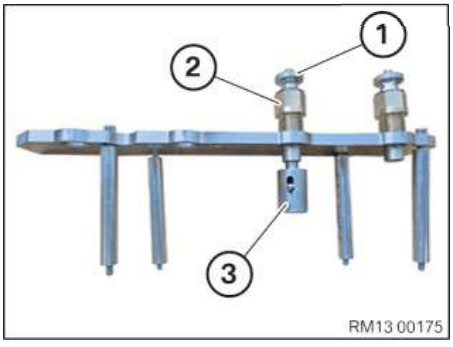
  Do **not** reuse the screws (M6x30).
- Remove rail (1) upwards.

  The injectors remain in the cylinder head.



- Remove seals (1) .

  The seals (1) are required during first assembly within the plant only and will not be installed again.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

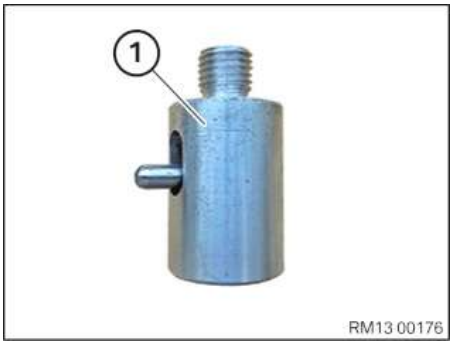
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use the special tool 2 358 417 to remove the injectors.

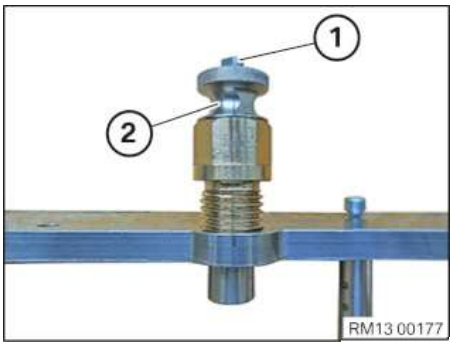
  The special tool 2 358 417 is used to ensure that the tensile force is not exceeded.

  The special tool 2 358 417 consists of:
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Mounting for the injectors

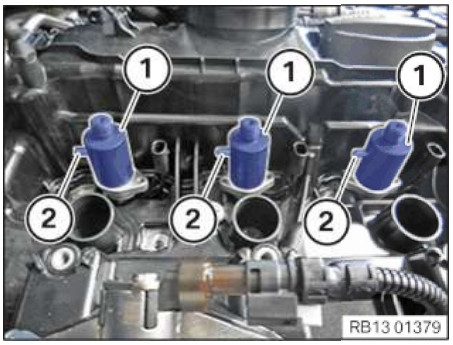
cardiagn.com



- Unscrew the fixture for injectors (1) from special tool 2 358 417.

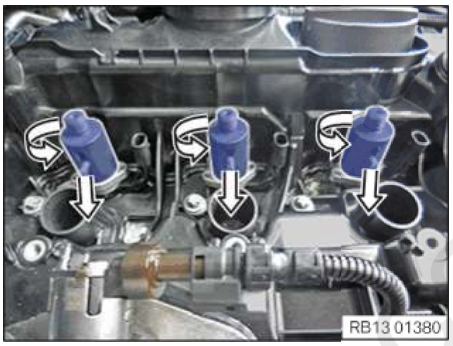


- Press lock (1) in and remove the threaded sleeve (2) from the special tool 2 358 417.



- Install all fixtures (1) for the injectors.

  The fixture (1) is not locked, if the lever is (2) on top.



- Turn fixtures (1) by 90° and lock the lever (2) downwards.



RISK OF DAMAGE

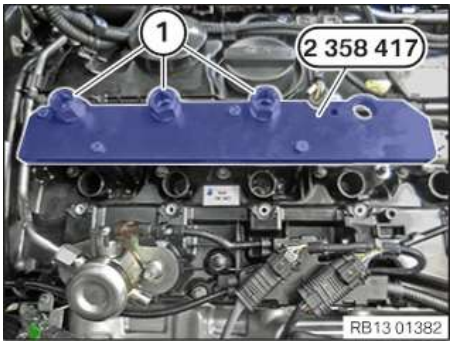
Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

- Attach special tool 2 358 417 to cylinder head.
- Hand-tighten the bolts (arrows).

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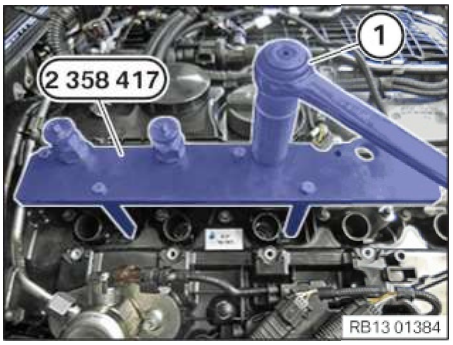
TECHNICAL INFORMATION

The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417 fully.



- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Then tighten screws (arrows) on special tool 2 358 417 to 5 Nm.

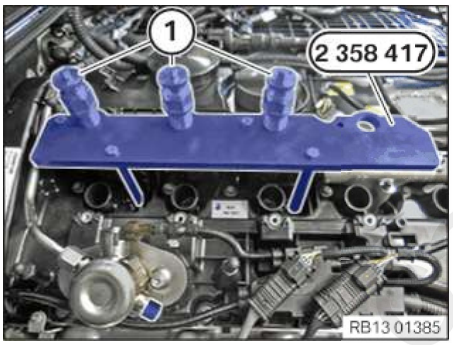


- Adjust torque wrench to 13 Nm **in clockwise** direction.
- Turn the torque wrench (1) with the special tool 0 496 106 (11 8 720) **clockwise**, until the injector is pulled out.

TECHNICAL INFORMATION

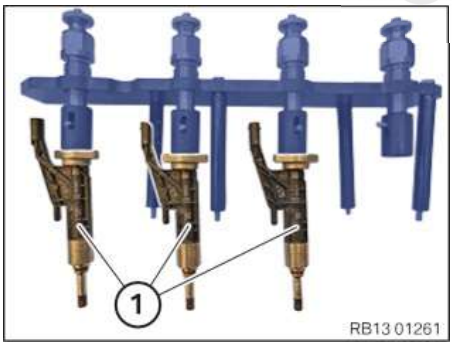
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

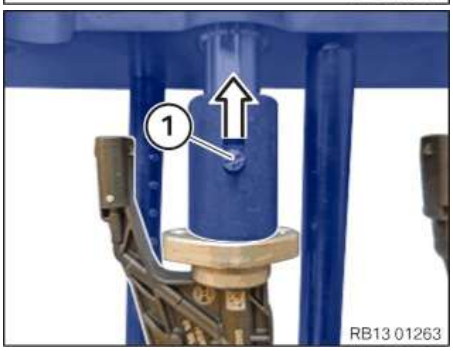


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  This can be recognised on the completely visible thread starts of the threaded sleeves (1).
- Loosen screws on special tool 2 358 417.



- Carefully remove the special tool 2 358 417 with the injectors (1) vertically straight up from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.

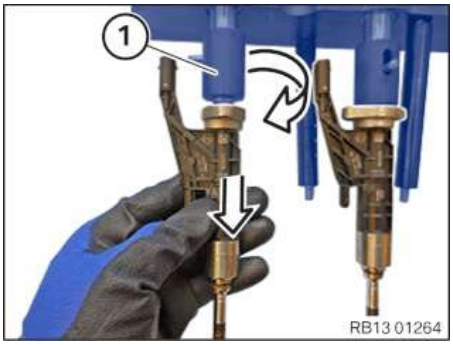


NOTICE

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

- Unlock the fixture lock (1) from the top.

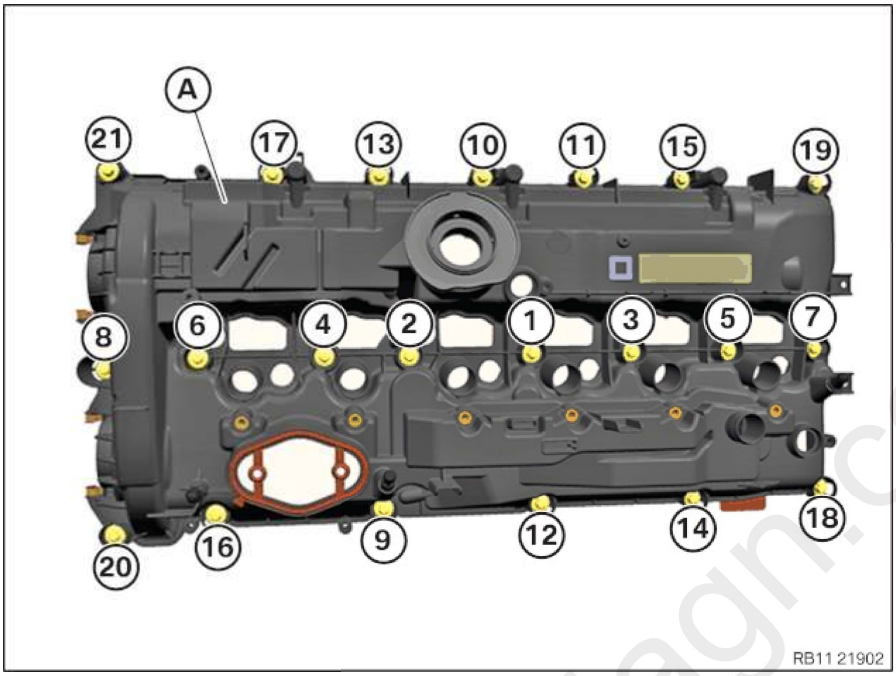
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- Turn the unlocked fixture(1) by 90°.
- Release and remove the injector downwards.

26 – Removing the cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 21 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

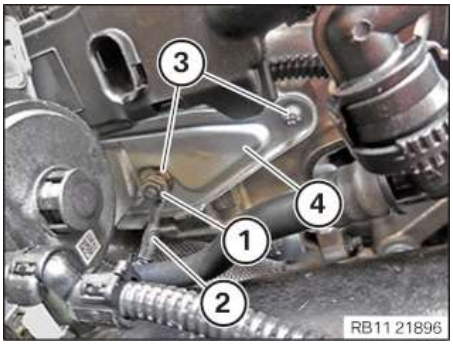
Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

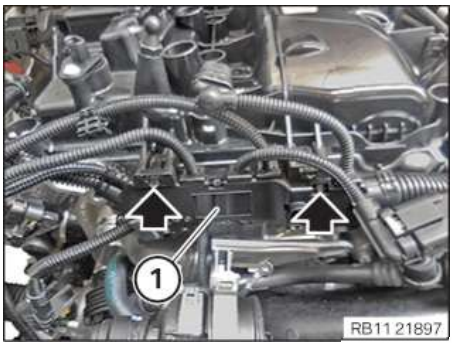


- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.

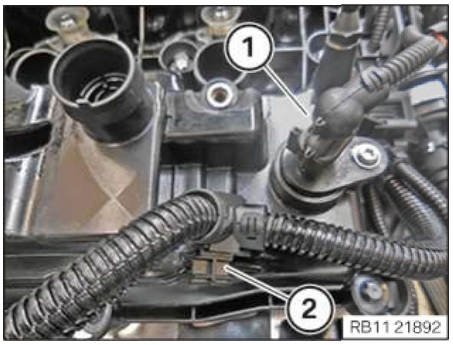
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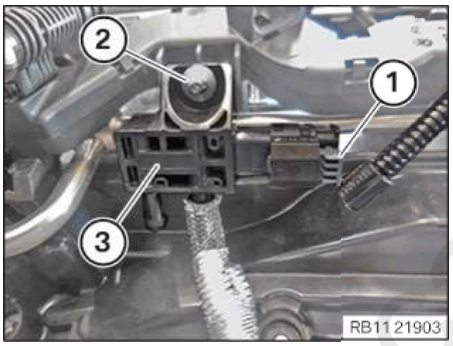
- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Loosen screws (3).
- Thread out holder (4) and set aside.



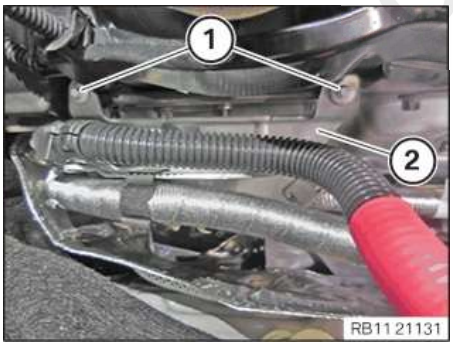
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for the sensor system **2** and place to one side.



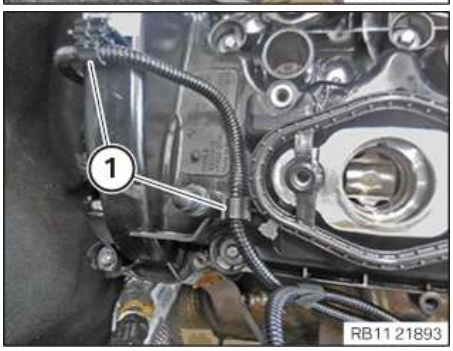
- Unlock and detach connector (1) on exhaust camshaft sensor .
- Loosen clamp (2).



- **If installed:**
- Unlock and loosen connector (1).
- Loosen screw (2).
- Remove the differential pressure sensor (3) and put it to one side.

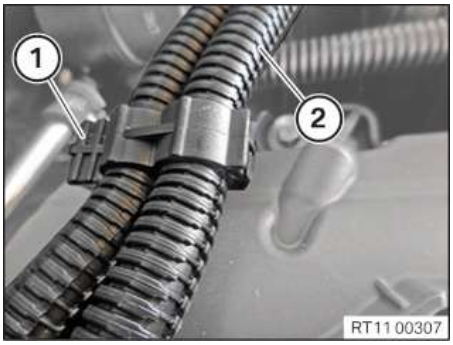


- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

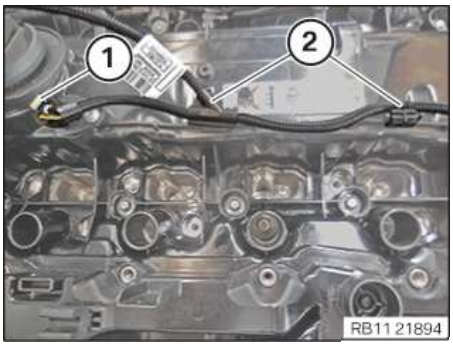


- Loosen clamps (1).

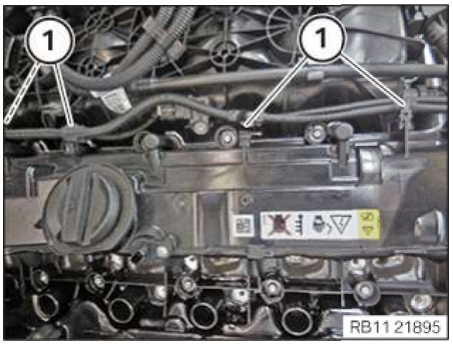
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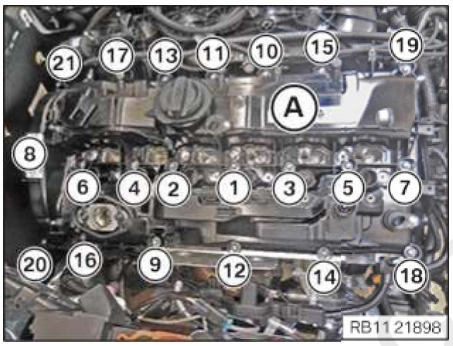
- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



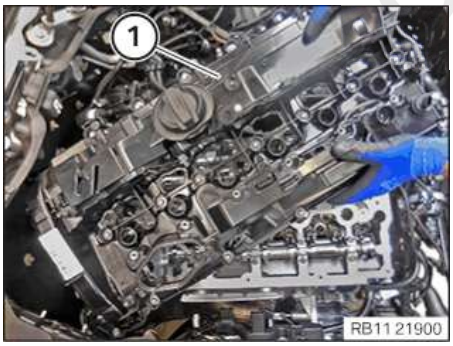
- Unlock and detach connector (1) on the intake camshaft sensor.
- Loosen clamps (2).



- Loosen clamps (1).



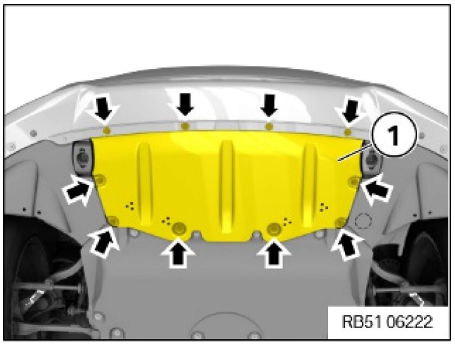
- Release all screws on the cylinder head cover (A) in the sequence (21) to (1).



- Guide the cylinder head cover (1) out and remove it.

27 – Removing the front underbody protection

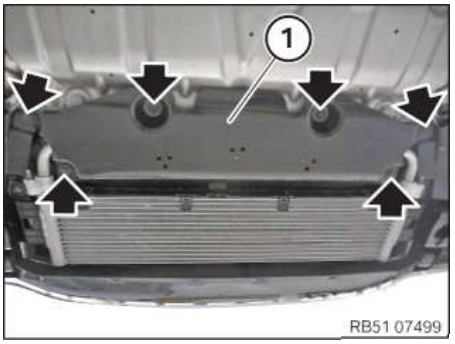
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- **Version 1:**

  Remove screws (arrows).

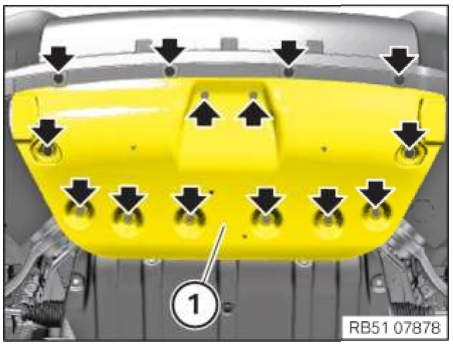
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

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

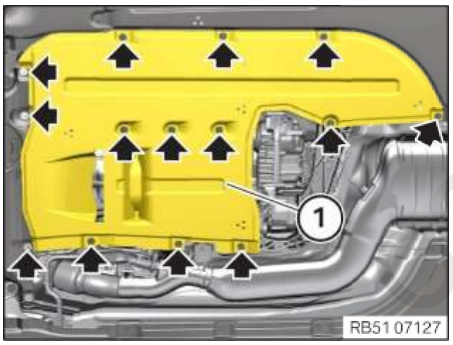


- **Version 3:**

  Remove screws (arrows).

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

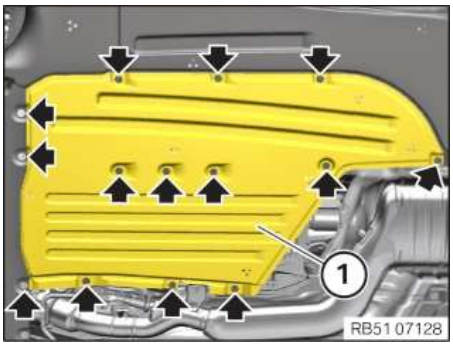
28 – Remove rear underbody protection



- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).



- **Version 2:**

  Remove screws (arrows).

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

29 – If installed: Partially release the engine oil cooler

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WARNING

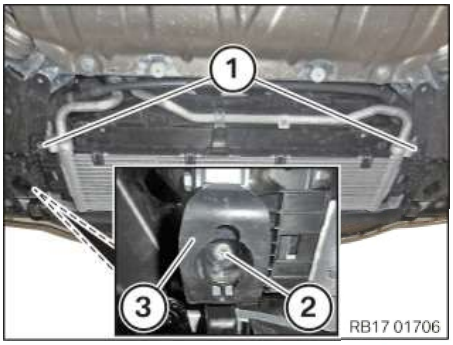
Hot surfaces.

Risk of burning!

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

TECHNICAL INFORMATION

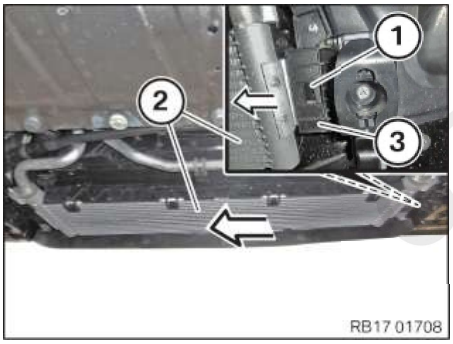
The work must be performed with care to prevent component damage.



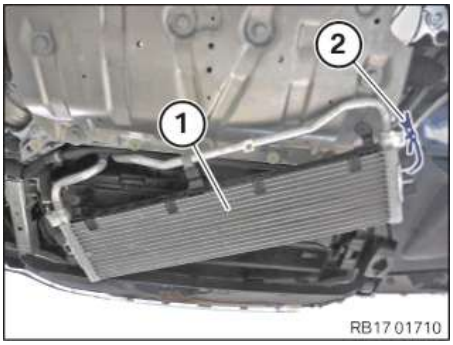
- Loosen screws (1).
- Drill out rivet on the left (2).
- Remove the left-hand damper (3).



- Loosen screw (1).



- Unlock lock (1).
- Feed out engine oil cooler (2) from the holder in the direction of arrow (3) and place to one side.

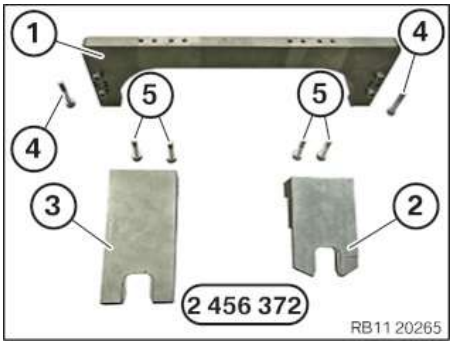


- Affix the engine oil cooler (1) with a cable strap (2) as shown.

MAIN WORK

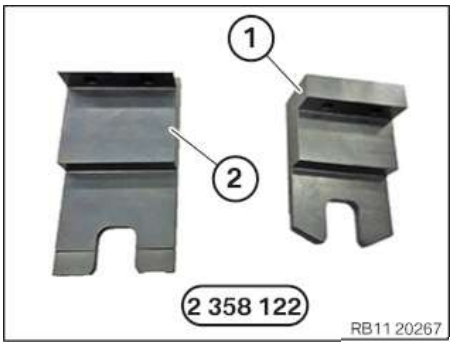
30 – Checking camshaft timing

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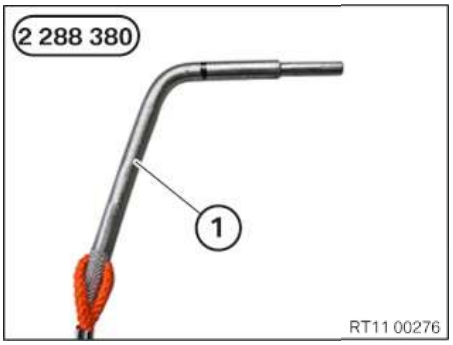
- Have the set of special tools 2 456 372 ready.

Number	Description
1	Basic carrier
2	0.7° setting gauge to adjust the intake camshaft
3	0.5° setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Keep the test gauge from the set of special tools 2 358 122 ready.

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



- Have the special tool 2 288 380 ready.

Number	Description
1	Locating stud



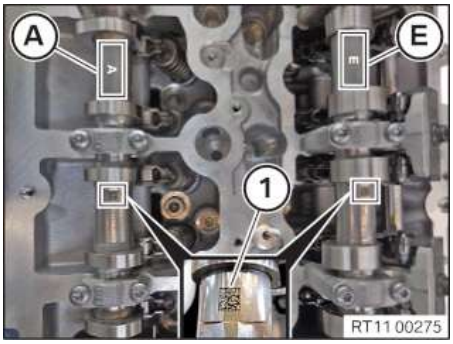
RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

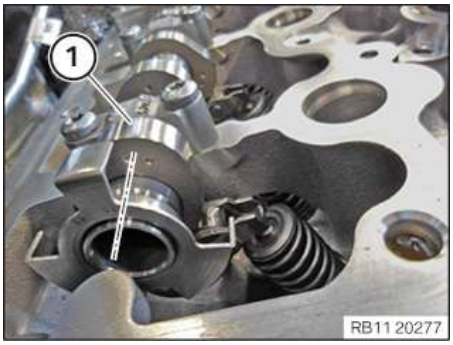
- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.

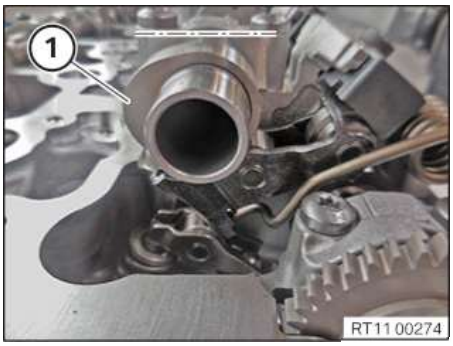


- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.

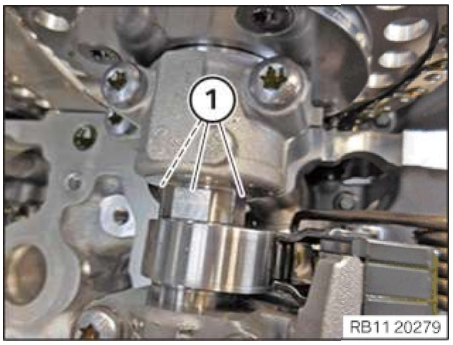
carlogn.com



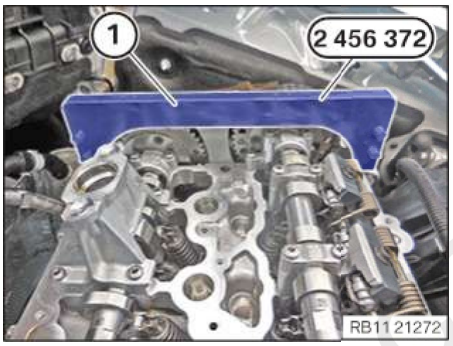
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



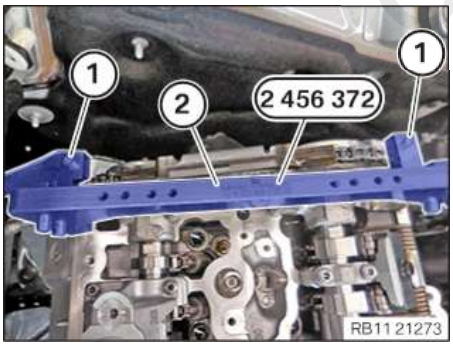
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



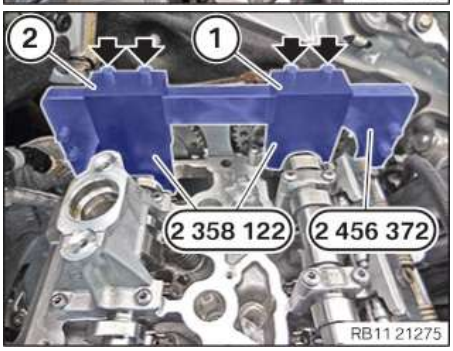
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

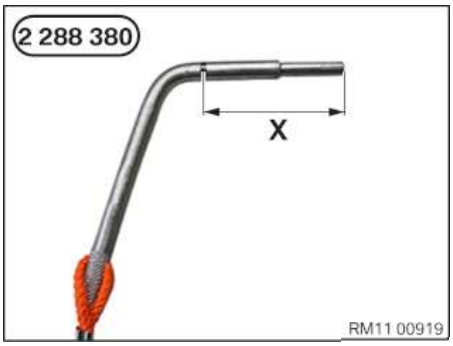
Test gauge to basic carrier

M6		Tightening torque	8 Nm

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- Thread the sealing cap (1) out and remove.



- **Vehicles with automatic transmission:**

  Dimensions (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.



- **Vehicles with automatic transmission:**

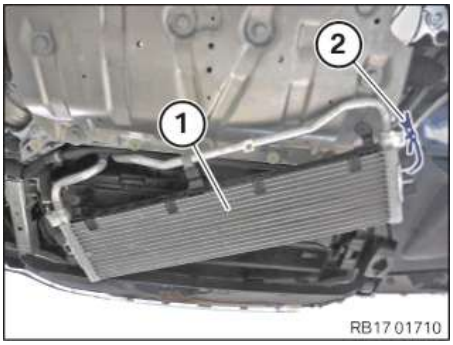
  Special tool 2 288 380 has been **correctly** positioned.

  The engine **is in the** TDC firing position of cylinder 1.

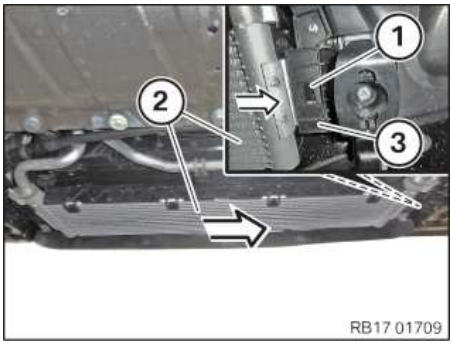
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POSTPROCESSES

31 – If installed: Secure engine oil cooler



- Remove the cable straps (2).
- Position engine oil cooler (1).



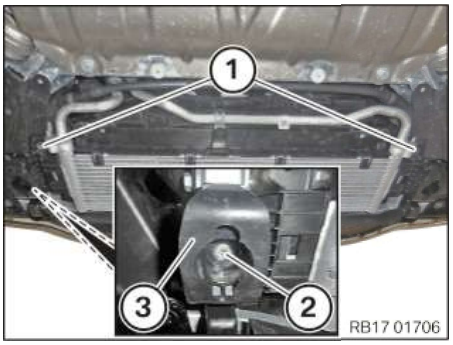
- Feed in and install the engine oil cooler (2) on the holder (3) in the direction of the arrow.
- Ensure that the lock (1)engages audibly.



- Tighten down screw (1).

Engine oil cooler to bumper support

M6X25		Tightening torque	8 Nm



- Renew rivet (2).

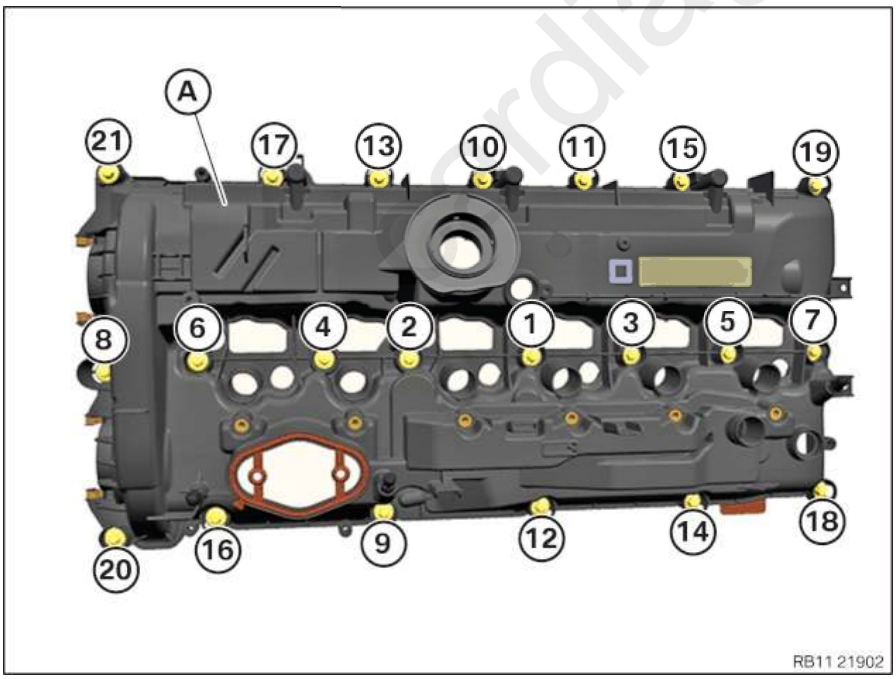
  Parts: Rivet
- Install and rivet damper (3).
- Tighten the screws (1).

Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

32 – Installing cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 21 Bolts of the cylinder head cover

A Cylinder head cover

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RISK OF DAMAGE

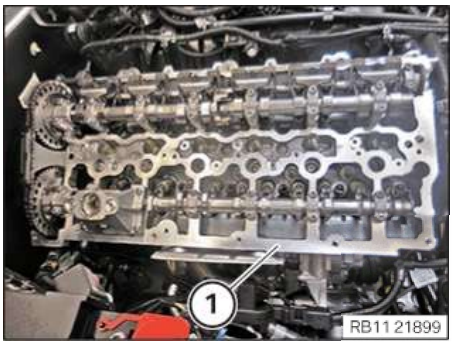
Improper routing of cables and wiring harnesses.

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

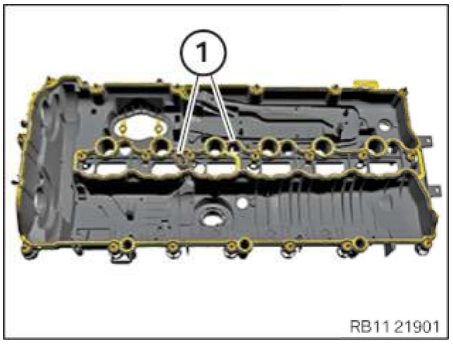
- Route all cables without abrasions, do not trap and crush.

TECHNICAL INFORMATION

Latch mechanisms, guides and mounting elements must not be damaged or missing.

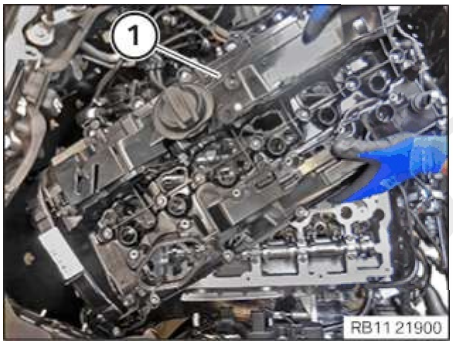


- Contact surface (1) must be free from oil and grease.



- Replace the seals (1).

  Parts: Seals



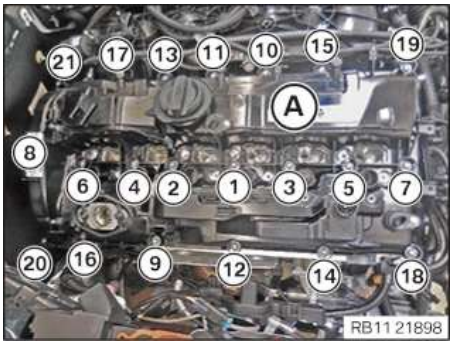
- Insert and install cylinder head cover (1).



- Ensure that the cylinder head cover (1) is installed in the **marked** area correctly on the high pressure pump bracket(2).

  The cylinder head cover (1) must not touch the high pressure pump bracket (2) in the **marked** area.

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- Position the cylinder head cover (A).
- Make sure that the cylinder head cover (A) does not touch the high pressure pump bracket!
- Tighten all bolts in sequence (1) to (21).

Cylinder head cover to cylinder head

M6X30		Jointing torque	8 Nm

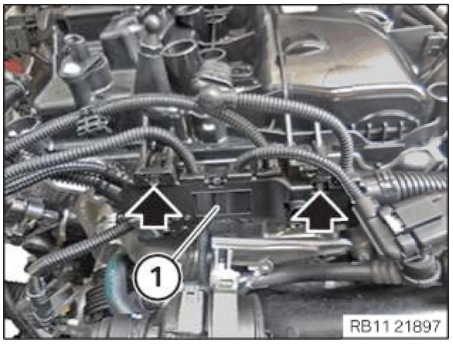
- Tighten all screws in a sequence from (1) to (21).

Cylinder head cover to cylinder head

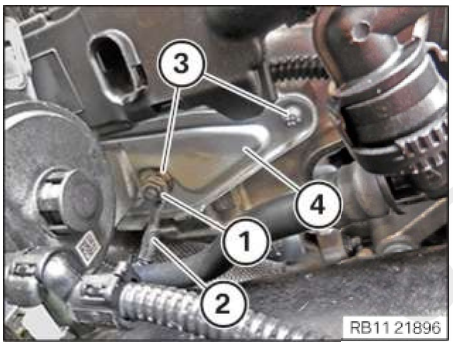
M6X30		Tightening torque	11 Nm



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



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



- Insert and position the holders (4).
- Tighten the screws (3).

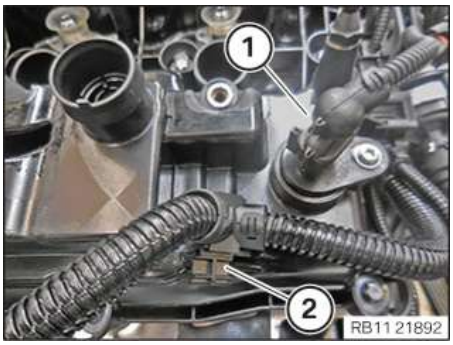
Auxiliary coolant pump holder to cylinder head

M6		Tightening torque	7 Nm

- Thread in ground cable (2) and install.
- Tighten nut (1).

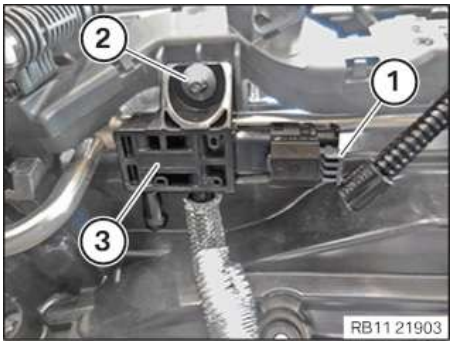
Standard screw connection M6

M6			8 Nm



- Connect and lock the connector (1) on the exhaust camshaft sensor .
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).

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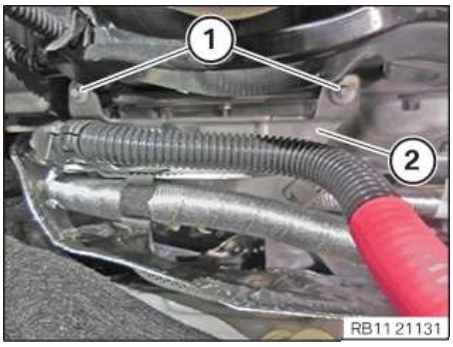


- **If installed:**
- Feed in and install the differential pressure sensor (3).
- Tighten down screw (2).

Differential pressure sensor to holder

TS6X18		Tightening torque	3,5 Nm

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



CAUTION

Improper routing of the positive battery cable.

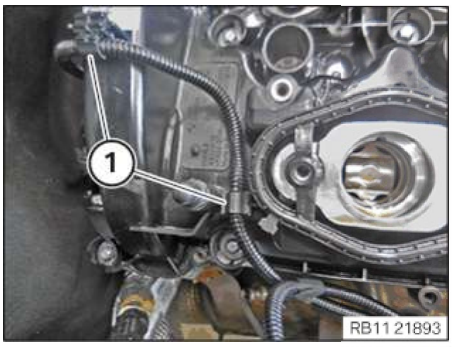
Risk of short circuits!

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

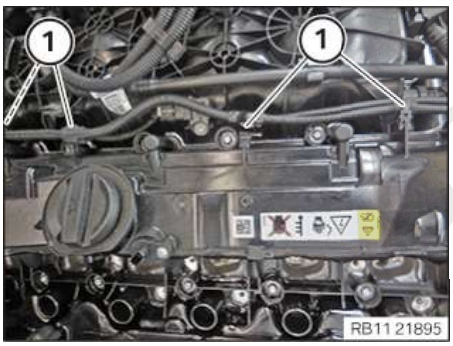
- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

Holder, positive battery cable to cylinder head cover

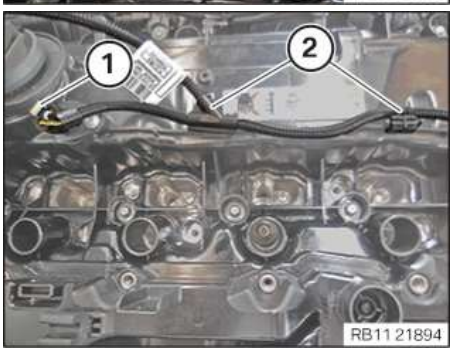
6X18		Tightening torque	6 Nm



- Secure clamps (1).



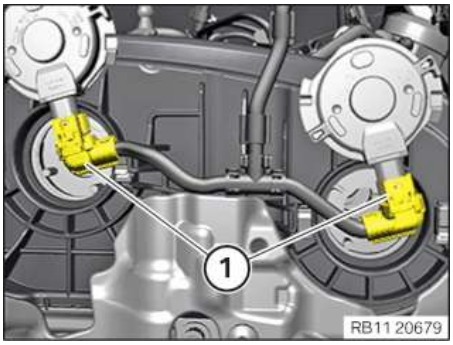
- Secure clamps (1).



- Connect connector (1) to the intake camshaft sensor and lock it.
- Make sure the connector (1) engages audibly.
- Secure clamps (2).

33 – Installing both actuators

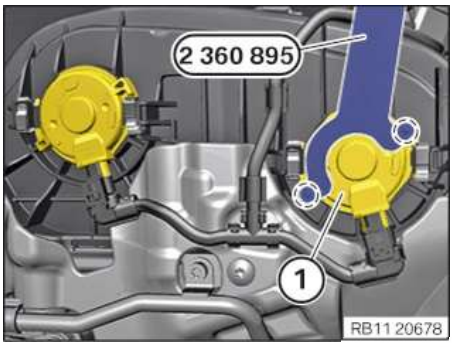
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NOTICE

The figure shows the rear side of the engine.

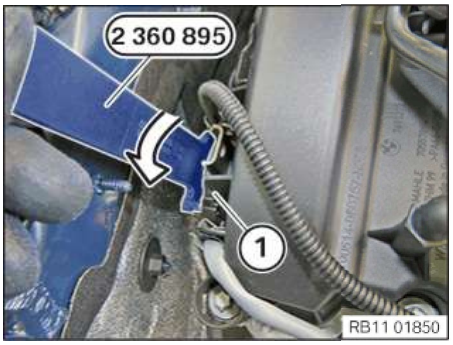
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



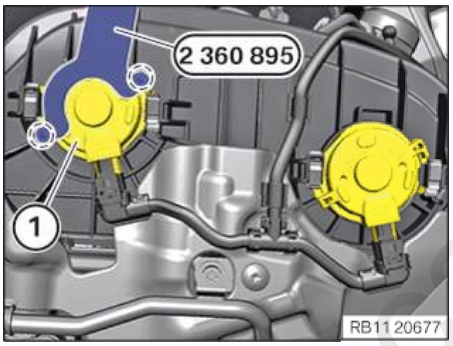
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



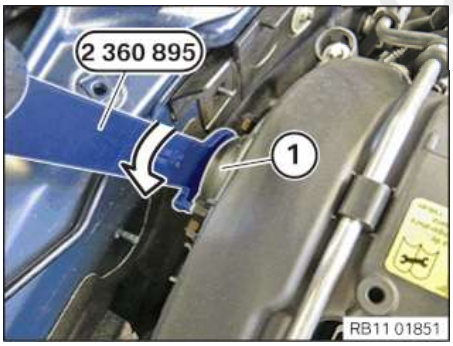
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.



NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

34 – Install high pressure pump

RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

Only G05 and G07

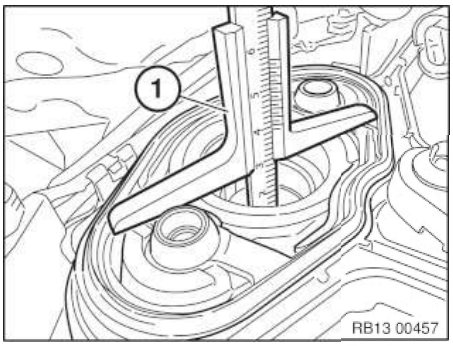
In vehicles with active anti-roll bar (ARS) the fan cowl must be removed in order to spin the engine.

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

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

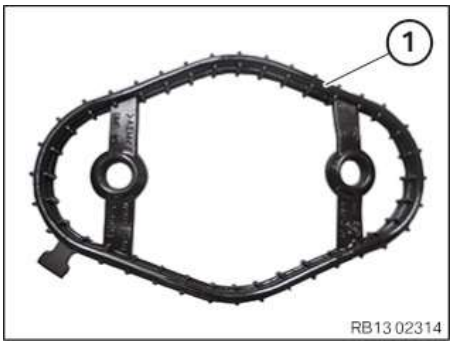
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket

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TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

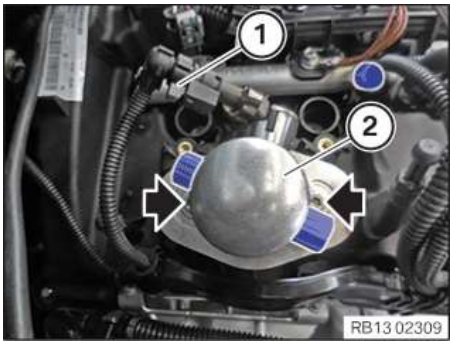
- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).

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- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

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

35 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

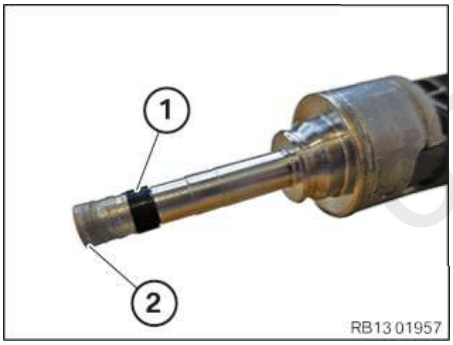
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

TECHNICAL INFORMATION

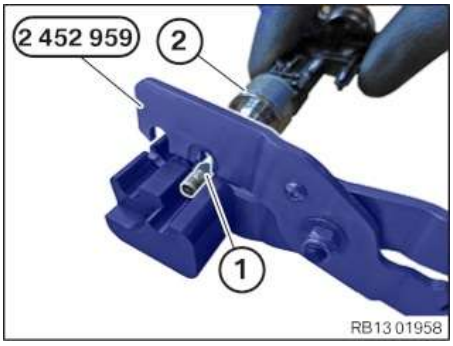
Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.



- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings
- Avoid mechanical contact with injector tip (2).



- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.

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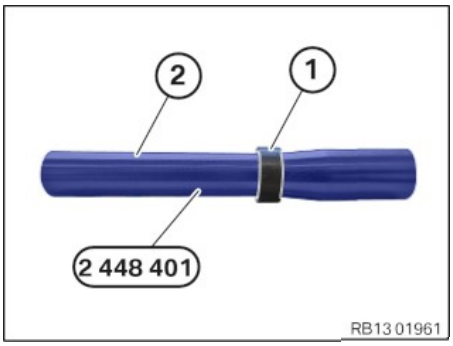


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

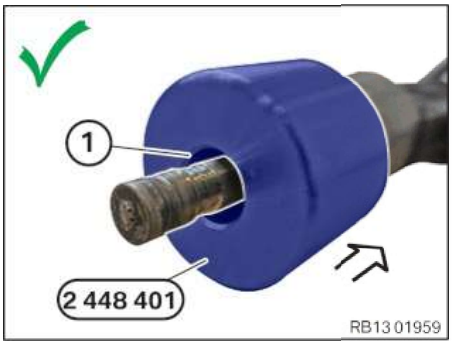
  (1) Installation cone

  (2) Sliding sleeve

  (3) Assembly sleeve

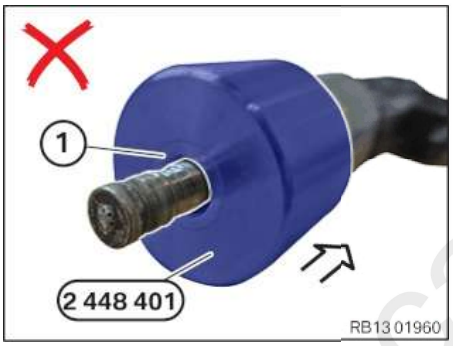


- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



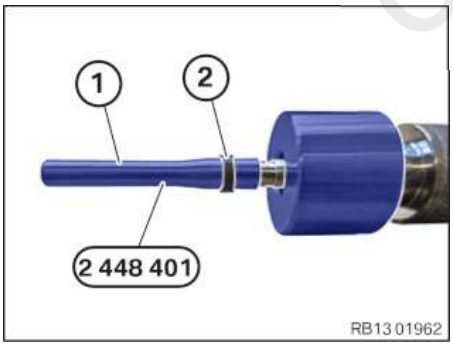
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The larger diameter of the assembly sleeve (1) must point to the injector tip.

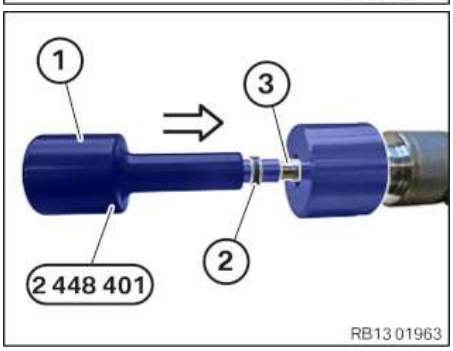


- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.

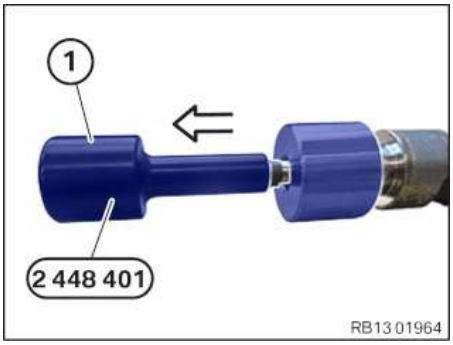


- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .

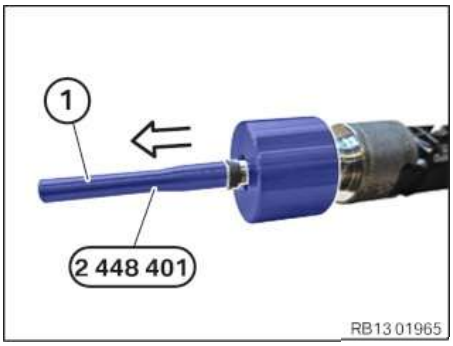


- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.

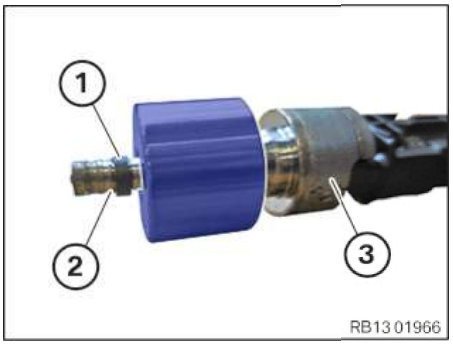
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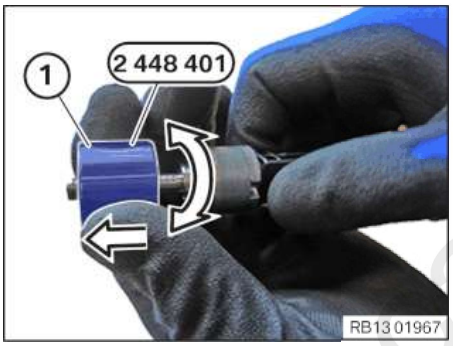
- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

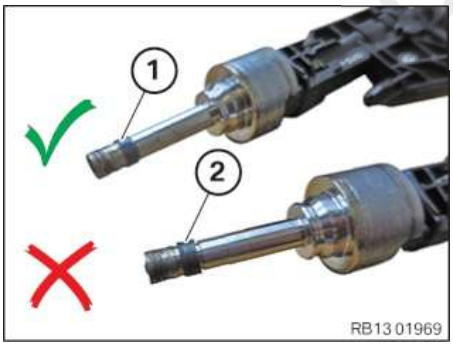


- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.



- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).

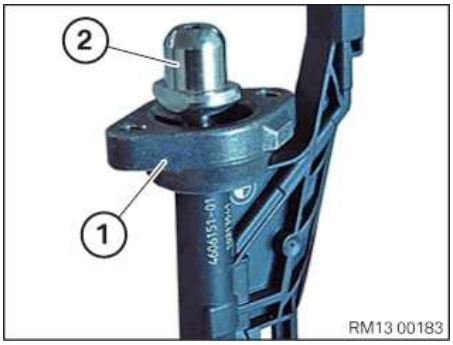


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

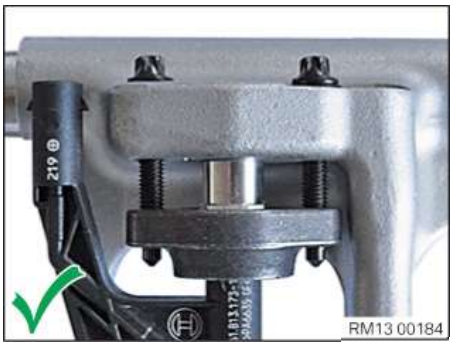
36 – Installing the high-pressure rail with injectors of the cylinders 4 to 6

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.

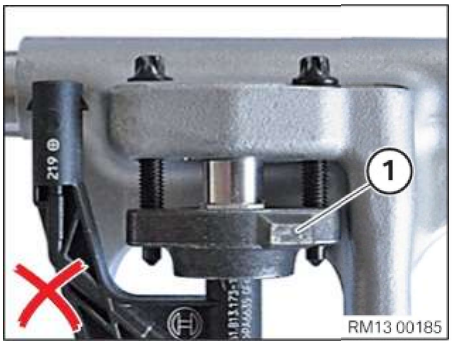


- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder**(1) **has a cast lug**: Make sure that the holder is installed in the correct position.



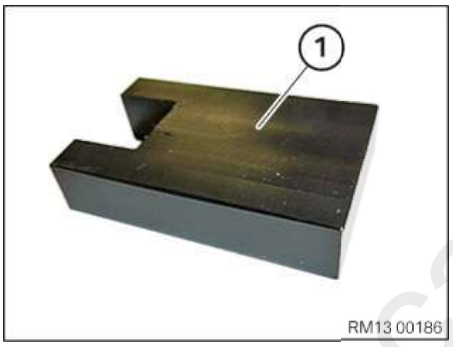
- If applicable, note the position of the cast lug:

  The holder is mounted **correctly** when the cast lug is located at the rear.



- If applicable, note the position of the cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.



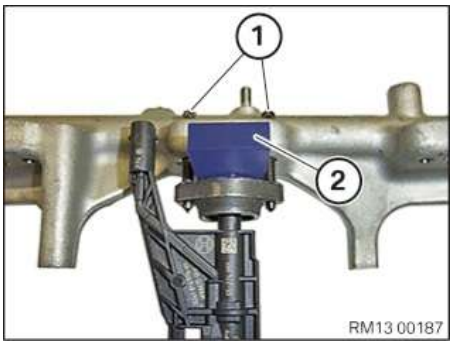
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).



- Replace (M5x30) screws.

  Parts: Screws (M5x30)
- Mount the injectors with the holders and the bolts (M5x30) (1) on the rail.
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.
- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) evenly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.

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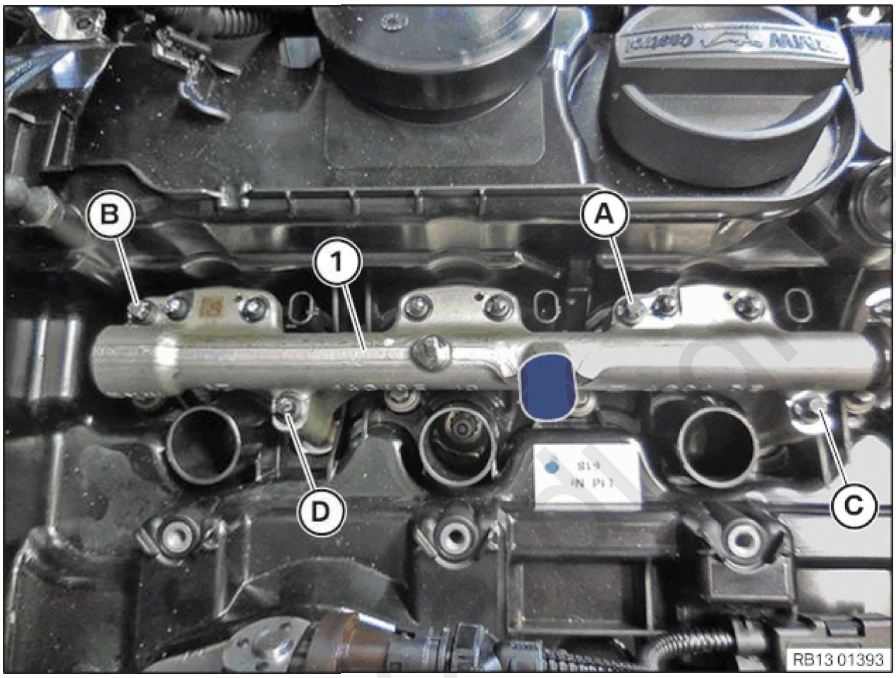


- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.



- Check injectors for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors must move freely.



- Renew screws (A) to (D).

  Parts: Bolts
- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- Press the rail (1) down until a resistance can be felt; join and hand-tighten the bolts (M6x30) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.

  The figure shows the rail resting flat against the cylinder head.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

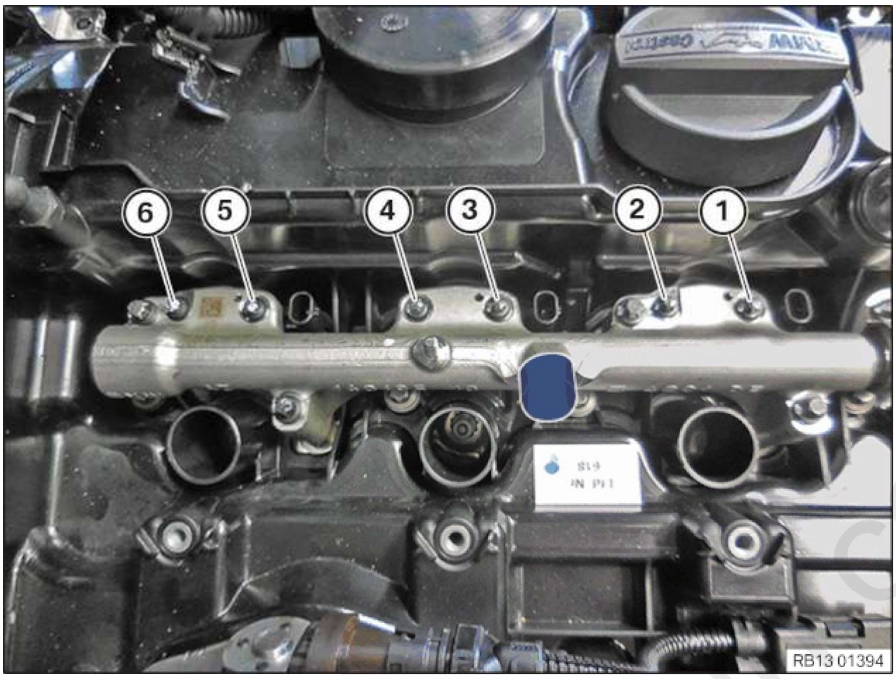
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.



- Make sure that the rail (1) rests flat against the cylinder head.



- Attach a socket to an extension.

  Do not use a reversible ratchet or torque wrench.
- Tighten the bolts (M5x30) in pairs ((1) with (2), (3) with (4), (5) with (6)) in alternating order **90° hand-tight**.
- Set the torque wrench to 5 Nm.

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

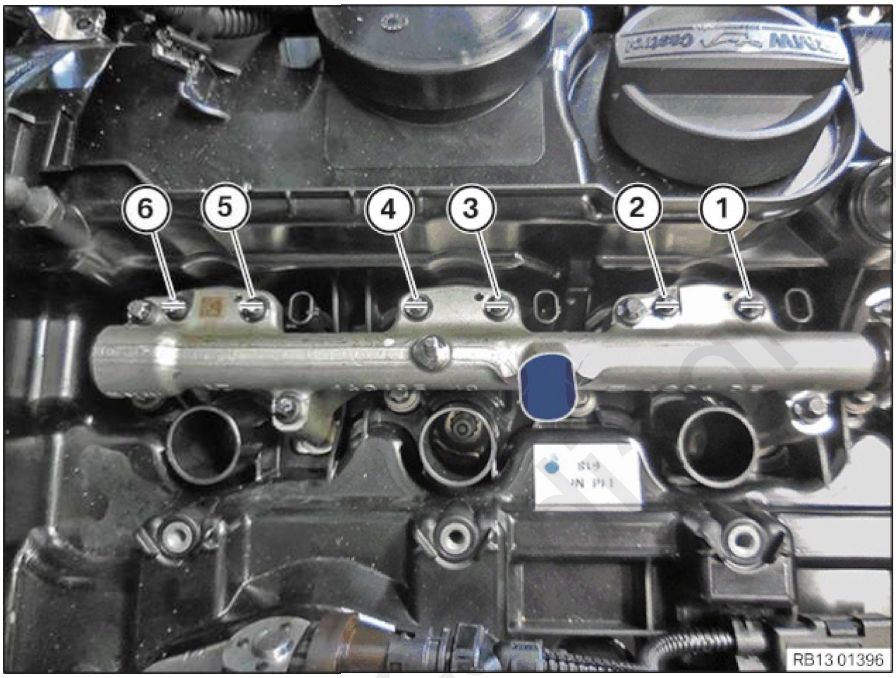
Non-observance of these requirements may result in leaks and damage.

- **Screw the (M5x30) bolts according to the following plan:**
  - **Fuel injector 4:**
  - Tighten screw (1) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (2) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 5:**
  - Tighten screw (3) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (4) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 6**:
  - Tighten screw (5) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (6) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts reach a torque of 5 Nm.

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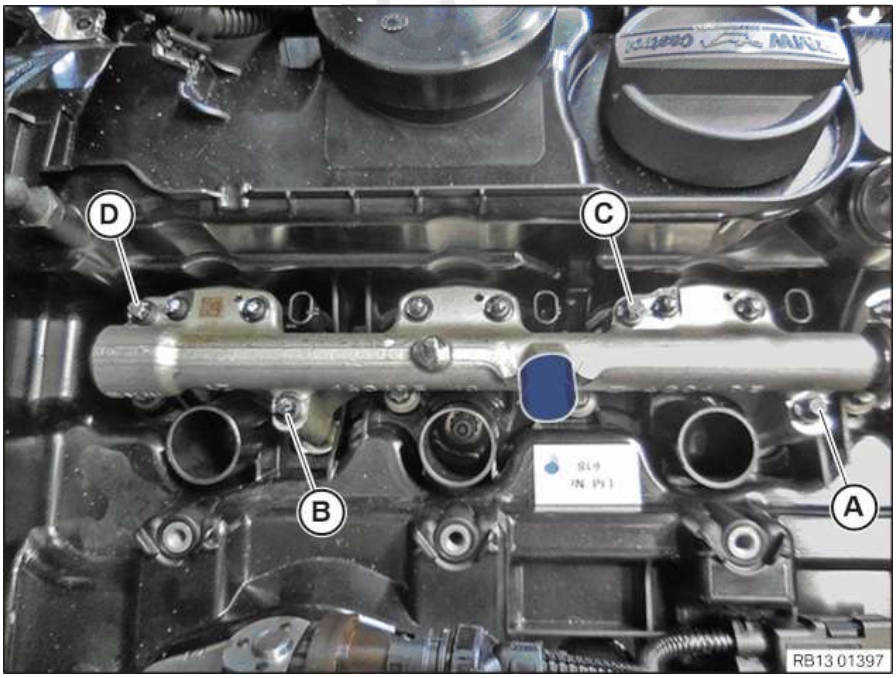


- Mark all bolts (1) to (6) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the screw (1) with an angle of rotation of 90° ±15°.
  - Tighten the screw (2) with an angle of rotation of 90° ±15°.
  - Tighten the screw (3) with an angle of rotation of 90° ±15°.
  - Tighten the screw (4) with an angle of rotation of 90° ±15°.
  - Tighten the screw (5) with an angle of rotation of 90° ±15°.
  - Tighten the screw (6) with an angle of rotation of 90° ±15°.



- Check if all bolts (1) to (6) have been tightened with a 90° ±15° angle of rotation.

  All marks (lines) must be horizontal (see figure).



- Unscrew the bolts (M6x70) (A) to (D).

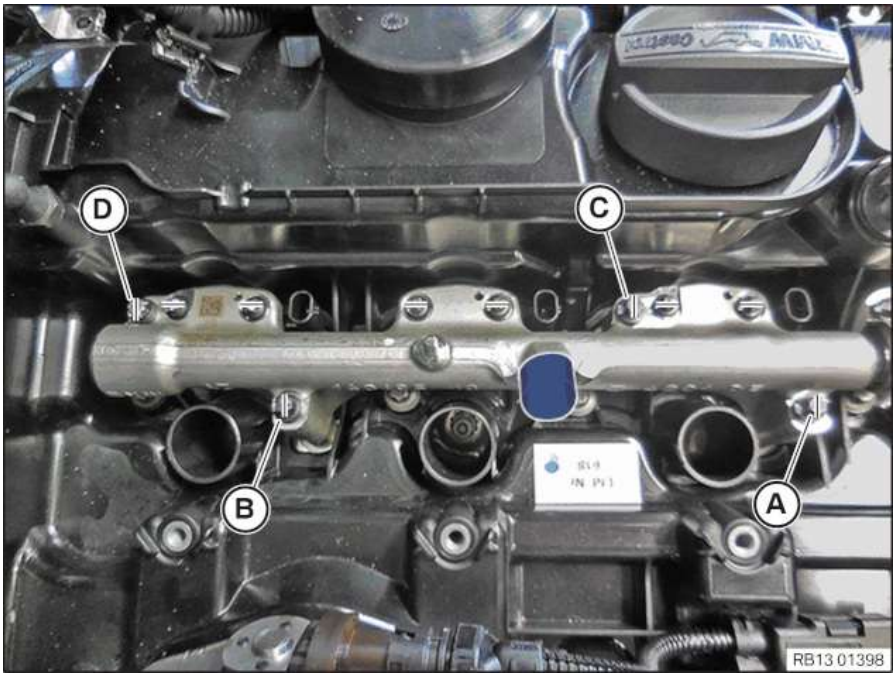
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

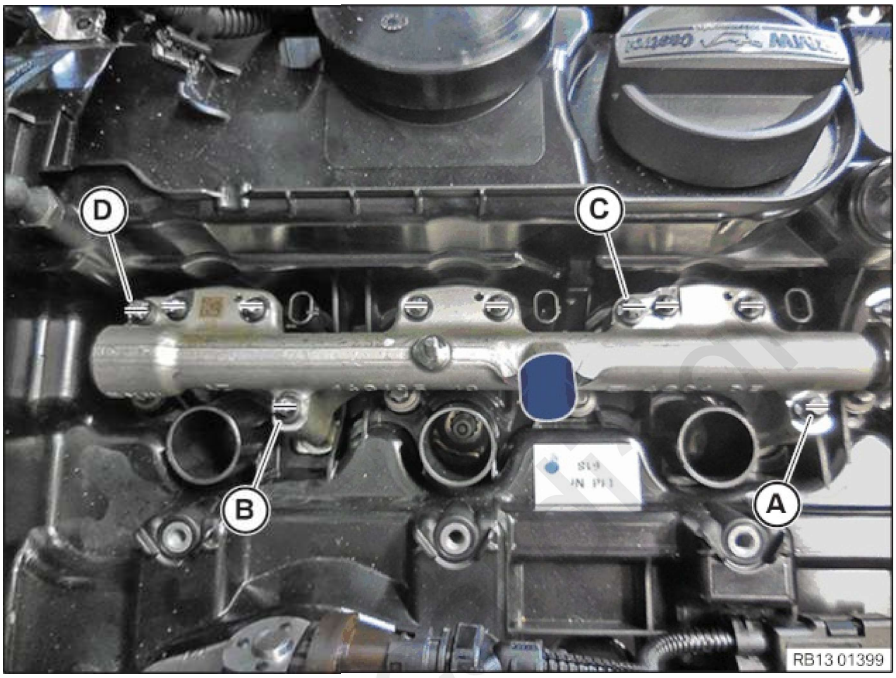
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.

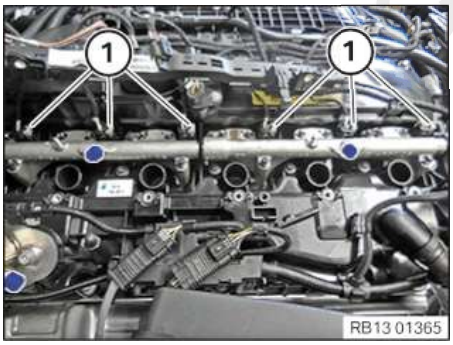


- Mark all bolts (A) to (D) with a vertical line (see figure).
- Tighten bolts (M6x70) (A) to (D) to a 90° angle of rotation.



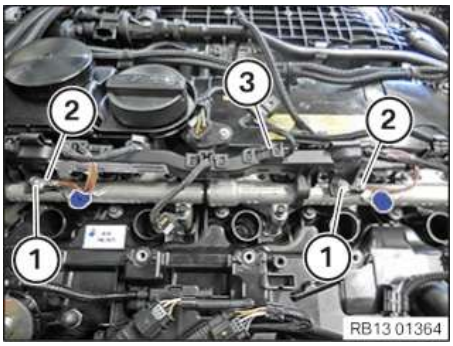
- Check if all bolts (A) to (D) have been tightened with a 90° angle of rotation.

  All marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nuts (1).

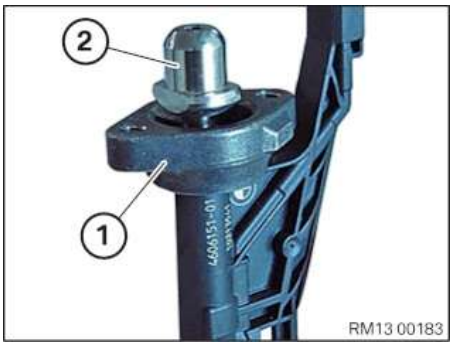
Ground cable to rail

M6			5 Nm

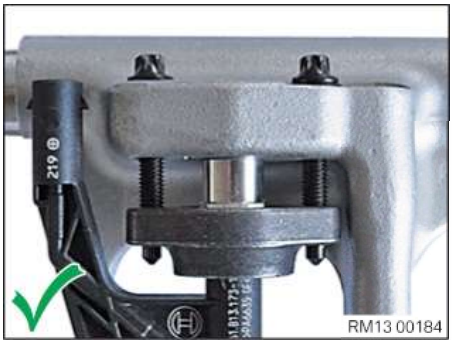
37 – Installing rail with injectors of cylinders 1 to 3

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.

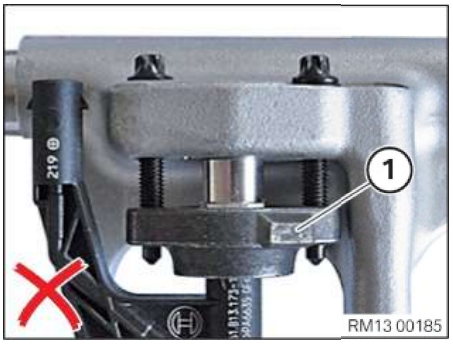


- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If there is a cast lug on the holder** (1) **:** Make sure that the holder is installed in the correct position.



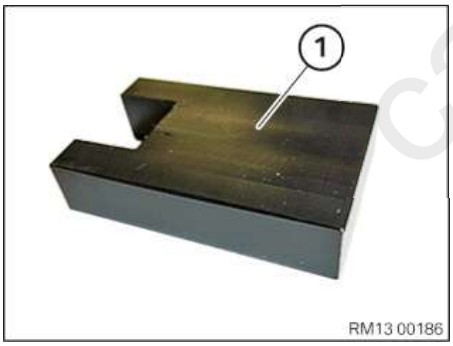
- Observe position of cast lug:

  The holder is mounted **correctly** when the cast lug is located at the rear.



- Observe position of cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.



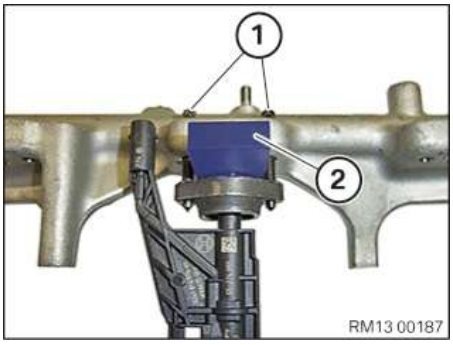
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use special tool 2 358 022(1) .



- Replace (M5x30) screws.

  Parts: Screws (M5x30)
- Mount the injectors with the holders and the bolts (M5x30) (1) on the rail.
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.
- Slide special tool 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure the special tool 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) uniformly until the special tool 2 358 022 (2) rests flat against the rail and the holder.

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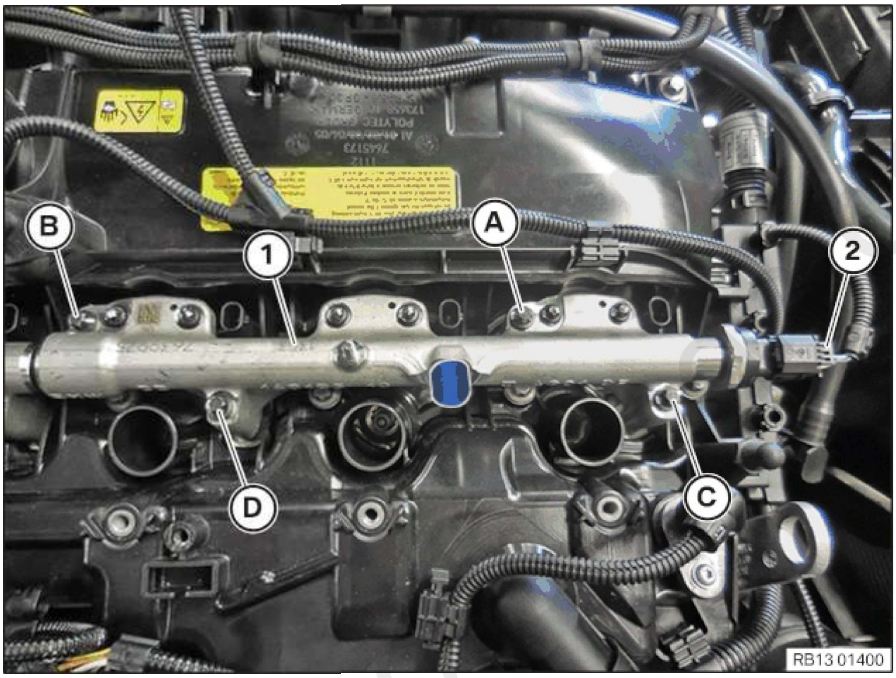


- Remove special tool 2 358 022(1) .
- Repeat this operation for all injectors.



- Check injectors for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors must move freely.



- Renew screws (A) to (D).

  Parts: Bolts
- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- Press rail (1) down until a resistance can be felt; join and hand-tighten screws (M6x30) (A) and (B).
- Tighten screws (A) and (B) alternately by **180°** each with the torque wrench until the rail is positioned on the cylinder head.

  The figure shows the rail resting flat against the cylinder head.
- Insert screws (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

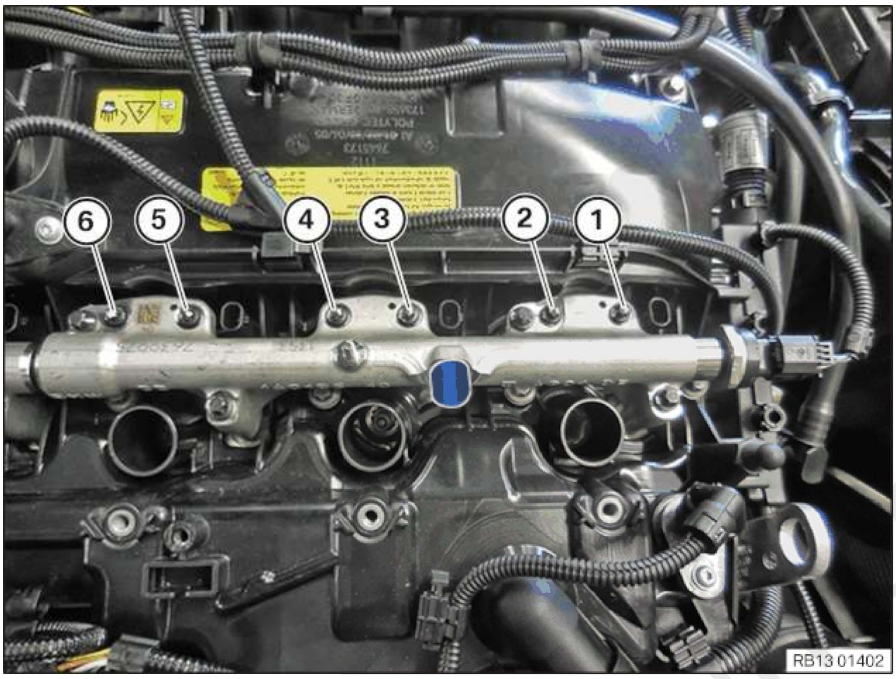
Non-observance of these requirements may result in leaks and damage.

- Tighten screw (A) to 5 Nm.
- Tighten screw (D) to 5 Nm.
- Tighten screw (B) to 5 Nm.
- Tighten screw (C) to 5 Nm.
- Connect and lock the connector (2).

  The connector (2) must engage audibly.



- Make sure that the rail (1) rests flat against the cylinder head.



- Attach a socket to an extension.

  Do not use a reversible ratchet or torque wrench.
- Hand-tighten screws (M5x30) in pairs ((1) with (2), (3) with (4), (5) with (6)) alternately by **90°**.
- Set torque wrench to 5 Nm.

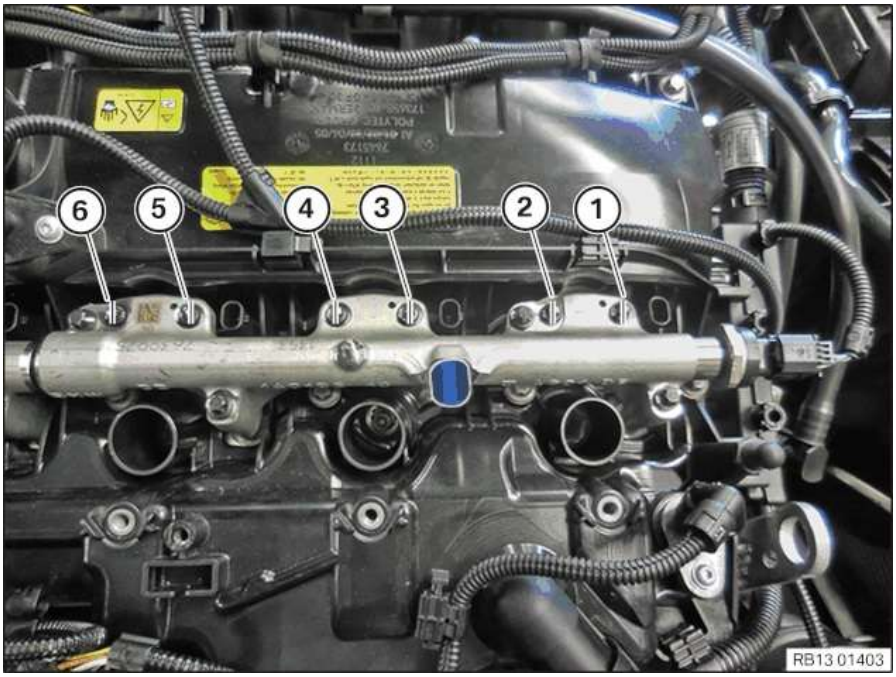
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

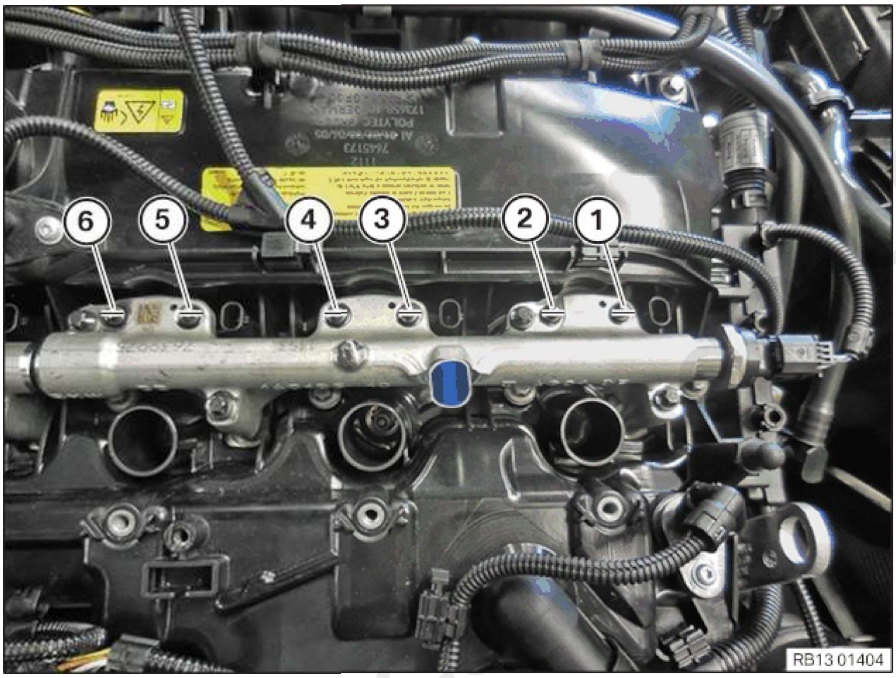
Non-observance of these requirements may result in leaks and damage.

- **Screw the (M5x30) bolts according to the following plan:**
  - **Fuel injector 1:**
  - Tighten screw (1) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (2) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten screw (3) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (4) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 3**:
  - Tighten screw (5) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (6) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts reach a torque of 5 Nm.

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- Mark all bolts (1) to (6) with a line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the screw (1) with an angle of rotation of 90° ±15°.
  - Tighten the screw (2) with an angle of rotation of 90° ±15°.
  - Tighten the screw (3) with an angle of rotation of 90° ±15°.
  - Tighten the screw (4) with an angle of rotation of 90° ±15°.
  - Tighten the screw (5) with an angle of rotation of 90° ±15°.
  - Tighten the screw (6) with an angle of rotation of 90° ±15°.



- Check if all bolts (1) to (6) have been tightened with a 90° ±15° angle of rotation.

  All markings (lines) must be horizontal (see Figure).



- Release screws (M6x70) (A) to (D) **without fail**.

TECHNICAL INFORMATION

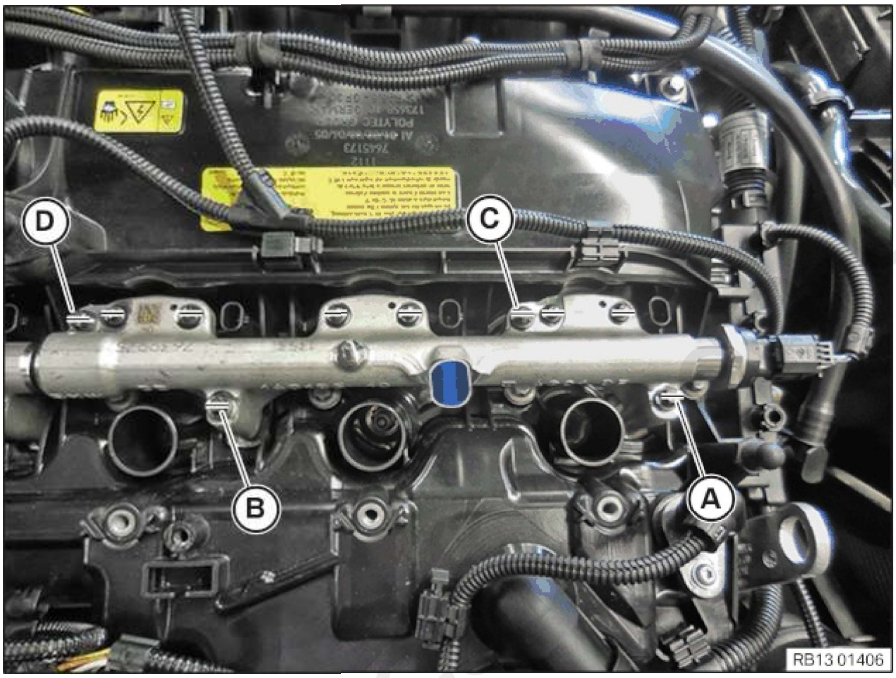
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten screw (A) to 5 Nm.
- Tighten screw (D) to 5 Nm.
- Tighten screw (B) to 5 Nm.
- Tighten screw (C) to 5 Nm.

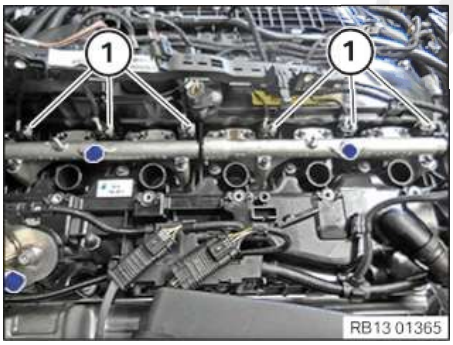


- Mark all the bolts (A) to (D) with a vertical line (see Figure).
- Tighten bolts (M6x70) (A) to (D) with an angle of rotation of 90°.



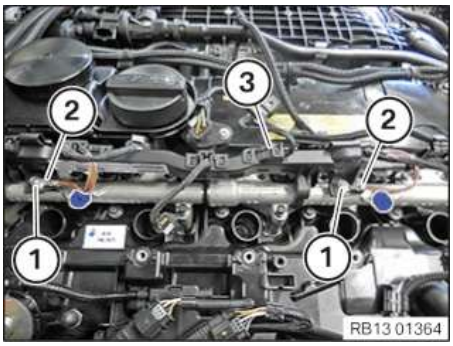
- Check whether all screws (A) to (D) have been tightened with an angle of rotation of 90°.

  All marks (lines) must be horizontal (see figure).



- Connect and lock all the connectors (1) to the injectors.

  All connectors (1) must engage audibly.

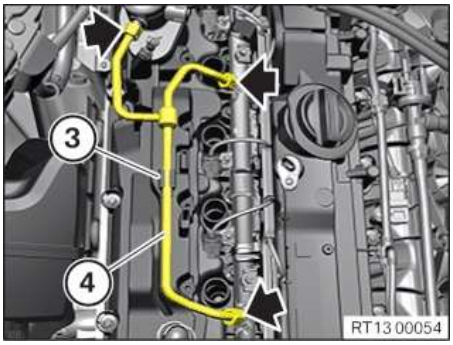


- Thread the cable channel (3) in and install.
- Thread in ground cable (2) and install.
- Tighten nuts (1).

Ground cable to rail

M6			5 Nm

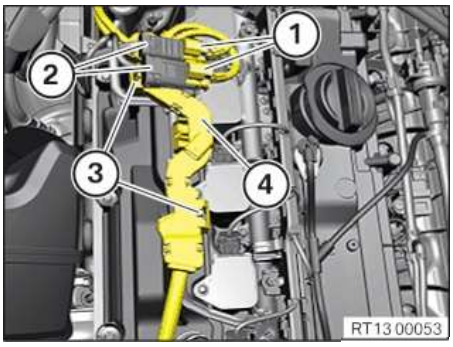
38 – Installing high pressure line between rail and high pressure pump



- Insert the high pressure line (4) into the holder (3) and install.
- Tighten union nuts (arrows) with the special tool .

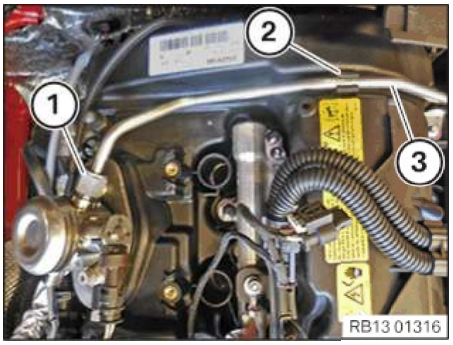
High pressure line between rail and high pressure pump

M14x1,5		Tightening torque	33 Nm



- Insert and install the wiring harness section of the engine wiring harness (4).
  The locks (3) must engage audibly.
- Connect connectors (1) and (2) and lock.
  The connectors (1) and (2) must audibly engage.

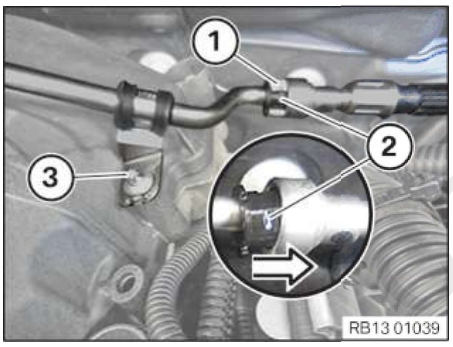
39 – Installing fuel delivery line



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

Fuel delivery line to high pressure pump

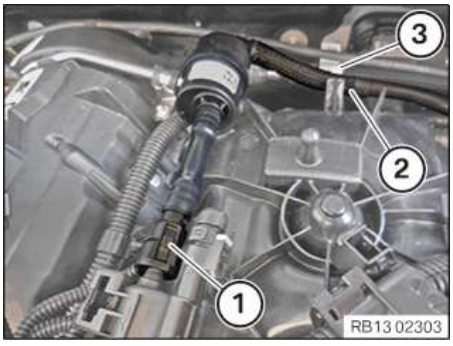
M14		Tightening torque	31 Nm



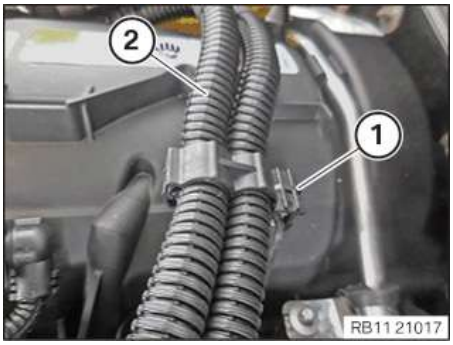
- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure clamps (1).
- Tighten down screw (3).

Fuel line to cylinder head cover

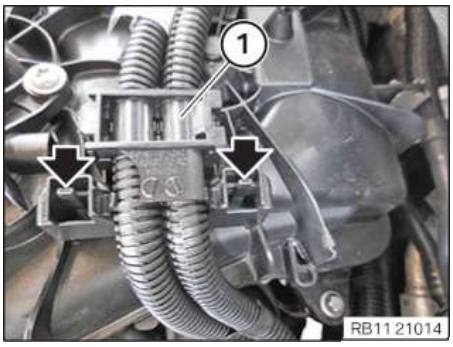
6x18		Tightening torque	6,5 Nm



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



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

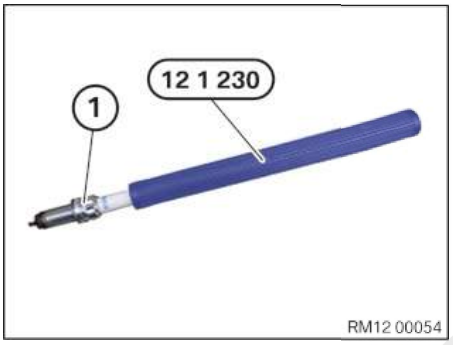


- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

40 – Installing all spark plugs

NOTICE

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



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



TECHNICAL INFORMATION

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

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



TECHNICAL INFORMATION

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

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

Spark plugs

M12x1.25		Tightening torque	23 Nm

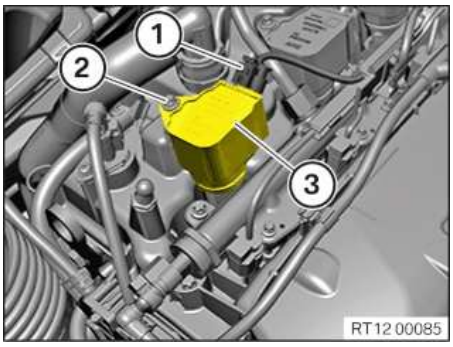
41 – Install all ignition coils

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NOTICE

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

▶ **Install ignition coil.**



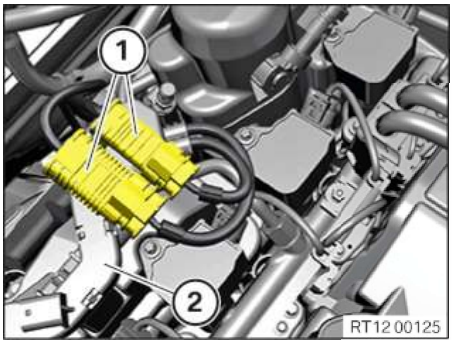
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

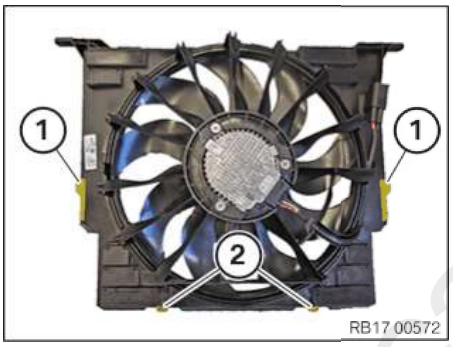
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

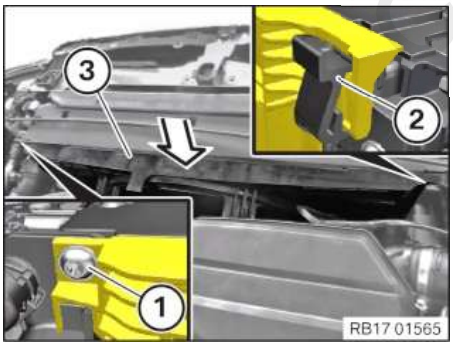


- Connect the connector (1) of the front oxygen sensor and the monitoring oxygen sensor on the cable shaft (2).

42 – Install fan cowl



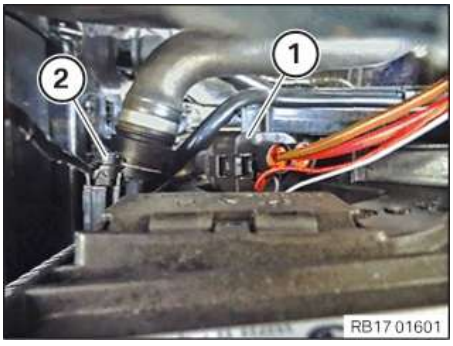
- Feed guides (1) into the radiator.
- Feed guides (2) into the charge air cooler.



- Guide in and install fan cowl (3) **carefully** in the direction of the arrow.
- Ensure that the lock (2)engages audibly.
- Tighten down screw (1).

Fan cowl with electric fan on radiator

TS6x20		Tightening torque	6,5 Nm

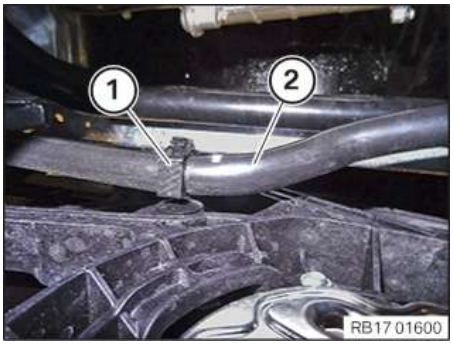


- Connect connectors (2) and lock.

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

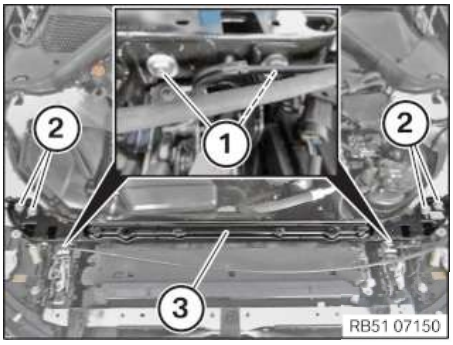
  The connector (1) must engage audibly.

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- **If installed:** Secure the transmission oil line (2).
  Insert and install the transmission oil line (2).
  Lock holder (1).

43 – Install the rear top cross connection



- Guide in and position the top rear cross connection (3).
- Tighten the screws (1).

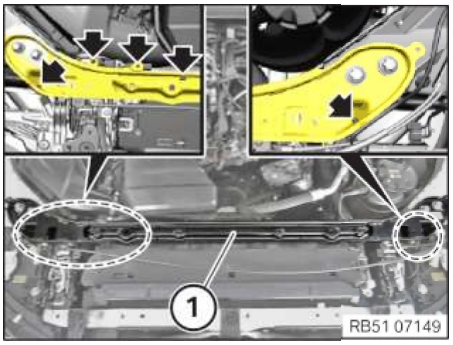
Top rear cross connection to bonnet catch support

Flat-head screw M6x20		Tightening torque	11,8 Nm

- Renew screws (2).
  Parts: Bolts
- Tighten the screws (2).

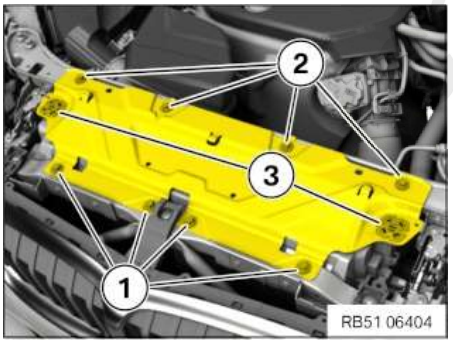
Rear top cross connection to wheel arch carrier support

M10x20 screw	Renew screw.	Jointing torque	56 Nm
		Angle of rotation	90 °



- Secure the clips (arrows) in the marked areas to the top rear cross connection (1).

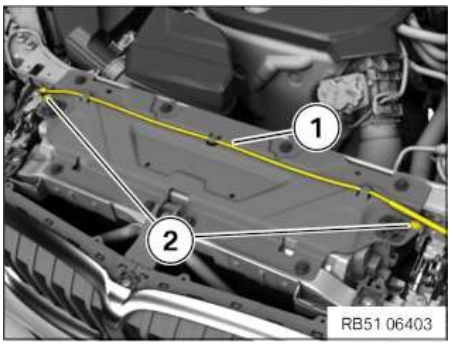
44 – Installing the top cross connection



- Set and position upper cross connection with holders (3) from above.
- Tighten down screws (1) and (2).

Cross connection, top

M8x20		Tightening torque	28 Nm



- Tighten down screws (2).

Cross connection, top

M6x20		Tightening torque	11,8 Nm

- Attach Bowden cable (1) on the upper cross connection.

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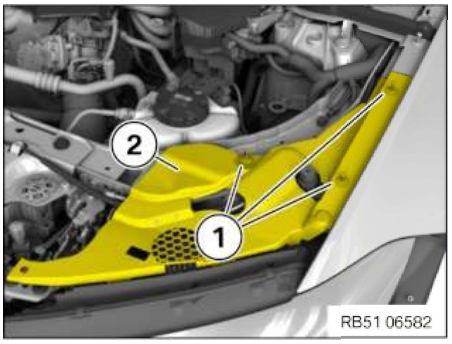
- Clip in the housing for the coupling of the Bowden cables (1).

45 – Install the cover in the engine compartment at top left and right partially

NOTICE

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

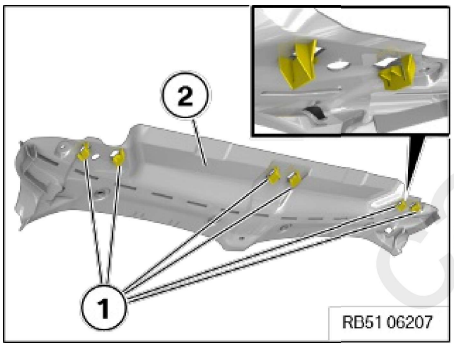
▶ Installing the cover in the engine compartment on top partially



- Install the cover in the engine compartment on top (2).
- Secure expanding rivet (1).

46 – Installing cover for engine compartment centre

Check



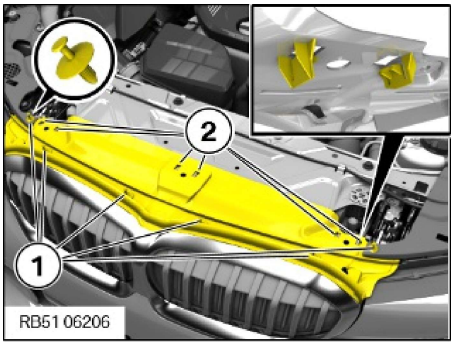
- Check latch mechanisms (1) of cover for engine compartment centre (2) for damage.

Result

» The latch mechanism (1) is damaged.

Measure

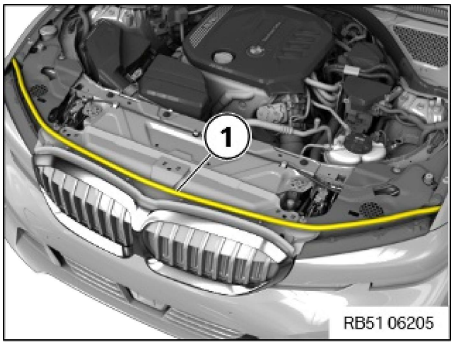
- Renew cover for engine compartment centre (2).



- Guide in the cover for the engine compartment centre from the rear and position it.
- Clip in the cover for the engine compartment centre with latch mechanisms (2).
- Mount all expanding rivets (1).

47 – Install the seal for the front bonnet

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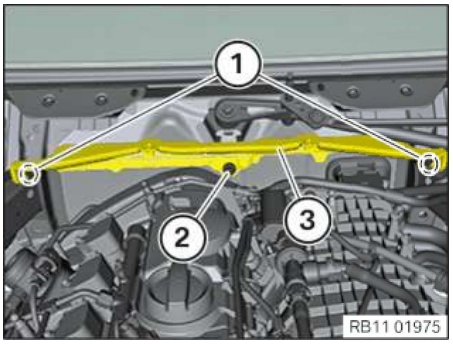
- Position the bonnet seal(1) and connect it on the mounting on the bumper and on the headlights.

48 – Disconnecting all battery earth leads



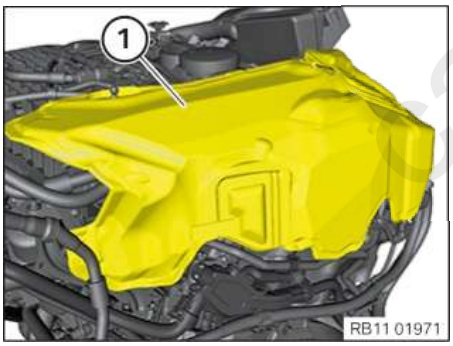
- See additional information.

49 – Installing centre bulkhead lower section



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

50 – Installing acoustic cover at rear



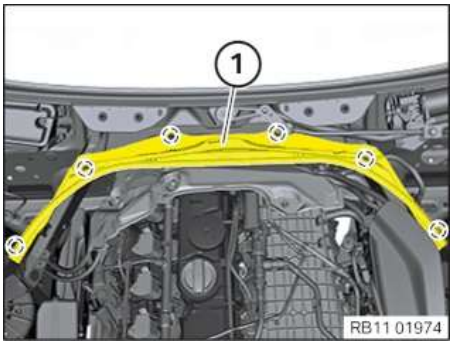
- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



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

51 – Installing the centre bulkhead upper part

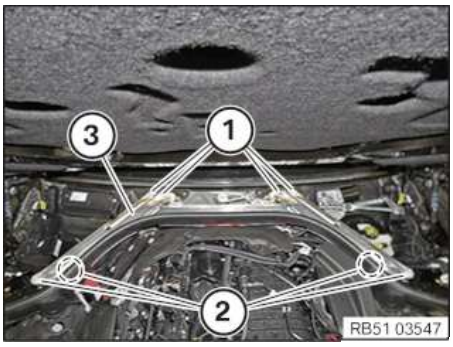
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- Position the centre bulkhead upper part (1).
- Tighten the bolts in the marked areas.

Bulkhead upper part to bottom bulkhead

		Tightening torque	3 Nm



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

Tension strut on bulkhead

M10x25 screw		Tightening torque	56 Nm

- Renew screws (2).

  Parts: Bolts
- Tighten the screws (2).

Tension strut to spring strut dome

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

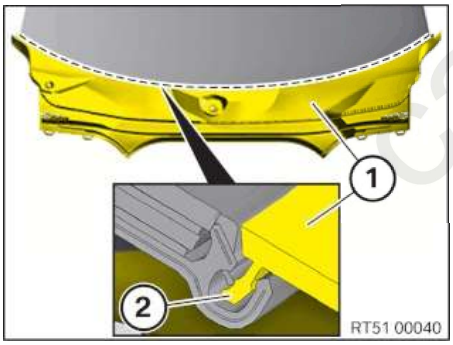
52 – Installing cowl panel cover

RISK OF DAMAGE

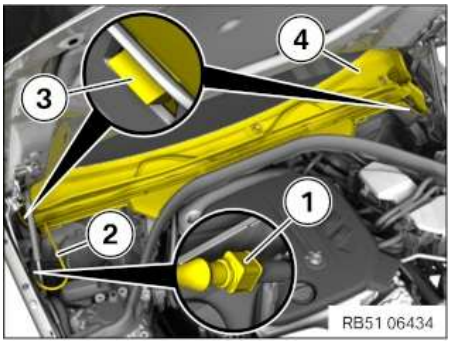
Damage caused by water ingress into the vehicle.

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

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



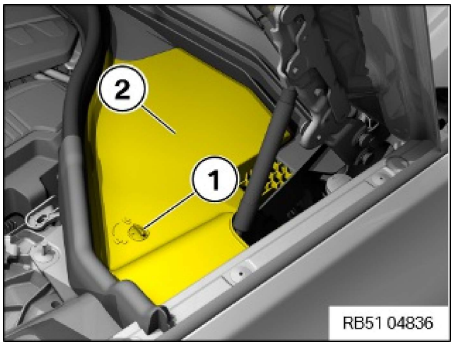
- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



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

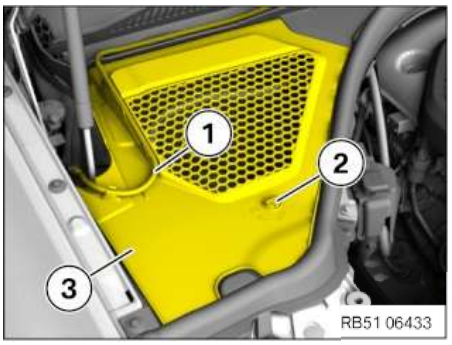
53 – Install the cover of the engine compartment on the rear left

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

54 – Install the rear right engine compartment cover



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

55 – Installing both wiper arms

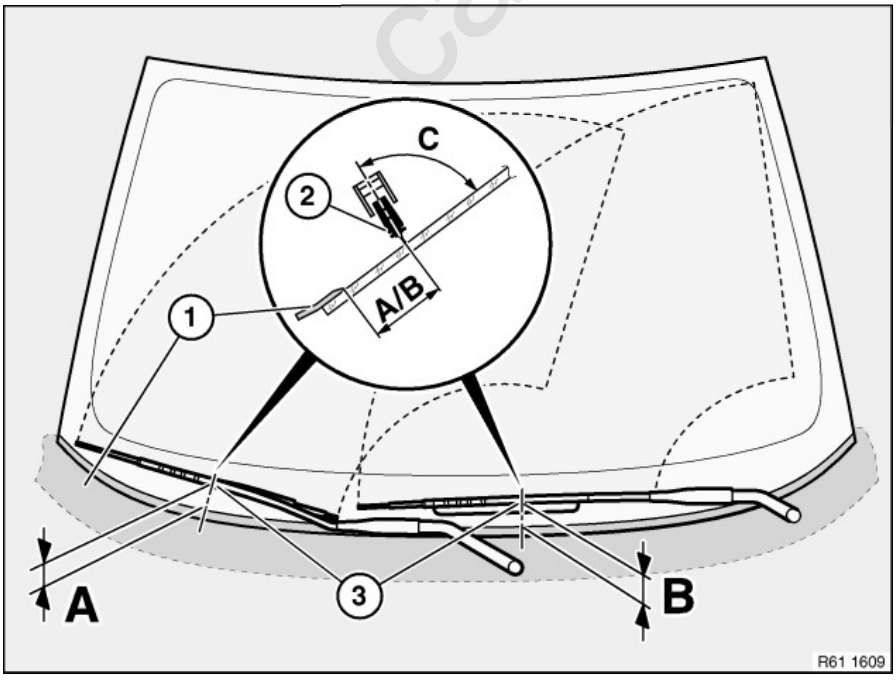
NOTICE

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

▸ **Install the wiper arm**

TECHNICAL INFORMATION

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

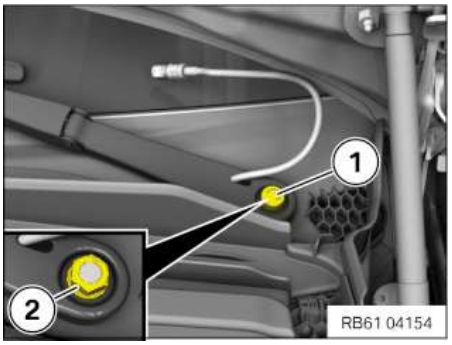


- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

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

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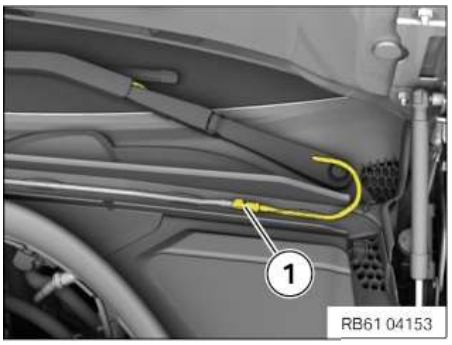


- Tighten nut (2).

Windscreen wiper arm

Combination hexagon nut		Tightening torque	35 Nm

- Connect the protective cap (1).



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

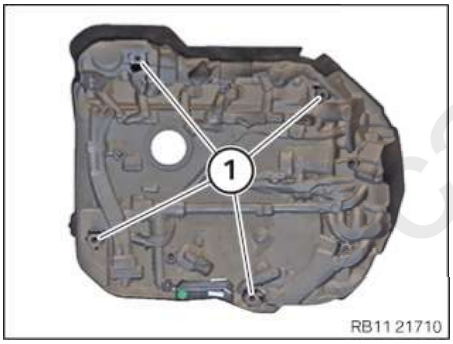
56 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

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

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



- Check the rubber mount (1) for correct fit in the acoustic cover.



- Install acoustic cover (1) and fix in the rubber mounts (marks).

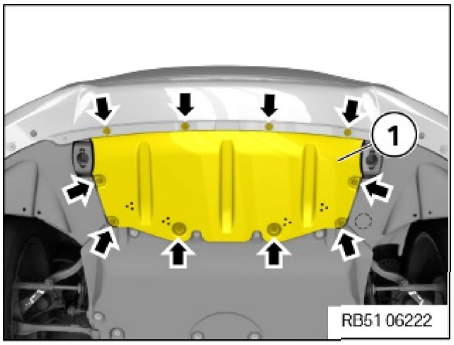
57 – Install the seal for the bonnet

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

58 – Installing the front underbody protection



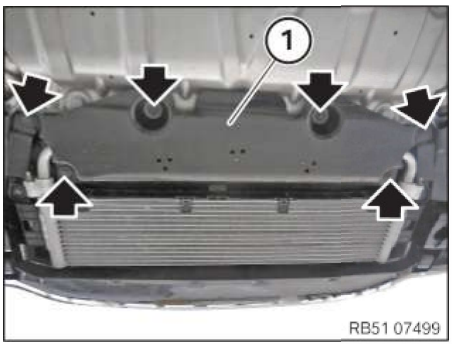
- **Version 1:**

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

  Tighten screws (arrows).

Underbody protection front

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



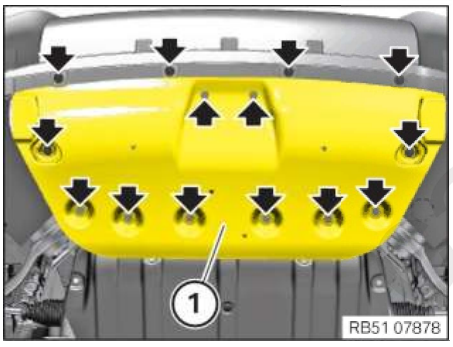
- **Version 2:**

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

  Tighten screws (arrows).

Underbody protection front

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



- **Version 3:**

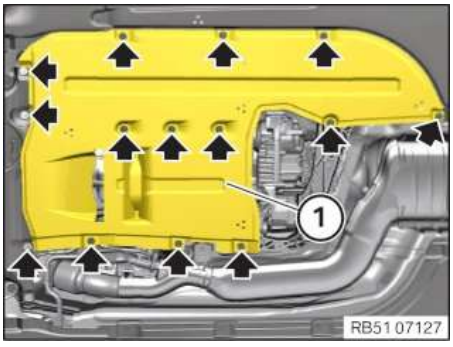
  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

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

59 – Installing underbody protection at rear



- **Version 1:**

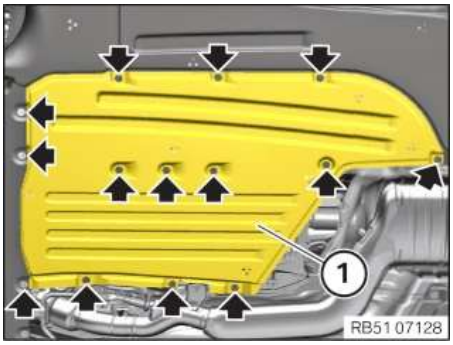
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

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- **Version 2:**

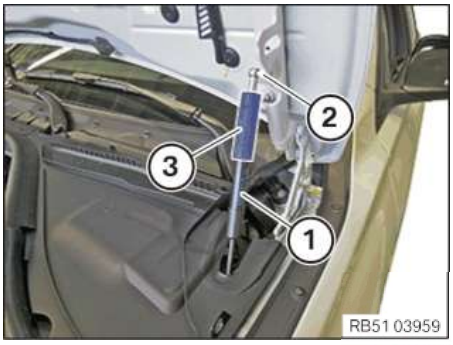
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

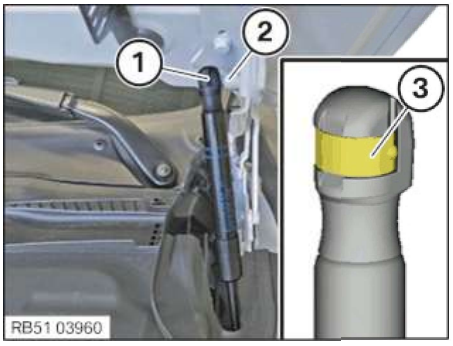
Underbody protection

Hexagon screw		Tightening torque	3 Nm

60 – Take bonnet out of the service position



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



CAUTION

Shutting bonnet or tailgate.

Danger of injury!

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

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

Additional Information

Overview of Tightening Torques

Basic carrier to cylinder head — Used in step 30

M6		Tightening torque	8 Nm

Test gauge to basic carrier — Used in step 30

M6		Tightening torque	8 Nm

Engine oil cooler to bumper support — Used in step 31

M6X25		Tightening torque	8 Nm

Cover, front bottom on side — Used in step 31

Hexagon screw for thermoplastic		Tightening torque	3 Nm

Cylinder head cover to cylinder head — Used in step 32

M6X30		Jointing torque	8 Nm

Cylinder head cover to cylinder head — Used in step 32

M6X30		Tightening torque	11 Nm

Auxiliary coolant pump holder to cylinder head — Used in step 32

M6		Tightening torque	7 Nm

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Standard screw connection M6			Used in step 32
M6			8 Nm

Differential pressure sensor to holder			Used in step 32
TS6X18		Tightening torque	3,5 Nm

Holder, positive battery cable to cylinder head cover			Used in step 32
6X18		Tightening torque	6 Nm

High pressure pump to high pressure pump flange			Used in step 34
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

Ground cable to rail			Used in step 3637
M6			5 Nm

High pressure line between rail and high pressure pump			Used in step 38
M14x1,5		Tightening torque	33 Nm

Fuel delivery line to high pressure pump			Used in step 39
M14		Tightening torque	31 Nm

Fuel line to cylinder head cover			Used in step 39
6x18		Tightening torque	6,5 Nm

Spark plugs			Used in step 40
M12x1.25		Tightening torque	23 Nm

Ignition coil			Used in step 41
Screw		Tightening torque	8 Nm

Fan cowl with electric fan on radiator			Used in step 42
TS6x20		Tightening torque	6,5 Nm

Top rear cross connection to bonnet catch support			Used in step 43
Flat-head screw M6x20		Tightening torque	11,8 Nm

Rear top cross connection to wheel arch carrier support			Used in step 43
M10x20 screw	Renew screw.	Jointing torque	56 Nm
		Angle of rotation	90 °

Cross connection, top			Used in step 44
M8x20		Tightening torque	28 Nm

Cross connection, top			Used in step 44
M6x20		Tightening torque	11,8 Nm

Bulkhead upper part to bottom bulkhead			Used in step 51
		Tightening torque	3 Nm

Tension strut on bulkhead			Used in step 51
M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome			Used in step 51
Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

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Windscreen wiper arm			Used in step 55
Combination hexagon nut		Tightening torque	35 Nm

Underbody protection front			Used in step 58
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Underbody protection			Used in step 59
Hexagon screw		Tightening torque	3 Nm

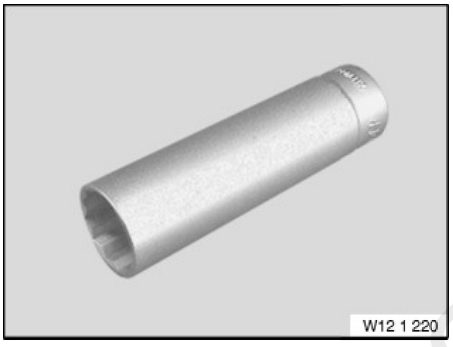
Overview of Special Tools

2 360 895 Pin wrench



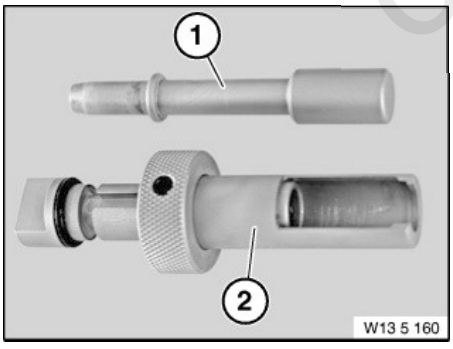
Common	Used in step 1233
Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 495 560 (12 1 220) Socket



Common	Used in step 2040
Usage	For removing and installing the spark plugs (WAF 14 bihexal).
Included in the tool or work	
Storage location	C18
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

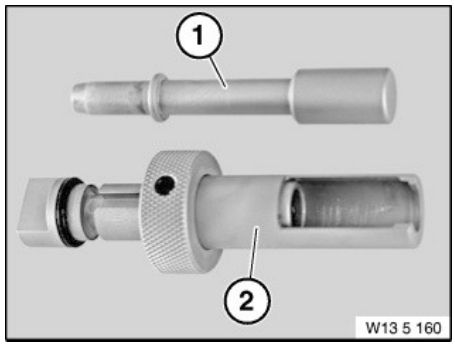
0 496 567 (13 5 161) Fastener



Common	Used in step 22
Usage	(Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

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0 496 568 (13 5 162) Fastener

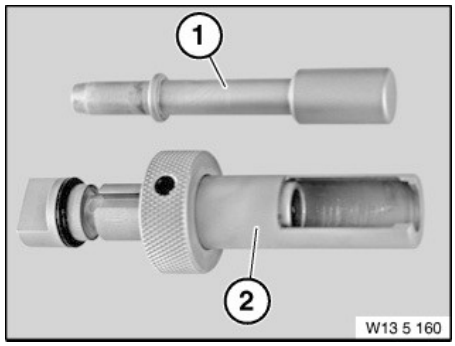


Common Used in step 22

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

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0 496 565 (13 5 160) Fastener



Common Used in step 22

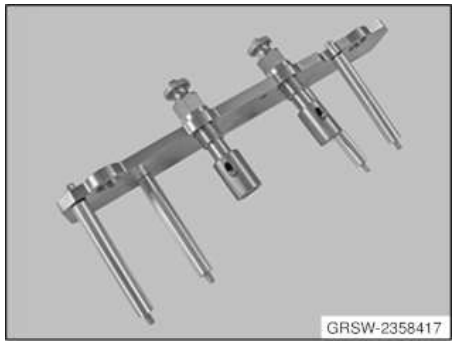
Usage	(Caps (2x)) To close off the fuel lines when removing and installing the engine.
Included in the tool or work	
Storage location	B26
Replaced by	
In connection with	
SI-Number	01 22 08 (498)

Consisting of

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

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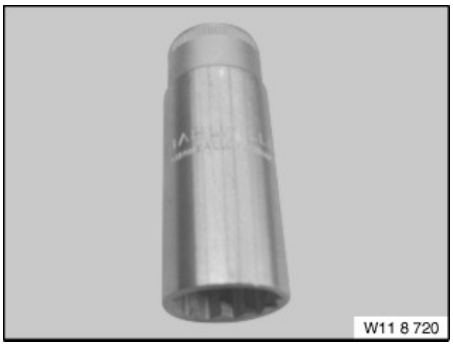
2 358 417 Device



Common Used in step 2425

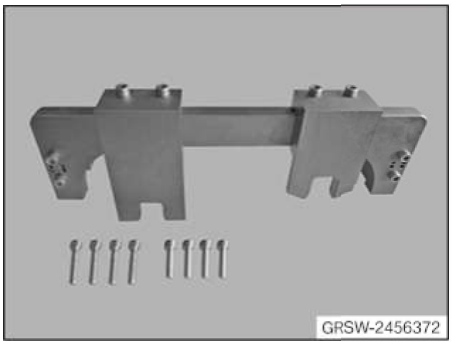
Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 106 (11 8 720) Socket WAF 46



Common	Used in step 2425
Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

2 456 372 Gauge



Common	Used in step 30
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 122 Gauge



Common	Used in step 30
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

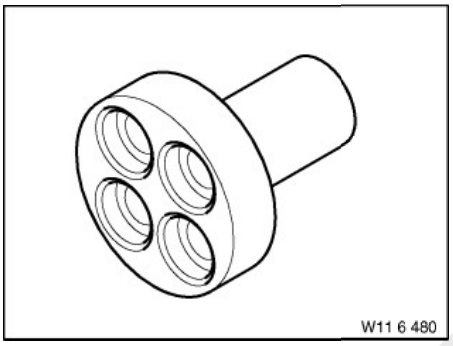
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2 288 380 Locating stud



Common	Used in step 30
Usage	For disconnecting the crankshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 04 14 (071)

0 493 380 (11 6 480) Connector



Common	Used in step 3034
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

2 452 959 Pliers



Common	Used in step 35
Usage	For disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ number 13 0 191). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A5
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

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2 448 401 Fitting aid



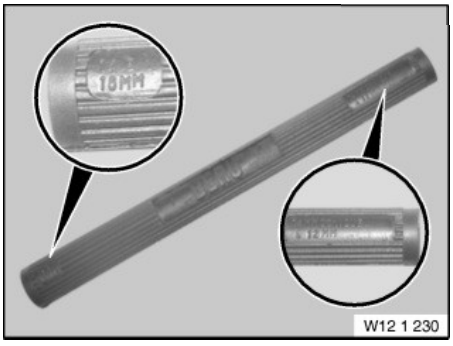
Common	Used in step 35
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 022 Gauge



Common	Used in step 3637
Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 065 (12 1 230) Fitting aid



Common	Used in step 40
Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

Overview Technical Data

Distance from window pane edge to wiper blade	Used in step 55
Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

Links

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Repair instructions	Used in step
61 20 900 Disconnecting and connecting battery earth lead	148
61 20 900 Disconnecting and connecting battery earth lead	148
61 20 900 Disconnecting and connecting battery earth lead	148
61 20 900 Disconnecting and connecting battery earth lead	148
61 20 900 Disconnecting and connecting battery earth lead	148
61 20 900 Disconnecting and connecting battery earth lead	148
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	148
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	148
61 20 900 Disconnecting and connecting battery earth lead	148
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	148
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	148
61 20 900 Disconnecting and connecting battery earth lead	148
61 20 900 Disconnecting and connecting battery earth lead	148
61 20 900 Disconnecting and connecting battery earth lead	148
61 20 900 Disconnecting and connecting battery earth lead	148
61 20 900 Disconnecting and connecting battery earth lead	148
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61 20 900 Disconnecting and connecting battery earth lead	148
61 20 900 Disconnecting and connecting battery earth lead	148
61 20 900 Disconnecting and connecting battery earth lead	148
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	148
61 20 900 Disconnecting and connecting battery earth lead	148
61 20 900 Disconnecting and connecting battery earth lead	148
61 20 900 Disconnecting and connecting battery earth lead	148
61 20 900 Disconnecting and connecting battery earth lead	148
61 20 900 Disconnecting and connecting battery earth lead	148
61 20 900 Disconnecting and connecting battery earth lead	148
61 20 900 Disconnecting and connecting battery earth lead	148
61 35 ... Notes on ESD protection (Electro Static Discharge)	12
61 35 ... Notes on ESD protection (Electro Static Discharge)	1219
13 53 ... Clean the cylinder heads in the area of injectors to prevent sand/dust contamination.	2425
17 11 035 Removing and installing/replacing fan cowl with electric fan	34

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11 31 090 Remove and install/replace chain tensioner piston

WARNING

Hot surfaces.

Risk of burning!

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

TECHNICAL INFORMATION

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

PRELIMINARY WORK

1 – Removing intake silencer housing

RISK OF DAMAGE

Damage to the clean air line. Damage to the air filter.

For changing the air filter insert, if the upper section of intake filter housing is only raised and not completely removed, the clean air line and the air filter insert may be damaged.

- Do not lift upper section of intake filter housing by force.
- Unfasten clamp.
- Remove upper section of intake filter housing completely.



- Unlock plug connection (1) and disconnect.
- Unfasten clamp (2).
- Pull out and remove the intake silencer housing (3) from the rubber mounts towards the top.

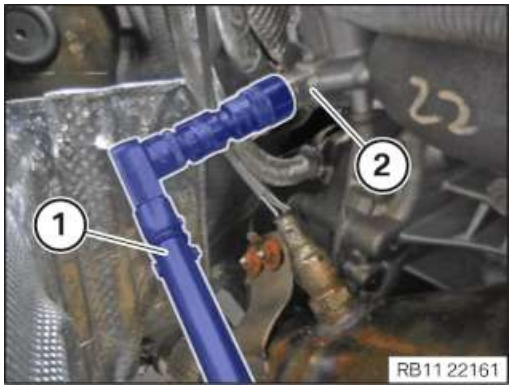
MAIN WORK

2 – Removing chain tensioner

TECHNICAL INFORMATION

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

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- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).



- Feed out and remove the chain tensioner (1).

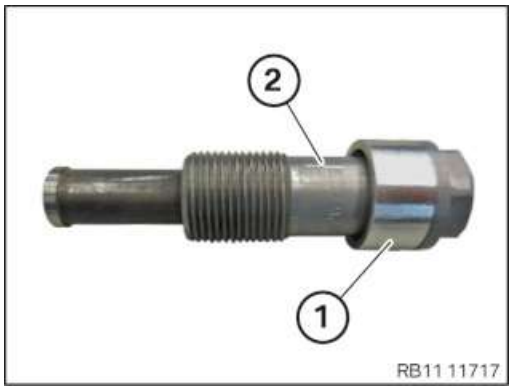
3 – Install chain tensioner

TECHNICAL INFORMATION

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



- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.



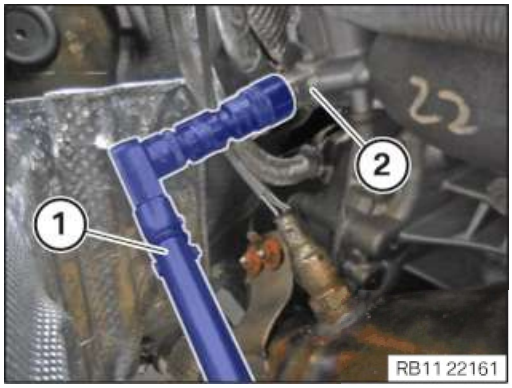
- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.

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- Insert and install the chain tensioner (1).



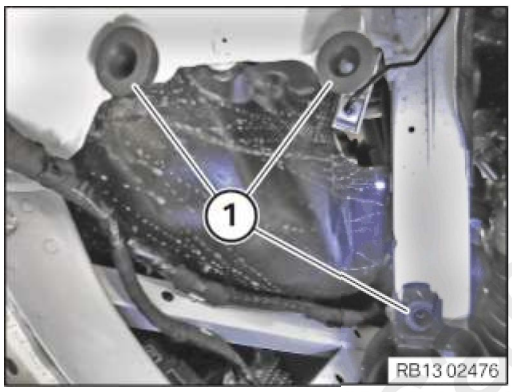
- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

POSTPROCESSES

4 – Installing intake silencer housing



- Check the rubber mount (1) for correct fit.



- Feed the intake filter housing (3) in and engage it in the rubber mounts.
- Tighten clamp (2).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

Additional Information

Overview of Tightening Torques

Chain tensioner to cylinder head Used in step 3

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

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Clean air pipe to upper section of intake filter housing Used in step 4

Clamp		Tightening torque	3 Nm

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11 31 028 Removing and installing / replacing exhaust camshaft

WARNING

Hot surfaces.

Risk of burning!

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

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

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

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

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

CAUTION

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

Danger of injury!

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

RISK OF DAMAGE

Damage to battery terminal, the safety battery terminal or the intelligent battery sensor (IBS).

Damaged battery terminals can lead to malfunctions or vehicle electrical system faults.

- Pull off battery terminal from battery pole by carefully moving to and fro. Do not pry off using a tool.

TECHNICAL INFORMATION

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

PRELIMINARY WORK

1 – Disconnecting all battery earth leads

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- See additional information.

2 – Bring front compartment lid in the service position

Prerequisite

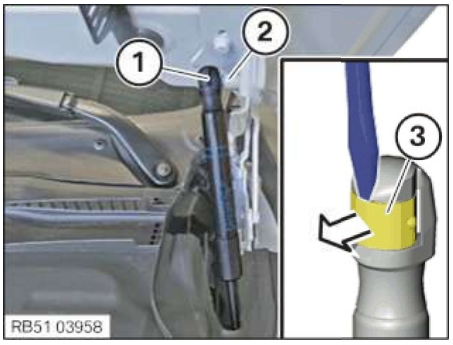
Engine compartment lid is open.

CAUTION

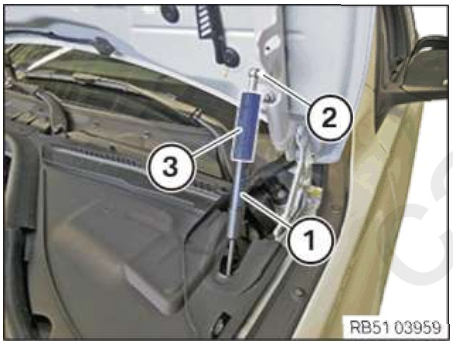
Shutting bonnet or tailgate.

Danger of injury!

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



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



TECHNICAL INFORMATION

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

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

3 – Remove the seal for the rear bonnet



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

4 – Removing the acoustic cover

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WARNING

Hot surfaces.

Risk of burning!

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

RISK OF DAMAGE

Damage to the acoustic cover.

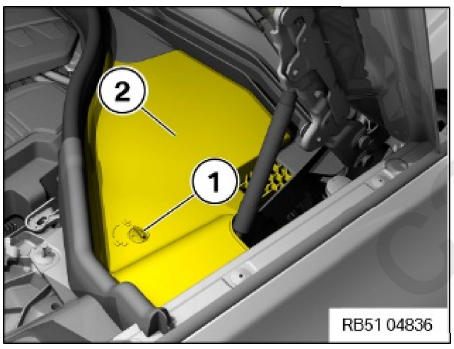
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

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



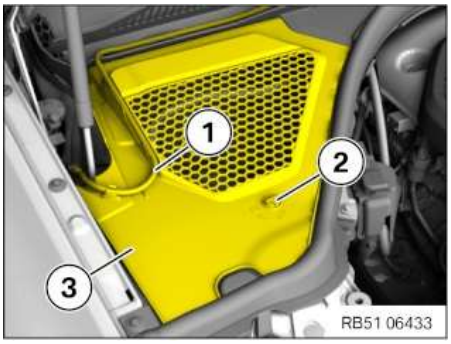
- Release the acoustic cover (1) towards the top from the rubber mounts (marks).

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



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

6 – Remove the cover of the rear right engine compartment



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

7 – Removing both wiper arms

NOTICE

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

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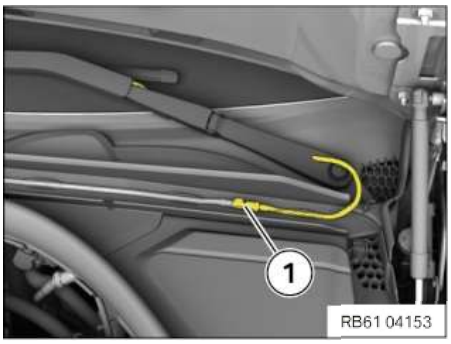
▸ **Remove the wiper arm**

RISK OF DAMAGE

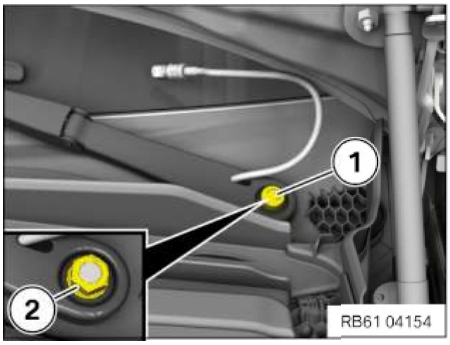
Damage to wiper console

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

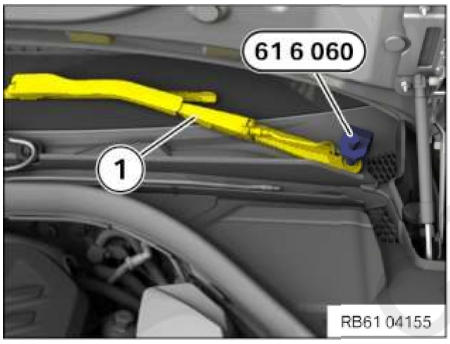
- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.



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

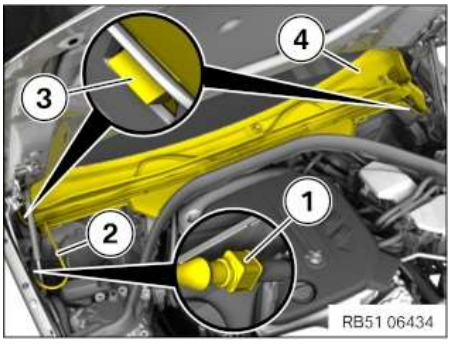


- Remove the protective cap (1).
- Loosen nut (2).



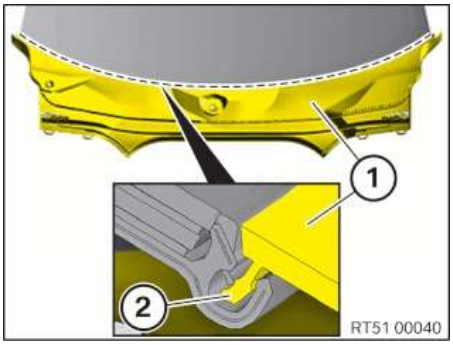
- Pull off the wiper arm (1) using special tool .

8 – Remove cowl panel cover



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

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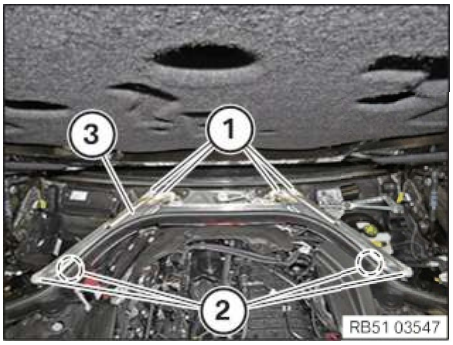


- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

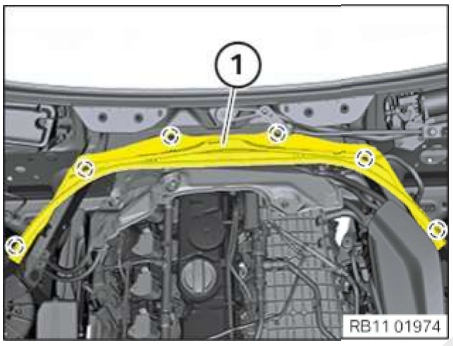
9 – Removing the centre bulkhead upper part

TECHNICAL INFORMATION

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



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



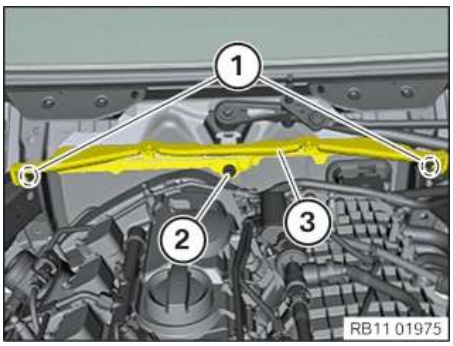
- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

10 – Removing acoustic cover at rear



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

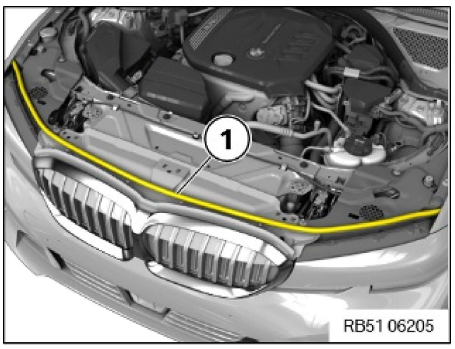
11 – Removing the centre bulkhead lower section



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

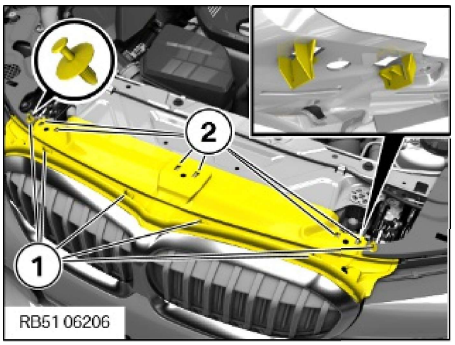
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12 – Remove the seal for the bonnet in front



- Pull off front bonnet seal (1) upwards.

13 – Removing the centre engine compartment cover



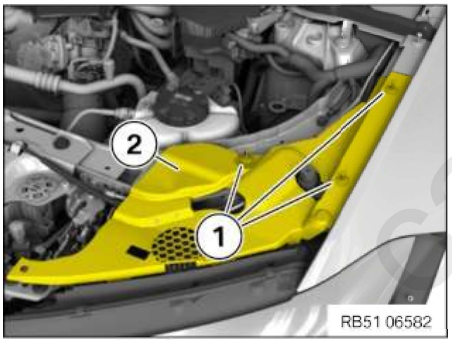
- Detach all expanding rivets (1).
- Release the cover of the centre engine compartment with the latch mechanisms (2) .
- Feed the cover for the centre engine compartment out to the rear.

14 – Partially remove the top left and right cover in the engine compartment

NOTICE

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

▶ **Removing the cover in the engine compartment on top partially**



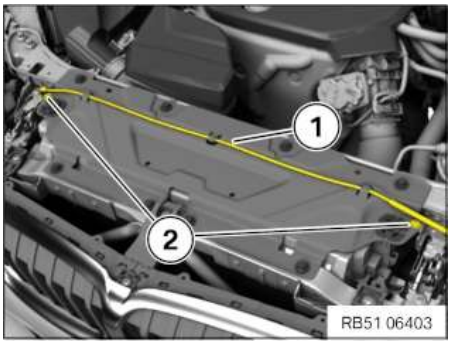
- Loosen the expanding rivet (1).
- Remove the cover in the engine compartment on top (2) partially.

15 – Removing the top cross connection

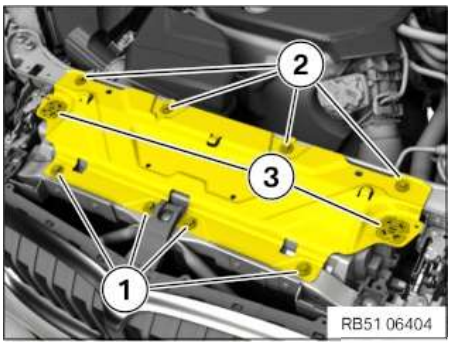


- Release the housing for the coupling of the Bowden cables (1) from the body.

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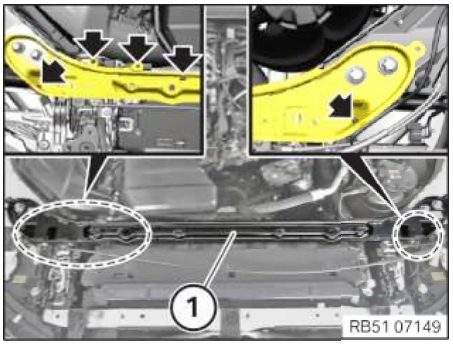


- Detach Bowden cable (1) at the top cross connection.
- Loosen screws (2).

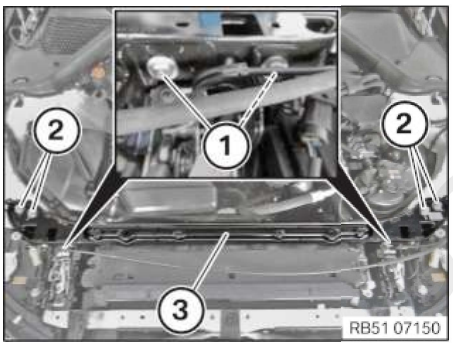


- Loosen screws (1) and (2).
- Remove the top cross connection with the holders(3) towards the top.

16 – Remove the rear top cross connection



- Release the clips (arrows) in the marked areas from the top rear cross connection (1).

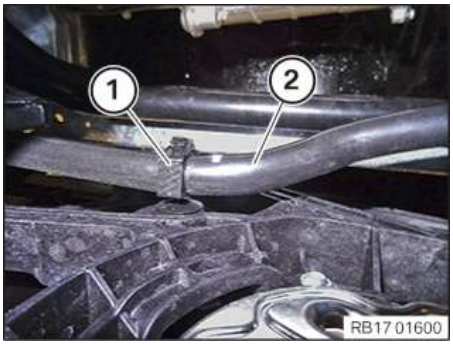


- Loosen screws (1).
- Loosen screws (2).
- Guide out and remove top rear cross connection (3).

17 – Remove fan cowl.

TECHNICAL INFORMATION

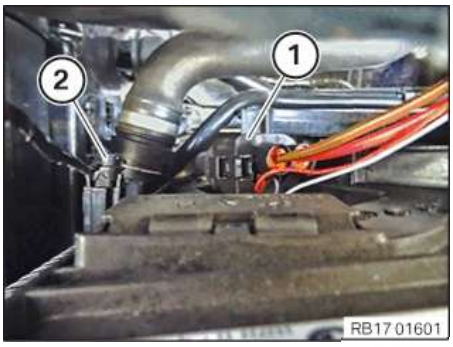
- When the engine is stopped after the end of the journey, it may be necessary to run the electric fan. In rare cases, operation of the electric fan can last up to 11 min. This protects the components. In this case, replacing the electric fan will not remedy the problem!



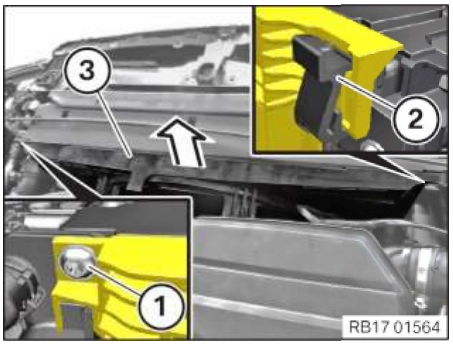
- **If installed:** Release transmission oil line (2).

  Unlock the holder (1).

  Thread out transmission oil line (2) and set aside.



- Unlock plug connection (1) and disconnect.
- Unlock plug connection (2) and disconnect.



- Loosen screw (1).
- Unlock lock (2).
- Guide out and remove fan cowl (3) **carefully** in the direction of the arrow.

18 – Removing intake silencer housing

RISK OF DAMAGE

Damage to the clean air line. Damage to the air filter.

For changing the air filter insert, if the upper section of intake filter housing is only raised and not completely removed, the clean air line and the air filter insert may be damaged.

- Do not lift upper section of intake filter housing by force.
- Unfasten clamp.
- Remove upper section of intake filter housing completely.



- Unlock plug connection (1) and disconnect.
- Unfasten clamp (2).
- Pull out and remove the intake silencer housing (3) from the rubber mounts towards the top.

19 – Remove all ignition coils.

NOTICE

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

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▸ **Removing the ignition coil**

WARNING

Hot surfaces.

Risk of burning!

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

RISK OF DAMAGE

Damage to the ignition coil.

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

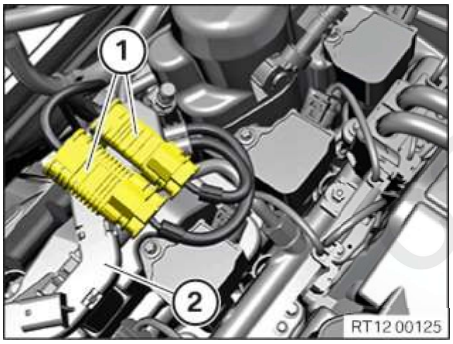
- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

RISK OF DAMAGE

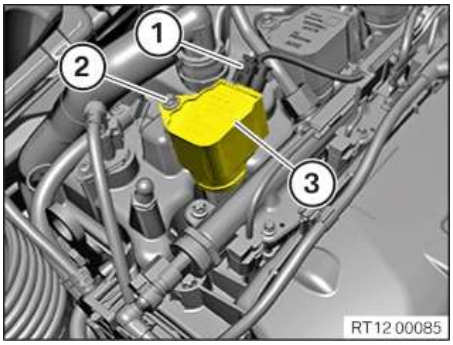
Electrostatic discharge.

Damage to or destruction of electrical components.

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



- Disconnect the connector (1) of the front oxygen sensor and the monitoring oxygen sensor from the cable channel (2) and set aside.



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

20 – Removing all spark plugs

WARNING

Hot surfaces.

Risk of burning!

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

CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

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



- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

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

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

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

NOTICE

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



TECHNICAL INFORMATION

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

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



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

21 – Remove the high pressure line between the high pressure pump and the rail

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WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

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

CAUTION

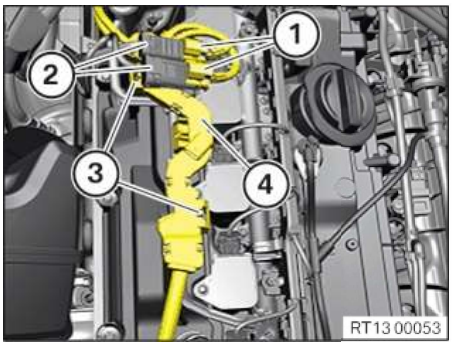
On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

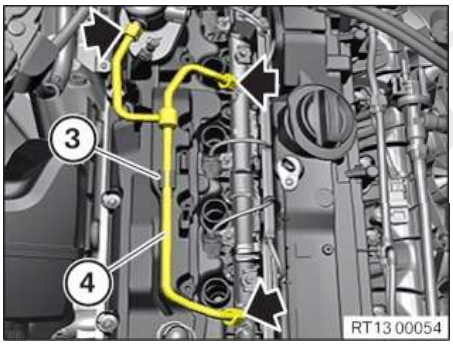
- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

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



- Unlock and disconnect the plug connections (1) and (2).
- Unlock the locks (3).
- Guide out the wiring harness section of the engine wiring harness (4) and set it aside.



- Position a lint-free rag under the union nuts.
- Unscrew union nuts (arrows) with the special tool .
- Catch and dispose of escaping fuel.
- Thread out the high pressure line (4) from the bracket (3) and remove it.
- Feed out and dispose of the lint-free cleaning clothes .

22 – Remove fuel delivery line

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

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

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CAUTION

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

Danger of injury!

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

RISK OF DAMAGE

Damage to the ignition coil.

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

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

RISK OF DAMAGE

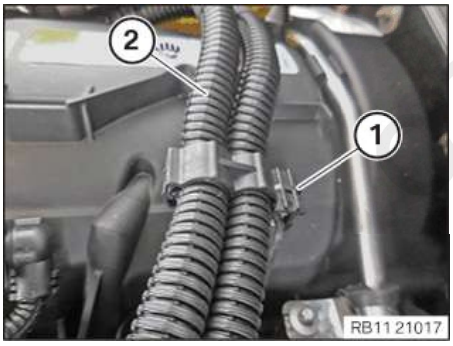
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

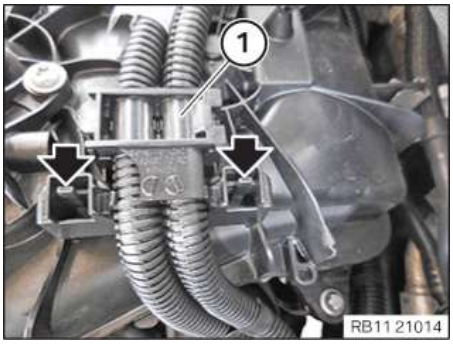
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

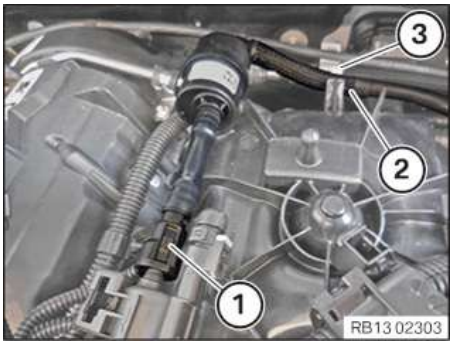
Reset special tool in early to avoid bending pressure lines.



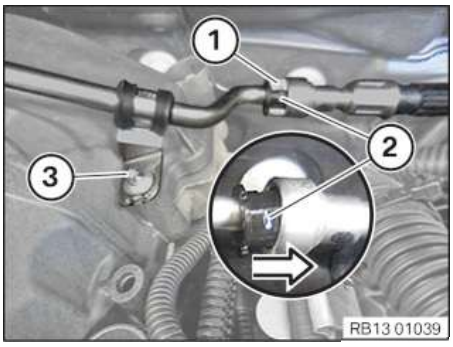
- Loosen clamp (1).
- Guide out wiring harness section (2) for the injectors and ignition coils and place it aside.



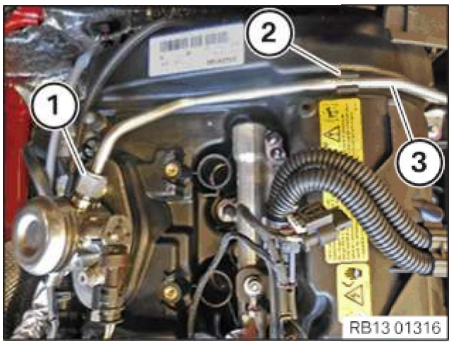
- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.



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



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



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

23 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

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

TECHNICAL INFORMATION

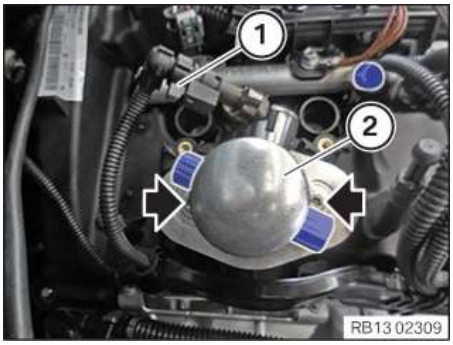
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.

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- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

24 – Removing rail with injectors of cylinders 1 to 3

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

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

RISK OF DAMAGE

Damage to the ignition coil.

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

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

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

Damage to injectors.

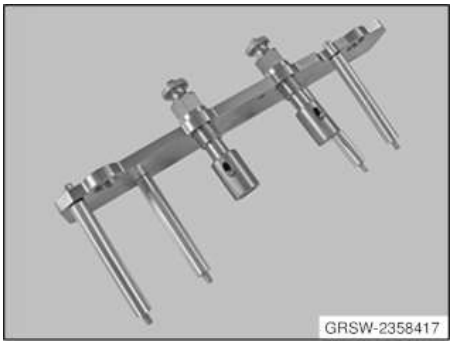
Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.



- Prepare special tool .

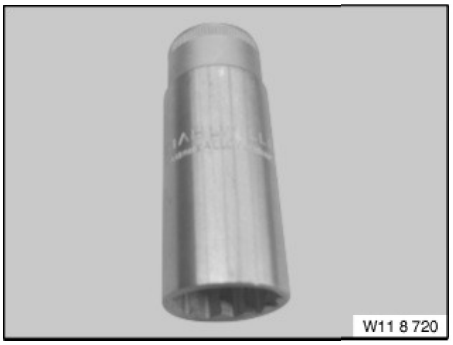
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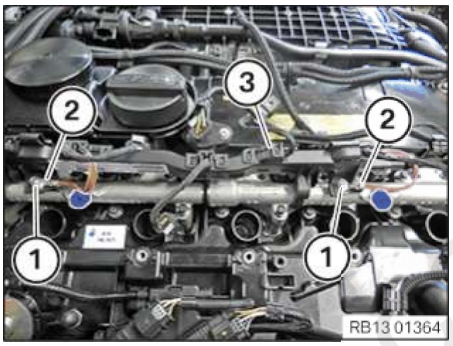
- Prepare special tool 2 358 417.



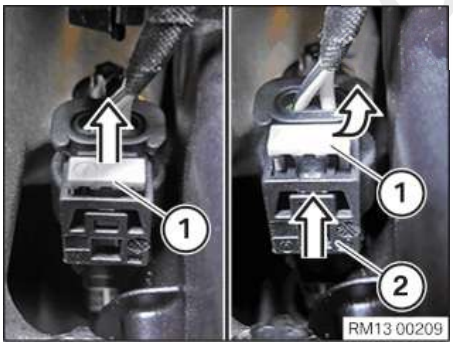
- Prepare special tool .



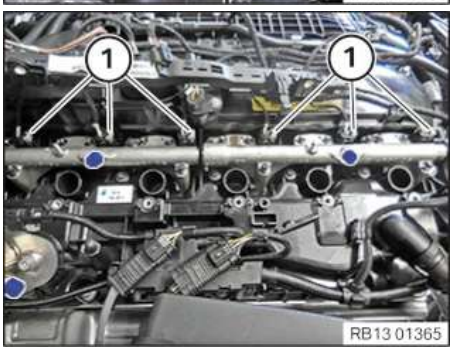
- Prepare special tool 0 496 106 (11 8 720).



- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.

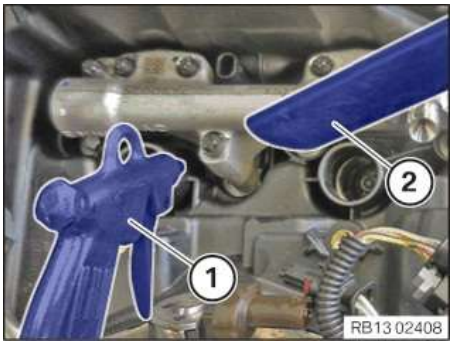


- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull out the connector (2) from the injectors.



- Unlock and release all connectors (1) of the injectors.

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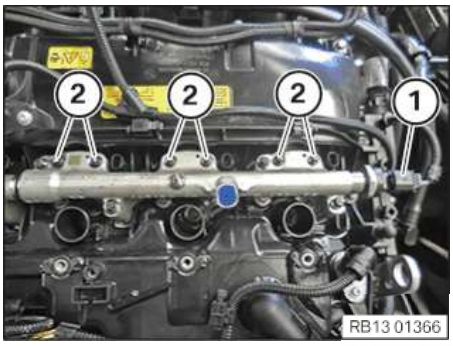


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

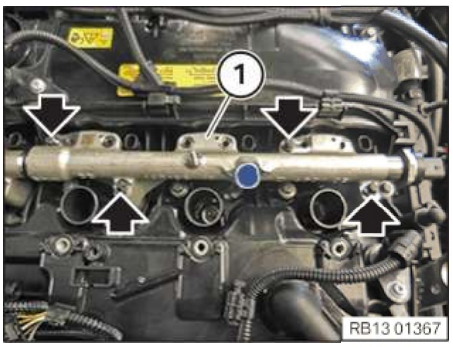
- Before releasing the high pressure lines: Blow out the injector shafts with an air gun(1) with less pressure.
- Simultaneously, draw off the dirt particles with an **explosion proof** vacuum cleaner (2).



- Unlock and loosen connector (1).
- Release screws (M5x30) (2).
- Remove screws (2).

  Do not reuse the bolts (2).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.

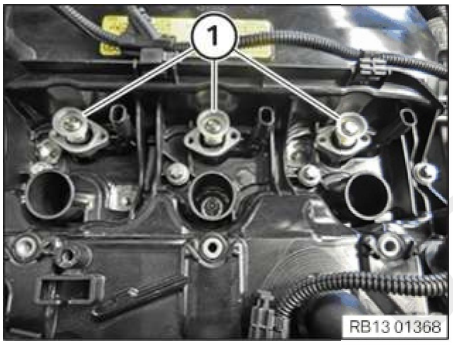


- Unscrew the screws (M6x30) (arrows).

  The screws may not be reused!
- Renew screws.

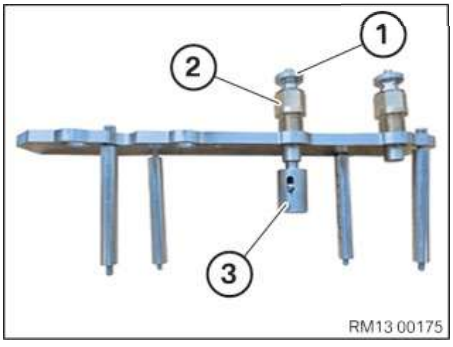
  Parts: Screws (M6x30)
- Remove rail (1) in upward direction.

  The injectors remain in the cylinder head.



- Remove the gaskets (1).

  The seals (1) are only required during the initial assembly at the plant and will not be installed again.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

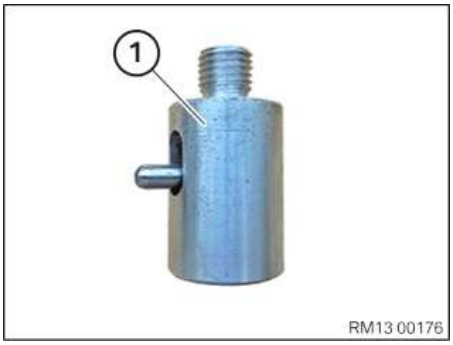
- Twist the injectors with a maximum torsional movement of 13 Nm.
- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use the special tool 2 358 417to remove the injectors.

  The special tool 2 358 417 is used to ensure that the tensile force is not exceeded.

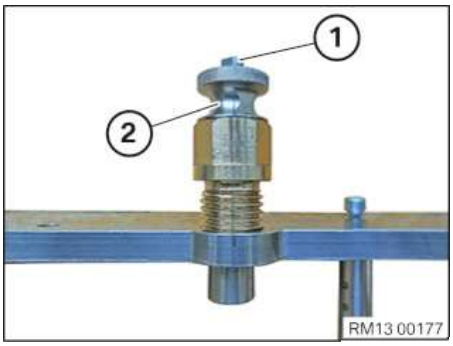
  Special tool 2 358 417 consists of:

  - **(1)** Threaded sleeves
  - **(2)** Pull-out thread (left-hand thread)
  - **(3)** Mounting for the injectors

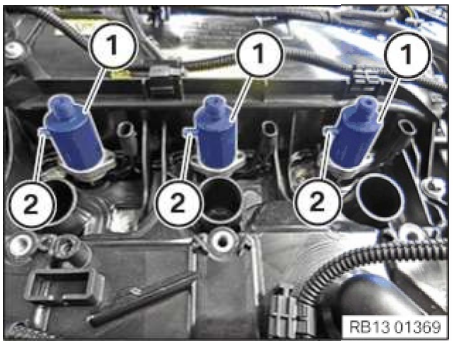
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- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.

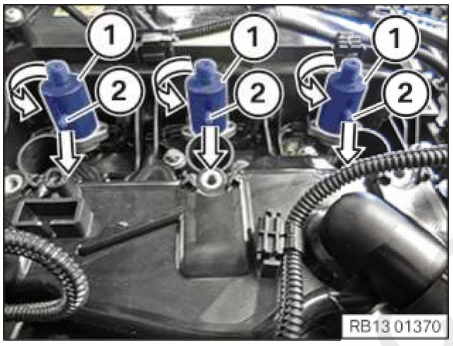


- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.

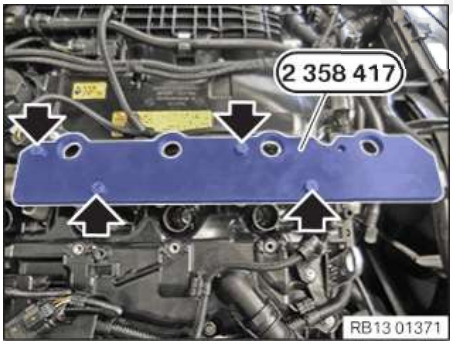


- Install all fixtures (1) for the injectors.

  The fixture (1) is not locked if the lever (2) is on the top.



- Turn fixtures (1) by 90° and lock the lever (2) downwards.



RISK OF DAMAGE

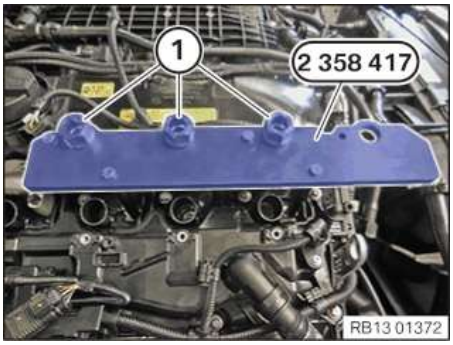
Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

- Attach special tool 2 358 417 to cylinder head.
- Hand-tighten the bolts (arrows).

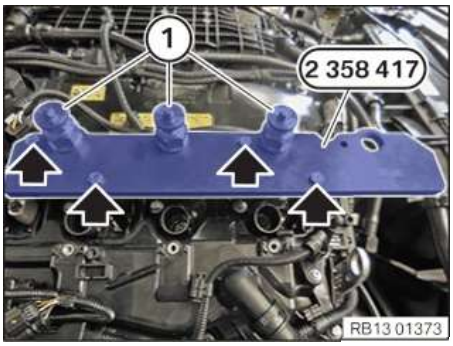
cardiagn.com



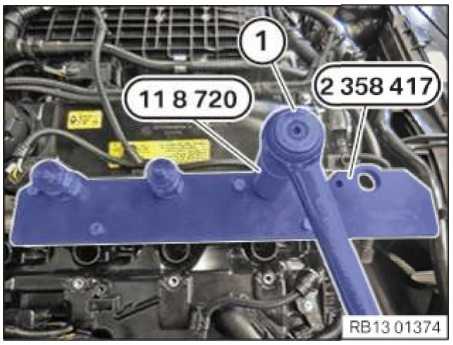
TECHNICAL INFORMATION

The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.



- Insert threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for injectors.
- Then tighten screws (arrows) on special tool 2 358 417 to 5 Nm.

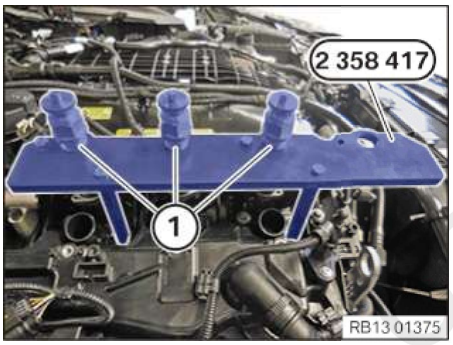


- Adjust torque wrench to 13 Nm **clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720)until the injector is pulled out.

TECHNICAL INFORMATION

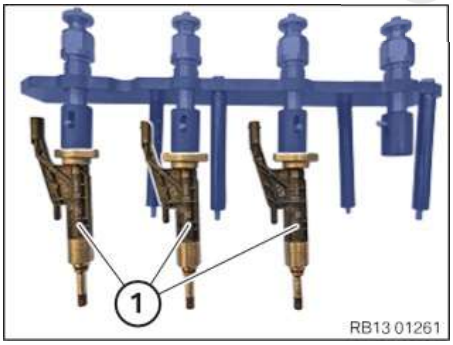
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

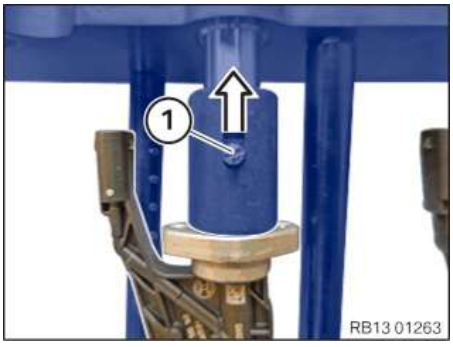


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  This can be recognised on the completely visible threads of the sleeves (1).
- Loosen screws on special tool 2 358 417.



- Carefully remove the special tool 2 358 417with injectors (1) from the cylinder head vertically upwards.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat on a clean table.

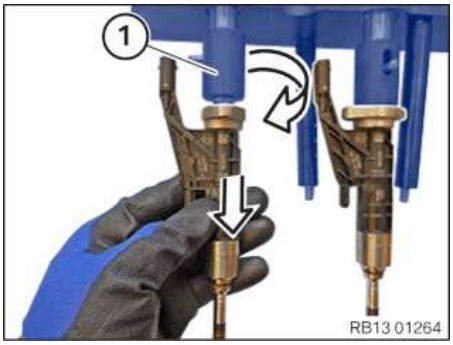


NOTICE

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

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture (1) by 90°.
- Release and remove the injector downwards.

25 – Removing rail with injectors of cylinders 4 to 6

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

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

RISK OF DAMAGE

Damage to the ignition coil.

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

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

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

Damage to injectors.

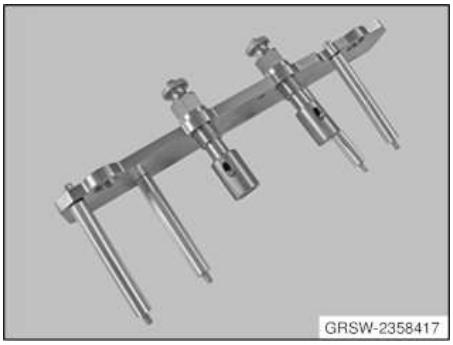
Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.



- Prepare special tool .

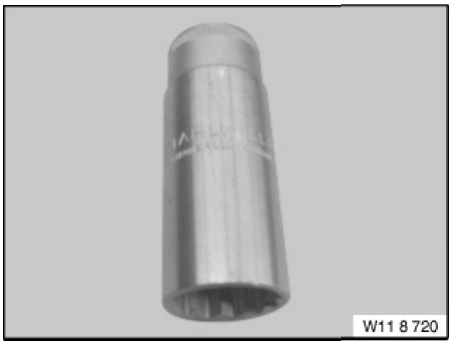
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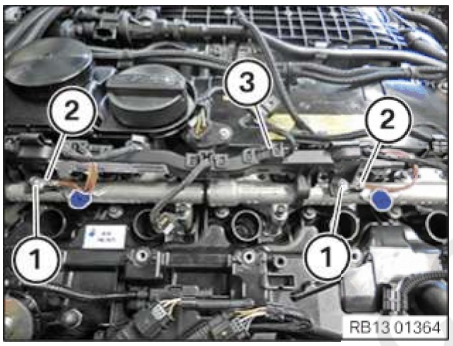
- Prepare special tool 2 358 417.



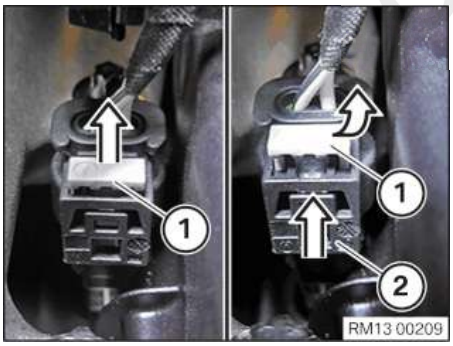
- Prepare special tool .



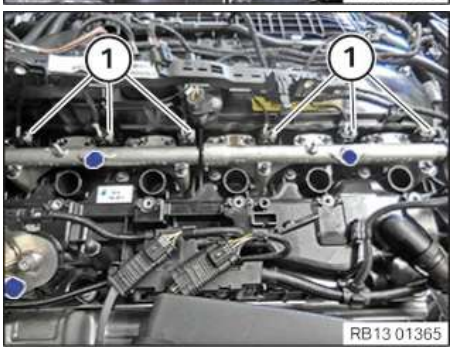
- Prepare special tool 0 496 106 (11 8 720).



- Release nuts (1) .
- Feed out ground cable (2) and set aside.
- Feed out cable channel (3) and set it aside.

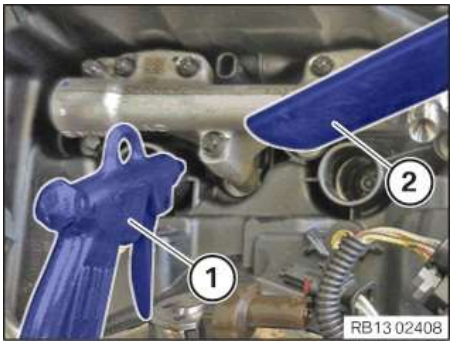


- Unlock lock (1) in direction of arrow upwards.
- Press lock (1) together and release.
- Disconnect the connector (2) from the injectors in the direction of the arrow.



- Unlock and release all connectors (1) of the injectors.

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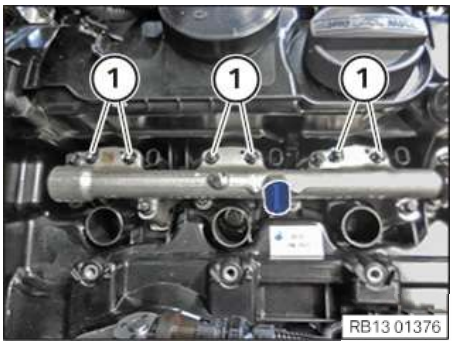


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

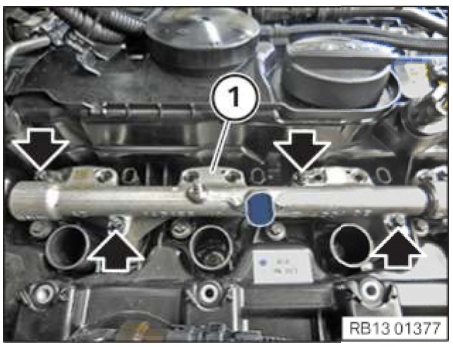
For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

- Before releasing the high pressure lines: Blow out the injector shaft with an air gun (1) with less pressure.
- Simultaneously, draw the dirt particles off **using an** explosion proof (2) vacuum cleaner.



- Release screws (M5x30) (1).
- Remove screws (M5x30) (1) .

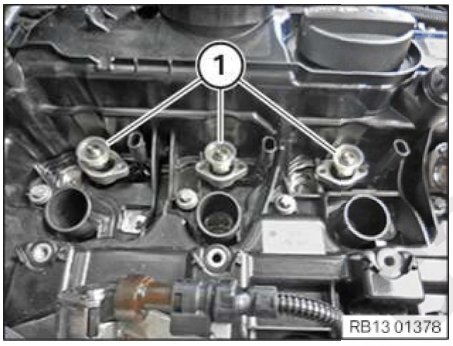
  Do **not** reuse screws (M5x30) (1).
- Catch and dispose of escaping fuel with suitable materials.



- Release screws (M6x30) (arrow).
- Remove screws (M6x30) (arrows).

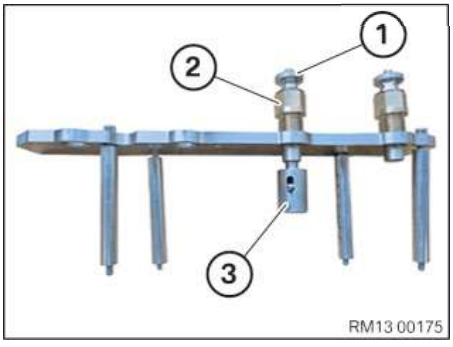
  Do **not** reuse the screws (M6x30).
- Remove rail (1) upwards.

  The injectors remain in the cylinder head.



- Remove seals (1) .

  The seals (1) are required during first assembly within the plant only and will not be installed again.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.

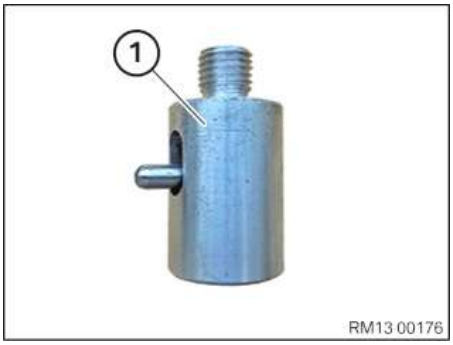
- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use the special tool 2 358 417 to remove the injectors.

  The special tool 2 358 417 is used to ensure that the tensile force is not exceeded.

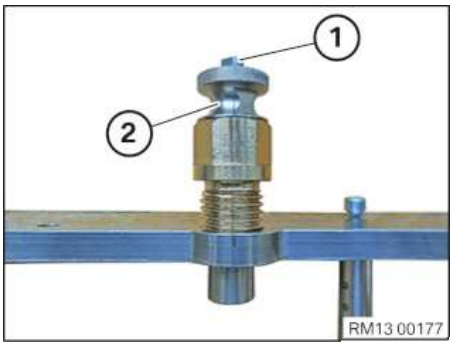
  The special tool 2 358 417 consists of:

  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Mounting for the injectors

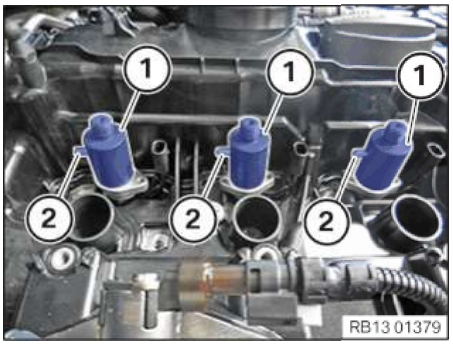
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- Unscrew the fixture for injectors (1) from special tool 2 358 417.

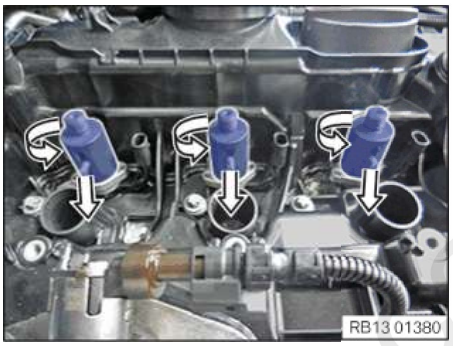


- Press lock (1) in and remove the threaded sleeve (2) from the special tool 2 358 417.



- Install all fixtures (1) for the injectors.

  The fixture (1) is not locked, if the lever is (2) on top.



- Turn fixtures (1) by 90° and lock the lever (2) downwards.



RISK OF DAMAGE

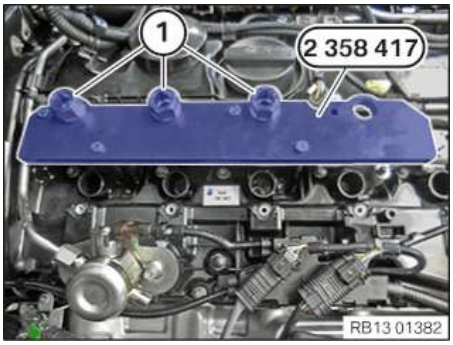
Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

- Attach special tool 2 358 417 to cylinder head.
- Hand-tighten the bolts (arrows).

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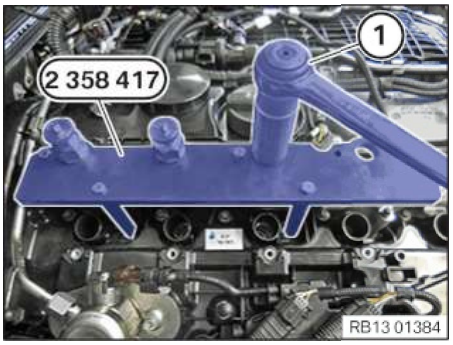
TECHNICAL INFORMATION

The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417 fully.



- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Then tighten screws (arrows) on special tool 2 358 417 to 5 Nm.

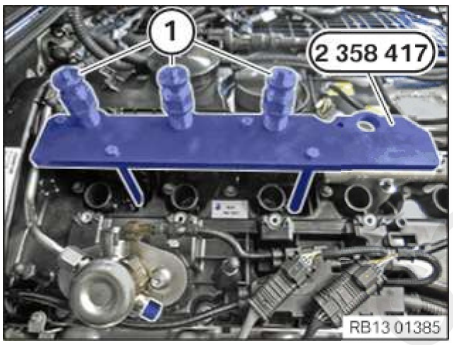


- Adjust torque wrench to 13 Nm **in clockwise** direction.
- Turn the torque wrench (1) with the special tool 0 496 106 (11 8 720) **clockwise**, until the injector is pulled out.

TECHNICAL INFORMATION

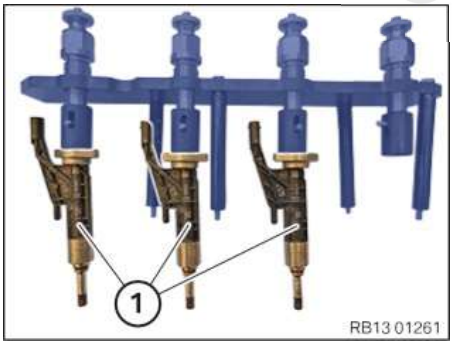
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

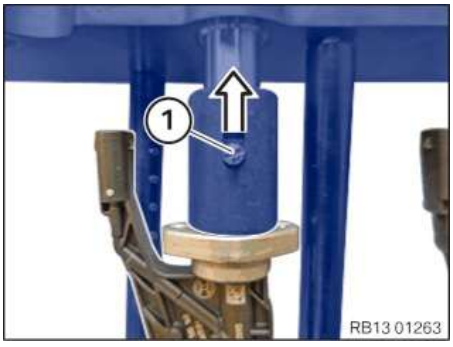


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  This can be recognised on the completely visible thread starts of the threaded sleeves (1).
- Loosen screws on special tool 2 358 417.



- Carefully remove the special tool 2 358 417 with the injectors (1) vertically straight up from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.

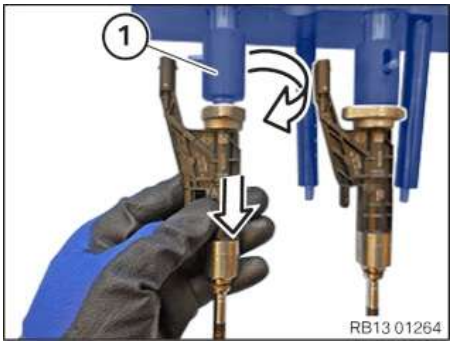


NOTICE

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

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture(1) by 90°.
- Release and remove the injector downwards.

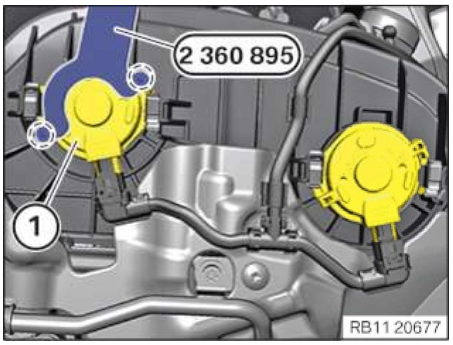
26 – Removing both actuators

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

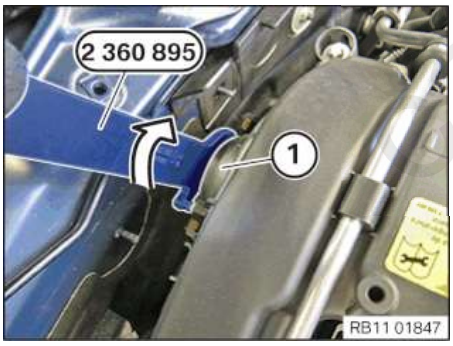
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the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



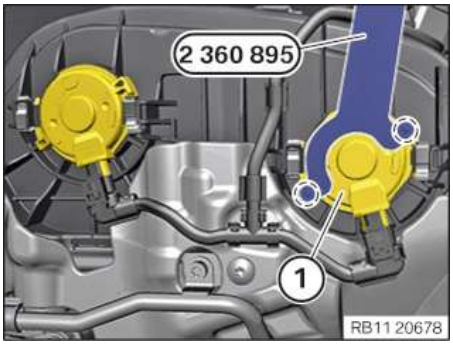
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.

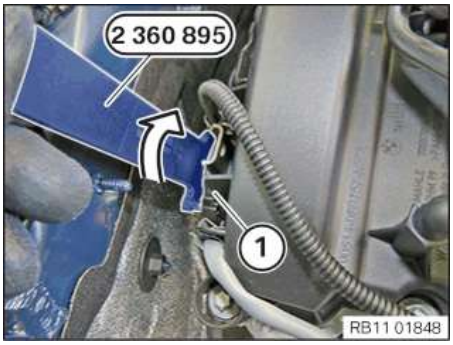


NOTICE

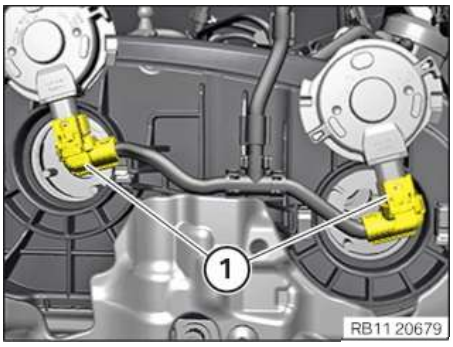
The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.

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- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



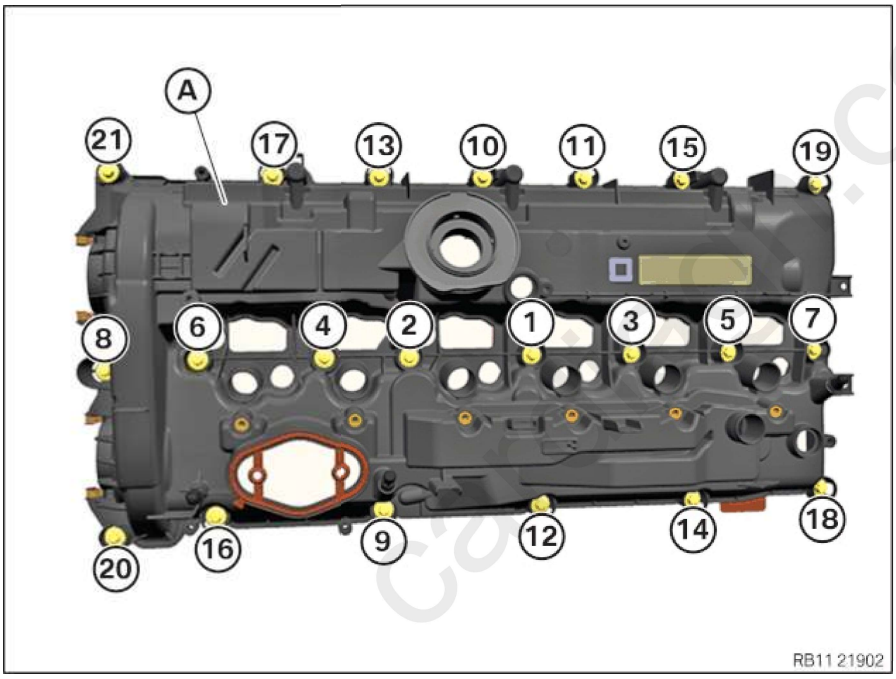
NOTICE

The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

27 – Removing the cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 21 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

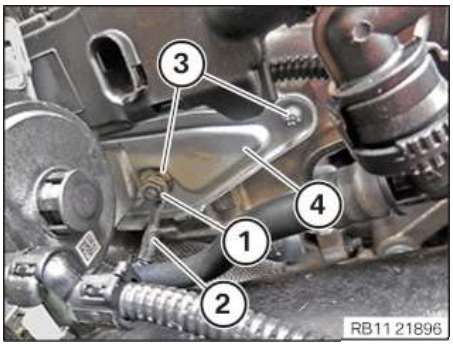
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

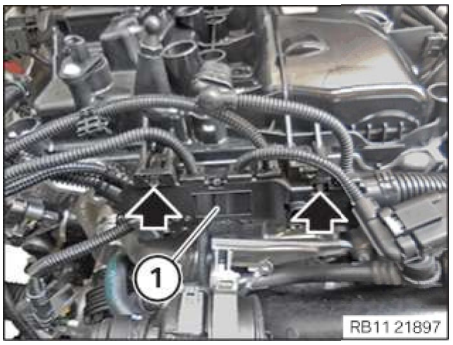
- Do not pull on the wires when disconnecting connectors and plug connections.



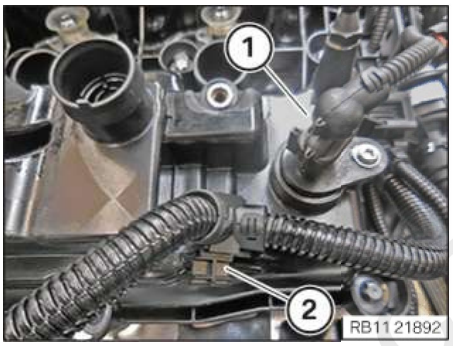
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



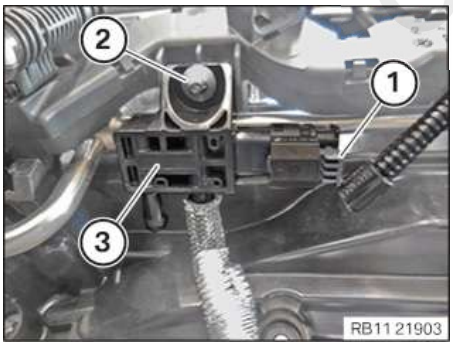
- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Loosen screws (3).
- Thread out holder (4) and set aside.



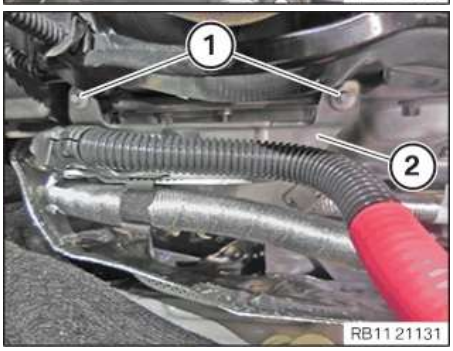
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for the sensor system **2** and place to one side.



- Unlock and detach connector (1) on exhaust camshaft sensor .
- Loosen clamp (2).

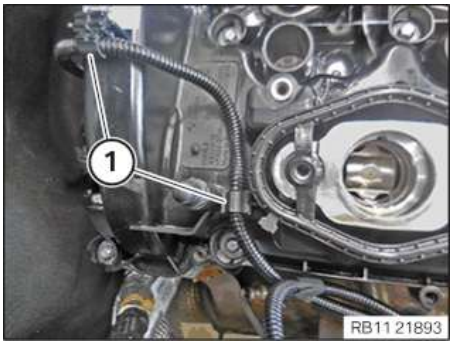


- **If installed:**
- Unlock and loosen connector (1).
- Loosen screw (2).
- Remove the differential pressure sensor (3) and put it to one side.

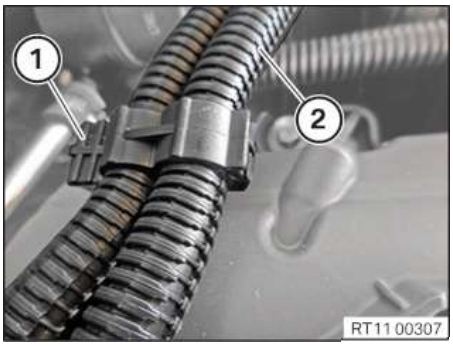


- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

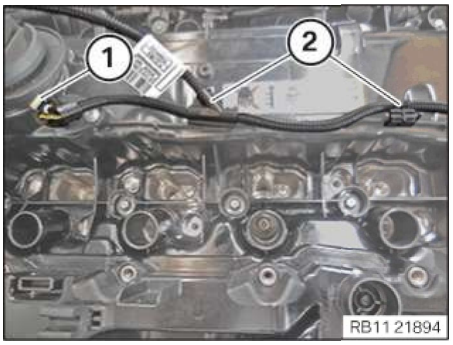
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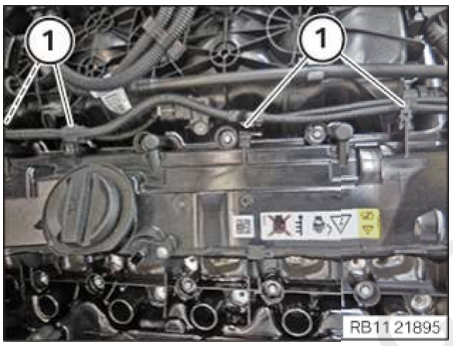
- Loosen clamps (1).



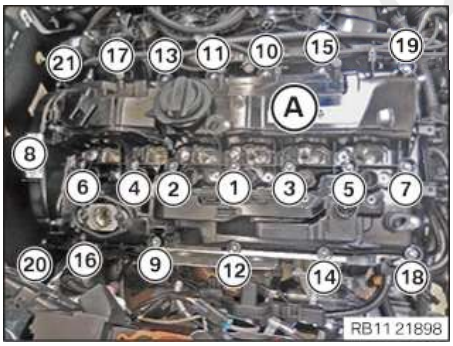
- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



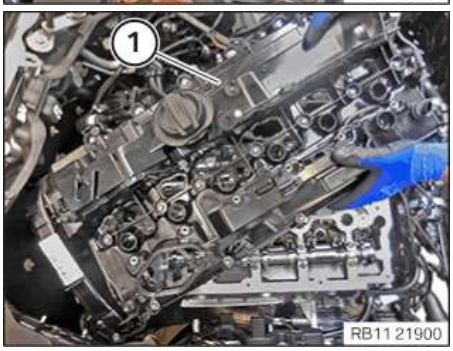
- Unlock and detach connector (1) on the intake camshaft sensor.
- Loosen clamps (2).



- Loosen clamps (1).



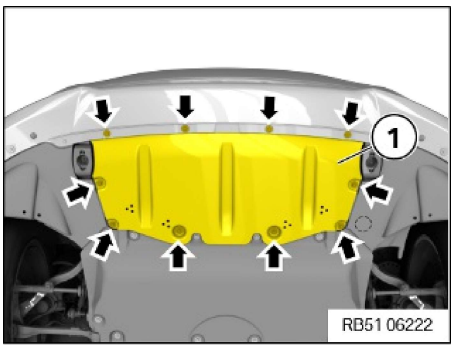
- Release all screws on the cylinder head cover (A) in the sequence (21) to (1).



- Guide the cylinder head cover (1) out and remove it.

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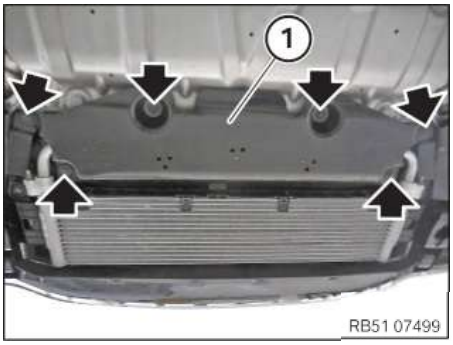
28 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

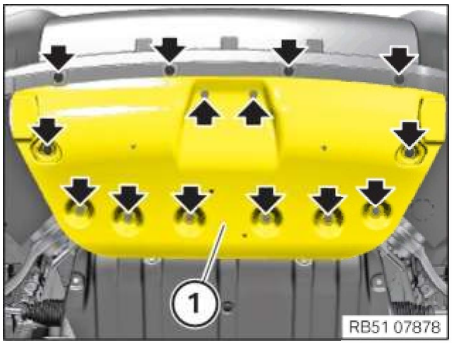
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

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

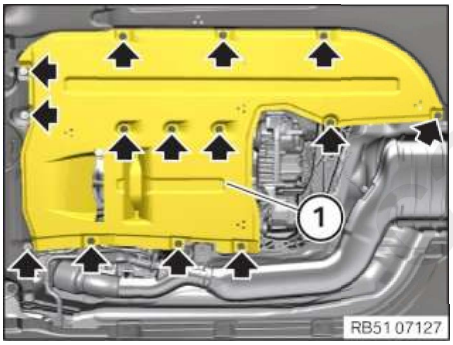


- **Version 3:**

  Remove screws (arrows).

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

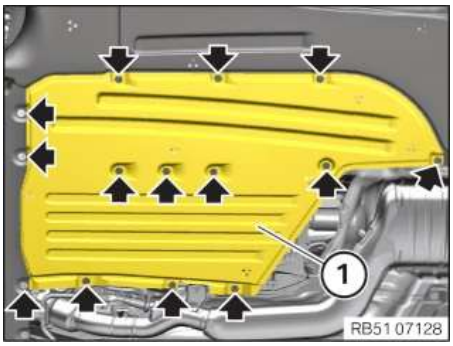
29 – Remove rear underbody protection



- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).



- **Version 2:**

  Remove screws (arrows).

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

30 – If installed: Partially release the engine oil cooler

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WARNING

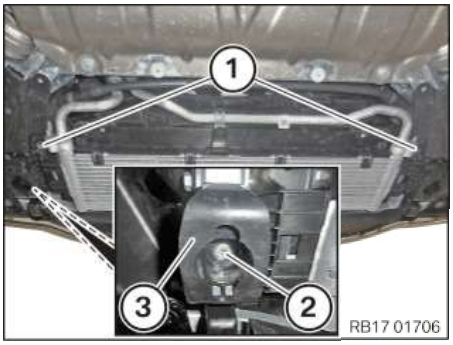
Hot surfaces.

Risk of burning!

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

TECHNICAL INFORMATION

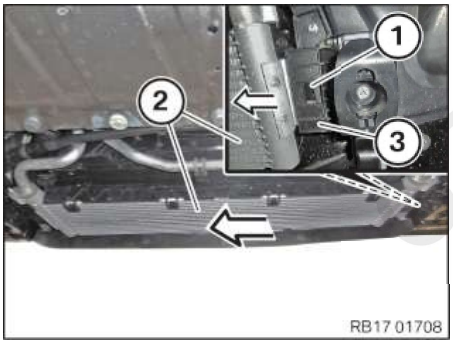
The work must be performed with care to prevent component damage.



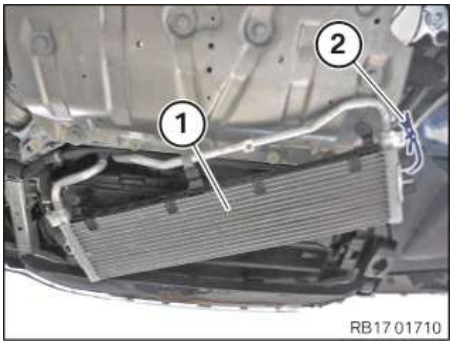
- Loosen screws (1).
- Drill out rivet on the left (2).
- Remove the left-hand damper (3).



- Loosen screw (1).



- Unlock lock (1).
- Feed out engine oil cooler (2) from the holder in the direction of arrow (3) and place to one side.



- Affix the engine oil cooler (1) with a cable strap (2) as shown.

31 – Block the engine with the special tool in TDC firing position

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- Thread the sealing cap (1) out and remove.



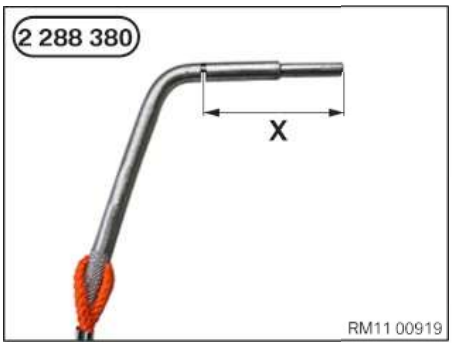
RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

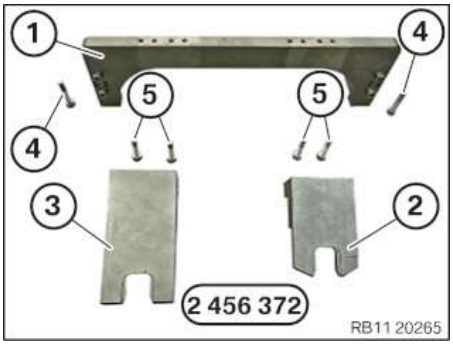


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **correctly** positioned.

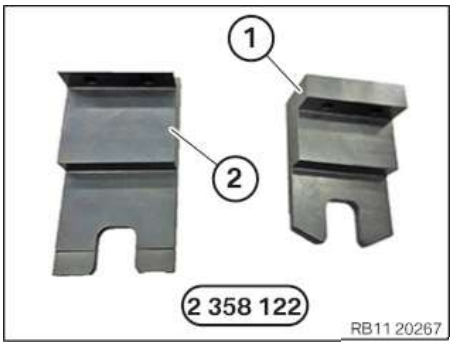
  The engine is in the TDC firing position of cylinder 1.

