11 34 552 Removing and installing/replacing all valves

PRELIMINARY WORK

1 – Removing the exhaust turbocharger (cylinder head removed)

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

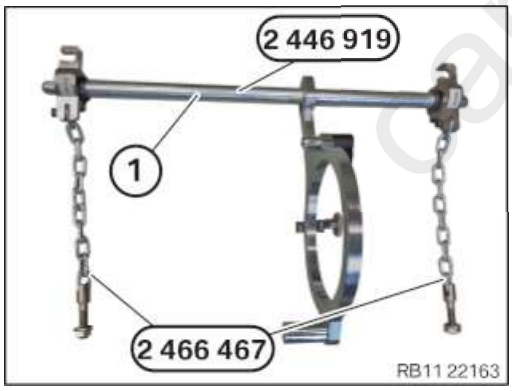
Damage to the electrical wastegate valve controller.

The electrical wastegate valve controller may be damaged as a result of the excessive forces required when removing and installing a jammed exhaust turbocharger.

- Do not pull on the electrical wastegate valve controller.
- Apply force to the turbine housing and exhaust manifold only.
  - Do not pull on the compressor housing.

TECHNICAL INFORMATION

Do not damage the thermal compensating elements. The disassembly and installation including intermediate storage of the exhaust turbocharger is only permitted with mounted special tool 2 466 919 .



- Have the special tool 2 446 919 and the special tool 2 466 467 ready.



- Install the special tool 2 446 919 on the exhaust turbocharger and secure it with the bolt (1).

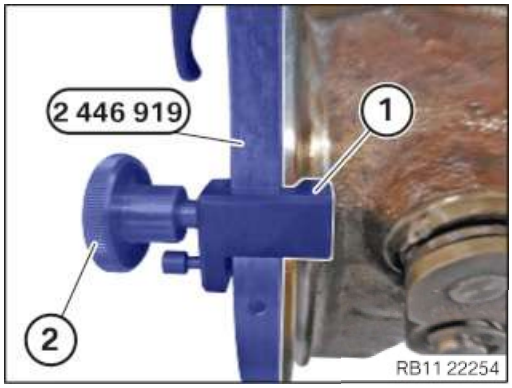
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- Fix the special tool 2 446 919 by turning the clamping lever (1) in the **direction** of the arrow.

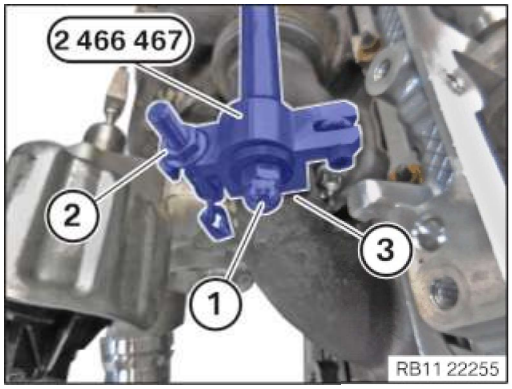
Note: The clamping lever that is shown in the graphic is already in its end position.

- Make sure that the special tool 2 446 919 is flush with the exhaust turbocharger in the **marked area**.

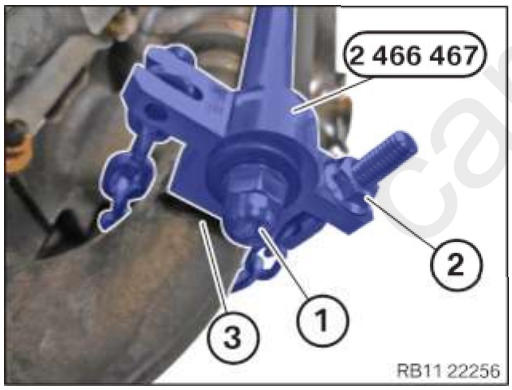


- Position the holder (1) and fasten it with the bolt (2).

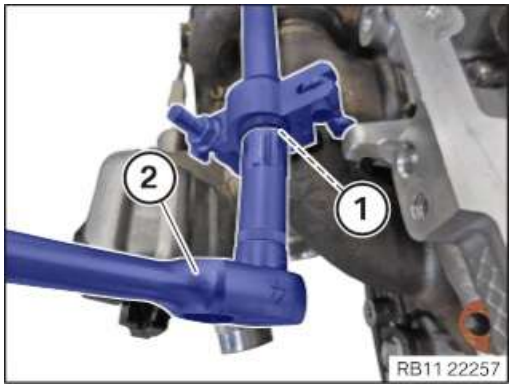
Note: The holder is used for the final mounting of the special tool **2 446 919**.



- Tighten the nut (1) hand-tight.
- Tighten the nut (2) hand-tight.
- Ensure that the special tool 2 466 467 rests correctly on the exhaust turbocharger (3).



- Tighten the nut (1) hand-tight.
- Tighten the nut (2) hand-tight.
- Ensure that the special tool 2 466 467 rests correctly on the exhaust turbocharger (3).

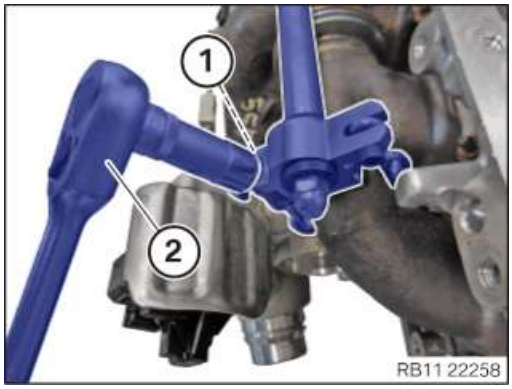


- Tighten the nut (1) using commercially available tools (2).

Special tool 2 466 467 to special tool 2 446 919

M8		Tightening torque	5 Nm

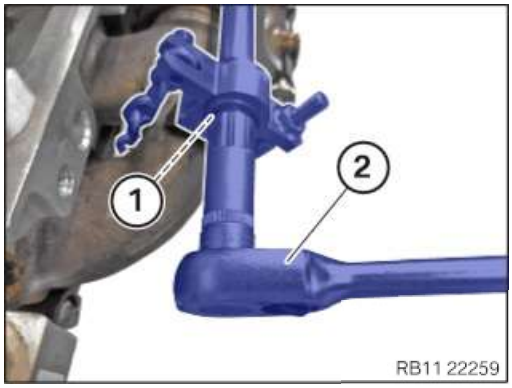
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- Tighten the nut (1) using commercially available tools (2).

Special tool 2 466 467 to special tool 2 446 919

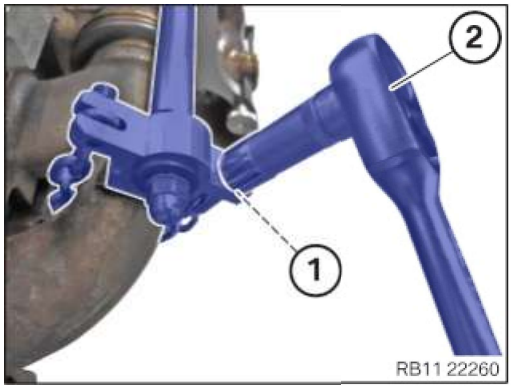
M8		Tightening torque	5 Nm



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

Special tool 2 466 467 to special tool 2 446 919

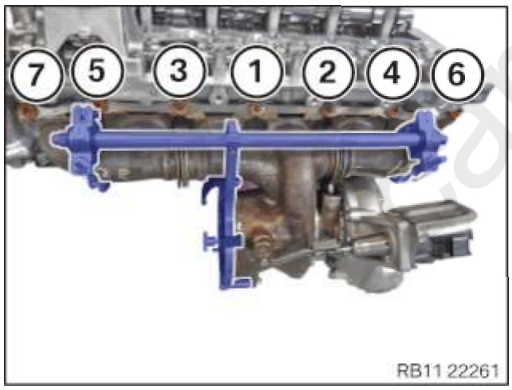
M8		Tightening torque	5 Nm



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

Special tool 2 466 467 to special tool 2 446 919

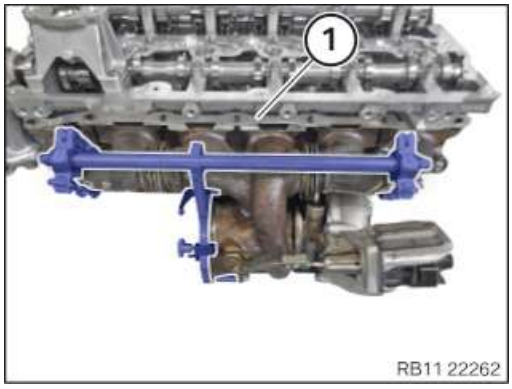
M8		Tightening torque	5 Nm



TECHNICAL INFORMATION

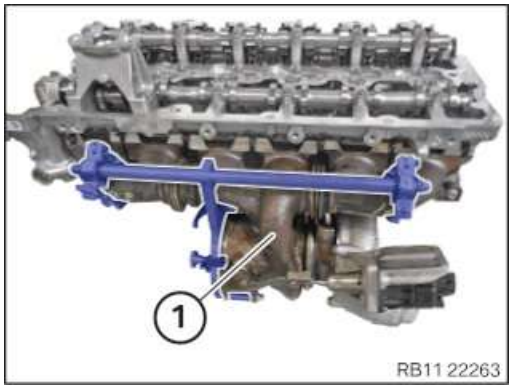
Exhaust manifold/exhaust turbocharger is not bolted to the underside, but clamped instead. When removing/replacing the exhaust manifold/exhaust turbocharger, the clamping strip remains screwed on.

- Unscrew the nuts in sequence (7) to (1).
- Secure exhaust turbocharger against falling down.



- Slide the slide rail (1) out and remove.

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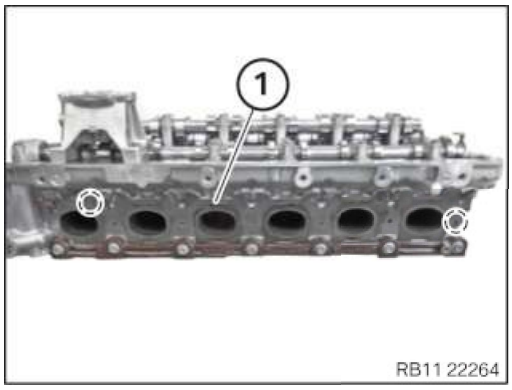
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

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

- Carefully guide out and remove the exhaust turbocharger (1).
- Thermal compensating elements of the exhaust turbocharger (1) or exhaust manifold should **not** be bent or deformed.



- Feed out and remove seal (1) in the **marked area.**

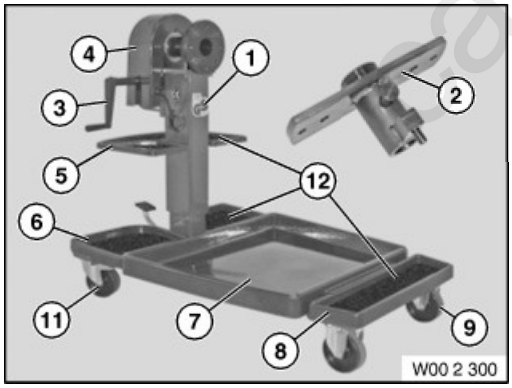
2 – Installing cylinder head on the assembly stand

CAUTION

Heavy component.

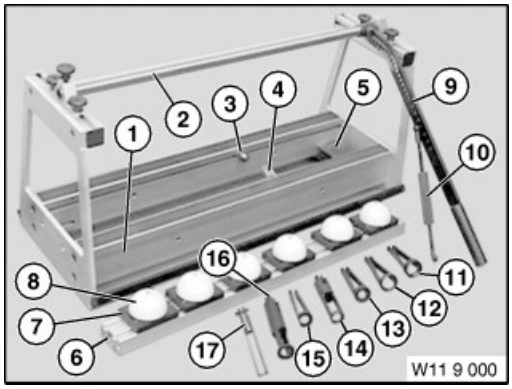
Heavy components can lead to injury or damage.

- 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



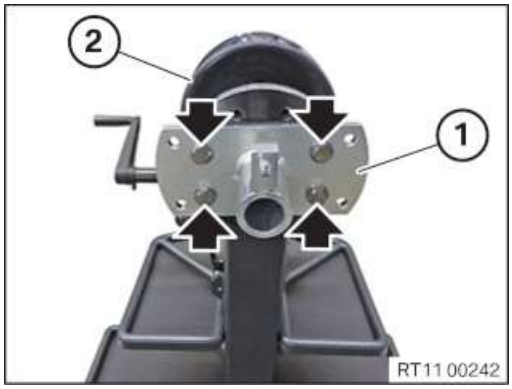
- Have the set of special tools 0 494 362 (11 9 000) ready.

Number	Description
1	Device
2	Rod
3	Adapter
4	Tab
5	Quick fastener
6	Aluminum strip
7	Shaped part
8	Shaped part made of plastic
9	Lever
10	Hook
11	Valve spring cage
12	Valve spring cage
13	Valve spring cage
14	Valve spring cage
15	Valve spring cage
16	Valve spring cage
17	Valve spring cage



- Stage special tool (workshop crane) 2 220 718.