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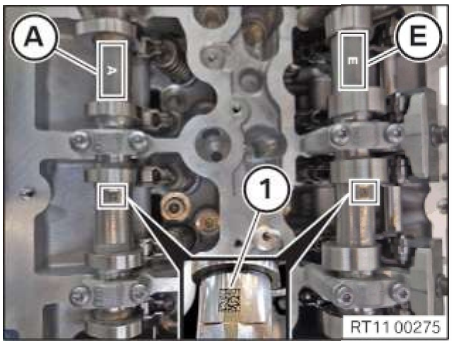
- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

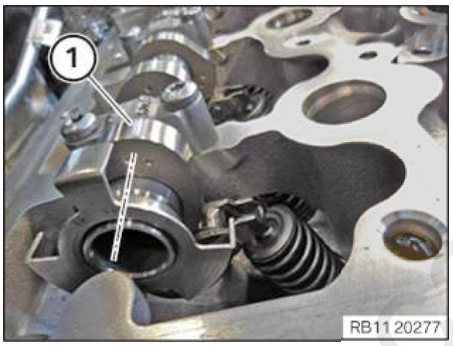


- Overview of the test gauges from the set of special tools 2 358 122:

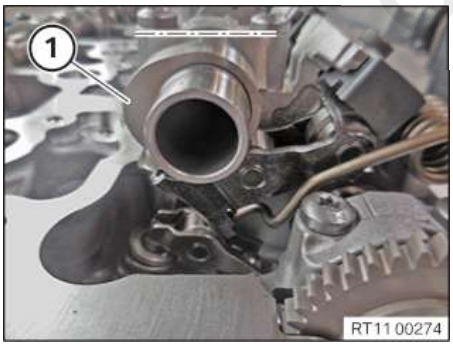
Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



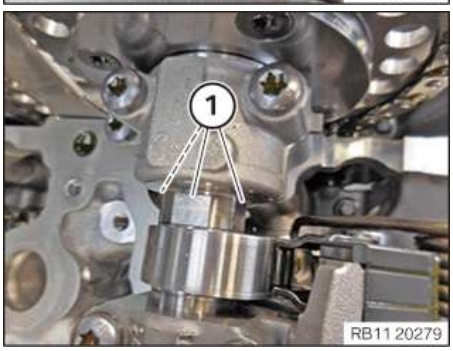
- Turn intake camshaft (E) and exhaust camshaft (A) until marks (1) can be read from the top.



- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.

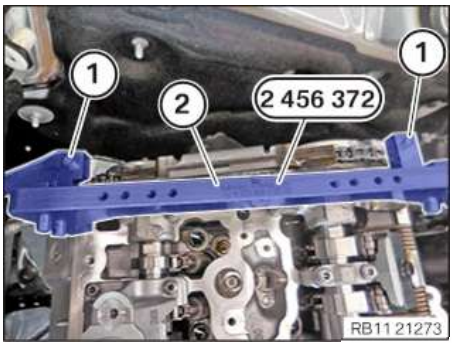


- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.

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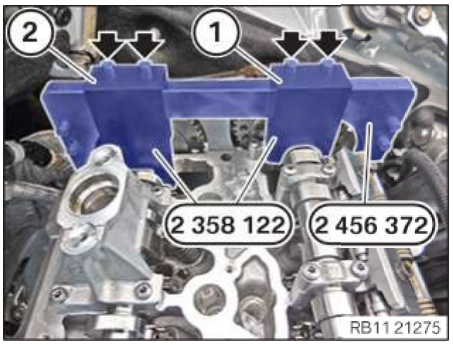
- Position basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

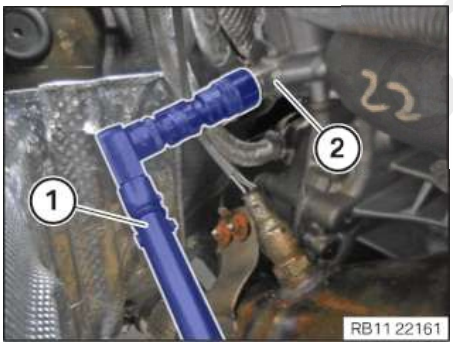
Test gauge to basic carrier

M6		Tightening torque	8 Nm

32 – Removing chain tensioner

TECHNICAL INFORMATION

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



- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).

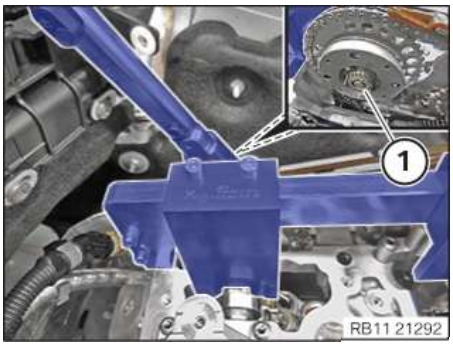


- Feed out and remove the chain tensioner (1).

33 – Releasing VANOS central valve of the exhaust camshaft adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

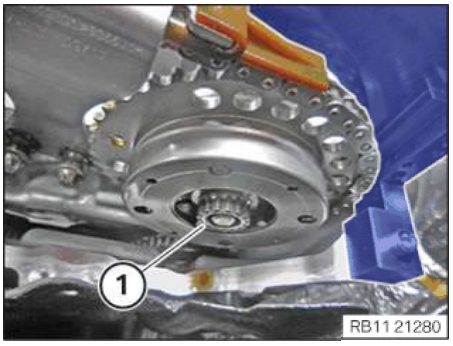


NOTICE

The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

34 – Remove the VANOS central valve of the exhaust camshaft adjuster

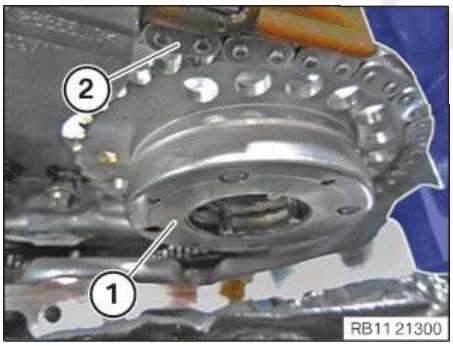


- Guide out and remove the VANOS central valve (1) of the exhaust camshaft adjuster.

35 – Remove exhaust camshaft adjuster

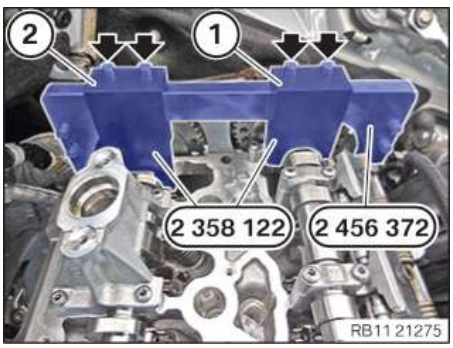
NOTICE

The figure shows the rear side of the engine.



- Guide out the exhaust camshaft adjuster (1) from the timing chain (2) and remove.

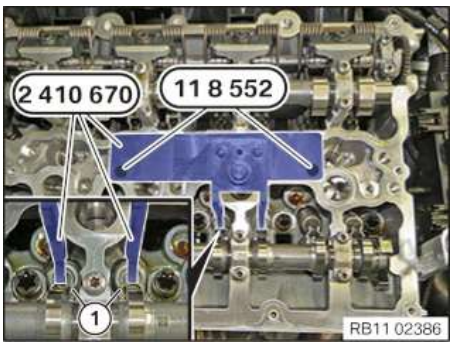
36 – Remove the test gauges to fix the camshafts



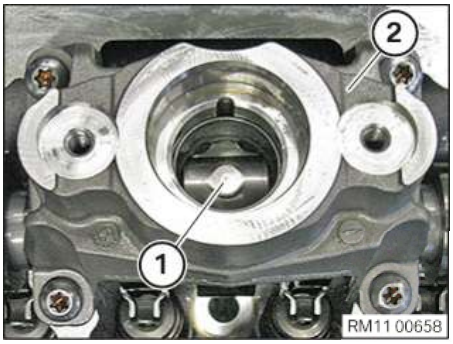
- Remove screws (arrows).
- Guide out and remove test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier of the set of special tools 2 456 372.
- Guide out and remove test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier of the set of special tools 2 456 372.

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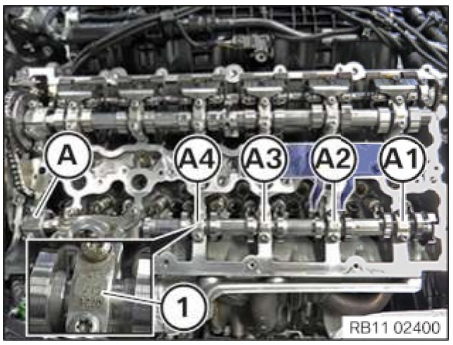
37 – Remove exhaust camshaft



- Position the special tool 2 410 670 at cylinder 2 and apply it hand-tight with the special tool 0 495 741 (11 8 552) from the set of special tools 0 495 739 (11 8 550).
- Screw in both roller cam followers (1) on cylinder 2 with the spindle nut of the special tool 2 410 670 to the stop.



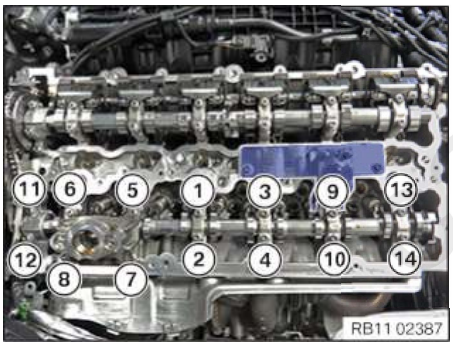
- Remove the roller tappet (1) from the high pressure pump bracket (2).



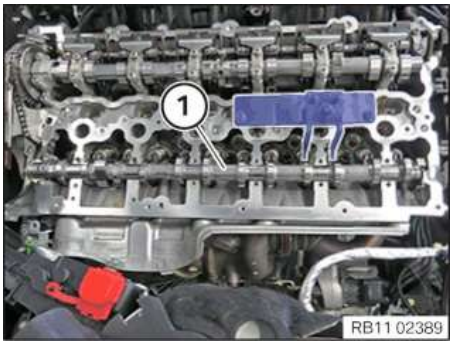
- Observe the numbering of the exhaust camshaft bearing caps.

  The exhaust camshaft bearing caps are numbered from (A1)till (A4).

  The exhaust camshaft bearing cap (A) is a thrust bearing.



- Release screws in the right sequence (14) till (1) in semi circle pattern.
- Remove high pressure pump bracket and all exhaust camshaft bearing cap.
- Place all exhaust camshaft bearing cap in order in special tool 0 495 105 (11 4 480).



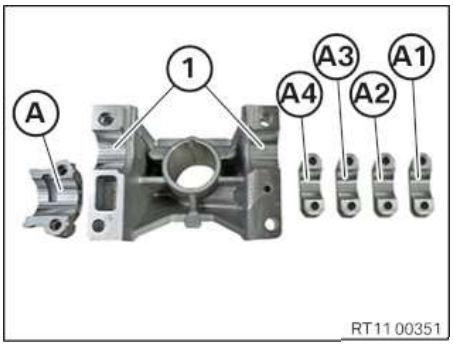
- (1)Remove exhaust camshaft in upward direction.

38 – Install exhaust camshaft

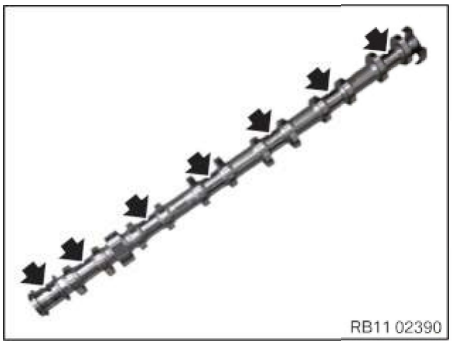
carodiagn.com



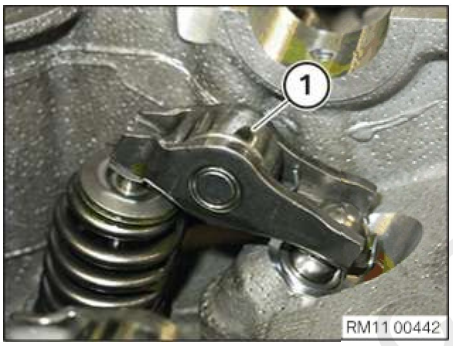
- Clean all the bearing positions (arrows).
- Coat all the bearing positions (arrows) with engine oil.



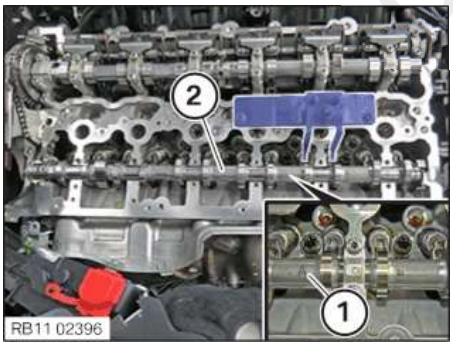
- Clean all bearing positions of exhaust camshaft bearing caps (A1), (A2), (A3), (A4) and (A) and coat with engine oil.
- Clean bearing positions (1) of the high pressure pump bracket and coat with engine oil.



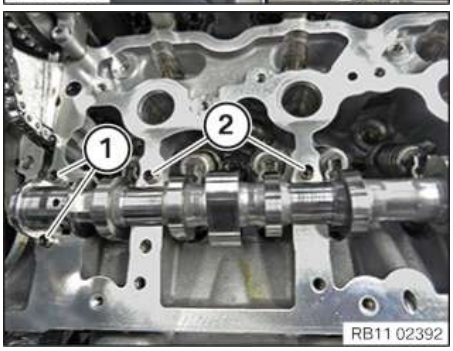
- Clean all the bearing positions (arrows) of the exhaust camshaft.
- Coat all the bearing positions (arrows) of the exhaust camshaft with engine oil.



- Check all roller cam follower (1) of the exhaust side for correct fit.

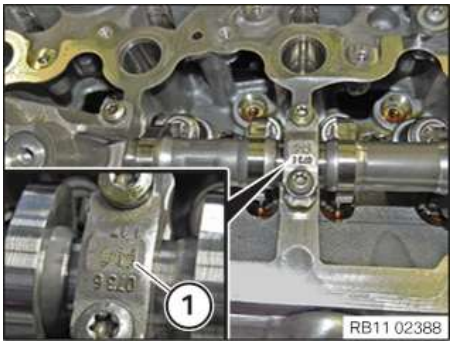


- Insert exhaust camshaft (2) in the cylinder head, such that the mark (1) points upwards.



- Check the fitting sleeves (1) of the thrust bearing for damage and renew if necessary.
- Check the fitting sleeves (2) of the high pressure pump bracket for damage and renew if necessary.

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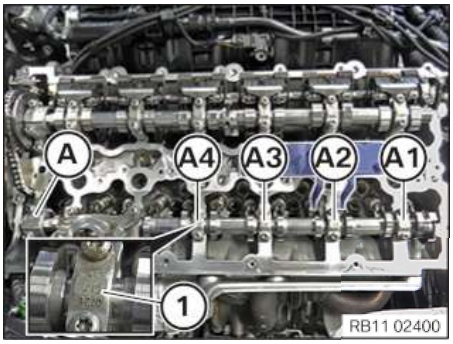
RISK OF DAMAGE

Engine damage caused by incorrectly installed bearing shells and bearing supports.

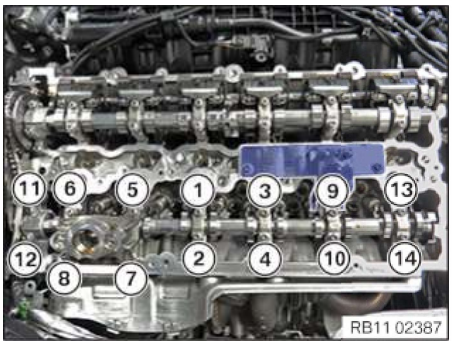
Engine damage may result from incorrectly installing bearing shells and bearing supports.

- Always install all bearing shells and bearing supports in the same position from which they were removed.

- Replace all exhaust camshaft bearing cap , that the labelling(1) from the intake side are readable.



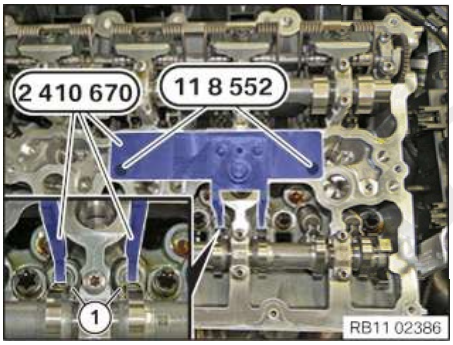
- Oil all the exhaust camshaft bearing caps (A1) to (A4) and the exhaust camshaft bearing cap for the thrust bearing (A) with engine oil and place into position.
- Oil the bearing position at the high pressure pump bracket with engine oil and place the high pressure pump bracket into position.



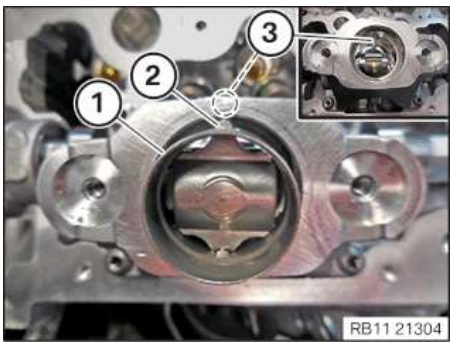
- Press down the exhaust camshaft bearing caps and hand-tighten the bolts incrementally in the sequence(1) to (14).
- Move up all screws in the sequence (1) to (14) **in half rotations.**
- **Adhere to the jointing torque.**
- Tighten all bolts in sequence (1) to (14) .

Exhaust camshaft to cylinder head

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm



- Relax special tool 2 410 670 above the spindle nut.
- Release special tools 0 495 741 (11 8 552) and remove the special tool 2 410 670.

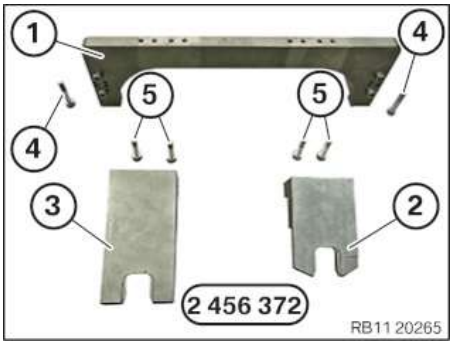


- Guide in and position roller tappet (1).
- Ensure that pin (2) is positioned correctly in guide (3).
- Feed in and install roller tappet (1).

POSTPROCESSES

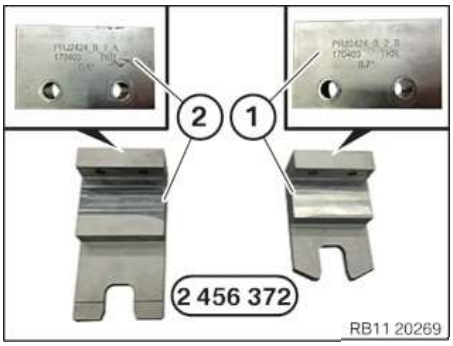
39 – Adjust the camshafts with the special tool

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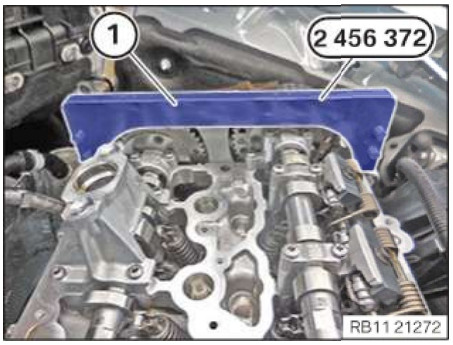


- Overview of the set of special tools 2 456 372:

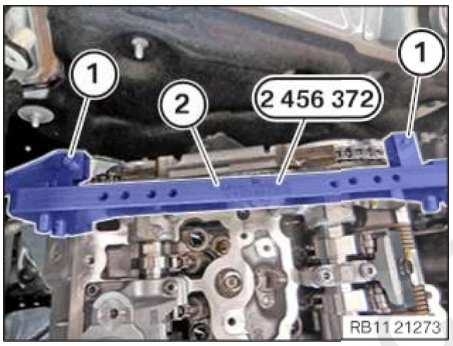
Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Use the setting gauge 0.7 ° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.



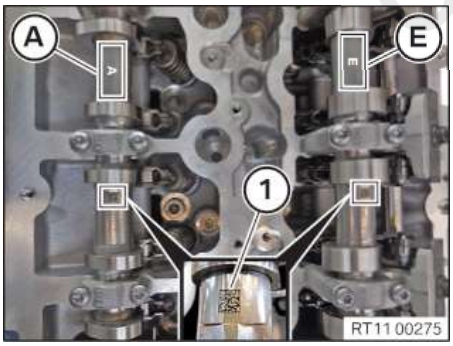
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



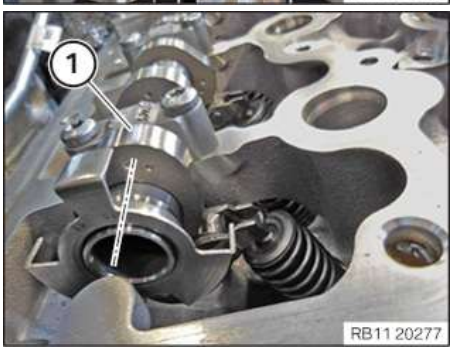
- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6	Tightening torque	8 Nm



- Turn the intake camshaft (E) and the exhaust camshaft (A) such that the marks (1) can be read from the top.

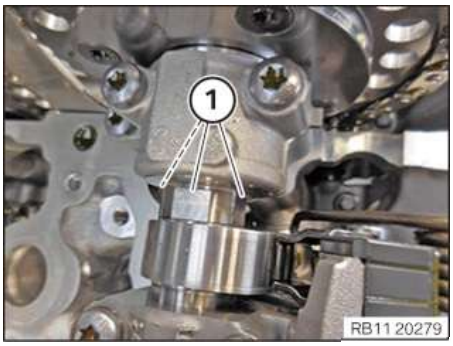


- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.

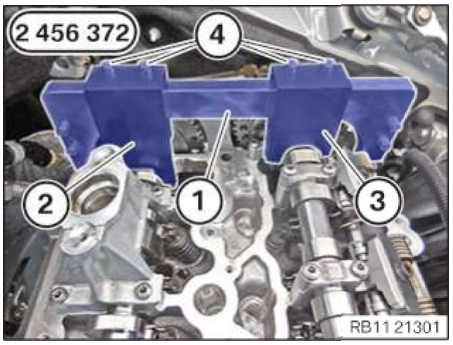
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- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



- Position the setting gauge 0.5° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten the screws (4).

Test gauge to basic carrier

M6		Tightening torque	8 Nm

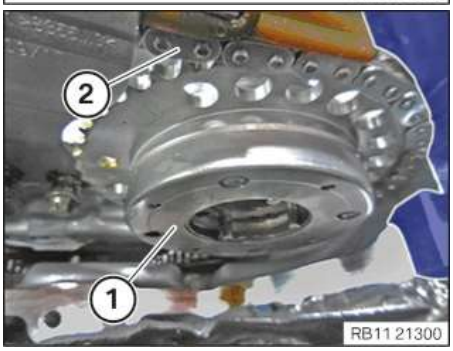
40 – Install exhaust camshaft adjuster

NOTICE

The figure shows the rear side of the engine.



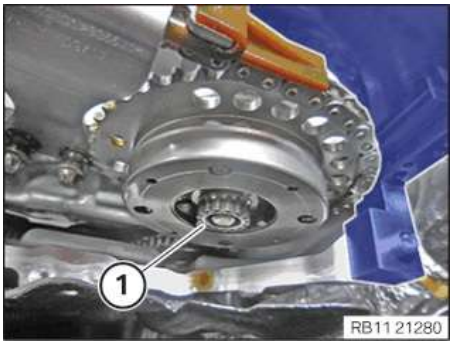
- Keep exhaust camshaft adjuster (1) marked EX ready.



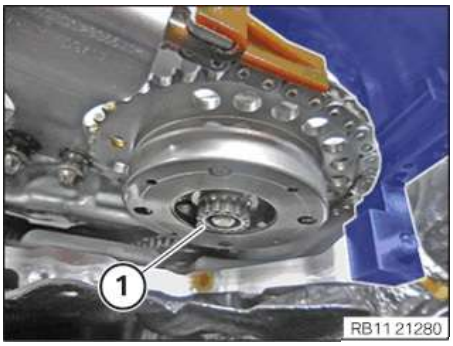
- Feed in exhaust camshaft adjuster (1) in the timing chain (2) and position on the exhaust camshaft .

41 – Installing the VANOS central valve of the exhaust camshaft adjuster

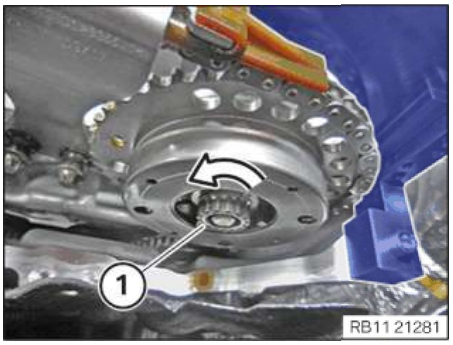
cardiagn.com



- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.



- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.



- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

42 – Releasing the VANOS central valve of the intake adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.



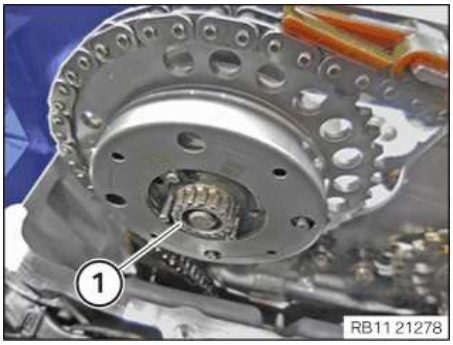
NOTICE

The figure shows the rear side of the engine.

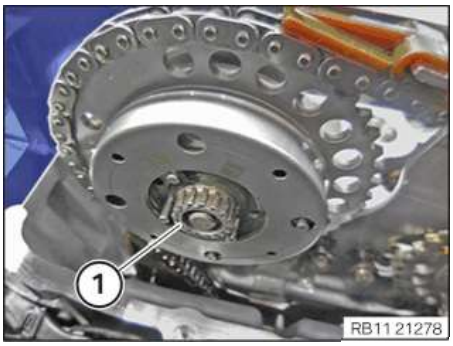
- Release the VANOS central valve (1) of the intake adjuster.

43 – Install the VANOS central valve of the intake adjuster

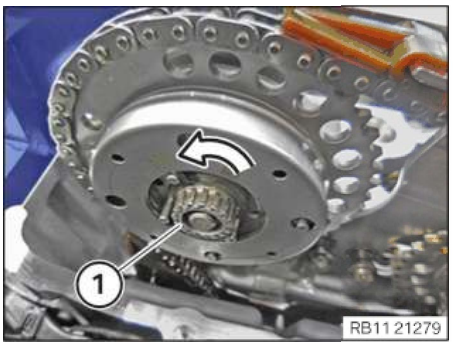
cardiagn.com



- Guide in the VANOS central valve (1) of the intake adjuster and install.

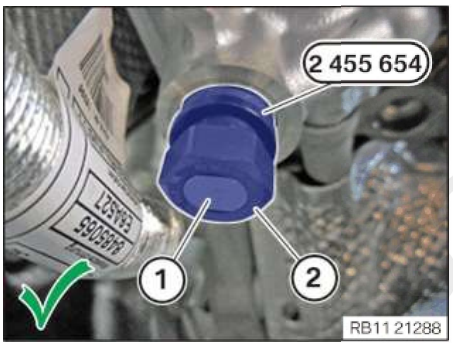


- Hand-tighten the VANOS central valve (1) of the intake adjuster.



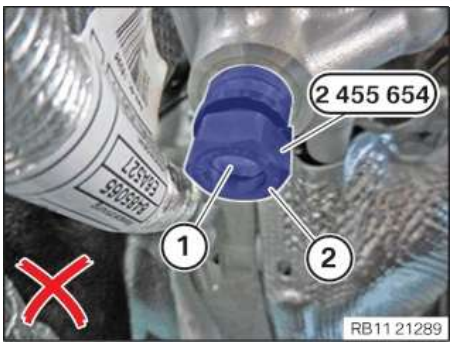
- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

44 – Pretension the timing chain with the special tool



- Make sure that the timing chain is **correctly** pre-tensioned with the special tool 2 455 654.

  The pin (1) must align **precisely** with housing (2).

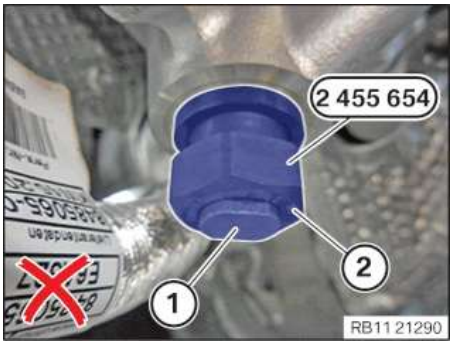


- Make sure that the preload of the timing chain is no **insufficient**.

  The preload is insufficient when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

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- Make sure that the preload of the timing chain is not **too high**.

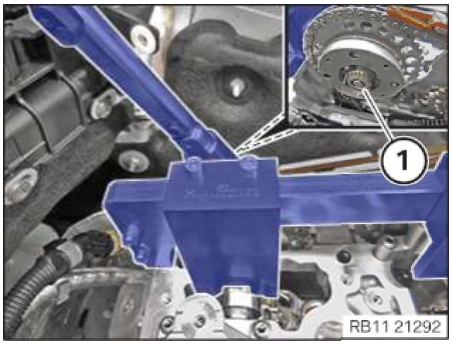
  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

45 – Tightening the VANOS central valve of the exhaust camshaft adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



- Tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

46 – Tightening the VANOS central valve of the intake adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



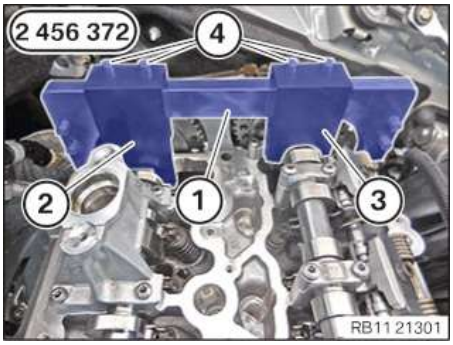
- Tighten the VANOS central valve (1) of the intake adjuster.

VANOS central valve to camshaft

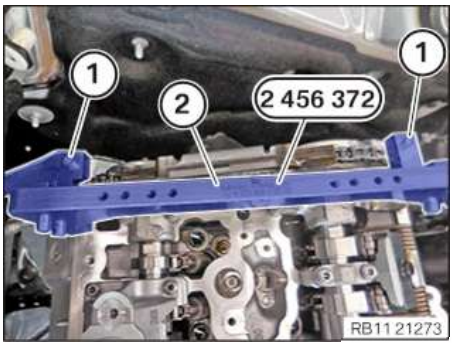
M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

47 – Disassembling all special tools

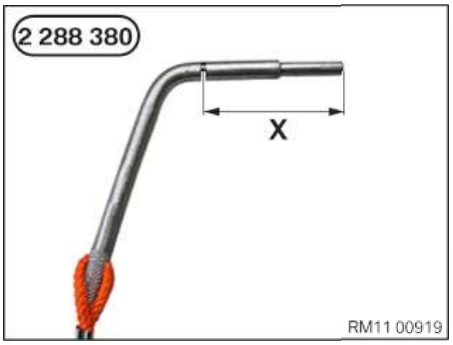
carDiagn.com



- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) and remove.



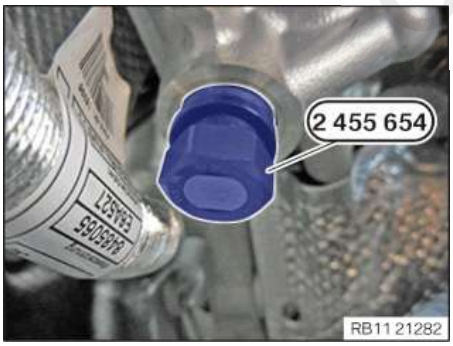
- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.



- Guide the special tool 2 288 380 out and remove.



- Guide the special tool 0 493 380 (11 6 480) out and remove.



- Guide the special tool (1)2 455 654 out and remove.

48 – Install chain tensioner

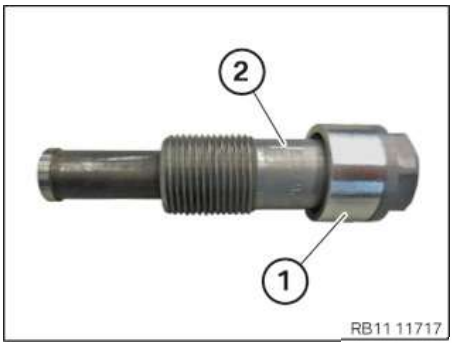
TECHNICAL INFORMATION

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

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- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.

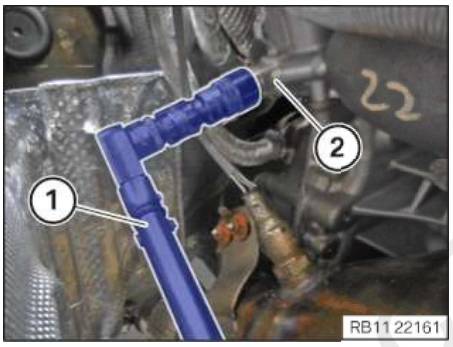


- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.



- Insert and install the chain tensioner (1).

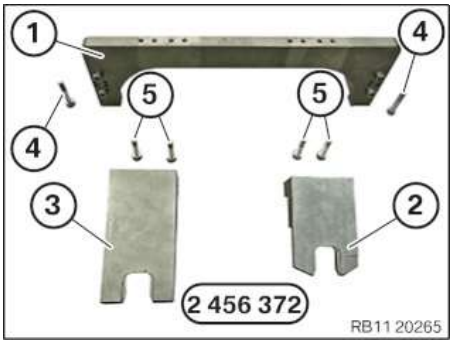


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

Chain tensioner	Tightening torque	20 Nm
	Angle of rotation	40 °

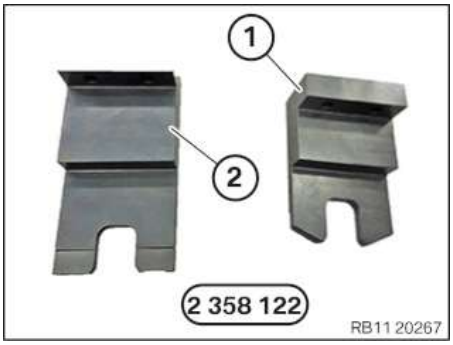
49 – Checking camshaft timing



- Have the set of special tools 2 456 372 ready.

Number	Description
1	Basic carrier
2	0.7° setting gauge to adjust the intake camshaft
3	0.5° setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

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- Keep the test gauge from the set of special tools 2 358 122 ready.

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



- Have the special tool 2 288 380 ready.

Number	Description
1	Locating stud



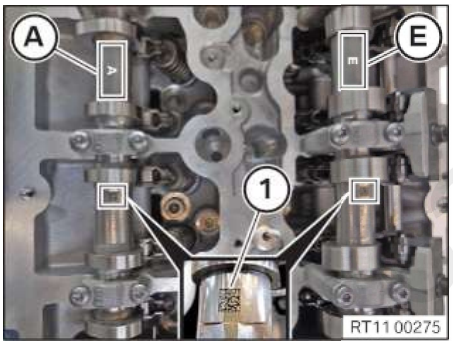
RISK OF DAMAGE

Damage to the engine.

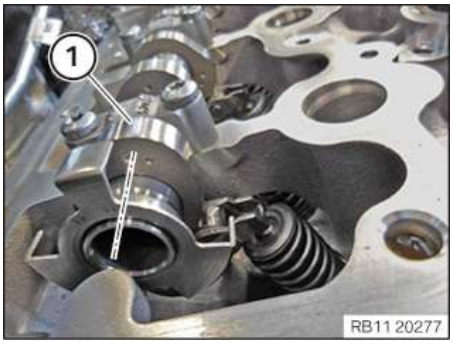
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



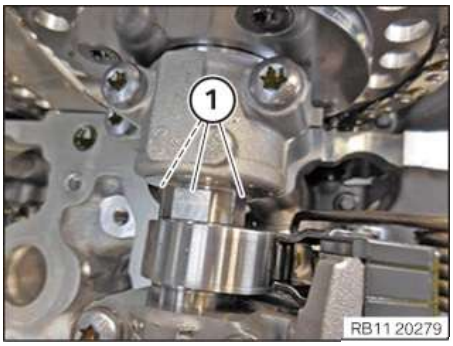
- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.



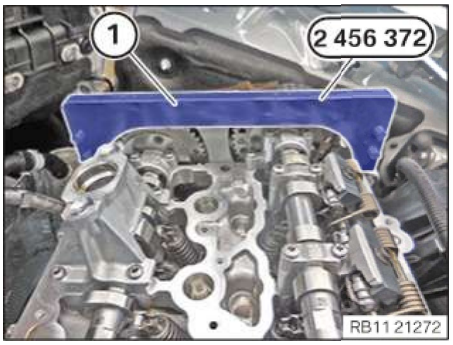
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



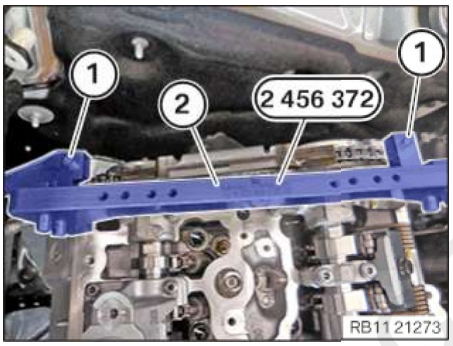
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



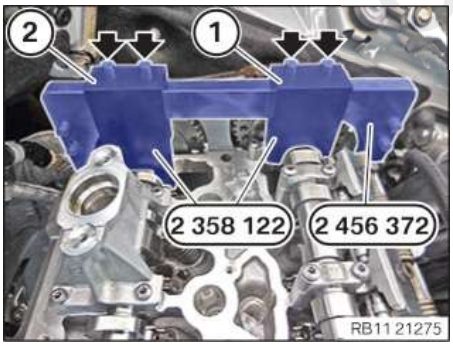
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

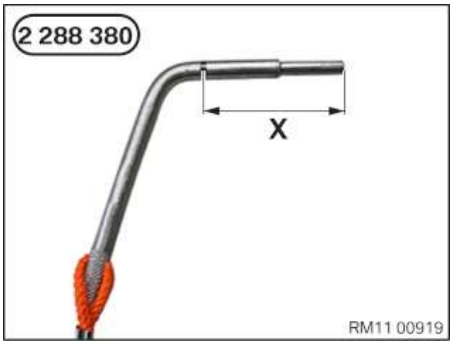
Test gauge to basic carrier

M6		Tightening torque	8 Nm



- Thread the sealing cap (1) out and remove.

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- **Vehicles with automatic transmission:**

  Dimensions (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

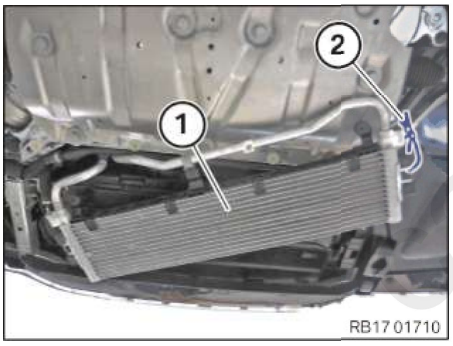


- **Vehicles with automatic transmission:**

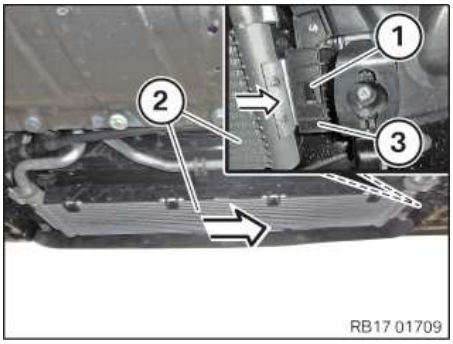
  Special tool 2 288 380 has been **correctly** positioned.

  The engine **is in the** TDC firing position of cylinder 1.

50 – If installed: Secure engine oil cooler



- Remove the cable straps (2).
- Position engine oil cooler (1).



- Feed in and install the engine oil cooler (2) on the holder (3) in the direction of the arrow.
- Ensure that the lock (1)engages audibly.

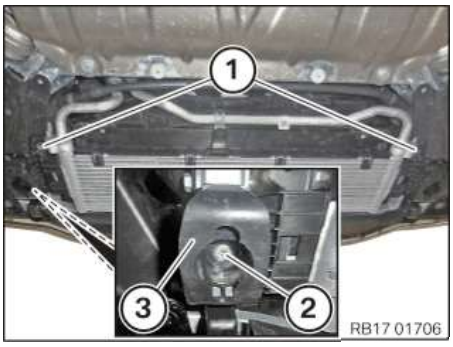
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- Tighten down screw (1).

Engine oil cooler to bumper support

M6X25		Tightening torque	8 Nm



- Renew rivet (2).

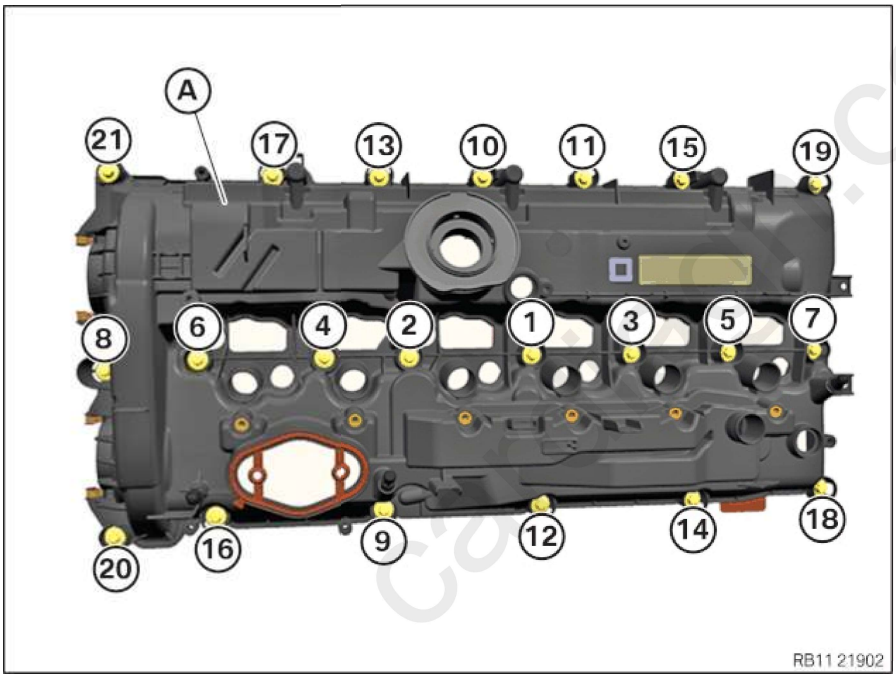
  Parts: Rivet
- Install and rivet damper (3).
- Tighten the screws (1).

Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

51 – Installing cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 21 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

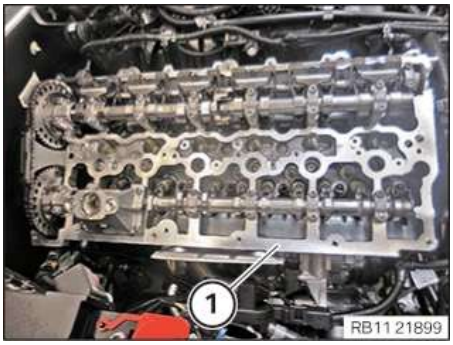
Improper routing of cables and wiring harnesses.

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

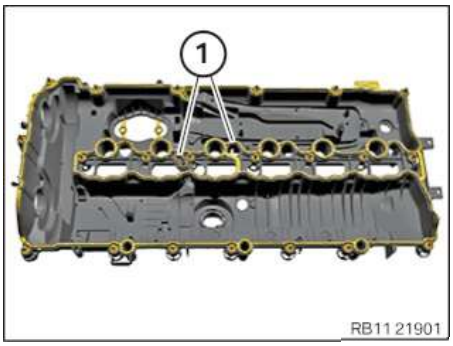
- Route all cables without abrasions, do not trap and crush.

TECHNICAL INFORMATION

Latch mechanisms, guides and mounting elements must not be damaged or missing.

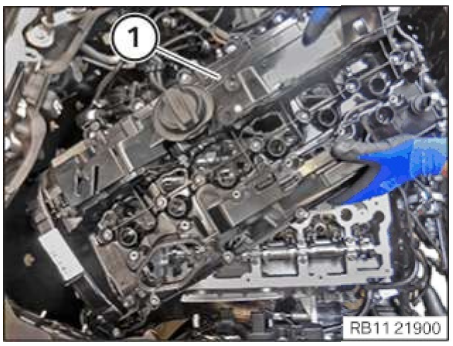


- Contact surface (1) must be free from oil and grease.



- Replace the seals (1).

  Parts: Seals

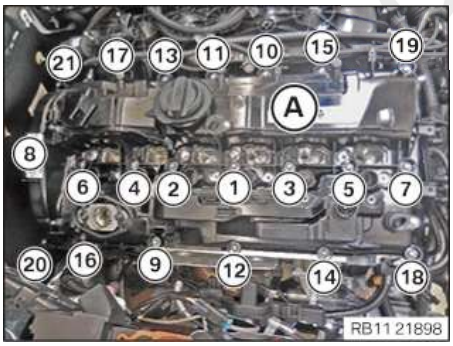


- Insert and install cylinder head cover (1).



- Ensure that the cylinder head cover (1) is installed in the **marked** area correctly on the high pressure pump bracket(2).

  The cylinder head cover (1) must not touch the high pressure pump bracket (2) in the **marked** area.



- Position the cylinder head cover (A).
- Make sure that the cylinder head cover (A) does not touch the high pressure pump bracket!
- Tighten all bolts in sequence (1) to (21).

Cylinder head cover to cylinder head

M6X30		Jointing torque	8 Nm

- Tighten all screws in a sequence from (1) to (21).

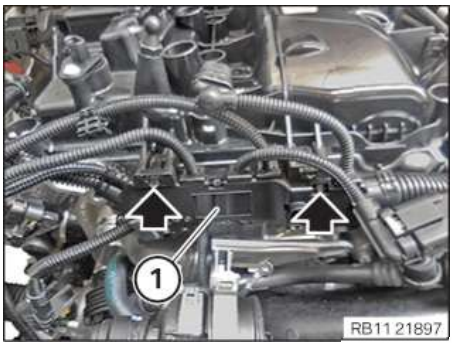
Cylinder head cover to cylinder head

M6X30		Tightening torque	11 Nm

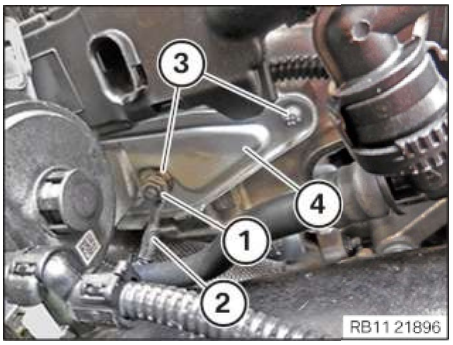
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- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.



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



- Insert and position the holders (4).
- Tighten the screws (3).

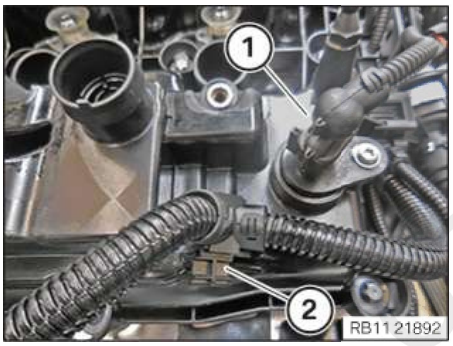
Auxiliary coolant pump holder to cylinder head

M6		Tightening torque	7 Nm

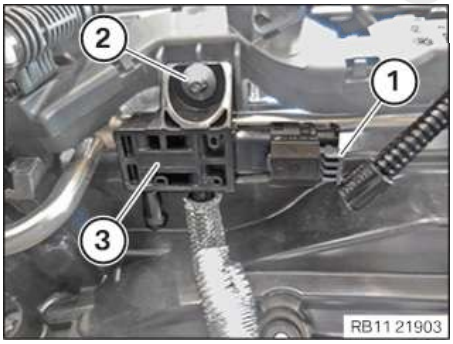
- Thread in ground cable (2) and install.
- Tighten nut (1).

Standard screw connection M6

M6			8 Nm



- Connect and lock the connector (1) on the exhaust camshaft sensor .
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).



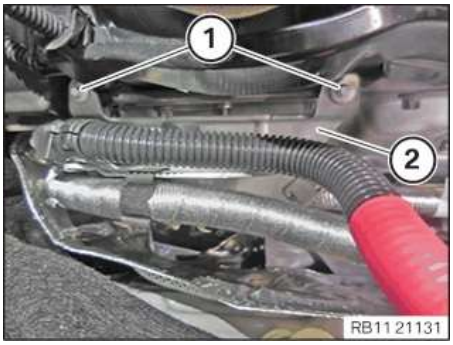
- **If installed:**
- Feed in and install the differential pressure sensor (3).
- Tighten down screw (2).

Differential pressure sensor to holder

TS6X18		Tightening torque	3,5 Nm

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

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CAUTION

Improper routing of the positive battery cable.

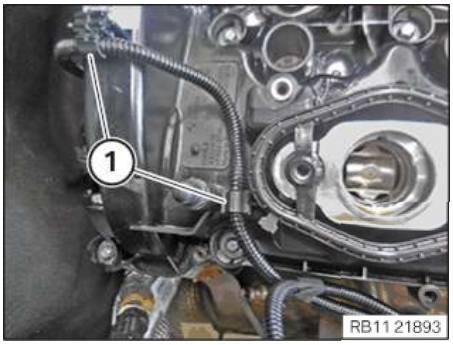
Risk of short circuits!

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

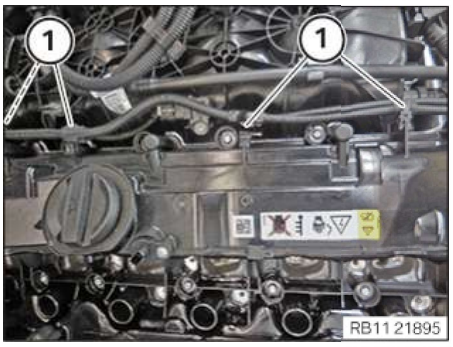
- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

Holder, positive battery cable to cylinder head cover

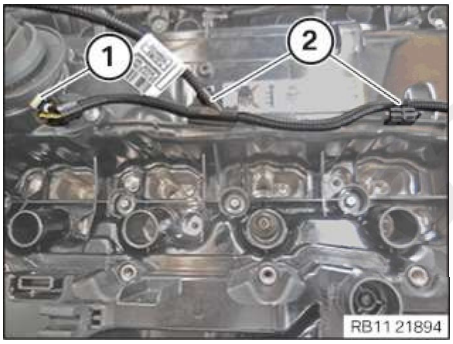
6X18		Tightening torque	6 Nm



- Secure clamps (1).

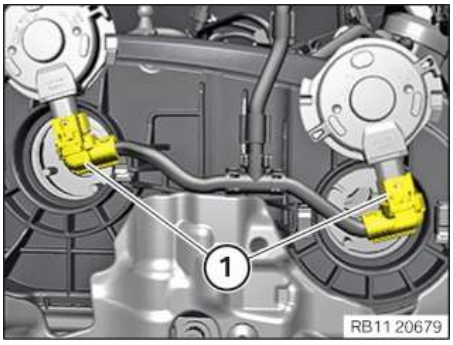


- Secure clamps (1).



- Connect connector (1) to the intake camshaft sensor and lock it.
- Make sure the connector (1) engages audibly.
- Secure clamps (2).

52 – Installing both actuators

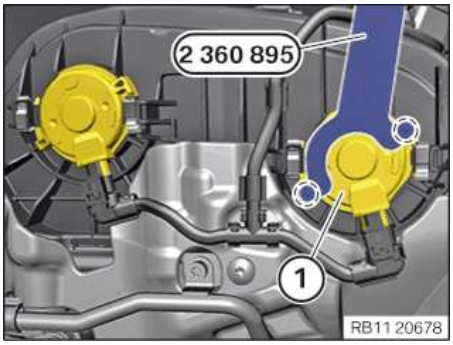


NOTICE

The figure shows the rear side of the engine.

- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.

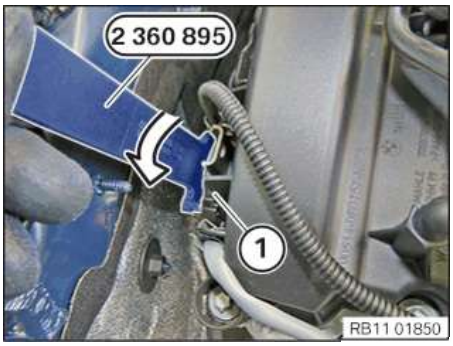
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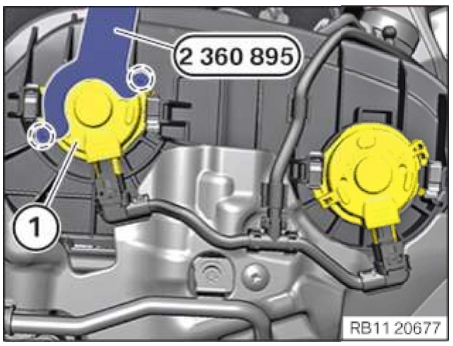
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



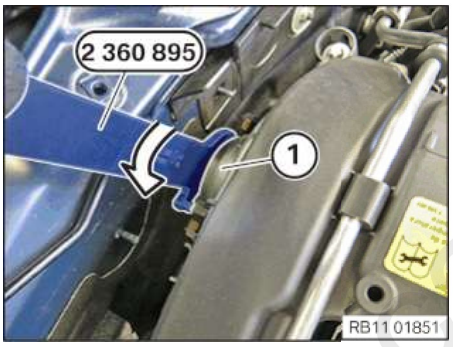
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.



NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

53 – Install high pressure pump

RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

Only G05 and G07

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

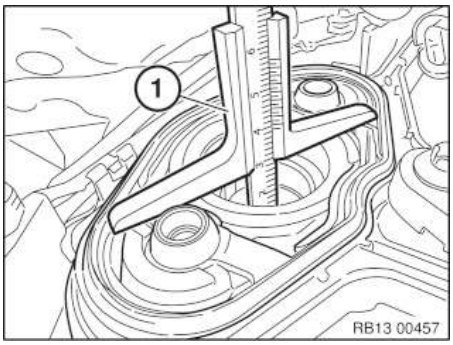
For additional information see: 17 11 035 Removing and installing/replacing the fan cowl including electric fan

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TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

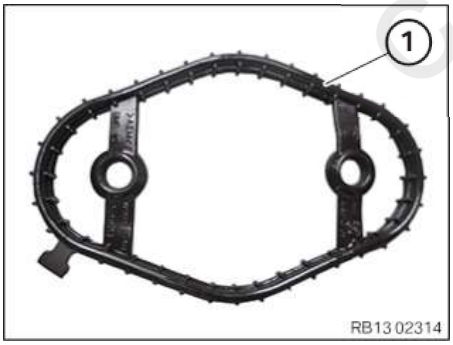
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.

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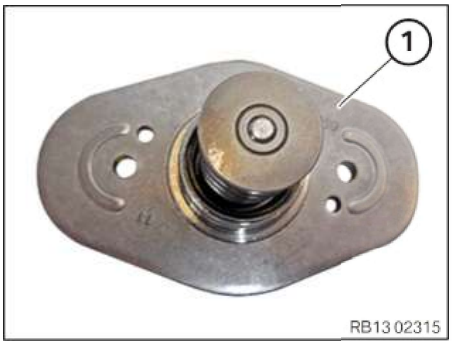
TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

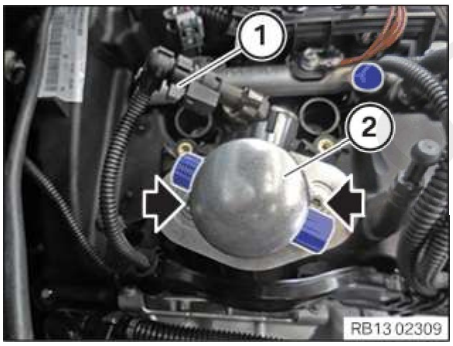
The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

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

54 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

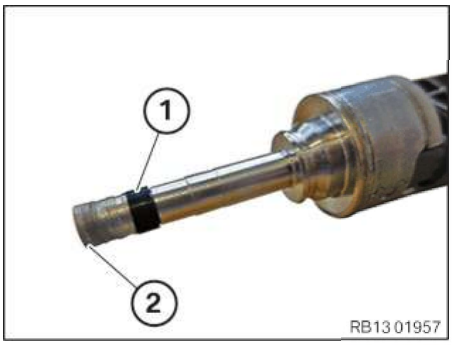
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

TECHNICAL INFORMATION

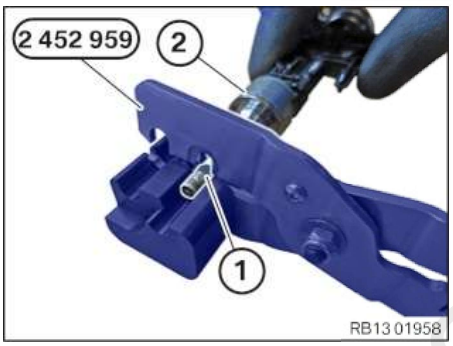
Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.



- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings
- Avoid mechanical contact with injector tip (2).



- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.

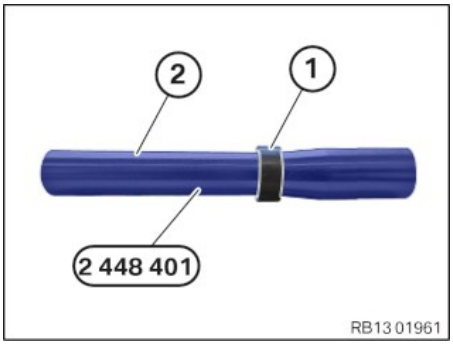


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

  (1) Installation cone

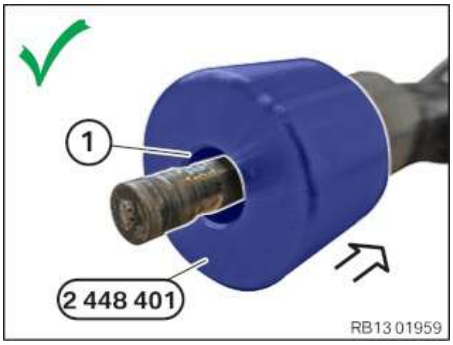
  (2) Sliding sleeve

  (3) Assembly sleeve



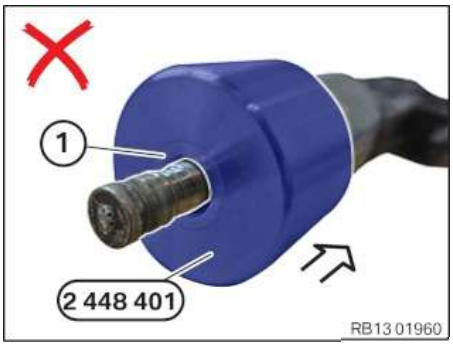
- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.

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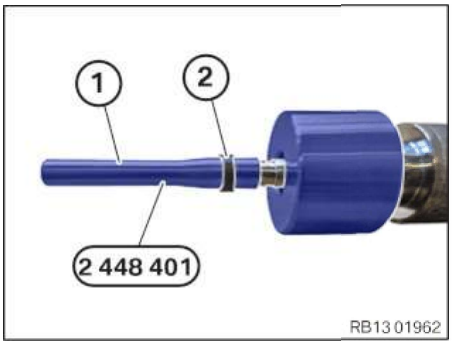
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The larger diameter of the assembly sleeve (1) must point to the injector tip.

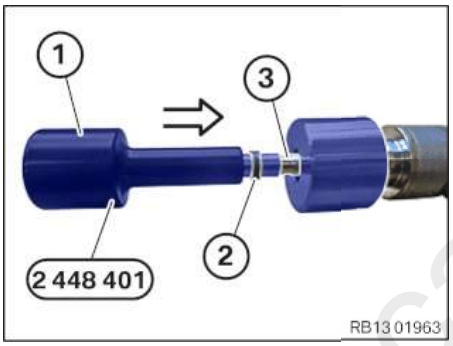


- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

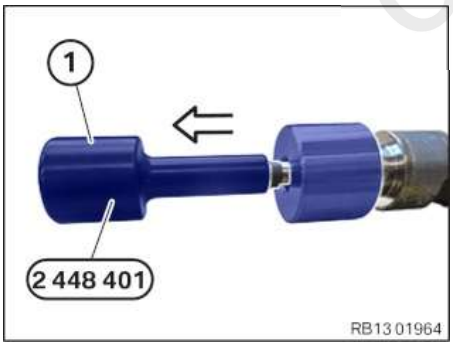
  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.



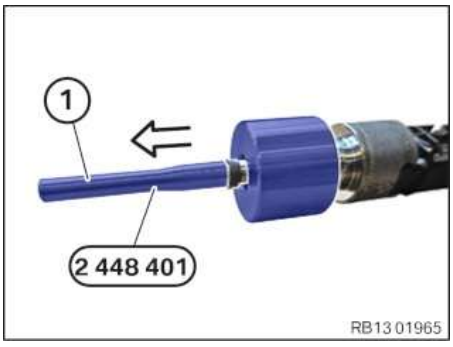
- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .



- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.

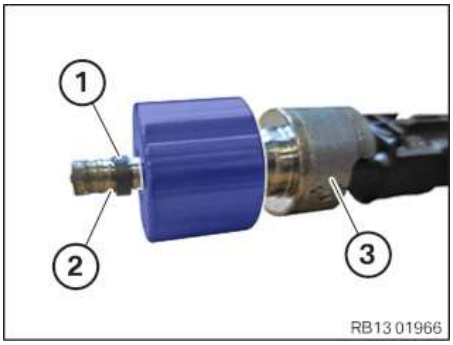


- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

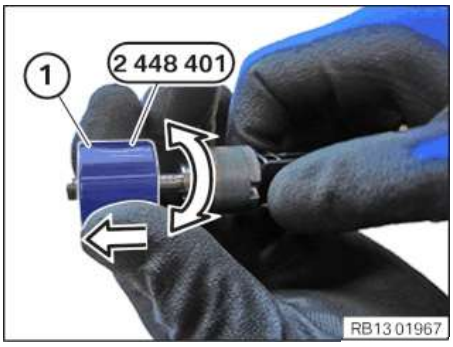


- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

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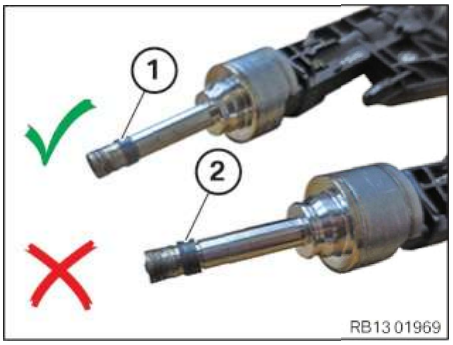


- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.



- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).

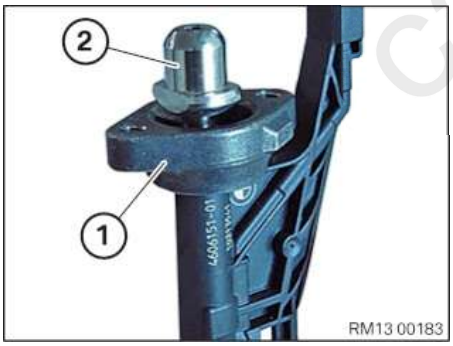


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

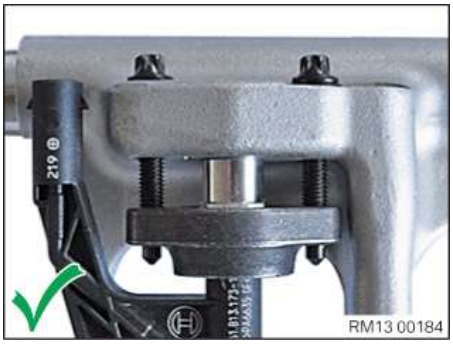
55 – Installing the high-pressure rail with injectors of the cylinders 4 to 6

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



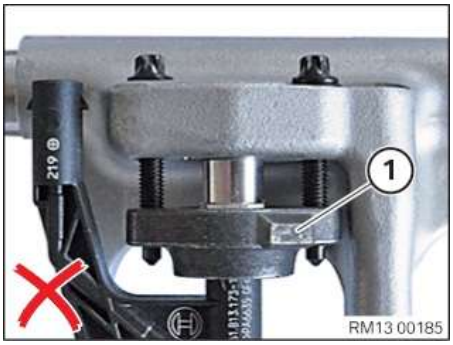
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder**(1) **has a cast lug**: Make sure that the holder is installed in the correct position.



- If applicable, note the position of the cast lug:

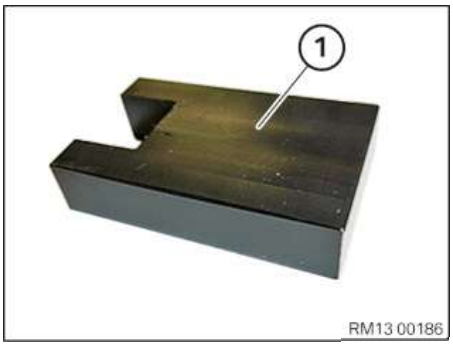
  The holder is mounted **correctly** when the cast lug is located at the rear.

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- If applicable, note the position of the cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.



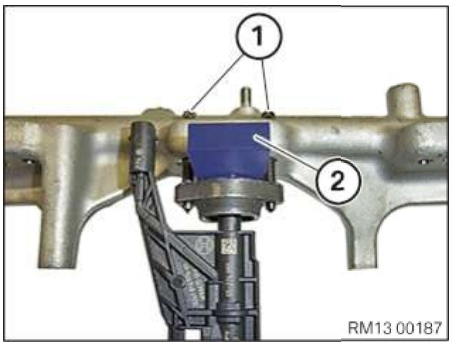
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).



- Replace (M5x30) screws.

  Parts: Screws (M5x30)
- Mount the injectors with the holders and the bolts (M5x30) (1) on the rail.
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.
- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) evenly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.



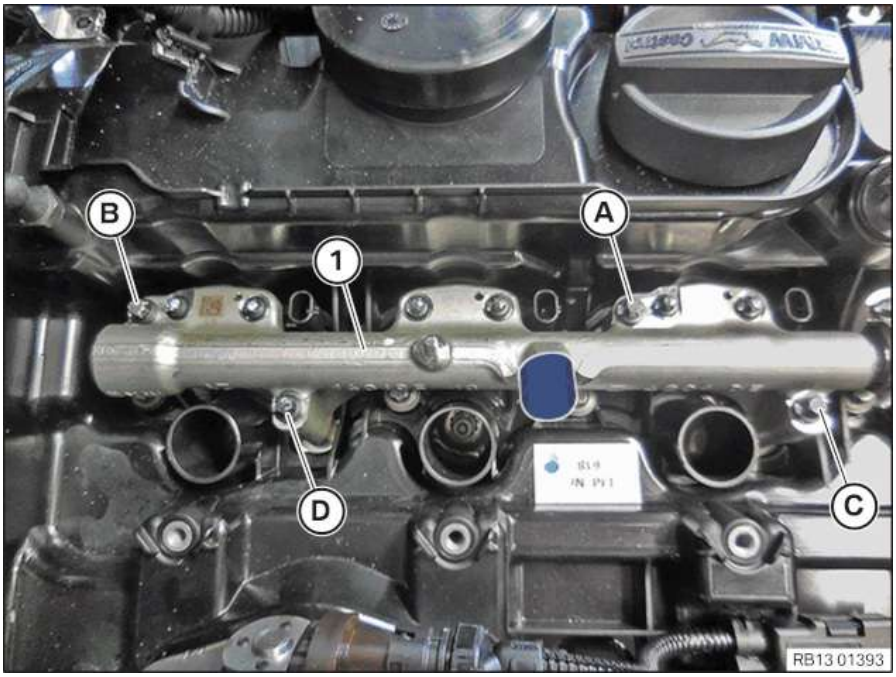
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.



- Check injectors for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors must move freely.

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- Renew screws (A) to (D).

  Parts: Bolts
- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- Press the rail (1) down until a resistance can be felt; join and hand-tighten the bolts (M6x30) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.

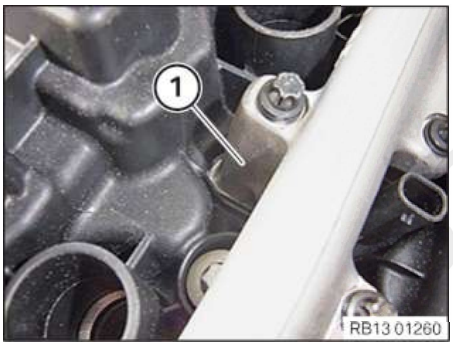
  The figure shows the rail resting flat against the cylinder head.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

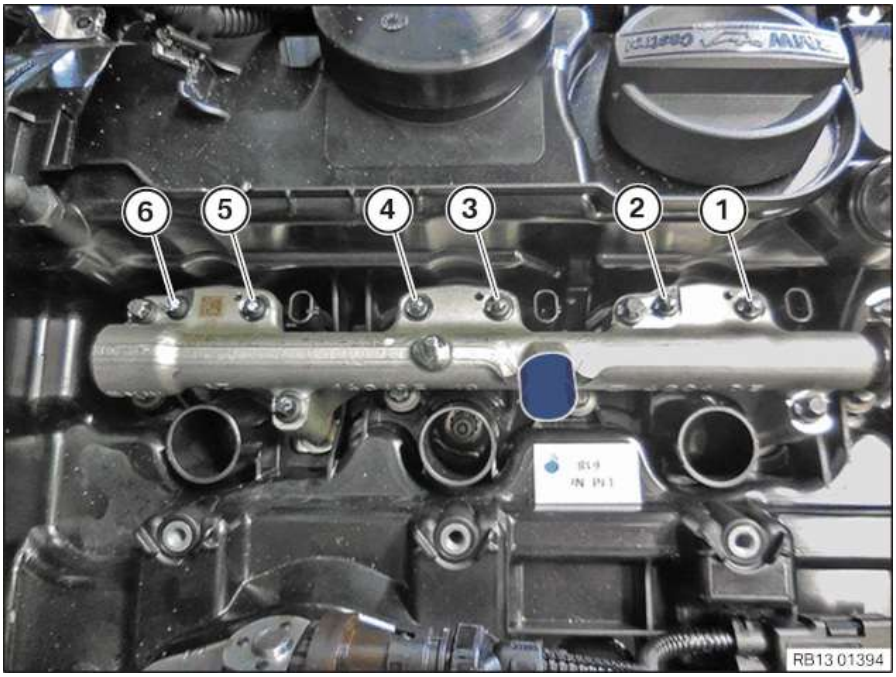
Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.



- Make sure that the rail (1) rests flat against the cylinder head.

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- Attach a socket to an extension.

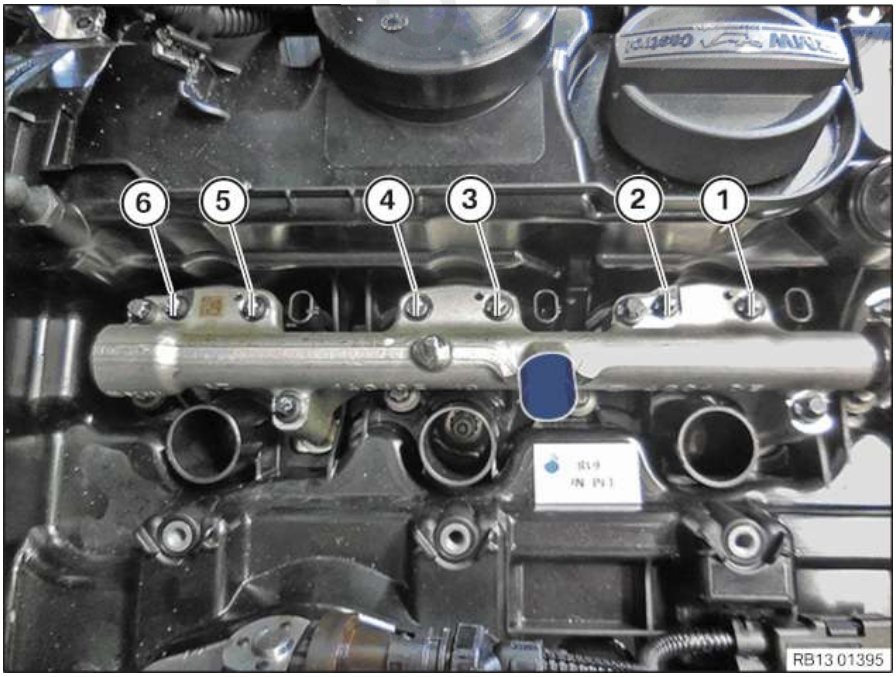
  Do not use a reversible ratchet or torque wrench.
- Tighten the bolts (M5x30) in pairs ((1) with (2), (3) with (4), (5) with (6)) in alternating order **90° hand-tight**.
- Set the torque wrench to 5 Nm.

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- **Screw the (M5x30) bolts according to the following plan:**
  - **Fuel injector 4:**
  - Tighten screw (1) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (2) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 5:**
  - Tighten screw (3) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (4) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 6**:
  - Tighten screw (5) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (6) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts reach a torque of 5 Nm.



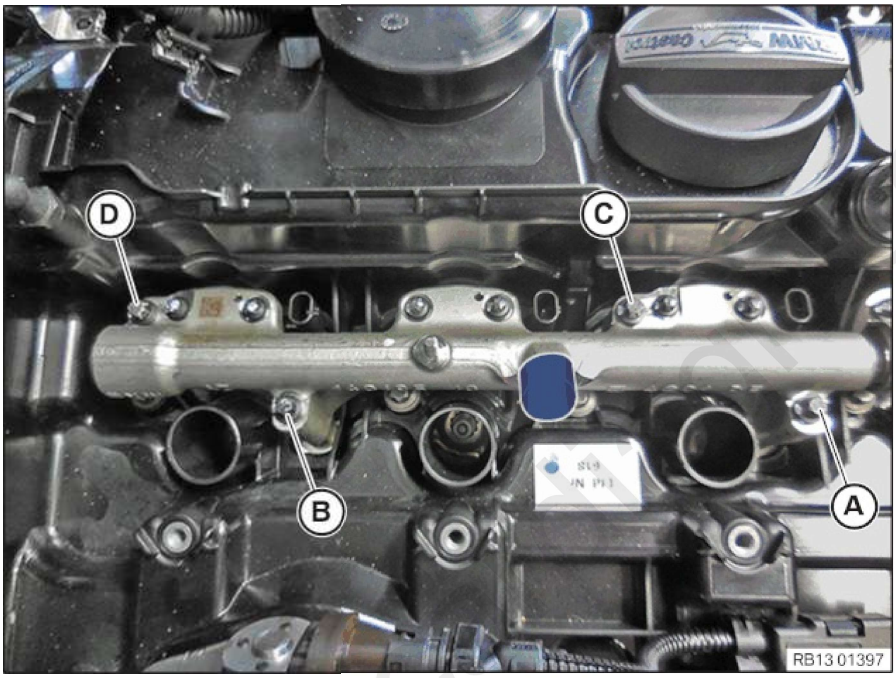
- Mark all bolts (1) to (6) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the screw (1) with an angle of rotation of 90° ±15°.
  - Tighten the screw (2) with an angle of rotation of 90° ±15°.
  - Tighten the screw (3) with an angle of rotation of 90° ±15°.
  - Tighten the screw (4) with an angle of rotation of 90° ±15°.
  - Tighten the screw (5) with an angle of rotation of 90° ±15°.
  - Tighten the screw (6) with an angle of rotation of 90° ±15°.

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- Check if all bolts (1) to (6) have been tightened with a 90° ±15° angle of rotation.

  All marks (lines) must be horizontal (see figure).



- Unscrew the bolts (M6x70) (A) to (D).

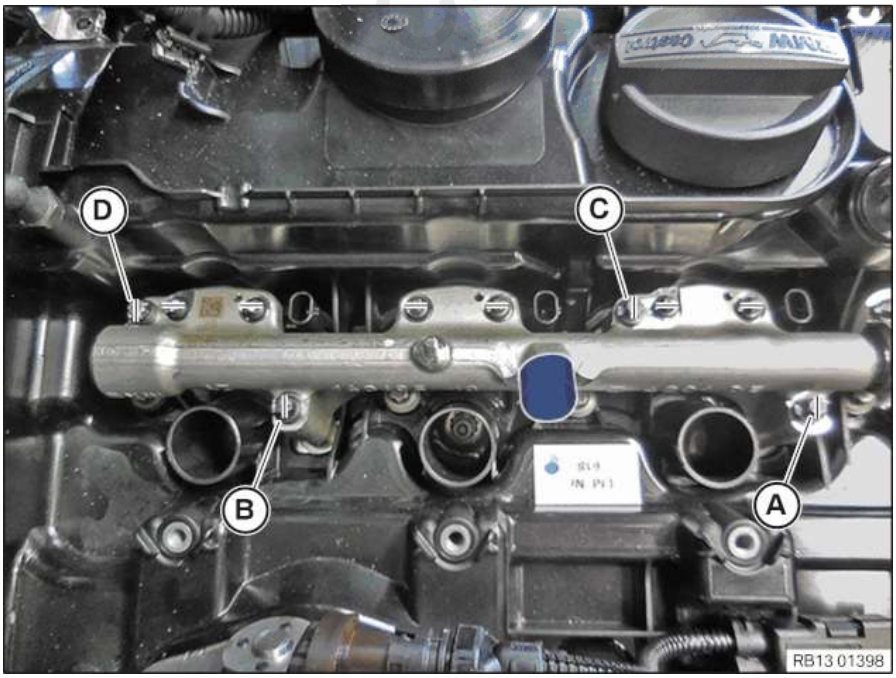
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

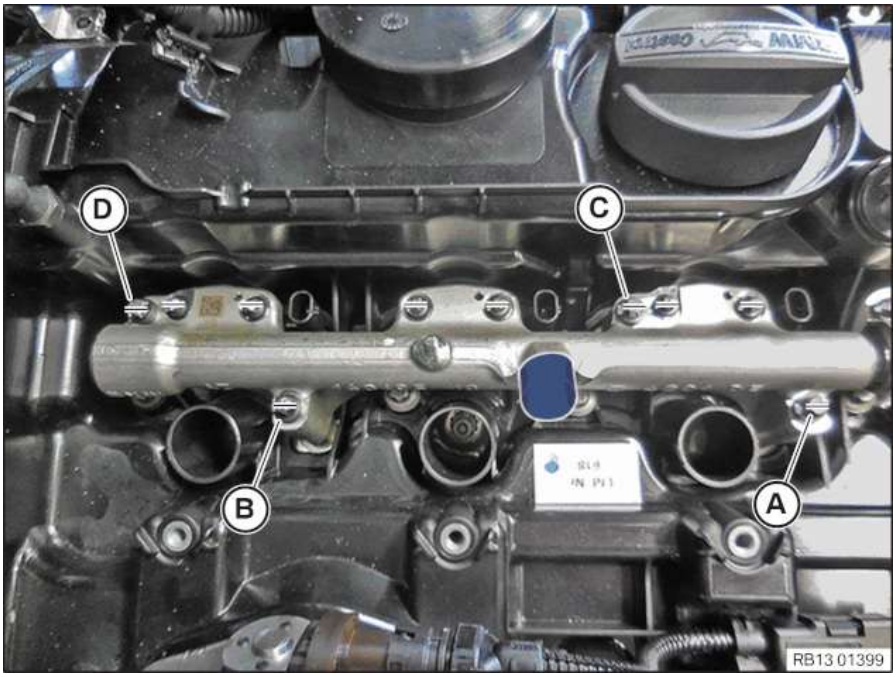
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.

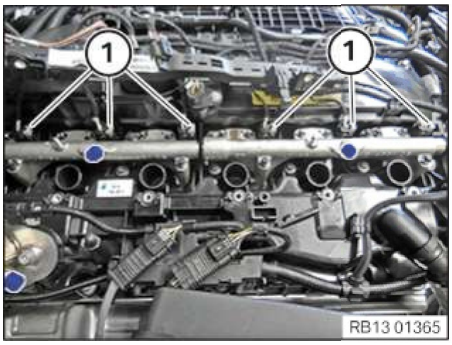


- Mark all bolts (A) to (D) with a vertical line (see figure).
- Tighten bolts (M6x70) (A) to (D) to a 90° angle of rotation.



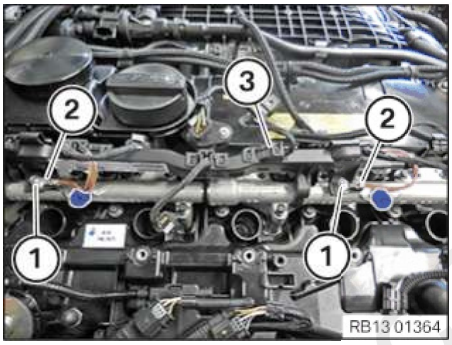
- Check if all bolts (A) to (D) have been tightened with a 90° angle of rotation.

  All marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nuts (1).

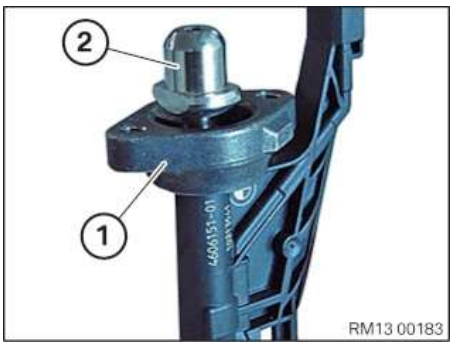
Ground cable to rail

M6			5 Nm

56 – Installing rail with injectors of cylinders 1 to 3

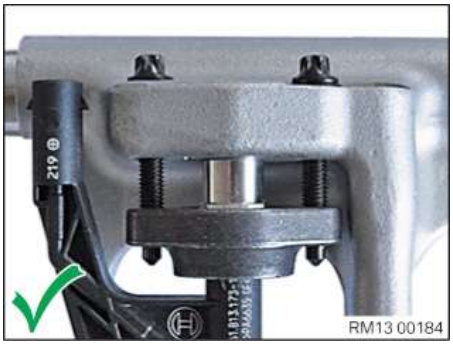
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



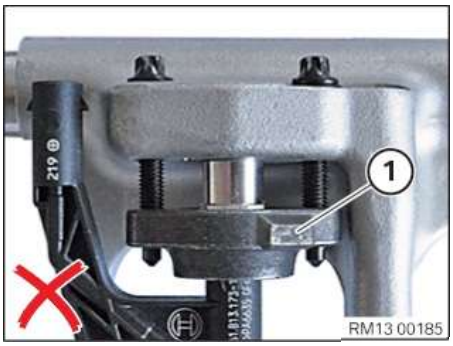
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If there is a cast lug on the holder** (1) **:** Make sure that the holder is installed in the correct position.

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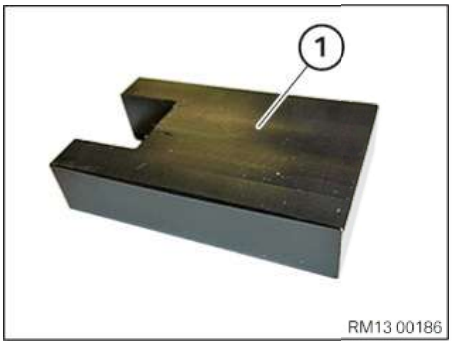
- Observe position of cast lug:

  The holder is mounted **correctly** when the cast lug is located at the rear.



- Observe position of cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.



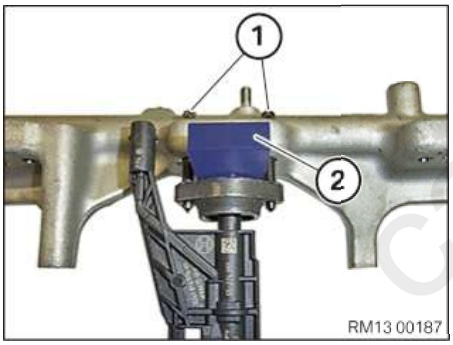
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use special tool 2 358 022(1) .



- Replace (M5x30) screws.

  Parts: Screws (M5x30)
- Mount the injectors with the holders and the bolts (M5x30) (1) on the rail.
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.
- Slide special tool 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure the special tool 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) *uniformly until the special* tool 2 358 022 (2) rests flat against the rail and the holder.



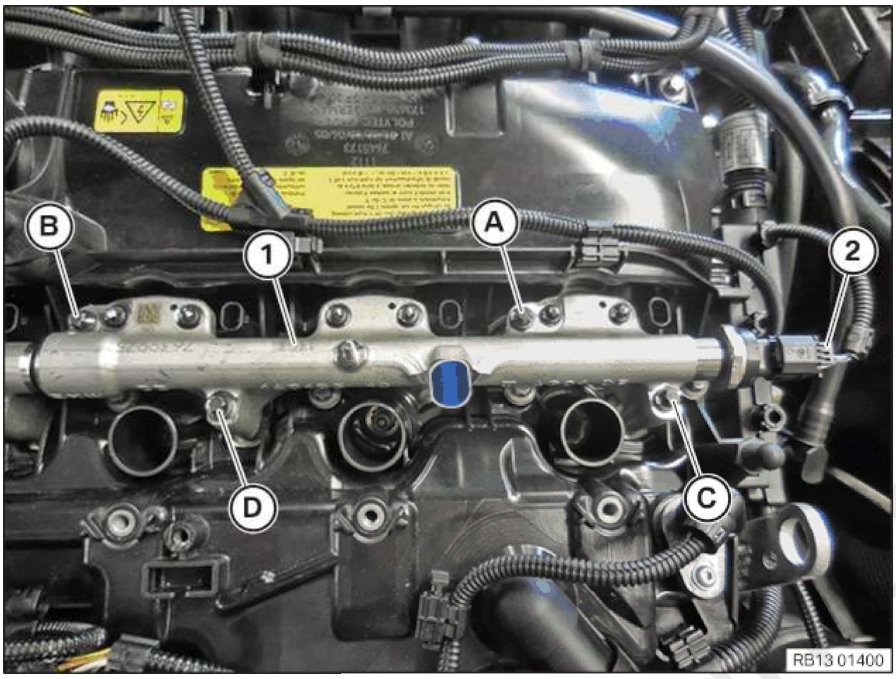
- Remove special tool 2 358 022(1) .
- Repeat this operation for all injectors.

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- Check injectors for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors must move freely.



- Renew screws (A) to (D).

  Parts: Bolts
- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- Press rail (1) down until a resistance can be felt; join and hand-tighten screws (M6x30) (A) and (B).
- Tighten screws (A) and (B) alternately by **180°** each with the torque wrench until the rail is positioned on the cylinder head.

  The figure shows the rail resting flat against the cylinder head.
- Insert screws (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

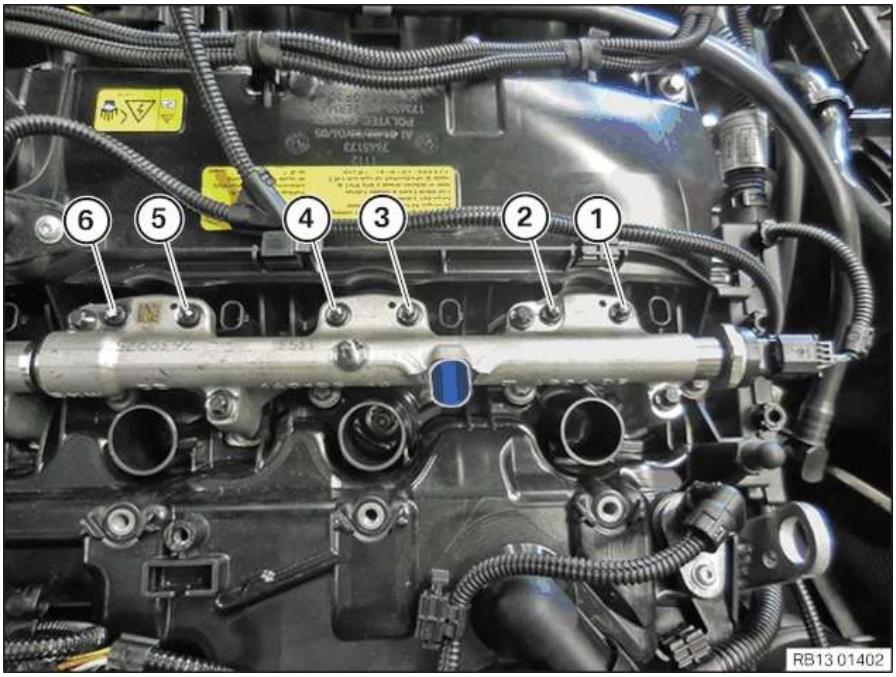
- Tighten screw (A) to 5 Nm.
- Tighten screw (D) to 5 Nm.
- Tighten screw (B) to 5 Nm.
- Tighten screw (C) to 5 Nm.
- Connect and lock the connector (2).

  The connector (2) must engage audibly.



- Make sure that the rail (1) rests flat against the cylinder head.

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- Attach a socket to an extension.

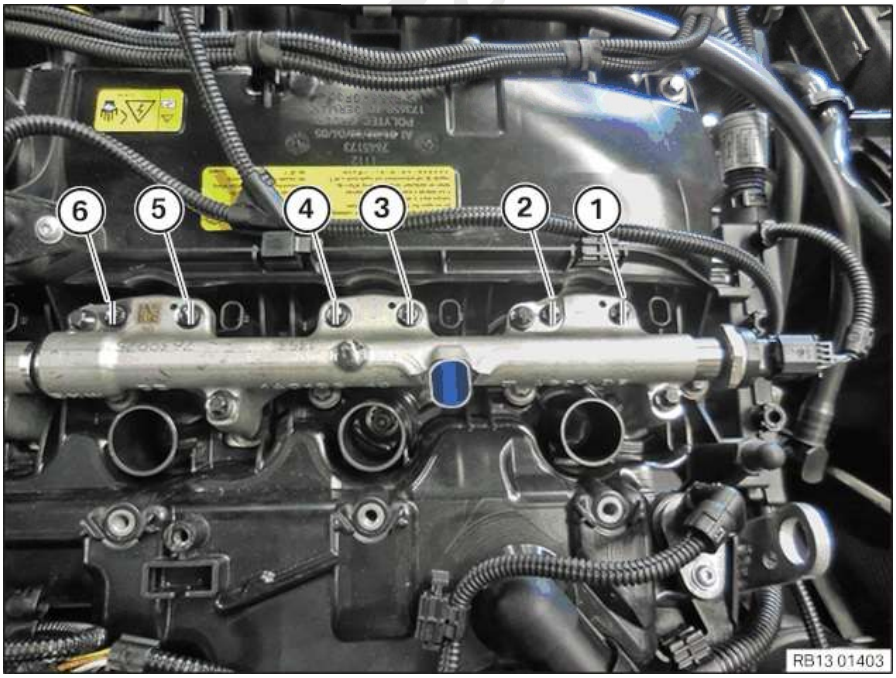
  Do not use a reversible ratchet or torque wrench.
- Hand-tighten screws (M5x30) in pairs ((1) with (2), (3) with (4), (5) with (6)) alternately by **90°**.
- Set torque wrench to 5 Nm.

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

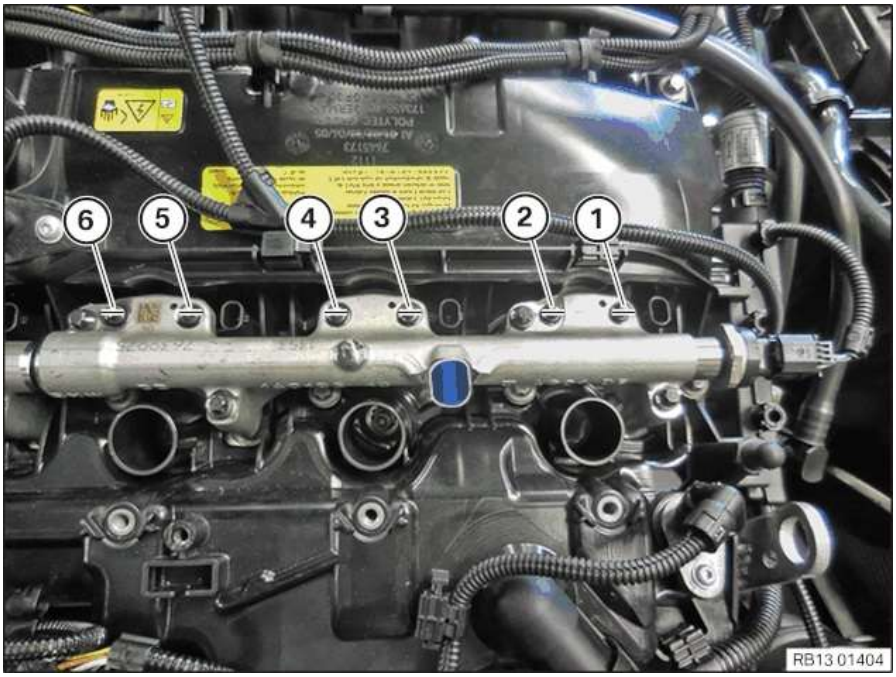
Non-observance of these requirements may result in leaks and damage.

- **Screw the (M5x30) bolts according to the following plan:**
  - **Fuel injector 1:**
  - Tighten screw (1) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (2) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten screw (3) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (4) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 3**:
  - Tighten screw (5) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (6) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts reach a torque of 5 Nm.



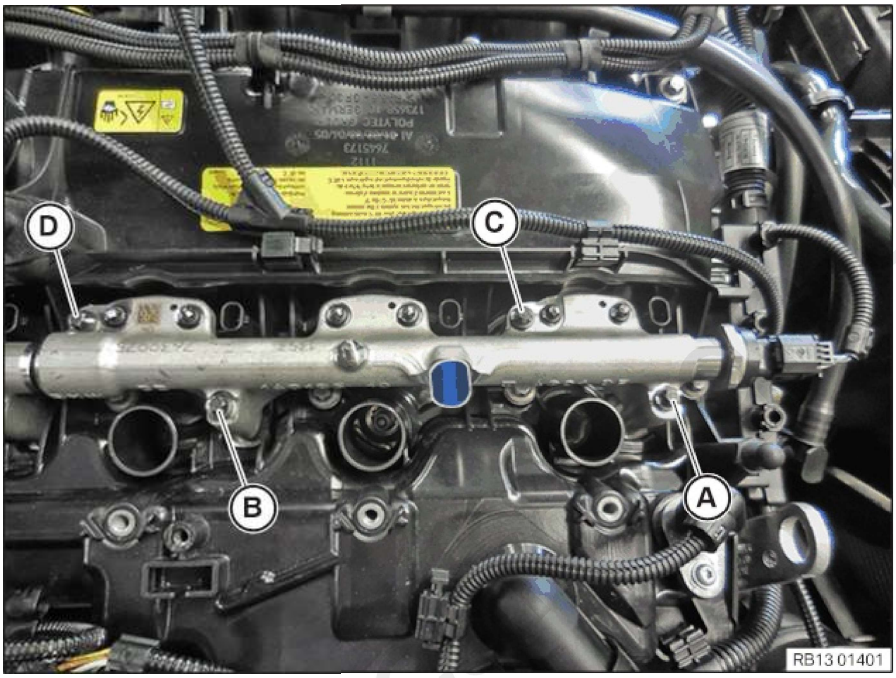
- Mark all bolts (1) to (6) with a line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the screw (1) with an angle of rotation of 90° ±15°.
  - Tighten the screw (2) with an angle of rotation of 90° ±15°.
  - Tighten the screw (3) with an angle of rotation of 90° ±15°.
  - Tighten the screw (4) with an angle of rotation of 90° ±15°.
  - Tighten the screw (5) with an angle of rotation of 90° ±15°.
  - Tighten the screw (6) with an angle of rotation of 90° ±15°.

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- Check if all bolts (1) to (6) have been tightened with a 90° ±15° angle of rotation.

  All markings (lines) must be horizontal (see Figure).



- Release screws (M6x70) (A) to (D) **without fail**.

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten screw (A) to 5 Nm.
- Tighten screw (D) to 5 Nm.
- Tighten screw (B) to 5 Nm.
- Tighten screw (C) to 5 Nm.

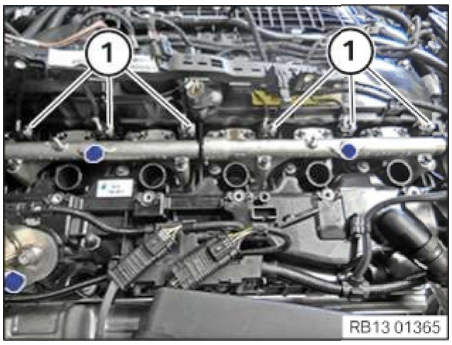


- Mark all the bolts (A) to (D) with a vertical line (see Figure).
- Tighten bolts (M6x70) (A) to (D) with an angle of rotation of 90°.



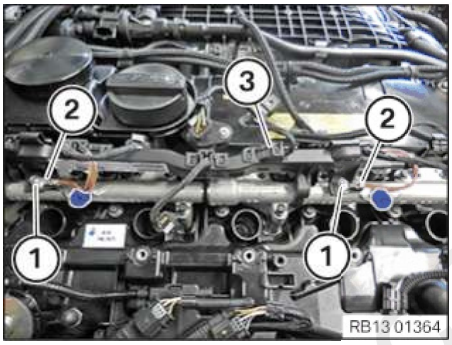
- Check whether all screws (A) to (D) have been tightened with an angle of rotation of 90°.

  All marks (lines) must be horizontal (see figure).



- Connect and lock all the connectors (1) to the injectors.

  All connectors (1) must engage audibly.

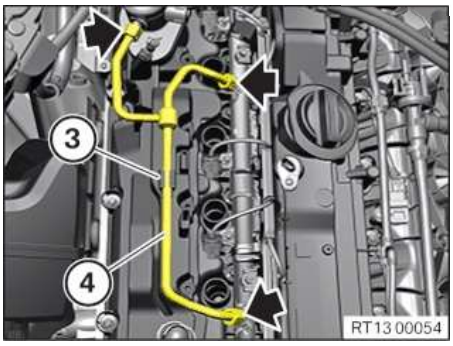


- Thread the cable channel (3) in and install.
- Thread in ground cable (2) and install.
- Tighten nuts (1).

Ground cable to rail

M6			5 Nm

57 – Installing high pressure line between rail and high pressure pump

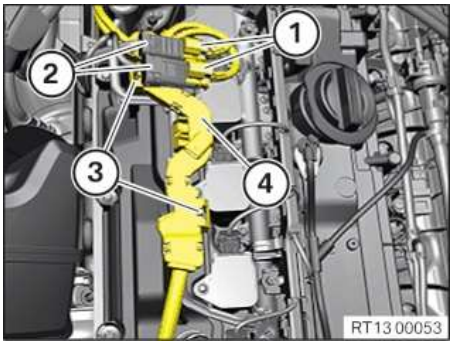


- Insert the high pressure line (4) into the holder (3) and install.
- Tighten union nuts (arrows) with the special tool .

High pressure line between rail and high pressure pump

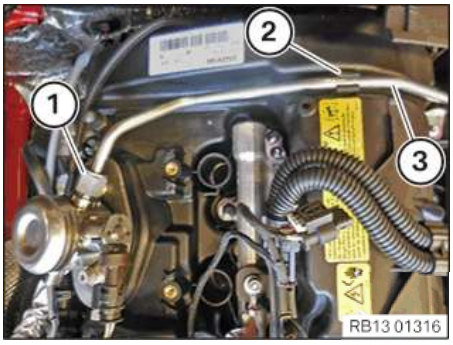
M14x1,5		Tightening torque	33 Nm

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- Insert and install the wiring harness section of the engine wiring harness (4).
  The locks (3) must engage audibly.
- Connect connectors (1) and (2) and lock.
  The connectors (1) and (2) must audibly engage.

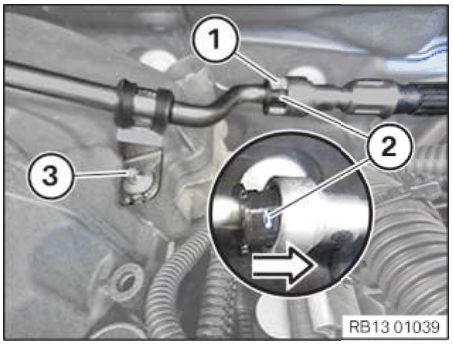
58 – Installing fuel delivery line



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

Fuel delivery line to high pressure pump

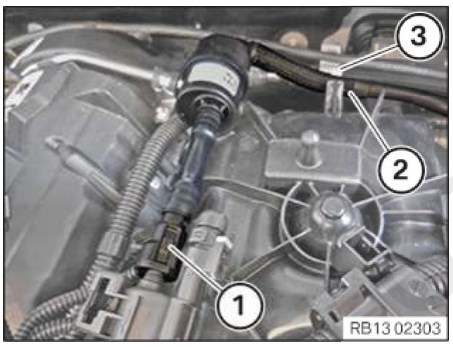
M14		Tightening torque	31 Nm



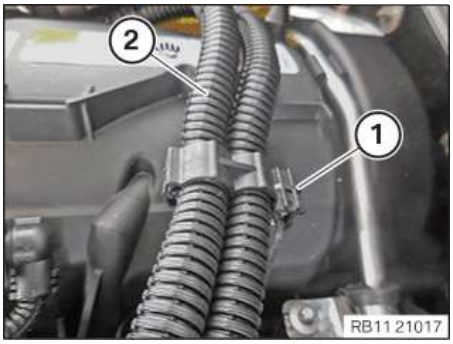
- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure clamps (1).
- Tighten down screw (3).

Fuel line to cylinder head cover

6x18		Tightening torque	6,5 Nm

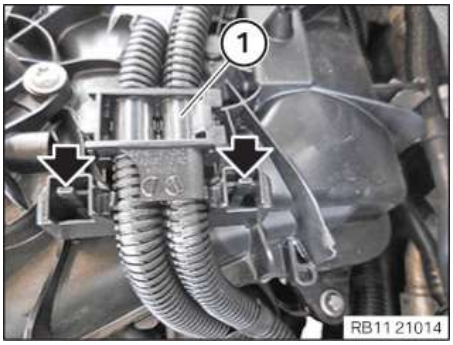


- Insert and install the tank ventilation line (2).
- Lock (1) must engage audibly.
- Secure the tank ventilation line (2) to the clamp (3).



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

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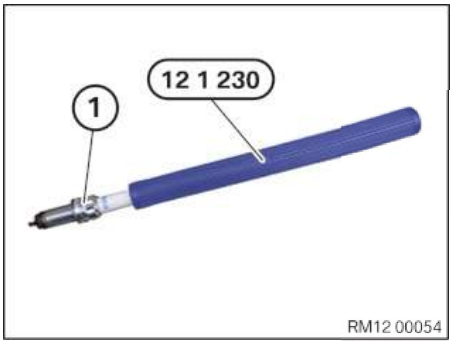


- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

59 – Installing all spark plugs

NOTICE

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



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



TECHNICAL INFORMATION

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

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



TECHNICAL INFORMATION

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

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

Spark plugs

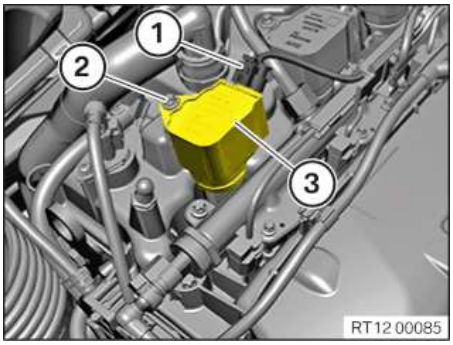
M12x1.25		Tightening torque	23 Nm

60 – Install all ignition coils

NOTICE

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

▸ **Install ignition coil.**



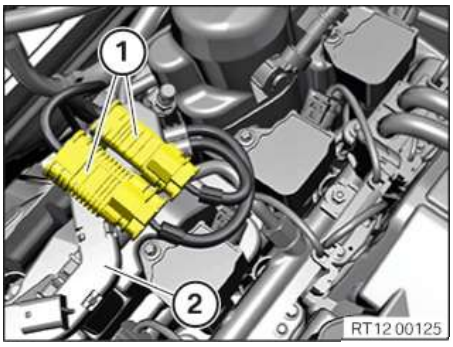
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

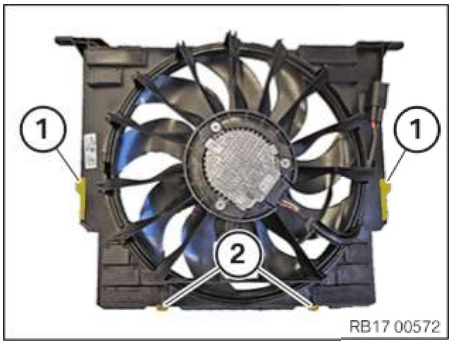
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

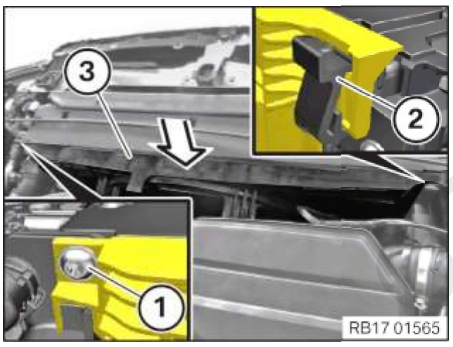


- Connect the connector (1) of the front oxygen sensor and the monitoring oxygen sensor on the cable shaft (2).

61 – Install fan cowl



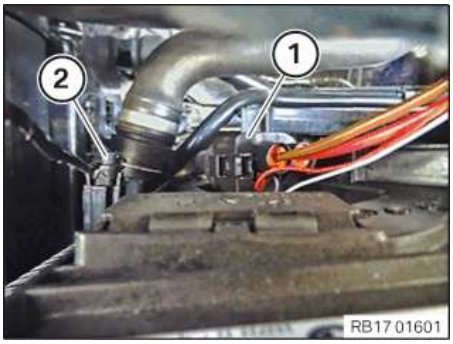
- Feed guides (1) into the radiator.
- Feed guides (2) into the charge air cooler.



- Guide in and install fan cowl (3) **carefully** in the direction of the arrow.
- Ensure that the lock (2)engages audibly.
- Tighten down screw (1).

Fan cowl with electric fan on radiator

TS6x20		Tightening torque	6,5 Nm

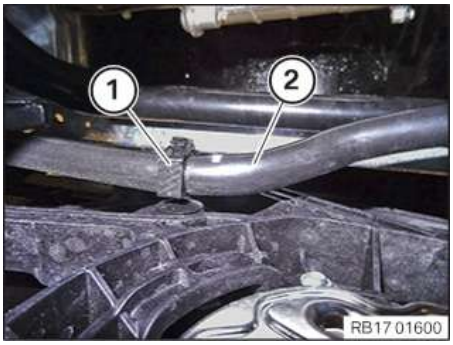


- Connect connectors (2) and lock.

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

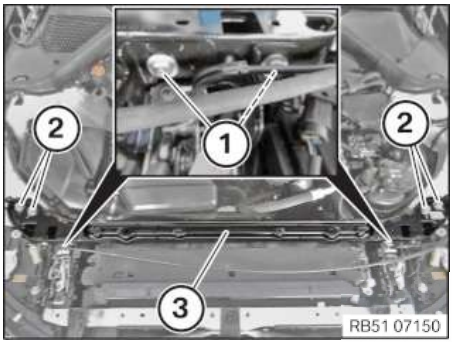
  The connector (1) must engage audibly.

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- **If installed:** Secure the transmission oil line (2).
  Insert and install the transmission oil line (2).
  Lock holder (1).

62 – Install the rear top cross connection



- Guide in and position the top rear cross connection (3).
- Tighten the screws (1).

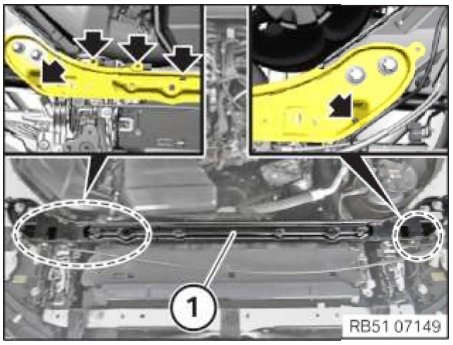
Top rear cross connection to bonnet catch support

Flat-head screw M6x20		Tightening torque	11,8 Nm

- Renew screws (2).
  Parts: Bolts
- Tighten the screws (2).

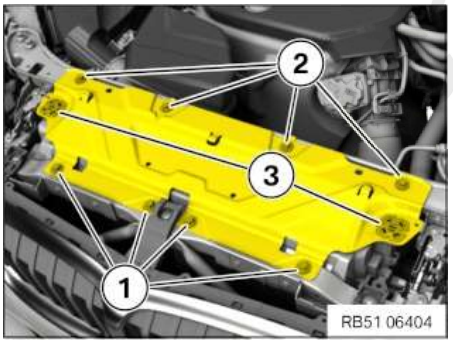
Rear top cross connection to wheel arch carrier support

M10x20 screw	Renew screw.	Jointing torque	56 Nm
		Angle of rotation	90 °



- Secure the clips (arrows) in the marked areas to the top rear cross connection (1).

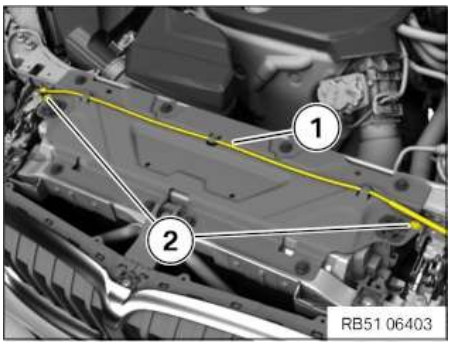
63 – Installing the top cross connection



- Set and position upper cross connection with holders (3) from above.
- Tighten down screws (1) and (2).

Cross connection, top

M8x20		Tightening torque	28 Nm



- Tighten down screws (2).

Cross connection, top

M6x20		Tightening torque	11,8 Nm

- Attach Bowden cable (1) on the upper cross connection.

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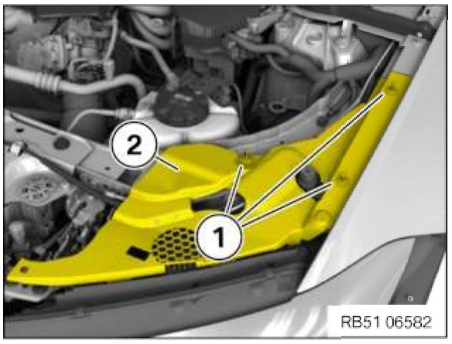
- Clip in the housing for the coupling of the Bowden cables (1).

64 – Install the cover in the engine compartment at top left and right partially

NOTICE

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

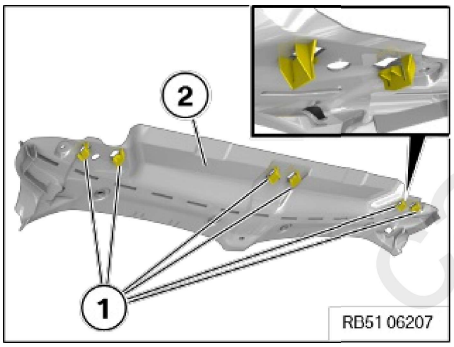
▶ Installing the cover in the engine compartment on top partially



- Install the cover in the engine compartment on top (2).
- Secure expanding rivet (1).

65 – Installing cover for engine compartment centre

Check



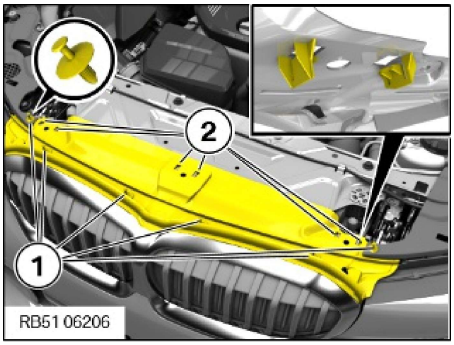
- Check latch mechanisms (1) of cover for engine compartment centre (2) for damage.

Result

» The latch mechanism (1) is damaged.

Measure

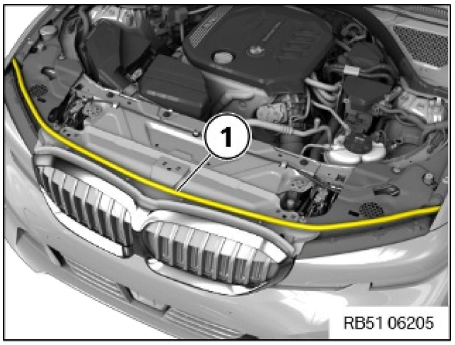
- Renew cover for engine compartment centre (2).



- Guide in the cover for the engine compartment centre from the rear and position it.
- Clip in the cover for the engine compartment centre with latch mechanisms (2).
- Mount all expanding rivets (1).

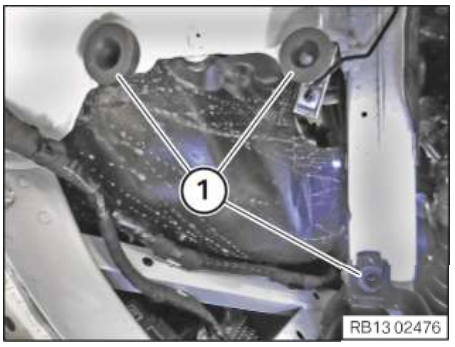
66 – Install the seal for the front bonnet

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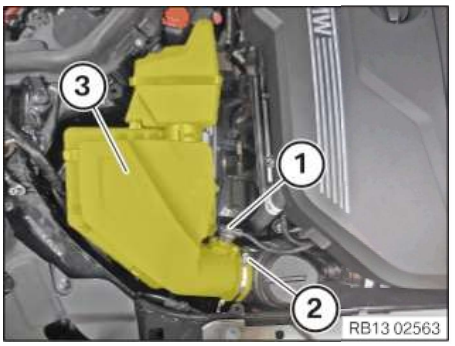


- Position the bonnet seal(1) and connect it on the mounting on the bumper and on the headlights.

67 – Installing intake silencer housing



- Check the rubber mount (1) for correct fit.



- Feed the intake filter housing (3) in and engage it in the rubber mounts.
- Tighten clamp (2).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Connect connectors (1) and lock.

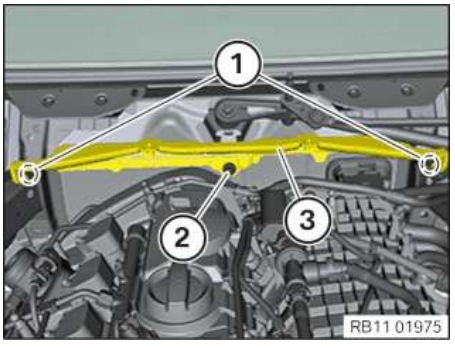
  The connector (1) must engage audibly.

68 – Disconnecting all battery earth leads



- See additional information.

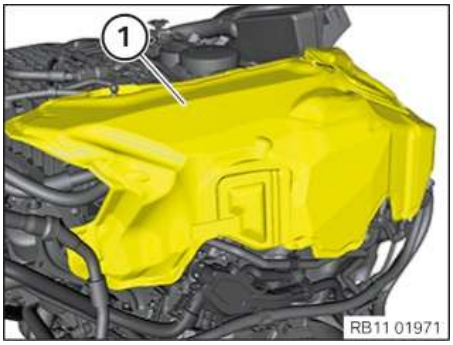
69 – Installing centre bulkhead lower section



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

70 – Installing acoustic cover at rear

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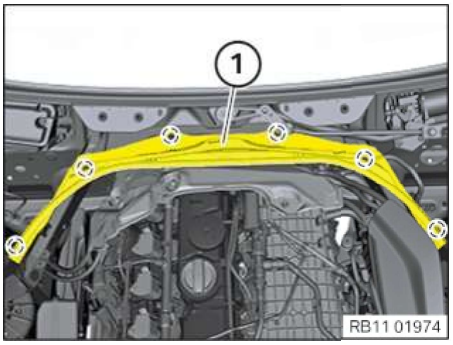


- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



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

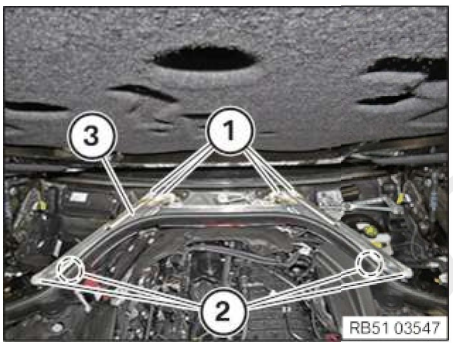
71 – Installing the centre bulkhead upper part



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

Bulkhead upper part to bottom bulkhead

	Tightening torque	3 Nm



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

Tension strut on bulkhead

M10x25 screw		Tightening torque	56 Nm

- Renew screws (2).

  Parts: Bolts
- Tighten the screws (2).

Tension strut to spring strut dome

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

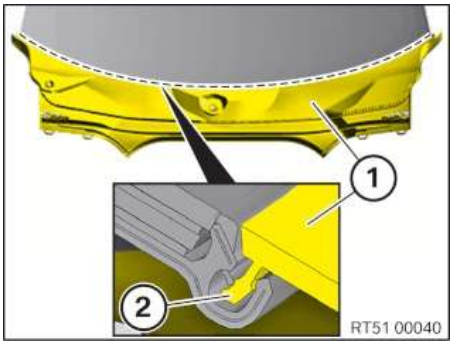
72 – Installing cowl panel cover

RISK OF DAMAGE

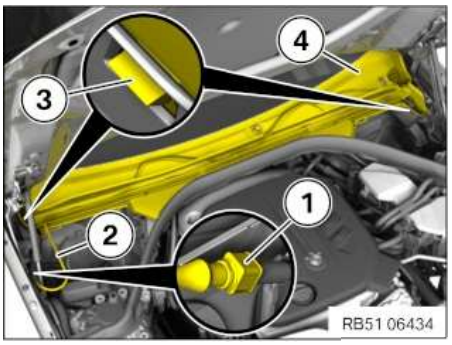
Damage caused by water ingress into the vehicle.

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

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

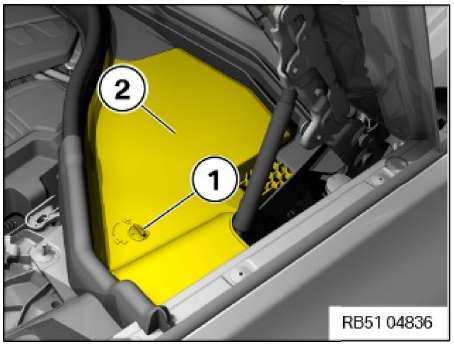


- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



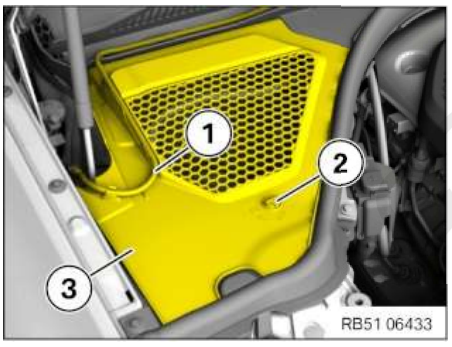
- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

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



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

74 – Install the rear right engine compartment cover



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

75 – Installing both wiper arms

NOTICE

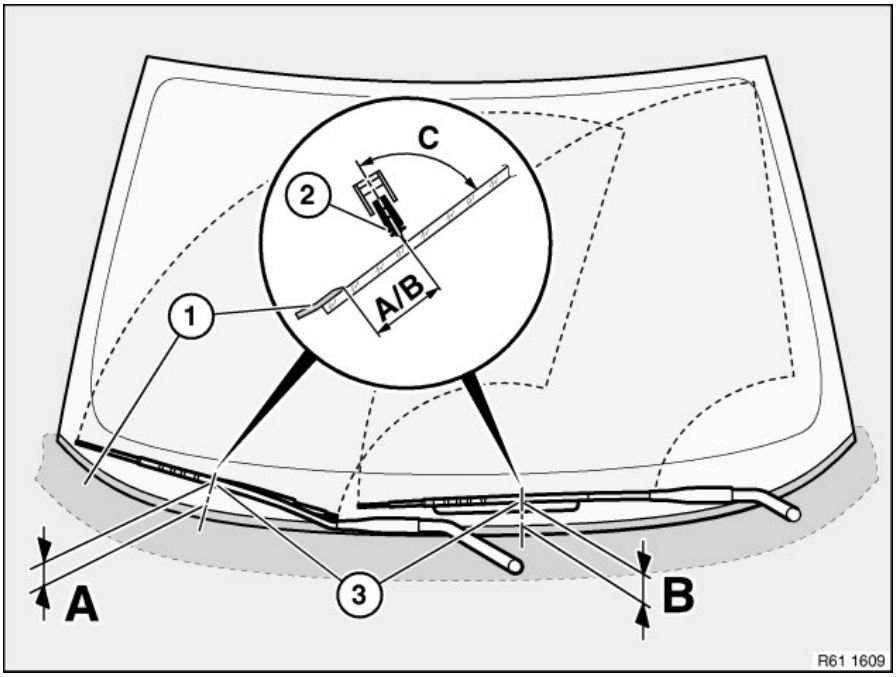
Description is for left component only. Procedure on the right side is identical.

▸ **Install the wiper arm**

TECHNICAL INFORMATION

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

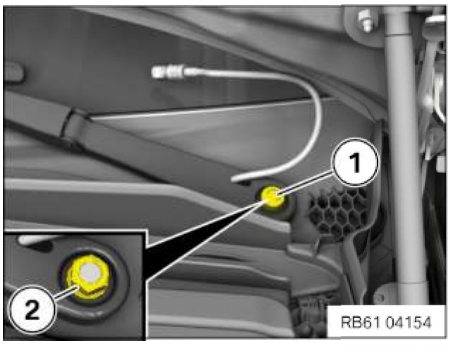
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- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

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

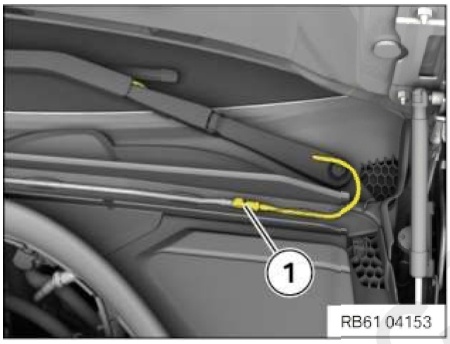


- Tighten nut (2).

Windscreen wiper arm

Combination hexagon nut		Tightening torque	35 Nm

- Connect the protective cap (1).



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

76 – Install acoustic cover

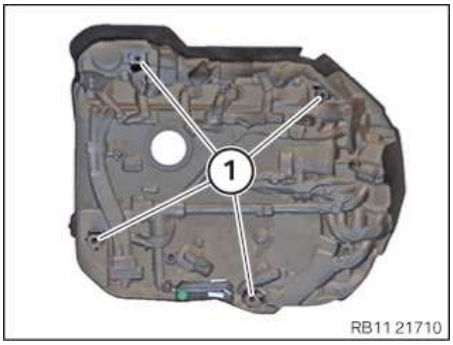
RISK OF DAMAGE

Damage to the acoustic cover.

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

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

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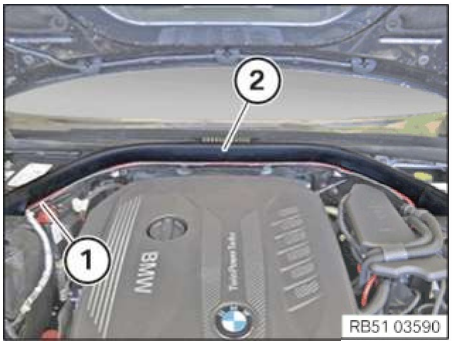


- Check the rubber mount (1) for correct fit in the acoustic cover.



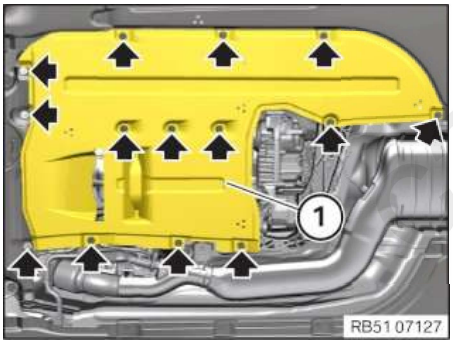
- Install acoustic cover (1) and fix in the rubber mounts (marks).

77 – Install the seal for the bonnet



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

78 – Installing underbody protection at rear



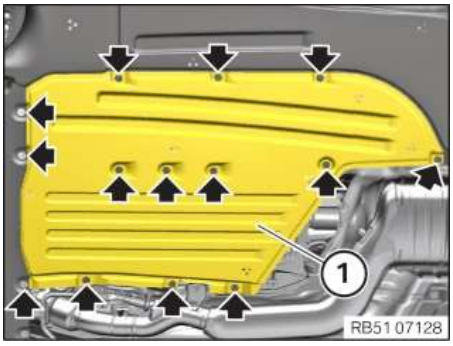
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

  Insert and install the rear underbody protection (1).

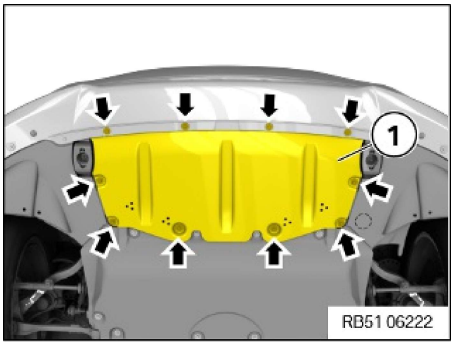
  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

79 – Installing the front underbody protection

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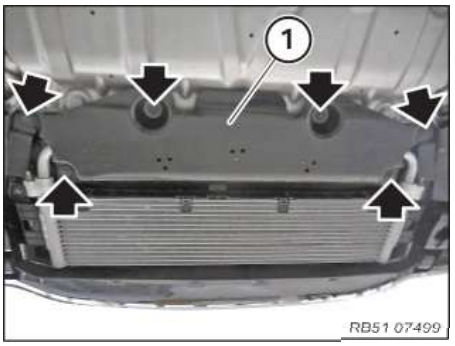
- **Version 1:**

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

  Tighten screws (arrows).

Underbody protection front

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



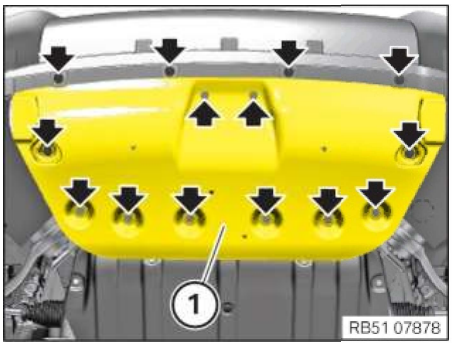
- **Version 2:**

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

  Tighten screws (arrows).

Underbody protection front

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



- **Version 3:**

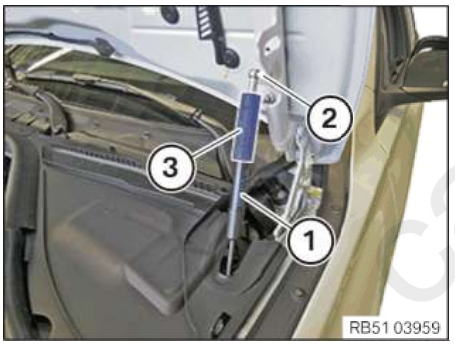
  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

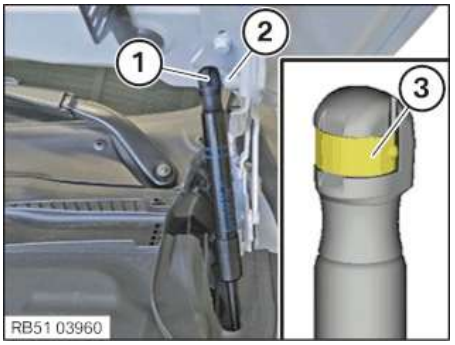
Underbody protection front

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

80 – Take bonnet out of the service position



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



CAUTION

Shutting bonnet or tailgate.

Danger of injury!

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

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

Additional Information

Overview of Tightening Torques

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Basic carrier to cylinder head — Used in step 313949

M6		Tightening torque	8 Nm

Test gauge to basic carrier — Used in step 313949

M6		Tightening torque	8 Nm

Exhaust camshaft to cylinder head — Used in step 38

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

VANOS central valve to camshaft — Used in step 4546

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

Chain tensioner to cylinder head — Used in step 48

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Engine oil cooler to bumper support — Used in step 50

M6X25		Tightening torque	8 Nm

Cover, front bottom on side — Used in step 50

Hexagon screw for thermoplastic		Tightening torque	3 Nm

Cylinder head cover to cylinder head — Used in step 51

M6X30		Jointing torque	8 Nm

Cylinder head cover to cylinder head — Used in step 51

M6X30		Tightening torque	11 Nm

Auxiliary coolant pump holder to cylinder head — Used in step 51

M6		Tightening torque	7 Nm

Standard screw connection M6 — Used in step 51

M6			8 Nm

Differential pressure sensor to holder — Used in step 51

TS6X18		Tightening torque	3,5 Nm

Holder, positive battery cable to cylinder head cover — Used in step 51

6X18		Tightening torque	6 Nm

High pressure pump to high pressure pump flange — Used in step 53

M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

Ground cable to rail — Used in step 5556

M6			5 Nm

High pressure line between rail and high pressure pump — Used in step 57

M14x1,5		Tightening torque	33 Nm

Fuel delivery line to high pressure pump — Used in step 58

M14		Tightening torque	31 Nm

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Fuel line to cylinder head cover			Used in step 58
6x18		Tightening torque	6,5 Nm

Spark plugs			Used in step 59
M12x1.25		Tightening torque	23 Nm

Ignition coil			Used in step 60
Screw		Tightening torque	8 Nm

Fan cowl with electric fan on radiator			Used in step 61
TS6x20		Tightening torque	6,5 Nm

Top rear cross connection to bonnet catch support			Used in step 62
Flat-head screw M6x20		Tightening torque	11,8 Nm

Rear top cross connection to wheel arch carrier support			Used in step 62
M10x20 screw	Renew screw.	Jointing torque	56 Nm
		Angle of rotation	90 °

Cross connection, top			Used in step 63
M8x20		Tightening torque	28 Nm

Cross connection, top			Used in step 63
M6x20		Tightening torque	11,8 Nm

Clean air pipe to upper section of intake filter housing			Used in step 67
Clamp		Tightening torque	3 Nm

Bulkhead upper part to bottom bulkhead			Used in step 71
		Tightening torque	3 Nm

Tension strut on bulkhead			Used in step 71
M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome			Used in step 71
Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

Windscreen wiper arm			Used in step 75
Combination hexagon nut		Tightening torque	35 Nm

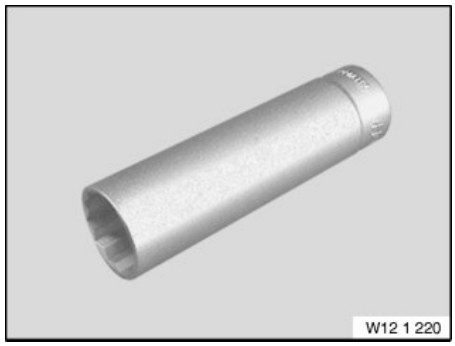
Underbody protection			Used in step 78
Hexagon screw		Tightening torque	3 Nm

Underbody protection front			Used in step 79
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

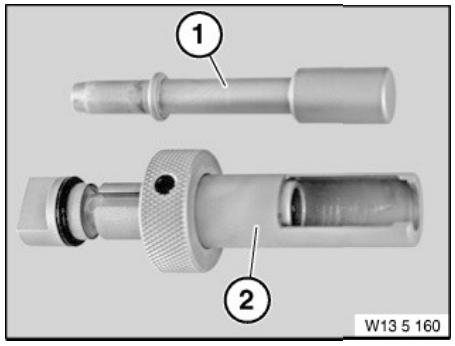
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0 495 560 (12 1 220) Socket



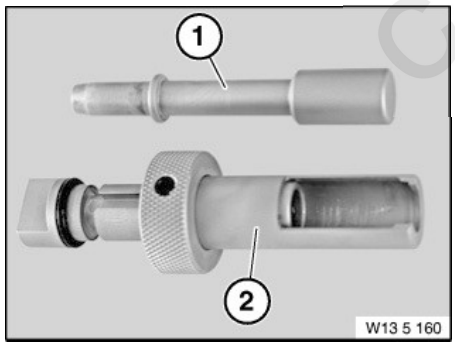
Common	Used in step 2059
Usage	For removing and installing the spark plugs (WAF 14 bihexal).
Included in the tool or work	
Storage location	C18
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

0 496 567 (13 5 161) Fastener



Common	Used in step 22
Usage	(Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

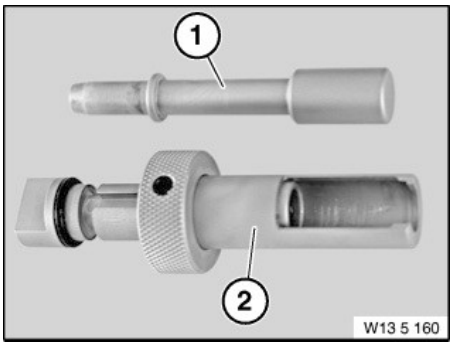
0 496 568 (13 5 162) Fastener



Common	Used in step 22
Usage	(Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

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0 496 565 (13 5 160) Fastener



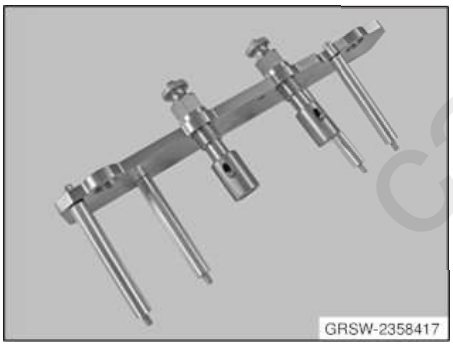
Common Used in step 22

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

Consisting of

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

2 358 417 Device

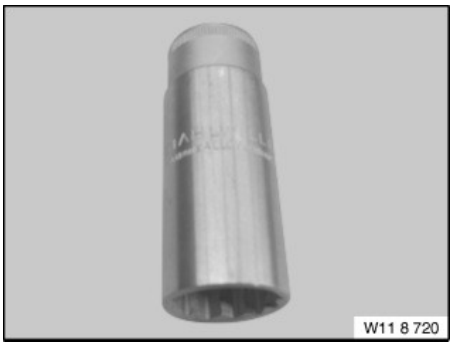


Common Used in step 2425

Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 496 106 (11 8 720) Socket WAF 46



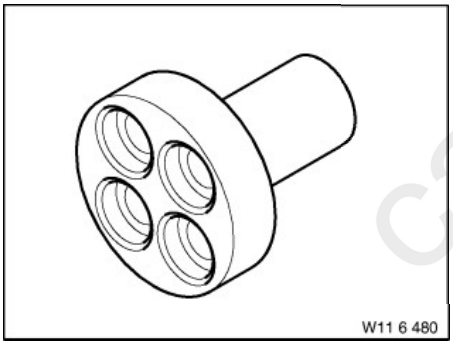
Common	Used in step 2425
Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

2 360 895 Pin wrench



Common	Used in step 2652
Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 493 380 (11 6 480) Connector



Common	Used in step 31474953
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

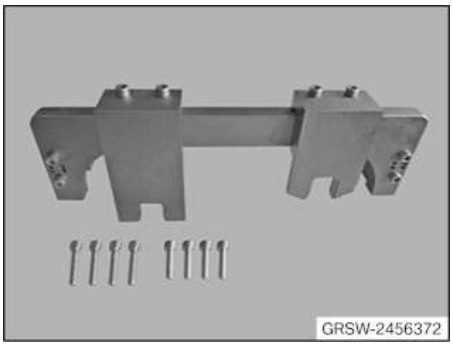
2 288 380 Locating stud



Common	Used in step 314749
Usage	For disconnecting the crankshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 04 14 (071)

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2 456 372 Gauge



Common	Used in step 3136394749
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 122 Gauge



Common	Used in step 313649
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 855 Ratchet handle



Common	Used in step 33424546
Usage	Insert reversible ratchet with nut for installation and disassembly of the VANOS- SW22. (only in longitudinal installation). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A55
Replaced by	
In connection with	
SI-Number	01 34 15 (306)

2 450 487 Socket



Common	Used in step 33424546
Usage	For removing and installing the VANOS adjuster. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	0496855
SI-Number	01 07 17 (487)

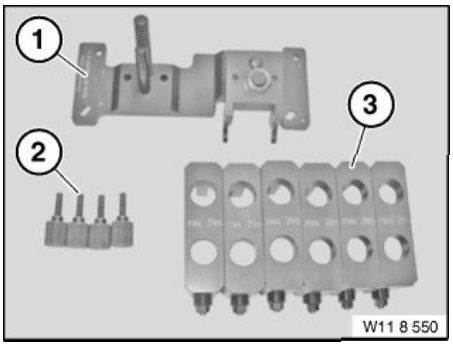
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2 410 670 Device



Common	Used in step 3738
Usage	To press down the valves on the 2nd cylinder, for de-energised disassembly/installation of the exhaust camshaft. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 23 15 (280)

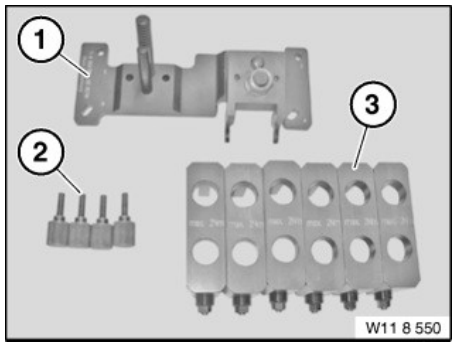
0 495 741 (11 8 552) Screw



Common	Used in step 3738
Usage	(Knurled screw (4 pieces))
Included in the tool or work	0 495 739
Storage location	C19
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

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0 495 739 (11 8 550) Device



Common Used in step 37

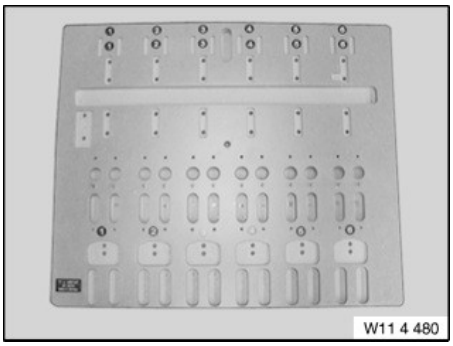
Usage	(Locking device) For holding the bearing strips in place when fitting intake camshaft.
Included in the tool or work	
Storage location	C19
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
2	0 495 741 (11 8 552)		**Screw** (knurled screw (4 pieces))	
1	0 495 740 (11 8 551)		**Tool** (Tool to press down) discontinued, available as part of set of special tools only	
3	0 495 742 (11 8 553)		**Synchronising key** Thrust piece (1 piece)	

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0 495 105 (11 4 480) oddments tray



Common Used in step 37

Usage	(Boards (2 pieces)) For setting down the individual components of the cylinder head.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 106 (11 4 481)		**oddments tray** (Board, intake side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	
2	0 495 107 (11 4 482)		**oddments tray** (Board, exhaust side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	

2 455 654 Tensioning tool



Common Used in step 4447

Usage	To pretension the timing chain when adjusting the timings. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 452 959 Pliers



Common Used in step 54

Usage	For disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ number 13 0 191). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A5
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

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2 448 401 Fitting aid



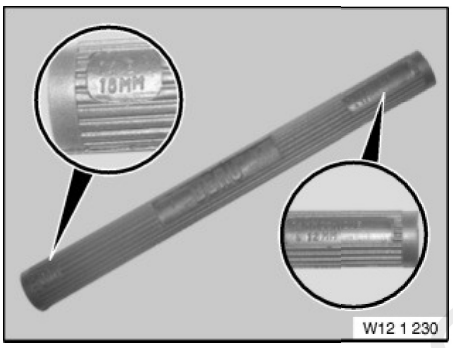
Common	Used in step 54
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 022 Gauge



Common	Used in step 5556
Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 065 (12 1 230) Fitting aid



Common	Used in step 59
Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

Overview Technical Data

Distance from window pane edge to wiper blade	Used in step 75
Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

Links

Repair instructions	Used in step
61 20 900 Disconnecting and connecting battery earth lead	168
61 20 900 Disconnecting and connecting battery earth lead	168
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61 20 900 Disconnecting and connecting battery earth lead	168
61 20 900 Disconnecting and connecting battery earth lead	168
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61 20 900 Disconnecting and connecting battery earth lead	168

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61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads) 168

61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle) 168
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61 35 ... Notes on ESD protection (Electro Static Discharge) 1926
13 53 ... Clean the cylinder heads in the area of injectors to prevent sand/dust contamination. 2425
61 35 ... Notes on ESD protection (Electro Static Discharge) 26
17 11 035 Removing and installing/replacing fan cowl with electric fan 53

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11 31 025 Removing and installing/replacing intake camshaft

WARNING

Hot surfaces.

Risk of burning!

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

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

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

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

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

CAUTION

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

Danger of injury!

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

RISK OF DAMAGE

Damage to battery terminal, the safety battery terminal or the intelligent battery sensor (IBS).

Damaged battery terminals can lead to malfunctions or vehicle electrical system faults.

- Pull off battery terminal from battery pole by carefully moving to and fro. Do not pry off using a tool.

TECHNICAL INFORMATION

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

PRELIMINARY WORK

1 – Disconnecting all battery earth leads

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- See additional information.

2 – Bring front compartment lid in the service position

Prerequisite

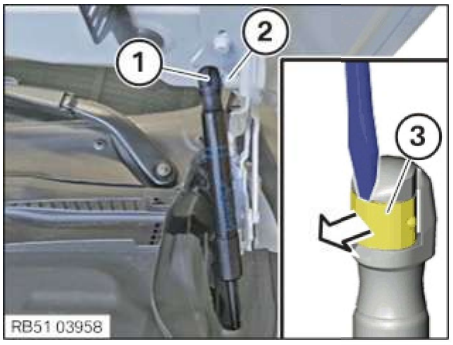
Engine compartment lid is open.

CAUTION

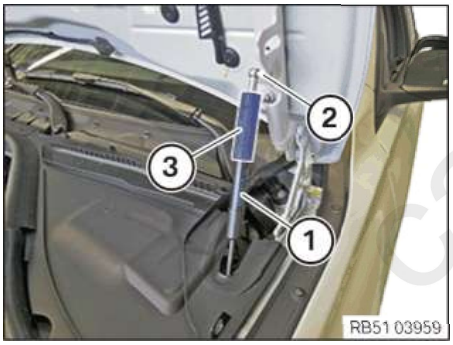
Shutting bonnet or tailgate.

Danger of injury!

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



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



TECHNICAL INFORMATION

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

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

3 – Remove the seal for the rear bonnet



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

4 – Removing the acoustic cover

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WARNING

Hot surfaces.

Risk of burning!

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

RISK OF DAMAGE

Damage to the acoustic cover.

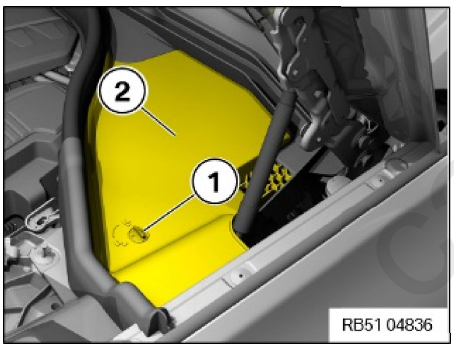
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

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



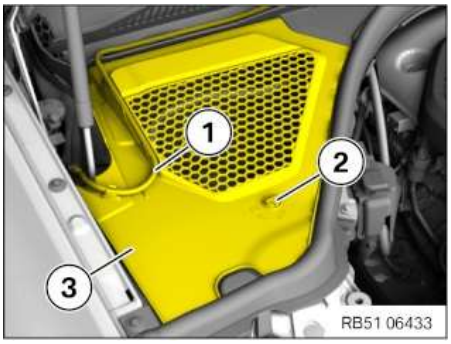
- Release the acoustic cover (1) towards the top from the rubber mounts (marks).

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



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

6 – Remove the cover of the rear right engine compartment



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

7 – Removing both wiper arms

NOTICE

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

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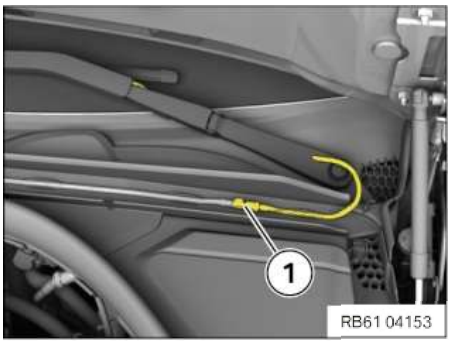
▸ **Remove the wiper arm**

RISK OF DAMAGE

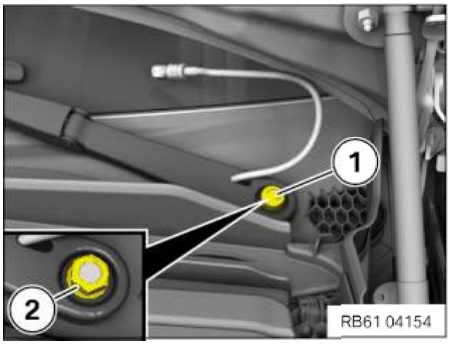
Damage to wiper console

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

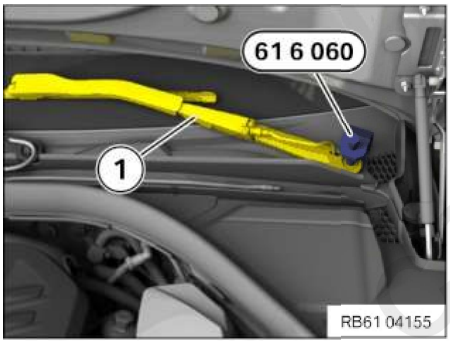
- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.



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

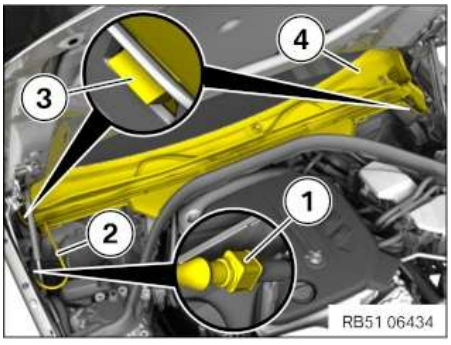


- Remove the protective cap (1).
- Loosen nut (2).



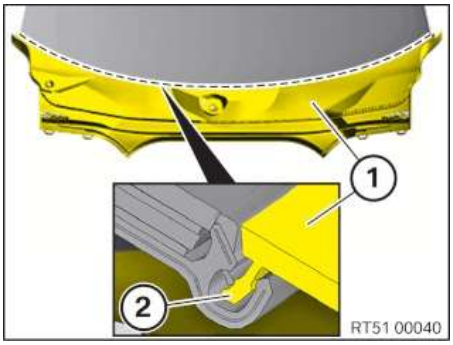
- Pull off the wiper arm (1) using special tool .

8 – Remove cowl panel cover



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

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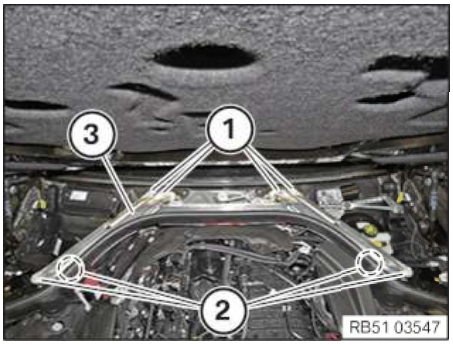


- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

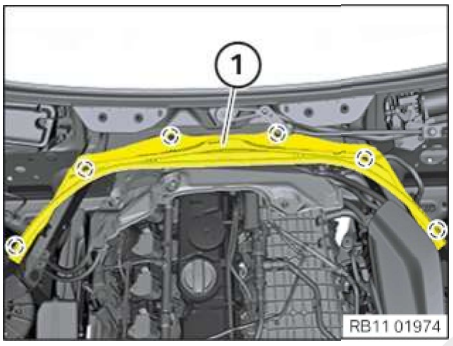
9 – Removing the centre bulkhead upper part

TECHNICAL INFORMATION

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



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



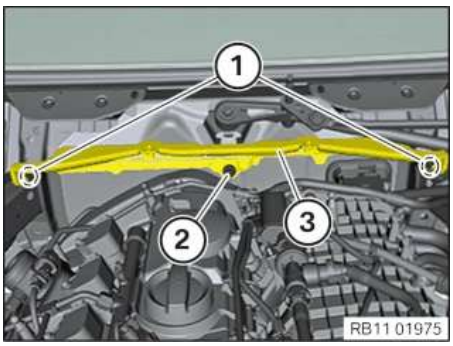
- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

10 – Removing acoustic cover at rear



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

11 – Removing the centre bulkhead lower section



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

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12 – Removing the DME control unit

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

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

TECHNICAL INFORMATION

Follow instructions for removing and installing control units.

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

TECHNICAL INFORMATION

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

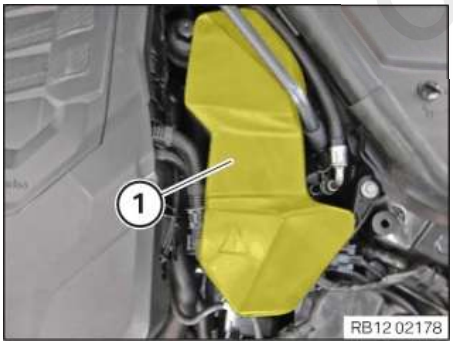
TECHNICAL INFORMATION

Control unit must be programmed after it is replaced.

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

TECHNICAL INFORMATION

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

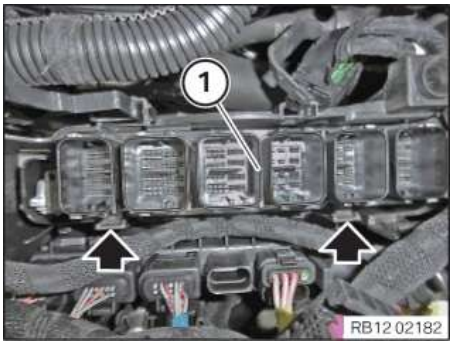


- Pull the cover (1) towards the top and feed out.



- Unlock and disconnect the plug connection (1).

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

13 – Removing integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

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

RISK OF DAMAGE

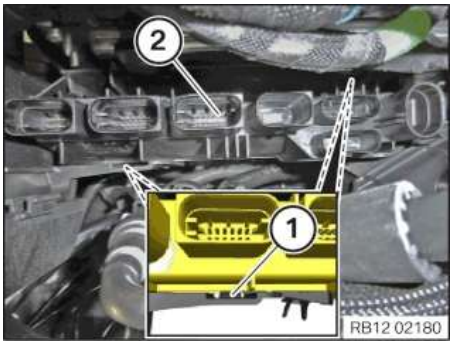
Electrostatic discharge.

Damage to or destruction of electrical components.

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



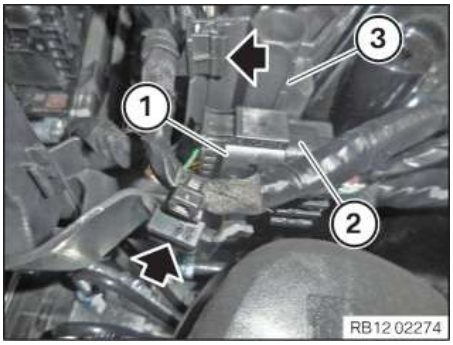
- Unlock and disconnect plug connections (1).



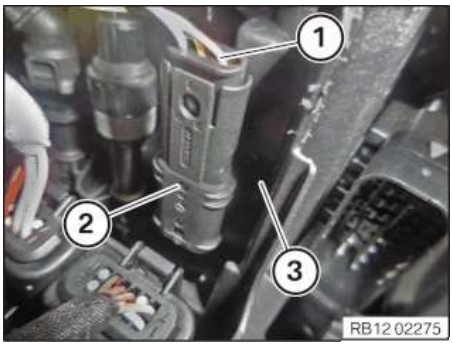
- Unlock the latch mechanisms (1).
- Guide out and remove integrated supply module (PDM) (2) upwards.

14 – Removing the control unit holder

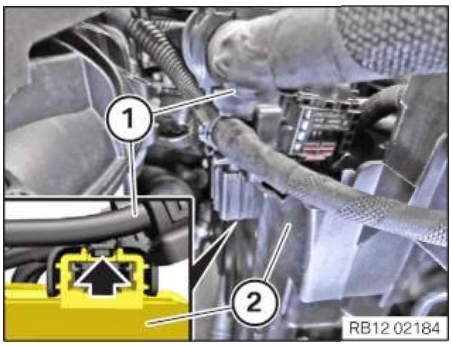
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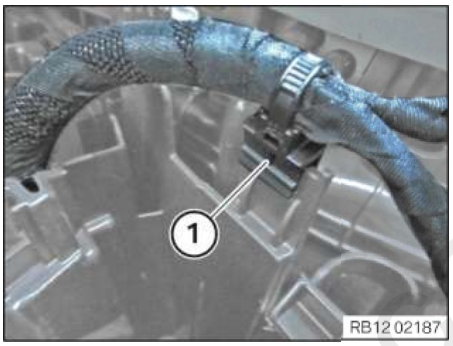
- Unlock plug connection (1) and disconnect.
- Unlock the connector (2) and disconnect from the control unit holder (3).
- Release the clamps (arrows).



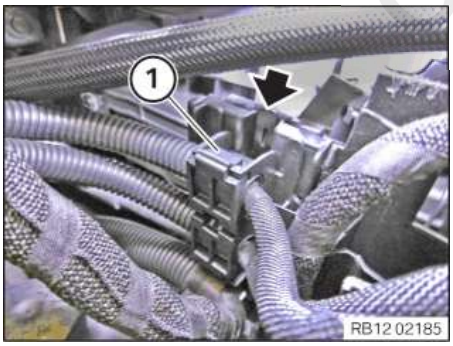
- Unlock plug connection (1) and disconnect.
- Unlock the connector and disconnect from the control unit holder (3).



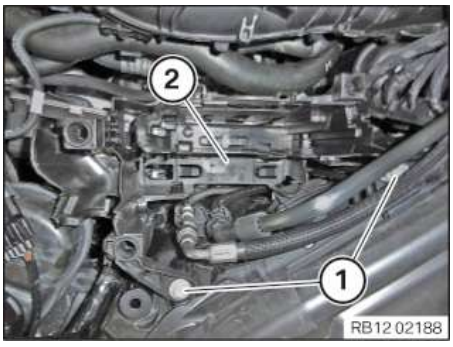
- Unlock the lock (arrow).
- Disconnect the cable holder (1) upwards from the control unit holder (2).



- Loosen clamp (1).



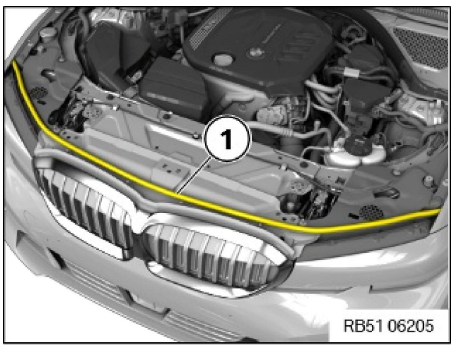
- Unlock the lock (arrow).
- Feed out the cable clip (1) upwards and set it aside.



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

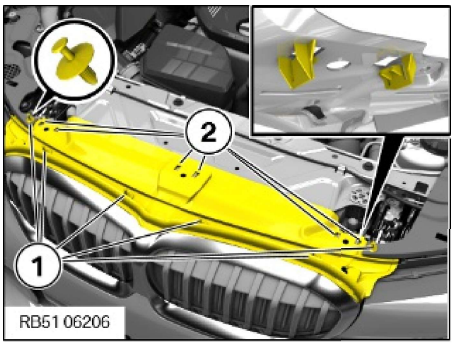
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15 – Remove the seal for the bonnet in front



- Pull off front bonnet seal (1) upwards.

16 – Removing the centre engine compartment cover



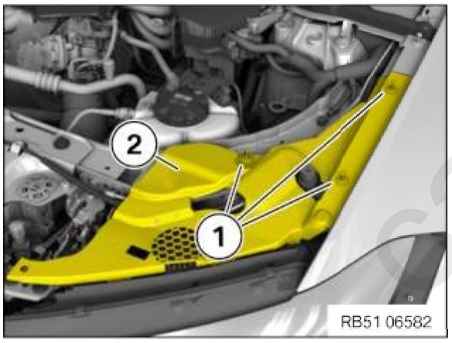
- Detach all expanding rivets (1).
- Release the cover of the centre engine compartment with the latch mechanisms (2) .
- Feed the cover for the centre engine compartment out to the rear.

17 – Partially remove the top left and right cover in the engine compartment

NOTICE

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

▶ **Removing the cover in the engine compartment on top partially**



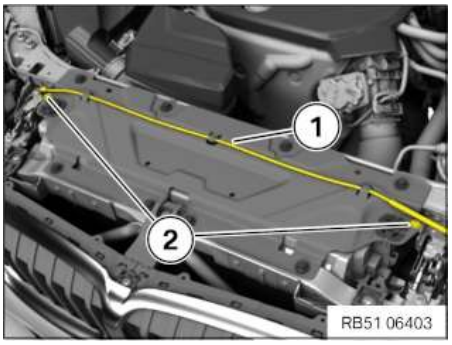
- Loosen the expanding rivet (1).
- Remove the cover in the engine compartment on top (2) partially.

18 – Removing the top cross connection

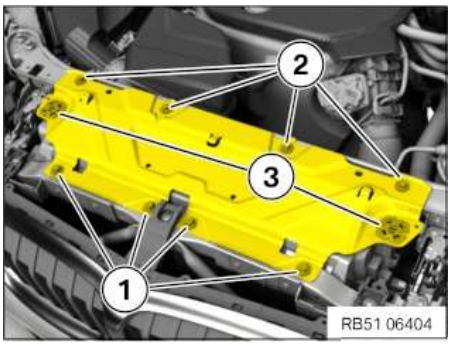


- Release the housing for the coupling of the Bowden cables (1) from the body.

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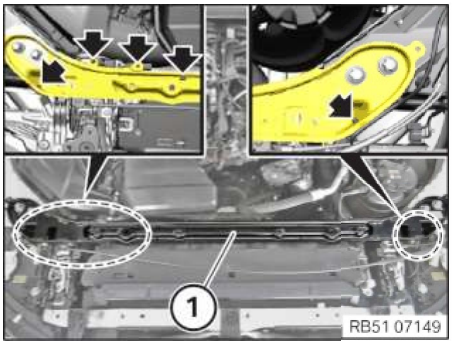


- Detach Bowden cable (1) at the top cross connection.
- Loosen screws (2).

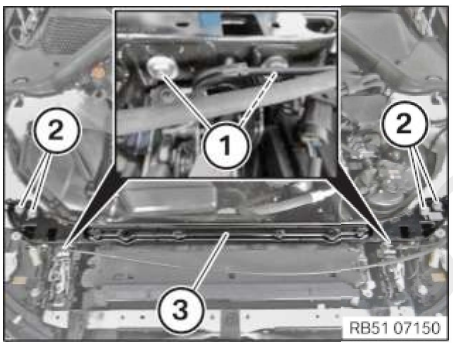


- Loosen screws (1) and (2).
- Remove the top cross connection with the holders(3) towards the top.

19 – Remove the rear top cross connection



- Release the clips (arrows) in the marked areas from the top rear cross connection (1).



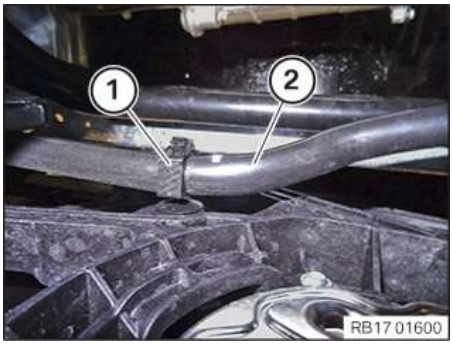
- Loosen screws (1).
- Loosen screws (2).
- Guide out and remove top rear cross connection (3).

20 – Remove fan cowl.

TECHNICAL INFORMATION

- When the engine is stopped after the end of the journey, it may be necessary to run the electric fan. In rare cases, operation of the electric fan can last up to 11 min. This protects the components. In this case, replacing the electric fan will not remedy the problem!

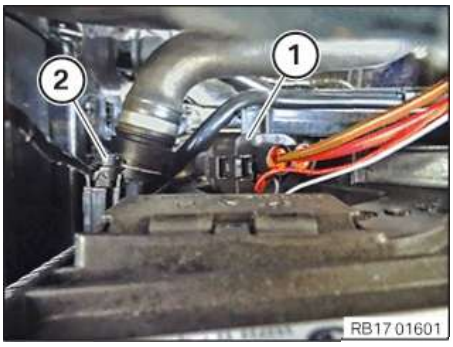
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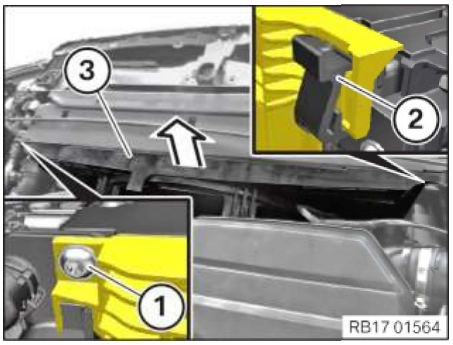
- **If installed:** Release transmission oil line (2).

  Unlock the holder (1).

  Thread out transmission oil line (2) and set aside.



- Unlock plug connection (1) and disconnect.
- Unlock plug connection (2) and disconnect.



- Loosen screw (1).
- Unlock lock (2).
- Guide out and remove fan cowl (3) **carefully** in the direction of the arrow.

21 – Removing intake silencer housing

RISK OF DAMAGE

Damage to the clean air line. Damage to the air filter.

For changing the air filter insert, if the upper section of intake filter housing is only raised and not completely removed, the clean air line and the air filter insert may be damaged.

- Do not lift upper section of intake filter housing by force.
- Unfasten clamp.
- Remove upper section of intake filter housing completely.



- Unlock plug connection (1) and disconnect.
- Unfasten clamp (2).
- Pull out and remove the intake silencer housing (3) from the rubber mounts towards the top.

22 – Remove all ignition coils.

NOTICE

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

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▸ **Removing the ignition coil**

WARNING

Hot surfaces.

Risk of burning!

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

RISK OF DAMAGE

Damage to the ignition coil.

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

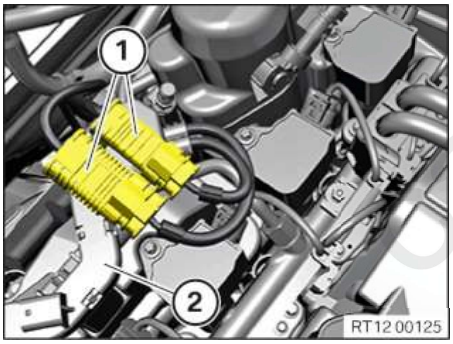
- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

RISK OF DAMAGE

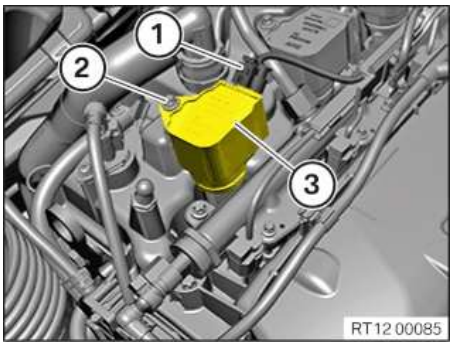
Electrostatic discharge.

Damage to or destruction of electrical components.

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



- Disconnect the connector (1) of the front oxygen sensor and the monitoring oxygen sensor from the cable channel (2) and set aside.



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

23 – Removing all spark plugs

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WARNING

Hot surfaces.

Risk of burning!

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

CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

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



- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

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

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

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

NOTICE

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



TECHNICAL INFORMATION

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

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



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

24 – Remove the high pressure line between the high pressure pump and the rail

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WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

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

CAUTION

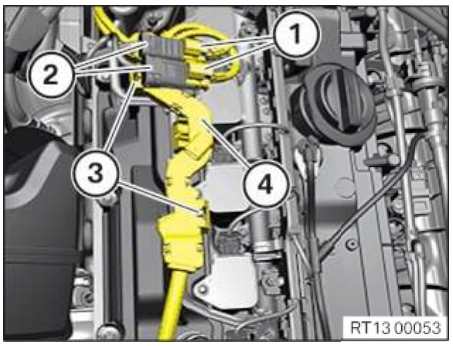
On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

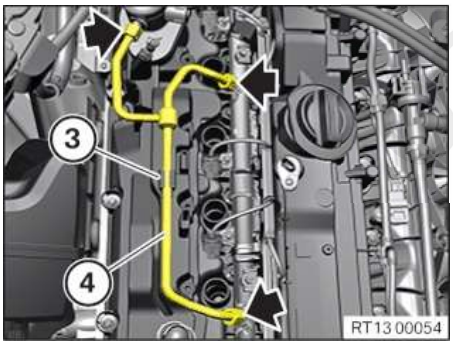
- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

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



- Unlock and disconnect the plug connections (1) and (2).
- Unlock the locks (3).
- Guide out the wiring harness section of the engine wiring harness (4) and set it aside.



- Position a lint-free rag under the union nuts.
- Unscrew union nuts (arrows) with the special tool .
- Catch and dispose of escaping fuel.
- Thread out the high pressure line (4) from the bracket (3) and remove it.
- Feed out and dispose of the lint-free cleaning clothes .

25 – Remove fuel delivery line

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

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

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CAUTION

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

Danger of injury!

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

RISK OF DAMAGE

Damage to the ignition coil.

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

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

RISK OF DAMAGE

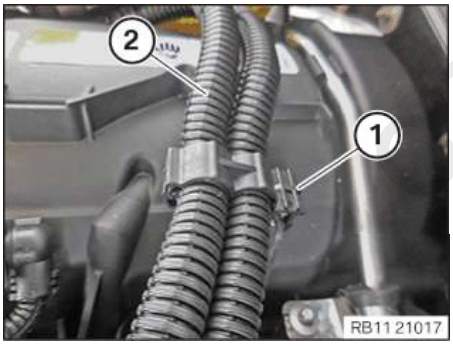
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

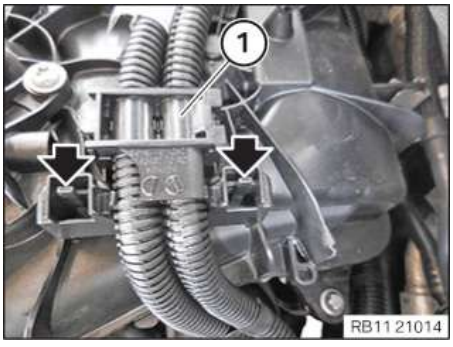
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

Reset special tool in early to avoid bending pressure lines.

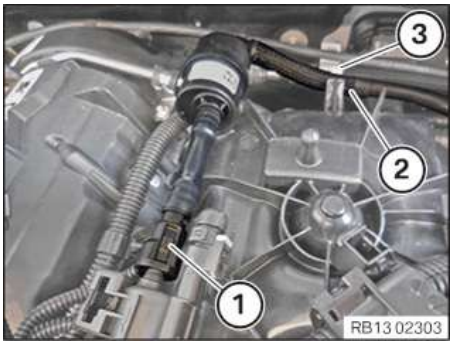


- Loosen clamp (1).
- Guide out wiring harness section (2) for the injectors and ignition coils and place it aside.

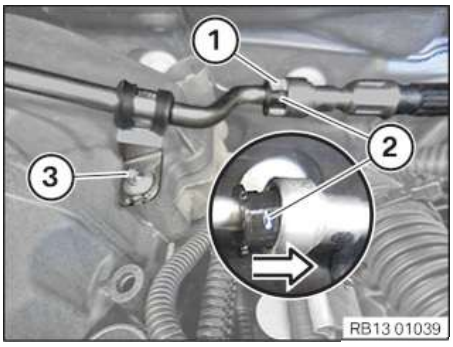


- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.

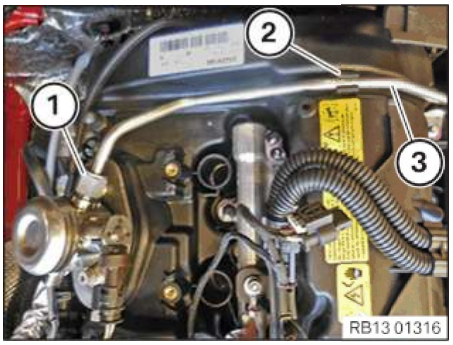
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- Unlock and loosen lock (1).
- Guide tank ventilation line (2) out of clamp (3) and place it aside.



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



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

26 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

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

TECHNICAL INFORMATION

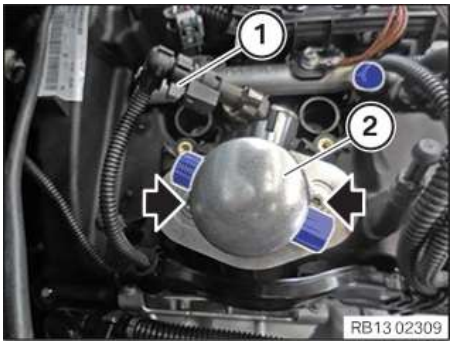
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.

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- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

27 – Removing rail with injectors of cylinders 1 to 3

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

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

RISK OF DAMAGE

Damage to the ignition coil.

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

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

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

Damage to injectors.

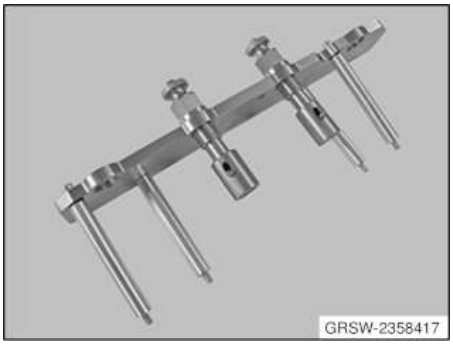
Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.



- Prepare special tool .

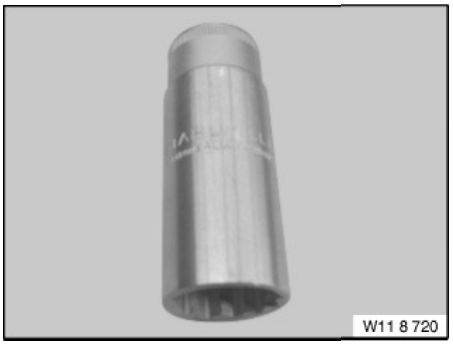
cardiagn.com



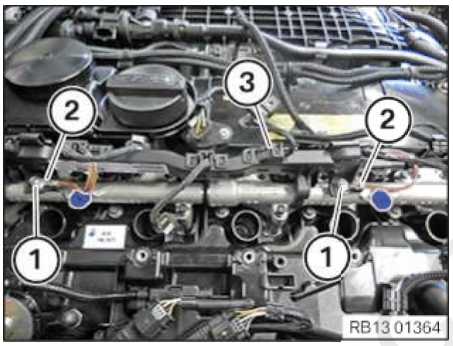
- Prepare special tool 2 358 417.



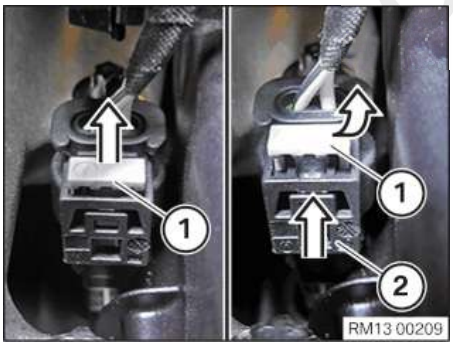
- Prepare special tool .



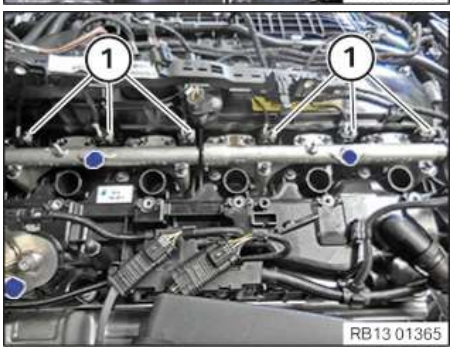
- Prepare special tool 0 496 106 (11 8 720).



- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.

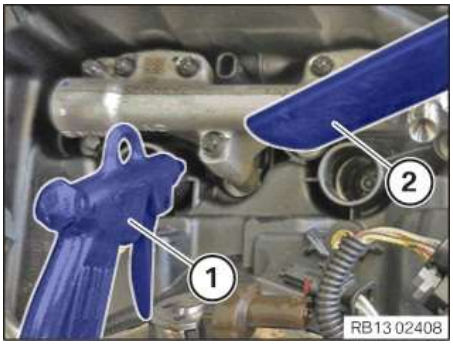


- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull out the connector (2) from the injectors.



- Unlock and release all connectors (1) of the injectors.

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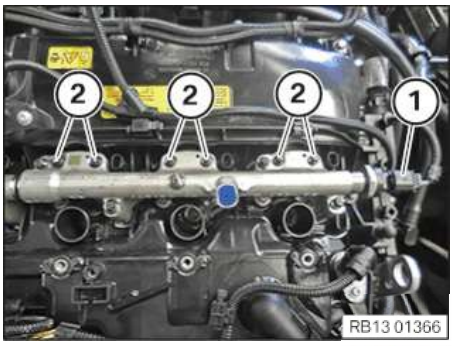


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

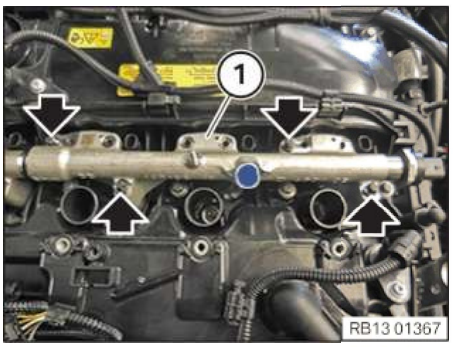
- Before releasing the high pressure lines: Blow out the injector shafts with an air gun(1) with less pressure.
- Simultaneously, draw off the dirt particles with an **explosion proof** vacuum cleaner (2).



- Unlock and loosen connector (1).
- Release screws (M5x30) (2).
- Remove screws (2).

  Do not reuse the bolts (2).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.

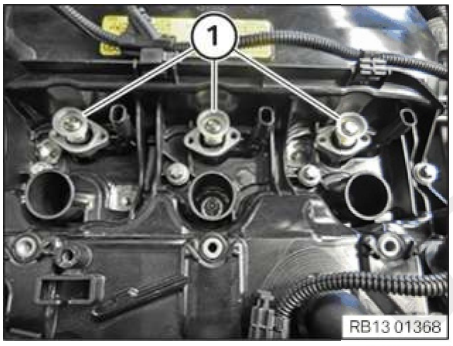


- Unscrew the screws (M6x30) (arrows).

  The screws may not be reused!
- Renew screws.

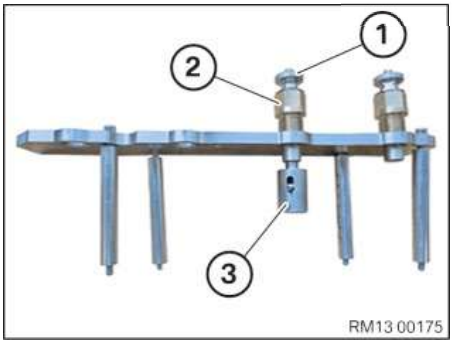
  Parts: Screws (M6x30)
- Remove rail (1) in upward direction.

  The injectors remain in the cylinder head.



- Remove the gaskets (1).

  The seals (1) are only required during the initial assembly at the plant and will not be installed again.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.

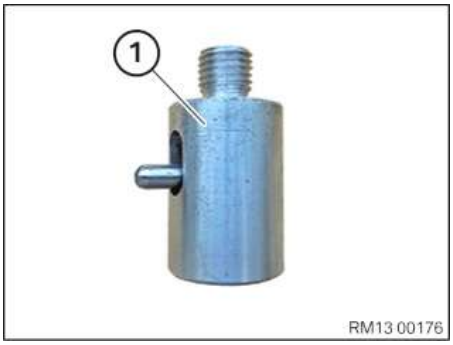
- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use the special tool 2 358 417to remove the injectors.

  The special tool 2 358 417 is used to ensure that the tensile force is not exceeded.

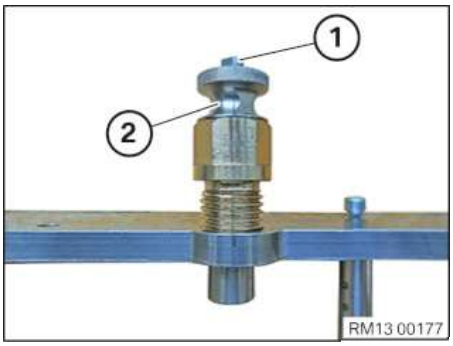
  Special tool 2 358 417 consists of:

  - **(1)** Threaded sleeves
  - **(2)** Pull-out thread (left-hand thread)
  - **(3)** Mounting for the injectors

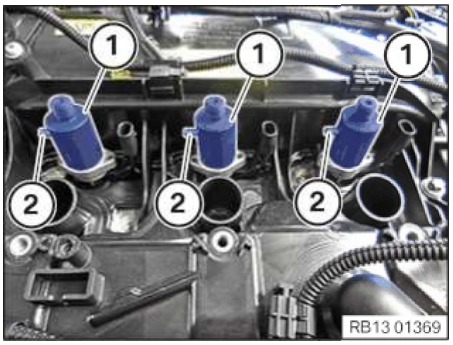
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- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.

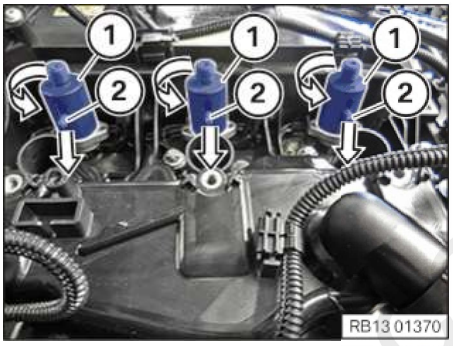


- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.

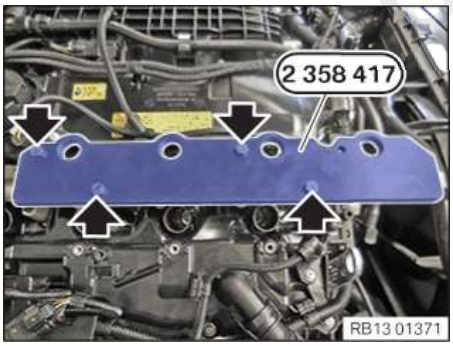


- Install all fixtures (1) for the injectors.

  The fixture (1) is not locked if the lever (2) is on the top.



- Turn fixtures (1) by 90° and lock the lever (2) downwards.



RISK OF DAMAGE

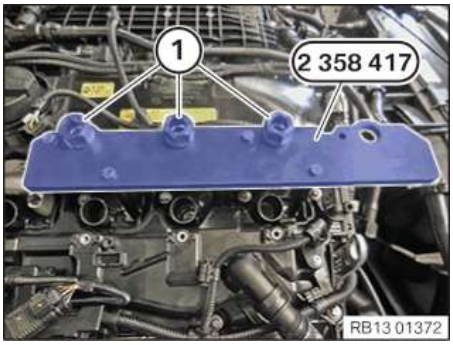
Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

- Attach special tool 2 358 417 to cylinder head.
- Hand-tighten the bolts (arrows).

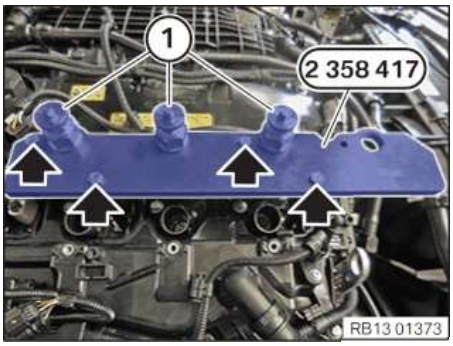
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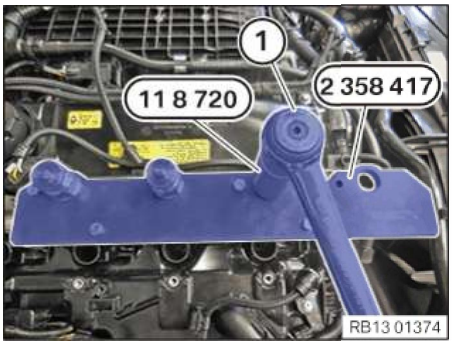
TECHNICAL INFORMATION

The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.



- Insert threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for injectors.
- Then tighten screws (arrows) on special tool 2 358 417 to 5 Nm.

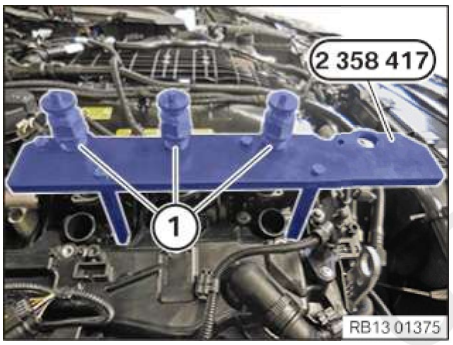


- Adjust torque wrench to 13 Nm **clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720)until the injector is pulled out.

TECHNICAL INFORMATION

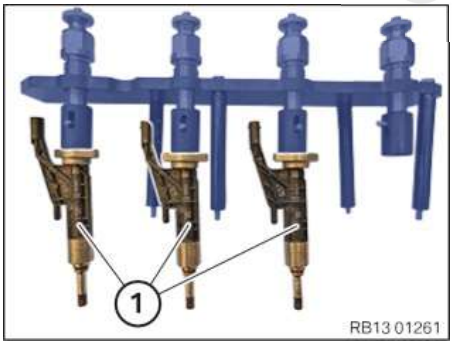
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

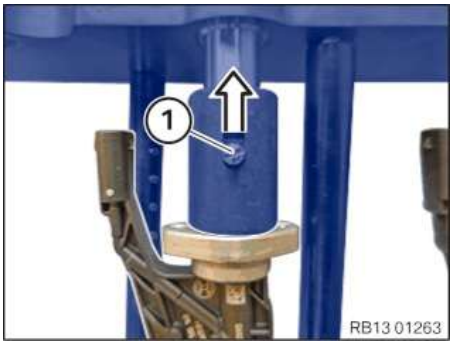


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  This can be recognised on the completely visible threads of the sleeves (1).
- Loosen screws on special tool 2 358 417.



- Carefully remove the special tool 2 358 417with injectors (1) from the cylinder head vertically upwards.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat on a clean table.

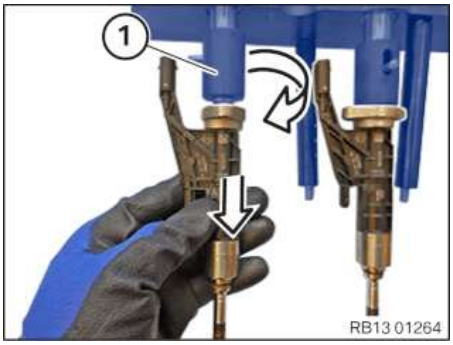


NOTICE

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

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture (1) by 90°.
- Release and remove the injector downwards.

28 – Removing rail with injectors of cylinders 4 to 6

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

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

RISK OF DAMAGE

Damage to the ignition coil.

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

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

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

Damage to injectors.

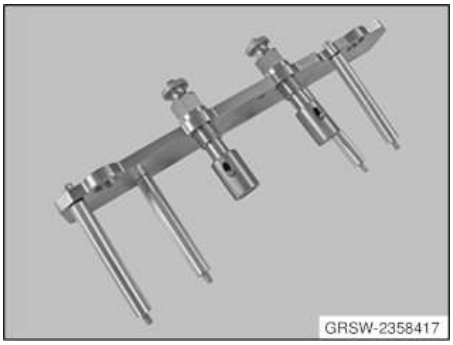
Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.



- Prepare special tool .

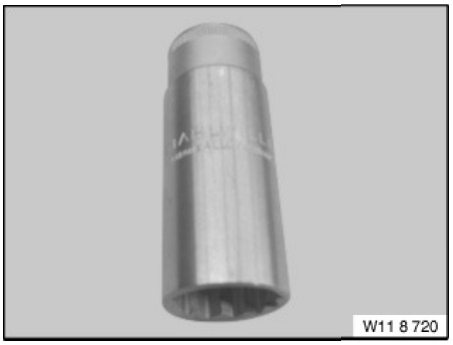
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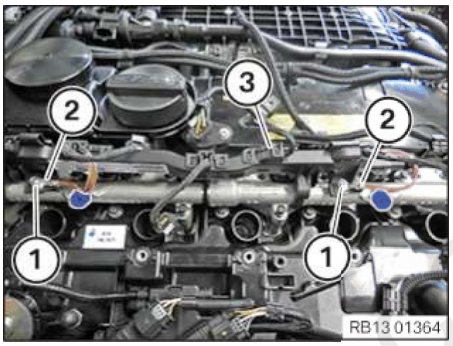
- Prepare special tool 2 358 417.



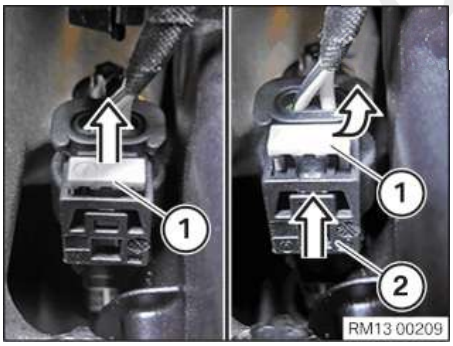
- Prepare special tool .



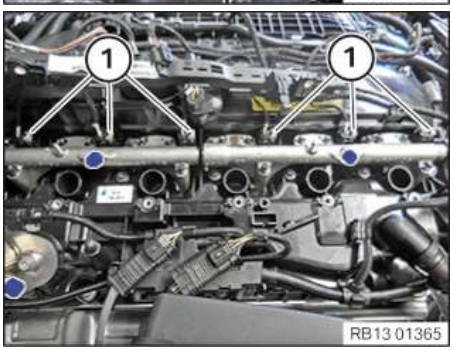
- Prepare special tool 0 496 106 (11 8 720).



- Release nuts (1) .
- Feed out ground cable (2) and set aside.
- Feed out cable channel (3) and set it aside.

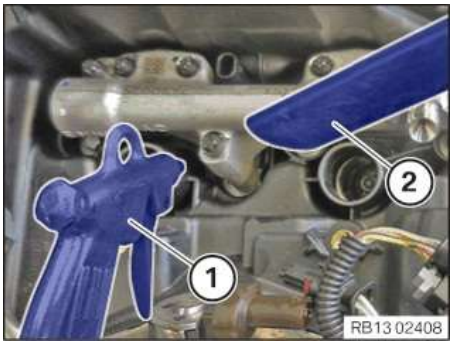


- Unlock lock (1) in direction of arrow upwards.
- Press lock (1) together and release.
- Disconnect the connector (2) from the injectors in the direction of the arrow.



- Unlock and release all connectors (1) of the injectors.

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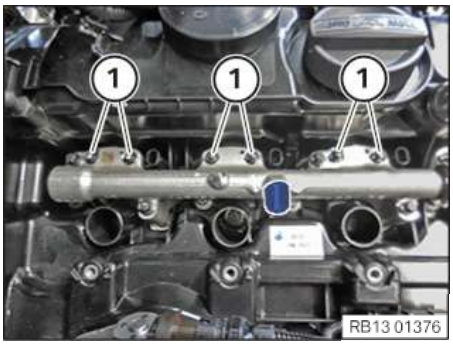


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

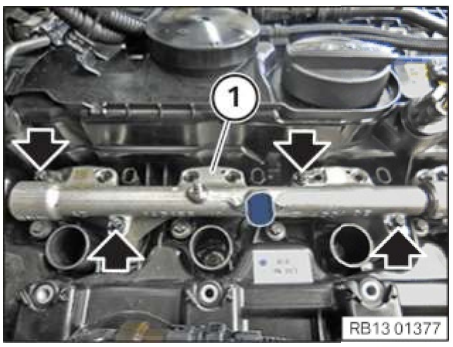
For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

- Before releasing the high pressure lines: Blow out the injector shaft with an air gun (1) with less pressure.
- Simultaneously, draw the dirt particles off **using an** explosion proof (2) vacuum cleaner.



- Release screws (M5x30) (1).
- Remove screws (M5x30) (1) .

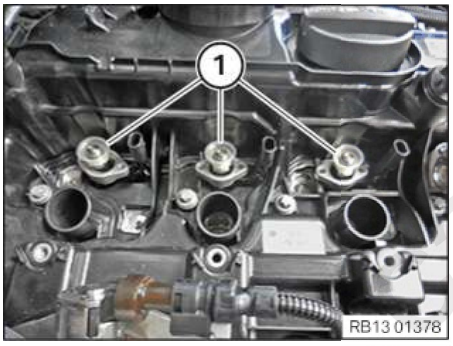
  Do **not** reuse screws (M5x30) (1).
- Catch and dispose of escaping fuel with suitable materials.



- Release screws (M6x30) (arrow).
- Remove screws (M6x30) (arrows).

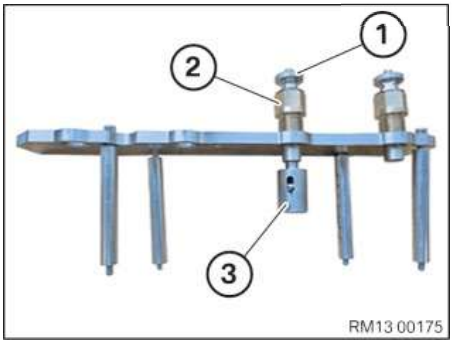
  Do **not** reuse the screws (M6x30).
- Remove rail (1) upwards.

  The injectors remain in the cylinder head.



- Remove seals (1) .

  The seals (1) are required during first assembly within the plant only and will not be installed again.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

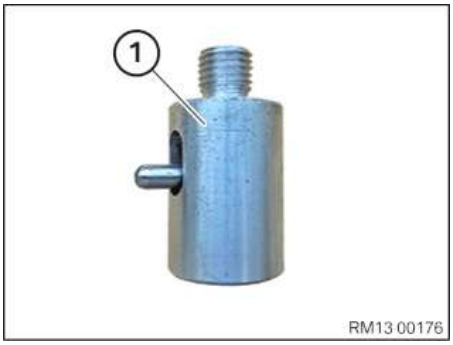
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use the special tool 2 358 417 to remove the injectors.

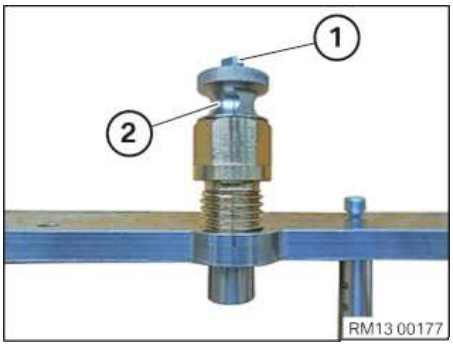
  The special tool 2 358 417 is used to ensure that the tensile force is not exceeded.

  The special tool 2 358 417 consists of:
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Mounting for the injectors

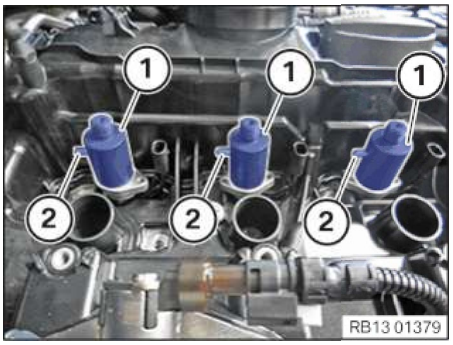
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- Unscrew the fixture for injectors (1) from special tool 2 358 417.

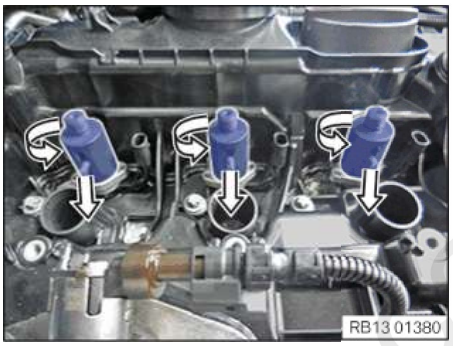


- Press lock (1) in and remove the threaded sleeve (2) from the special tool 2 358 417.



- Install all fixtures (1) for the injectors.

  The fixture (1) is not locked, if the lever is (2) on top.



- Turn fixtures (1) by 90° and lock the lever (2) downwards.



RISK OF DAMAGE

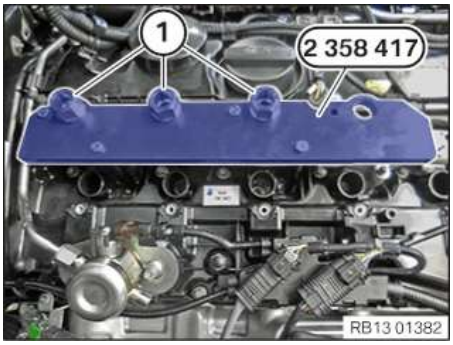
Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

- Attach special tool 2 358 417 to cylinder head.
- Hand-tighten the bolts (arrows).

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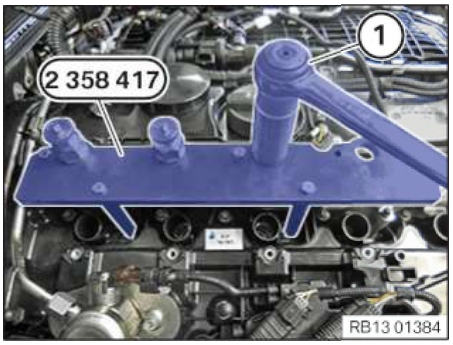
TECHNICAL INFORMATION

The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417 fully.



- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Then tighten screws (arrows) on special tool 2 358 417 to 5 Nm.

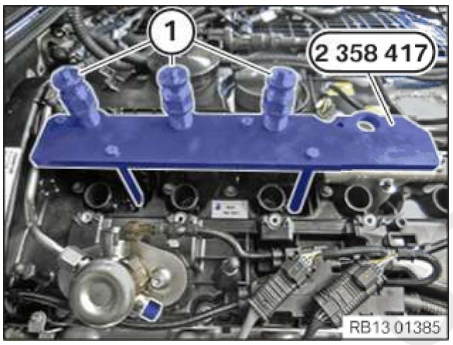


- Adjust torque wrench to 13 Nm **in clockwise** direction.
- Turn the torque wrench (1) with the special tool 0 496 106 (11 8 720) **clockwise**, until the injector is pulled out.

TECHNICAL INFORMATION

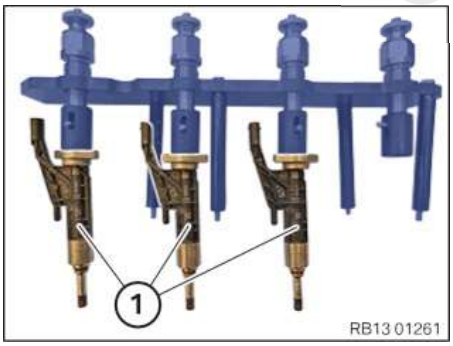
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

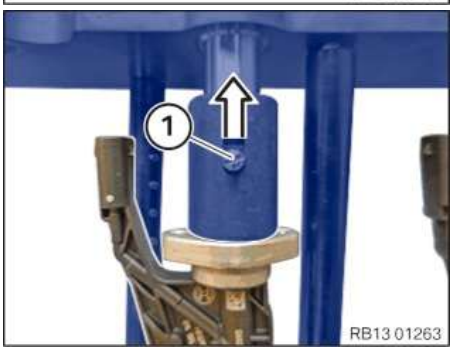


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  This can be recognised on the completely visible thread starts of the threaded sleeves (1).
- Loosen screws on special tool 2 358 417.



- Carefully remove the special tool 2 358 417 with the injectors (1) vertically straight up from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.

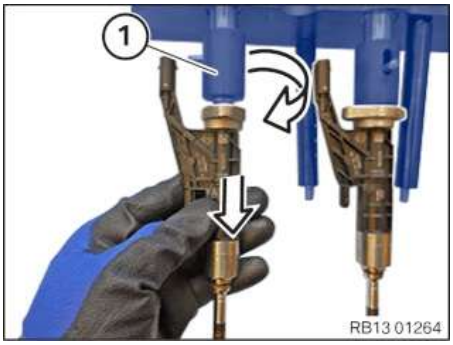


NOTICE

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

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture(1) by 90°.
- Release and remove the injector downwards.

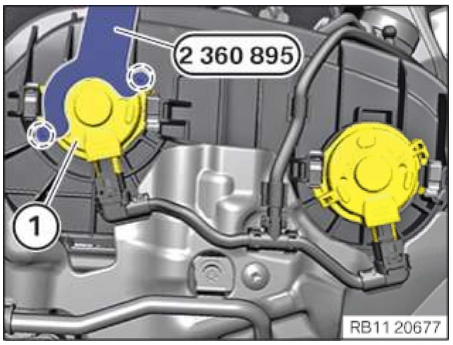
29 – Removing both actuators

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

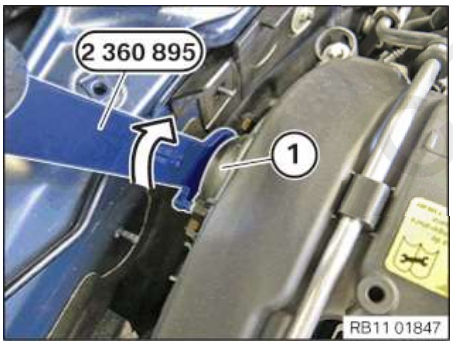
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the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



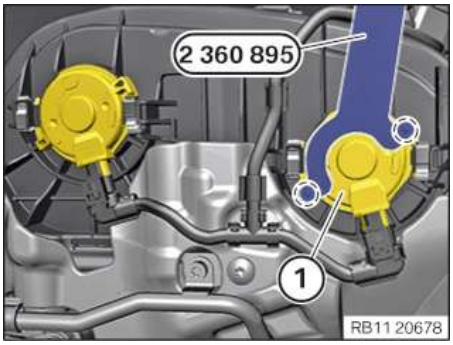
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.