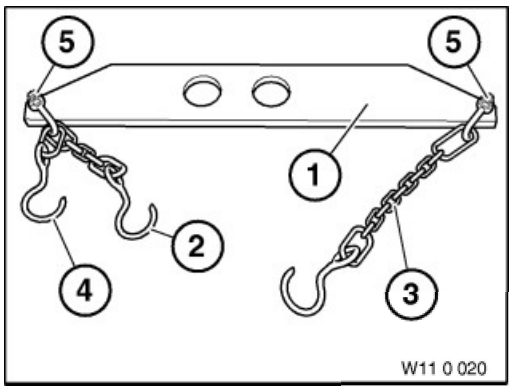
cardiagn.com



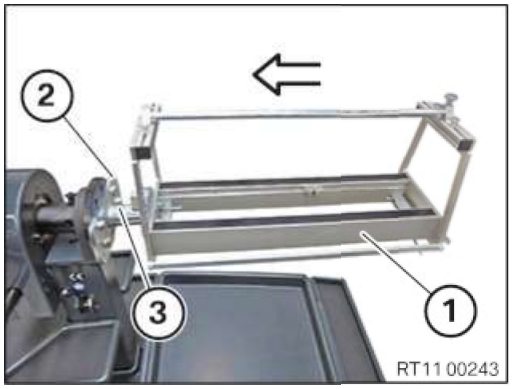
- Position flange (1) on assembly stand (2).
- Tighten screws (arrows).

Flange to assembly stand

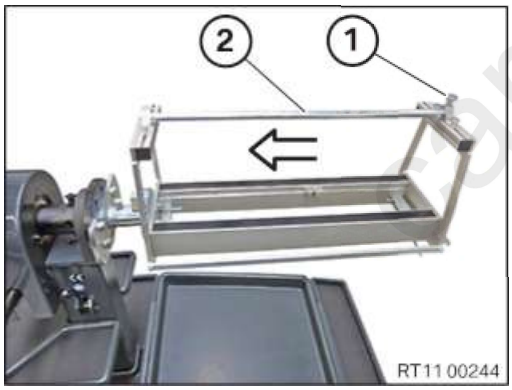
M14X30		Tightening torque	135 Nm



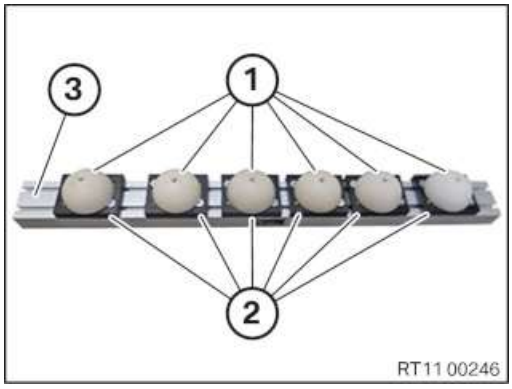
- Prepare the special tool 0 490 567 (11 0 020).



- Fit device (1) onto the flange (2) in the direction of the arrow and install.
- Make sure that the lock (3) engages audibly.

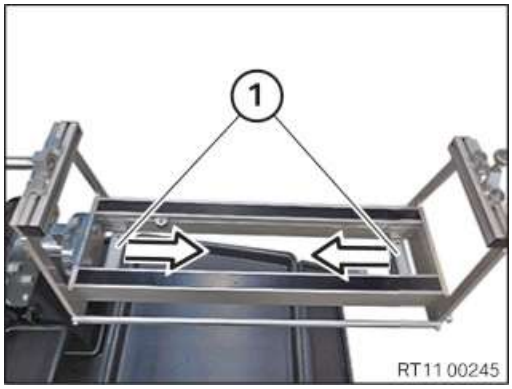


- Loosen screw (1).
- Pull out rod (2) in direction of arrow and set it aside.

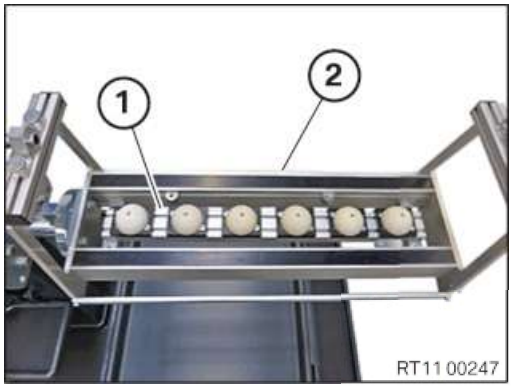


- Prepare plastic shaped part (1) with the shaped parts (2) and the aluminium strip (3).

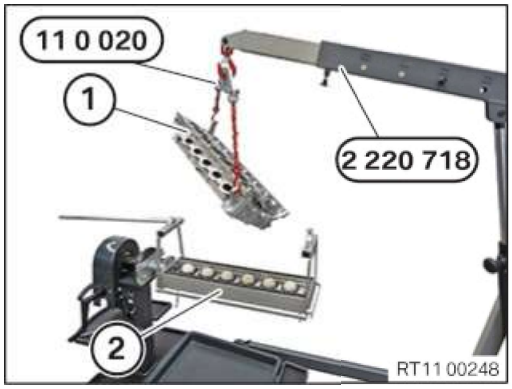
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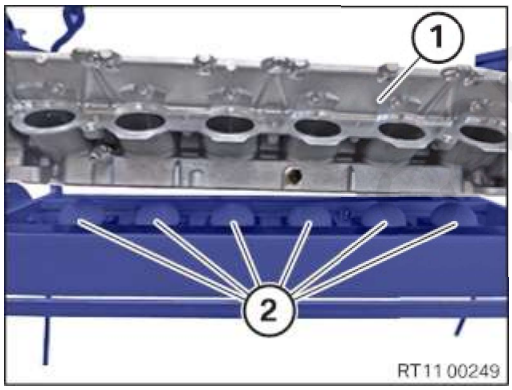
- Slide quick fastener (1) in the direction of the arrow to the limit position.



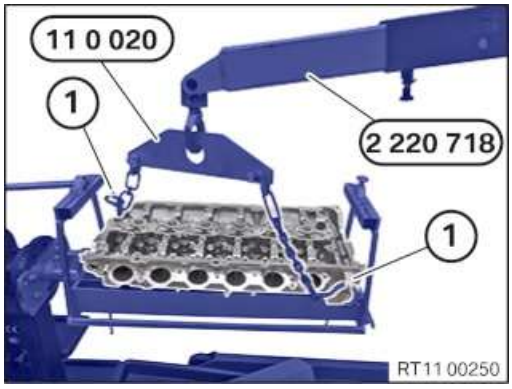
- Position completed aluminium strip (1) **centred** on the device (2).



- Position cylinder head (1) with the work crane 2 220 718 and special tool 0 490 567 (11 0 020) on the device (2).

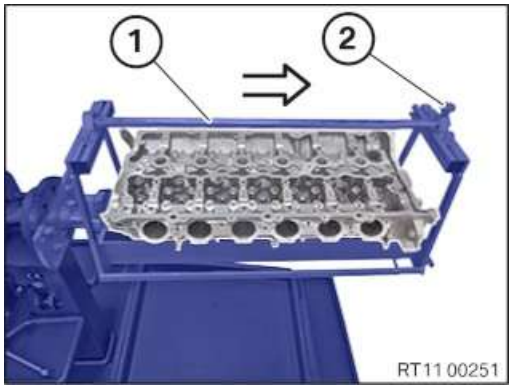


- Position cylinder head (1) correctly on the completed aluminium strip (2).

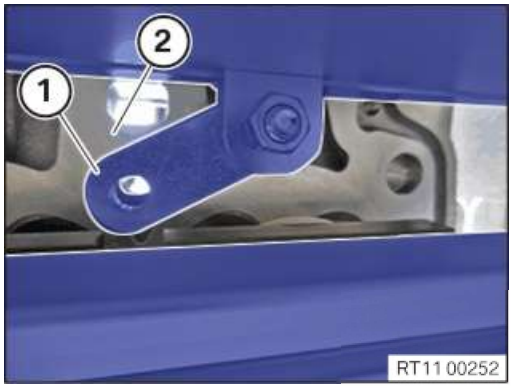


- Lower workshop crane 2 220 718.
- Pull out special tool 0 490 567 (11 0 020) at the cylinder head (1) and remove.
- Remove workshop crane 2 220 718 and set aside.

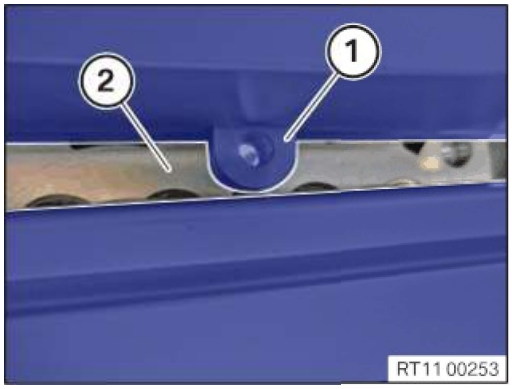
mdiagn.com



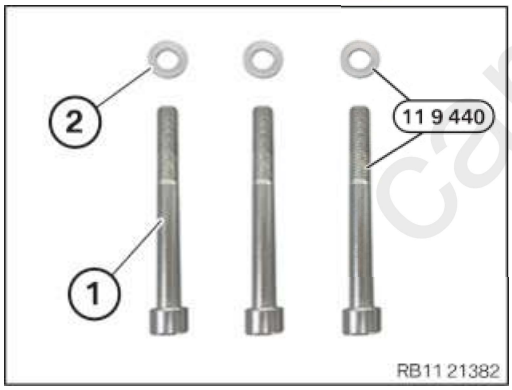
- Pull in rod (1) in the direction of the arrow and install.
- Hand-tighten the bolt (2).



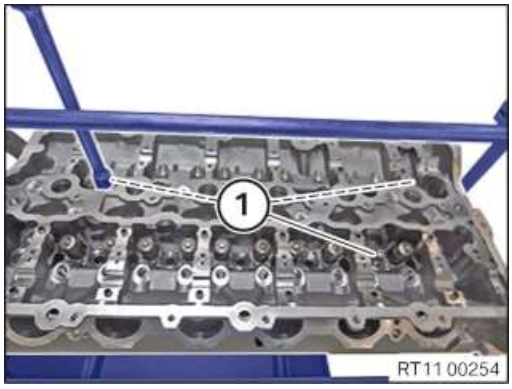
- Position screw connection (1) on cylinder head (2).



- Position screw connection (1) on cylinder head (2).



- Keep **M10x90** screws (1) from special tool ready.
- Keep washers (2) from special tool ready.

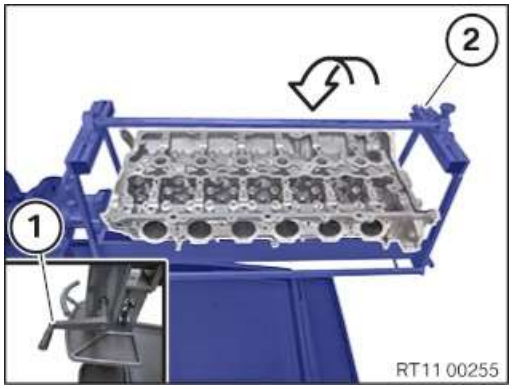


- Tighten screws (1) from special tool.

Cylinder head on device

M10X90x1.5		Tightening torque	30 Nm

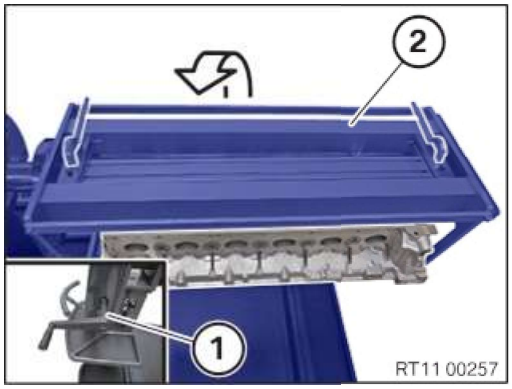
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- Turn device (2) on the crank (1) by 180° in direction of arrow.

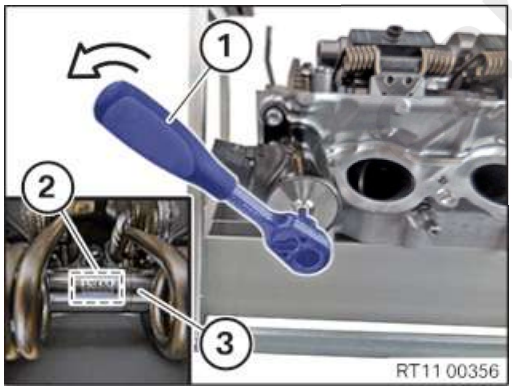


- Lock quick fastener (1) in direction of arrow.



- Turn device (2) on the crank (1) by 180° in direction of arrow.