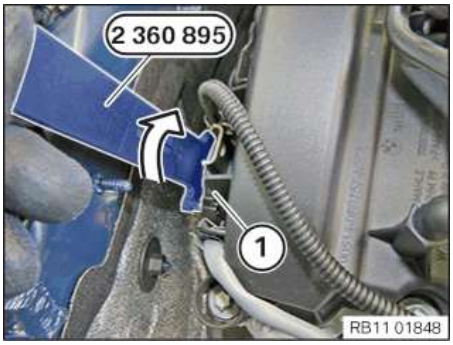


NOTICE

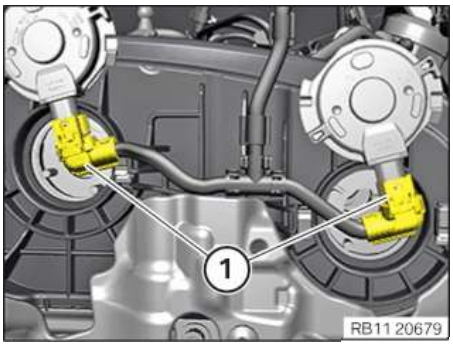
The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.

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- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



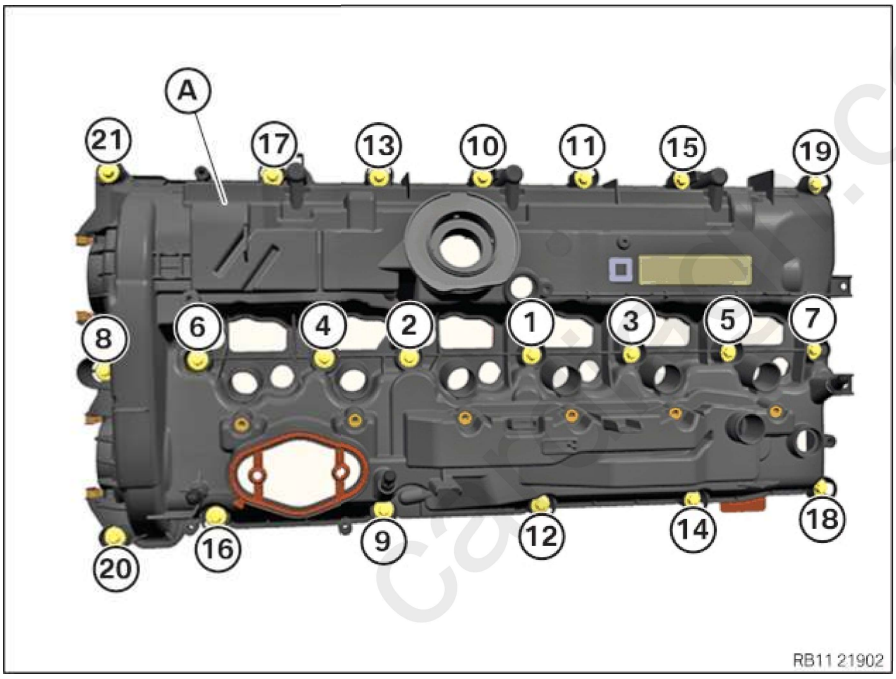
NOTICE

The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

30 – Removing the cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 21 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

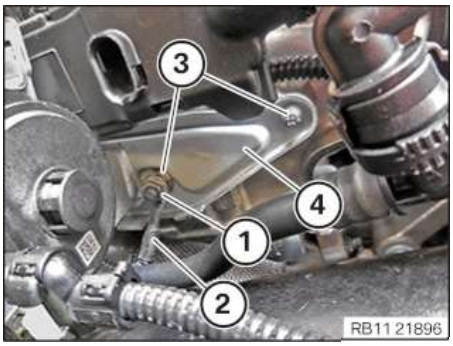
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

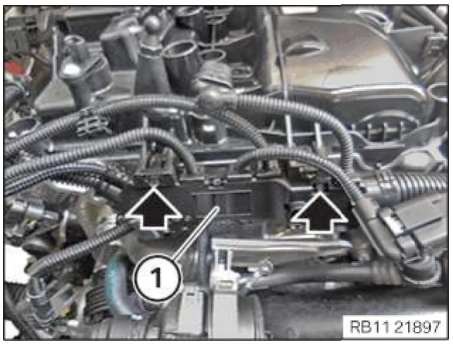
- Do not pull on the wires when disconnecting connectors and plug connections.



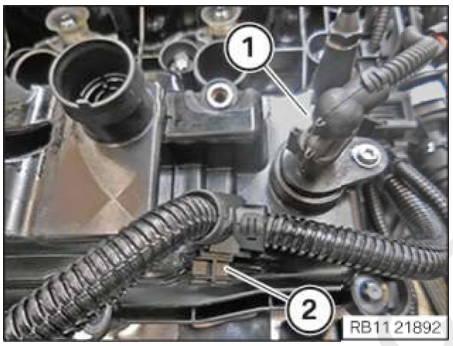
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



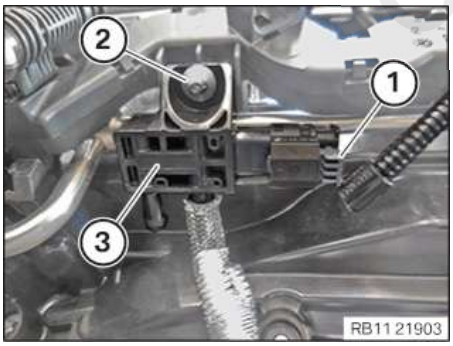
- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Loosen screws (3).
- Thread out holder (4) and set aside.



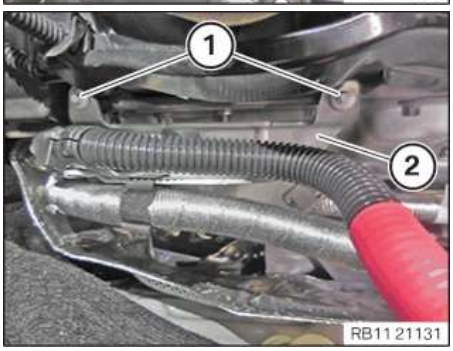
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for the sensor system **2** and place to one side.



- Unlock and detach connector (1) on exhaust camshaft sensor .
- Loosen clamp (2).

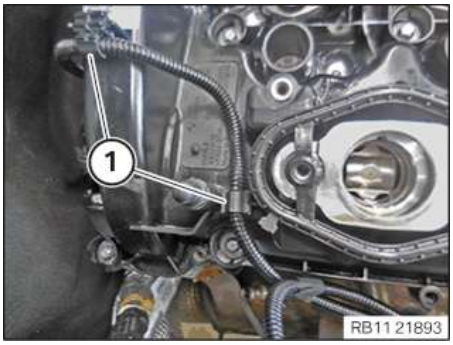


- **If installed:**
- Unlock and loosen connector (1).
- Loosen screw (2).
- Remove the differential pressure sensor (3) and put it to one side.

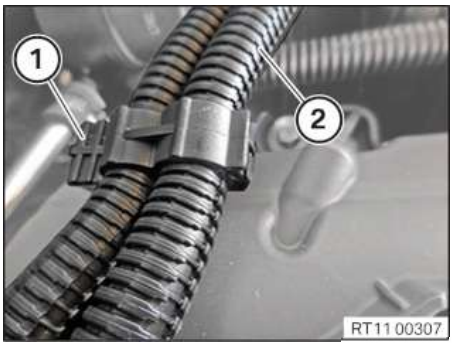


- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

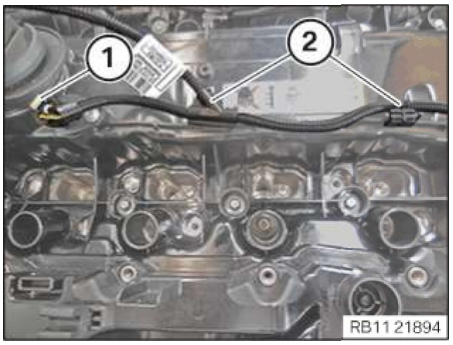
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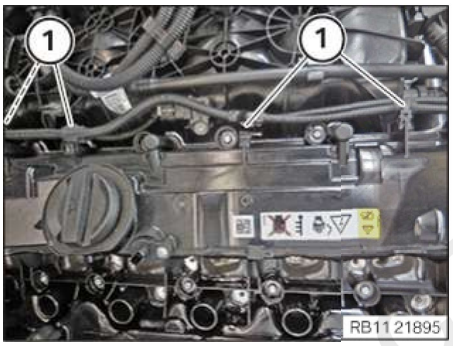
- Loosen clamps (1).



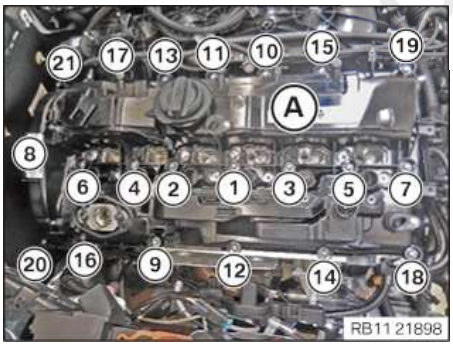
- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



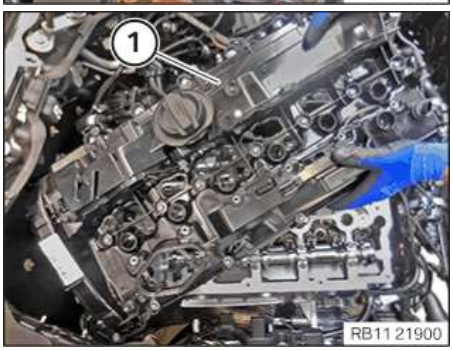
- Unlock and detach connector (1) on the intake camshaft sensor.
- Loosen clamps (2).



- Loosen clamps (1).



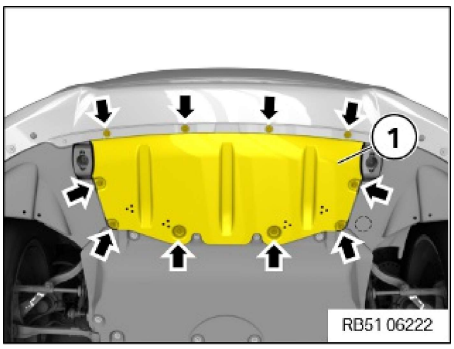
- Release all screws on the cylinder head cover (A) in the sequence (21) to (1).



- Guide the cylinder head cover (1) out and remove it.

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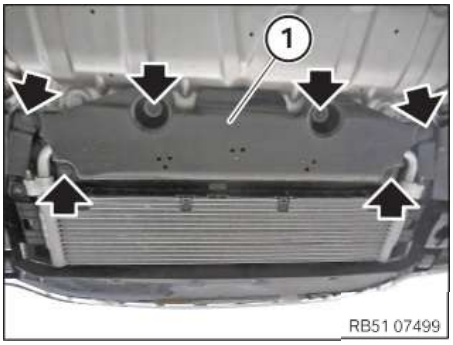
31 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

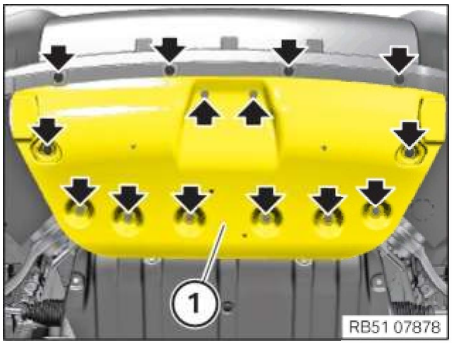
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

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



- **Version 3:**

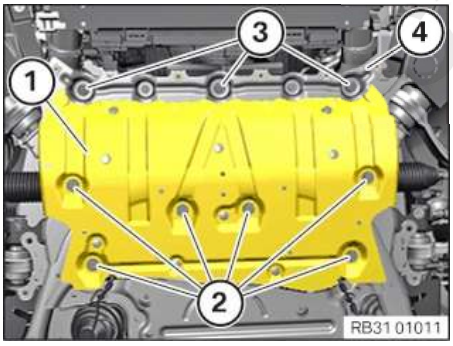
  Remove screws (arrows).

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

32 – Removing the stiffening plate

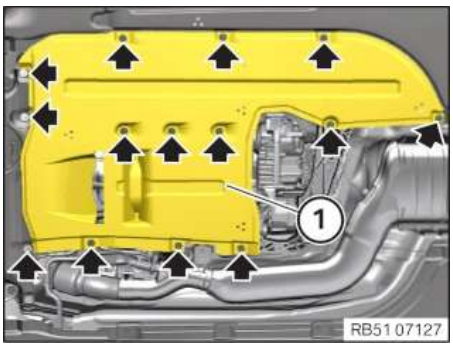
TECHNICAL INFORMATION

Driving without stiffening plate is not permissible.



- Loosen screws (3).
- Remove the holder of the underride protection (4).
- Loosen screws (2).
- Remove stiffening plate (1).

33 – Remove rear underbody protection

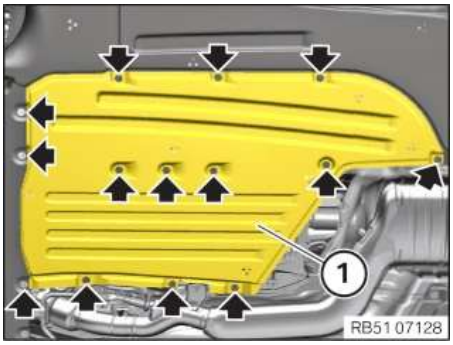


- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).

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- **Version 2:**

  Remove screws (arrows).

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

34 – If installed: Partially release the engine oil cooler

WARNING

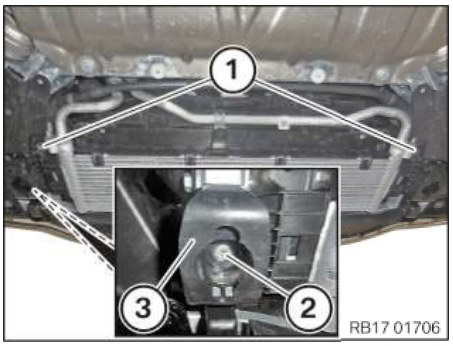
Hot surfaces.

Risk of burning!

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

TECHNICAL INFORMATION

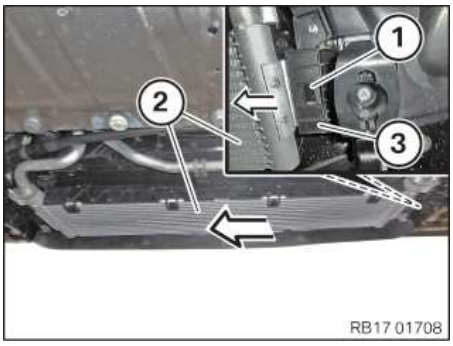
The work must be performed with care to prevent component damage.



- Loosen screws (1).
- Drill out rivet on the left (2).
- Remove the left-hand damper (3).

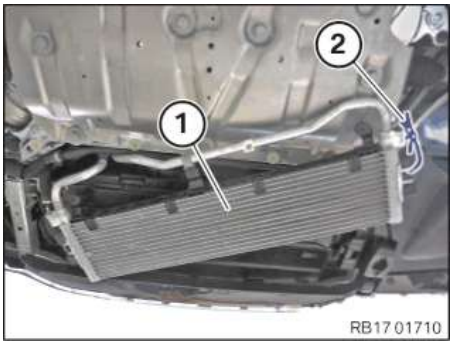


- Loosen screw (1).



- Unlock lock (1).
- Feed out engine oil cooler (2) from the holder in the direction of arrow (3) and place to one side.

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- Affix the engine oil cooler (1) with a cable strap (2) as shown.

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

WARNING

Hot surfaces.

Risk of burning!

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

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

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

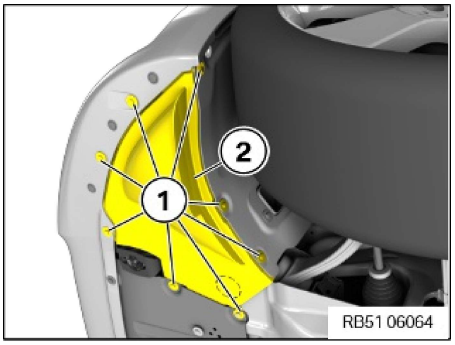
In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

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

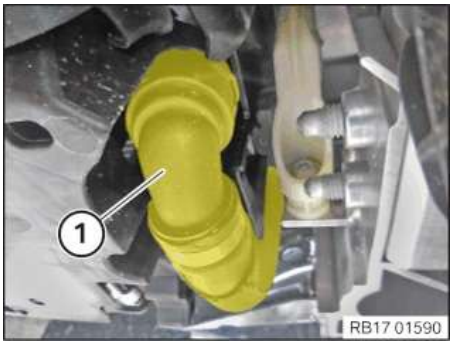


- Loosen sealing cap (1).



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

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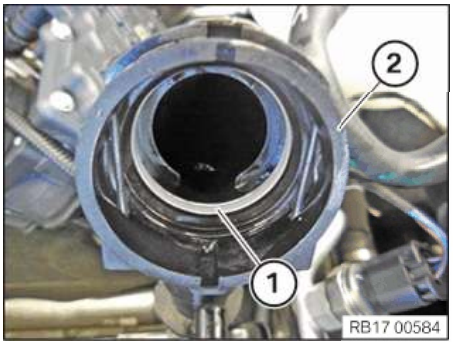


- Unlock and disconnect the coolant line (1).
- Catch and dispose of escaping coolant.

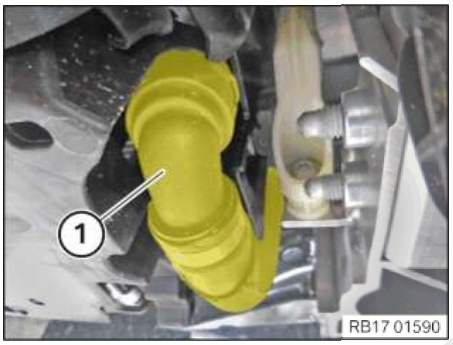
36 – Connecting the coolant lines for the low-temperature coolant circuit

TECHNICAL INFORMATION

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

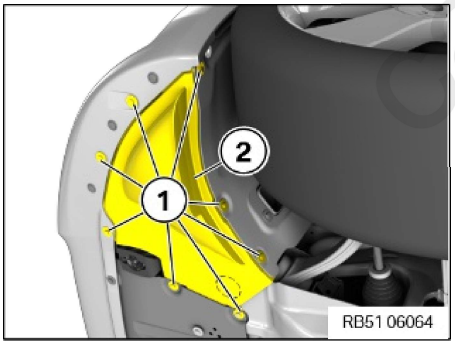


- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock the coolant line (1).

  The coolant line (1) must audibly engage.



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

Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

37 – Remove tank vent valve

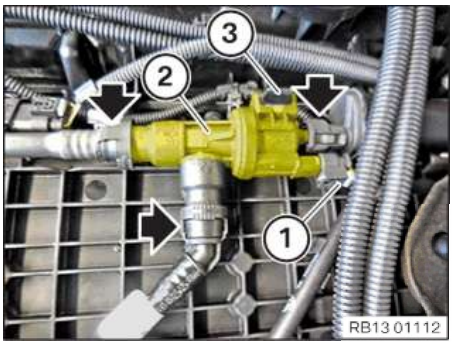
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RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

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



- Unlock and disconnect connector (1).
- Unlock and disconnect the tank ventilation lines (arrows).
- Detach and remove the tank vent valve (2) from the holder (3).

38 – Removing the intake plenum

RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

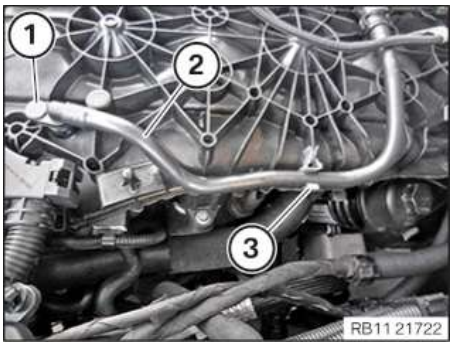
- Do not pull on the wires when disconnecting connectors and plug connections.

TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

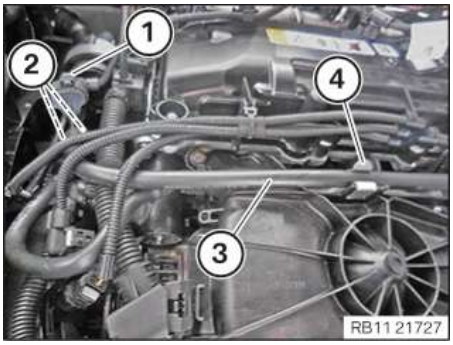
TECHNICAL INFORMATION

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

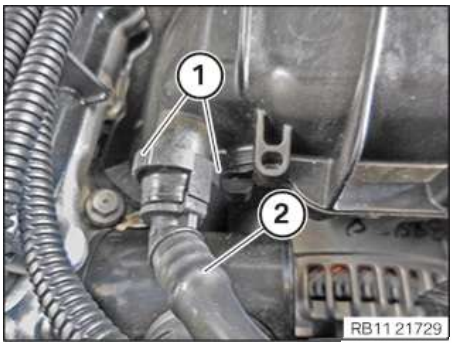


- Loosen screw (1).
- Guide tank ventilation line (2) out of clamp (3) and remove it.

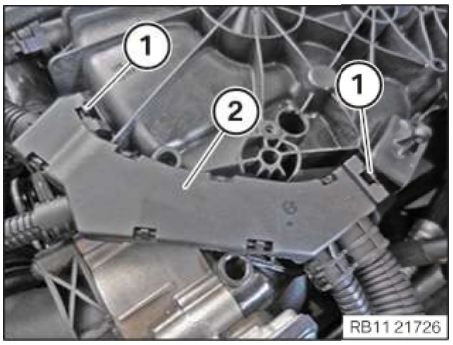
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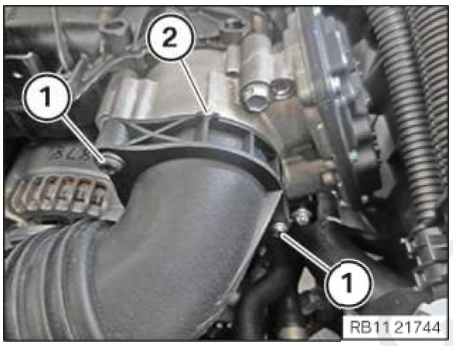
- Unlock and loosen connector (1).
- Unlock the locks (2).
- Guide tank ventilation line (3) out of clamp (4) and remove it.



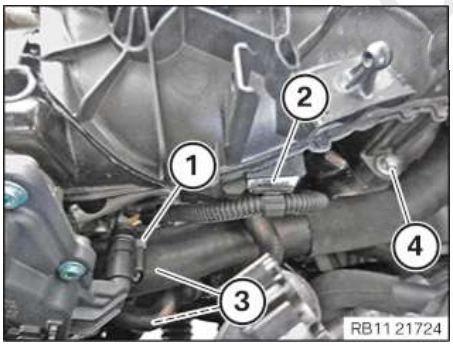
- Unlock the locks (1).
- Feed the tank ventilation line (2) out and set it aside.



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



- Loosen screws (1).
- Feed out charge air line (2) and place to one side.

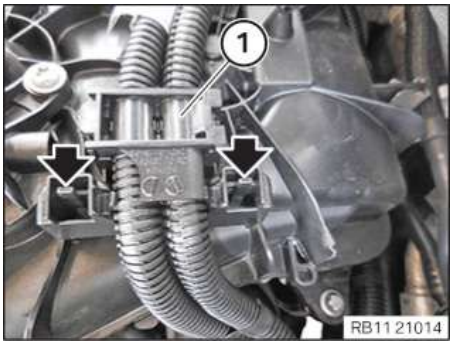


- Unlock and loosen connector (1).
- Loosen clamp (2).
- Thread off coolant line (3) and place to the side.
- Loosen screw (4).

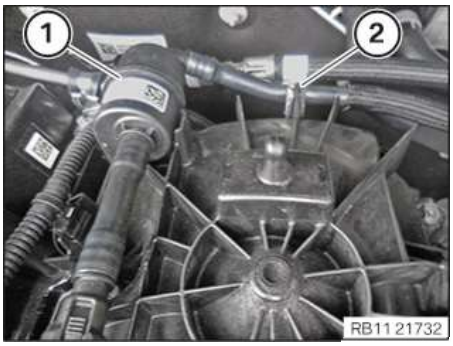


- Unlock and loosen connector (1).

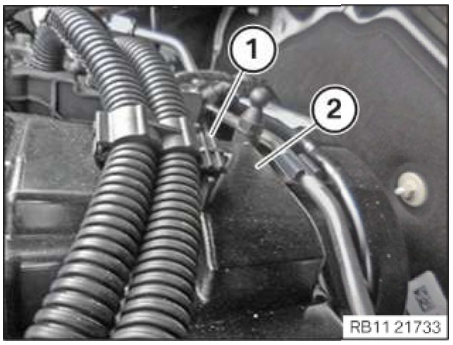
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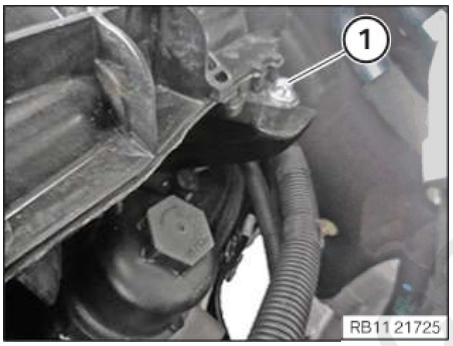
- Unlock the locks (arrows).
- Thread out the wiring harness section (1) for the injectors and ignition coils and set it aside.



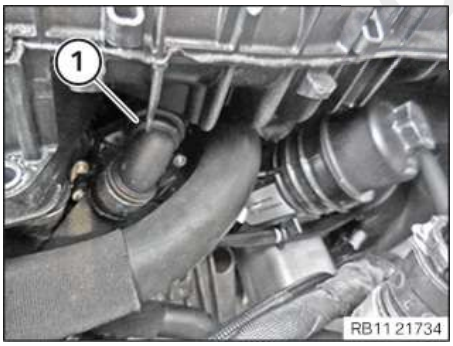
- Guide tank ventilation line (1) out of clamp (2) and place it aside.



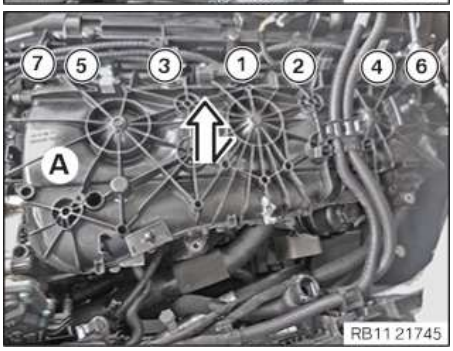
- Guide out the wiring harness section (1) for the injectors and ignition coils of the cylinder head cover (2) and set it aside.



- Loosen screw (1).

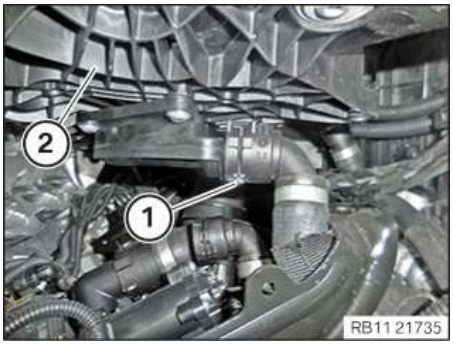


- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.



- Loosen screws in the order (7) to (1).
- Slightly raise intake plenum (A) in direction of arrow.

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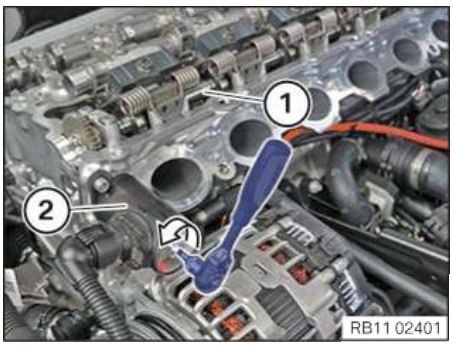


TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

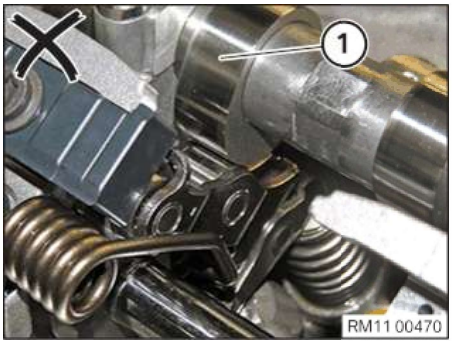
- Unlock and release coolant line (1) below the intake plenum (2).
- Catch and dispose of escaping coolant.
- Thread out intake plenum (2) and remove.

39 – Adjusting eccentric shaft on minimum lift



- Use servomotor (2) to adjust eccentric shaft (1) slowly to minimum lift.

40 – Checking the position of the intake camshaft



Check

- Check position of the intake camshaft on the respective cylinders.

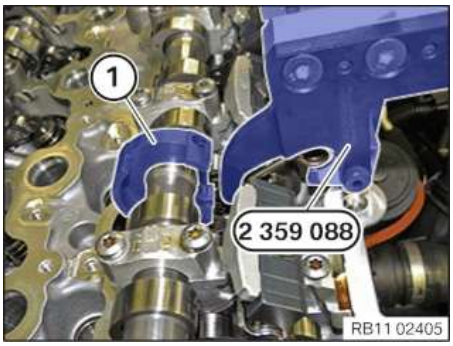
Result

» Cam (1) of the intake camshaft runs on the intermediate lever.

Measure

- Continue to turn the engine at the vibration damper with the special tool 0 493 380 (11 6 480) in the direction of engine rotation.

41 – Check the position of the intake camshaft at cylinders 3 and 4



Check

- Check the position of the intake camshaft at cylinders 3 and 4.

  To remove the torsion spring on cylinder 3 and 4 the camshaft sensor wheel (1) of the intake camshaft must be positioned as shown.

Result

» Camshaft sensor wheel (1) of the intake camshaft is not in the indicated position.

Measure

- Turn engine on the vibration damper using special tool 0 493 380 (11 6 480) till the camshaft sensor wheel (1) of the intake camshaft is positioned as shown.

42 – Remove all torsion springs

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CAUTION

Spring preload.

Danger of injury!

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

TECHNICAL INFORMATION

- Wear safety goggles.

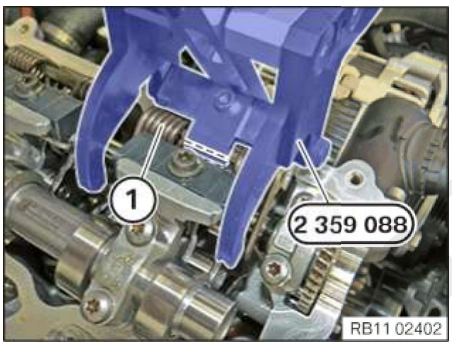
NOTICE

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

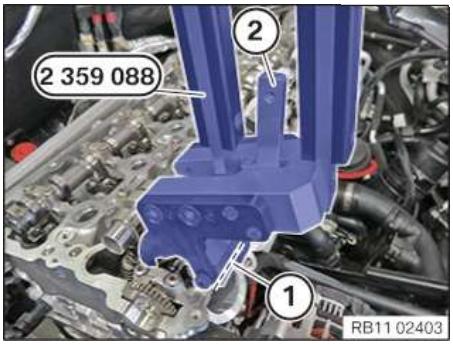


- Have the set of special tools 2 359 088 ready.

Number	Description
1	Clamping lever
2	Mounting for clamping lever (fitting aid)



- Open the special tool 2 359 088 and position it at the torsion spring (1).



- Ensure that the special tool 2 359 088 lies flat in the area (1) on the cylinder head.
- Carefully close the clamping lever of the special tool 2 359 088 until the retaining hook (2) engages.

Check

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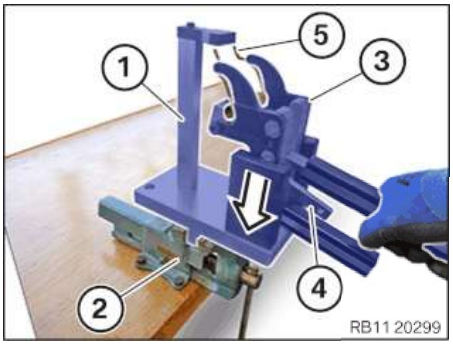
- Check if the special tool 2 359 088 is positioned correctly on the torsion spring.

Result

» Special tool 2 359 088 is not positioned correctly on the torsion spring.

Measure

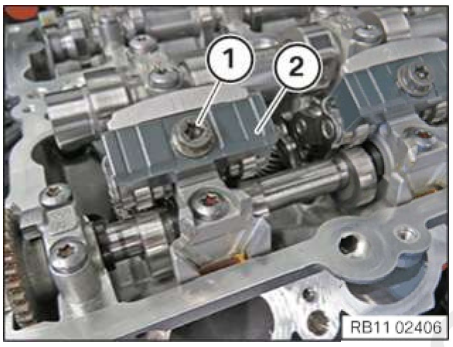
- Carefully release the clamping lever of the special tool 2 359 088 and repeat the process.



- Clamp fixture (1) of the special tool 2 359 088 in the vice (2).
- Position clamping lever (3) of special tool 2 359 088 with pre-tensioned torsion spring (5) in direction of arrow in the mounting (1) of the special tool 2 359 088.
- Carefully unlock retaining hook (4) of the special tool 2 359 088.

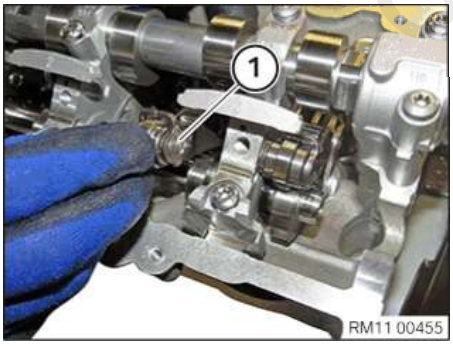
  The torsion spring (5) is relieved.
- Slowly open clamping lever (3) and remove the torsion spring (5).
- Place torsion spring (5) neatly into special tool 0 495 105 (11 4 480).
- Repeat the operations for the remaining torsion springs.

43 – Removing all gates



- Loosen screw (1).
- Remove the gates (2) and place it arranged in order in the special tool 0 495 105 (11 4 480) .
- Repeat the step for all the gates.

44 – Removing all intermediate levers



- Remove the intermediate lever (1) and arrange it in the special tool 0 495 105 (11 4 480) in order.
- Repeat the step for all intermediate levers (1).

45 – Block the engine with the special tool in TDC firing position

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- Thread the sealing cap (1) out and remove.



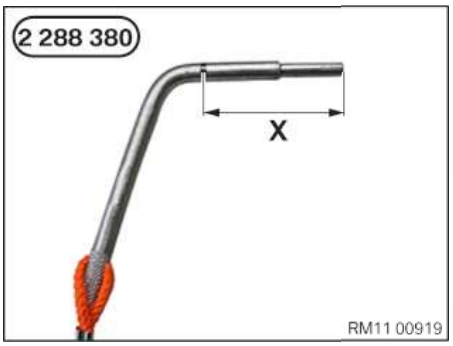
RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

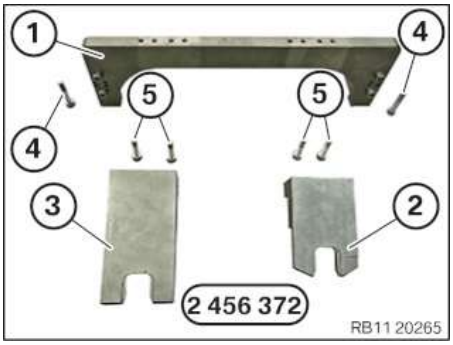
  The TDC firing position of cylinder 1 was **not** reached.



- **Vehicles with automatic transmission:**

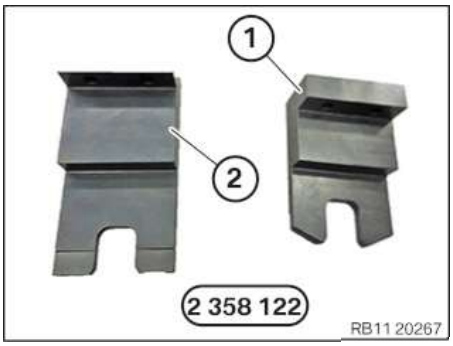
  Special tool 2 288 380 **correctly** positioned.

  The engine is in the TDC firing position of cylinder 1.



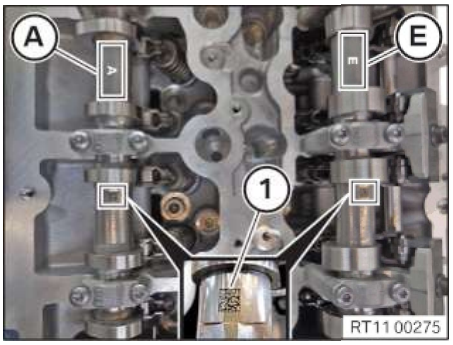
- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

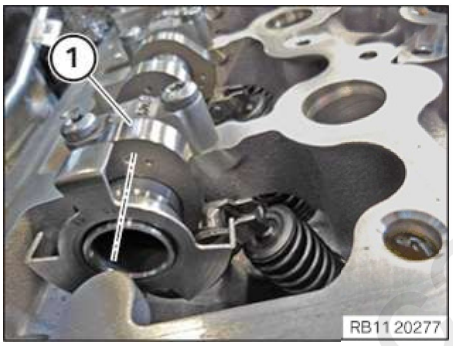


- Overview of the test gauges from the set of special tools 2 358 122:

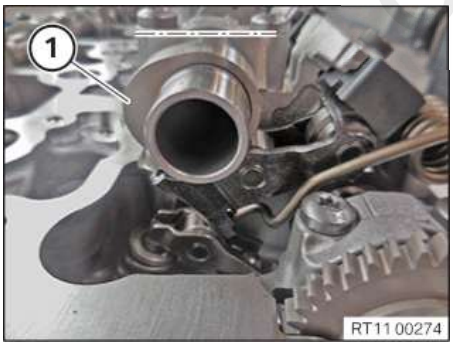
Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



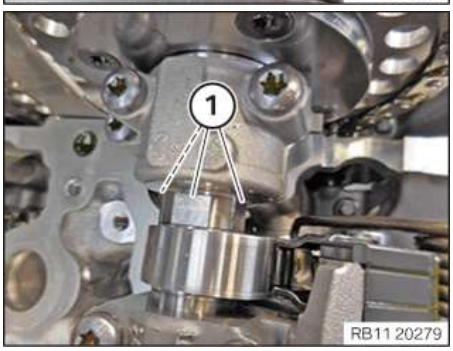
- Turn intake camshaft (E) and exhaust camshaft (A) until marks (1) can be read from the top.



- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.

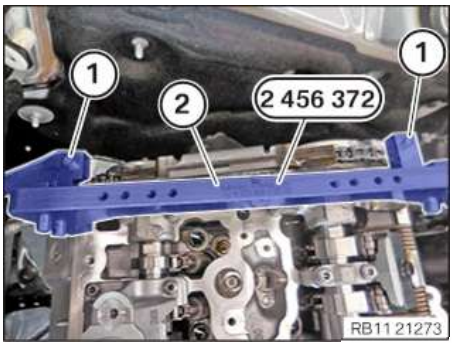


- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.

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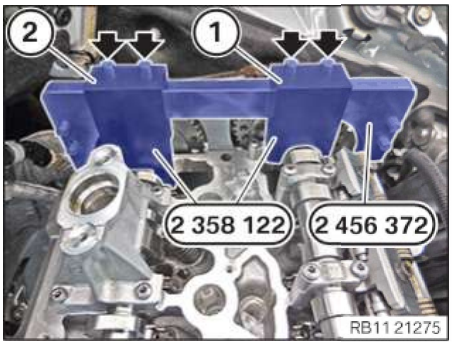
- Position basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

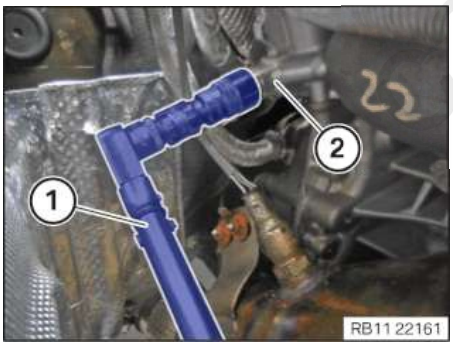
Test gauge to basic carrier

M6		Tightening torque	8 Nm

46 – Removing chain tensioner

TECHNICAL INFORMATION

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



- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).



- Feed out and remove the chain tensioner (1).

47 – Releasing the VANOS central valve of the intake adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

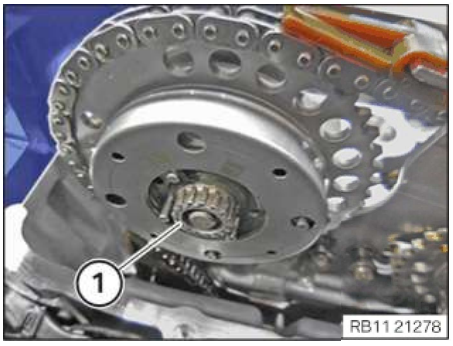


NOTICE

The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the intake adjuster.

48 – Removing the VANOS central valve of the intake adjuster

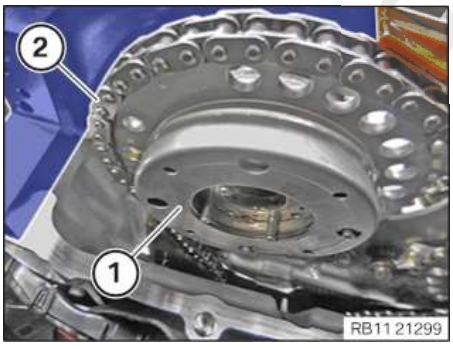


- Guide out and remove the VANOS central valve (1) of the intake adjuster.

49 – Removing intake adjuster

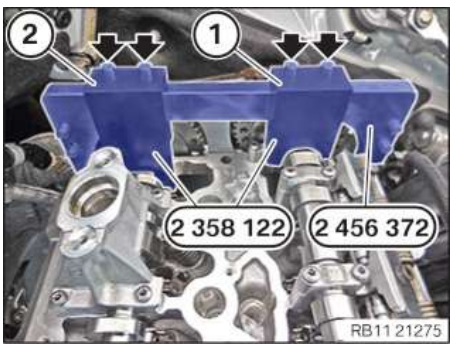
NOTICE

The figure shows the rear side of the engine.



- Guide out the intake adjuster (1) from the timing chain (2) and remove.

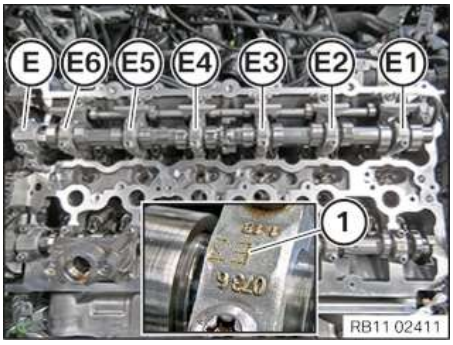
50 – Remove the test gauges to fix the camshafts



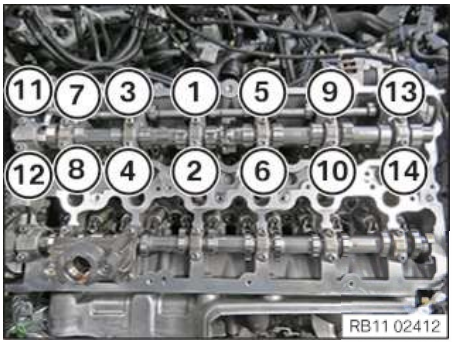
- Remove screws (arrows).
- Guide out and remove test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier of the set of special tools 2 456 372.
- Guide out and remove test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier of the set of special tools 2 456 372.

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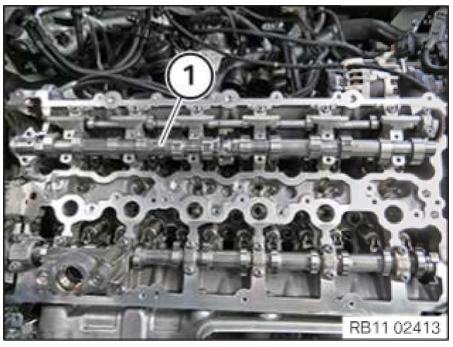
51 – Remove intake camshaft



- Observe numbering of intake camshaft bearing caps from (E1) to (E6).
  Intake camshaft bearing cap (E) is a thrust bearing.

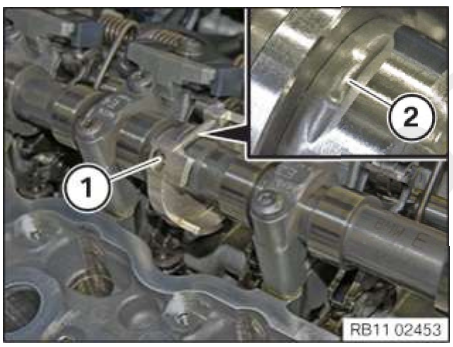


- Loosen screws in the order (14) to (1).
- Set all intake camshaft bearing caps neatly in the special tool 0 495 105 (11 4 480).

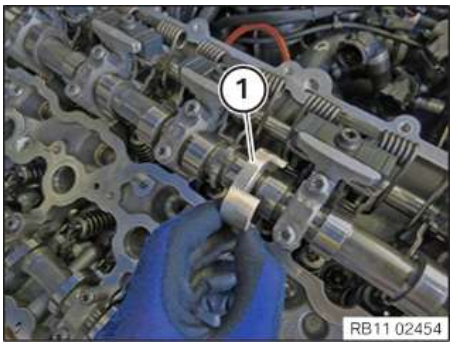


- Remove intake camshaft (1) in upward direction.

52 – When replacing intake camshaft: Remounting the camshaft sensor wheel

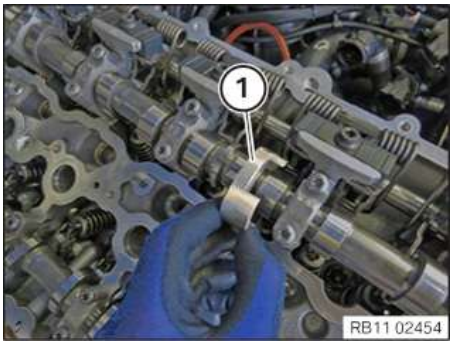


- If required, turn the intake camshaft into the position shown up to the recess (2).
- Loosen screw (1).

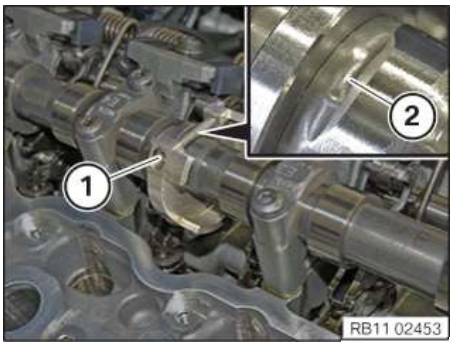


- Feed out camshaft sensor wheel (1) and remove.

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- Guide the camshaft sensor wheel (1) into the new intake camshaft.



- Rotate intake camshaft, if necessary in the position shown.

  Note: The recess (2) must point upwards.
- Position camshaft sensor wheel and tighten the screws (1).

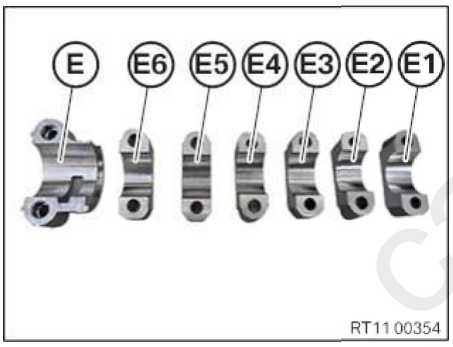
Camshaft sensor wheel to intake camshaft

M4 x35		4,5 Nm

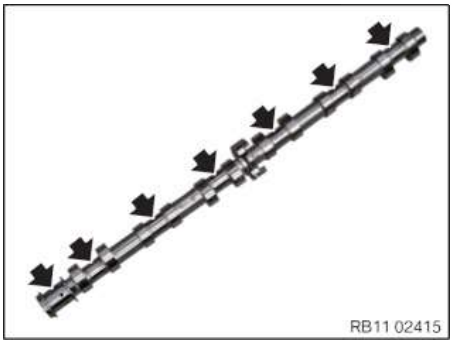
53 – Install intake camshaft



- Clean all bearing positions and coat with engine oil.

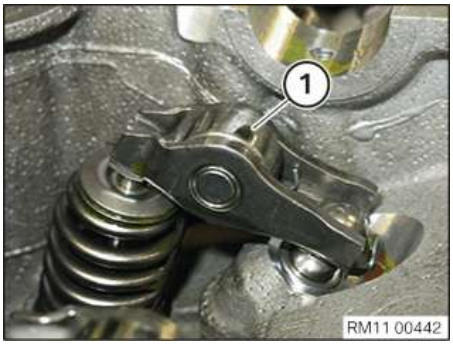


- Clean all bearing positions of intake camshaft bearing caps (E1),(E2),(E3),(E4),(E5),(E6) and (E) and coat with engine oil.

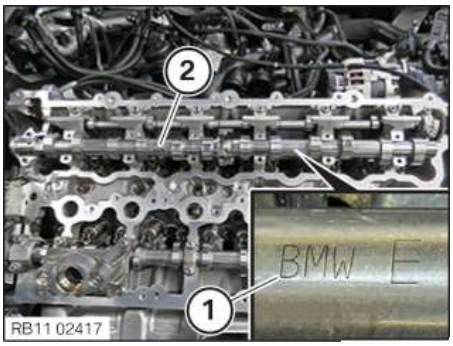


- Clean all bearing positions of the intake camshaft and coat with engine oil.

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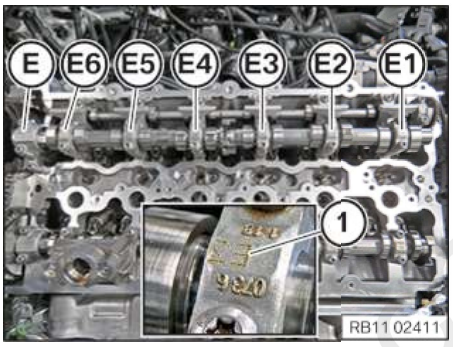
- Check all roller cam followers(1) of the intake side for correct fit.



- Insert intake camshaft (2) in the bearing supports in such a way that the mark (1) points towards the top.



- Check fitting sleeves (1) of the thrust bearing for damage, renew if necessary.



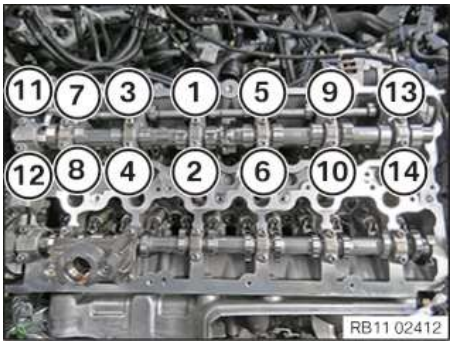
RISK OF DAMAGE

Engine damage caused by incorrectly installed bearing shells and bearing supports.

Engine damage may result from incorrectly installing bearing shells and bearing supports.

- Always install all bearing shells and bearing supports in the same position from which they were removed.

- Coat all the intake camshaft bearing caps(E1) till (E6) and lay the bearing caps for the thrust bearing(E) with *engine oil*.



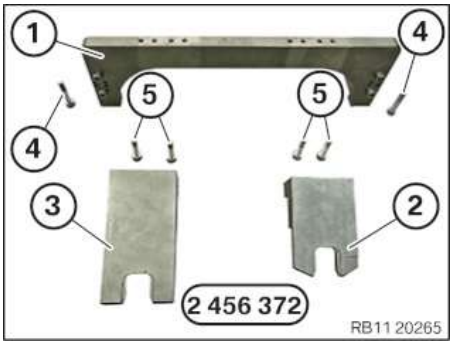
- Press intake camshaft bearing cap down and hand-tighten the bolts incrementally in sequence (1) to (14).
- Join all the screws in the sequence (1) to (14) **in half turns** .
- **Adhere to the jointing torque.**
- Tighten all screws in a sequence from (1) to (14) .

Intake camshaft to cylinder head

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque.	10 Nm

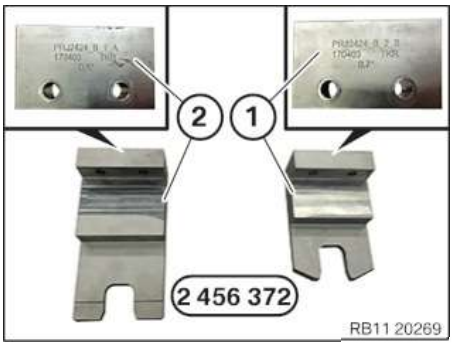
POSTPROCESSES

54 – Adjust the camshafts with the special tool

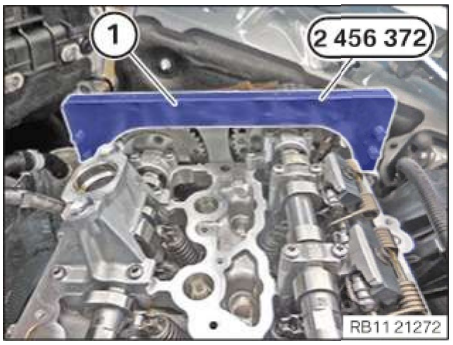


- Overview of the set of special tools 2 456 372:

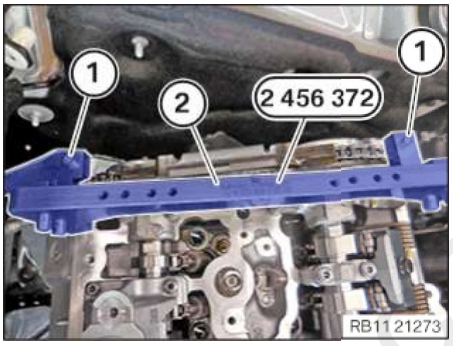
Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Use the setting gauge 0.7 ° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.



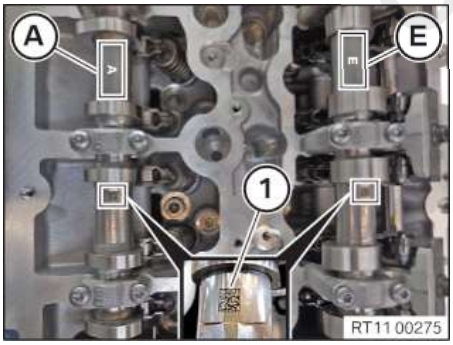
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



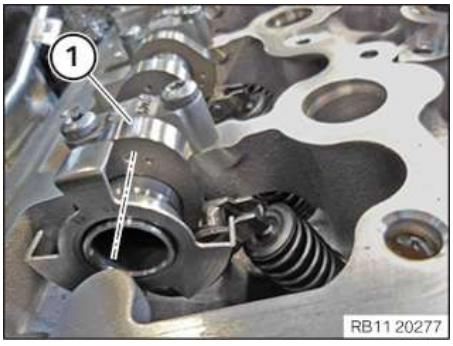
- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6	Tightening torque	8 Nm



- Turn the intake camshaft (E) and the exhaust camshaft (A) such that the marks (1) can be read from the top.

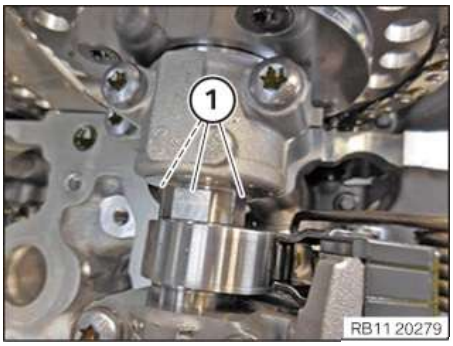


- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.

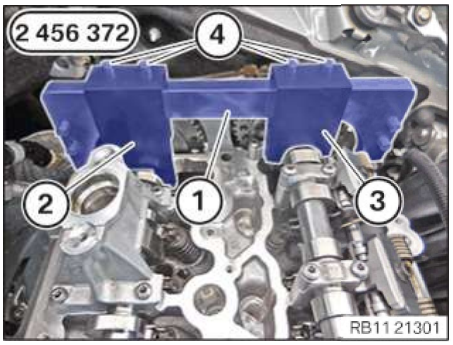
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- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



- Position the setting gauge 0.5° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten the screws (4).

Test gauge to basic carrier

M6		Tightening torque	8 Nm

55 – Installing the intake adjuster

NOTICE

The figure shows the rear side of the engine.



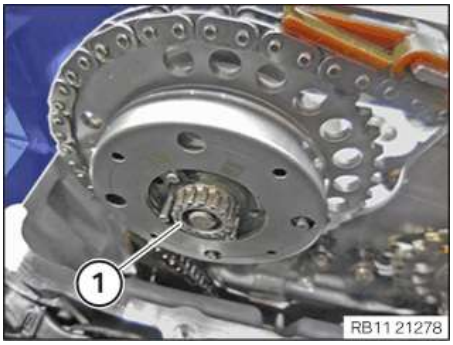
- Keep intake adjuster (1) marked IN ready.



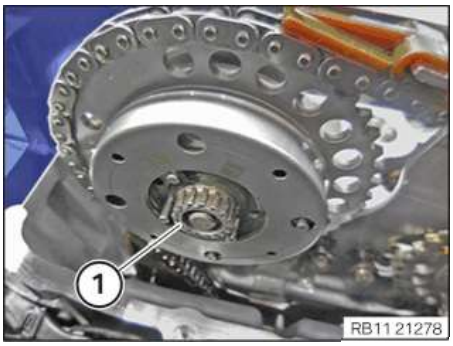
- Feed in intake adjuster (1) in the timing chain (2) and position on the intake camshaft .

56 – Install the VANOS central valve of the intake adjuster

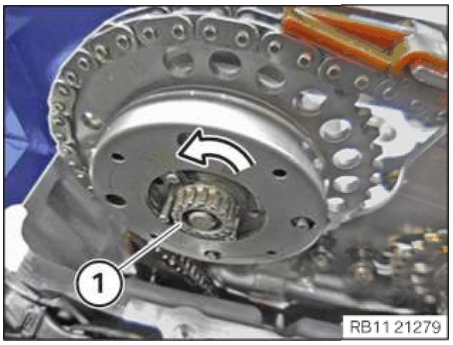
cardiagn.com



- Guide in the VANOS central valve (1) of the intake adjuster and install.



- Hand-tighten the VANOS central valve (1) of the intake adjuster.

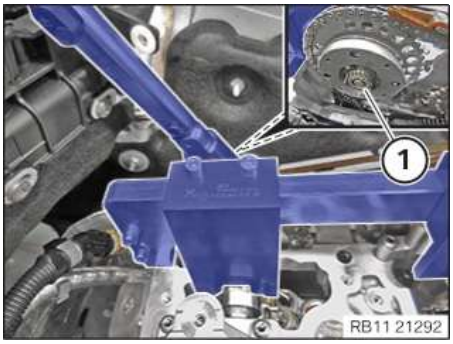


- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

57 – Releasing VANOS central valve of the exhaust camshaft adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.



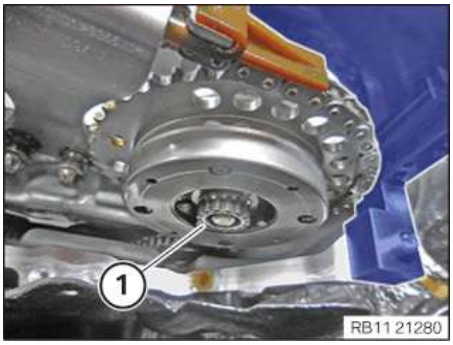
NOTICE

The figure shows the rear side of the engine.

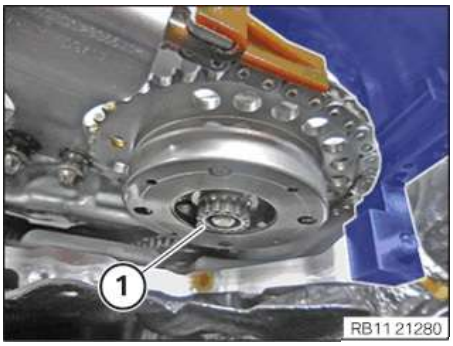
- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

58 – Installing the VANOS central valve of the exhaust camshaft adjuster

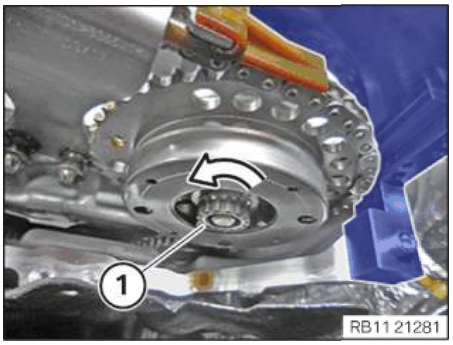
cardiagn.com



- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.

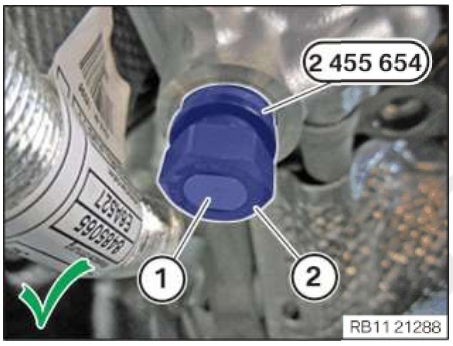


- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.



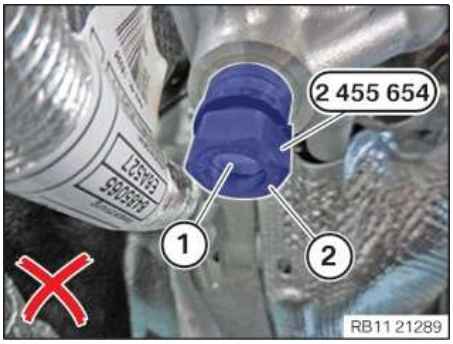
- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

59 – Pretension the timing chain with the special tool



- Make sure that the timing chain is **correctly** pre-tensioned with the special tool 2 455 654.

  The pin (1) must align **precisely** with housing (2).

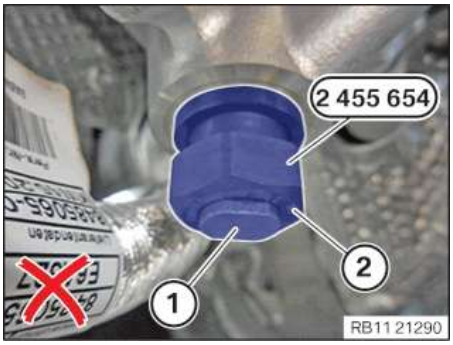


- Make sure that the preload of the timing chain is no **insufficient**.

  The preload is insufficient when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

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- Make sure that the preload of the timing chain is not **too high**.

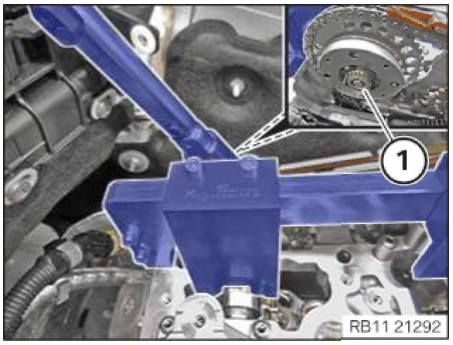
  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

60 – Tightening the VANOS central valve of the exhaust camshaft adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



- Tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

61 – Tightening the VANOS central valve of the intake adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



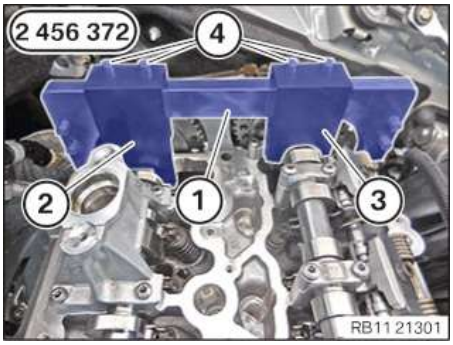
- Tighten the VANOS central valve (1) of the intake adjuster.

VANOS central valve to camshaft

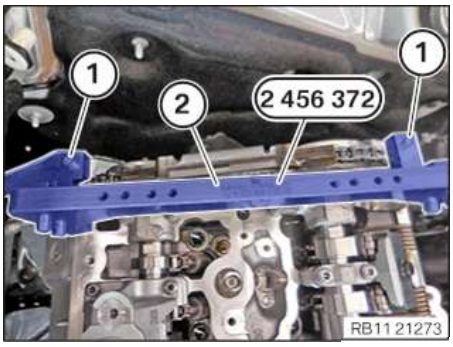
M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

62 – Disassembling all special tools

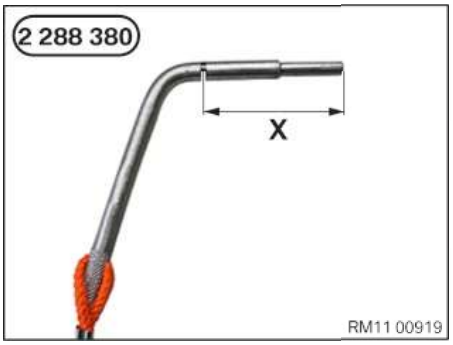
carDiagn.com



- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) and remove.



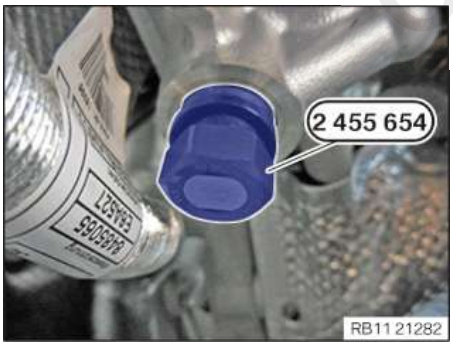
- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.



- Guide the special tool 2 288 380 out and remove.



- Guide the special tool 0 493 380 (11 6 480) out and remove.



- Guide the special tool (1)2 455 654 out and remove.

63 – Install chain tensioner

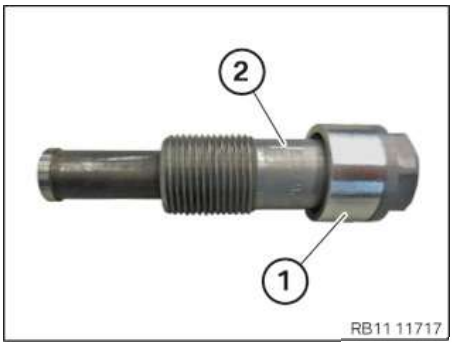
TECHNICAL INFORMATION

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

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- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.

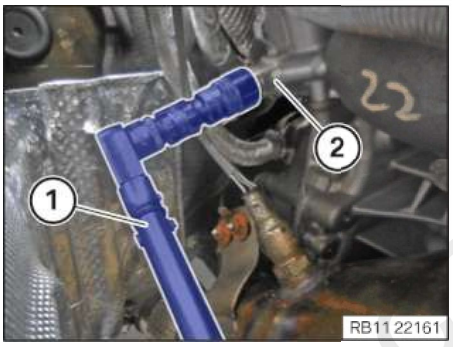


- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.



- Insert and install the chain tensioner (1).

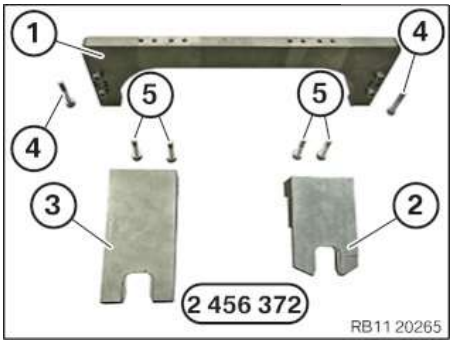


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

Chain tensioner	Tightening torque	20 Nm
	Angle of rotation	40 °

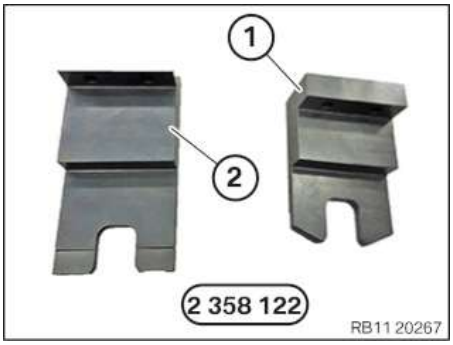
64 – Checking camshaft timing



- Have the set of special tools 2 456 372 ready.

Number	Description
1	Basic carrier
2	0.7° setting gauge to adjust the intake camshaft
3	0.5° setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

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- Keep the test gauge from the set of special tools 2 358 122 ready.

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



- Have the special tool 2 288 380 ready.

Number	Description
1	Locating stud



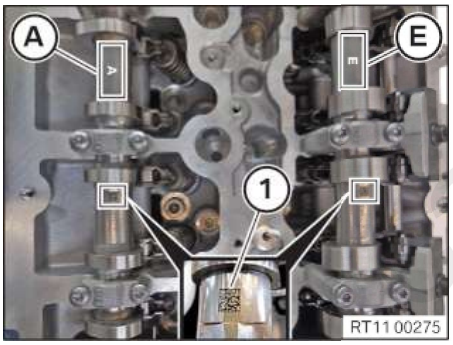
RISK OF DAMAGE

Damage to the engine.

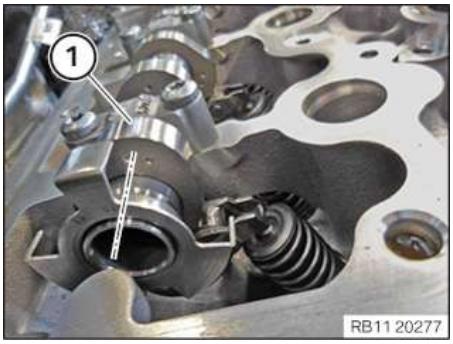
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



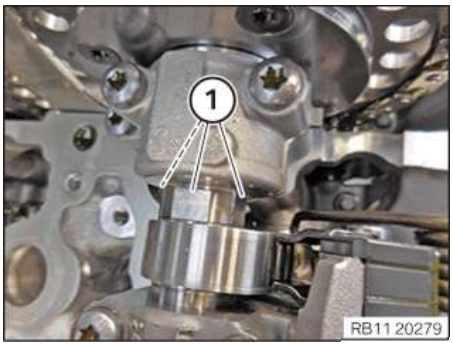
- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.



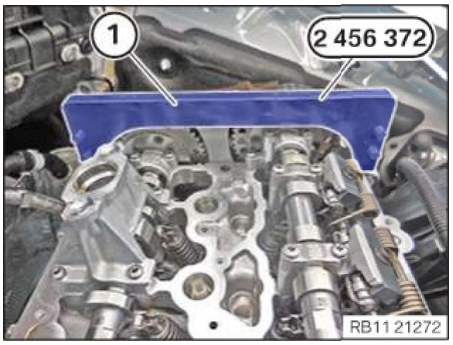
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



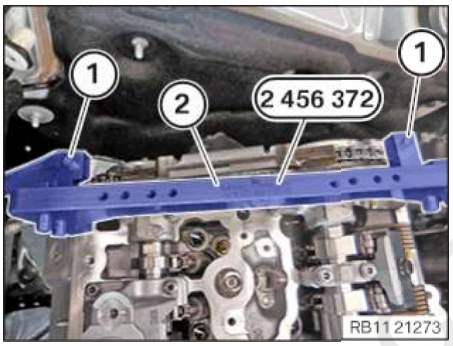
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



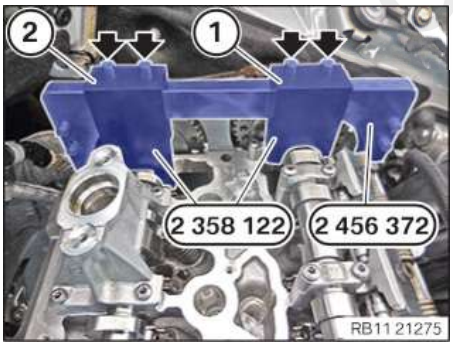
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

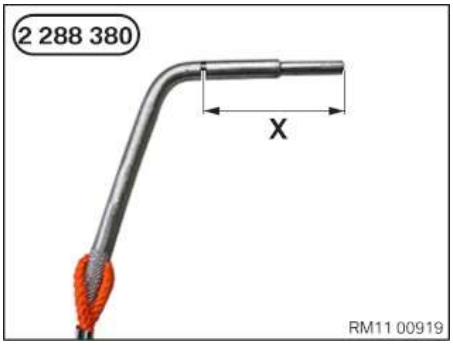
Test gauge to basic carrier

M6		Tightening torque	8 Nm



- Thread the sealing cap (1) out and remove.

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- **Vehicles with automatic transmission:**

  Dimensions (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

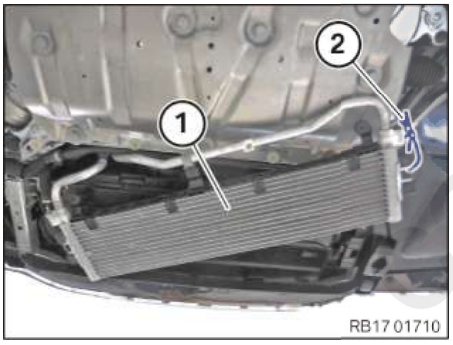


- **Vehicles with automatic transmission:**

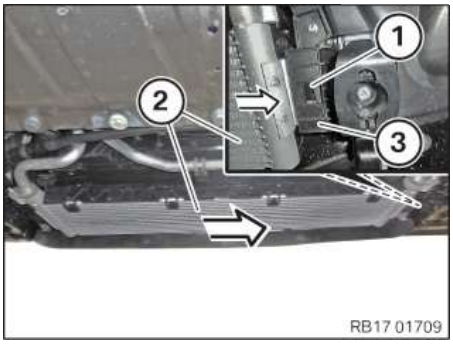
  Special tool 2 288 380 has been **correctly** positioned.

  The engine **is in the** TDC firing position of cylinder 1.

65 – If installed: Secure engine oil cooler



- Remove the cable straps (2).
- Position engine oil cooler (1).



- Feed in and install the engine oil cooler (2) on the holder (3) in the direction of the arrow.
- Ensure that the lock (1)engages audibly.

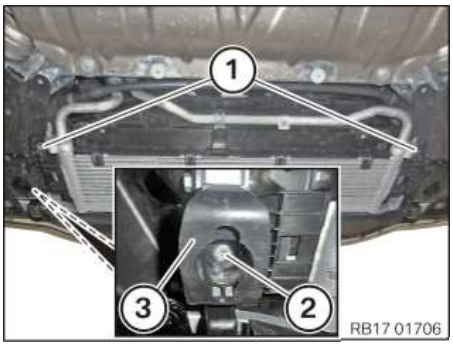
cardiagn.com



- Tighten down screw (1).

Engine oil cooler to bumper support

M6X25		Tightening torque	8 Nm



- Renew rivet (2).

  Parts: Rivet
- Install and rivet damper (3).
- Tighten the screws (1).

Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

66 – Checking the intermediate lever classification



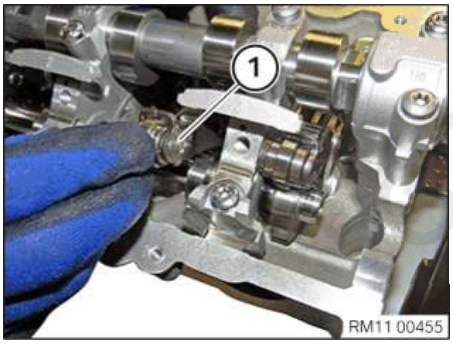
TECHNICAL INFORMATION

All intermediate levers are classified. Only one classification may be used per engine.

All intermediate levers must be installed in the same position in an engine which has already been in use.

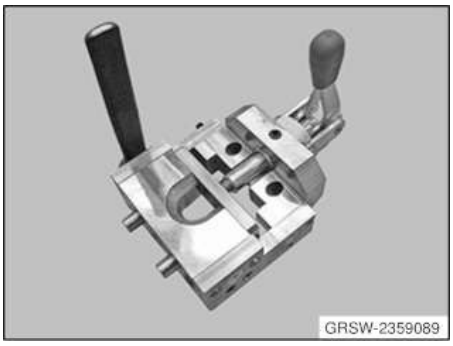
- Checking the intermediate lever classification.

67 – Installing all intermediate levers



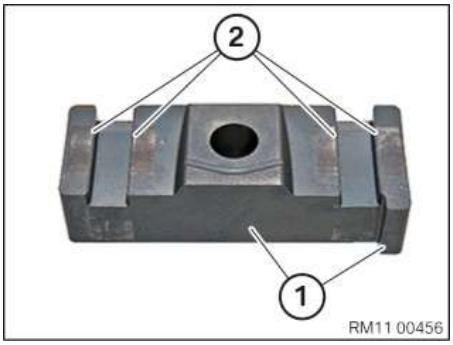
- Install intermediate lever (1).
- Repeat the step for all intermediate levers (1).

68 – Installing all gates

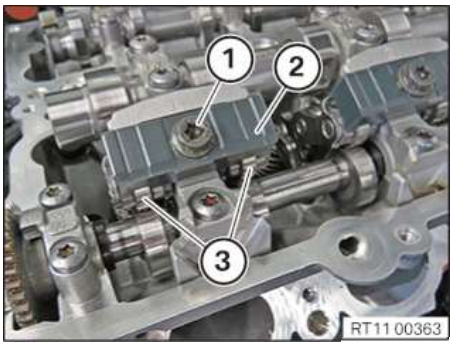


- Have the special tool 2 359 089 ready.

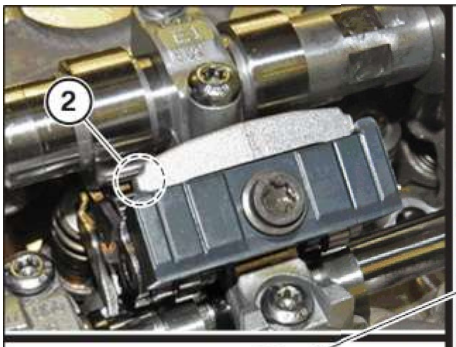
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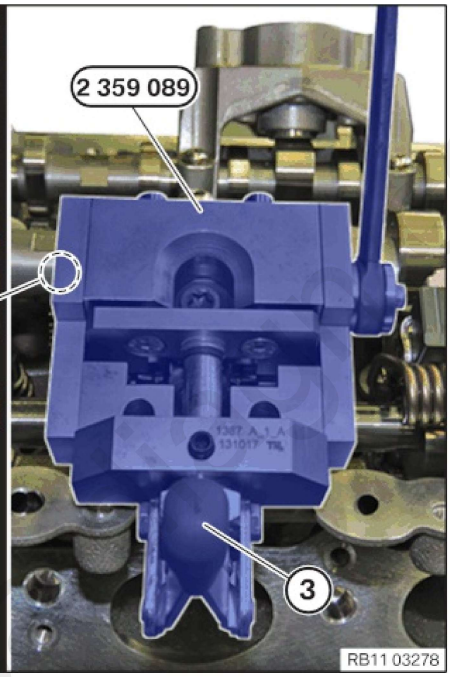


- Clean contact surfaces (1) and (2) off oil, grease and dirt.

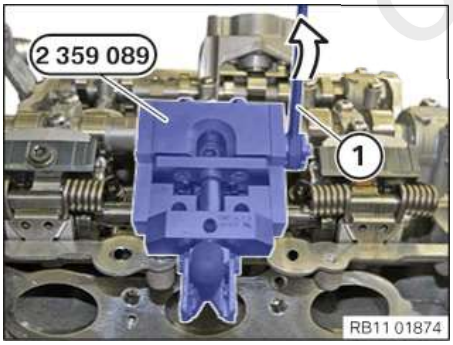


- Position the gate (2) and hand-tighten the bolt (1).
- Check that the intermediate lever (3) is in the correct mounting orientation.





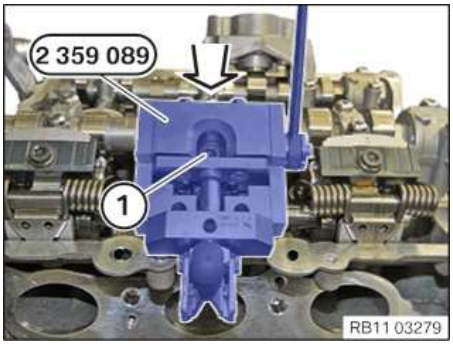
- Position the special tool 2 359 089 on the cylinder head.
- Pre-tension the gate with the lever (3).
- Abut the bolt (1) in the area (2).
- Make sure that the special tool 2 359 089 does not rotate during this process.



- Secure the gate with the lever (1).



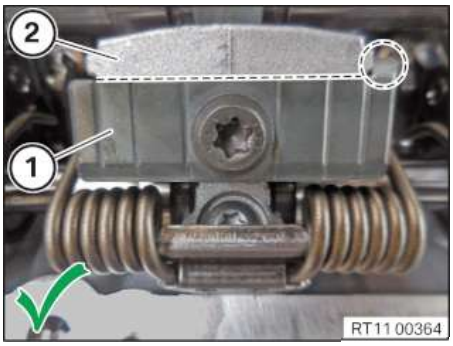
- Ensure that the special tool 2 359 089 lies flat on the cylinder head.



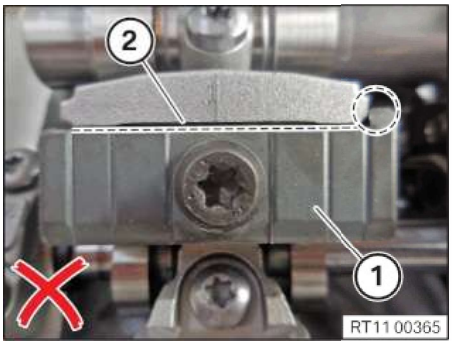
- Press the special tool 2 359 089 onto the cylinder head.
- Tighten the bolt (1) at the same time.

Gate to bearing bracket

M8		20 Nm

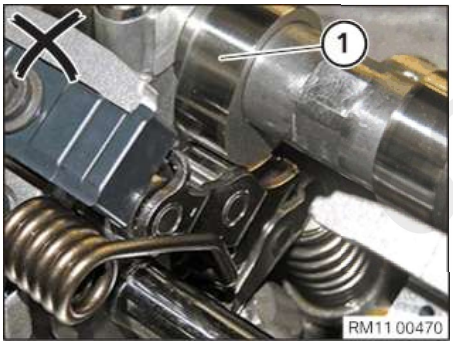


- Make sure that gate (1) rests correctly against bearing bracket (2).
  Gate (1) is installed correctly in the marked area.



- Make sure that gate (1) rests correctly against bearing bracket (2).
  Gate (1) is installed incorrectly in the marked area.
- Repeat the procedure for all gates.

69 – Checking the position of the intake camshaft



Check

- Check position of the intake camshaft on the respective cylinders.

Result

» Cam (1) of the intake camshaft runs on the intermediate lever.

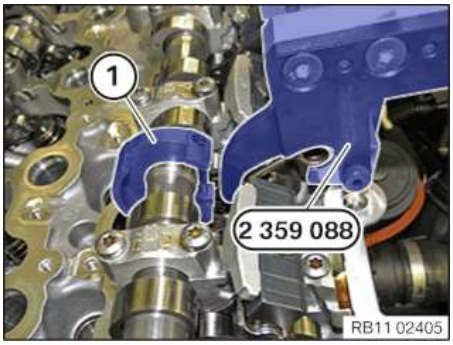
Measure

- Continue to turn the engine at the vibration damper with the special tool 0 493 380 (11 6 480) in the direction of engine rotation.

70 – Check the position of the intake camshaft at cylinders 3 and 4

Check

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- Check the position of the intake camshaft at cylinders 3 and 4.

  To remove the torsion spring on cylinder 3 and 4 the camshaft sensor wheel (1) of the intake camshaft must be positioned as shown.

Result

» Camshaft sensor wheel (1) of the intake camshaft is not in the indicated position.

Measure

- Turn engine on the vibration damper using special tool 0 493 380 (11 6 480) till the camshaft sensor wheel (1) of the intake camshaft is positioned as shown.

71 – Install all torsion springs

CAUTION

Spring preload.

Danger of injury!

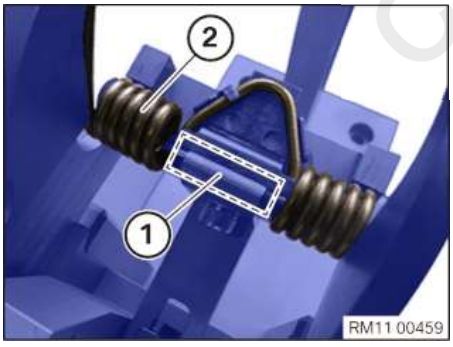
- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

TECHNICAL INFORMATION

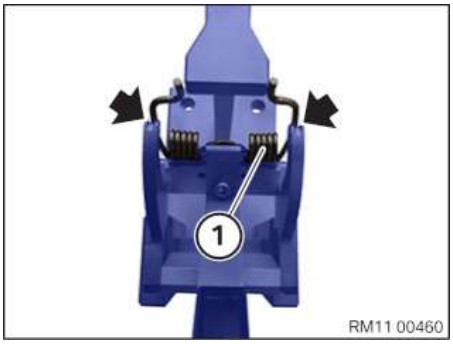
- Wear safety goggles.

NOTICE

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

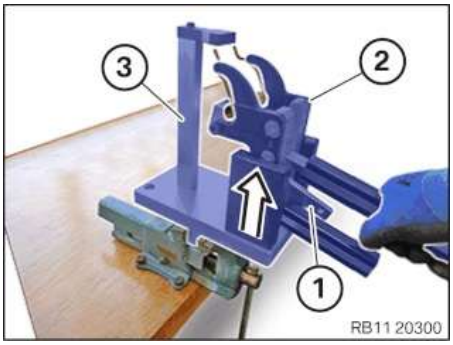


- Insert the torsion spring (2) in the clamping lever of the special tool 2 359 088.
- Make sure that the torsion spring (2) is correctly positioned in the marked area (1) of the special tool 2 359 088.



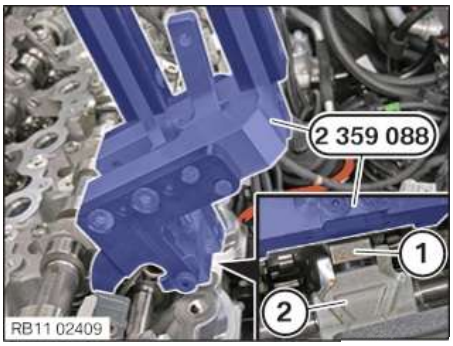
- Carefully close the clamping lever of the special tool 2 359 088 in the accompanying fixture until the retaining hook engages.
- Ensure that the torsion spring (1) lies correctly in the lateral guides (arrows) of the special tool 2 359 088 during tensioning.

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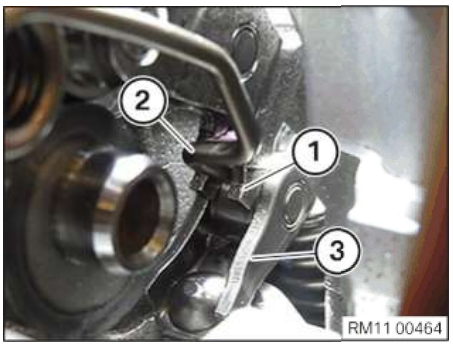


- Carefully close the clamping lever (2) of the special tool 2 359 088 in the fixture (3) until the retaining hook (1) audibly engages.

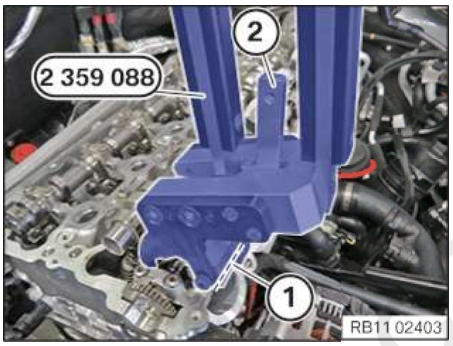
  The torsion spring is tensioned.
- **Carefully** take the clamping lever (2) of the special tool 2 359 088 with the stretched torsion spring out of the fixture (3) of the special tool 2 359 088 in the direction of arrow.



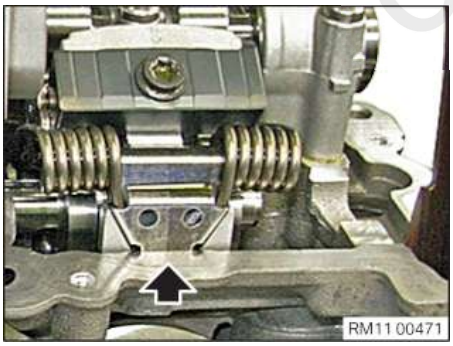
- Insert the torsion spring (1) with the special tool 2 359 088 in the cylinder head (2).



- Insert the torsion spring (2) into the intermediate levers (1).
- Check all roller cam followers (3) for correct installation position.



- Lay special tool 2 359 088 flat in the marked area (1).
- Press the clamping lever of the special tool 2 359 088 together until the retaining hook (2) unlocks.
- Carefully open the clamping lever of the special tool 2 359 088 until the torsion spring is completely relaxed.
- Remove special tool 2 359 088.



- Check the correct mounting orientation of the torsion spring (arrow).
- Repeat the operations for the remaining torsion springs.

72 – Installing the intake plenum

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

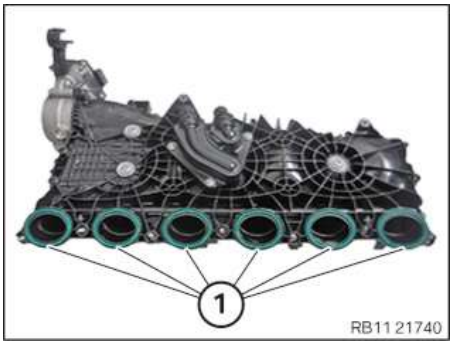
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

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

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TECHNICAL INFORMATION

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

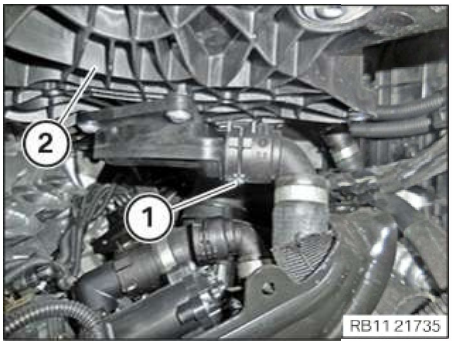


- Renew gaskets (1).

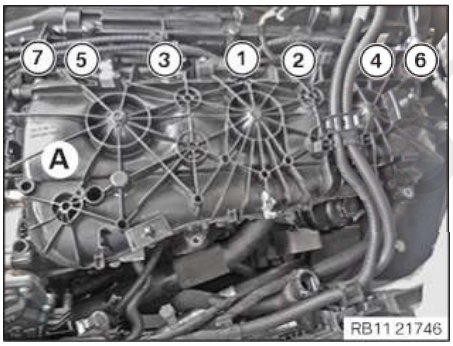
  Parts: Seals



- Clean contact surface (1).



- Feed in and position intake plenum (2).
- Connect and lock coolant line (1).
- Make sure that the cooling line (1) engages audibly.



TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Position the intake plenum (A).
- Tighten screws in the order (1) to (7).

Note: Tighten the bolts in 360 degree steps.

Intake plenum to cylinder head

M6		Tightening torque	10 Nm



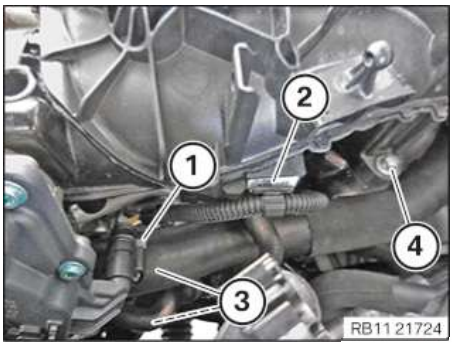
- Connect and lock coolant line (1).
- Make sure that the cooling line (1) engages audibly.



- Tighten down screw 1.

Intake plenum to support

M6X25		Tightening torque	8 Nm

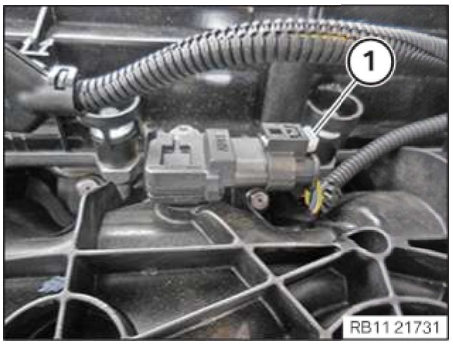


- Tighten down screw (4).

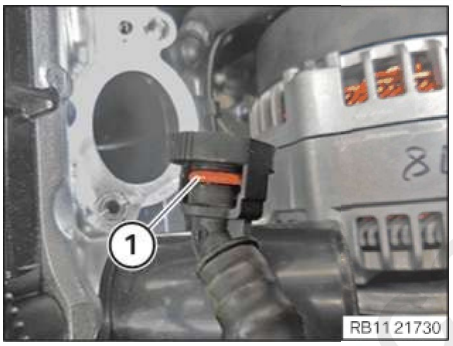
Intake plenum to support

M6X25		Tightening torque	8 Nm

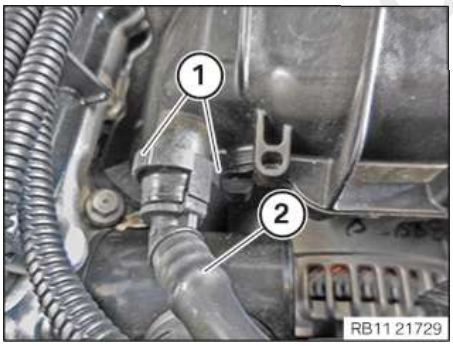
- Thread in and install coolant line (3).
- Secure clamps (2).
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.



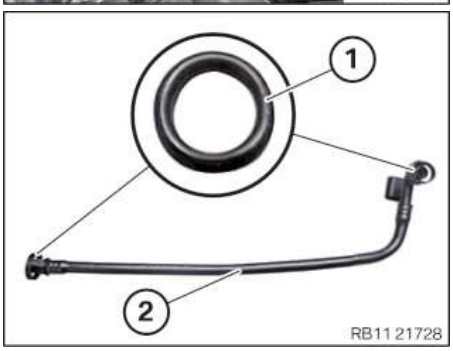
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.



- Check sealing ring (1) for damage and renew tank ventilation line if necessary.

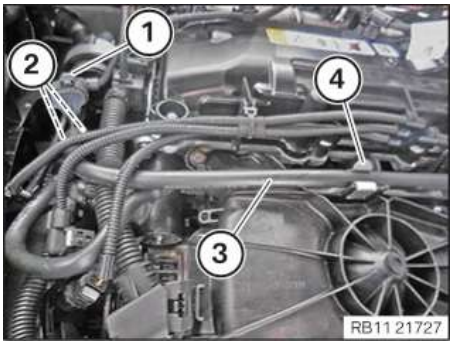


- Insert and install the tank ventilation line (2).
- Ensure that the locks (1) engage audibly.

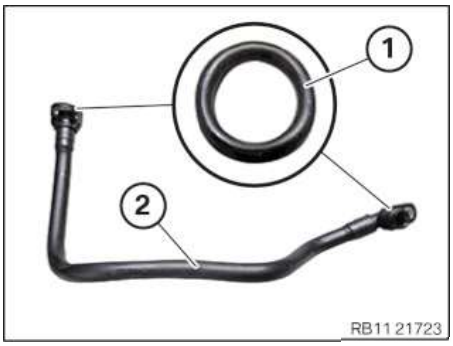


- Check sealing ring (1) for damage and renew tank ventilation line (2) if necessary.

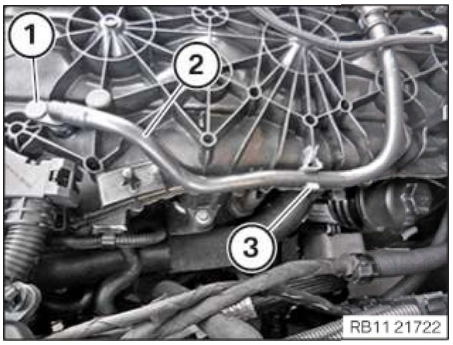
cardiagn.com



- Insert and install the tank ventilation line (3).
- Ensure that the locks (2) engage audibly.
- Secure the tank ventilation line (3) to the clamp (4).
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.



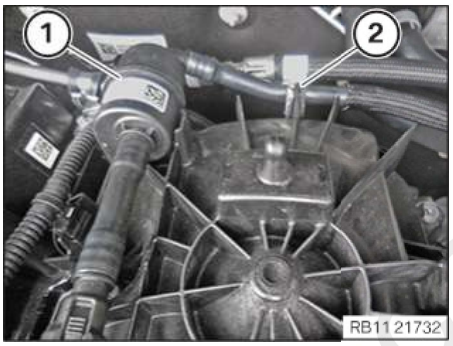
- Check sealing ring (1) for damage and renew tank ventilation line (2) if necessary.



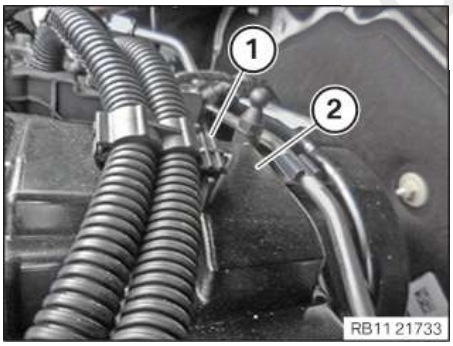
- Insert and install the tank ventilation line (2).
- Secure the tank ventilation line (2) to the clamp (3).
- Tighten down screw (1).

Tank ventilation line to intake plenum

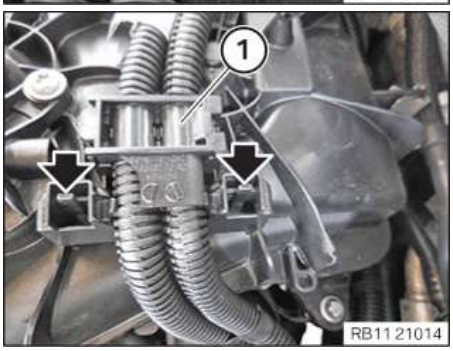
Oval-head screw		Tightening torque	3 Nm



- Insert and install the tank ventilation line (1).
- Secure the tank ventilation line (1) to the clamp (2).



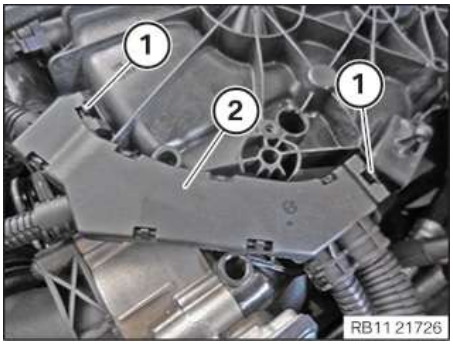
- Secure the wiring harness section(1) for the injectors and ignition coils on the cylinder head cover (2).



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

  The locks (arrows) must engage audibly.

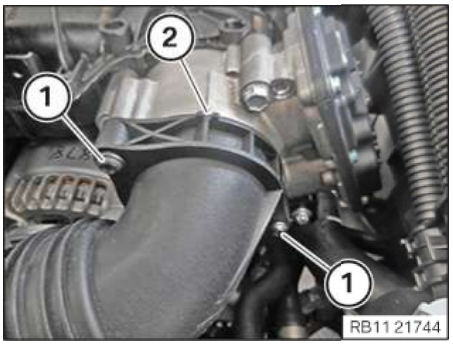
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- Feed in and install wiring harness section (2) for sensor system **2**.
- Ensure that the locks (1) engage audibly.



- Check the sealing ring (1) for damage and renew the sealing ring (1) as needed.

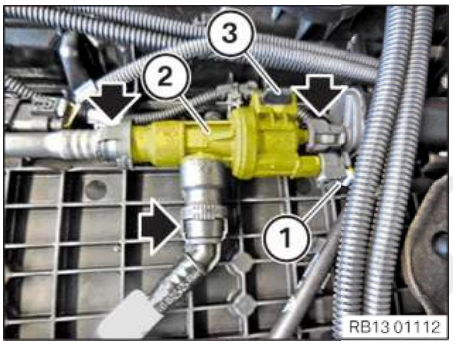


- Insert and install charge air line (2).
- Tighten the screws (1).

Charge air line to throttle valve

M6x30		Tightening torque	8 Nm

73 – Installing the tank vent valve

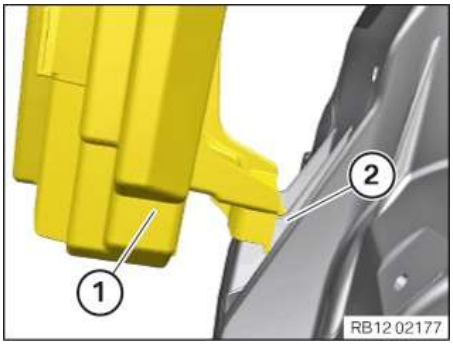


- Secure the tank vent valve (2) to the holder (3).
- Connect and lock the tank ventilation lines (arrows).

  The tank ventilation lines (arrows) must audibly engage.
- Connect connectors (1) and lock.

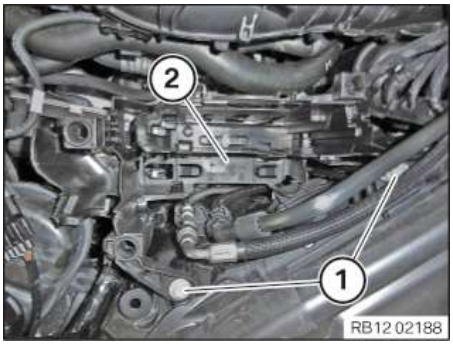
  The connector (1) must engage audibly.

74 – Installing the control unit holder



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

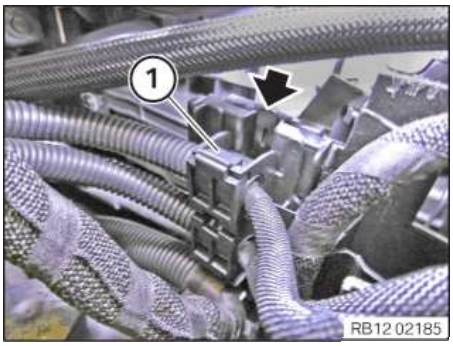
carmanuals.com



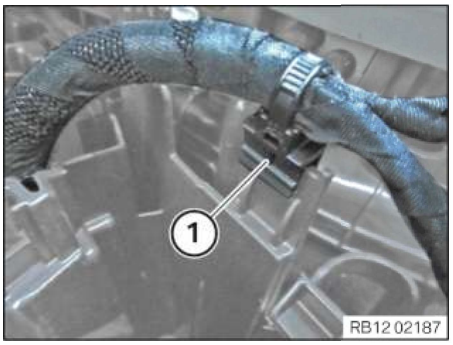
- Guide in and install control unit holder (2).
- Tighten the screws (1).

Control unit holder on spring strut dome

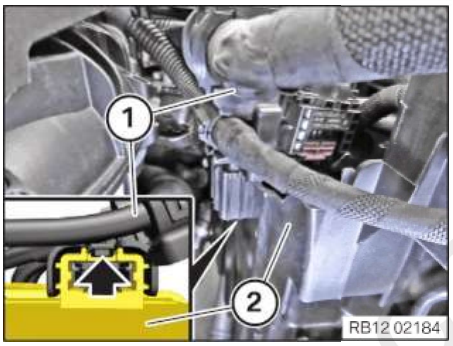
Hexagon screw		Tightening torque	8 Nm



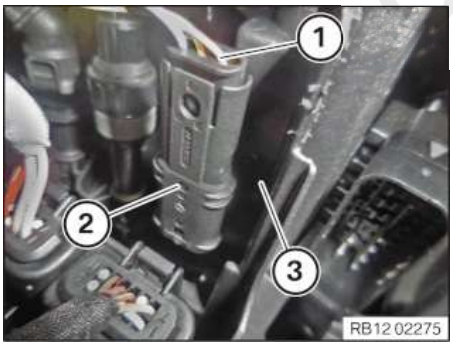
- Feed in and install the cable clip (1).
  Lock (arrow) must audibly engage.



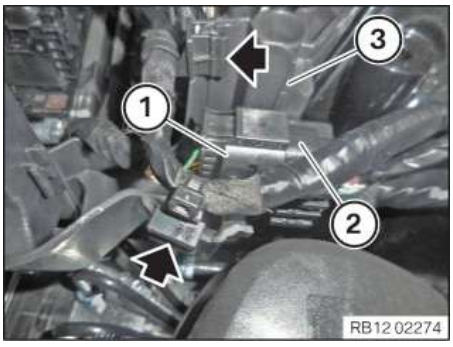
- Secure clamps (1).



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



- Connect connector (2) to the control unit holder (3) and lock it.
  The connector (2) must engage audibly.
- Connect connectors (1) and lock.
  The connector (1) must engage audibly.



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

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75 – Installing the integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

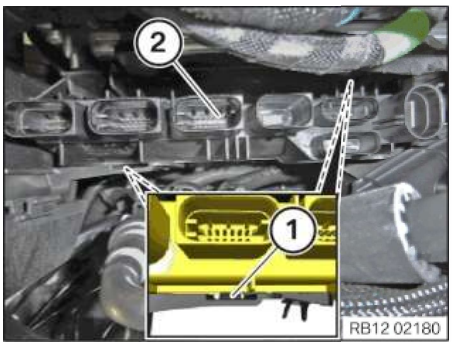
- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

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

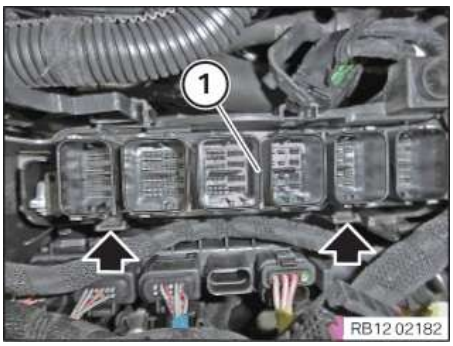


- Insert and install the integrated supply module (PDM) (2).
  The latch mechanisms (1) must engage audibly.
- Unlock the latch mechanisms (1).



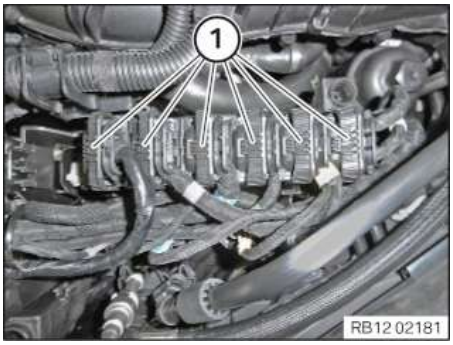
- Connect connectors (1) and lock.
  The connectors (1) must engage audibly.

76 – Installing the DME control unit

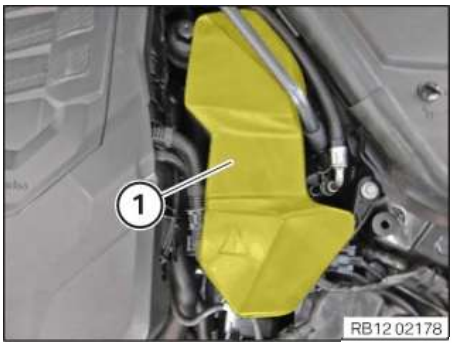


- Feed in and install DME control unit (1).
  The locks (arrows) must engage audibly.

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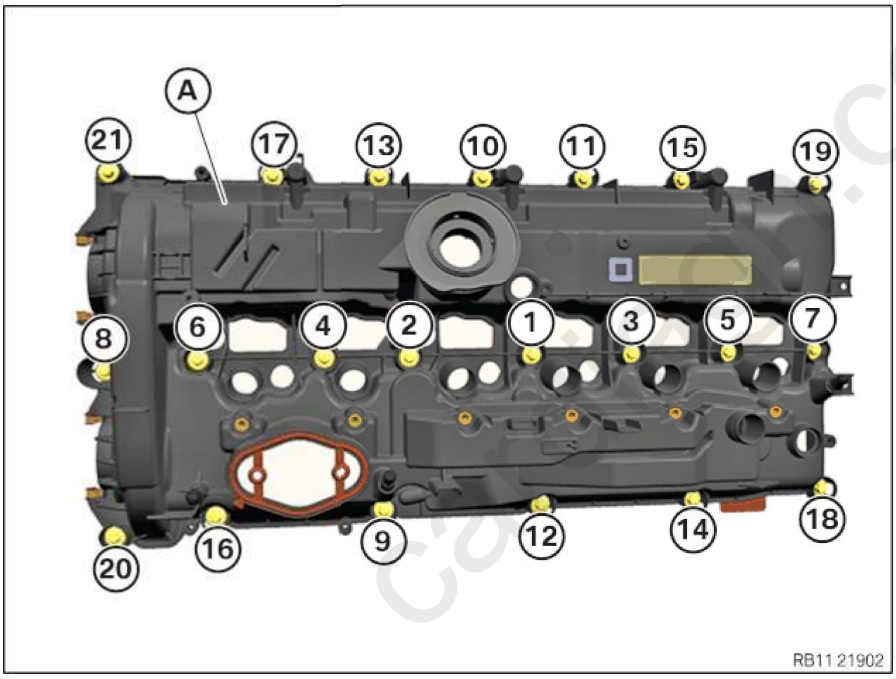
- Connect connectors (1) and lock.
  All connectors (1) must engage audibly.



- Insert and install cover (1) into guides.

77 – Installing cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 21 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

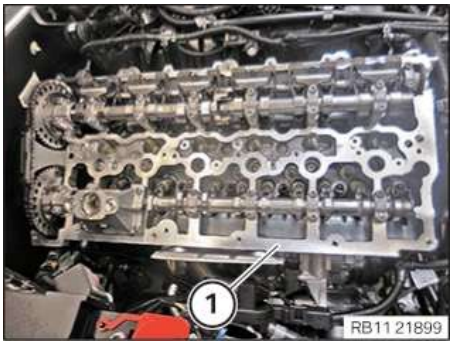
Improper routing of cables and wiring harnesses.

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

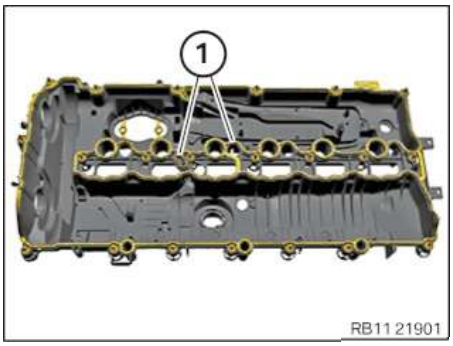
- Route all cables without abrasions, do not trap and crush.

TECHNICAL INFORMATION

Latch mechanisms, guides and mounting elements must not be damaged or missing.

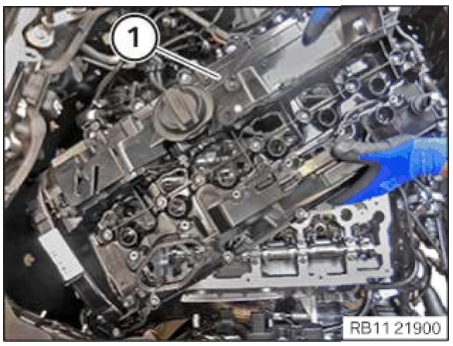


- Contact surface (1) must be free from oil and grease.



- Replace the seals (1).

  Parts: Seals

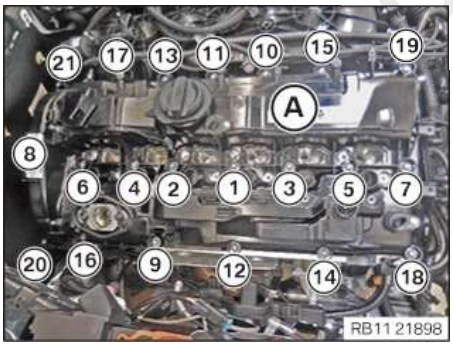


- Insert and install cylinder head cover (1).



- Ensure that the cylinder head cover (1) is installed in the **marked** area correctly on the high pressure pump bracket(2).

  The cylinder head cover (1) must not touch the high pressure pump bracket (2) in the **marked** area.



- Position the cylinder head cover (A).
- Make sure that the cylinder head cover (A) does not touch the high pressure pump bracket!
- Tighten all bolts in sequence (1) to (21).

Cylinder head cover to cylinder head

M6X30		Jointing torque	8 Nm

- Tighten all screws in a sequence from (1) to (21).

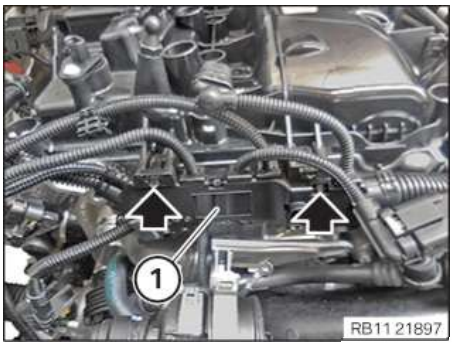
Cylinder head cover to cylinder head

M6X30		Tightening torque	11 Nm

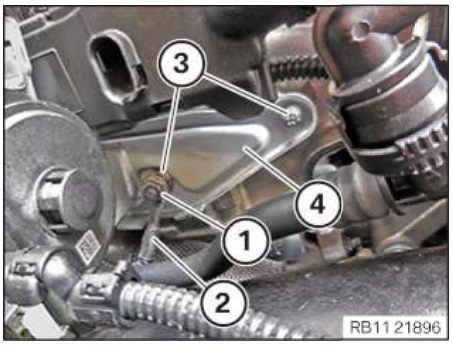
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- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.



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



- Insert and position the holders (4).
- Tighten the screws (3).

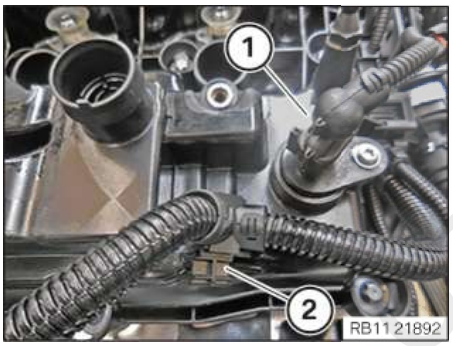
Auxiliary coolant pump holder to cylinder head

M6		Tightening torque	7 Nm

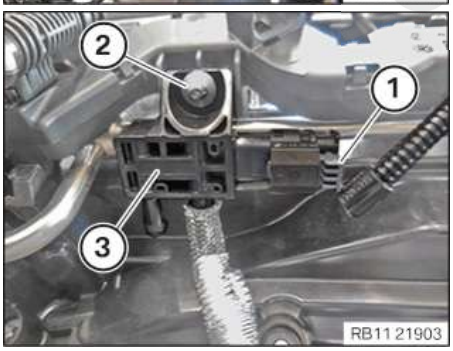
- Thread in ground cable (2) and install.
- Tighten nut (1).

Standard screw connection M6

M6			8 Nm



- Connect and lock the connector (1) on the exhaust camshaft sensor .
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).



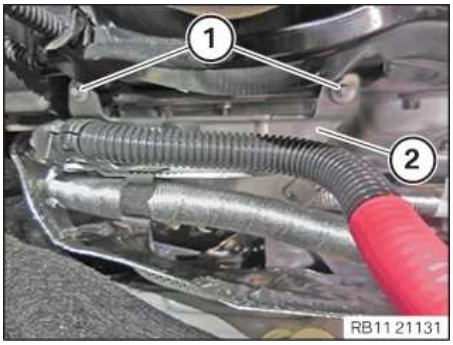
- **If installed:**
- Feed in and install the differential pressure sensor (3).
- Tighten down screw (2).

Differential pressure sensor to holder

TS6X18		Tightening torque	3,5 Nm

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

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CAUTION

Improper routing of the positive battery cable.

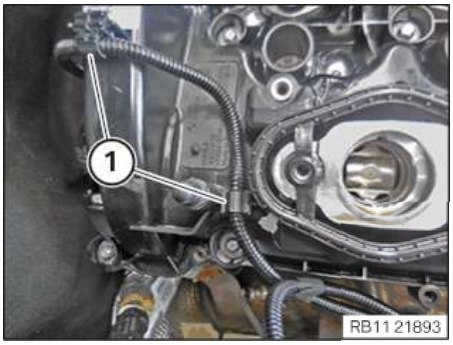
Risk of short circuits!

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

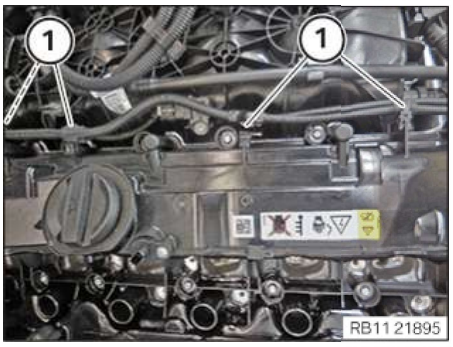
- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

Holder, positive battery cable to cylinder head cover

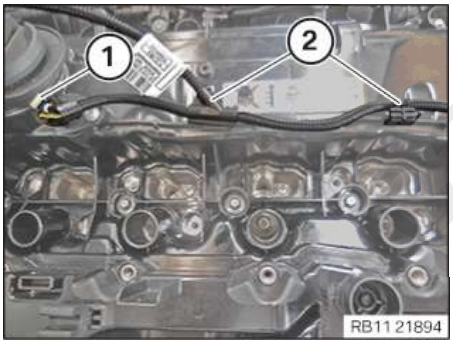
6X18		Tightening torque	6 Nm



- Secure clamps (1).

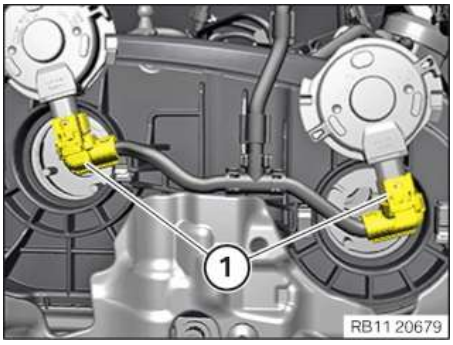


- Secure clamps (1).



- Connect connector (1) to the intake camshaft sensor and lock it.
- Make sure the connector (1) engages audibly.
- Secure clamps (2).

78 – Installing both actuators

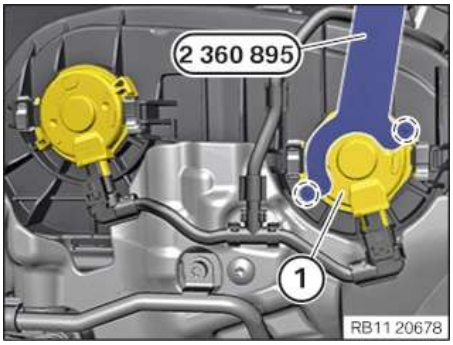


NOTICE

The figure shows the rear side of the engine.

- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.

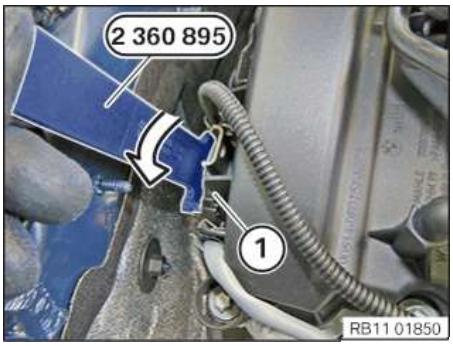
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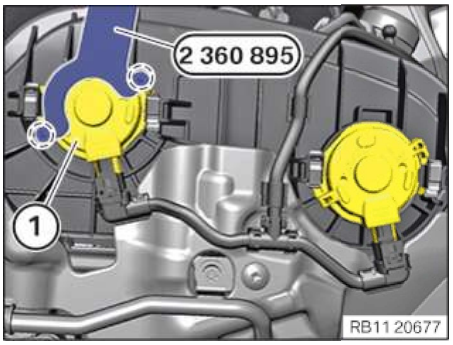
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



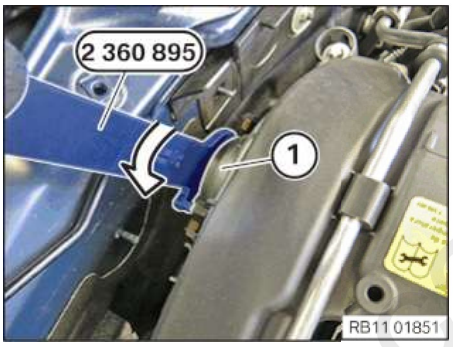
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.



NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

79 – Install high pressure pump

RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

Only G05 and G07

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

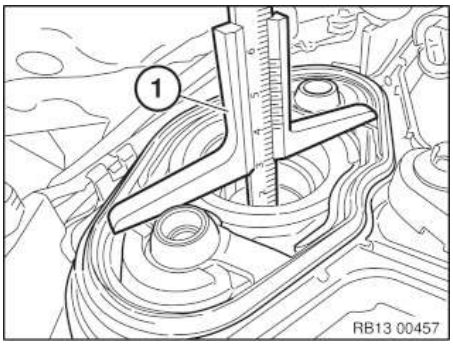
For additional information see: 17 11 035 Removing and installing/replacing the fan cowl including electric fan

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TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

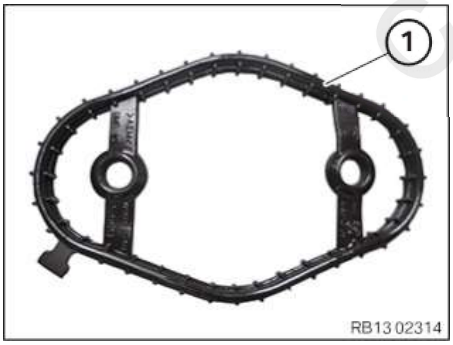
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.

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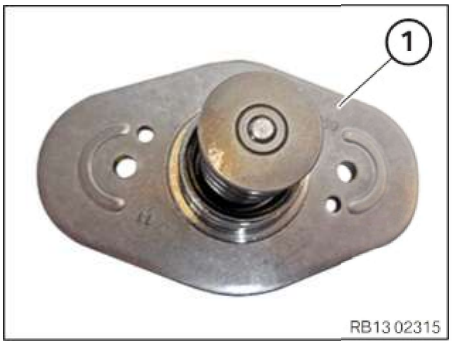
TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

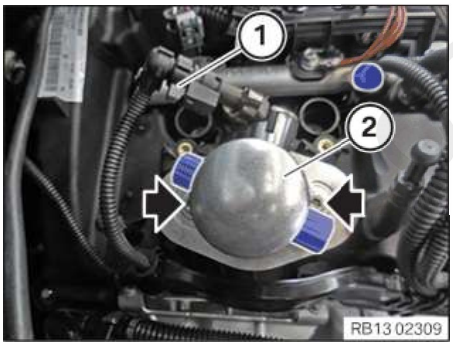
The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

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

80 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

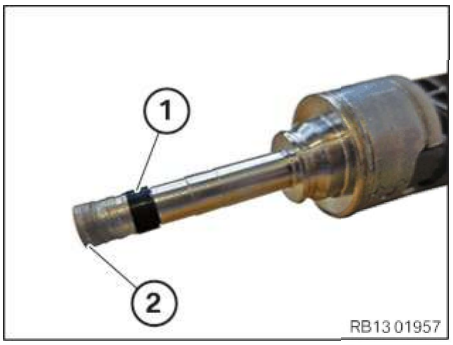
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

TECHNICAL INFORMATION

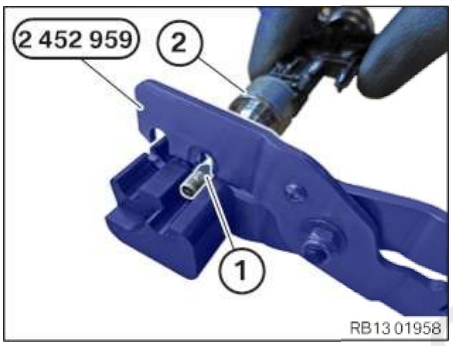
Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.



- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings
- Avoid mechanical contact with injector tip (2).



- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.

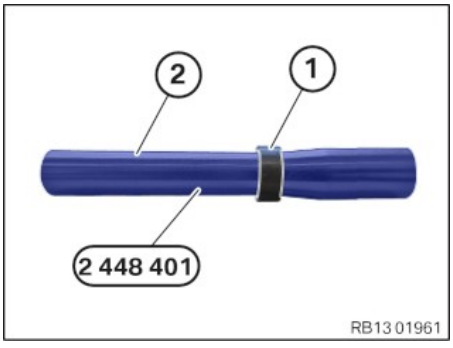


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

  (1) Installation cone

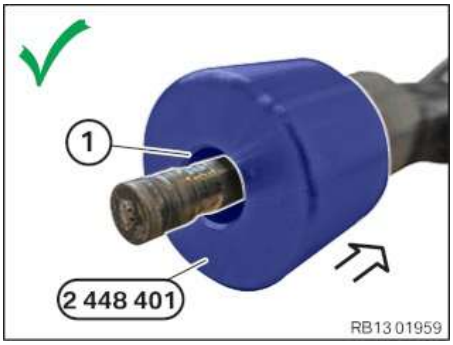
  (2) Sliding sleeve

  (3) Assembly sleeve



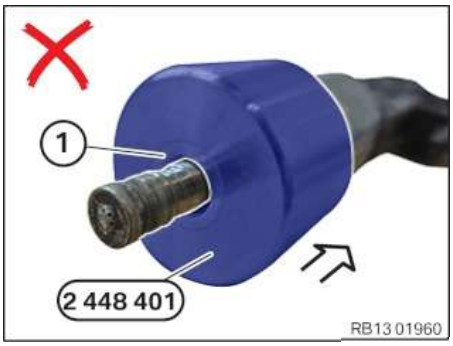
- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.

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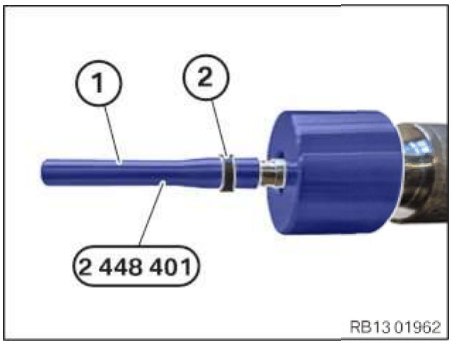
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The larger diameter of the assembly sleeve (1) must point to the injector tip.

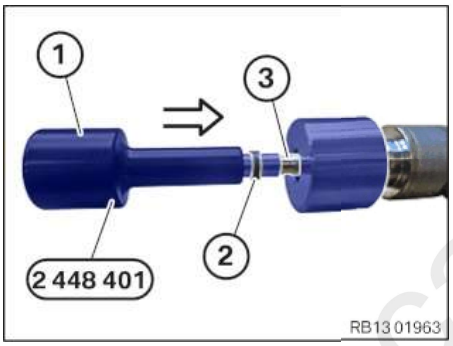


- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

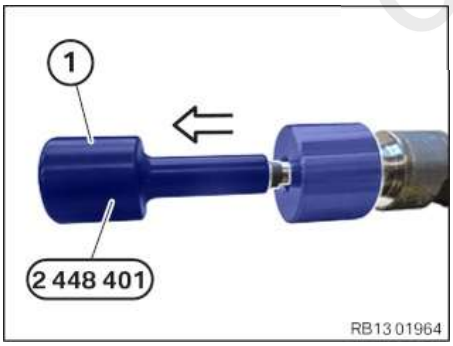
  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.



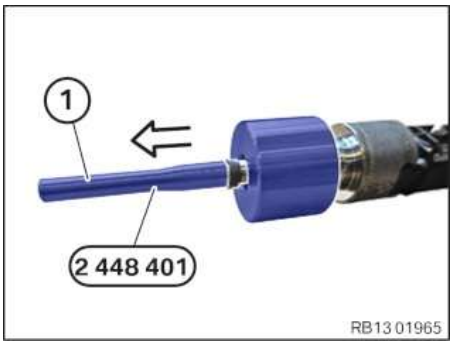
- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .



- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.

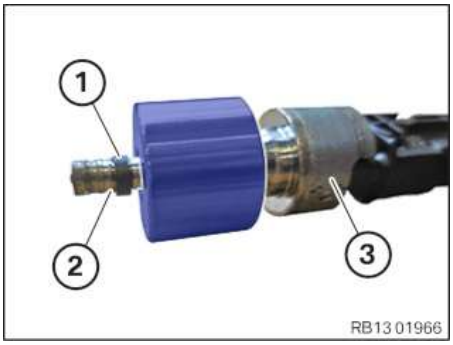


- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

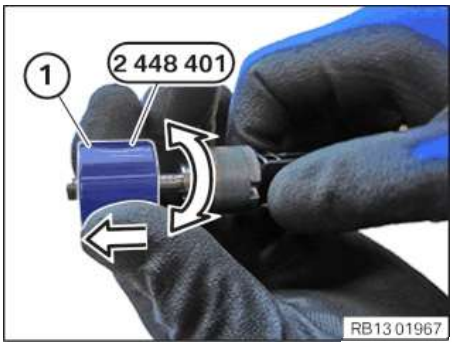


- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

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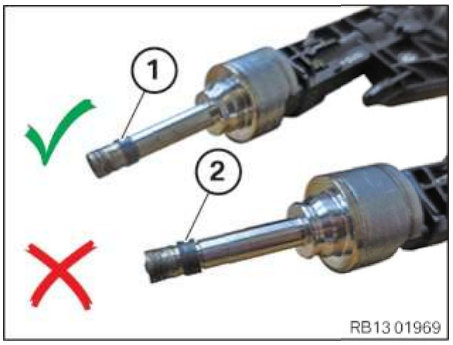


- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.



- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).

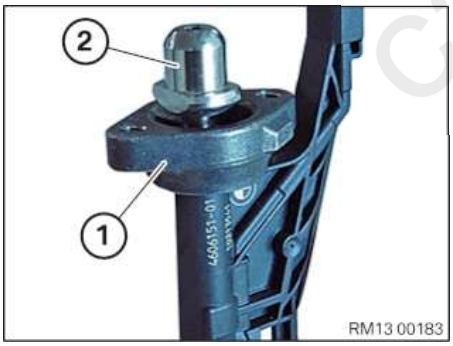


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

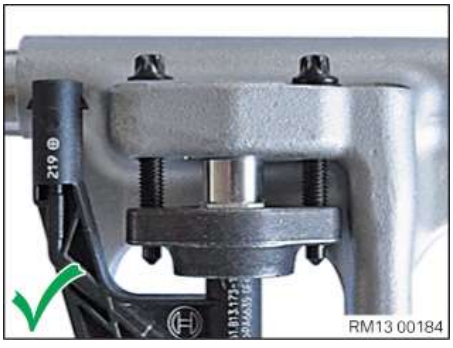
81 – Installing the high-pressure rail with injectors of the cylinders 4 to 6

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



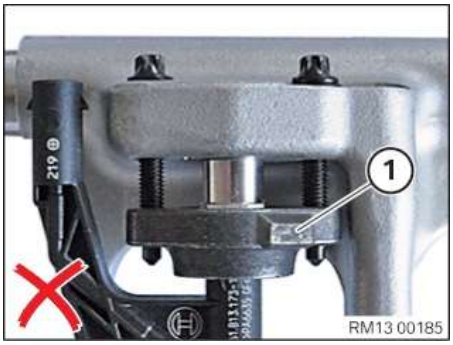
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder**(1) **has a cast lug**: Make sure that the holder is installed in the correct position.



- If applicable, note the position of the cast lug:

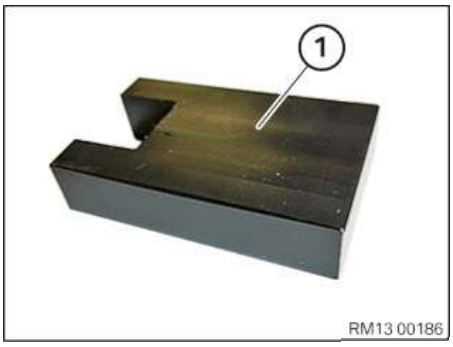
  The holder is mounted **correctly** when the cast lug is located at the rear.

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- If applicable, note the position of the cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.



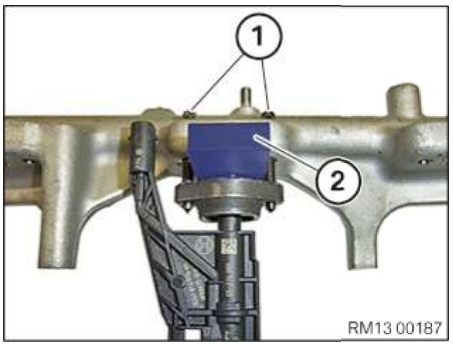
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).



- Replace (M5x30) screws.

  Parts: Screws (M5x30)
- Mount the injectors with the holders and the bolts (M5x30) (1) on the rail.
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.
- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) evenly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.



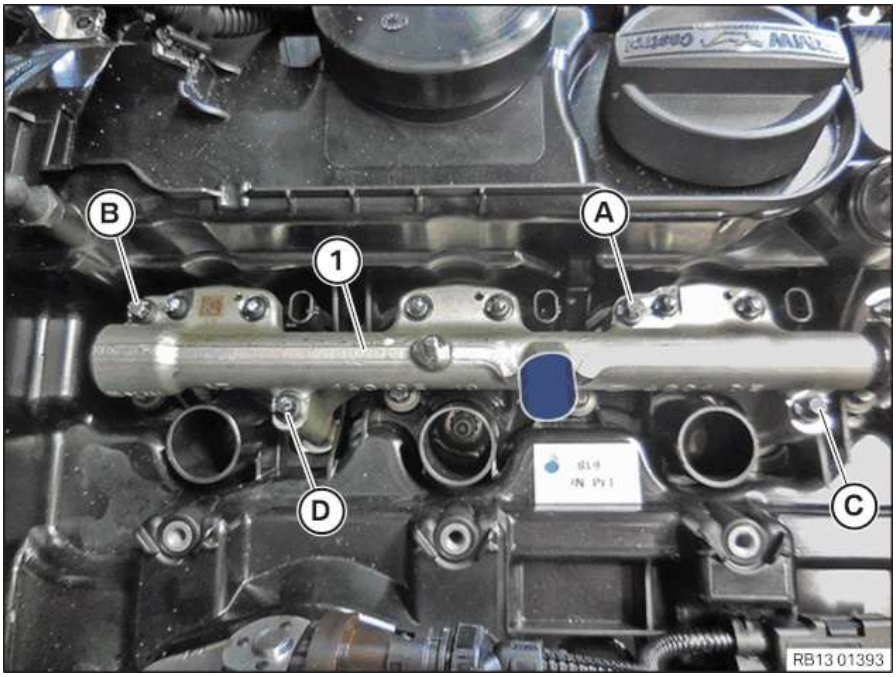
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.



- Check injectors for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors must move freely.

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- Renew screws (A) to (D).

  Parts: Bolts
- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- Press the rail (1) down until a resistance can be felt; join and hand-tighten the bolts (M6x30) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.

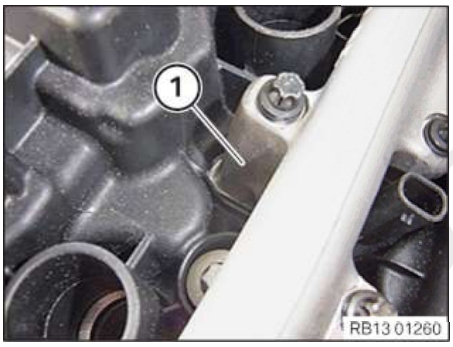
  The figure shows the rail resting flat against the cylinder head.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

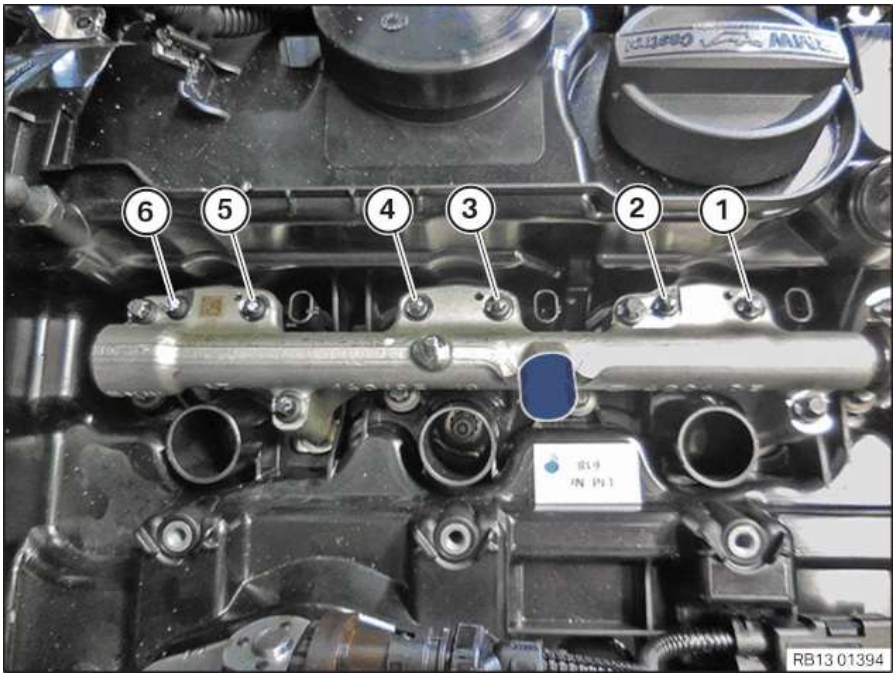
Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.



- Make sure that the rail (1) rests flat against the cylinder head.

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- Attach a socket to an extension.

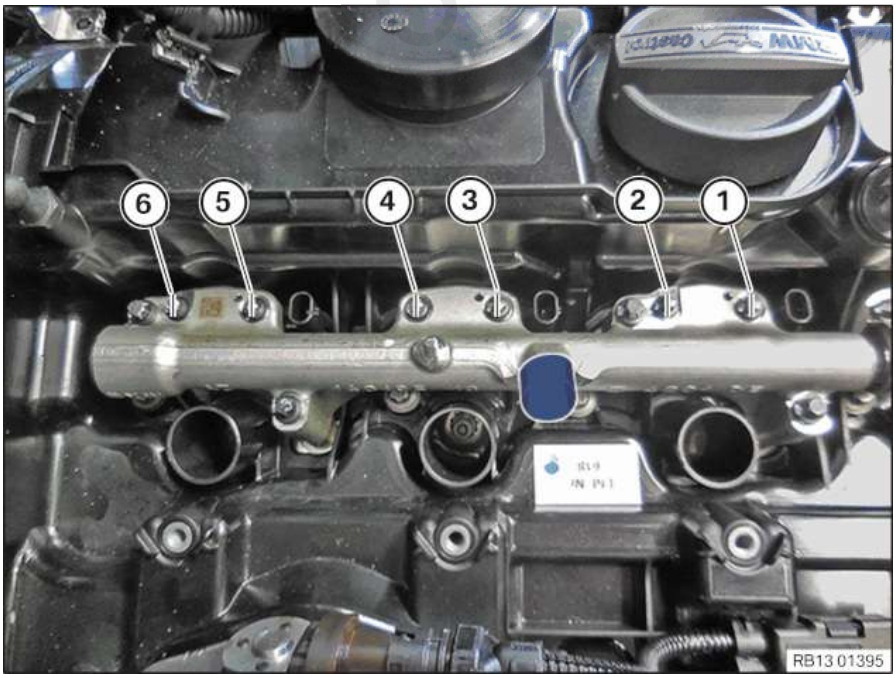
  Do not use a reversible ratchet or torque wrench.
- Tighten the bolts (M5x30) in pairs ((1) with (2), (3) with (4), (5) with (6)) in alternating order **90° hand-tight**.
- Set the torque wrench to 5 Nm.

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- **Screw the (M5x30) bolts according to the following plan:**
  - **Fuel injector 4:**
  - Tighten screw (1) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (2) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 5:**
  - Tighten screw (3) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (4) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 6**:
  - Tighten screw (5) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (6) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts reach a torque of 5 Nm.



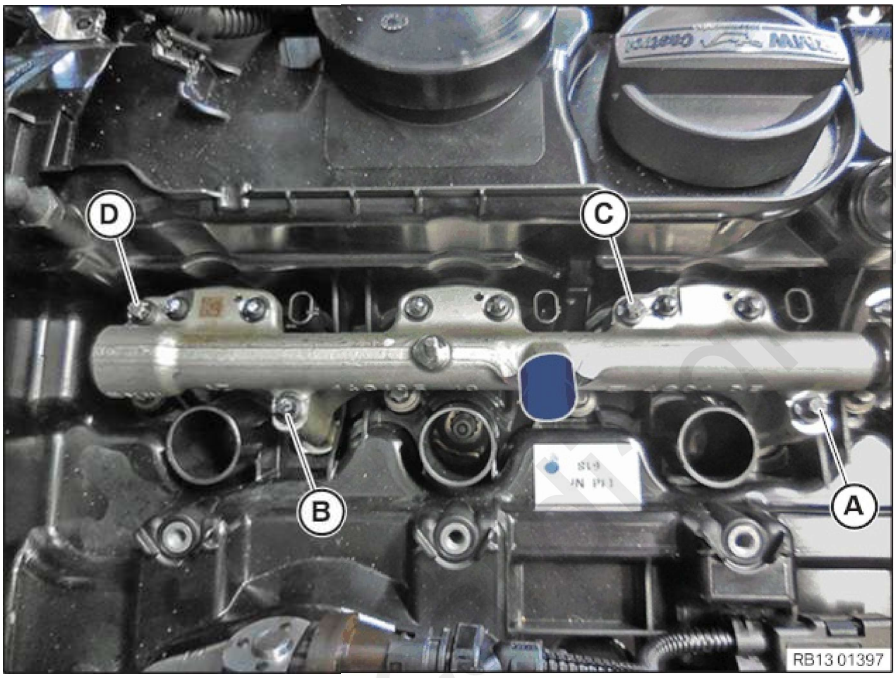
- Mark all bolts (1) to (6) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the screw (1) with an angle of rotation of 90° ±15°.
  - Tighten the screw (2) with an angle of rotation of 90° ±15°.
  - Tighten the screw (3) with an angle of rotation of 90° ±15°.
  - Tighten the screw (4) with an angle of rotation of 90° ±15°.
  - Tighten the screw (5) with an angle of rotation of 90° ±15°.
  - Tighten the screw (6) with an angle of rotation of 90° ±15°.

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- Check if all bolts (1) to (6) have been tightened with a 90° ±15° angle of rotation.

  All marks (lines) must be horizontal (see figure).



- Unscrew the bolts (M6x70) (A) to (D).

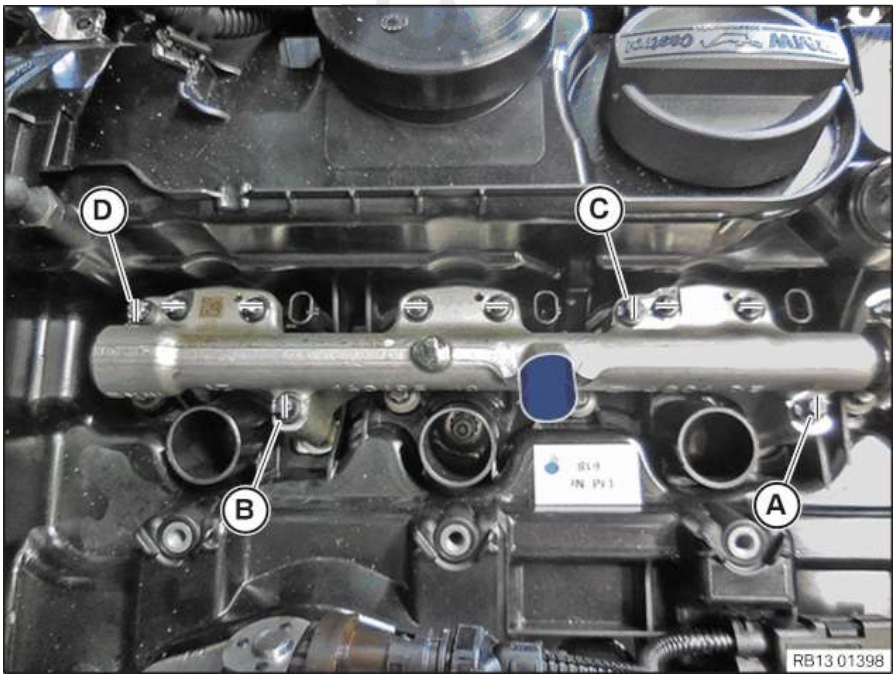
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

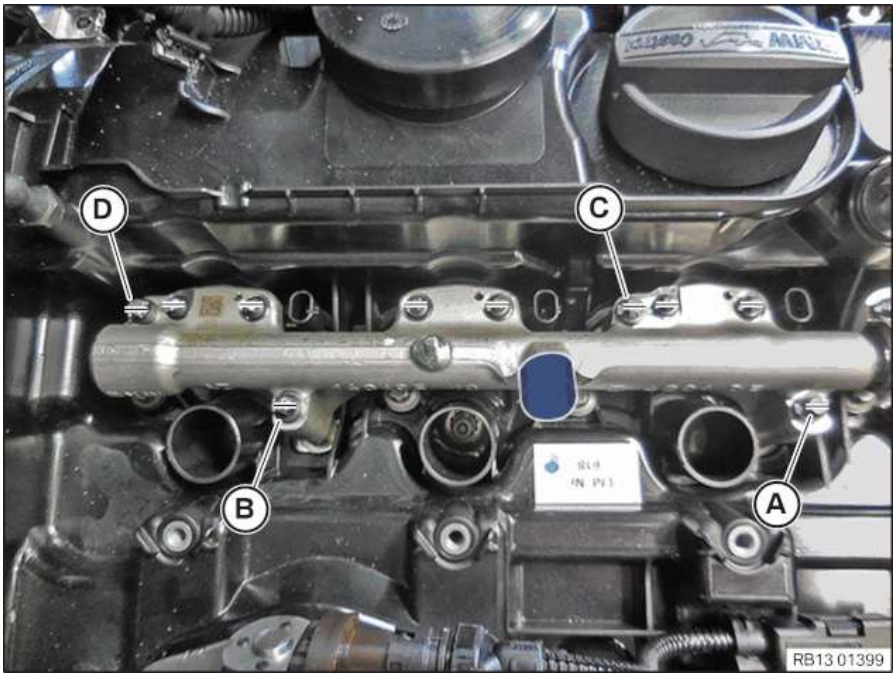
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.

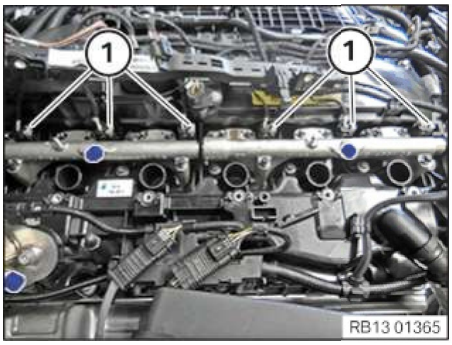


- Mark all bolts (A) to (D) with a vertical line (see figure).
- Tighten bolts (M6x70) (A) to (D) to a 90° angle of rotation.



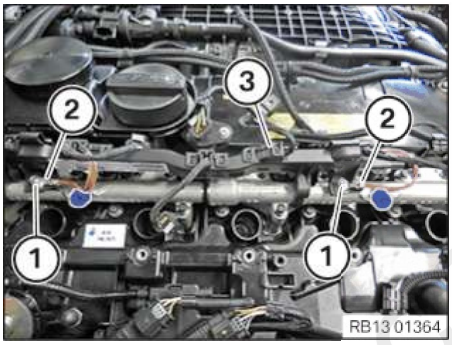
- Check if all bolts (A) to (D) have been tightened with a 90° angle of rotation.

  All marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nuts (1).

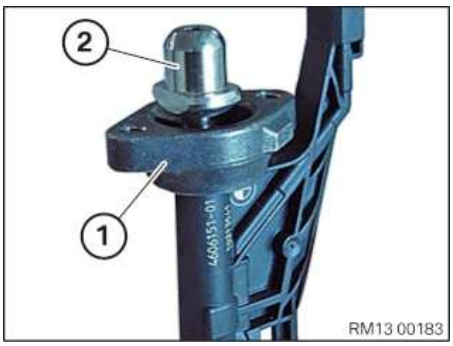
Ground cable to rail

M6			5 Nm

82 – Installing rail with injectors of cylinders 1 to 3

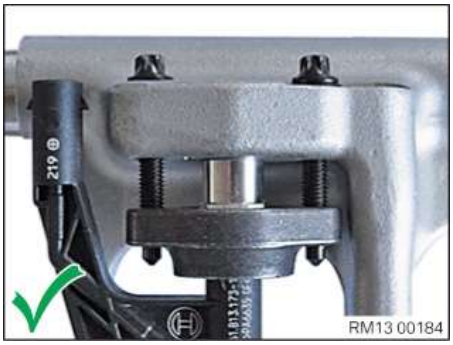
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



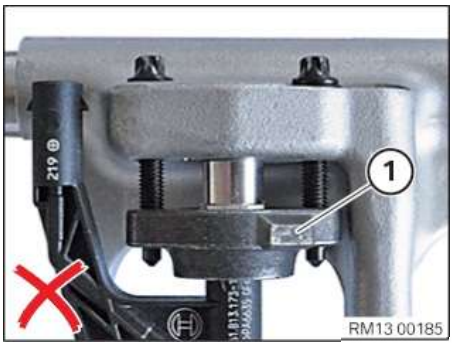
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If there is a cast lug on the holder** (1) **:** Make sure that the holder is installed in the correct position.

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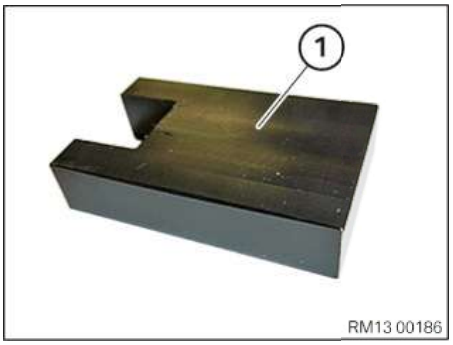
- Observe position of cast lug:

  The holder is mounted **correctly** when the cast lug is located at the rear.



- Observe position of cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.



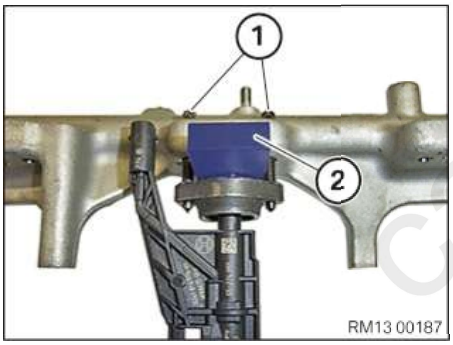
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use special tool 2 358 022(1) .



- Replace (M5x30) screws.

  Parts: Screws (M5x30)
- Mount the injectors with the holders and the bolts (M5x30) (1) on the rail.
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.
- Slide special tool 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure the special tool 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) *uniformly until the special* tool 2 358 022 (2) rests flat against the rail and the holder.



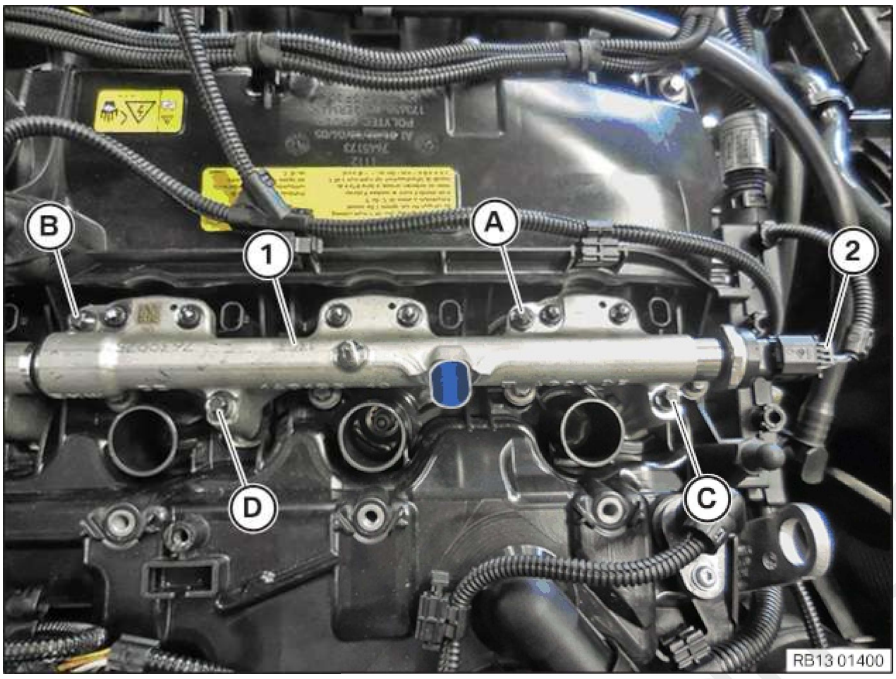
- Remove special tool 2 358 022(1) .
- Repeat this operation for all injectors.

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- Check injectors for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors must move freely.



- Renew screws (A) to (D).

  Parts: Bolts
- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- Press rail (1) down until a resistance can be felt; join and hand-tighten screws (M6x30) (A) and (B).
- Tighten screws (A) and (B) alternately by **180°** each with the torque wrench until the rail is positioned on the cylinder head.

  The figure shows the rail resting flat against the cylinder head.
- Insert screws (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

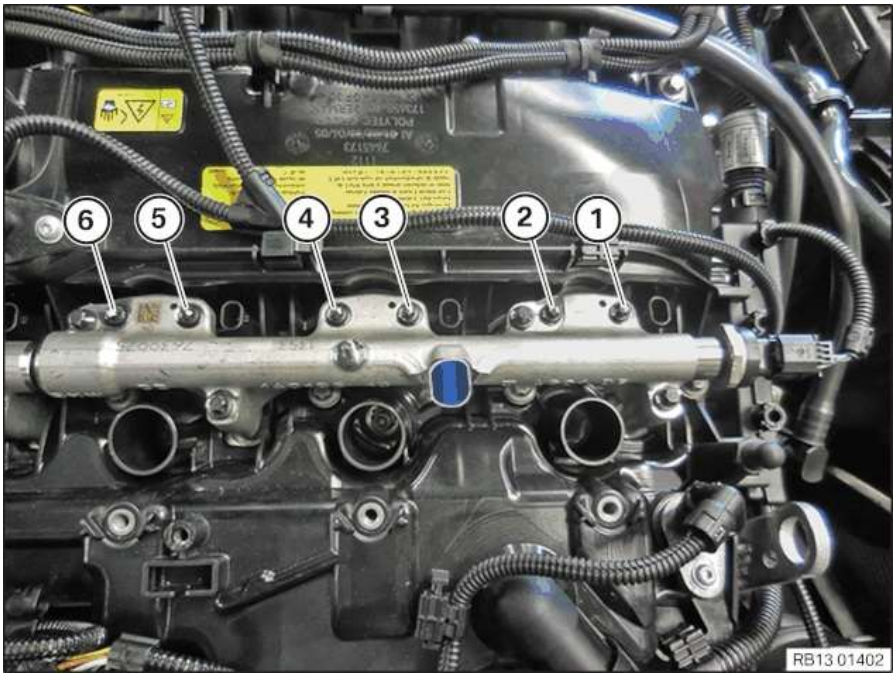
- Tighten screw (A) to 5 Nm.
- Tighten screw (D) to 5 Nm.
- Tighten screw (B) to 5 Nm.
- Tighten screw (C) to 5 Nm.
- Connect and lock the connector (2).

  The connector (2) must engage audibly.



- Make sure that the rail (1) rests flat against the cylinder head.

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- Attach a socket to an extension.

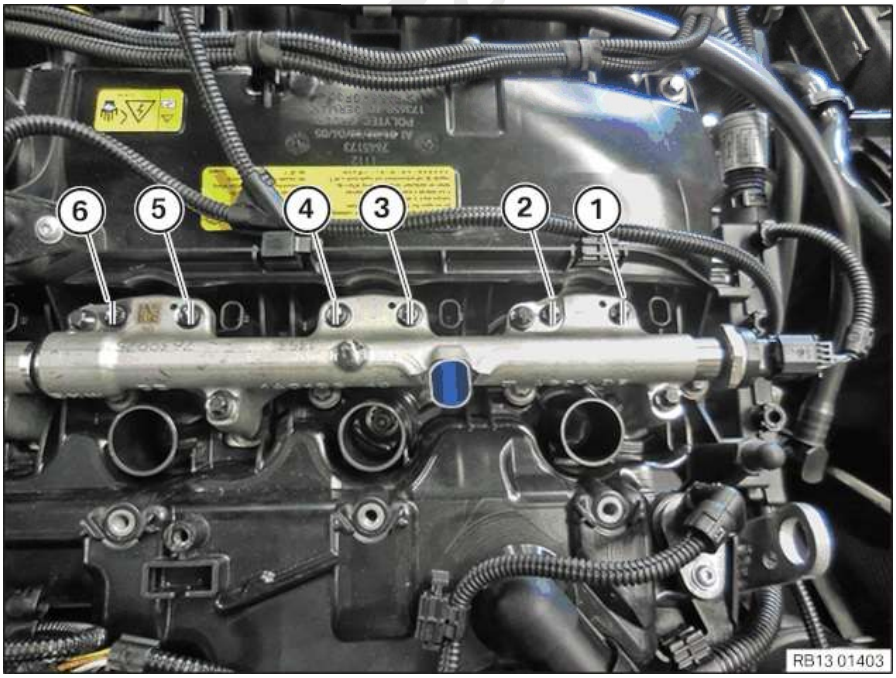
  Do not use a reversible ratchet or torque wrench.
- Hand-tighten screws (M5x30) in pairs ((1) with (2), (3) with (4), (5) with (6)) alternately by **90°**.
- Set torque wrench to 5 Nm.

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

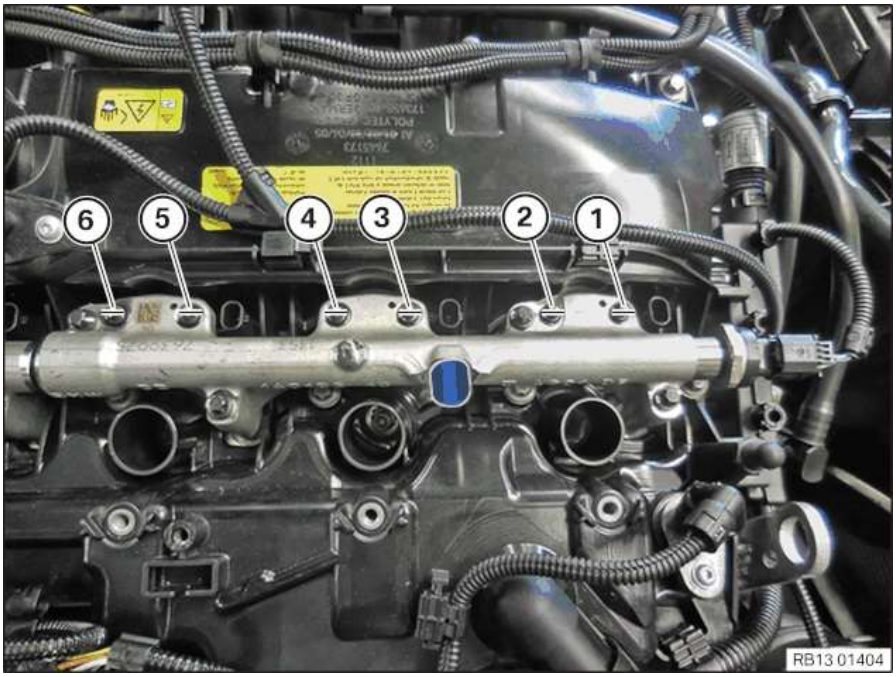
Non-observance of these requirements may result in leaks and damage.

- **Screw the (M5x30) bolts according to the following plan:**
  - **Fuel injector 1:**
  - Tighten screw (1) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (2) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten screw (3) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (4) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 3**:
  - Tighten screw (5) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (6) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts reach a torque of 5 Nm.



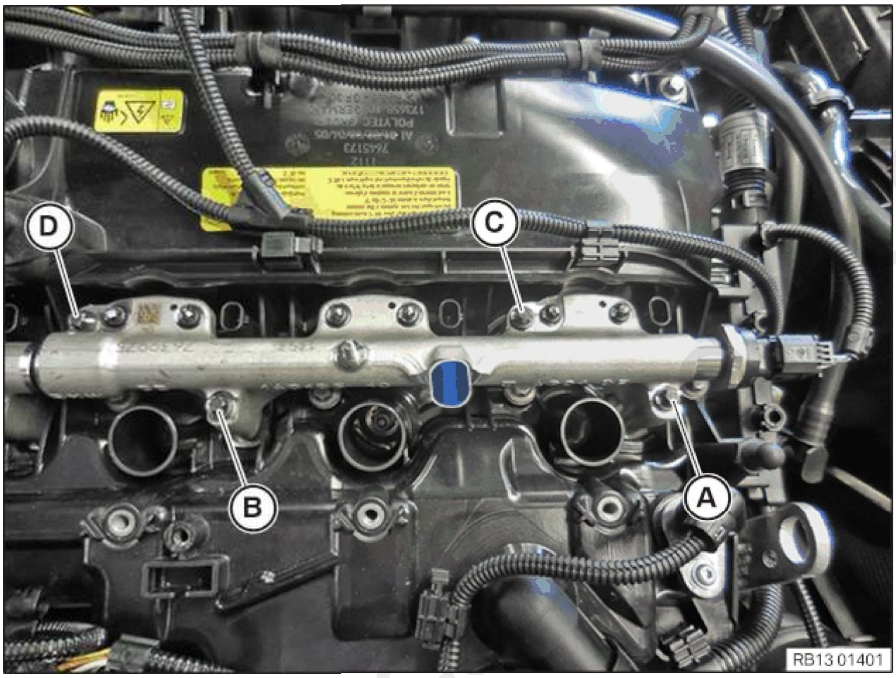
- Mark all bolts (1) to (6) with a line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the screw (1) with an angle of rotation of 90° ±15°.
  - Tighten the screw (2) with an angle of rotation of 90° ±15°.
  - Tighten the screw (3) with an angle of rotation of 90° ±15°.
  - Tighten the screw (4) with an angle of rotation of 90° ±15°.
  - Tighten the screw (5) with an angle of rotation of 90° ±15°.
  - Tighten the screw (6) with an angle of rotation of 90° ±15°.

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- Check if all bolts (1) to (6) have been tightened with a 90° ±15° angle of rotation.

  All markings (lines) must be horizontal (see Figure).



- Release screws (M6x70) (A) to (D) **without fail**.

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten screw (A) to 5 Nm.
- Tighten screw (D) to 5 Nm.
- Tighten screw (B) to 5 Nm.
- Tighten screw (C) to 5 Nm.

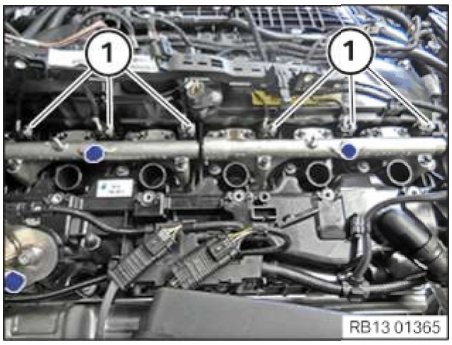


- Mark all the bolts (A) to (D) with a vertical line (see Figure).
- Tighten bolts (M6x70) (A) to (D) with an angle of rotation of 90°.



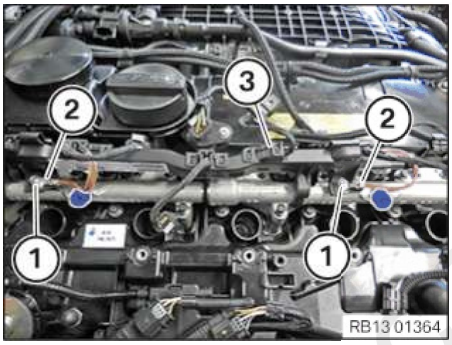
- Check whether all screws (A) to (D) have been tightened with an angle of rotation of 90°.

  All marks (lines) must be horizontal (see figure).



- Connect and lock all the connectors (1) to the injectors.

  All connectors (1) must engage audibly.

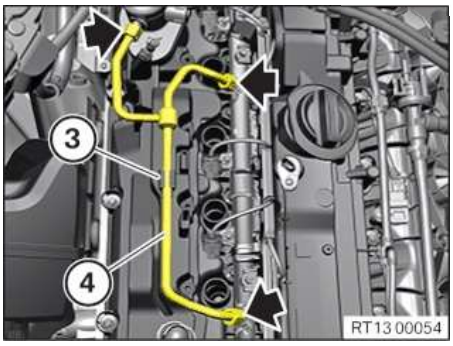


- Thread the cable channel (3) in and install.
- Thread in ground cable (2) and install.
- Tighten nuts (1).

Ground cable to rail

M6			5 Nm

83 – Installing high pressure line between rail and high pressure pump

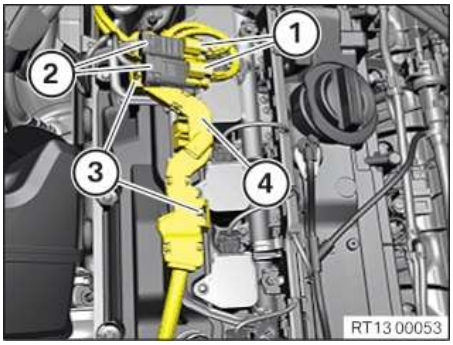


- Insert the high pressure line (4) into the holder (3) and install.
- Tighten union nuts (arrows) with the special tool .

High pressure line between rail and high pressure pump

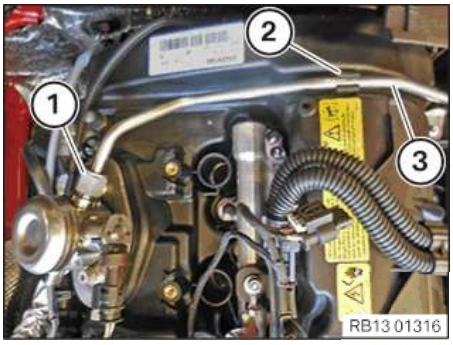
M14x1,5		Tightening torque	33 Nm

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- Insert and install the wiring harness section of the engine wiring harness (4).
  The locks (3) must engage audibly.
- Connect connectors (1) and (2) and lock.
  The connectors (1) and (2) must audibly engage.

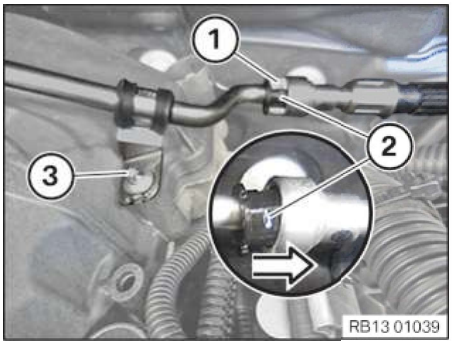
84 – Installing fuel delivery line



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

Fuel delivery line to high pressure pump

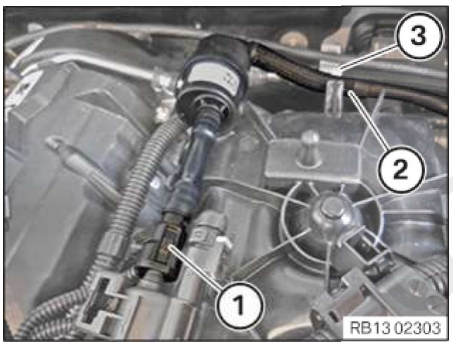
M14		Tightening torque	31 Nm



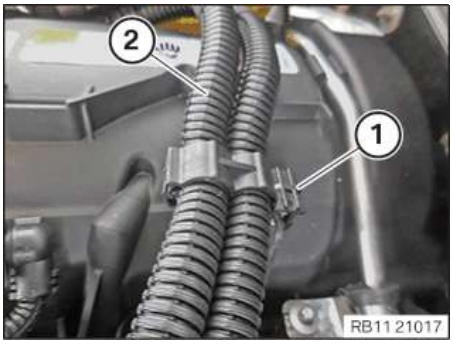
- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure clamps (1).
- Tighten down screw (3).

Fuel line to cylinder head cover

6x18		Tightening torque	6,5 Nm

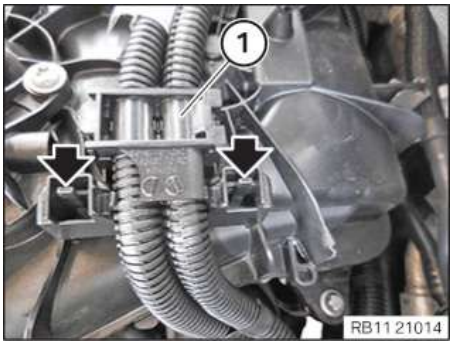


- Insert and install the tank ventilation line (2).
- Lock (1) must engage audibly.
- Secure the tank ventilation line (2) to the clamp (3).



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

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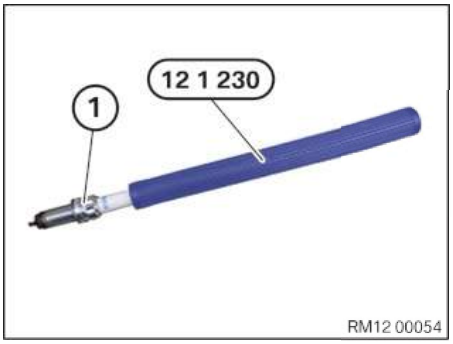


- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

85 – Installing all spark plugs

NOTICE

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



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



TECHNICAL INFORMATION

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

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



TECHNICAL INFORMATION

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

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

Spark plugs

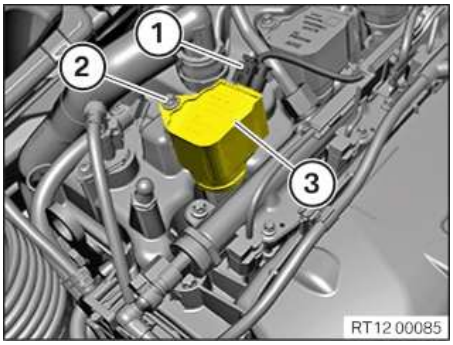
M12x1.25		Tightening torque	23 Nm

86 – Install all ignition coils

NOTICE

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

▸ **Install ignition coil.**



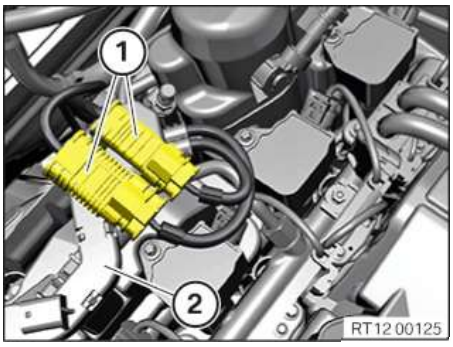
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

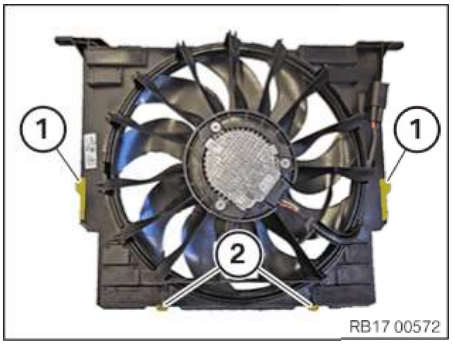
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

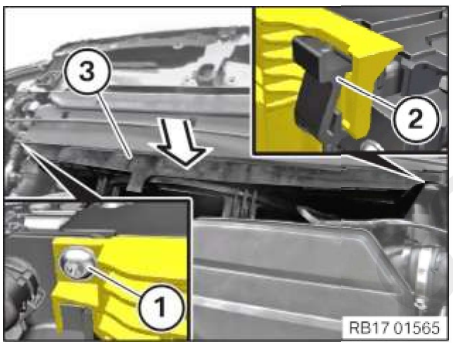


- Connect the connector (1) of the front oxygen sensor and the monitoring oxygen sensor on the cable shaft (2).

87 – Install fan cowl



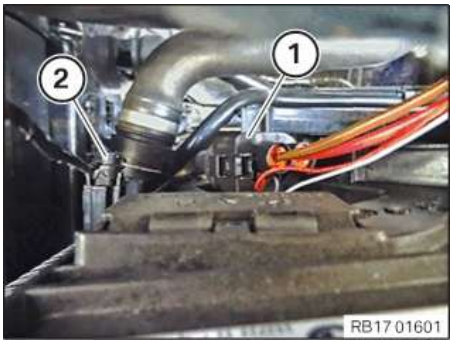
- Feed guides (1) into the radiator.
- Feed guides (2) into the charge air cooler.



- Guide in and install fan cowl (3) **carefully** in the direction of the arrow.
- Ensure that the lock (2)engages audibly.
- Tighten down screw (1).

Fan cowl with electric fan on radiator

TS6x20		Tightening torque	6,5 Nm

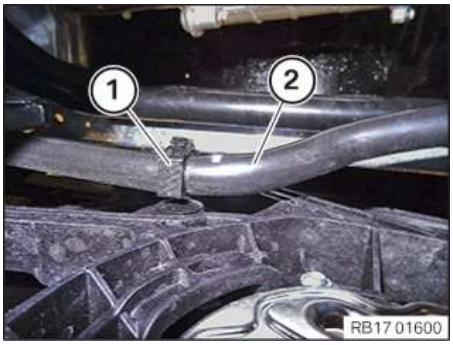


- Connect connectors (2) and lock.

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

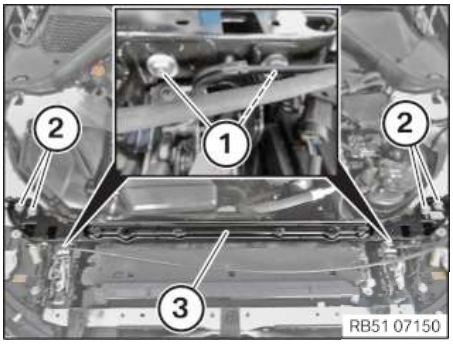
  The connector (1) must engage audibly.

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- **If installed:** Secure the transmission oil line (2).
  Insert and install the transmission oil line (2).
  Lock holder (1).

88 – Install the rear top cross connection



- Guide in and position the top rear cross connection (3).
- Tighten the screws (1).

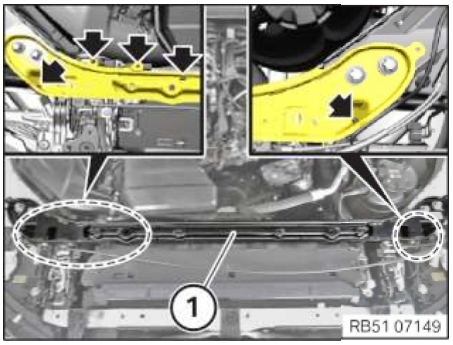
Top rear cross connection to bonnet catch support

Flat-head screw M6x20		Tightening torque	11,8 Nm

- Renew screws (2).
  Parts: Bolts
- Tighten the screws (2).

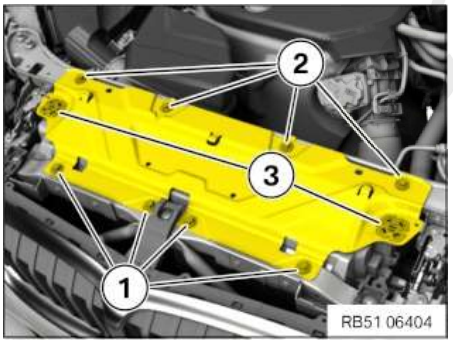
Rear top cross connection to wheel arch carrier support

M10x20 screw	Renew screw.	Jointing torque	56 Nm
		Angle of rotation	90 °



- Secure the clips (arrows) in the marked areas to the top rear cross connection (1).

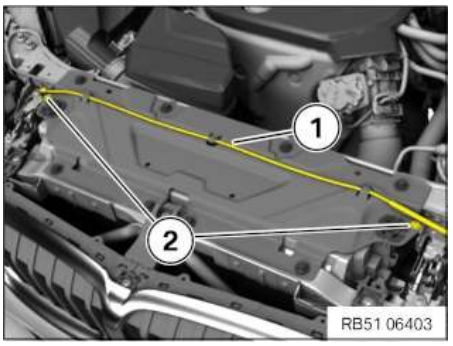
89 – Installing the top cross connection



- Set and position upper cross connection with holders (3) from above.
- Tighten down screws (1) and (2).

Cross connection, top

M8x20		Tightening torque	28 Nm



- Tighten down screws (2).

Cross connection, top

M6x20		Tightening torque	11,8 Nm

- Attach Bowden cable (1) on the upper cross connection.

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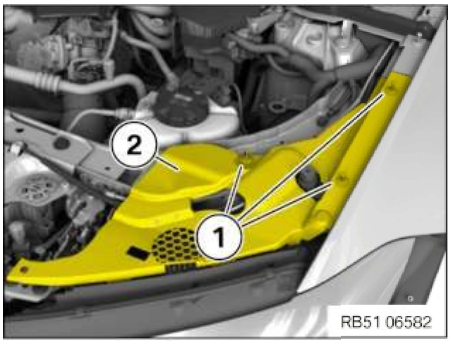
- Clip in the housing for the coupling of the Bowden cables (1).

90 – Install the cover in the engine compartment at top left and right partially

NOTICE

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

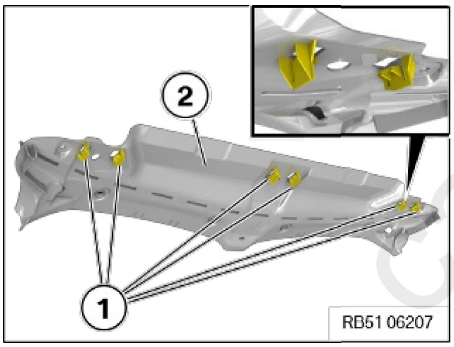
▶ Installing the cover in the engine compartment on top partially



- Install the cover in the engine compartment on top (2).
- Secure expanding rivet (1).

91 – Installing cover for engine compartment centre

Check



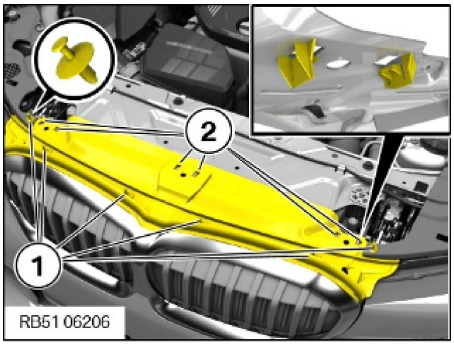
- Check latch mechanisms (1) of cover for engine compartment centre (2) for damage.

Result

» The latch mechanism (1) is damaged.

Measure

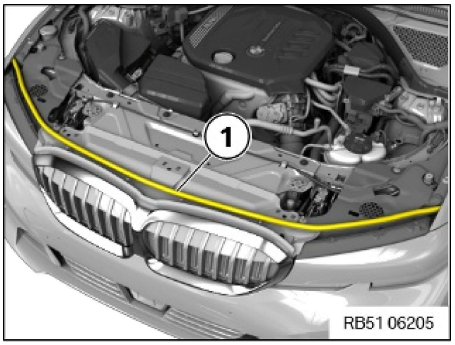
- Renew cover for engine compartment centre (2).



- Guide in the cover for the engine compartment centre from the rear and position it.
- Clip in the cover for the engine compartment centre with latch mechanisms (2).
- Mount all expanding rivets (1).

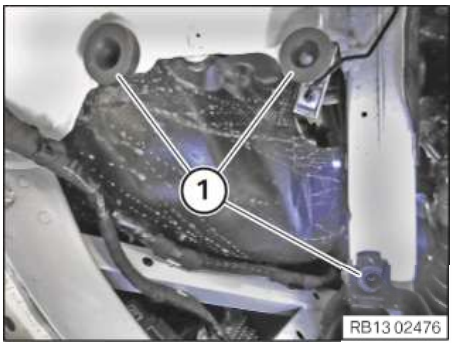
92 – Install the seal for the front bonnet

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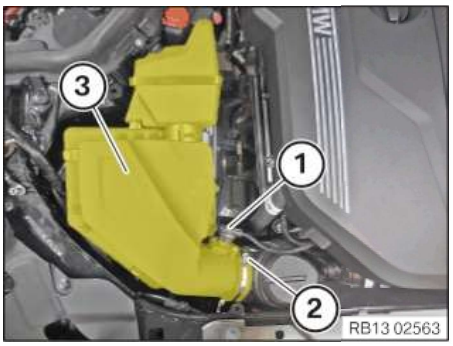


- Position the bonnet seal(1) and connect it on the mounting on the bumper and on the headlights.

93 – Installing intake silencer housing



- Check the rubber mount (1) for correct fit.



- Feed the intake filter housing (3) in and engage it in the rubber mounts.
- Tighten clamp (2).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

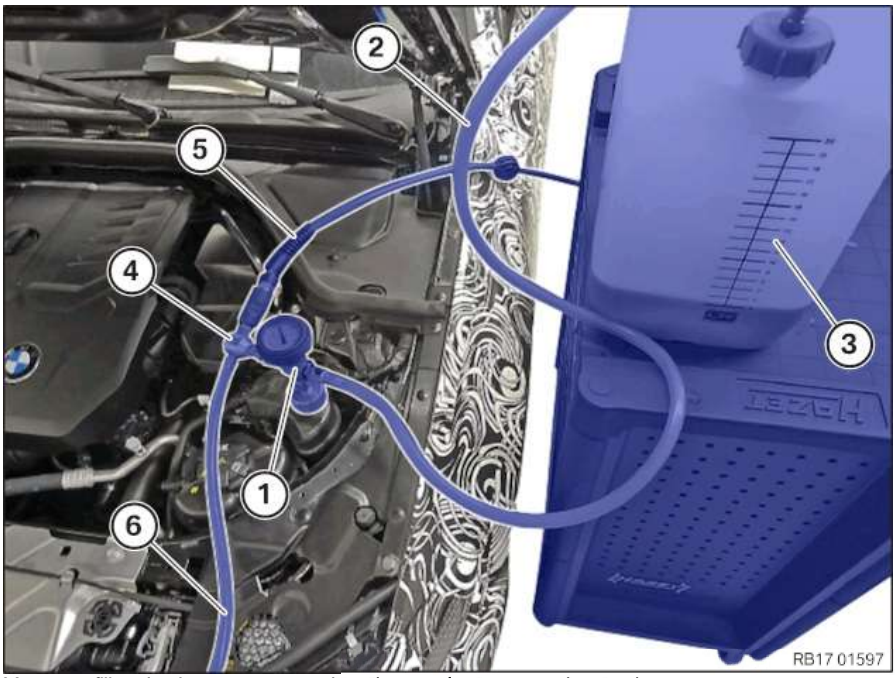
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

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

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Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

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

Prerequisite

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

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

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

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

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

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

TECHNICAL INFORMATION

Mixing different coolants is not permitted.

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TECHNICAL INFORMATION

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

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

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

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

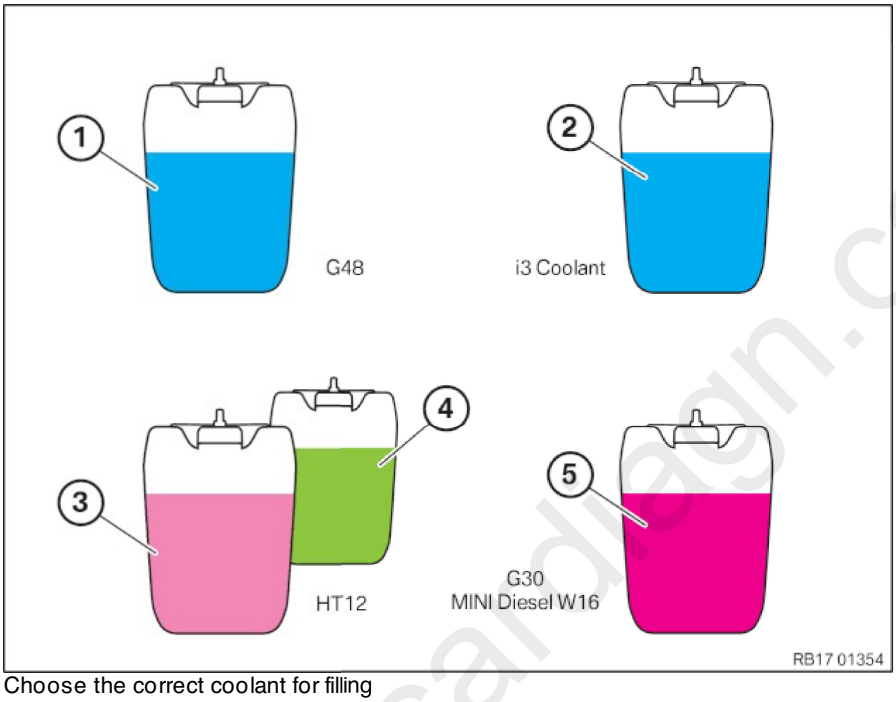
A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

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

▸ **Observe the coolant type**

Coolant in the vacuum filler device container



Choose the correct coolant for filling

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

1. G48 (Blue) G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.

2. i3 coolant (blue) is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.

3. HT12 (Pink) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

4. HT12 (Green) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

5. G30 (Pink) must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

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

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

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

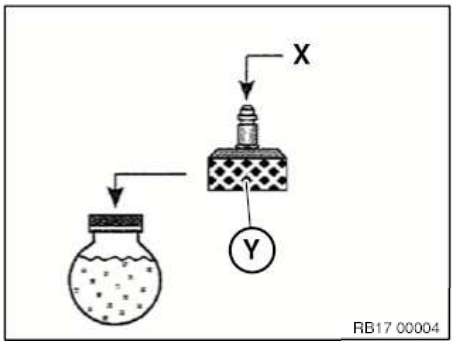
Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 109

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

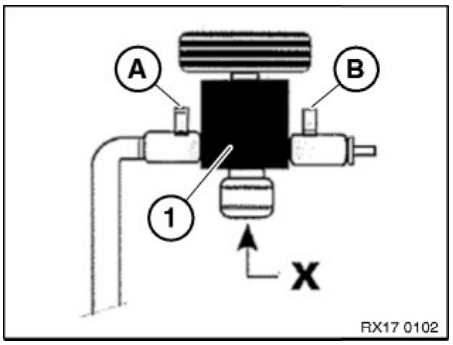
Capacity of low-temperature coolant circuit G20/G29

B58B30O1	4,5 l

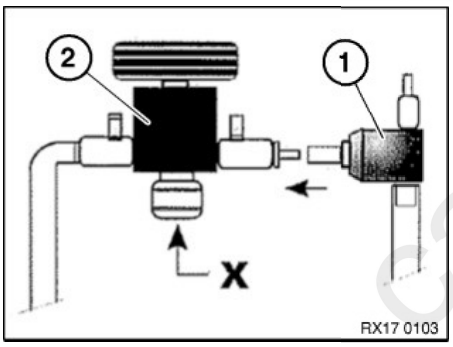
Expendable materials: Technically suitable antifreeze and corrosion inhibitor



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

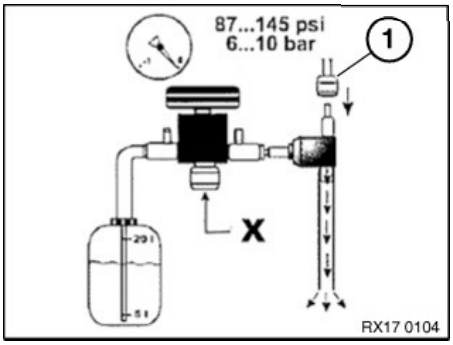


- Check that shutoff valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



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

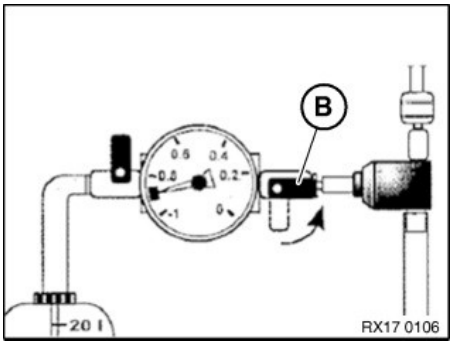
  (X)is the connection on the coolant expansion tank.



- Connect compressed air (1).

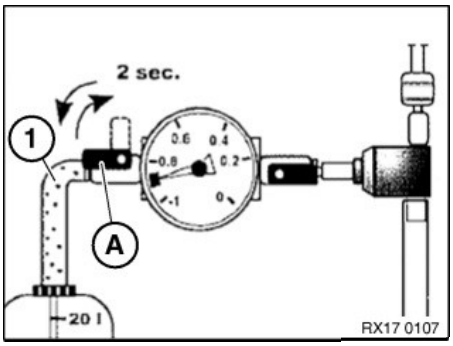
  (X)is the connection on the coolant expansion tank.

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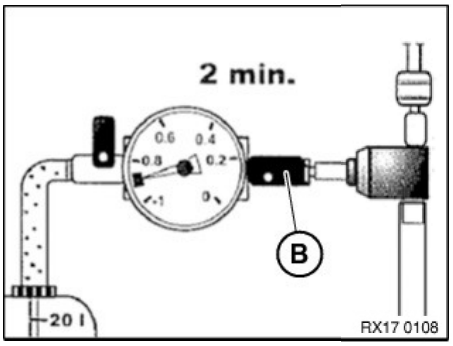
- Open shut-off valve (B).

  The venturi nozzle produces a flow noise.



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

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

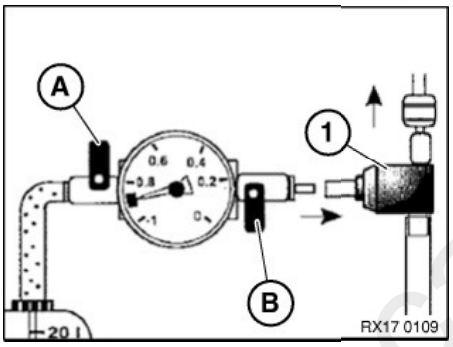


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

TECHNICAL INFORMATION

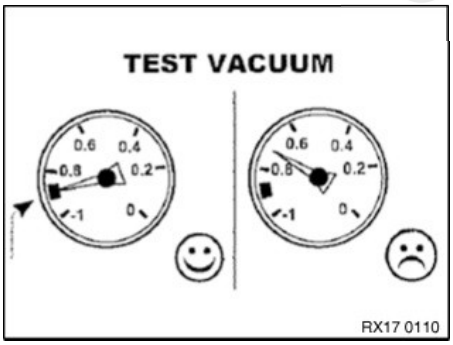
The coolant hoses contract during vacuum build-up.

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



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

Check



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

Result

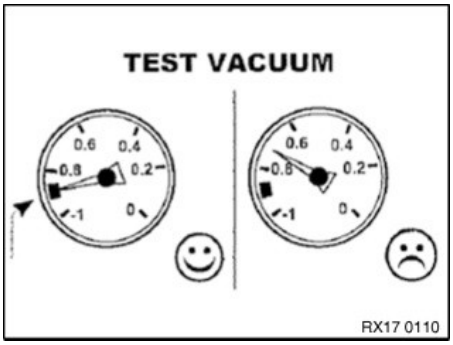
» Vacuum drops.

Measure

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

Check

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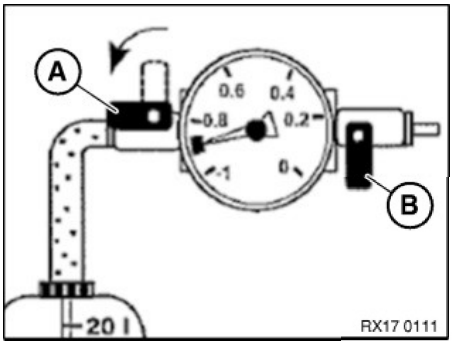
- The vacuum in the coolant circuit must be maintained for at least 30 seconds.

Result

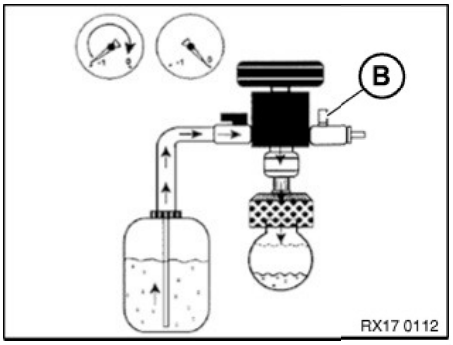
» Vacuum remains constant.

Measure

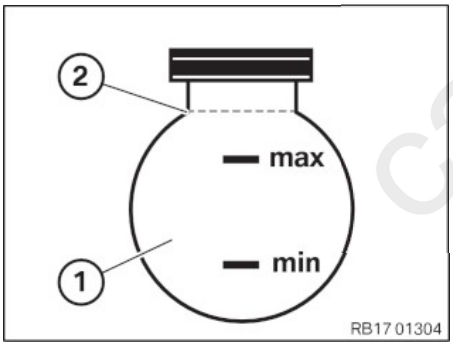
- Continue with filling.



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



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



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

95 – Disconnecting all battery earth leads



- See additional information.

96 – Bleeding the low-temperature cooling system

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TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

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

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

TECHNICAL INFORMATION

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

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

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

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

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

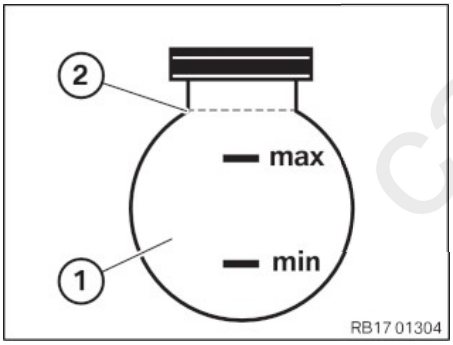
TECHNICAL INFORMATION

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

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

TECHNICAL INFORMATION

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



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

  The cooling system bleeding routine will start.

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

  The cooling system bleeding routine ends after 11 minutes.

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

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

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- Loosen sealing cap (1).



TECHNICAL INFORMATION

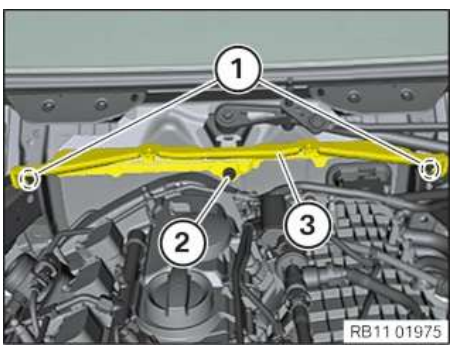
After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

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

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

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

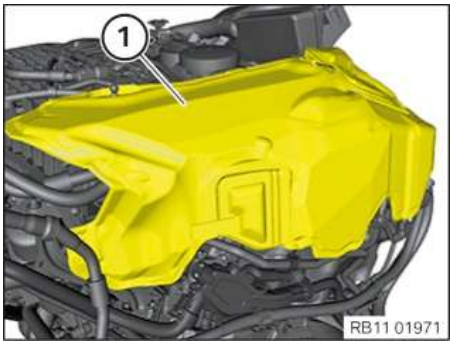
97 – Installing centre bulkhead lower section



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

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98 – Installing acoustic cover at rear

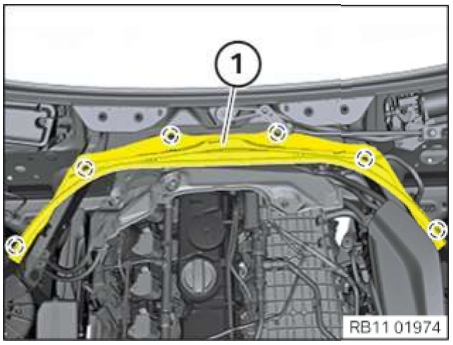


- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



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

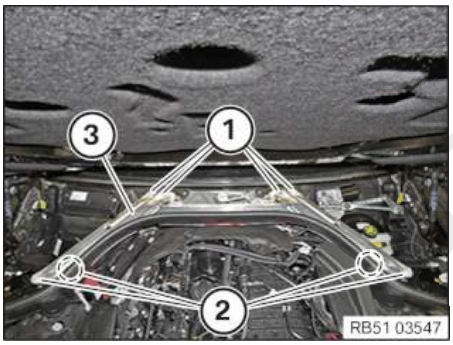
99 – Installing the centre bulkhead upper part



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

Bulkhead upper part to bottom bulkhead

		Tightening torque	3 Nm



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

Tension strut on bulkhead

M10x25 screw		Tightening torque	56 Nm

- Renew screws (2).

  Parts: Bolts
- Tighten the screws (2).

Tension strut to spring strut dome

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

100 – Installing cowl panel cover

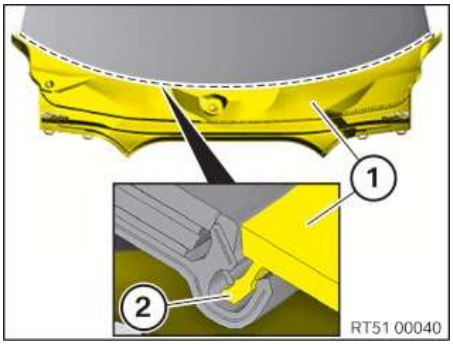
RISK OF DAMAGE

Damage caused by water ingress into the vehicle.

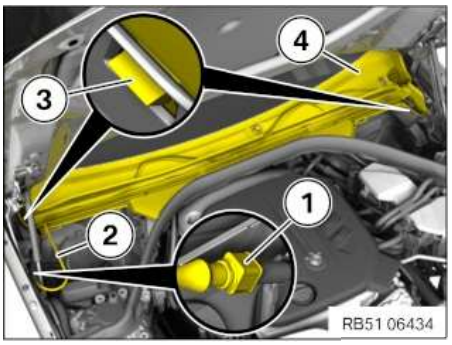
Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

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

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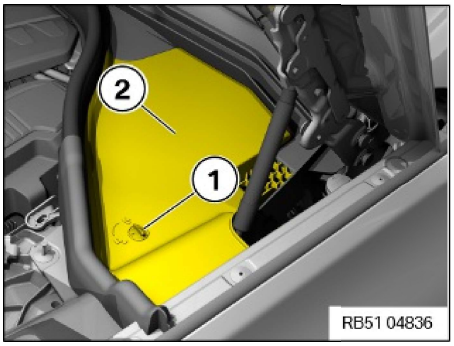


- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



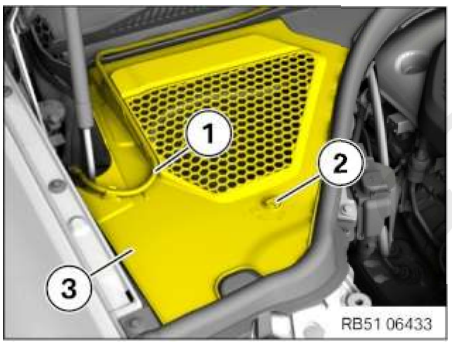
- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

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



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

102 – Install the rear right engine compartment cover



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

103 – Installing both wiper arms

NOTICE

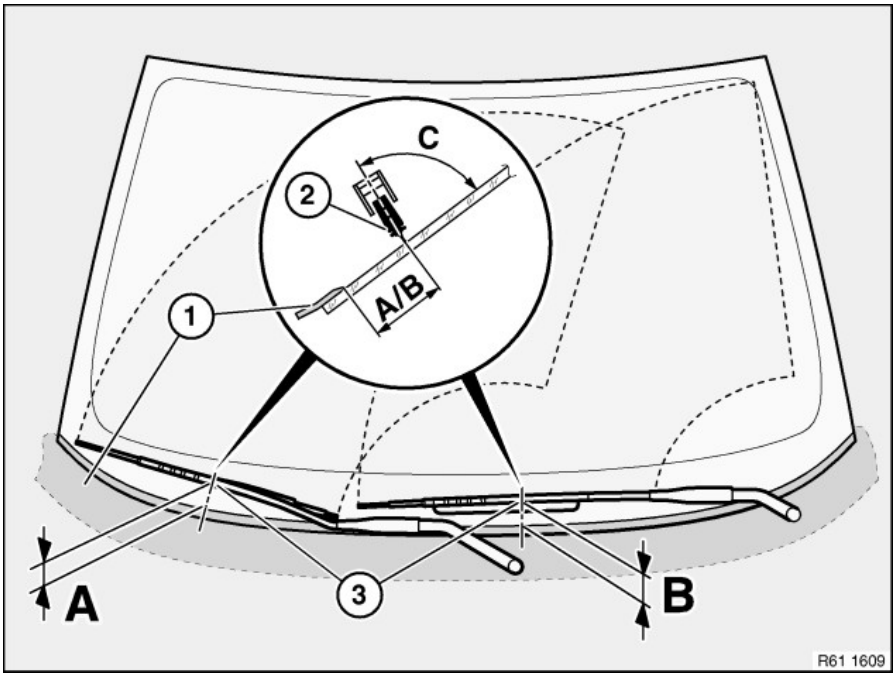
Description is for left component only. Procedure on the right side is identical.

▸ **Install the wiper arm**

TECHNICAL INFORMATION

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

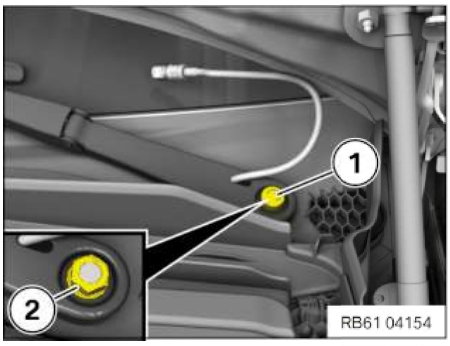
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- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

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

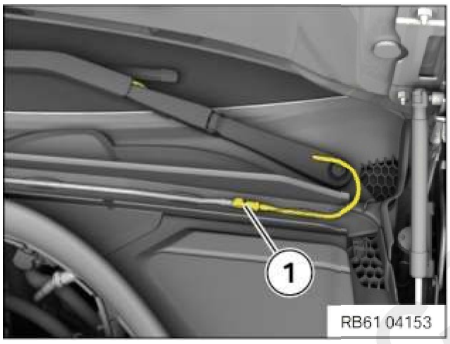


- Tighten nut (2).

Windscreen wiper arm

Combination hexagon nut		Tightening torque	35 Nm

- Connect the protective cap (1).



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

104 – Install acoustic cover

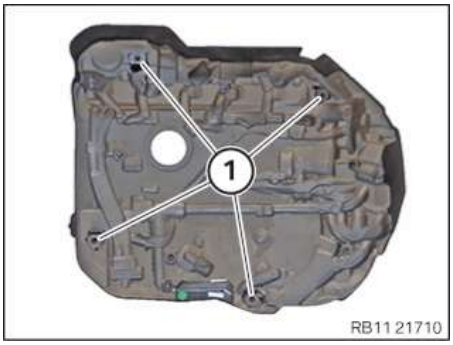
RISK OF DAMAGE

Damage to the acoustic cover.

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

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

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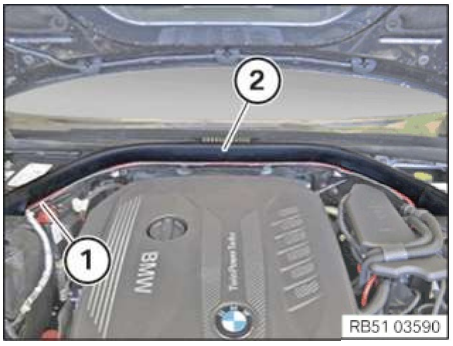


- Check the rubber mount (1) for correct fit in the acoustic cover.



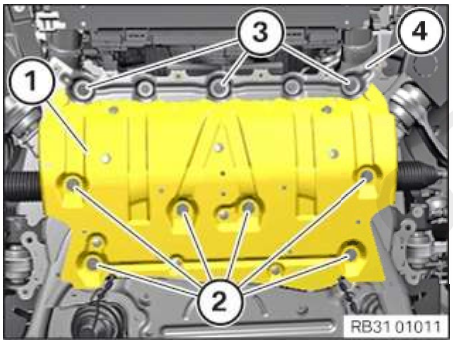
- Install acoustic cover (1) and fix in the rubber mounts (marks).

105 – Install the seal for the bonnet



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

106 – Installing the stiffening plate

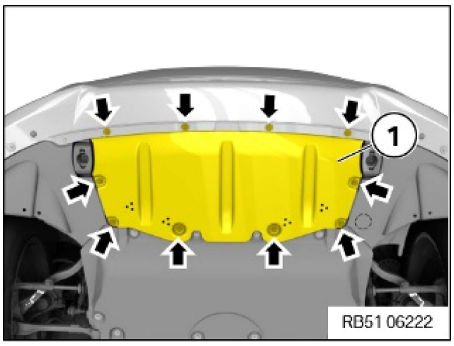


- Position stiffening plate (1).
- Screw screws (2) in.
- Position holder of underride protection (4).
- Screw screws (3) in.
- Tighten down screws (2) and (3).

Stiffening plate to front axle support

M10		Tightening torque	56 Nm

107 – Installing the front underbody protection



- **Version 1:**

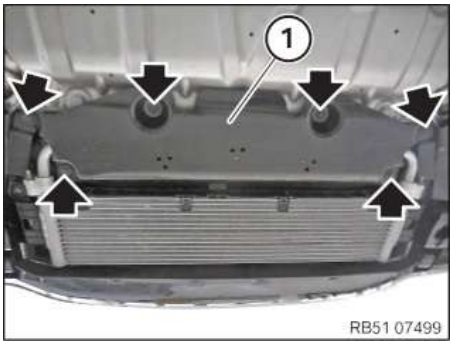
  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

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

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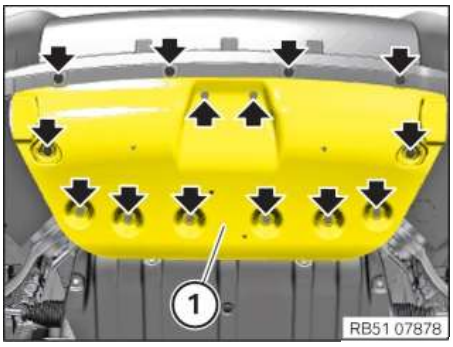
- **Version 2:**

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

  Tighten screws (arrows).

Underbody protection front

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



- **Version 3:**

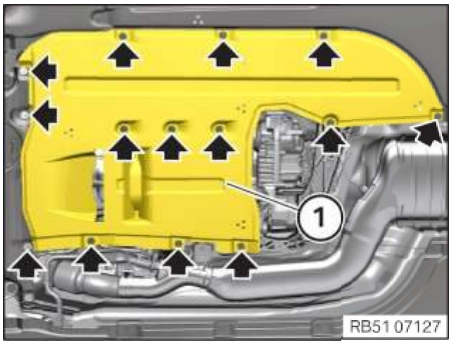
  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

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

108 – Installing underbody protection at rear



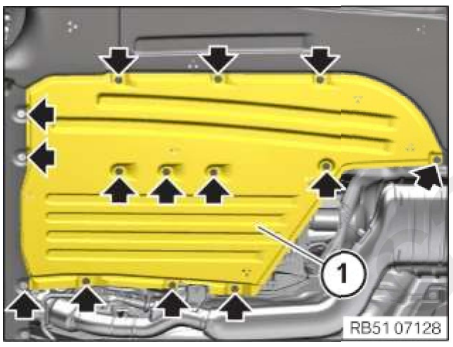
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

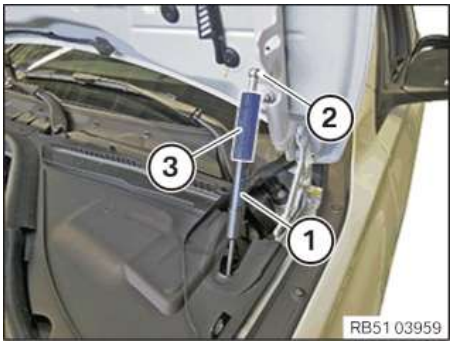
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

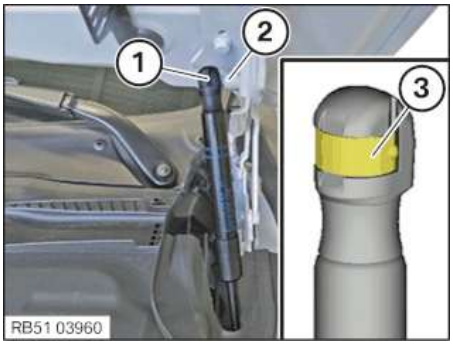
Hexagon screw		Tightening torque	3 Nm

109 – Take bonnet out of the service position



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

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CAUTION

Shutting bonnet or tailgate.

Danger of injury!

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

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

Additional Information

Overview of Tightening Torques

Cover, front bottom on side — Used in step 3665

Hexagon screw for thermoplastic		Tightening torque	3 Nm

Basic carrier to cylinder head — Used in step 455464

M6		Tightening torque	8 Nm

Test gauge to basic carrier — Used in step 455464

M6		Tightening torque	8 Nm

Camshaft sensor wheel to intake camshaft — Used in step 52

M4 x35			4,5 Nm

Intake camshaft to cylinder head — Used in step 53

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque.	10 Nm

VANOS central valve to camshaft — Used in step 6061

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

Chain tensioner to cylinder head — Used in step 63

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Engine oil cooler to bumper support — Used in step 65

M6X25		Tightening torque	8 Nm

Gate to bearing bracket — Used in step 68

M8			20 Nm

Intake plenum to cylinder head — Used in step 72

M6		Tightening torque	10 Nm

Intake plenum to support — Used in step 72

M6X25		Tightening torque	8 Nm

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Tank ventilation line to intake plenum			Used in step 72
Oval-head screw		Tightening torque	3 Nm

Charge air line to throttle valve			Used in step 72
M6x30		Tightening torque	8 Nm

Control unit holder on spring strut dome			Used in step 74
Hexagon screw		Tightening torque	8 Nm

Cylinder head cover to cylinder head			Used in step 77
M6X30		Jointing torque	8 Nm

Cylinder head cover to cylinder head			Used in step 77
M6X30		Tightening torque	11 Nm

Auxiliary coolant pump holder to cylinder head			Used in step 77
M6		Tightening torque	7 Nm

Standard screw connection M6			Used in step 77
M6			8 Nm

Differential pressure sensor to holder			Used in step 77
TS6X18		Tightening torque	3,5 Nm

Holder, positive battery cable to cylinder head cover			Used in step 77
6X18		Tightening torque	6 Nm

High pressure pump to high pressure pump flange			Used in step 79
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

Ground cable to rail			Used in step 8182
M6			5 Nm

High pressure line between rail and high pressure pump			Used in step 83
M14x1,5		Tightening torque	33 Nm

Fuel delivery line to high pressure pump			Used in step 84
M14		Tightening torque	31 Nm

Fuel line to cylinder head cover			Used in step 84
6x18		Tightening torque	6,5 Nm

Spark plugs			Used in step 85
M12x1.25		Tightening torque	23 Nm

Ignition coil			Used in step 86
Screw		Tightening torque	8 Nm

Fan cowl with electric fan on radiator			Used in step 87
TS6x20		Tightening torque	6,5 Nm

Top rear cross connection to bonnet catch support			Used in step 88
Flat-head screw M6x20		Tightening torque	11,8 Nm

Rear top cross connection to wheel arch carrier support			Used in step 88
M10x20 screw	Renew screw.	Jointing torque	56 Nm
		Angle of rotation	90 °

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Cross connection, top			Used in step 89
M8x20		Tightening torque	28 Nm

Cross connection, top			Used in step 89
M6x20		Tightening torque	11,8 Nm

Clean air pipe to upper section of intake filter housing			Used in step 93
Clamp		Tightening torque	3 Nm

Bulkhead upper part to bottom bulkhead			Used in step 99
		Tightening torque	3 Nm

Tension strut on bulkhead			Used in step 99
M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome			Used in step 99
Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

Windscreen wiper arm			Used in step 103
Combination hexagon nut		Tightening torque	35 Nm

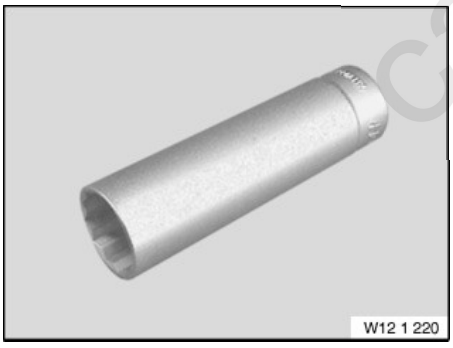
Stiffening plate to front axle support			Used in step 106
M10		Tightening torque	56 Nm

Underbody protection front			Used in step 107
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Underbody protection			Used in step 108
Hexagon screw		Tightening torque	3 Nm

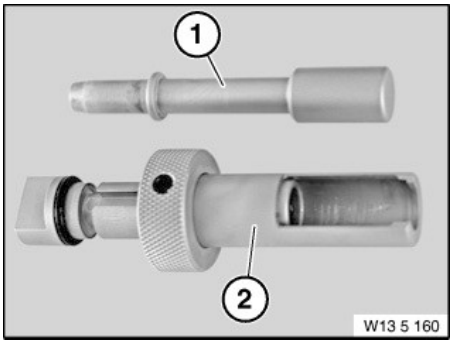
Overview of Special Tools

0 495 560 (12 1 220) Socket



Common	Used in step 2385
Usage	For removing and installing the spark plugs (WAF 14 bihexal).
Included in the tool or work	
Storage location	C18
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

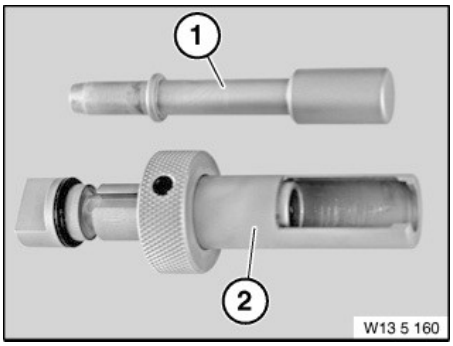
0 496 567 (13 5 161) Fastener



Common	Used in step 25
Usage	(Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

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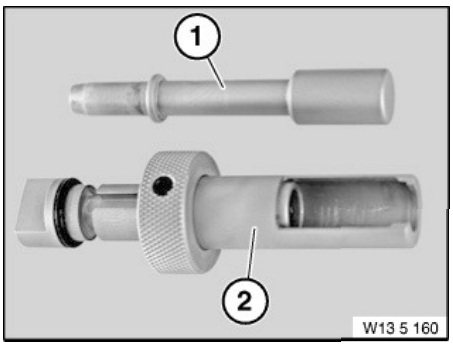
0 496 568 (13 5 162) Fastener



Common Used in step 25

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

0 496 565 (13 5 160) Fastener



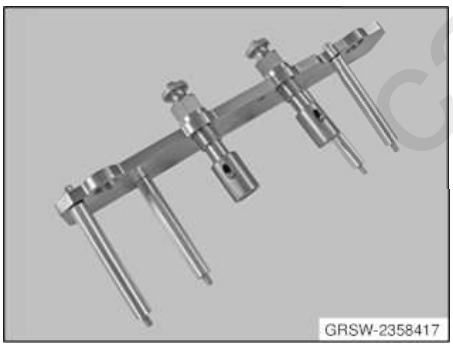
Common Used in step 25

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

Consisting of

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

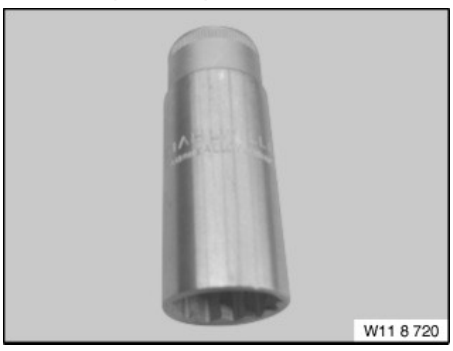
2 358 417 Device



Common Used in step 2728

Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 106 (11 8 720) Socket WAF 46



Common Used in step 2728

Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

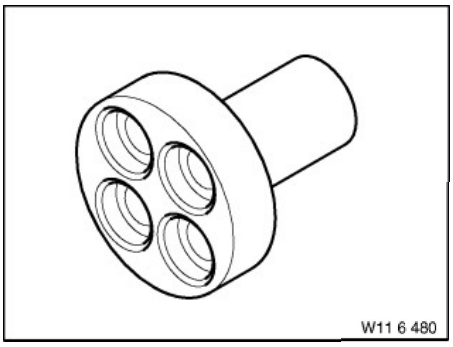
cardiagn.com

2 360 895 Pin wrench



Common	Used in step 2978
Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 493 380 (11 6 480) Connector



Common	Used in step 4041456264697079
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

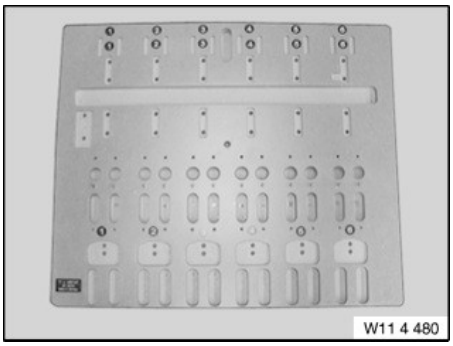
2 359 088 Device



Common	Used in step 4271
Usage	For removing and installing torsion spring of the intermediate lever.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 495 105 (11 4 480) oddments tray



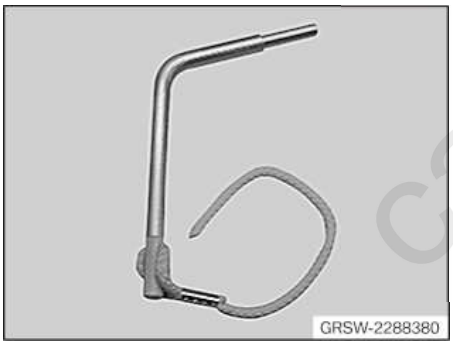
Common Used in step 42434451

Usage	(Boards (2 pieces)) For setting down the individual components of the cylinder head.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 106 (11 4 481)		**oddments tray** (Board, intake side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	
2	0 495 107 (11 4 482)		**oddments tray** (Board, exhaust side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	

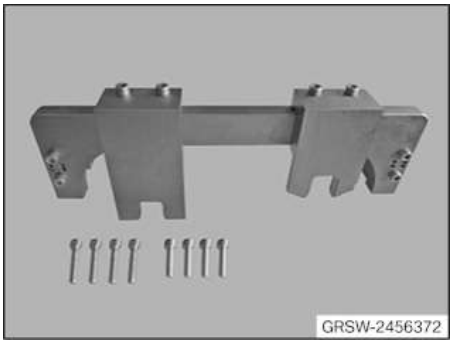
2 288 380 Locating stud



Common Used in step 456264

Usage	For disconnecting the crankshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 04 14 (071)

2 456 372 Gauge



Common Used in step 4550546264

Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

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2 358 122 Gauge



Common	Used in step 455064
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 855 Ratchet handle



Common	Used in step 47576061
Usage	Insert reversible ratchet with nut for installation and disassembly of the VANOS- SW22. (only in longitudinal installation). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A55
Replaced by	
In connection with	
SI-Number	01 34 15 (306)

2 450 487 Socket



Common	Used in step 47576061
Usage	For removing and installing the VANOS adjuster. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	0496855
SI-Number	01 07 17 (487)

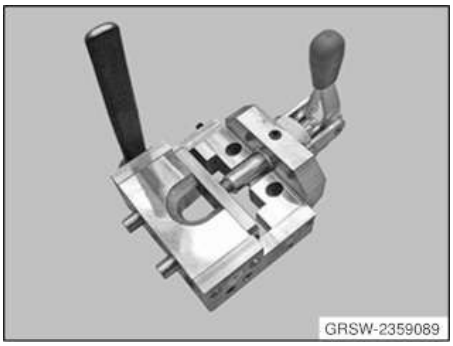
2 455 654 Tensioning tool



Common	Used in step 5962
Usage	To pretension the timing chain when adjusting the timings. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

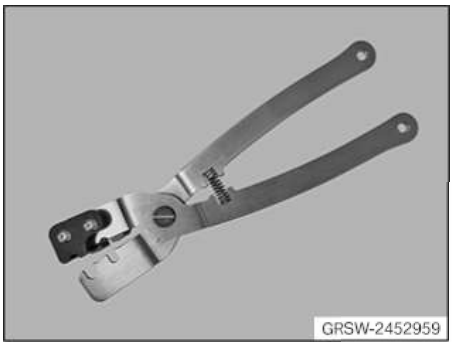
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2 359 089 Device



Common	Used in step 68
Usage	For positioning the sliding block. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

2 452 959 Pliers



Common	Used in step 80
Usage	For disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ number 13 0 191). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A5
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 448 401 Fitting aid



Common	Used in step 80
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

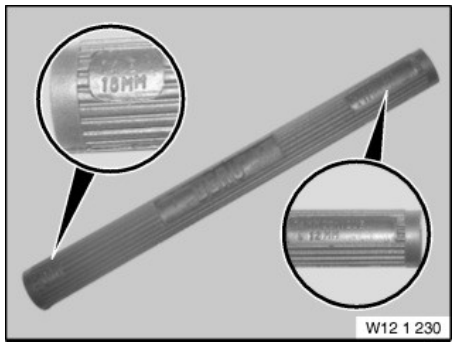
2 358 022 Gauge



Common	Used in step 8182
Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 496 065 (12 1 230) Fitting aid

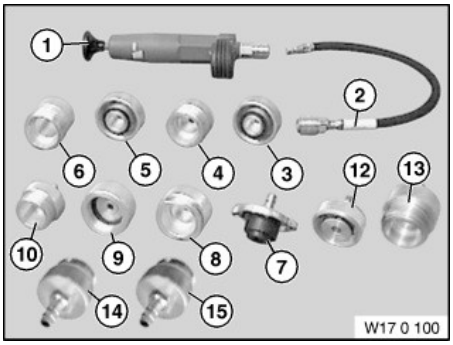


Common	Used in step 85
Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

0 494 417 (17 0 100) Tester

Used in step 94

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Common

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

Consisting of

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

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Overview Technical Data

Distance from window pane edge to wiper blade Used in step 103

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

Capacity of low-temperature coolant circuit G20/G29	Used in step 94
B58B30O1	4,5 l

Expendable materials: Technically suitable antifreeze and corrosion inhibitor

Links

General repair instructions	Used in step
12 00 ... Instructions for removal and replacement of control units	1276

Repair instructions	Used in step
61 20 900 Disconnecting and connecting battery earth lead	195
61 20 900 Disconnecting and connecting battery earth lead	195
61 20 900 Disconnecting and connecting battery earth lead	195
61 20 900 Disconnecting and connecting battery earth lead	195
61 20 900 Disconnecting and connecting battery earth lead	195
61 20 900 Disconnecting and connecting battery earth lead	195
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	195
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	195
61 20 900 Disconnecting and connecting battery earth lead	195
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	195
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	195
61 20 900 Disconnecting and connecting battery earth lead	195
61 20 900 Disconnecting and connecting battery earth lead	195
61 20 900 Disconnecting and connecting battery earth lead	195
61 20 900 Disconnecting and connecting battery earth lead	195
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61 20 900 Disconnecting and connecting battery earth lead	195
61 20 900 Disconnecting and connecting battery earth lead	195
61 20 900 Disconnecting and connecting battery earth lead	195
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	195
61 20 900 Disconnecting and connecting battery earth lead	195
61 20 900 Disconnecting and connecting battery earth lead	195
61 20 900 Disconnecting and connecting battery earth lead	195
61 20 900 Disconnecting and connecting battery earth lead	195
61 20 900 Disconnecting and connecting battery earth lead	195
61 20 900 Disconnecting and connecting battery earth lead	195
61 20 900 Disconnecting and connecting battery earth lead	195
61 35 ... Notes on ESD protection (Electro Static Discharge)	121322293775
13 53 ... Clean the cylinder heads in the area of injectors to prevent sand/dust contamination.	2728
61 35 ... Notes on ESD protection (Electro Static Discharge)	29
61 00 730 Encode/program control unit(s) (after vehicle test)	76
17 11 035 Removing and installing/replacing fan cowl with electric fan	79
17 00 ... Notes for working on cooling system.	94

Operating materials	Used in step
Main group 17	94

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This documentation refers to special tools that were not yet available when going to press.

11 31 051 Replacing the timing chain

CAUTION

Component with heavy weight.

Danger of injury!

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

CAUTION

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

Danger of injury!

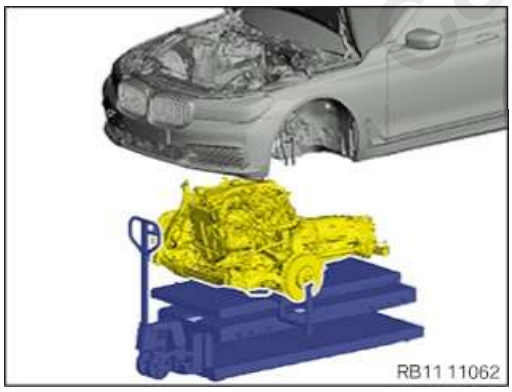
- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

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

PRELIMINARY WORK

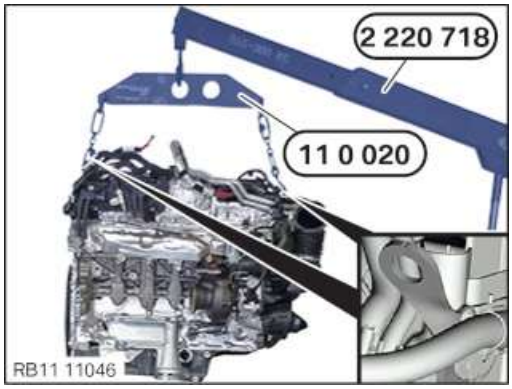
1 – Remove the front axle completely with the engine and transmission



- See additional information.

2 – Remove engine from front axle

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- See additional information.

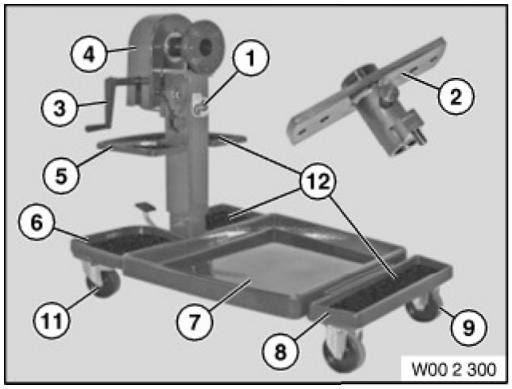
3 – Install the engine on the assembly stand

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

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



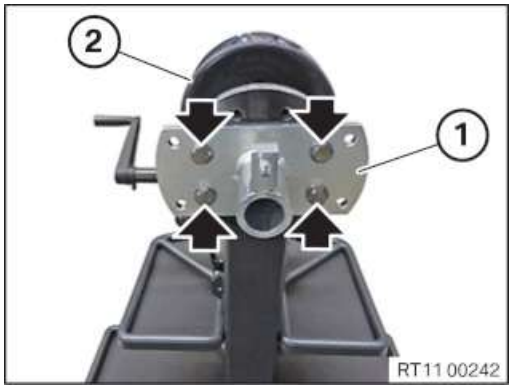
- Have the set of special tools 0 495 187 (00 2 300) ready.

Number	Description
1	Assembly stand
2	Flange
3	Crank
4	Cover
5	oddments tray
6	Shaped element rear
7	Collection pan
8	Shaped element front
9	Front wheel
10	Rear wheel with stop
11	Mat



- Have the special tool 2 411 718 ready.

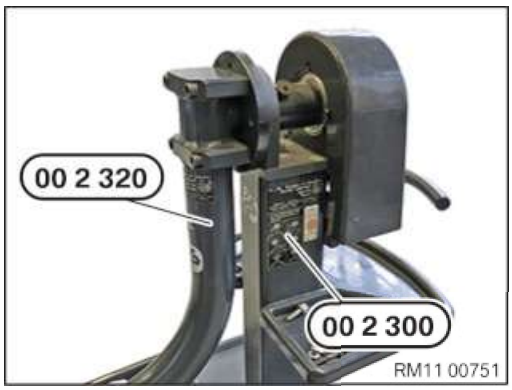
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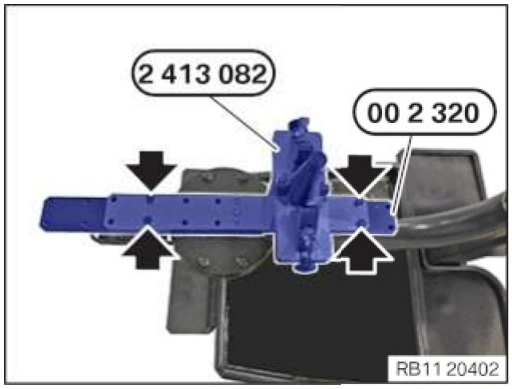
- Position flange (1) on assembly stand (2).
- Tighten screws (arrows).

Flange to assembly stand

M14X30		Tightening torque	135 Nm



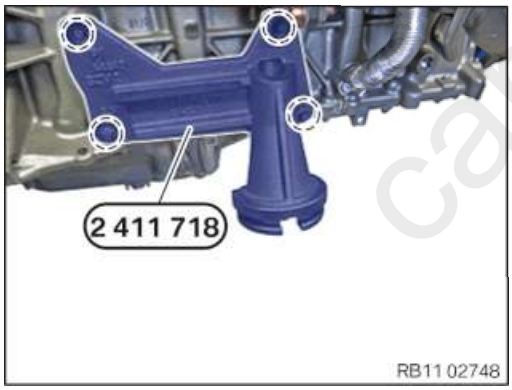
- Prepare the assembly stand 0 495 187 (00 2 300) with the special tool 0 495 196 (00 2 320).



- Screw the special tool 2 413 082 to the 0 495 196 (00 2 320) special tool.
- Tighten screws (arrows).

Special tool 11 8 930 to special tool 00 2 320

M14x35		Tightening torque	160 Nm



- Position and secure special tool (engine fixture) 2 411 718 on the engine.
- Tighten the bolts (marks).

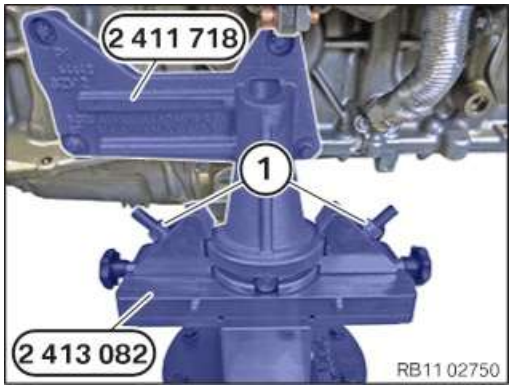
Special tool 2 411 718 to crankcase

M10x30		Tightening torque	38 Nm



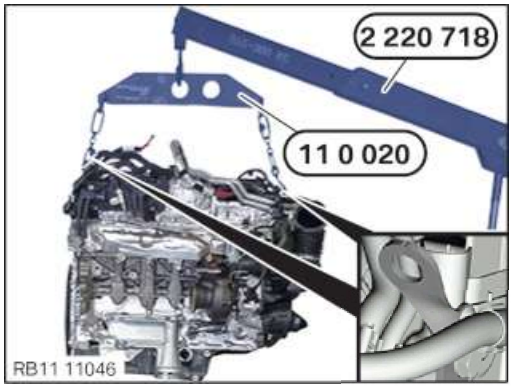
- Lower engine slowly.

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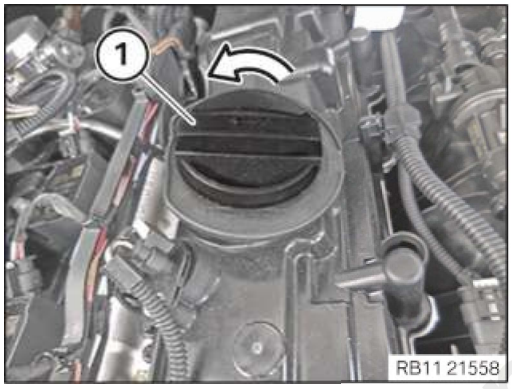
- Make sure special tool 2 411 718 engages with special tool 2 413 082.
- Tighten nuts (1) by hand.

  The clamping jaws must fit completely.



- Release both hooks of the special tool (lifting gear) 0 490 567 (11 0 020) at the front and back of the engine from the mounting brackets.
- Remove the workshop crane 2 220 718.

4 – Removing the oil filler cap



- Open the oil filler cap (1) in the direction of arrow.

5 – Releasing the oil drain plug

WARNING

Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

TECHNICAL INFORMATION

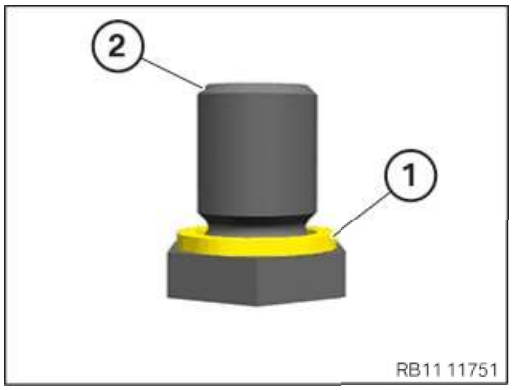
Catch and dispose of drained engine oil in a suitable collecting vessel. Observe country-specific waste disposal regulations.

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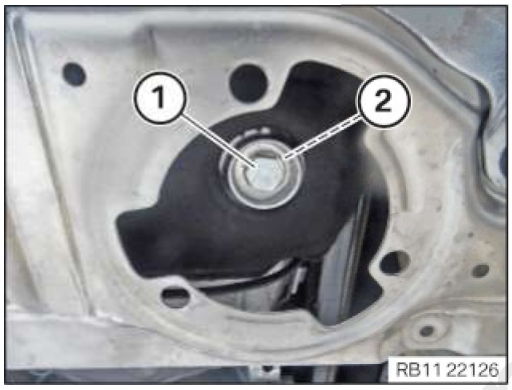
- Release oil drain plug (1).
- Feed out the oil drain plug (1) using sealing ring (2) and remove.
- Allow the engine oil to drain out fully.

6 – Tightening the oil drain plug



- Renew sealing ring (1) on the oil drain plug (2).

  Parts: Sealing ring
- Guide in the sealing ring (1) on the oil drain plug (2) and install.



- Feed in the oil drain plug (1) with the sealing ring (2) and install.
- Tighten oil drain plug (1).

Oil drain plug

M12x16	Replace sealing ring.	Tightening torque	25 Nm

7 – Removing engine ventilation line

WARNING

Hot surfaces.

Risk of burning!

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

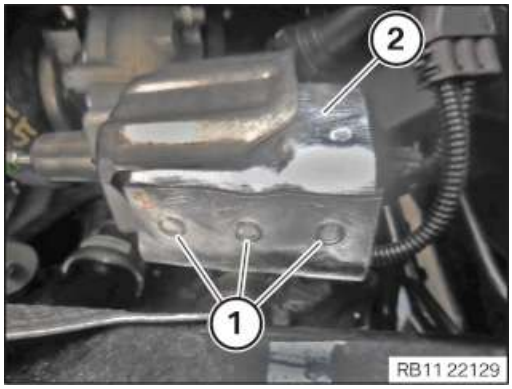
RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

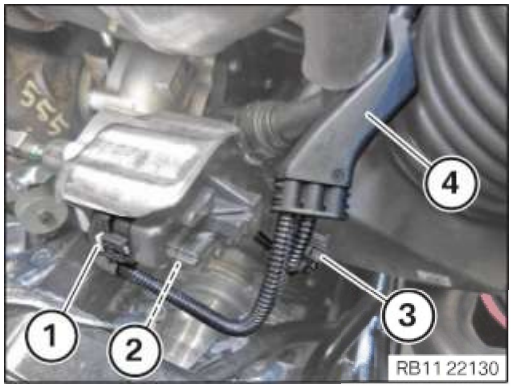
Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

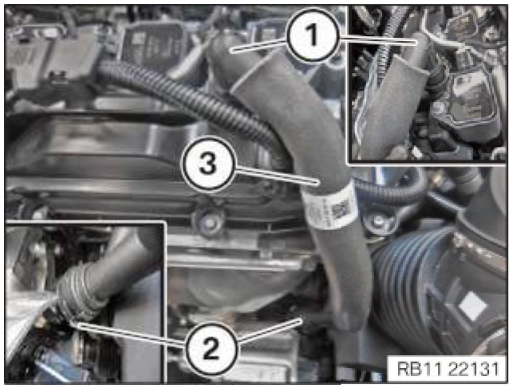
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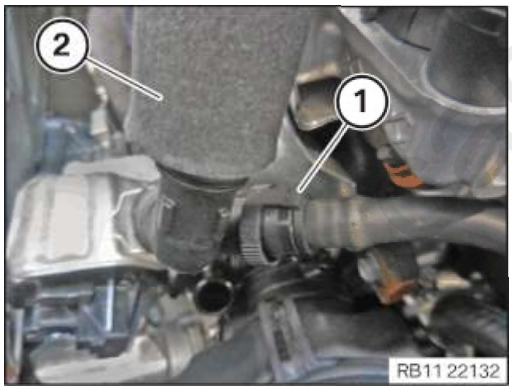
- Unlock the locks (1).
- Feed out and remove heat protection (2).



- Unlock and disconnect the plug connection (1).
- Unlock and disconnect the plug connection (2).
- Loosen clamp (3).
- Feed out wiring harness section for sensor system **2** (4) and set it aside.



- Unlock and loosen the locks (1).
- Unlock and loosen lock (2).
- Feed the engine ventilation line (3) out and set it aside.



- Unlock and release tank ventilation line (1).
- Feed out the engine ventilation line (2) and remove.

8 – Removing acoustic cover at rear



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

9 – Remove the front oxygen sensor

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WARNING

Hot surfaces.

Risk of burning!

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

RISK OF DAMAGE

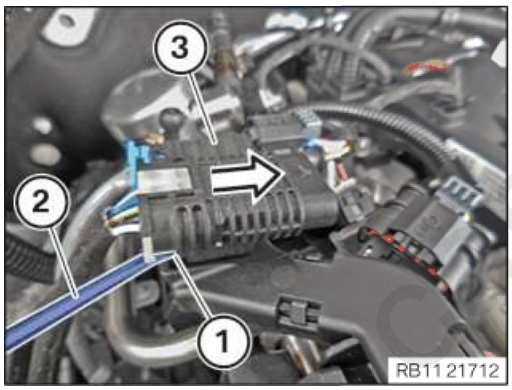
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

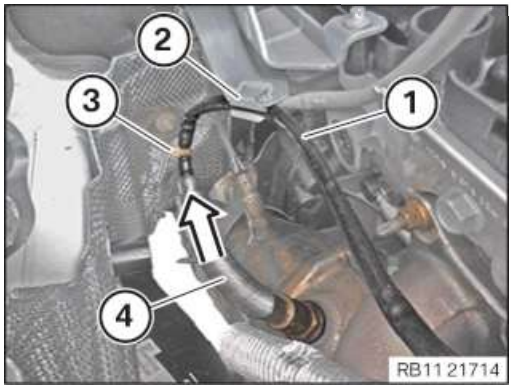
- Do not pull on the wires when disconnecting connectors and plug connections.



- Unlock and loosen connector (1).



- Unlock the locks (1) with a conventional screwdriver (2) and release.
- Feed out the connector (3) in **the direction of arrow** and set aside.



- Detach the line of the front oxygen sensor (1) from the holder (2).
- Unfasten cable strap (3).
- Feed out the heat shield (4) **in direction of arrow** and set it aside.

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- Release and remove the control sensor (1) with the special tool .

10 – Remove the monitoring oxygen sensor

WARNING

Hot surfaces.

Risk of burning!

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

RISK OF DAMAGE

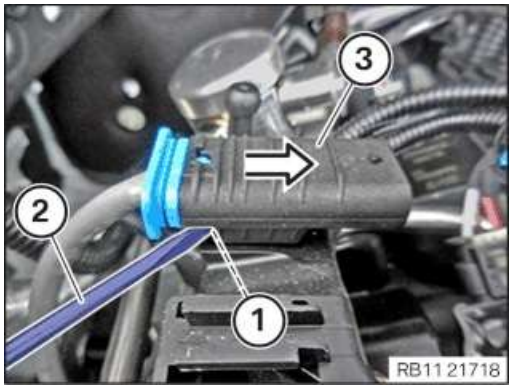
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

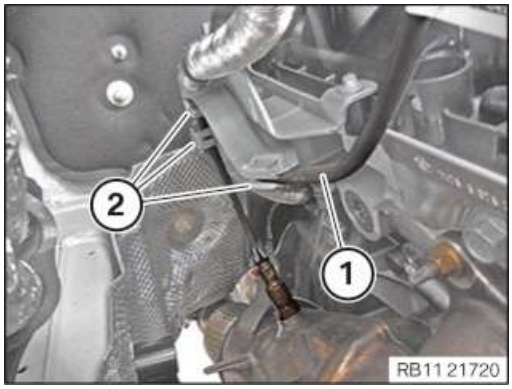


- Unlock and loosen connector (1).

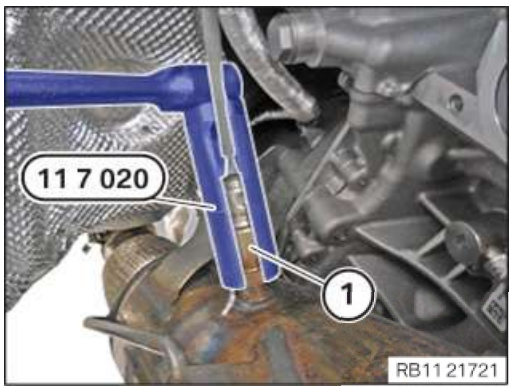


- Unlock the lock (1) with a suitable screwdriver (2).
- Feed out the connector (3) in the direction of the **arrow** and set it aside.

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- Detach the line of the monitoring oxygen sensor (1) from the holder (2).



- Release the monitoring oxygen sensor (1) using special tool .
- Remove the monitoring sensor (1).

11 – Remove catalytic converter

WARNING

Hot surfaces.

Risk of burning!

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

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

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

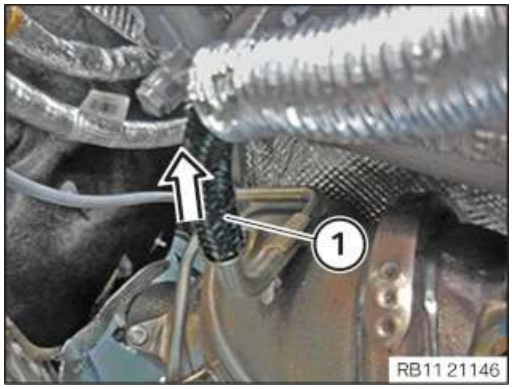
CAUTION

Component with heavy weight.

Danger of injury!

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

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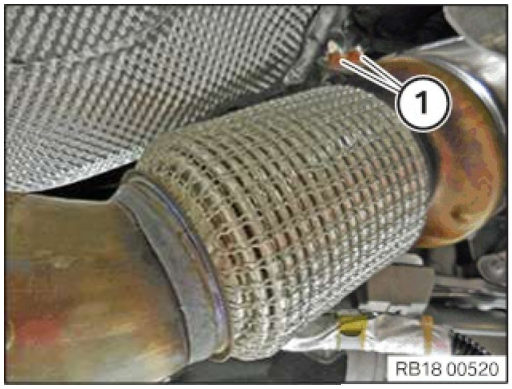


- **If installed: Disconnect pressure hose.**

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



- Loosen V-band clamp (1).



- Loosen nuts (1).



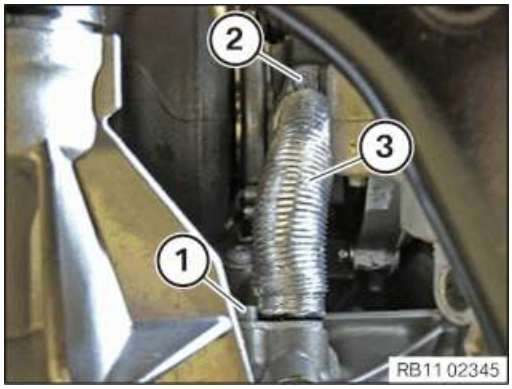
- Unlock and loosen clamp (1).
- Feed out catalytic converter and remove.

12 – Removing the oil return line for the exhaust turbocharger

TECHNICAL INFORMATION

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

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- Have cleaning rags ready for any escaping engine oil.
- Loosen screws (1) and (2).
- Guide out and remove the oil return line (3).

13 – Remove the coolant line between the cylinder head and the coolant pump

WARNING

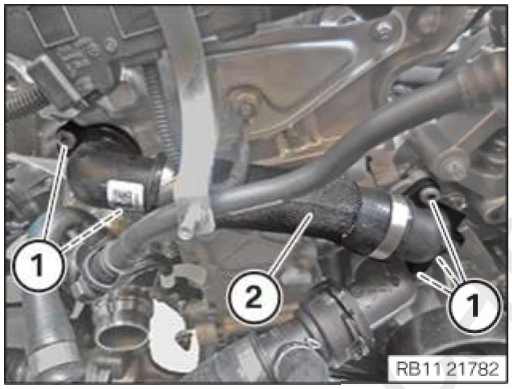
Hot surfaces.

Risk of burning!

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

TECHNICAL INFORMATION

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



- Loosen screws (1).
- Remove the coolant line (2).
- Catch and dispose of escaping coolant.

14 – Remove all ignition coils.

NOTICE

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

▸ **Removing the ignition coil**

WARNING

Hot surfaces.

Risk of burning!

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

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RISK OF DAMAGE

Damage to the ignition coil.

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

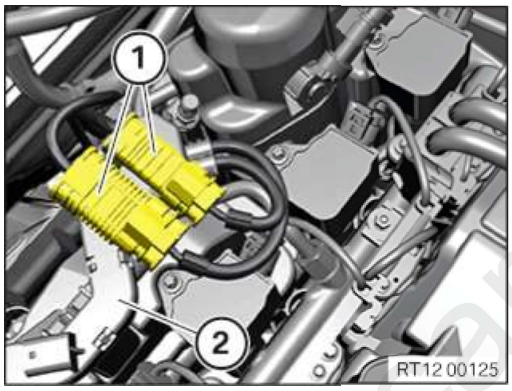
- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

RISK OF DAMAGE

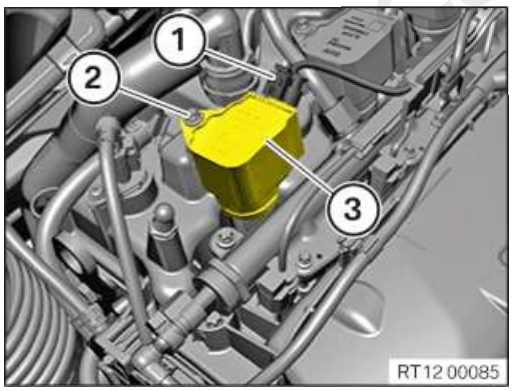
Electrostatic discharge.

Damage to or destruction of electrical components.

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



- Disconnect the connector (1) of the front oxygen sensor and the monitoring oxygen sensor from the cable channel (2) and set aside.



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

15 – Removing all spark plugs

WARNING

Hot surfaces.

Risk of burning!

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

CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

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



- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

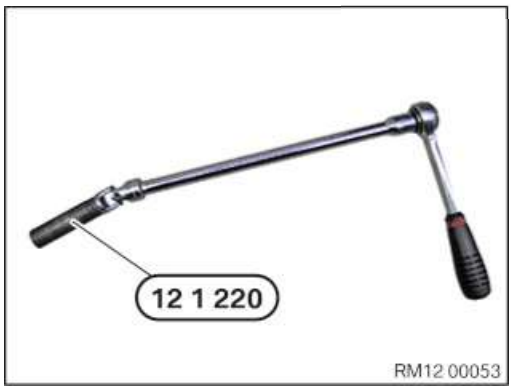
The spark plug shaft must be cleaned using compressed air after having removed the ignition coils and before removing the spark plugs. After having removed the spark plugs, once again check the sealing surface for contamination and (if necessary) clean using a moist cloth or clean using compressed air.

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

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

NOTICE

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



TECHNICAL INFORMATION

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

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

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

16 – Remove the high pressure line between the high pressure pump and the rail

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

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

CAUTION

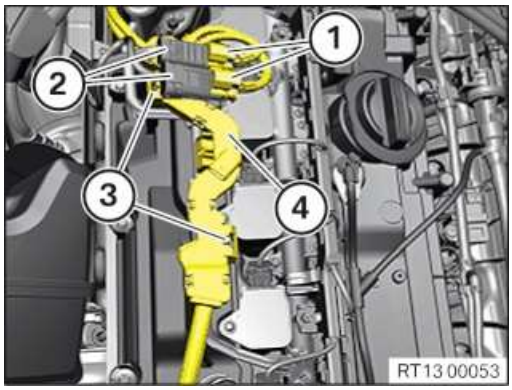
On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

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

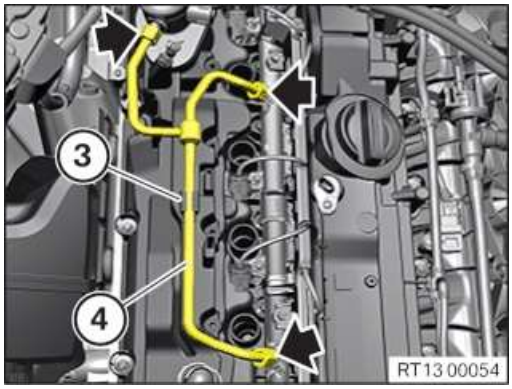
TECHNICAL INFORMATION

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



- Unlock and disconnect the plug connections (1) and (2).
- Unlock the locks (3).
- Guide out the wiring harness section of the engine wiring harness (4) and set it aside.

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- Position a lint-free rag under the union nuts.
- Unscrew union nuts (arrows) with the special tool .
- Catch and dispose of escaping fuel.
- Thread out the high pressure line (4) from the bracket (3) and remove it.
- Feed out and dispose of the lint-free cleaning clothes .

17 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

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

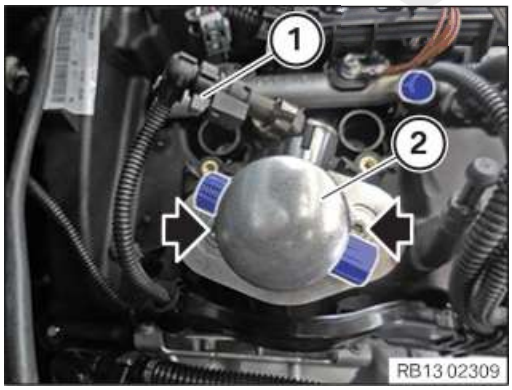
TECHNICAL INFORMATION

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

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

18 – Removing rail with injectors of cylinders 1 to 3

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

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

RISK OF DAMAGE

Damage to the ignition coil.

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

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

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

Damage to injectors.

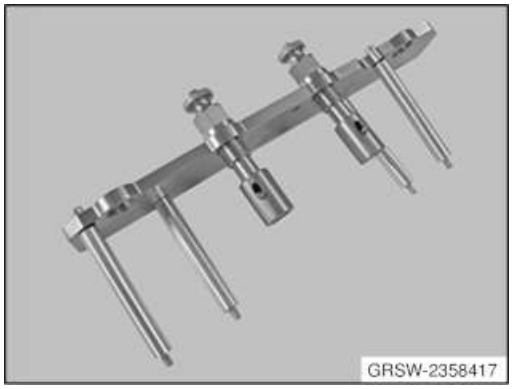
Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.



- Prepare special tool .

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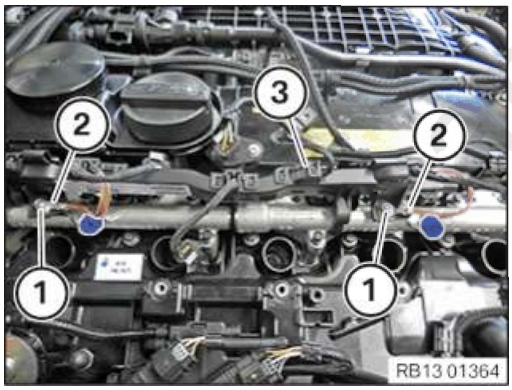
- Prepare special tool 2 358 417.



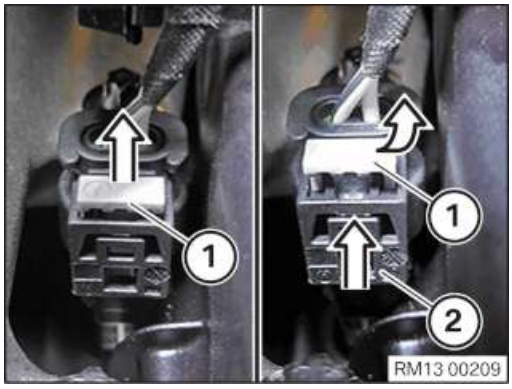
- Prepare special tool .



- Prepare special tool 0 496 106 (11 8 720).

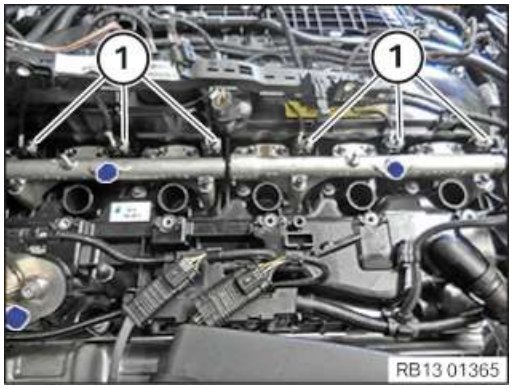


- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.

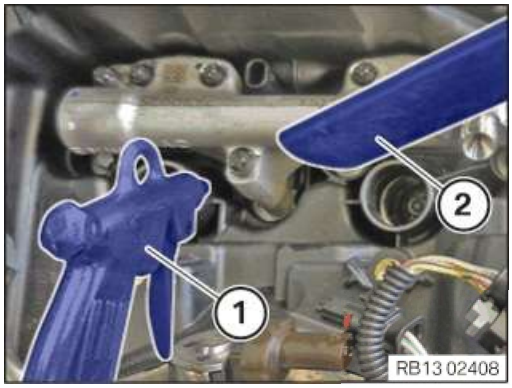


- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull out the connector (2) from the injectors.

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- Unlock and release all connectors (1) of the injectors.

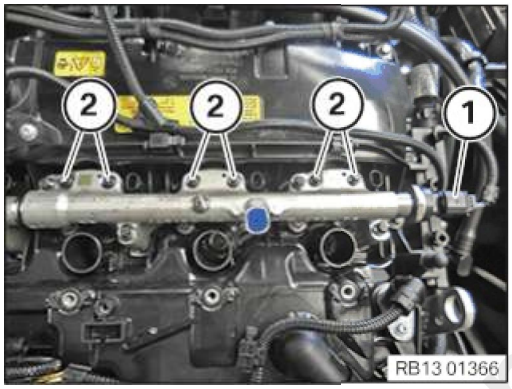


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

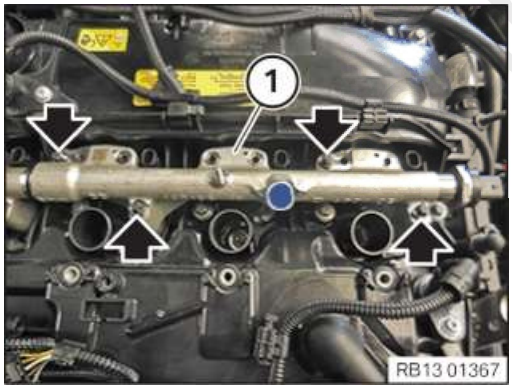
- Before releasing the high pressure lines: Blow out the injector shafts with an air gun(1) with less pressure.
- Simultaneously, draw off the dirt particles with an **explosion proof** vacuum cleaner (2).



- Unlock and loosen connector (1).
- Release screws (M5x30) (2).
- Remove screws (2).

  Do not reuse the bolts (2).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.

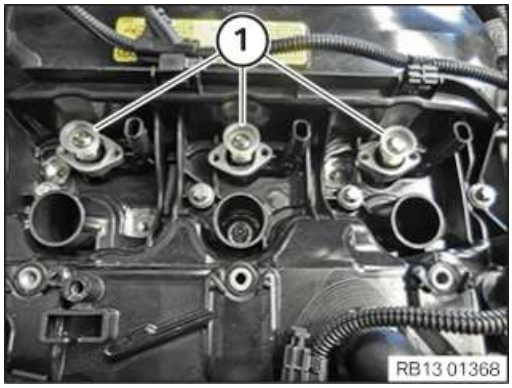


- Unscrew the screws (M6x30) (arrows).

  The screws may not be reused!
- Renew screws.

  Parts: Screws (M6x30)
- Remove rail (1) in upward direction.

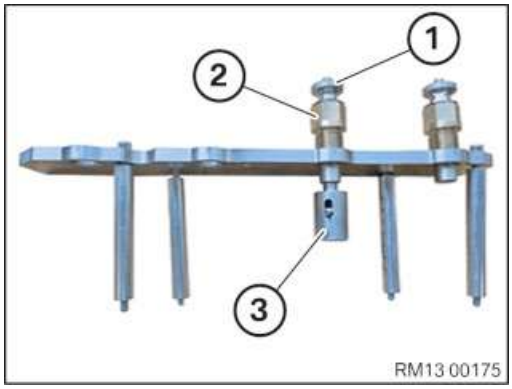
  The injectors remain in the cylinder head.



- Remove the gaskets (1).

  The seals (1) are only required during the initial assembly at the plant and will not be installed again.

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RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

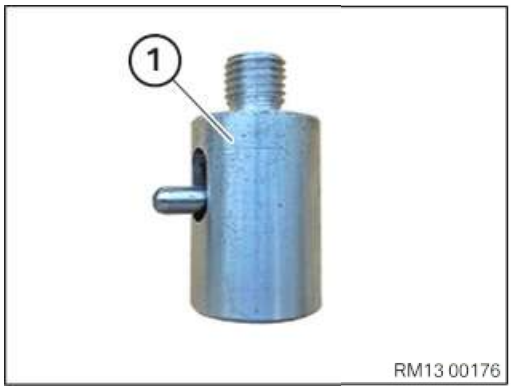
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use the special tool 2 358 417to remove the injectors.

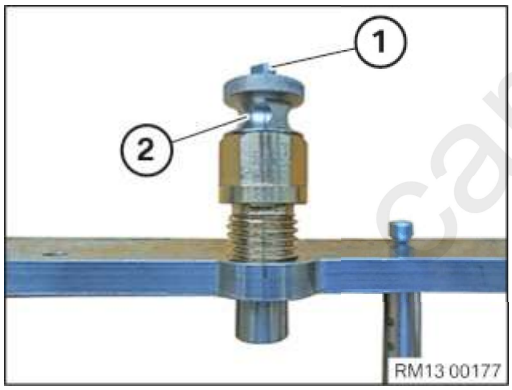
  The special tool 2 358 417 is used to ensure that the tensile force is not exceeded.

  Special tool 2 358 417 consists of:

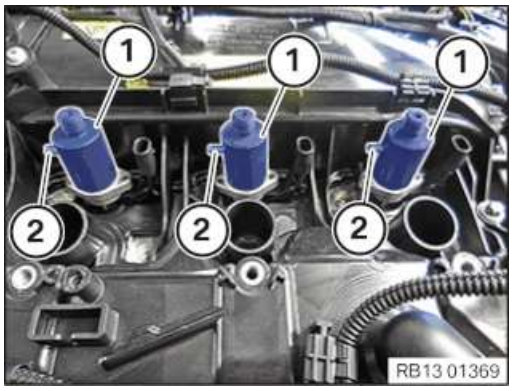
  - **(1)** Threaded sleeves
  - **(2)** Pull-out thread (left-hand thread)
  - **(3)** Mounting for the injectors



- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.



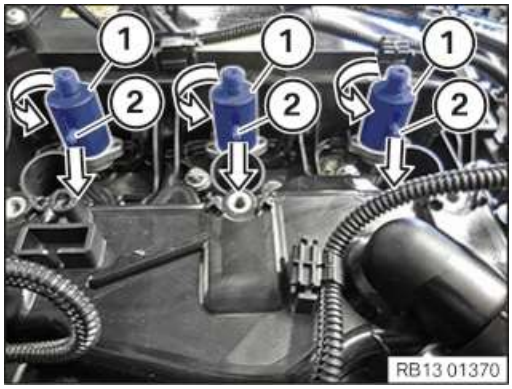
- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.



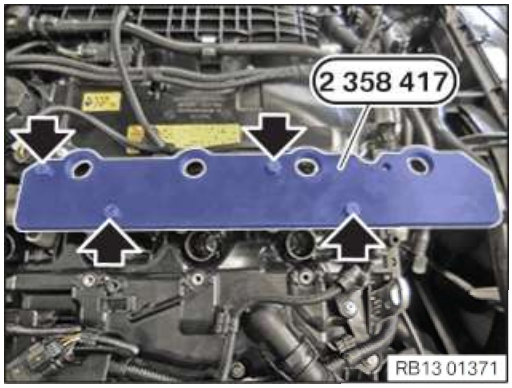
- Install all fixtures (1) for the injectors.

  The fixture (1) is not locked if the lever (2) is on the top.

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- Turn fixtures (1) by 90° and lock the lever (2) downwards.



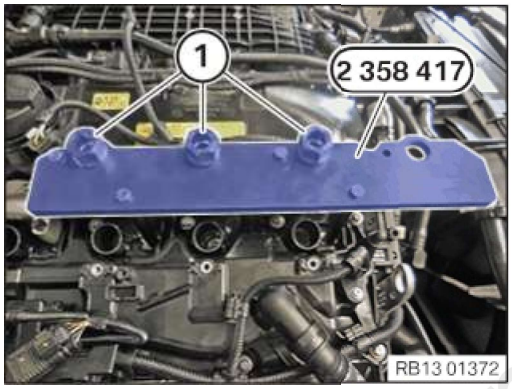
RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

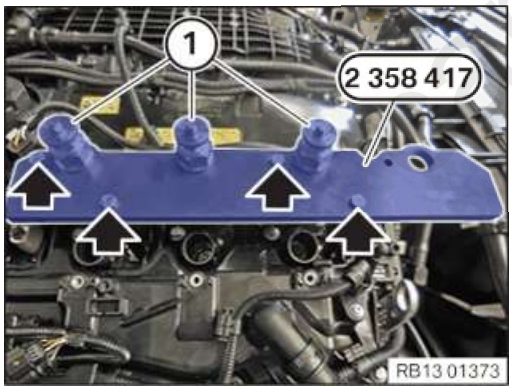
- Attach special tool 2 358 417 to cylinder head.
- Hand-tighten the bolts (arrows).



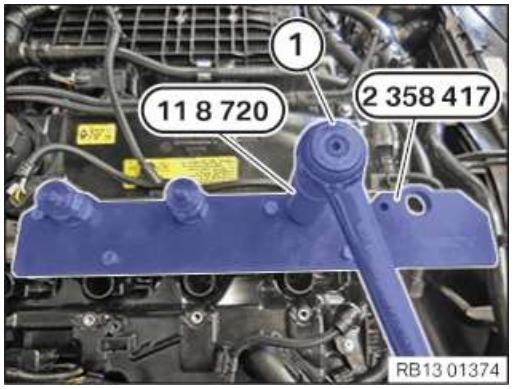
TECHNICAL INFORMATION

The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.



- Insert threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for injectors.
- Then tighten screws (arrows) on special tool 2 358 417 to 5 Nm.



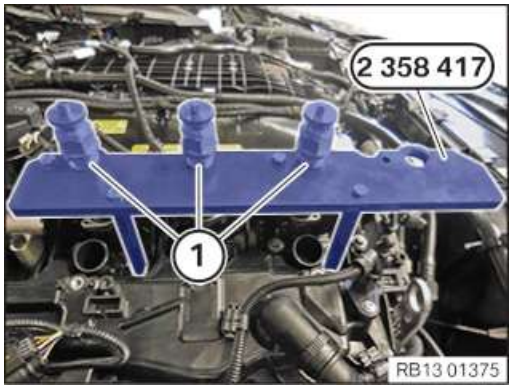
- Adjust torque wrench to 13 Nm **clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720)until the injector is pulled out.

TECHNICAL INFORMATION

If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

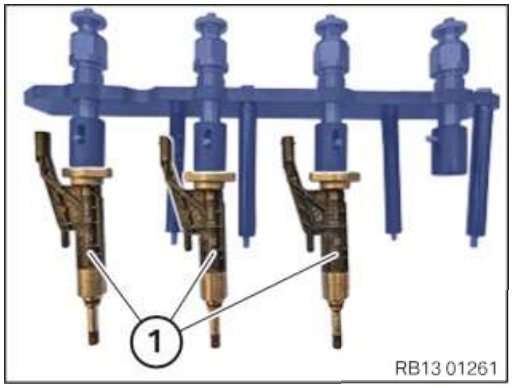
- Disassemble all injectors individually.

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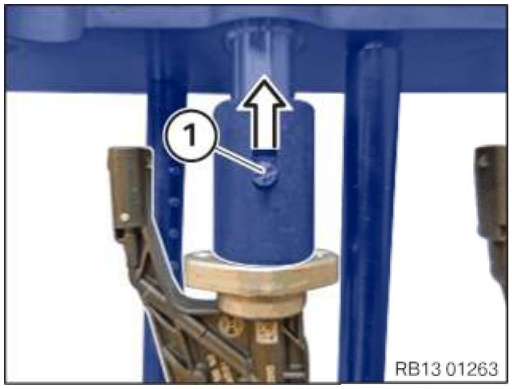


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  This can be recognised on the completely visible threads of the sleeves (1).
- Loosen screws on special tool 2 358 417.



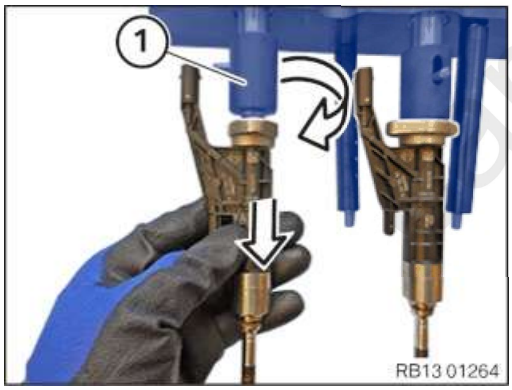
- Carefully remove the special tool 2 358 417with injectors (1) from the cylinder head vertically upwards.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat on a clean table.



NOTICE

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

- Unlock the fixture lock (1) from the top.



- Turn the unlocked fixture (1) by 90°.
- Release and remove the injector downwards.

19 – Removing rail with injectors of cylinders 4 to 6

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

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

RISK OF DAMAGE

Damage to the ignition coil.

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

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

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

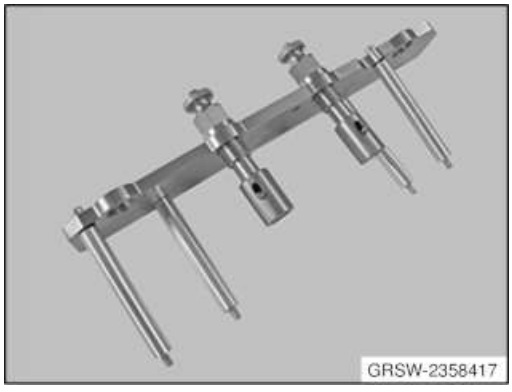
Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.



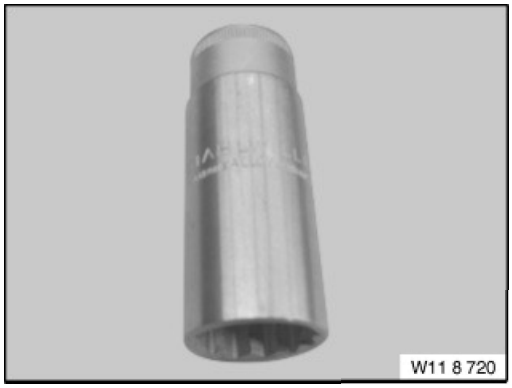
- Prepare special tool .



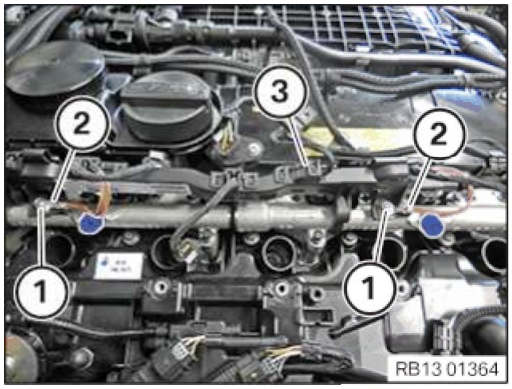
- Prepare special tool 2 358 417.



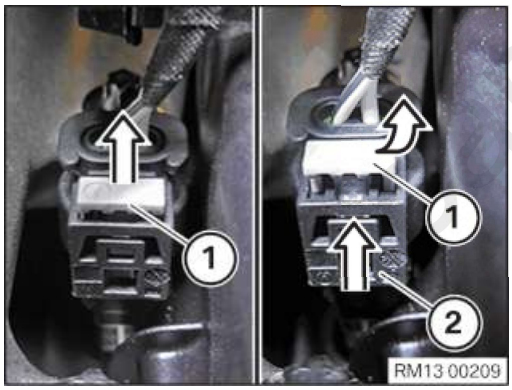
- Prepare special tool .



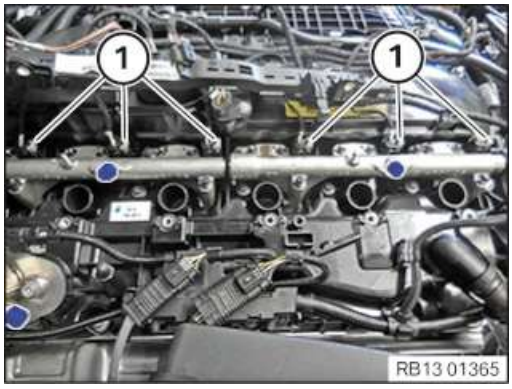
- Prepare special tool 0 496 106 (11 8 720).



- Release nuts (1) .
- Feed out ground cable (2) and set aside.
- Feed out cable channel (3) and set it aside.

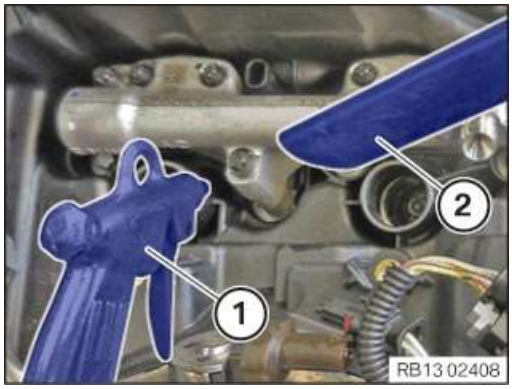


- Unlock lock (1) in direction of arrow upwards.
- Press lock (1) together and release.
- Disconnect the connector (2) from the injectors in the direction of the arrow.



- Unlock and release all connectors (1) of the injectors.

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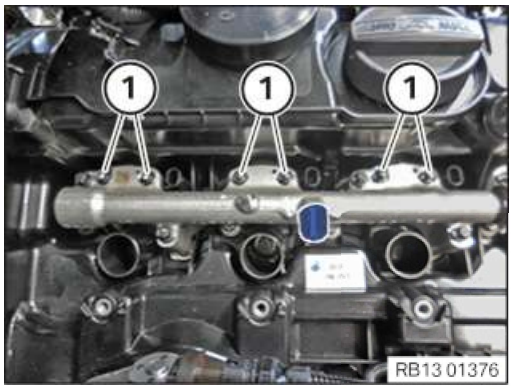


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

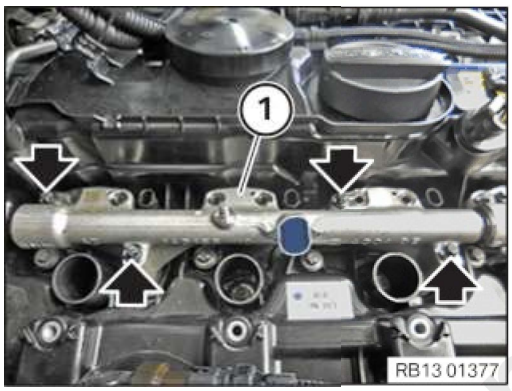
For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

- Before releasing the high pressure lines: Blow out the injector shaft with an air gun (1) with less pressure.
- Simultaneously, draw the dirt particles off **using an** explosion proof (2) vacuum cleaner.



- Release screws (M5x30) (1).
- Remove screws (M5x30) (1) .

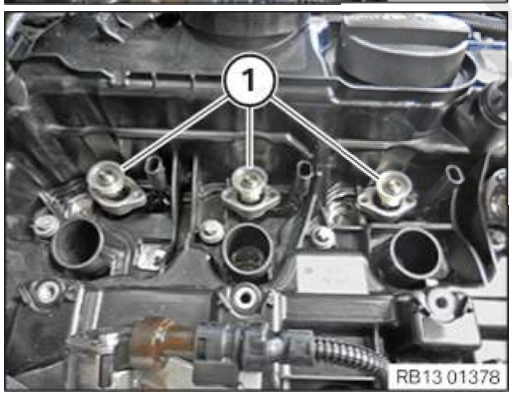
  Do **not** reuse screws (M5x30) (1).
- Catch and dispose of escaping fuel with suitable materials.



- Release screws (M6x30) (arrow).
- Remove screws (M6x30) (arrows).

  Do **not** reuse the screws (M6x30).
- Remove rail (1) upwards.

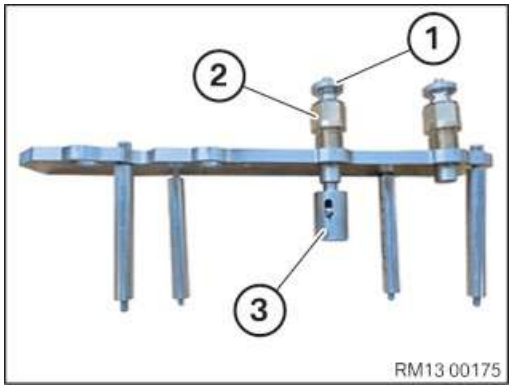
  The injectors remain in the cylinder head.



- Remove seals (1) .

  The seals (1) are required during first assembly within the plant only and will not be installed again.

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RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

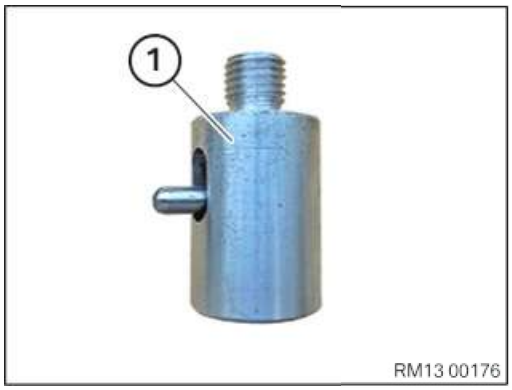
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use the special tool 2 358 417 to remove the injectors.

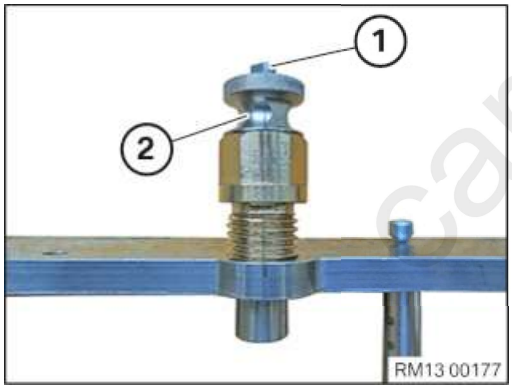
  The special tool 2 358 417 is used to ensure that the tensile force is not exceeded.

  The special tool 2 358 417 consists of:

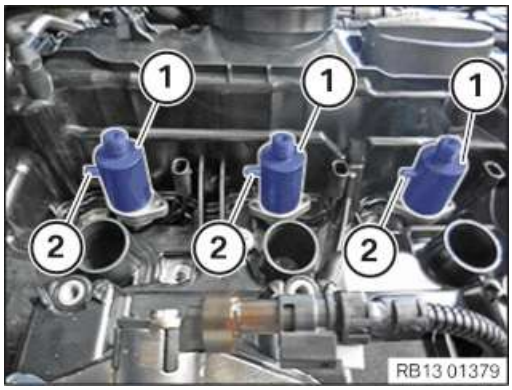
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Mounting for the injectors



- Unscrew the fixture for injectors (1) from special tool 2 358 417.



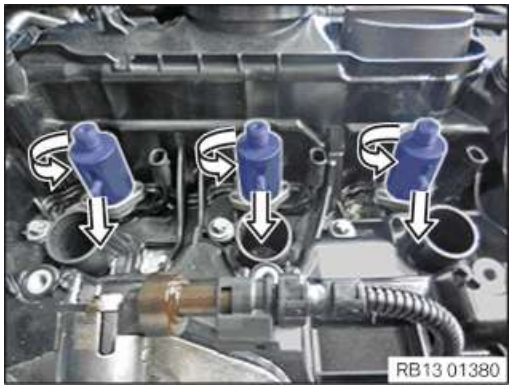
- Press lock (1) in and remove the threaded sleeve (2) from the special tool 2 358 417.



- Install all fixtures (1) for the injectors.

  The fixture (1) is not locked, if the lever is (2) on top.

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- Turn fixtures (1) by 90° and lock the lever (2) downwards.



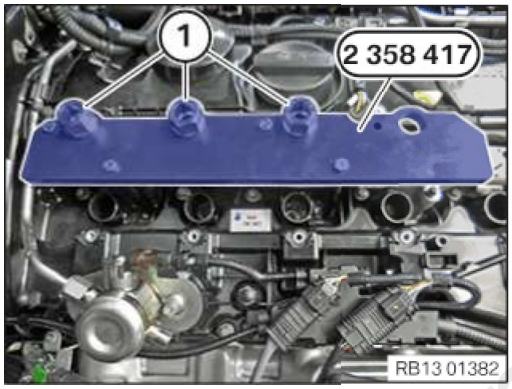
RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

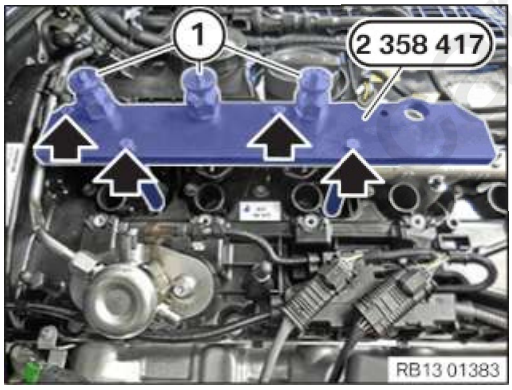
- Attach special tool 2 358 417 to cylinder head.
- Hand-tighten the bolts (arrows).



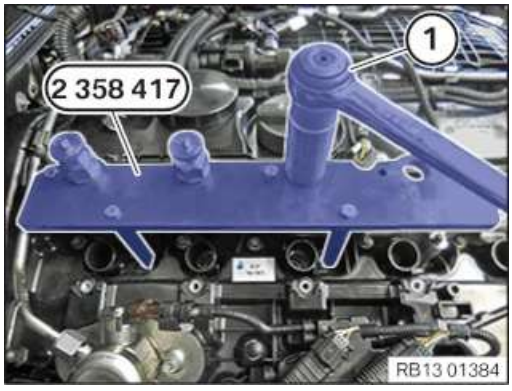
TECHNICAL INFORMATION

The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417 fully.



- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Then tighten screws (arrows) on special tool 2 358 417 to 5 Nm.



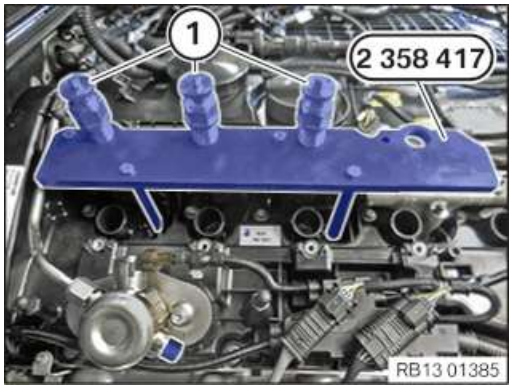
- Adjust torque wrench to 13 Nm **in clockwise** direction.
- Turn the torque wrench (1) with the special tool 0 496 106 (11 8 720) **clockwise**, until the injector is pulled out.

TECHNICAL INFORMATION

If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

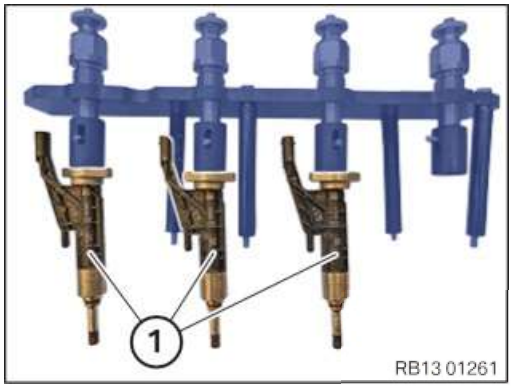
- Disassemble all injectors individually.

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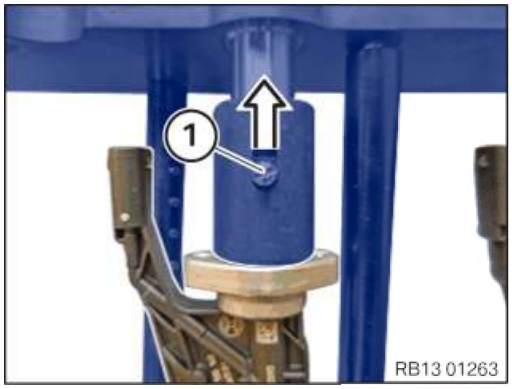


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  This can be recognised on the completely visible thread starts of the threaded sleeves (1).
- Loosen screws on special tool 2 358 417.



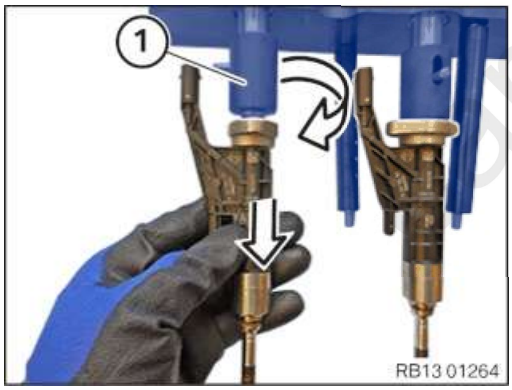
- Carefully remove the special tool 2 358 417 with the injectors (1) vertically straight up from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.



NOTICE

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

- Unlock the fixture lock (1) from the top.



- Turn the unlocked fixture(1) by 90°.
- Release and remove the injector downwards.

20 – Removing both actuators

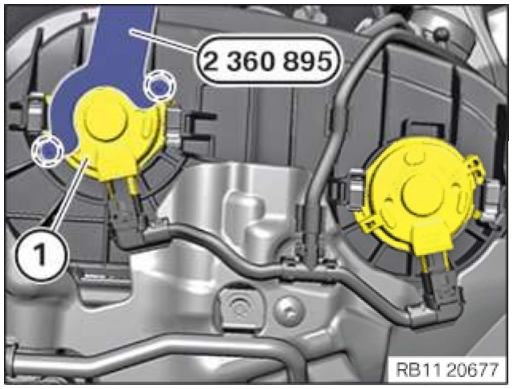
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RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

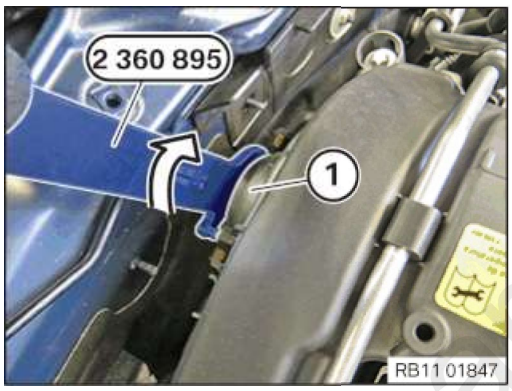
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the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



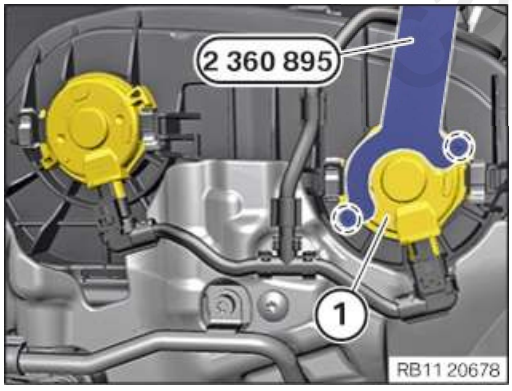
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



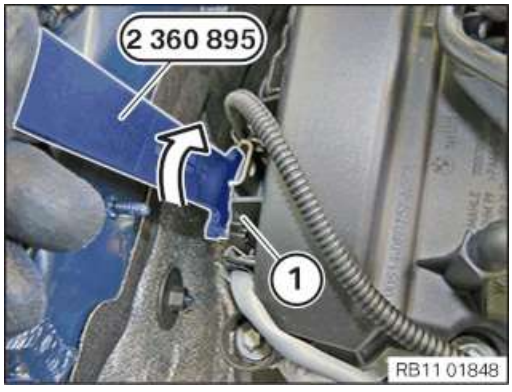
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



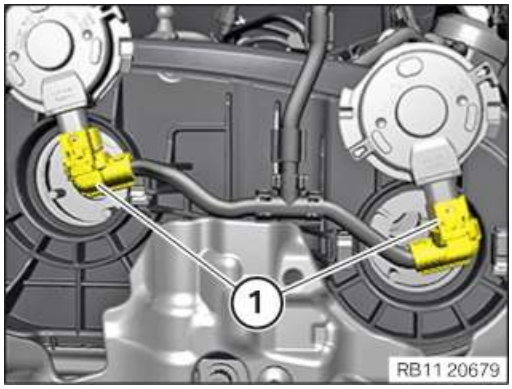
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



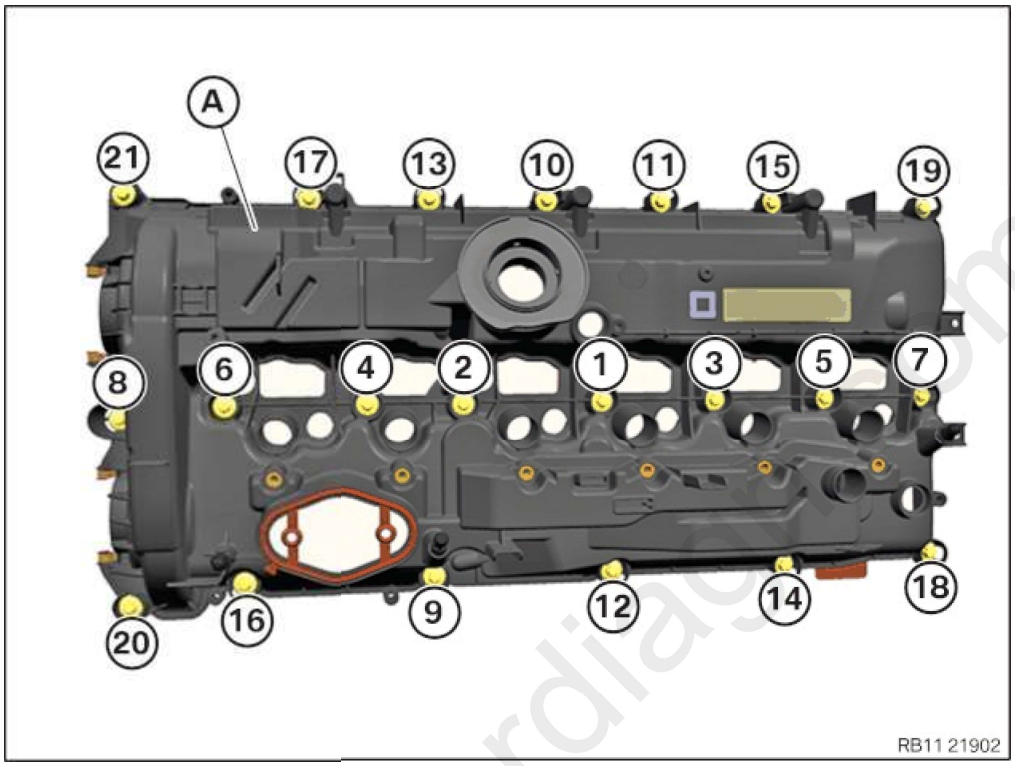
NOTICE

The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

21 – Removing the cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 21 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

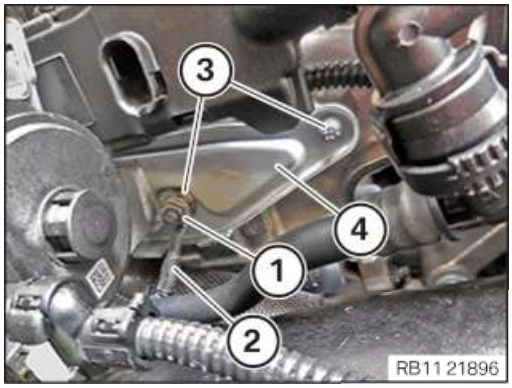
Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

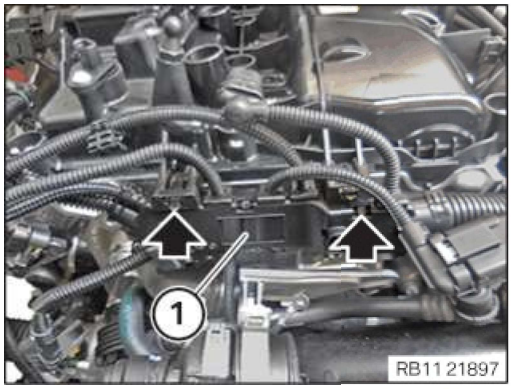
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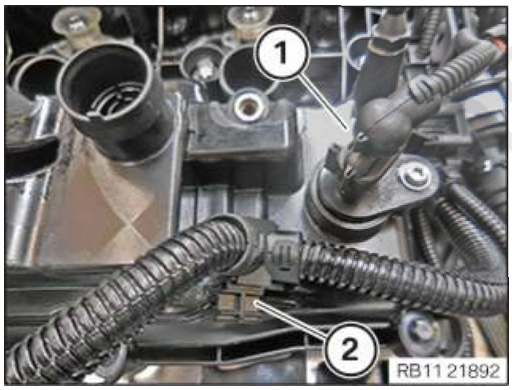
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



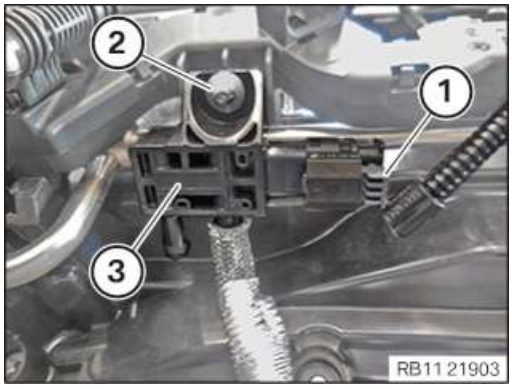
- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Loosen screws (3).
- Thread out holder (4) and set aside.



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

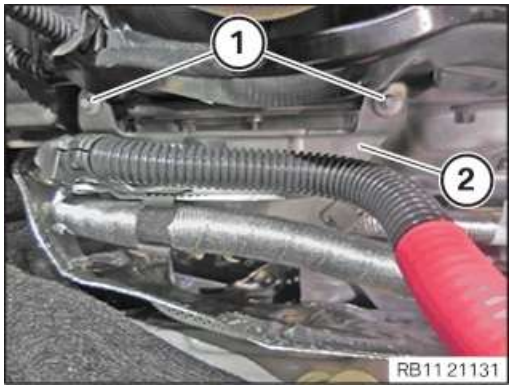


- Unlock and detach connector (1) on exhaust camshaft sensor .
- Loosen clamp (2).

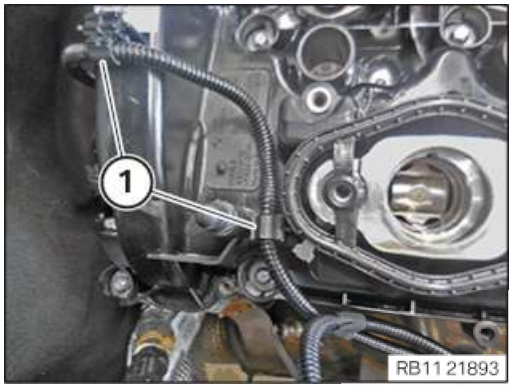


- **If installed:**
- Unlock and loosen connector (1).
- Loosen screw (2).
- Remove the differential pressure sensor (3) and put it to one side.

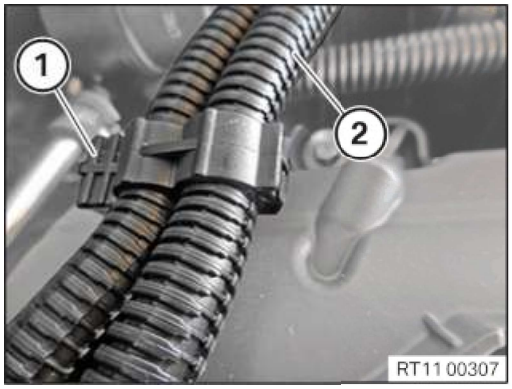
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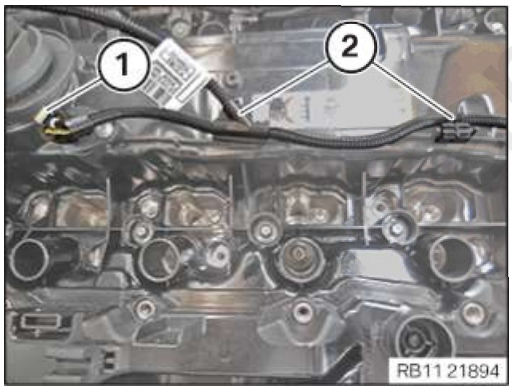
- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.



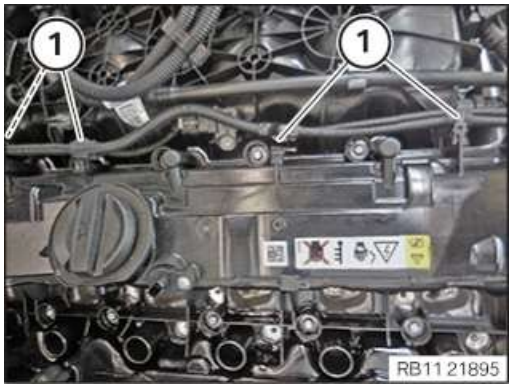
- Loosen clamps (1).



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

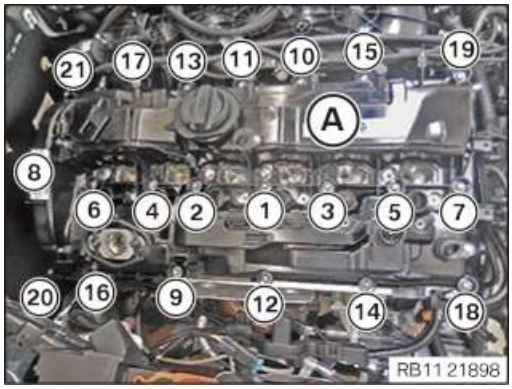


- Unlock and detach connector (1) on the intake camshaft sensor.
- Loosen clamps (2).

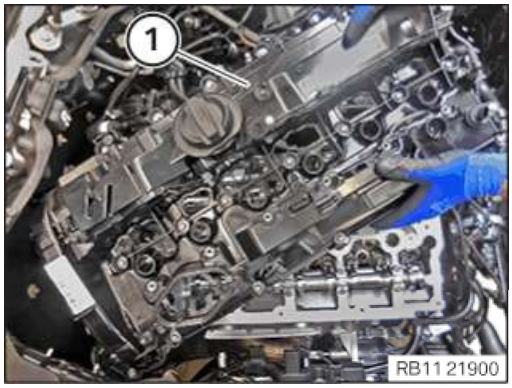


- Loosen clamps (1).

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- Release all screws on the cylinder head cover (A) in the sequence (21) to (1).



- Guide the cylinder head cover (1) out and remove it.

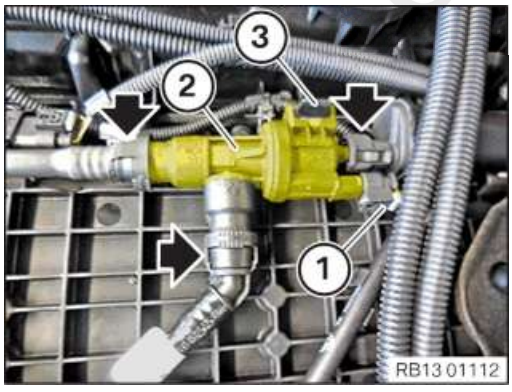
22 – Remove tank vent valve

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

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



- Unlock and disconnect connector (1).
- Unlock and disconnect the tank ventilation lines (arrows).
- Detach and remove the tank vent valve (2) from the holder (3).

23 – Removing the intake plenum

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RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

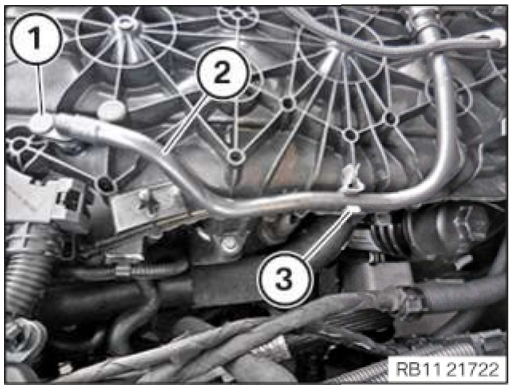
- Do not pull on the wires when disconnecting connectors and plug connections.

TECHNICAL INFORMATION

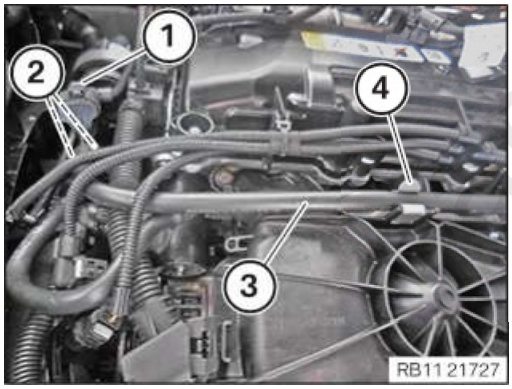
Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

TECHNICAL INFORMATION

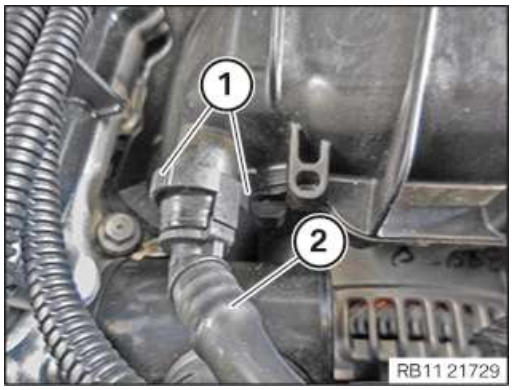
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screw (1).
- Guide tank ventilation line (2) out of clamp (3) and remove it.

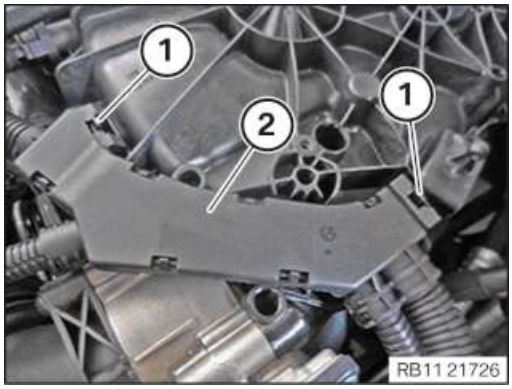


- Unlock and loosen connector (1).
- Unlock the locks (2).
- Guide tank ventilation line (3) out of clamp (4) and remove it.

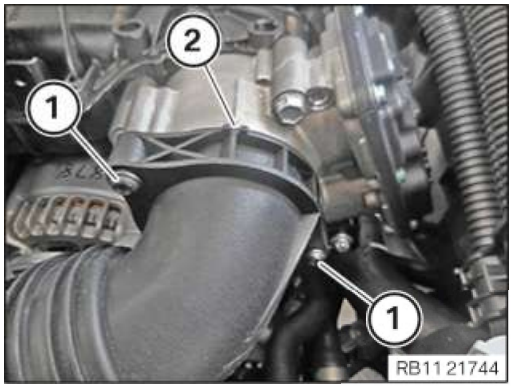


- Unlock the locks (1).
- Feed the tank ventilation line (2) out and set it aside.

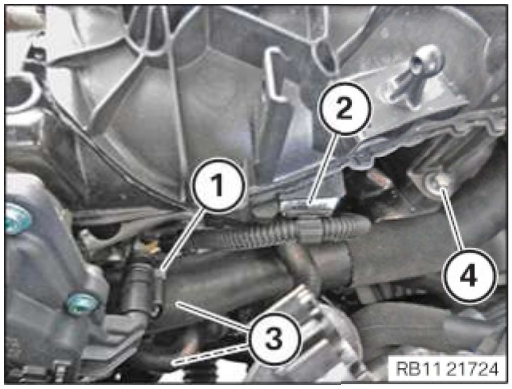
.com



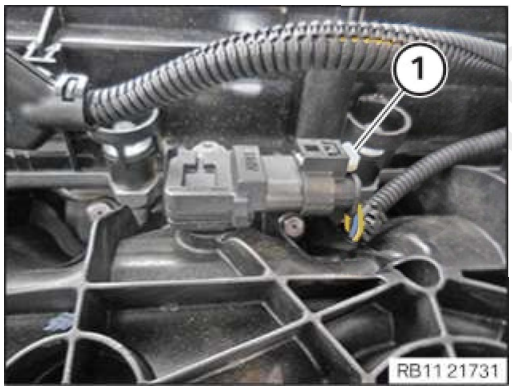
- Unlock the locks (1).
- Guide out the wiring harness section (2) for the sensor system **2** and place to one side.



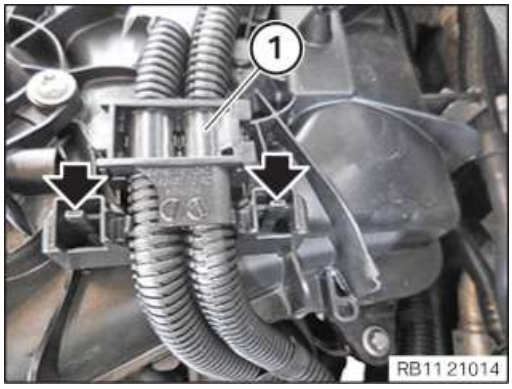
- Loosen screws (1).
- Feed out charge air line (2) and place to one side.



- Unlock and loosen connector (1).
- Loosen clamp (2).
- Thread off coolant line (3) and place to the side.
- Loosen screw (4).

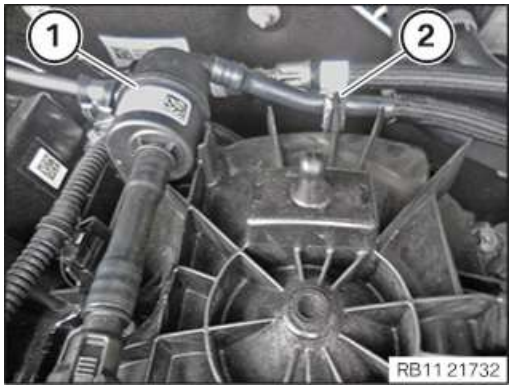


- Unlock and loosen connector (1).

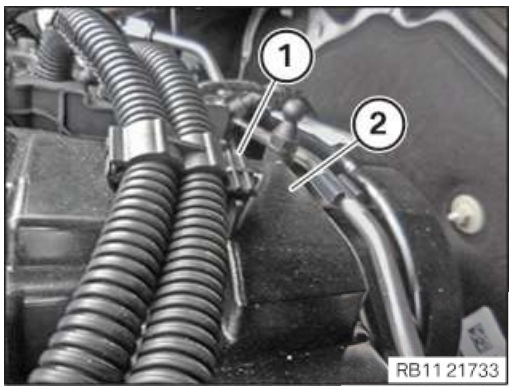


- Unlock the locks (arrows).
- Thread out the wiring harness section (1) for the injectors and ignition coils and set it aside.

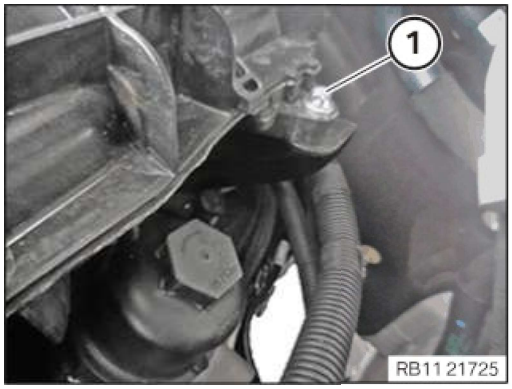
fdiagn.com



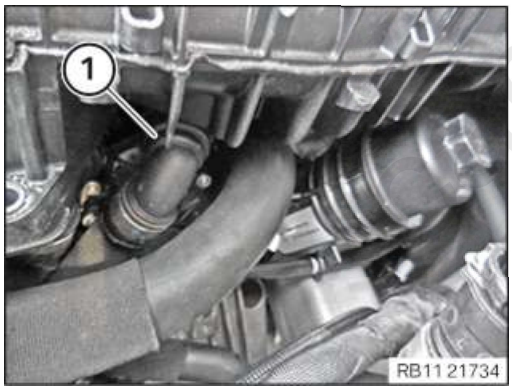
- Guide tank ventilation line (1) out of clamp (2) and place it aside.



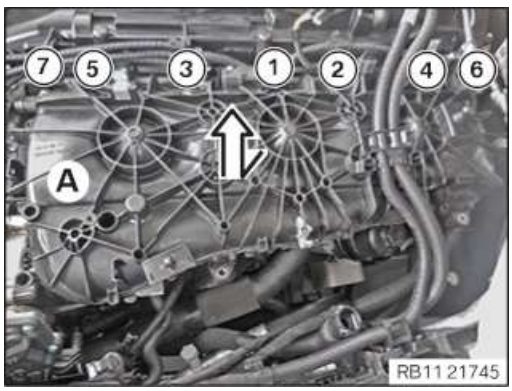
- Guide out the wiring harness section (1) for the injectors and ignition coils of the cylinder head cover (2) and set it aside.



- Loosen screw (1).

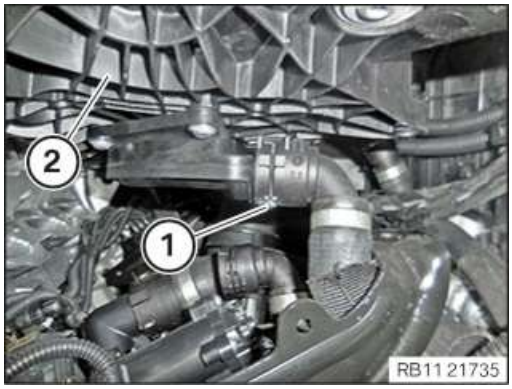


- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.



- Loosen screws in the order (7) to (1).
- Slightly raise intake plenum (A) in direction of arrow.

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TECHNICAL INFORMATION

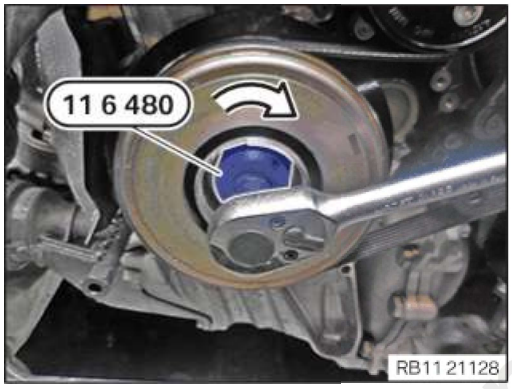
Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Unlock and release coolant line (1) below the intake plenum (2).
- Catch and dispose of escaping coolant.
- Thread out intake plenum (2) and remove.

24 – Block the engine with the special tool in TDC firing position



- Thread the sealing cap (1) out and remove.



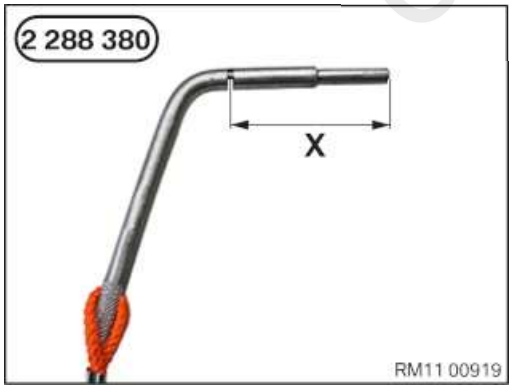
RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).

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- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

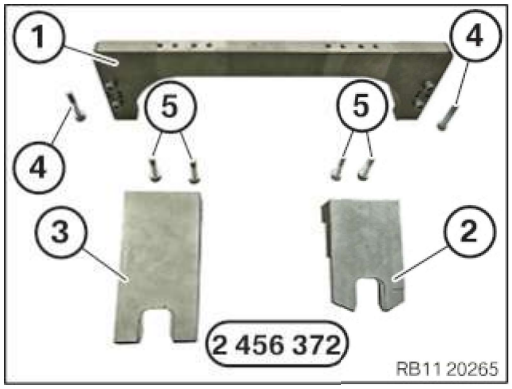
  The TDC firing position of cylinder 1 was **not** reached.



- **Vehicles with automatic transmission:**

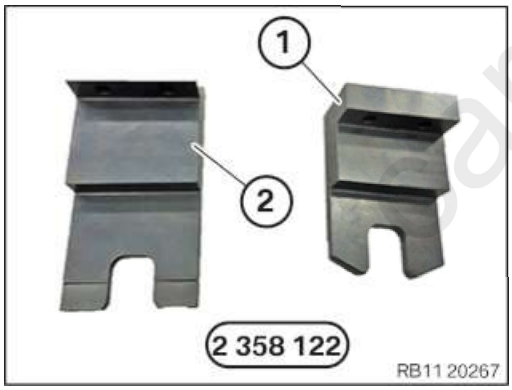
  Special tool 2 288 380 **correctly** positioned.

  The engine is in the TDC firing position of cylinder 1.



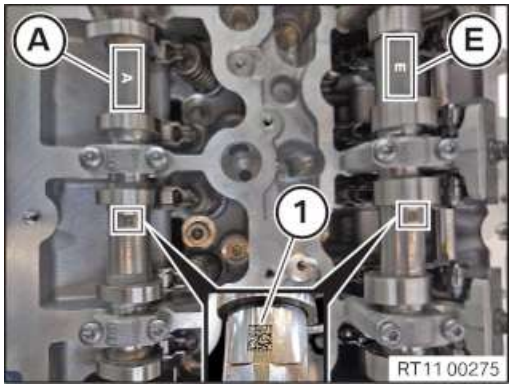
- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



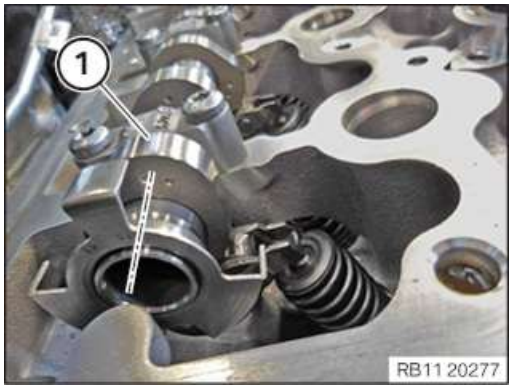
- Overview of the test gauges from the set of special tools 2 358 122:

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



- Turn intake camshaft (E) and exhaust camshaft (A) until marks (1) can be read from the top.

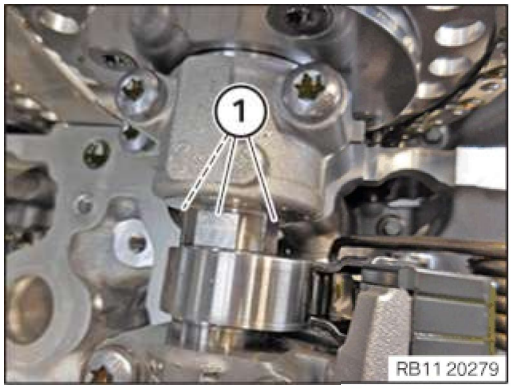
carldiag.com



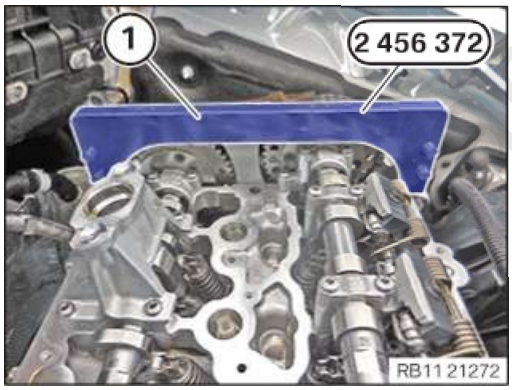
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



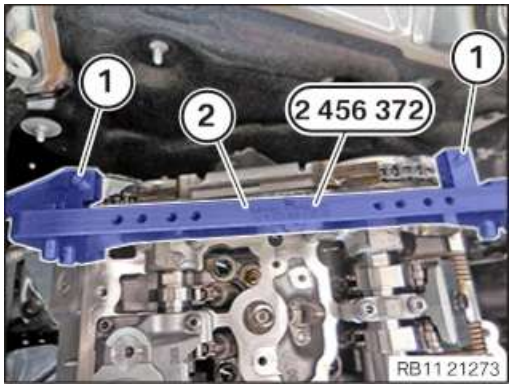
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



- Position basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.

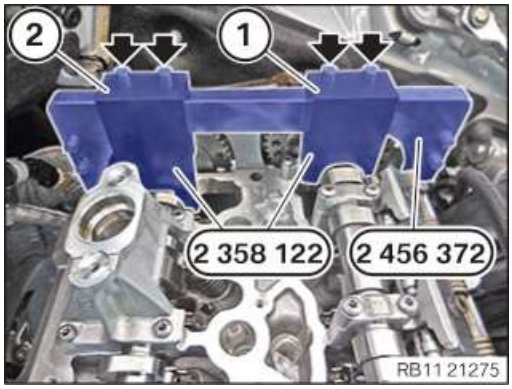


- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm

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- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

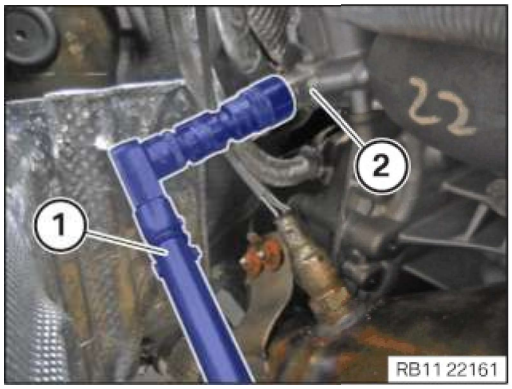
Test gauge to basic carrier

M6		Tightening torque	8 Nm

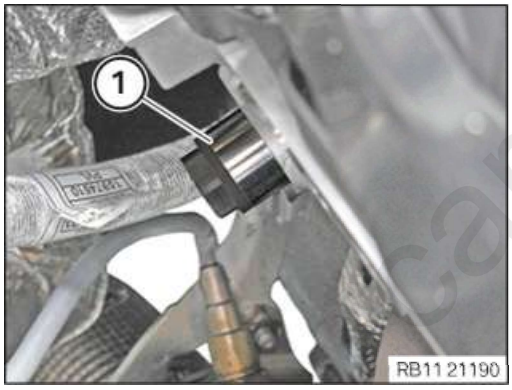
25 – Removing chain tensioner

TECHNICAL INFORMATION

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



- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).



- Feed out and remove the chain tensioner (1).

26 – Releasing the VANOS central valve of the intake adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

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NOTICE

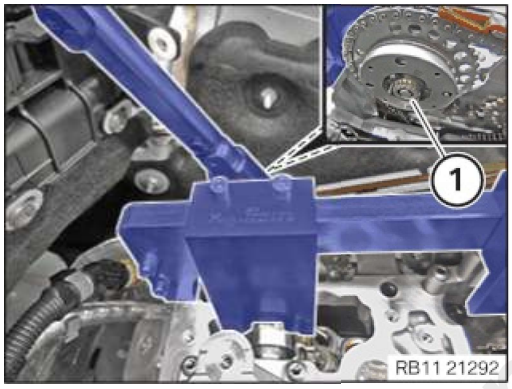
The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the intake adjuster.

27 – Releasing VANOS central valve of the exhaust camshaft adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

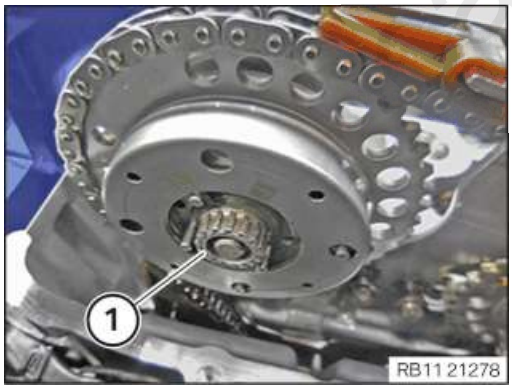


NOTICE

The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

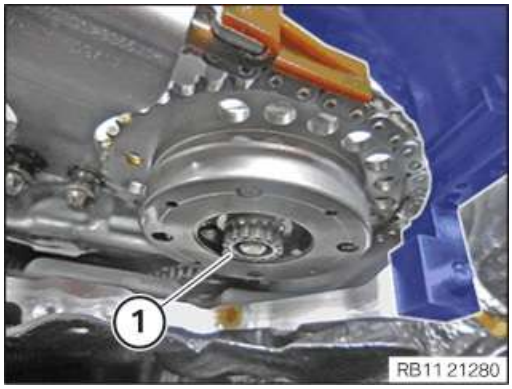
28 – Removing the VANOS central valve of the intake adjuster



- Guide out and remove the VANOS central valve (1) of the intake adjuster.

29 – Remove the VANOS central valve of the exhaust camshaft adjuster

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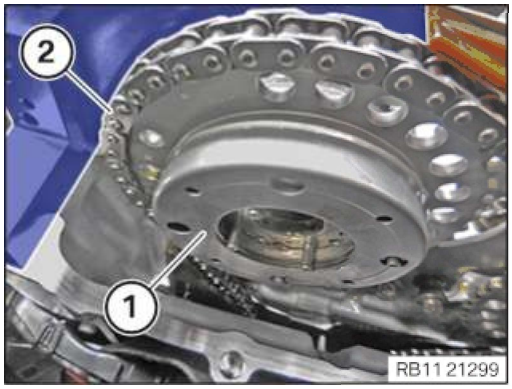


- Guide out and remove the VANOS central valve (1) of the exhaust camshaft adjuster.

30 – Removing intake adjuster

NOTICE

The figure shows the rear side of the engine.

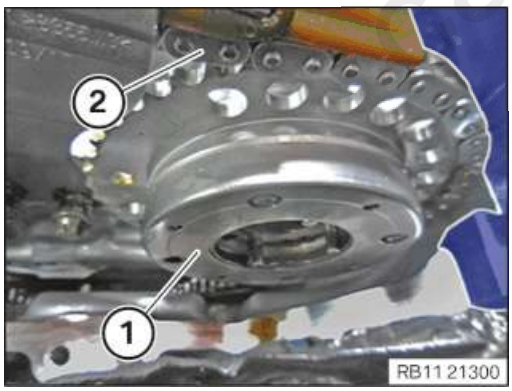


- Guide out the intake adjuster (1) from the timing chain (2) and remove.

31 – Remove exhaust camshaft adjuster

NOTICE

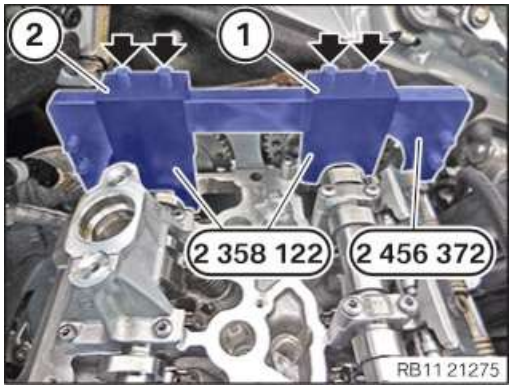
The figure shows the rear side of the engine.



- Guide out the exhaust camshaft adjuster (1) from the timing chain (2) and remove.

32 – Remove the test gauges to fix the camshafts

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- Remove screws (arrows).
- Guide out and remove test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier of the set of special tools 2 456 372.
- Guide out and remove test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier of the set of special tools 2 456 372.

33 – Remove cylinder head.

CAUTION

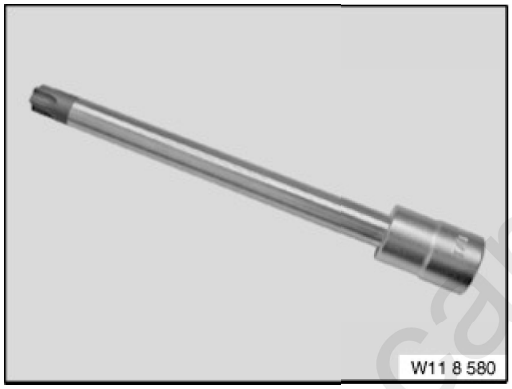
Heavy component.

Heavy components can lead to injury or damage.

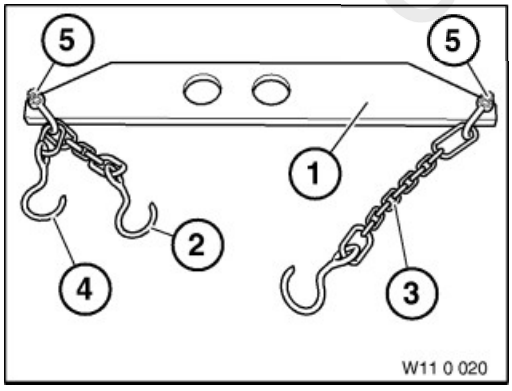
- Remove and install heavy components with the aid of another person/other persons.

TECHNICAL INFORMATION

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



- Prepare special tool 0 495 747 (11 8 580).

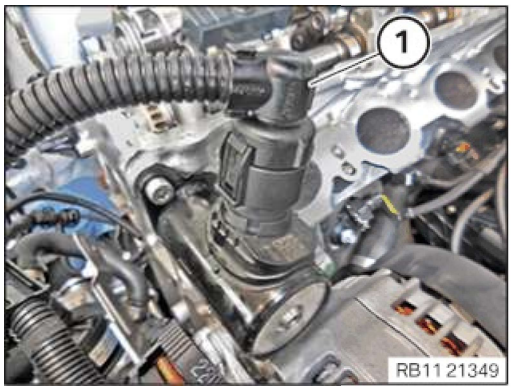


- Prepare special tool 0 490 567 (11 0 020).

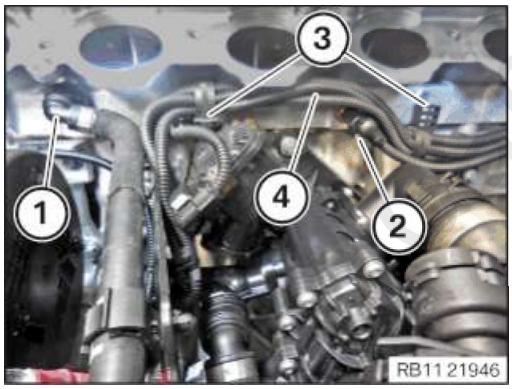
cardiagn.com



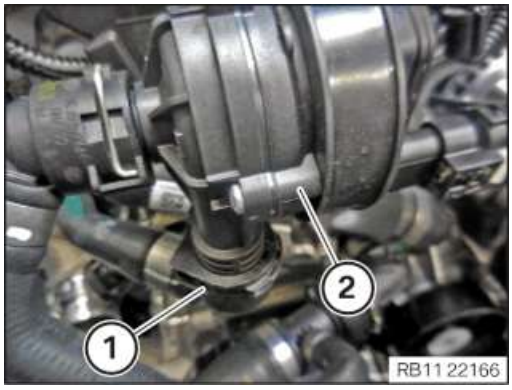
- Prepare the workshop crane 2 220 718.



- Unlock plug connection (1) and disconnect.

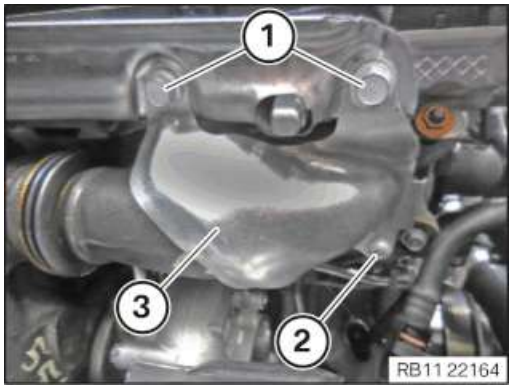


- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.
- Unlock plug connection (2) and disconnect.
- Loosen clamps (3).
- Feed out wiring harness section (4) for sensor system **1** and set it aside.



- Unlock and release coolant return line (1) on coolant pump (2) for the exhaust turbocharger.
- Catch and dispose of escaping coolant.

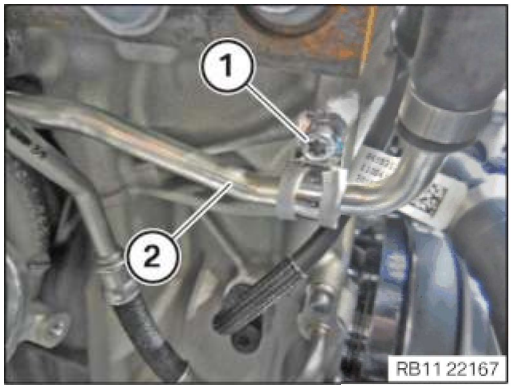
rdiagn.com



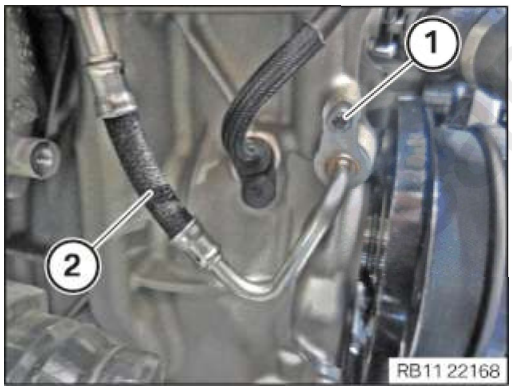
- Loosen screws (1).
- Loosen screw (2).
- Feed out and remove the heat shield (3).



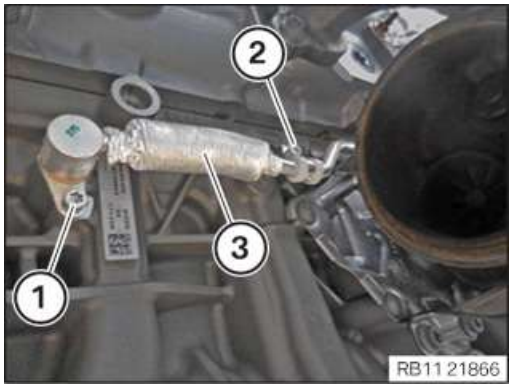
- Loosen screws (1).
- Feed out and remove the heat shield (2).



- Release screw (1) on coolant return line (2).

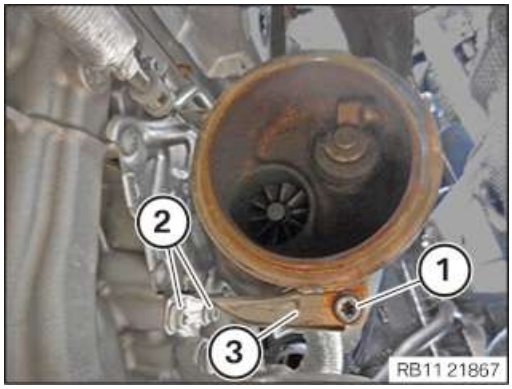


- Loosen screw (1).
- Guide out oil feed line (2) for the exhaust turbocharger and place it aside.
- Catch and dispose of emerging engine oil.

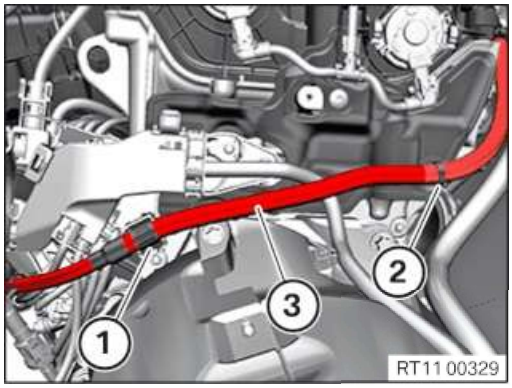


- Loosen screws (1) and (2).
- Guide the coolant feed line for exhaust turbocharger (3) from the crankcase and place it aside.
- Catch and dispose of escaping coolant.

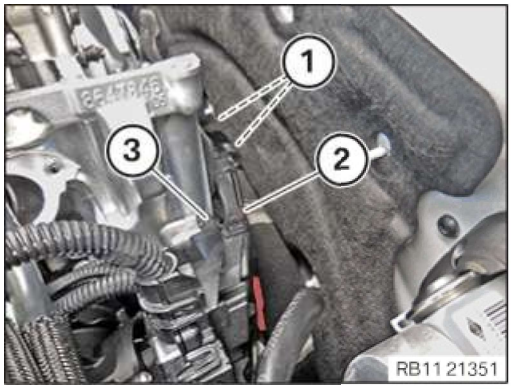
rdiagn.com



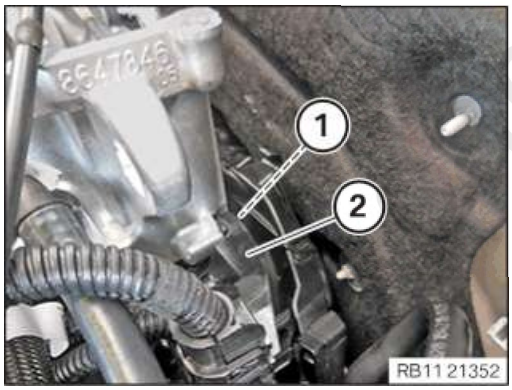
- Loosen screws (1) and (2).
- Feed the support (3) out and remove.



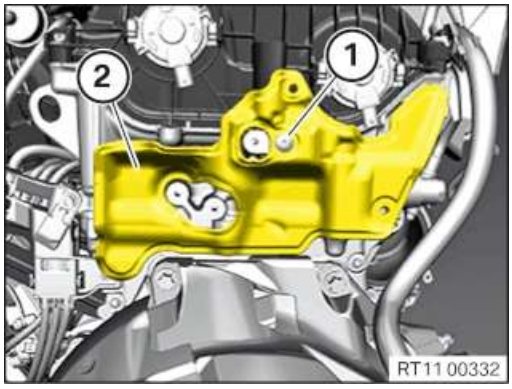
- Unlock and release clamps (1) and (2).
- Feed out positive battery cable (3) and put to one side.



- Loosen screws (1).
- Guide out transmission wiring harness (2) on wiring harness section (3) for sensor system 1 and set it aside.



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

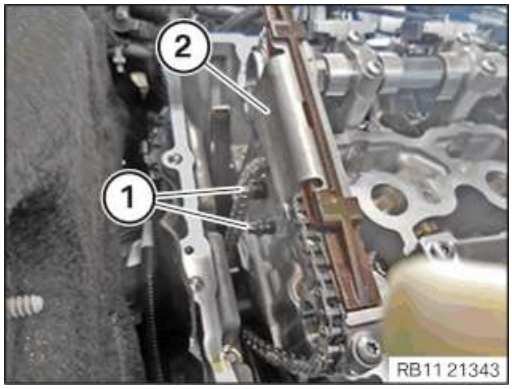


NOTICE

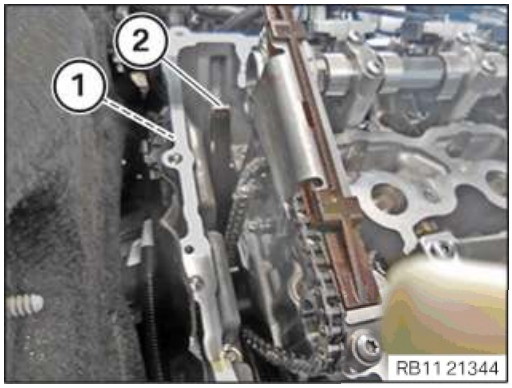
The figure shows the rear side of the engine.

- Loosen screw (1).
- Guide out and remove the cover (2).

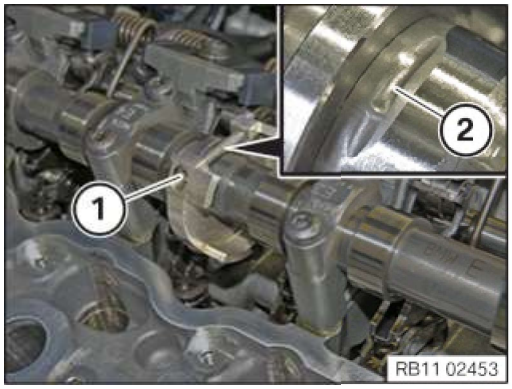
mdiagn.com



- Loosen screws (1).
- Guide out the slide rail (2) and remove.

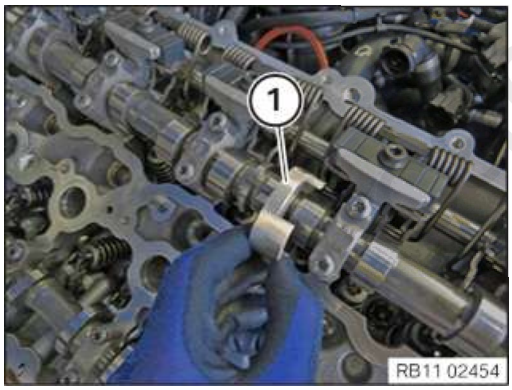


- Release the bearing journal (1) from the guide rail (2).



- Rotate intake camshaft, if necessary in the position shown.

  The recess (2) must point upwards.
- Loosen screw (1).



- Slide camshaft sensor wheel (1) in the direction of cylinder 1 and guide it out from the intake camshaft.

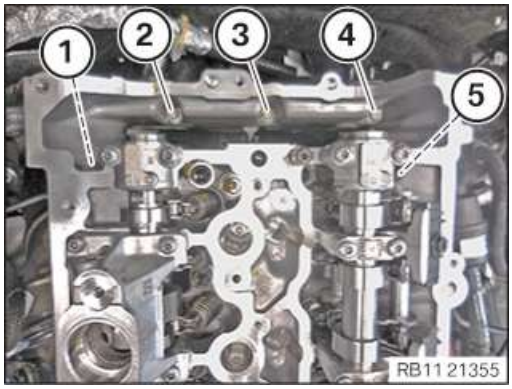


- Guide in and position special tool on the cylinder head.
- Tighten the screws (1) of special tool .

Special tool to cylinder head

M8		Tightening torque	21,5 Nm

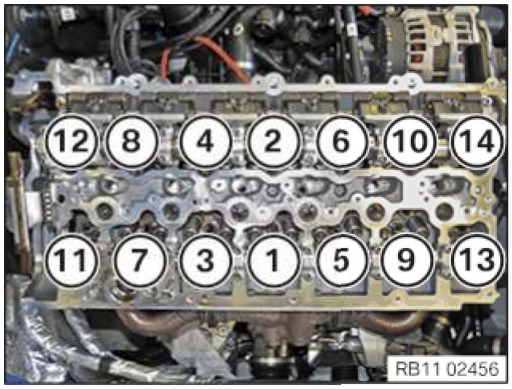
rdiagn.com



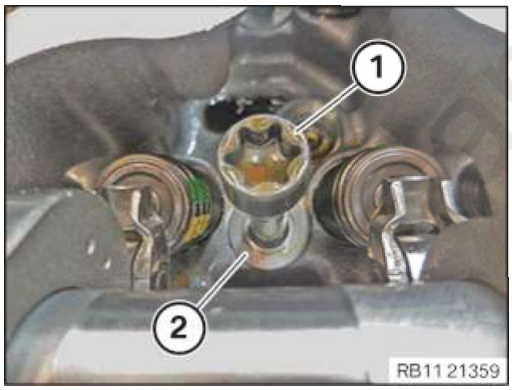
- Loosen the cylinder head bolts in the sequence from (5) to (1).



- Release cylinder head bolts with the special tool 0 495 747 (11 8 580).

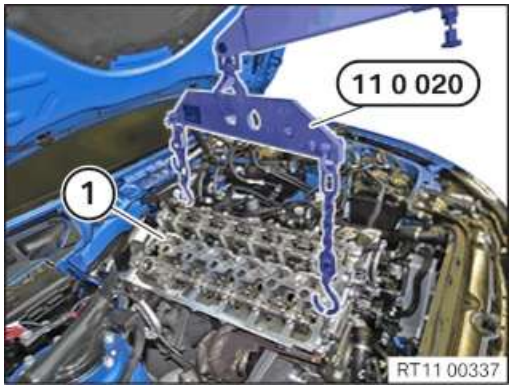


- Undo the screws using the special tool 0 495 747 (11 8 580) in the order (14) to (1) .



- Feed out and remove all the cylinder head bolts (1).
- Feed out and remove all the washers (2).

erdiagn.com



CAUTION

Heavy component.

Heavy components can lead to injury or damage.

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

RISK OF DAMAGE

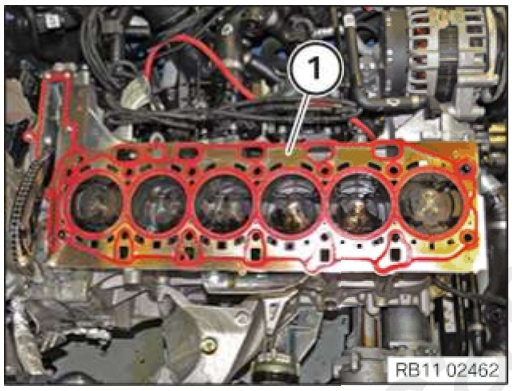
Damage to the guide rails.

Large amounts of force may damage the guide rails of the timing chain.

- Make sure not to damage the guide rail with the cylinder head when removing and installing the cylinder head.

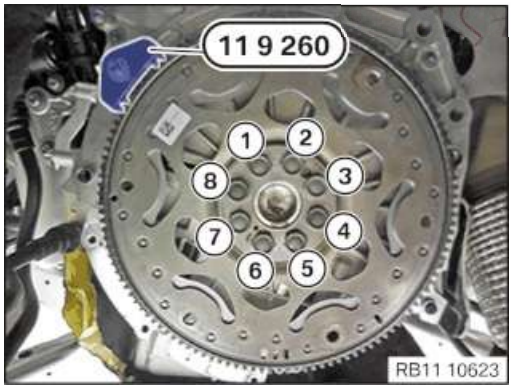
- Attach special tool 0 490 567 (11 0 020) to workshop crane.
- Lift out cylinder head (1) and the exhaust turbocharger with an auxiliary person, the workshop crane and special tool 0 490 567 (11 0 020).

34 – Removing the cylinder head gasket



- Thread out and remove cylinder head gasket (1).

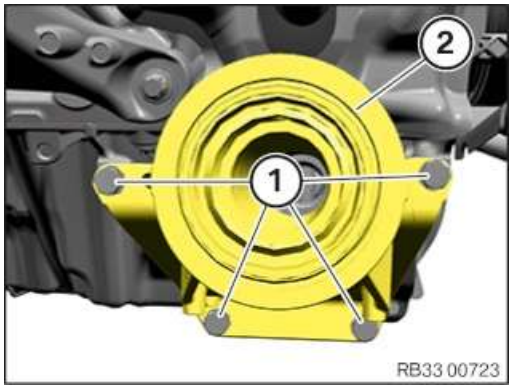
35 – Removing flywheel



- Fasten the flywheel with the special tool 0 493 938 (11 9 260) and tighten with the special tool 0 494 130 (11 9 264).
- Loosen screws (1-8).

36 – Remove bearing support

cardiagn.com

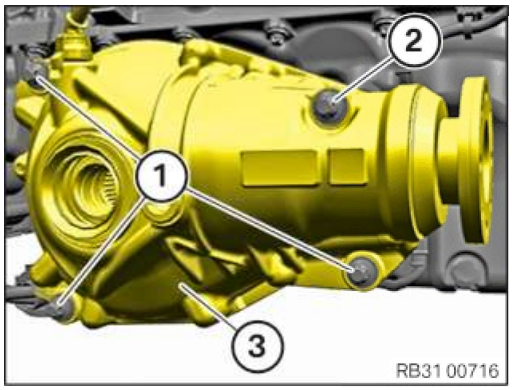


- Loosen screws (1).
- Remove the bearing support (2).

37 – Remove front axle differential

TECHNICAL INFORMATION

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



- Mark installation location of the screws (1) and (2).
  - Screws (1) M12x55
  - Screw (2) M12x105
- Loosen screws (1) and (2).
- Remove front axle differential (3).

38 – Remove oil sump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

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

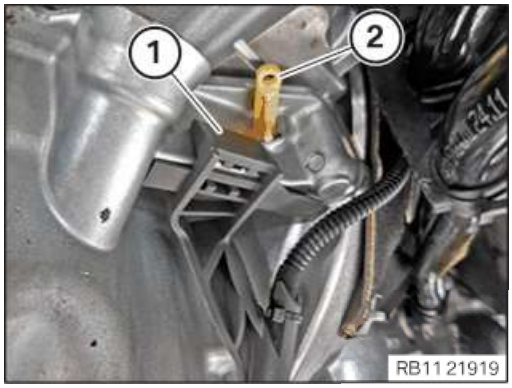
TECHNICAL INFORMATION

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

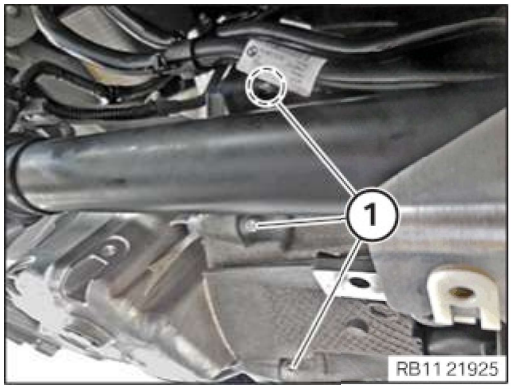
cardiagn.com



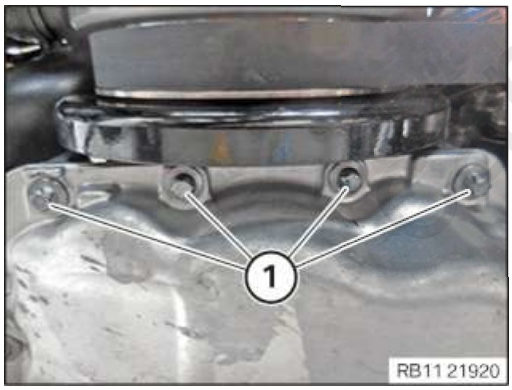
- Unlock clamps (arrows) and disconnect.
- Unlock and loosen connector (1).



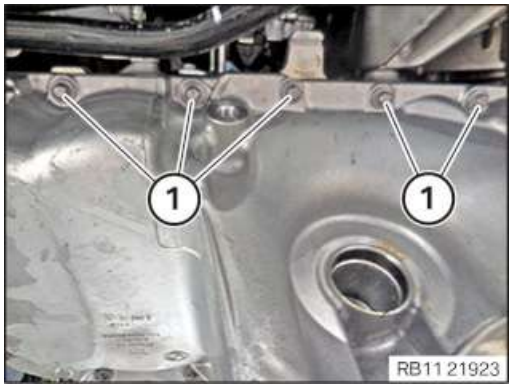
- Loosen clamp (1).
- Thread the sealing cap (2) out and remove.



- Unscrew the transmission bolts (1).

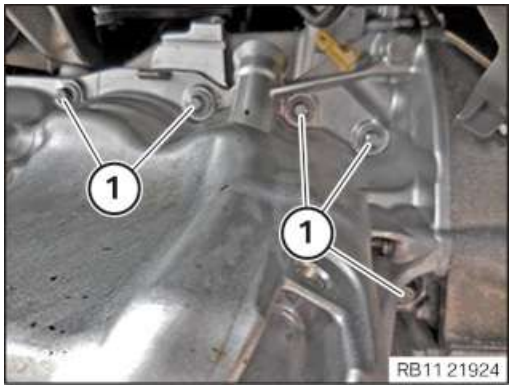


- Loosen screws (1).

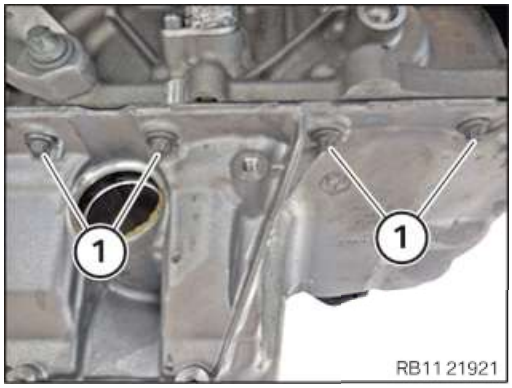


- Loosen screws (1).

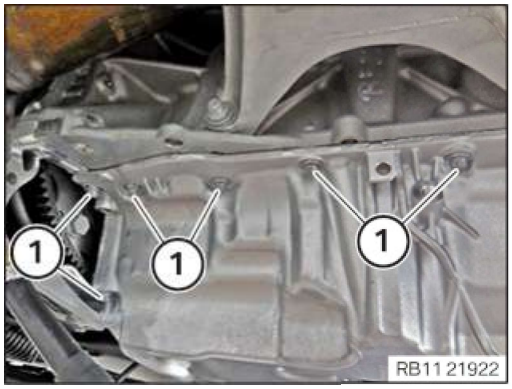
rdiagn.com



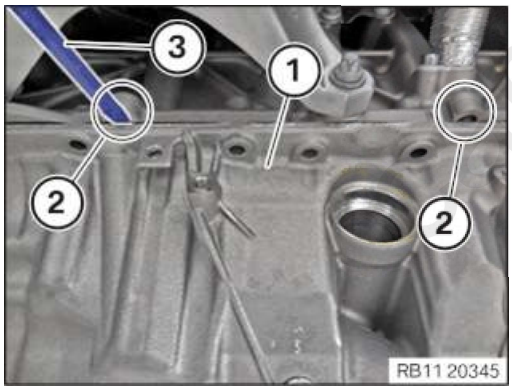
- Loosen screws (1).



- Loosen screws (1).



- Loosen screws (1).

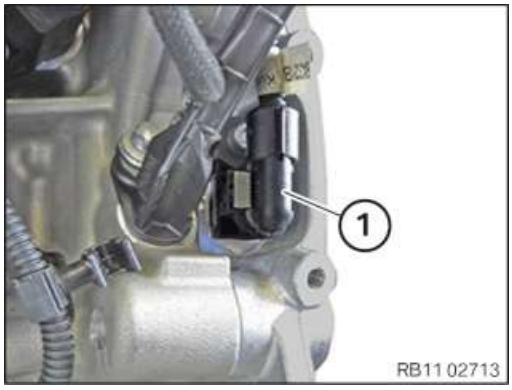


TECHNICAL INFORMATION

Increased force may be necessary during disassembly because the component is bonded with liquid sealing compound.

- Release the oil sump (1) in the **marked** areas (2) using suitable tools (3).
- Guide out the oil sump (1) downwards to the rear and remove.

39 – Remove rear timing case cover



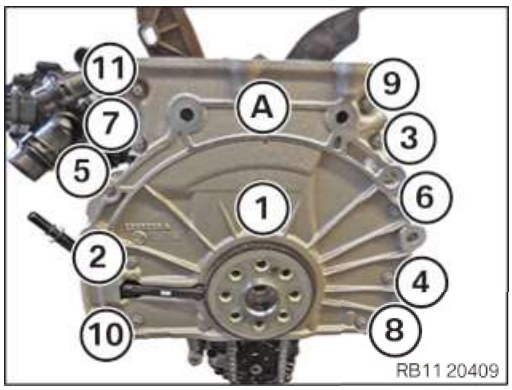
- Unlock the connector (1) and pull it off the crankshaft sensor.



TECHNICAL INFORMATION

Increment wheel is magnetic. Protect the increment wheel from contact with metallic swarf after disassembly.

- Remove the magnet wheel (1) from the crankshaft.



- Loosen screws in the order (11) to (1).

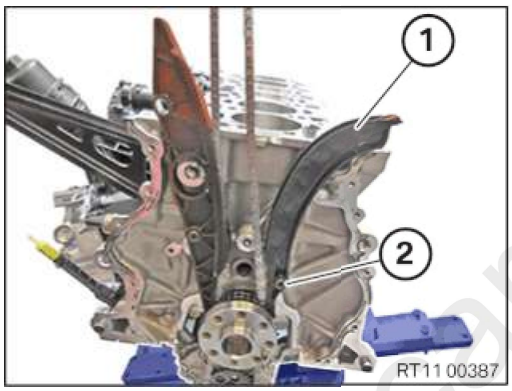
TECHNICAL INFORMATION

Increased force may be necessary during disassembly because the component is bonded with liquid sealing compound.

- Release and remove timing case cover (A) carefully.

MAIN WORK

40 – Removing timing chain



TECHNICAL INFORMATION

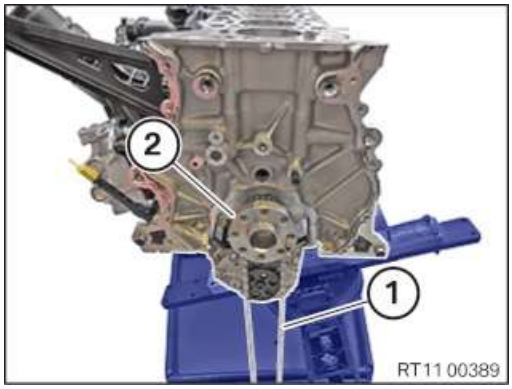
The bearing journal does not have to be removed.

- Thread the tensioning rail (1) out of the bearing journal (2) and remove.



- Loosen the bearing journals (1).
- Guide out the guide rail (2) and remove.

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- Pull timing chain (1) out from the crankshaft (2) and remove.

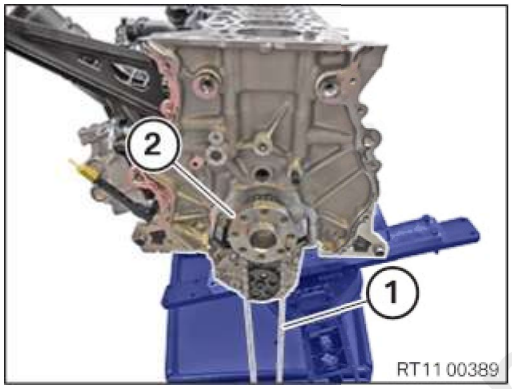
41 – Installing timing chain

RISK OF DAMAGE

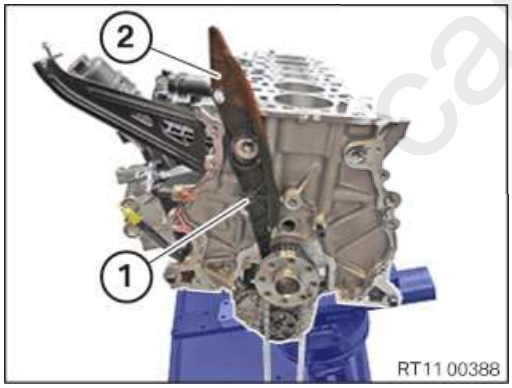
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

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



- Pull timing chain (1) in on the crankshaft (2) and install.



- Renew bearing journal (1).

  Parts: Bearing journal
- Insert and position the guide rail (2).

TECHNICAL INFORMATION

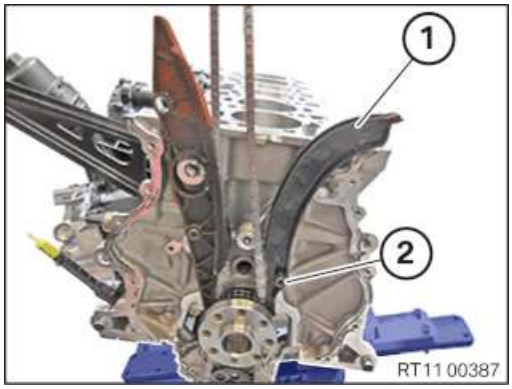
Clean screw thread.

- Tighten the bearing journals (1).

Bearing journal to crankcase

Bearing journal	Replace bearing journal.	Tightening torque	20 Nm

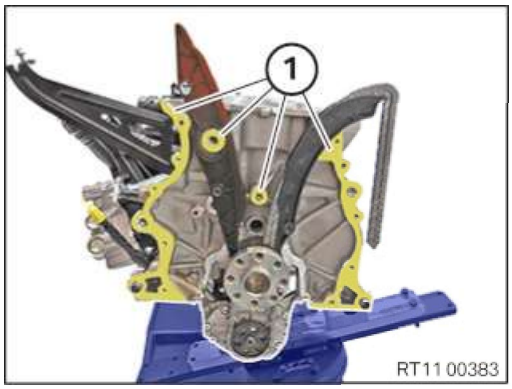
car-diagn.com



- Insert and install the tensioning rail (1) on the bearing journal (2).

POSTPROCESSES

42 – Install the rear timing case cover



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

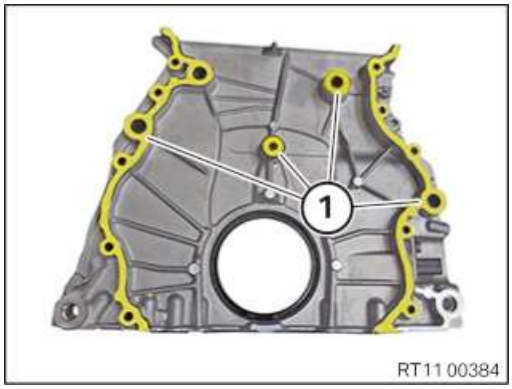
- Do not use any metal-cutting tools.

- Clean sealing surfaces (1) with special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215

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RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

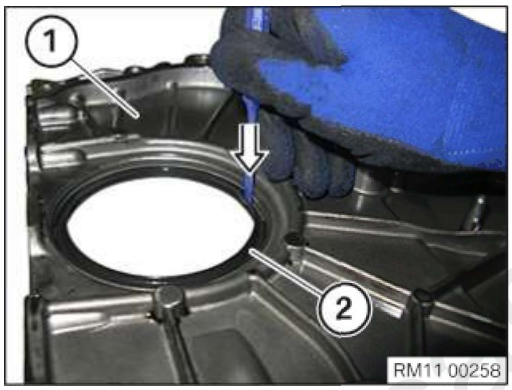
TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

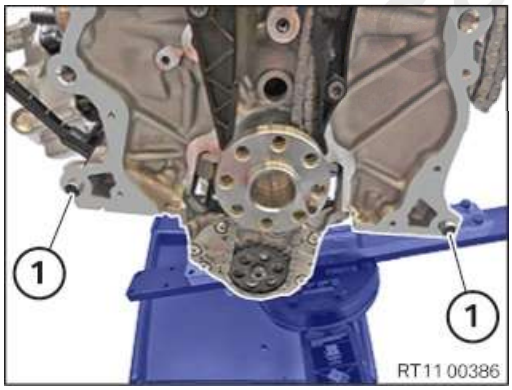
- Clean sealing surfaces (1) with special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215



- Position the timing case cover (1) underneath.
- Position the inner punch in the crankshaft sealing ring (2).
- Remove the crankshaft sealing ring (2) outward in the direction of the arrow.



- Check the fitting sleeves (1) for damage and renew if necessary.
- Check for correct fit of fitting sleeves(1).

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- Have the special tool ready.

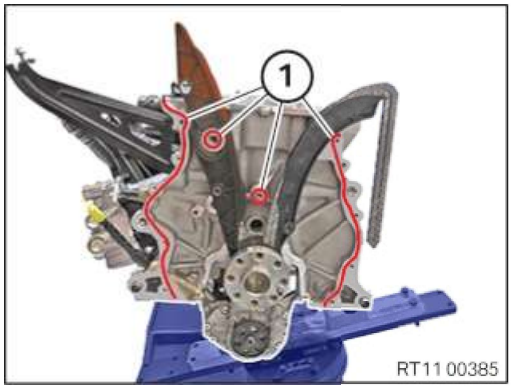


TECHNICAL INFORMATION

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

- Position the sealing compound (1) on special tool as shown.

  Parts: Sealing compound



TECHNICAL INFORMATION

The maximum application time of the liquid sealing compound is 12 minutes.

- Apply the sealing compound in area (1)along the inner edge.

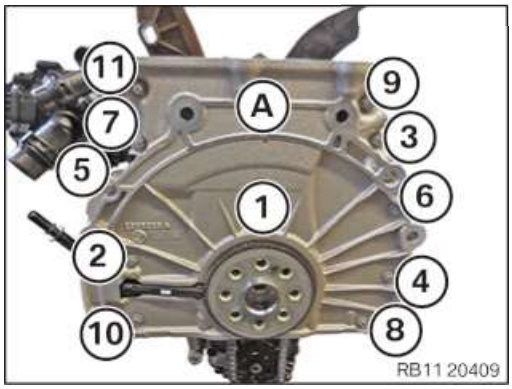
Sealing compound

Loctite 5970 liquid sealing compound	50 ml, Cartridge	83190404517

Overview of consumables (Electronic Parts Catalogue)

Height of the sealing bead

2,0 mm ... 2,5 mm



- Renew screws (1) to (11).

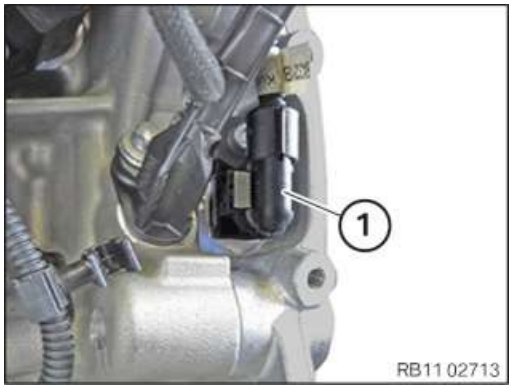
  Parts: Bolts

- Carefully mount the timing case cover (A).
- Tighten the bolts in sequence (1) to (11) with the special tool 0 490 504 (00 9 120).

Rear timing case cover to crankcase

M6 x 31	Renew screws.	Jointing torque	8 Nm
		Angle of rotation	90 °

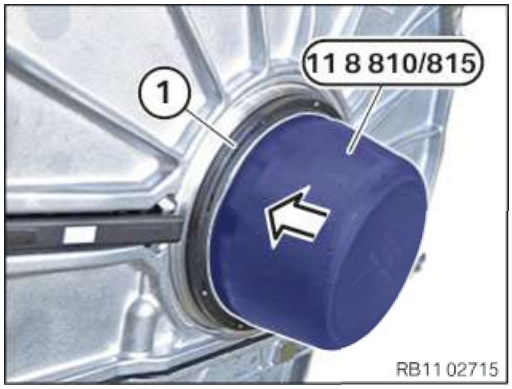
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- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

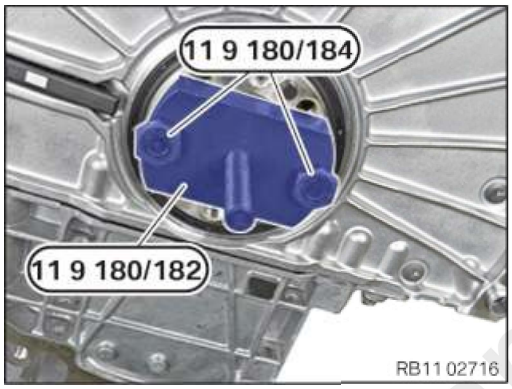
▸ **Installing the rear crankshaft seal**



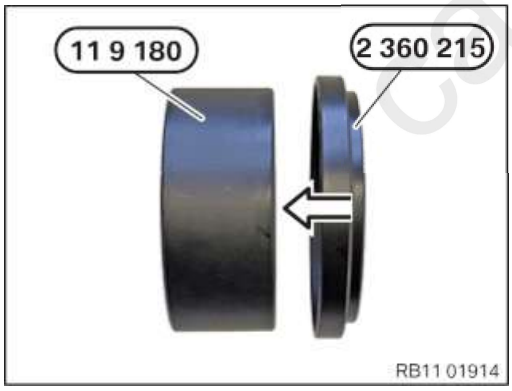
TECHNICAL INFORMATION

The radial shaft seal must be installed dry. Do not use engine oil or lubricant.

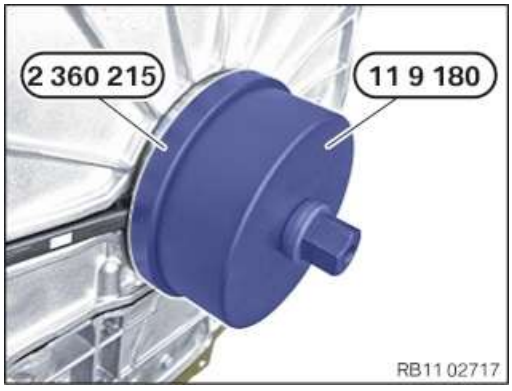
- Install special tool 0 496 137 (11 8 815) on the crankshaft.
- Slide off the crankshaft seal (1) over special tool 0 496 137 (11 8 815) so that it is fully in contact with the timing case cover.
- Guide the special tool 0 496 137 (11 8 815) out and remove.



- Secure special tool 0 494 029 (11 9 182) to the crankshaft using special tool 0 494 031 (11 9 184).



- Connect special tool 2 360 215 to special tool 0 494 028 (11 9 181).



- Position special tools 0 494 028 (11 9 181) and 2 360 215 and move them combined with special tool 0 494 030 (11 9 183) until they rest against the crankshaft sealing ring.
- Check the freedom of movement between the special tool 2 360 215 and the crankshaft sensor during installation.
- Screw in crankshaft seal until the limit position of the special tool 2 360 215 on the timing case cover.

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RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

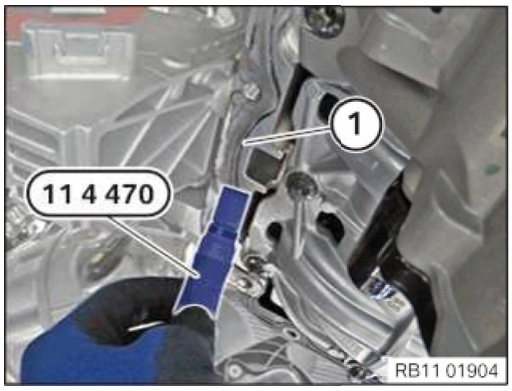
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.



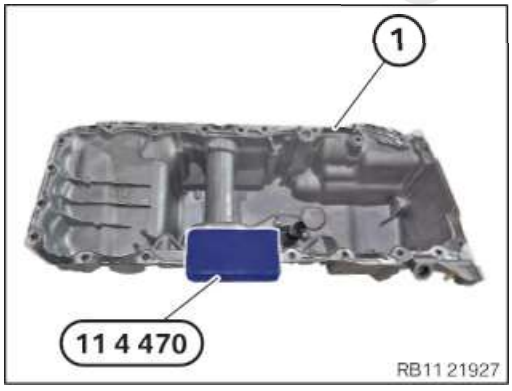
TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Remove the coarse sealing residue on sealing surface (1) on the crankcase with special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Remove the fine seal remains on the sealing surface (1) of the oil sump with the special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215

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- Have the special tool ready.

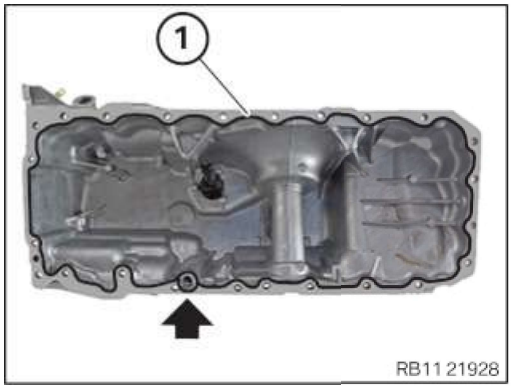


TECHNICAL INFORMATION

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

- Position the sealing compound (1) on special tool as shown.

  Parts: Sealing compound



TECHNICAL INFORMATION

The maximum application time of the liquid sealing compound is 12 minutes.

- Apply sealing bead (1) with the sealing compound in the **marked** area along the inner edge.

Sealing compound

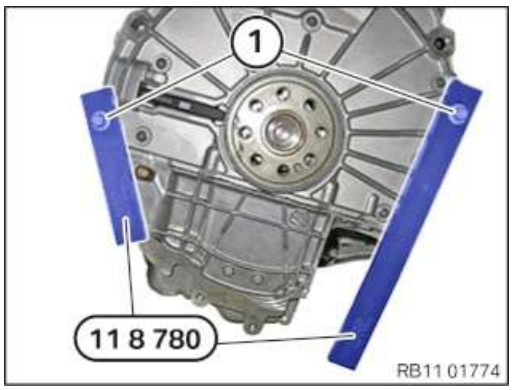
Loctite 5970 liquid sealing compound	50 ml, Cartridge	83190404517

Overview of consumables (Electronic Parts Catalogue)

Height of the sealing bead

	2,0 mm ... 2,5 mm

- Completely encircle the oil return orifice (arrow) with the sealing compound.



TECHNICAL INFORMATION

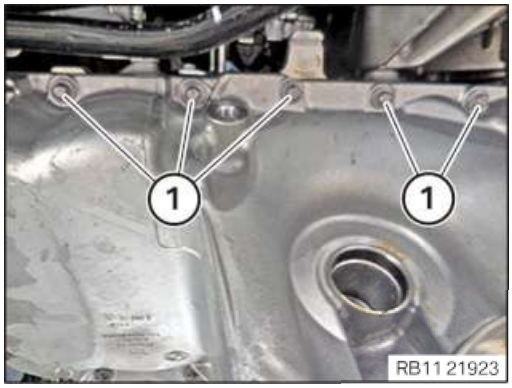
The special tool 11 8 780 is only required when the transmission is removed.

- Position the special tool 0 496 120 (11 8 780) with the transmission bolts (1) so that the oil sump is exactly flush with the timing case cover.
- Renew the centring sleeves where required.

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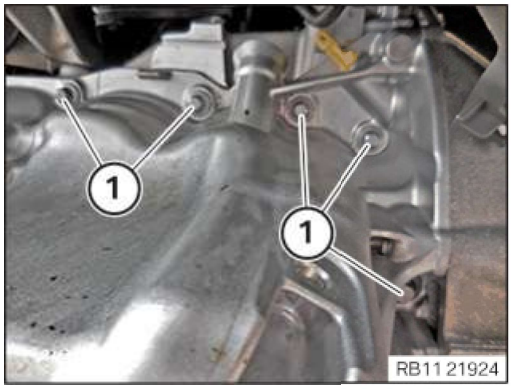
- Insert oil sump (1) upwards and forwards and position.



- Tighten the screws (1).

Oil sump to crankcase

M8 x 30		Tightening torque	24 Nm



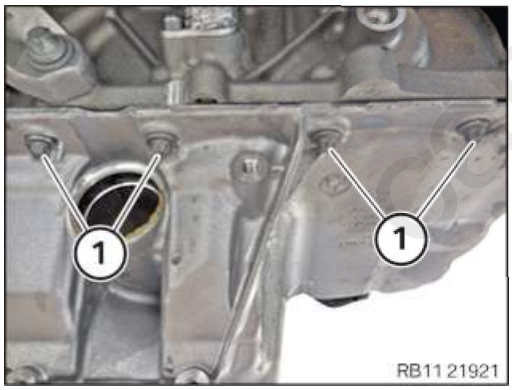
- Tighten the screws (1).

Oil sump to crankcase

M8 x 30		Tightening torque	24 Nm

Oil sump to crankcase

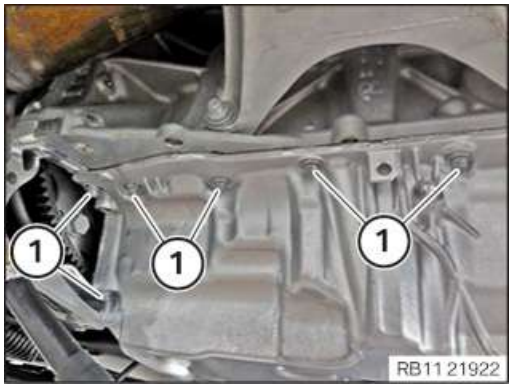
M8 x 110		Tightening torque	24 Nm



- Tighten the screws (1).

Oil sump to crankcase

M8 x 30		Tightening torque	24 Nm



- Tighten the screws (1).

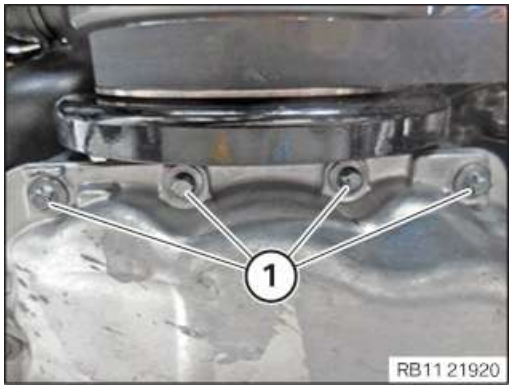
Oil sump to crankcase

M8 x 30		Tightening torque	24 Nm

Oil sump to crankcase

M8 x 110		Tightening torque	24 Nm

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- Tighten the screws (1).

Oil sump to crankcase

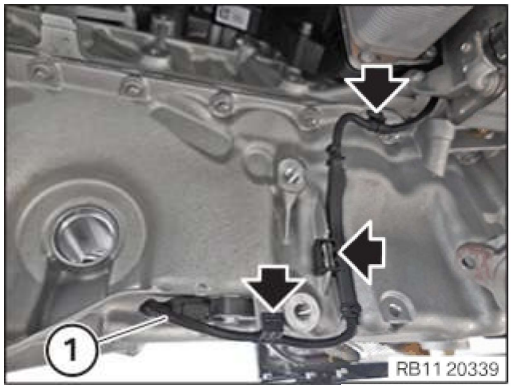
M8 x 30		Tightening torque	24 Nm



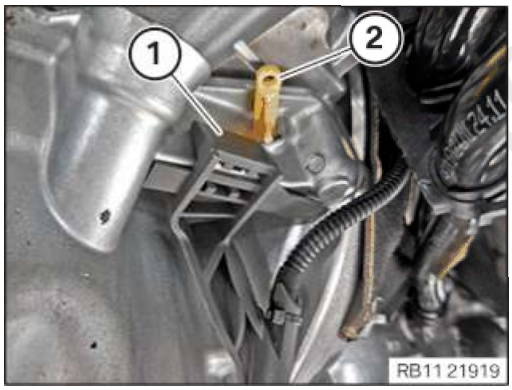
- Tighten transmission screws (1).

Transmission to oil sump (manual gearbox and automatic transmission)

M8 x 50		Tightening torque	19 Nm

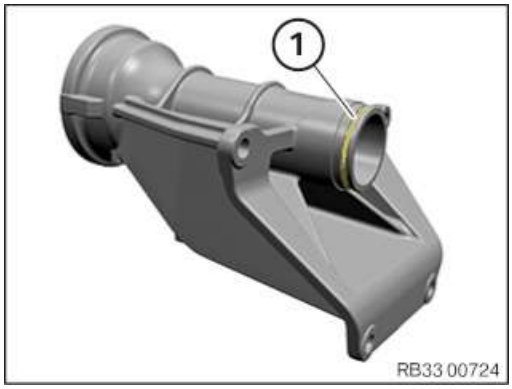


- Secure the clamps (arrows).
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.



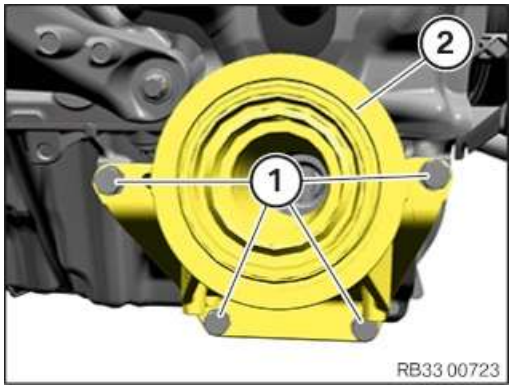
- Secure clamps (1).
- Guide in and install sealing cap (2).

44 – Install bearing support



- Coat the O-ring (1) with front axle transmission oil.

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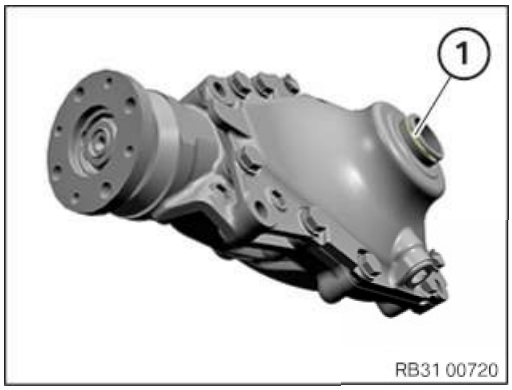


- Position the bearing support (2) at the engine oil sump.
- Tighten the screws (1).

Bearing support to oil sump

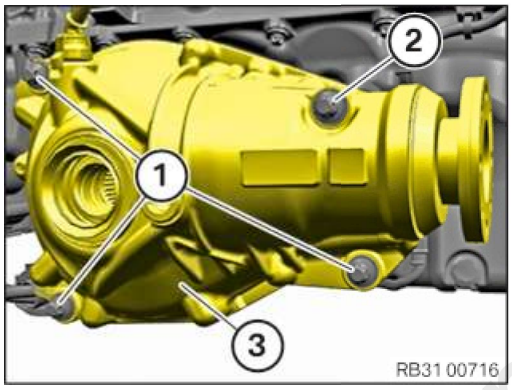
M8		Tightening torque	19 Nm

45 – Install front axle differential



- Renew O-ring (1).

  Parts: O-ring
- Coat the O-ring (1) with front axle transmission oil.



- Position front axle differential (3).

  Make sure marked screws are installed in correct installation locations:
  - Screws (1) M12x55
  - Screw (2) M12x105
- Tighten down screws (1) and (2).

Front axle final drive to engine oil pan

M12		Tightening torque	140 Nm

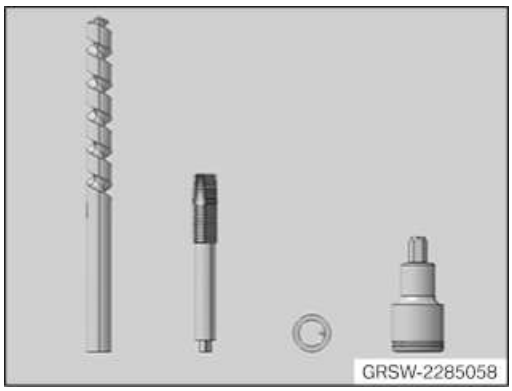
46 – Installing the flywheel



TECHNICAL INFORMATION

Clean all threads with a screw tap.

- Clean all the screw threads (1).



- Use the set of special tools 2 285 058.

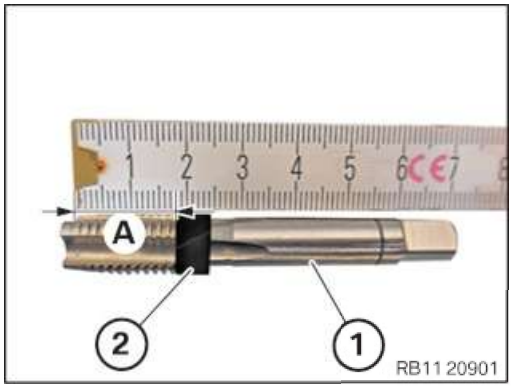
Description
Twist drill
Thread cutter M12x1.5
Depth
Insertion tool

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- Assemble tool set.

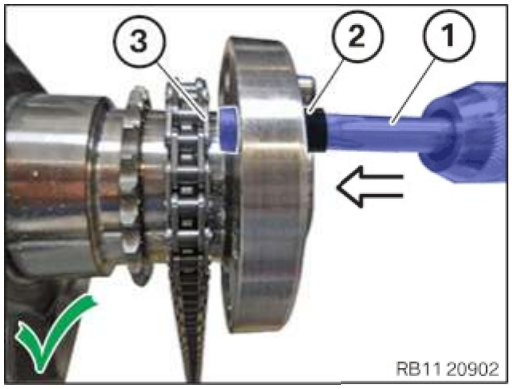
Number	Description
1	Tool holder
2	Thread cutter M12X1,5



- Mark the screw-in depth (A) on thread cutter (1) from the set of special tools 2 285 058 with a standard tool (2).

Screw-in depth of thread cutter

Screw-in depth	18 mm



NOTICE

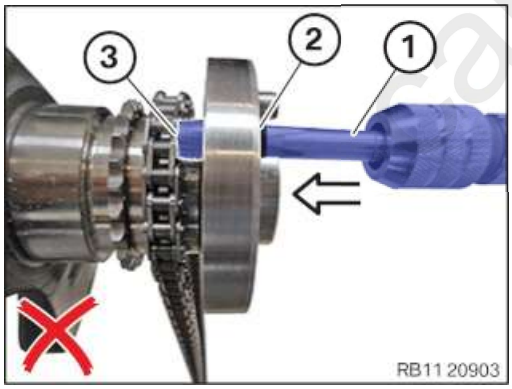
To provide a better overview: Shown with engine removed.

- Screw in the thread cutter (1) from the set of special tools 2 285 058 in direction of arrow up to the screw-in depth (2).

Screw-in depth of thread cutter

Screw-in depth	18 mm

- Make sure that the thread cutter does (1) **not** rest on the timing chain (3).



TECHNICAL INFORMATION

- **Carefully** handle the timing chain, to protect the timing chain and timing chain drive against damage.

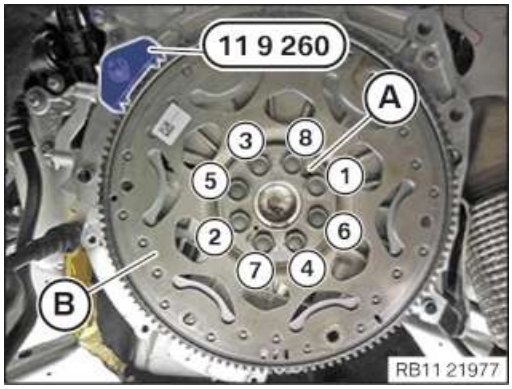
- Make sure that the screw-in depth (2) of the screw tap (1) is not exceeded.

  The thread cutter (1) may not rest on the timing chain (3).



- Make sure the magnet wheel (1) is installed correctly.

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- Renew screws (1) to (8).

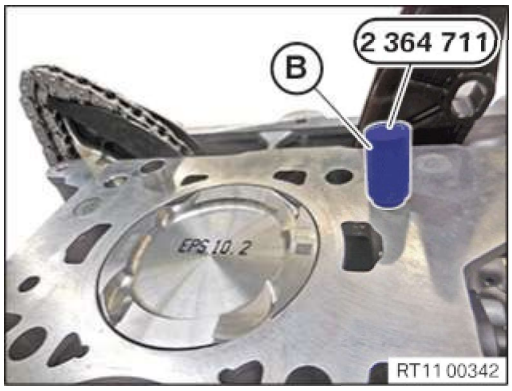
  Parts: Bolts
- Position flywheel (B) .
- Screw in flywheel bolt (1) to (8) by hand.
- Fix the flywheel (B) with the special tool 0 494 034 (11 9 261) and screw the special tool 0 494 130 (11 9 264) tightly.
- Make sure the tightening sequence starts at dowel pin (A).
- Tighten flywheel bolts in sequence (1) to (8).

Flywheel to crankshaft

M12x1.5	Renew screws.	Jointing torque	45 Nm
		Angle of rotation	40 °

- Remove special tool 0 493 938 (11 9 260).

47 – Sealing the oil duct



- Seal the oil duct using special tool (B) from the set of special tools 2 364 711.

48 – Clean sealing surfaces

RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

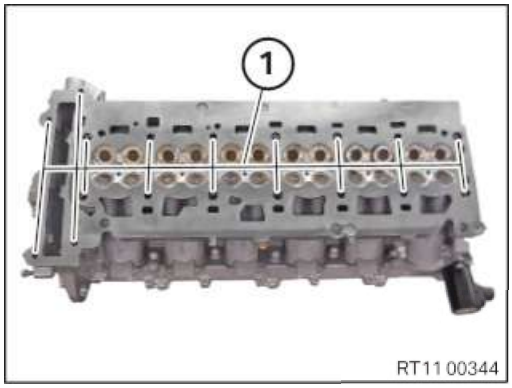


- Remove coarse backlogs from the sealing surfaces of the cylinder head using special tool 0 495 103 (11 4 471).

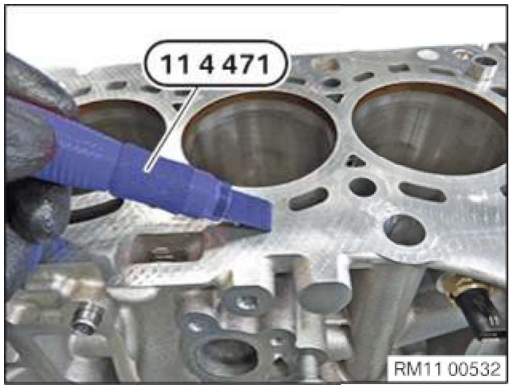
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- Remove fine residues from the sealing surfaces of the cylinder head using special tool 0 495 104 (11 4 472).



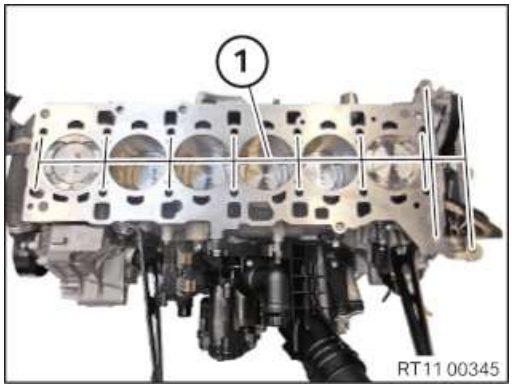
- Clean all blind holes (1) of the cylinder head.



- Remove coarse backlogs from the sealing surfaces of the crankcase using special tool 0 495 103 (11 4 471).



- Remove fine backlogs from the sealing surfaces of the crankcase using special tool 0 495 104 (11 4 472).
- Clean all blind holes of the crankcase.



CAUTION

Swirling dirt particles caused by compressed air.

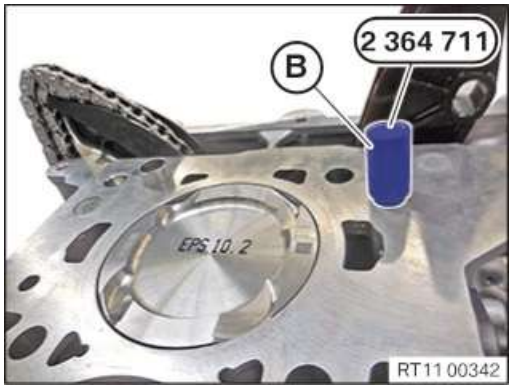
Danger of injury!

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

- Wear safety goggles.

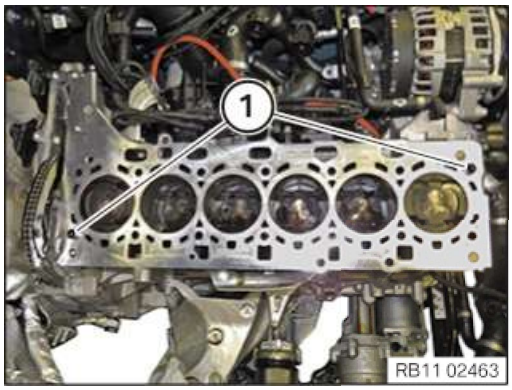
- Clean all threaded holes (1) of the crankcase with compressed air.

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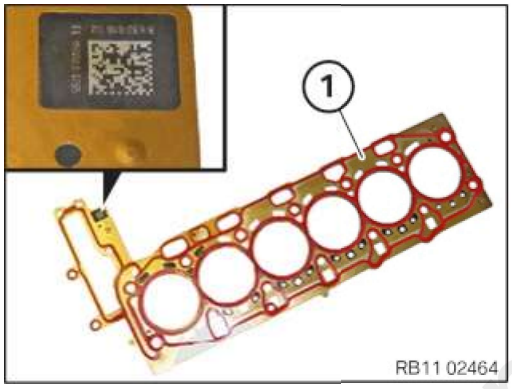


- Remove special tool (B) contained in the set of special tools 2 364 711.

49 – Installing the cylinder head gasket

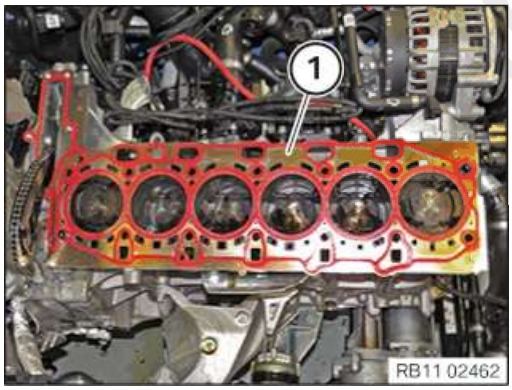


- Check the fitting sleeves (1) for damage and renew if necessary.



- Renew cylinder head gasket (1).

  Parts: Cylinder head gasket
- Install a thicker cylinder head gasket (1) with +0.3 mm in rebuilt cylinder heads.
- Check cylinder head gasket (1) using the part number.



- Install cylinder head gasket (1) and place it correctly on the fitting sleeves.

50 – Block the crankshaft in he TDC firing position of cylinder 1



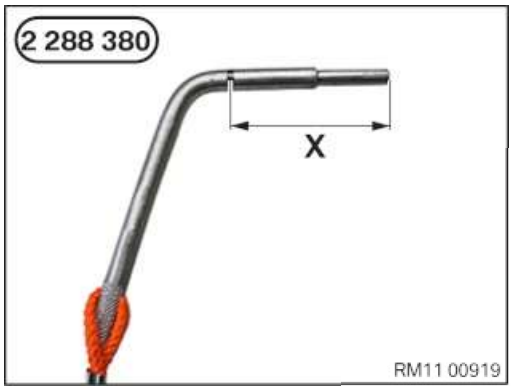
RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

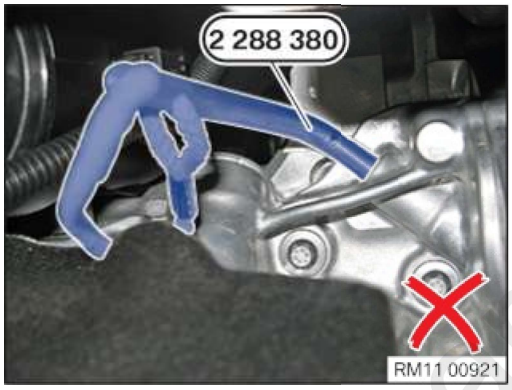
- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

  The engine is in the TDC firing position of cylinder 1.

51 – Installing the cylinder head

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

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

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RISK OF DAMAGE

Damage to threads.

Fluid in the threaded hole may damage the thread when screws are tightened in the threads.

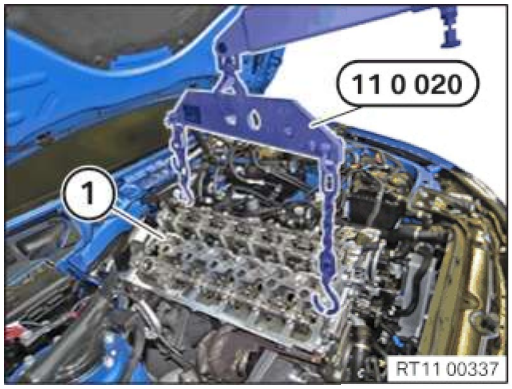
- Dry threaded holes (e.g. using compressed air).

TECHNICAL INFORMATION

Do not remove bolt coating.

TECHNICAL INFORMATION

When replacing the cylinder head: The complete valve control and the Valvetronic servomotor are already pre-assembled for new cylinder heads.



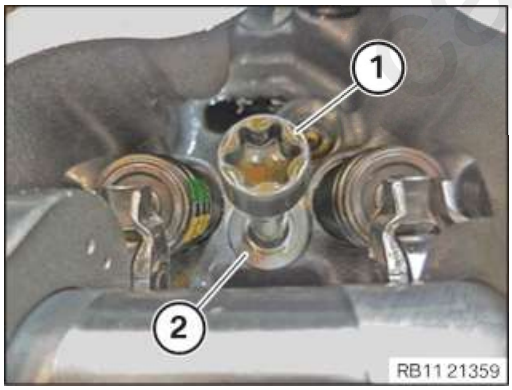
RISK OF DAMAGE

Damage to the guide rails.

Large amounts of force may damage the guide rails of the timing chain.

- Make sure not to damage the guide rail with the cylinder head when removing and installing the cylinder head.

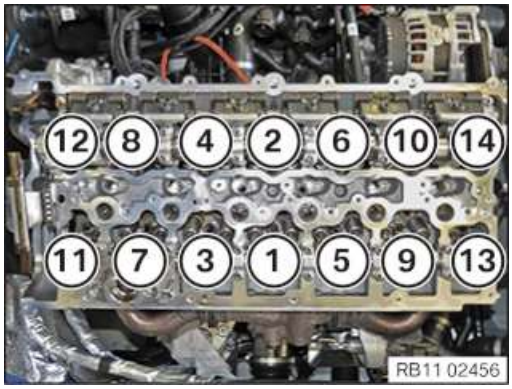
- Feed in, position and install cylinder head (1) and exhaust turbocharger with the help of an auxiliary person, the workshop crane and the special tool 0 490 567 (11 0 020).
- Ensure that the **guide rails** of the timing chain are **not** damaged.



- Insert and install washer (2).
- Renew the cylinder head bolts (1).

  Parts: Cylinder head bolts
- Do not wash off the coating (1) **of the cylinder head bolts** .
- **Lightly** oil contact surfaces of cylinder head bolt screw heads.

  No coolant, water or engine oil must be present in threaded holes of crankcase.
- Guide in and install cylinder head bolts (1).



TECHNICAL INFORMATION

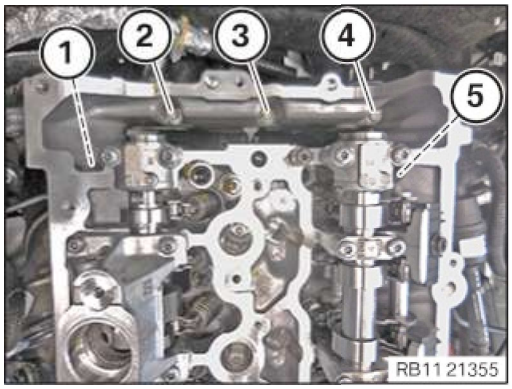
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Screw in the cylinder head bolts in the sequence (1) to (14).
- Tighten the cylinder head bolts using the special tool 0 495 747 (11 8 580) and 0 490 504 (00 9 120) in the sequence (1) to (14).

Cylinder head to crankcase

M11	Observe tightening sequence. Fit new cylinder head bolts.	1. Jointing torque 2. Angle of rotation 3. Angle of rotation	30 Nm 90 ° 180 °

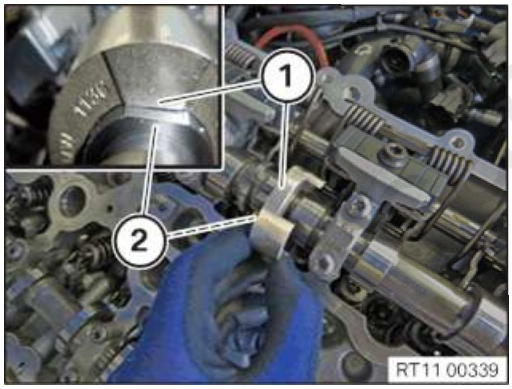


- Renew cylinder head bolts (1) to (5).

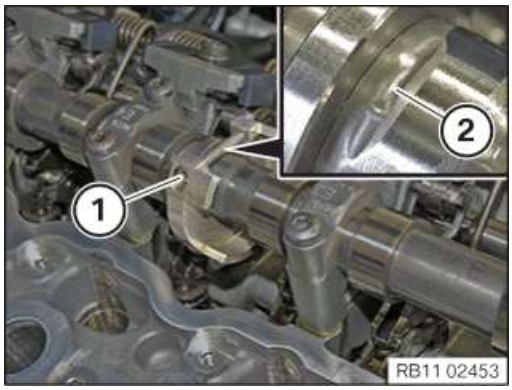
  Parts: Cylinder head bolts
- Make sure that there is **no** coolant, water or engine oil in the threaded holes of the timing case cover.
- Screw in cylinder head bolts (1) to (5).
- Tighten the cylinder head bolts in the order (1) to (5).

Cylinder head bolt to timing case cover

M8x40	Renew screws.	Tightening torque	19 Nm



- Feed in and position camshaft sensor wheel (1) on the intake camshaft (2).



- Rotate intake camshaft, if necessary in the position shown.

  The recess (2) must point upwards.
- Tighten down screw (1).

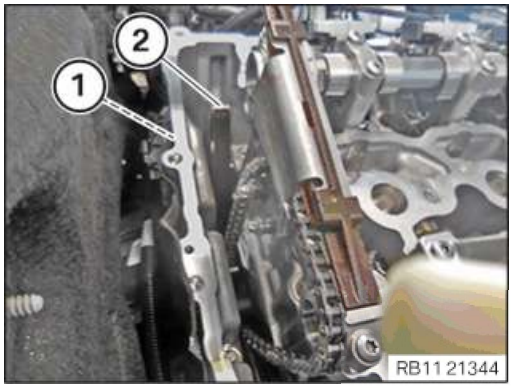
Camshaft sensor wheel to intake camshaft

M4 x35		4,5 Nm



- Renew bearing journal (1).

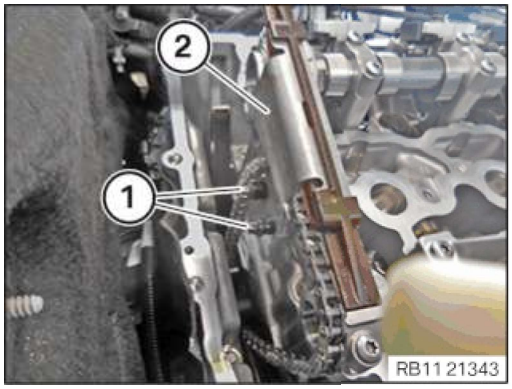
  Parts: Bearing journal



- Feed in and install bearing journal (1) on the guide rail (2).
- Tighten the bearing journals (1).

Bearing journal to cylinder head

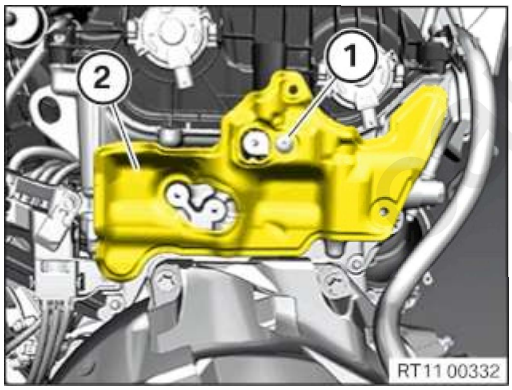
Bearing journal	Renew the bearing journal!	Tightening torque	20 Nm



- Insert slide rail (2) and install.
- Tighten the screws (1).