3 – Adjusting eccentric shaft to minimum lift (cylinder head removed)



- With the help of the servomotor, use a standard hexagon socket wrench (1) to slowly adjust eccentric shaft (3) to the minimum lift at **4 mm** in the **direction of the arrow**.
- Make sure that the mark (2) on the eccentric shaft (3) points upwards.

4 – Removing all torsion springs (cylinder head removed)

CAUTION

Spring preload.

Danger of injury!

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

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TECHNICAL INFORMATION

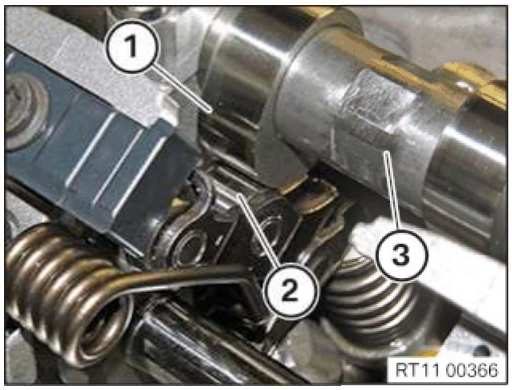
- Wear safety goggles.



- Have the set of special tools 2 359 088 ready.

Number	Description
1	Clamping lever
2	Mounting for clamping lever (fitting aid)

▸ Checking the position of the intake camshaft (cylinder head removed)



Check

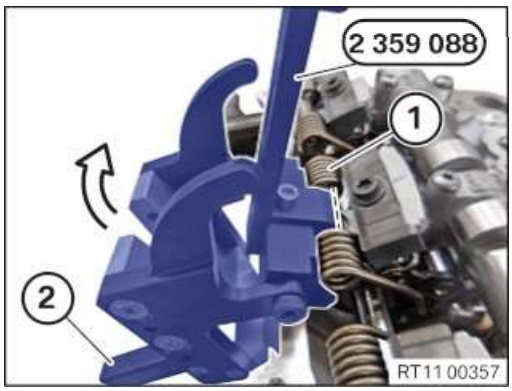
- Check position of the intake camshaft on the respective cylinders.

Result

» Cam (1) of the intake camshaft runs on the intermediate lever (2).

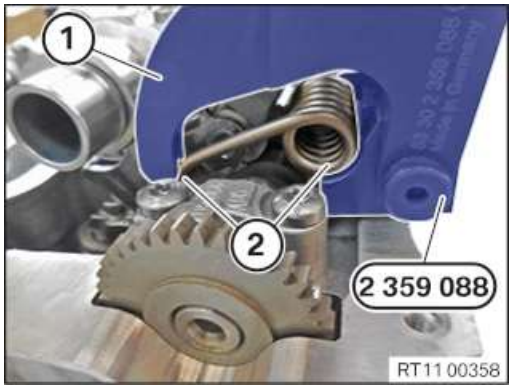
Measure

- Turn intake camshaft (3) further using a standard open-end spanner until the cam (1) does not override on the intermediate lever (2).

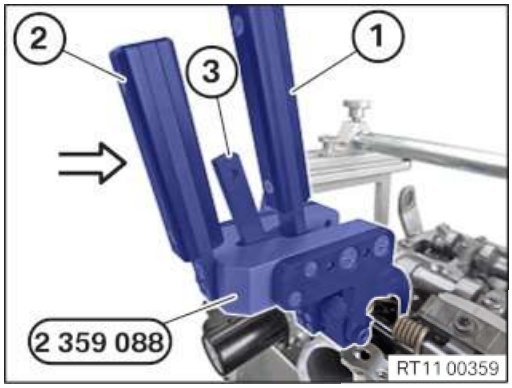


- Open the special tool 2 359 088 and position it at the torsion spring (1).
- Position retaining hook (2) of the special tool 2 359 088 in the direction of arrow.

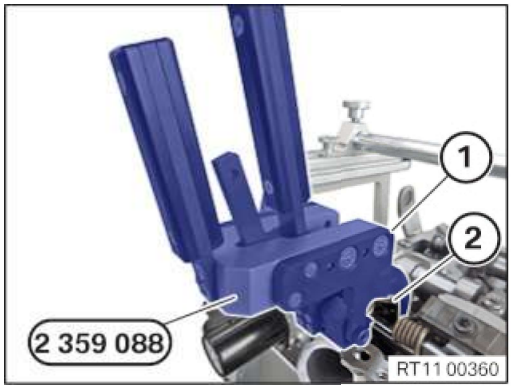
cardiagn.com



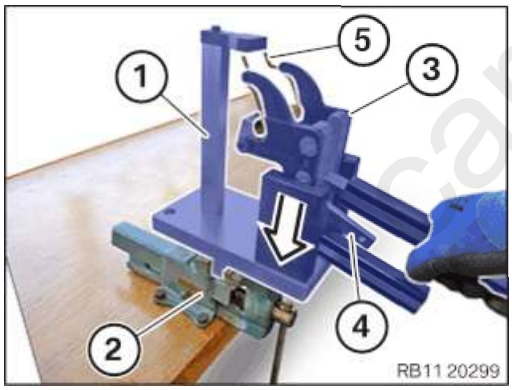
- Make sure that the torsion spring (2) is correctly positioned in the clamping lever (1) of the special tool 2 359 088.



- Hold down lever (1) of special tool 2 359 088.
- Close lever (2) of the special tool 2 359 088 carefully in the **direction of arrow** until the retaining hook (3) engages audibly.



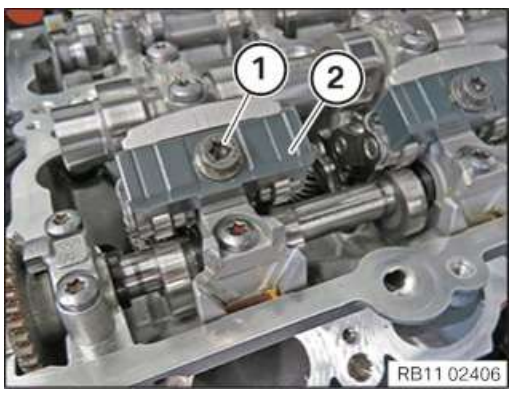
- Guide out and remove clamping lever (1) of special tool 2 359 088 with preloaded spring (2) **carefully**.



- 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.

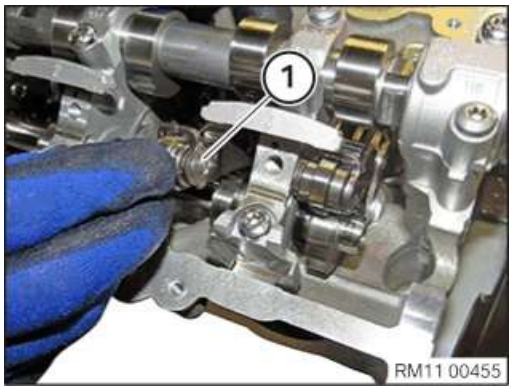
5 – Removing all gates



- 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.

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6 – 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).

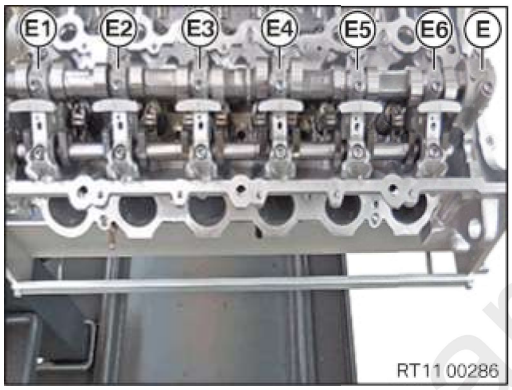
7 – Removing intake camshaft (cylinder head removed)

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

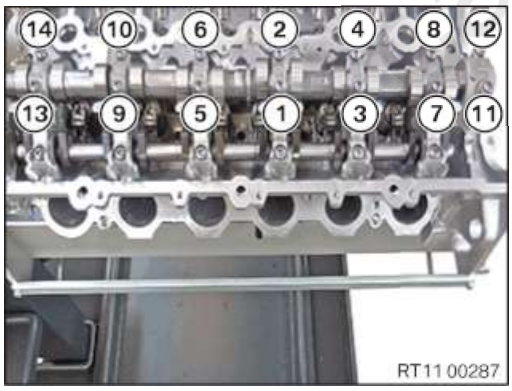
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.



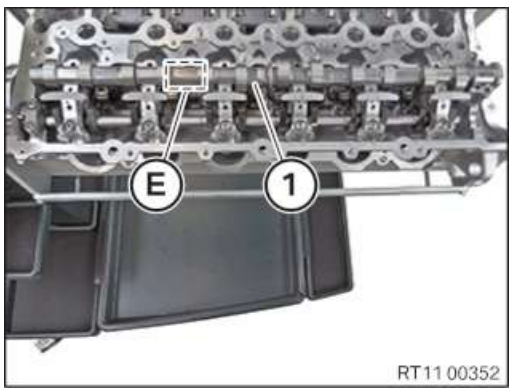
- Observe the numbering of the intake camshaft bearing caps.

  The intake camshaft bearing caps are numbered from (E1) to (E6) and are laid down according to their numbering in the special tool 0 495 105 (11 4 480).

  The intake camshaft bearing cap (E) is a thrust bearing.



- Release screws in the right sequence (14) till (1) in semi circle pattern.
- Set all intake camshaft bearing caps neatly in the special tool 0 495 105 (11 4 480).



- Guide out intake camshaft (1) toward the top and remove it.

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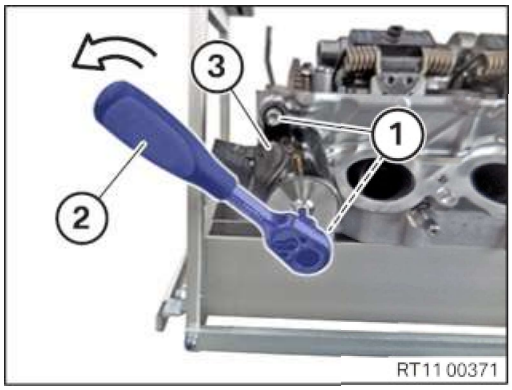
8 – Remove the servomotor for the eccentric shaft (cylinder head removed)

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.

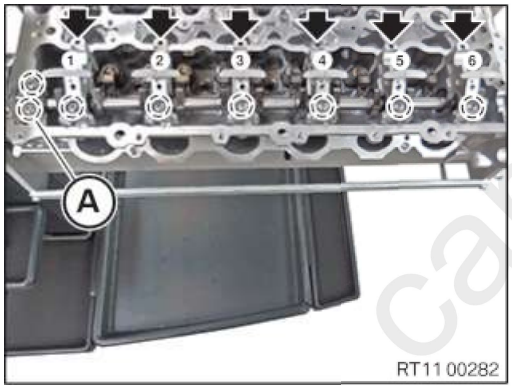


- Loosen screws (1).
- Use a standard hexagon socket wrench (2) to slowly adjust the servomotor for eccentric shaft (3) to the minimum lift at **4 mm** in direction of arrow.

  This releases the tension of the eccentric shaft.

  Do **not** turn the eccentric shaft beyond the end stop.
- Guide out and remove the servomotor for eccentric shaft (3).

9 – Removing the eccentric shaft (cylinder head removed)



RISK OF DAMAGE

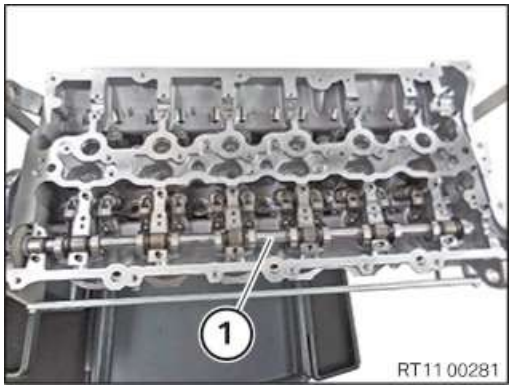
Contaminant or foreign body.

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.

- Unscrew all bolts (markings).
- Work mounting brackets (1) to (6) (arrowed) out and remove.
- Place mounting brackets (1) to (6) in order in the special tool 0 495 105 (11 4 480).
- Work bearing caps (A) out and remove.
- Place the bearing cap (A) in the special tool 0 495 105 (11 4 480) in order.

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- Guide out the eccentric shaft (1) toward the top and remove it.