Sliding rail to cylinder head

M6x16			8 Nm

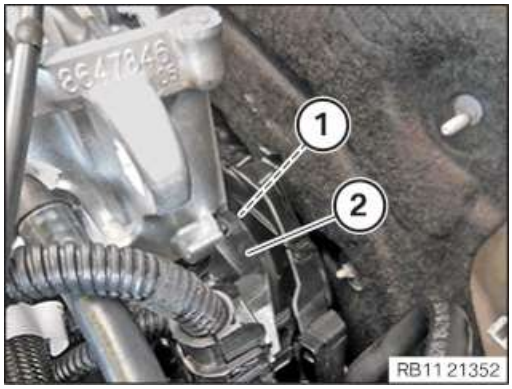


- Guide in and install cover (2).
- Tighten down screw (1).

Cover on rear cylinder head

M6		Tightening torque	8 Nm

carjdiagn.com



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

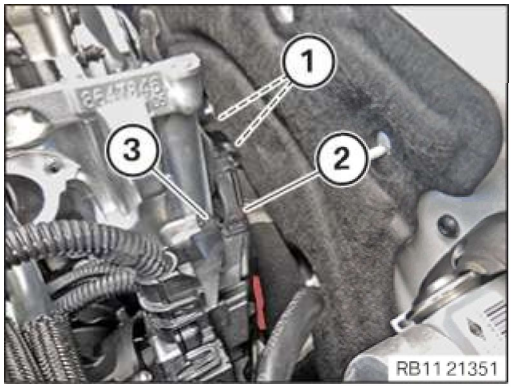
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

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

- Guide in and install wiring harness section (2) for sensor system 1.
- Tighten down screw (1).

Cable routing to cylinder head, rear

M6 x 20		Tightening torque	8 Nm



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

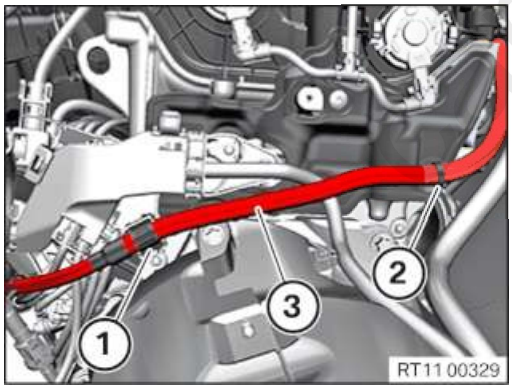
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

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

- Guide in and install transmission wiring harness (2) on wiring harness section (3) for sensor system 1.
- Tighten the screws (1).

Cable routing to cylinder head, rear

M6 x 20		Tightening torque	8 Nm



CAUTION

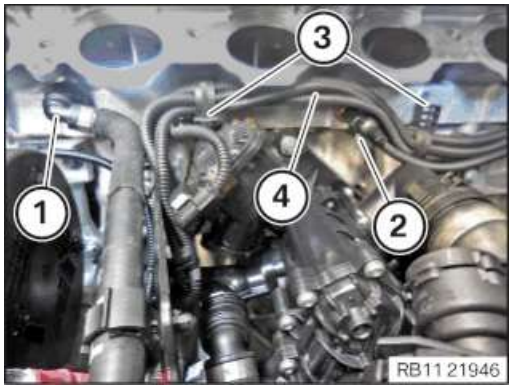
Improper routing of the positive battery cable.

Risk of short circuits!

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

- Insert and install the positive battery cable (3).
- Secure clamps (1) and (2).

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RISK OF DAMAGE

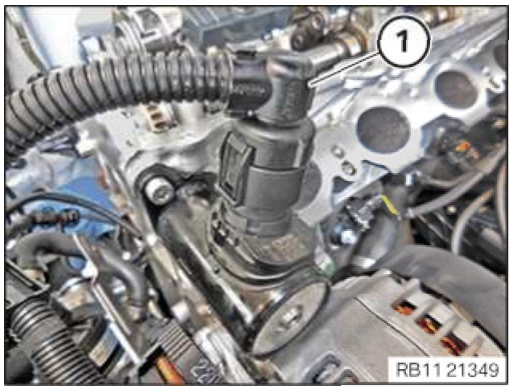
Improper routing of cables and wiring harnesses.

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

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

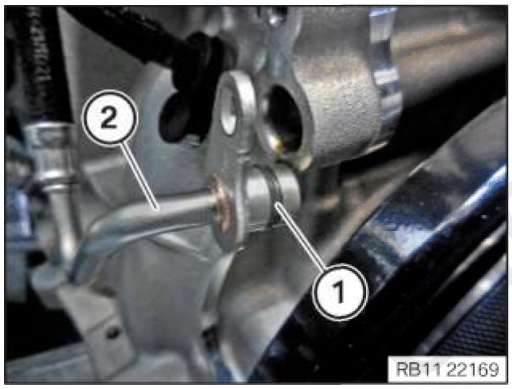
- Connect connectors (2) and lock.

  The connector must engage audibly.
- Guide in and position the wiring harness section (4) of sensor system **1**.
- Secure clamps (3).
- Connect and lock coolant line (1).
- Make sure that the cooling line (1) engages audibly.



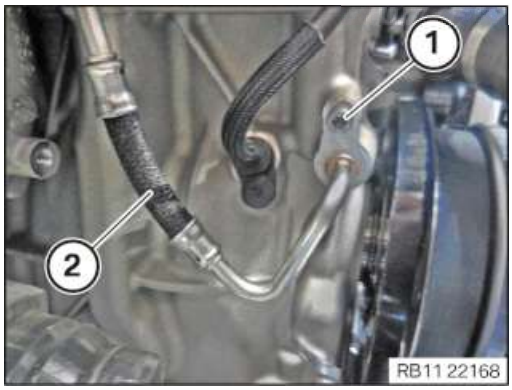
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Renew sealing ring (1) on the oil feed line (2) of the exhaust turbocharger with special tool 0 496 714 (00 9 030).

  Parts: Sealing ring

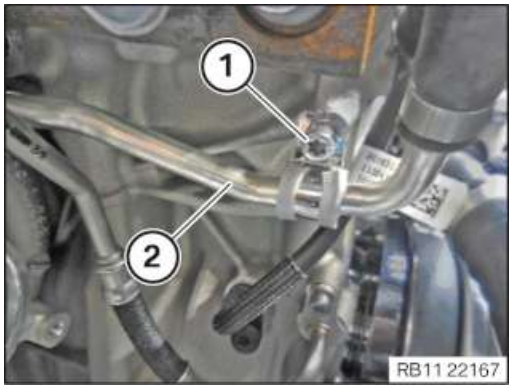


- Feed in and install the oil feed line (2) for the exhaust turbocharger.
- Tighten down screw (1).

Oil feed line for exhaust turbocharger to crankcase

M6 x 12	Replace sealing ring.	Tightening torque	8 Nm

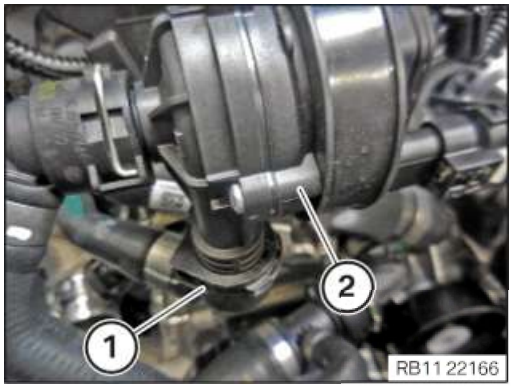
dlagn.com



- Tighten screw (1) on the coolant return line (2).

Coolant return line holder bracket to crankcase

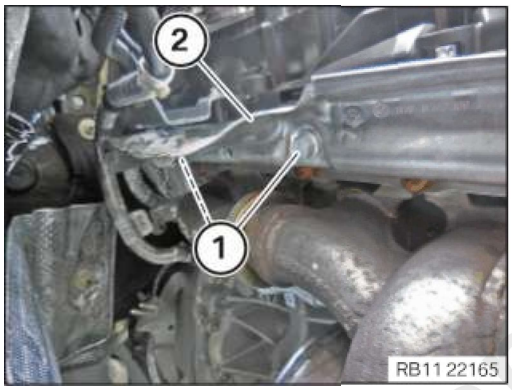
M6X12		Tightening torque	8 Nm



- Connect coolant return line (1) to the coolant pump (2) for the exhaust turbocharger and lock.

  The coolant return line (1) must engage audibly.

- Connect coolant return line (1) for the exhaust turbocharger and lock.
- Ensure the coolant return line (1) audibly engages.



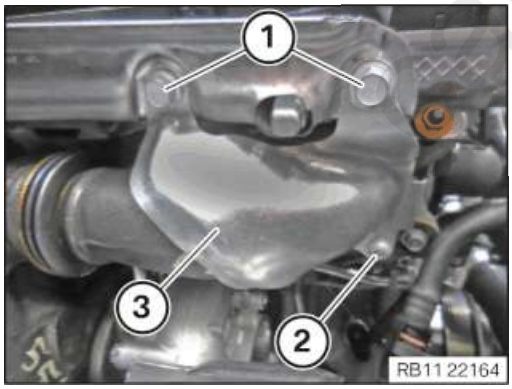
- Feed in and install the heat shield (2).
- Renew screws (1).

  Parts: Bolts

  Tighten the screws (1).

Heat shield to cylinder head

M8X12	Renew screws.	Tightening torque	19 Nm



- Feed in and install the heat shield (3).
- Renew screws (1).

  Parts: Bolts

  Tighten the screws (1).

Heat shield to cylinder head

M8X12	Renew screws.	Tightening torque	19 Nm

- Renew the screw (2).

  Parts: Screw

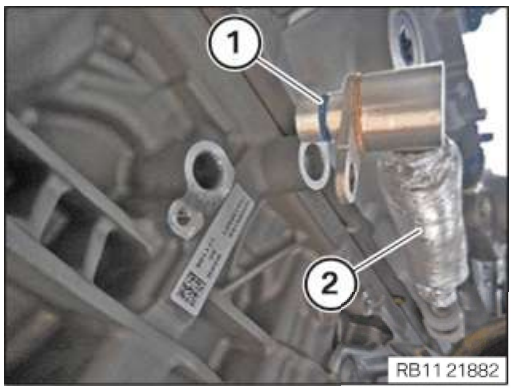
  Tighten down screw (2).

Heat shield to clamping strip

M6X16	Renew screw.	Tightening torque	8 Nm

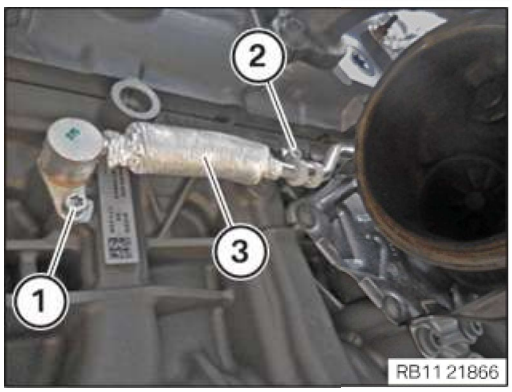


- Unscrew the bolts (1) of the special tool .
- Feed out the special tool at the cylinder head and remove.



- Renew sealing ring (1) on the coolant feed line (2) of the exhaust turbocharger with special tool 0 496 714 (00 9 030).

  Parts: Sealing ring



- Feed in and install coolant feed line for the exhaust turbocharger (3).
- Tighten down screw (1).

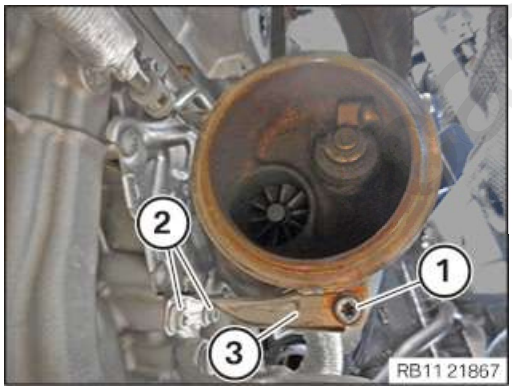
Coolant feed line to crankcase

M6X12		Tightening torque	8 Nm

- Tighten down screw (2).

Coolant feed line to crankcase

M6X12		Tightening torque	8 Nm



- Renew screws (1) and (2).

  Parts: Bolts
- Feed in and install support (3).
- Tighten the screws (2).

Exhaust turbocharger support to crankcase

M8 x 20	Renew screws.	19 Nm

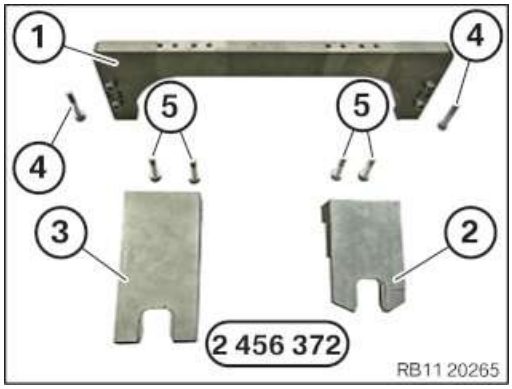
- Tighten the screws (1).

Exhaust turbocharger to support

M8 x 25	Renew screw.	19 Nm

52 – Adjust the camshafts with the special tool

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- Overview of the set of special tools 2 456 372:

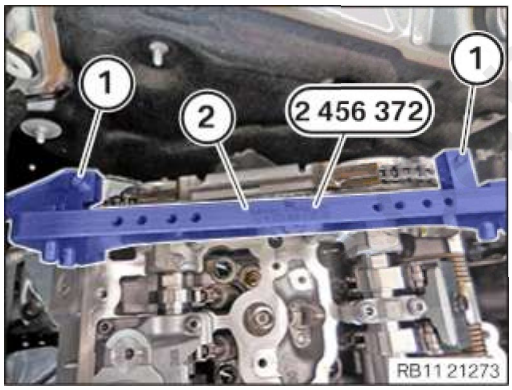
Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Use the setting gauge 0.7 ° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.



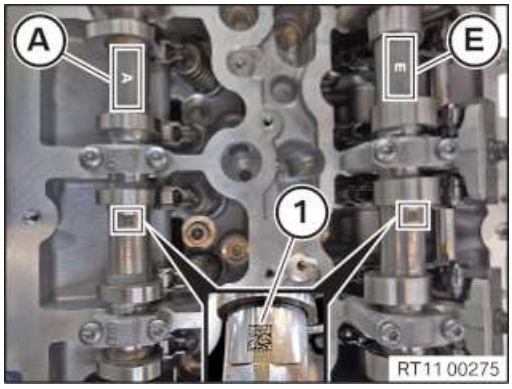
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

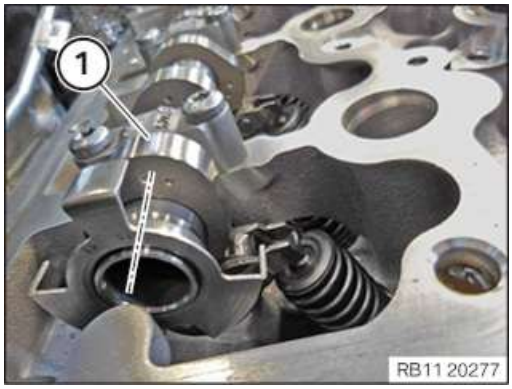
Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Turn the intake camshaft (E) and the exhaust camshaft (A) such that the marks (1) can be read from the top.

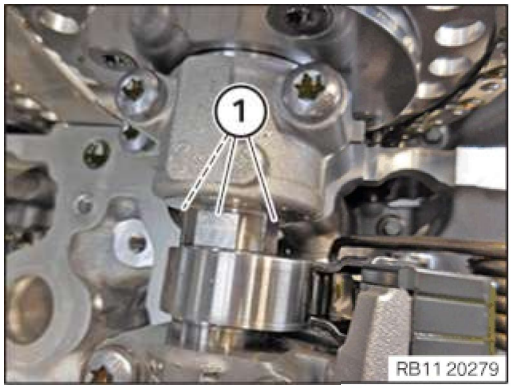
.diagn.com



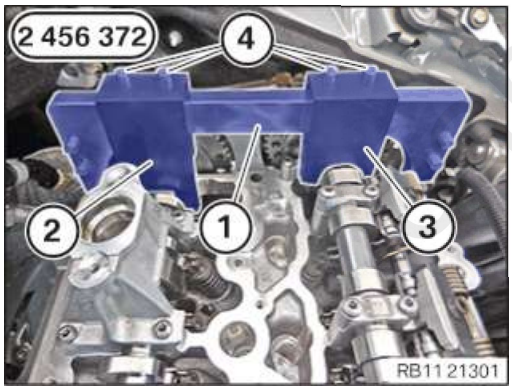
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



- Position the setting gauge 0.5° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten the screws (4).

Test gauge to basic carrier

M6		Tightening torque	8 Nm

53 – Installing the intake adjuster

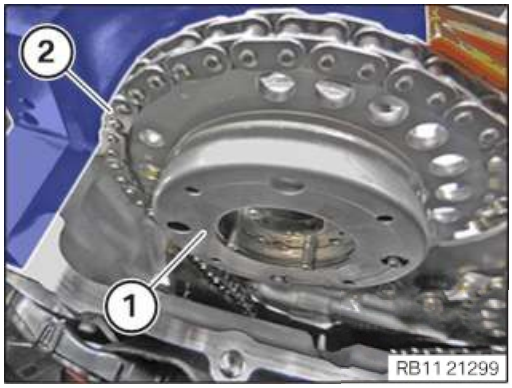
NOTICE

The figure shows the rear side of the engine.

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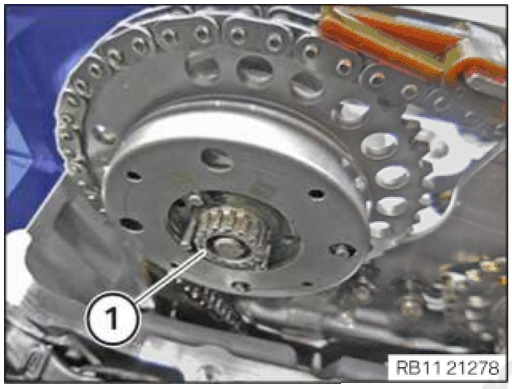


- Keep intake adjuster (1) marked IN ready.

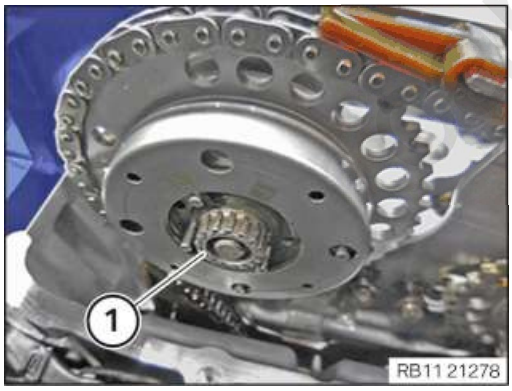


- Feed in intake adjuster (1) in the timing chain (2) and position on the intake camshaft .

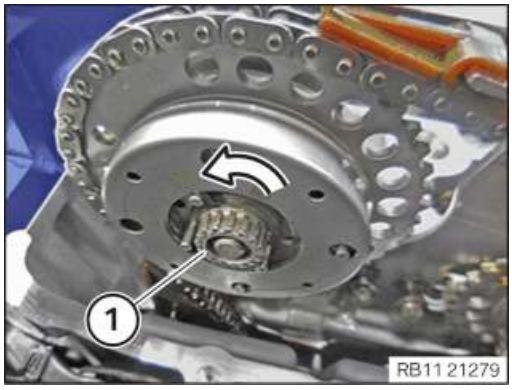
54 – Install the VANOS central valve of the intake adjuster



- Guide in the VANOS central valve (1) of the intake adjuster and install.



- Hand-tighten the VANOS central valve (1) of the intake adjuster.



- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

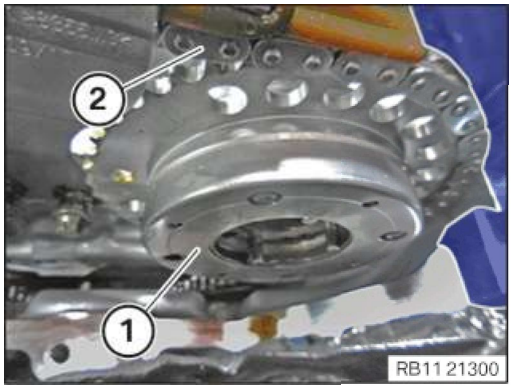
55 – Install exhaust camshaft adjuster

NOTICE

The figure shows the rear side of the engine.

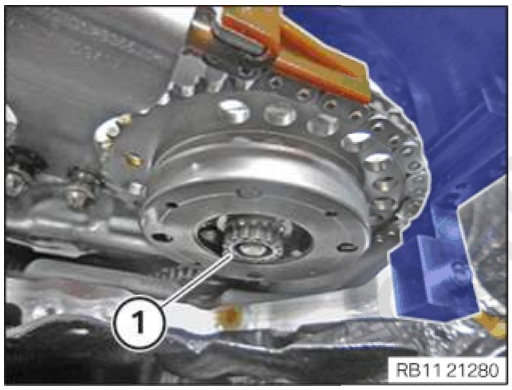


- Keep exhaust camshaft adjuster (1) marked EX ready.

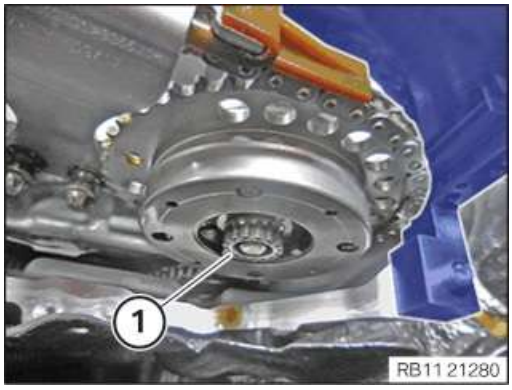


- Feed in exhaust camshaft adjuster (1) in the timing chain (2) and position on the exhaust camshaft .

56 – Installing the VANOS central valve of the exhaust camshaft adjuster

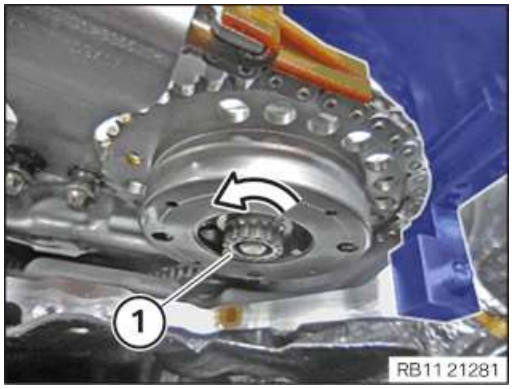


- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.



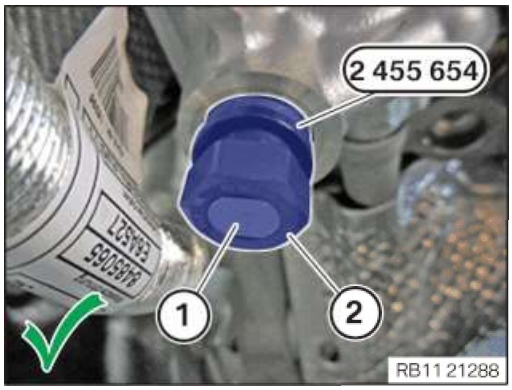
- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

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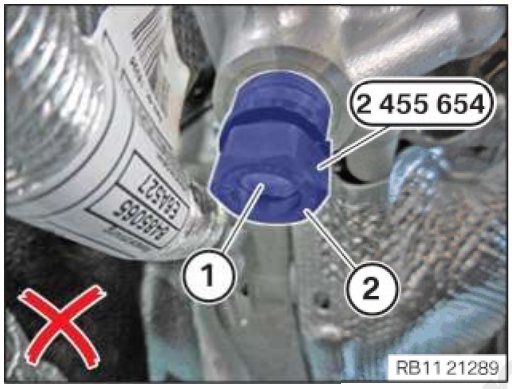
- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

57 – Pretension the timing chain with the special tool



- Make sure that the timing chain is **correctly** pre-tensioned with the special tool 2 455 654.

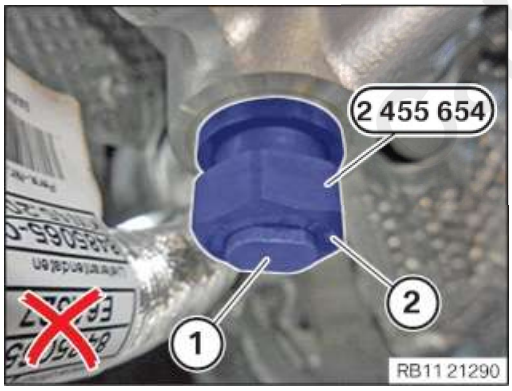
  The pin (1) must align **precisely** with housing (2).



- Make sure that the preload of the timing chain is no **insufficient**.

  The preload is insufficient when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.



- Make sure that the preload of the timing chain is not **too high**.

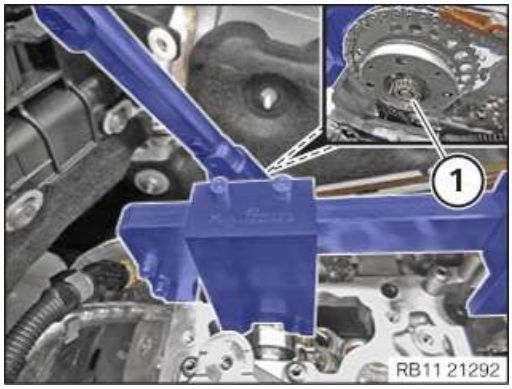
  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

58 – Tightening the VANOS central valve of the exhaust camshaft adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



- Tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

59 – Tightening the VANOS central valve of the intake adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.

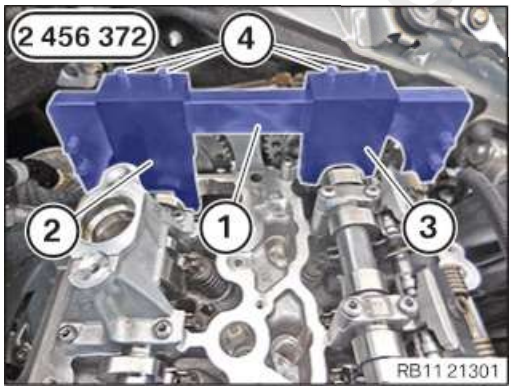


- Tighten the VANOS central valve (1) of the intake adjuster.

VANOS central valve to camshaft

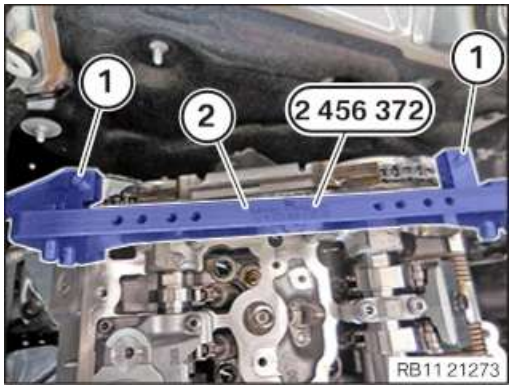
M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

60 – Disassembling all special tools

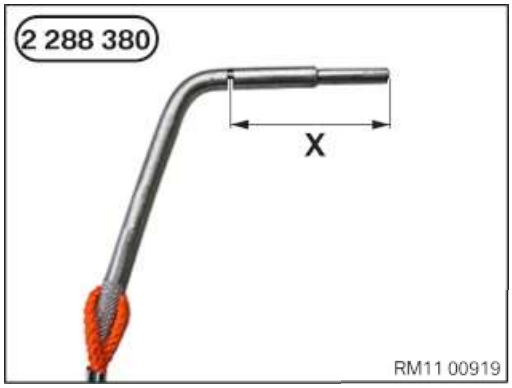


- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) and remove.

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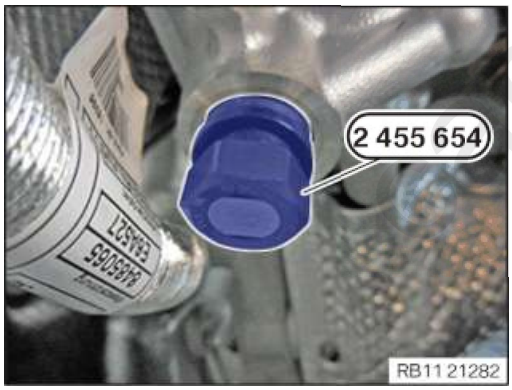
- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.



- Guide the special tool 2 288 380 out and remove.



- Guide the special tool 0 493 380 (11 6 480) out and remove.



- Guide the special tool (1)2 455 654 out and remove.

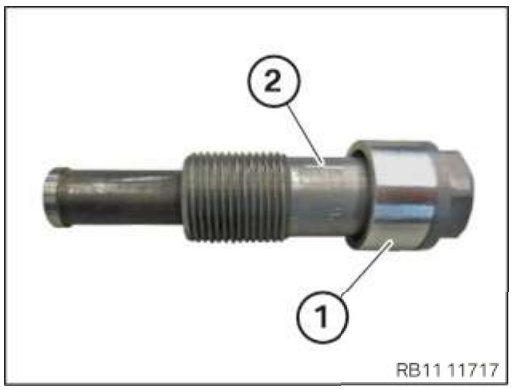
61 – Install chain tensioner

TECHNICAL INFORMATION

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

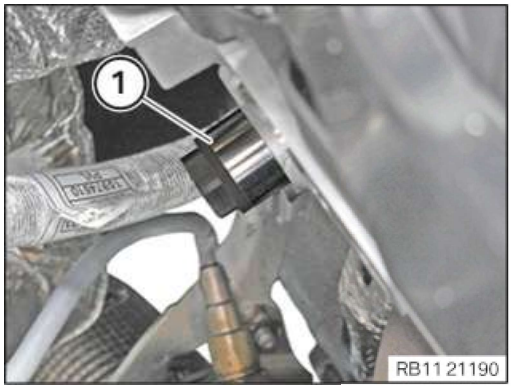


- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.

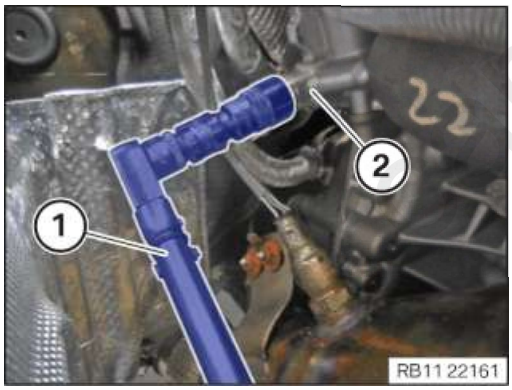


- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.



- Insert and install the chain tensioner (1).

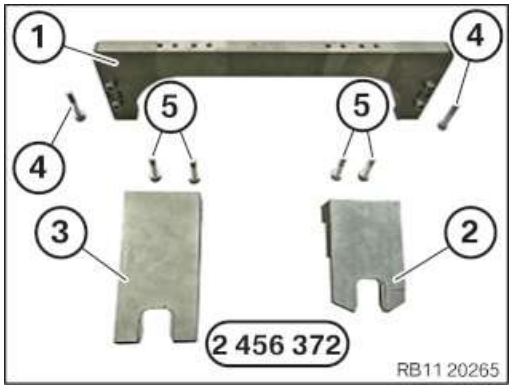


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

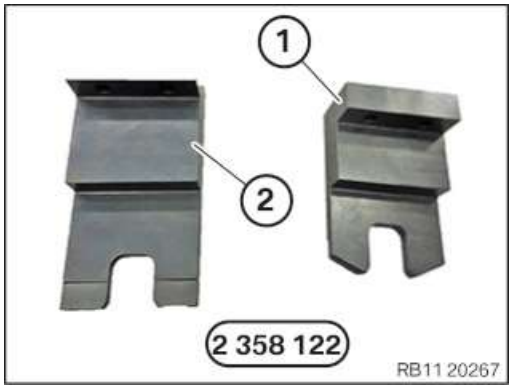
62 – Checking camshaft timing



- Have the set of special tools 2 456 372 ready.

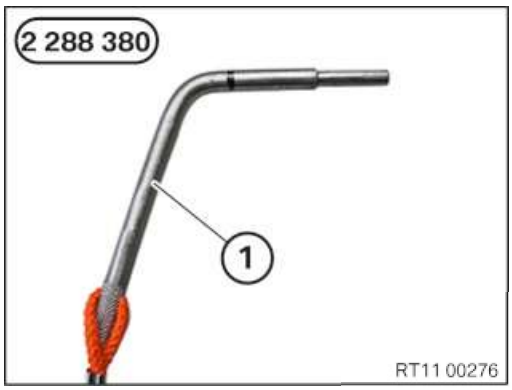
Number	Description
1	Basic carrier
2	0.7° setting gauge to adjust the intake camshaft
3	0.5° setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

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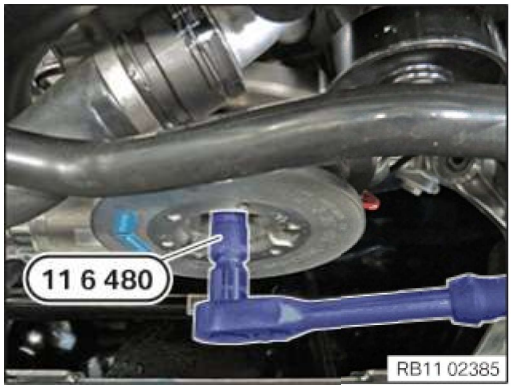
- Keep the test gauge from the set of special tools 2 358 122 ready.

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



- Have the special tool 2 288 380 ready.

Number	Description
1	Locating stud



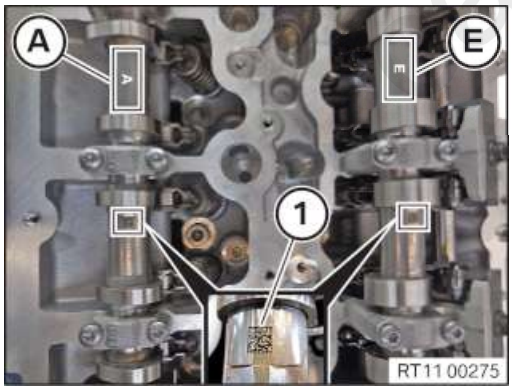
RISK OF DAMAGE

Damage to the engine.

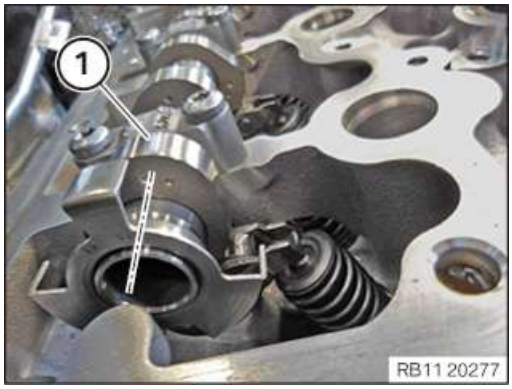
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



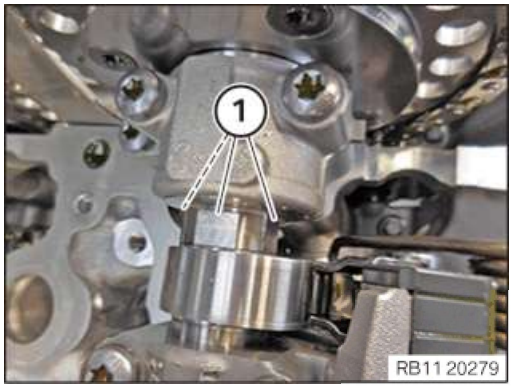
- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.



- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



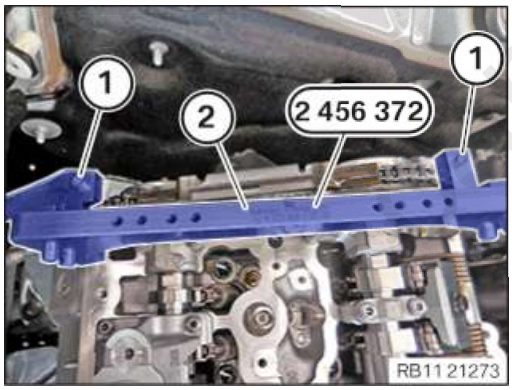
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



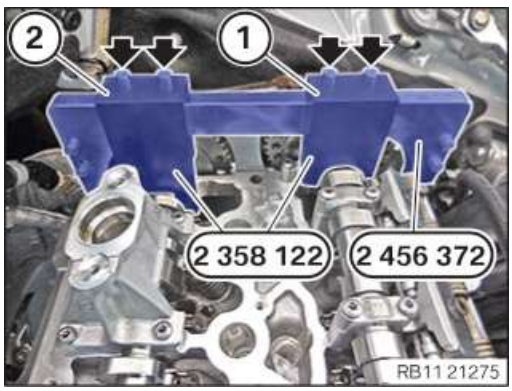
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



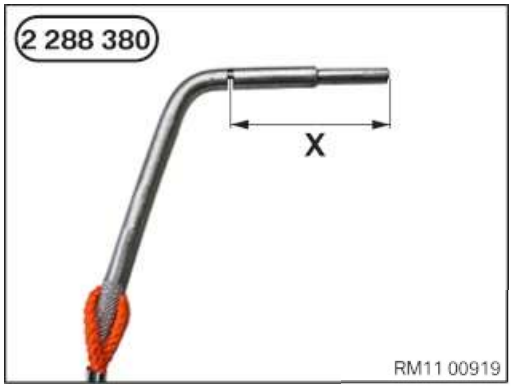
- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

Test gauge to basic carrier

M6		Tightening torque	8 Nm



- Thread the sealing cap (1) out and remove.



- **Vehicles with automatic transmission:**

  Dimensions (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

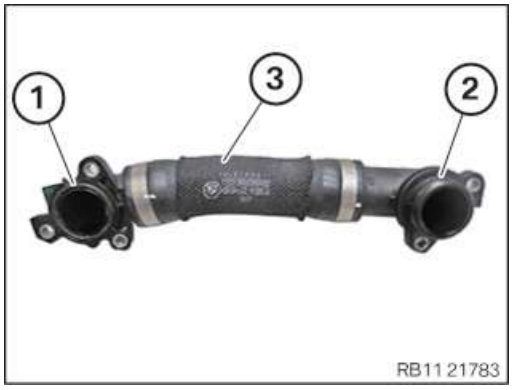


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

  The engine **is in the** TDC firing position of cylinder 1.

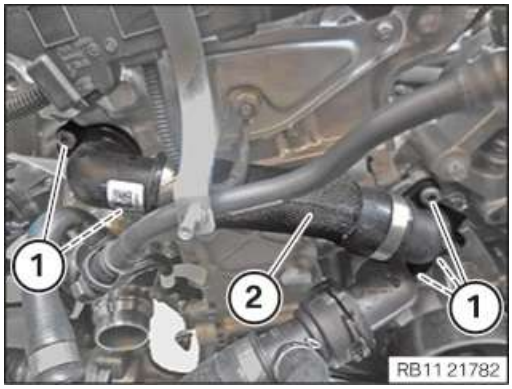
63 – Install the coolant line between the cylinder head and the coolant pump



- Check sealing rings (1) and (2) for damage; renew coolant line (3) if necessary.

  Parts: Sealing ring

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TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

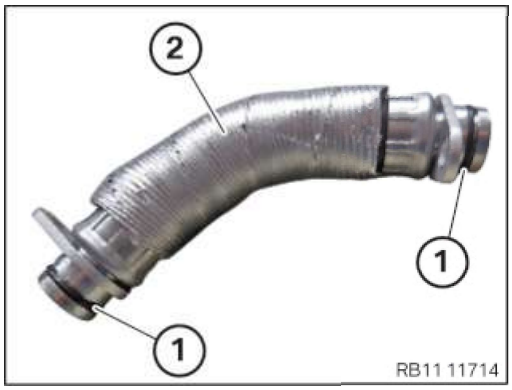
Non-observance of these requirements may result in leaks and damage.

- Feed in and install coolant line (2).
- Hand-tighten the bolts (1).
- Tighten the screws (1).

Coolant line to coolant pump/cylinder head

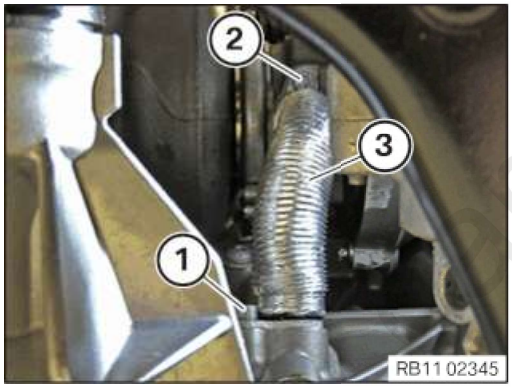
M6x20		Tightening torque	8 Nm

64 – Installing the oil return line for the exhaust turbocharger



- Renew the sealing rings (1) on the oil return line (2).

  Parts: Sealing ring



- Feed in and install the oil return line (3).
- Tighten down screw (2).

Oil return line to turbocharger

M6 x 12		8 Nm

- Tighten down screw (1).

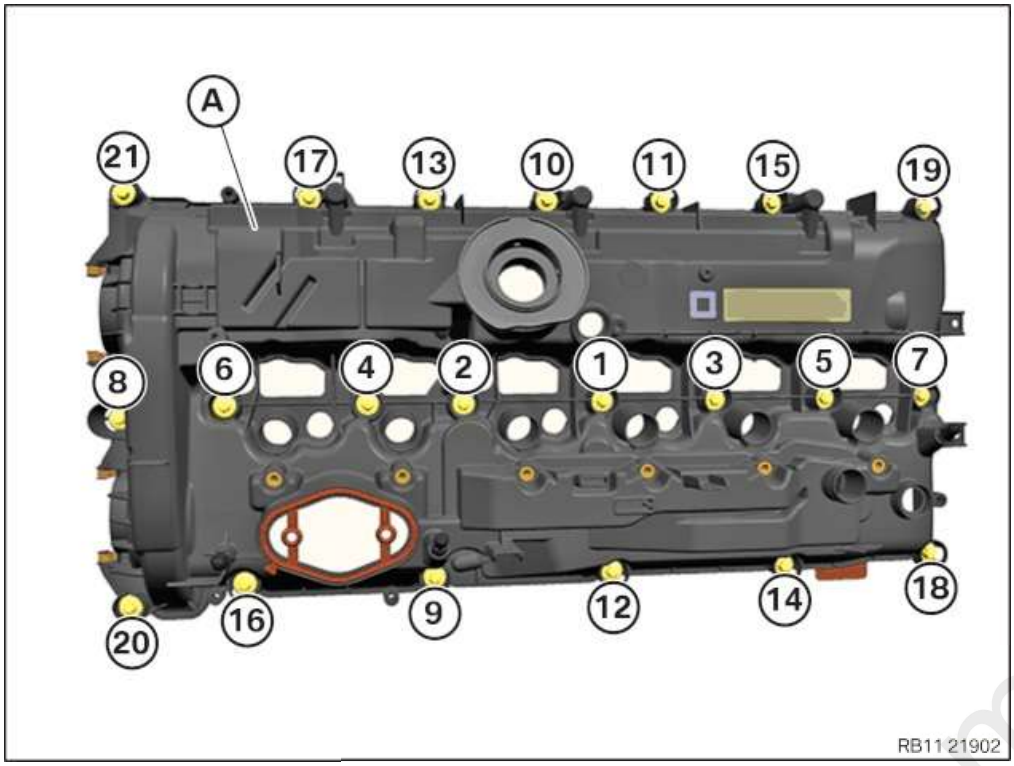
Oil return line to crankcase

M6 x 12		8 Nm

65 – Installing cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 21 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

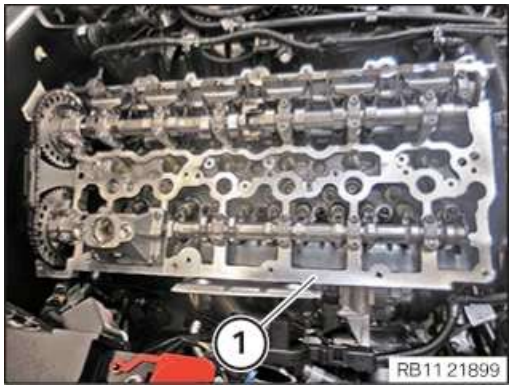
Improper routing of cables and wiring harnesses.

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

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

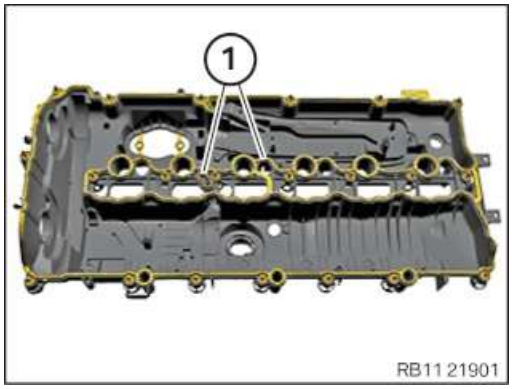
TECHNICAL INFORMATION

Latch mechanisms, guides and mounting elements must not be damaged or missing.



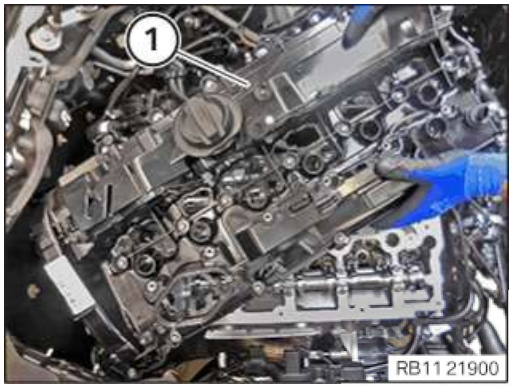
- Contact surface (1) must be free from oil and grease.

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- Replace the seals (1).

  Parts: Seals

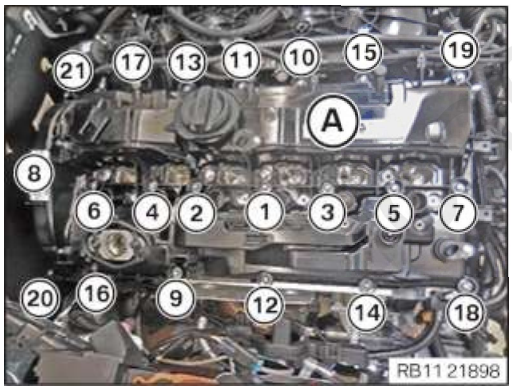


- Insert and install cylinder head cover (1).



- Ensure that the cylinder head cover (1) is installed in the **marked** area correctly on the high pressure pump bracket(2).

  The cylinder head cover (1) must not touch the high pressure pump bracket (2) in the **marked** area.



- Position the cylinder head cover (A).
- Make sure that the cylinder head cover (A) does not touch the high pressure pump bracket!
- Tighten all bolts in sequence (1) to (21).

Cylinder head cover to cylinder head

M6X30		Jointing torque	8 Nm

- Tighten all screws in a sequence from (1) to (21).

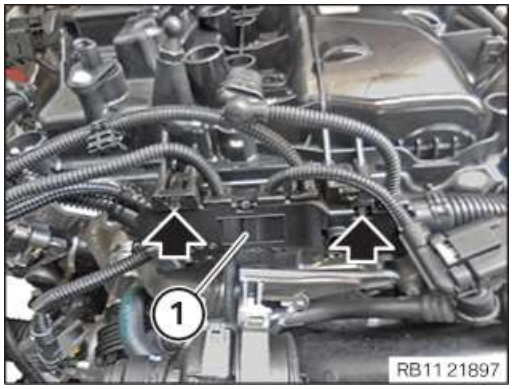
Cylinder head cover to cylinder head

M6X30		Tightening torque	11 Nm

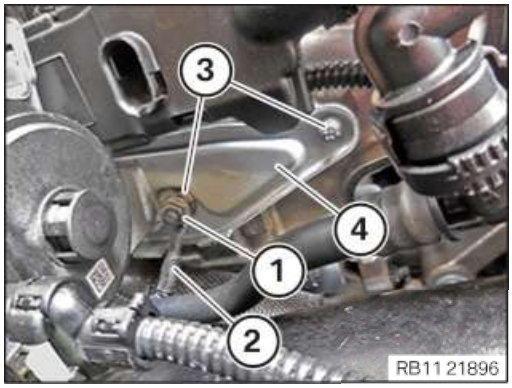


- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

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



- Insert and position the holders (4).
- Tighten the screws (3).

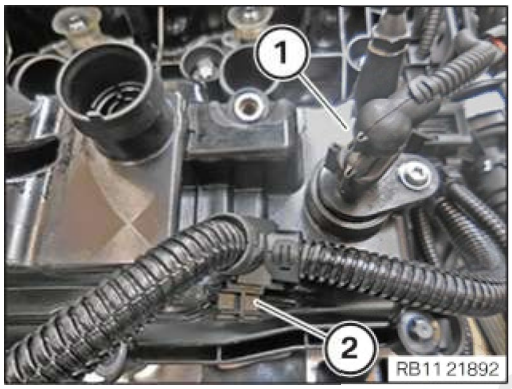
Auxiliary coolant pump holder to cylinder head

M6		Tightening torque	7 Nm

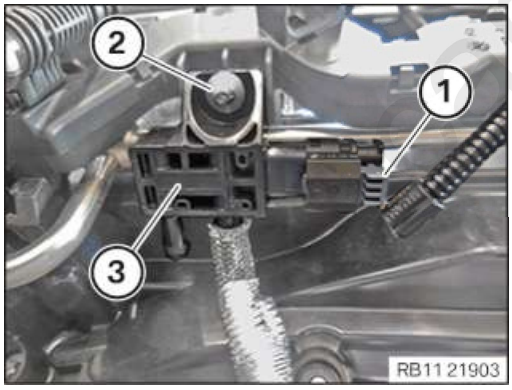
- Thread in ground cable (2) and install.
- Tighten nut (1).

Standard screw connection M6

M6		8 Nm



- Connect and lock the connector (1) on the exhaust camshaft sensor .
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).



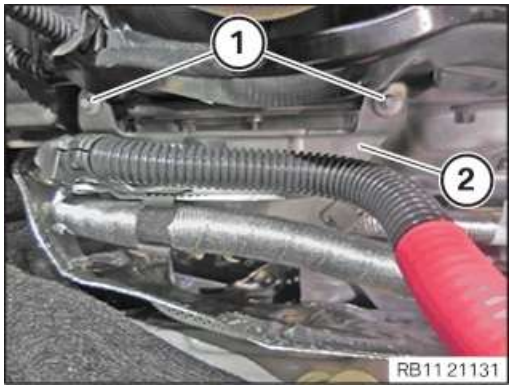
- **If installed:**
- Feed in and install the differential pressure sensor (3).
- Tighten down screw (2).

Differential pressure sensor to holder

TS6X18		Tightening torque	3,5 Nm

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

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CAUTION

Improper routing of the positive battery cable.

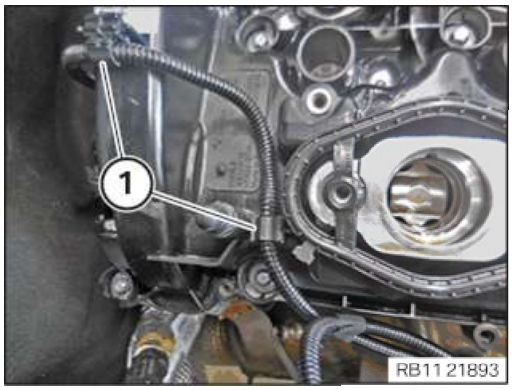
Risk of short circuits!

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

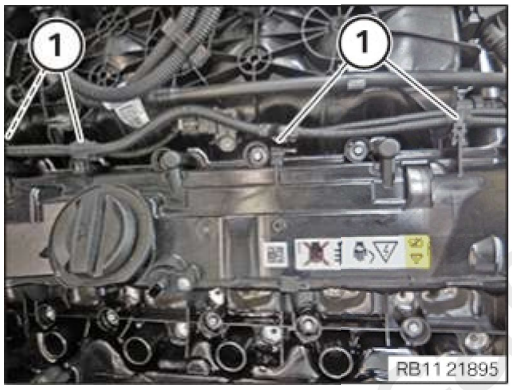
- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

Holder, positive battery cable to cylinder head cover

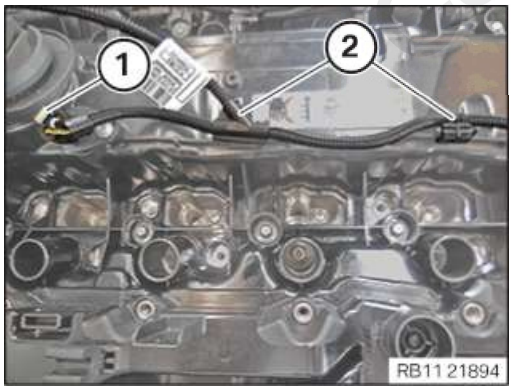
6X18		Tightening torque	6 Nm



- Secure clamps (1).



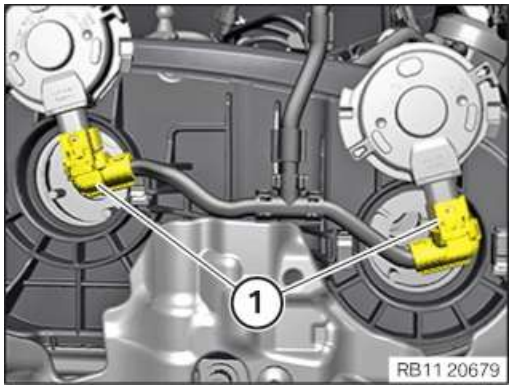
- Secure clamps (1).



- Connect connector (1) to the intake camshaft sensor and lock it.
- Make sure the connector (1) engages audibly.
- Secure clamps (2).

66 – Installing both actuators

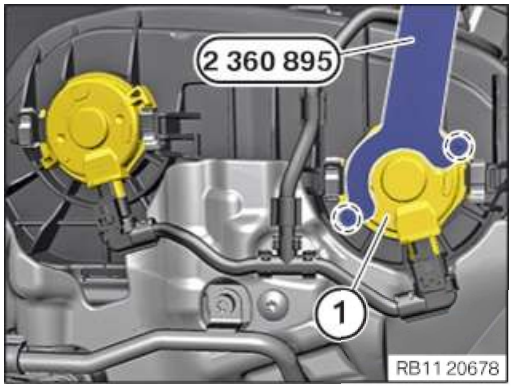
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NOTICE

The figure shows the rear side of the engine.

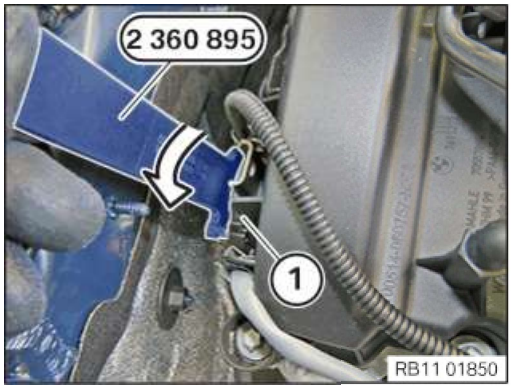
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



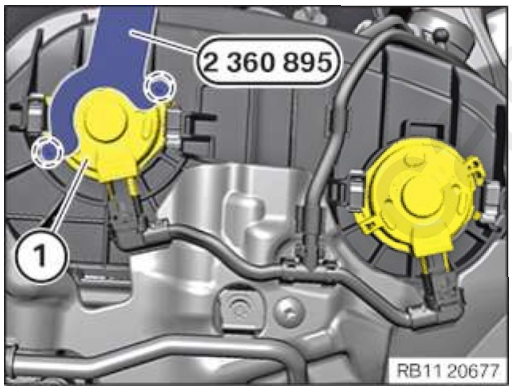
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



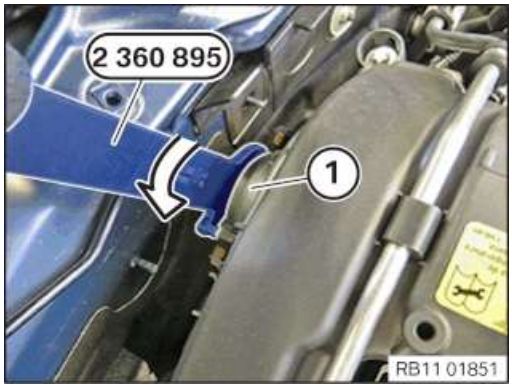
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.



NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

67 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

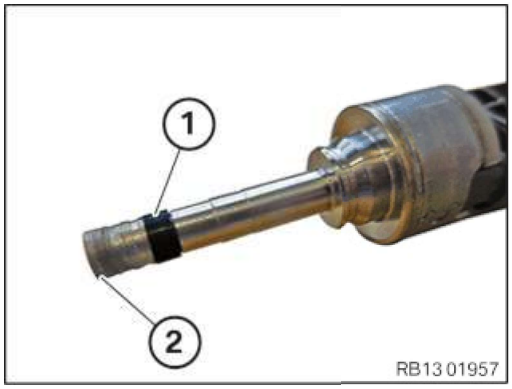
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

TECHNICAL INFORMATION

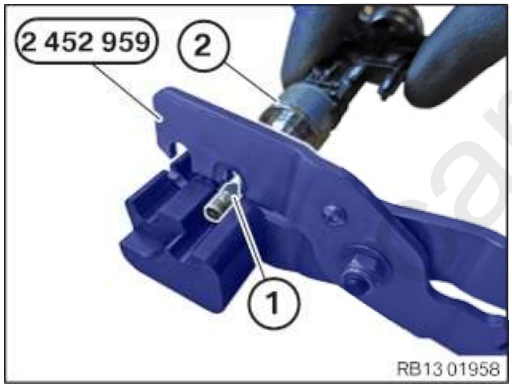
Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.



- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings
- Avoid mechanical contact with injector tip (2).



- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.



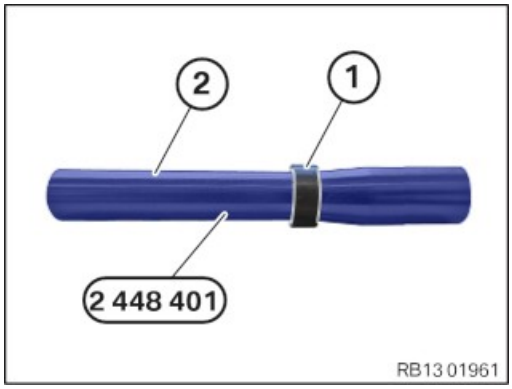
- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

  (1) Installation cone

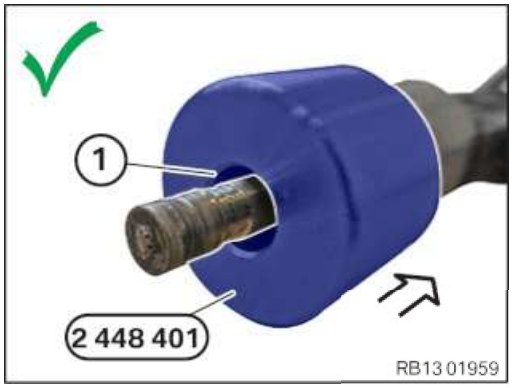
  (2) Sliding sleeve

  (3) Assembly sleeve

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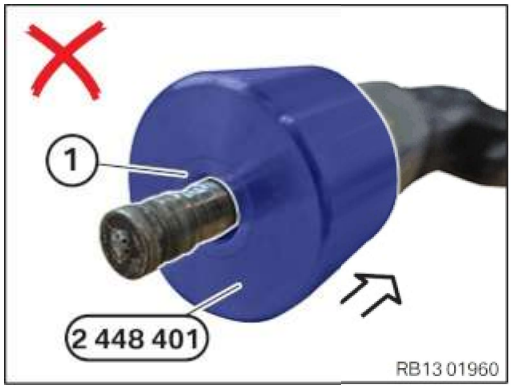


- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



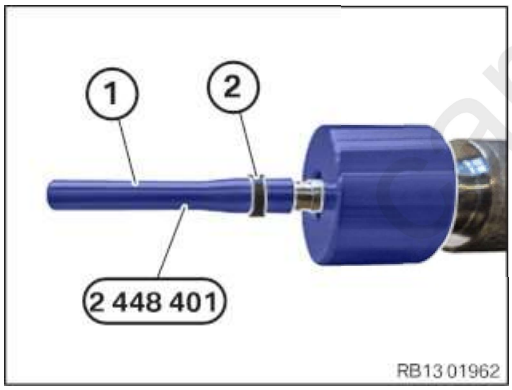
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The larger diameter of the assembly sleeve (1) must point to the injector tip.

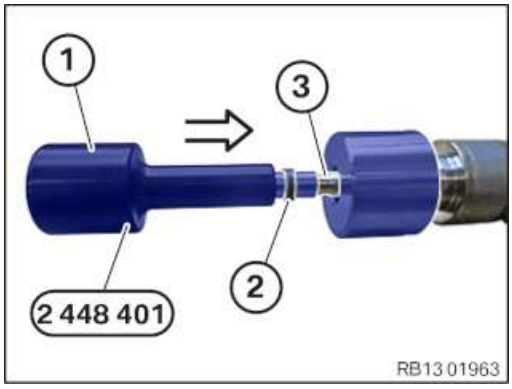


- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.

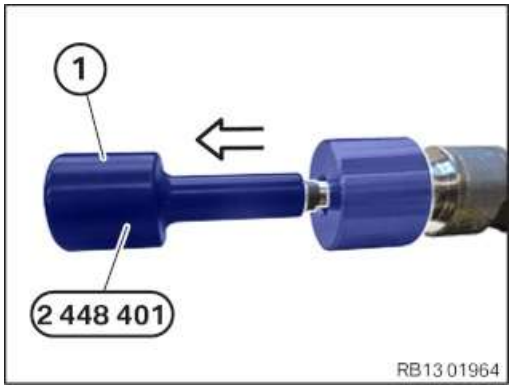


- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .

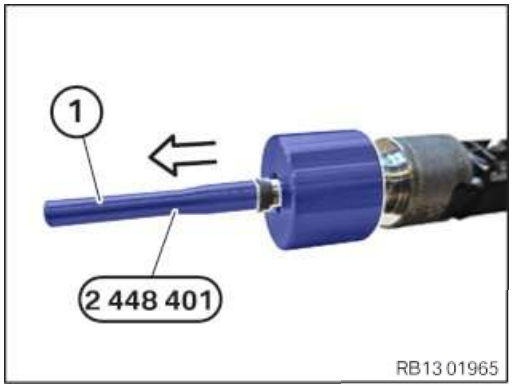


- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.

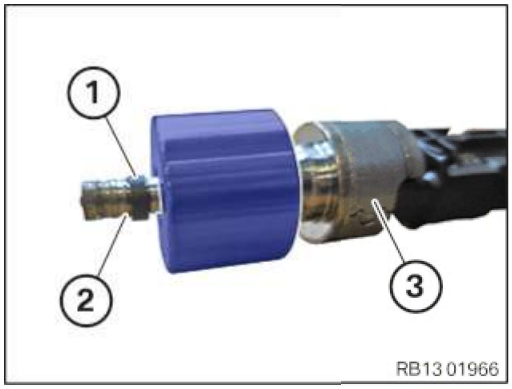
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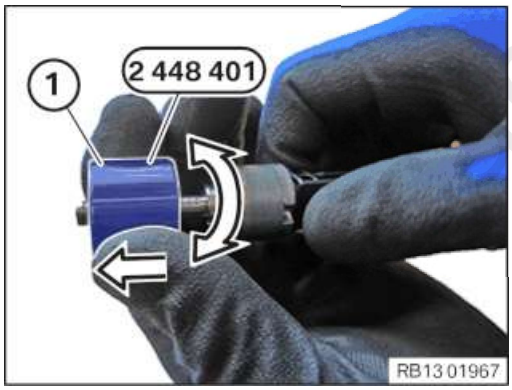
- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

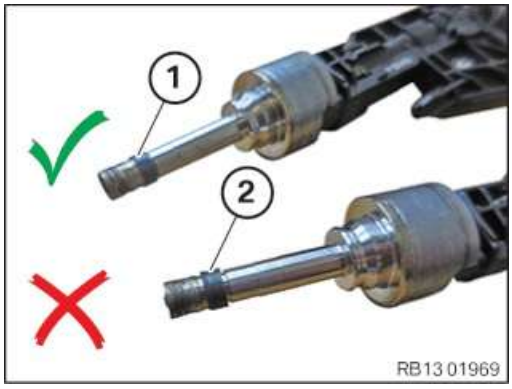


- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.



- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).

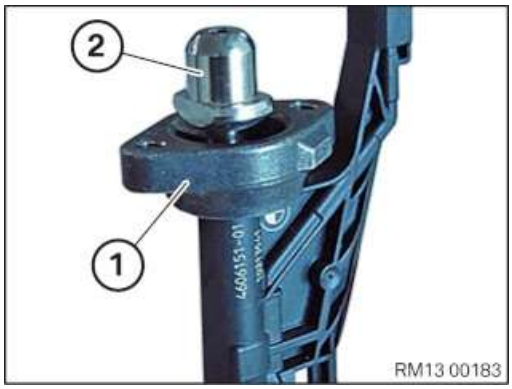


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

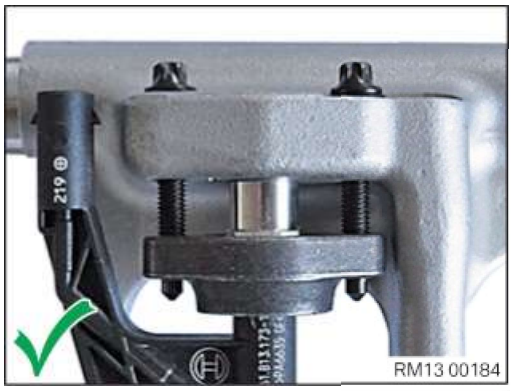
68 – Installing the high-pressure rail with injectors of the cylinders 4 to 6

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.

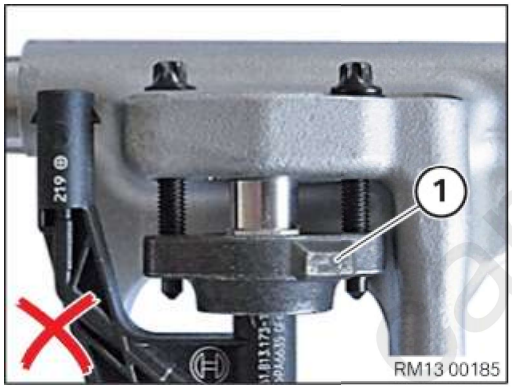


- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder**(1) **has a cast lug**: Make sure that the holder is installed in the correct position.



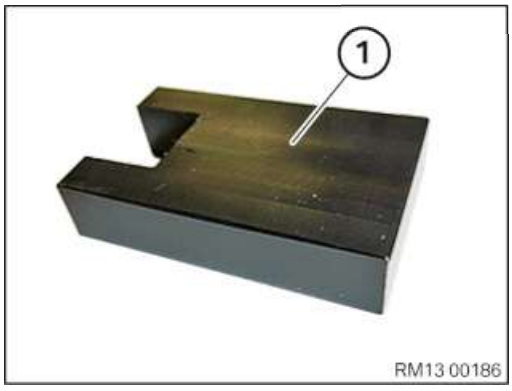
- If applicable, note the position of the cast lug:

  The holder is mounted **correctly** when the cast lug is located at the rear.



- If applicable, note the position of the cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.



RISK OF DAMAGE

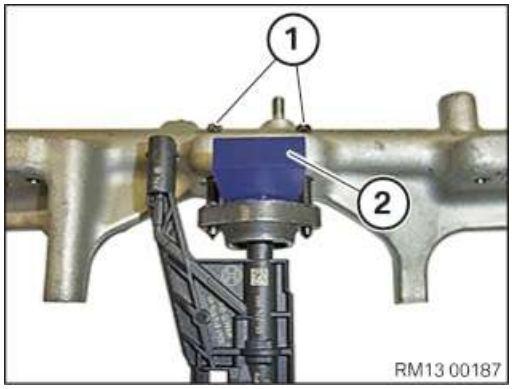
Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).

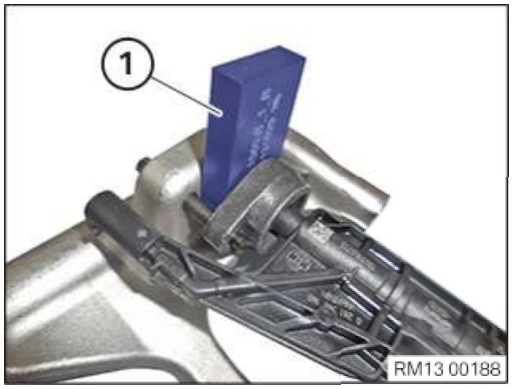
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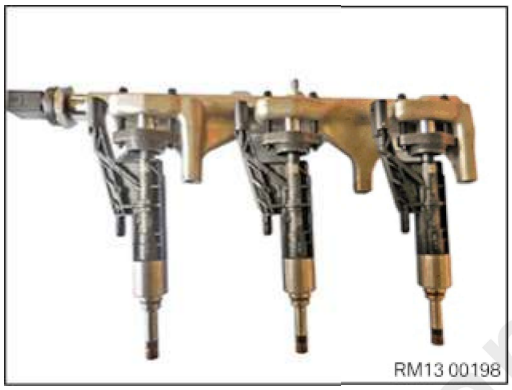
- Replace (M5x30) screws.

  Parts: Screws (M5x30)
- Mount the injectors with the holders and the bolts (M5x30) (1) on the rail.
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.
- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) evenly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.



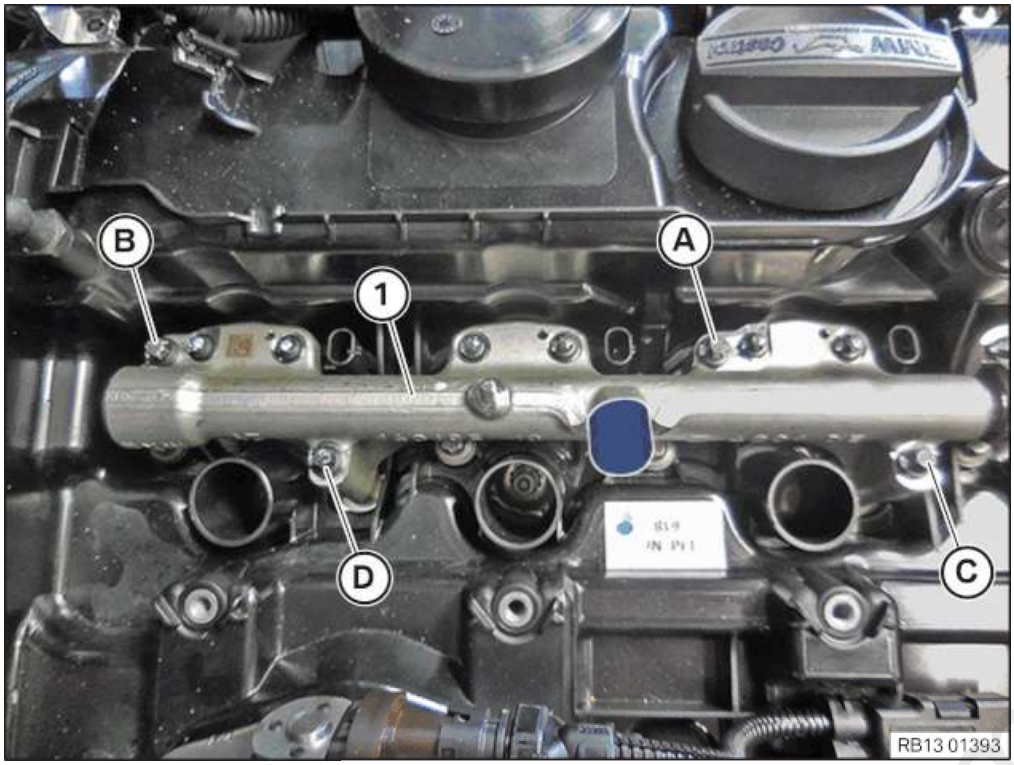
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.



- Check injectors for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors must move freely.

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- Renew screws (A) to (D).

  Parts: Bolts
- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- Press the rail (1) down until a resistance can be felt; join and hand-tighten the bolts (M6x30) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.

  The figure shows the rail resting flat against the cylinder head.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

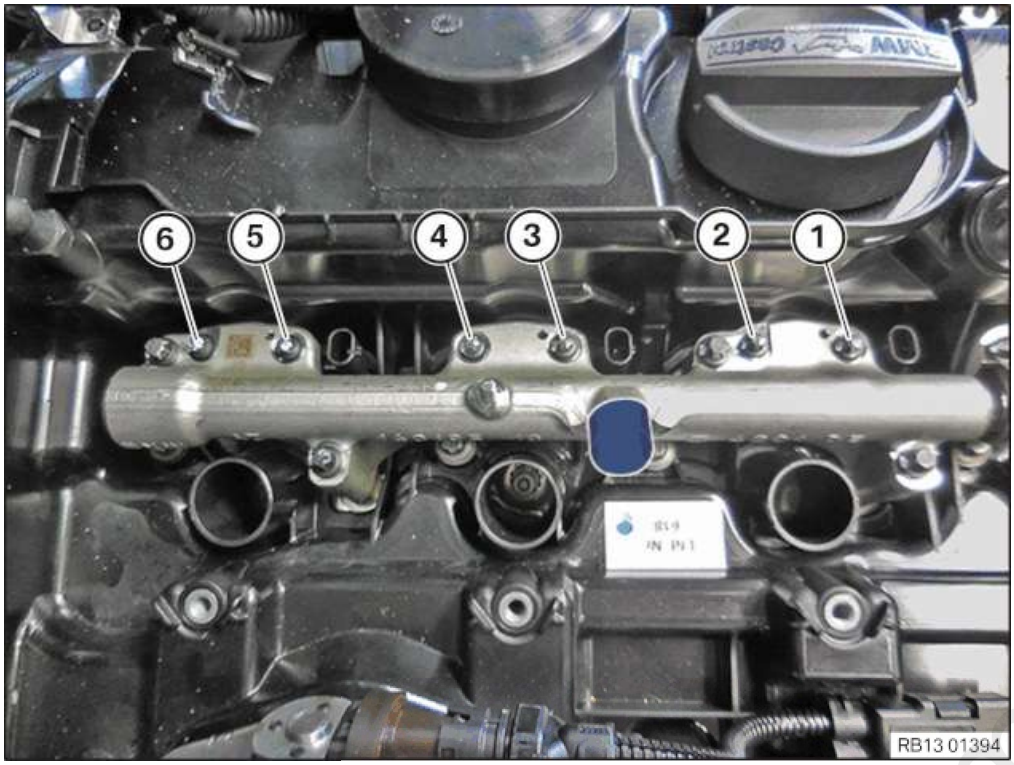
Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.



- Make sure that the rail (1) rests flat against the cylinder head.

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- Attach a socket to an extension.

  Do not use a reversible ratchet or torque wrench.
- Tighten the bolts (M5x30) in pairs ((1) with (2), (3) with (4), (5) with (6)) in alternating order **90° hand-tight**.
- Set the torque wrench to 5 Nm.

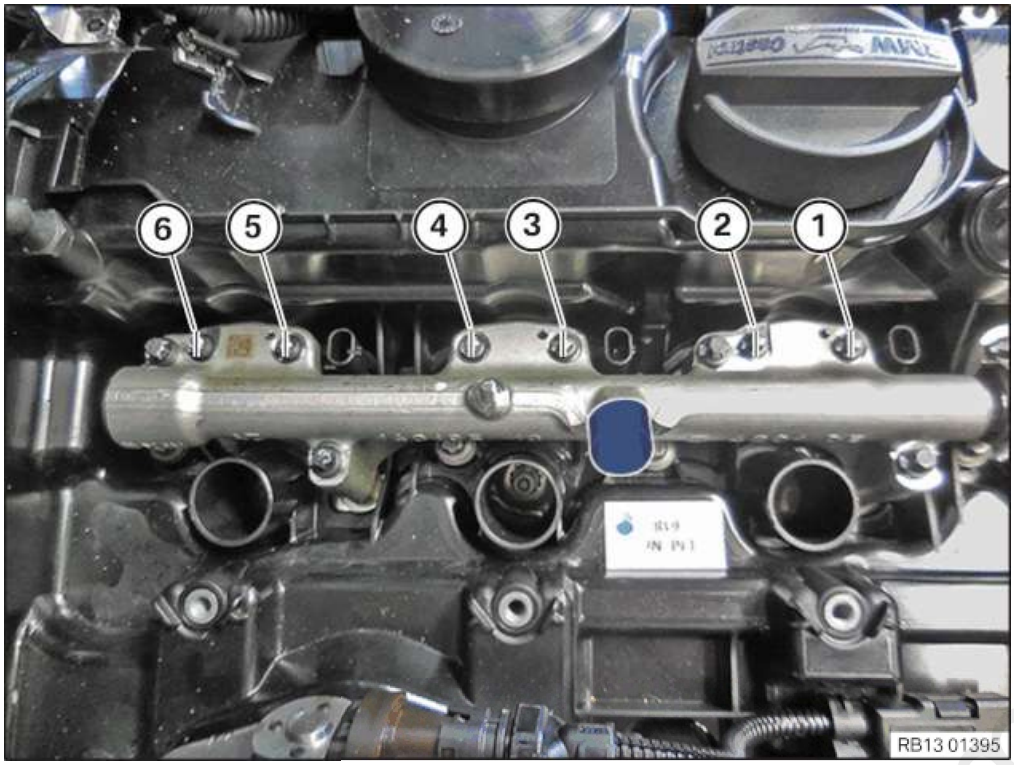
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

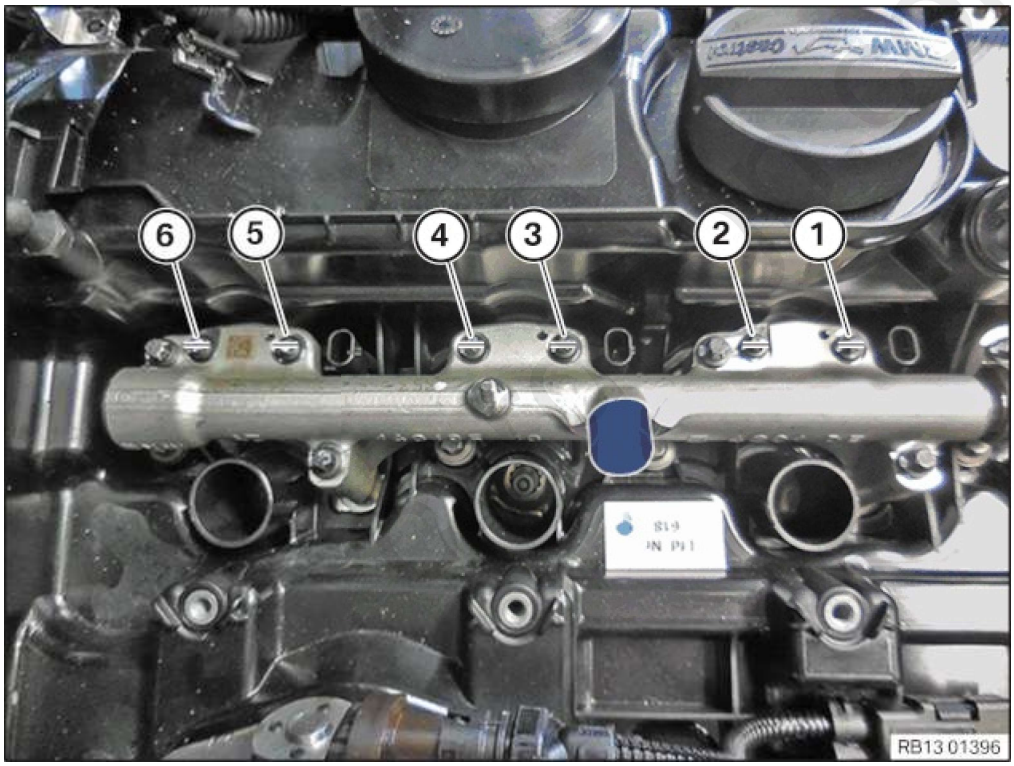
Non-observance of these requirements may result in leaks and damage.

- **Screw the (M5x30) bolts according to the following plan:**
  - **Fuel injector 4:**
  - Tighten screw (1) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (2) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 5:**
  - Tighten screw (3) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (4) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 6**:
  - Tighten screw (5) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (6) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts reach a torque of 5 Nm.

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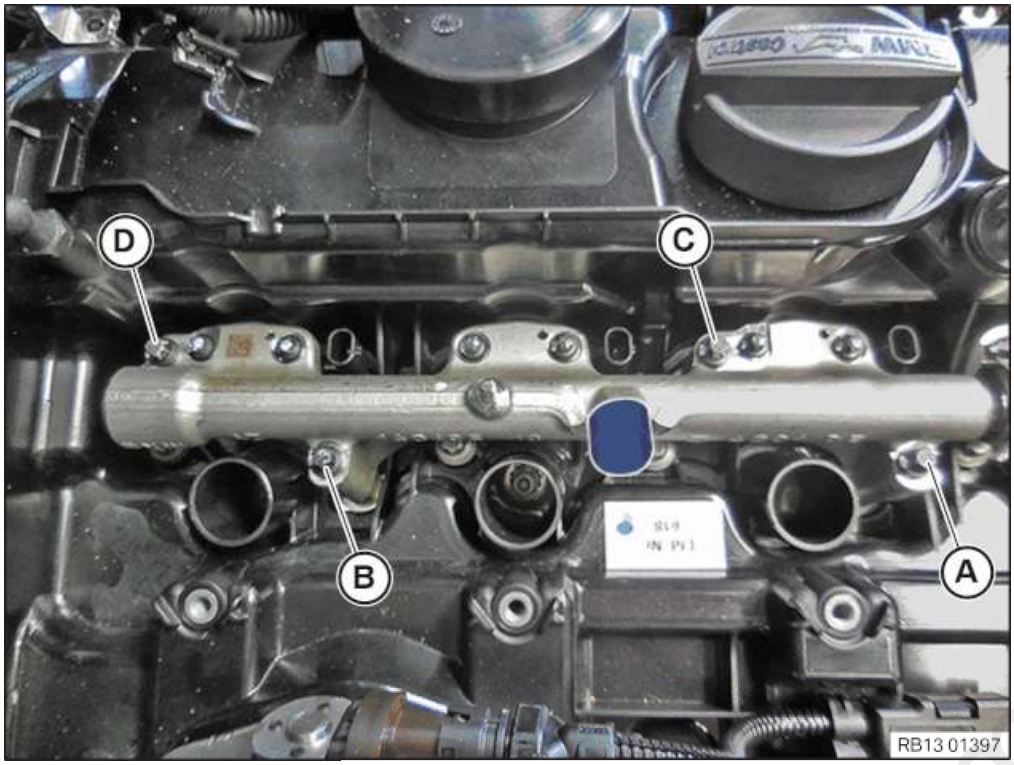


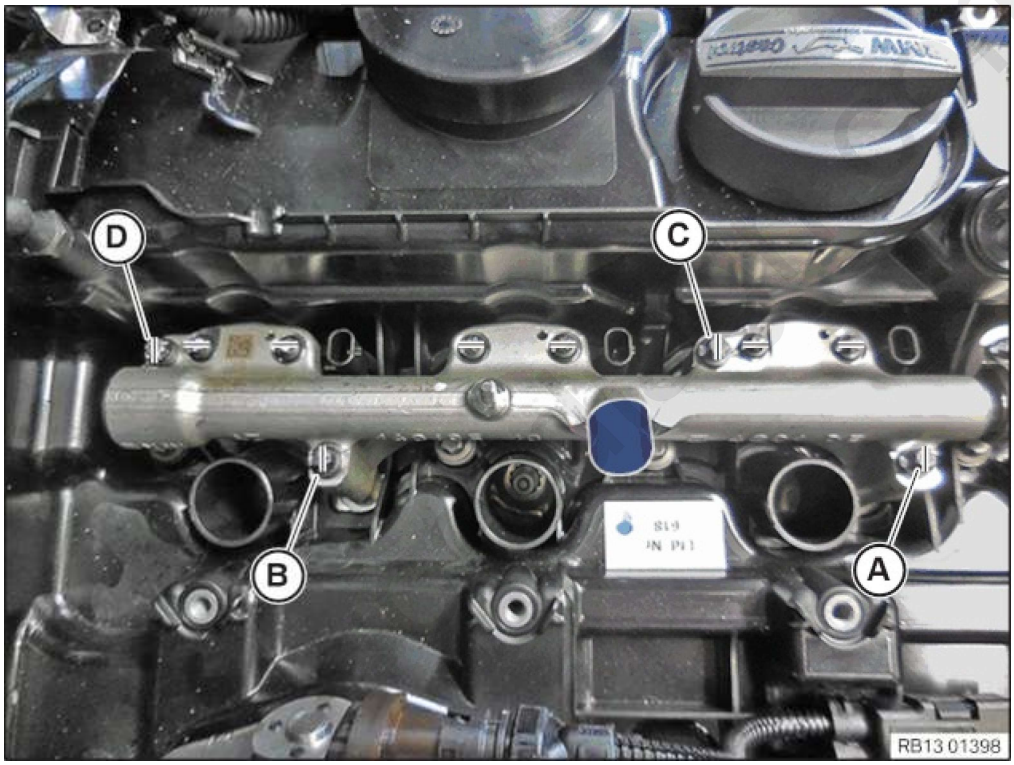
- Mark all bolts (1) to (6) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the screw (1) with an angle of rotation of 90° ±15°.
  - Tighten the screw (2) with an angle of rotation of 90° ±15°.
  - Tighten the screw (3) with an angle of rotation of 90° ±15°.
  - Tighten the screw (4) with an angle of rotation of 90° ±15°.
  - Tighten the screw (5) with an angle of rotation of 90° ±15°.
  - Tighten the screw (6) with an angle of rotation of 90° ±15°.



- Check if all bolts (1) to (6) have been tightened with a 90° ±15° angle of rotation.

  All marks (lines) must be horizontal (see figure).





- Unscrew the bolts (M6x70) (A) to (D).

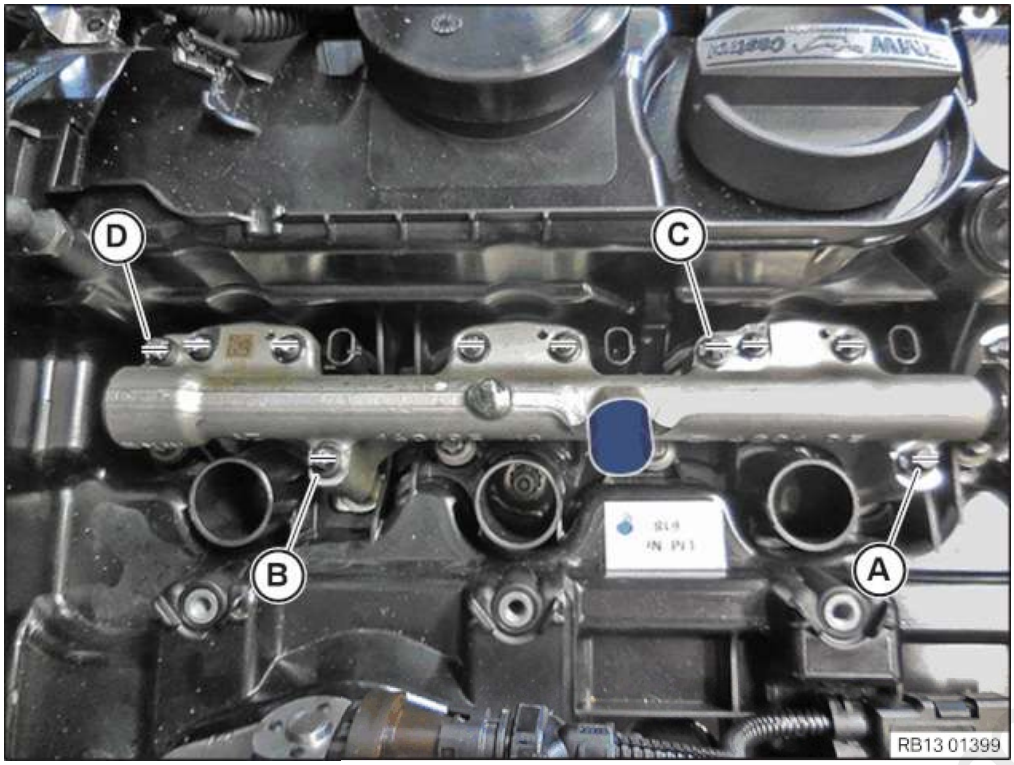
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

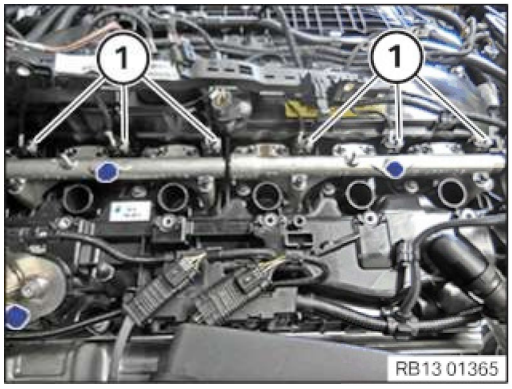
Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.
- Mark all bolts (A) to (D) with a vertical line (see figure).
- Tighten bolts (M6x70) (A) to (D) to a 90° angle of rotation.



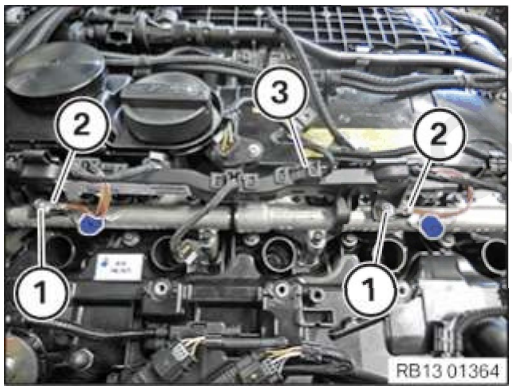
- Check if all bolts (A) to (D) have been tightened with a 90° angle of rotation.

  All marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nuts (1).

Ground cable to rail

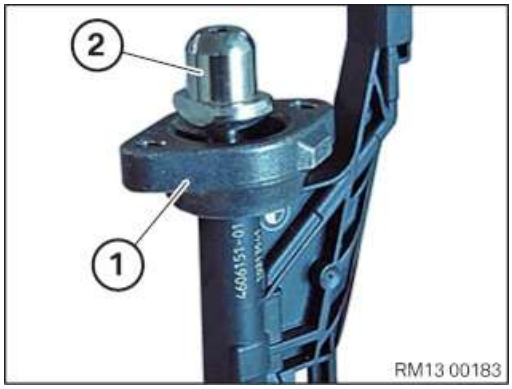
M6			5 Nm

69 – Installing rail with injectors of cylinders 1 to 3

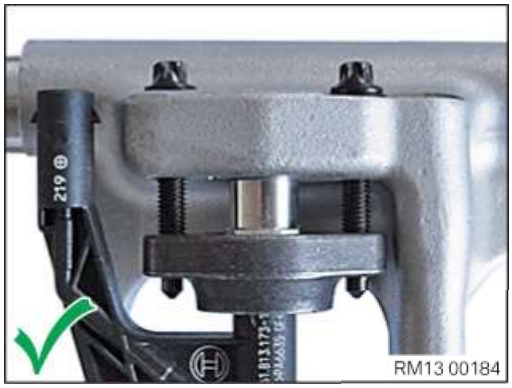
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.

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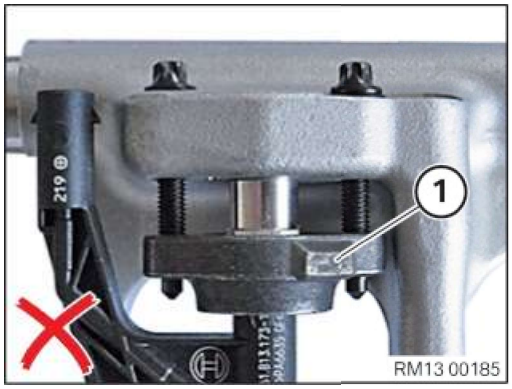


- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If there is a cast lug on the holder** (1) **:** Make sure that the holder is installed in the correct position.



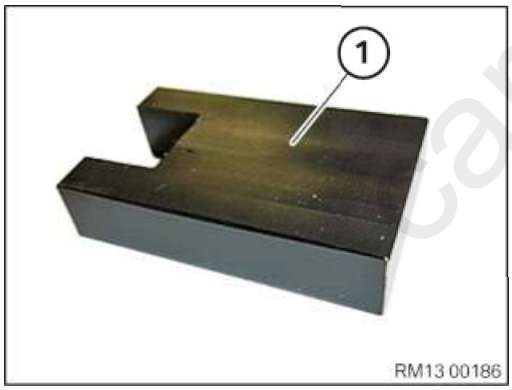
- Observe position of cast lug:

  The holder is mounted **correctly** when the cast lug is located at the rear.



- Observe position of cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.



RISK OF DAMAGE

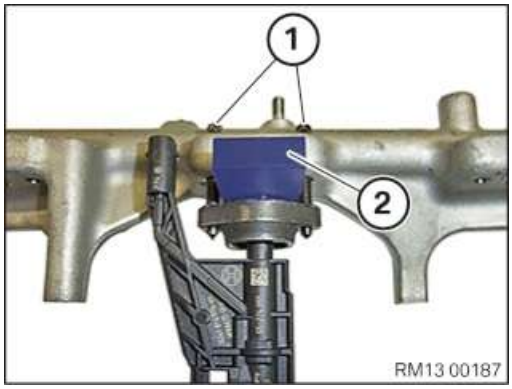
Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use special tool 2 358 022(1) .

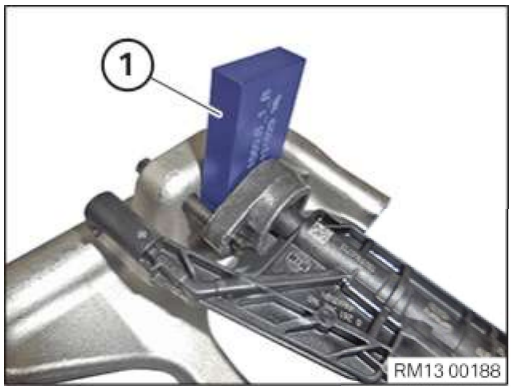
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- Replace (M5x30) screws.

  Parts: Screws (M5x30)
- Mount the injectors with the holders and the bolts (M5x30) (1) on the rail.
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.
- Slide special tool 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure the special tool 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) uniformly until the special tool 2 358 022 (2) rests flat against the rail and the holder.



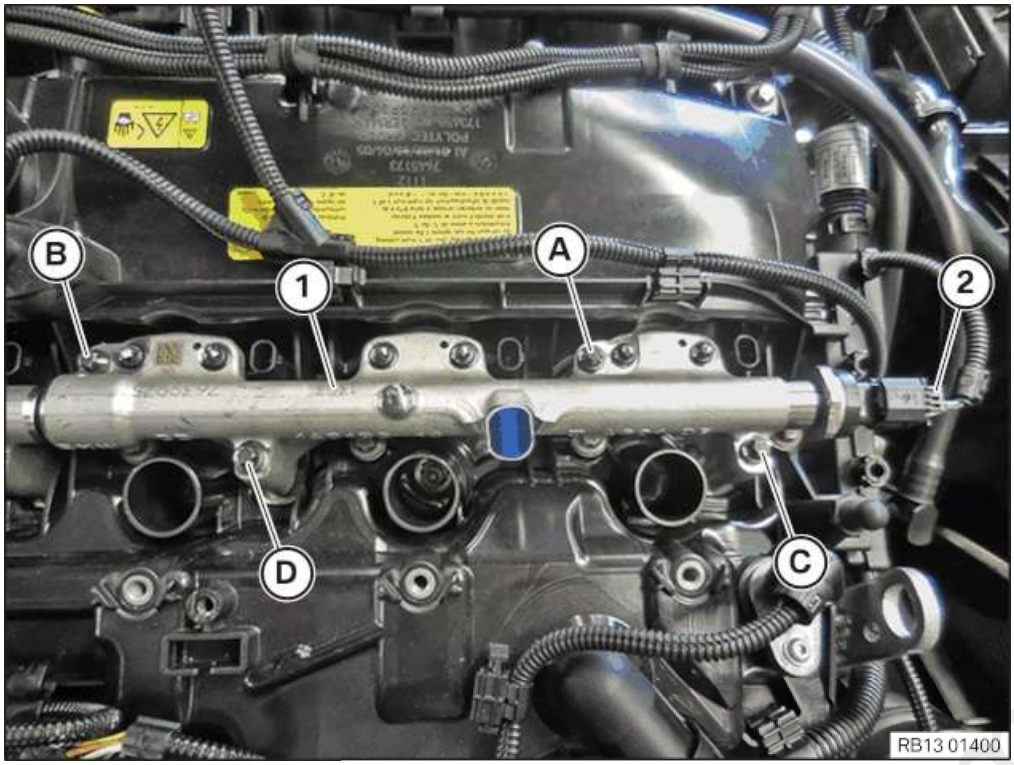
- Remove special tool 2 358 022(1) .
- Repeat this operation for all injectors.



- Check injectors for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors must move freely.

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- Renew screws (A) to (D).

  Parts: Bolts
- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- Press rail (1) down until a resistance can be felt; join and hand-tighten screws (M6x30) (A) and (B).
- Tighten screws (A) and (B) alternately by **180°** each with the torque wrench until the rail is positioned on the cylinder head.

  The figure shows the rail resting flat against the cylinder head.
- Insert screws (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

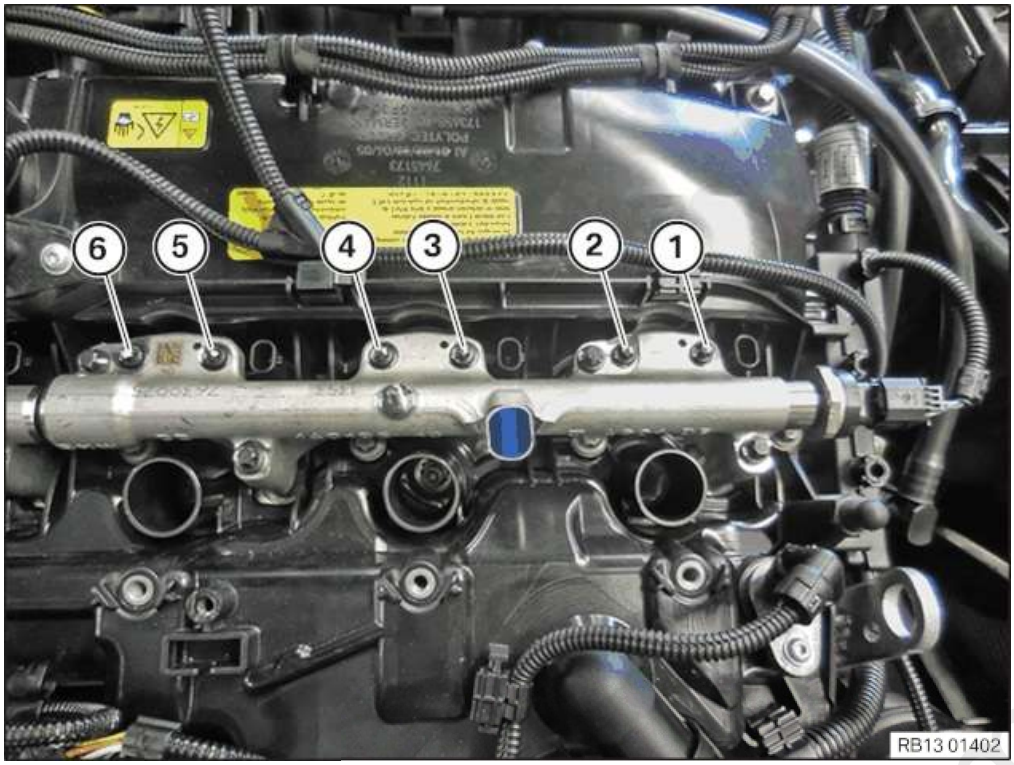
- Tighten screw (A) to 5 Nm.
- Tighten screw (D) to 5 Nm.
- Tighten screw (B) to 5 Nm.
- Tighten screw (C) to 5 Nm.
- Connect and lock the connector (2).

  The connector (2) must engage audibly.



- Make sure that the rail (1) rests flat against the cylinder head.

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- Attach a socket to an extension.

  Do not use a reversible ratchet or torque wrench.
- Hand-tighten screws (M5x30) in pairs ((1) with (2), (3) with (4), (5) with (6)) alternately by **90°**.
- Set torque wrench to 5 Nm.

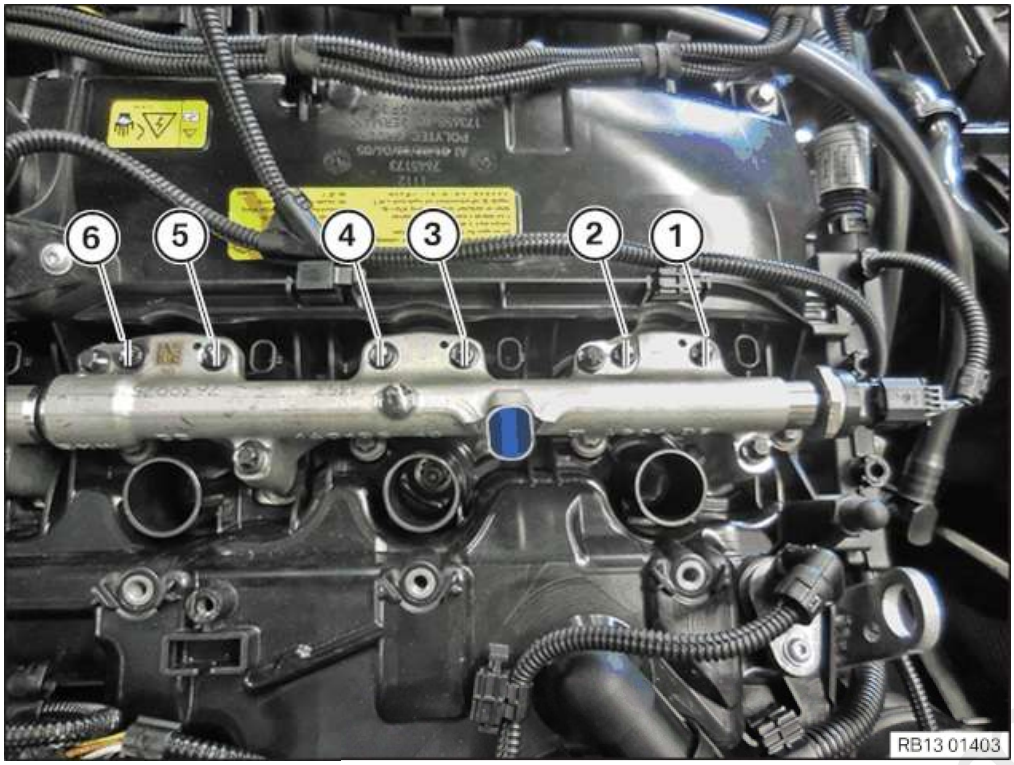
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

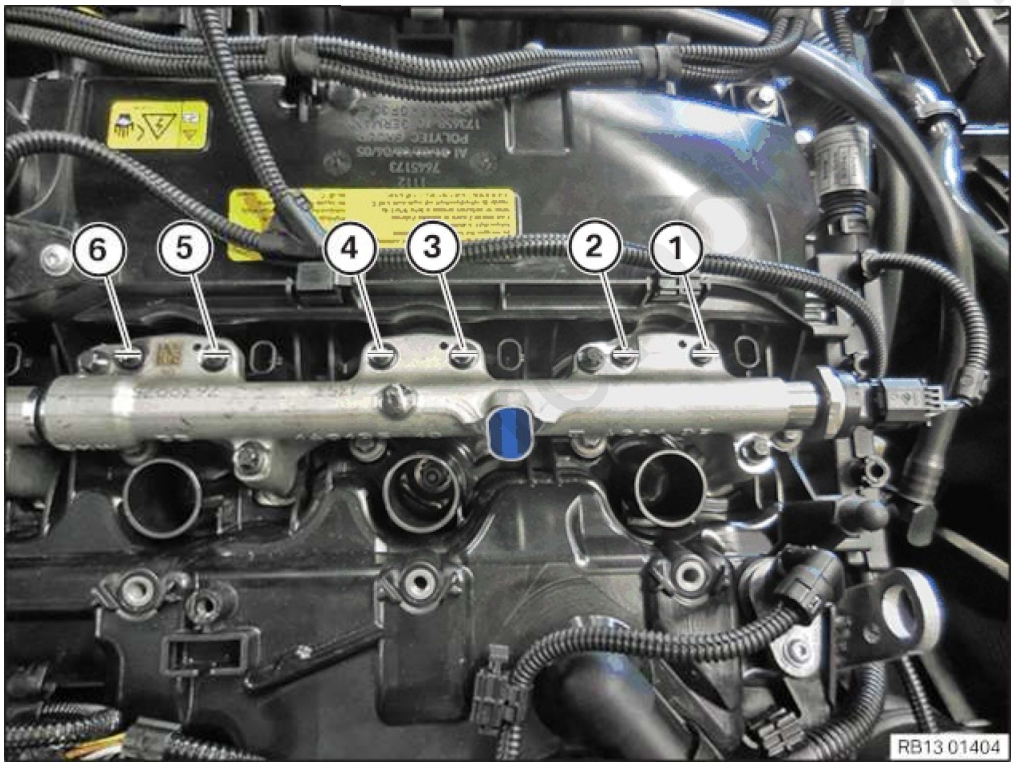
Non-observance of these requirements may result in leaks and damage.

- **Screw the (M5x30) bolts according to the following plan:**
  - **Fuel injector 1:**
  - Tighten screw (1) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (2) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten screw (3) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (4) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 3**:
  - Tighten screw (5) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (6) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts reach a torque of 5 Nm.

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- Mark all bolts (1) to (6) with a line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the screw (1) with an angle of rotation of 90° ±15°.
  - Tighten the screw (2) with an angle of rotation of 90° ±15°.
  - Tighten the screw (3) with an angle of rotation of 90° ±15°.
  - Tighten the screw (4) with an angle of rotation of 90° ±15°.
  - Tighten the screw (5) with an angle of rotation of 90° ±15°.
  - Tighten the screw (6) with an angle of rotation of 90° ±15°.



- Check if all bolts (1) to (6) have been tightened with a 90° ±15° angle of rotation.

  All markings (lines) must be horizontal (see Figure).



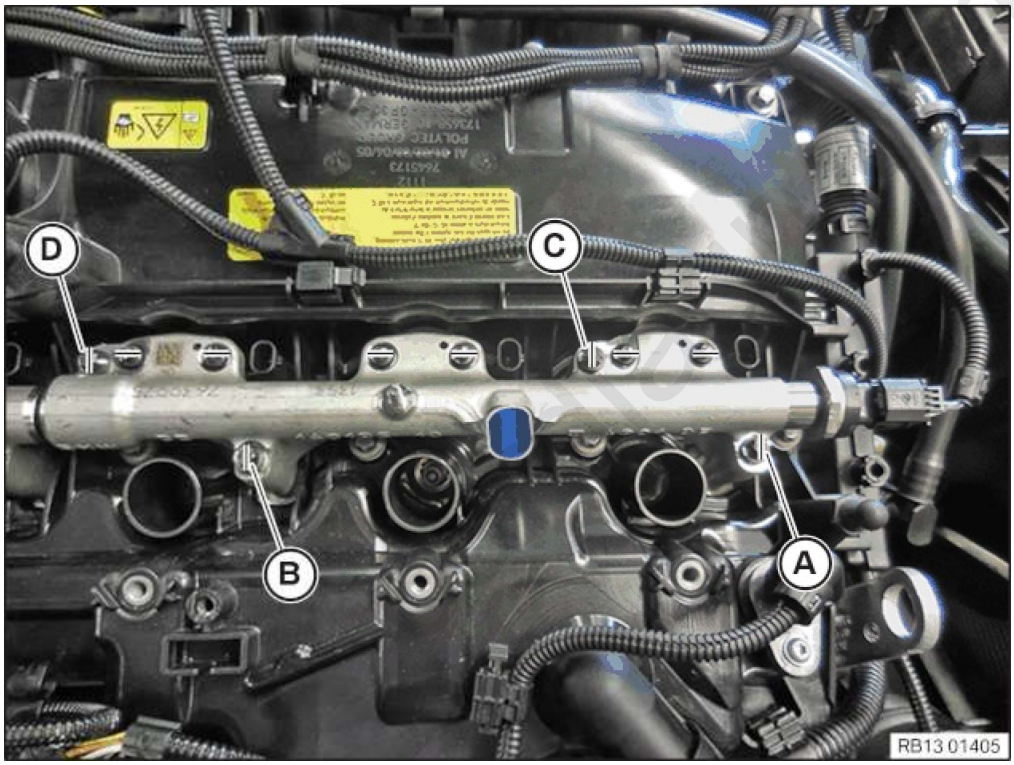
- Release screws (M6x70) (A) to (D) **without fail**.

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten screw (A) to 5 Nm.
- Tighten screw (D) to 5 Nm.
- Tighten screw (B) to 5 Nm.
- Tighten screw (C) to 5 Nm.

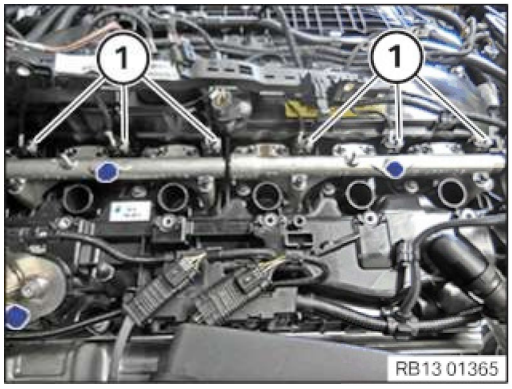


- Mark all the bolts (A) to (D) with a vertical line (see Figure).
- Tighten bolts (M6x70) (A) to (D) with an angle of rotation of 90°.



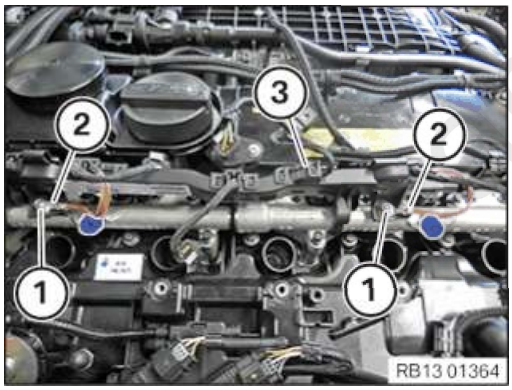
- Check whether all screws (A) to (D) have been tightened with an angle of rotation of 90°.

  All marks (lines) must be horizontal (see figure).



- Connect and lock all the connectors (1) to the injectors.

  All connectors (1) must engage audibly.

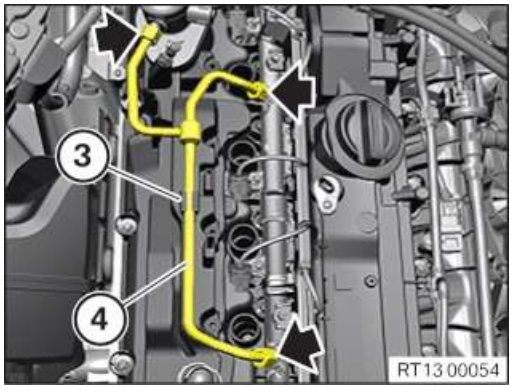


- Thread the cable channel (3) in and install.
- Thread in ground cable (2) and install.
- Tighten nuts (1).

Ground cable to rail

M6			5 Nm

70 – Installing high pressure line between rail and high pressure pump

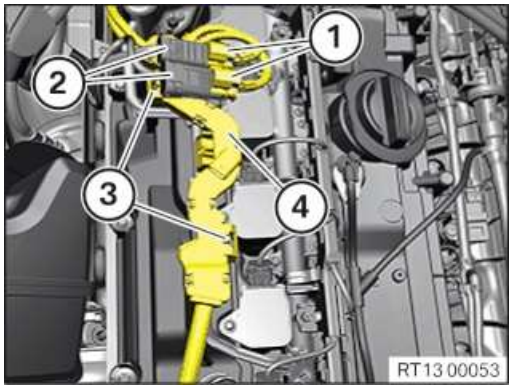


- Insert the high pressure line (4) into the holder (3) and install.
- Tighten union nuts (arrows) with the special tool .

High pressure line between rail and high pressure pump

M14x1,5		Tightening torque	33 Nm

rdiagn.com



- Insert and install the wiring harness section of the engine wiring harness (4).

  The locks (3) must engage audibly.
- Connect connectors (1) and (2) and lock.

  The connectors (1) and (2) must audibly engage.

71 – Install high pressure pump

RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

Only G05 and G07

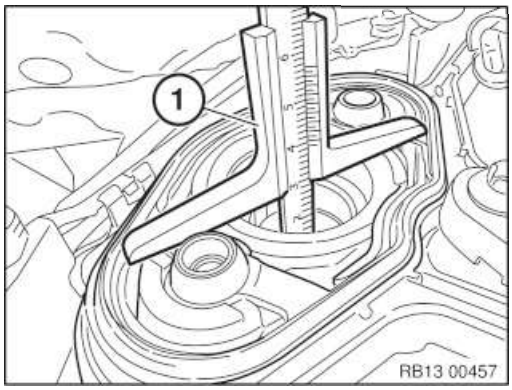
In vehicles with active anti-roll bar (ARS) the fan cowl must be removed in order to spin the engine.

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

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

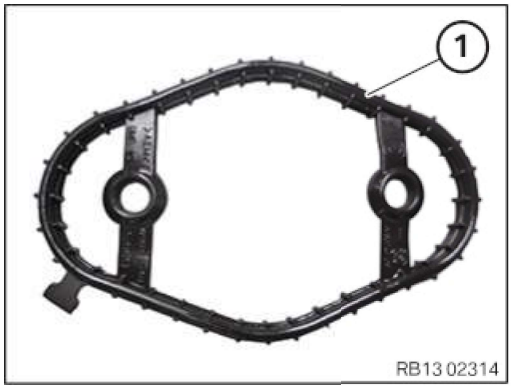
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.



TECHNICAL INFORMATION

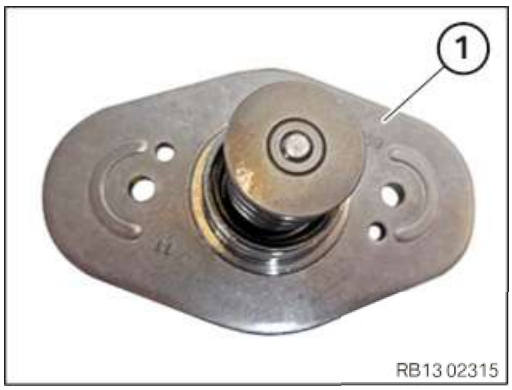
The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).

mdiagn.com



- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

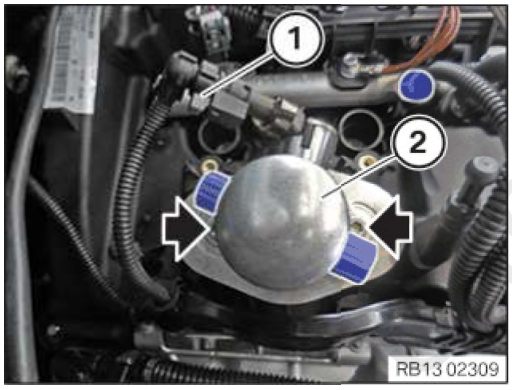
The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

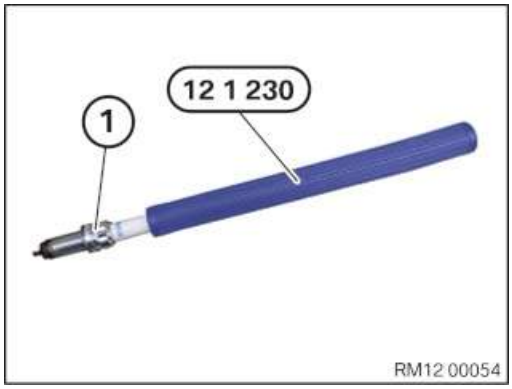
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

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

72 – Installing all spark plugs

NOTICE

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



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



TECHNICAL INFORMATION

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

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



TECHNICAL INFORMATION

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

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

Spark plugs

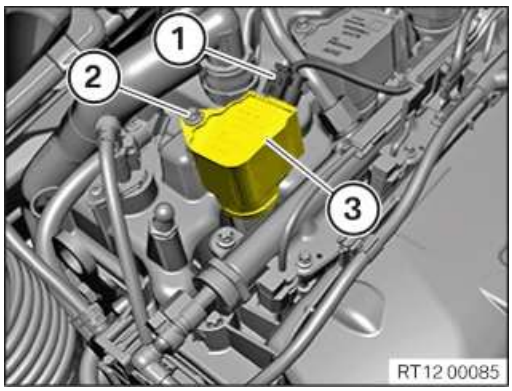
M12x1.25		Tightening torque	23 Nm

73 – Install all ignition coils

NOTICE

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

▶ **Install ignition coil.**



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

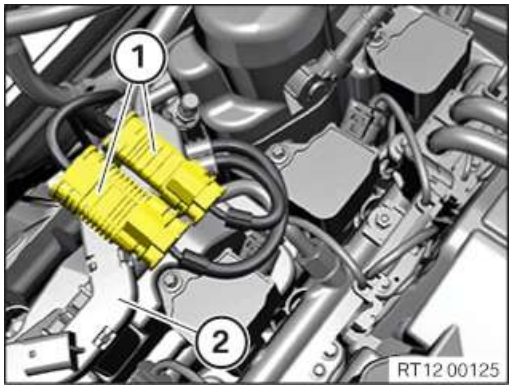
Ignition coil

Screw		Tightening torque	8 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

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- Connect the connector (1) of the front oxygen sensor and the monitoring oxygen sensor on the cable shaft (2).

74 – Install catalytic converter



- Renew the V-clip (1).

  Parts: V-band clamp



- Renew the gasket (1).

  Parts: Gasket



- Feed in and install catalytic converter.
- Lock clamp (1).

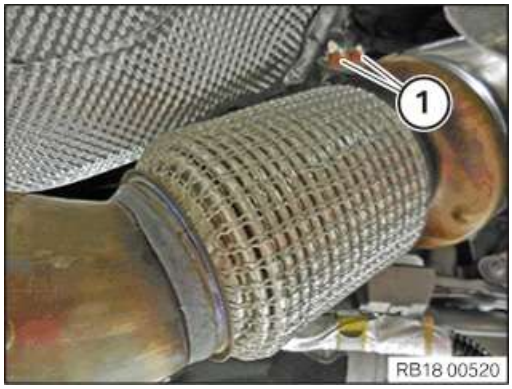
  The clamp (1) must engage audibly.



- Tighten V-band clamp (1).

Catalytic converter to turbocharger

V-band clamp	Replace V-band clamp.	Tightening torque	19 Nm



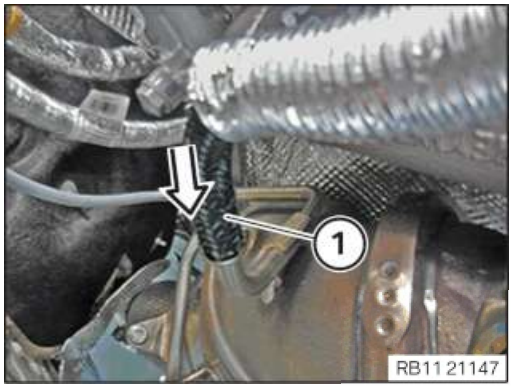
- Renew nuts (1).

  Parts: Nuts

- Tighten nuts (1).

Catalytic converter to holder

M8 nut	Renew nut.	Tightening torque	28 Nm



- **If installed: Connect pressure hose.**

  Renew pressure hose (1).

  Parts: Pressure hose

- Connect the pressure hose (1) in direction of arrow to the limit position.

75 – Install the monitoring oxygen sensor

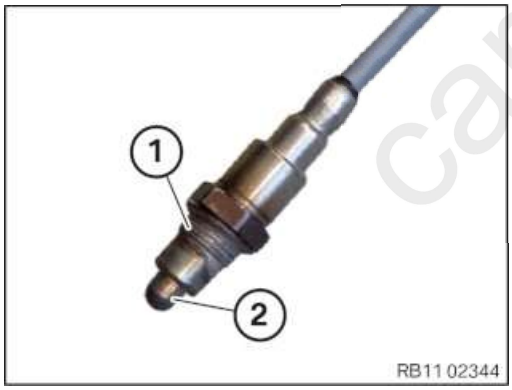
TECHNICAL INFORMATION

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

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

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

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



- Prepare the oxygen sensor.

  Do not damage the sensor ceramics.

  (1) = Thread

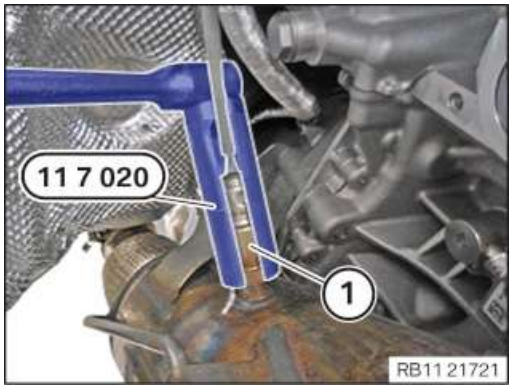
  (2) = Sensor ceramics

- Grease the thread (1) of the Lambda monitoring oxygen sensor thinly and evenly.

Expendable materials

Brake block paste * TU = Trade Unit. TU numbers cannot be ordered! For invoicing purposes only.	3 g, Bag	83192158851
	100 g, Tube	83192158852
	5 g, TU*	83230140233

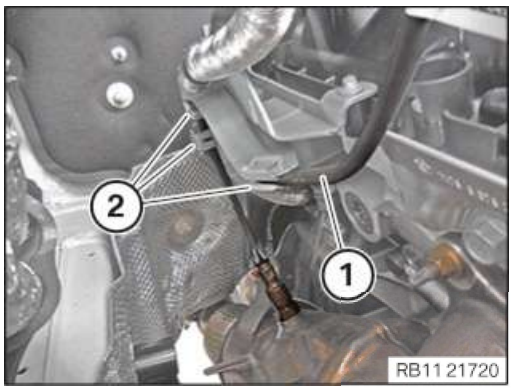
cardiagn.com



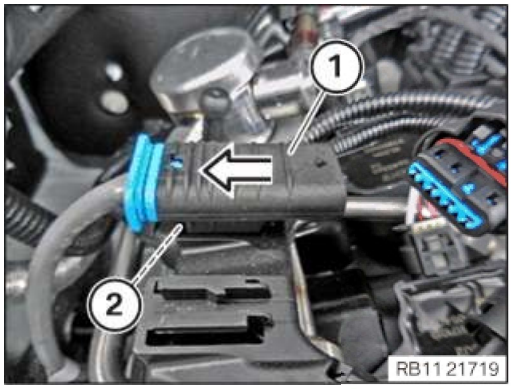
- Feed in the monitoring oxygen sensor (1) and install.
- Tighten monitoring oxygen sensor (1) using special tools 0 493 751 (11 9 150) and 0 491 075 (11 7 030) .

Monitoring oxygen sensor to catalytic converter

M18X1.5		Tightening torque	50 Nm



- Guide monitoring oxygen sensor line (1) into holder (2) and install it.



- Insert and install the connector (1) in the **direction of arrow**.
- Ensure that the lock (2)engages audibly.



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

76 – Install the front oxygen sensor

TECHNICAL INFORMATION

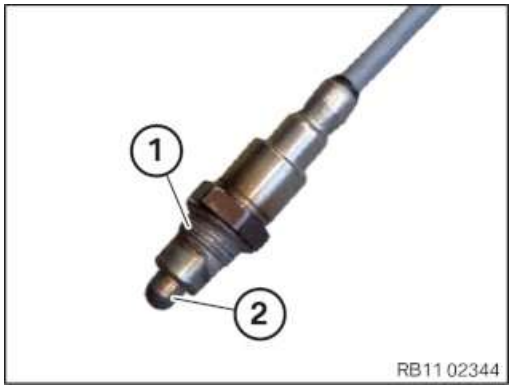
New oxygen sensors are to be greased lightly and evenly on the thread.

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

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

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

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- Prepare the oxygen sensor.

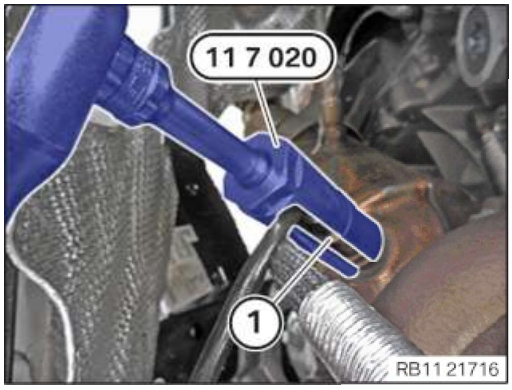
  Do not damage the sensor ceramics.

  (1) = Thread

  (2) = Sensor ceramics
- Apply a thin and even coat of grease to the thread (1) of the front oxygen sensor.

Expendable materials

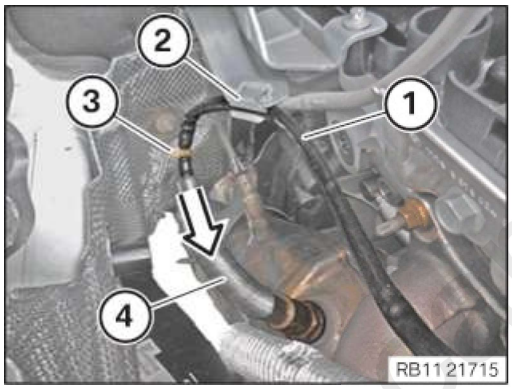
Brake block paste * TU = Trade Unit. TU numbers cannot be ordered! For invoicing purposes only.	3 g, Bag	83192158851
	100 g, Tube	83192158852
	5 g, TU*	83230140233



- Screw the control sensor (1) in and tighten it with the special tool .

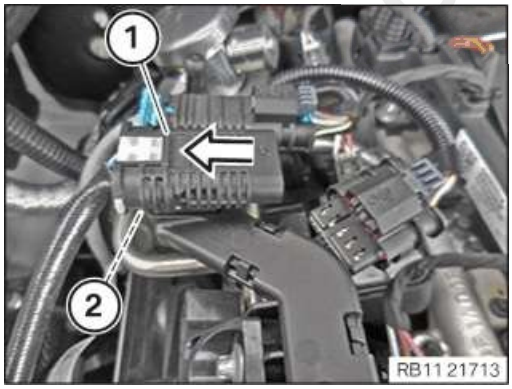
Front oxygen sensor to catalytic converter

M18X1.5		Tightening torque	50 Nm



- Guide in the heat protection (4) in the **direction of arrow** and install.
- Renew the cable straps (3).

  Parts: Cable strap
- Guide in and install the cable strap (3).
- Feed in and install the line of the front oxygen sensor (1) in the holder (2).



- Insert and install the connector (1) in the **direction of arrow**.
- Ensure that the lock (2)engages audibly.



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

77 – Installing the intake plenum

RISK OF DAMAGE

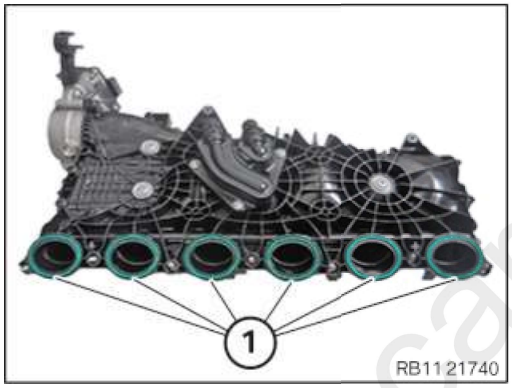
Improper routing of cables and wiring harnesses.

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

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

TECHNICAL INFORMATION

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



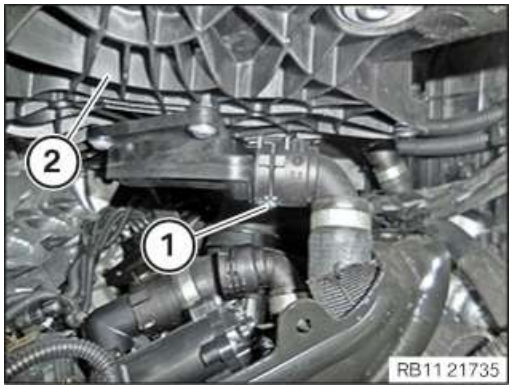
- Renew gaskets (1).

  Parts: Seals

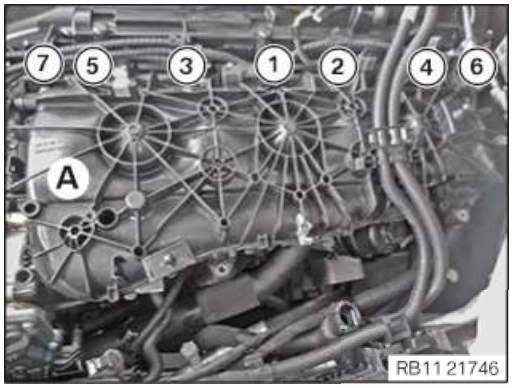


- Clean contact surface (1).

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- Feed in and position intake plenum (2).
- Connect and lock coolant line (1).
- Make sure that the cooling line (1) engages audibly.



TECHNICAL INFORMATION

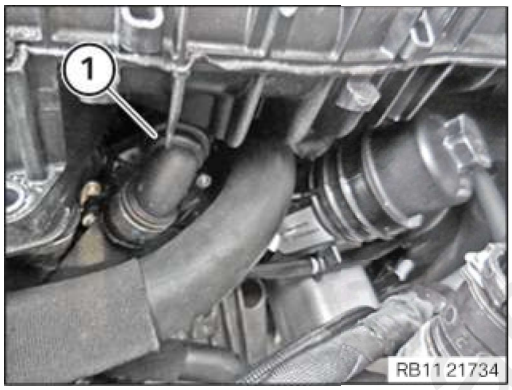
Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Position the intake plenum (A).
- Tighten screws in the order (1) to (7).

Note: Tighten the bolts in 360 degree steps.

Intake plenum to cylinder head

M6		Tightening torque	10 Nm



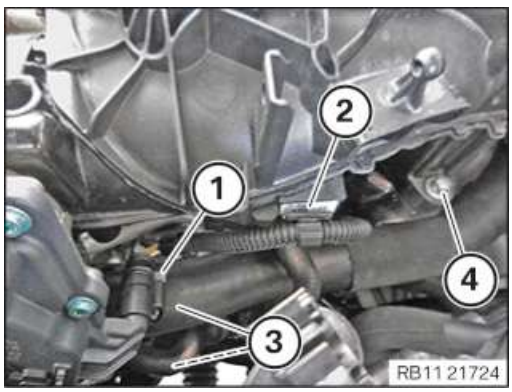
- Connect and lock coolant line (1).
- Make sure that the cooling line (1) engages audibly.



- Tighten down screw 1.

Intake plenum to support

M6X25		Tightening torque	8 Nm



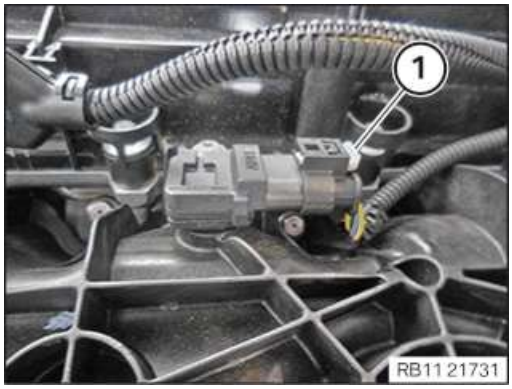
- Tighten down screw (4).

Intake plenum to support

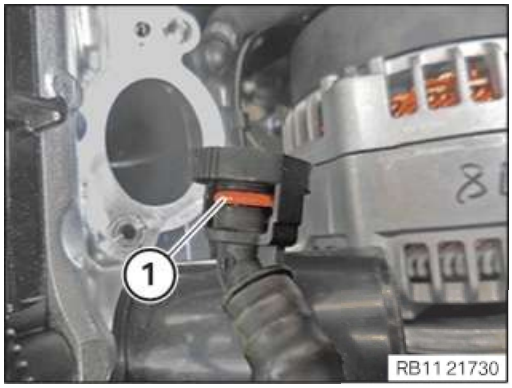
M6X25		Tightening torque	8 Nm

- Thread in and install coolant line (3).
- Secure clamps (2).
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.

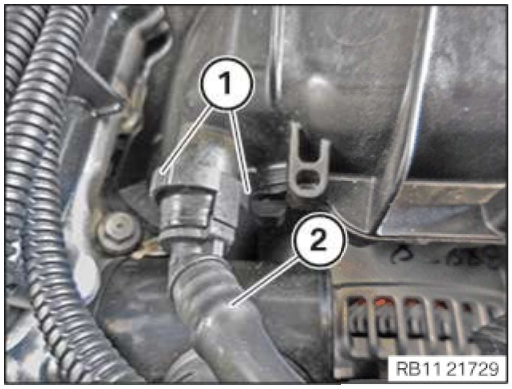
fdiagn.com



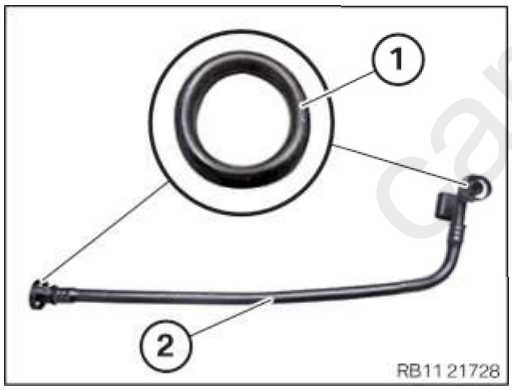
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.



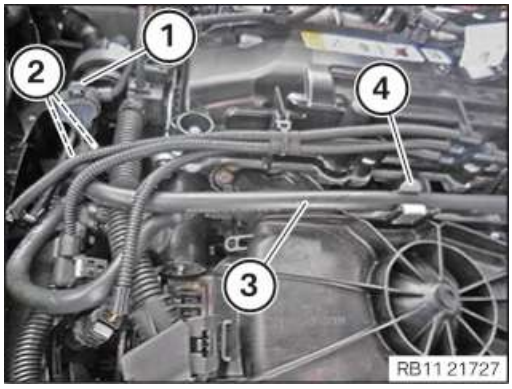
- Check sealing ring (1) for damage and renew tank ventilation line if necessary.



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

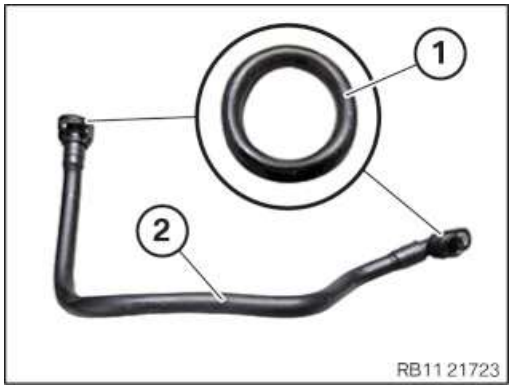


- Check sealing ring (1) for damage and renew tank ventilation line (2) if necessary.

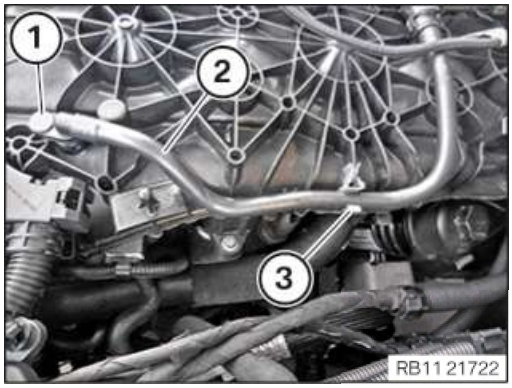


- Insert and install the tank ventilation line (3).
- Ensure that the locks (2) engage audibly.
- Secure the tank ventilation line (3) to the clamp (4).
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.

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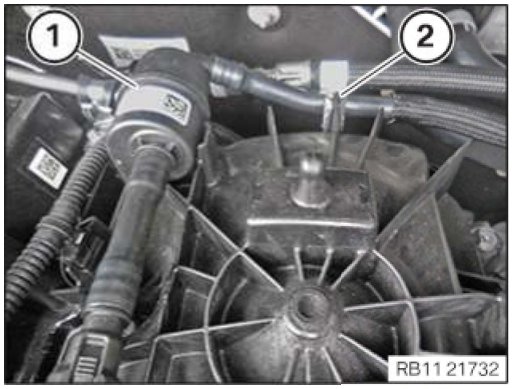
- Check sealing ring (1) for damage and renew tank ventilation line (2) if necessary.



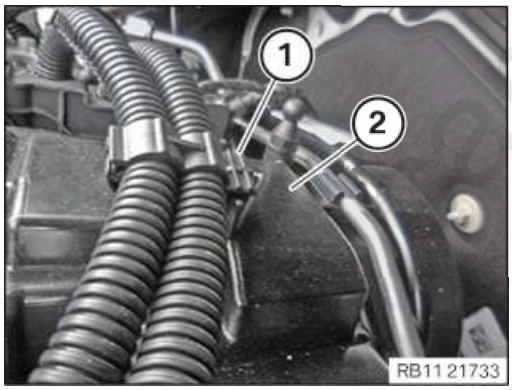
- Insert and install the tank ventilation line (2).
- Secure the tank ventilation line (2) to the clamp (3).
- Tighten down screw (1).

Tank ventilation line to intake plenum

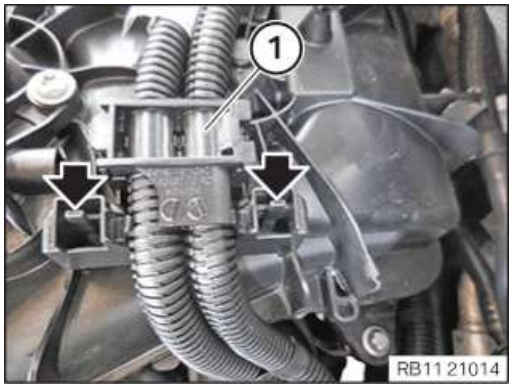
Oval-head screw		Tightening torque	3 Nm



- Insert and install the tank ventilation line (1).
- Secure the tank ventilation line (1) to the clamp (2).



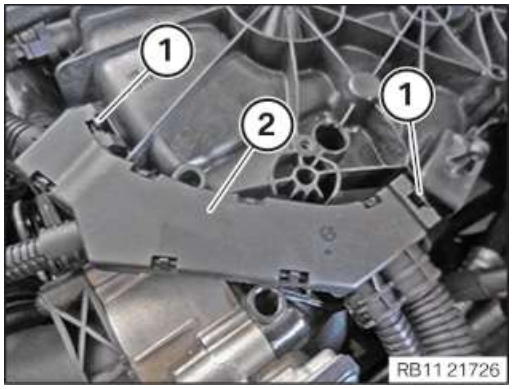
- Secure the wiring harness section(1) for the injectors and ignition coils on the cylinder head cover (2).



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

  The locks (arrows) must engage audibly.

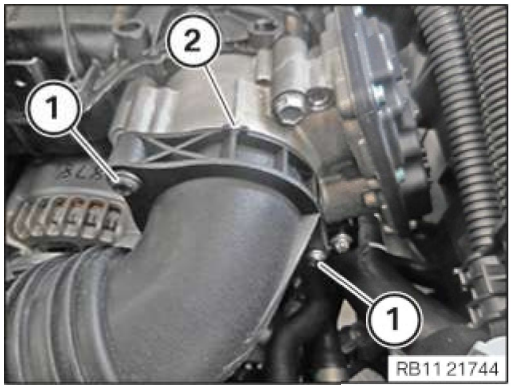
carfdiagn.com



- Feed in and install wiring harness section (2) for sensor system **2**.
- Ensure that the locks (1) engage audibly.



- Check the sealing ring (1) for damage and renew the sealing ring (1) as needed.

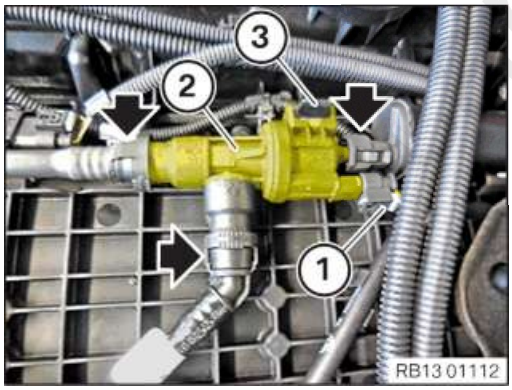


- Insert and install charge air line (2).
- Tighten the screws (1).

Charge air line to throttle valve

M6x30		Tightening torque	8 Nm

78 – Installing the tank vent valve



- Secure the tank vent valve (2) to the holder (3).
- Connect and lock the tank ventilation lines (arrows).

  The tank ventilation lines (arrows) must audibly engage.
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

79 – Install engine ventilation line

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

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

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

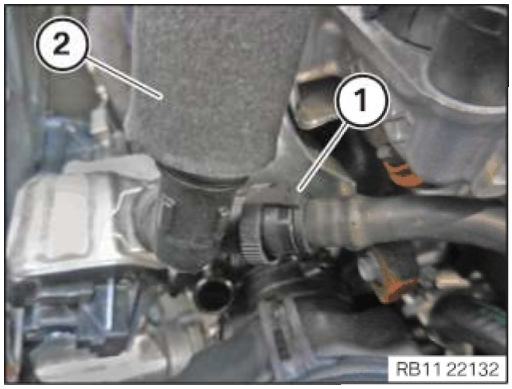
rdiagn.com

TECHNICAL INFORMATION

Check the retaining lug on the connector for damage and perform a tension check as needed.

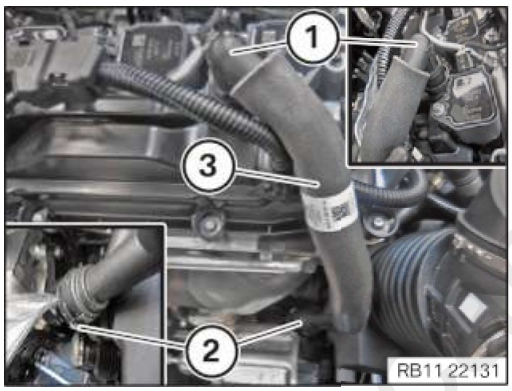


- Check sealing ring (1) for damage and renew tank ventilation line if necessary.

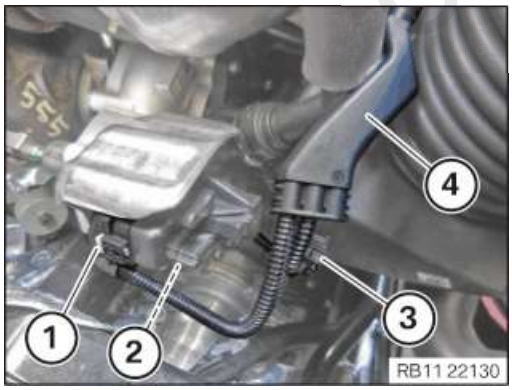


- Insert and position the engine ventilation line (2).
- Insert and install the tank ventilation line (1).

  Tank ventilation line (1) must engage audibly into place.



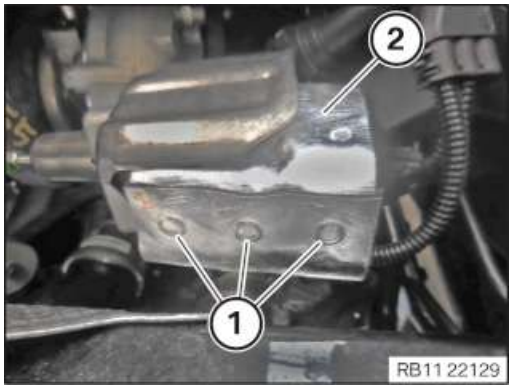
- Insert and install the engine ventilation line (3).
- Make sure you can hear the locks (1) and (2) engage.



- Feed in and position the wiring harness section of sensor system **2** (4).
- Connect connectors (2) and lock.
- Connect connectors (1) and lock.

  The connectors (1) and (2) must audibly engage.
- Secure clamps (3).

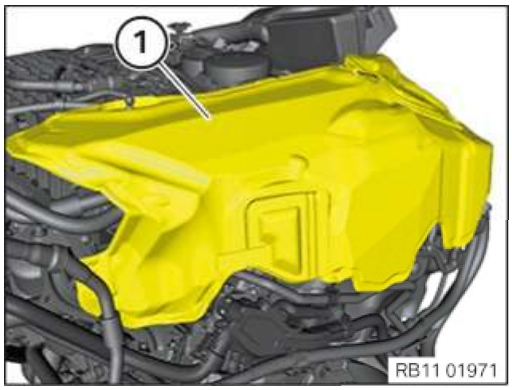
carfdiag.com



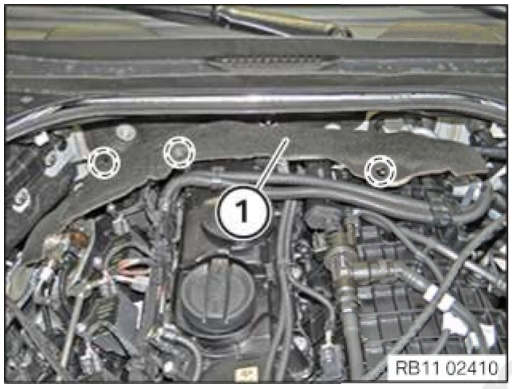
- Feed in and install heat shield (2).
- Lock the locks (1).

  Locks (1) must engage audibly.

80 – Installing acoustic cover at rear



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



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

81 – Topping up the engine oil

RISK OF DAMAGE

Damage to the petrol particulate filter.

Vehicles equipped with a petrol particulate filter must be operated with low-ash engine oil only.

- Use BMW Longlife-04 , BMW Longlife-12 FE or BMW Longlife-17 FE+ engine oils or engine oils approved by BMW matching the same specifications only.
- For additional information see: Overview of approved engine oils for BMW Group engines.

RISK OF DAMAGE

Engine damage caused by excessively filling the engine with engine oil.

Filling an excessive quantity of engine oil may cause engine damage.

- Observe the exact engine oil filling capacity.
- Drain the engine oil.

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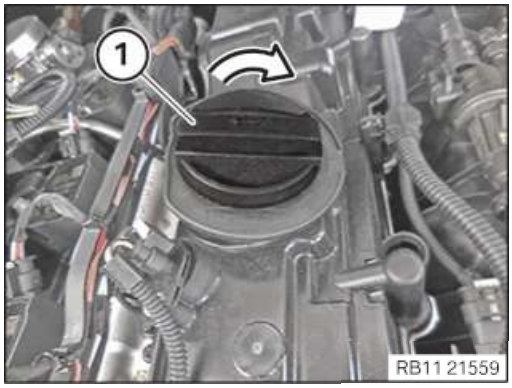
- Pour in engine oil.

Engine oil B58B30M1/B58B30O1

Filling capacity, engine oil change with oil filter element	6,50 l

Engine oil: Technically suitable engine oils for BMW Group engines

82 – Installing the oil filler cap



- Close oil filler cap (1) in direction of arrow.
- Make sure that the sealing cap (1) engages audibly.

83 – Remove engine from assembly stand

CAUTION

Heavy component.

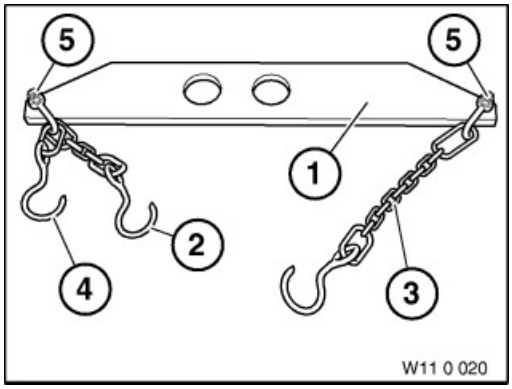
Heavy components can lead to injury or damage.

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

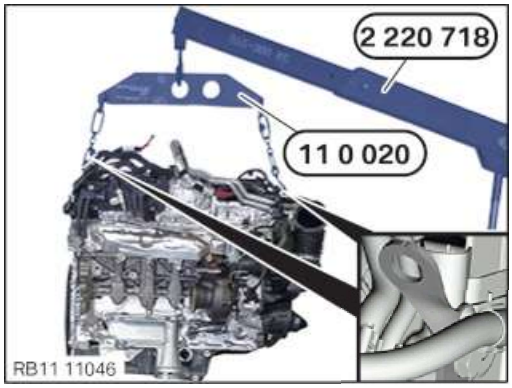


- Stage the workshop crane 2 220 718.

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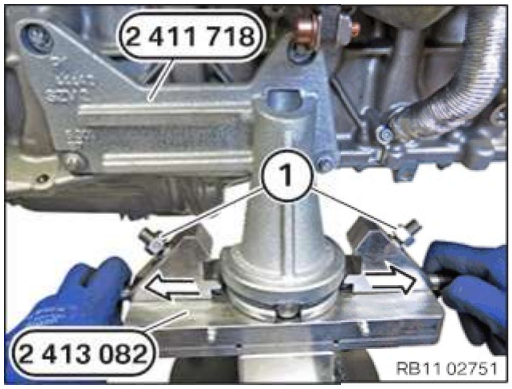
- Stage special tool (lifting gear) 0 490 567 (11 0 020).



TECHNICAL INFORMATION

The workshop crane, lifting gear and the mounting brackets on the engine must all be connected to each other so that the engine hangs straight upon lifting.

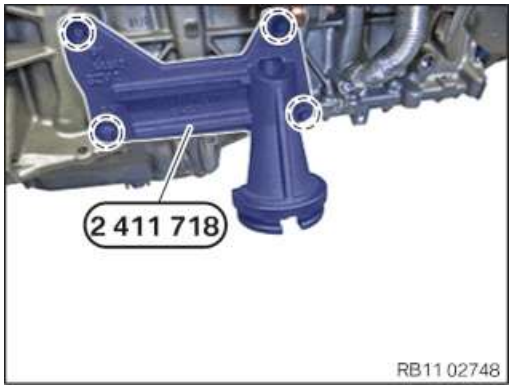
- Connect both hooks of the special tool 0 490 567 (11 0 020) to the front and back of the engine with the mounting brackets.
- Connect the workshop crane 2 220 718 to the special tool (lifting gear) 0 490 567 (11 0 020).



- Slacken nuts (1).
- Unclamp the clamping jaws of the special tool (engine fixture) 2 413 082 in the direction of arrow.

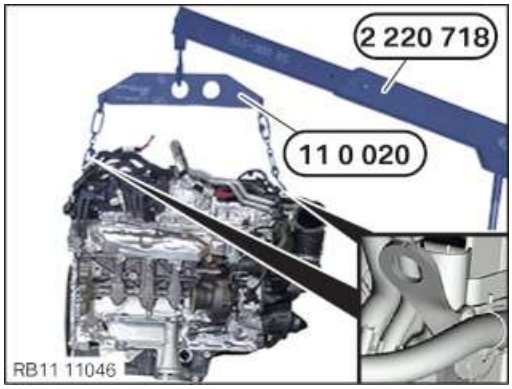


- Raise the engine slowly.



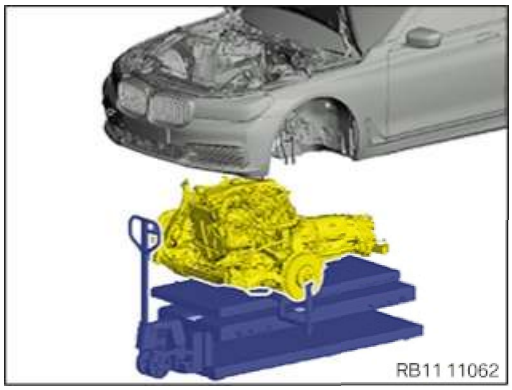
- Release the screws (marks) and remove the special tool (engine fixture) 2 411 718.

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- See additional information.

85 – Installing the complete front axle including engine and transmission



- See additional information.

Additional Information

Overview of Tightening Torques

Flange to assembly stand			Used in step 3
M14X30		Tightening torque	135 Nm

Special tool 11 8 930 to special tool 00 2 320			Used in step 3
M14x35		Tightening torque	160 Nm

Special tool 2 411 718 to crankcase			Used in step 3
M10x30		Tightening torque	38 Nm

Oil drain plug			Used in step 6
M12x16	Replace sealing ring.	Tightening torque	25 Nm

Basic carrier to cylinder head			Used in step 245262
M6		Tightening torque	8 Nm

Test gauge to basic carrier			Used in step 245262
M6		Tightening torque	8 Nm

Special tool to cylinder head			Used in step 33
M8		Tightening torque	21,5 Nm

Bearing journal to crankcase			Used in step 41
Bearing journal	Replace bearing journal.	Tightening torque	20 Nm

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Rear timing case cover to crankcase — Used in step 42

M6 x 31	Renew screws.	Jointing torque	8 Nm
		Angle of rotation	90 °

Oil sump to crankcase — Used in step 43

M8 x 30		Tightening torque	24 Nm

Oil sump to crankcase — Used in step 43

M8 x 110		Tightening torque	24 Nm

Transmission to oil sump (manual gearbox and automatic transmission) — Used in step 43

M8 x 50		Tightening torque	19 Nm

Bearing support to oil sump — Used in step 44

M8		Tightening torque	19 Nm

Front axle final drive to engine oil pan — Used in step 45

M12		Tightening torque	140 Nm

Flywheel to crankshaft — Used in step 46

M12x1.5	Renew screws.	Jointing torque	45 Nm
		Angle of rotation	40 °

Cylinder head to crankcase — Used in step 51

M11	Observe tightening sequence. Fit new cylinder head bolts.	1. Jointing torque	30 Nm
		2. Angle of rotation	90 °
		3. Angle of rotation	180 °

Cylinder head bolt to timing case cover — Used in step 51

M8x40	Renew screws.	Tightening torque	19 Nm

Camshaft sensor wheel to intake camshaft — Used in step 51

M4 x35			4,5 Nm

Bearing journal to cylinder head — Used in step 51

Bearing journal	Renew the bearing journal!	Tightening torque	20 Nm

Sliding rail to cylinder head — Used in step 51

M6x16			8 Nm

Cover on rear cylinder head — Used in step 51

M6		Tightening torque	8 Nm

Cable routing to cylinder head, rear — Used in step 51

M6 x 20		Tightening torque	8 Nm

Oil feed line for exhaust turbocharger to crankcase — Used in step 51

M6 x 12	Replace sealing ring.	Tightening torque	8 Nm

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Coolant return line holder bracket to crankcase — Used in step 51

M6X12		Tightening torque	8 Nm

Heat shield to cylinder head — Used in step 51

M8X12	Renew screws.	Tightening torque	19 Nm

Heat shield to clamping strip — Used in step 51

M6X16	Renew screw.	Tightening torque	8 Nm

Coolant feed line to crankcase — Used in step 51

M6X12		Tightening torque	8 Nm

Exhaust turbocharger support to crankcase — Used in step 51

M8 x 20	Renew screws.		19 Nm

Exhaust turbocharger to support — Used in step 51

M8 x 25	Renew screw.		19 Nm

VANOS central valve to camshaft — Used in step 5859

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

Chain tensioner to cylinder head — Used in step 61

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Coolant line to coolant pump/cylinder head — Used in step 63

M6x20		Tightening torque	8 Nm

Oil return line to turbocharger — Used in step 64

M6 x 12			8 Nm

Oil return line to crankcase — Used in step 64

M6 x 12			8 Nm

Cylinder head cover to cylinder head — Used in step 65

M6X30		Jointing torque	8 Nm

Cylinder head cover to cylinder head — Used in step 65

M6X30		Tightening torque	11 Nm

Auxiliary coolant pump holder to cylinder head — Used in step 65

M6		Tightening torque	7 Nm

Standard screw connection M6 — Used in step 65

M6			8 Nm

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Differential pressure sensor to holder — Used in step 65

TS6X18		Tightening torque	3,5 Nm

Holder, positive battery cable to cylinder head cover — Used in step 65

6X18		Tightening torque	6 Nm

Ground cable to rail — Used in step 6869

M6			5 Nm

High pressure line between rail and high pressure pump — Used in step 70

M14x1,5		Tightening torque	33 Nm

High pressure pump to high pressure pump flange — Used in step 71

M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

Spark plugs — Used in step 72

M12x1.25		Tightening torque	23 Nm

Ignition coil — Used in step 73

Screw		Tightening torque	8 Nm

Catalytic converter to turbocharger — Used in step 74

V-band clamp	Replace V-band clamp.	Tightening torque	19 Nm

Catalytic converter to holder — Used in step 74

M8 nut	Renew nut.	Tightening torque	28 Nm

Monitoring oxygen sensor to catalytic converter — Used in step 75

M18X1.5		Tightening torque	50 Nm

Front oxygen sensor to catalytic converter — Used in step 76

M18X1.5		Tightening torque	50 Nm

Intake plenum to cylinder head — Used in step 77

M6		Tightening torque	10 Nm

Intake plenum to support — Used in step 77

M6X25		Tightening torque	8 Nm

Tank ventilation line to intake plenum — Used in step 77

Oval-head screw		Tightening torque	3 Nm

Charge air line to throttle valve — Used in step 77

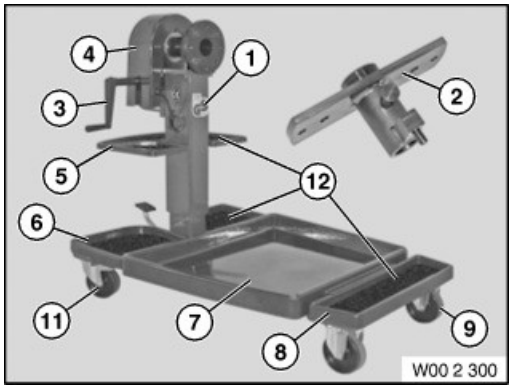
M6x30		Tightening torque	8 Nm

Overview of Special Tools

0 495 187 (00 2 300) Assembly stand

Common — Used in step 3

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Usage	Assembly stand with universal flange for mounting engines from S85
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 25 04 (155)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 188 (00 2 301)		**Assembly stand** available only as complete assembly stand 83 30 0 495 187.	
2	0 495 189 (00 2 302)	2 299 563	**Tool** (Universal flange). Do not use any more!!! Technically locked. Replaced with a new flange with material number 83 30 2 299 563. All flanges delivered until the end of 2011 will be replaced at no charge. From 2012, only the new flange will be supplied. Also applies to the complete engine mounting stand 00 2 300.	
3	0 495 200 (00 2 303)		**Crank**	
4	0 495 201 (00 2 304)		**Cover** (Protective hood)	
5	0 495 202 (00 2 305)		**oddments tray** (Oddments tray for small parts)	
6	0 495 203 (00 2 306)		**Shaped element** (Rear shaped pan)	
7	0 495 204 (00 2 307)		**Collection pan** (Oil collection pan)	
8	0 495 205 (00 2 308)		**Shaped element** (Front shaped pan)	
9	0 495 206 (00 2 309)		**Wheel** (Front wheel (without stop))	
10	0 495 207 (00 2 311)		**Wheel** (Rear wheel (with stop))	
11	0 495 208 (00 2 312)		**Mat** (Checker mat set)	
2	2 299 563		**Adapter** New adapter for the engine assembly stand. Replacement for 83 30 0 495 189 - 00 2 302.	

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2 411 718 Engine support



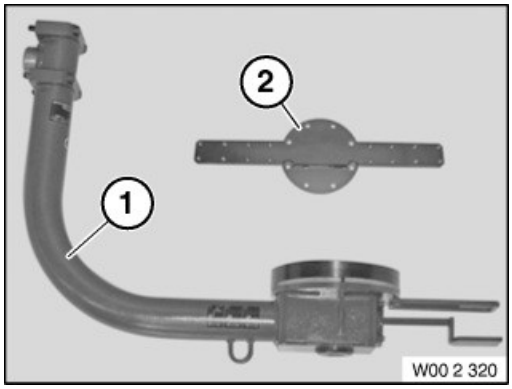
Common Used in step 383

Usage	For accommodating engine on assembly stand. Engine: B58; S58
Included in the tool or work	
Storage location	
Replaced by	
In connection with	2413082
SI-Number	01 23 15 (280)

0 495 196 (00 2 320) Support arm

Used in step 3

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Common

Usage	(Support arm with fixture) For mounting engines using the engine mounting bracket.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	002300 = 0495187
SI-Number	01 25 04 (155)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 197 (00 2 321)		**Support arm**	
2	0 495 198 (00 2 322)		**Panel** (take-up plate)	
3	0 495 380 (00 2 323)		**Panel** (fixture) Engine N73	
6	0 496 287 (00 2 326)		**Panel** (fixture) Engine: M73	
5	0 496 288 (00 2 327)	0 496 373	**Panel** (fixture) Engine: S62 Replaced by 11 5 420 (0 496 373)	
8	0 496 533 (00 2 328)		**Support** (Engine mount) Engine: N57, N57Top	
9	0 496 579 (00 2 329)	0 496 680	**Support** (Engine mount) Engine: N74 Replaced by 116160 (0 496 680)	
4	0 495 379 (00 2 324)		**Panel** (fixture) Engine M67TU	
5	0 495 381 (00 2 325)		**Panel** (fixture) Engine N62, N62TU	

2 413 082 Support

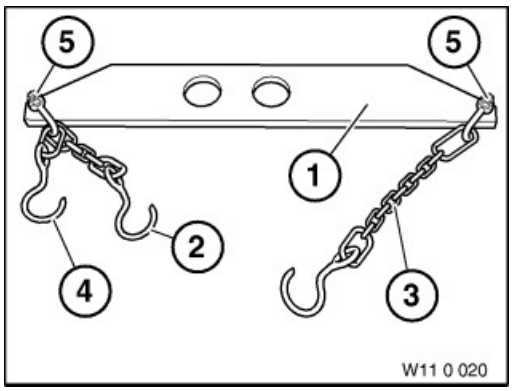


Common Used in step 383

Usage	For mounting the engines on the assembly stand.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	0495196
SI-Number	01 23 15 (280)

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0 490 567 (11 0 020) Lifting gear



Common Used in step 3335183

Usage	For removing and installing the engines. 08/2011 only available as a complete set. Delivered with TÜV inspection certificate and operating instructions. No delivery of separate parts.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 13 94 (888)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
5	0 490 572 (11 0 029)		**Shackle** (Shackle) 2 pieces As of 08/2011, only available as a complete set via 11 0 020 = 0490567. Delivered with TÜV inspection certificate and operating instructions.	
1	0 490 568 (11 0 021)		**Lifting gear** (Cross member) As of 08/2011, only available as a complete set via 11 0 020 = 0490567. Delivered with TÜV inspection certificate and operating instructions.	
2	0 490 569 (11 0 022)		**Chain** (Chain) As of 08/2011, only available as a complete set via 11 0 020 = 0490567. Delivered with TÜV inspection certificate and operating instructions.	
3	0 490 570 (11 0 023)		**Chain** (Chain) Version: long As of 08/2011, only available as a complete set via 11 0 020 = 0490567. Delivered with TÜV inspection certificate and operating instructions.	
4	0 490 571 (11 0 024)		**Chain** (Chain) Version: short As of 08/2011, only available as a complete set via 11 0 020 = 0490567. Delivered with TÜV inspection certificate and operating instructions.	

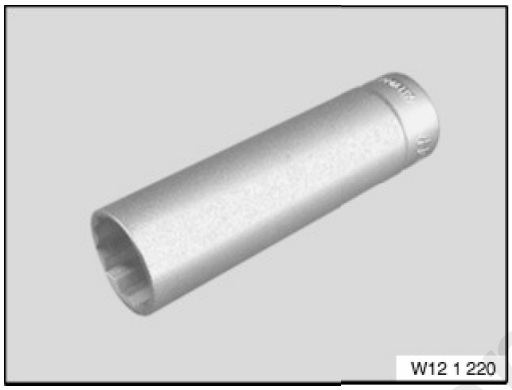
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2 220 718 Workshop crane



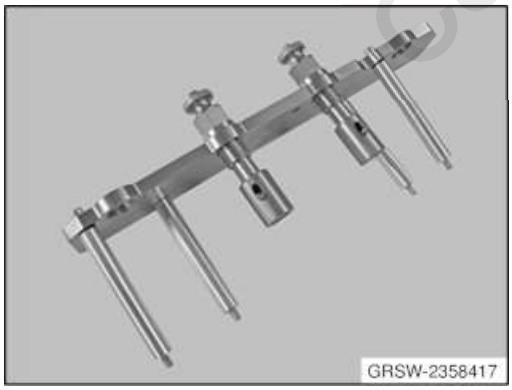
Common	Used in step	33383
Usage	WSK 1000	
Included in the tool or work		
Storage location	Individual	
Replaced by		
In connection with		
SI-Number	06 01 11 (701)	

0 495 560 (12 1 220) Socket



Common	Used in step	1572
Usage	For removing and installing the spark plugs (WAF 14 bihexal).	
Included in the tool or work		
Storage location	C18	
Replaced by		
In connection with		
SI-Number	01 20 06 (299)	

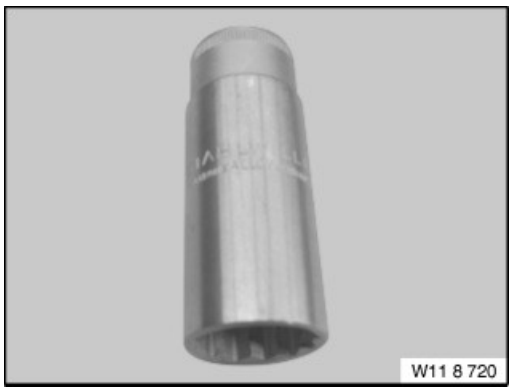
2 358 417 Device



Common	Used in step	1819
Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).	
Included in the tool or work		
Storage location	A57	
Replaced by		
In connection with		
SI-Number	01 13 14 (098)	

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0 496 106 (11 8 720) Socket WAF 46



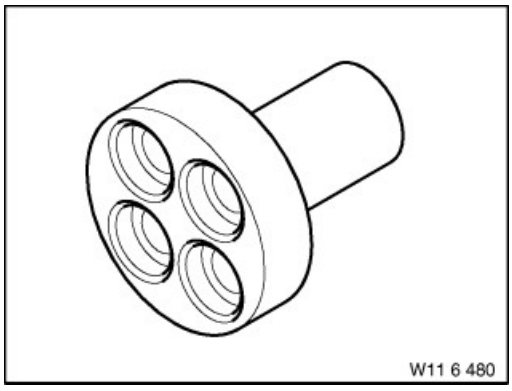
Common	Used in step 1819
Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

2 360 895 Pin wrench



Common	Used in step 2066
Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 493 380 (11 6 480) Connector



Common	Used in step 2450606271
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

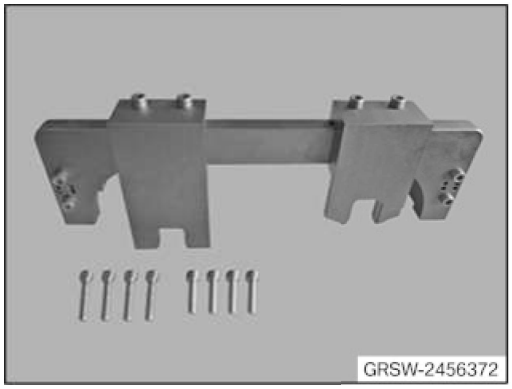
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2 288 380 Locating stud



Common	Used in step 24506062
Usage	For disconnecting the crankshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 04 14 (071)

2 456 372 Gauge



Common	Used in step 2432526062
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 122 Gauge



Common	Used in step 243262
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 496 855 Ratchet handle



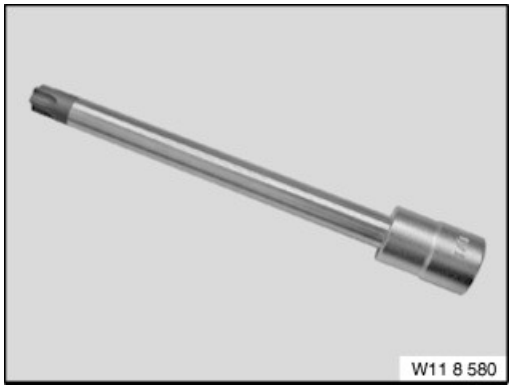
Common	Used in step 26275859
Usage	Insert reversible ratchet with nut for installation and disassembly of the VANOS- SW22. (only in longitudinal installation). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A55
Replaced by	
In connection with	
SI-Number	01 34 15 (306)

2 450 487 Socket



Common	Used in step 26275859
Usage	For removing and installing the VANOS adjuster. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	0496855
SI-Number	01 07 17 (487)

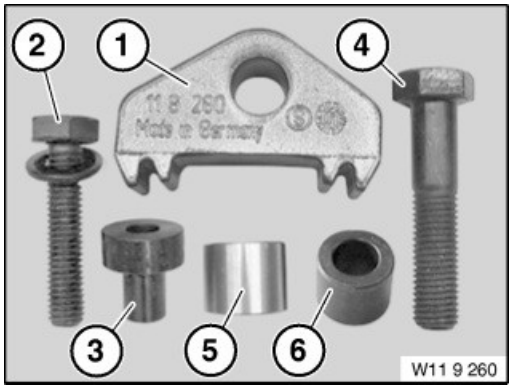
0 495 747 (11 8 580) Socket wrench



Common	Used in step 3351
Usage	(wrench socket Torx T60) For removing and installing cylinder head (outside diameter 13.5 mm).
Included in the tool or work	
Storage location	A19
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

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0 493 938 (11 9 260) Holder



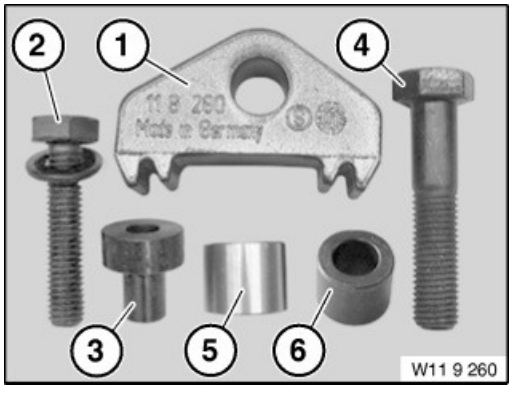
Common Used in step 3546

Usage	(Counter support with screw connection) For holding the flywheel when gearbox is removed
Included in the tool or work	
Storage location	A44
Replaced by	
In connection with	
SI-Number	01 01 01 (662)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 494 034 (11 9 261)		**Holder** (Individual counter support)	
2	0 494 035 (11 9 262)		**Screw** (Bolt (thread M10) with washer) For screwing counter support	
3	0 494 129 (11 9 263)		**Bush** (Bush for counter support) For counter support, for retaining flywheel when gearbox is removed Engine: N62, N73	
6	0 495 216 (11 9 266)		**Bush** For counter support, for retaining flywheel when gearbox is removed Engine: M57TU2	
4	0 494 130 (11 9 264)		**Screw** (Bolt (thread M12)) For counter support for retaining flywheel when gearbox is removed	
5	0 494 793 (11 9 265)		**Bush**	

0 494 130 (11 9 264) Screw

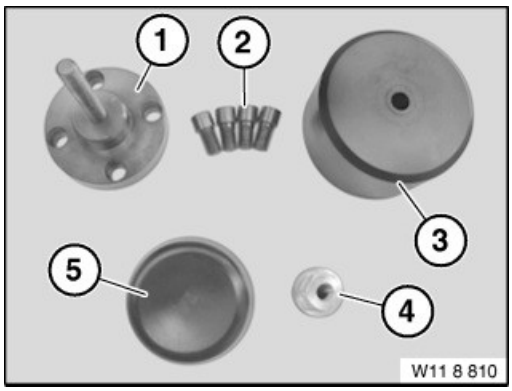


Common Used in step 3546

Usage	(Bolt (thread M12)) For counter support for retaining flywheel when gearbox is removed
Included in the tool or work	0 493 938
Storage location	A44
Replaced by	
In connection with	
SI-Number	

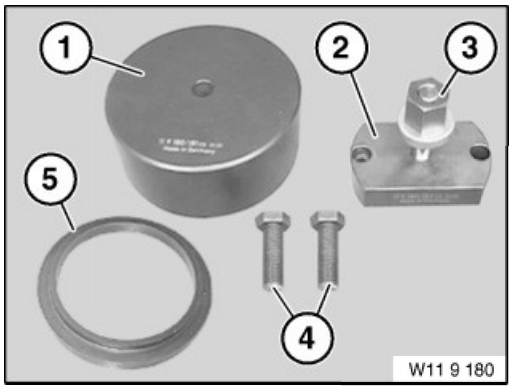
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0 496 137 (11 8 815) Holding sleeve



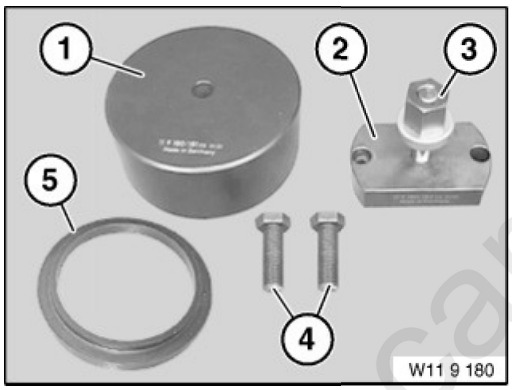
Common	Used in step 42
Usage	(Slip sleeve) Liquidation of existing inventory and then available only via complete tool set 11 8 810 = 83 30 0 496 132 - status 09.12.2011
Included in the tool or work	0 496 132
Storage location	
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

0 494 029 (11 9 182) Synchronising key



Common	Used in step 42
Usage	
Included in the tool or work	0 493 881
Storage location	C26
Replaced by	
In connection with	
SI-Number	

0 494 031 (11 9 184) Screw



Common	Used in step 42
Usage	(screws (2 x))
Included in the tool or work	0 493 881
Storage location	C26
Replaced by	
In connection with	
SI-Number	

2 360 215 Adapter



Common	Used in step 42
Usage	For installing the rear radial shaft seal. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B56
Replaced by	
In connection with	11 9 180 = 0493881
SI-Number	01 13 14 (098)

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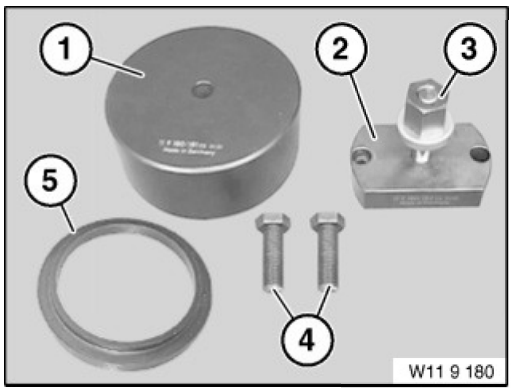
0 494 028 (11 9 181) Bush



Common Used in step 42

Usage	
Included in the tool or work	0 493 881
Storage location	C26
Replaced by	
In connection with	
SI-Number	

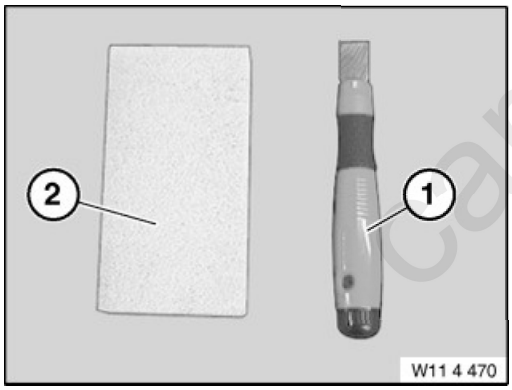
0 494 030 (11 9 183) Nut



Common Used in step 42

Usage	
Included in the tool or work	0 493 881
Storage location	C26
Replaced by	
In connection with	
SI-Number	

0 495 102 (11 4 470) Tool



Common Used in step 4243

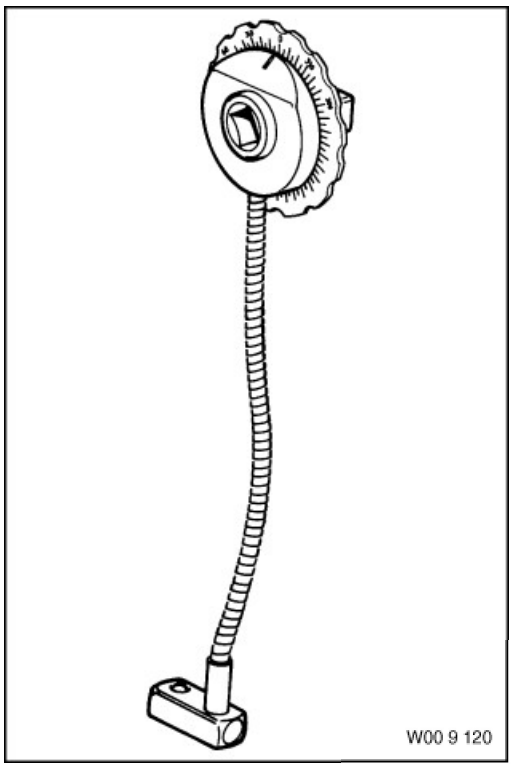
Usage	(cleaning kit) For cleaning sealing surfaces on magnesium crankcase/cylinder head.
Included in the tool or work	
Storage location	C52
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 103 (11 4 471)		**Scraper**	
2	0 495 104 (11 4 472)		**Extractor** (grindstone)	

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

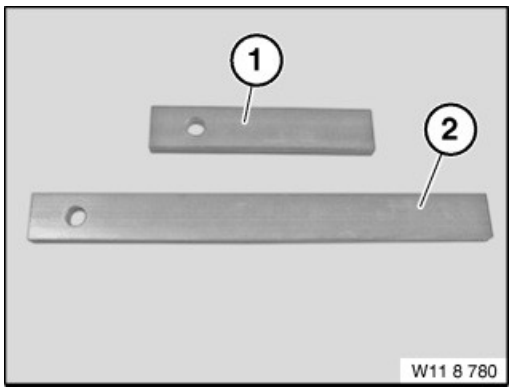


Common Used in step 4251

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

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0 496 120 (11 8 780) Plate



Common

Used in step 43

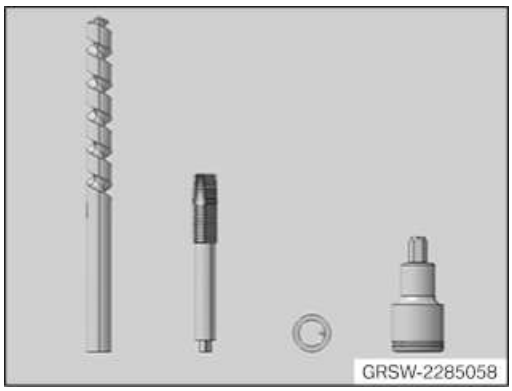
Usage	(Mounting plates) For securing transmission oil sump when gearbox is removed.
Included in the tool or work	
Storage location	B24
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 121 (11 8 781)		**Plate** (Mounting plate, short)Discontinued; only available via set 11 8 780 = 0496120.	
2	0 496 122 (11 8 782)		**Plate** (Mounting plate, long) Discontinued; only available via set 11 8 780 = 0496120.	

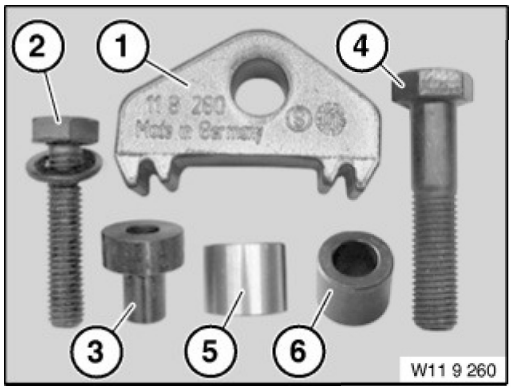
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2 285 058 Tool set



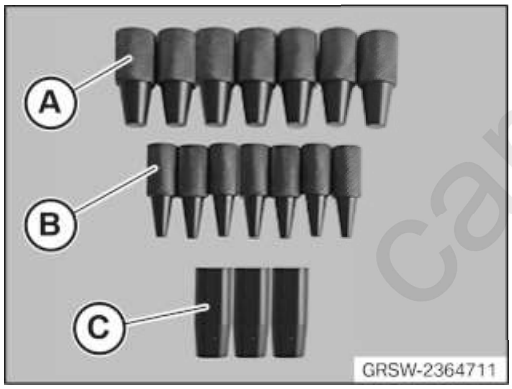
Common	Used in step 46
Usage	
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 02 14 (069)

0 494 034 (11 9 261) Holder



Common	Used in step 46
Usage	(Individual counter support)
Included in the tool or work	0 493 938
Storage location	
Replaced by	
In connection with	
SI-Number	

2 364 711 Plug



Common	Used in step 4748
Usage	For closing the pressure oil holes for cleaning the cylinder head sealing surfaces.
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 50 14 (203)

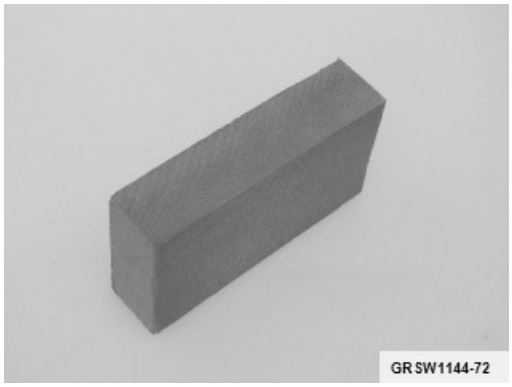
0 495 103 (11 4 471) Scraper



Common	Used in step 48
Usage	
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

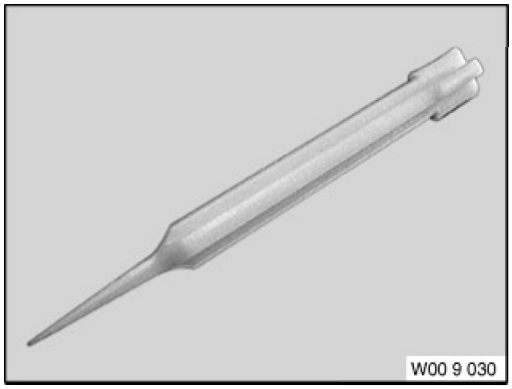
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0 495 104 (11 4 472) Extractor



Common	Used in step 48
Usage	(grindstone)
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

0 496 714 (00 9 030) Wedge



Common	Used in step 51
Usage	For dismantling O-rings, gaskets and trim panels. This special tool replaces special tool 00 9 316.
Included in the tool or work	
Storage location	A50
Replaced by	
In connection with	
SI-Number	01 20 09 (581)

2 455 654 Tensioning tool



Common	Used in step 5760
Usage	To pretension the timing chain when adjusting the timings. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

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2 452 959 Pliers



Common	Used in step 67
Usage	For disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ number 13 0 191). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A5
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 448 401 Fitting aid



Common	Used in step 67
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

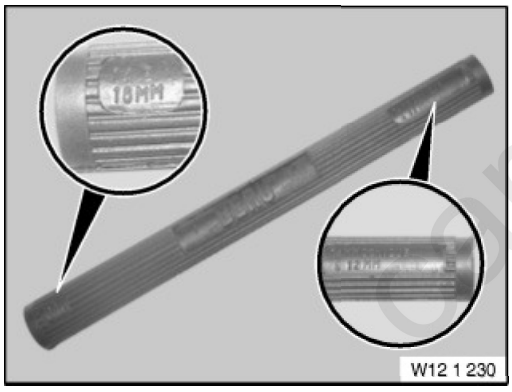
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2 358 022 Gauge



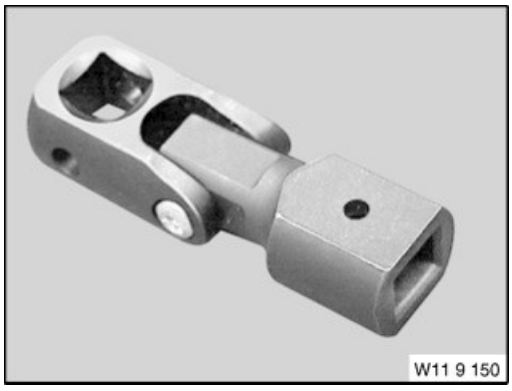
Common	Used in step 6869
Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 065 (12 1 230) Fitting aid



Common	Used in step 72
Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

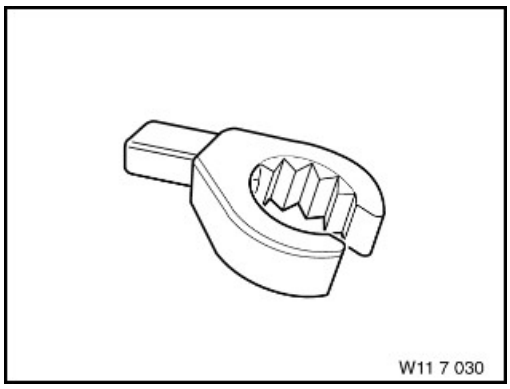
0 493 751 (11 9 150) Extension



Common	Used in step 75
Usage	(Socket wrench extension) For loosening and tightening the oxygen sensor
Included in the tool or work	
Storage location	C41
Replaced by	
In connection with	
SI-Number	01 15 00 (609)

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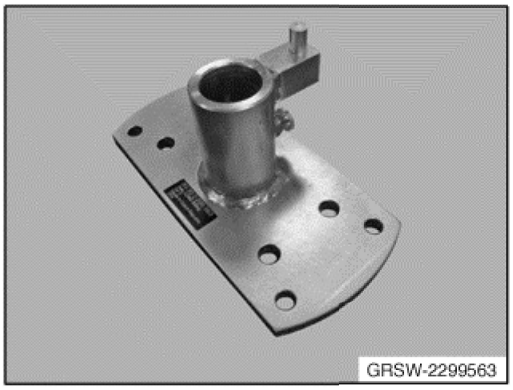
0 491 075 (11 7 030) Socket wrench insert



Common	Used in step 75
Usage	(Socket wrench insert 22 mm) For loosening and tightening the oxygen sensor
Included in the tool or work	
Storage location	A9
Replaced by	
In connection with	
SI-Number	01 06 95 (963)

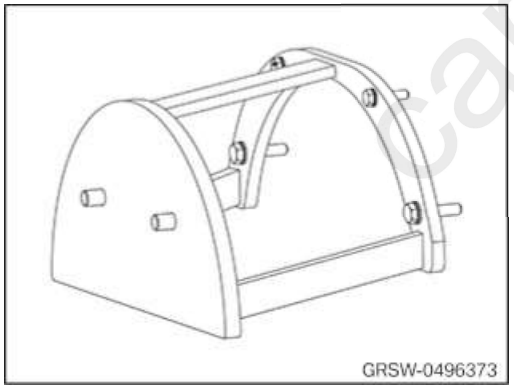
Replacement tools:

2 299 563 Adapter



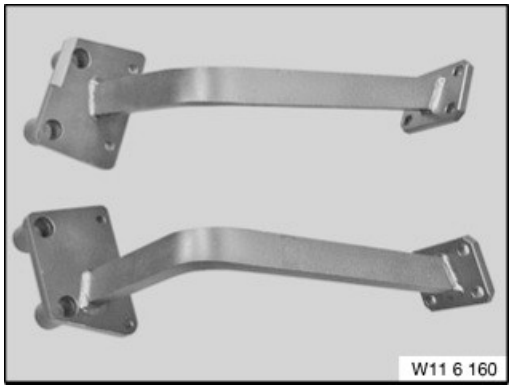
Common	Used in step 3
Usage	New adapter for the engine assembly stand. Replacement for 83 30 0 495 189 - 00 2 302.
Included in the tool or work	0 495 187
Storage location	
Replaced by	
In connection with	
SI-Number	

0 496 373 (11 5 420) Plate



Common	Used in step 3
Usage	(Fixture) Engine S62
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	

0 496 680 (11 6 160) Support



Common	Used in step 3
Usage	For mounting N74 engine on the assembly stand. In combination with 00 2 300, 00 2 320
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	00 2 300; 00 2 320 = 0495196
SI-Number	01 31 09 (604)

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Overview Technical Data

Height of the sealing bead	Used in step 4243
	2,0 mm ... 2,5 mm

Engine oil B58B30M1/B58B30O1	Used in step 81
Filling capacity, engine oil change with oil filter element	6,50 l
Engine oil: Technically suitable engine oils for BMW Group engines	

Screw-in depth of thread cutter	Used in step 46
Screw-in depth	18 mm

Links

General repair instructions	**Used in step**
11 00 ... Overview of consumables (Electronic Parts Catalogue)	42437576

Repair instructions	**Used in step**
31 10 001 Completely removing and installing front axle with engine and transmission	185
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31 10 001 Completely remove and install front axle with engine and transmission (FRU specification without wheel alignment)	185
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11 00 050 Remove and install engine	185
31 10 001 Completely removing and installing front axle with engine and transmission	185
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11 00 598 Removing and installing engine on front axle (for part no. 31 10 001/501)	284
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11 00 598 Removing and installing engine on front axle (for part no. 31 10 001/501)	284
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11 00 598 Removing and installing engine on front axle (for part no. 31 10 001/501)	284
61 35 ... Notes on ESD protection (Electro Static Discharge)	142022
13 53 ... Clean the cylinder heads in the area of injectors to prevent sand/dust contamination.	1819
61 35 ... Notes on ESD protection (Electro Static Discharge)	20
17 11 035 Removing and installing/replacing fan cowl with electric fan	71
31 10 001 Completely removing and installing front axle with engine and transmission	85
31 10 001 Completely removing and installing front axle with engine and transmission	85
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Operating materials	**Used in step**
3.0 Technically appropriate engine oils for BMW Group engines	81

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11 33 050 Removing and installing/replacing all rocker arms

WARNING

Hot surfaces.

Risk of burning!

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

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

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

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

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

CAUTION

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

Danger of injury!

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

RISK OF DAMAGE

Damage to battery terminal, the safety battery terminal or the intelligent battery sensor (IBS).

Damaged battery terminals can lead to malfunctions or vehicle electrical system faults.

- Pull off battery terminal from battery pole by carefully moving to and fro. Do not pry off using a tool.

TECHNICAL INFORMATION

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

PRELIMINARY WORK

1 – Disconnecting all battery earth leads

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- See additional information.

2 – Bring front compartment lid in the service position

Prerequisite

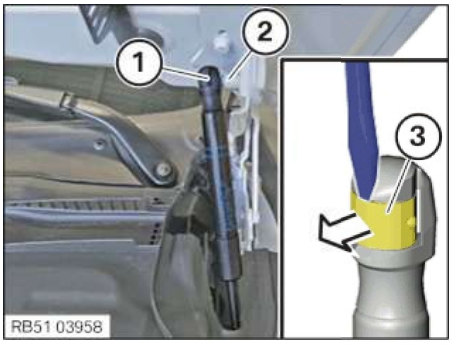
Engine compartment lid is open.

CAUTION

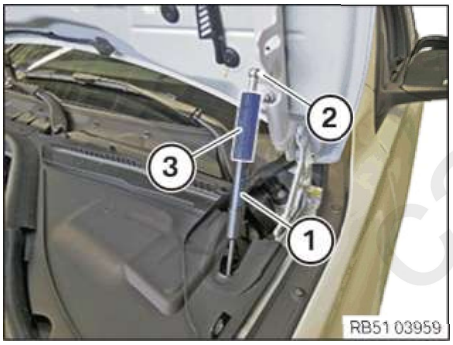
Shutting bonnet or tailgate.

Danger of injury!

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



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



TECHNICAL INFORMATION

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

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

3 – Remove the seal for the rear bonnet



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

4 – Removing the acoustic cover

carDiagn.com

WARNING

Hot surfaces.

Risk of burning!

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

RISK OF DAMAGE

Damage to the acoustic cover.

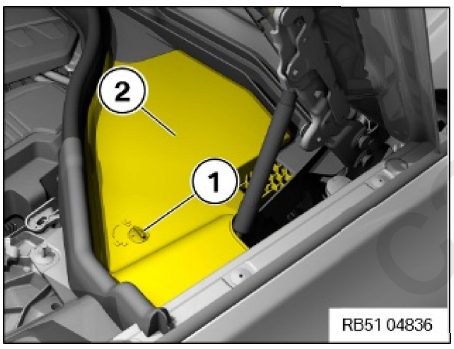
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

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



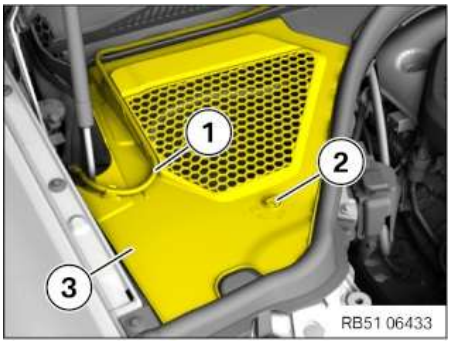
- Release the acoustic cover (1) towards the top from the rubber mounts (marks).

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



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

6 – Remove the cover of the rear right engine compartment



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

7 – Removing both wiper arms

NOTICE

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

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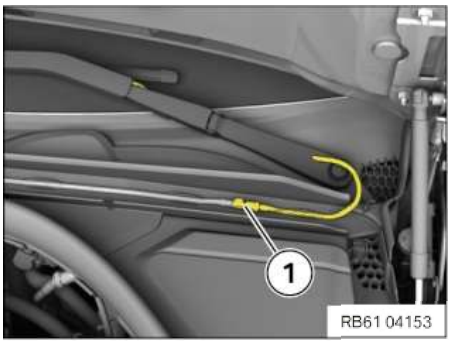
▸ **Remove the wiper arm**

RISK OF DAMAGE

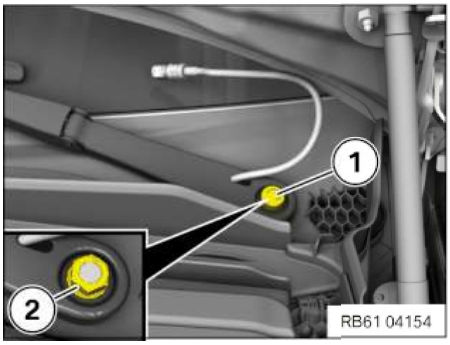
Damage to wiper console

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

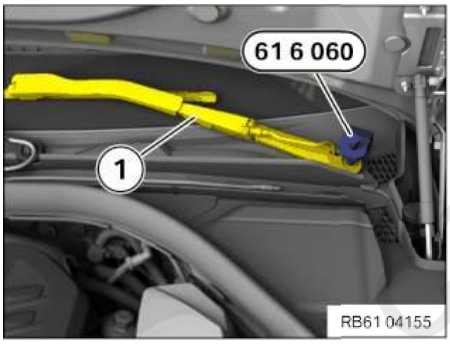
- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.



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

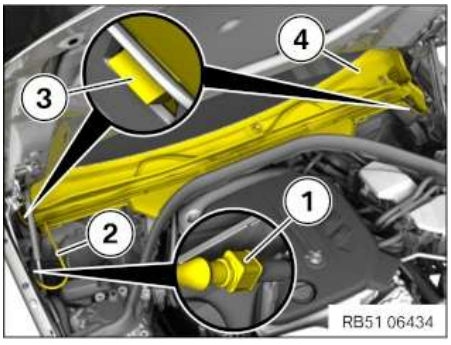


- Remove the protective cap (1).
- Loosen nut (2).



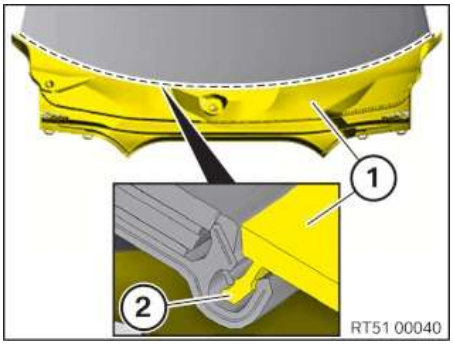
- Pull off the wiper arm (1) using special tool .

8 – Remove cowl panel cover



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

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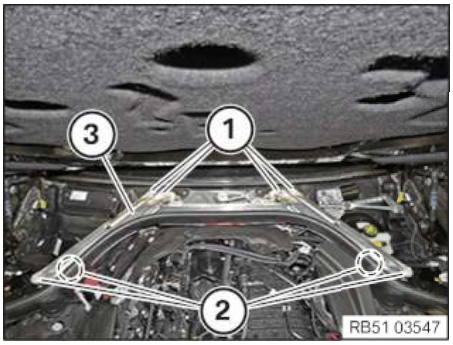


- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

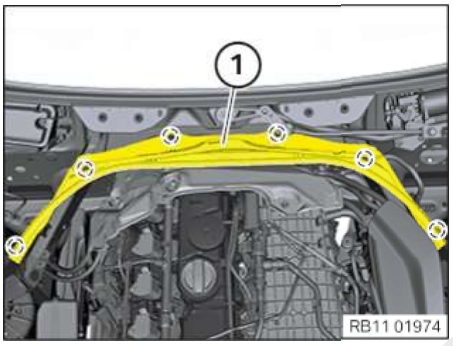
9 – Removing the centre bulkhead upper part

TECHNICAL INFORMATION

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



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



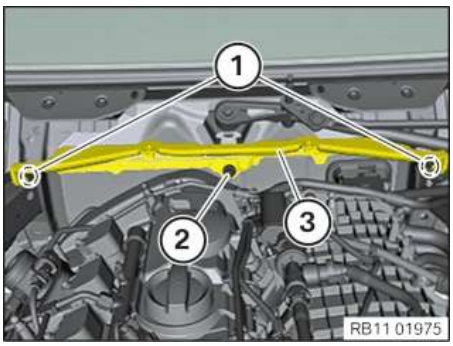
- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

10 – Removing acoustic cover at rear



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

11 – Removing the centre bulkhead lower section



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

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12 – Removing the DME control unit

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

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

TECHNICAL INFORMATION

Follow instructions for removing and installing control units.