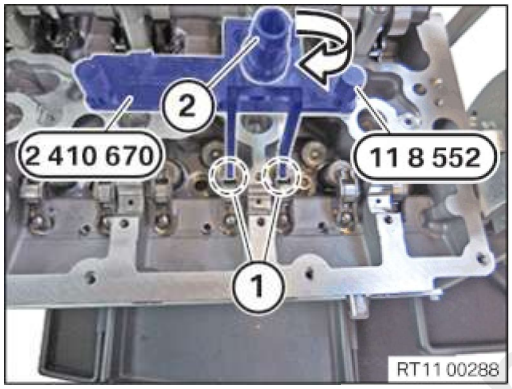
10 – Removing exhaust camshaft (cylinder head removed)

RISK OF DAMAGE

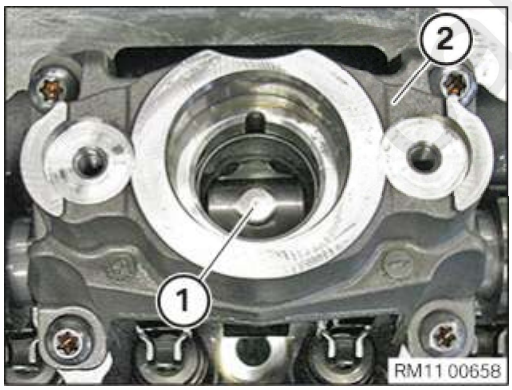
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

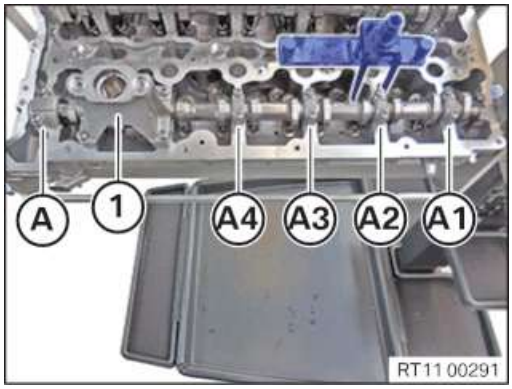
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.



- 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 the 2nd cylinder using the spindle nut (2) of the special tool 2 410 670 in direction of arrow up to the limit position.



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

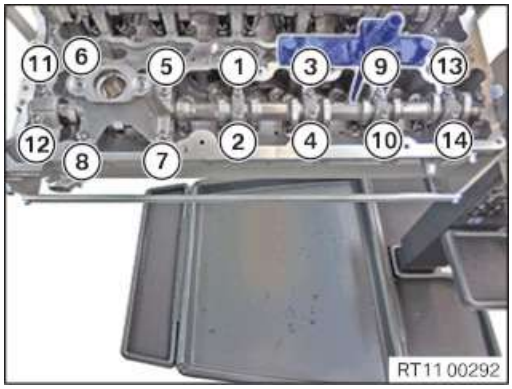


- Observe the numbering of the exhaust camshaft bearing caps.

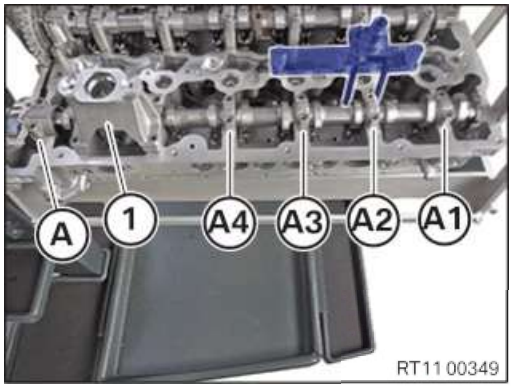
  The exhaust camshaft bearing caps are numbered from (A1) to (A4) and are placed in the special tool 0 495 105 (11 4 480) according to their numbering.

  The exhaust camshaft bearing caps can be read from the intake side.

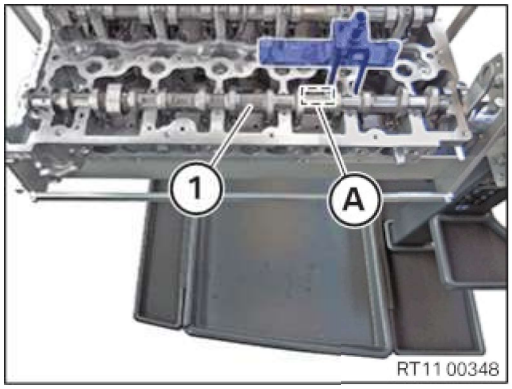
  The exhaust camshaft bearing cap (A) is a thrust bearing.



- Release screws in the right sequence (14) till (1) in semi circle pattern.

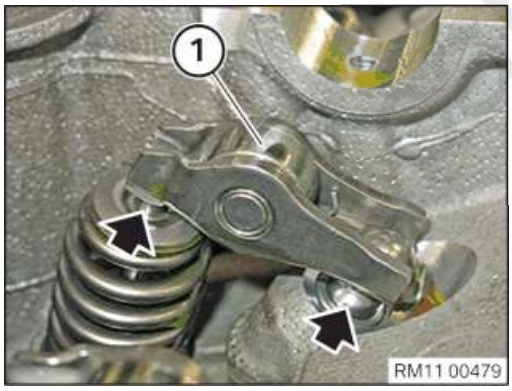


- Pull out all exhaust camshaft bearing caps (A1) to(A4) and the exhaust camshaft bearing cap (A) and remove.
- Place all exhaust camshaft bearing cap in order in special tool 0 495 105 (11 4 480).
- Thread the high pressure pump bracket (1) out and remove.

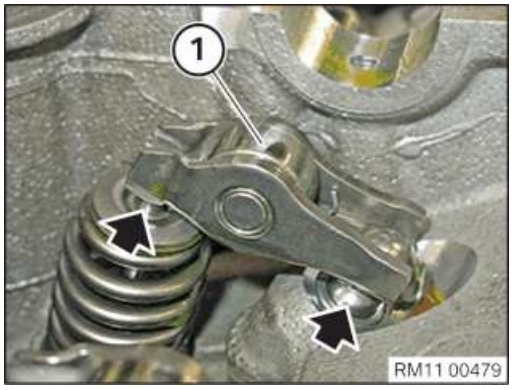


- (1)Remove exhaust camshaft in upward direction.

11 – 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).

12 – Remove all valve springs

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CAUTION

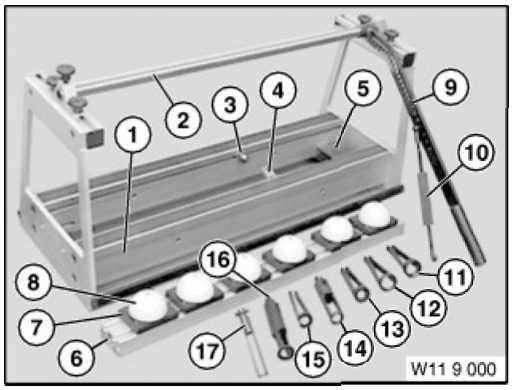
Spring preload.

Danger of injury!

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

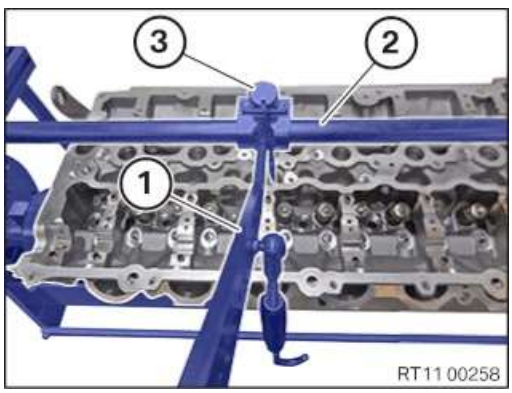
NOTICE

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



- Have the set of special tools 0 494 362 (11 9 000) ready.

Number	Description
1	Device
2	Rod
3	Adapter
4	Tab
5	Quick fastener
6	Aluminum strip
7	Shaped part
8	Shaped part made of plastic
9	Lever
10	Hook
11	Valve spring cage
12	Valve spring cage
13	Valve spring cage
14	Valve spring cage
15	Valve spring cage
16	Valve spring cage
17	Valve spring cage



- Feed in and install lever (1) on the rod (2).
- Guide in and install lock (3).

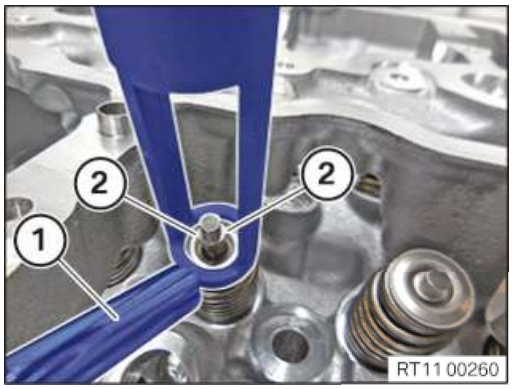
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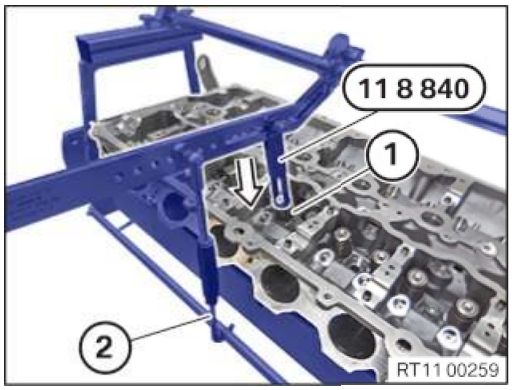
TECHNICAL INFORMATION

- Wear safety goggles.

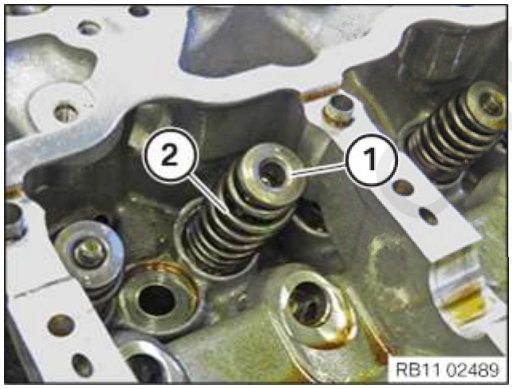
- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in direction of arrow.
- Hold valve spring (1) **pressed down** using the hook (2).



- Remove valve shims (2) with a magnet (1).



- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in **direction of arrow**.
- Thread out hook (2) and place to the side.
- Relieve the valve spring (1) **carefully**.



- Remove the spring cup (1) and the valve spring (2) and position neatly in the special tool 0 495 105 (11 4 480).

13 – Remove valve stem seals

RISK OF DAMAGE

Contaminant or foreign body.

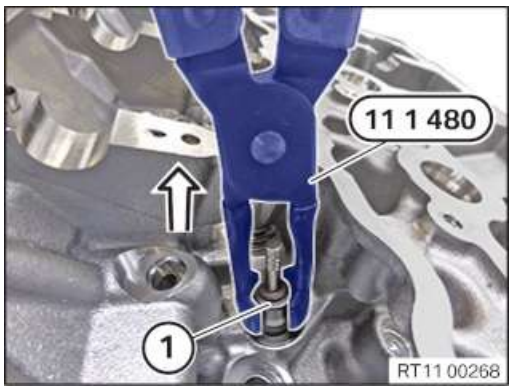
Contamination can result in malfunctions, operating failure or leaks.

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

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NOTICE

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



- Remove the valve stem seal (1) in the **direction of arrow** using the special tool 0 490 796 (11 1 480).

MAIN WORK

14 – Remove all valves

RISK OF DAMAGE

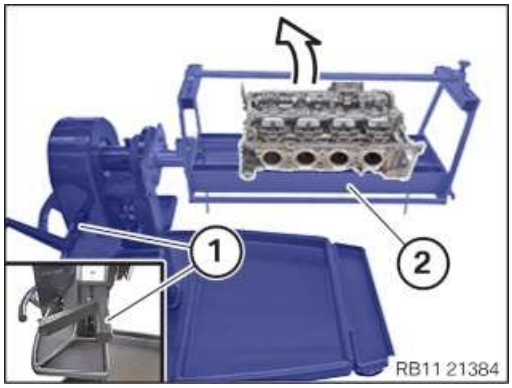
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

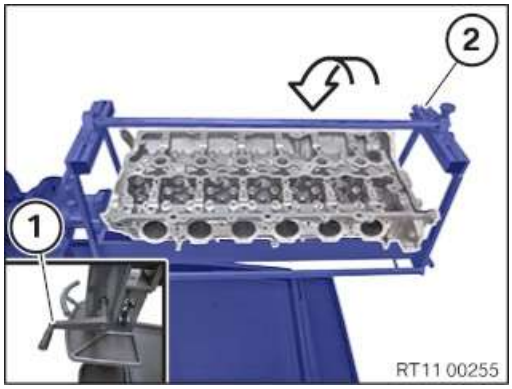
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.



- **Equipment specification B38**
- Twist the device (2) on the crank (1) 180°.



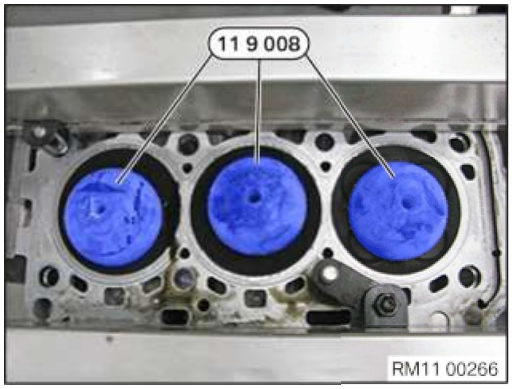
- **Equipment specification B46/B48**
- Turn device (2) on the crank (1) by 180° in **direction of arrow**.



- **Equipment specification B58**
- Turn device (2) on the crank (1) by 180° in direction of arrow.



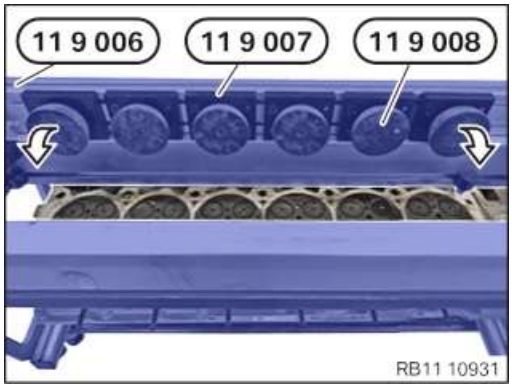
- Unlock the special tool 0 494 370 (11 9 005) in **direction of arrow**.



- **Equipment specification B38**
- Remove special tool 0 494 373 (11 9 008) if necessary.

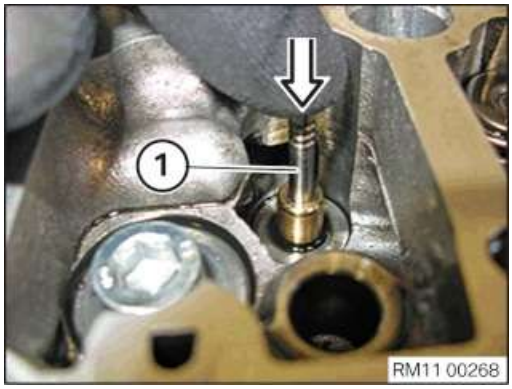


- **Equipment specification B46/B48**
- Remove special tool 0 494 373 (11 9 008) if necessary.

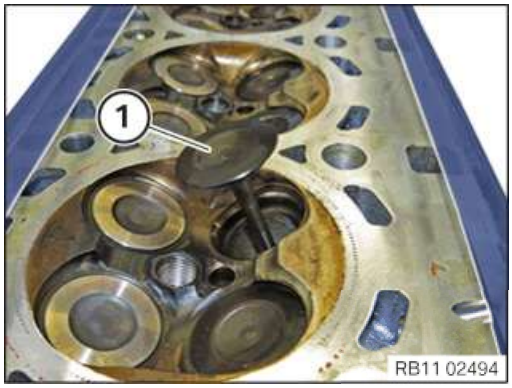


- **Equipment specification B58**
- Thread out and remove special tools 0 494 371 (11 9 006), 0 494 372 (11 9 007) and 0 494 373 (11 9 008) in direction of arrow.

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- Push the valve stem (1) into the cylinder head in **direction of arrow**.



- Remove the valve (1) and position in special tool 0 495 105 (11 4 480) in order.

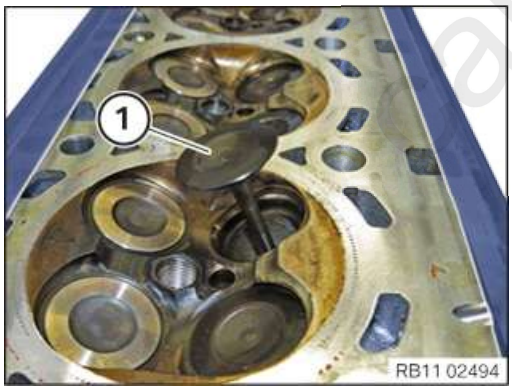
15 – Install all valves

RISK OF DAMAGE

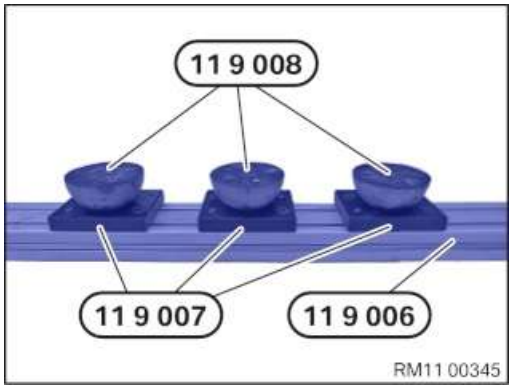
Contaminant or foreign body.

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.

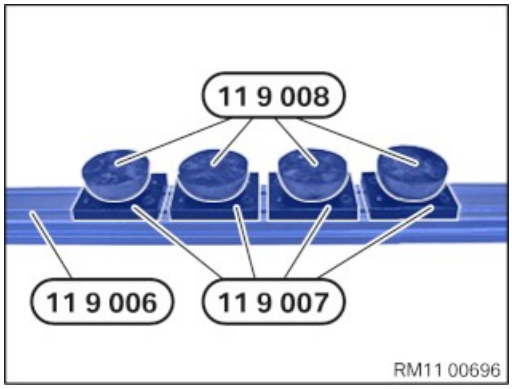


- Slide the valve (1) **carefully** into the cylinder head.

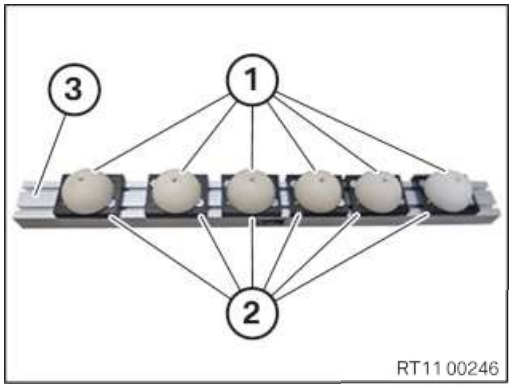


- **Equipment specification B38**
- Prepare the special tools 0 494 371 (11 9 006), 0 494 372 (11 9 007) and 0 494 373 (11 9 008) as shown.

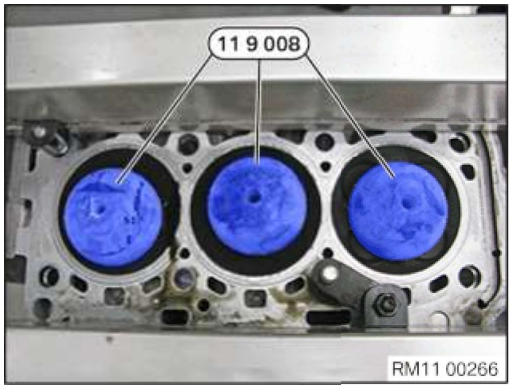
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- **Equipment specification B46/B48**
- Prepare the special tools 0 494 371 (11 9 006), 0 494 372 (11 9 007) and 0 494 373 (11 9 008) as shown.



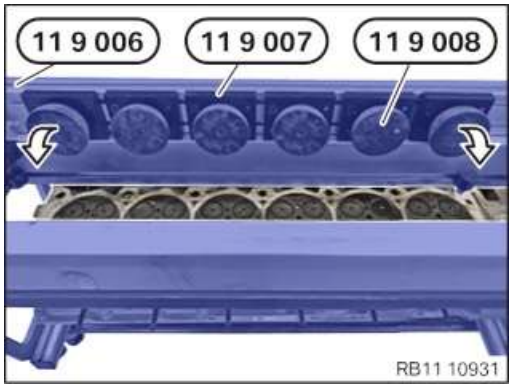
- **Equipment specification B58**
- Prepare plastic shaped part (1) with the shaped parts (2) and the aluminium strip (3).



- **Equipment specification B38**
- The special tools 0 494 373 (11 9 008) must be set up accordingly in the next operation.



- **Equipment specification B46/B48**
- The special tools 0 494 373 (11 9 008) must be set up accordingly in the next operation.

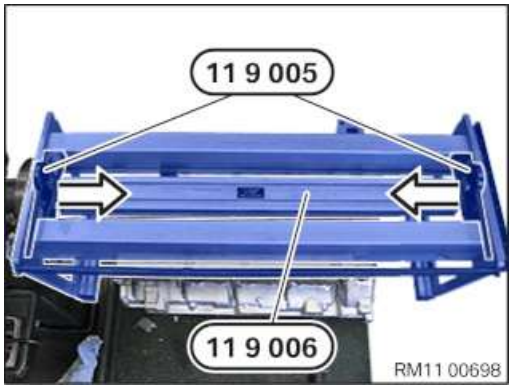


TECHNICAL INFORMATION

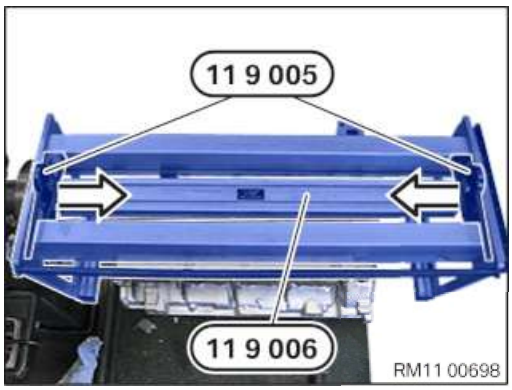
The figure shows the engine B58.

- Position special tools 0 494 371 (11 9 006), 0 494 372 (11 9 007) and 0 494 373 (11 9 008) in the centre on the cylinder head in the direction of the arrow.

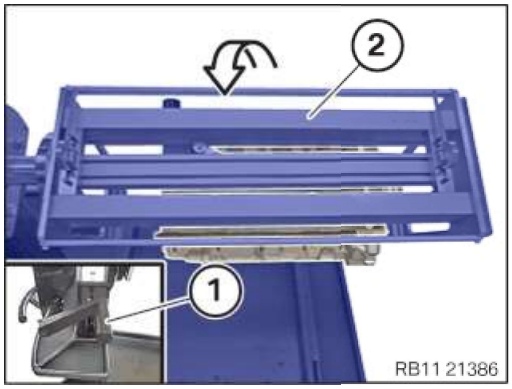
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- Turn round special tool 0 494 371 (11 9 006) and insert as shown.
- Lock special tool 0 494 370 (11 9 005)in direction of arrow.



- Move and lock special tool 0 494 370 (11 9 005) in the direction of the arrow over the edges of special tool 0 494 371 (11 9 006).



- Turn device (2) on the crank (1) by 180° in **direction of arrow**.

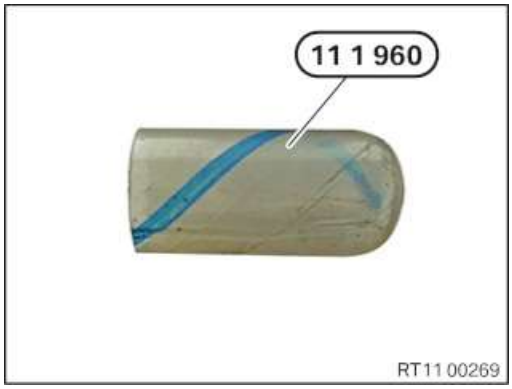
POSTPROCESSES

16 – Installing valve stem seals



- Remove oil and dirt from the contact surface (1).

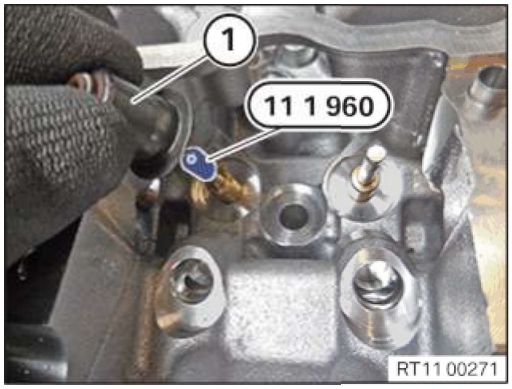
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- Make sure that the special tool 0 490 797 (11 1 960) is used when installing the valve stem seal.



- Guide in and install the special tool 0 490 797 (11 1 960) on valve (1).



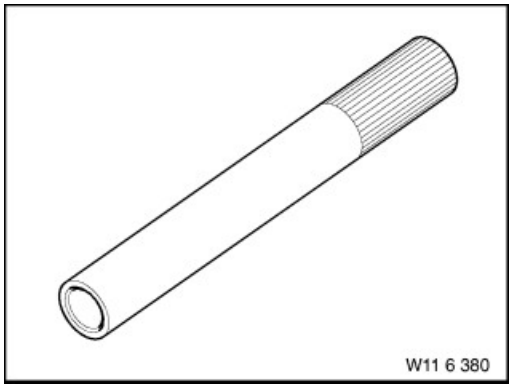
- Renew the valve stem seal (1).

  Parts: Valve stem seal

- Guide in and install valve stem seal (1) on the special tool 0 490 797 (11 1 960).