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

TECHNICAL INFORMATION

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

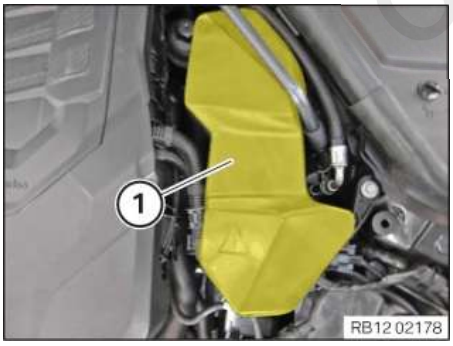
TECHNICAL INFORMATION

Control unit must be programmed after it is replaced.

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

TECHNICAL INFORMATION

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

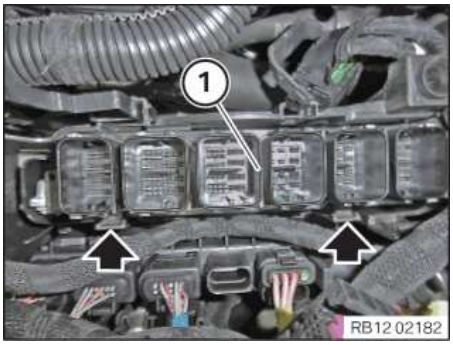


- Pull the cover (1) towards the top and feed out.



- Unlock and disconnect the plug connection (1).

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

13 – Removing integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

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

RISK OF DAMAGE

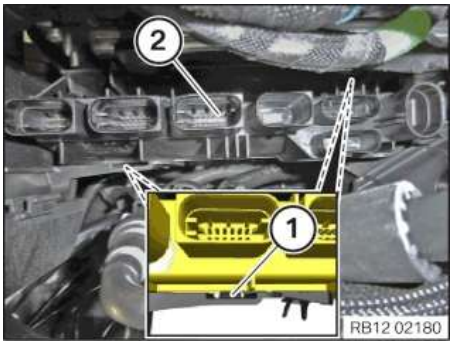
Electrostatic discharge.

Damage to or destruction of electrical components.

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



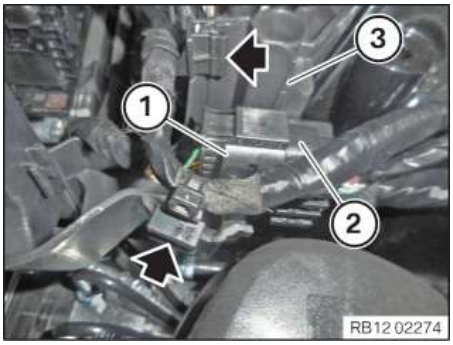
- Unlock and disconnect plug connections (1).



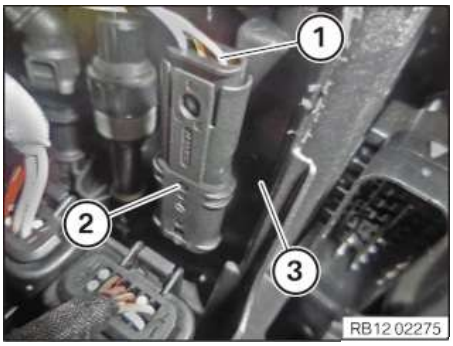
- Unlock the latch mechanisms (1).
- Guide out and remove integrated supply module (PDM) (2) upwards.

14 – Removing the control unit holder

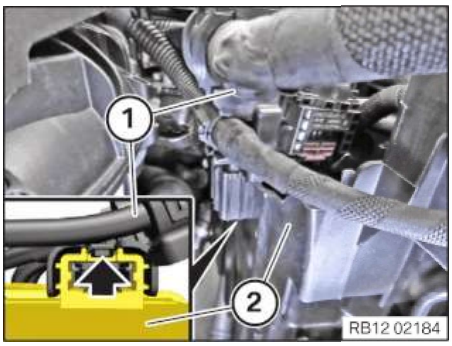
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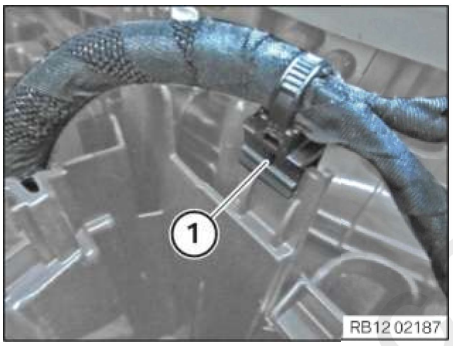
- Unlock plug connection (1) and disconnect.
- Unlock the connector (2) and disconnect from the control unit holder (3).
- Release the clamps (arrows).



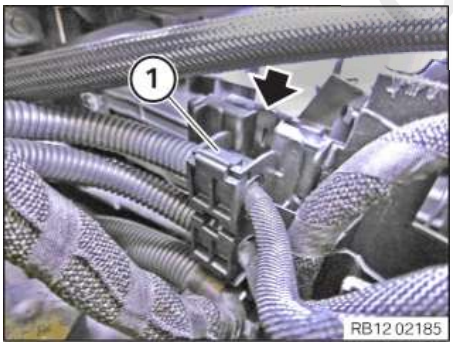
- Unlock plug connection (1) and disconnect.
- Unlock the connector and disconnect from the control unit holder (3).



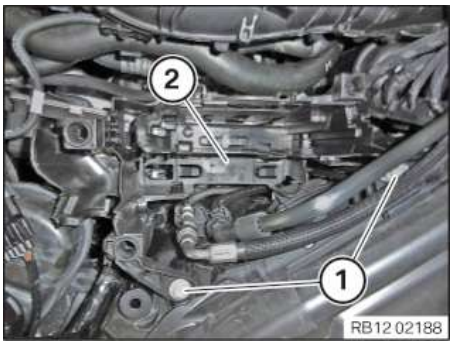
- Unlock the lock (arrow).
- Disconnect the cable holder (1) upwards from the control unit holder (2).



- Loosen clamp (1).



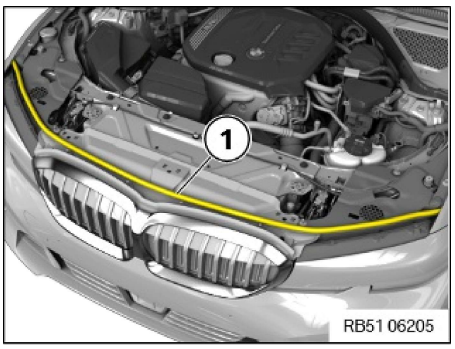
- Unlock the lock (arrow).
- Feed out the cable clip (1) upwards and set it aside.



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

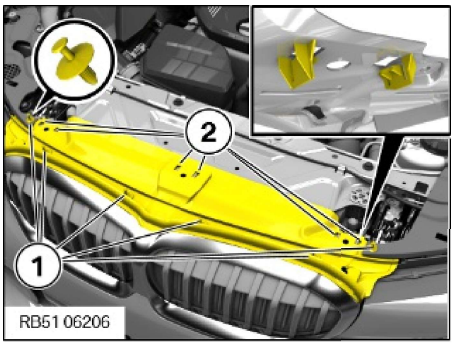
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15 – Remove the seal for the bonnet in front



- Pull off front bonnet seal (1) upwards.

16 – Removing the centre engine compartment cover



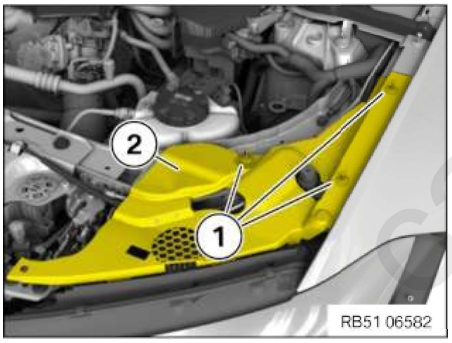
- Detach all expanding rivets (1).
- Release the cover of the centre engine compartment with the latch mechanisms (2) .
- Feed the cover for the centre engine compartment out to the rear.

17 – Partially remove the top left and right cover in the engine compartment

NOTICE

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

▶ **Removing the cover in the engine compartment on top partially**



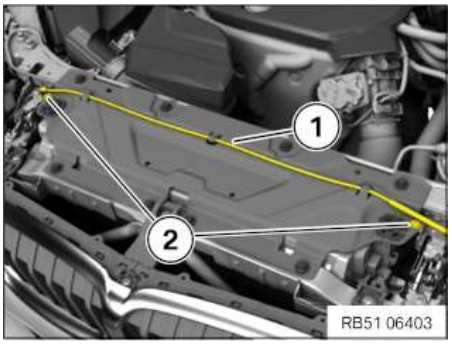
- Loosen the expanding rivet (1).
- Remove the cover in the engine compartment on top (2) partially.

18 – Removing the top cross connection

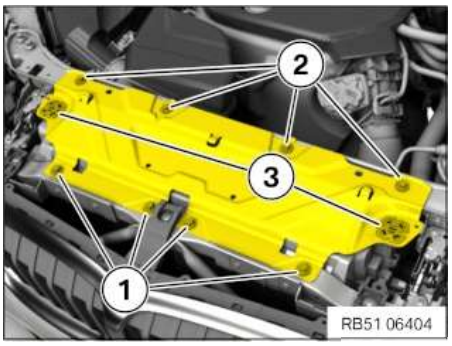


- Release the housing for the coupling of the Bowden cables (1) from the body.

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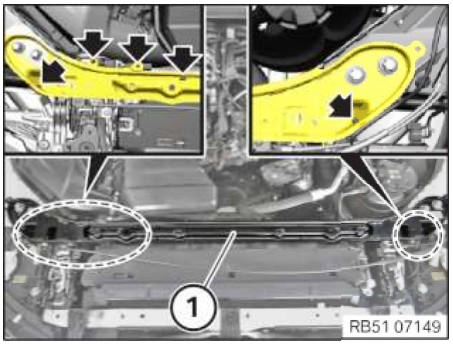


- Detach Bowden cable (1) at the top cross connection.
- Loosen screws (2).

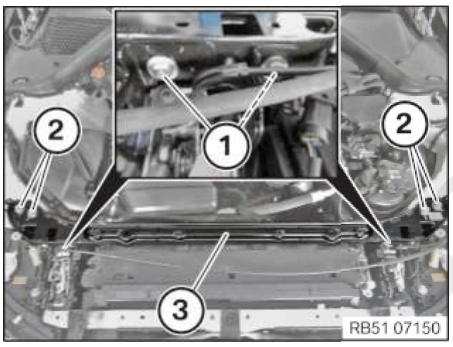


- Loosen screws (1) and (2).
- Remove the top cross connection with the holders(3) towards the top.

19 – Remove the rear top cross connection



- Release the clips (arrows) in the marked areas from the top rear cross connection (1).



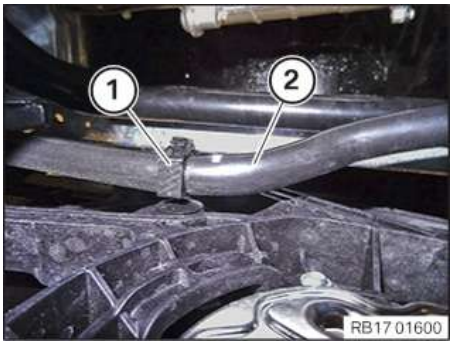
- Loosen screws (1).
- Loosen screws (2).
- Guide out and remove top rear cross connection (3).

20 – Remove fan cowl.

TECHNICAL INFORMATION

- When the engine is stopped after the end of the journey, it may be necessary to run the electric fan. In rare cases, operation of the electric fan can last up to 11 min. This protects the components. In this case, replacing the electric fan will not remedy the problem!

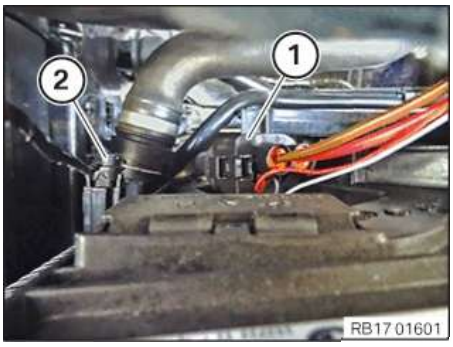
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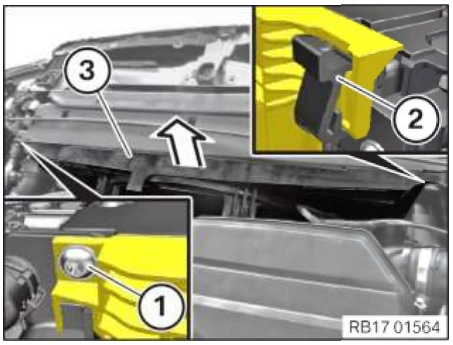
- **If installed:** Release transmission oil line (2).

  Unlock the holder (1).

  Thread out transmission oil line (2) and set aside.



- Unlock plug connection (1) and disconnect.
- Unlock plug connection (2) and disconnect.



- Loosen screw (1).
- Unlock lock (2).
- Guide out and remove fan cowl (3) **carefully** in the direction of the arrow.

21 – Removing intake silencer housing

RISK OF DAMAGE

Damage to the clean air line. Damage to the air filter.

For changing the air filter insert, if the upper section of intake filter housing is only raised and not completely removed, the clean air line and the air filter insert may be damaged.

- Do not lift upper section of intake filter housing by force.
- Unfasten clamp.
- Remove upper section of intake filter housing completely.



- Unlock plug connection (1) and disconnect.
- Unfasten clamp (2).
- Pull out and remove the intake silencer housing (3) from the rubber mounts towards the top.

22 – Remove all ignition coils.

NOTICE

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

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▸ **Removing the ignition coil**

WARNING

Hot surfaces.

Risk of burning!

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

RISK OF DAMAGE

Damage to the ignition coil.

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

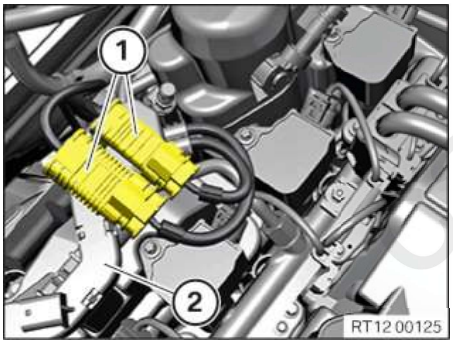
- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

RISK OF DAMAGE

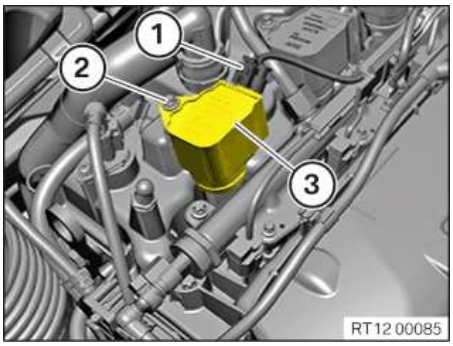
Electrostatic discharge.

Damage to or destruction of electrical components.

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



- Disconnect the connector (1) of the front oxygen sensor and the monitoring oxygen sensor from the cable channel (2) and set aside.



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

23 – Removing all spark plugs

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WARNING

Hot surfaces.

Risk of burning!

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

CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

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



- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

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

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

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

NOTICE

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



TECHNICAL INFORMATION

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

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



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

24 – Remove the high pressure line between the high pressure pump and the rail

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WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

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

CAUTION

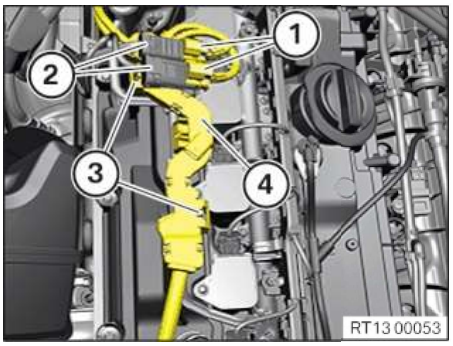
On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

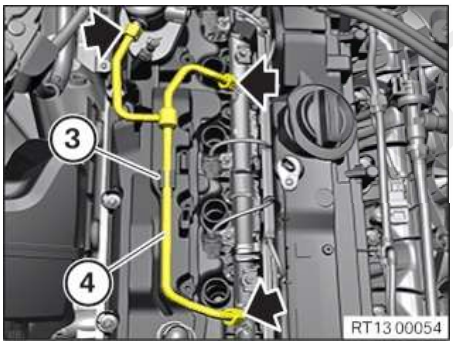
- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

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



- Unlock and disconnect the plug connections (1) and (2).
- Unlock the locks (3).
- Guide out the wiring harness section of the engine wiring harness (4) and set it aside.



- Position a lint-free rag under the union nuts.
- Unscrew union nuts (arrows) with the special tool .
- Catch and dispose of escaping fuel.
- Thread out the high pressure line (4) from the bracket (3) and remove it.
- Feed out and dispose of the lint-free cleaning clothes .

25 – Remove fuel delivery line

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

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

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CAUTION

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

Danger of injury!

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

RISK OF DAMAGE

Damage to the ignition coil.

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

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

RISK OF DAMAGE

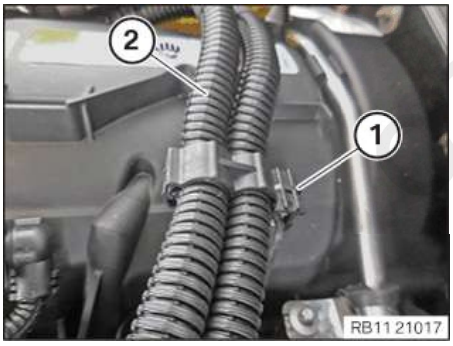
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

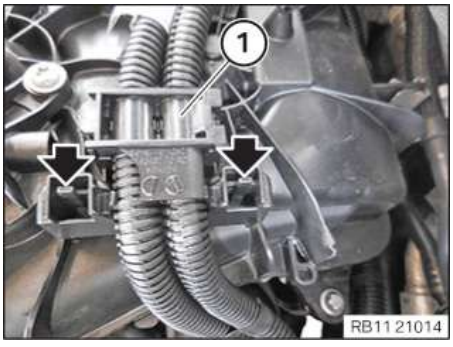
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

Reset special tool in early to avoid bending pressure lines.

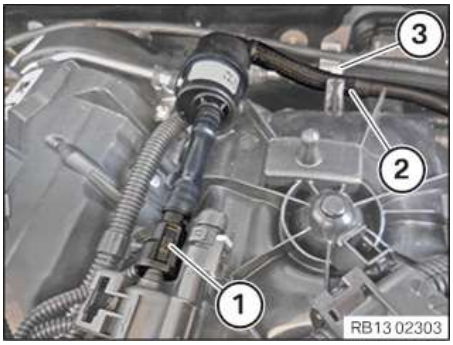


- Loosen clamp (1).
- Guide out wiring harness section (2) for the injectors and ignition coils and place it aside.

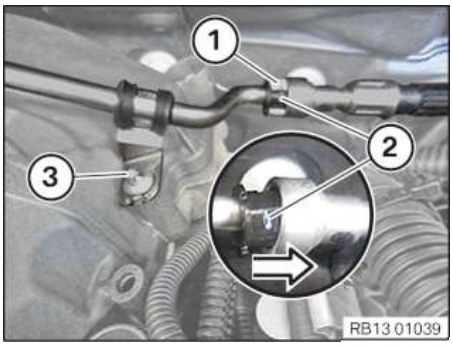


- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.

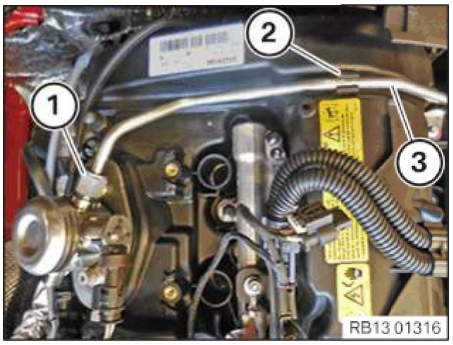
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- Unlock and loosen lock (1).
- Guide tank ventilation line (2) out of clamp (3) and place it aside.



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



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

26 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

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

TECHNICAL INFORMATION

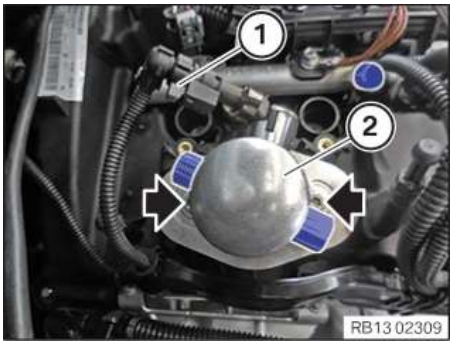
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.

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- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

27 – Removing rail with injectors of cylinders 1 to 3

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

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

RISK OF DAMAGE

Damage to the ignition coil.

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

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

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

Damage to injectors.

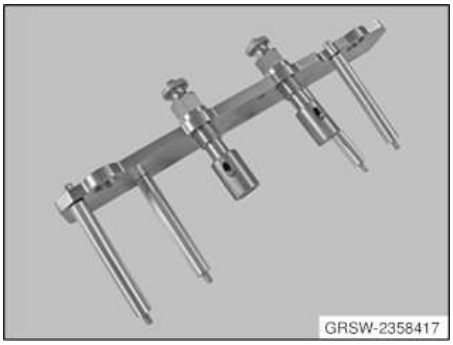
Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.



- Prepare special tool .

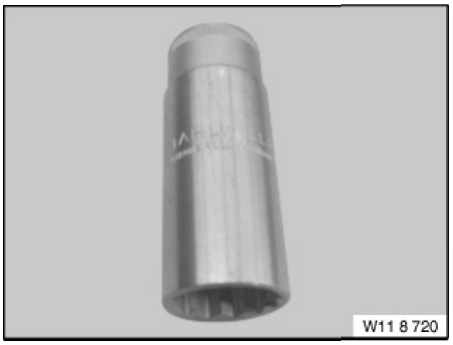
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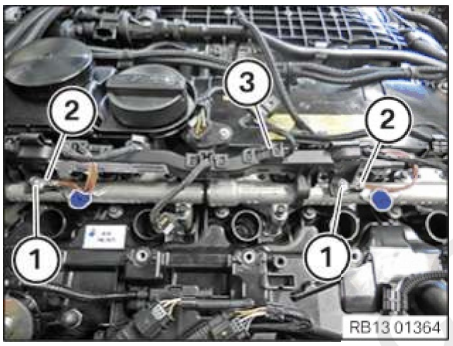
- Prepare special tool 2 358 417.



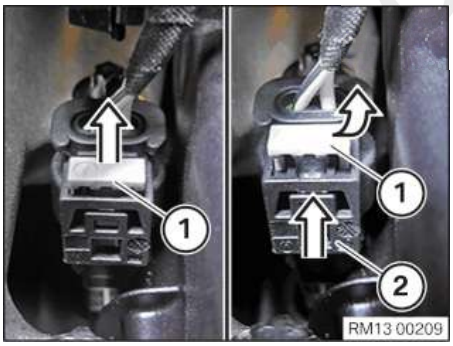
- Prepare special tool .



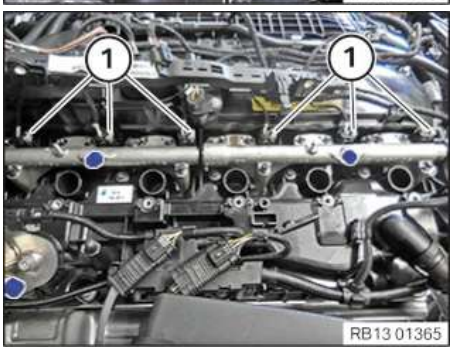
- Prepare special tool 0 496 106 (11 8 720).



- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.

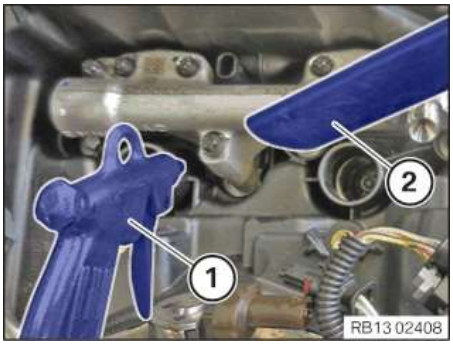


- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull out the connector (2) from the injectors.



- Unlock and release all connectors (1) of the injectors.

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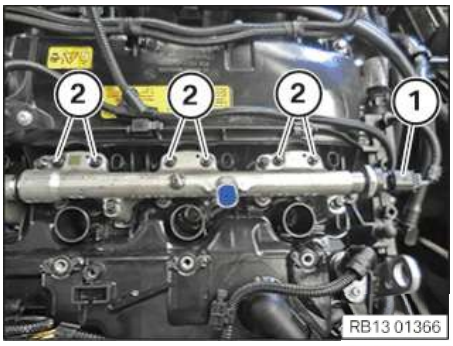


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

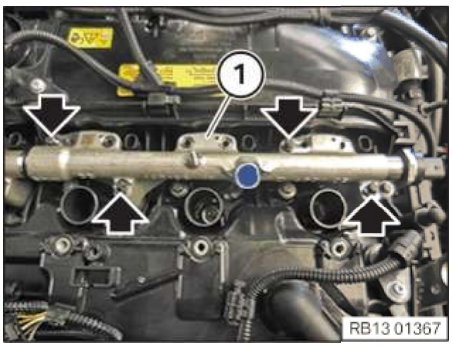
- Before releasing the high pressure lines: Blow out the injector shafts with an air gun(1) with less pressure.
- Simultaneously, draw off the dirt particles with an **explosion proof** vacuum cleaner (2).



- Unlock and loosen connector (1).
- Release screws (M5x30) (2).
- Remove screws (2).

  Do not reuse the bolts (2).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.

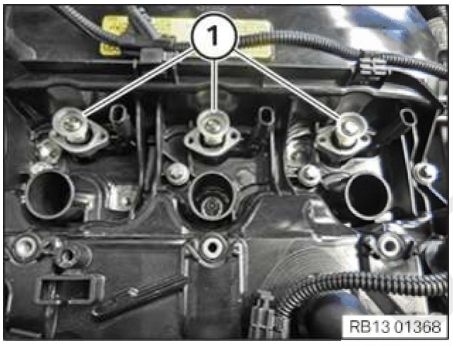


- Unscrew the screws (M6x30) (arrows).

  The screws may not be reused!
- Renew screws.

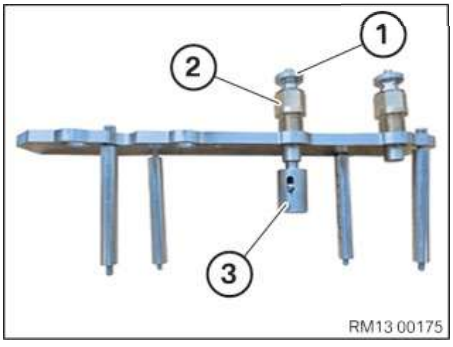
  Parts: Screws (M6x30)
- Remove rail (1) in upward direction.

  The injectors remain in the cylinder head.



- Remove the gaskets (1).

  The seals (1) are only required during the initial assembly at the plant and will not be installed again.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.

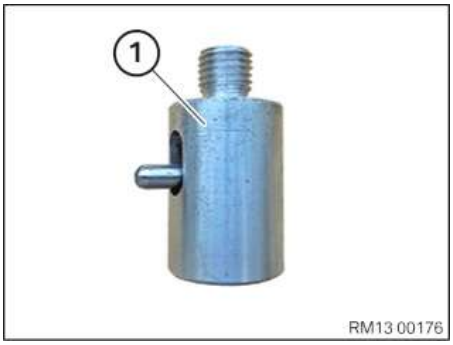
- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use the special tool 2 358 417to remove the injectors.

  The special tool 2 358 417 is used to ensure that the tensile force is not exceeded.

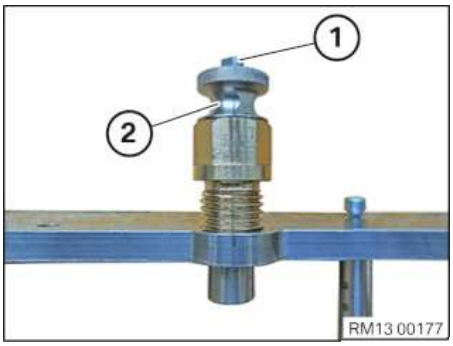
  Special tool 2 358 417 consists of:

  - **(1)** Threaded sleeves
  - **(2)** Pull-out thread (left-hand thread)
  - **(3)** Mounting for the injectors

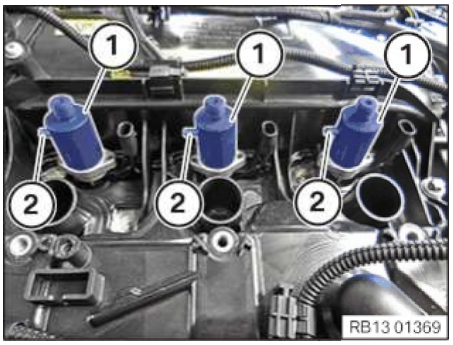
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- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.

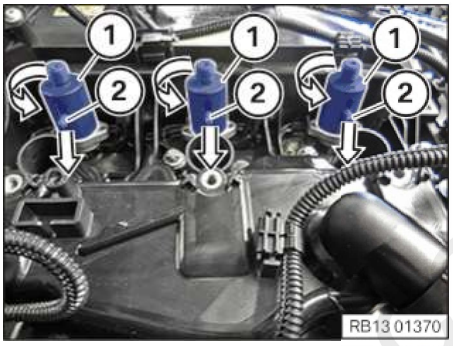


- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.

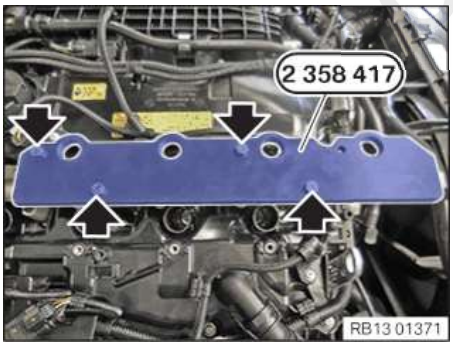


- Install all fixtures (1) for the injectors.

  The fixture (1) is not locked if the lever (2) is on the top.



- Turn fixtures (1) by 90° and lock the lever (2) downwards.



RISK OF DAMAGE

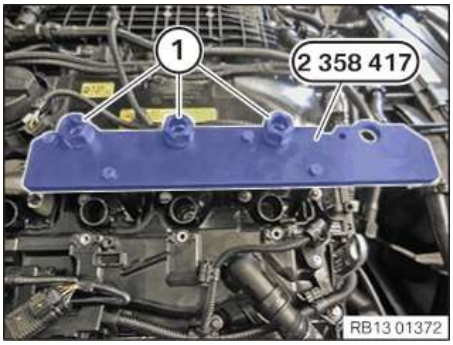
Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

- Attach special tool 2 358 417 to cylinder head.
- Hand-tighten the bolts (arrows).

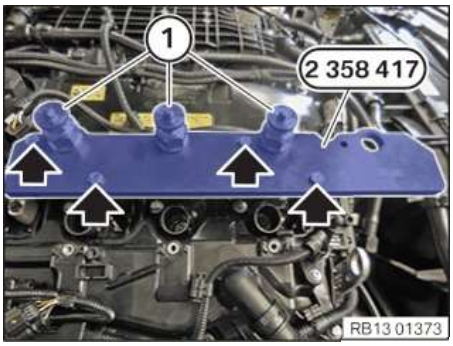
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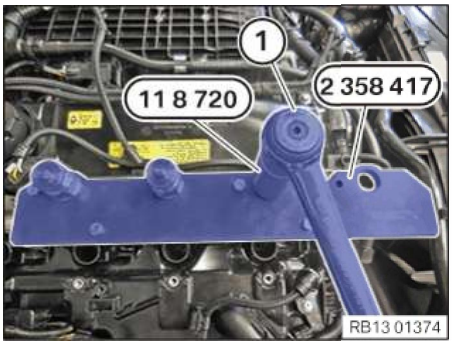
TECHNICAL INFORMATION

The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.



- Insert threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for injectors.
- Then tighten screws (arrows) on special tool 2 358 417 to 5 Nm.

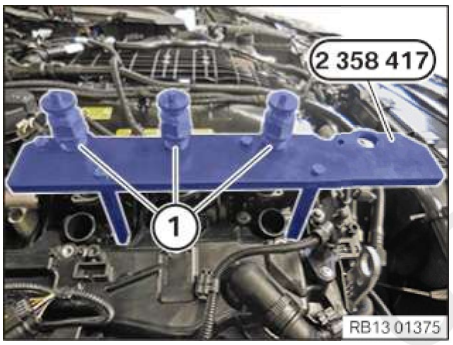


- Adjust torque wrench to 13 Nm **clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720)until the injector is pulled out.

TECHNICAL INFORMATION

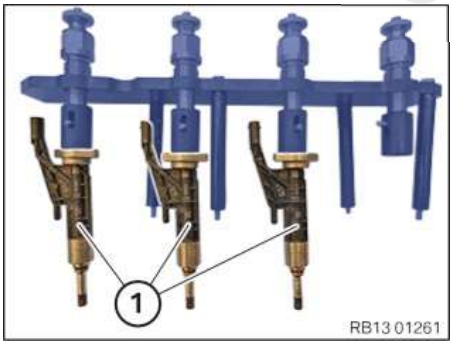
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

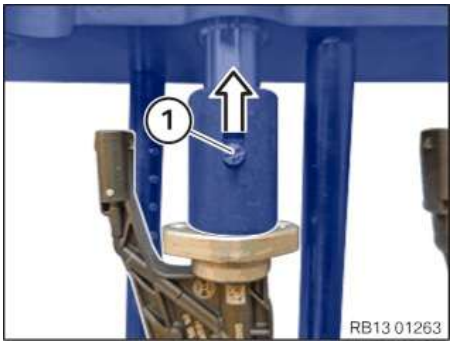


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  This can be recognised on the completely visible threads of the sleeves (1).
- Loosen screws on special tool 2 358 417.



- Carefully remove the special tool 2 358 417with injectors (1) from the cylinder head vertically upwards.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat on a clean table.

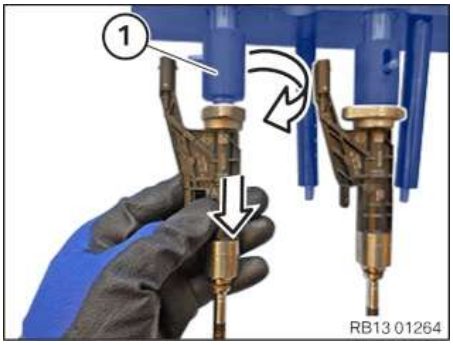


NOTICE

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

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture (1) by 90°.
- Release and remove the injector downwards.

28 – Removing rail with injectors of cylinders 4 to 6

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

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

RISK OF DAMAGE

Damage to the ignition coil.

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

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

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

Damage to injectors.

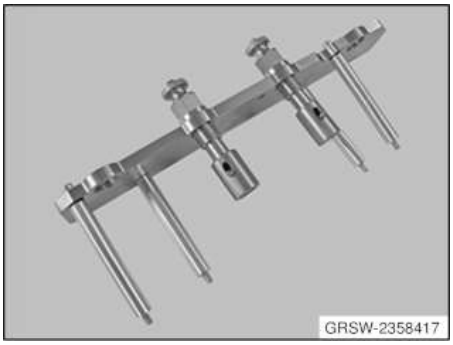
Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.



- Prepare special tool .

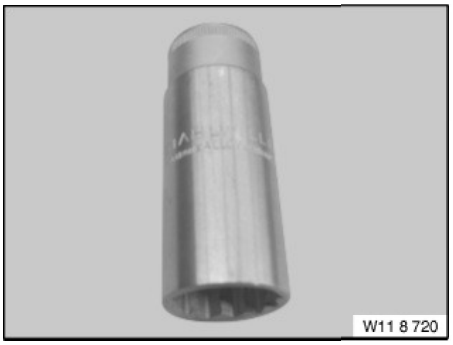
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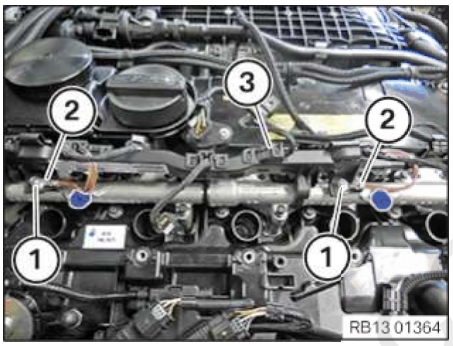
- Prepare special tool 2 358 417.



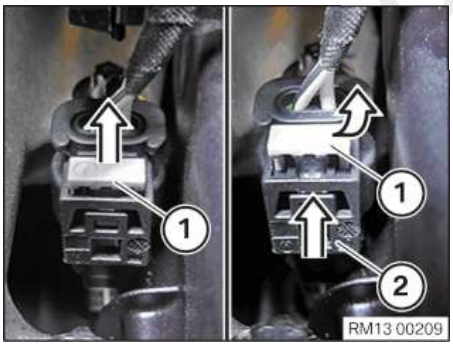
- Prepare special tool .



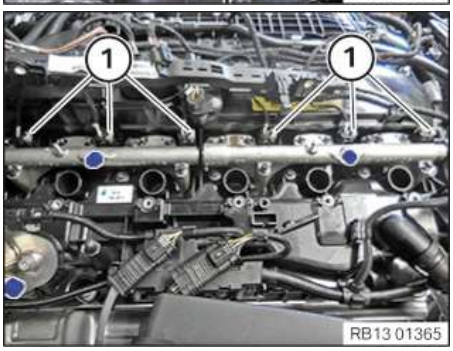
- Prepare special tool 0 496 106 (11 8 720).



- Release nuts (1) .
- Feed out ground cable (2) and set aside.
- Feed out cable channel (3) and set it aside.

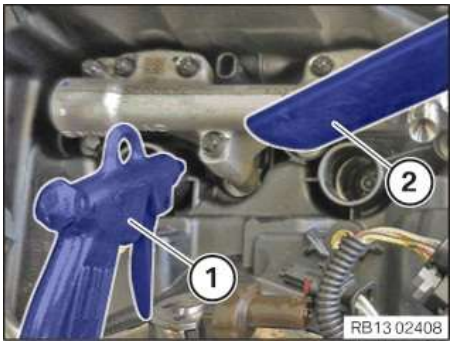


- Unlock lock (1) in direction of arrow upwards.
- Press lock (1) together and release.
- Disconnect the connector (2) from the injectors in the direction of the arrow.



- Unlock and release all connectors (1) of the injectors.

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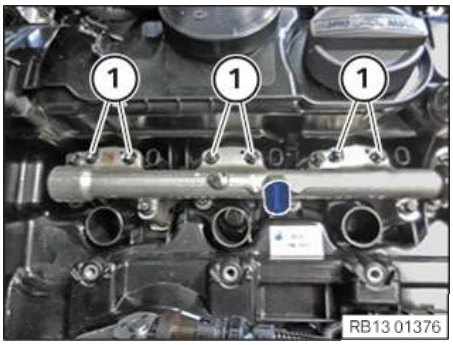


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

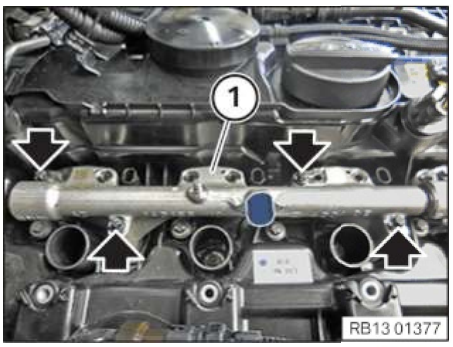
For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

- Before releasing the high pressure lines: Blow out the injector shaft with an air gun (1) with less pressure.
- Simultaneously, draw the dirt particles off **using an** explosion proof (2) vacuum cleaner.



- Release screws (M5x30) (1).
- Remove screws (M5x30) (1) .

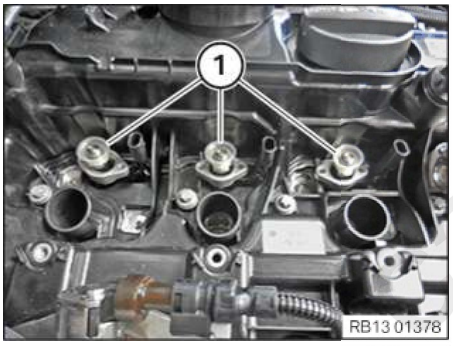
  Do **not** reuse screws (M5x30) (1).
- Catch and dispose of escaping fuel with suitable materials.



- Release screws (M6x30) (arrow).
- Remove screws (M6x30) (arrows).

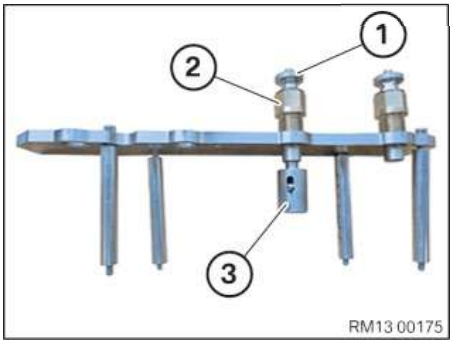
  Do **not** reuse the screws (M6x30).
- Remove rail (1) upwards.

  The injectors remain in the cylinder head.



- Remove seals (1) .

  The seals (1) are required during first assembly within the plant only and will not be installed again.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

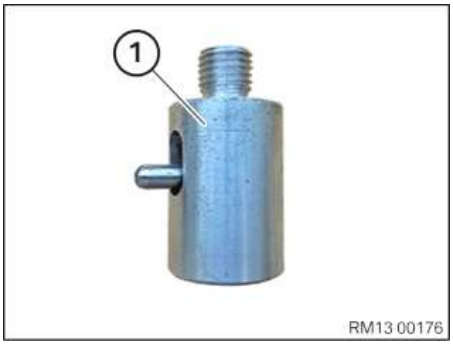
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use the special tool 2 358 417 to remove the injectors.

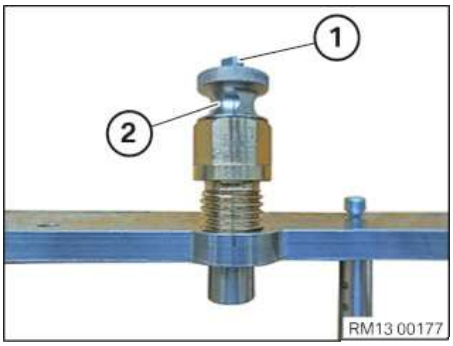
  The special tool 2 358 417 is used to ensure that the tensile force is not exceeded.

  The special tool 2 358 417 consists of:
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Mounting for the injectors

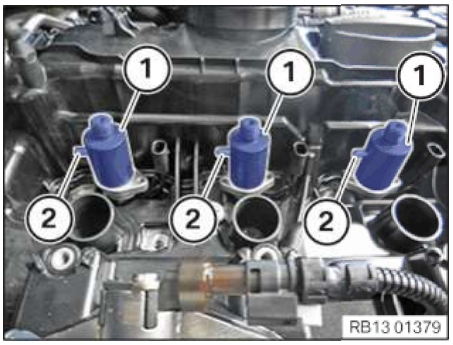
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- Unscrew the fixture for injectors (1) from special tool 2 358 417.

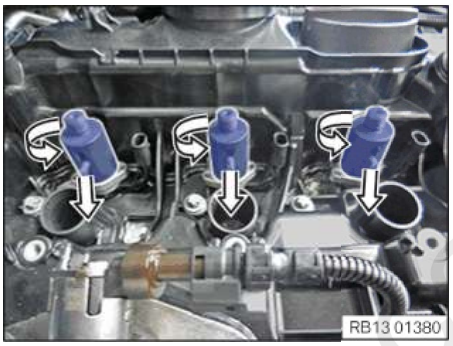


- Press lock (1) in and remove the threaded sleeve (2) from the special tool 2 358 417.



- Install all fixtures (1) for the injectors.

  The fixture (1) is not locked, if the lever is (2) on top.



- Turn fixtures (1) by 90° and lock the lever (2) downwards.



RISK OF DAMAGE

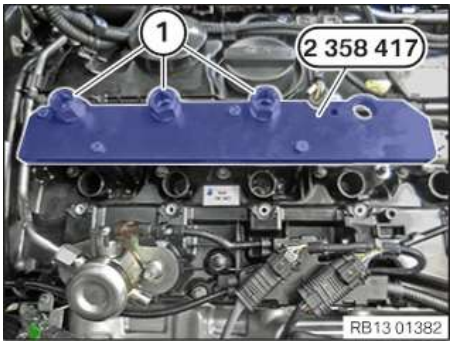
Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

- Attach special tool 2 358 417 to cylinder head.
- Hand-tighten the bolts (arrows).

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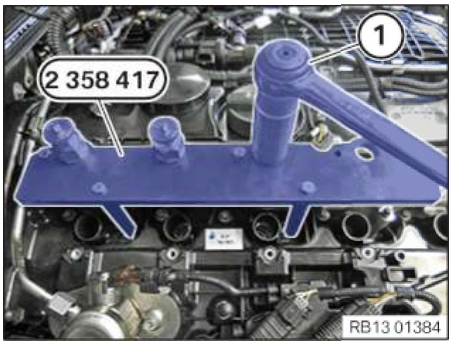
TECHNICAL INFORMATION

The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417 fully.



- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Then tighten screws (arrows) on special tool 2 358 417 to 5 Nm.

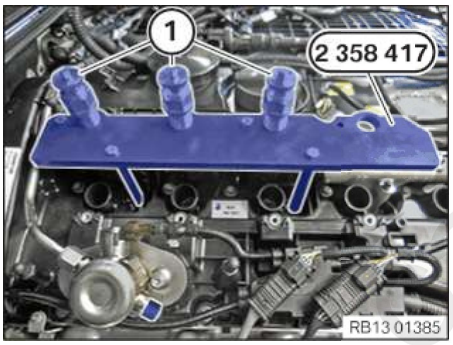


- Adjust torque wrench to 13 Nm **in clockwise** direction.
- Turn the torque wrench (1) with the special tool 0 496 106 (11 8 720) **clockwise**, until the injector is pulled out.

TECHNICAL INFORMATION

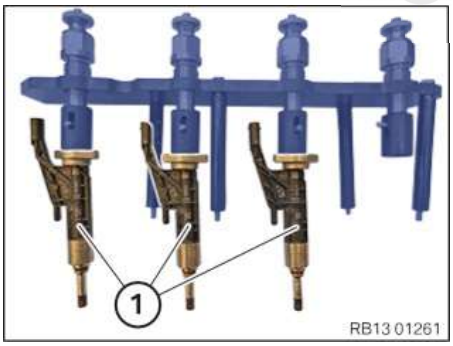
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

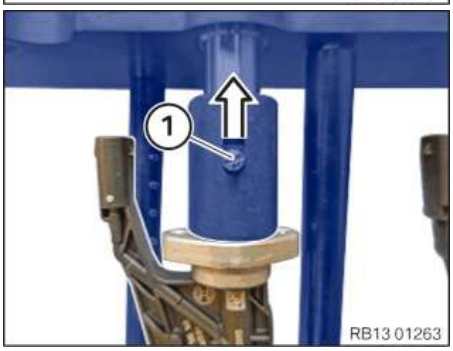


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  This can be recognised on the completely visible thread starts of the threaded sleeves (1).
- Loosen screws on special tool 2 358 417.



- Carefully remove the special tool 2 358 417 with the injectors (1) vertically straight up from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.

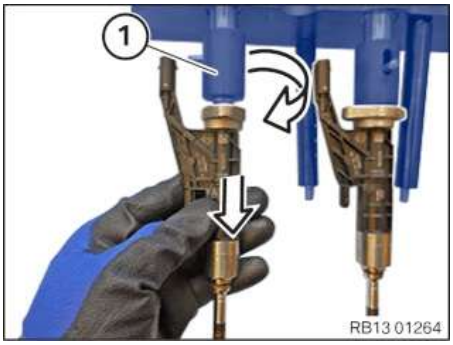


NOTICE

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

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture(1) by 90°.
- Release and remove the injector downwards.

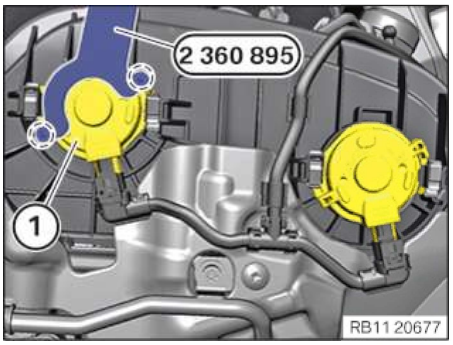
29 – Removing both actuators

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

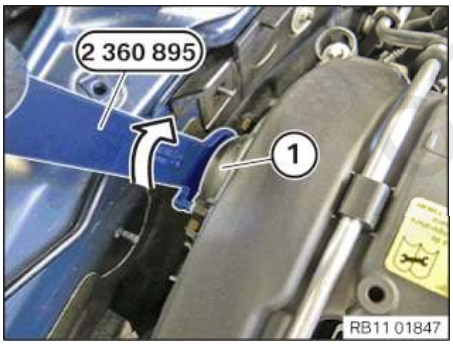
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the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



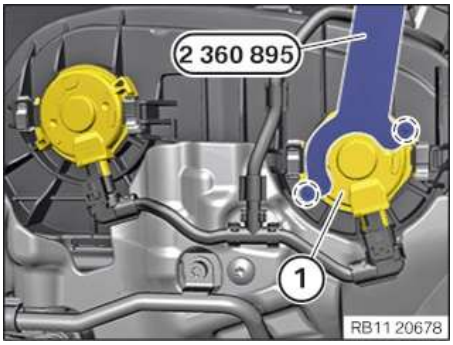
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.

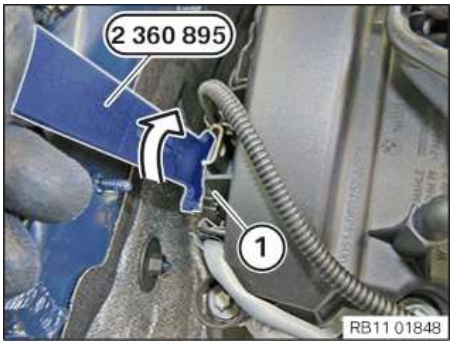


NOTICE

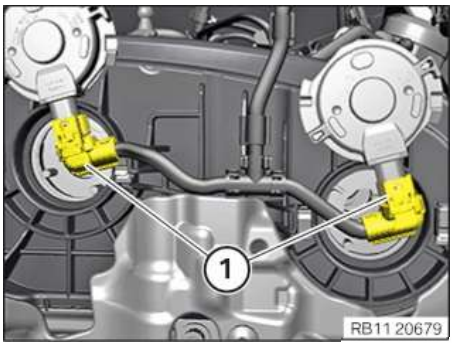
The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.

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- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



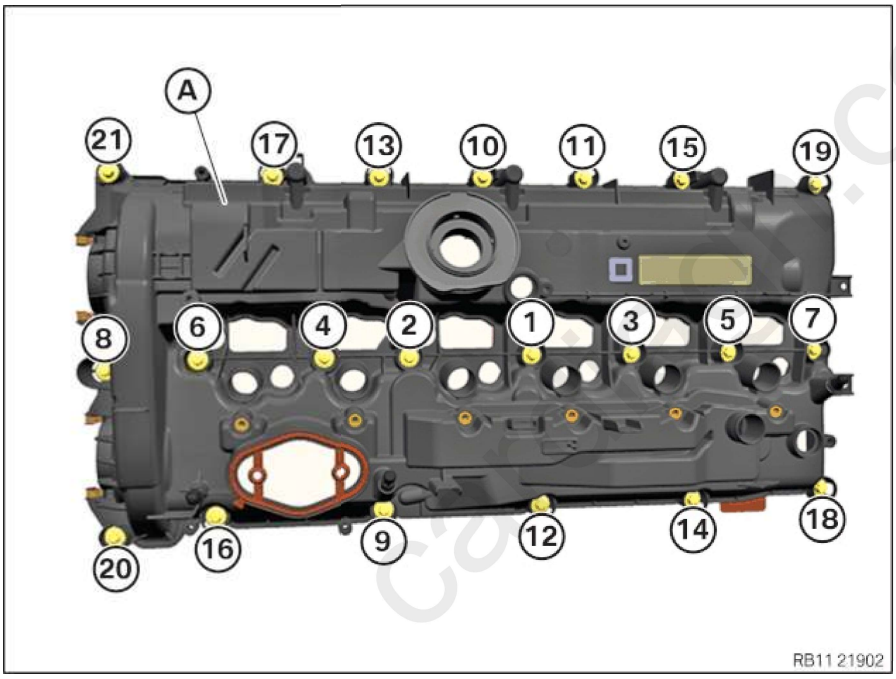
NOTICE

The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

30 – Removing the cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 21 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

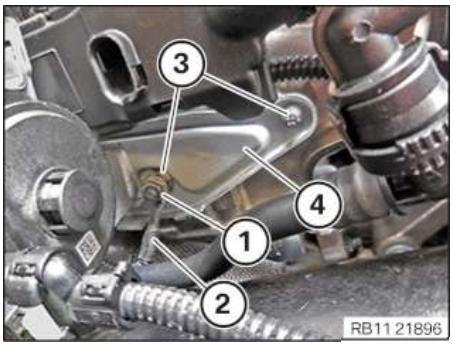
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

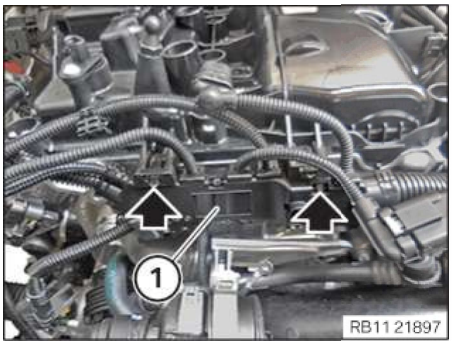
- Do not pull on the wires when disconnecting connectors and plug connections.



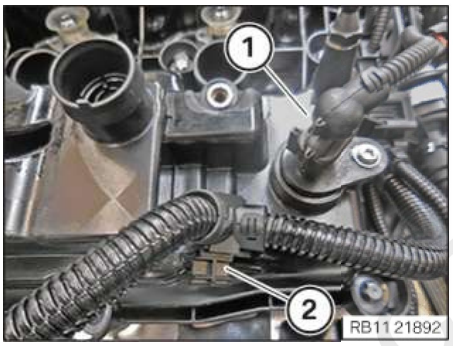
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



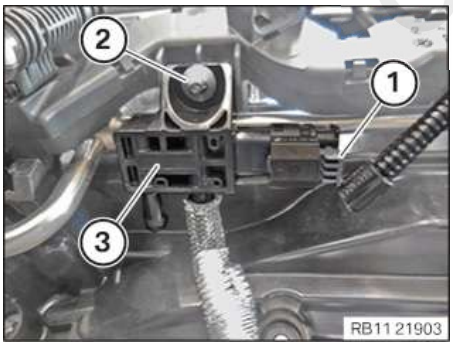
- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Loosen screws (3).
- Thread out holder (4) and set aside.



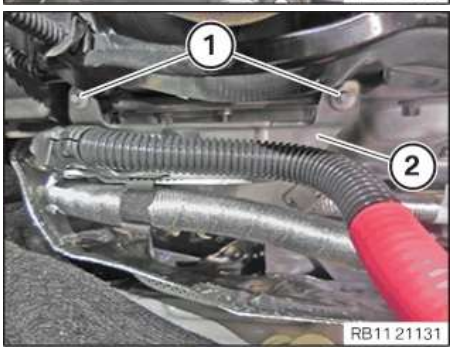
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for the sensor system **2** and place to one side.



- Unlock and detach connector (1) on exhaust camshaft sensor .
- Loosen clamp (2).

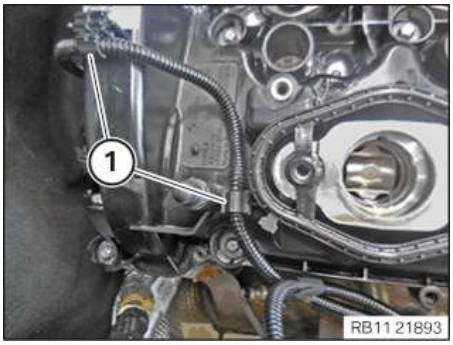


- **If installed:**
- Unlock and loosen connector (1).
- Loosen screw (2).
- Remove the differential pressure sensor (3) and put it to one side.

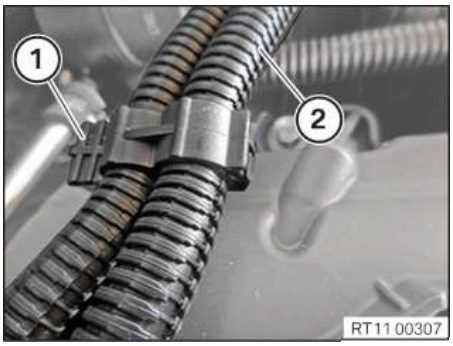


- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

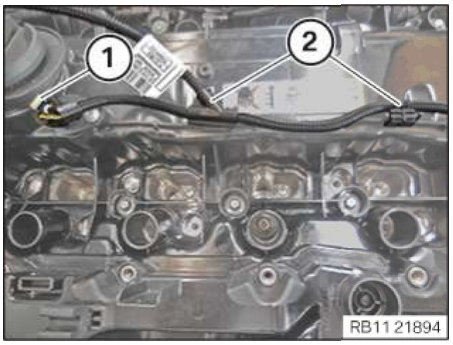
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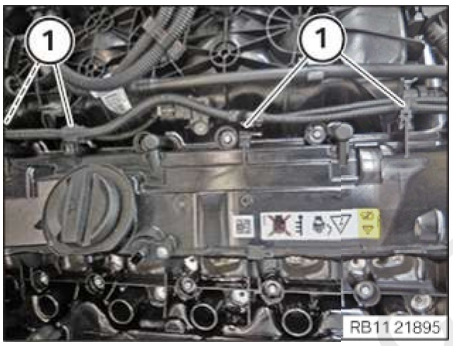
- Loosen clamps (1).



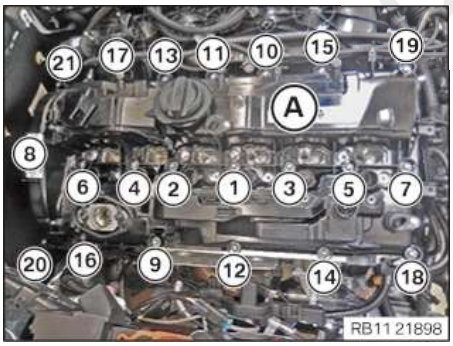
- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



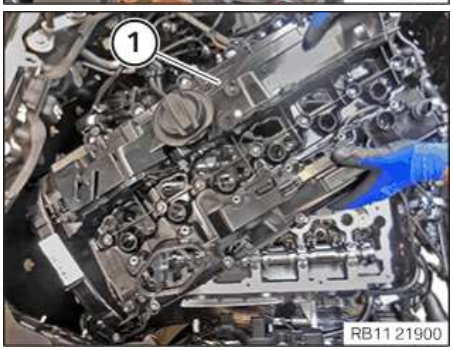
- Unlock and detach connector (1) on the intake camshaft sensor.
- Loosen clamps (2).



- Loosen clamps (1).



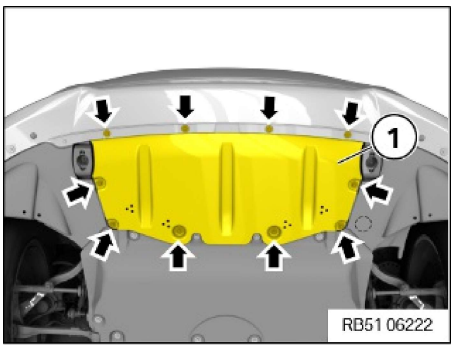
- Release all screws on the cylinder head cover (A) in the sequence (21) to (1).



- Guide the cylinder head cover (1) out and remove it.

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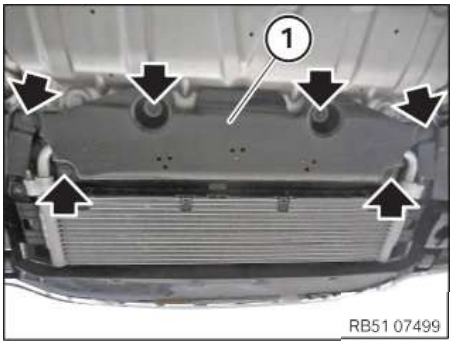
31 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

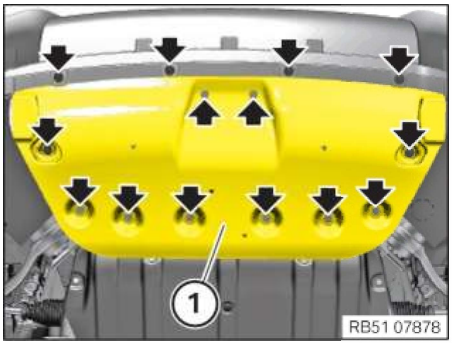
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

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



- **Version 3:**

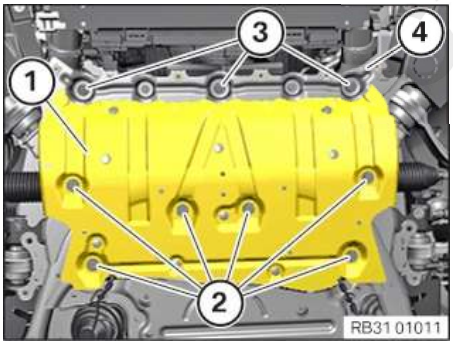
  Remove screws (arrows).

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

32 – Removing the stiffening plate

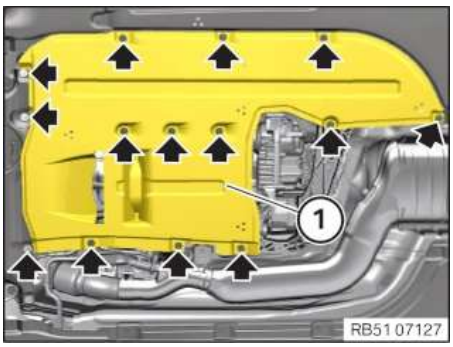
TECHNICAL INFORMATION

Driving without stiffening plate is not permissible.



- Loosen screws (3).
- Remove the holder of the underride protection (4).
- Loosen screws (2).
- Remove stiffening plate (1).

33 – Remove rear underbody protection

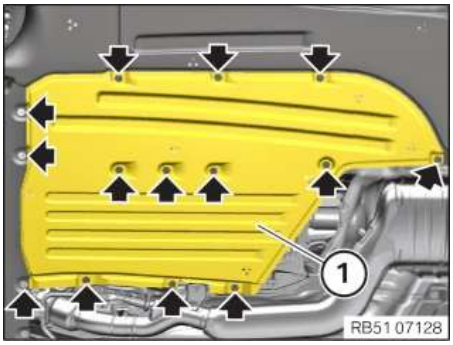


- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).

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- **Version 2:**

  Remove screws (arrows).

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

34 – If installed: Partially release the engine oil cooler

WARNING

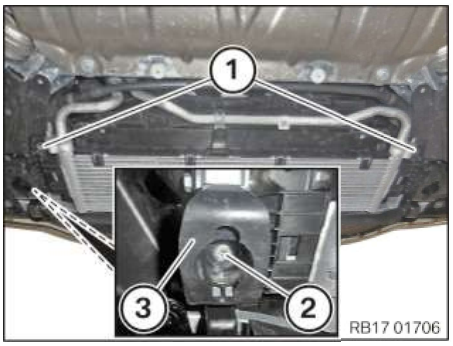
Hot surfaces.

Risk of burning!

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

TECHNICAL INFORMATION

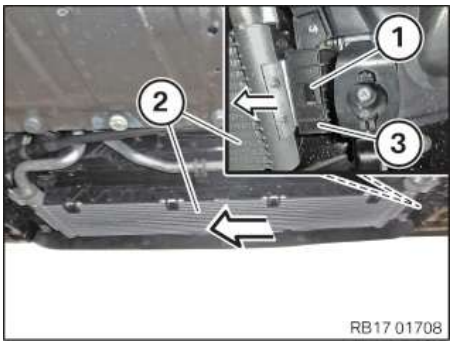
The work must be performed with care to prevent component damage.



- Loosen screws (1).
- Drill out rivet on the left (2).
- Remove the left-hand damper (3).

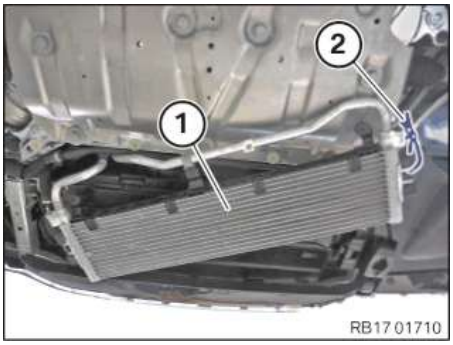


- Loosen screw (1).



- Unlock lock (1).
- Feed out engine oil cooler (2) from the holder in the direction of arrow (3) and place to one side.

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- Affix the engine oil cooler (1) with a cable strap (2) as shown.

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

WARNING

Hot surfaces.

Risk of burning!

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

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

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

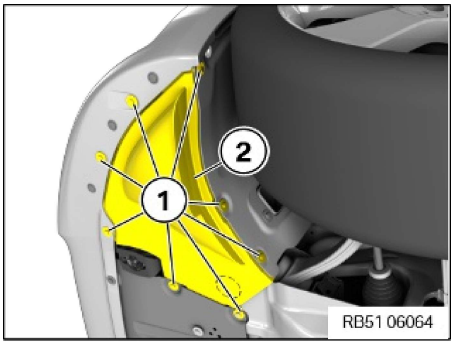
In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

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

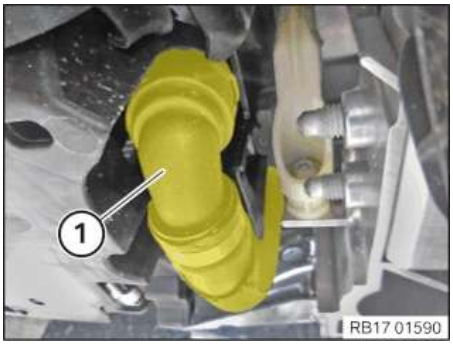


- Loosen sealing cap (1).



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

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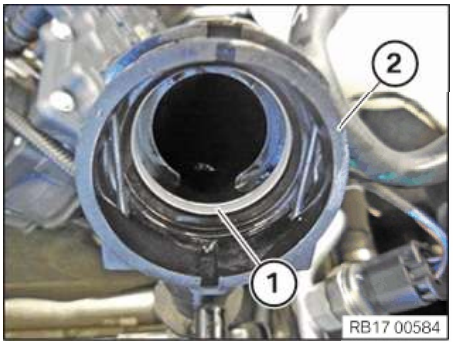


- Unlock and disconnect the coolant line (1).
- Catch and dispose of escaping coolant.

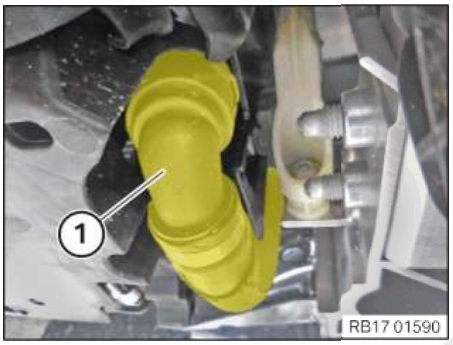
36 – Connecting the coolant lines for the low-temperature coolant circuit

TECHNICAL INFORMATION

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

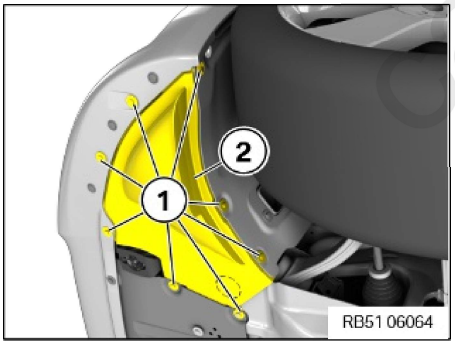


- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock the coolant line (1).

  The coolant line (1) must audibly engage.



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

Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

37 – Remove tank vent valve

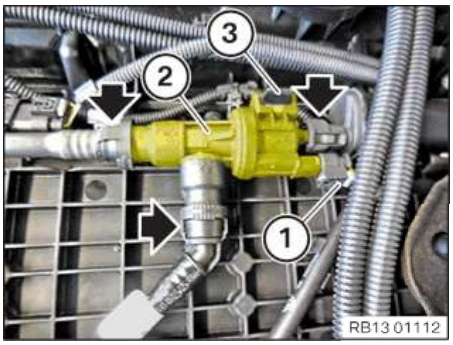
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RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

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



- Unlock and disconnect connector (1).
- Unlock and disconnect the tank ventilation lines (arrows).
- Detach and remove the tank vent valve (2) from the holder (3).

38 – Removing the intake plenum

RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

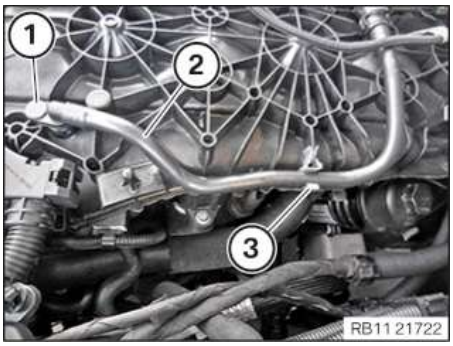
- Do not pull on the wires when disconnecting connectors and plug connections.

TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

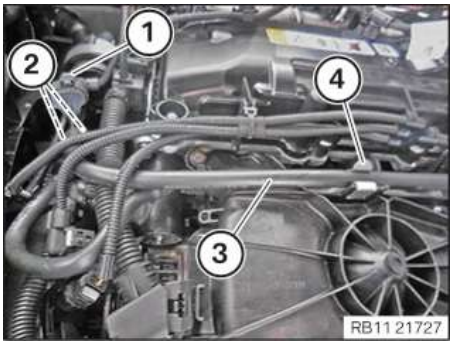
TECHNICAL INFORMATION

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

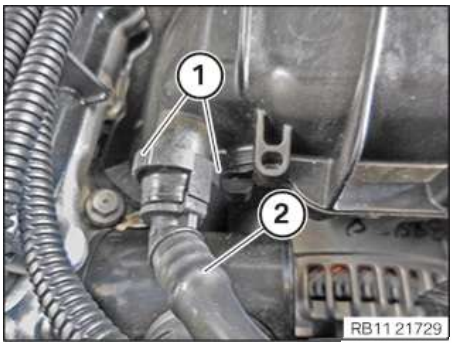


- Loosen screw (1).
- Guide tank ventilation line (2) out of clamp (3) and remove it.

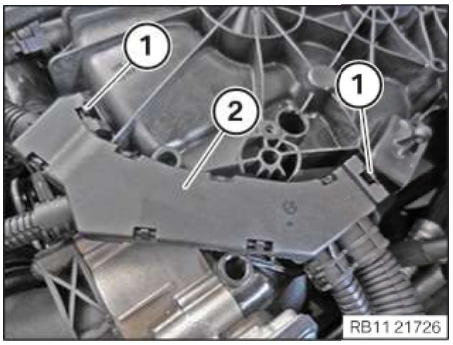
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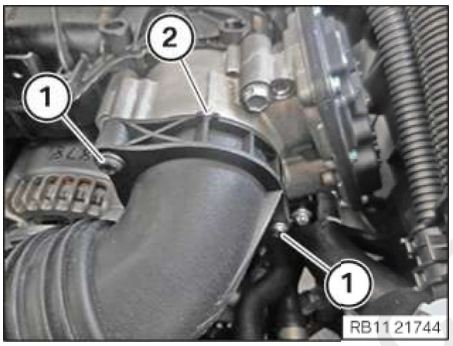
- Unlock and loosen connector (1).
- Unlock the locks (2).
- Guide tank ventilation line (3) out of clamp (4) and remove it.



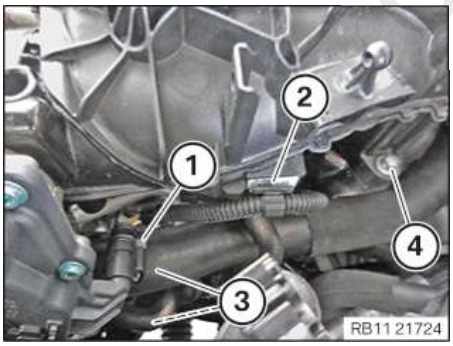
- Unlock the locks (1).
- Feed the tank ventilation line (2) out and set it aside.



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



- Loosen screws (1).
- Feed out charge air line (2) and place to one side.

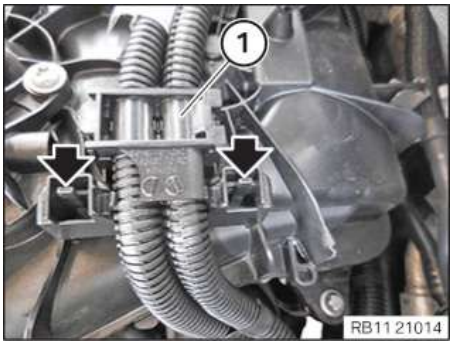


- Unlock and loosen connector (1).
- Loosen clamp (2).
- Thread off coolant line (3) and place to the side.
- Loosen screw (4).

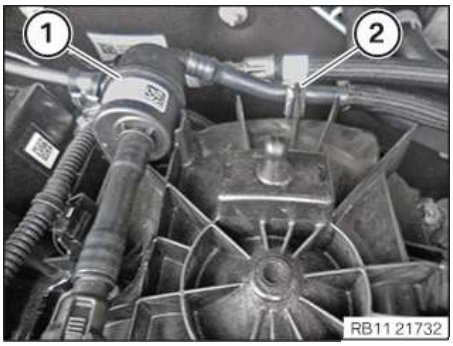


- Unlock and loosen connector (1).

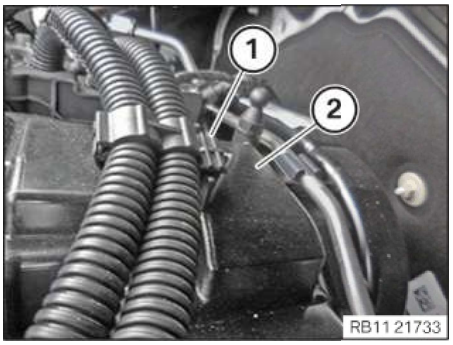
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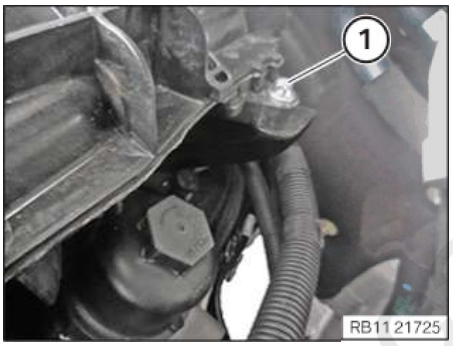
- Unlock the locks (arrows).
- Thread out the wiring harness section (1) for the injectors and ignition coils and set it aside.



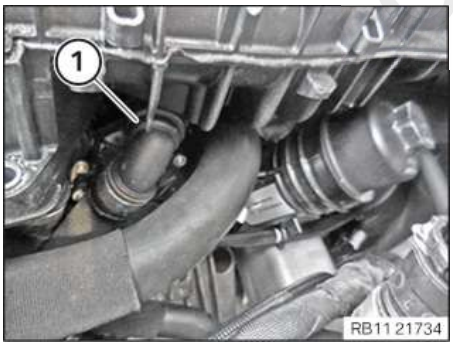
- Guide tank ventilation line (1) out of clamp (2) and place it aside.



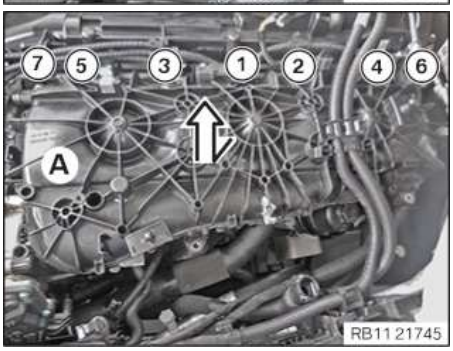
- Guide out the wiring harness section (1) for the injectors and ignition coils of the cylinder head cover (2) and set it aside.



- Loosen screw (1).

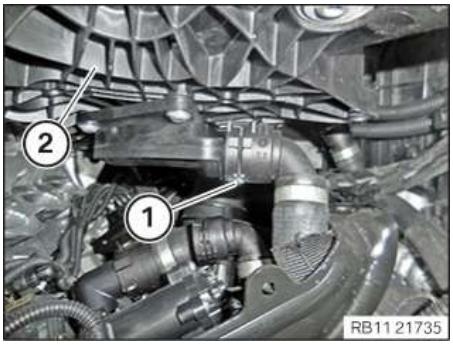


- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.



- Loosen screws in the order (7) to (1).
- Slightly raise intake plenum (A) in direction of arrow.

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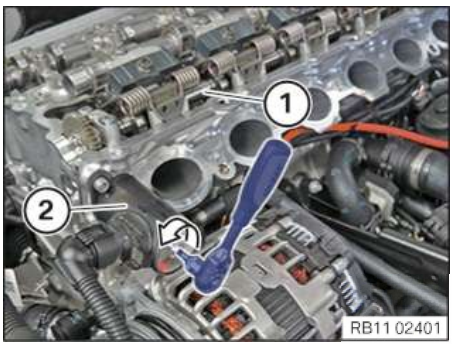


TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

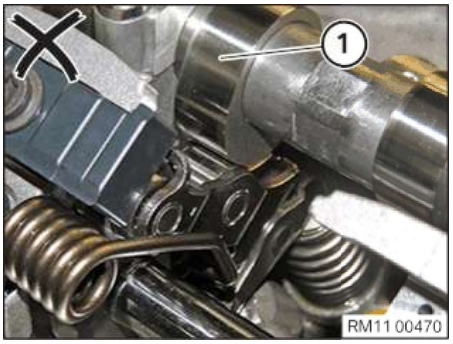
- Unlock and release coolant line (1) below the intake plenum (2).
- Catch and dispose of escaping coolant.
- Thread out intake plenum (2) and remove.

39 – Adjusting eccentric shaft on minimum lift



- Use servomotor (2) to adjust eccentric shaft (1) slowly to minimum lift.

40 – Checking the position of the intake camshaft



Check

- Check position of the intake camshaft on the respective cylinders.

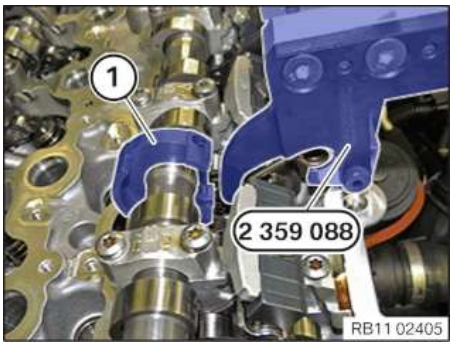
Result

» Cam (1) of the intake camshaft runs on the intermediate lever.

Measure

- Continue to turn the engine at the vibration damper with the special tool 0 493 380 (11 6 480) in the direction of engine rotation.

41 – Check the position of the intake camshaft at cylinders 3 and 4



Check

- Check the position of the intake camshaft at cylinders 3 and 4.

  To remove the torsion spring on cylinder 3 and 4 the camshaft sensor wheel (1) of the intake camshaft must be positioned as shown.

Result

» Camshaft sensor wheel (1) of the intake camshaft is not in the indicated position.

Measure

- Turn engine on the vibration damper using special tool 0 493 380 (11 6 480) till the camshaft sensor wheel (1) of the intake camshaft is positioned as shown.

42 – Remove all torsion springs

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CAUTION

Spring preload.

Danger of injury!

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

TECHNICAL INFORMATION

- Wear safety goggles.

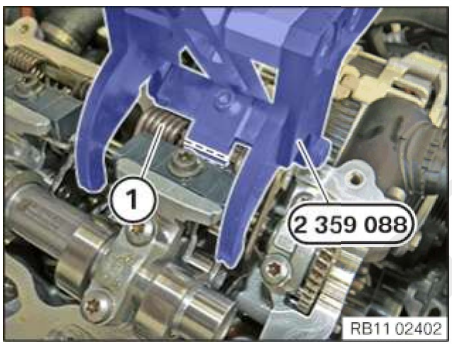
NOTICE

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

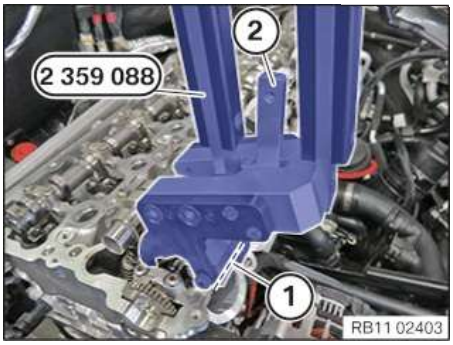


- Have the set of special tools 2 359 088 ready.

Number	Description
1	Clamping lever
2	Mounting for clamping lever (fitting aid)



- Open the special tool 2 359 088 and position it at the torsion spring (1).



- Ensure that the special tool 2 359 088 lies flat in the area (1) on the cylinder head.
- Carefully close the clamping lever of the special tool 2 359 088 until the retaining hook (2) engages.

Check

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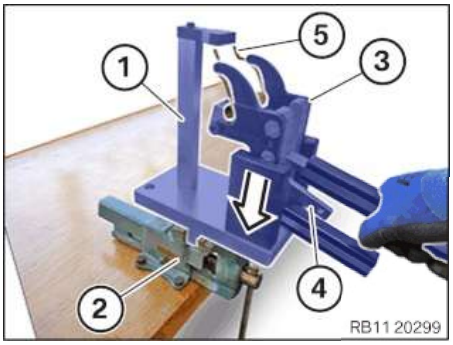
- Check if the special tool 2 359 088 is positioned correctly on the torsion spring.

Result

» Special tool 2 359 088 is not positioned correctly on the torsion spring.

Measure

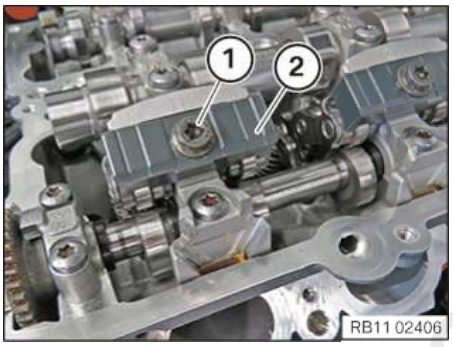
- Carefully release the clamping lever of the special tool 2 359 088 and repeat the process.



- Clamp fixture (1) of the special tool 2 359 088 in the vice (2).
- Position clamping lever (3) of special tool 2 359 088 with pre-tensioned torsion spring (5) in direction of arrow in the mounting (1) of the special tool 2 359 088.
- Carefully unlock retaining hook (4) of the special tool 2 359 088.

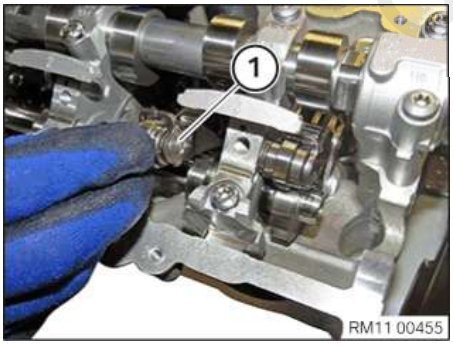
  The torsion spring (5) is relieved.
- Slowly open clamping lever (3) and remove the torsion spring (5).
- Place torsion spring (5) neatly into special tool 0 495 105 (11 4 480).
- Repeat the operations for the remaining torsion springs.

43 – Removing all gates



- Loosen screw (1).
- Remove the gates (2) and place it arranged in order in the special tool 0 495 105 (11 4 480) .
- Repeat the step for all the gates.

44 – Removing all intermediate levers



- Remove the intermediate lever (1) and arrange it in the special tool 0 495 105 (11 4 480) in order.
- Repeat the step for all intermediate levers (1).

45 – Block the engine with the special tool in TDC firing position

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- Thread the sealing cap (1) out and remove.



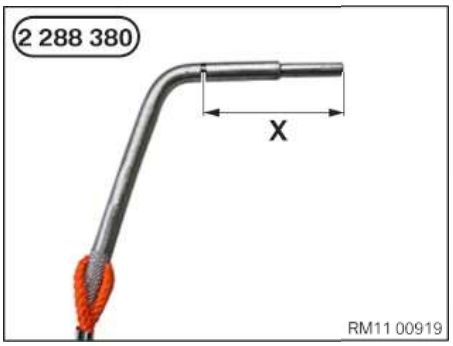
RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

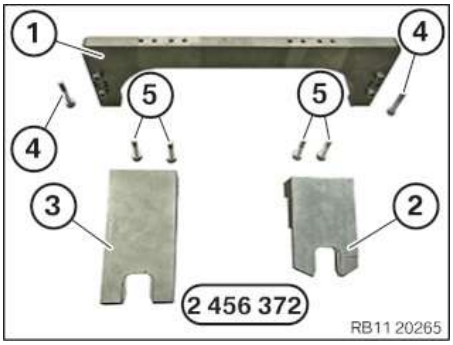
  The TDC firing position of cylinder 1 was **not** reached.



- **Vehicles with automatic transmission:**

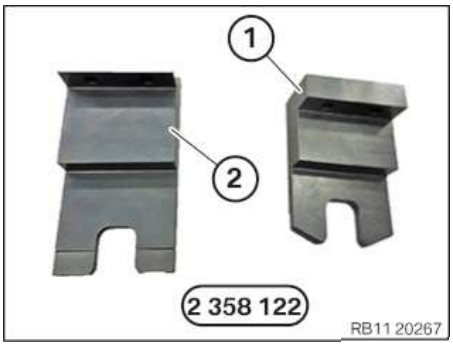
  Special tool 2 288 380 **correctly** positioned.

  The engine is in the TDC firing position of cylinder 1.



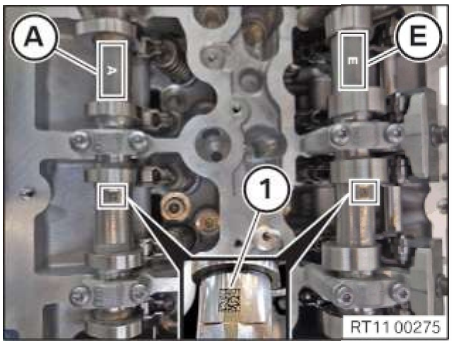
- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

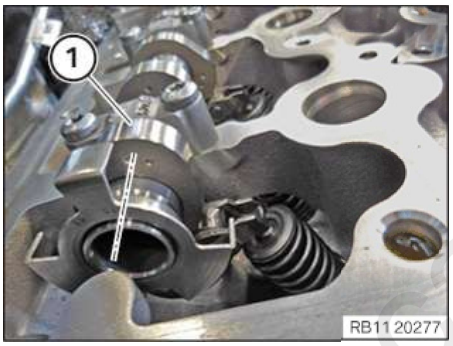


- Overview of the test gauges from the set of special tools 2 358 122:

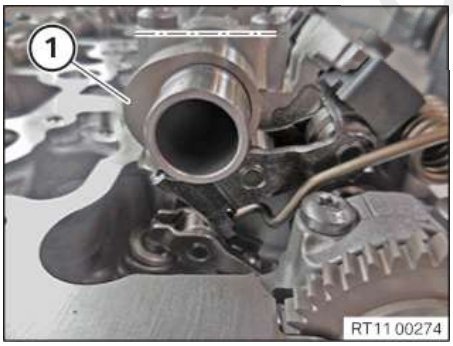
Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



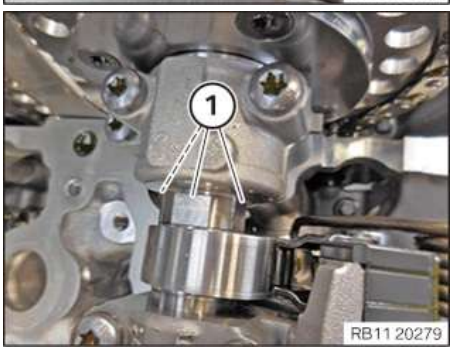
- Turn intake camshaft (E) and exhaust camshaft (A) until marks (1) can be read from the top.



- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.

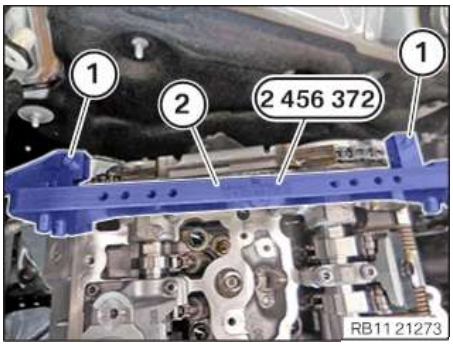


- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.

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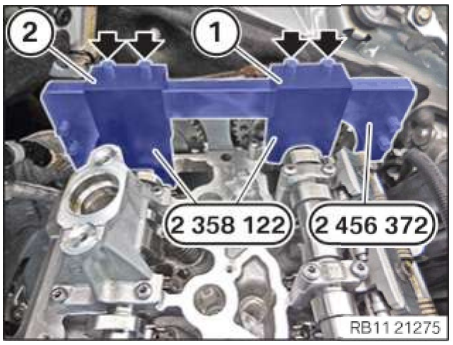
- Position basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

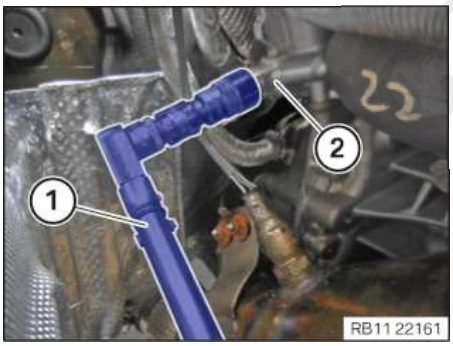
Test gauge to basic carrier

M6		Tightening torque	8 Nm

46 – Removing chain tensioner

TECHNICAL INFORMATION

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



- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).



- Feed out and remove the chain tensioner (1).

47 – Releasing the VANOS central valve of the intake adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.



NOTICE

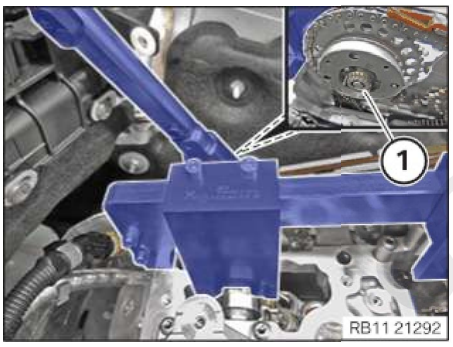
The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the intake adjuster.

48 – Releasing VANOS central valve of the exhaust camshaft adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

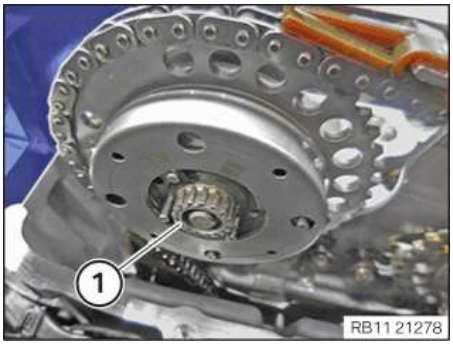


NOTICE

The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

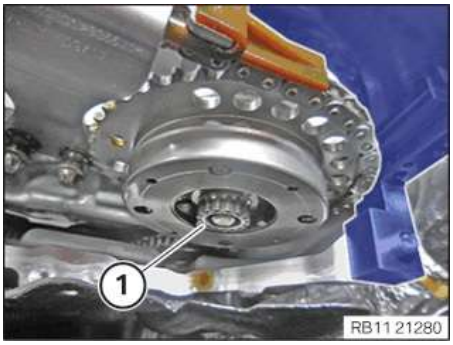
49 – Removing the VANOS central valve of the intake adjuster



- Guide out and remove the VANOS central valve (1) of the intake adjuster.

50 – Remove the VANOS central valve of the exhaust camshaft adjuster

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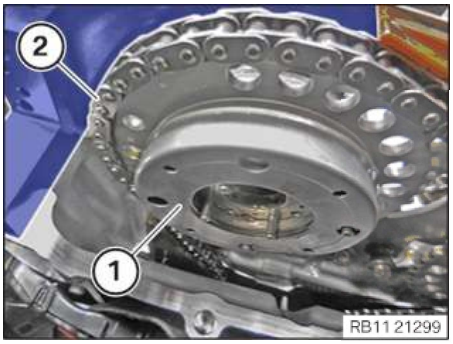


- Guide out and remove the VANOS central valve (1) of the exhaust camshaft adjuster.

51 – Removing intake adjuster

NOTICE

The figure shows the rear side of the engine.

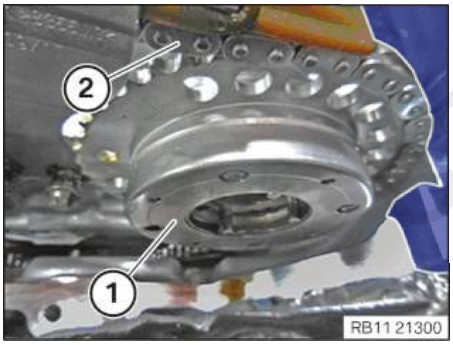


- Guide out the intake adjuster (1) from the timing chain (2) and remove.

52 – Remove exhaust camshaft adjuster

NOTICE

The figure shows the rear side of the engine.



- Guide out the exhaust camshaft adjuster (1) from the timing chain (2) and remove.

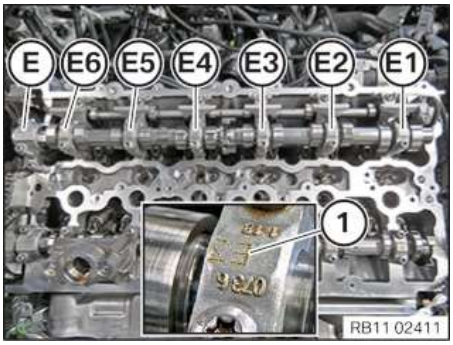
53 – Remove the test gauges to fix the camshafts



- Remove screws (arrows).
- Guide out and remove test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier of the set of special tools 2 456 372.
- Guide out and remove test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier of the set of special tools 2 456 372.

54 – Remove intake camshaft

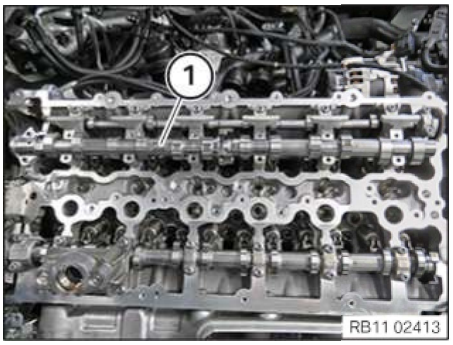
cardiagn.com



- Observe numbering of intake camshaft bearing caps from (E1) to (E6).
  Intake camshaft bearing cap (E) is a thrust bearing.

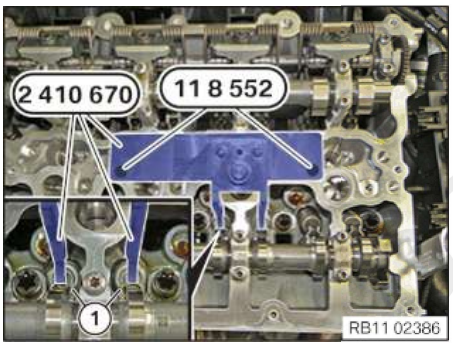


- Loosen screws in the order (14) to (1).
- Set all intake camshaft bearing caps neatly in the special tool 0 495 105 (11 4 480).

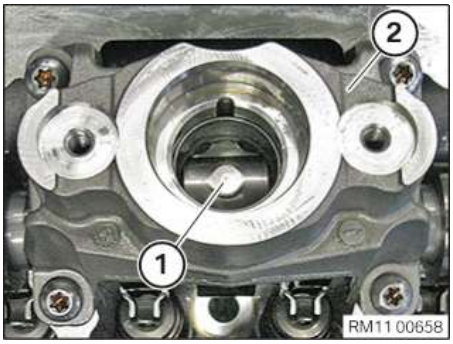


- Remove intake camshaft (1) in upward direction.

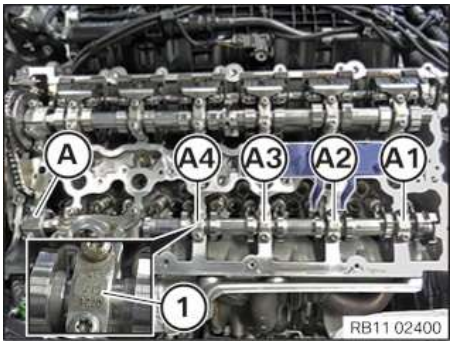
55 – Remove exhaust camshaft



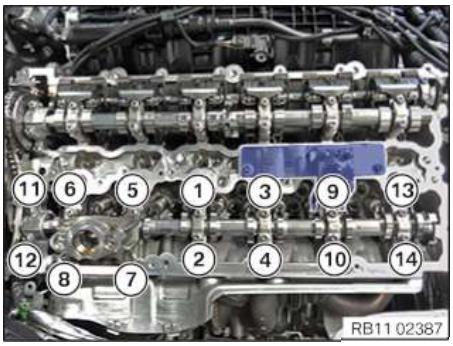
- Position the special tool 2 410 670 at cylinder 2 and apply it hand-tight with the special tool 0 495 741 (11 8 552) from the set of special tools 0 495 739 (11 8 550).
- Screw in both roller cam followers (1) on cylinder 2 with the spindle nut of the special tool 2 410 670 to the stop.



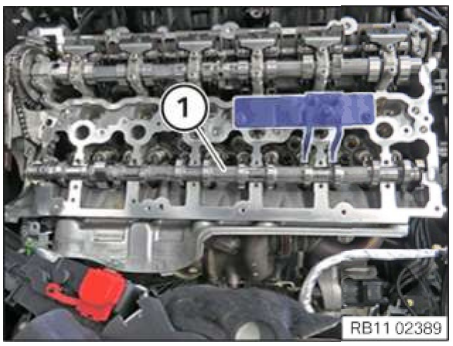
- Remove the roller tappet (1) from the high pressure pump bracket (2).



- Observe the numbering of the exhaust camshaft bearing caps.
  The exhaust camshaft bearing caps are numbered from (A1)till (A4).
  The exhaust camshaft bearing cap (A) is a thrust bearing.



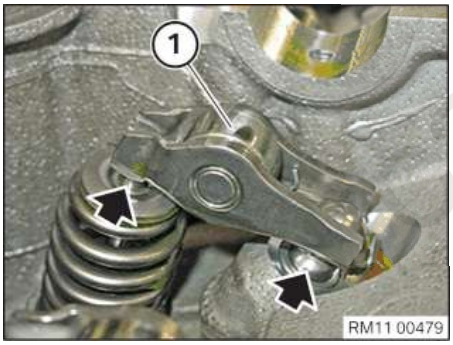
- Release screws in the right sequence (14) till (1) in semi circle pattern.
- Remove high pressure pump bracket and all exhaust camshaft bearing cap.
- Place all exhaust camshaft bearing cap in order in special tool 0 495 105 (11 4 480).



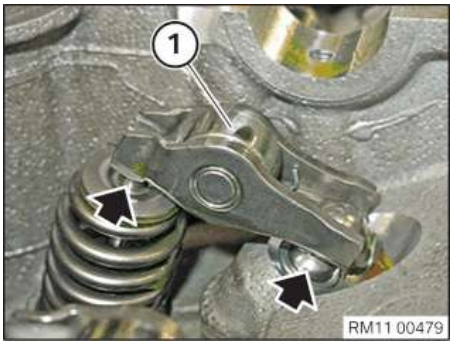
- (1)Remove exhaust camshaft in upward direction.

MAIN WORK

56 – Remove all roller cam followers



- Detach and remove the roller cam followers (1) on the intake side from hydraulic valve clearance compensating elements (arrows).
- Place all roller cam followers in order in special tool 0 495 105 (11 4 480).



- Detach and remove the roller cam followers (1) on the output side from hydraulic valve clearance compensating elements (arrows).
- Place all roller cam followers in order in special tool 0 495 105 (11 4 480).

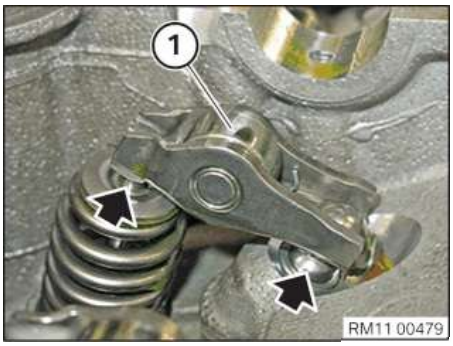
57 – Install all roller cam followers

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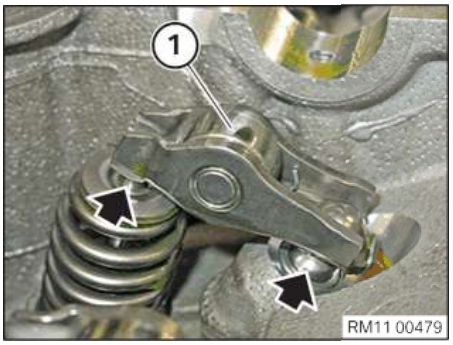


- The classification in digits from 1 to 5 has been printed on the roller cam follower.

Classification	Idle speed
1	Repair case - slow engine speed when idling
2	Installed as standard/initial installation
3	Installed as standard/initial installation
4	Installed as standard/initial installation
5	Repair case - high engine speed when idling



- Install the roller cam follower (1) on the intake side.
- Make sure the roller cam followers are correctly positioned on the hydraulic valve clearance compensating elements (arrows) and on the intake valves.



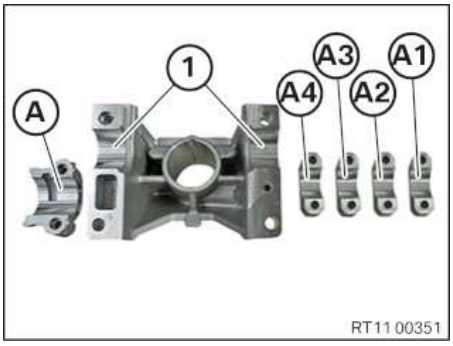
- Install the roller cam followers (1) on the exhaust side.
- Make sure the roller cam followers are correctly positioned on the hydraulic valve clearance compensating elements (arrows) and on the exhaust valves.

POSTPROCESSES

58 – Install exhaust camshaft

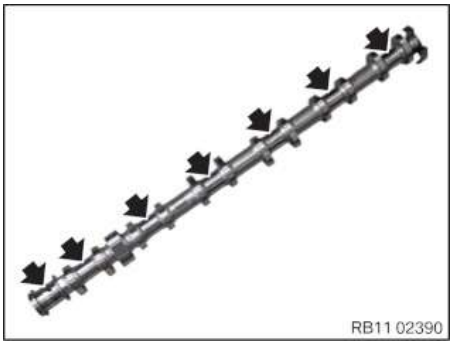


- Clean all the bearing positions (arrows).
- Coat all the bearing positions (arrows) with engine oil.

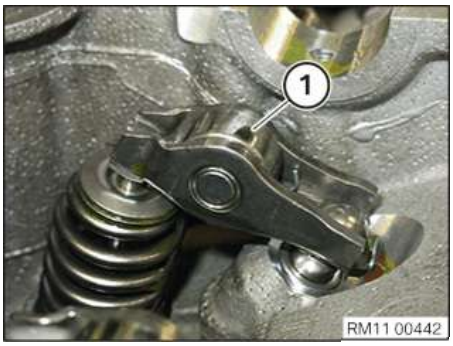


- Clean all bearing positions of exhaust camshaft bearing caps (A1), (A2), (A3), (A4) and (A) and coat with engine oil.
- Clean bearing positions (1) of the high pressure pump bracket and coat with engine oil.

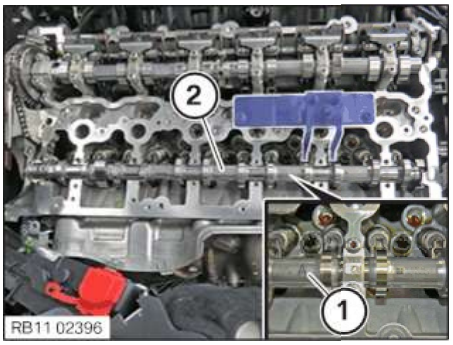
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- Clean all the bearing positions (arrows) of the exhaust camshaft.
- Coat all the bearing positions (arrows) of the exhaust camshaft with engine oil.



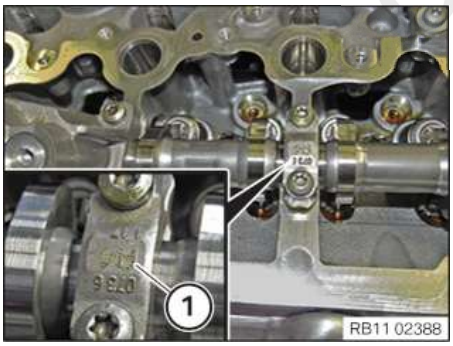
- Check all roller cam follower (1) of the exhaust side for correct fit.



- Insert exhaust camshaft (2) in the cylinder head, such that the mark (1) points upwards.



- Check the fitting sleeves (1) of the thrust bearing for damage and renew if necessary.
- Check the fitting sleeves (2) of the high pressure pump bracket for damage and renew if necessary.



RISK OF DAMAGE

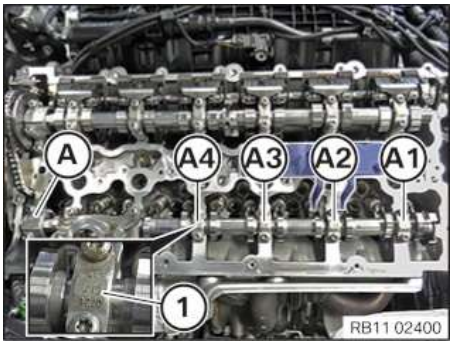
Engine damage caused by incorrectly installed bearing shells and bearing supports.

Engine damage may result from incorrectly installing bearing shells and bearing supports.

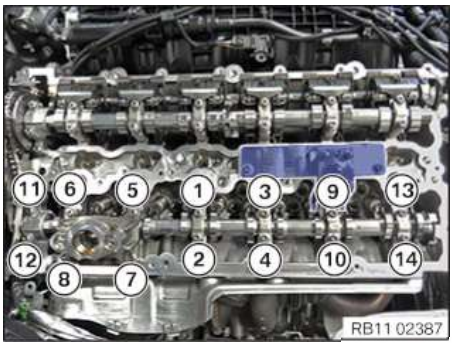
- Always install all bearing shells and bearing supports in the same position from which they were removed.

- Replace all exhaust camshaft bearing cap , that the labelling(1) from the intake side are readable.

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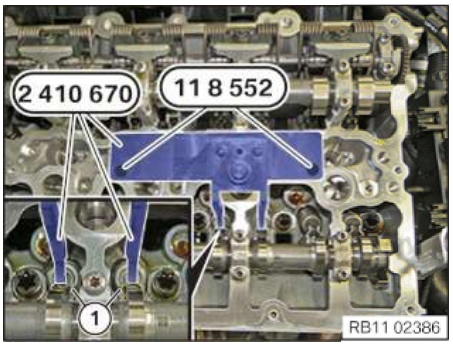
- Oil all the exhaust camshaft bearing caps (A1) to (A4) and the exhaust camshaft bearing cap for the thrust bearing (A) with engine oil and place into position.
- Oil the bearing position at the high pressure pump bracket with engine oil and place the high pressure pump bracket into position.



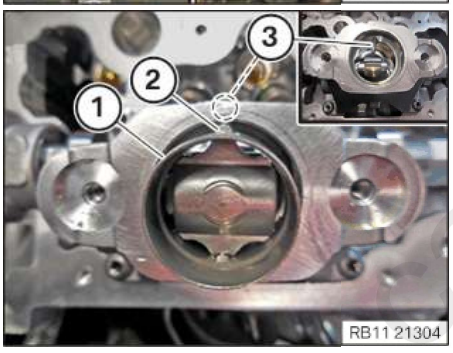
- Press down the exhaust camshaft bearing caps and hand-tighten the bolts incrementally in the sequence(1) to (14).
- Move up all screws in the sequence (1) to (14) **in half rotations.**
- **Adhere to the jointing torque.**
- Tighten all bolts in sequence (1) to (14) .

Exhaust camshaft to cylinder head

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm



- Relax special tool 2 410 670 above the spindle nut.
- Release special tools 0 495 741 (11 8 552) and remove the special tool 2 410 670.



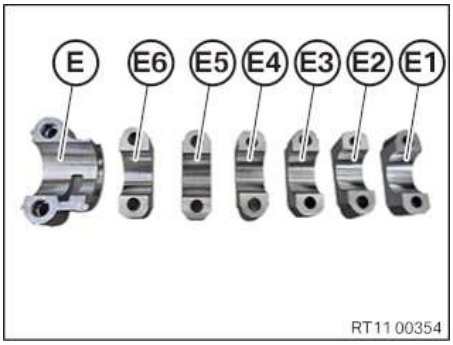
- Guide in and position roller tappet (1).
- Ensure that pin (2) is positioned correctly in guide (3).
- Feed in and install roller tappet (1).

59 – Install intake camshaft

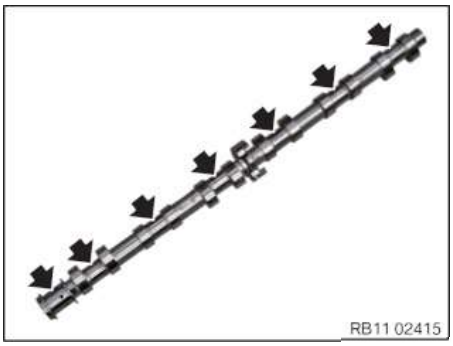


- Clean all bearing positions and coat with engine oil.

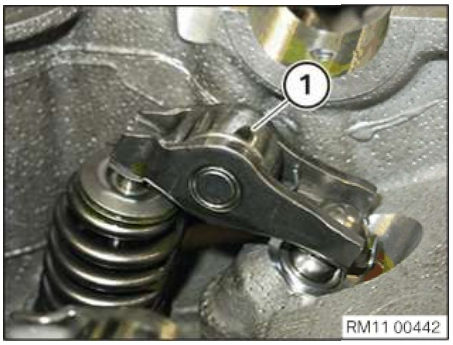
carmanualsonline.com



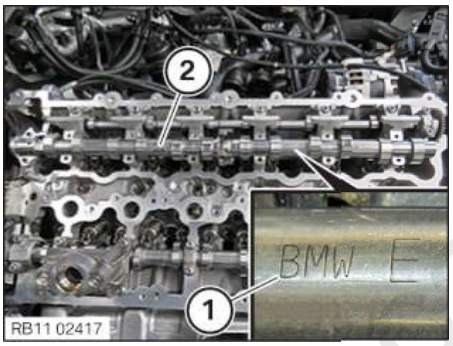
- Clean all bearing positions of intake camshaft bearing caps (E1),(E2),(E3),(E4),(E5),(E6) and (E) and coat with engine oil.



- Clean all bearing positions of the intake camshaft and coat with engine oil.



- Check all roller cam followers(1) of the intake side for correct fit.

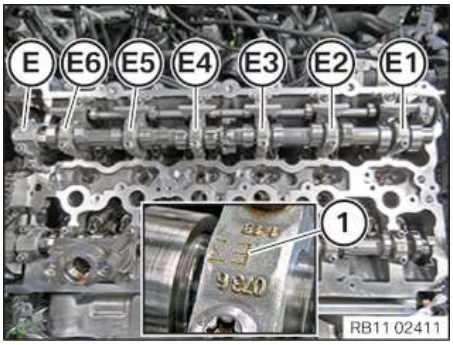


- Insert intake camshaft (2) in the bearing supports in such a way that the mark (1) points towards the top.



- Check fitting sleeves (1) of the thrust bearing for damage, renew if necessary.

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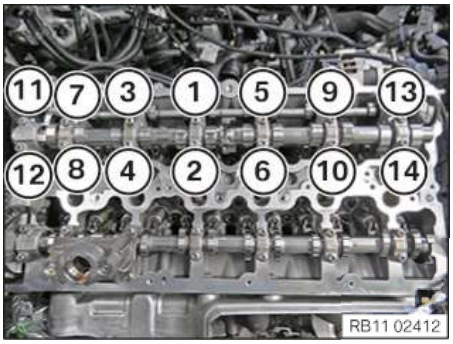
RISK OF DAMAGE

Engine damage caused by incorrectly installed bearing shells and bearing supports.

Engine damage may result from incorrectly installing bearing shells and bearing supports.

- Always install all bearing shells and bearing supports in the same position from which they were removed.

- Coat all the intake camshaft bearing caps(E1) till (E6) and lay the bearing caps for the thrust bearing(E) with engine oil.

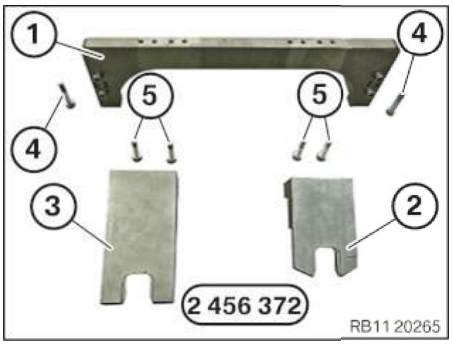


- Press intake camshaft bearing cap down and hand-tighten the bolts incrementally in sequence (1) to (14).
- Join all the screws in the sequence (1) to (14) **in half turns** .
- **Adhere to the jointing torque.**
- Tighten all screws in a sequence from (1) to (14) .

Intake camshaft to cylinder head

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque.	10 Nm

60 – Adjust the camshafts with the special tool



- Overview of the set of special tools 2 456 372:

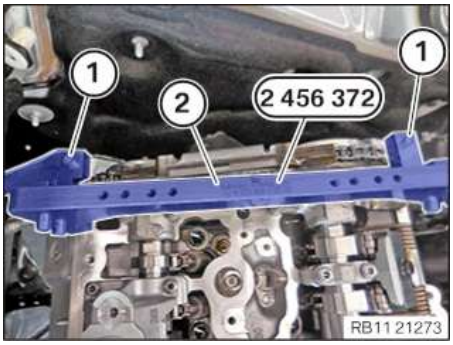
Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Use the setting gauge 0.7 ° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.



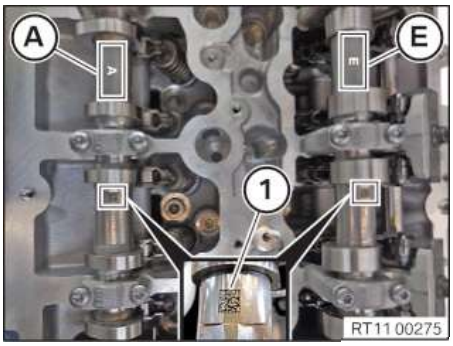
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



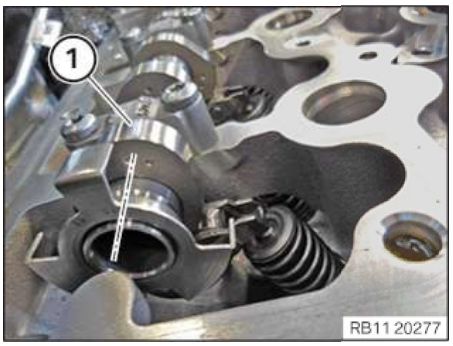
- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



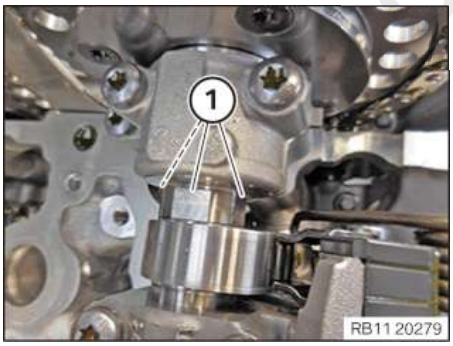
- Turn the intake camshaft (E) and the exhaust camshaft (A) such that the marks (1) can be read from the top.



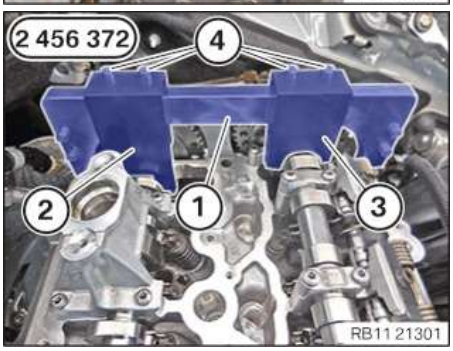
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



- Position the setting gauge 0.5° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten the screws (4).

Test gauge to basic carrier

M6		Tightening torque	8 Nm

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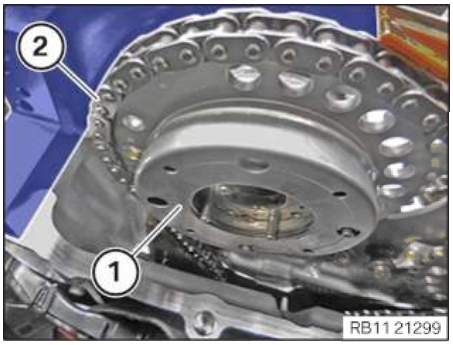
61 – Installing the intake adjuster

NOTICE

The figure shows the rear side of the engine.

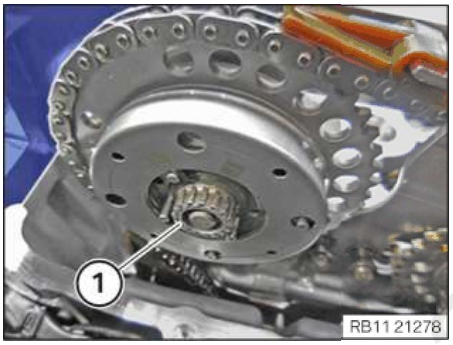


- Keep intake adjuster (1) marked IN ready.

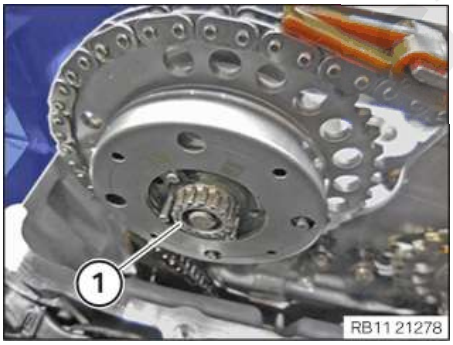


- Feed in intake adjuster (1) in the timing chain (2) and position on the intake camshaft .

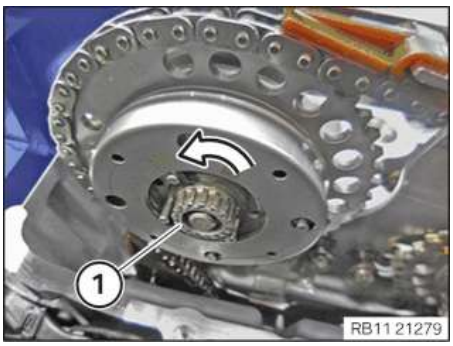
62 – Install the VANOS central valve of the intake adjuster



- Guide in the VANOS central valve (1) of the intake adjuster and install.



- Hand-tighten the VANOS central valve (1) of the intake adjuster.



- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

63 – Install exhaust camshaft adjuster

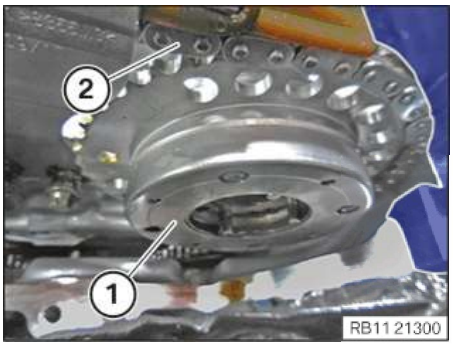
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NOTICE

The figure shows the rear side of the engine.

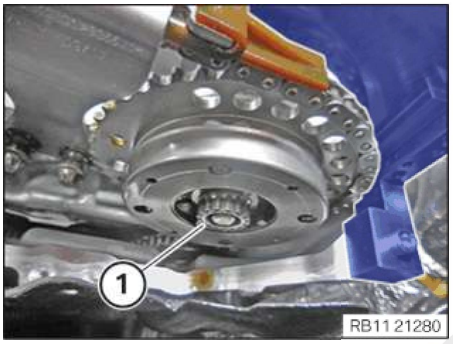


- Keep exhaust camshaft adjuster (1) marked EX ready.

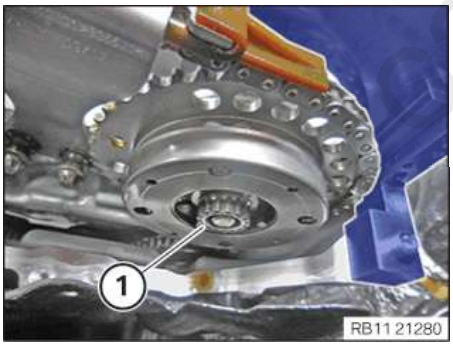


- Feed in exhaust camshaft adjuster (1) in the timing chain (2) and position on the exhaust camshaft .

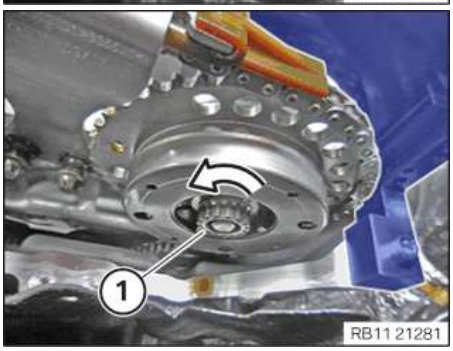
64 – Installing the VANOS central valve of the exhaust camshaft adjuster



- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.



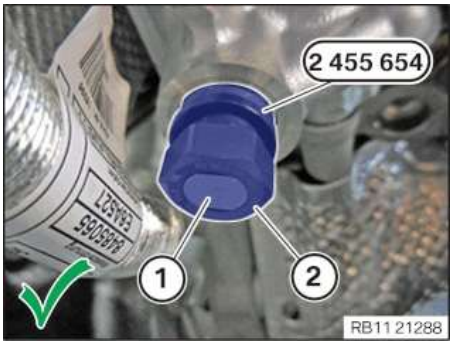
- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.



- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

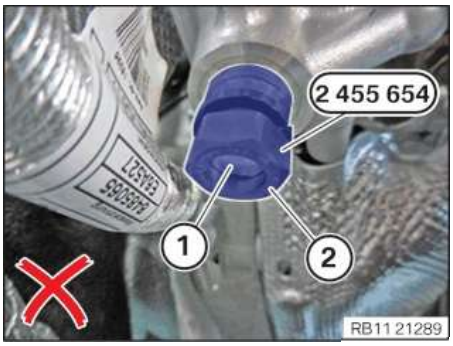
65 – Pretension the timing chain with the special tool

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- Make sure that the timing chain is **correctly** pre-tensioned with the special tool 2 455 654.

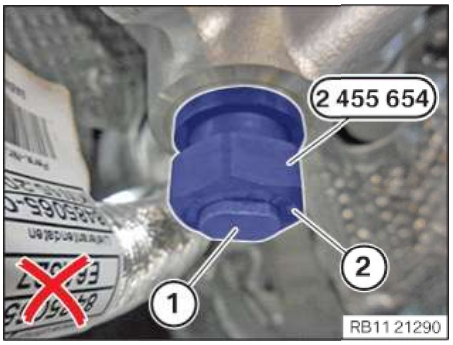
  The pin (1) must align **precisely** with housing (2).



- Make sure that the preload of the timing chain is no **insufficient**.

  The preload is insufficient when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.



- Make sure that the preload of the timing chain is not **too high**.

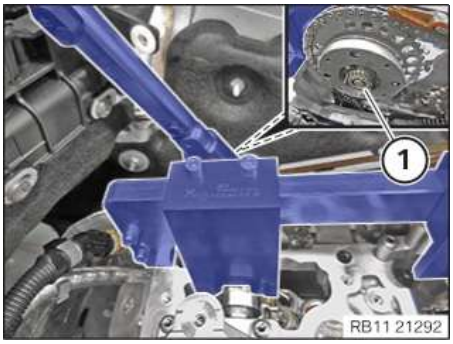
  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

66 – Tightening the VANOS central valve of the exhaust camshaft adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



- Tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

67 – Tightening the VANOS central valve of the intake adjuster

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- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.

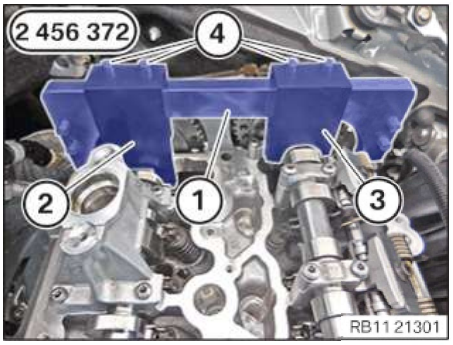


- Tighten the VANOS central valve (1) of the intake adjuster.

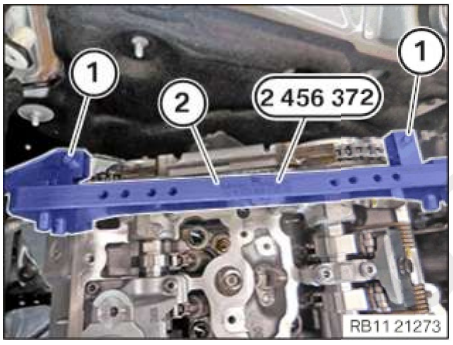
VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

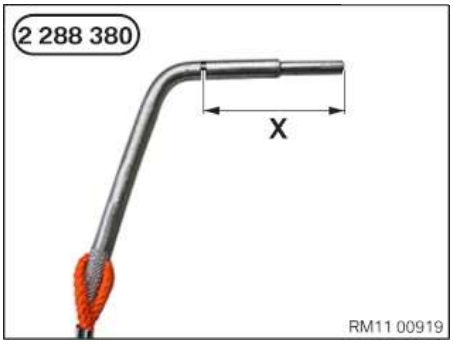
68 – Disassembling all special tools



- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) and remove.



- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.



- Guide the special tool 2 288 380 out and remove.



- Guide the special tool 0 493 380 (11 6 480) out and remove.



- Guide the special tool (1)2 455 654 out and remove.

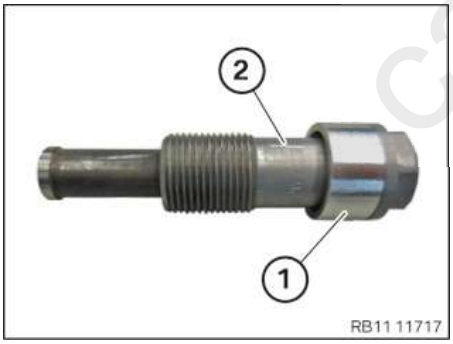
69 – Install chain tensioner

TECHNICAL INFORMATION

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



- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.



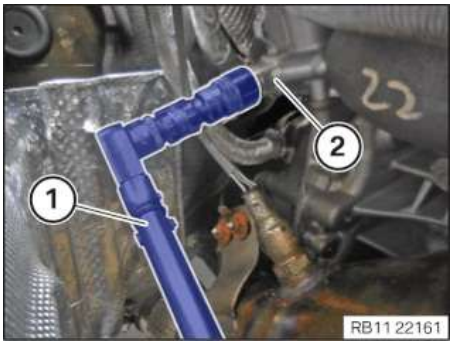
- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.



- Insert and install the chain tensioner (1).

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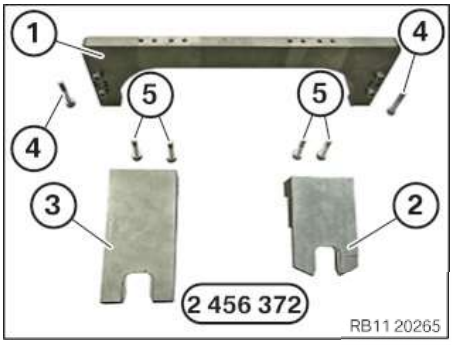


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

70 – Checking camshaft timing



- Have the set of special tools 2 456 372 ready.

Number	Description
1	Basic carrier
2	0.7° setting gauge to adjust the intake camshaft
3	0.5° setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Keep the test gauge from the set of special tools 2 358 122 ready.

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



- Have the special tool 2 288 380 ready.

Number	Description
1	Locating stud



RISK OF DAMAGE

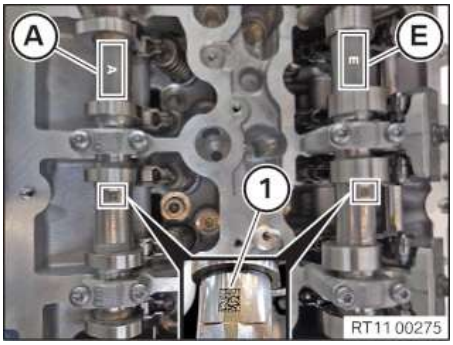
Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

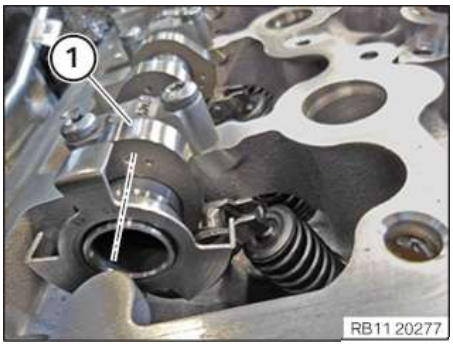
- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.

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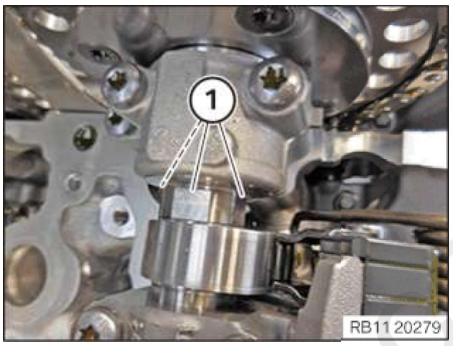
- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.



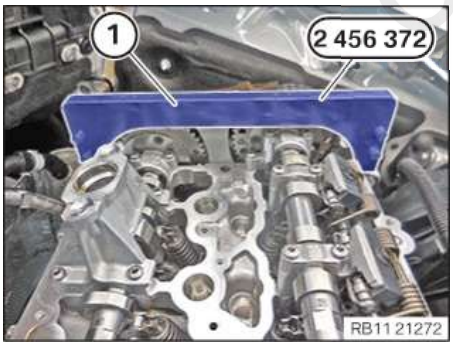
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



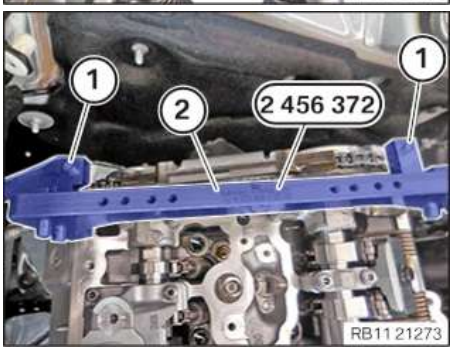
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.

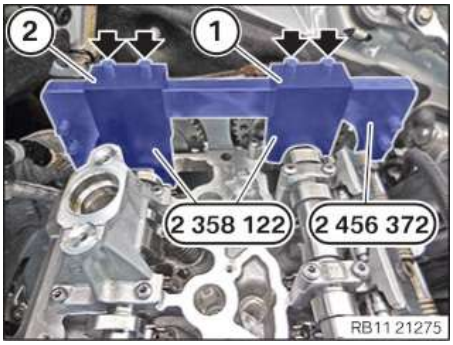


- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm

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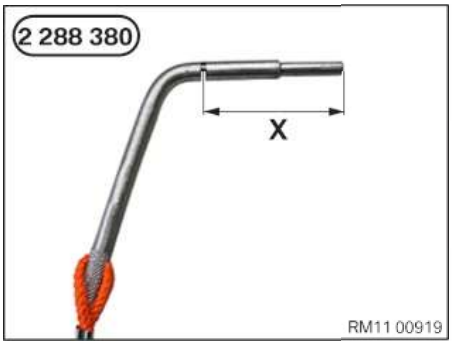
- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

Test gauge to basic carrier

M6		Tightening torque	8 Nm



- Thread the sealing cap (1) out and remove.



- **Vehicles with automatic transmission:**

  Dimensions (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.



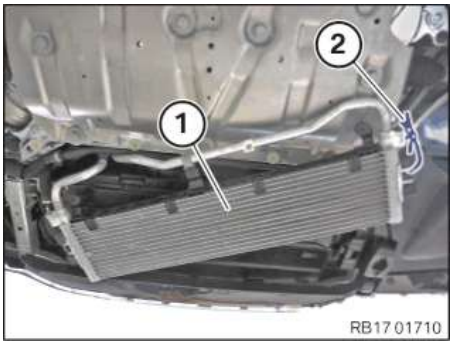
- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

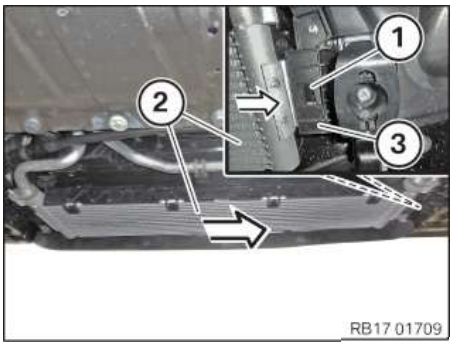
  The engine **is in the** TDC firing position of cylinder 1.

71 – If installed: Secure engine oil cooler

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- Remove the cable straps (2).
- Position engine oil cooler (1).



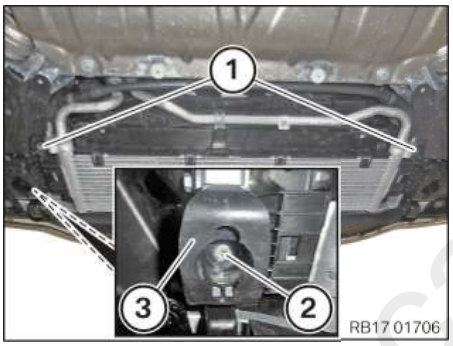
- Feed in and install the engine oil cooler (2) on the holder (3) in the direction of the arrow.
- Ensure that the lock (1)engages audibly.



- Tighten down screw (1).

Engine oil cooler to bumper support

M6X25		Tightening torque	8 Nm



- Renew rivet (2).

  Parts: Rivet
- Install and rivet damper (3).
- Tighten the screws (1).

Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

72 – Checking the intermediate lever classification



TECHNICAL INFORMATION

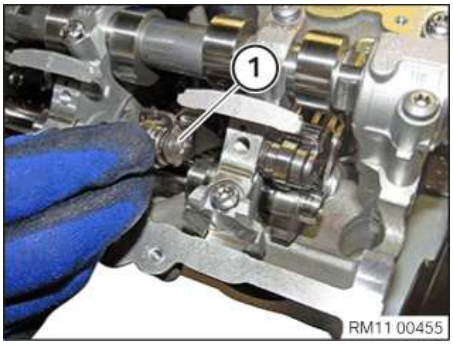
All intermediate levers are classified. Only one classification may be used per engine.

All intermediate levers must be installed in the same position in an engine which has already been in use.

- Checking the intermediate lever classification.

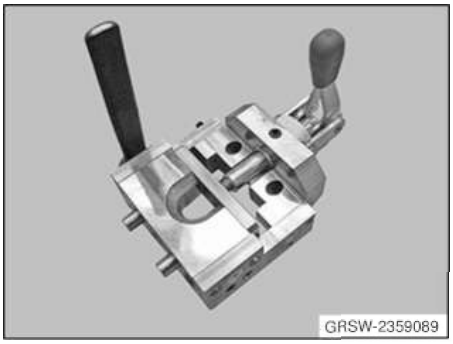
73 – Installing all intermediate levers

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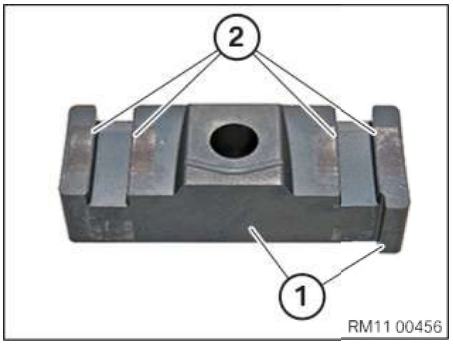


- Install intermediate lever (1).
- Repeat the step for all intermediate levers (1).

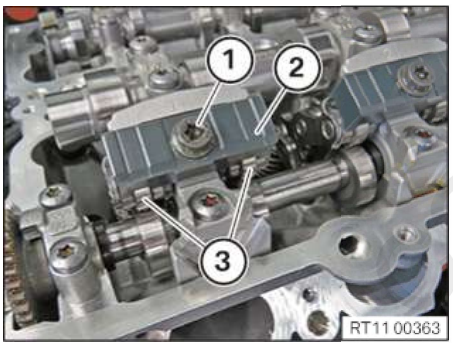
74 – Installing all gates



- Have the special tool 2 359 089 ready.

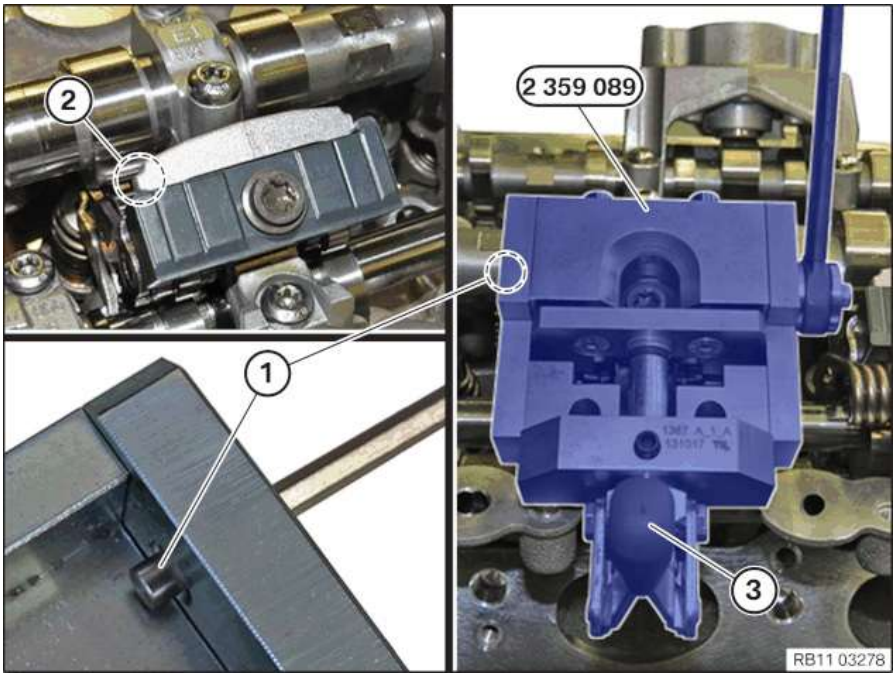


- Clean contact surfaces (1) and (2) off oil, grease and dirt.

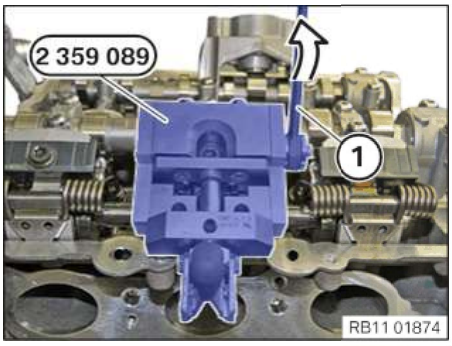


- Position the gate (2) and hand-tighten the bolt (1).
- Check that the intermediate lever (3) is in the correct mounting orientation.

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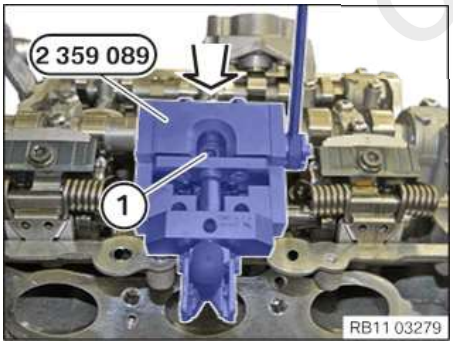
- Position the special tool 2 359 089 on the cylinder head.
- Pre-tension the gate with the lever (3).
- Abut the bolt (1) in the area (2).
- Make sure that the special tool 2 359 089 does not rotate during this process.



- Secure the gate with the lever (1).



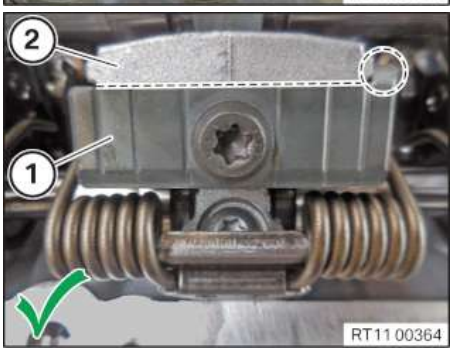
- Ensure that the special tool 2 359 089 lies flat on the cylinder head.



- Press the special tool 2 359 089 onto the cylinder head.
- Tighten the bolt (1) at the same time.

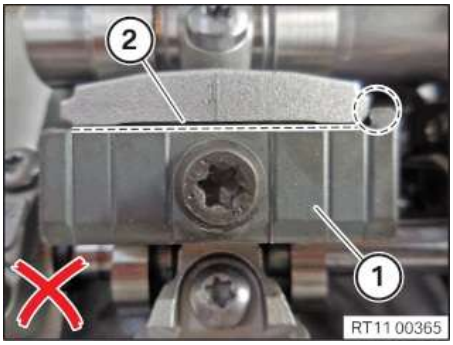
Gate to bearing bracket

M8		20 Nm



- Make sure that gate (1) rests correctly against bearing bracket (2).
  Gate (1) is installed correctly in the marked area.

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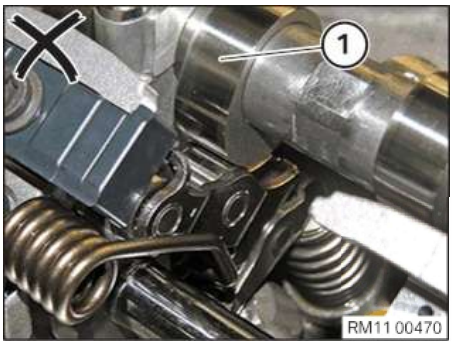


- Make sure that gate (1) rests correctly against bearing bracket (2).

  Gate (1) is installed incorrectly in the marked area.

- Repeat the procedure for all gates.

75 – Checking the position of the intake camshaft



Check

- Check position of the intake camshaft on the respective cylinders.

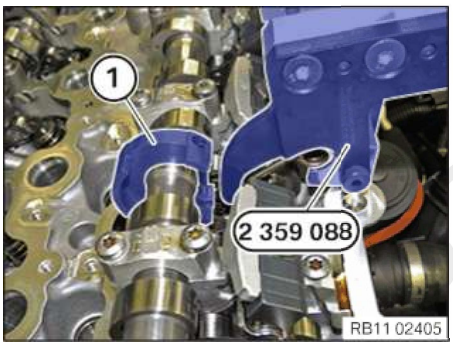
Result

» Cam (1) of the intake camshaft runs on the intermediate lever.

Measure

- Continue to turn the engine at the vibration damper with the special tool 0 493 380 (11 6 480) in the direction of engine rotation.

76 – Check the position of the intake camshaft at cylinders 3 and 4



Check

- Check the position of the intake camshaft at cylinders 3 and 4.

  To remove the torsion spring on cylinder 3 and 4 the camshaft sensor wheel (1) of the intake camshaft must be positioned as shown.

Result

» Camshaft sensor wheel (1) of the intake camshaft is not in the indicated position.

Measure

- Turn engine on the vibration damper using special tool 0 493 380 (11 6 480) till the camshaft sensor wheel (1) of the intake camshaft is positioned as shown.

77 – Install all torsion springs

CAUTION

Spring preload.

Danger of injury!

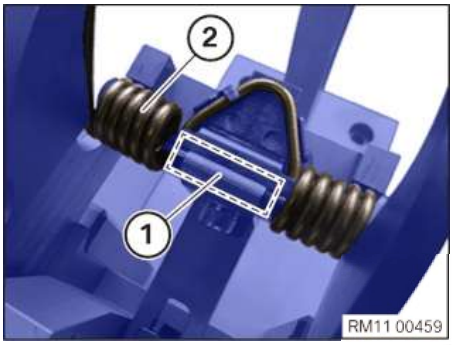
- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

TECHNICAL INFORMATION

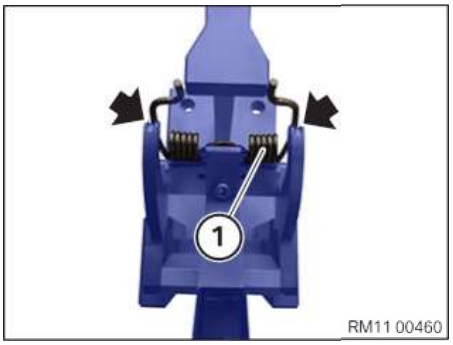
- Wear safety goggles.

NOTICE

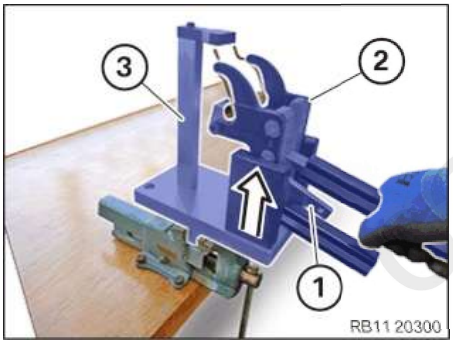
The description is for one component only. The procedure is identical for all further components.



- Insert the torsion spring (2) in the clamping lever of the special tool 2 359 088.
- Make sure that the torsion spring (2) is correctly positioned in the marked area (1) of the special tool 2 359 088.

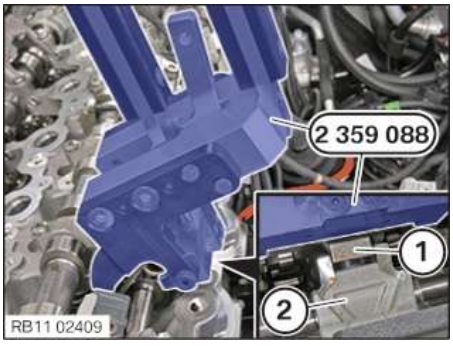


- Carefully close the clamping lever of the special tool 2 359 088 in the accompanying fixture until the retaining hook engages.
- Ensure that the torsion spring (1) lies correctly in the lateral guides (arrows) of the special tool 2 359 088 during tensioning.



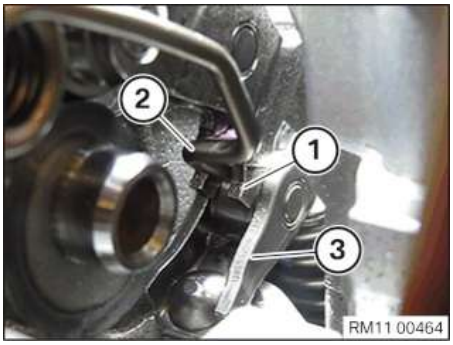
- Carefully close the clamping lever (2) of the special tool 2 359 088 in the fixture (3) until the retaining hook (1) audibly engages.

  The torsion spring is tensioned.
- **Carefully** take the clamping lever (2) of the special tool 2 359 088 with the stretched torsion spring out of the fixture (3) of the special tool 2 359 088 in the direction of arrow.

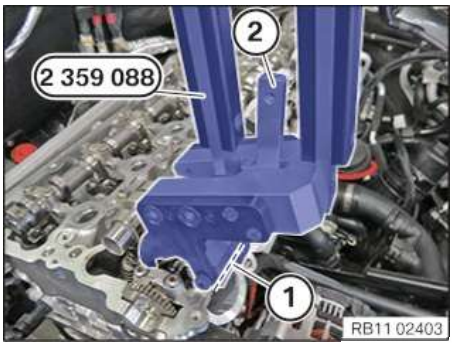


- Insert the torsion spring (1) with the special tool 2 359 088 in the cylinder head (2).

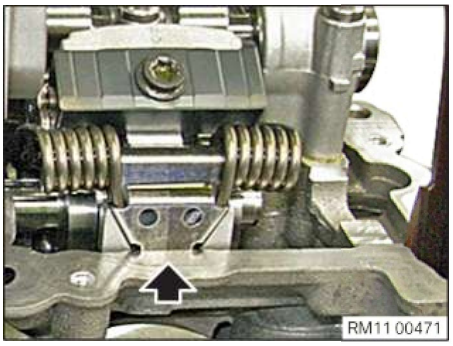
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- Insert the torsion spring (2) into the intermediate levers (1).
- Check all roller cam followers (3) for correct installation position.



- Lay special tool 2 359 088 flat in the marked area (1).
- Press the clamping lever of the special tool 2 359 088 together until the retaining hook (2) unlocks.
- Carefully open the clamping lever of the special tool 2 359 088 until the torsion spring is completely relaxed.
- Remove special tool 2 359 088.



- Check the correct mounting orientation of the torsion spring (arrow).

- Repeat the operations for the remaining torsion springs.

78 – Installing the intake plenum

RISK OF DAMAGE

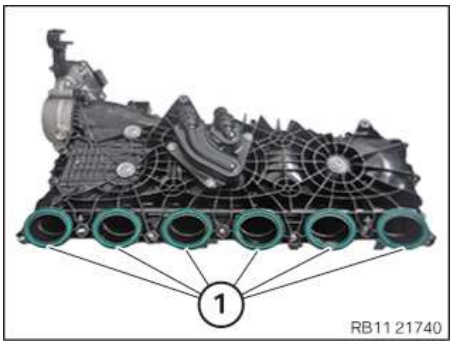
Improper routing of cables and wiring harnesses.

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

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

TECHNICAL INFORMATION

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



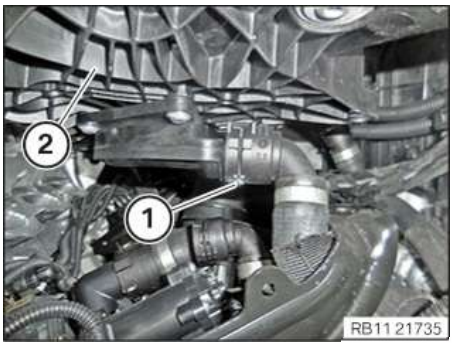
- Renew gaskets (1).

  Parts: Seals

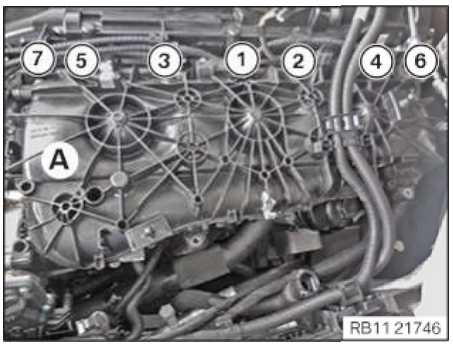
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- Clean contact surface (1).



- Feed in and position intake plenum (2).
- Connect and lock coolant line (1).
- Make sure that the cooling line (1) engages audibly.



TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Position the intake plenum (A).
- Tighten screws in the order (1) to (7).

Note: Tighten the bolts in 360 degree steps.

Intake plenum to cylinder head

M6	Tightening torque	10 Nm



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

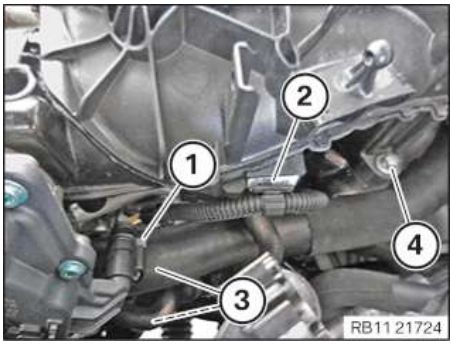


- Tighten down screw 1.

Intake plenum to support

M6X25		Tightening torque	8 Nm

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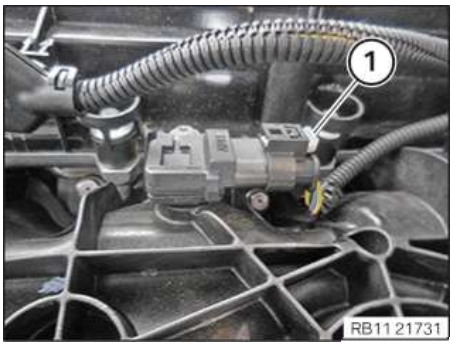


- Tighten down screw (4).

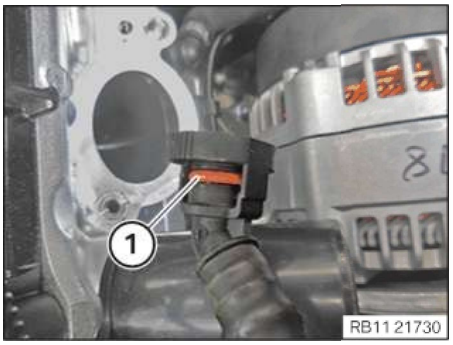
Intake plenum to support

M6X25		Tightening torque	8 Nm

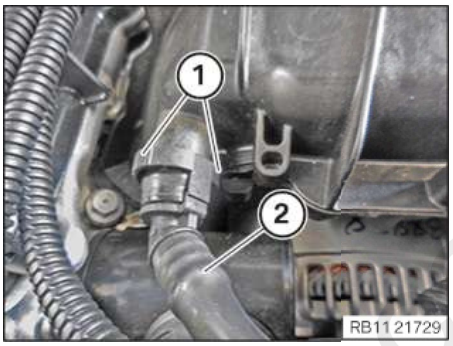
- Thread in and install coolant line (3).
- Secure clamps (2).
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.



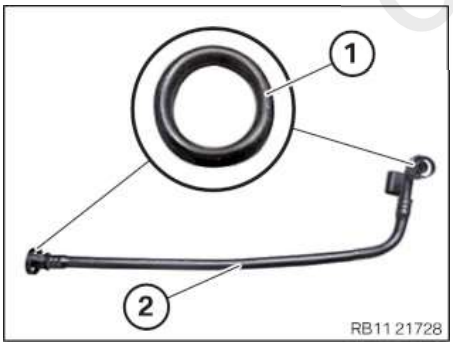
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.



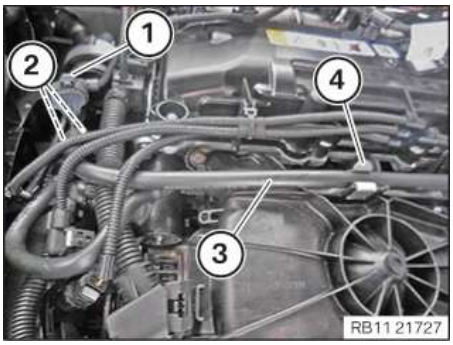
- Check sealing ring (1) for damage and renew tank ventilation line if necessary.



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

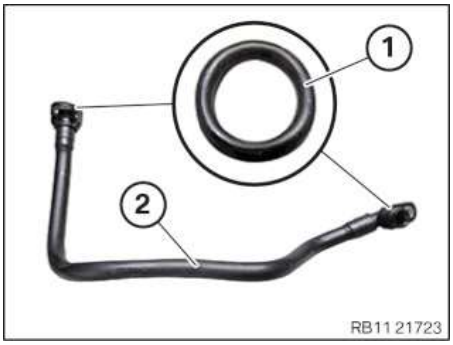


- Check sealing ring (1) for damage and renew tank ventilation line (2) if necessary.

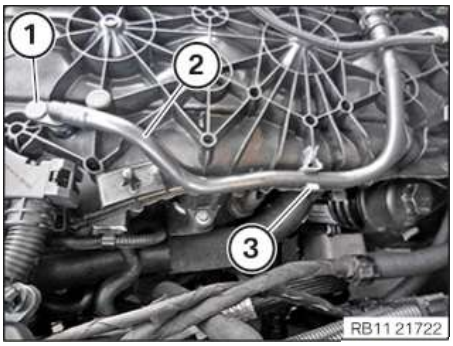


- Insert and install the tank ventilation line (3).
- Ensure that the locks (2) engage audibly.
- Secure the tank ventilation line (3) to the clamp (4).
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.

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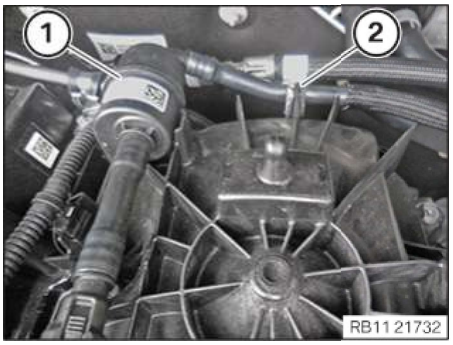
- Check sealing ring (1) for damage and renew tank ventilation line (2) if necessary.



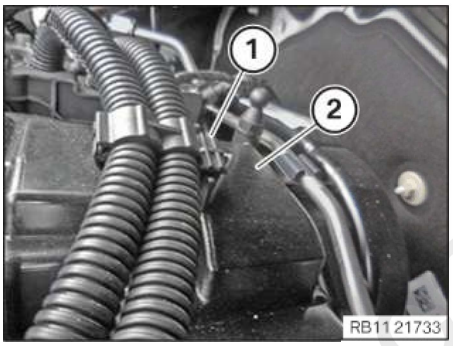
- Insert and install the tank ventilation line (2).
- Secure the tank ventilation line (2) to the clamp (3).
- Tighten down screw (1).

Tank ventilation line to intake plenum

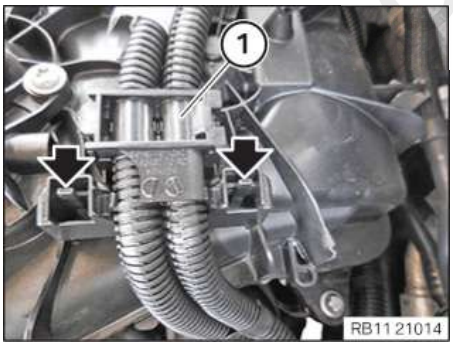
Oval-head screw		Tightening torque	3 Nm



- Insert and install the tank ventilation line (1).
- Secure the tank ventilation line (1) to the clamp (2).

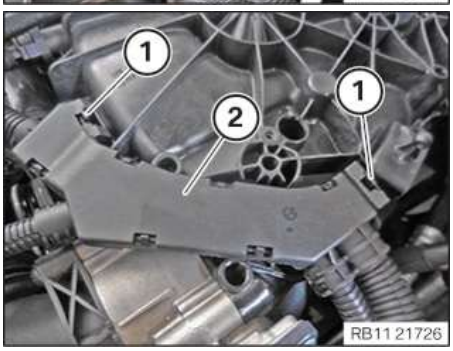


- Secure the wiring harness section(1) for the injectors and ignition coils on the cylinder head cover (2).



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

  The locks (arrows) must engage audibly.

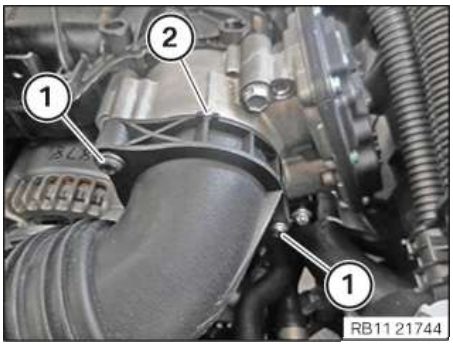


- Feed in and install wiring harness section (2) for sensor system **2**.
- Ensure that the locks (1) engage audibly.

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- Check the sealing ring (1) for damage and renew the sealing ring (1) as needed.

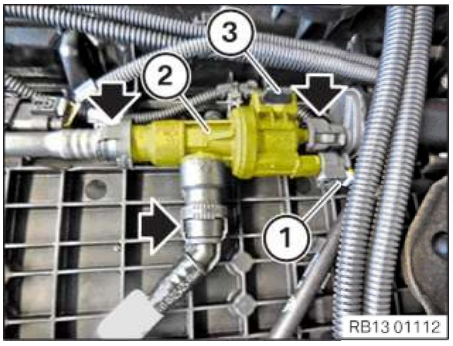


- Insert and install charge air line (2).
- Tighten the screws (1).

Charge air line to throttle valve

M6x30		Tightening torque	8 Nm

79 – Installing the tank vent valve

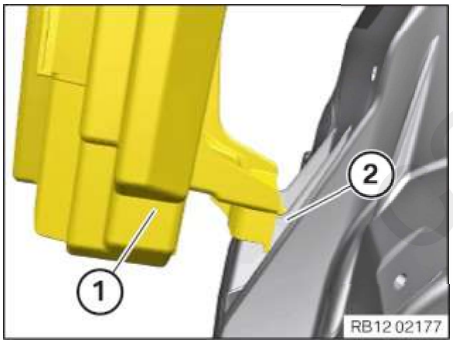


- Secure the tank vent valve (2) to the holder (3).
- Connect and lock the tank ventilation lines (arrows).

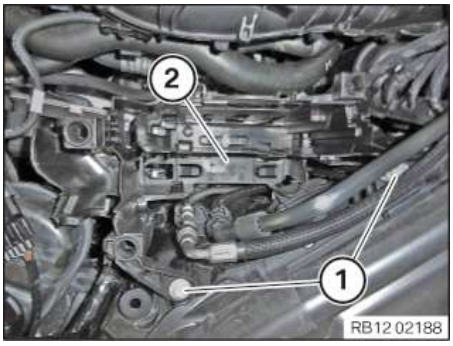
  The tank ventilation lines (arrows) must audibly engage.
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

80 – Installing the control unit holder



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

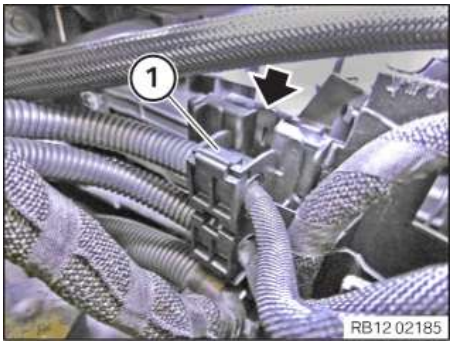


- Guide in and install control unit holder (2).
- Tighten the screws (1).

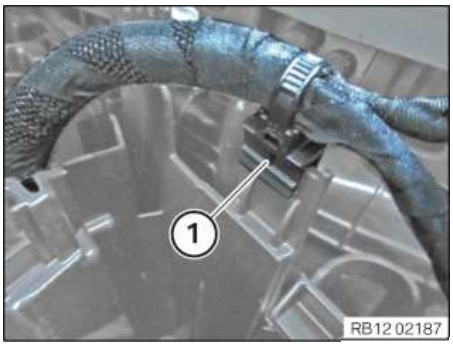
Control unit holder on spring strut dome

Hexagon screw		Tightening torque	8 Nm

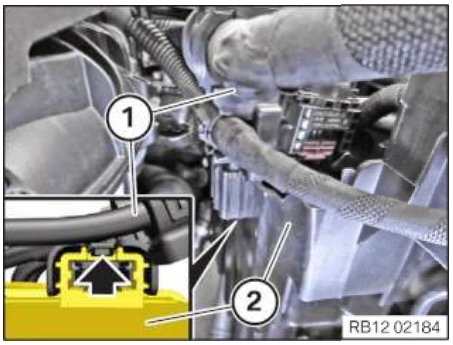
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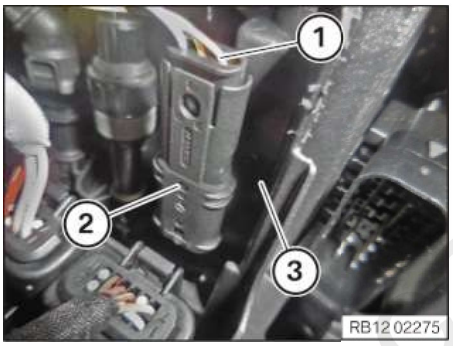
- Feed in and install the cable clip (1).
  Lock (arrow) must audibly engage.



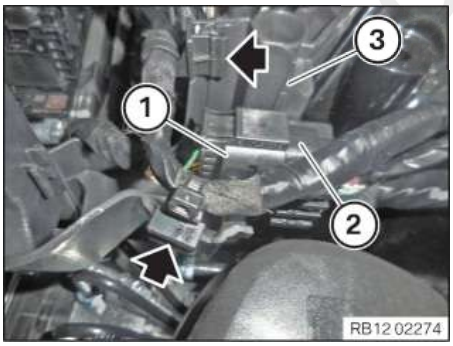
- Secure clamps (1).



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



- Connect connector (2) to the control unit holder (3) and lock it.
  The connector (2) must engage audibly.
- Connect connectors (1) and lock.
  The connector (1) must engage audibly.



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

81 – Installing the integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

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

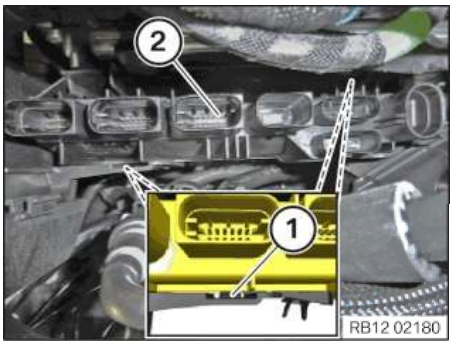
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RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

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



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

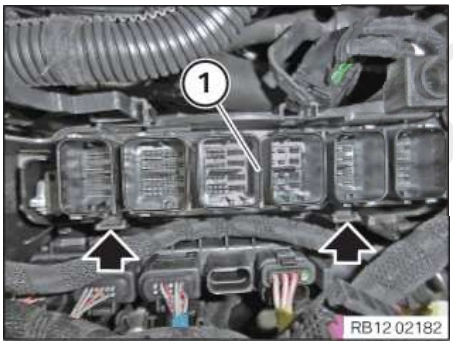
  The latch mechanisms (1) must engage audibly.
- Unlock the latch mechanisms (1).



- Connect connectors (1) and lock.

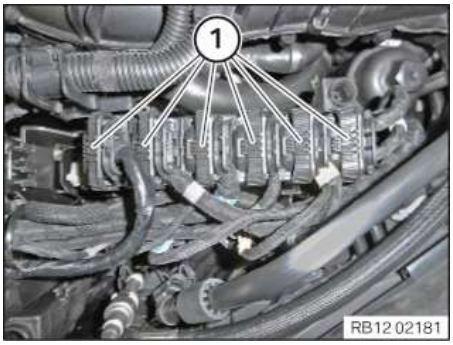
  The connectors (1) must engage audibly.

82 – Installing the DME control unit



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

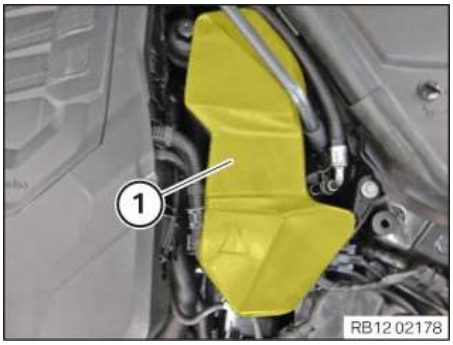
  The locks (arrows) must engage audibly.



- Connect connectors (1) and lock.

  All connectors (1) must engage audibly.

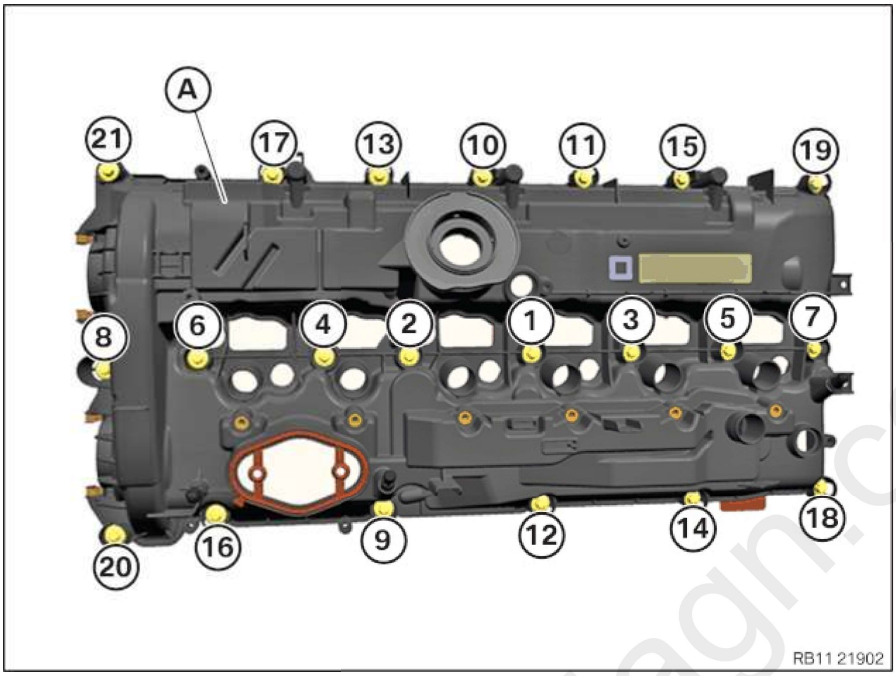
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- Insert and install cover (1) into guides.

83 – Installing cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 21 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

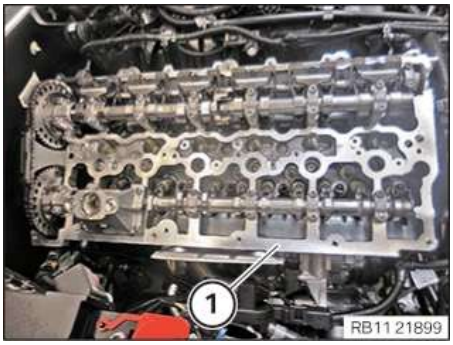
Improper routing of cables and wiring harnesses.

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

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

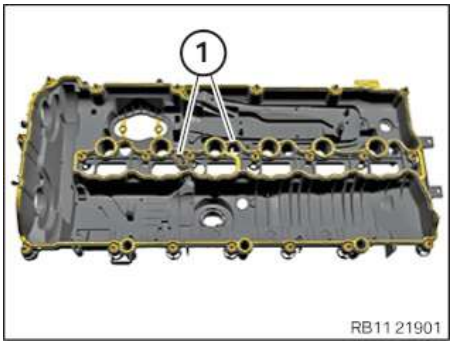
TECHNICAL INFORMATION

Latch mechanisms, guides and mounting elements must not be damaged or missing.



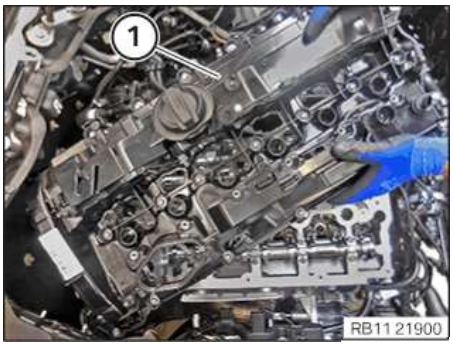
- Contact surface (1) must be free from oil and grease.

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- Replace the seals (1).

  Parts: Seals

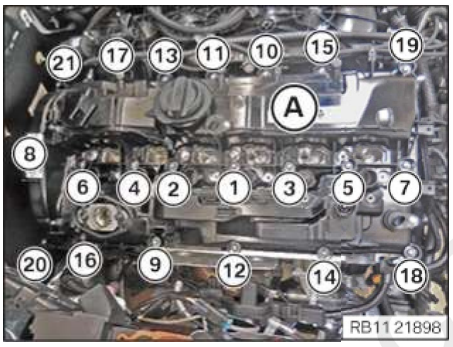


- Insert and install cylinder head cover (1).



- Ensure that the cylinder head cover (1) is installed in the **marked** area correctly on the high pressure pump bracket(2).

  The cylinder head cover (1) must not touch the high pressure pump bracket (2) in the **marked** area.



- Position the cylinder head cover (A).
- Make sure that the cylinder head cover (A) does not touch the high pressure pump bracket!
- Tighten all bolts in sequence (1) to (21).

Cylinder head cover to cylinder head

M6X30		Jointing torque	8 Nm

- Tighten all screws in a sequence from (1) to (21).

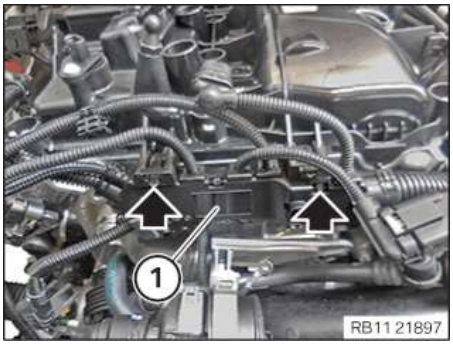
Cylinder head cover to cylinder head

M6X30		Tightening torque	11 Nm

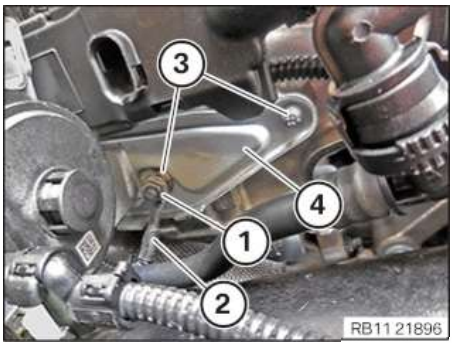


- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

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



- Insert and position the holders (4).
- Tighten the screws (3).

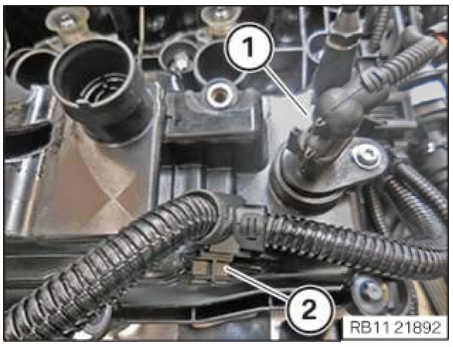
Auxiliary coolant pump holder to cylinder head

M6		Tightening torque	7 Nm

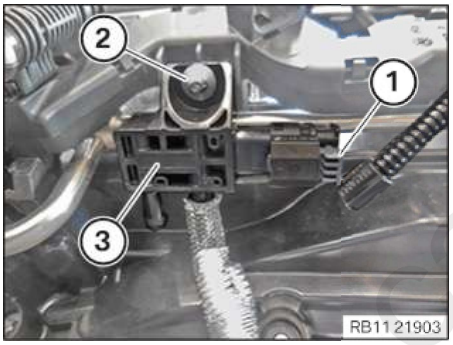
- Thread in ground cable (2) and install.
- Tighten nut (1).

Standard screw connection M6

M6			8 Nm



- Connect and lock the connector (1) on the exhaust camshaft sensor .
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).

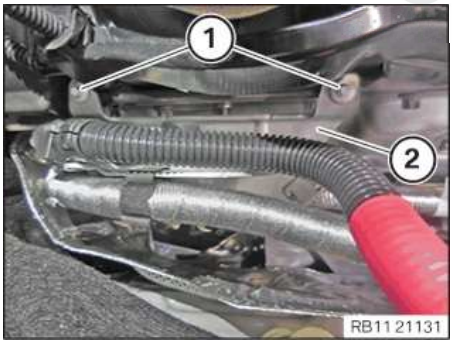


- **If installed:**
- Feed in and install the differential pressure sensor (3).
- Tighten down screw (2).

Differential pressure sensor to holder

TS6X18		Tightening torque	3,5 Nm

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



CAUTION

Improper routing of the positive battery cable.

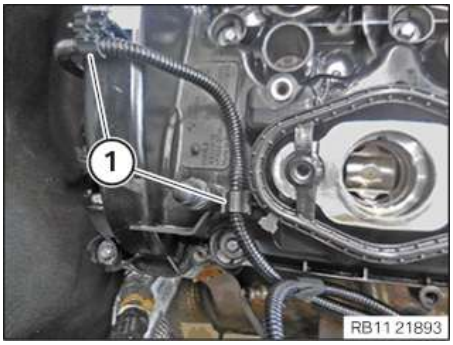
Risk of short circuits!

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

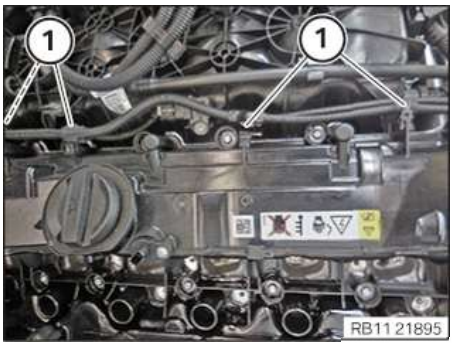
- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

Holder, positive battery cable to cylinder head cover

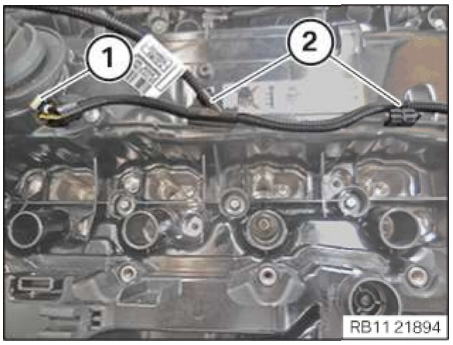
6X18		Tightening torque	6 Nm



- Secure clamps (1).

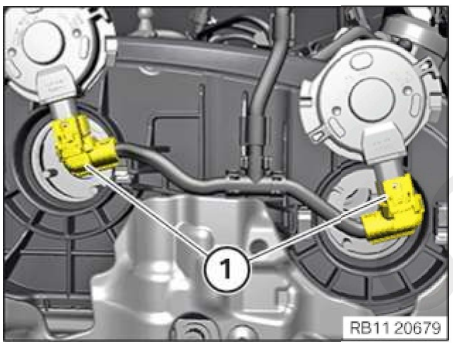


- Secure clamps (1).



- Connect connector (1) to the intake camshaft sensor and lock it.
- Make sure the connector (1) engages audibly.
- Secure clamps (2).

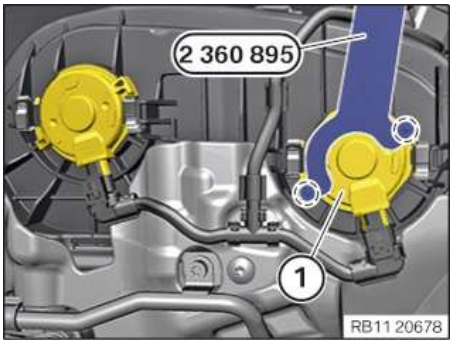
84 – Installing both actuators



NOTICE

The figure shows the rear side of the engine.

- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.

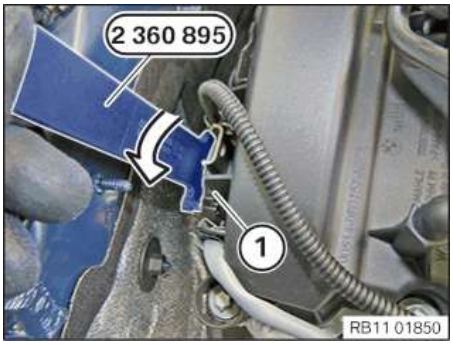


NOTICE

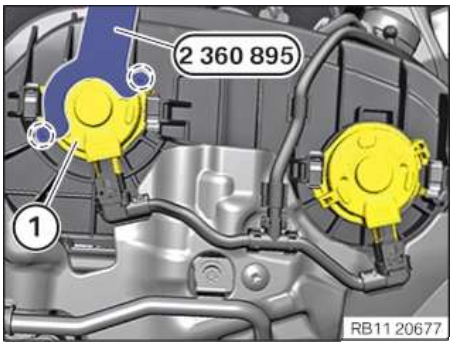
The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.

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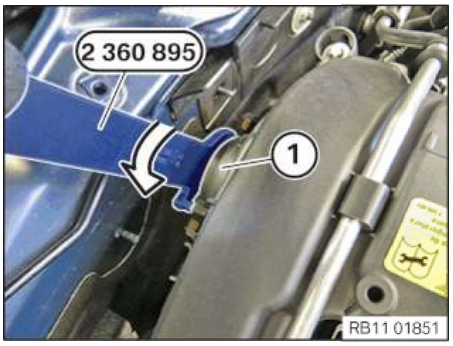
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.



NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

85 – Install high pressure pump

RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

Only G05 and G07

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

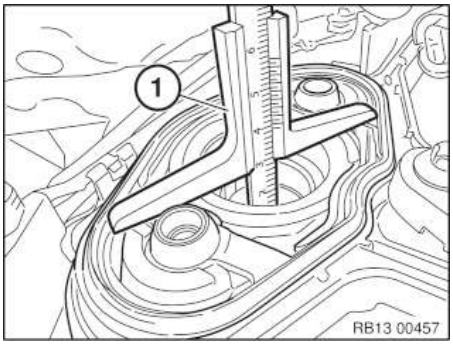
For additional information see: 17 11 035 Removing and installing/replacing the fan cowl including electric fan

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.

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- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

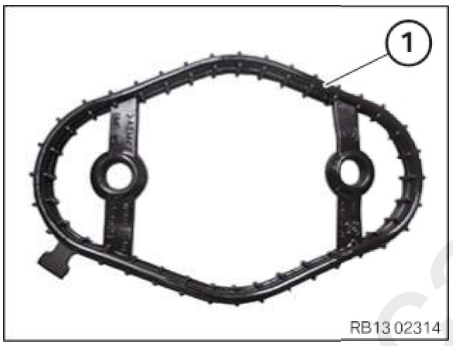
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.



TECHNICAL INFORMATION

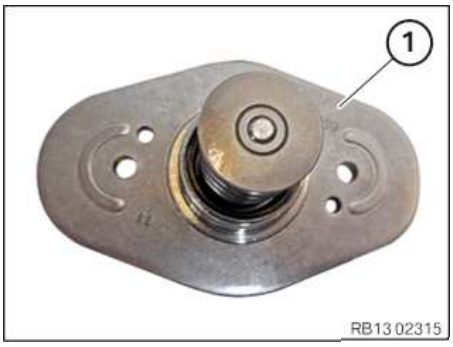
The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).

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- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

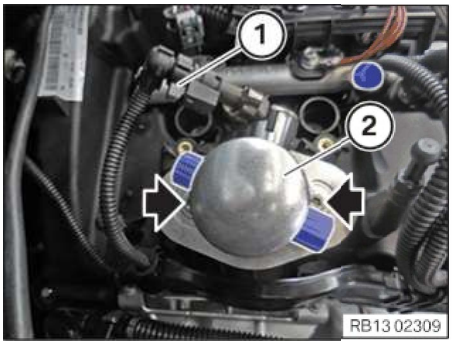
The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

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

86 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

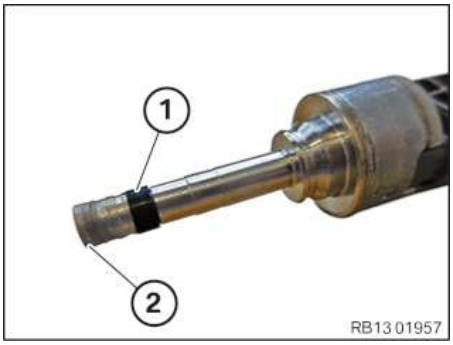
- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

TECHNICAL INFORMATION

Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.

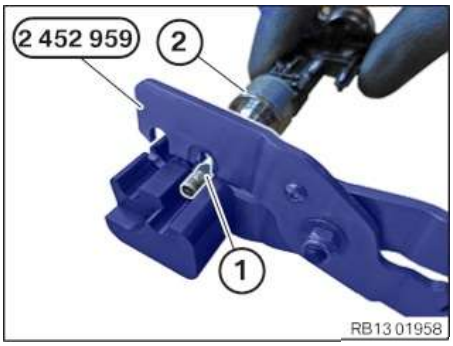
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- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings

- Avoid mechanical contact with injector tip (2).



- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.

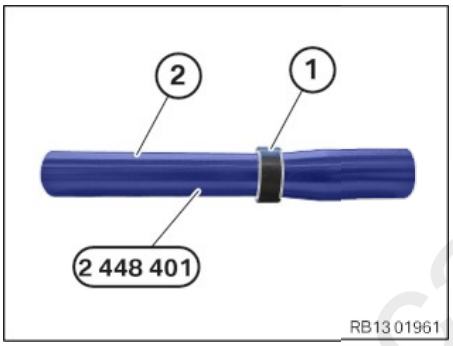


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

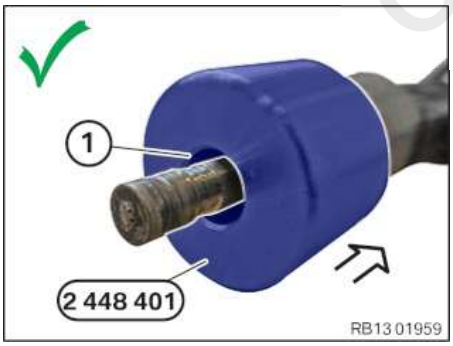
  (1) Installation cone

  (2) Sliding sleeve

  (3) Assembly sleeve

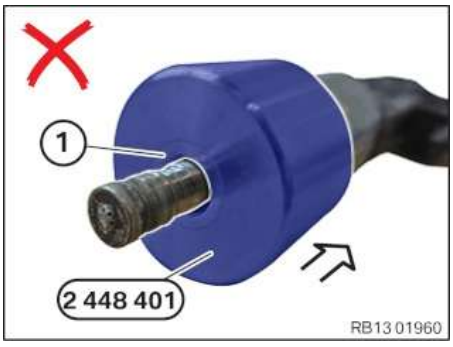


- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

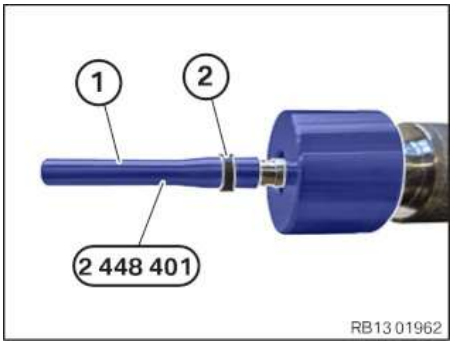
  The larger diameter of the assembly sleeve (1) must point to the injector tip.



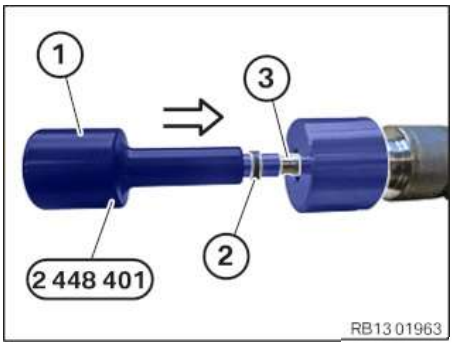
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.

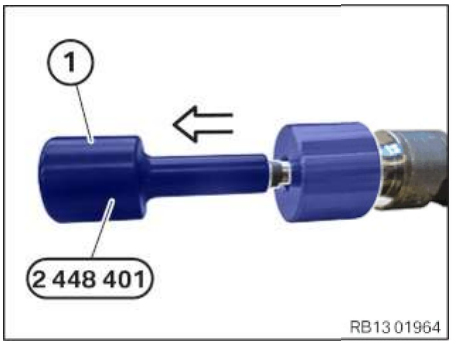
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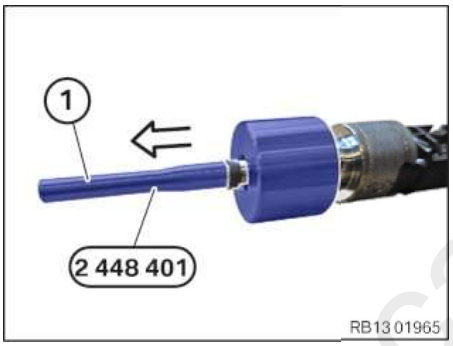
- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .



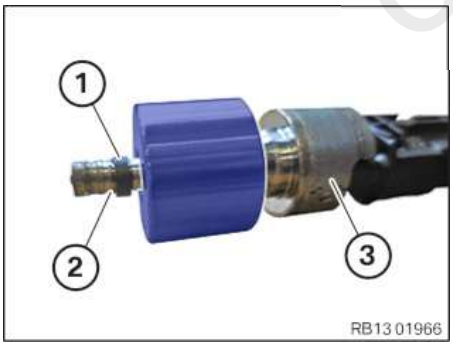
- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.



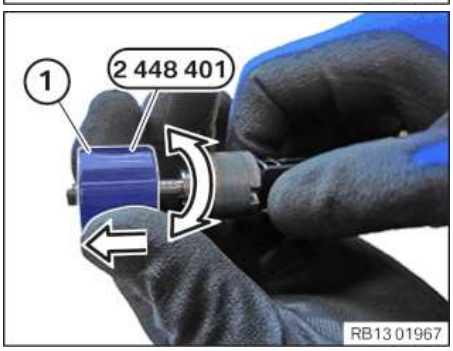
- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



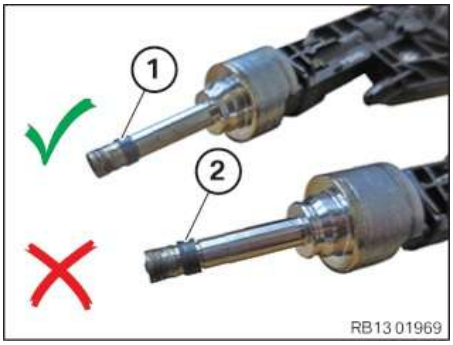
- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.



- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).

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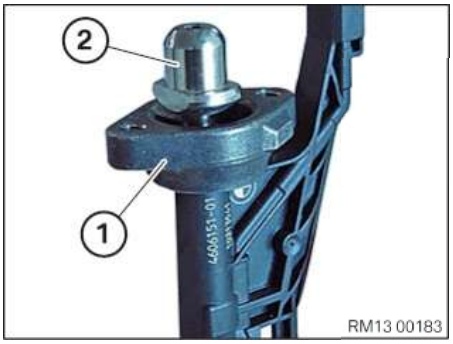


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

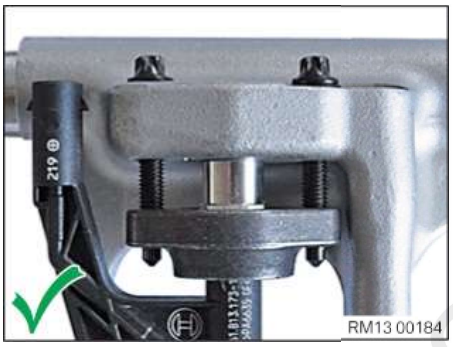
87 – Installing the high-pressure rail with injectors of the cylinders 4 to 6

TECHNICAL INFORMATION

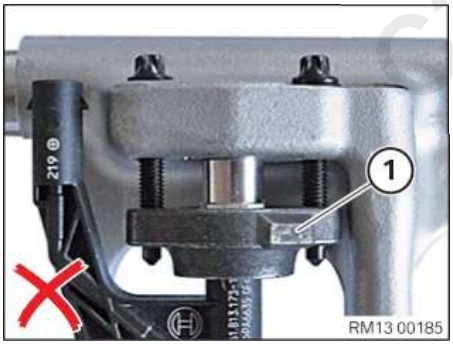
When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



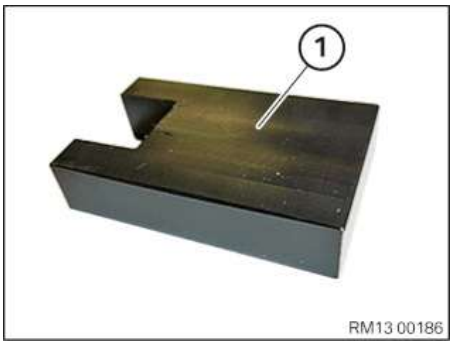
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder**(1) **has a cast lug**: Make sure that the holder is installed in the correct position.



- If applicable, note the position of the cast lug:
  The holder is mounted **correctly** when the cast lug is located at the rear.



- If applicable, note the position of the cast lug:
  The holder is mounted **incorrectly** when the cast lug (1) is in front.



RISK OF DAMAGE

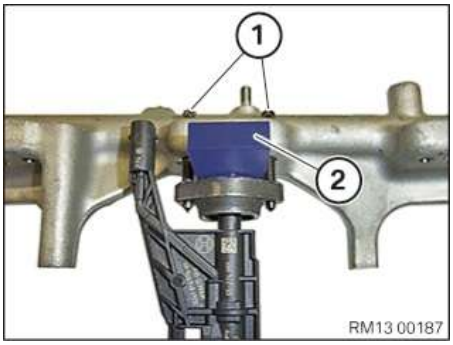
Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).

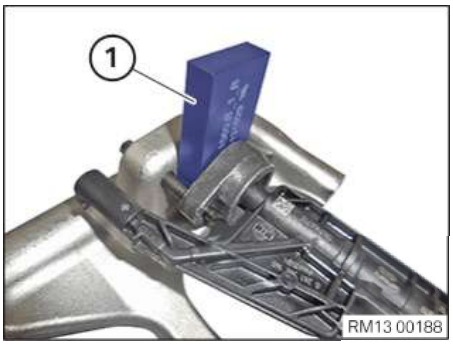
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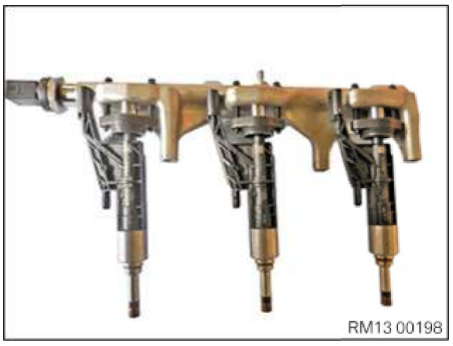
- Replace (M5x30) screws.

  Parts: Screws (M5x30)
- Mount the injectors with the holders and the bolts (M5x30) (1) on the rail.
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.
- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) evenly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.



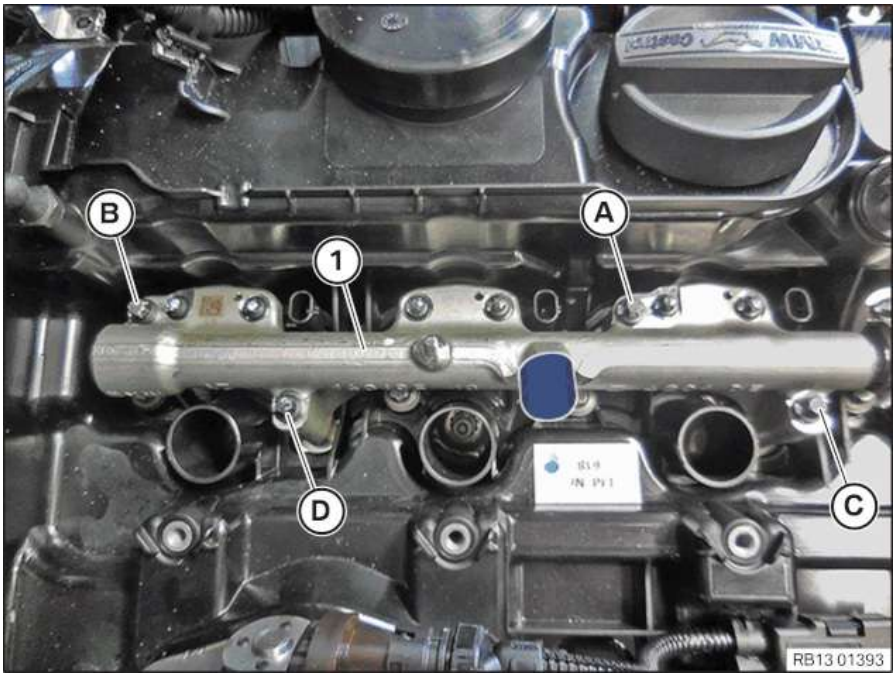
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.



- Check injectors for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors must move freely.

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- Renew screws (A) to (D).

  Parts: Bolts
- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- Press the rail (1) down until a resistance can be felt; join and hand-tighten the bolts (M6x30) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.

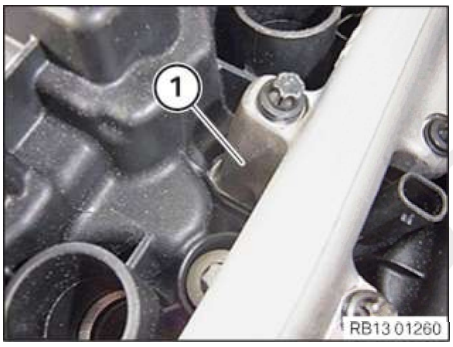
  The figure shows the rail resting flat against the cylinder head.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

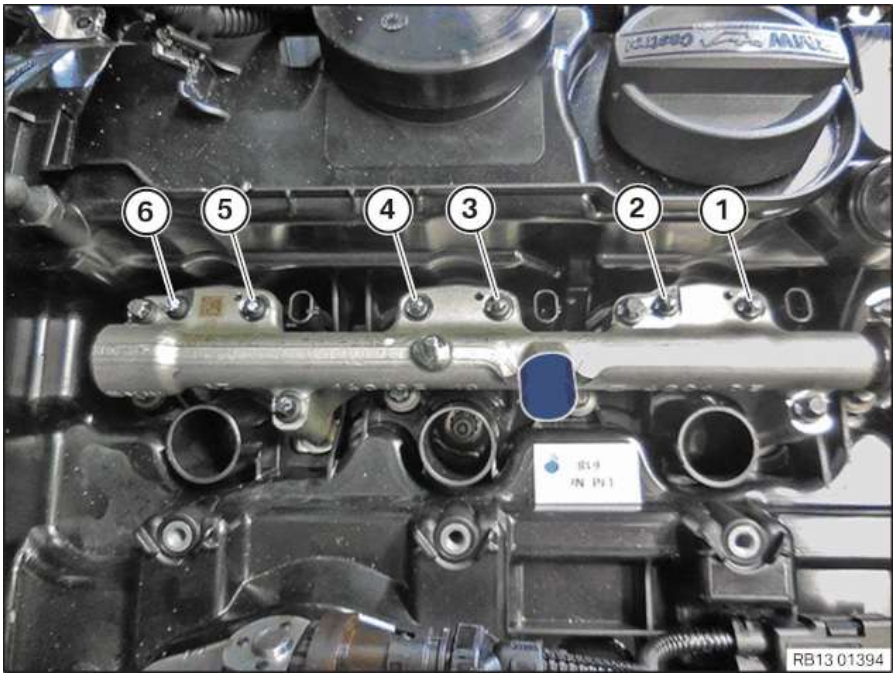
Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.