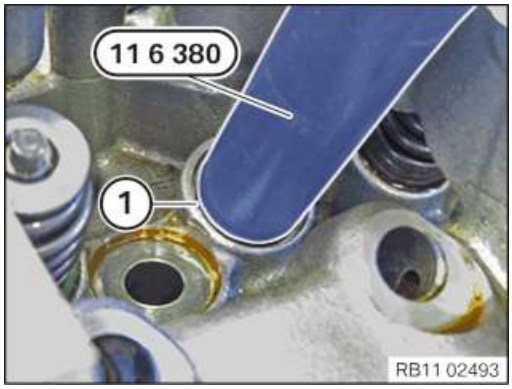


- Guide the special tool 0 490 797 (11 1 960) out and remove.

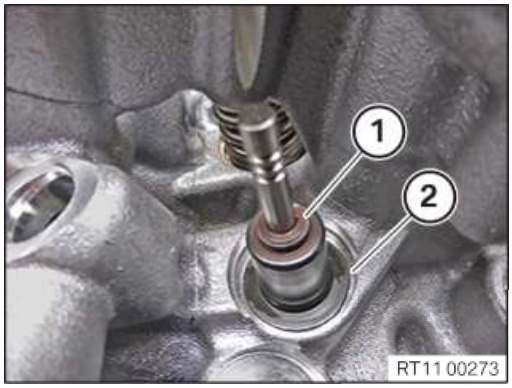


- Prepare special tool 0 493 249 (11 6 380).

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- Press the valve stem seal (1) onto the cylinder head till the limit position using special tool 0 493 249 (11 6 380).



- Make sure that valve stem seal (1) is positioned correctly on cylinder head (2).

17 – Install all valve springs

CAUTION

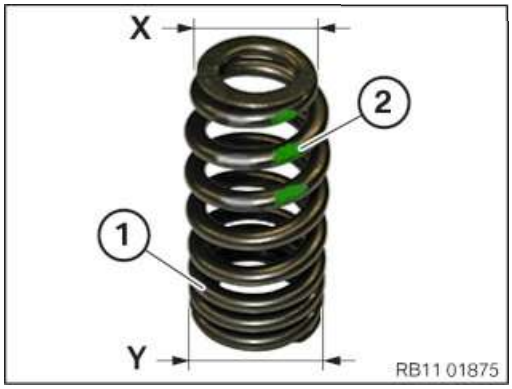
Spring preload.

Danger of injury!

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

NOTICE

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



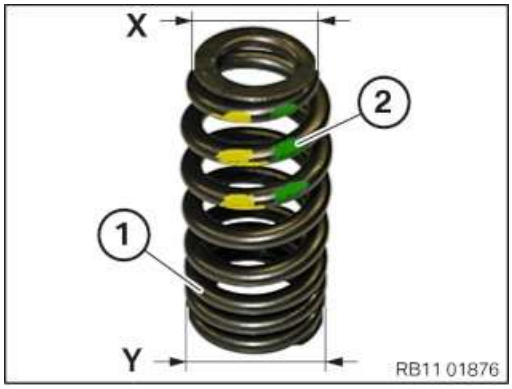
- Note the installation position of the valve spring.

Note: Install the valve spring so that the larger diameter (Y) points to the bottom spring cup.

- Make sure that the intake valves are not switched with the exhaust valves.

Note: Valve springs (1) are marked in colour (2). Colour for the intake valves: Green

cardiagn.com

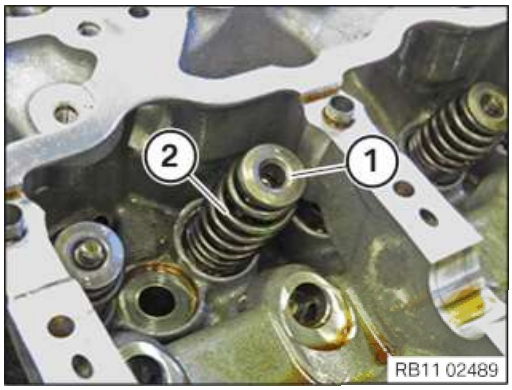


- Note the installation position of the valve spring.

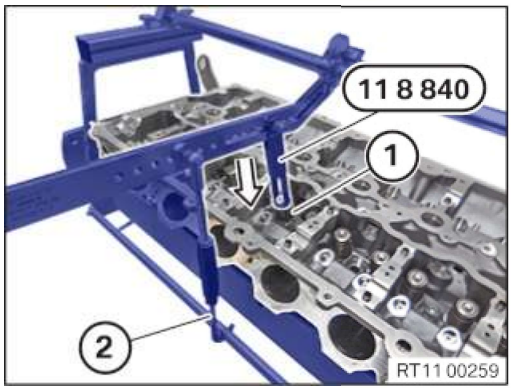
Note: Install the valve spring so that the larger diameter (Y) points to the bottom spring cup.

- Make sure that the intake valves are not switched with the exhaust valves.

Note: Valve springs (1) are marked in colour (2). Colour for the exhaust valves: green/yellow



- Install the valve spring (2) and the spring cup (1).

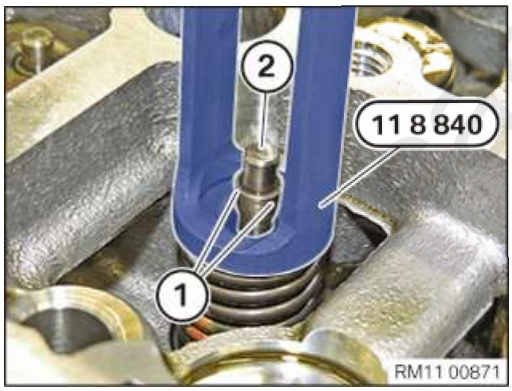


TECHNICAL INFORMATION

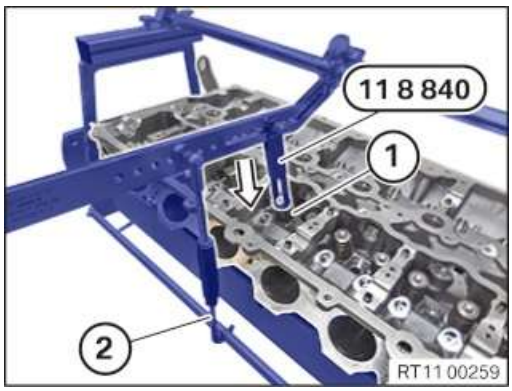


- Wear safety goggles.

- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in direction of arrow.
- Hold valve spring (1) **pressed down** using the hook (2).

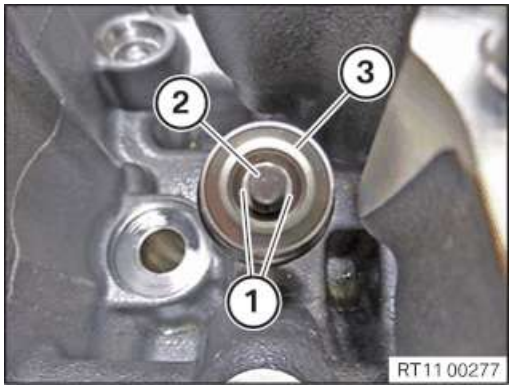


- Position the valve shims (1) on the valve (2).



- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in **direction of arrow**.
- Thread out hook (2) and place to the side.
- Relieve the valve spring (1) **carefully**.

mydiagram.com



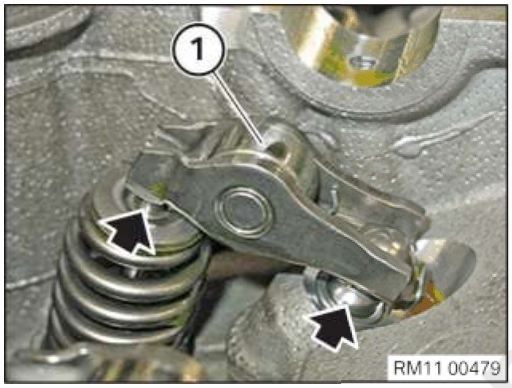
- Make sure that the valve shims (1) are positioned correctly on the valve (2) and on the valve spring (3).

18 – Install all roller cam followers

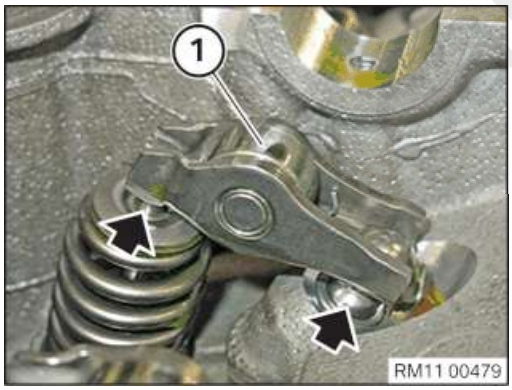


- The classification in digits from 1 to 5 has been printed on the roller cam follower.

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

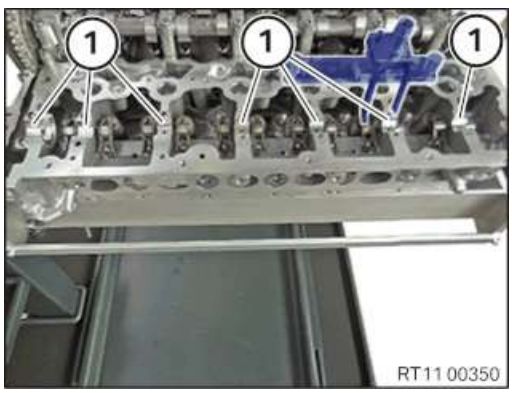


- Install the roller cam follower (1) on the intake side.
- Make sure the roller cam followers are correctly positioned on the hydraulic valve clearance compensating elements (arrows) and on the intake valves.

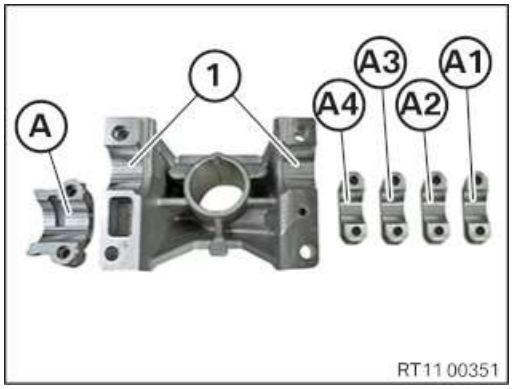


- Install the roller cam followers (1) on the exhaust side.
- Make sure the roller cam followers are correctly positioned on the hydraulic valve clearance compensating elements (arrows) and on the exhaust valves.

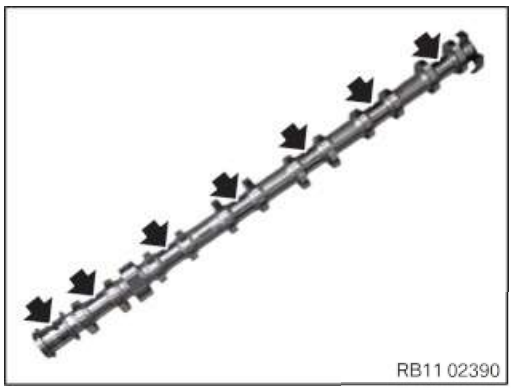
19 – Mount exhaust camshaft (cylinder head removed)



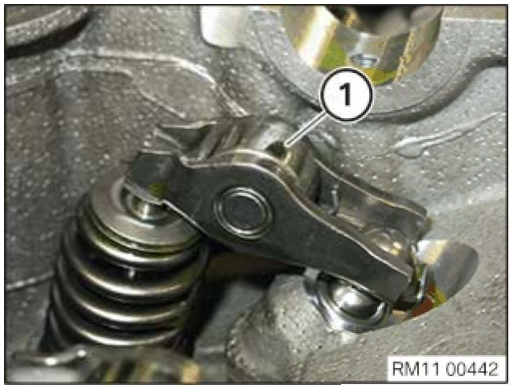
- Clean all bearing positions (1) and coat with engine oil.



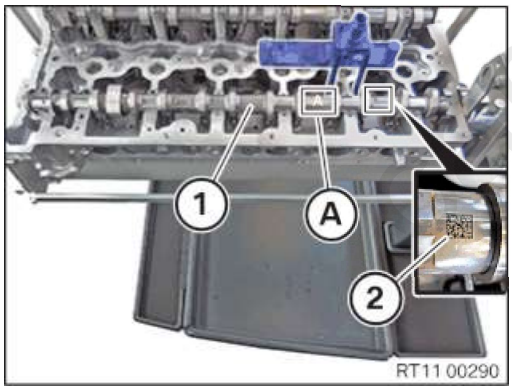
- Clean all bearing positions of exhaust camshaft bearing caps (A1), (A2), (A3), (A4) and (A) and coat with engine oil.
- Clean bearing positions (1) of the high pressure pump bracket and coat with engine oil.



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



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

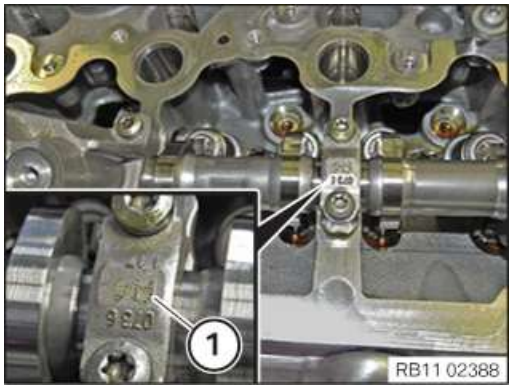


- Insert exhaust camshaft (1) in the cylinder head, such that the mark (2) points upwards.



- 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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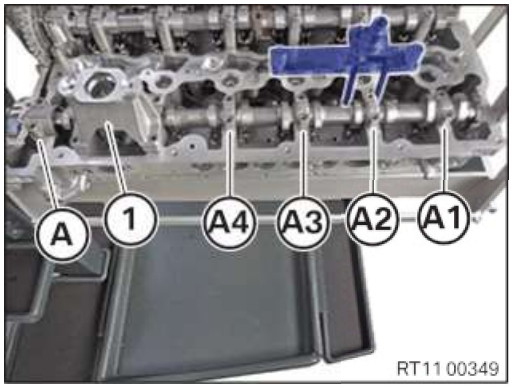
RISK OF DAMAGE

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

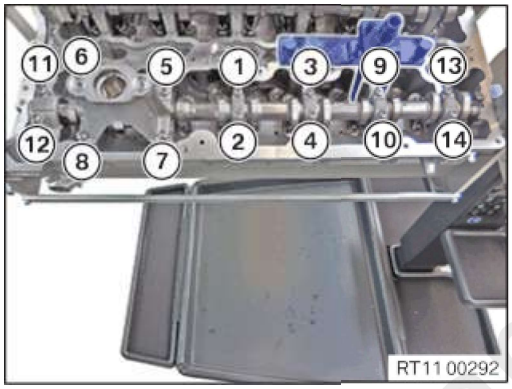
Engine damage may result from incorrectly installing bearing shells and bearing supports.

- 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.



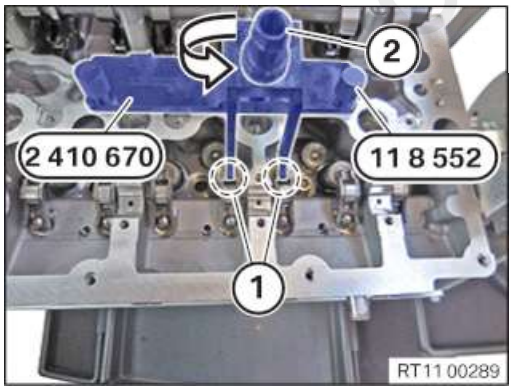
- Feed in all exhaust camshaft bearing cap (A1) until (A4) and the exhaust camshaft bearing cap (A) and position.
- Pull in the high pressure pump bracket (1) and position.



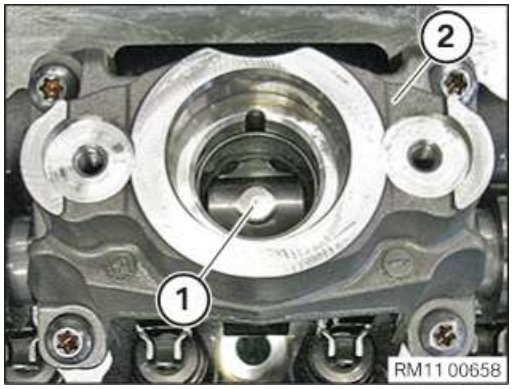
- Press down the exhaust camshaft bearing caps and hand-tighten the bolts incrementally in the sequence(1) to (14).
- Move up all screws in the sequence (1) to (14) **in half rotations.**
- **Adhere to the jointing torque.**
- Tighten all screws in a sequence from (1) to (14) .

Exhaust camshaft to cylinder head

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

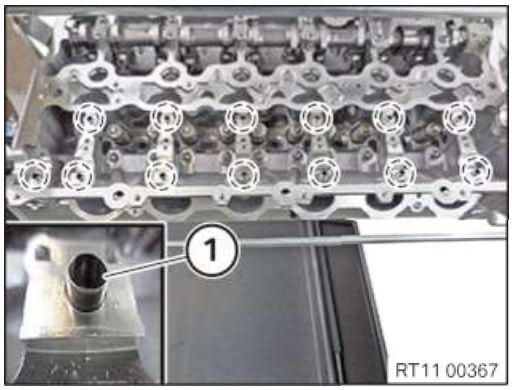


- Twist special tool 2 410 670 using the spindle nut (2) in direction of arrow and relax.
- Release special tool 0 495 741 (11 8 552) and remove special tool 2 410 670.

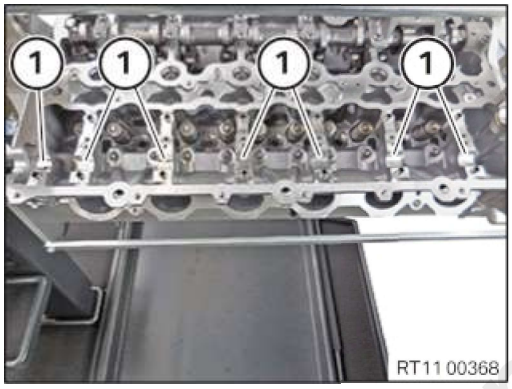


- Install roller tappet (1) into the high pressure pump bracket (2).

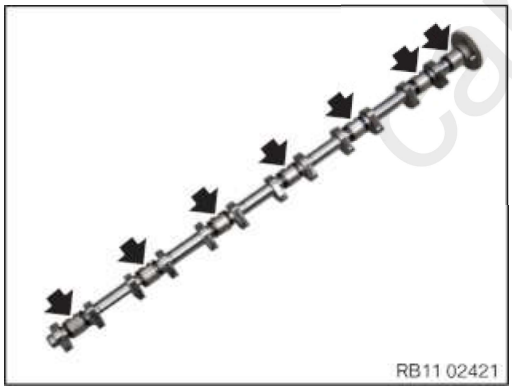
20 – Mounting eccentric shaft (cylinder head removed)



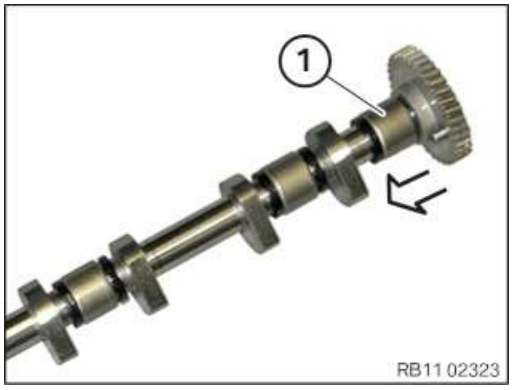
- Check all guide bushes (marks) (1) for damage and renew them if necessary.



- Clean all the bearing positions (arrows) in the cylinder head and coat them with engine oil.

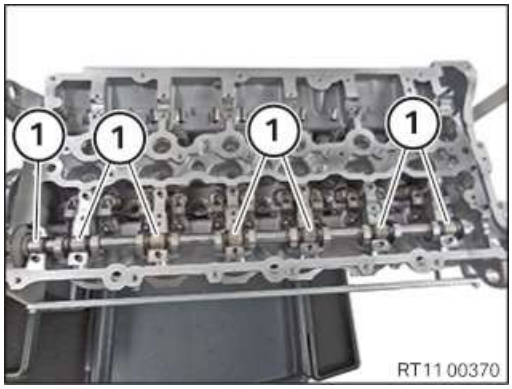


- Check all the needle bearings (arrows) of the eccentric shaft for ease of movement.
- Renew the eccentric shaft in case of tight needle bearings.

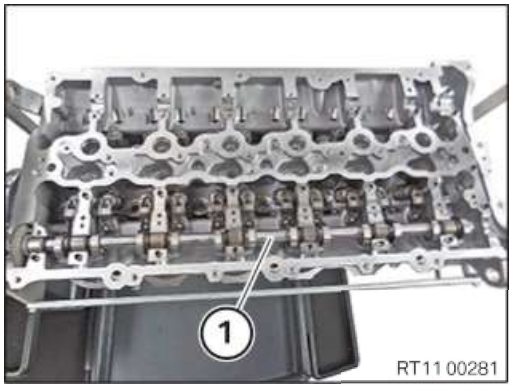


- Push needle bearing (1) up to the limit position in direction of arrow before installing the eccentric shaft.

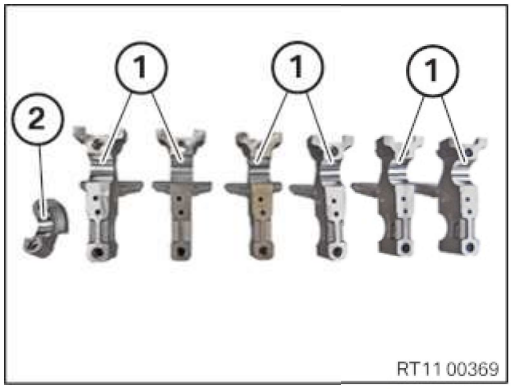
cardiagn.com



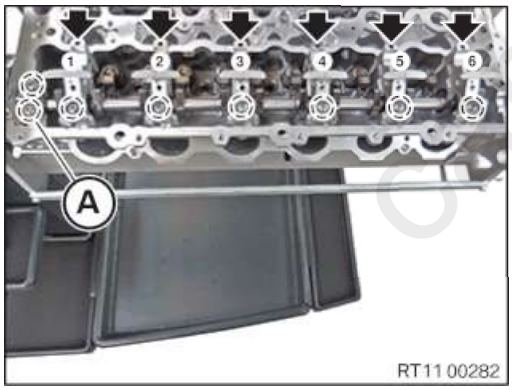
- Clean all needle bearings of the eccentric shaft (arrows) and coat with engine oil.



- Pull in eccentric shaft (1) and install.



- Clean bearing positions (1) of the bearing supports and coat with engine oil.
- Clean bearing position (2) of the bearing cap and coat with engine oil.



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.

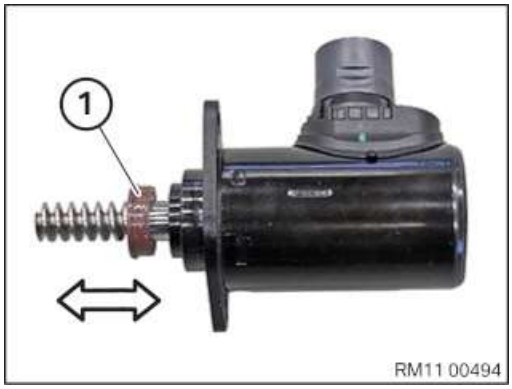
- Pull bearing supports (1) to (6) (arrows) in and install.

  The bearing supports (1) to (6) **must** each be installed again in the **position** from where they were removed.
- Pull in bearing cap (A) and install.
- Tighten the bolts (marks).

Eccentric shaft to bearing support/cylinder head

M6		10 Nm

21 – Install the servomotor for the eccentric shaft (cylinder head removed)

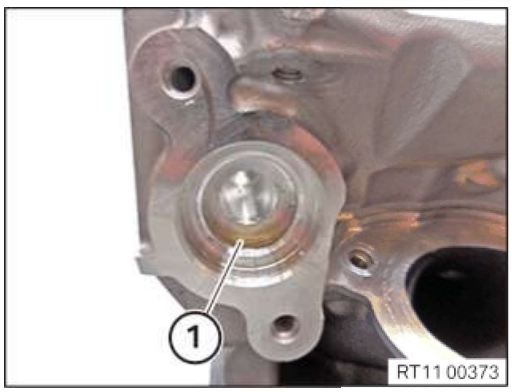


- Renew gasket (1).

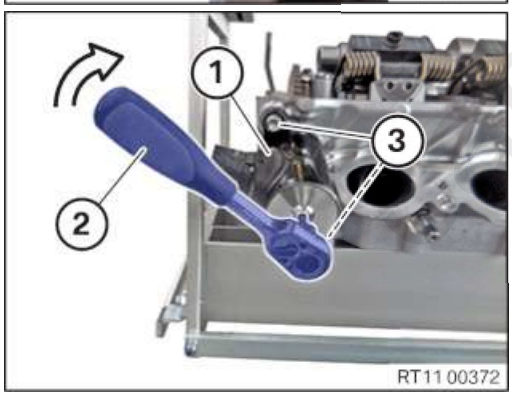
  Parts: Gasket



- Press the gasket (1) in to the limit position on the housing.



- Clean sealing surface (1).



- Slide servomotor for the eccentric shaft (1) up to the limit position and install it.
- Turn servomotor for the eccentric shaft (1) using a standard hexagon socket wrench (2) of **4 mm** in the **direction of arrow** until the servomotor for the eccentric shaft (1) lies on the cylinder head.
- Tighten down screws (3).