- Make sure that the rail (1) rests flat against the cylinder head.

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- Attach a socket to an extension.

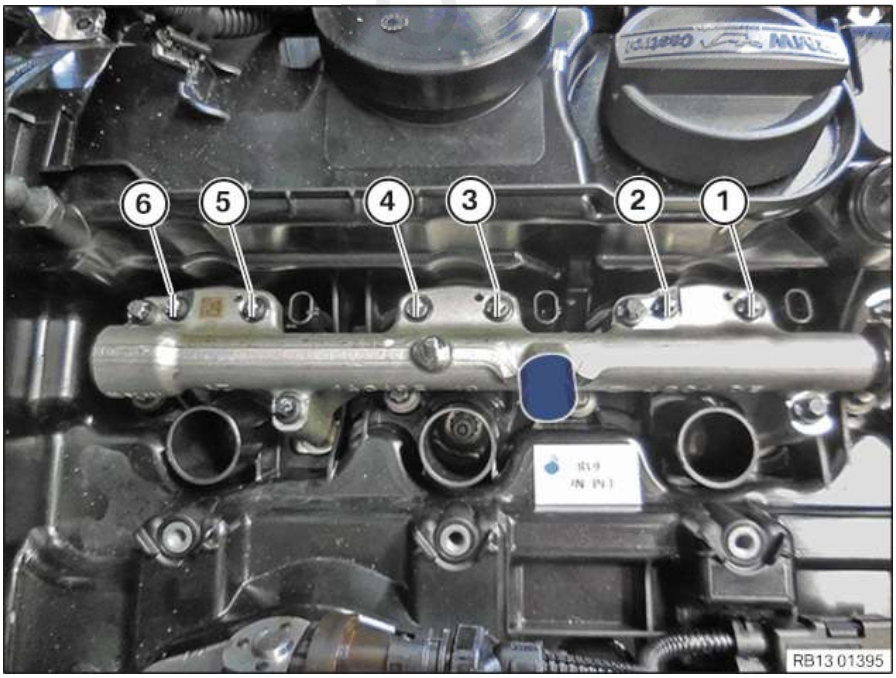
  Do not use a reversible ratchet or torque wrench.
- Tighten the bolts (M5x30) in pairs ((1) with (2), (3) with (4), (5) with (6)) in alternating order **90° hand-tight**.
- Set the torque wrench to 5 Nm.

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- **Screw the (M5x30) bolts according to the following plan:**
  - **Fuel injector 4:**
  - Tighten screw (1) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (2) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 5:**
  - Tighten screw (3) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (4) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 6**:
  - Tighten screw (5) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (6) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts reach a torque of 5 Nm.



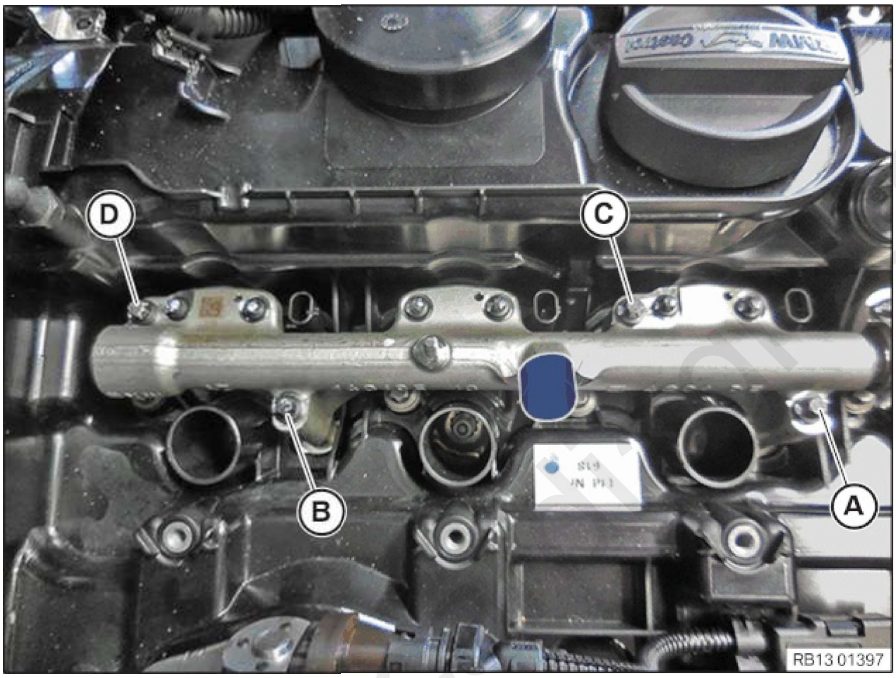
- Mark all bolts (1) to (6) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the screw (1) with an angle of rotation of 90° ±15°.
  - Tighten the screw (2) with an angle of rotation of 90° ±15°.
  - Tighten the screw (3) with an angle of rotation of 90° ±15°.
  - Tighten the screw (4) with an angle of rotation of 90° ±15°.
  - Tighten the screw (5) with an angle of rotation of 90° ±15°.
  - Tighten the screw (6) with an angle of rotation of 90° ±15°.

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- Check if all bolts (1) to (6) have been tightened with a 90° ±15° angle of rotation.

  All marks (lines) must be horizontal (see figure).



- Unscrew the bolts (M6x70) (A) to (D).

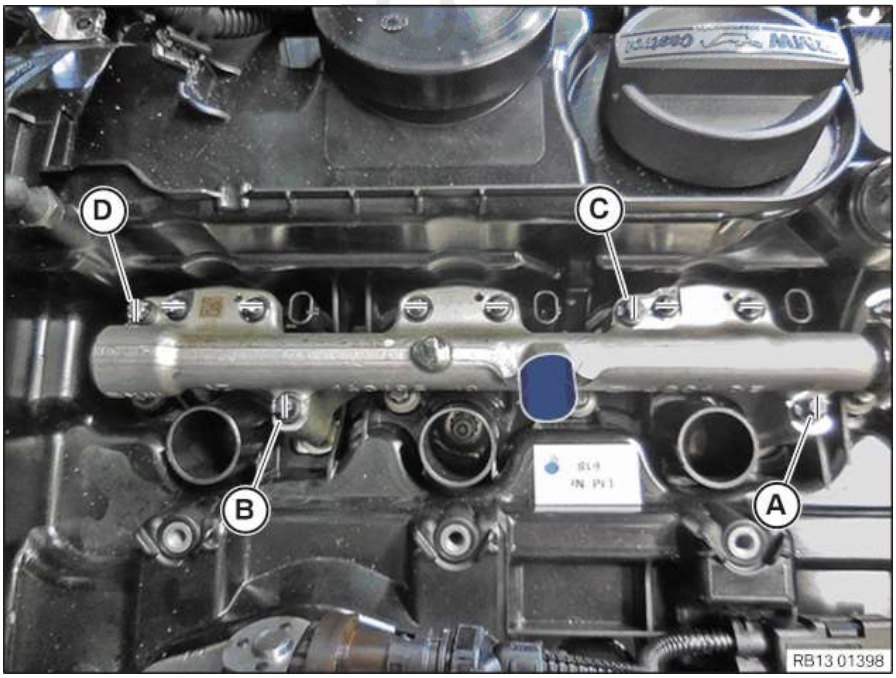
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

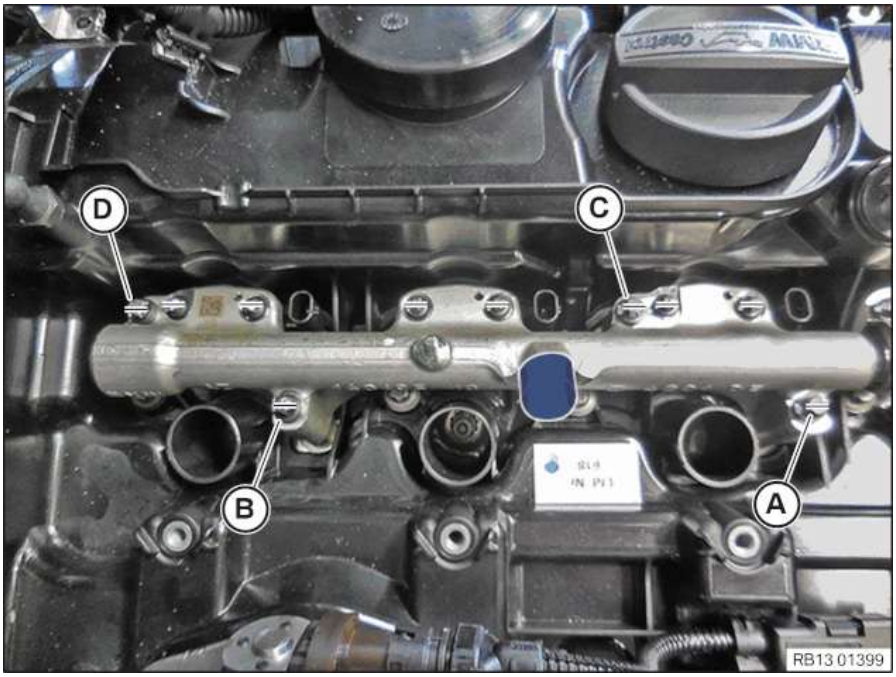
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.

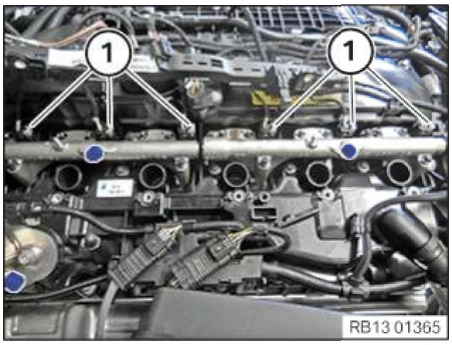


- Mark all bolts (A) to (D) with a vertical line (see figure).
- Tighten bolts (M6x70) (A) to (D) to a 90° angle of rotation.



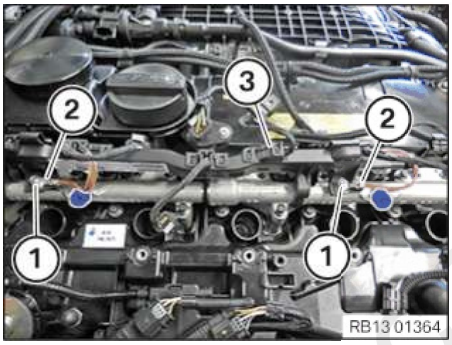
- Check if all bolts (A) to (D) have been tightened with a 90° angle of rotation.

  All marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nuts (1).

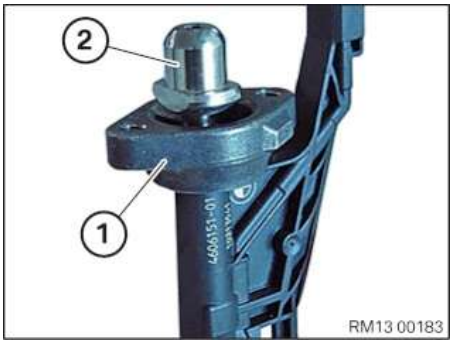
Ground cable to rail

M6			5 Nm

88 – Installing rail with injectors of cylinders 1 to 3

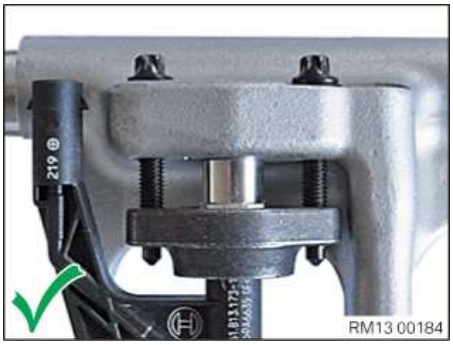
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



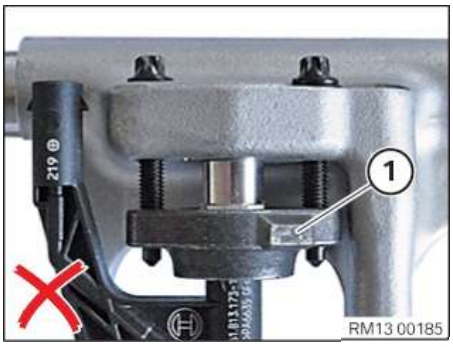
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If there is a cast lug on the holder** (1) **:** Make sure that the holder is installed in the correct position.

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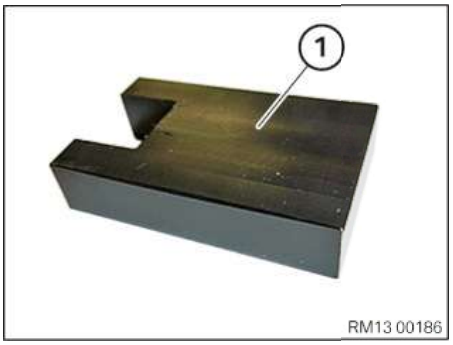
- Observe position of cast lug:

  The holder is mounted **correctly** when the cast lug is located at the rear.



- Observe position of cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.



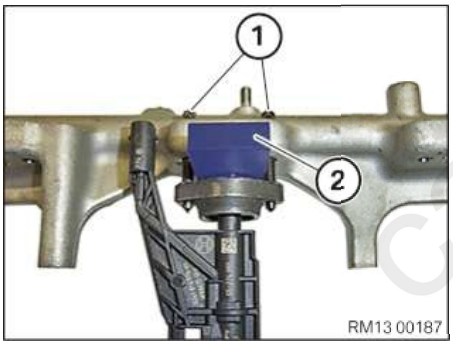
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use special tool 2 358 022(1) .



- Replace (M5x30) screws.

  Parts: Screws (M5x30)
- Mount the injectors with the holders and the bolts (M5x30) (1) on the rail.
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.
- Slide special tool 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure the special tool 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) *uniformly until the special* tool 2 358 022 (2) rests flat against the rail and the holder.



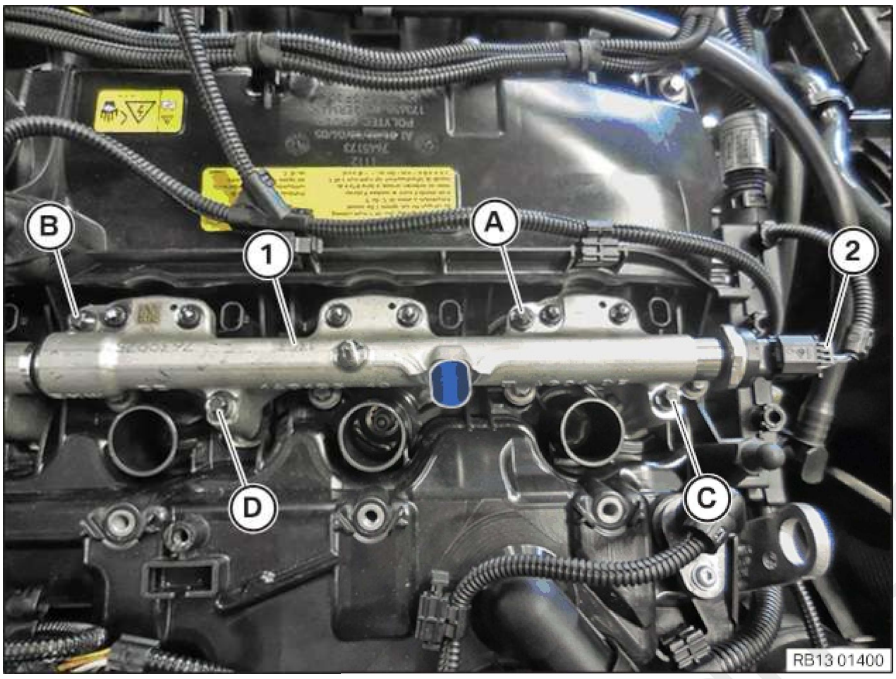
- Remove special tool 2 358 022(1) .
- Repeat this operation for all injectors.

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- Check injectors for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors must move freely.



- Renew screws (A) to (D).

  Parts: Bolts
- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- Press rail (1) down until a resistance can be felt; join and hand-tighten screws (M6x30) (A) and (B).
- Tighten screws (A) and (B) alternately by **180°** each with the torque wrench until the rail is positioned on the cylinder head.

  The figure shows the rail resting flat against the cylinder head.
- Insert screws (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

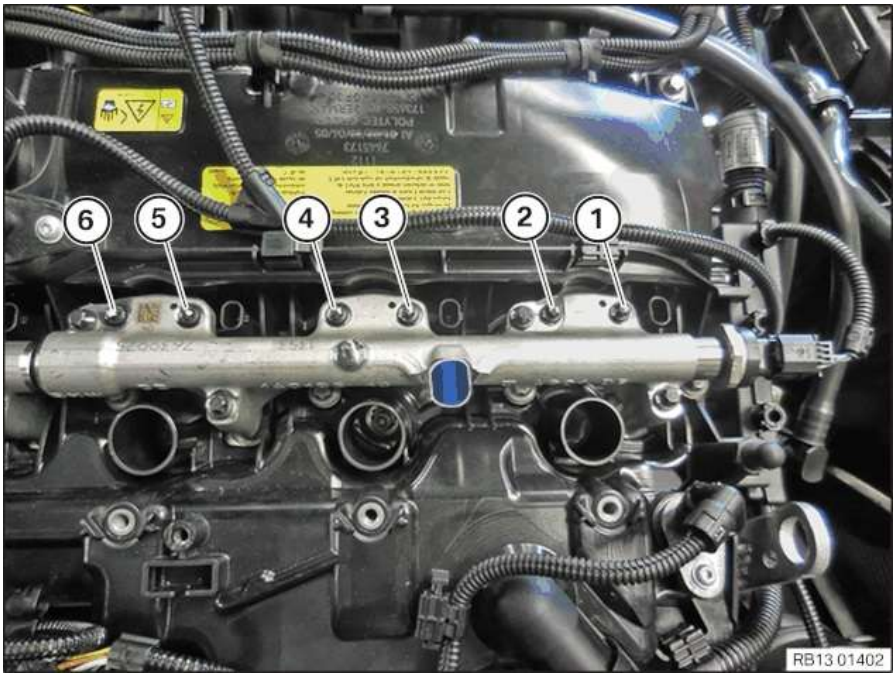
- Tighten screw (A) to 5 Nm.
- Tighten screw (D) to 5 Nm.
- Tighten screw (B) to 5 Nm.
- Tighten screw (C) to 5 Nm.
- Connect and lock the connector (2).

  The connector (2) must engage audibly.



- Make sure that the rail (1) rests flat against the cylinder head.

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- Attach a socket to an extension.

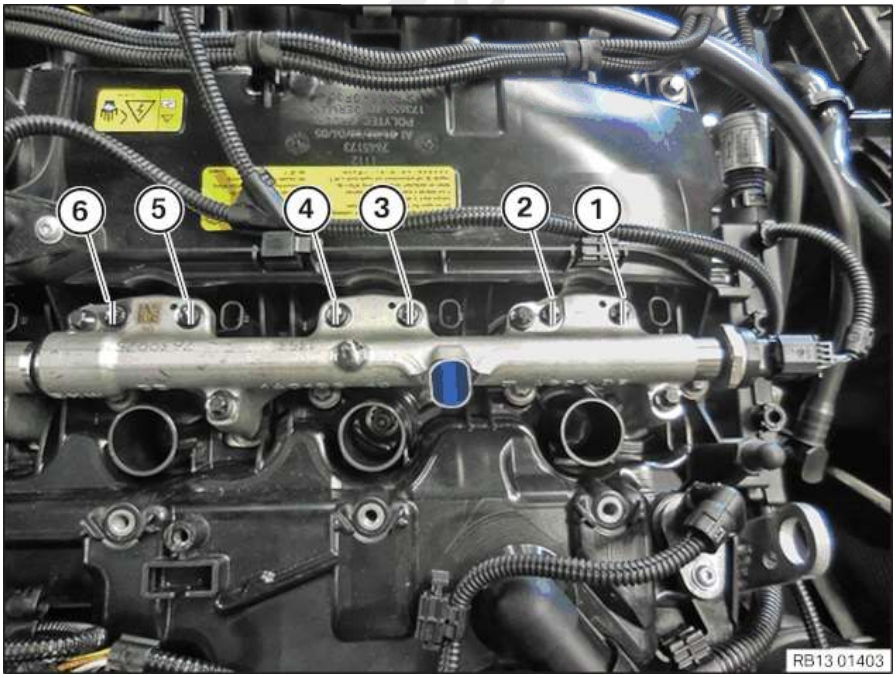
  Do not use a reversible ratchet or torque wrench.
- Hand-tighten screws (M5x30) in pairs ((1) with (2), (3) with (4), (5) with (6)) alternately by **90°**.
- Set torque wrench to 5 Nm.

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

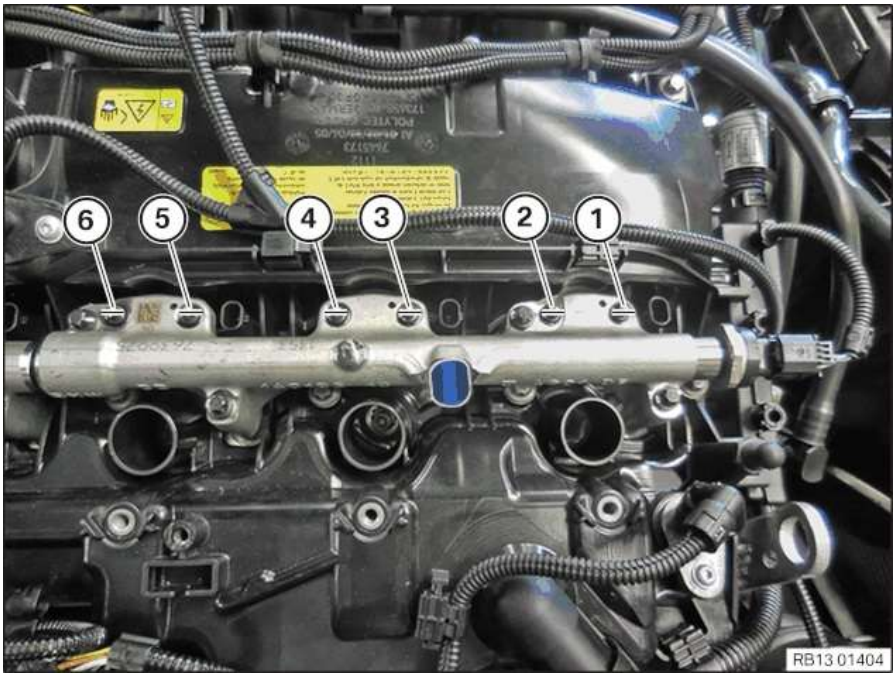
Non-observance of these requirements may result in leaks and damage.

- **Screw the (M5x30) bolts according to the following plan:**
  - **Fuel injector 1:**
  - Tighten screw (1) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (2) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten screw (3) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (4) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 3**:
  - Tighten screw (5) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (6) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts reach a torque of 5 Nm.



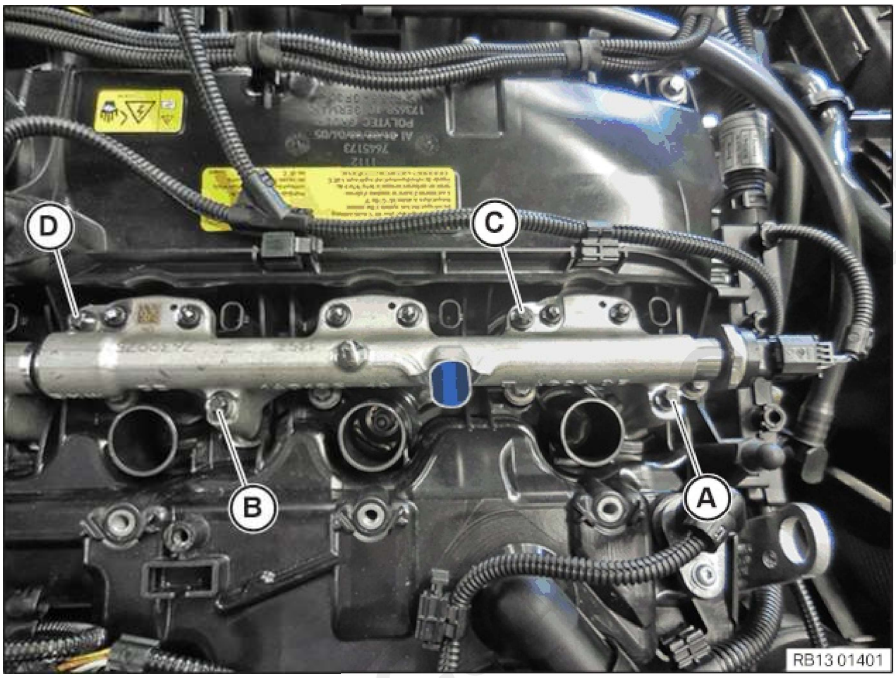
- Mark all bolts (1) to (6) with a line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the screw (1) with an angle of rotation of 90° ±15°.
  - Tighten the screw (2) with an angle of rotation of 90° ±15°.
  - Tighten the screw (3) with an angle of rotation of 90° ±15°.
  - Tighten the screw (4) with an angle of rotation of 90° ±15°.
  - Tighten the screw (5) with an angle of rotation of 90° ±15°.
  - Tighten the screw (6) with an angle of rotation of 90° ±15°.

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- Check if all bolts (1) to (6) have been tightened with a 90° ±15° angle of rotation.

  All markings (lines) must be horizontal (see Figure).



- Release screws (M6x70) (A) to (D) **without fail**.

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten screw (A) to 5 Nm.
- Tighten screw (D) to 5 Nm.
- Tighten screw (B) to 5 Nm.
- Tighten screw (C) to 5 Nm.

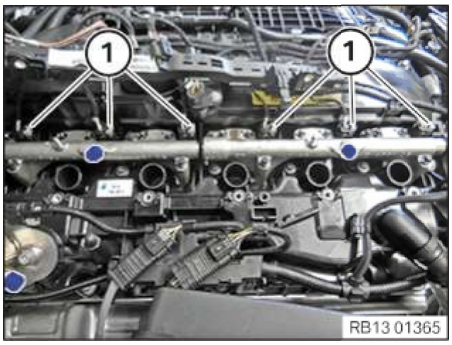


- Mark all the bolts (A) to (D) with a vertical line (see Figure).
- Tighten bolts (M6x70) (A) to (D) with an angle of rotation of 90°.



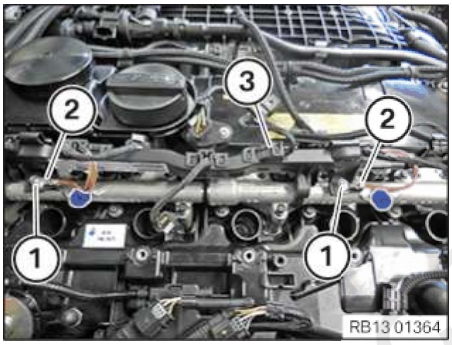
- Check whether all screws (A) to (D) have been tightened with an angle of rotation of 90°.

  All marks (lines) must be horizontal (see figure).



- Connect and lock all the connectors (1) to the injectors.

  All connectors (1) must engage audibly.

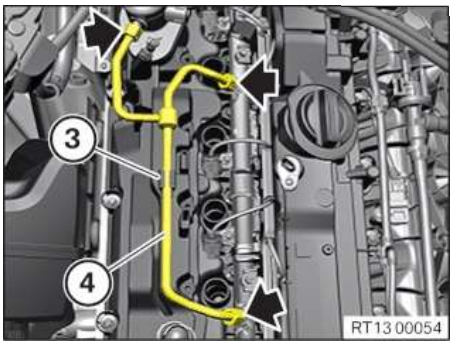


- Thread the cable channel (3) in and install.
- Thread in ground cable (2) and install.
- Tighten nuts (1).

Ground cable to rail

M6			5 Nm

89 – Installing high pressure line between rail and high pressure pump

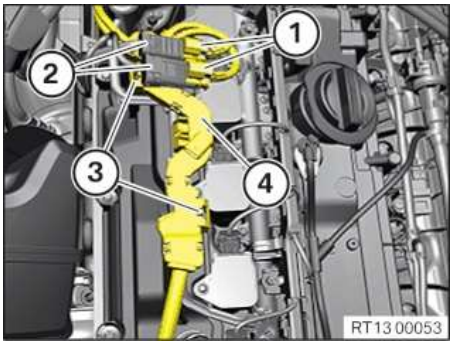


- Insert the high pressure line (4) into the holder (3) and install.
- Tighten union nuts (arrows) with the special tool .

High pressure line between rail and high pressure pump

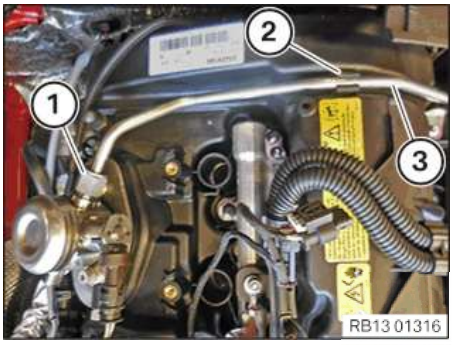
M14x1,5		Tightening torque	33 Nm

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- Insert and install the wiring harness section of the engine wiring harness (4).
  The locks (3) must engage audibly.
- Connect connectors (1) and (2) and lock.
  The connectors (1) and (2) must audibly engage.

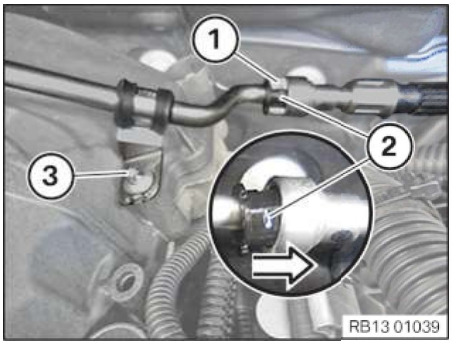
90 – Installing fuel delivery line



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

Fuel delivery line to high pressure pump

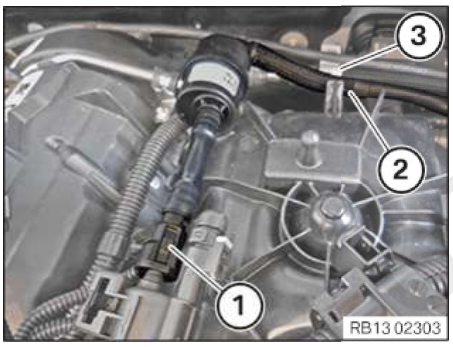
M14		Tightening torque	31 Nm



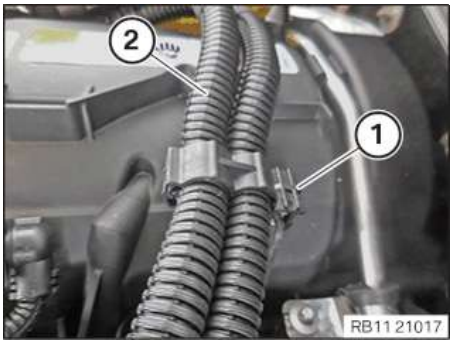
- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure clamps (1).
- Tighten down screw (3).

Fuel line to cylinder head cover

6x18		Tightening torque	6,5 Nm

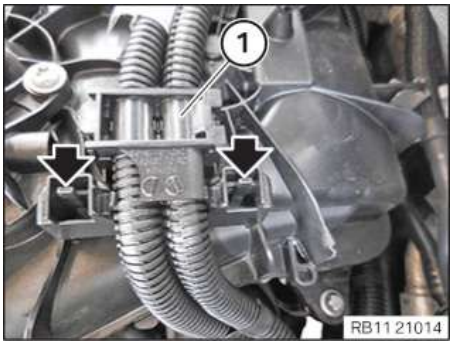


- Insert and install the tank ventilation line (2).
- Lock (1) must engage audibly.
- Secure the tank ventilation line (2) to the clamp (3).



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

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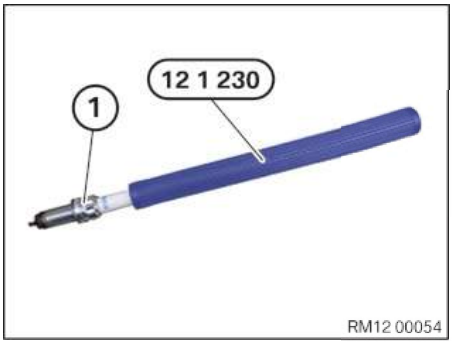


- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

91 – Installing all spark plugs

NOTICE

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



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



TECHNICAL INFORMATION

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

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



TECHNICAL INFORMATION

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

- Tighten the spark plugs with the torque wrench, the special tool 0 495 560 (12 1 220) and a swivelling extension.

Spark plugs

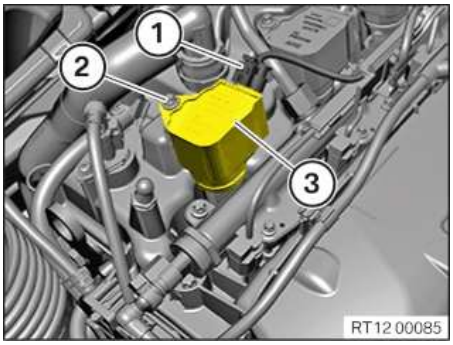
M12x1.25		Tightening torque	23 Nm

92 – Install all ignition coils

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Install ignition coil.**



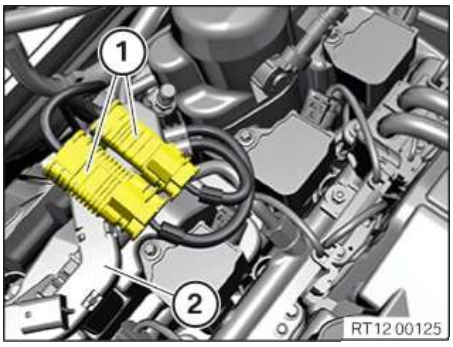
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

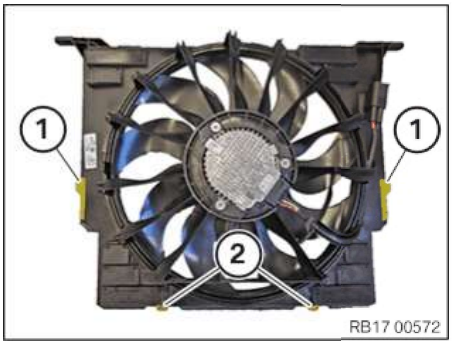
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

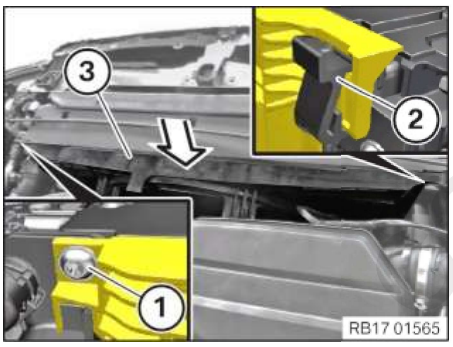


- Connect the connector (1) of the front oxygen sensor and the monitoring oxygen sensor on the cable shaft (2).

93 – Install fan cowl



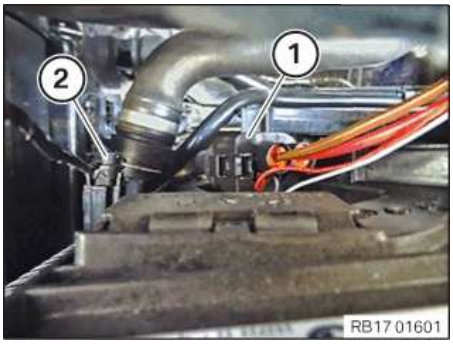
- Feed guides (1) into the radiator.
- Feed guides (2) into the charge air cooler.



- Guide in and install fan cowl (3) **carefully** in the direction of the arrow.
- Ensure that the lock (2)engages audibly.
- Tighten down screw (1).

Fan cowl with electric fan on radiator

TS6x20		Tightening torque	6,5 Nm

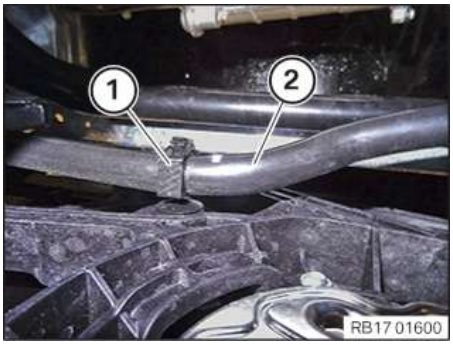


- Connect connectors (2) and lock.

  The connector (2) must engage audibly.
- Connect connectors (1) and lock.

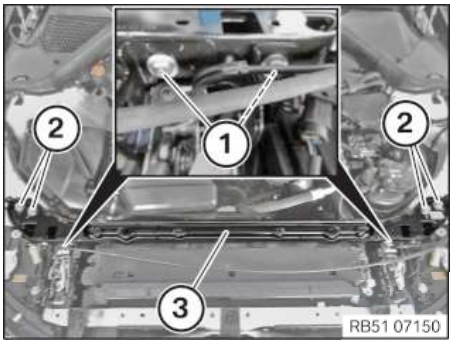
  The connector (1) must engage audibly.

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- **If installed:** Secure the transmission oil line (2).
  Insert and install the transmission oil line (2).
  Lock holder (1).

94 – Install the rear top cross connection



- Guide in and position the top rear cross connection (3).
- Tighten the screws (1).

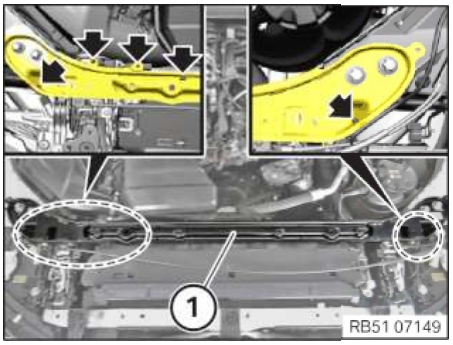
Top rear cross connection to bonnet catch support

Flat-head screw M6x20		Tightening torque	11,8 Nm

- Renew screws (2).
  Parts: Bolts
- Tighten the screws (2).

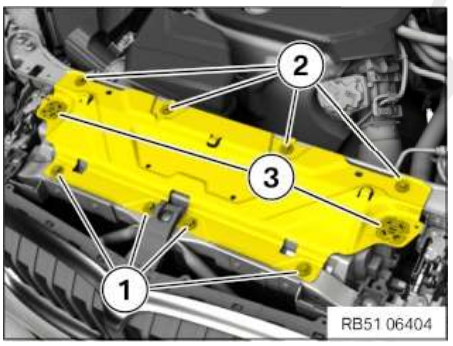
Rear top cross connection to wheel arch carrier support

M10x20 screw	Renew screw.	Jointing torque	56 Nm
		Angle of rotation	90 °



- Secure the clips (arrows) in the marked areas to the top rear cross connection (1).

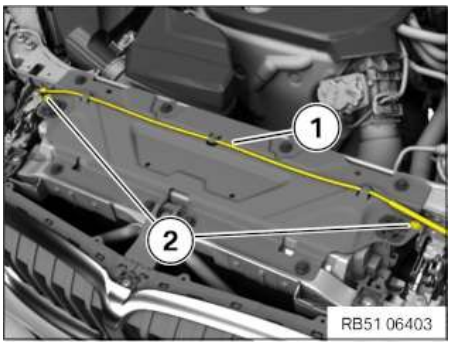
95 – Installing the top cross connection



- Set and position upper cross connection with holders (3) from above.
- Tighten down screws (1) and (2).

Cross connection, top

M8x20		Tightening torque	28 Nm



- Tighten down screws (2).

Cross connection, top

M6x20		Tightening torque	11,8 Nm

- Attach Bowden cable (1) on the upper cross connection.

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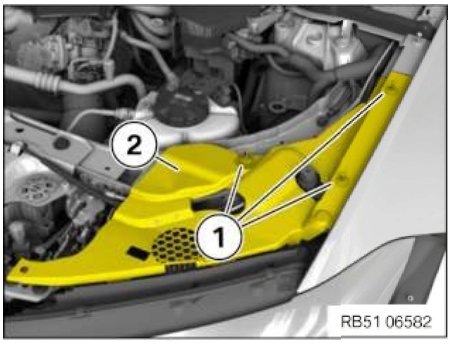
- Clip in the housing for the coupling of the Bowden cables (1).

96 – Install the cover in the engine compartment at top left and right partially

NOTICE

Description is for left component only. Procedure on the right side is identical.

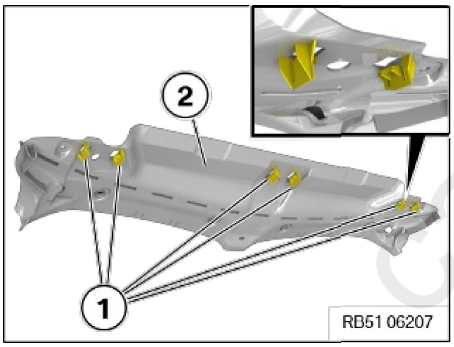
▶ Installing the cover in the engine compartment on top partially



- Install the cover in the engine compartment on top (2).
- Secure expanding rivet (1).

97 – Installing cover for engine compartment centre

Check



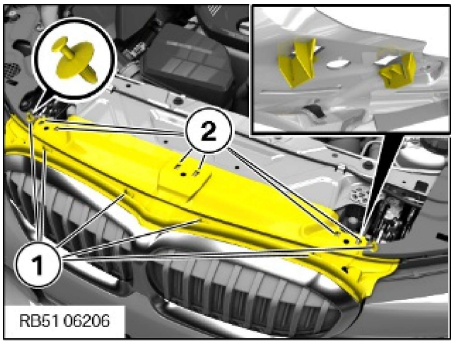
- Check latch mechanisms (1) of cover for engine compartment centre (2) for damage.

Result

» The latch mechanism (1) is damaged.

Measure

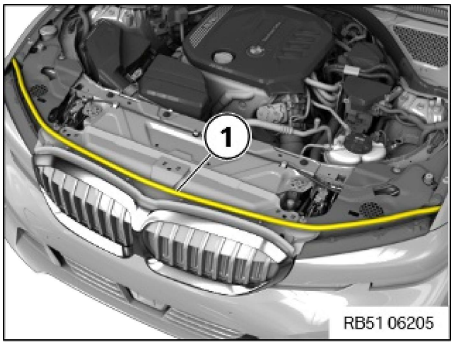
- Renew cover for engine compartment centre (2).



- Guide in the cover for the engine compartment centre from the rear and position it.
- Clip in the cover for the engine compartment centre with latch mechanisms (2).
- Mount all expanding rivets (1).

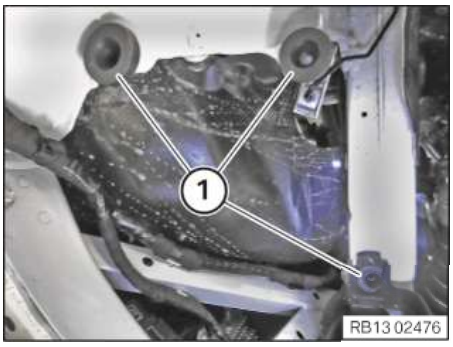
98 – Install the seal for the front bonnet

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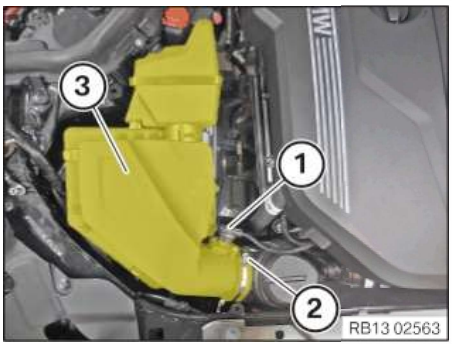


- Position the bonnet seal(1) and connect it on the mounting on the bumper and on the headlights.

99 – Installing intake silencer housing



- Check the rubber mount (1) for correct fit.



- Feed the intake filter housing (3) in and engage it in the rubber mounts.
- Tighten clamp (2).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

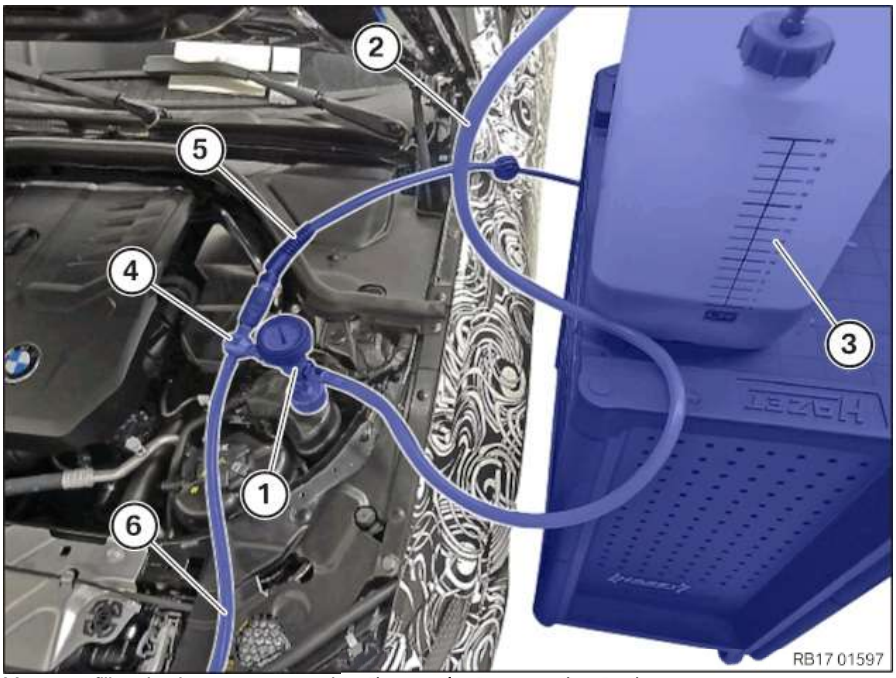
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

100 – Filling the low-temperature cooling system with the vacuum filler device

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Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Mixing different coolants is not permitted.

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TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

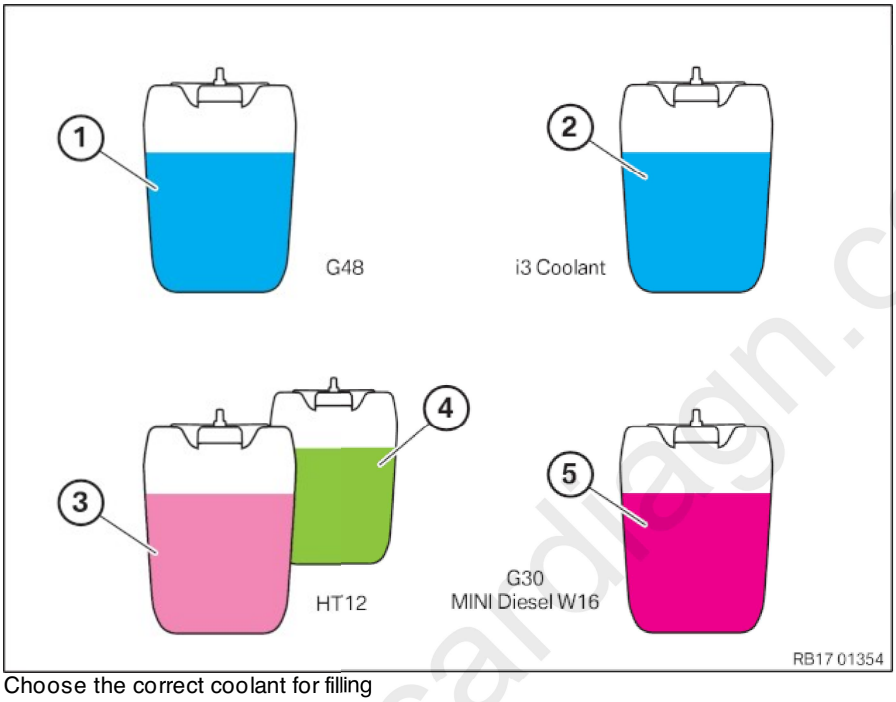
A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. G48 (Blue) G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.

2. i3 coolant (blue) is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.

3. HT12 (Pink) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

4. HT12 (Green) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

5. G30 (Pink) must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

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- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

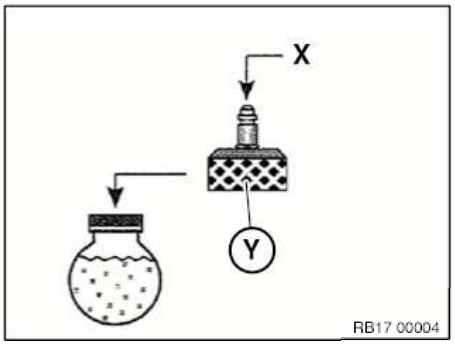
Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 109

- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

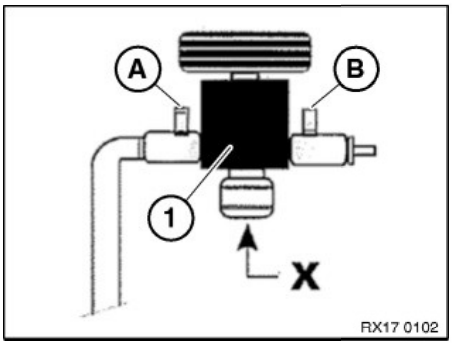
Capacity of low-temperature coolant circuit G20/G29

B58B30O1	4,5 l

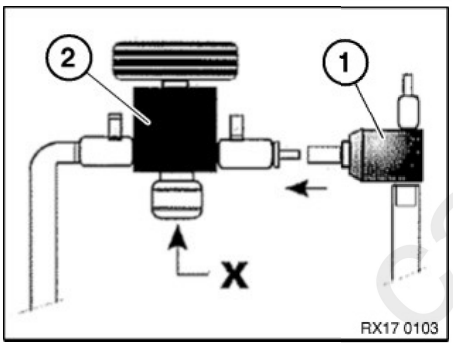
Expendable materials: Technically suitable antifreeze and corrosion inhibitor



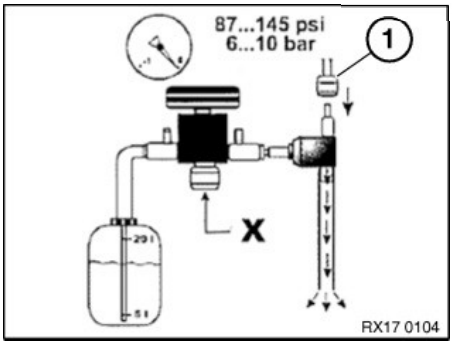
- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.



- Check that shutoff valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.

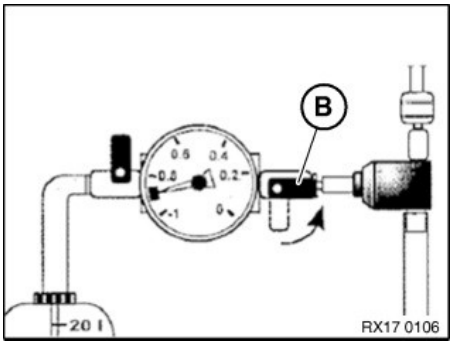


- Connect Venturi nozzle (1) to the vacuum filler device (2).
  (X)is the connection on the coolant expansion tank.



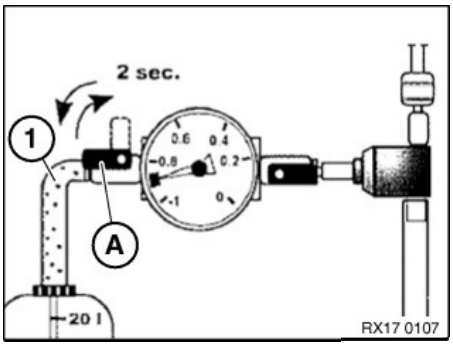
- Connect compressed air (1).
  (X)is the connection on the coolant expansion tank.

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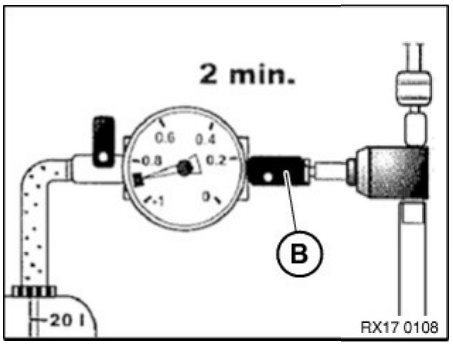
- Open shut-off valve (B).

  The venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

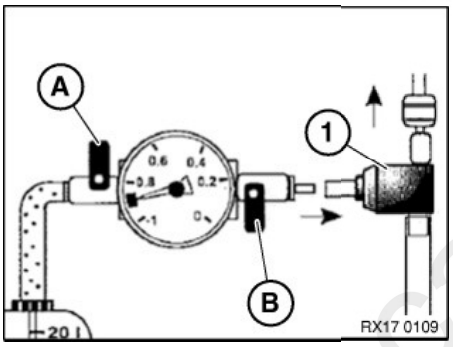


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

TECHNICAL INFORMATION

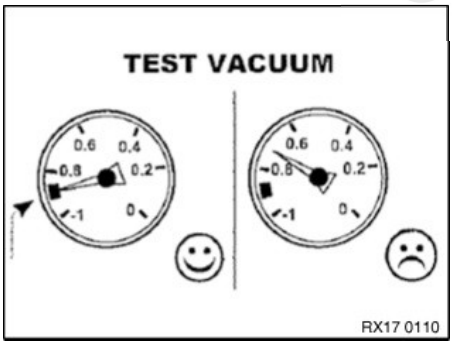
The coolant hoses contract during vacuum build-up.

- After a vacuum of -0.7 to -0.95 bar has been created in the coolant circuit (duration approx. 2 min), shut the shutoff valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).

Check



- The vacuum in the coolant circuit must be maintained for at least 30 seconds.

Result

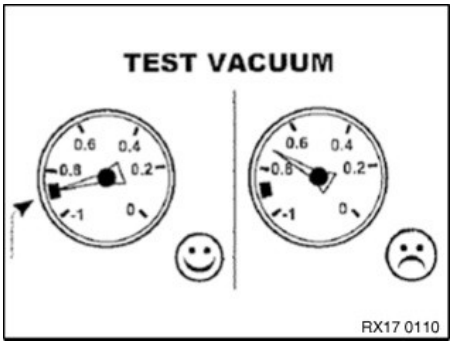
» Vacuum drops.

Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check

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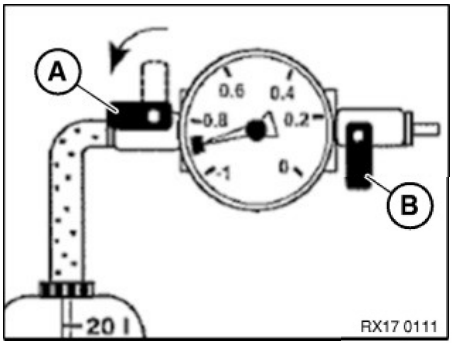
- The vacuum in the coolant circuit must be maintained for at least 30 seconds.

Result

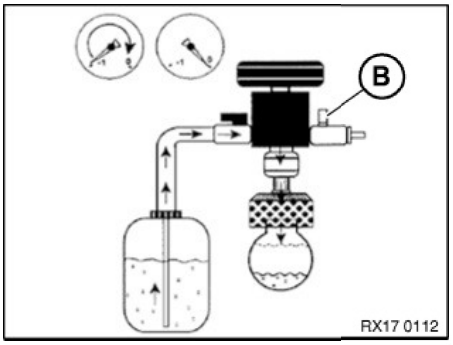
» Vacuum remains constant.

Measure

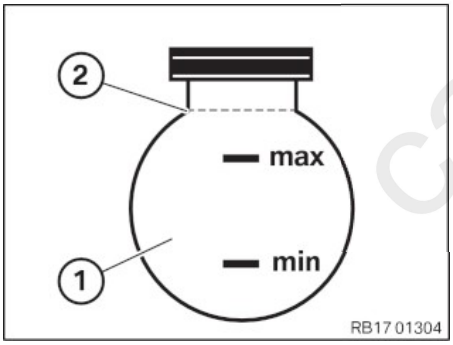
- Continue with filling.



- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.



- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).



- Remove the vacuum filler device with the adapter from the low-temperature coolant expansion tank (1).
- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to the lower edge of the coolant filler neck (2) of the low-temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

101 – Disconnecting all battery earth leads



- See additional information.

102 – Bleeding the low-temperature cooling system

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TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

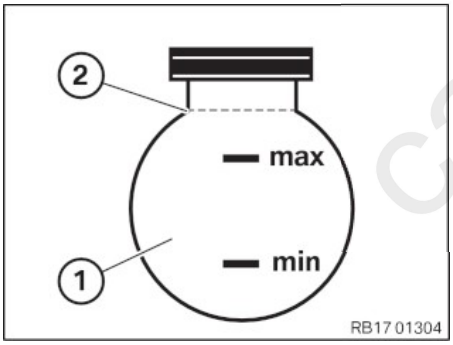
TECHNICAL INFORMATION

Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.



- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to lower edge (2) of the coolant filler neck of low-temperature coolant expansion tank (1).
- Close the sealing cap on the coolant expansion tank of the low-temperature coolant circuit.
- Ensure that the bonnet is **open**.
- Connect battery charger.
- Switch on the ignition and ensure that it remains **switched on** (for example, activate the low-beam headlight and the hazard warning lights **at the same time**).
- If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Ensure that the Driving Experience Control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **not** press on the brake pedal.
- Do **not** start engine.

  The cooling system bleeding routine will start.

  The electric coolant pump in the low-temperature coolant circuit is activated for 11 minutes according to a cooling system bleeding routine.

  The cooling system bleeding routine ends after 11 minutes.

  The electric coolant pump is **no** longer activated.
- Note the display in the instrument cluster (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Allow the coolant temperature to cool down to **< 50°C**.

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- Loosen sealing cap (1).



TECHNICAL INFORMATION

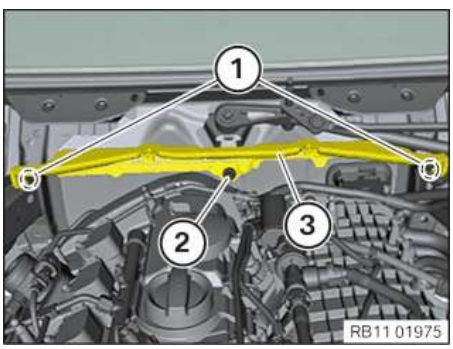
After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

The normal filling level of the coolant is reached while driving.

- Adjust the filling level in coolant expansion tank (2) of the low-temperature coolant circuit to **100 ml** above the **maximum mark** (1) .
- Close sealing cap (1).

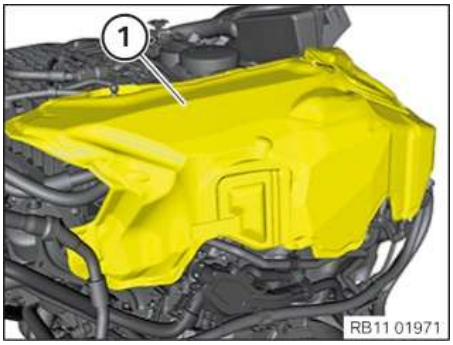
103 – Installing centre bulkhead lower section



- Position the centre bulkhead lower part (3).
- Tighten nut (2) and screws (1).

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104 – Installing acoustic cover at rear

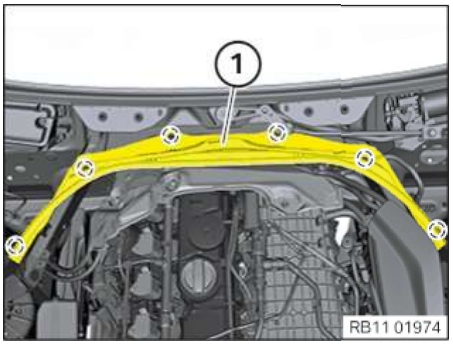


- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

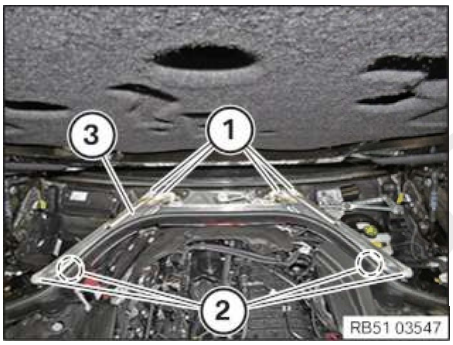
105 – Installing the centre bulkhead upper part



- Position the centre bulkhead upper part (1).
- Tighten the bolts in the marked areas.

Bulkhead upper part to bottom bulkhead

		Tightening torque	3 Nm



- **If installed:** Install tension strut on spring strut dome.
- Install the tension strut (3) on the spring strut dome.
- Tighten the screws (1).

Tension strut on bulkhead

M10x25 screw		Tightening torque	56 Nm

- Renew screws (2).

  Parts: Bolts
- Tighten the screws (2).

Tension strut to spring strut dome

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

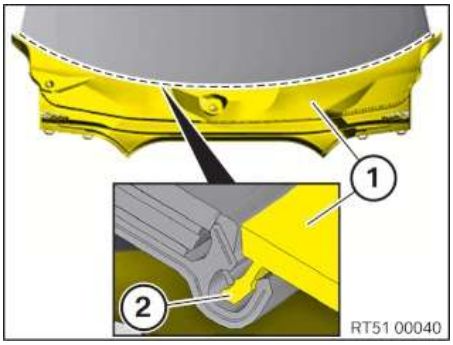
106 – Installing cowl panel cover

RISK OF DAMAGE

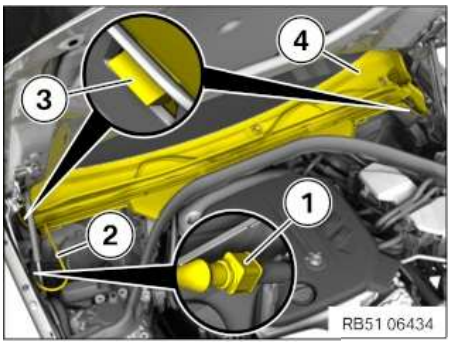
Damage caused by water ingress into the vehicle.

Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

- Ensure correct installation of the components.
- Only use undamaged components.

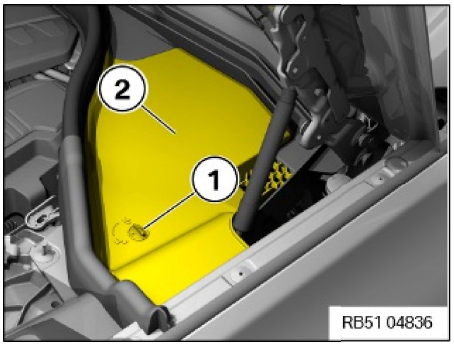


- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



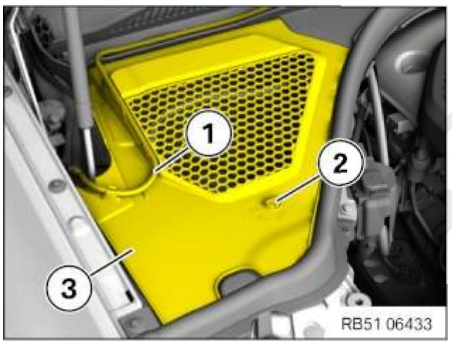
- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

107 – Install the cover of the engine compartment on the rear left



- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

108 – Install the rear right engine compartment cover



- Position the cover of the engine compartment on the rear right (3).
- Close lock (2).
- Insert washer fluid hose (1) into the guides.

109 – Installing both wiper arms

NOTICE

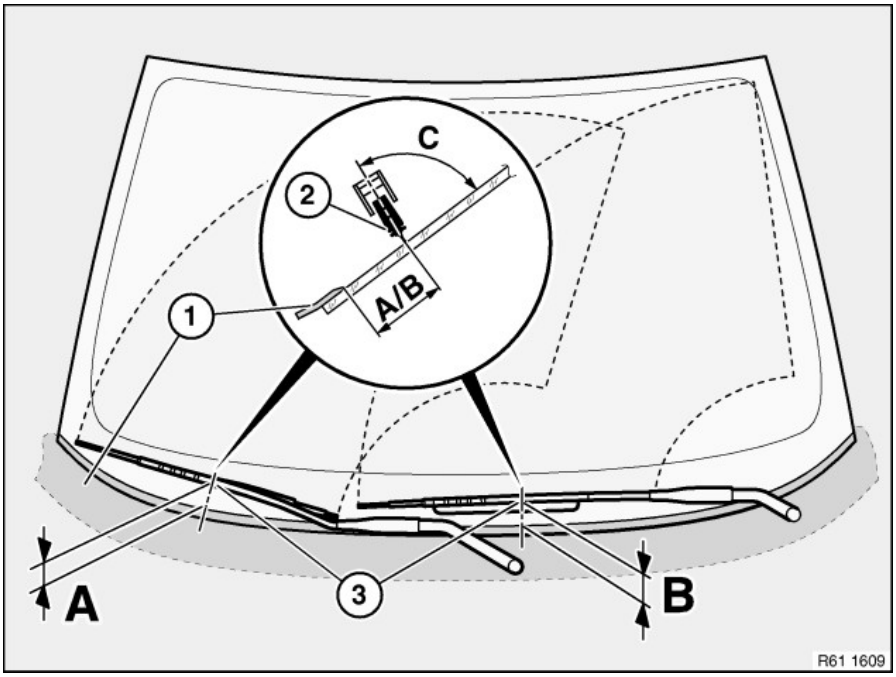
Description is for left component only. Procedure on the right side is identical.

▸ **Install the wiper arm**

TECHNICAL INFORMATION

The wiper system must be in zero position.
After installing the cowl panel cover and before fitting the wiper arm:
Activate the wiper system once to ensure that it has the correct installation position.

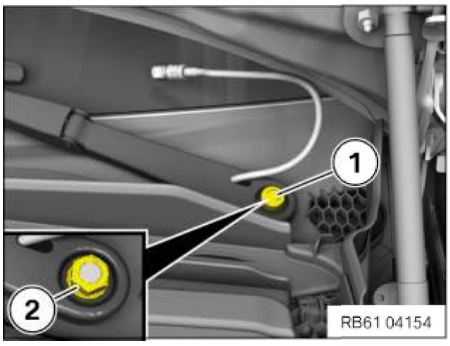
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- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

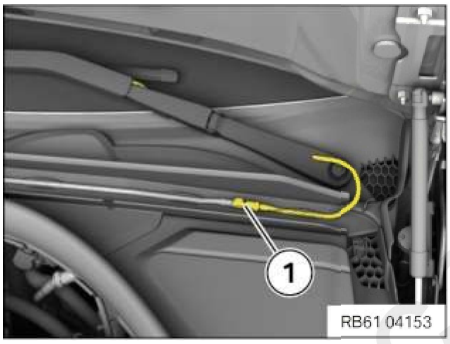


- Tighten nut (2).

Windscreen wiper arm

Combination hexagon nut		Tightening torque	35 Nm

- Connect the protective cap (1).



- Insert windscreen wash hose (1) into the cowl and connect at the separating point.

110 – Install acoustic cover

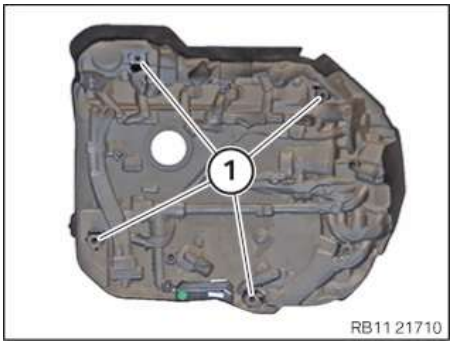
RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.

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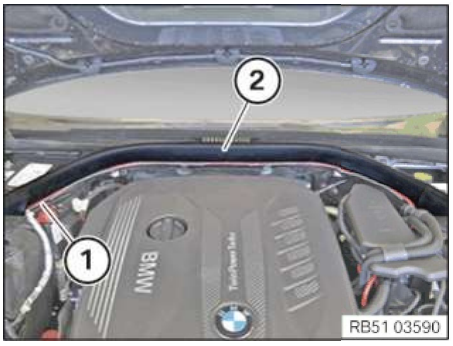


- Check the rubber mount (1) for correct fit in the acoustic cover.



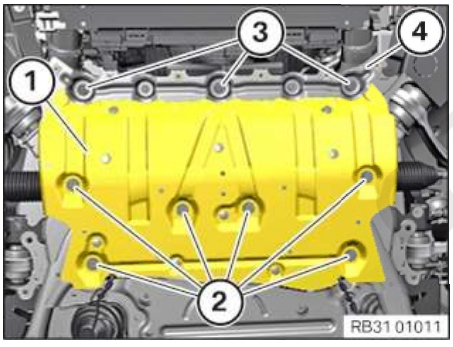
- Install acoustic cover (1) and fix in the rubber mounts (marks).

111 – Install the seal for the bonnet



- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

112 – Installing the stiffening plate

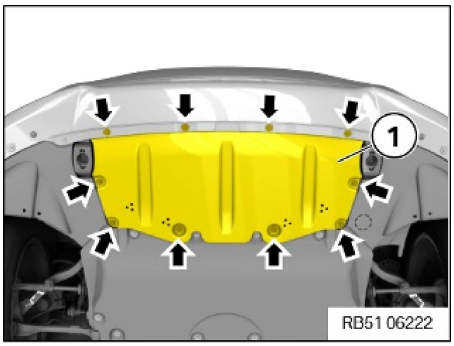


- Position stiffening plate (1).
- Screw screws (2) in.
- Position holder of underride protection (4).
- Screw screws (3) in.
- Tighten down screws (2) and (3).

Stiffening plate to front axle support

M10		Tightening torque	56 Nm

113 – Installing the front underbody protection



- **Version 1:**

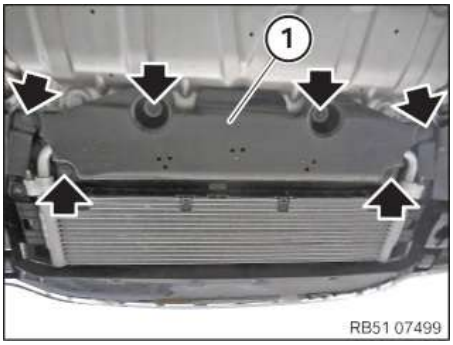
  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

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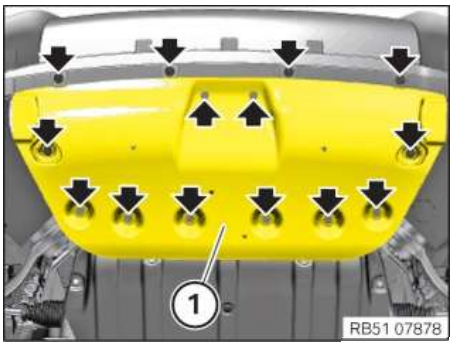
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

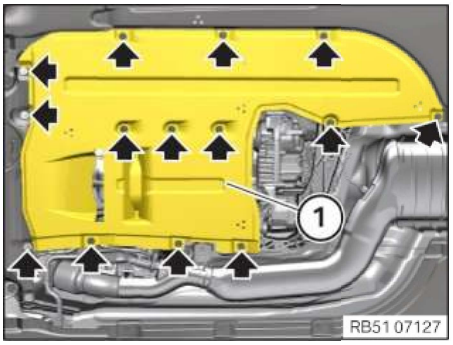
  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

114 – Installing underbody protection at rear



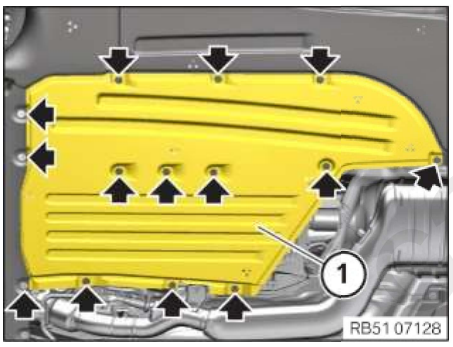
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

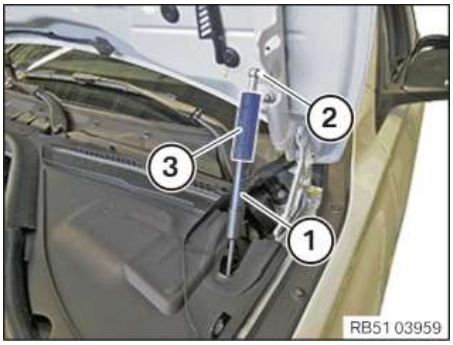
Hexagon screw		Tightening torque	3 Nm

115 – Check engine oil level

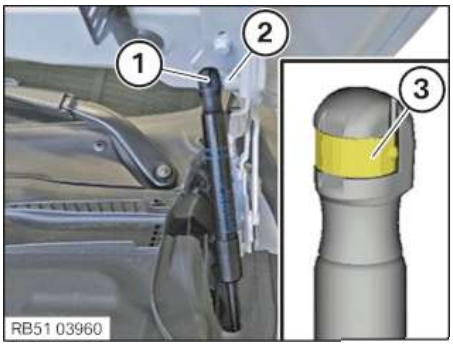
- Park vehicle on a horizontal surface.
- In the case of automatic transmission, shift to selector lever position N or P.
- Accelerator pedal is not pressed.
- Engine is running and is at operating temperature.
- Read off the engine oil level in the instrument cluster (KOMBI) or on the control display.
- Top up engine oil if necessary.

116 – Take bonnet out of the service position

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- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.



CAUTION

Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

Additional Information

Overview of Tightening Torques

Cover, front bottom on side — Used in step 3671

Hexagon screw for thermoplastic		Tightening torque	3 Nm

Basic carrier to cylinder head — Used in step 456070

M6		Tightening torque	8 Nm

Test gauge to basic carrier — Used in step 456070

M6		Tightening torque	8 Nm

Exhaust camshaft to cylinder head — Used in step 58

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

Intake camshaft to cylinder head — Used in step 59

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque.	10 Nm

VANOS central valve to camshaft — Used in step 6667

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

Chain tensioner to cylinder head — Used in step 69

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

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Engine oil cooler to bumper support			Used in step 71
M6X25		Tightening torque	8 Nm

Gate to bearing bracket			Used in step 74
M8			20 Nm

Intake plenum to cylinder head			Used in step 78
M6		Tightening torque	10 Nm

Intake plenum to support			Used in step 78
M6X25		Tightening torque	8 Nm

Tank ventilation line to intake plenum			Used in step 78
Oval-head screw		Tightening torque	3 Nm

Charge air line to throttle valve			Used in step 78
M6x30		Tightening torque	8 Nm

Control unit holder on spring strut dome			Used in step 80
Hexagon screw		Tightening torque	8 Nm

Cylinder head cover to cylinder head			Used in step 83
M6X30		Jointing torque	8 Nm

Cylinder head cover to cylinder head			Used in step 83
M6X30		Tightening torque	11 Nm

Auxiliary coolant pump holder to cylinder head			Used in step 83
M6		Tightening torque	7 Nm

Standard screw connection M6			Used in step 83
M6			8 Nm

Differential pressure sensor to holder			Used in step 83
TS6X18		Tightening torque	3,5 Nm

Holder, positive battery cable to cylinder head cover			Used in step 83
6X18		Tightening torque	6 Nm

High pressure pump to high pressure pump flange			Used in step 85
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

Ground cable to rail			Used in step 8788
M6			5 Nm

High pressure line between rail and high pressure pump			Used in step 89
M14x1,5		Tightening torque	33 Nm

Fuel delivery line to high pressure pump			Used in step 90
M14		Tightening torque	31 Nm

Fuel line to cylinder head cover			Used in step 90
6x18		Tightening torque	6,5 Nm

Spark plugs			Used in step 91
M12x1.25		Tightening torque	23 Nm

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Ignition coil			Used in step 92
Screw		Tightening torque	8 Nm

Fan cowl with electric fan on radiator			Used in step 93
TS6x20		Tightening torque	6,5 Nm

Top rear cross connection to bonnet catch support			Used in step 94
Flat-head screw M6x20		Tightening torque	11,8 Nm

Rear top cross connection to wheel arch carrier support			Used in step 94
M10x20 screw	Renew screw.	Jointing torque	56 Nm
		Angle of rotation	90 °

Cross connection, top			Used in step 95
M8x20		Tightening torque	28 Nm

Cross connection, top			Used in step 95
M6x20		Tightening torque	11,8 Nm

Clean air pipe to upper section of intake filter housing			Used in step 99
Clamp		Tightening torque	3 Nm

Bulkhead upper part to bottom bulkhead			Used in step 105
		Tightening torque	3 Nm

Tension strut on bulkhead			Used in step 105
M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome			Used in step 105
Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

Windscreen wiper arm			Used in step 109
Combination hexagon nut		Tightening torque	35 Nm

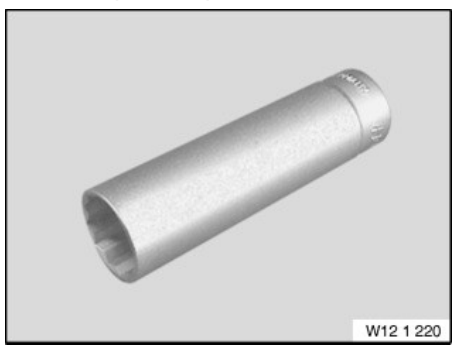
Stiffening plate to front axle support			Used in step 112
M10		Tightening torque	56 Nm

Underbody protection front			Used in step 113
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Underbody protection			Used in step 114
Hexagon screw		Tightening torque	3 Nm

Overview of Special Tools

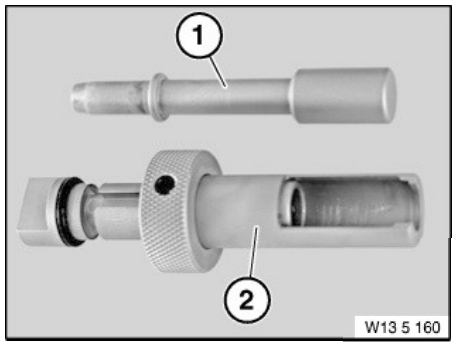
0 495 560 (12 1 220) Socket



Common		Used in step 2391
Usage	For removing and installing the spark plugs (WAF 14 bihexal).	
Included in the tool or work		
Storage location	C18	
Replaced by		
In connection with		
SI-Number	01 20 06 (299)	

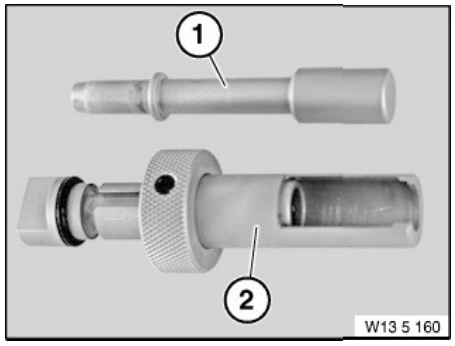
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0 496 567 (13 5 161) Fastener



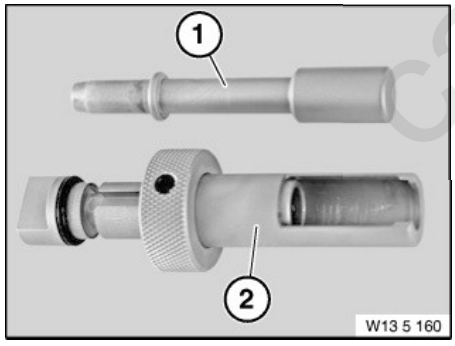
Common	Used in step 25
Usage	(Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

0 496 568 (13 5 162) Fastener



Common	Used in step 25
Usage	(Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

0 496 565 (13 5 160) Fastener



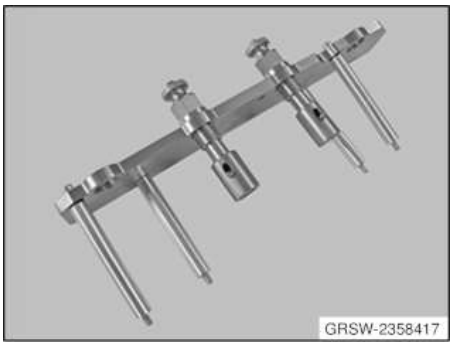
Common	Used in step 25
Usage	(Caps (2x)) To close off the fuel lines when removing and installing the engine.
Included in the tool or work	
Storage location	B26
Replaced by	
In connection with	
SI-Number	01 22 08 (498)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 567 (13 5 161)		**Fastener** (Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set	
2	0 496 568 (13 5 162)		**Fastener** (Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool	

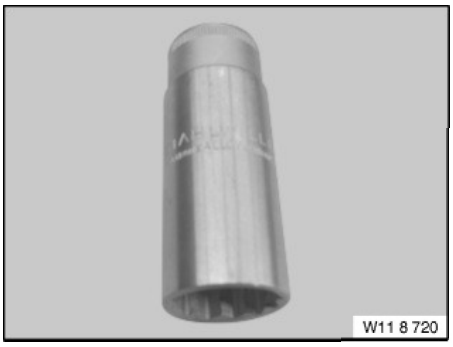
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2 358 417 Device



Common	Used in step 2728
Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 106 (11 8 720) Socket WAF 46



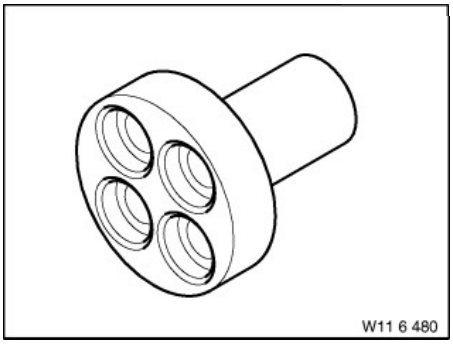
Common	Used in step 2728
Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

2 360 895 Pin wrench



Common	Used in step 2984
Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 493 380 (11 6 480) Connector



Common	Used in step 4041456870757685
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

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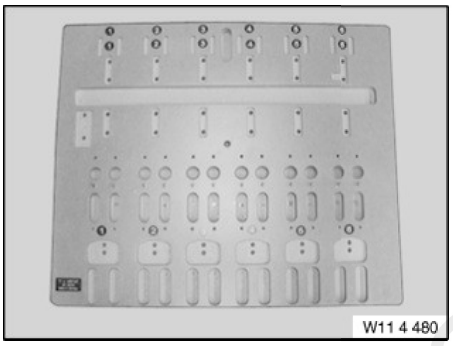
2 359 088 Device



Common Used in step 4277

Usage	For removing and installing torsion spring of the intermediate lever.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 495 105 (11 4 480) oddments tray



Common Used in step 424344545556

Usage	(Boards (2 pieces)) For setting down the individual components of the cylinder head.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 106 (11 4 481)		**oddments tray** (Board, intake side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	
2	0 495 107 (11 4 482)		**oddments tray** (Board, exhaust side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	

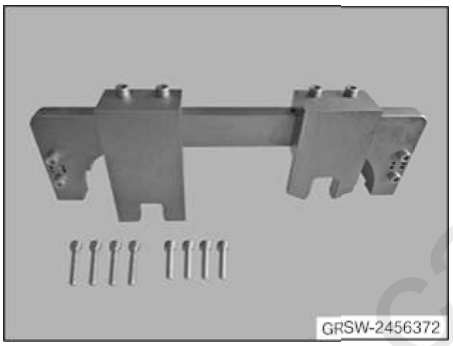
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2 288 380 Locating stud



Common	Used in step 456870
Usage	For disconnecting the crankshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 04 14 (071)

2 456 372 Gauge



Common	Used in step 4553606870
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 122 Gauge



Common	Used in step 455370
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 496 855 Ratchet handle



Common	Used in step 47486667
Usage	Insert reversible ratchet with nut for installation and disassembly of the VANOS- SW22. (only in longitudinal installation). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A55
Replaced by	
In connection with	
SI-Number	01 34 15 (306)

2 450 487 Socket



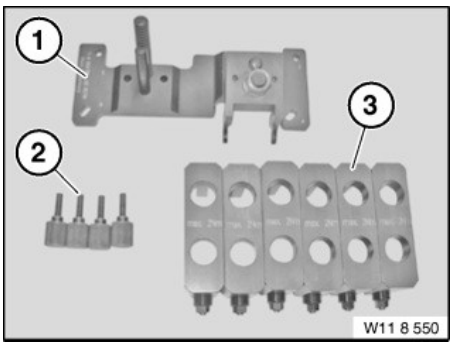
Common	Used in step 47486667
Usage	For removing and installing the VANOS adjuster. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	0496855
SI-Number	01 07 17 (487)

2 410 670 Device



Common	Used in step 5558
Usage	To press down the valves on the 2nd cylinder, for de-energised disassembly/installation of the exhaust camshaft. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 23 15 (280)

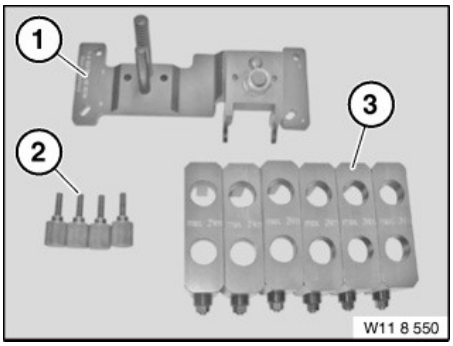
0 495 741 (11 8 552) Screw



Common	Used in step 5558
Usage	(Knurled screw (4 pieces))
Included in the tool or work	0 495 739
Storage location	C19
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

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0 495 739 (11 8 550) Device



Common Used in step 55

Usage	(Locking device) For holding the bearing strips in place when fitting intake camshaft.
Included in the tool or work	
Storage location	C19
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
2	0 495 741 (11 8 552)		**Screw** (knurled screw (4 pieces))	
1	0 495 740 (11 8 551)		**Tool** (Tool to press down) discontinued, available as part of set of special tools only	
3	0 495 742 (11 8 553)		**Synchronising key** Thrust piece (1 piece)	

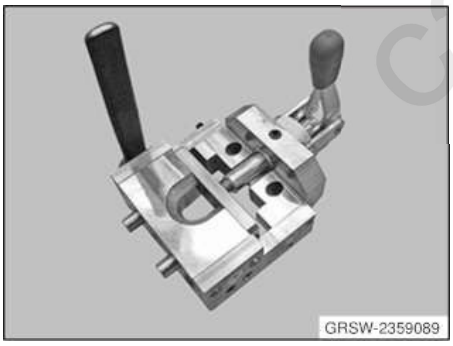
2 455 654 Tensioning tool



Common Used in step 6568

Usage	To pretension the timing chain when adjusting the timings. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 359 089 Device



Common Used in step 74

Usage	For positioning the sliding block. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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2 452 959 Pliers



Common	Used in step 86
Usage	For disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ number 13 0 191). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A5
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 448 401 Fitting aid



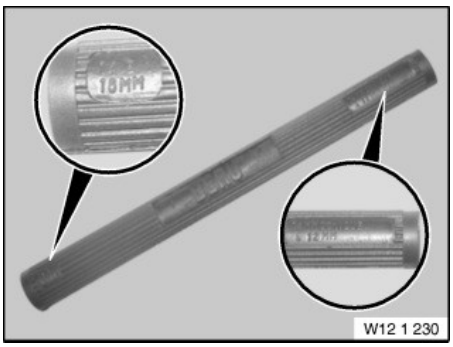
Common	Used in step 86
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 022 Gauge



Common	Used in step 8788
Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

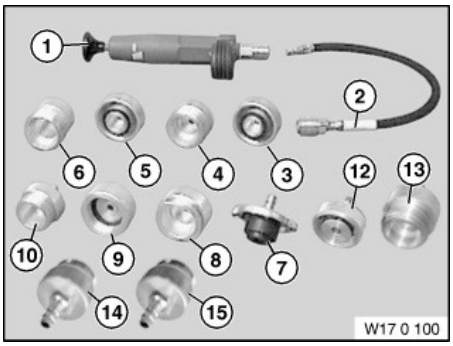
0 496 065 (12 1 230) Fitting aid



Common	Used in step 91
Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

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0 494 417 (17 0 100) Tester



Common Used in step 100

Usage	For checking engine cooling system on watertightness. For checking radiator cap.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 02 (884)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
5	0 494 422 (17 0 105)		**Adapter** For radiator cap (sawtooth thread)	
10	0 494 427 (17 0 111)		**Adapter** For radiator cap R53/W11, R50/W17 adapter replaced 17 0 052.	
1	0 494 418 (17 0 101)		**Pump**	
2	0 494 419 (17 0 102)		**Hose** (hose with quick-release coupling)	
3	0 494 420 (17 0 103)		**Adapter** For radiator cap (normal thread)	
4	0 494 421 (17 0 104)		**Adapter** For radiator cap (normal thread)	
6	0 494 423 (17 0 106)		**Adapter** For radiator cap (sawtooth thread)	
7	0 494 424 (17 0 107)		**Adapter** For radiator cap R50 / W10	
8	0 494 425 (17 0 108)		**Adapter** For radiator cap R50 / W10	
9	0 494 426 (17 0 109)		**Adapter** For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051	
11	0 494 428 (17 0 112)		**Case**	
12	0 494 642 (17 0 113)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
13	0 494 643 (17 0 114)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
14	0 495 889 (17 0 115)		**Adapter** For radiator cap Model series: N12, N14	

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Overview Technical Data

Distance from window pane edge to wiper blade	Used in step 109
Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

Capacity of low-temperature coolant circuit G20/G29	Used in step 100
B58B30O1	4,5 l
Expendable materials: Technically suitable antifreeze and corrosion inhibitor	

Links

General repair instructions	Used in step
12 00 ... Instructions for removal and replacement of control units	1282

Repair instructions	Used in step
61 20 900 Disconnecting and connecting battery earth lead	1101
61 20 900 Disconnecting and connecting battery earth lead	1101
61 20 900 Disconnecting and connecting battery earth lead	1101
61 20 900 Disconnecting and connecting battery earth lead	1101
61 20 900 Disconnecting and connecting battery earth lead	1101
61 20 900 Disconnecting and connecting battery earth lead	1101
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1101
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1101
61 20 900 Disconnecting and connecting battery earth lead	1101
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1101
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	1101
61 20 900 Disconnecting and connecting battery earth lead	1101
61 20 900 Disconnecting and connecting battery earth lead	1101
61 20 900 Disconnecting and connecting battery earth lead	1101
61 20 900 Disconnecting and connecting battery earth lead	1101
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61 20 900 Disconnecting and connecting battery earth lead	1101
61 20 900 Disconnecting and connecting battery earth lead	1101
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1101
61 20 900 Disconnecting and connecting battery earth lead	1101
61 20 900 Disconnecting and connecting battery earth lead	1101
61 20 900 Disconnecting and connecting battery earth lead	1101
61 20 900 Disconnecting and connecting battery earth lead	1101
61 20 900 Disconnecting and connecting battery earth lead	1101
61 20 900 Disconnecting and connecting battery earth lead	1101
61 20 900 Disconnecting and connecting battery earth lead	1101
61 35 ... Notes on ESD protection (Electro Static Discharge)	121322293781
13 53 ... Clean the cylinder heads in the area of injectors to prevent sand/dust contamination.	2728
61 35 ... Notes on ESD protection (Electro Static Discharge)	29
61 00 730 Encode/program control unit(s) (after vehicle test)	82
17 11 035 Removing and installing/replacing fan cowl with electric fan	85
17 00 ... Notes for working on cooling system.	100

Operating materials	Used in step

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11 33 062 Replacing all hydraulic valve clearance compensating elements

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

RISK OF DAMAGE

Damage to battery terminal, the safety battery terminal or the intelligent battery sensor (IBS).

Damaged battery terminals can lead to malfunctions or vehicle electrical system faults.

- Pull off battery terminal from battery pole by carefully moving to and fro. Do not pry off using a tool.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

PRELIMINARY WORK

1 – Disconnecting all battery earth leads

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- See additional information.

2 – Bring front compartment lid in the service position

Prerequisite

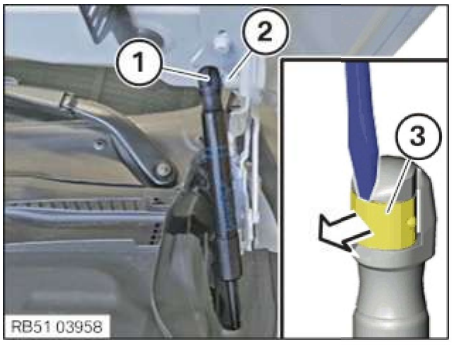
Engine compartment lid is open.

CAUTION

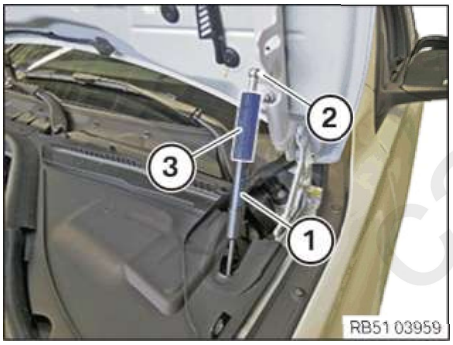
Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.



- Lift clamp (3) slightly using a screwdriver, in the direction of the arrow.
- Lift off ball socket (1) from ball pin (2).
- Repeat the operation on the other side of vehicle.



TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

- Remove the bonnet support and open the bonnet further.
- Push special tool or (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

3 – Remove the seal for the rear bonnet



- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

4 – Removing the acoustic cover

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WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

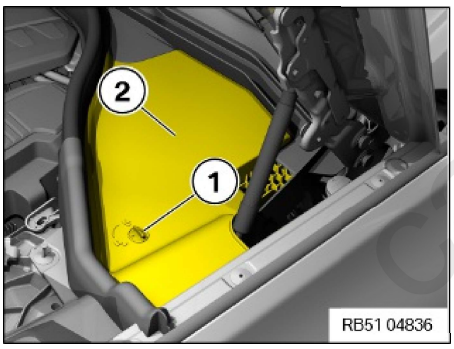
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



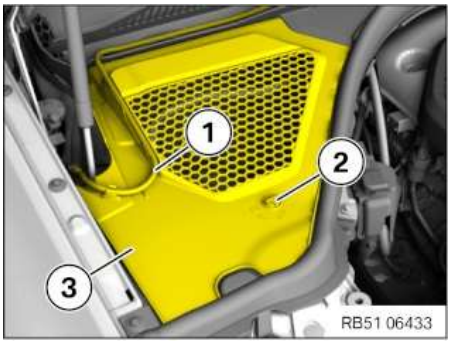
- Release the acoustic cover (1) towards the top from the rubber mounts (marks).

5 – Remove the cover of the engine compartment at the rear left



- Loosen the lock (1).
- Remove rear left cover of engine compartment (2).

6 – Remove the cover of the rear right engine compartment



- Release washer fluid hose (1) from the guides.
- Loosen the lock (2).
- Remove the cover of rear right engine compartment (3).

7 – Removing both wiper arms

NOTICE

Description is for left component only. Procedure on the right side is identical.

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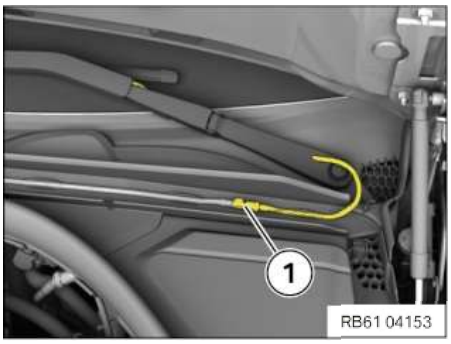
▸ **Remove the wiper arm**

RISK OF DAMAGE

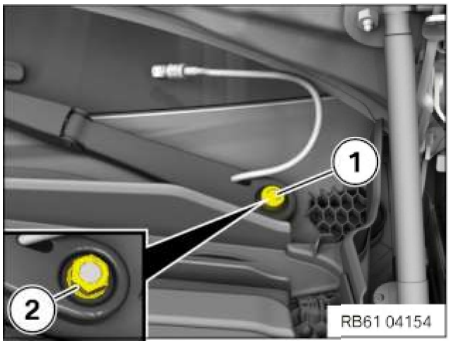
Damage to wiper console

While removing the wiper arms without using special tool, the wiper console can break.

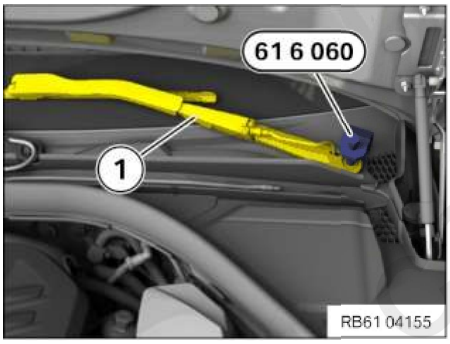
- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.



- Disconnect the windscreen wash hose(1) at the separation point and remove from the cowl guide.

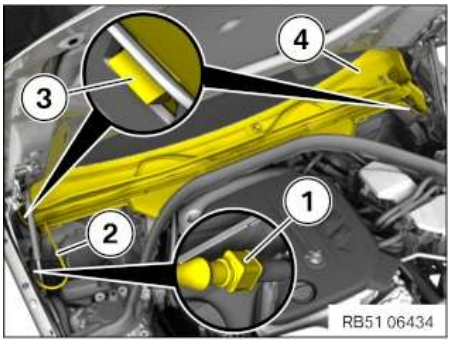


- Remove the protective cap (1).
- Loosen nut (2).



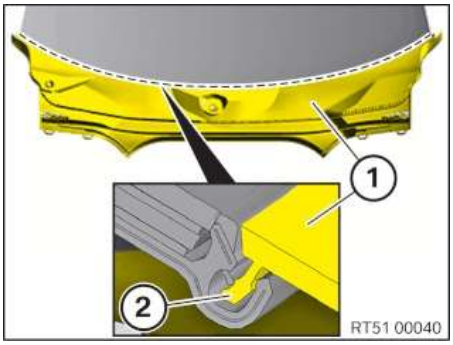
- Pull off the wiper arm (1) using special tool .

8 – Remove cowl panel cover



- Release snap fastener of the washer fluid hose (1) and put the washer fluid hose(2) to one side.
- Unclip clips (3) on the cowl panel cover (4).

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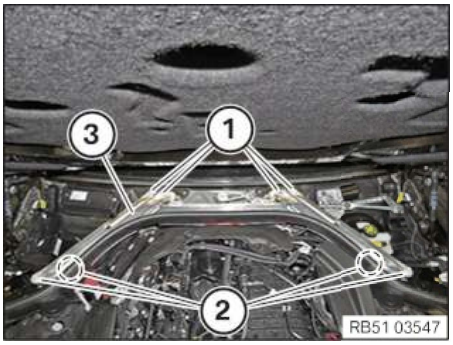


- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

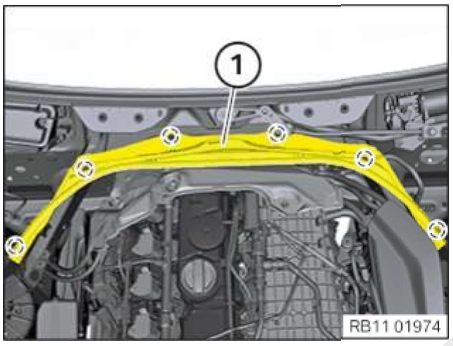
9 – Removing the centre bulkhead upper part

TECHNICAL INFORMATION

Driving without the strut brace/front end or tension strut is not permitted.



- **If installed:** Remove tension strut on spring strut dome.
- Loosen screws (1) and (2).
- Remove tension strut (3) in the spring strut dome upwards.



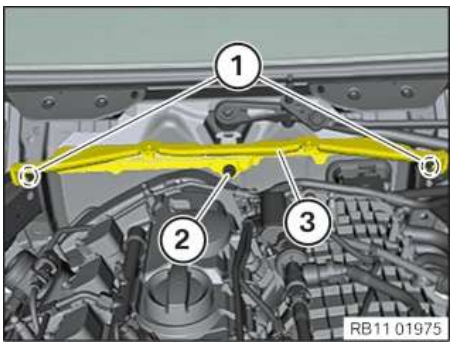
- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

10 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

11 – Removing the centre bulkhead lower section



- Loosen screws (1).
- Loosen nut (2).
- Remove the centre bulkhead lower part (3).

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12 – Removing the DME control unit

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

TECHNICAL INFORMATION

Follow instructions for removing and installing control units.

For additional information see: 12 00 ... Notes on removal and installation of control units

TECHNICAL INFORMATION

In a warranty case, you must always provide a fault memory printout with the defective part, even if the fault memory does not contain an entry.

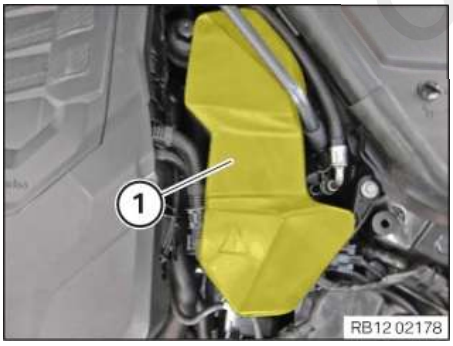
TECHNICAL INFORMATION

Control unit must be programmed after it is replaced.

For additional information see: 61 00 ... Programming/encoding control unit(s)

TECHNICAL INFORMATION

Disconnecting control units may cause fault code entries and functional limitations. Fault code entries must be read out and deleted if necessary.

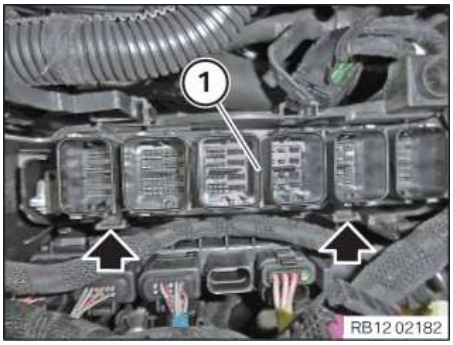


- Pull the cover (1) towards the top and feed out.



- Unlock and disconnect the plug connection (1).

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- Unlock the locks (arrows).
- Guide out and remove DME control unit (1).

13 – Removing integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

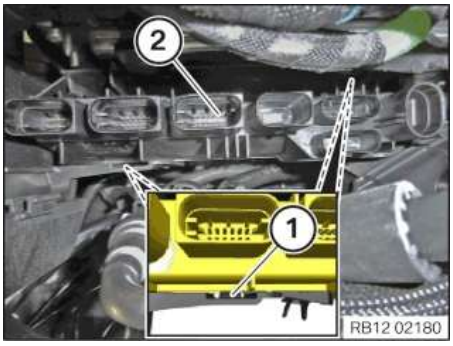
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



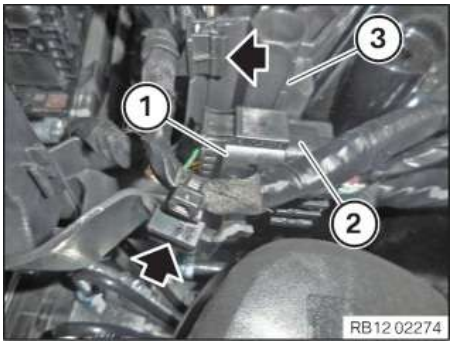
- Unlock and disconnect plug connections (1).



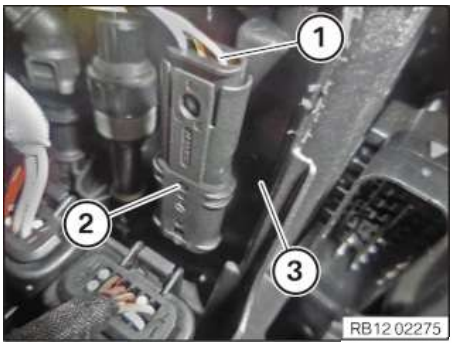
- Unlock the latch mechanisms (1).
- Guide out and remove integrated supply module (PDM) (2) upwards.

14 – Removing the control unit holder

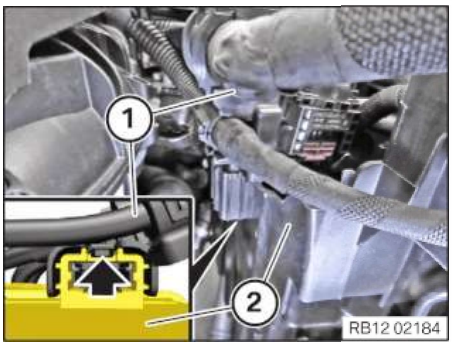
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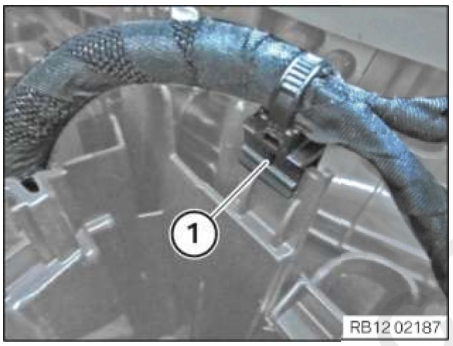
- Unlock plug connection (1) and disconnect.
- Unlock the connector (2) and disconnect from the control unit holder (3).
- Release the clamps (arrows).



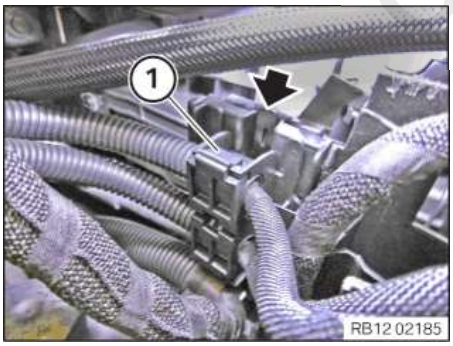
- Unlock plug connection (1) and disconnect.
- Unlock the connector and disconnect from the control unit holder (3).



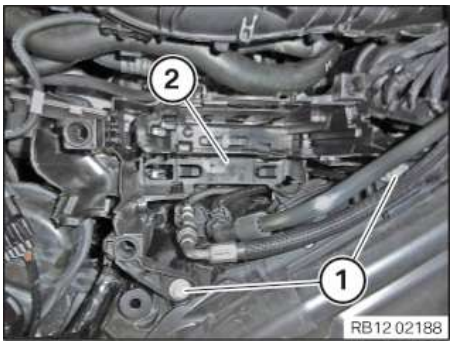
- Unlock the lock (arrow).
- Disconnect the cable holder (1) upwards from the control unit holder (2).



- Loosen clamp (1).



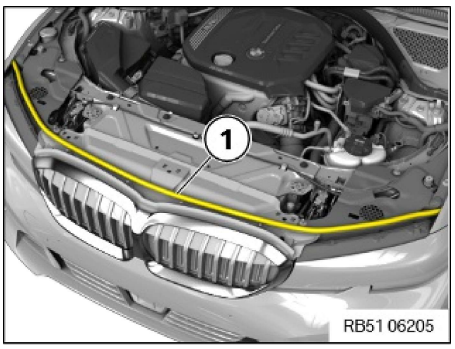
- Unlock the lock (arrow).
- Feed out the cable clip (1) upwards and set it aside.



- Loosen screws (1).
- Guide out and remove the control unit holder (2).

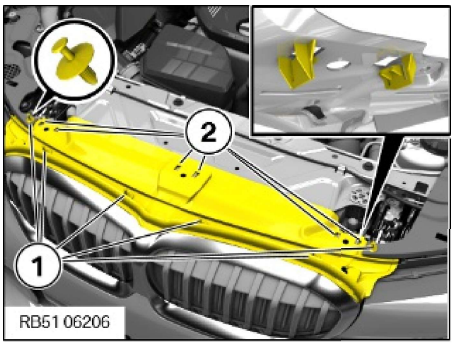
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15 – Remove the seal for the bonnet in front



- Pull off front bonnet seal (1) upwards.

16 – Removing the centre engine compartment cover



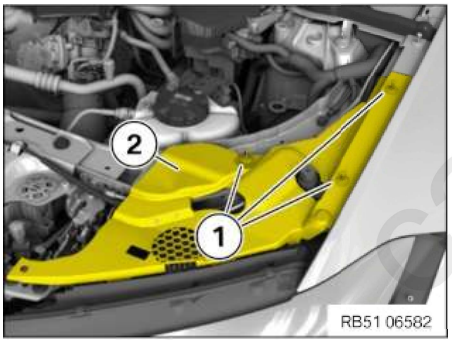
- Detach all expanding rivets (1).
- Release the cover of the centre engine compartment with the latch mechanisms (2) .
- Feed the cover for the centre engine compartment out to the rear.

17 – Partially remove the top left and right cover in the engine compartment

NOTICE

Description is for left component only. Procedure on the right side is identical.

▶ **Removing the cover in the engine compartment on top partially**



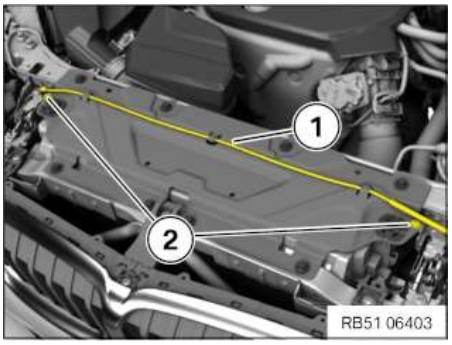
- Loosen the expanding rivet (1).
- Remove the cover in the engine compartment on top (2) partially.

18 – Removing the top cross connection

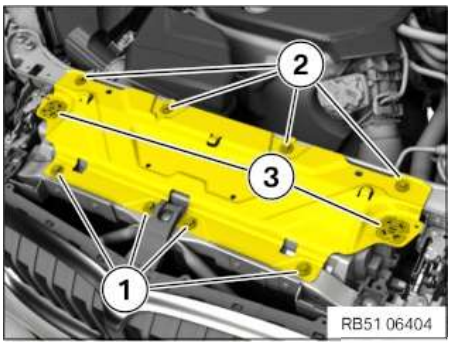


- Release the housing for the coupling of the Bowden cables (1) from the body.

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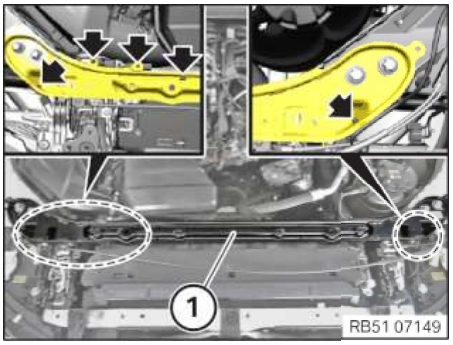


- Detach Bowden cable (1) at the top cross connection.
- Loosen screws (2).

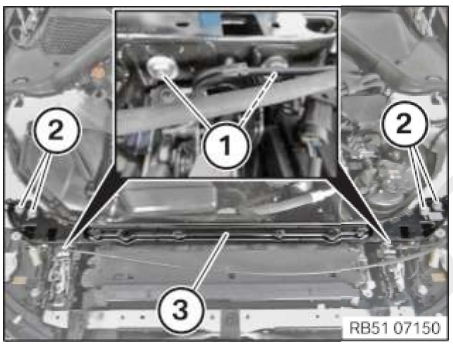


- Loosen screws (1) and (2).
- Remove the top cross connection with the holders(3) towards the top.

19 – Remove the rear top cross connection



- Release the clips (arrows) in the marked areas from the top rear cross connection (1).



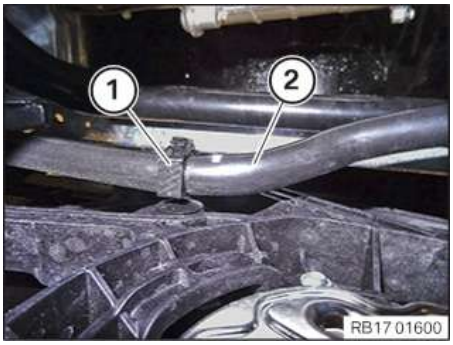
- Loosen screws (1).
- Loosen screws (2).
- Guide out and remove top rear cross connection (3).

20 – Remove fan cowl.

TECHNICAL INFORMATION

- When the engine is stopped after the end of the journey, it may be necessary to run the electric fan. In rare cases, operation of the electric fan can last up to 11 min. This protects the components. In this case, replacing the electric fan will not remedy the problem!

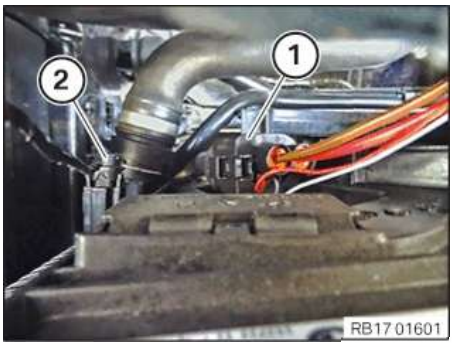
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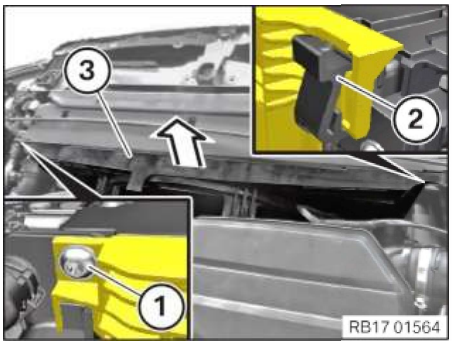
- **If installed:** Release transmission oil line (2).

  Unlock the holder (1).

  Thread out transmission oil line (2) and set aside.



- Unlock plug connection (1) and disconnect.
- Unlock plug connection (2) and disconnect.



- Loosen screw (1).
- Unlock lock (2).
- Guide out and remove fan cowl (3) **carefully** in the direction of the arrow.

21 – Removing intake silencer housing

RISK OF DAMAGE

Damage to the clean air line. Damage to the air filter.

For changing the air filter insert, if the upper section of intake filter housing is only raised and not completely removed, the clean air line and the air filter insert may be damaged.

- Do not lift upper section of intake filter housing by force.
- Unfasten clamp.
- Remove upper section of intake filter housing completely.



- Unlock plug connection (1) and disconnect.
- Unfasten clamp (2).
- Pull out and remove the intake silencer housing (3) from the rubber mounts towards the top.

22 – Remove all ignition coils.

NOTICE

The description is for one component only. The procedure is identical for all further components.

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▸ **Removing the ignition coil**

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the ignition coil.

The silicone hose of the ignition coil must not be contaminated by fuel as this can lead to failure of the ignition coil.

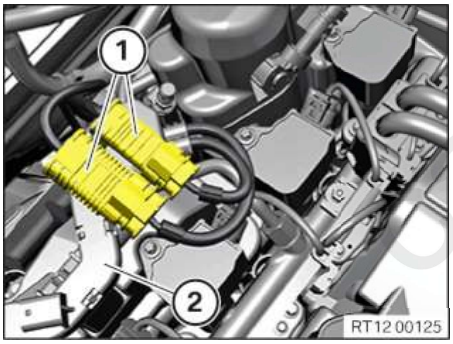
- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

RISK OF DAMAGE

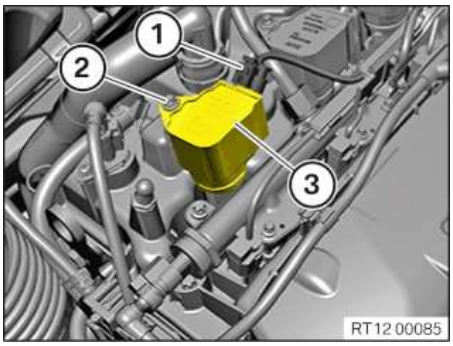
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Disconnect the connector (1) of the front oxygen sensor and the monitoring oxygen sensor from the cable channel (2) and set aside.



- Unlock plug connection (1) and disconnect.
- Loosen screw (2).
- Remove ignition coil (3).

23 – Removing all spark plugs

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WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.



- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

The spark plug shaft must be cleaned using compressed air after having removed the ignition coils and before removing the spark plugs. After having removed the spark plugs, once again check the sealing surface for contamination and (if necessary) clean using a moist cloth or clean using compressed air.

Deposits that are not removed according to instructions may enter the combustion chamber and lead to uncontrolled combustion. Remaining deposits on the spark plug sealing surfaces may lead to leaks and the spark plugs may come loose during engine operation.

Spark plug threads must not be greased or oiled. Insufficiently tightened spark plugs may cause leaks and the sparks plugs may come loose during engine operation.

NOTICE

The description is for one component only. The procedure is identical for all further components.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Mount the special tool 0 495 560 (12 1 220) on a pivoting extension.



- Unscrew spark plugs with the special tool 0 495 560 (12 1 220) and a pivoting extension.

24 – Remove the high pressure line between the high pressure pump and the rail

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WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

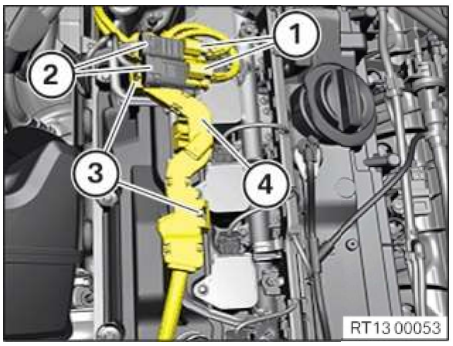
On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

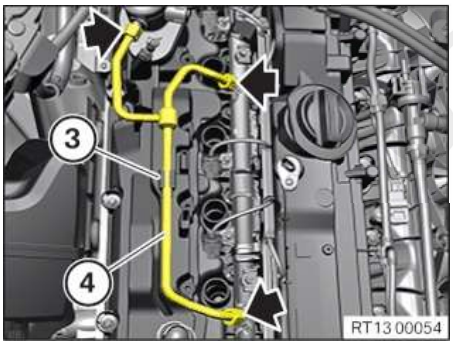
- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Unlock and disconnect the plug connections (1) and (2).
- Unlock the locks (3).
- Guide out the wiring harness section of the engine wiring harness (4) and set it aside.



- Position a lint-free rag under the union nuts.
- Unscrew union nuts (arrows) with the special tool .
- Catch and dispose of escaping fuel.
- Thread out the high pressure line (4) from the bracket (3) and remove it.
- Feed out and dispose of the lint-free cleaning clothes .

25 – Remove fuel delivery line

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

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CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

RISK OF DAMAGE

Damage to the ignition coil.

The silicone hose of the ignition coil must not be contaminated by fuel as this can lead to failure of the ignition coil.

- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

RISK OF DAMAGE

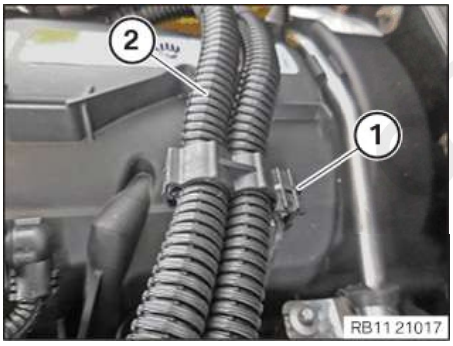
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

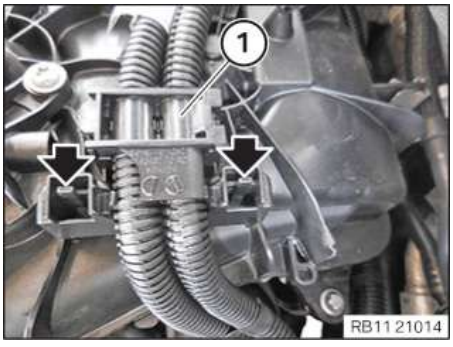
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

Reset special tool in early to avoid bending pressure lines.

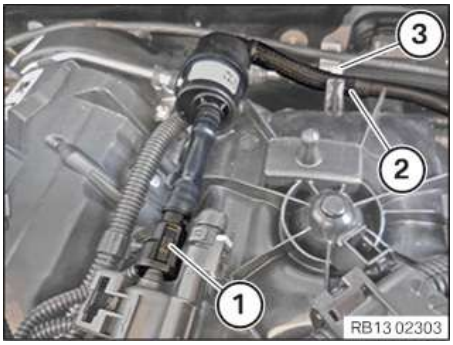


- Loosen clamp (1).
- Guide out wiring harness section (2) for the injectors and ignition coils and place it aside.

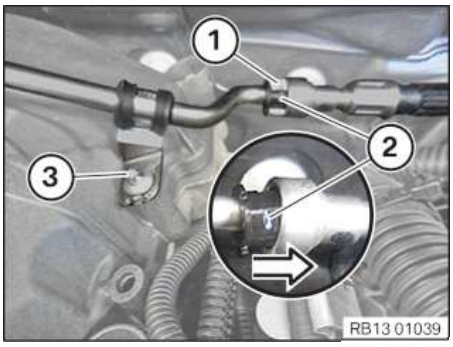


- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.

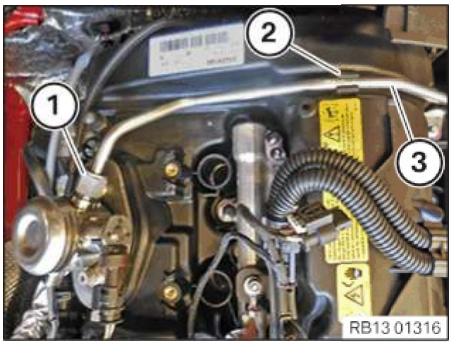
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- Unlock and loosen lock (1).
- Guide tank ventilation line (2) out of clamp (3) and place it aside.



- Unlock and loosen clamp (1).
- Unlock and remove the snap fastener (2) in the direction of the arrow.
- Catch and dispose of escaping fuel.
- Seal the fuel lines with special tools 0 496 567 (13 5 161) and 0 496 568 (13 5 162) from the set of special tools 0 496 565 (13 5 160).
- Loosen screw (3).



- Slacken the union nut (1) on the high pressure pump.
- Catch and dispose of escaping fuel.
- Seal all openings with the special tool .
- Guide the fuel feed line (3) out and remove.
- Make sure that the rubber damper (2) is not lost.

26 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

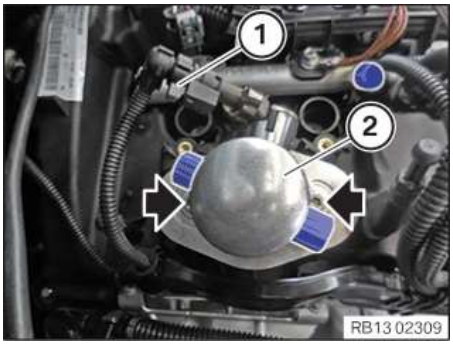
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.

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- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

27 – Removing rail with injectors of cylinders 1 to 3

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

Damage to the ignition coil.

The silicone hose of the ignition coil must not be contaminated by fuel as this can lead to failure of the ignition coil.

- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

Damage to injectors.

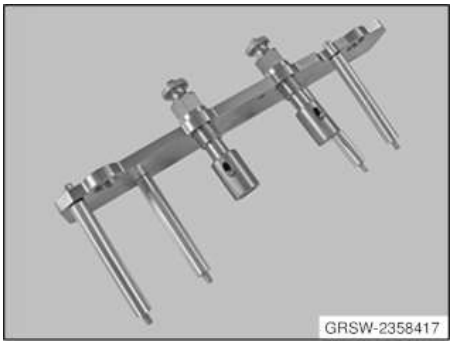
Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.



- Prepare special tool .

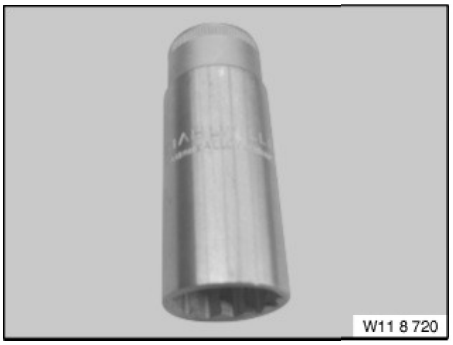
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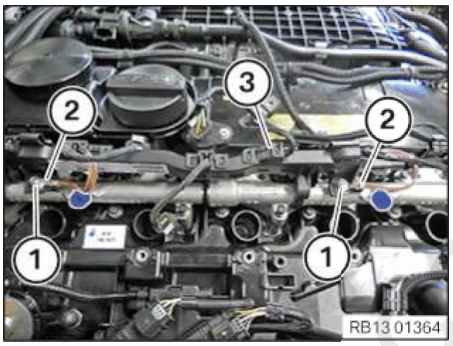
- Prepare special tool 2 358 417.



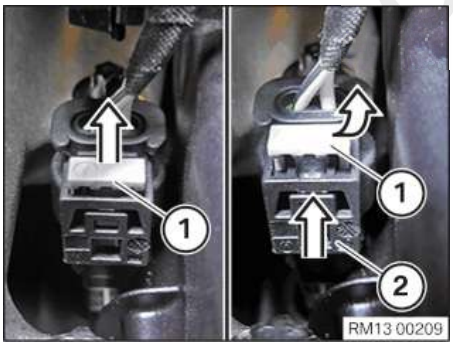
- Prepare special tool .



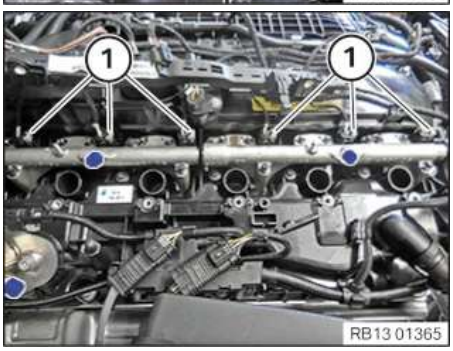
- Prepare special tool 0 496 106 (11 8 720).



- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.

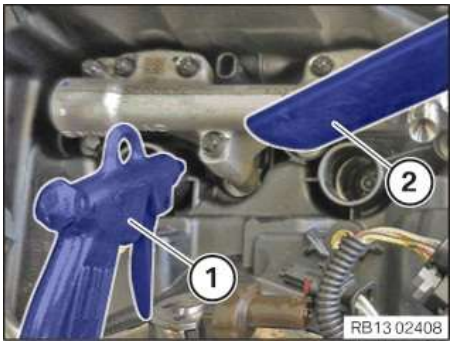


- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull out the connector (2) from the injectors.



- Unlock and release all connectors (1) of the injectors.

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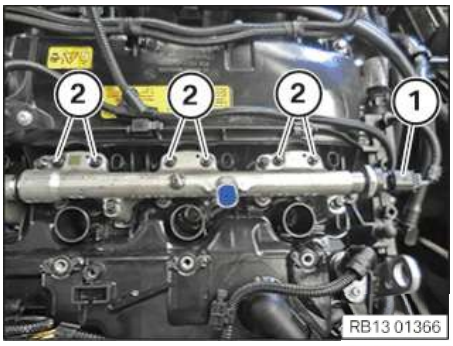


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

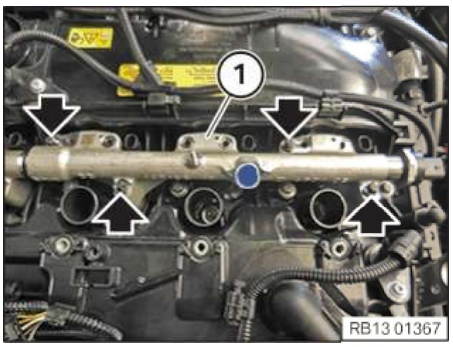
- Before releasing the high pressure lines: Blow out the injector shafts with an air gun(1) with less pressure.
- Simultaneously, draw off the dirt particles with an **explosion proof** vacuum cleaner (2).



- Unlock and loosen connector (1).
- Release screws (M5x30) (2).
- Remove screws (2).

  Do not reuse the bolts (2).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.

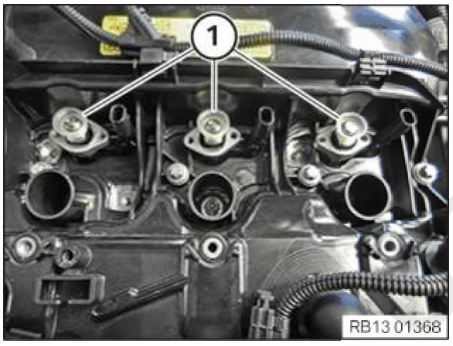


- Unscrew the screws (M6x30) (arrows).

  The screws may not be reused!
- Renew screws.

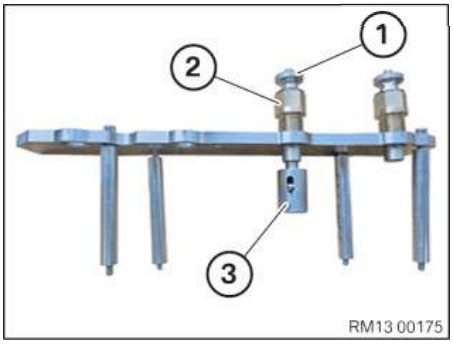
  Parts: Screws (M6x30)
- Remove rail (1) in upward direction.

  The injectors remain in the cylinder head.



- Remove the gaskets (1).

  The seals (1) are only required during the initial assembly at the plant and will not be installed again.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.

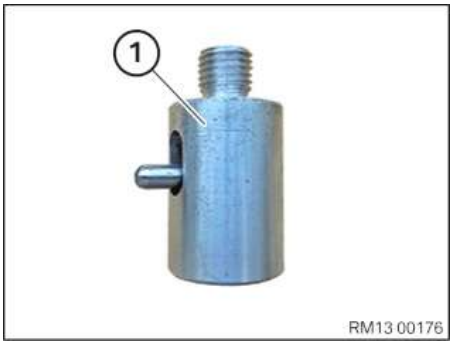
- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use the special tool 2 358 417to remove the injectors.

  The special tool 2 358 417 is used to ensure that the tensile force is not exceeded.

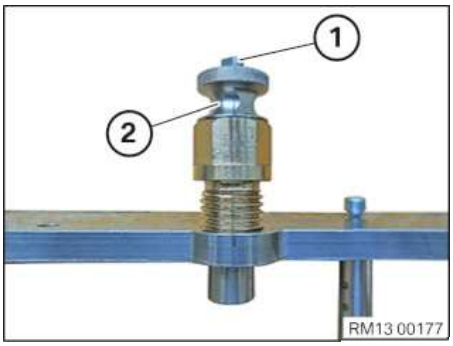
  Special tool 2 358 417 consists of:

  - **(1)** Threaded sleeves
  - **(2)** Pull-out thread (left-hand thread)
  - **(3)** Mounting for the injectors

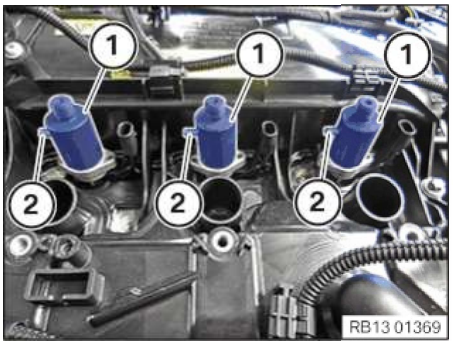
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- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.

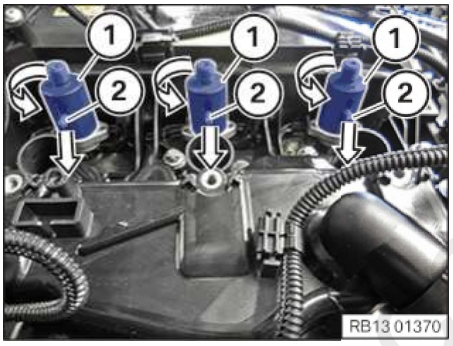


- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.

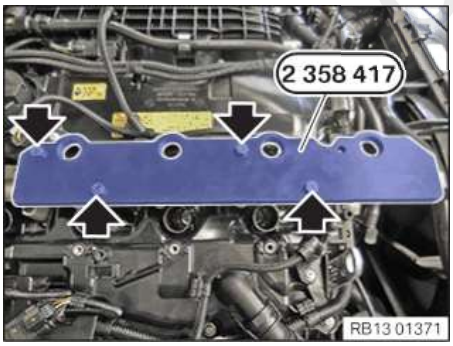


- Install all fixtures (1) for the injectors.

  The fixture (1) is not locked if the lever (2) is on the top.



- Turn fixtures (1) by 90° and lock the lever (2) downwards.



RISK OF DAMAGE

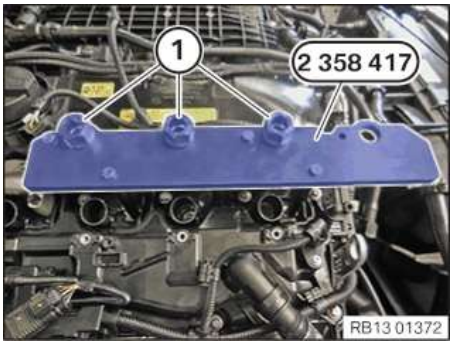
Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

- Attach special tool 2 358 417 to cylinder head.
- Hand-tighten the bolts (arrows).

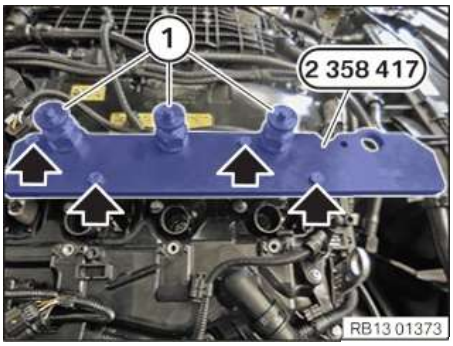
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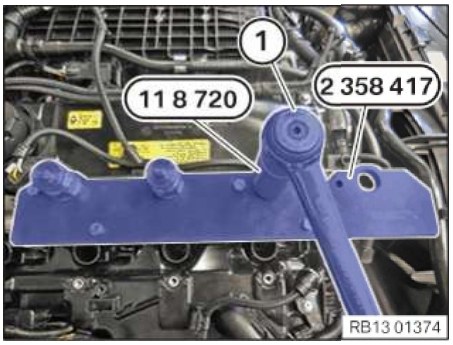
TECHNICAL INFORMATION

The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.



- Insert threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for injectors.
- Then tighten screws (arrows) on special tool 2 358 417 to 5 Nm.

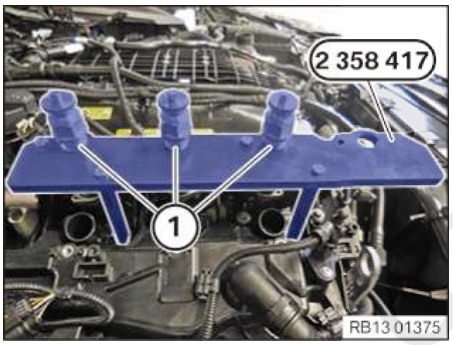


- Adjust torque wrench to 13 Nm **clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720)until the injector is pulled out.

TECHNICAL INFORMATION

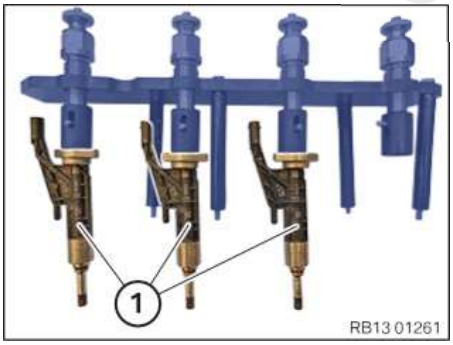
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

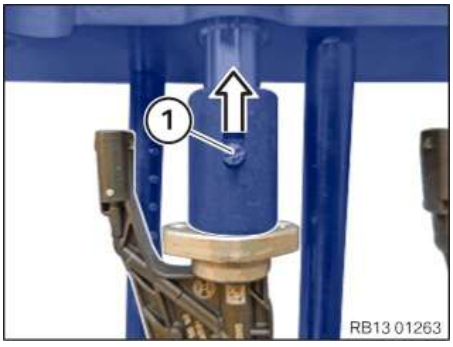


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  This can be recognised on the completely visible threads of the sleeves (1).
- Loosen screws on special tool 2 358 417.



- Carefully remove the special tool 2 358 417with injectors (1) from the cylinder head vertically upwards.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat on a clean table.

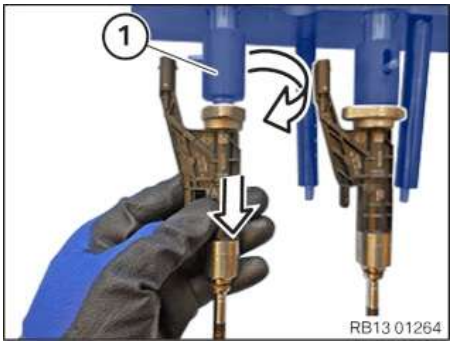


NOTICE

The description is for one component only. The procedure is identical for all further components.

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture (1) by 90°.
- Release and remove the injector downwards.

28 – Removing rail with injectors of cylinders 4 to 6

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

Damage to the ignition coil.

The silicone hose of the ignition coil must not be contaminated by fuel as this can lead to failure of the ignition coil.

- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

Damage to injectors.

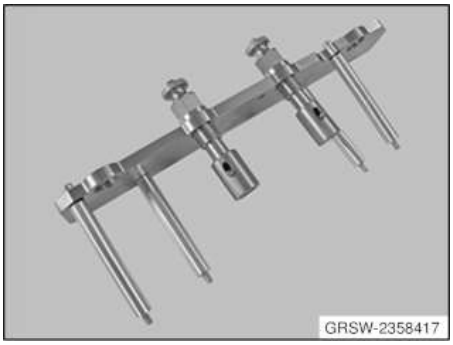
Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.



- Prepare special tool .

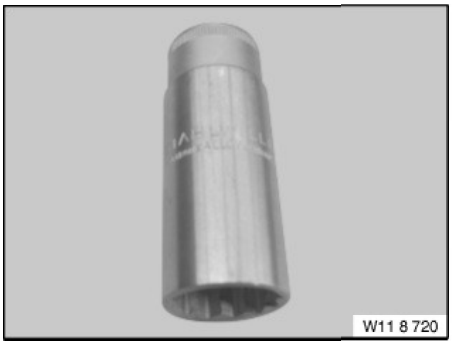
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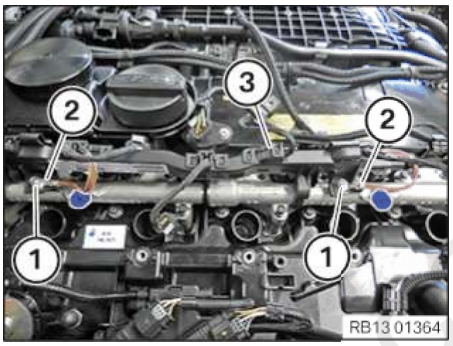
- Prepare special tool 2 358 417.



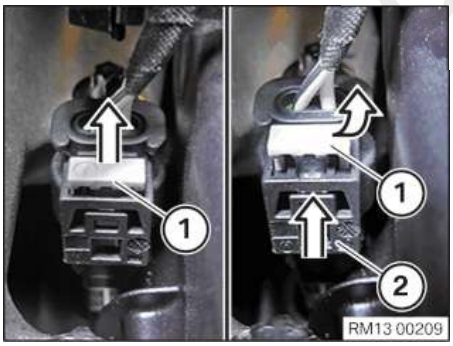
- Prepare special tool .



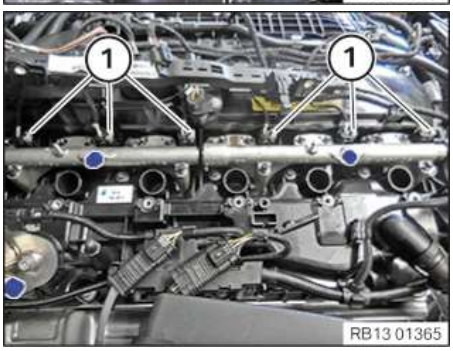
- Prepare special tool 0 496 106 (11 8 720).



- Release nuts (1) .
- Feed out ground cable (2) and set aside.
- Feed out cable channel (3) and set it aside.

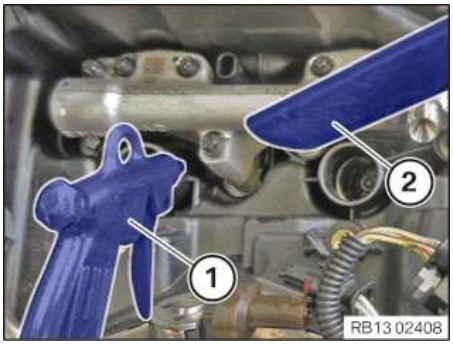


- Unlock lock (1) in direction of arrow upwards.
- Press lock (1) together and release.
- Disconnect the connector (2) from the injectors in the direction of the arrow.



- Unlock and release all connectors (1) of the injectors.

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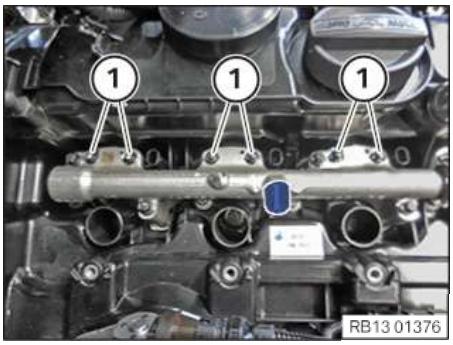


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

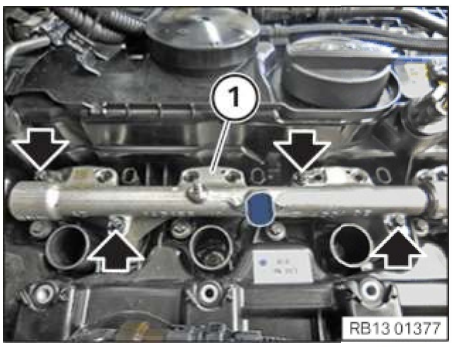
For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

- Before releasing the high pressure lines: Blow out the injector shaft with an air gun (1) with less pressure.
- Simultaneously, draw the dirt particles off **using an** explosion proof (2) vacuum cleaner.



- Release screws (M5x30) (1).
- Remove screws (M5x30) (1) .

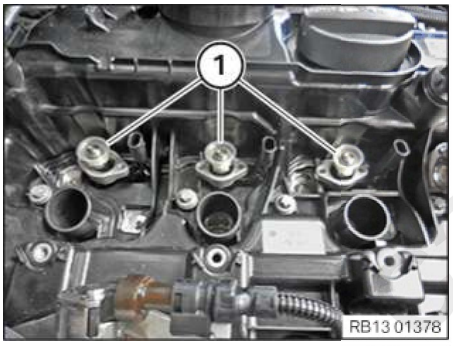
  Do **not** reuse screws (M5x30) (1).
- Catch and dispose of escaping fuel with suitable materials.



- Release screws (M6x30) (arrow).
- Remove screws (M6x30) (arrows).

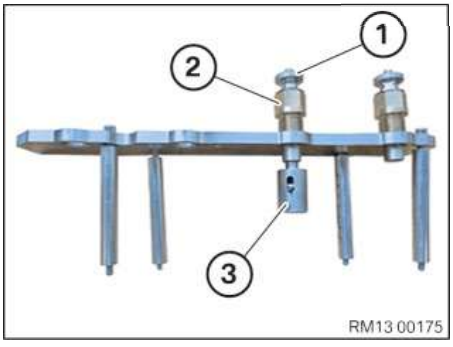
  Do **not** reuse the screws (M6x30).
- Remove rail (1) upwards.

  The injectors remain in the cylinder head.



- Remove seals (1) .

  The seals (1) are required during first assembly within the plant only and will not be installed again.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

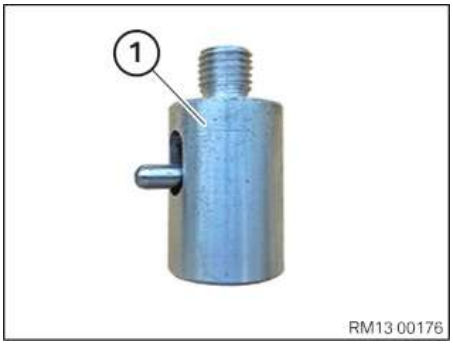
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use the special tool 2 358 417 to remove the injectors.

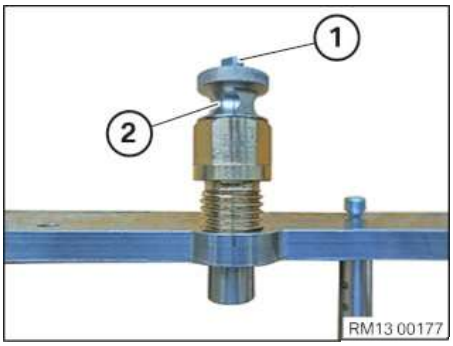
  The special tool 2 358 417 is used to ensure that the tensile force is not exceeded.

  The special tool 2 358 417 consists of:
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Mounting for the injectors

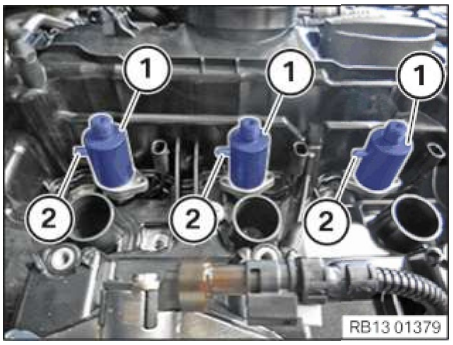
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- Unscrew the fixture for injectors (1) from special tool 2 358 417.

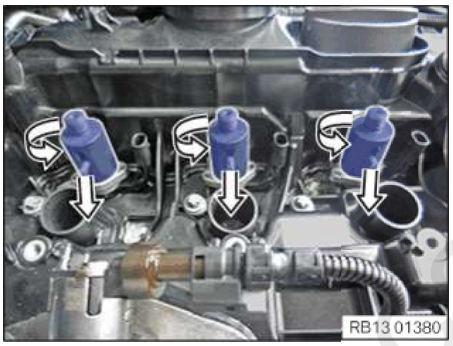


- Press lock (1) in and remove the threaded sleeve (2) from the special tool 2 358 417.



- Install all fixtures (1) for the injectors.

  The fixture (1) is not locked, if the lever is (2) on top.



- Turn fixtures (1) by 90° and lock the lever (2) downwards.



RISK OF DAMAGE

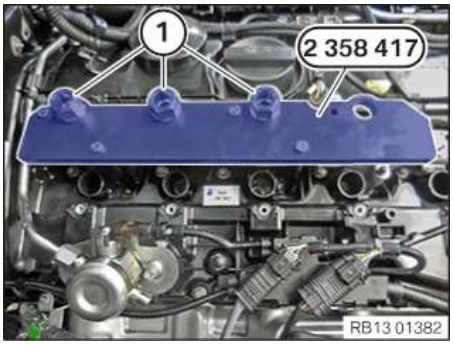
Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

- Attach special tool 2 358 417 to cylinder head.
- Hand-tighten the bolts (arrows).

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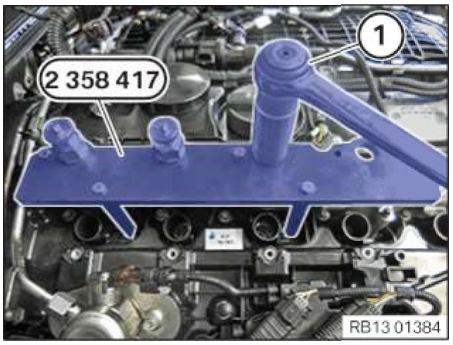
TECHNICAL INFORMATION

The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417 fully.



- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Then tighten screws (arrows) on special tool 2 358 417 to 5 Nm.

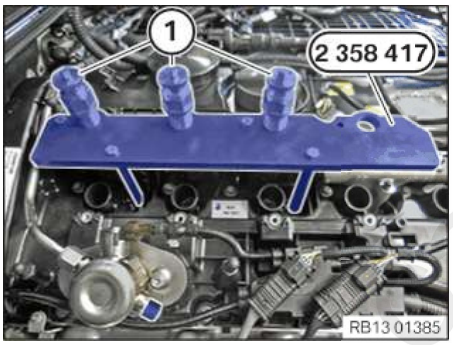


- Adjust torque wrench to 13 Nm **in clockwise** direction.
- Turn the torque wrench (1) with the special tool 0 496 106 (11 8 720) **clockwise**, until the injector is pulled out.

TECHNICAL INFORMATION

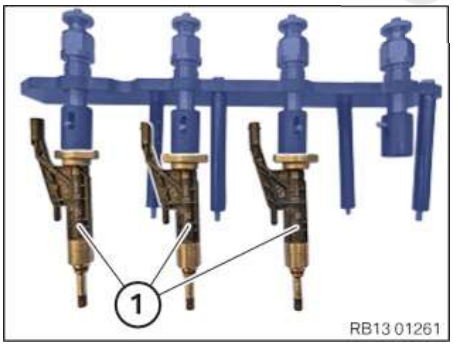
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

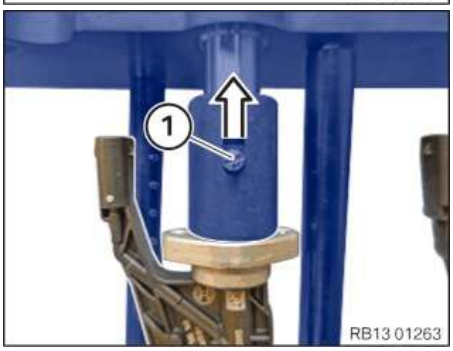


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  This can be recognised on the completely visible thread starts of the threaded sleeves (1).
- Loosen screws on special tool 2 358 417.



- Carefully remove the special tool 2 358 417 with the injectors (1) vertically straight up from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.

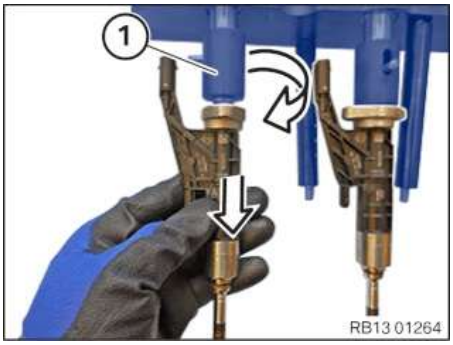


NOTICE

The description is for one component only. The procedure is identical for all further components.

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture(1) by 90°.
- Release and remove the injector downwards.

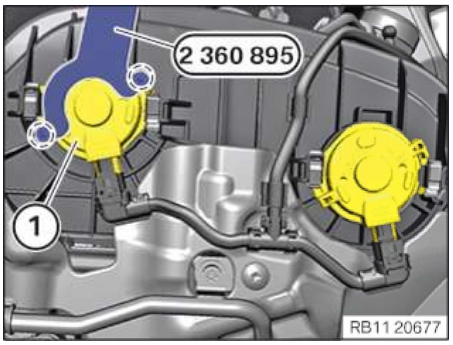
29 – Removing both actuators

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

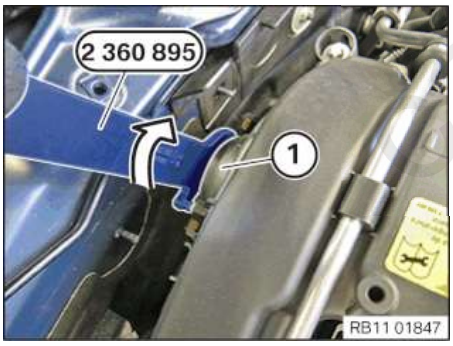
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



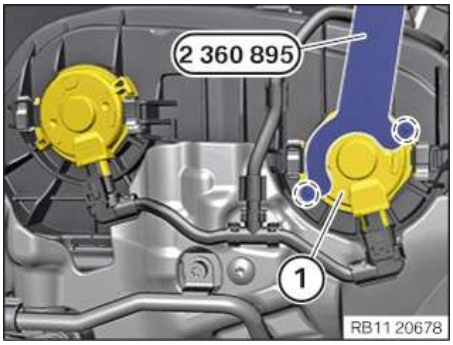
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.

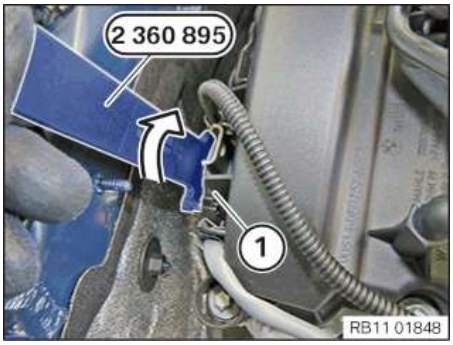


NOTICE

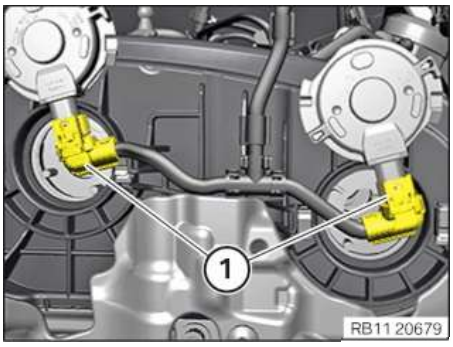
The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.

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- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



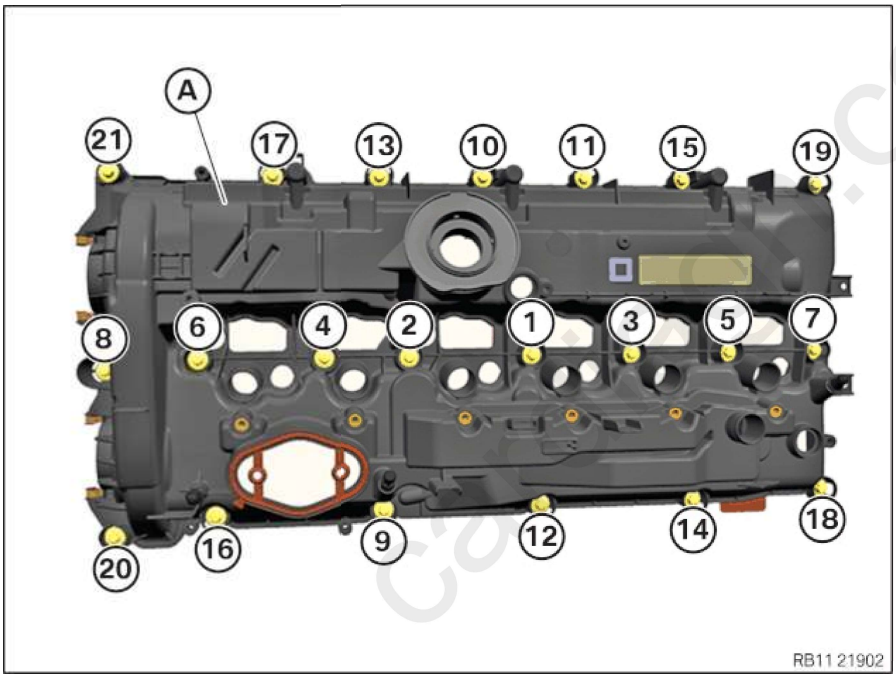
NOTICE

The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

30 – Removing the cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 21 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

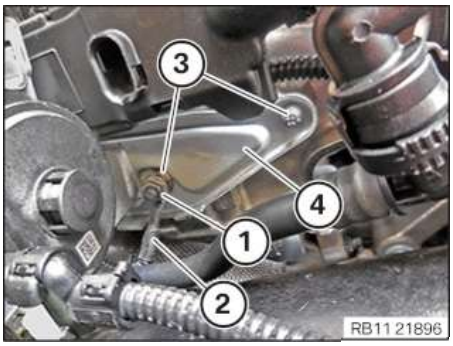
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

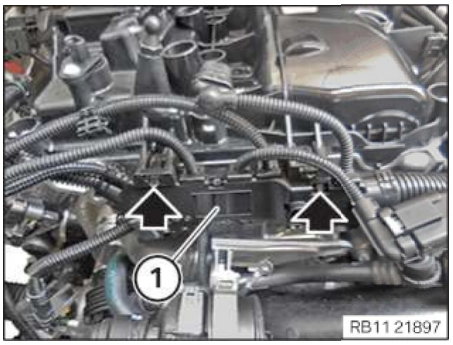
- Do not pull on the wires when disconnecting connectors and plug connections.



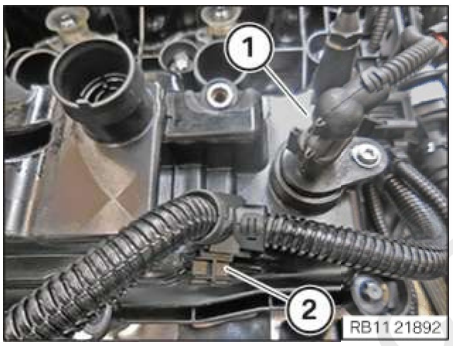
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



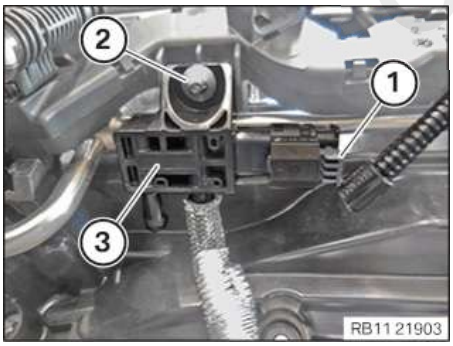
- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Loosen screws (3).
- Thread out holder (4) and set aside.



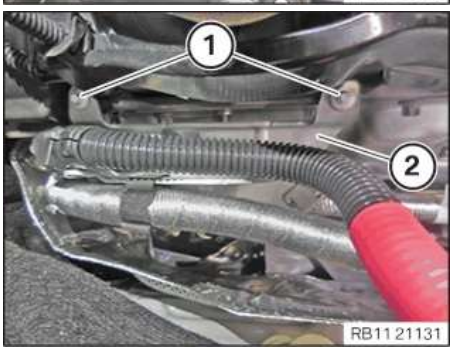
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for the sensor system **2** and place to one side.



- Unlock and detach connector (1) on exhaust camshaft sensor .
- Loosen clamp (2).

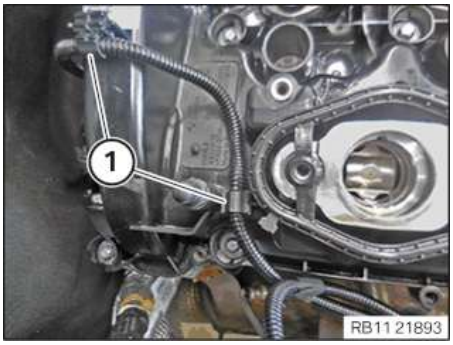


- **If installed:**
- Unlock and loosen connector (1).
- Loosen screw (2).
- Remove the differential pressure sensor (3) and put it to one side.

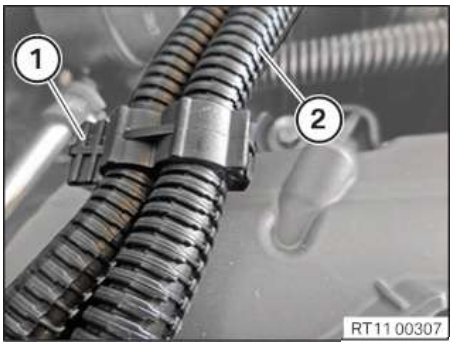


- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

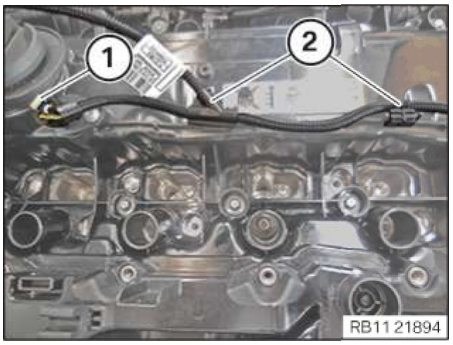
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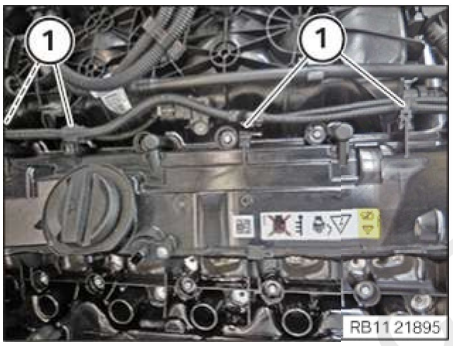
- Loosen clamps (1).



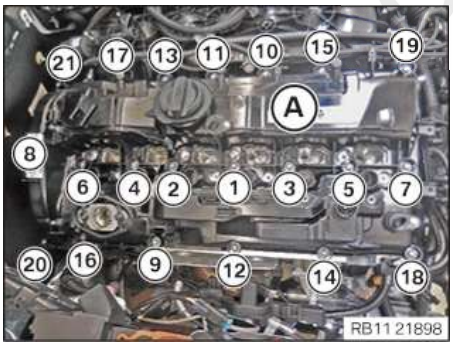
- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



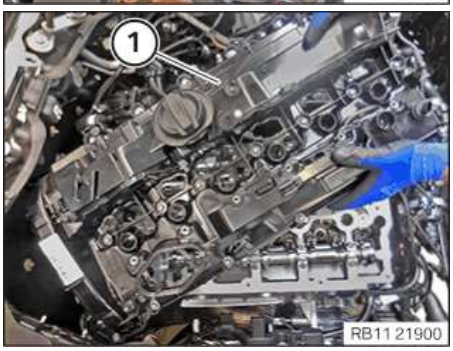
- Unlock and detach connector (1) on the intake camshaft sensor.
- Loosen clamps (2).



- Loosen clamps (1).



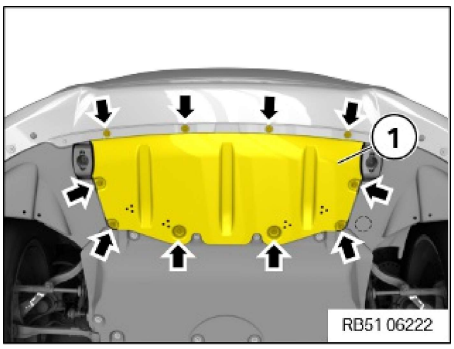
- Release all screws on the cylinder head cover (A) in the sequence (21) to (1).



- Guide the cylinder head cover (1) out and remove it.

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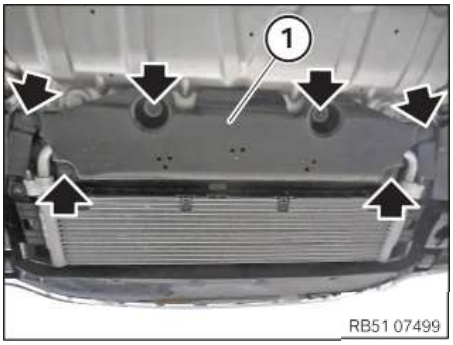
31 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

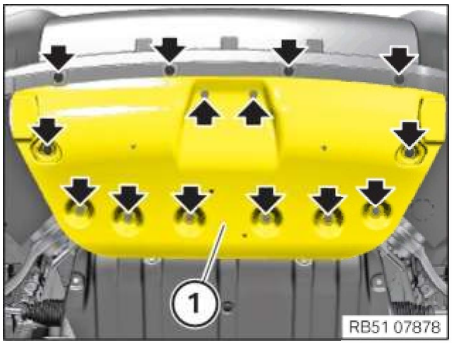
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.



- **Version 3:**

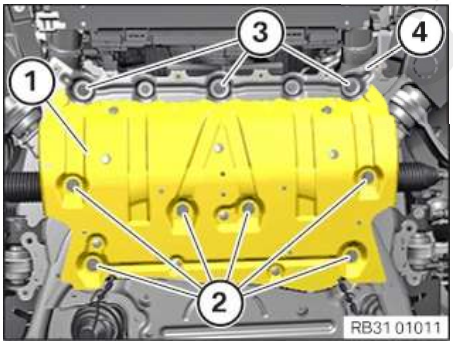
  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

32 – Removing the stiffening plate

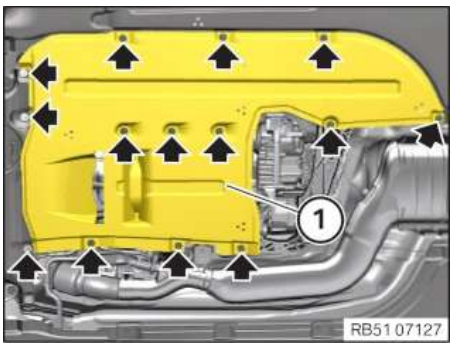
TECHNICAL INFORMATION

Driving without stiffening plate is not permissible.



- Loosen screws (3).
- Remove the holder of the underride protection (4).
- Loosen screws (2).
- Remove stiffening plate (1).

33 – Remove rear underbody protection

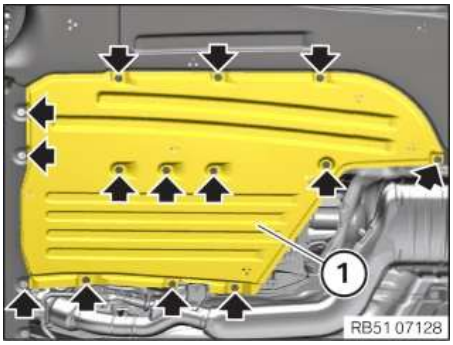


- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).

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- **Version 2:**

  Remove screws (arrows).

  Guide out rear underbody protection (1) and remove it.

34 – If installed: Partially release the engine oil cooler

WARNING

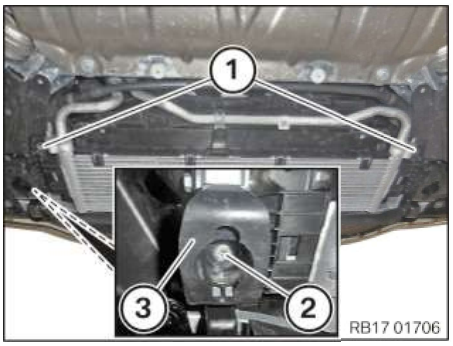
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

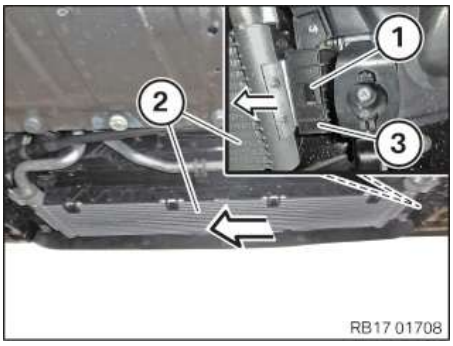
The work must be performed with care to prevent component damage.



- Loosen screws (1).
- Drill out rivet on the left (2).
- Remove the left-hand damper (3).

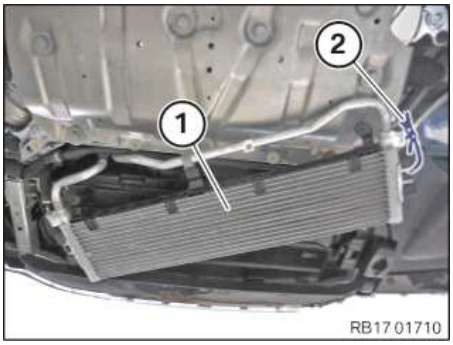


- Loosen screw (1).



- Unlock lock (1).
- Feed out engine oil cooler (2) from the holder in the direction of arrow (3) and place to one side.

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- Affix the engine oil cooler (1) with a cable strap (2) as shown.

35 – Draining the coolant from the low-temperature cooling system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

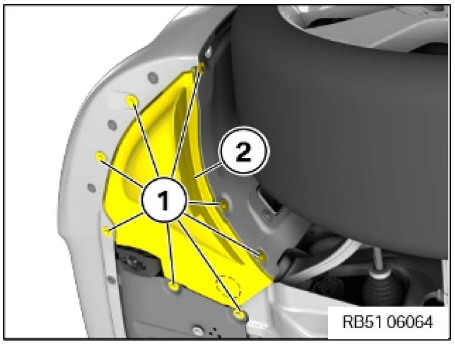
In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

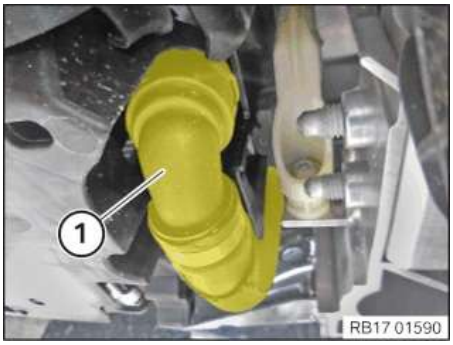


- Loosen sealing cap (1).



- Loosen screws (1).
- Guide out and remove bottom left cover (2) to the front.

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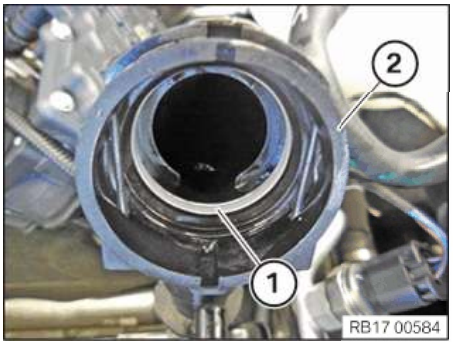


- Unlock and disconnect the coolant line (1).
- Catch and dispose of escaping coolant.

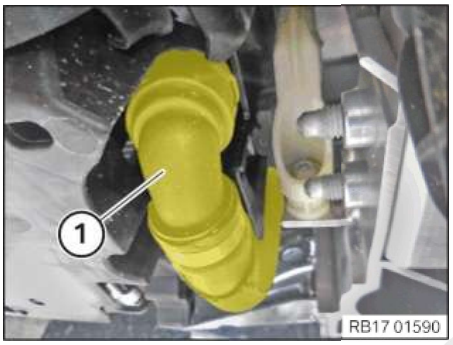
36 – Connecting the coolant lines for the low-temperature coolant circuit

TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

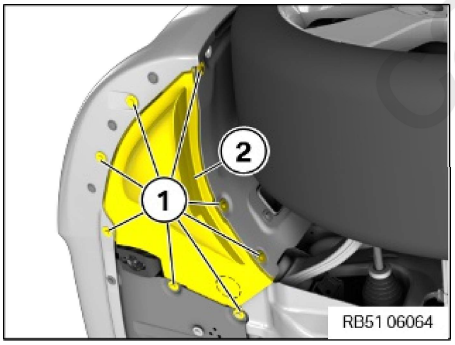


- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock the coolant line (1).

  The coolant line (1) must audibly engage.



- Feed in and install cover (2) at the bottom front left.
- Tighten the screws (1).

Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

37 – Remove tank vent valve

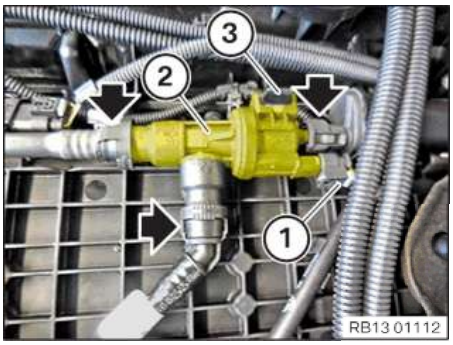
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RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Unlock and disconnect connector (1).
- Unlock and disconnect the tank ventilation lines (arrows).
- Detach and remove the tank vent valve (2) from the holder (3).

38 – Removing the intake plenum

RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

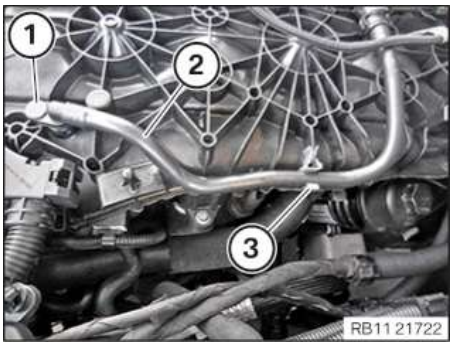
- Do not pull on the wires when disconnecting connectors and plug connections.

TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

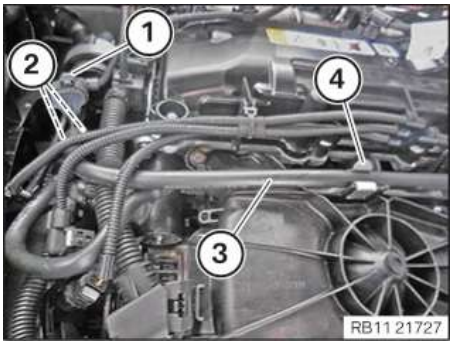
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

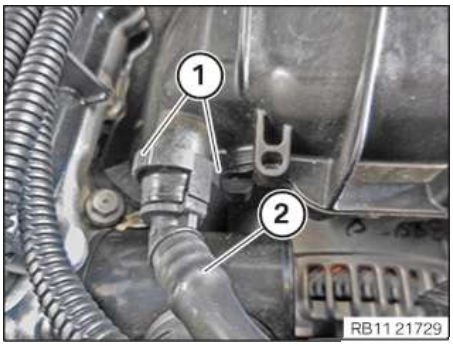


- Loosen screw (1).
- Guide tank ventilation line (2) out of clamp (3) and remove it.

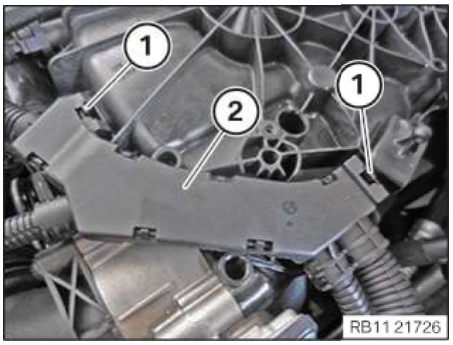
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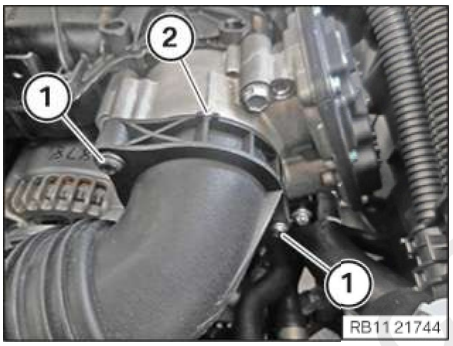
- Unlock and loosen connector (1).
- Unlock the locks (2).
- Guide tank ventilation line (3) out of clamp (4) and remove it.



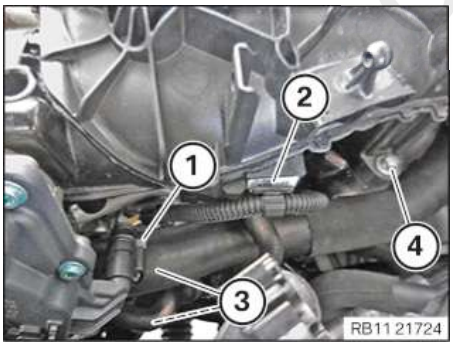
- Unlock the locks (1).
- Feed the tank ventilation line (2) out and set it aside.



- Unlock the locks (1).
- Guide out the wiring harness section (2) for the sensor system **2** and place to one side.



- Loosen screws (1).
- Feed out charge air line (2) and place to one side.

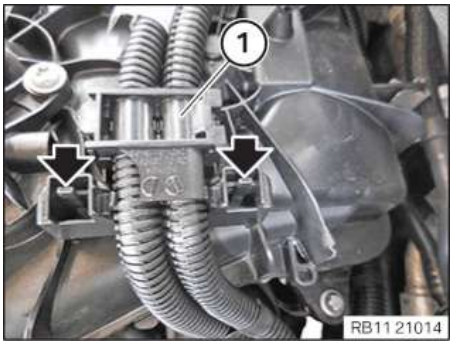


- Unlock and loosen connector (1).
- Loosen clamp (2).
- Thread off coolant line (3) and place to the side.
- Loosen screw (4).

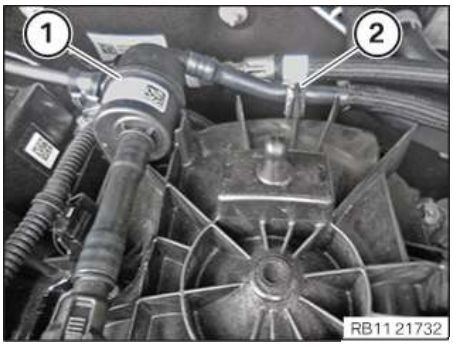


- Unlock and loosen connector (1).

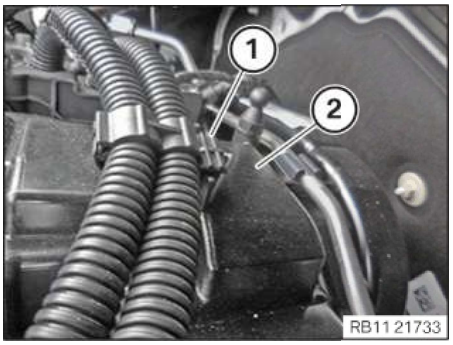
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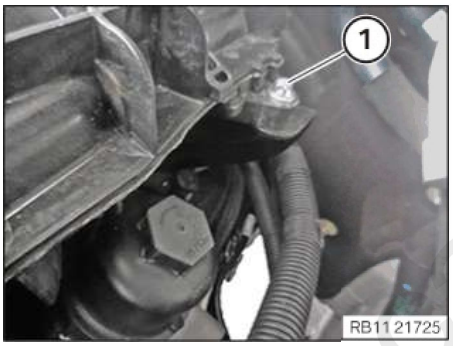
- Unlock the locks (arrows).
- Thread out the wiring harness section (1) for the injectors and ignition coils and set it aside.



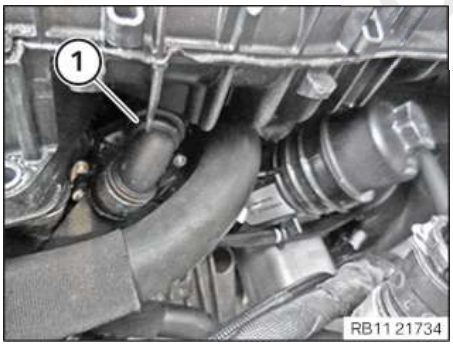
- Guide tank ventilation line (1) out of clamp (2) and place it aside.



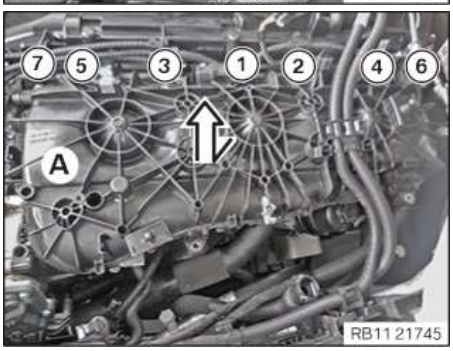
- Guide out the wiring harness section (1) for the injectors and ignition coils of the cylinder head cover (2) and set it aside.



- Loosen screw (1).

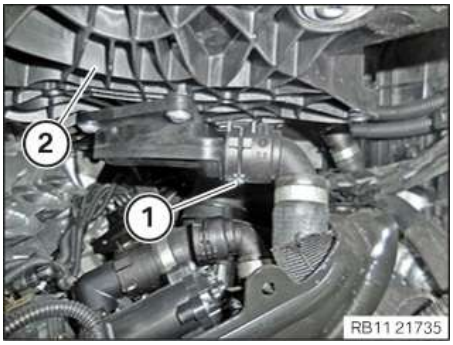


- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.



- Loosen screws in the order (7) to (1).
- Slightly raise intake plenum (A) in direction of arrow.

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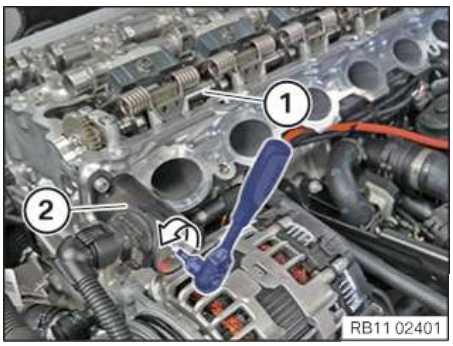


TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

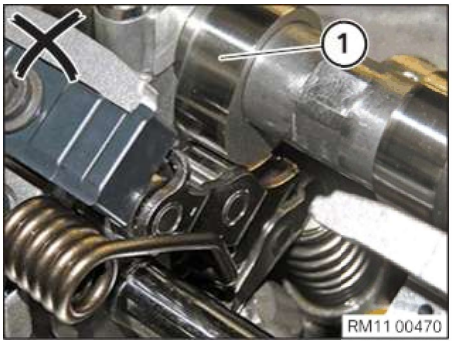
- Unlock and release coolant line (1) below the intake plenum (2).
- Catch and dispose of escaping coolant.
- Thread out intake plenum (2) and remove.

39 – Adjusting eccentric shaft on minimum lift



- Use servomotor (2) to adjust eccentric shaft (1) slowly to minimum lift.

40 – Checking the position of the intake camshaft



Check

- Check position of the intake camshaft on the respective cylinders.

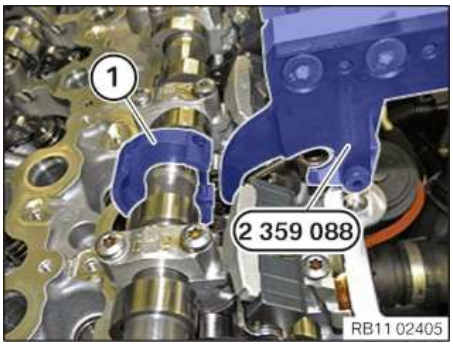
Result

» Cam (1) of the intake camshaft runs on the intermediate lever.

Measure

- Continue to turn the engine at the vibration damper with the special tool 0 493 380 (11 6 480) in the direction of engine rotation.

41 – Check the position of the intake camshaft at cylinders 3 and 4



Check

- Check the position of the intake camshaft at cylinders 3 and 4.

  To remove the torsion spring on cylinder 3 and 4 the camshaft sensor wheel (1) of the intake camshaft must be positioned as shown.

Result

» Camshaft sensor wheel (1) of the intake camshaft is not in the indicated position.

Measure

- Turn engine on the vibration damper using special tool 0 493 380 (11 6 480) till the camshaft sensor wheel (1) of the intake camshaft is positioned as shown.

42 – Remove all torsion springs

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CAUTION

Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

TECHNICAL INFORMATION

- Wear safety goggles.

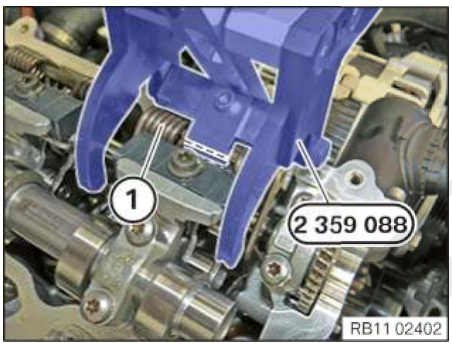
NOTICE

The description is for one component only. The procedure is identical for all further components.

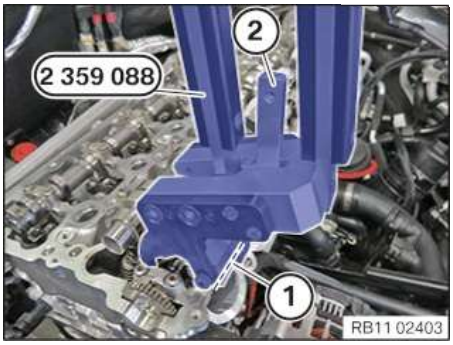


- Have the set of special tools 2 359 088 ready.

Number	Description
1	Clamping lever
2	Mounting for clamping lever (fitting aid)



- Open the special tool 2 359 088 and position it at the torsion spring (1).



- Ensure that the special tool 2 359 088 lies flat in the area (1) on the cylinder head.
- Carefully close the clamping lever of the special tool 2 359 088 until the retaining hook (2) engages.

Check

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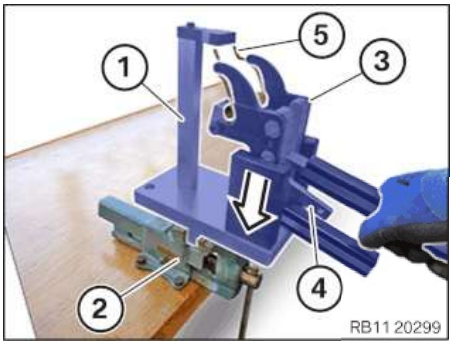
- Check if the special tool 2 359 088 is positioned correctly on the torsion spring.

Result

» Special tool 2 359 088 is not positioned correctly on the torsion spring.

Measure

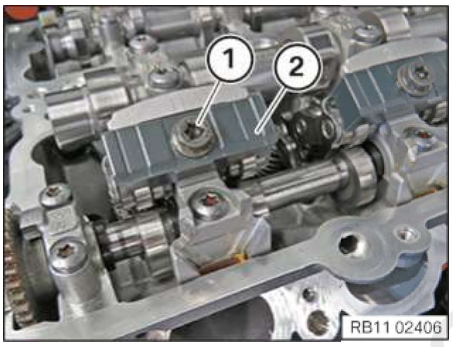
- Carefully release the clamping lever of the special tool 2 359 088 and repeat the process.



- Clamp fixture (1) of the special tool 2 359 088 in the vice (2).
- Position clamping lever (3) of special tool 2 359 088 with pre-tensioned torsion spring (5) in direction of arrow in the mounting (1) of the special tool 2 359 088.
- Carefully unlock retaining hook (4) of the special tool 2 359 088.

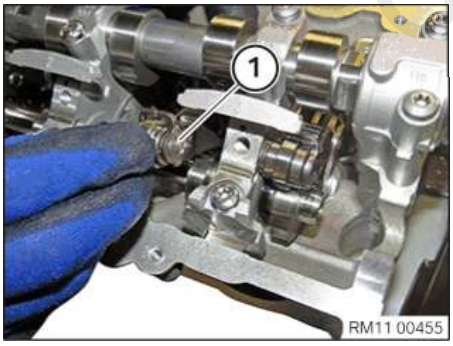
  The torsion spring (5) is relieved.
- Slowly open clamping lever (3) and remove the torsion spring (5).
- Place torsion spring (5) neatly into special tool 0 495 105 (11 4 480).
- Repeat the operations for the remaining torsion springs.

43 – Removing all gates



- Loosen screw (1).
- Remove the gates (2) and place it arranged in order in the special tool 0 495 105 (11 4 480) .
- Repeat the step for all the gates.

44 – Removing all intermediate levers



- Remove the intermediate lever (1) and arrange it in the special tool 0 495 105 (11 4 480) in order.
- Repeat the step for all intermediate levers (1).

45 – Block the engine with the special tool in TDC firing position

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- Thread the sealing cap (1) out and remove.



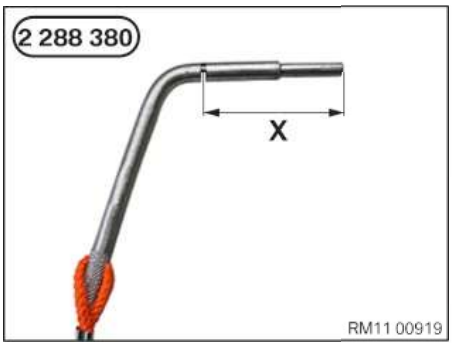
RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

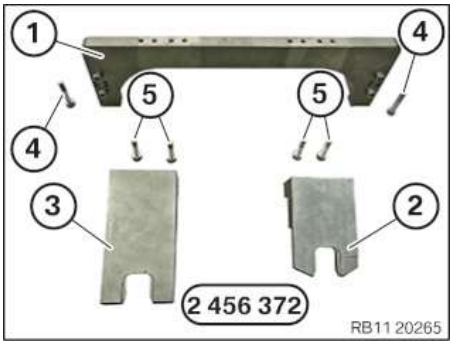
  The TDC firing position of cylinder 1 was **not** reached.



- **Vehicles with automatic transmission:**

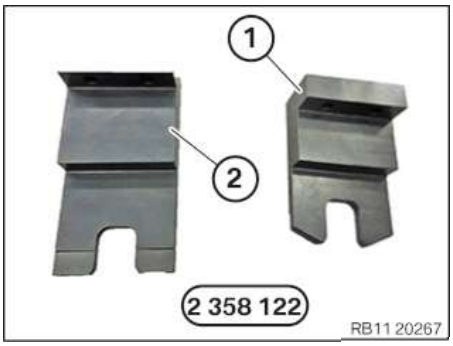
  Special tool 2 288 380 **correctly** positioned.

  The engine is in the TDC firing position of cylinder 1.



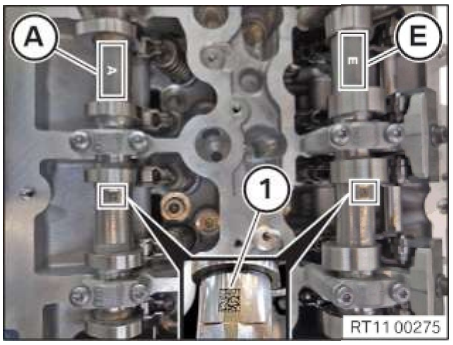
- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

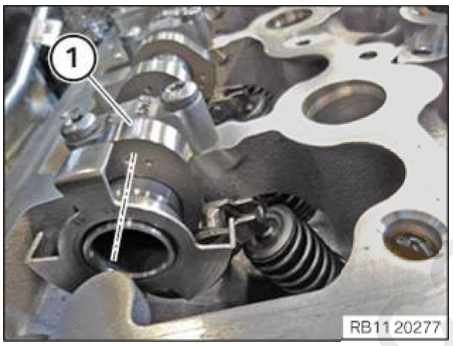


- Overview of the test gauges from the set of special tools 2 358 122:

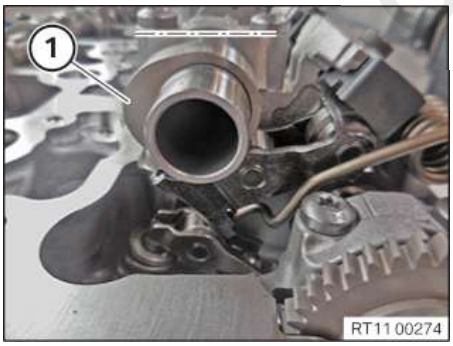
Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



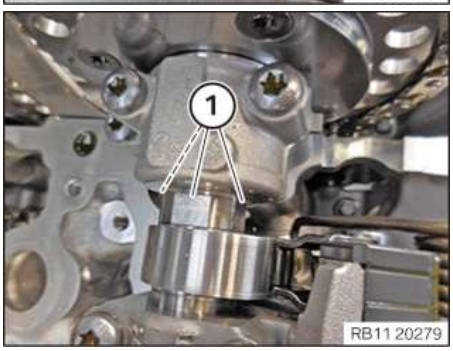
- Turn intake camshaft (E) and exhaust camshaft (A) until marks (1) can be read from the top.



- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.

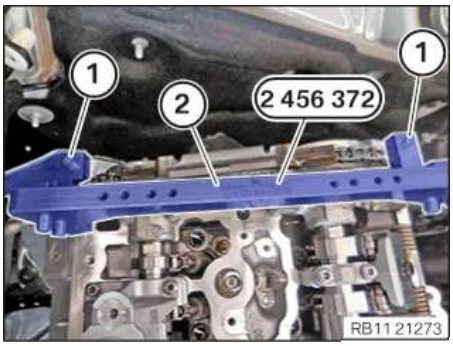


- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.

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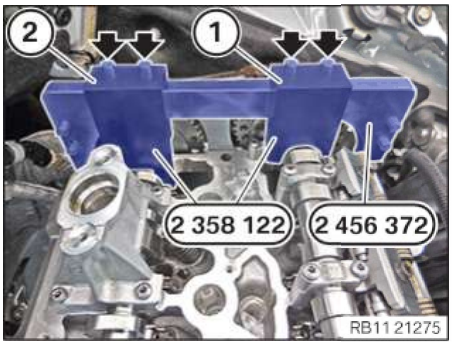
- Position basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

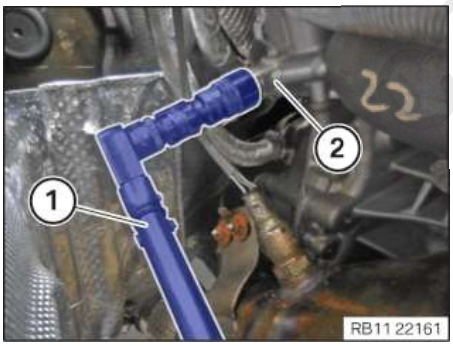
Test gauge to basic carrier

M6		Tightening torque	8 Nm

46 – Removing chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).



- Feed out and remove the chain tensioner (1).

47 – Releasing the VANOS central valve of the intake adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.



NOTICE

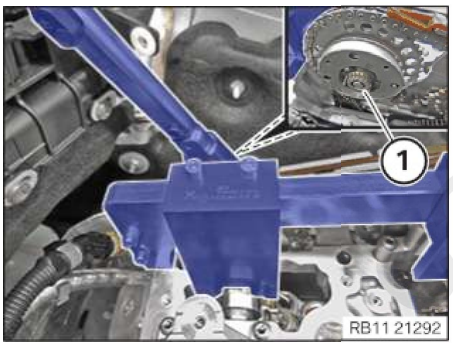
The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the intake adjuster.

48 – Releasing VANOS central valve of the exhaust camshaft adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

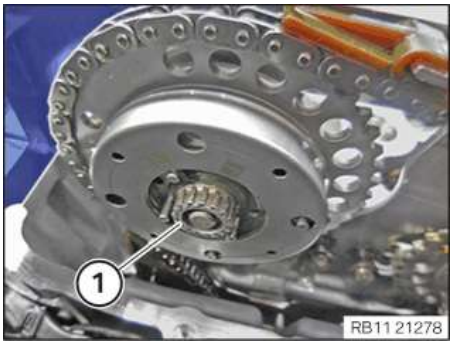


NOTICE

The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

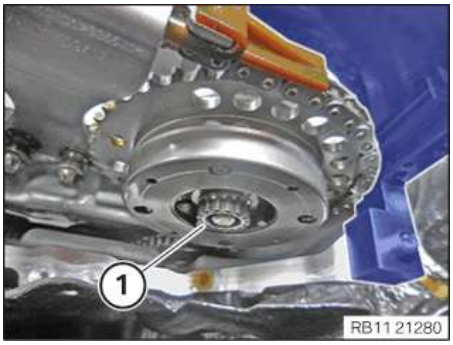
49 – Removing the VANOS central valve of the intake adjuster



- Guide out and remove the VANOS central valve (1) of the intake adjuster.

50 – Remove the VANOS central valve of the exhaust camshaft adjuster

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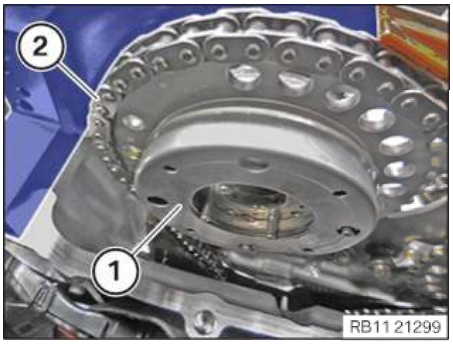


- Guide out and remove the VANOS central valve (1) of the exhaust camshaft adjuster.

51 – Removing intake adjuster

NOTICE

The figure shows the rear side of the engine.

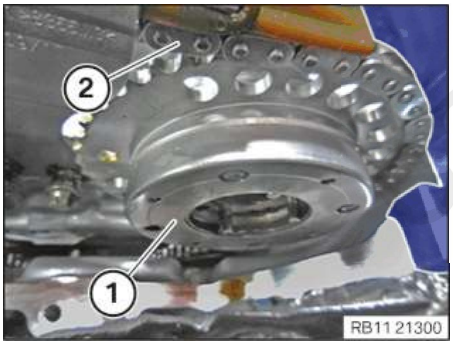


- Guide out the intake adjuster (1) from the timing chain (2) and remove.

52 – Remove exhaust camshaft adjuster

NOTICE

The figure shows the rear side of the engine.



- Guide out the exhaust camshaft adjuster (1) from the timing chain (2) and remove.

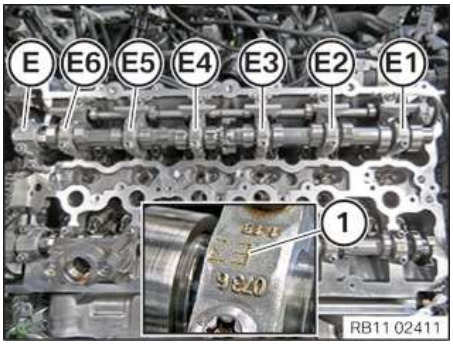
53 – Remove the test gauges to fix the camshafts



- Remove screws (arrows).
- Guide out and remove test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier of the set of special tools 2 456 372.
- Guide out and remove test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier of the set of special tools 2 456 372.

54 – Remove intake camshaft

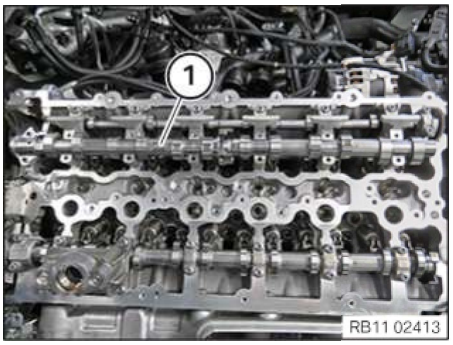
cardiagn.com



- Observe numbering of intake camshaft bearing caps from (E1) to (E6).
  Intake camshaft bearing cap (E) is a thrust bearing.

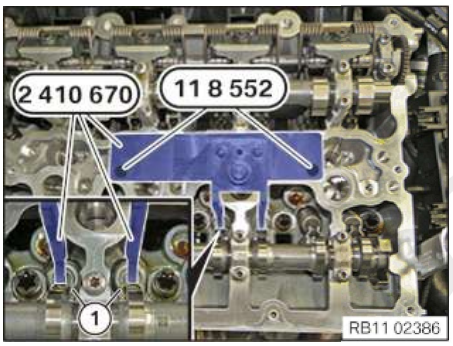


- Loosen screws in the order (14) to (1).
- Set all intake camshaft bearing caps neatly in the special tool 0 495 105 (11 4 480).

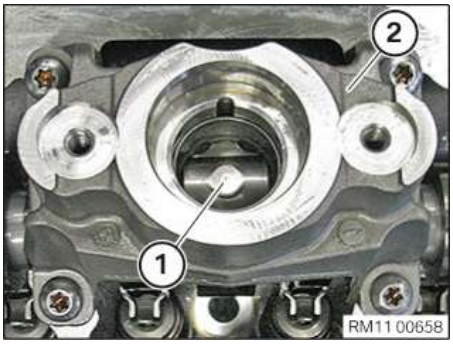


- Remove intake camshaft (1) in upward direction.

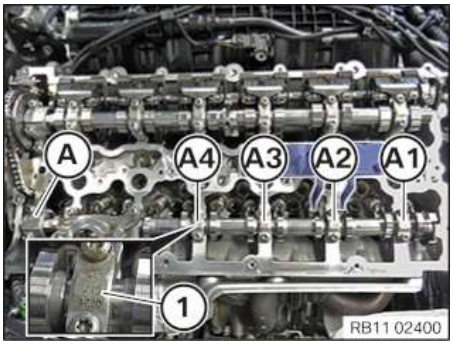
55 – Remove exhaust camshaft



- Position the special tool 2 410 670 at cylinder 2 and apply it hand-tight with the special tool 0 495 741 (11 8 552) from the set of special tools 0 495 739 (11 8 550).
- Screw in both roller cam followers (1) on cylinder 2 with the spindle nut of the special tool 2 410 670 to the stop.



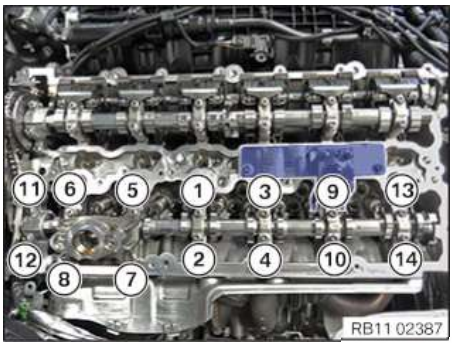
- Remove the roller tappet (1) from the high pressure pump bracket (2).



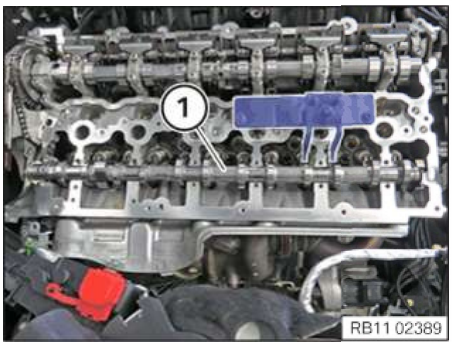
- Observe the numbering of the exhaust camshaft bearing caps.

  The exhaust camshaft bearing caps are numbered from (A1)till (A4).

  The exhaust camshaft bearing cap (A) is a thrust bearing.

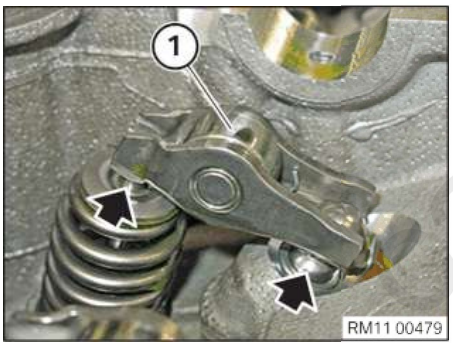


- Release screws in the right sequence (14) till (1) in semi circle pattern.
- Remove high pressure pump bracket and all exhaust camshaft bearing cap.
- Place all exhaust camshaft bearing cap in order in special tool 0 495 105 (11 4 480).

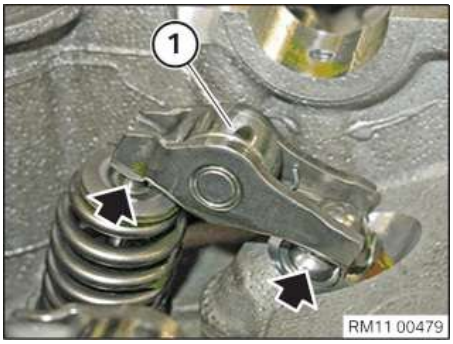


- (1)Remove exhaust camshaft in upward direction.

56 – Remove all roller cam followers



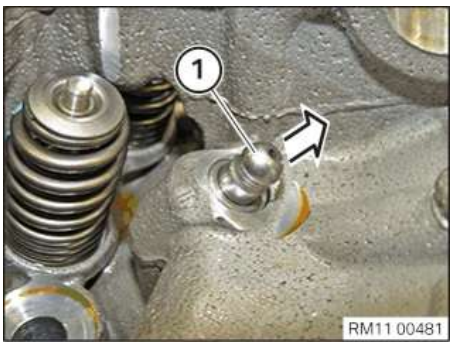
- Detach and remove the roller cam followers (1) on the intake side from hydraulic valve clearance compensating elements (arrows).
- Place all roller cam followers in order in special tool 0 495 105 (11 4 480).



- Detach and remove the roller cam followers (1) on the output side from hydraulic valve clearance compensating elements (arrows).
- Place all roller cam followers in order in special tool 0 495 105 (11 4 480).

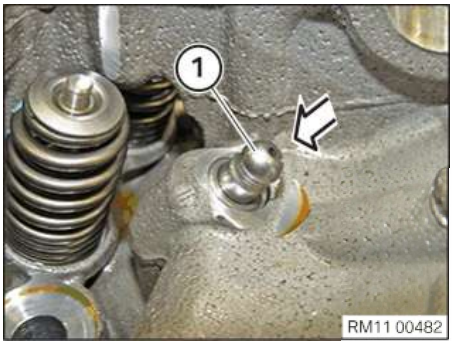
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57 – Removing all hydraulic valve clearance compensating elements



- Remove all hydraulic valve clearance compensating elements (1) to the top.
- Place all hydraulic valve clearance compensating elements, together with the rocker arms, orderly into the special tool 0 495 105 (11 4 480).

58 – Installing all hydraulic valve clearance compensating elements



TECHNICAL INFORMATION

If the hydraulic valve clearance compensating elements are reused, they must be reinstalled at the same position.

- Install all hydraulic valve clearance compensating elements (1).

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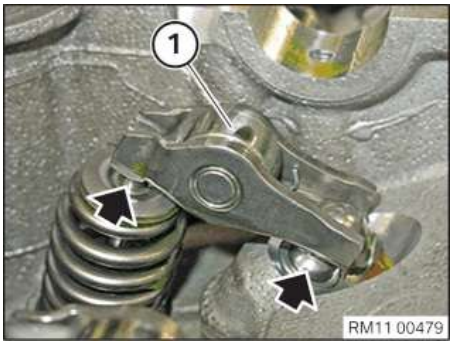
POSTPROCESSES

59 – Install all roller cam followers

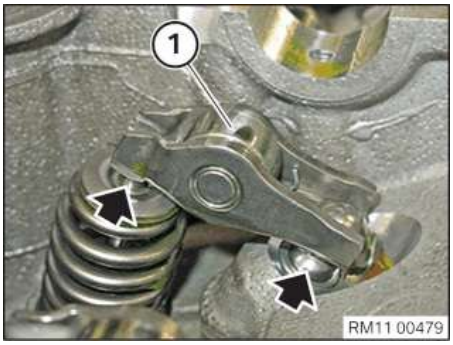


- The classification in digits from 1 to 5 has been printed on the roller cam follower.

Classification	Idle speed
1	Repair case - slow engine speed when idling
2	Installed as standard/initial installation
3	Installed as standard/initial installation
4	Installed as standard/initial installation
5	Repair case - high engine speed when idling



- Install the roller cam follower (1) on the intake side.
- Make sure the roller cam followers are correctly positioned on the hydraulic valve clearance compensating elements (arrows) and on the intake valves.

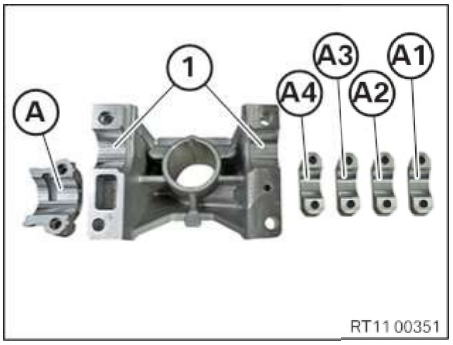


- Install the roller cam followers (1) on the exhaust side.
- Make sure the roller cam followers are correctly positioned on the hydraulic valve clearance compensating elements (arrows) and on the exhaust valves.

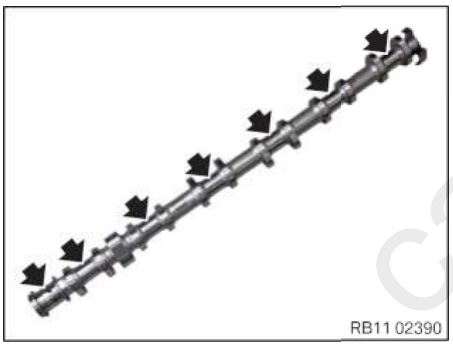
60 – Install exhaust camshaft



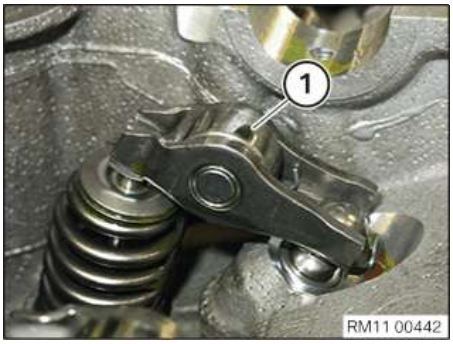
- Clean all the bearing positions (arrows).
- Coat all the bearing positions (arrows) with engine oil.



- Clean all bearing positions of exhaust camshaft bearing caps (A1), (A2), (A3), (A4) and (A) and coat with engine oil.
- Clean bearing positions (1) of the high pressure pump bracket and coat with engine oil.

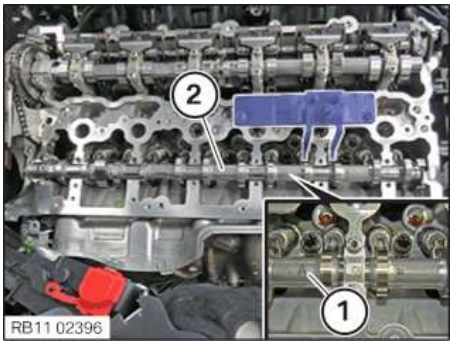


- Clean all the bearing positions (arrows) of the exhaust camshaft.
- Coat all the bearing positions (arrows) of the exhaust camshaft with engine oil.



- Check all roller cam follower (1) of the exhaust side for correct fit.

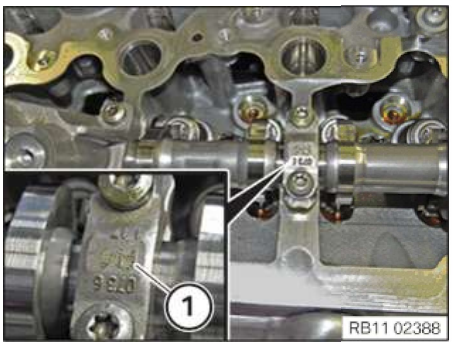
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- Insert exhaust camshaft (2) in the cylinder head, such that the mark (1) points upwards.



- Check the fitting sleeves (1) of the thrust bearing for damage and renew if necessary.
- Check the fitting sleeves (2) of the high pressure pump bracket for damage and renew if necessary.



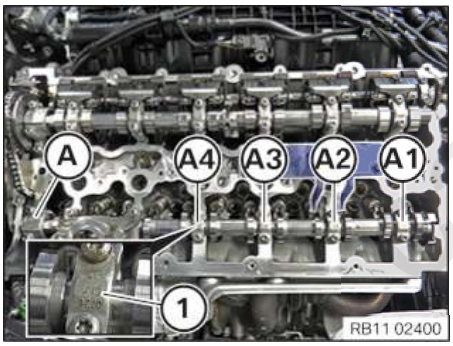
RISK OF DAMAGE

Engine damage caused by incorrectly installed bearing shells and bearing supports.

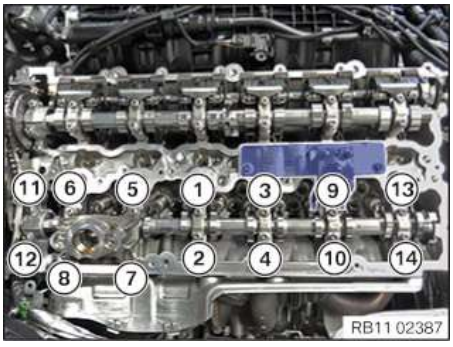
Engine damage may result from incorrectly installing bearing shells and bearing supports.

- Always install all bearing shells and bearing supports in the same position from which they were removed.

- Replace all exhaust camshaft bearing cap , that the labelling(1) from the intake side are readable.



- Oil all the exhaust camshaft bearing caps (A1) to (A4) and the exhaust camshaft bearing cap for the thrust bearing (A) with engine oil and place into position.
- Oil the bearing position at the high pressure pump bracket with engine oil and place the high pressure pump bracket into position.

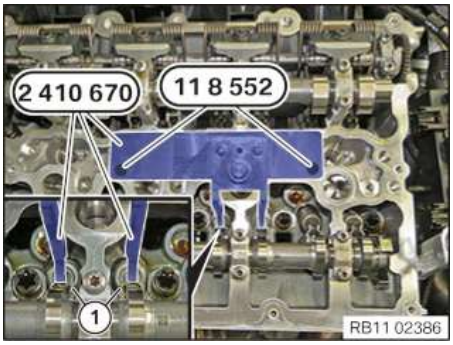


- Press down the exhaust camshaft bearing caps and hand-tighten the bolts incrementally in the sequence(1) to (14).
- Move up all screws in the sequence (1) to (14) **in half rotations.**
- **Adhere to the jointing torque.**
- Tighten all bolts in sequence (1) to (14) .

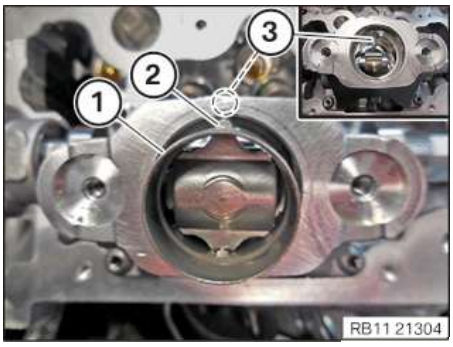
Exhaust camshaft to cylinder head

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

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- Relax special tool 2 410 670 above the spindle nut.
- Release special tools 0 495 741 (11 8 552) and remove the special tool 2 410 670.

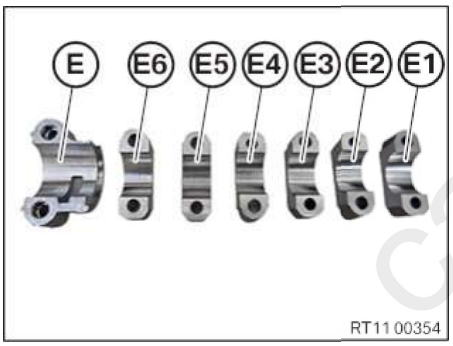


- Guide in and position roller tappet (1).
- Ensure that pin (2) is positioned correctly in guide (3).
- Feed in and install roller tappet (1).

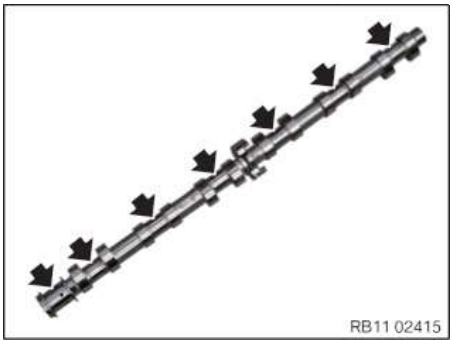
61 – Install intake camshaft



- Clean all bearing positions and coat with engine oil.

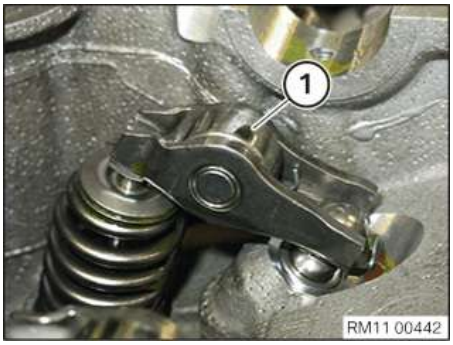


- Clean all bearing positions of intake camshaft bearing caps (E1),(E2),(E3),(E4),(E5),(E6) and (E) and coat with engine oil.

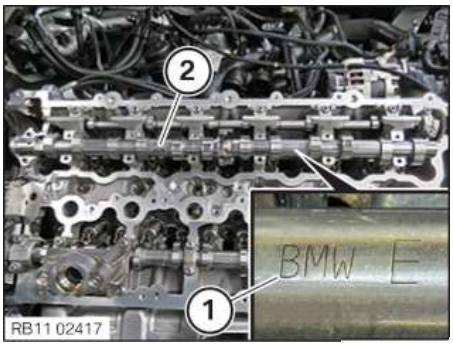


- Clean all bearing positions of the intake camshaft and coat with engine oil.

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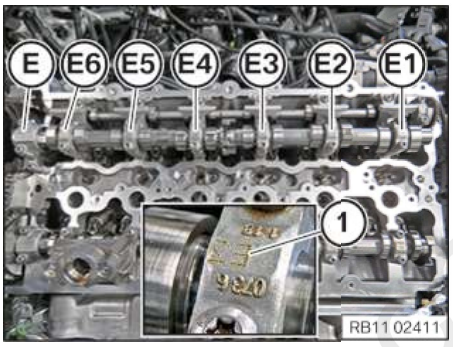
- Check all roller cam followers(1) of the intake side for correct fit.



- Insert intake camshaft (2) in the bearing supports in such a way that the mark (1) points towards the top.



- Check fitting sleeves (1) of the thrust bearing for damage, renew if necessary.



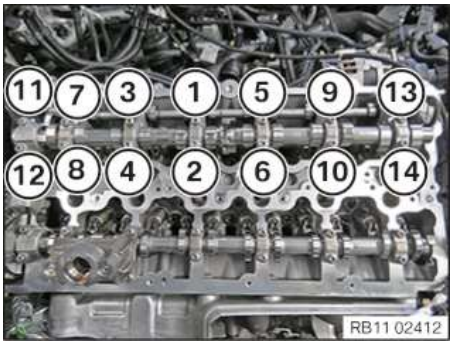
RISK OF DAMAGE

Engine damage caused by incorrectly installed bearing shells and bearing supports.

Engine damage may result from incorrectly installing bearing shells and bearing supports.

- Always install all bearing shells and bearing supports in the same position from which they were removed.

- Coat all the intake camshaft bearing caps(E1) till (E6) and lay the bearing caps for the thrust bearing(E) with *engine oil*.

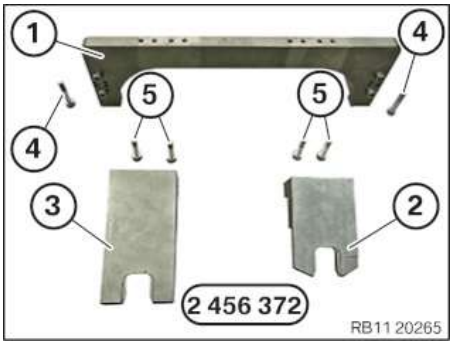


- Press intake camshaft bearing cap down and hand-tighten the bolts incrementally in sequence (1) to (14).
- Join all the screws in the sequence (1) to (14) **in half turns** .
- **Adhere to the jointing torque.**
- Tighten all screws in a sequence from (1) to (14) .

Intake camshaft to cylinder head

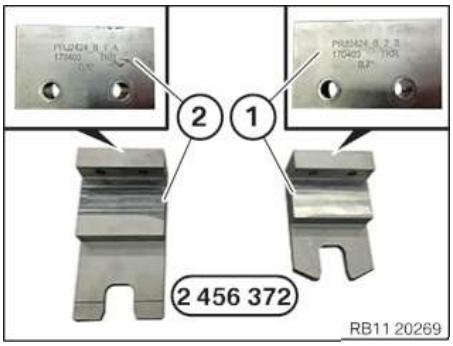
M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque.	10 Nm

62 – Adjust the camshafts with the special tool

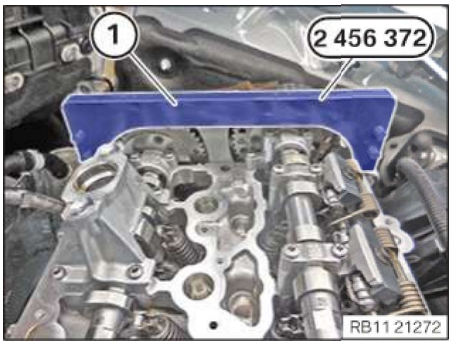


- Overview of the set of special tools 2 456 372:

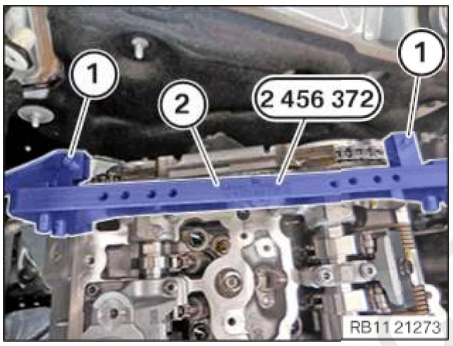
Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Use the setting gauge 0.7 ° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.



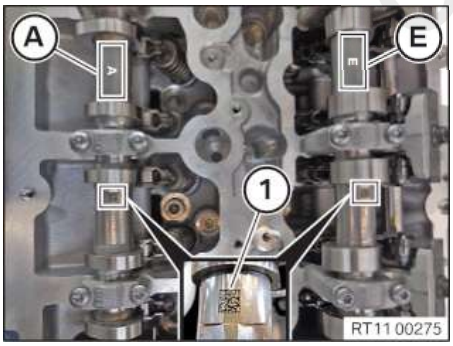
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



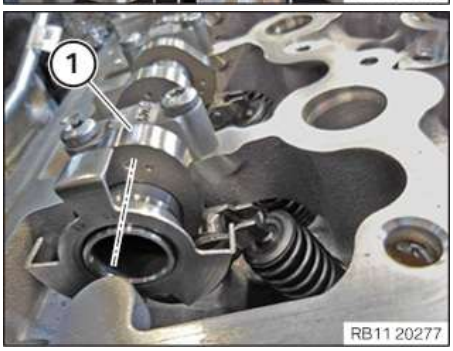
- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6	Tightening torque	8 Nm



- Turn the intake camshaft (E) and the exhaust camshaft (A) such that the marks (1) can be read from the top.

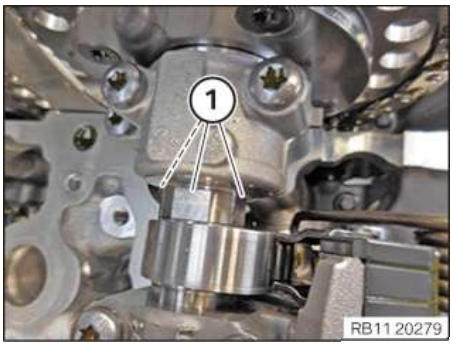


- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.

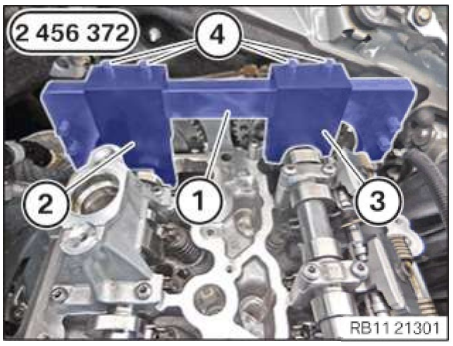
cardiagn.com



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



- Position the setting gauge 0.5° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten the screws (4).

Test gauge to basic carrier

M6		Tightening torque	8 Nm

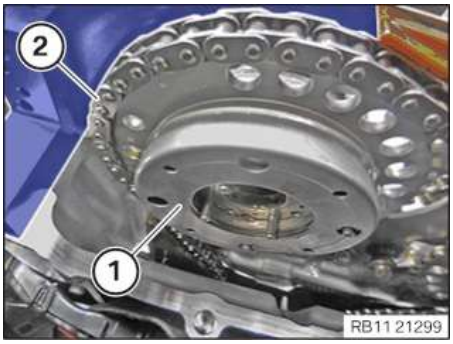
63 – Installing the intake adjuster

NOTICE

The figure shows the rear side of the engine.



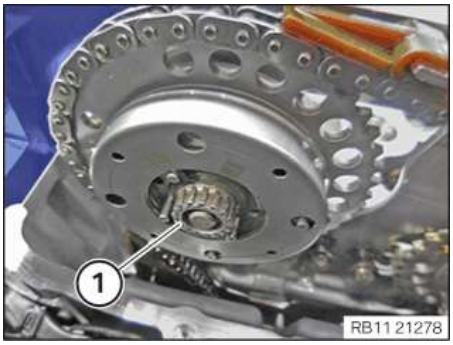
- Keep intake adjuster (1) marked IN ready.



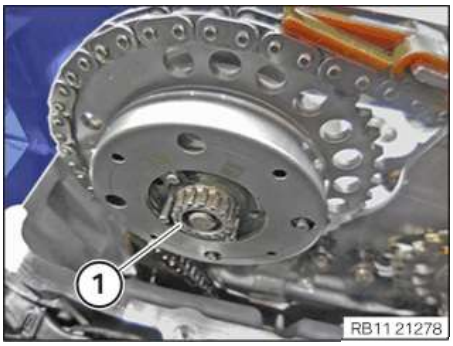
- Feed in intake adjuster (1) in the timing chain (2) and position on the intake camshaft .

64 – Install the VANOS central valve of the intake adjuster

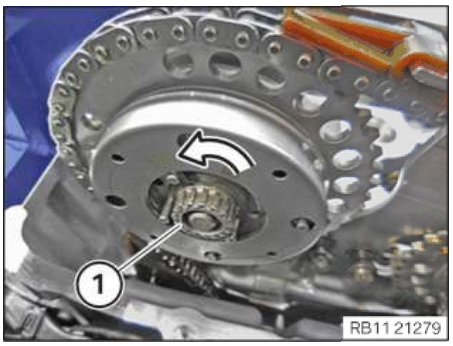
cardiagn.com



- Guide in the VANOS central valve (1) of the intake adjuster and install.



- Hand-tighten the VANOS central valve (1) of the intake adjuster.



- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

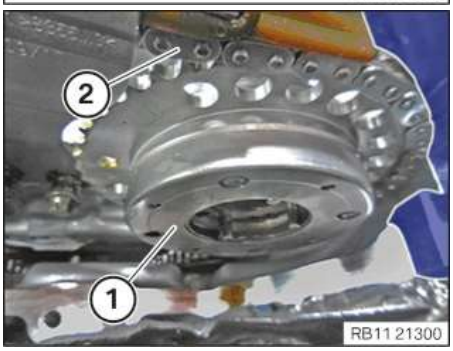
65 – Install exhaust camshaft adjuster

NOTICE

The figure shows the rear side of the engine.



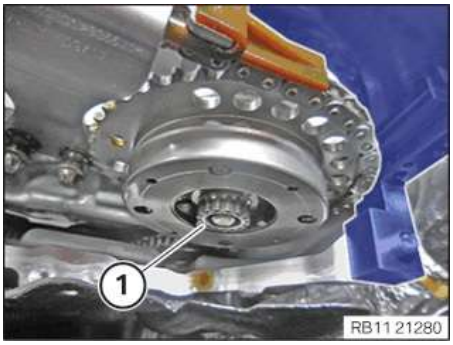
- Keep exhaust camshaft adjuster (1) marked EX ready.



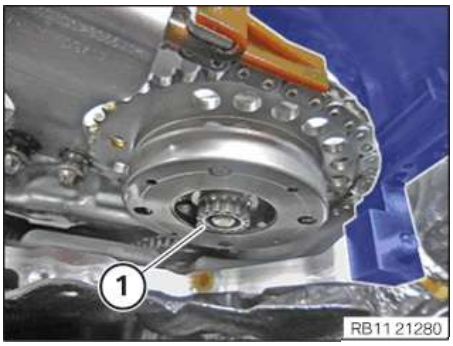
- Feed in exhaust camshaft adjuster (1) in the timing chain (2) and position on the exhaust camshaft .

66 – Installing the VANOS central valve of the exhaust camshaft adjuster

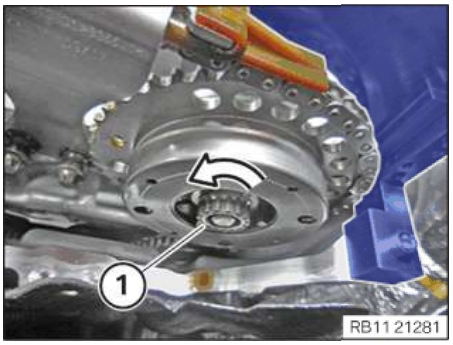
cardiagn.com



- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.

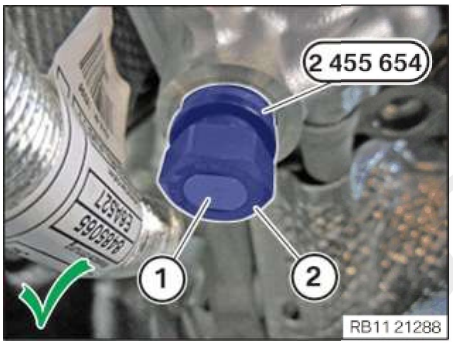


- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.



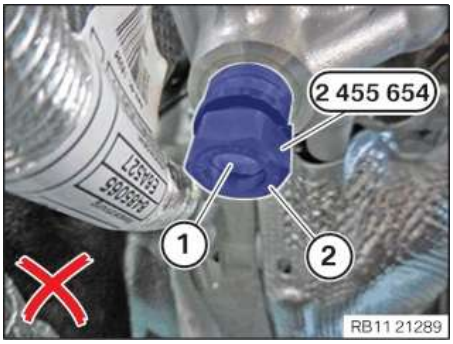
- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

67 – Pretension the timing chain with the special tool



- Make sure that the timing chain is **correctly** pre-tensioned with the special tool 2 455 654.

  The pin (1) must align **precisely** with housing (2).

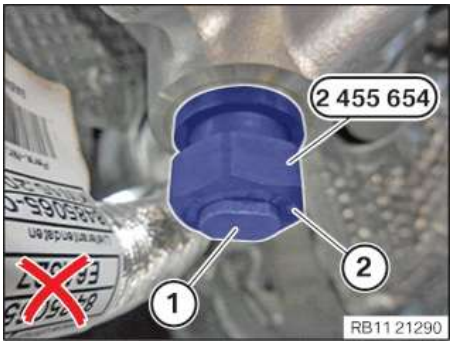


- Make sure that the preload of the timing chain is no **insufficient**.

  The preload is insufficient when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

bardiagn.com



- Make sure that the preload of the timing chain is not **too high**.

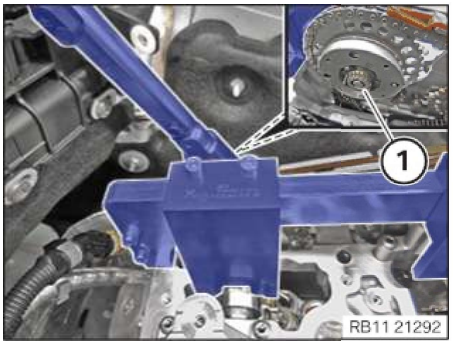
  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

68 – Tightening the VANOS central valve of the exhaust camshaft adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



- Tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

69 – Tightening the VANOS central valve of the intake adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



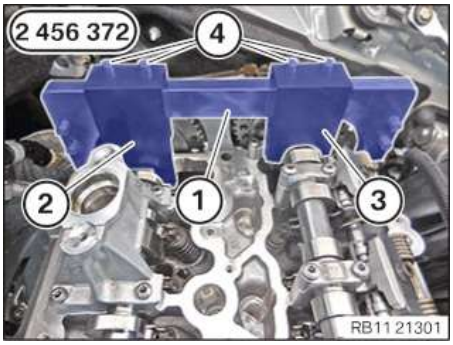
- Tighten the VANOS central valve (1) of the intake adjuster.

VANOS central valve to camshaft

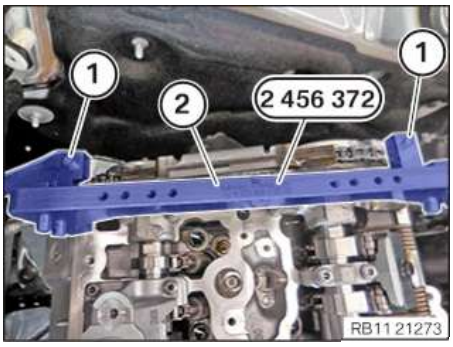
M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

70 – Disassembling all special tools

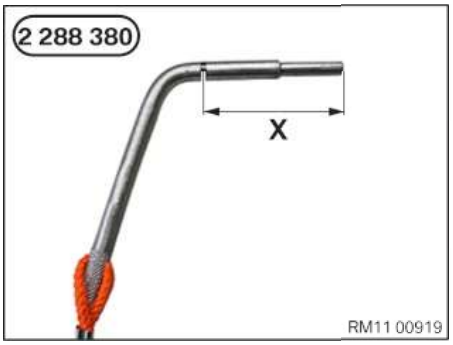
carDiagn.com



- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) and remove.



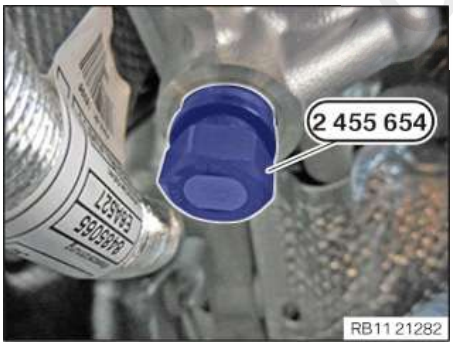
- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.



- Guide the special tool 2 288 380 out and remove.



- Guide the special tool 0 493 380 (11 6 480) out and remove.



- Guide the special tool (1)2 455 654 out and remove.

71 – Install chain tensioner

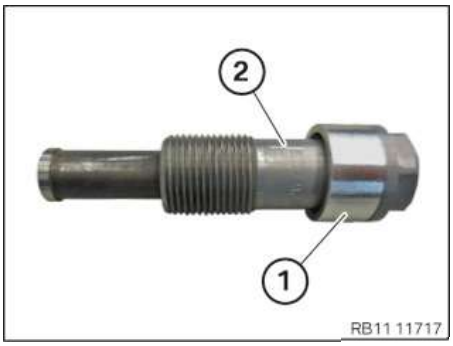
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.

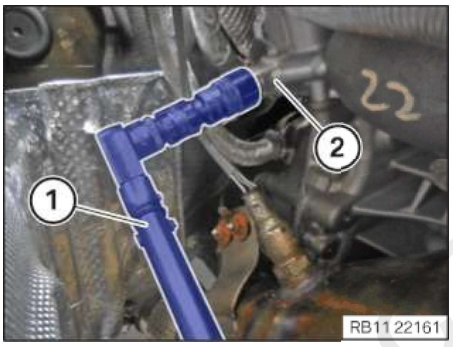


- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.



- Insert and install the chain tensioner (1).

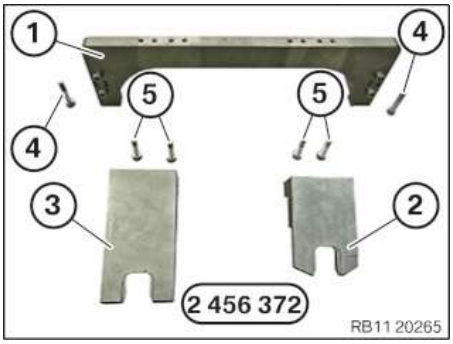


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

Chain tensioner	Tightening torque	20 Nm
	Angle of rotation	40 °

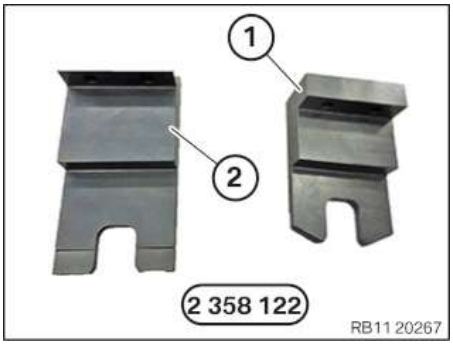
72 – Checking camshaft timing



- Have the set of special tools 2 456 372 ready.

Number	Description
1	Basic carrier
2	0.7° setting gauge to adjust the intake camshaft
3	0.5° setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

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- Keep the test gauge from the set of special tools 2 358 122 ready.

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



- Have the special tool 2 288 380 ready.

Number	Description
1	Locating stud



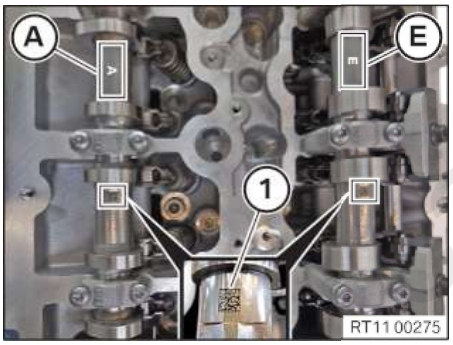
RISK OF DAMAGE

Damage to the engine.

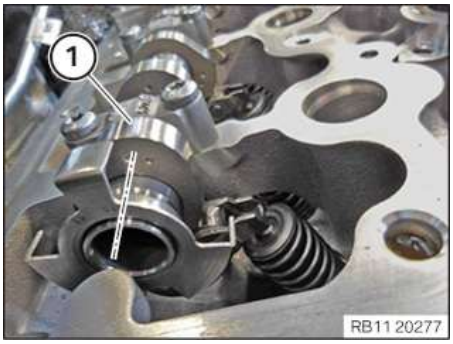
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



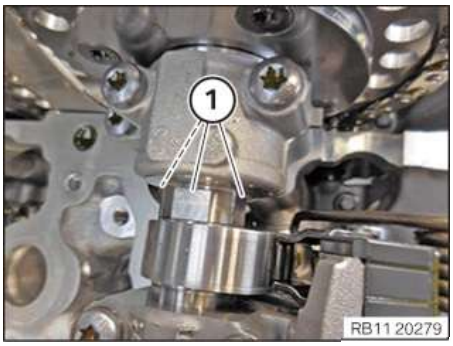
- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.



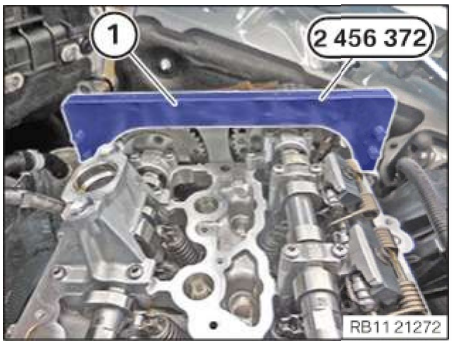
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



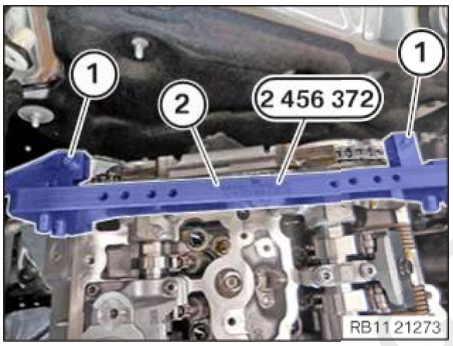
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



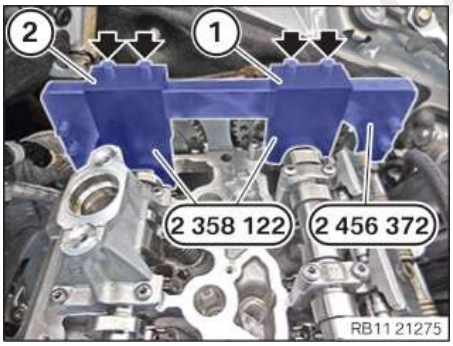
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

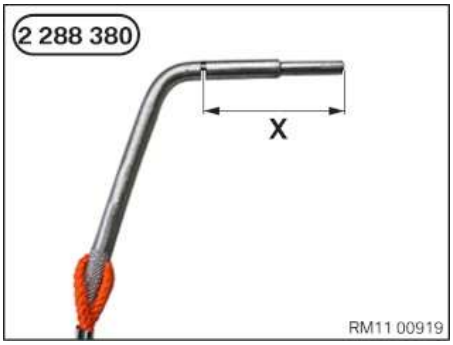
Test gauge to basic carrier

M6		Tightening torque	8 Nm



- Thread the sealing cap (1) out and remove.

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- **Vehicles with automatic transmission:**

  Dimensions (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

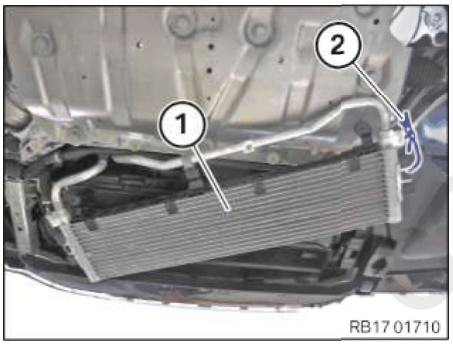


- **Vehicles with automatic transmission:**

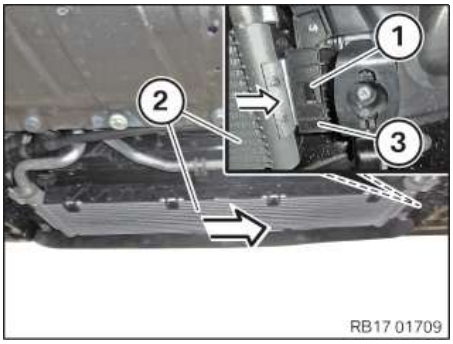
  Special tool 2 288 380 has been **correctly** positioned.

  The engine **is in the** TDC firing position of cylinder 1.

73 – If installed: Secure engine oil cooler



- Remove the cable straps (2).
- Position engine oil cooler (1).



- Feed in and install the engine oil cooler (2) on the holder (3) in the direction of the arrow.
- Ensure that the lock (1)engages audibly.

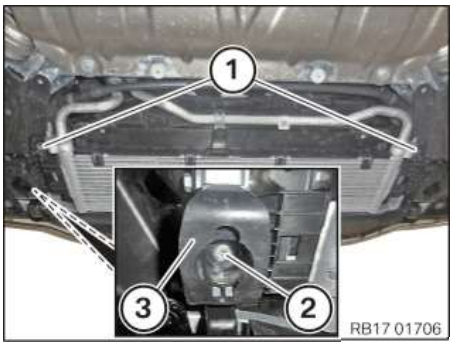
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- Tighten down screw (1).

Engine oil cooler to bumper support

M6X25		Tightening torque	8 Nm



- Renew rivet (2).

  Parts: Rivet
- Install and rivet damper (3).
- Tighten the screws (1).

Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

74 – Checking the intermediate lever classification



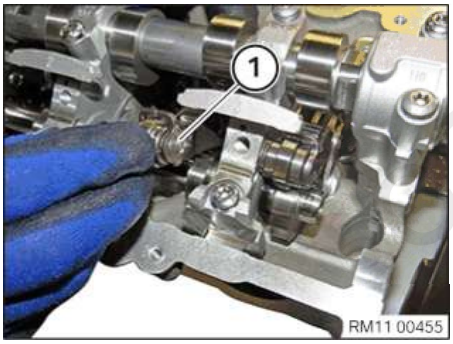
TECHNICAL INFORMATION

All intermediate levers are classified. Only one classification may be used per engine.

All intermediate levers must be installed in the same position in an engine which has already been in use.

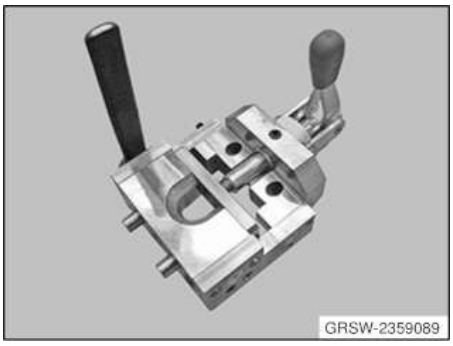
- Checking the intermediate lever classification.

75 – Installing all intermediate levers



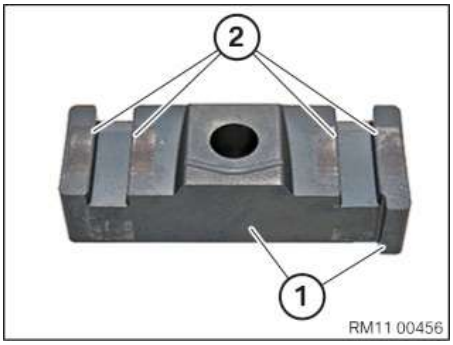
- Install intermediate lever (1).
- Repeat the step for all intermediate levers (1).

76 – Installing all gates

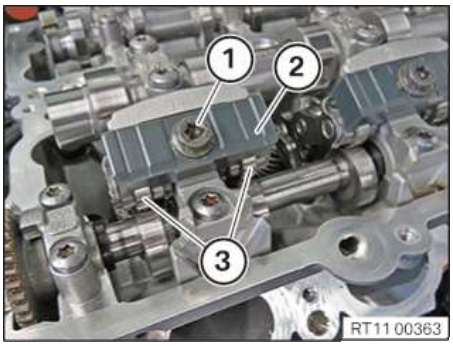


- Have the special tool 2 359 089 ready.

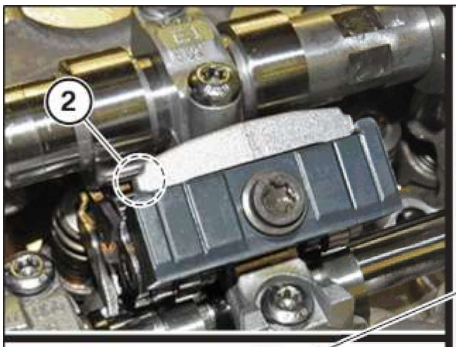
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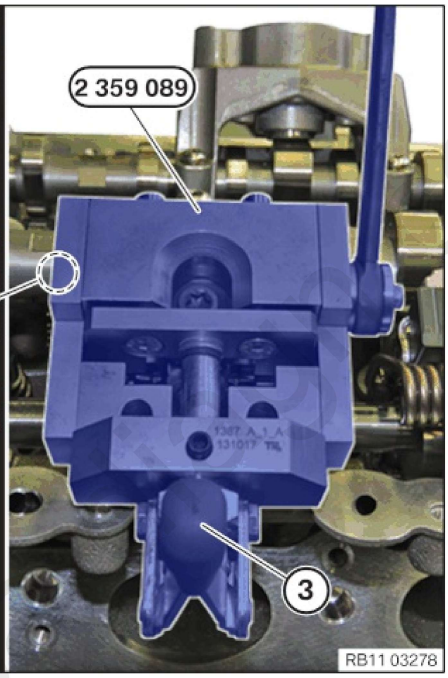


- Clean contact surfaces (1) and (2) off oil, grease and dirt.

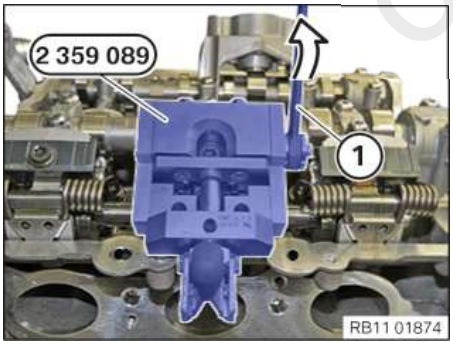


- Position the gate (2) and hand-tighten the bolt (1).
- Check that the intermediate lever (3) is in the correct mounting orientation.





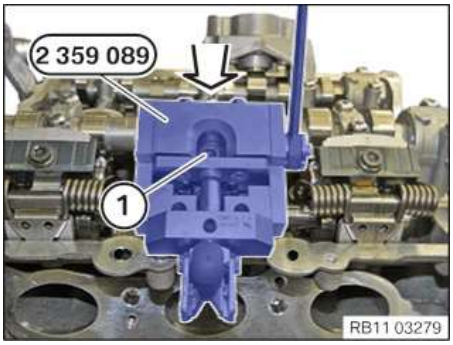
- Position the special tool 2 359 089 on the cylinder head.
- Pre-tension the gate with the lever (3).
- Abut the bolt (1) in the area (2).
- Make sure that the special tool 2 359 089 does not rotate during this process.



- Secure the gate with the lever (1).



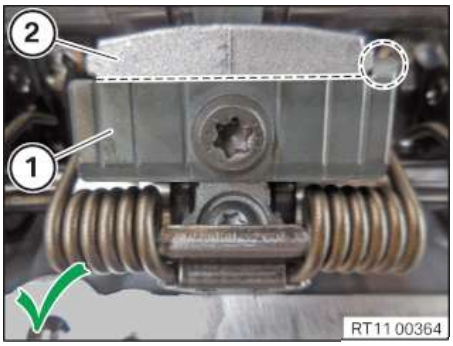
- Ensure that the special tool 2 359 089 lies flat on the cylinder head.



- Press the special tool 2 359 089 onto the cylinder head.
- Tighten the bolt (1) at the same time.

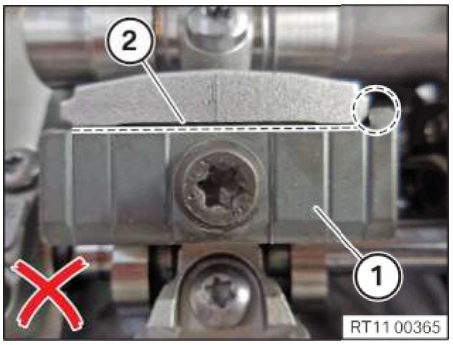
Gate to bearing bracket

M8		20 Nm



- Make sure that gate (1) rests correctly against bearing bracket (2).

  Gate (1) is installed correctly in the marked area.

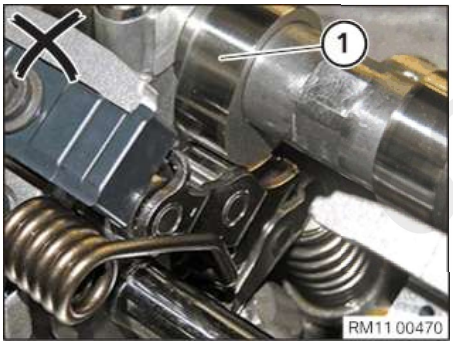


- Make sure that gate (1) rests correctly against bearing bracket (2).

  Gate (1) is installed incorrectly in the marked area.

- Repeat the procedure for all gates.

77 – Checking the position of the intake camshaft



Check

- Check position of the intake camshaft on the respective cylinders.

Result

» Cam (1) of the intake camshaft runs on the intermediate lever.

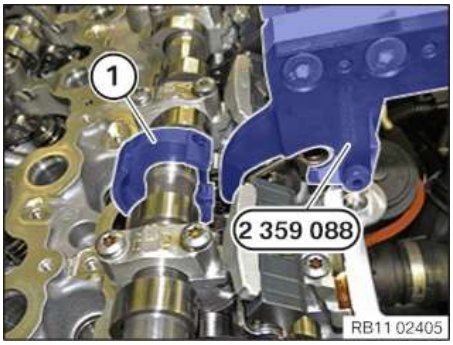
Measure

- Continue to turn the engine at the vibration damper with the special tool 0 493 380 (11 6 480) in the direction of engine rotation.

78 – Check the position of the intake camshaft at cylinders 3 and 4

Check

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- Check the position of the intake camshaft at cylinders 3 and 4.

  To remove the torsion spring on cylinder 3 and 4 the camshaft sensor wheel (1) of the intake camshaft must be positioned as shown.

Result

» Camshaft sensor wheel (1) of the intake camshaft is not in the indicated position.

Measure

- Turn engine on the vibration damper using special tool 0 493 380 (11 6 480) till the camshaft sensor wheel (1) of the intake camshaft is positioned as shown.

79 – Install all torsion springs

CAUTION

Spring preload.

Danger of injury!

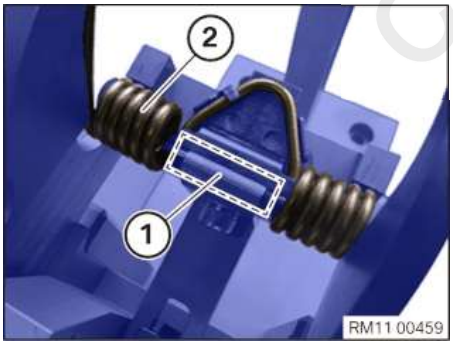
- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

TECHNICAL INFORMATION

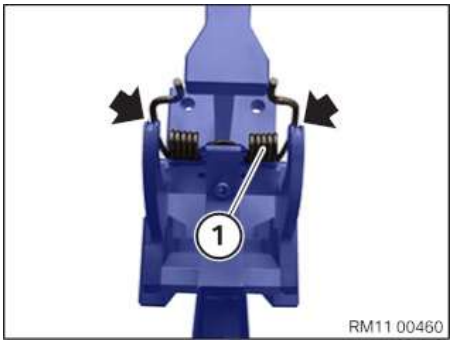
- Wear safety goggles.

NOTICE

The description is for one component only. The procedure is identical for all further components.

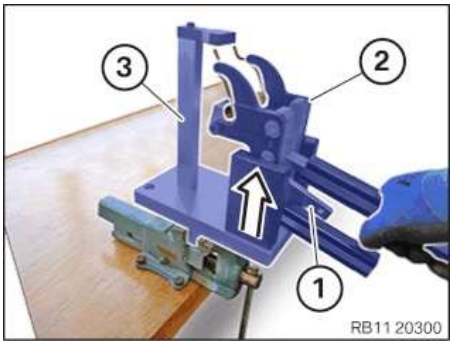


- Insert the torsion spring (2) in the clamping lever of the special tool 2 359 088.
- Make sure that the torsion spring (2) is correctly positioned in the marked area (1) of the special tool 2 359 088.



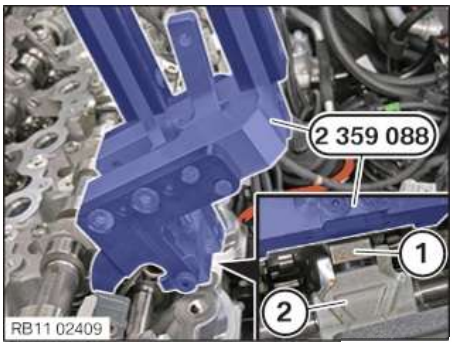
- Carefully close the clamping lever of the special tool 2 359 088 in the accompanying fixture until the retaining hook engages.
- Ensure that the torsion spring (1) lies correctly in the lateral guides (arrows) of the special tool 2 359 088 during tensioning.

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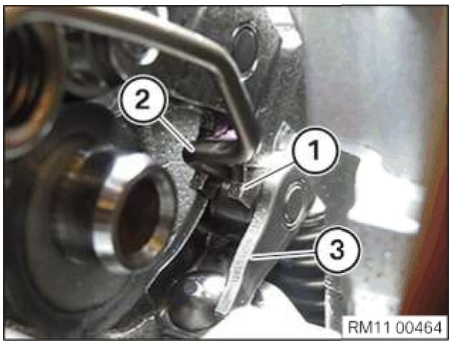


- Carefully close the clamping lever (2) of the special tool 2 359 088 in the fixture (3) until the retaining hook (1) audibly engages.

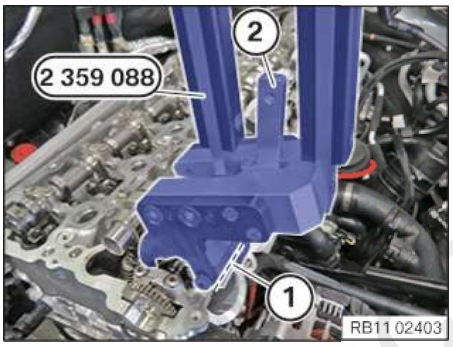
  The torsion spring is tensioned.
- **Carefully** take the clamping lever (2) of the special tool 2 359 088 with the stretched torsion spring out of the fixture (3) of the special tool 2 359 088 in the direction of arrow.



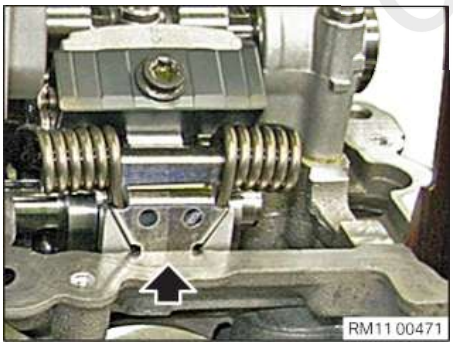
- Insert the torsion spring (1) with the special tool 2 359 088 in the cylinder head (2).



- Insert the torsion spring (2) into the intermediate levers (1).
- Check all roller cam followers (3) for correct installation position.



- Lay special tool 2 359 088 flat in the marked area (1).
- Press the clamping lever of the special tool 2 359 088 together until the retaining hook (2) unlocks.
- Carefully open the clamping lever of the special tool 2 359 088 until the torsion spring is completely relaxed.
- Remove special tool 2 359 088.



- Check the correct mounting orientation of the torsion spring (arrow).

- Repeat the operations for the remaining torsion springs.

80 – Installing the intake plenum

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

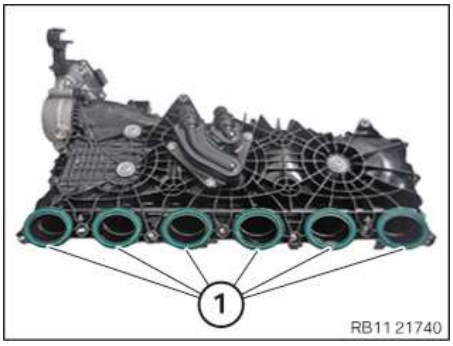
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

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TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

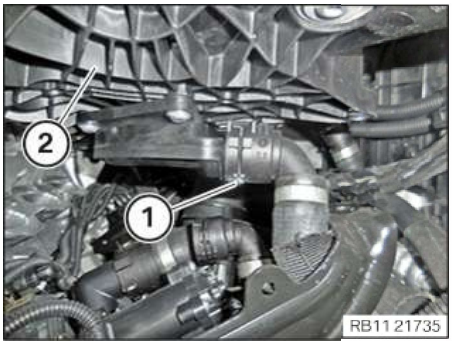


- Renew gaskets (1).

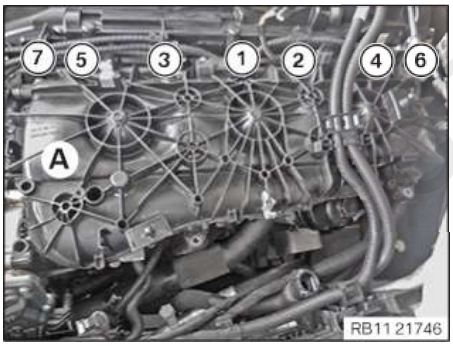
  Parts: Seals



- Clean contact surface (1).



- Feed in and position intake plenum (2).
- Connect and lock coolant line (1).
- Make sure that the cooling line (1) engages audibly.



TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Position the intake plenum (A).
- Tighten screws in the order (1) to (7).

Note: Tighten the bolts in 360 degree steps.

Intake plenum to cylinder head

M6		Tightening torque	10 Nm



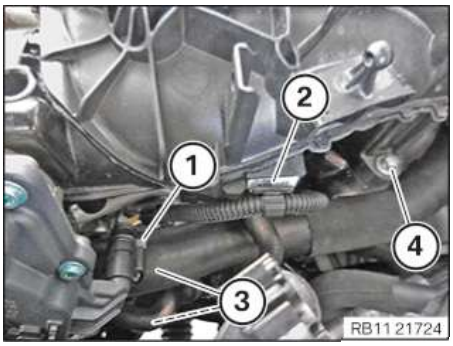
- Connect and lock coolant line (1).
- Make sure that the cooling line (1) engages audibly.



- Tighten down screw 1.

Intake plenum to support

M6X25		Tightening torque	8 Nm

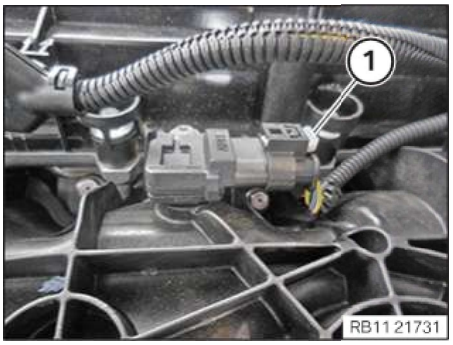


- Tighten down screw (4).

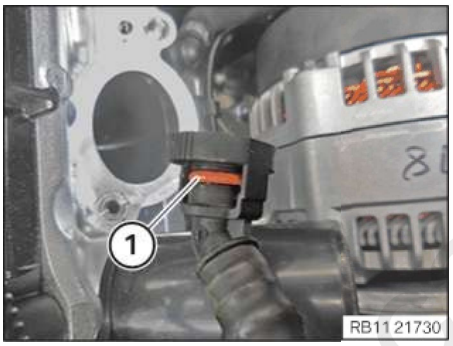
Intake plenum to support

M6X25		Tightening torque	8 Nm

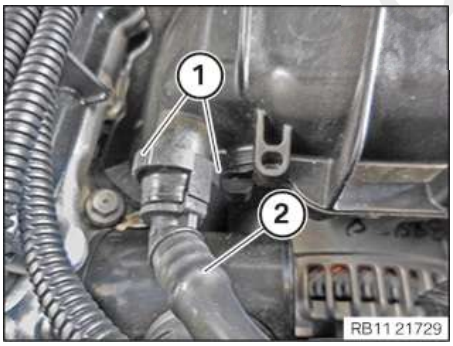
- Thread in and install coolant line (3).
- Secure clamps (2).
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.



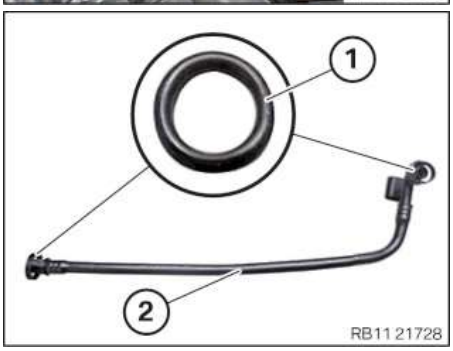
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.



- Check sealing ring (1) for damage and renew tank ventilation line if necessary.

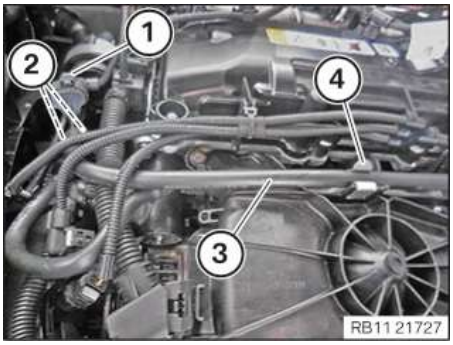


- Insert and install the tank ventilation line (2).
- Ensure that the locks (1) engage audibly.

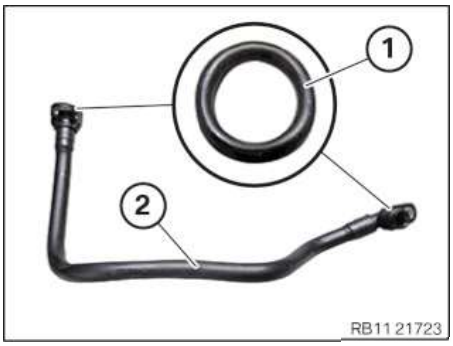


- Check sealing ring (1) for damage and renew tank ventilation line (2) if necessary.

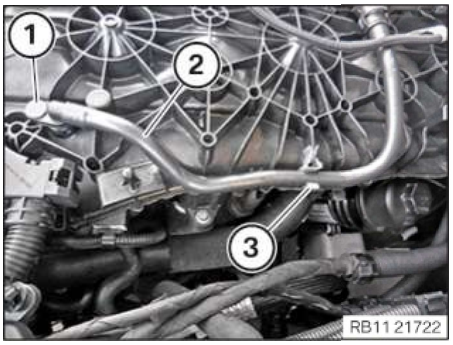
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- Insert and install the tank ventilation line (3).
- Ensure that the locks (2) engage audibly.
- Secure the tank ventilation line (3) to the clamp (4).
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.



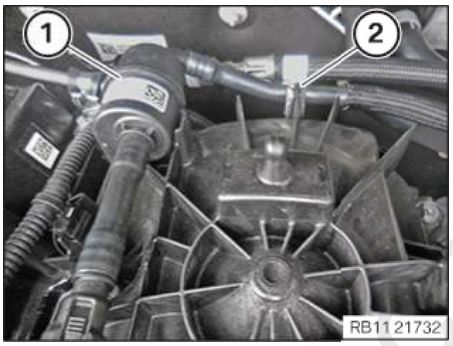
- Check sealing ring (1) for damage and renew tank ventilation line (2) if necessary.



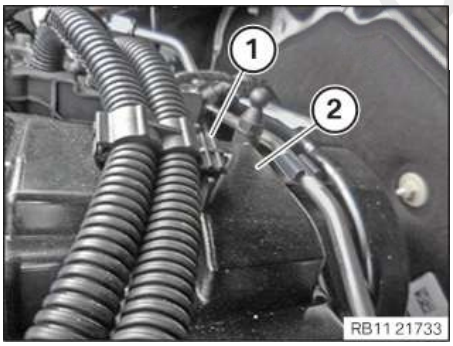
- Insert and install the tank ventilation line (2).
- Secure the tank ventilation line (2) to the clamp (3).
- Tighten down screw (1).

Tank ventilation line to intake plenum

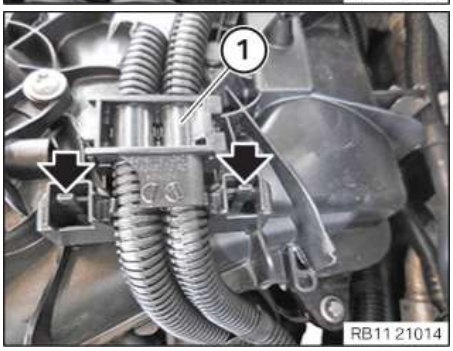
Oval-head screw		Tightening torque	3 Nm



- Insert and install the tank ventilation line (1).
- Secure the tank ventilation line (1) to the clamp (2).



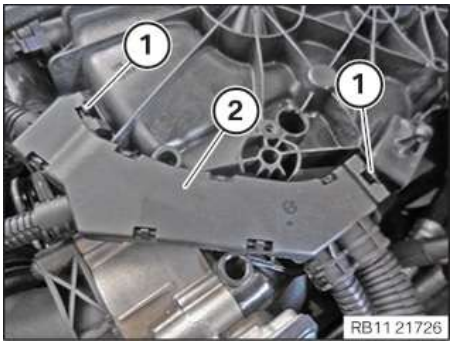
- Secure the wiring harness section(1) for the injectors and ignition coils on the cylinder head cover (2).



- Insert and install the wiring harness section (1) for the injectors and ignition coils.

  The locks (arrows) must engage audibly.

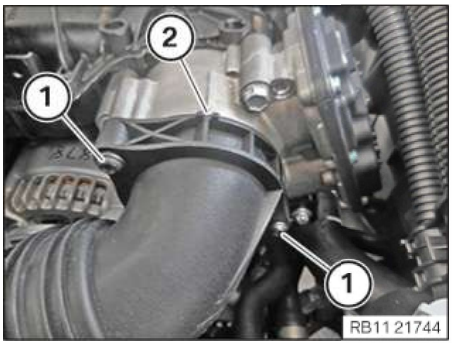
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- Feed in and install wiring harness section (2) for sensor system **2**.
- Ensure that the locks (1) engage audibly.



- Check the sealing ring (1) for damage and renew the sealing ring (1) as needed.

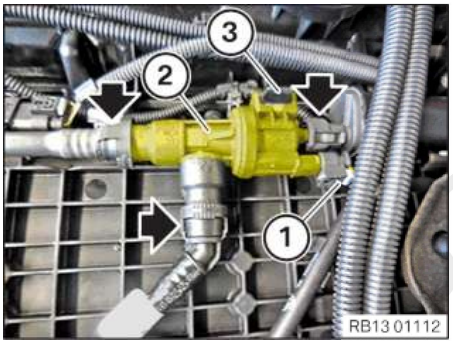


- Insert and install charge air line (2).
- Tighten the screws (1).

Charge air line to throttle valve

M6x30		Tightening torque	8 Nm

81 – Installing the tank vent valve

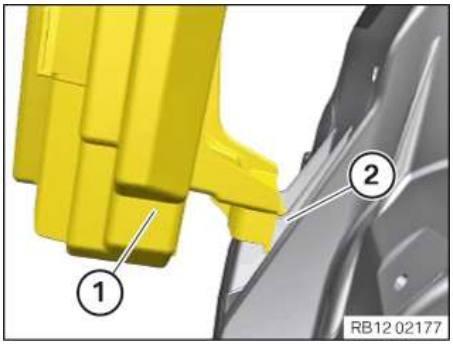


- Secure the tank vent valve (2) to the holder (3).
- Connect and lock the tank ventilation lines (arrows).

  The tank ventilation lines (arrows) must audibly engage.
- Connect connectors (1) and lock.

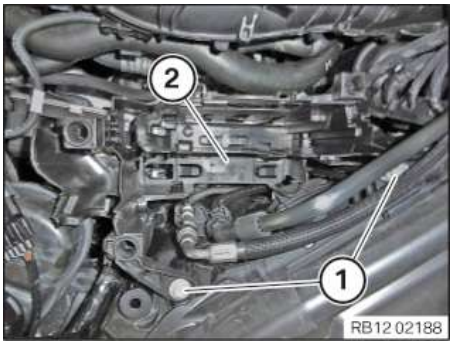
  The connector (1) must engage audibly.

82 – Installing the control unit holder



- Make sure the bottom control unit holder (1) is inserted correctly into the fixture (2).

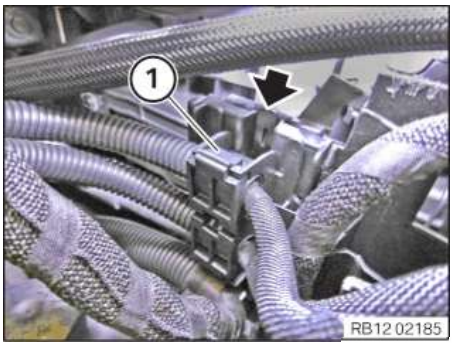
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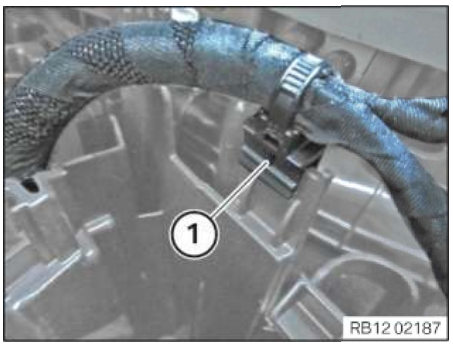
- Guide in and install control unit holder (2).
- Tighten the screws (1).

Control unit holder on spring strut dome

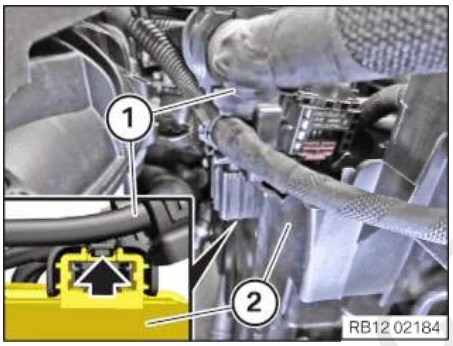
Hexagon screw		Tightening torque	8 Nm



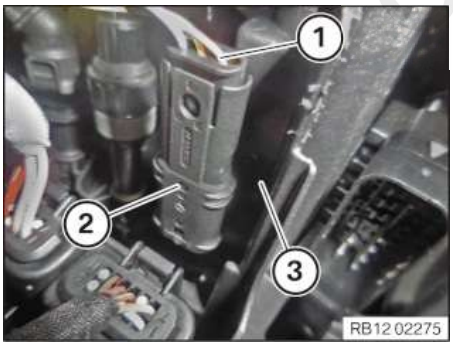
- Feed in and install the cable clip (1).
  Lock (arrow) must audibly engage.



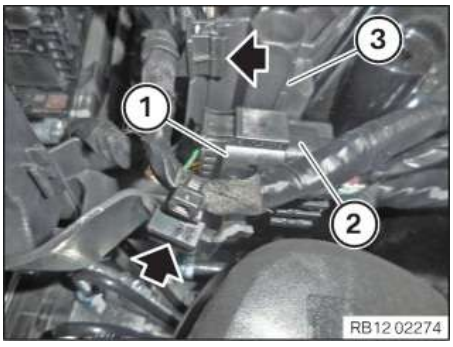
- Secure clamps (1).



- Connect the cable clip (1) with the control unit holder (2) and lock it.
  Lock (arrow) must audibly engage.



- Connect connector (2) to the control unit holder (3) and lock it.
  The connector (2) must engage audibly.
- Connect connectors (1) and lock.
  The connector (1) must engage audibly.



- Connect and lock the connector (2) with the control unit holder (3).
  The connector (2) must engage audibly.
- Connect connectors (1) and lock.
  The connector (1) must engage audibly.
- Secure the clamps (arrows).

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83 – Installing the integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

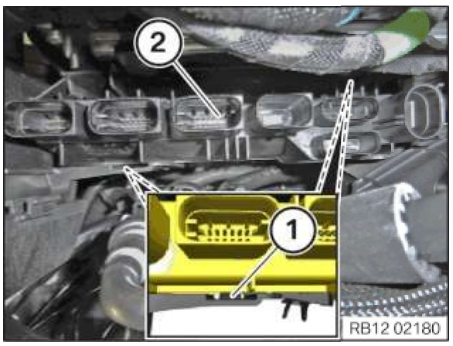
- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

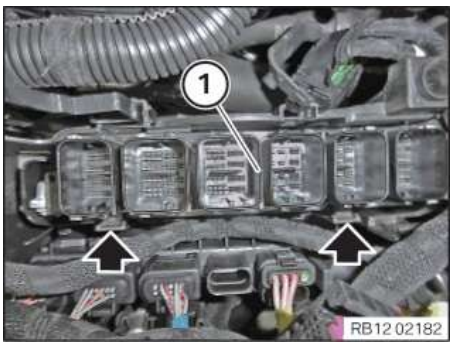


- Insert and install the integrated supply module (PDM) (2).
  The latch mechanisms (1) must engage audibly.
- Unlock the latch mechanisms (1).



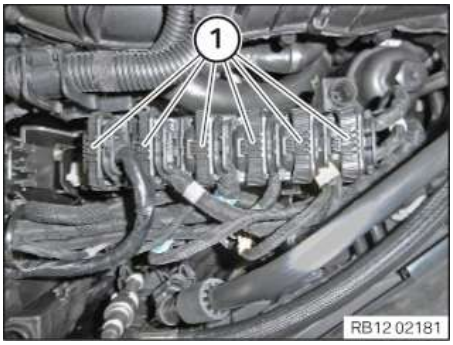
- Connect connectors (1) and lock.
  The connectors (1) must engage audibly.

84 – Installing the DME control unit

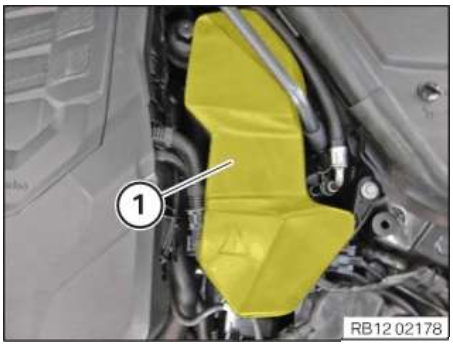


- Feed in and install DME control unit (1).
  The locks (arrows) must engage audibly.

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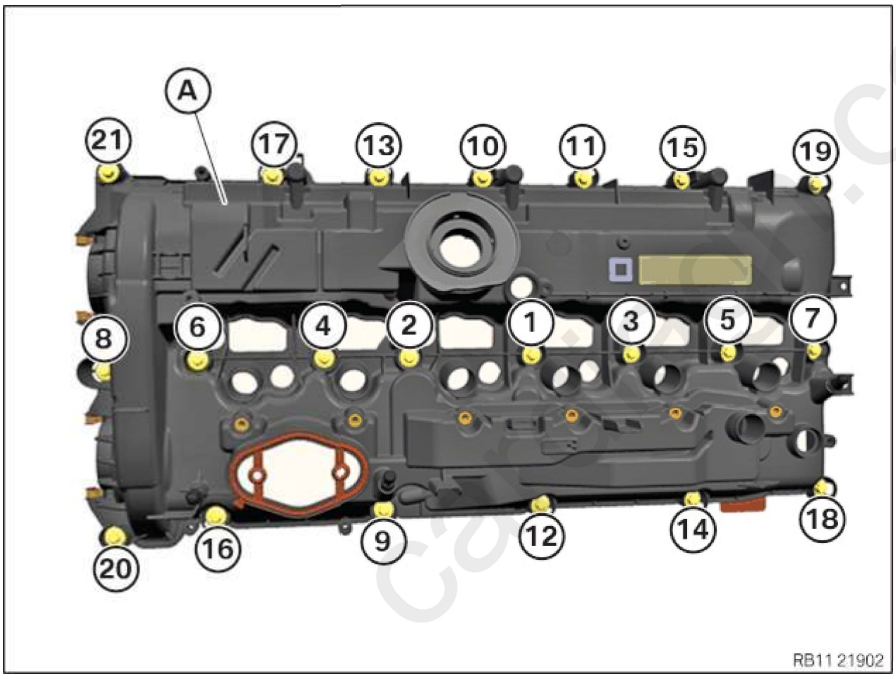
- Connect connectors (1) and lock.
  All connectors (1) must engage audibly.



- Insert and install cover (1) into guides.

85 – Installing cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 21 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

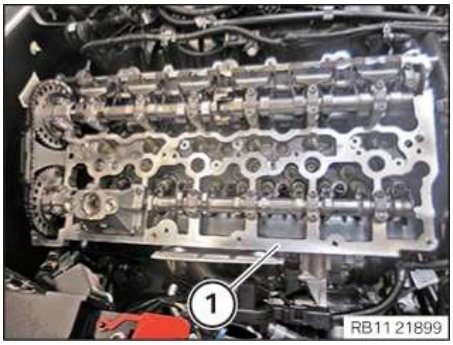
Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

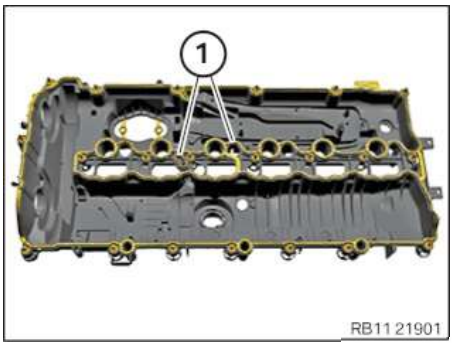
- Route all cables without abrasions, do not trap and crush.

TECHNICAL INFORMATION

Latch mechanisms, guides and mounting elements must not be damaged or missing.

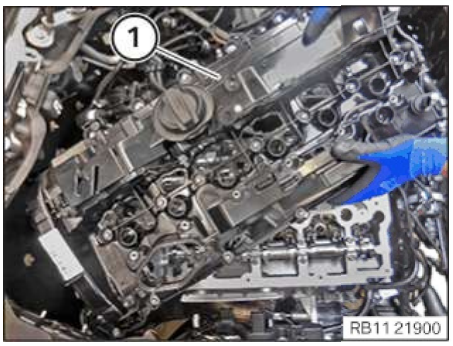


- Contact surface (1) must be free from oil and grease.



- Replace the seals (1).

  Parts: Seals

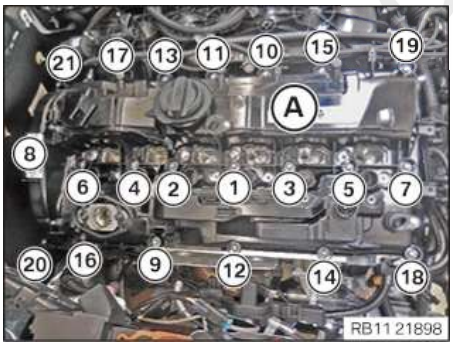


- Insert and install cylinder head cover (1).



- Ensure that the cylinder head cover (1) is installed in the **marked** area correctly on the high pressure pump bracket(2).

  The cylinder head cover (1) must not touch the high pressure pump bracket (2) in the **marked** area.



- Position the cylinder head cover (A).
- Make sure that the cylinder head cover (A) does not touch the high pressure pump bracket!
- Tighten all bolts in sequence (1) to (21).

Cylinder head cover to cylinder head

M6X30		Jointing torque	8 Nm

- Tighten all screws in a sequence from (1) to (21).

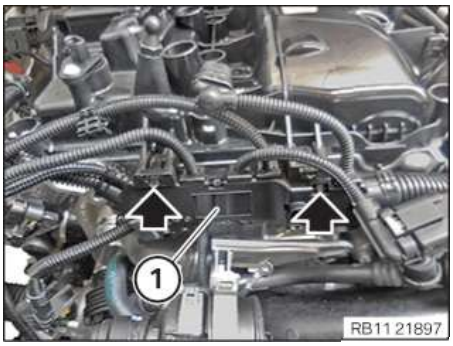
Cylinder head cover to cylinder head

M6X30		Tightening torque	11 Nm

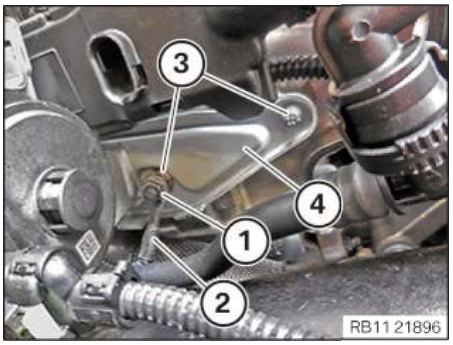
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- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.



- Feed in and install wiring harness section (1) for sensor system **2**.
- Make sure that you can hear the locks (arrows) engage.



- Insert and position the holders (4).
- Tighten the screws (3).

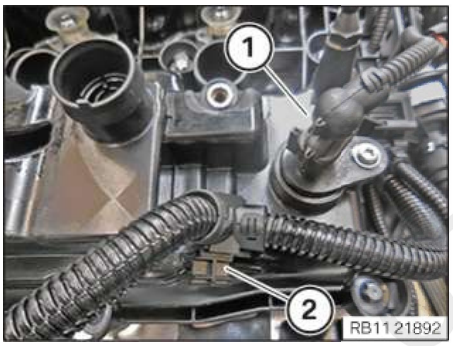
Auxiliary coolant pump holder to cylinder head

M6		Tightening torque	7 Nm

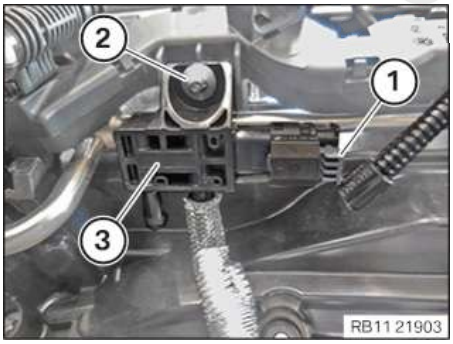
- Thread in ground cable (2) and install.
- Tighten nut (1).

Standard screw connection M6

M6		8 Nm



- Connect and lock the connector (1) on the exhaust camshaft sensor .
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).



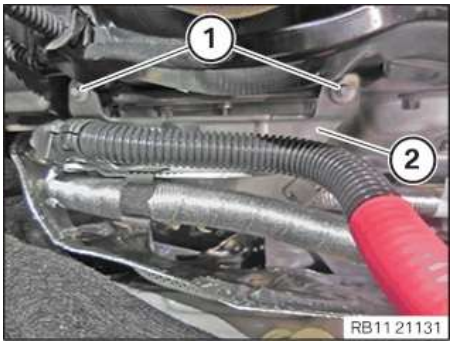
- **If installed:**
- Feed in and install the differential pressure sensor (3).
- Tighten down screw (2).

Differential pressure sensor to holder

TS6X18		Tightening torque	3,5 Nm

- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.

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CAUTION

Improper routing of the positive battery cable.

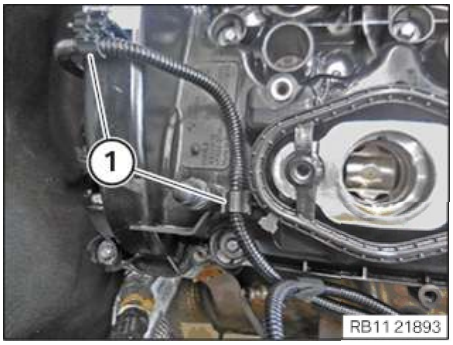
Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

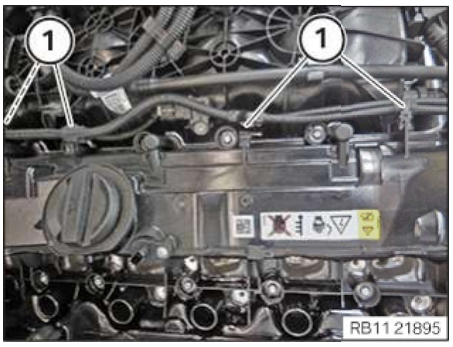
- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

Holder, positive battery cable to cylinder head cover

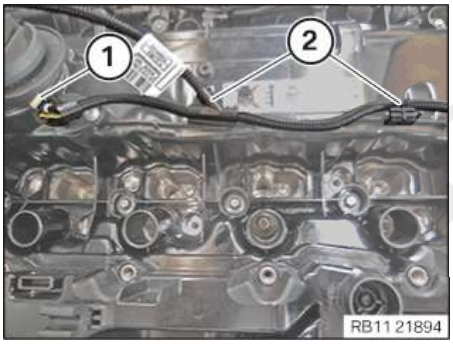
6X18		Tightening torque	6 Nm



- Secure clamps (1).

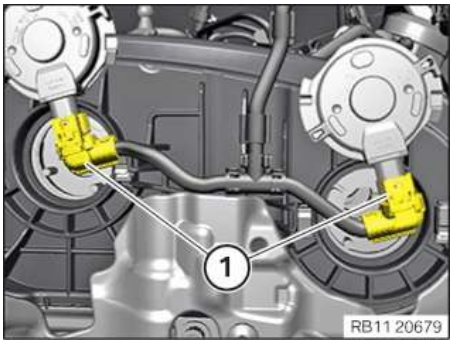


- Secure clamps (1).



- Connect connector (1) to the intake camshaft sensor and lock it.
- Make sure the connector (1) engages audibly.
- Secure clamps (2).

86 – Installing both actuators

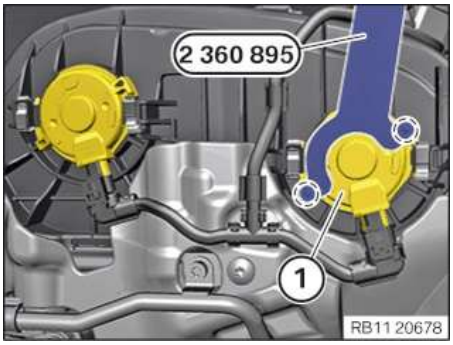


NOTICE

The figure shows the rear side of the engine.

- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.

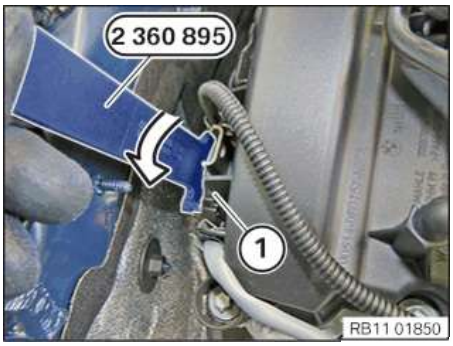
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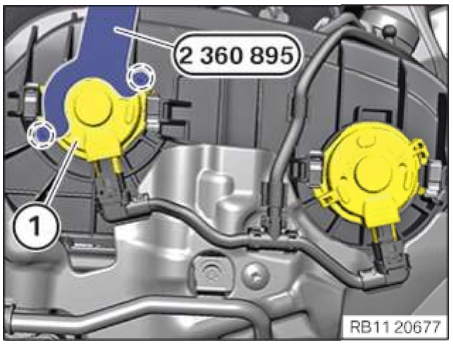
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



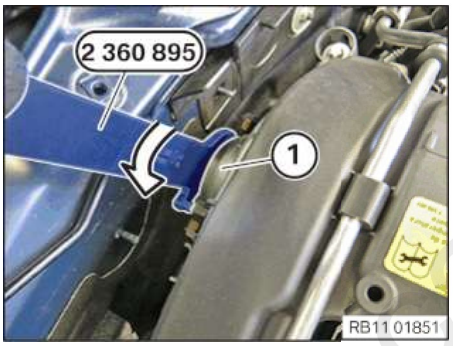
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.



NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

87 – Install high pressure pump

RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

Only G05 and G07

In vehicles with active anti-roll bar (ARS) the fan cowl must be removed in order to spin the engine.

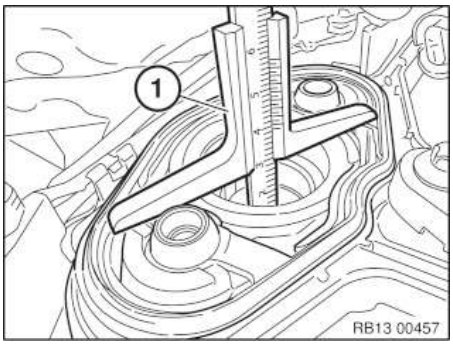
For additional information see: 17 11 035 Removing and installing/replacing the fan cowl including electric fan

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TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

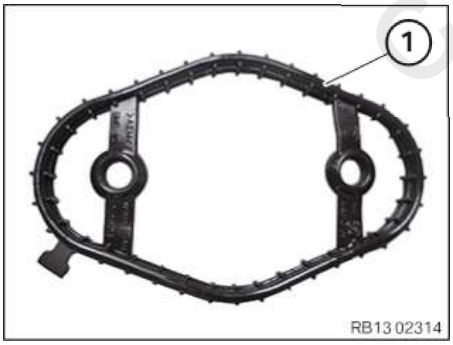
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.

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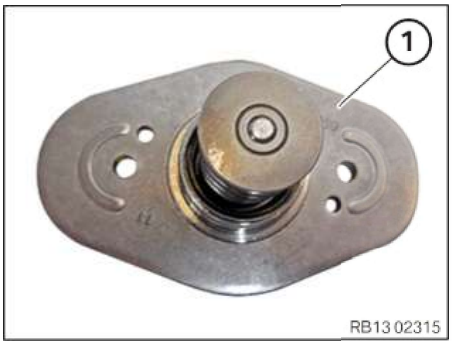
TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

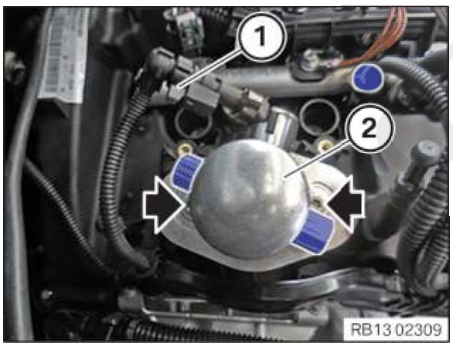
The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

88 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

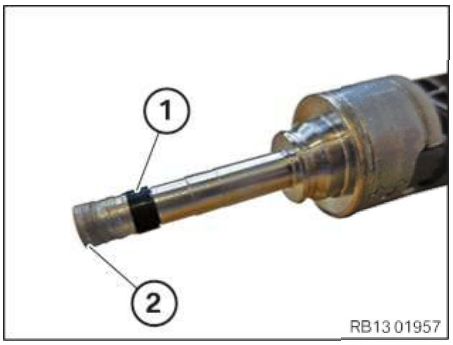
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

TECHNICAL INFORMATION

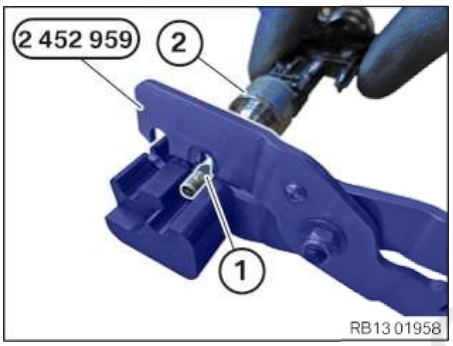
Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.



- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings
- Avoid mechanical contact with injector tip (2).



- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.

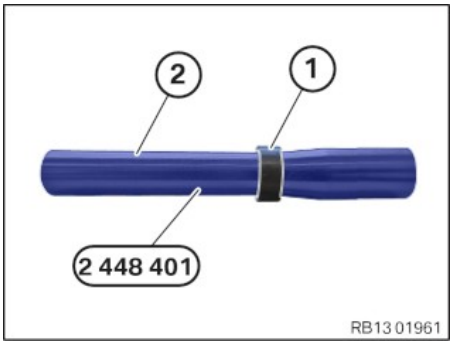


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

  (1) Installation cone

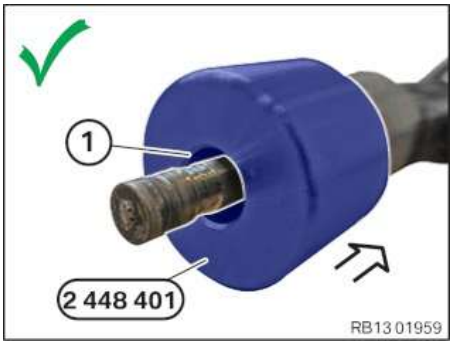
  (2) Sliding sleeve

  (3) Assembly sleeve



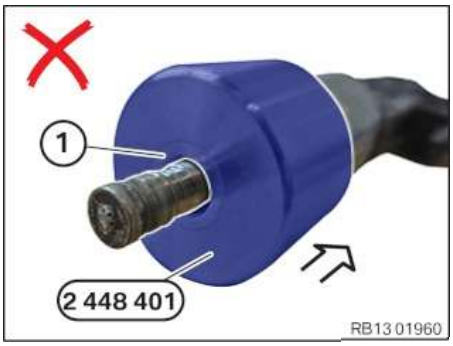
- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.

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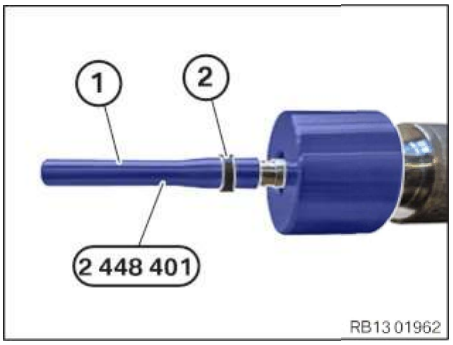
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The larger diameter of the assembly sleeve (1) must point to the injector tip.

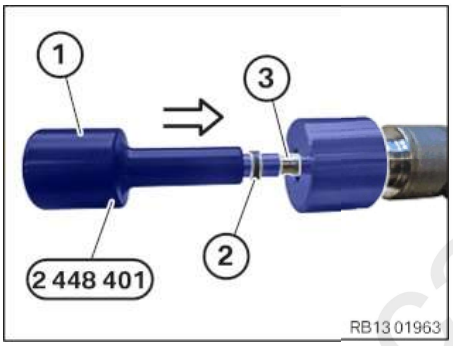


- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

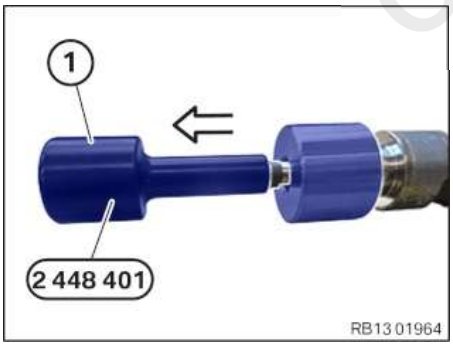
  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.



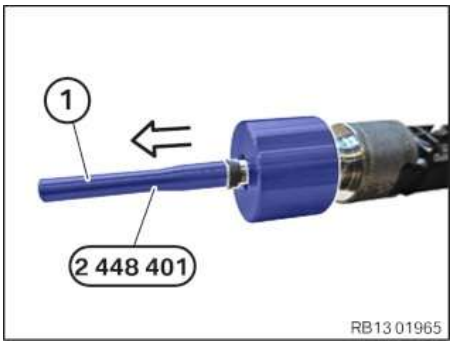
- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .



- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.

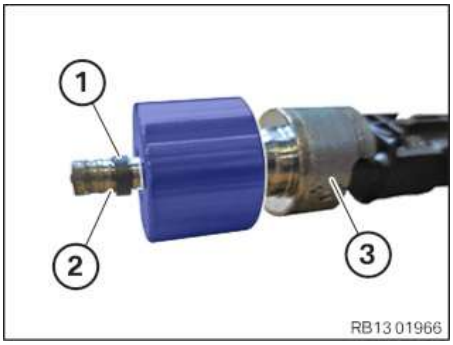


- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

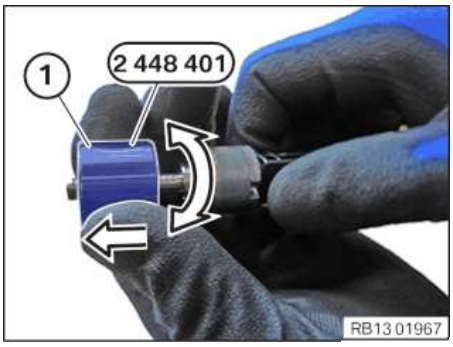


- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

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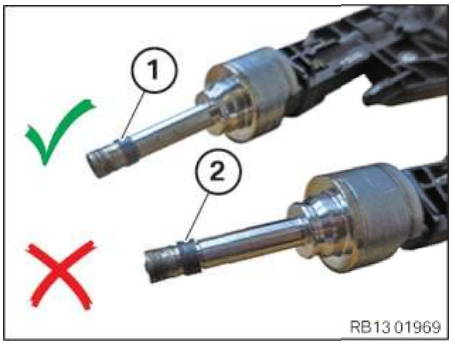


- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.



- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).

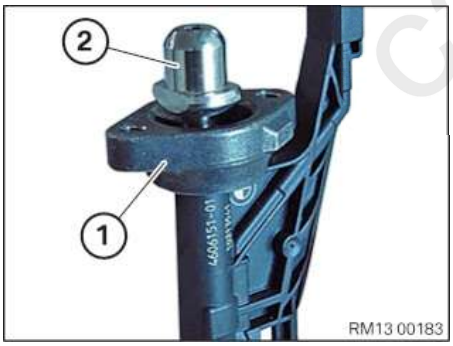


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

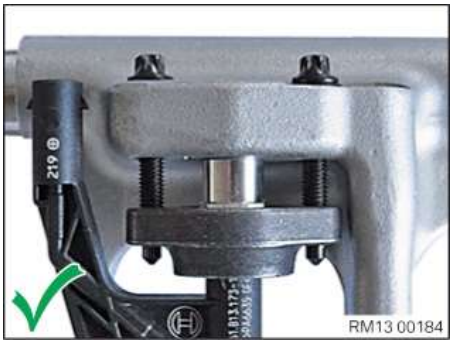
89 – Installing the high-pressure rail with injectors of the cylinders 4 to 6

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



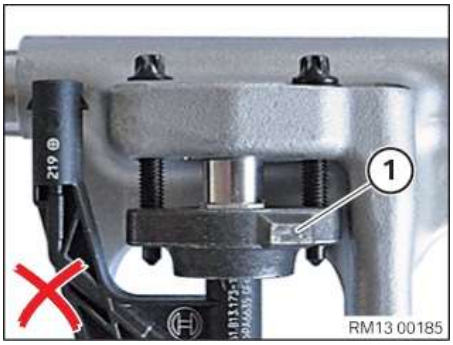
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder**(1) **has a cast lug**: Make sure that the holder is installed in the correct position.



- If applicable, note the position of the cast lug:

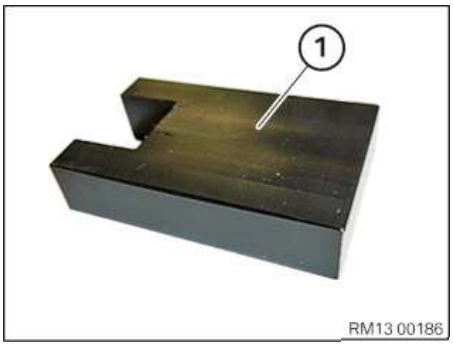
  The holder is mounted **correctly** when the cast lug is located at the rear.

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- If applicable, note the position of the cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.



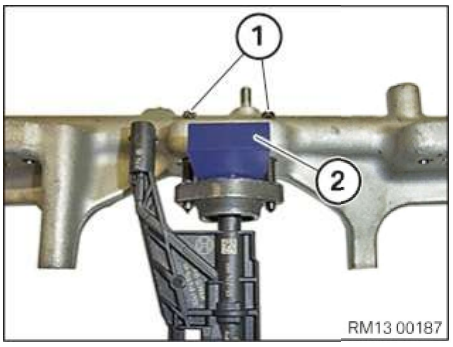
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).



- Replace (M5x30) screws.

  Parts: Screws (M5x30)
- Mount the injectors with the holders and the bolts (M5x30) (1) on the rail.
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.
- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) evenly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.



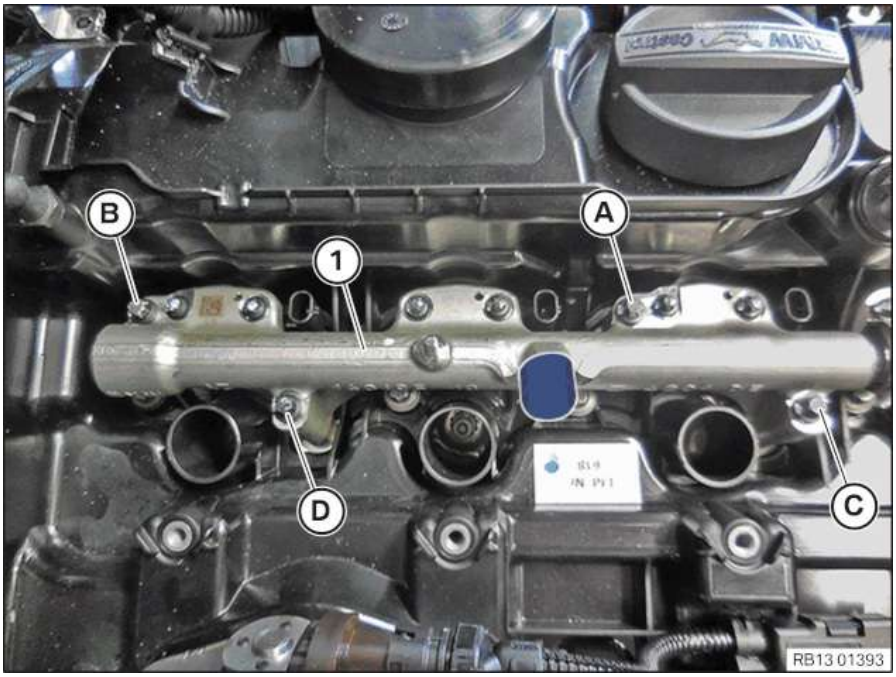
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.



- Check injectors for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors must move freely.

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- Renew screws (A) to (D).

  Parts: Bolts
- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- Press the rail (1) down until a resistance can be felt; join and hand-tighten the bolts (M6x30) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.

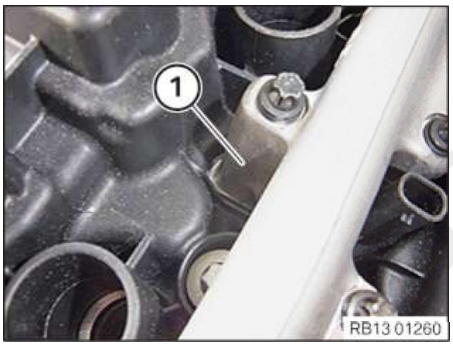
  The figure shows the rail resting flat against the cylinder head.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

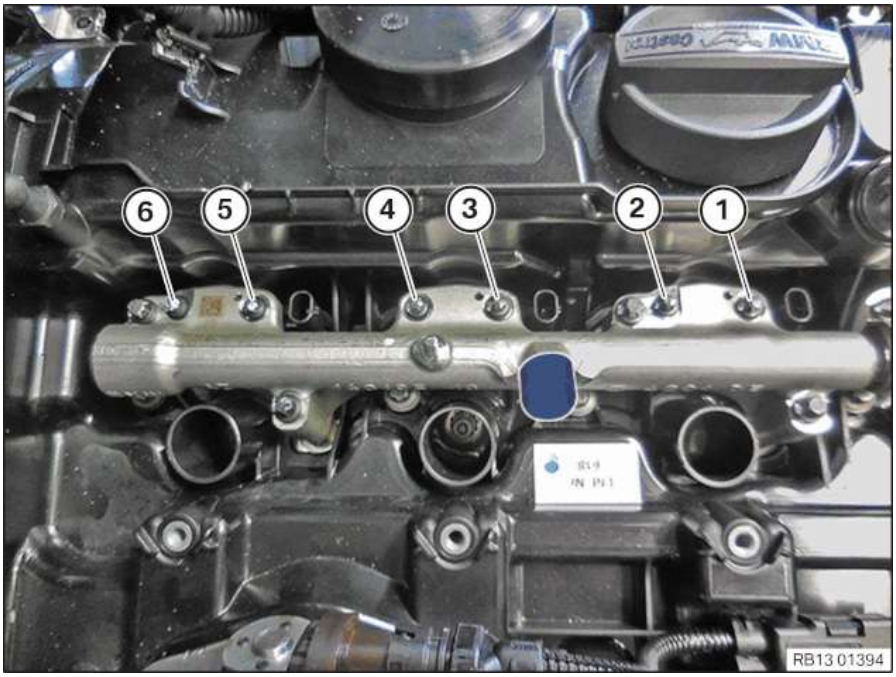
Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.



- Make sure that the rail (1) rests flat against the cylinder head.

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- Attach a socket to an extension.

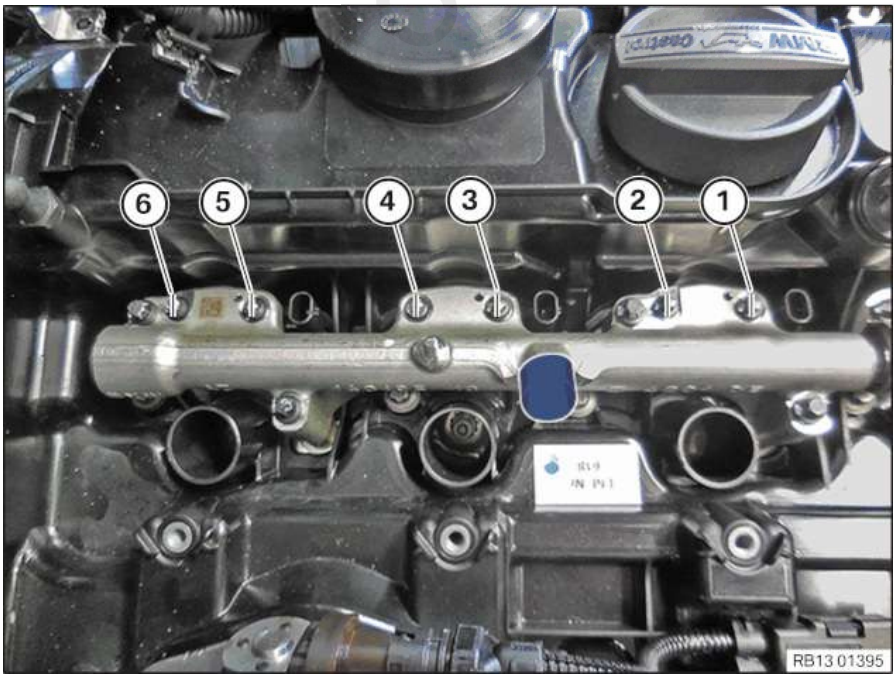
  Do not use a reversible ratchet or torque wrench.
- Tighten the bolts (M5x30) in pairs ((1) with (2), (3) with (4), (5) with (6)) in alternating order **90° hand-tight**.
- Set the torque wrench to 5 Nm.

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- **Screw the (M5x30) bolts according to the following plan:**
  - **Fuel injector 4:**
  - Tighten screw (1) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (2) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 5:**
  - Tighten screw (3) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (4) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 6**:
  - Tighten screw (5) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (6) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts reach a torque of 5 Nm.



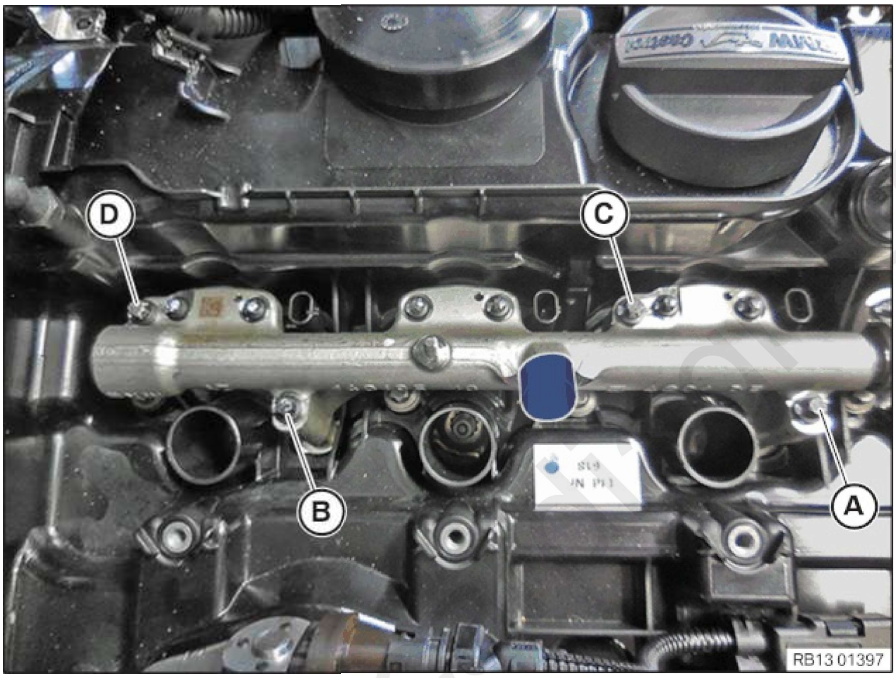
- Mark all bolts (1) to (6) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the screw (1) with an angle of rotation of 90° ±15°.
  - Tighten the screw (2) with an angle of rotation of 90° ±15°.
  - Tighten the screw (3) with an angle of rotation of 90° ±15°.
  - Tighten the screw (4) with an angle of rotation of 90° ±15°.
  - Tighten the screw (5) with an angle of rotation of 90° ±15°.
  - Tighten the screw (6) with an angle of rotation of 90° ±15°.

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- Check if all bolts (1) to (6) have been tightened with a 90° ±15° angle of rotation.

  All marks (lines) must be horizontal (see figure).



- Unscrew the bolts (M6x70) (A) to (D).

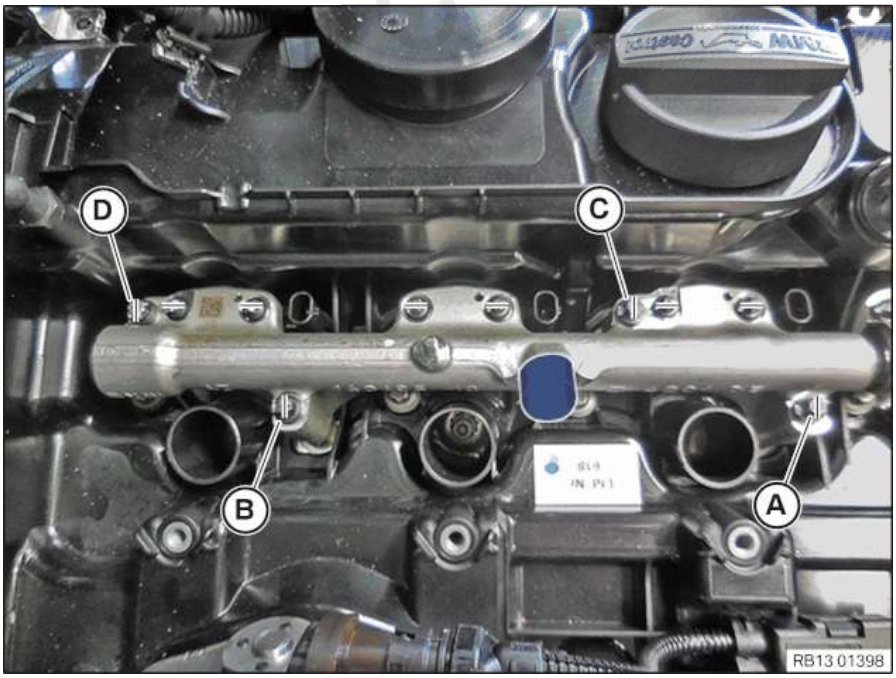
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

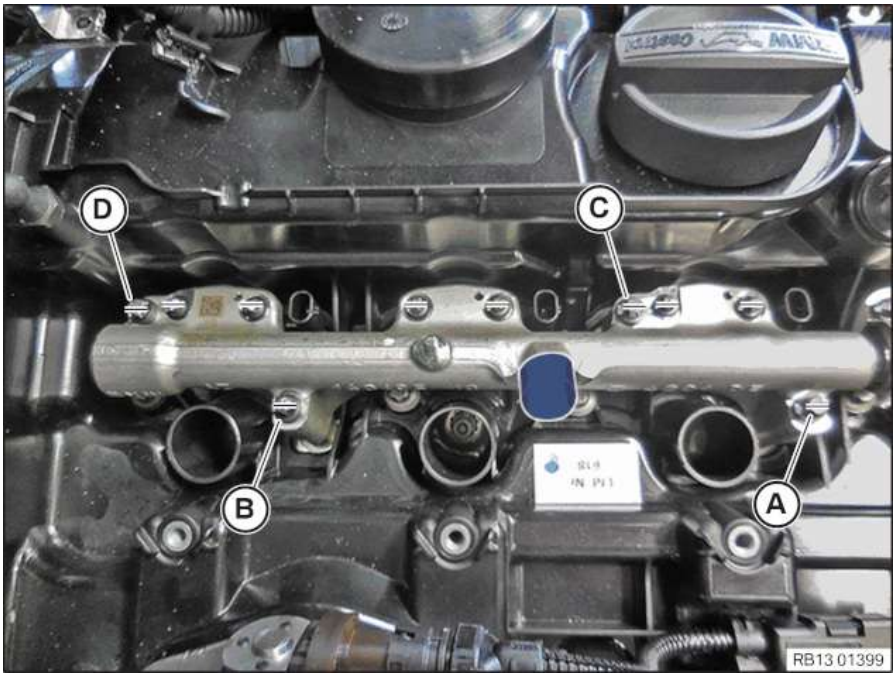
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.

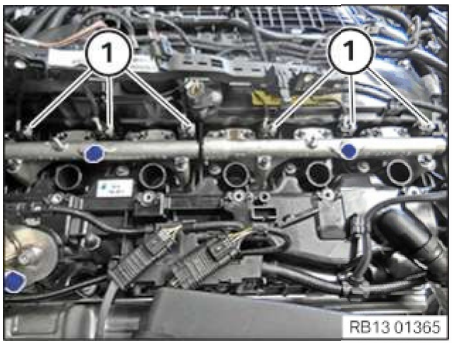


- Mark all bolts (A) to (D) with a vertical line (see figure).
- Tighten bolts (M6x70) (A) to (D) to a 90° angle of rotation.



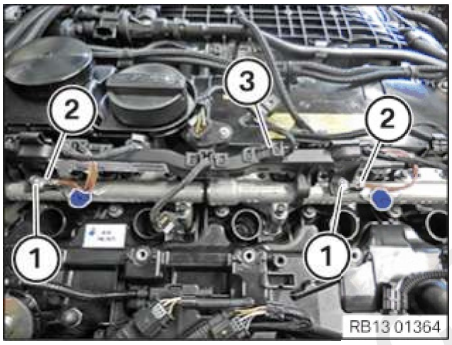
- Check if all bolts (A) to (D) have been tightened with a 90° angle of rotation.

  All marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nuts (1).

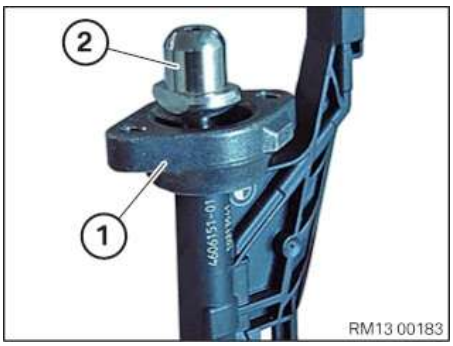
Ground cable to rail

M6			5 Nm

90 – Installing rail with injectors of cylinders 1 to 3

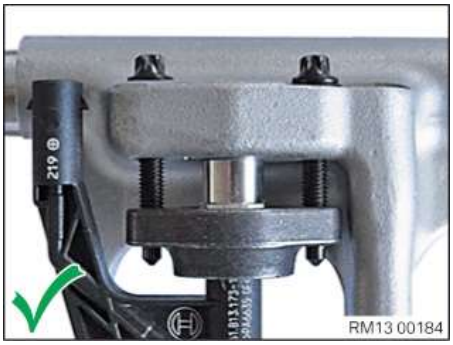
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



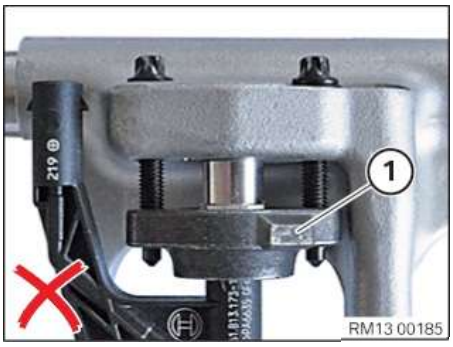
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If there is a cast lug on the holder** (1) **:** Make sure that the holder is installed in the correct position.

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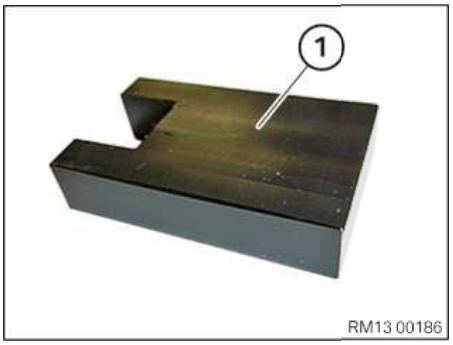
- Observe position of cast lug:

  The holder is mounted **correctly** when the cast lug is located at the rear.



- Observe position of cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.



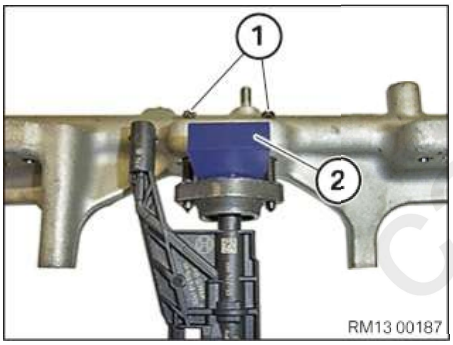
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use special tool 2 358 022(1) .



- Replace (M5x30) screws.

  Parts: Screws (M5x30)
- Mount the injectors with the holders and the bolts (M5x30) (1) on the rail.
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.
- Slide special tool 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure the special tool 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) *uniformly until the special* tool 2 358 022 (2) rests flat against the rail and the holder.



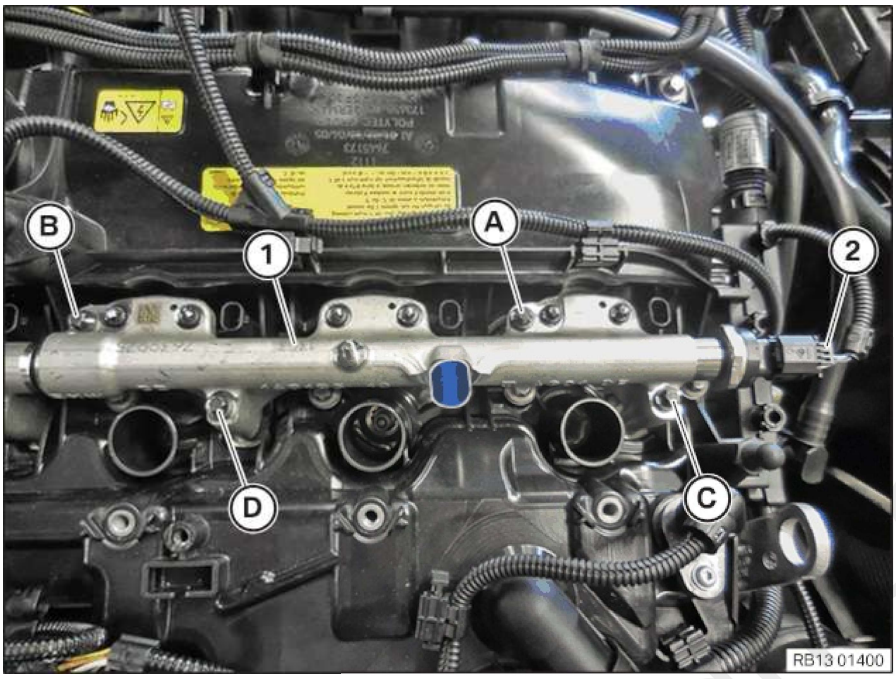
- Remove special tool 2 358 022(1) .
- Repeat this operation for all injectors.

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- Check injectors for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors must move freely.



- Renew screws (A) to (D).

  Parts: Bolts
- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- Press rail (1) down until a resistance can be felt; join and hand-tighten screws (M6x30) (A) and (B).
- Tighten screws (A) and (B) alternately by **180°** each with the torque wrench until the rail is positioned on the cylinder head.

  The figure shows the rail resting flat against the cylinder head.
- Insert screws (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

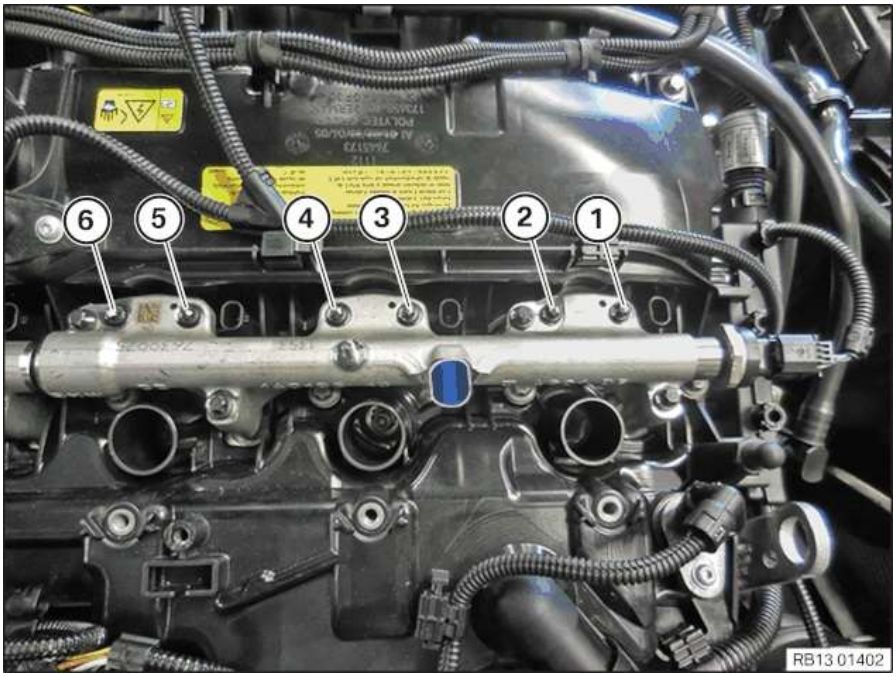
- Tighten screw (A) to 5 Nm.
- Tighten screw (D) to 5 Nm.
- Tighten screw (B) to 5 Nm.
- Tighten screw (C) to 5 Nm.
- Connect and lock the connector (2).

  The connector (2) must engage audibly.



- Make sure that the rail (1) rests flat against the cylinder head.

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- Attach a socket to an extension.

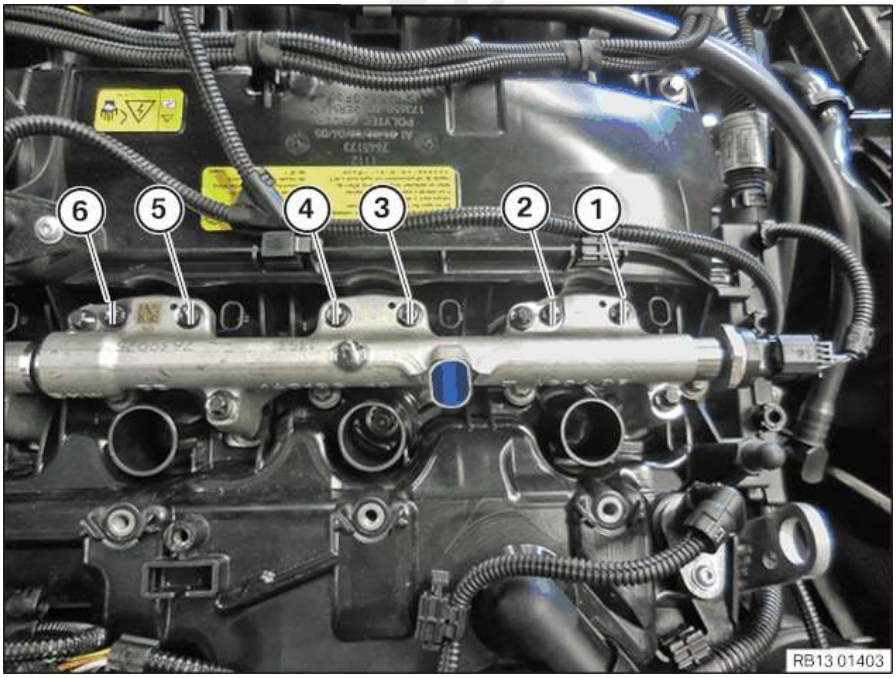
  Do not use a reversible ratchet or torque wrench.
- Hand-tighten screws (M5x30) in pairs ((1) with (2), (3) with (4), (5) with (6)) alternately by **90°**.
- Set torque wrench to 5 Nm.

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

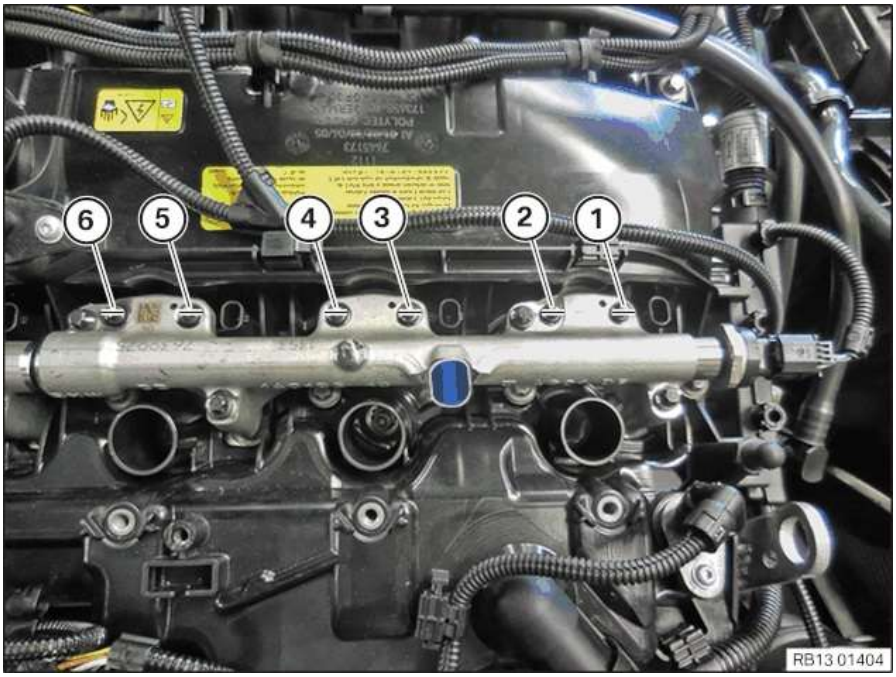
Non-observance of these requirements may result in leaks and damage.

- **Screw the (M5x30) bolts according to the following plan:**
  - **Fuel injector 1:**
  - Tighten screw (1) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (2) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten screw (3) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (4) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 3**:
  - Tighten screw (5) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (6) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts reach a torque of 5 Nm.



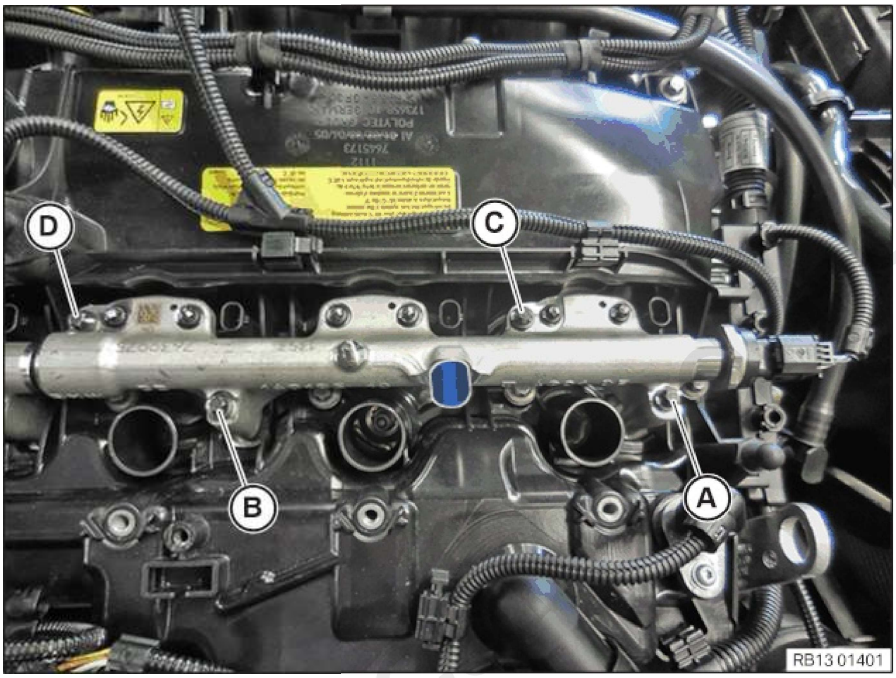
- Mark all bolts (1) to (6) with a line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the screw (1) with an angle of rotation of 90° ±15°.
  - Tighten the screw (2) with an angle of rotation of 90° ±15°.
  - Tighten the screw (3) with an angle of rotation of 90° ±15°.
  - Tighten the screw (4) with an angle of rotation of 90° ±15°.
  - Tighten the screw (5) with an angle of rotation of 90° ±15°.
  - Tighten the screw (6) with an angle of rotation of 90° ±15°.

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- Check if all bolts (1) to (6) have been tightened with a 90° ±15° angle of rotation.

  All markings (lines) must be horizontal (see Figure).



- Release screws (M6x70) (A) to (D) **without fail**.

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten screw (A) to 5 Nm.
- Tighten screw (D) to 5 Nm.
- Tighten screw (B) to 5 Nm.
- Tighten screw (C) to 5 Nm.

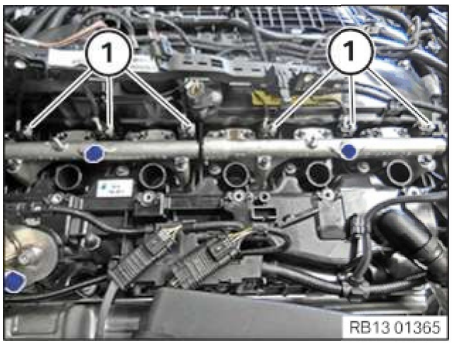


- Mark all the bolts (A) to (D) with a vertical line (see Figure).
- Tighten bolts (M6x70) (A) to (D) with an angle of rotation of 90°.



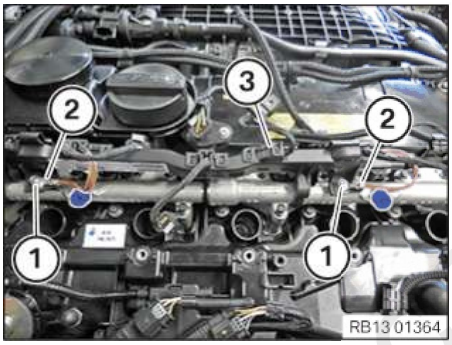
- Check whether all screws (A) to (D) have been tightened with an angle of rotation of 90°.

  All marks (lines) must be horizontal (see figure).



- Connect and lock all the connectors (1) to the injectors.

  All connectors (1) must engage audibly.

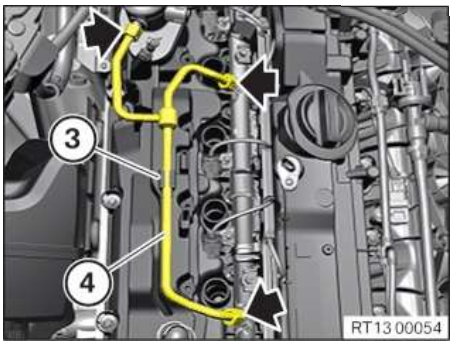


- Thread the cable channel (3) in and install.
- Thread in ground cable (2) and install.
- Tighten nuts (1).

Ground cable to rail

M6			5 Nm

91 – Installing high pressure line between rail and high pressure pump

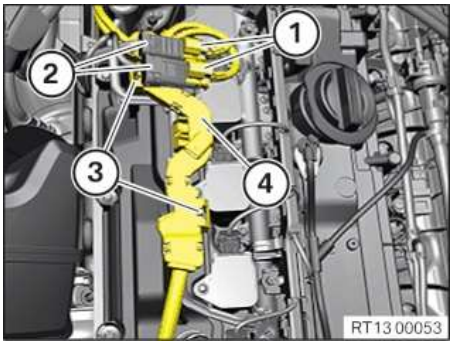


- Insert the high pressure line (4) into the holder (3) and install.
- Tighten union nuts (arrows) with the special tool .

High pressure line between rail and high pressure pump

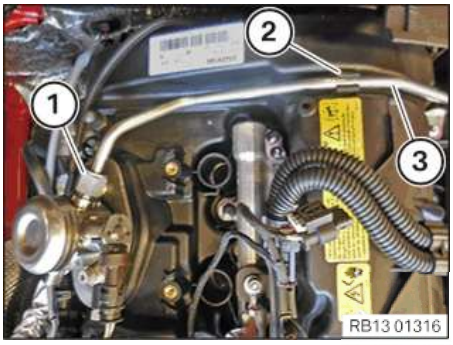
M14x1,5		Tightening torque	33 Nm

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- Insert and install the wiring harness section of the engine wiring harness (4).
  The locks (3) must engage audibly.
- Connect connectors (1) and (2) and lock.
  The connectors (1) and (2) must audibly engage.

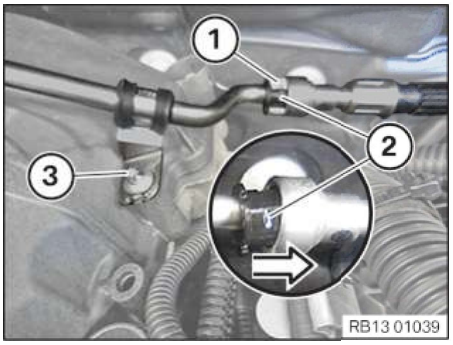
92 – Installing fuel delivery line



- Guide the fuel delivery line (3) in and install.
- Install rubber damper (2).
- Check the rubber damper (2) for the correct fit.
- Tighten the union nut (1) hand-tight.
- Tighten union nut (1).

Fuel delivery line to high pressure pump

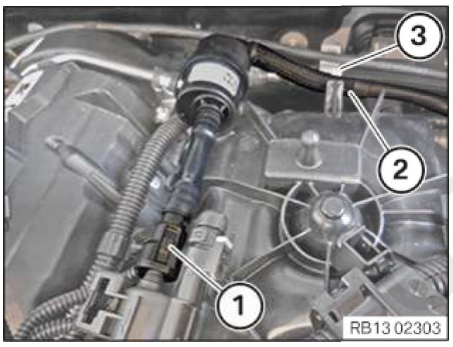
M14		Tightening torque	31 Nm



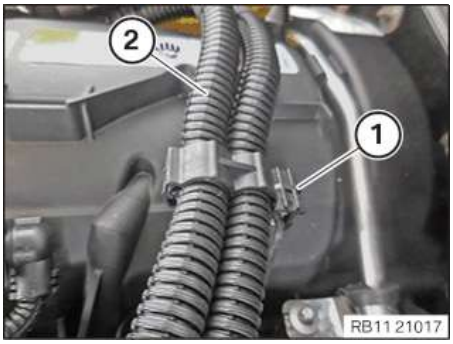
- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure clamps (1).
- Tighten down screw (3).

Fuel line to cylinder head cover

6x18		Tightening torque	6,5 Nm

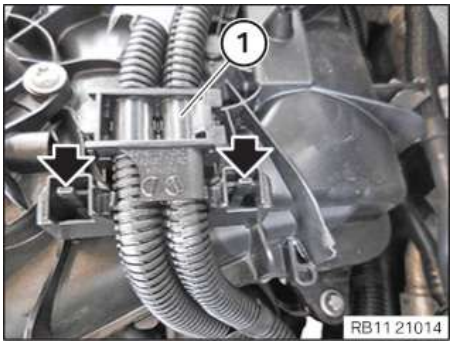


- Insert and install the tank ventilation line (2).
- Lock (1) must engage audibly.
- Secure the tank ventilation line (2) to the clamp (3).



- Insert and install wiring harness section (2) for injectors and ignition coils.
- Secure clamps (1).

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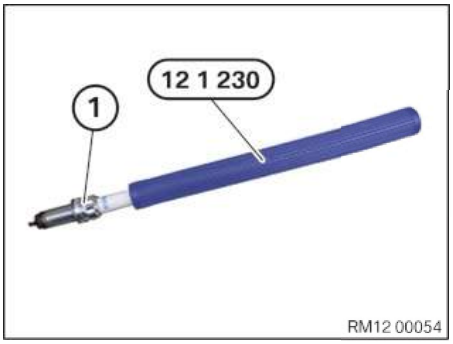


- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

93 – Installing all spark plugs

NOTICE

The description is for one component only. The procedure is identical for all further components.



- Insert spark plug (1) into special tool 0 496 065 (12 1 230).



TECHNICAL INFORMATION

Do not drop spark plug into spark plug shaft! This can lead to a reduction of the electrode gap and can thus impair smooth running of the engine, especially in idle position.

- Screw in the spark plugs in the engine with the special tool 0 496 065 (12 1 230) until hand-tight.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Tighten the spark plugs with the torque wrench, the special tool 0 495 560 (12 1 220) and a swivelling extension.

Spark plugs

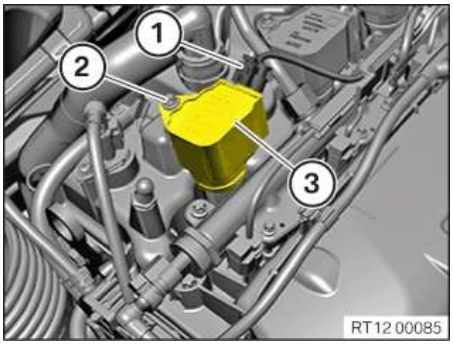
M12x1.25		Tightening torque	23 Nm

94 – Install all ignition coils

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Install ignition coil.**



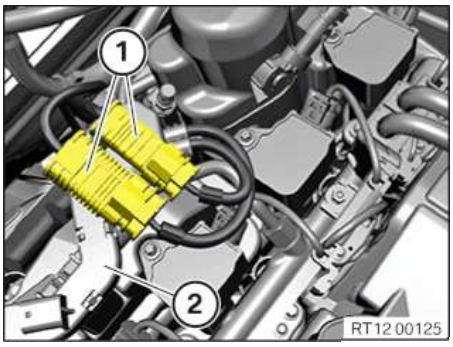
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

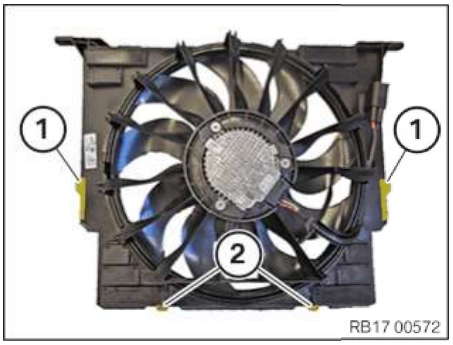
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

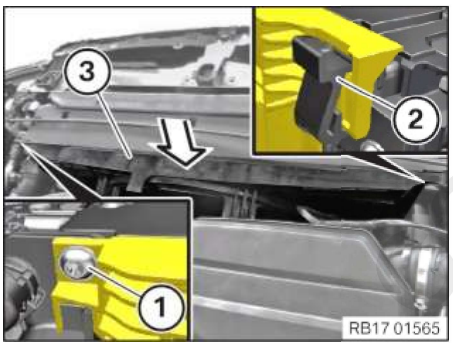


- Connect the connector (1) of the front oxygen sensor and the monitoring oxygen sensor on the cable shaft (2).

95 – Install fan cowl



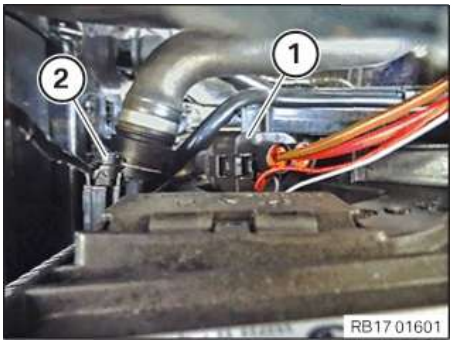
- Feed guides (1) into the radiator.
- Feed guides (2) into the charge air cooler.



- Guide in and install fan cowl (3) **carefully** in the direction of the arrow.
- Ensure that the lock (2)engages audibly.
- Tighten down screw (1).

Fan cowl with electric fan on radiator

TS6x20		Tightening torque	6,5 Nm

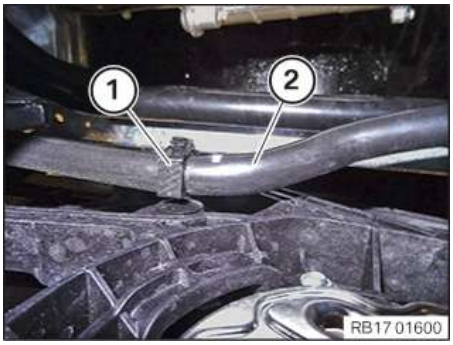


- Connect connectors (2) and lock.

  The connector (2) must engage audibly.
- Connect connectors (1) and lock.

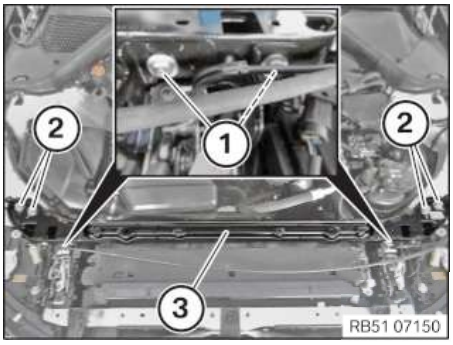
  The connector (1) must engage audibly.

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- **If installed:** Secure the transmission oil line (2).
  Insert and install the transmission oil line (2).
  Lock holder (1).

96 – Install the rear top cross connection



- Guide in and position the top rear cross connection (3).
- Tighten the screws (1).

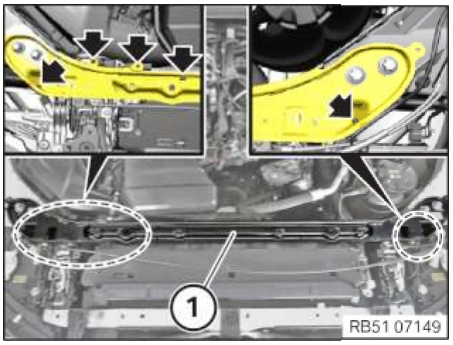
Top rear cross connection to bonnet catch support

Flat-head screw M6x20		Tightening torque	11,8 Nm

- Renew screws (2).
  Parts: Bolts
- Tighten the screws (2).

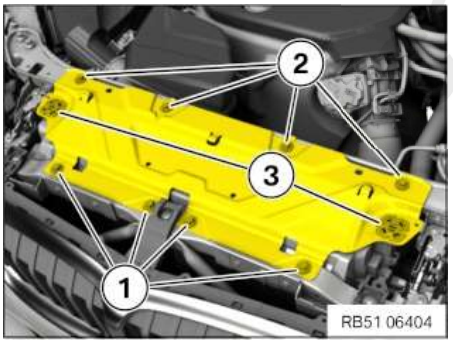
Rear top cross connection to wheel arch carrier support

M10x20 screw	Renew screw.	Jointing torque	56 Nm
		Angle of rotation	90 °



- Secure the clips (arrows) in the marked areas to the top rear cross connection (1).

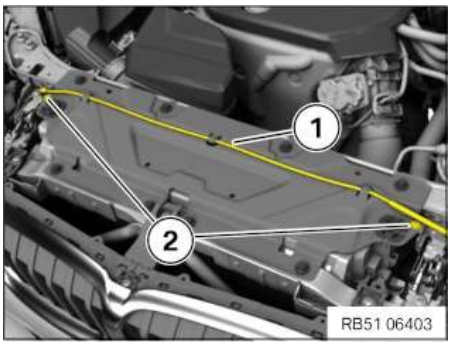
97 – Installing the top cross connection



- Set and position upper cross connection with holders (3) from above.
- Tighten down screws (1) and (2).

Cross connection, top

M8x20		Tightening torque	28 Nm



- Tighten down screws (2).

Cross connection, top

M6x20		Tightening torque	11,8 Nm

- Attach Bowden cable (1) on the upper cross connection.

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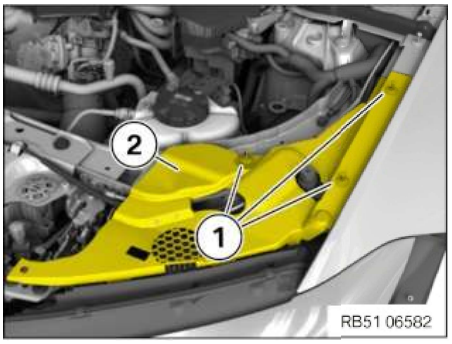
- Clip in the housing for the coupling of the Bowden cables (1).

98 – Install the cover in the engine compartment at top left and right partially

NOTICE

Description is for left component only. Procedure on the right side is identical.

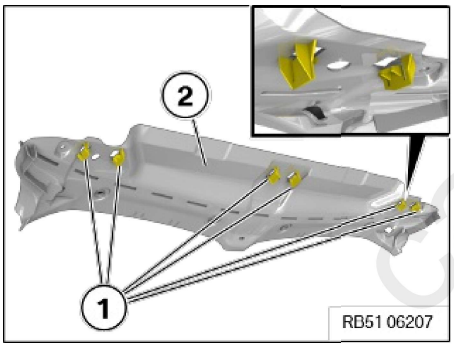
▶ Installing the cover in the engine compartment on top partially



- Install the cover in the engine compartment on top (2).
- Secure expanding rivet (1).

99 – Installing cover for engine compartment centre

Check



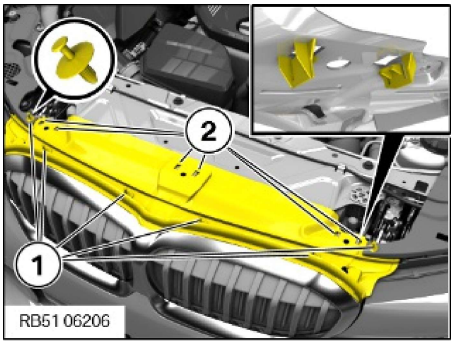
- Check latch mechanisms (1) of cover for engine compartment centre (2) for damage.

Result

» The latch mechanism (1) is damaged.

Measure

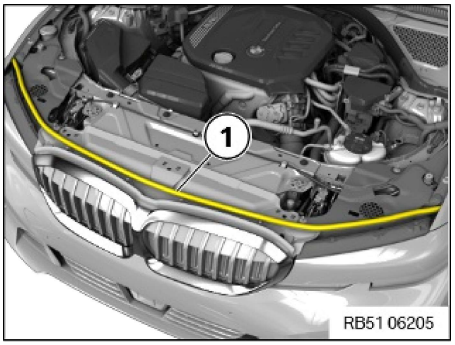
- Renew cover for engine compartment centre (2).



- Guide in the cover for the engine compartment centre from the rear and position it.
- Clip in the cover for the engine compartment centre with latch mechanisms (2).
- Mount all expanding rivets (1).

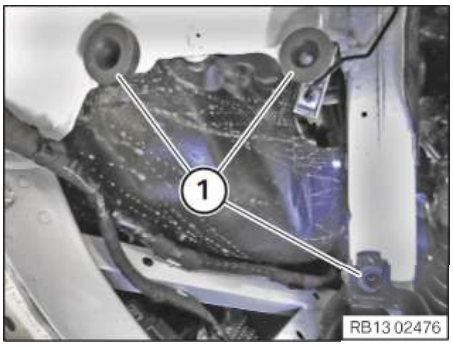
100 – Install the seal for the front bonnet

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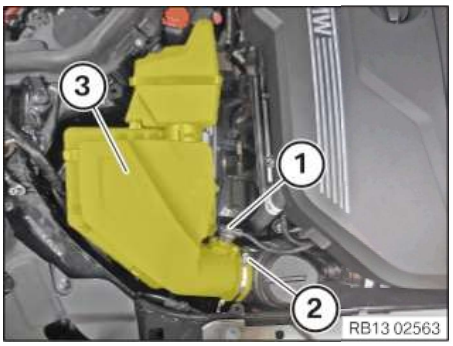


- Position the bonnet seal(1) and connect it on the mounting on the bumper and on the headlights.

101 – Installing intake silencer housing



- Check the rubber mount (1) for correct fit.



- Feed the intake filter housing (3) in and engage it in the rubber mounts.
- Tighten clamp (2).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

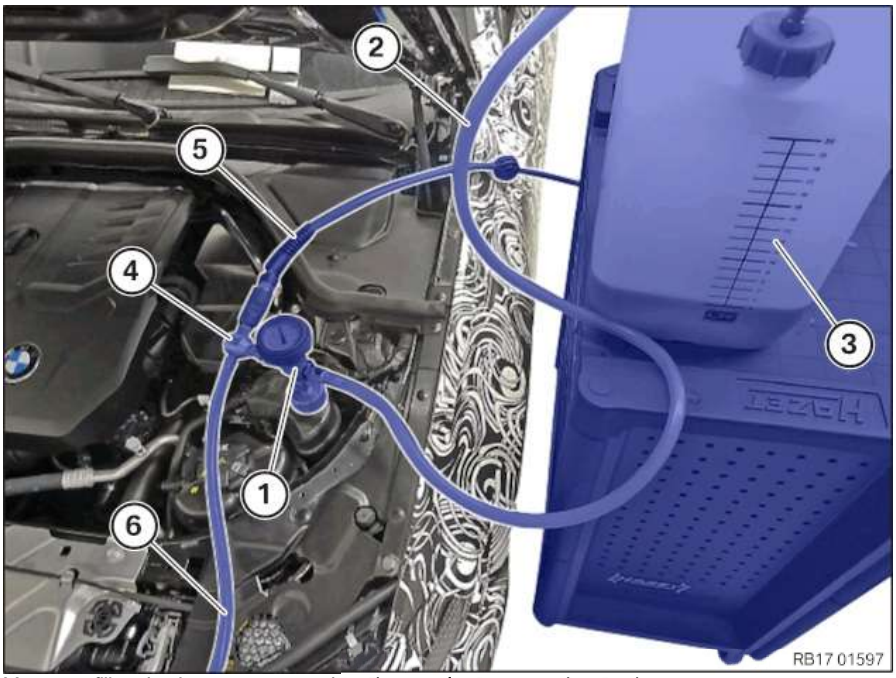
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

102 – Filling the low-temperature cooling system with the vacuum filler device

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Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Mixing different coolants is not permitted.

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TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

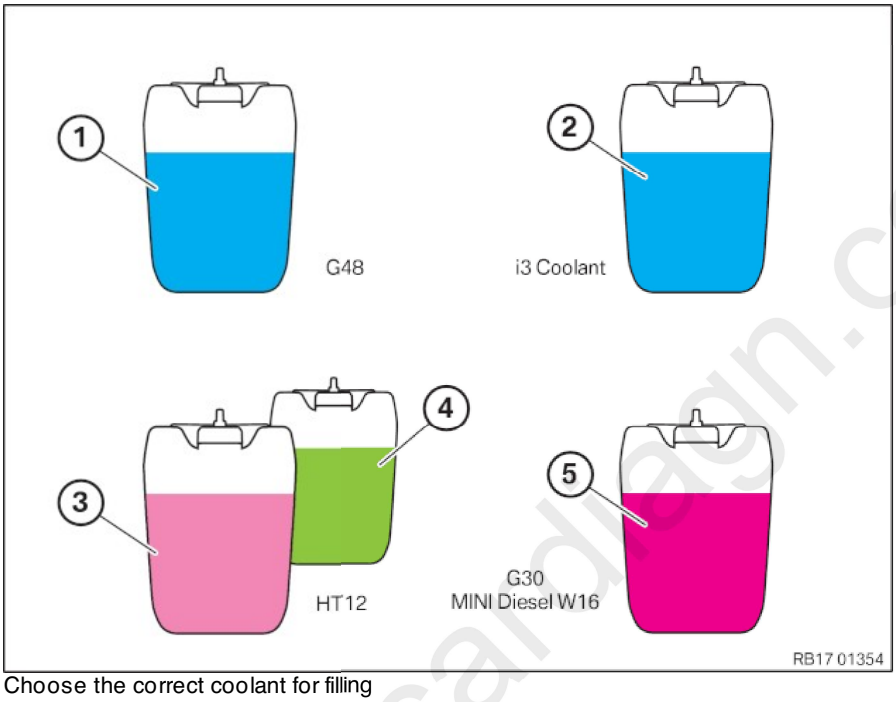
A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. G48 (Blue) G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.

2. i3 coolant (blue) is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.

3. HT12 (Pink) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

4. HT12 (Green) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

5. G30 (Pink) must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

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- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

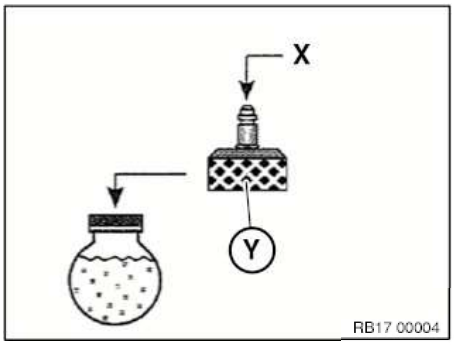
Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 109

- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

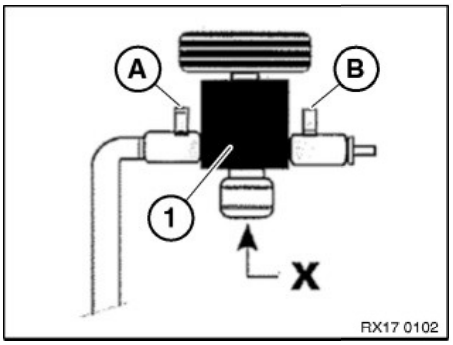
Capacity of low-temperature coolant circuit G20/G29

B58B30O1	4,5 l

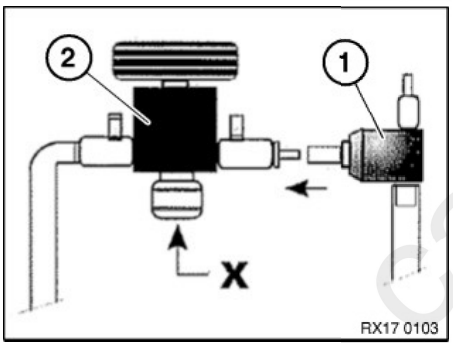
Expendable materials: Technically suitable antifreeze and corrosion inhibitor



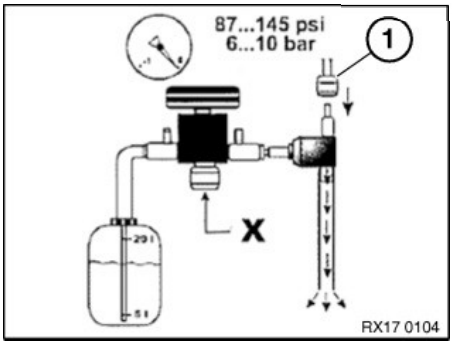
- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.



- Check that shutoff valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.

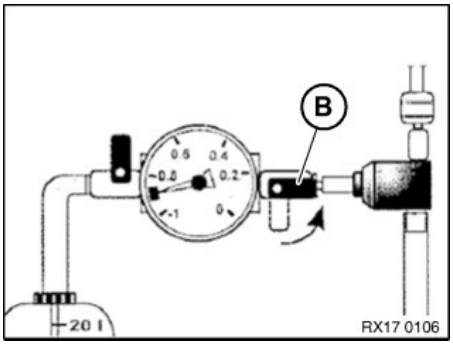


- Connect Venturi nozzle (1) to the vacuum filler device (2).
  (X)is the connection on the coolant expansion tank.



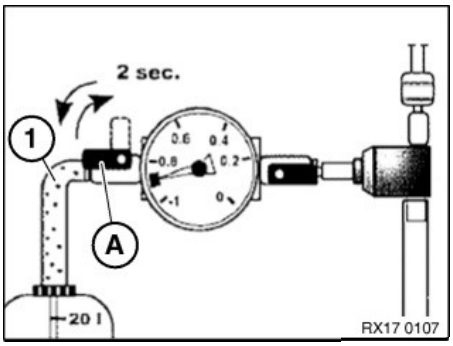
- Connect compressed air (1).
  (X)is the connection on the coolant expansion tank.

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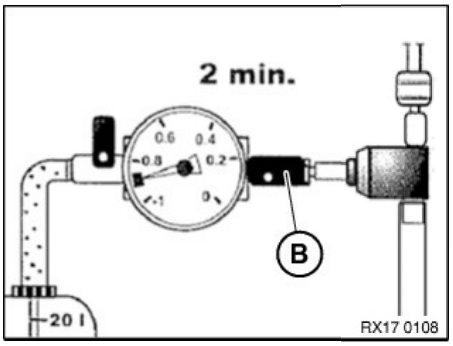
- Open shut-off valve (B).

  The venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

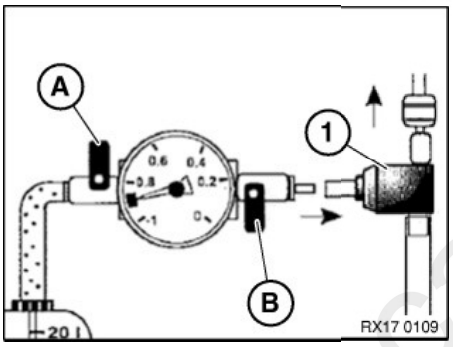


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

TECHNICAL INFORMATION

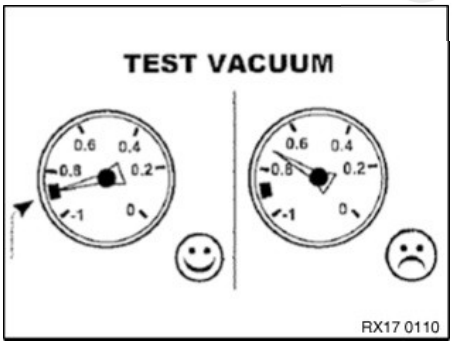
The coolant hoses contract during vacuum build-up.

- After a vacuum of -0.7 to -0.95 bar has been created in the coolant circuit (duration approx. 2 min), shut the shutoff valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).

Check



- The vacuum in the coolant circuit must be maintained for at least 30 seconds.

Result

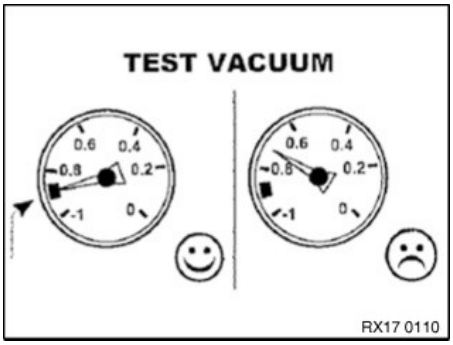
» Vacuum drops.

Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check

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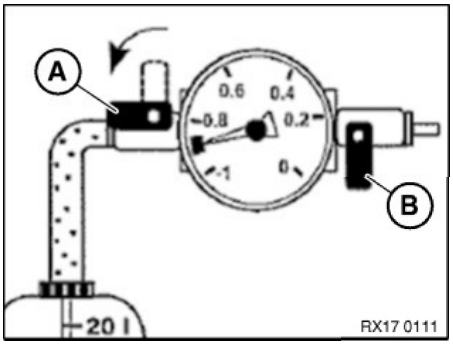
- The vacuum in the coolant circuit must be maintained for at least 30 seconds.

Result

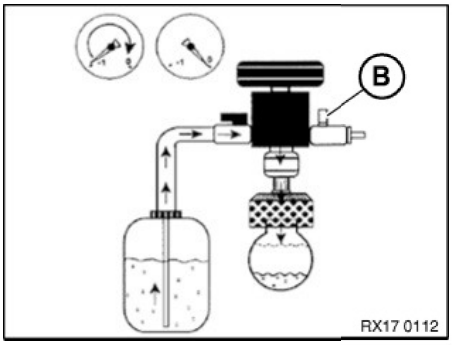
» Vacuum remains constant.

Measure

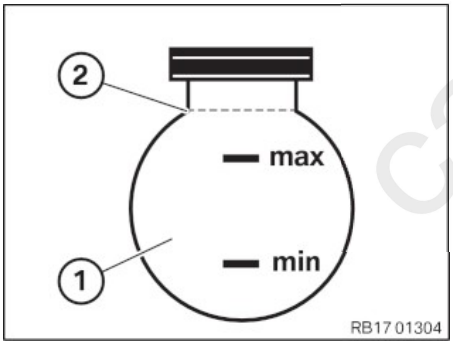
- Continue with filling.



- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.



- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).



- Remove the vacuum filler device with the adapter from the low-temperature coolant expansion tank (1).
- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to the lower edge of the coolant filler neck (2) of the low-temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

103 – Disconnecting all battery earth leads



- See additional information.

104 – Bleeding the low-temperature cooling system

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TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

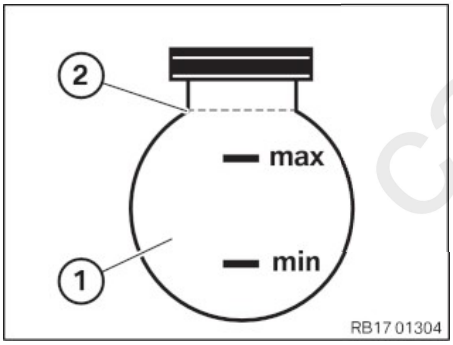
TECHNICAL INFORMATION

Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.



- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to lower edge (2) of the coolant filler neck of low-temperature coolant expansion tank (1).
- Close the sealing cap on the coolant expansion tank of the low-temperature coolant circuit.
- Ensure that the bonnet is **open**.
- Connect battery charger.
- Switch on the ignition and ensure that it remains **switched on** (for example, activate the low-beam headlight and the hazard warning lights **at the same time**).
- If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Ensure that the Driving Experience Control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **not** press on the brake pedal.
- Do **not** start engine.

  The cooling system bleeding routine will start.

  The electric coolant pump in the low-temperature coolant circuit is activated for 11 minutes according to a cooling system bleeding routine.

  The cooling system bleeding routine ends after 11 minutes.

  The electric coolant pump is **no** longer activated.
- Note the display in the instrument cluster (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Allow the coolant temperature to cool down to **< 50°C**.

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- Loosen sealing cap (1).



TECHNICAL INFORMATION

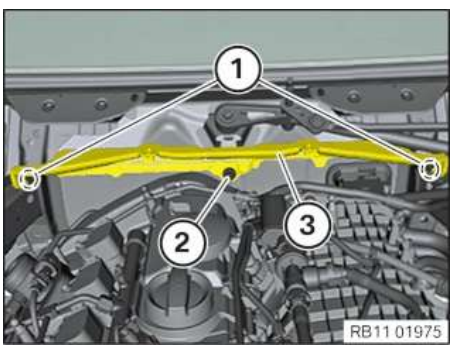
After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

The normal filling level of the coolant is reached while driving.

- Adjust the filling level in coolant expansion tank (2) of the low-temperature coolant circuit to **100 ml** above the **maximum mark** (1) .
- Close sealing cap (1).

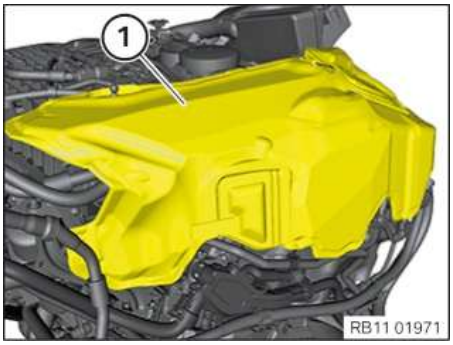
105 – Installing centre bulkhead lower section



- Position the centre bulkhead lower part (3).
- Tighten nut (2) and screws (1).

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106 – Installing acoustic cover at rear

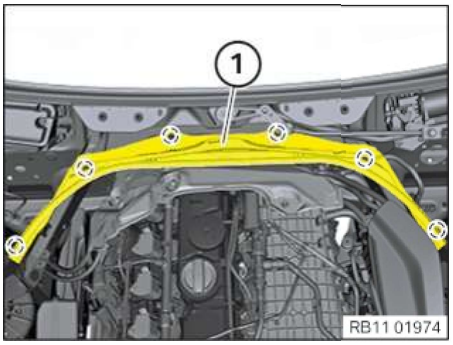


- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

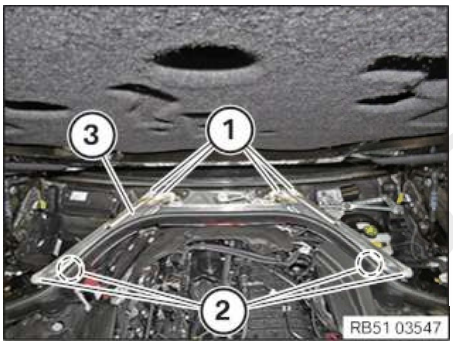
107 – Installing the centre bulkhead upper part



- Position the centre bulkhead upper part (1).
- Tighten the bolts in the marked areas.

Bulkhead upper part to bottom bulkhead

		Tightening torque	3 Nm



- **If installed:** Install tension strut on spring strut dome.
- Install the tension strut (3) on the spring strut dome.
- Tighten the screws (1).

Tension strut on bulkhead

M10x25 screw		Tightening torque	56 Nm

- Renew screws (2).

  Parts: Bolts
- Tighten the screws (2).

Tension strut to spring strut dome

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

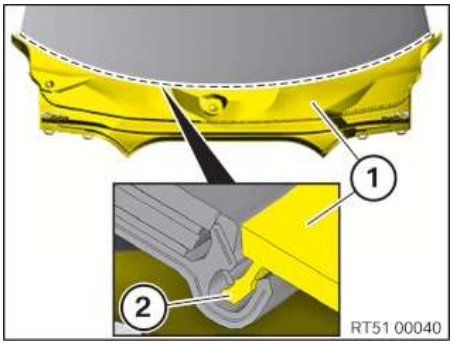
108 – Installing cowl panel cover

RISK OF DAMAGE

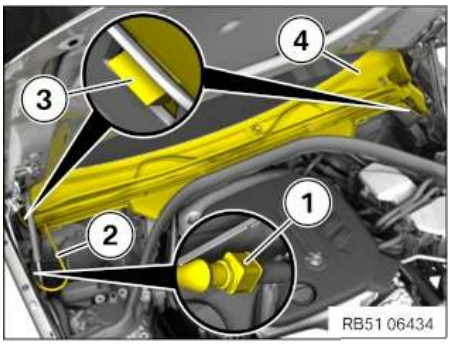
Damage caused by water ingress into the vehicle.

Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

- Ensure correct installation of the components.
- Only use undamaged components.

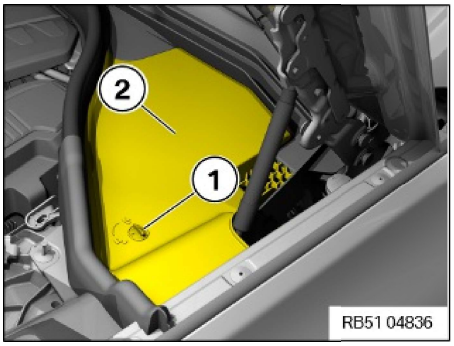


- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



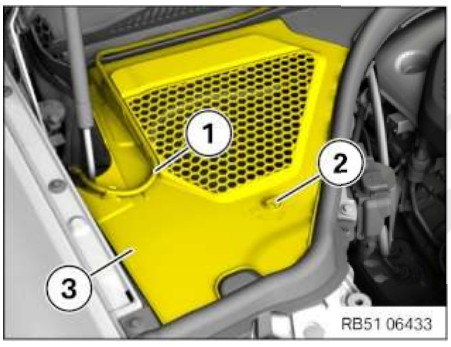
- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

109 – Install the cover of the engine compartment on the rear left



- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

110 – Install the rear right engine compartment cover



- Position the cover of the engine compartment on the rear right (3).
- Close lock (2).
- Insert washer fluid hose (1) into the guides.

111 – Installing both wiper arms

NOTICE

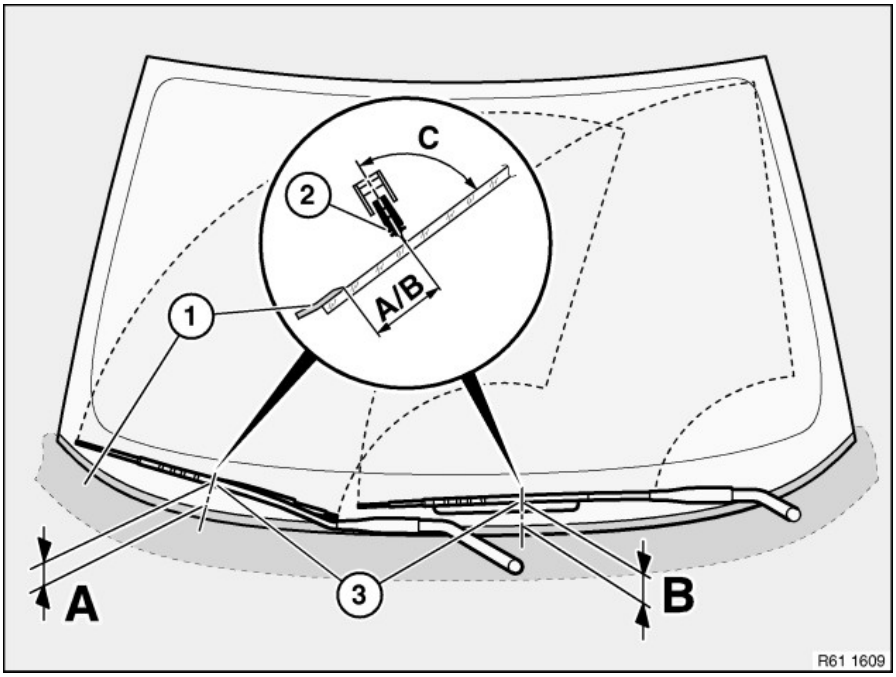
Description is for left component only. Procedure on the right side is identical.

▸ **Install the wiper arm**

TECHNICAL INFORMATION

The wiper system must be in zero position.
After installing the cowl panel cover and before fitting the wiper arm:
Activate the wiper system once to ensure that it has the correct installation position.

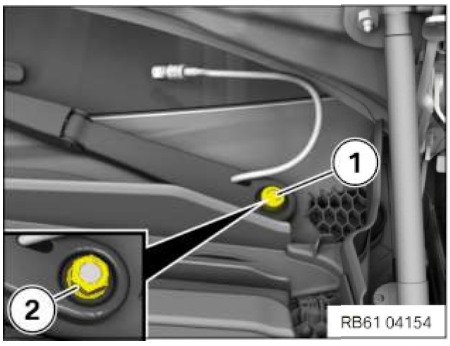
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- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

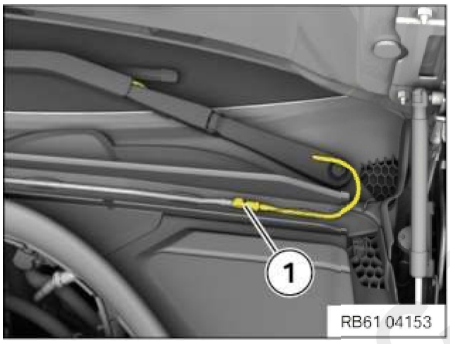


- Tighten nut (2).

Windscreen wiper arm

Combination hexagon nut		Tightening torque	35 Nm

- Connect the protective cap (1).



- Insert windscreen wash hose (1) into the cowl and connect at the separating point.

112 – Install acoustic cover

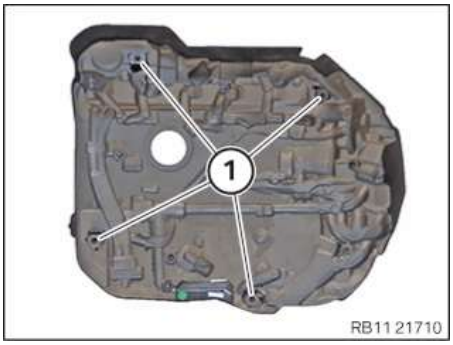
RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.

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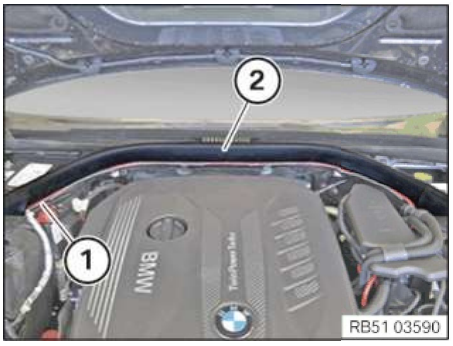


- Check the rubber mount (1) for correct fit in the acoustic cover.



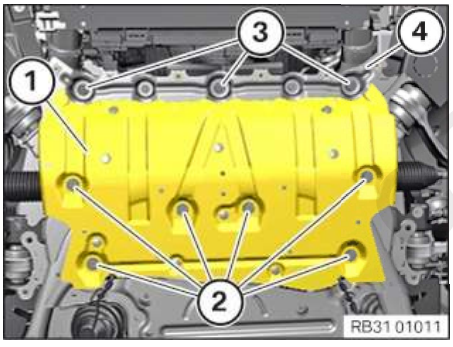
- Install acoustic cover (1) and fix in the rubber mounts (marks).

113 – Install the seal for the bonnet



- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

114 – Installing the stiffening plate

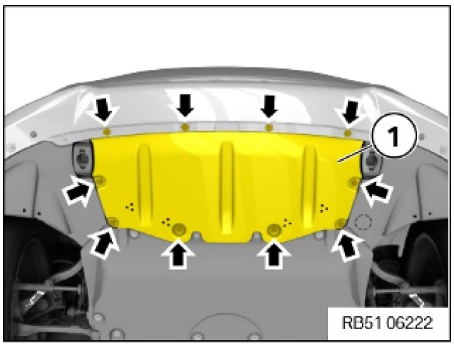


- Position stiffening plate (1).
- Screw screws (2) in.
- Position holder of underride protection (4).
- Screw screws (3) in.
- Tighten down screws (2) and (3).

Stiffening plate to front axle support

M10		Tightening torque	56 Nm

115 – Installing the front underbody protection



- **Version 1:**

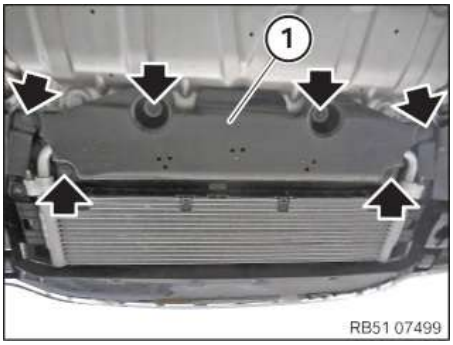
  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

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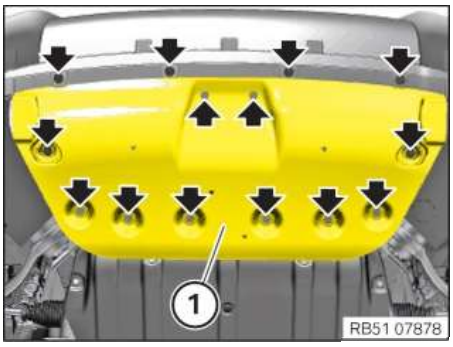
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

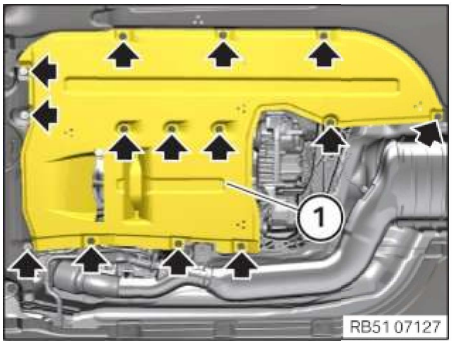
  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

116 – Installing underbody protection at rear



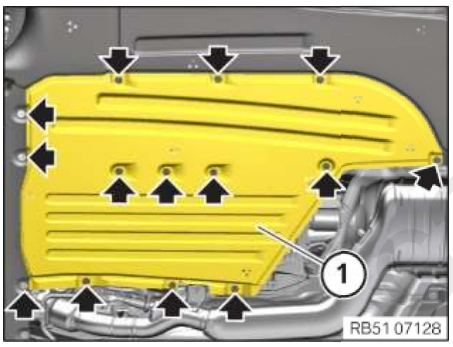
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

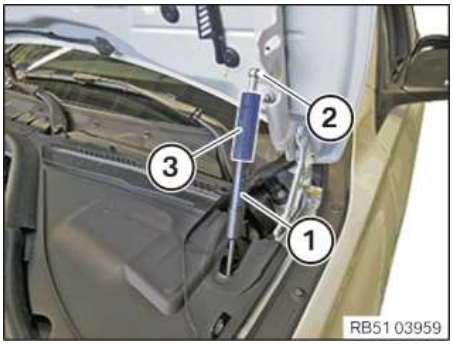
Hexagon screw		Tightening torque	3 Nm

117 – Check engine oil level

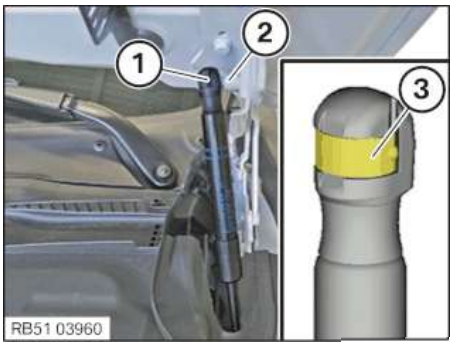
- Park vehicle on a horizontal surface.
- In the case of automatic transmission, shift to selector lever position N or P.
- Accelerator pedal is not pressed.
- Engine is running and is at operating temperature.
- Read off the engine oil level in the instrument cluster (KOMBI) or on the control display.
- Top up engine oil if necessary.

118 – Take bonnet out of the service position

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- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.



CAUTION

Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

Additional Information

Overview of Tightening Torques

Cover, front bottom on side — Used in step 3673

Hexagon screw for thermoplastic		Tightening torque	3 Nm

Basic carrier to cylinder head — Used in step 456272

M6		Tightening torque	8 Nm

Test gauge to basic carrier — Used in step 456272

M6		Tightening torque	8 Nm

Exhaust camshaft to cylinder head — Used in step 60

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

Intake camshaft to cylinder head — Used in step 61

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque.	10 Nm

VANOS central valve to camshaft — Used in step 6869

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

Chain tensioner to cylinder head — Used in step 71

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

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Engine oil cooler to bumper support			Used in step 73
M6X25		Tightening torque	8 Nm

Gate to bearing bracket			Used in step 76
M8			20 Nm

Intake plenum to cylinder head			Used in step 80
M6		Tightening torque	10 Nm

Intake plenum to support			Used in step 80
M6X25		Tightening torque	8 Nm

Tank ventilation line to intake plenum			Used in step 80
Oval-head screw		Tightening torque	3 Nm

Charge air line to throttle valve			Used in step 80
M6x30		Tightening torque	8 Nm

Control unit holder on spring strut dome			Used in step 82
Hexagon screw		Tightening torque	8 Nm

Cylinder head cover to cylinder head			Used in step 85
M6X30		Jointing torque	8 Nm

Cylinder head cover to cylinder head			Used in step 85
M6X30		Tightening torque	11 Nm

Auxiliary coolant pump holder to cylinder head			Used in step 85
M6		Tightening torque	7 Nm

Standard screw connection M6			Used in step 85
M6			8 Nm

Differential pressure sensor to holder			Used in step 85
TS6X18		Tightening torque	3,5 Nm

Holder, positive battery cable to cylinder head cover			Used in step 85
6X18		Tightening torque	6 Nm

High pressure pump to high pressure pump flange			Used in step 87
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

Ground cable to rail			Used in step 8990
M6			5 Nm

High pressure line between rail and high pressure pump			Used in step 91
M14x1,5		Tightening torque	33 Nm

Fuel delivery line to high pressure pump			Used in step 92
M14		Tightening torque	31 Nm

Fuel line to cylinder head cover			Used in step 92
6x18		Tightening torque	6,5 Nm

Spark plugs			Used in step 93
M12x1.25		Tightening torque	23 Nm

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Ignition coil			Used in step 94
Screw		Tightening torque	8 Nm

Fan cowl with electric fan on radiator			Used in step 95
TS6x20		Tightening torque	6,5 Nm

Top rear cross connection to bonnet catch support			Used in step 96
Flat-head screw M6x20		Tightening torque	11,8 Nm

Rear top cross connection to wheel arch carrier support			Used in step 96
M10x20 screw	Renew screw.	Jointing torque	56 Nm
		Angle of rotation	90 °

Cross connection, top			Used in step 97
M8x20		Tightening torque	28 Nm

Cross connection, top			Used in step 97
M6x20		Tightening torque	11,8 Nm

Clean air pipe to upper section of intake filter housing			Used in step 101
Clamp		Tightening torque	3 Nm

Bulkhead upper part to bottom bulkhead			Used in step 107
		Tightening torque	3 Nm

Tension strut on bulkhead			Used in step 107
M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome			Used in step 107
Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

Windscreen wiper arm			Used in step 111
Combination hexagon nut		Tightening torque	35 Nm

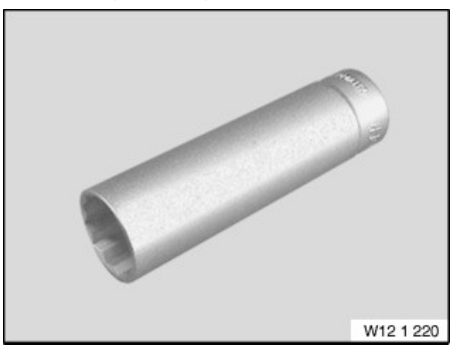
Stiffening plate to front axle support			Used in step 114
M10		Tightening torque	56 Nm

Underbody protection front			Used in step 115
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Underbody protection			Used in step 116
Hexagon screw		Tightening torque	3 Nm

Overview of Special Tools

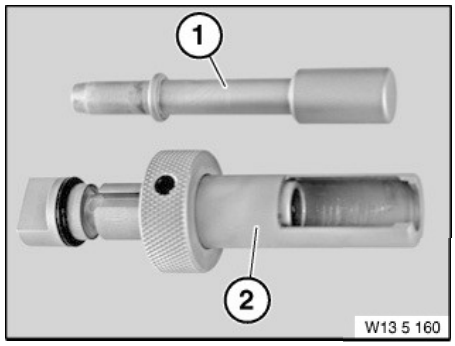
0 495 560 (12 1 220) Socket



Common		Used in step 2393
Usage	For removing and installing the spark plugs (WAF 14 bihexal).	
Included in the tool or work		
Storage location	C18	
Replaced by		
In connection with		
SI-Number	01 20 06 (299)	

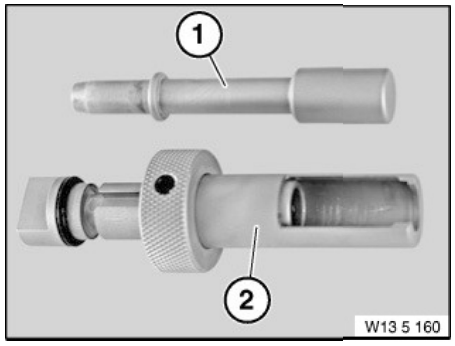
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0 496 567 (13 5 161) Fastener



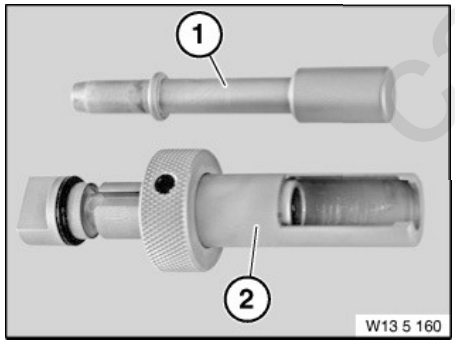
Common	Used in step 25
Usage	(Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

0 496 568 (13 5 162) Fastener



Common	Used in step 25
Usage	(Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

0 496 565 (13 5 160) Fastener



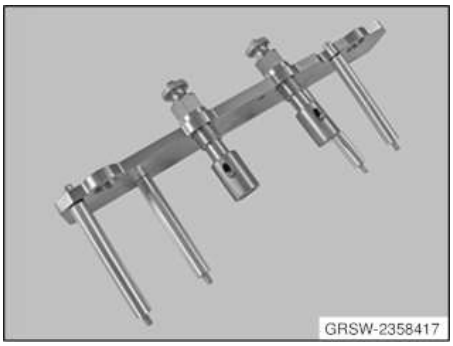
Common	Used in step 25
Usage	(Caps (2x)) To close off the fuel lines when removing and installing the engine.
Included in the tool or work	
Storage location	B26
Replaced by	
In connection with	
SI-Number	01 22 08 (498)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 567 (13 5 161)		**Fastener** (Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set	
2	0 496 568 (13 5 162)		**Fastener** (Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool	

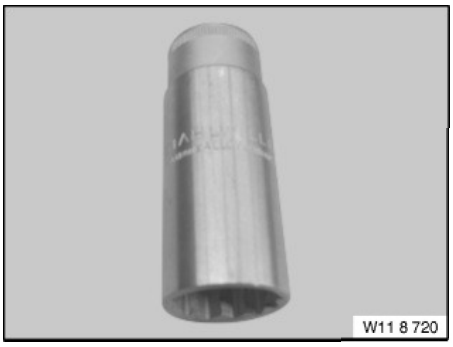
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2 358 417 Device



Common	Used in step 2728
Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 106 (11 8 720) Socket WAF 46



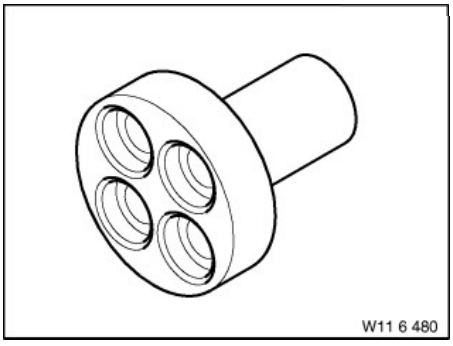
Common	Used in step 2728
Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

2 360 895 Pin wrench



Common	Used in step 2986
Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 493 380 (11 6 480) Connector



Common	Used in step 4041457072777887
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

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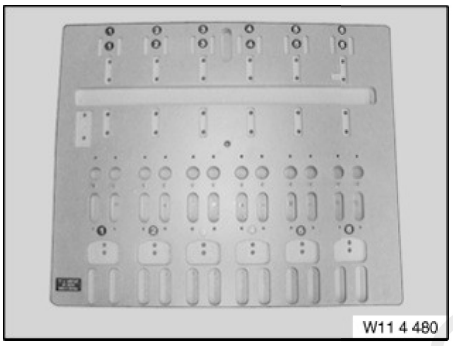
2 359 088 Device



Common Used in step 4279

Usage	For removing and installing torsion spring of the intermediate lever.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 495 105 (11 4 480) oddments tray



Common Used in step 42434454555657

Usage	(Boards (2 pieces)) For setting down the individual components of the cylinder head.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 106 (11 4 481)		**oddments tray** (Board, intake side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	
2	0 495 107 (11 4 482)		**oddments tray** (Board, exhaust side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	

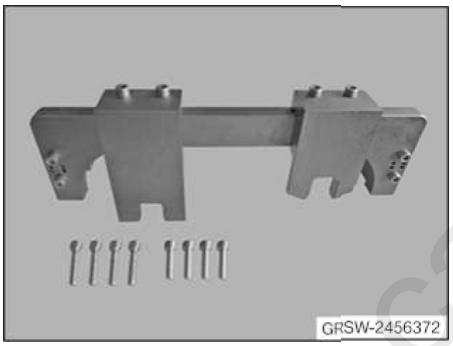
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2 288 380 Locating stud



Common	Used in step 457072
Usage	For disconnecting the crankshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 04 14 (071)

2 456 372 Gauge



Common	Used in step 4553627072
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 122 Gauge



Common	Used in step 455372
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 496 855 Ratchet handle



Common	Used in step 47486869
Usage	Insert reversible ratchet with nut for installation and disassembly of the VANOS- SW22. (only in longitudinal installation). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A55
Replaced by	
In connection with	
SI-Number	01 34 15 (306)

2 450 487 Socket



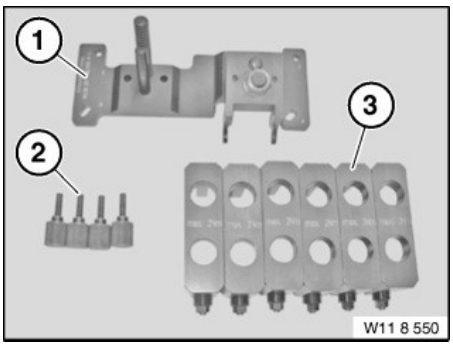
Common	Used in step 47486869
Usage	For removing and installing the VANOS adjuster. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	0496855
SI-Number	01 07 17 (487)

2 410 670 Device



Common	Used in step 5560
Usage	To press down the valves on the 2nd cylinder, for de-energised disassembly/installation of the exhaust camshaft. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 23 15 (280)

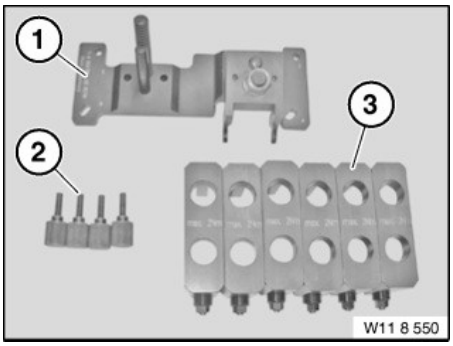
0 495 741 (11 8 552) Screw



Common	Used in step 5560
Usage	(Knurled screw (4 pieces))
Included in the tool or work	0 495 739
Storage location	C19
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

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0 495 739 (11 8 550) Device



Common Used in step 55

Usage	(Locking device) For holding the bearing strips in place when fitting intake camshaft.
Included in the tool or work	
Storage location	C19
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
2	0 495 741 (11 8 552)		**Screw** (knurled screw (4 pieces))	
1	0 495 740 (11 8 551)		**Tool** (Tool to press down) discontinued, available as part of set of special tools only	
3	0 495 742 (11 8 553)		**Synchronising key** Thrust piece (1 piece)	

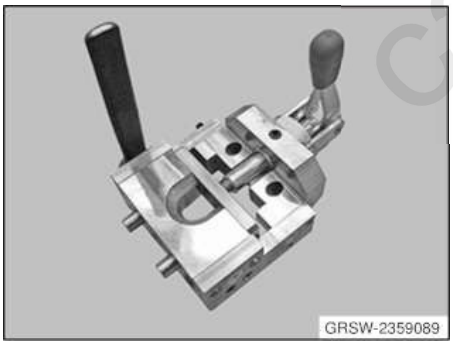
2 455 654 Tensioning tool



Common Used in step 6770

Usage	To pretension the timing chain when adjusting the timings. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 359 089 Device



Common Used in step 76

Usage	For positioning the sliding block. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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2 452 959 Pliers



Common	Used in step 88
Usage	For disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ number 13 0 191). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A5
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 448 401 Fitting aid



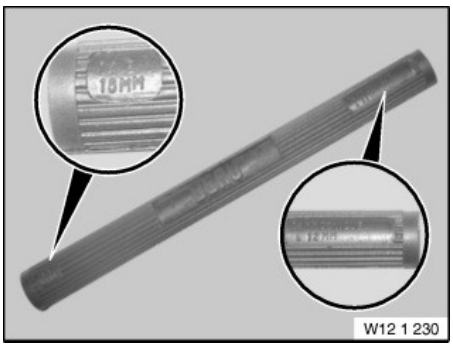
Common	Used in step 88
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 022 Gauge



Common	Used in step 8990
Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

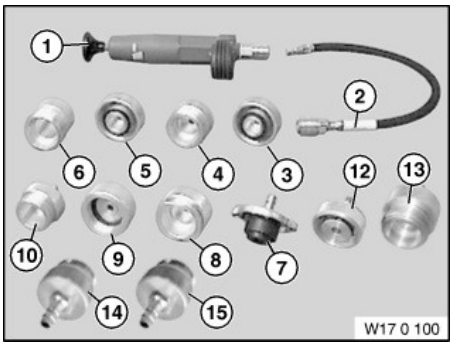
0 496 065 (12 1 230) Fitting aid



Common	Used in step 93
Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

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0 494 417 (17 0 100) Tester



Common Used in step 102

Usage	For checking engine cooling system on watertightness. For checking radiator cap.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 02 (884)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
5	0 494 422 (17 0 105)		**Adapter** For radiator cap (sawtooth thread)	
10	0 494 427 (17 0 111)		**Adapter** For radiator cap R53/W11, R50/W17 adapter replaced 17 0 052.	
1	0 494 418 (17 0 101)		**Pump**	
2	0 494 419 (17 0 102)		**Hose** (hose with quick-release coupling)	
3	0 494 420 (17 0 103)		**Adapter** For radiator cap (normal thread)	
4	0 494 421 (17 0 104)		**Adapter** For radiator cap (normal thread)	
6	0 494 423 (17 0 106)		**Adapter** For radiator cap (sawtooth thread)	
7	0 494 424 (17 0 107)		**Adapter** For radiator cap R50 / W10	
8	0 494 425 (17 0 108)		**Adapter** For radiator cap R50 / W10	
9	0 494 426 (17 0 109)		**Adapter** For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051	
11	0 494 428 (17 0 112)		**Case**	
12	0 494 642 (17 0 113)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
13	0 494 643 (17 0 114)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
14	0 495 889 (17 0 115)		**Adapter** For radiator cap Model series: N12, N14	

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Overview Technical Data

Distance from window pane edge to wiper blade	Used in step 111
Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

Capacity of low-temperature coolant circuit G20/G29	Used in step 102
B58B30O1	4,5 l
Expendable materials: Technically suitable antifreeze and corrosion inhibitor	

Links

General repair instructions	Used in step
12 00 ... Instructions for removal and replacement of control units	1284

Repair instructions	Used in step
61 20 900 Disconnecting and connecting battery earth lead	1103
61 20 900 Disconnecting and connecting battery earth lead	1103
61 20 900 Disconnecting and connecting battery earth lead	1103
61 20 900 Disconnecting and connecting battery earth lead	1103
61 20 900 Disconnecting and connecting battery earth lead	1103
61 20 900 Disconnecting and connecting battery earth lead	1103
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1103
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1103
61 20 900 Disconnecting and connecting battery earth lead	1103
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1103
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	1103
61 20 900 Disconnecting and connecting battery earth lead	1103
61 20 900 Disconnecting and connecting battery earth lead	1103
61 20 900 Disconnecting and connecting battery earth lead	1103
61 20 900 Disconnecting and connecting battery earth lead	1103
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61 20 900 Disconnecting and connecting battery earth lead	1103
61 20 900 Disconnecting and connecting battery earth lead	1103
61 20 900 Disconnecting and connecting battery earth lead	1103
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1103
61 20 900 Disconnecting and connecting battery earth lead	1103
61 20 900 Disconnecting and connecting battery earth lead	1103
61 20 900 Disconnecting and connecting battery earth lead	1103
61 20 900 Disconnecting and connecting battery earth lead	1103
61 20 900 Disconnecting and connecting battery earth lead	1103
61 20 900 Disconnecting and connecting battery earth lead	1103
61 20 900 Disconnecting and connecting battery earth lead	1103
61 35 ... Notes on ESD protection (Electro Static Discharge)	121322293783
13 53 ... Clean the cylinder heads in the area of injectors to prevent sand/dust contamination.	2728
61 35 ... Notes on ESD protection (Electro Static Discharge)	29
61 00 730 Encode/program control unit(s) (after vehicle test)	84
17 11 035 Removing and installing/replacing fan cowl with electric fan	87
17 00 ... Notes for working on cooling system.	102

Operating materials	Used in step

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