Electrical servomotor to cylinder head

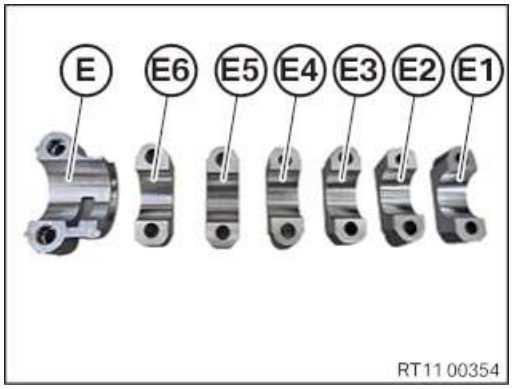
M6		Tightening torque	8 Nm

22 – Mounting intake camshaft (cylinder head removed)

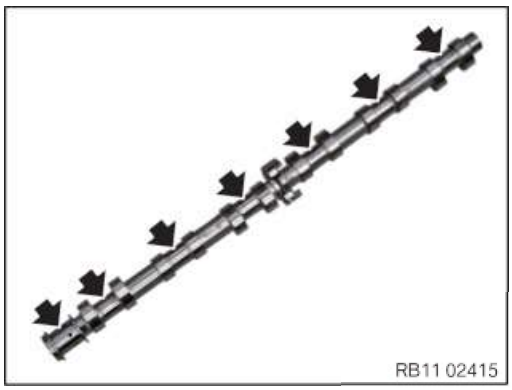


- Clean all bearing positions (arrows) and coat with engine oil.

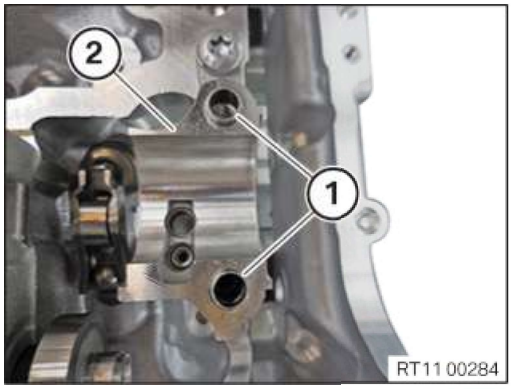
rdiagn.com



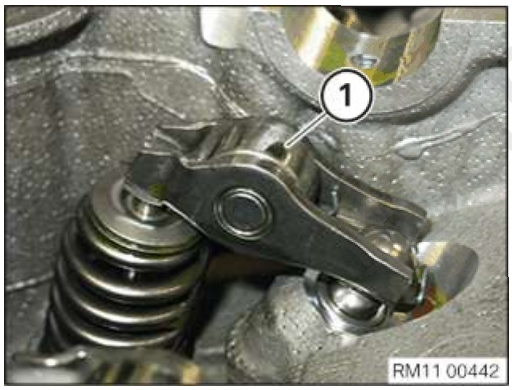
- Clean all bearing positions of intake camshaft bearing caps (E1),(E2),(E3), (E4),(E5),(E6) and (E) and coat with engine oil.



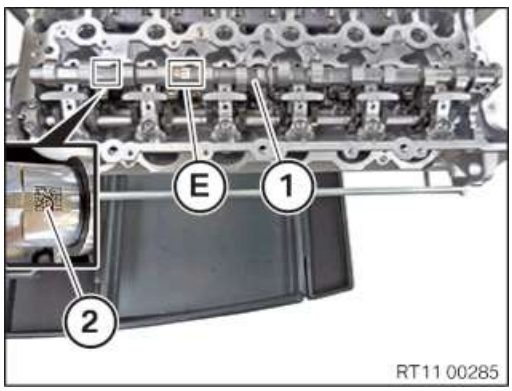
- Clean all bearing positions (arrows) of the intake camshaft and coat with engine oil.



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

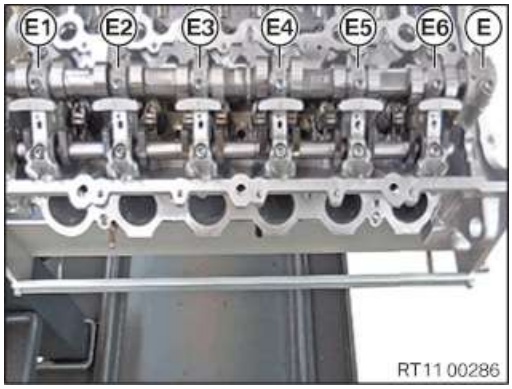


- Check all roller cam followers(1) of the intake side for correct fit.



- Insert the intake camshaft (1) into the cylinder head so that the mark (2) points up.

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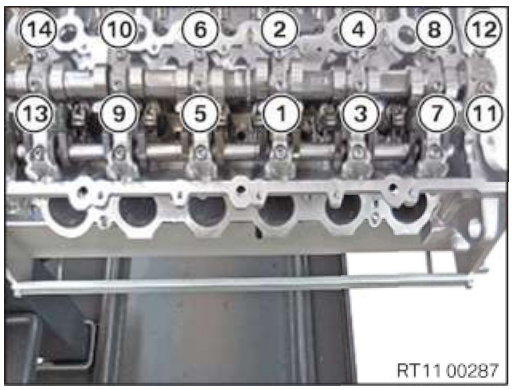
RISK OF DAMAGE

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.

- Feed in all intake camshaft bearing caps (E1) to (E6) and the intake camshaft bearing cap (E) and position.



- Press down the intake 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 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

23 – Checking the intermediate lever classification



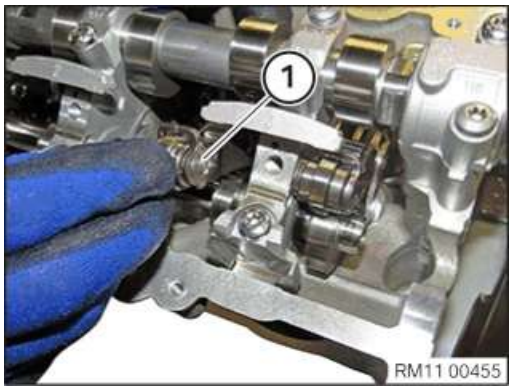
TECHNICAL INFORMATION

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.

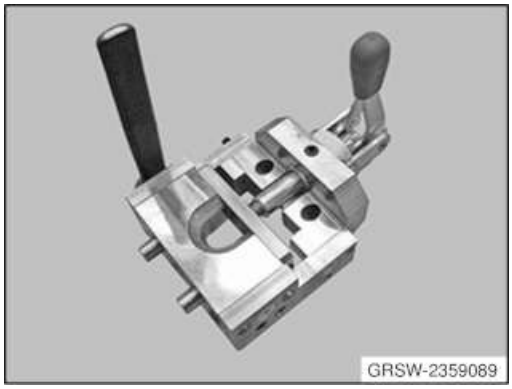
24 – Installing all intermediate levers



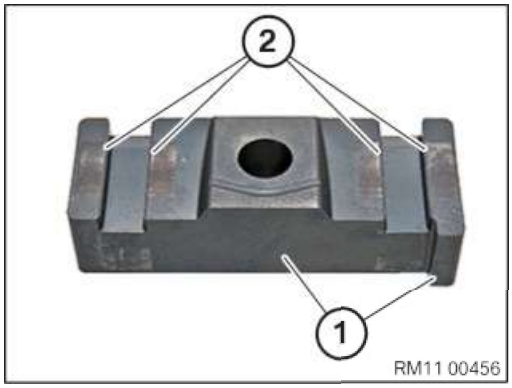
- Install intermediate lever (1).
- Repeat the step for all intermediate levers (1).

25 – Installing all gates

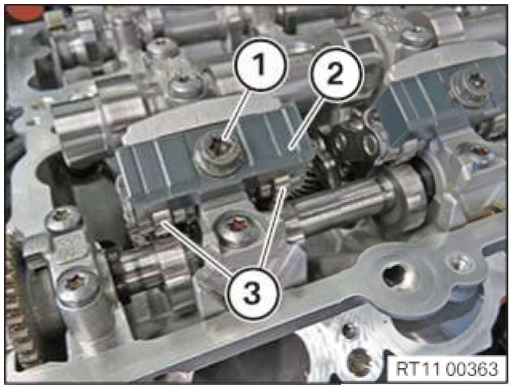
carmagn.com



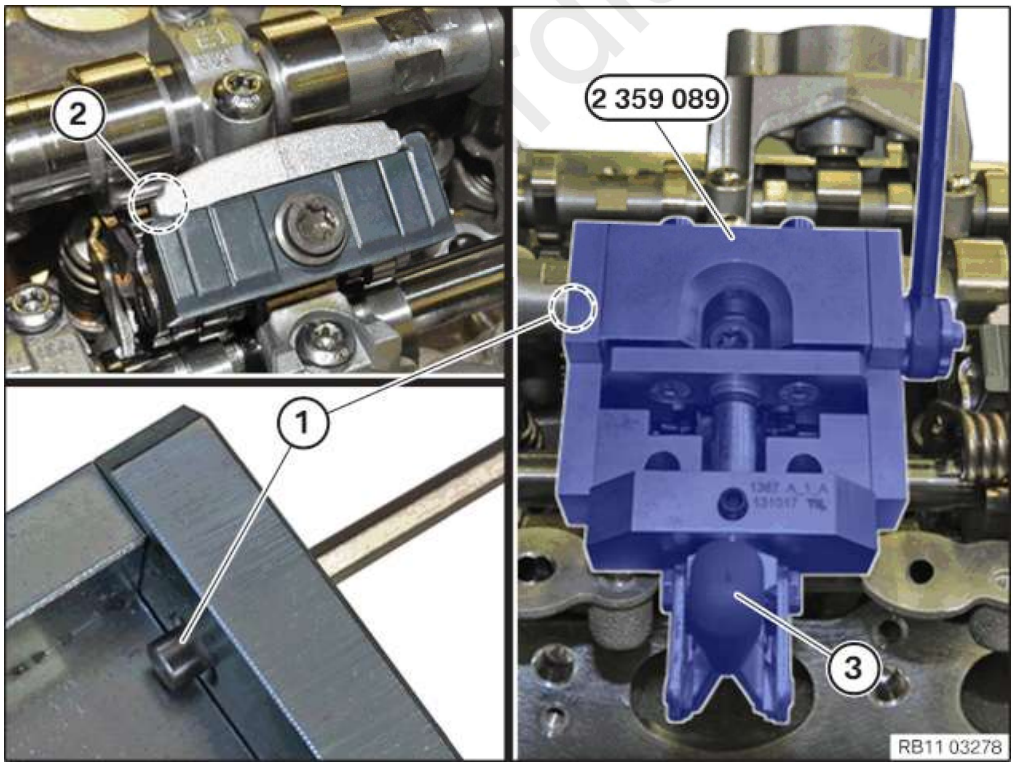
- Have the special tool 2 359 089 ready.



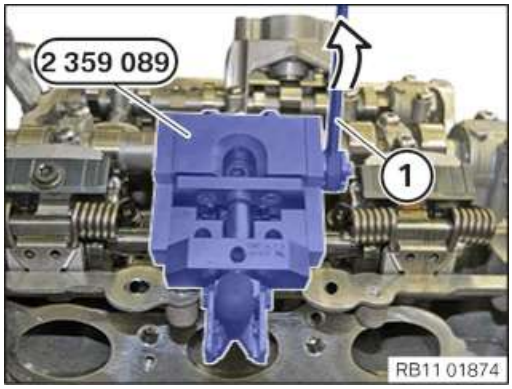
- Clean contact surfaces (1) and (2) off oil, grease and dirt.



- Position the gate (2) and hand-tighten the bolt (1).
- Check that the intermediate lever (3) is in the correct mounting orientation.



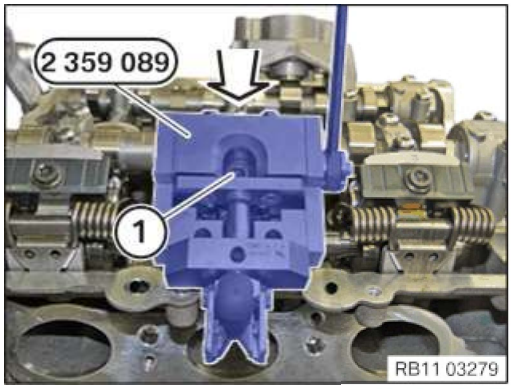
- Position the special tool 2 359 089 on the cylinder head.
- Pre-tension the gate with the lever (3).
- Abut the bolt (1) in the area (2).
- Make sure that the special tool 2 359 089 does not rotate during this process.



- Secure the gate with the lever (1).



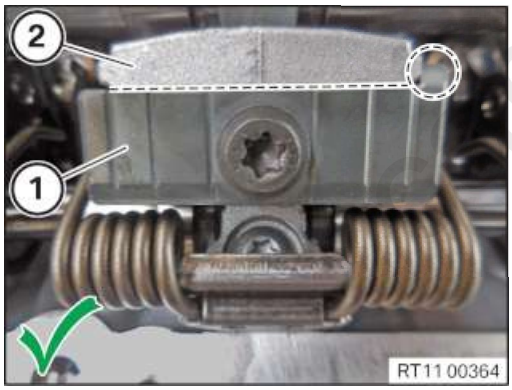
- Ensure that the special tool 2 359 089 lies flat on the cylinder head.



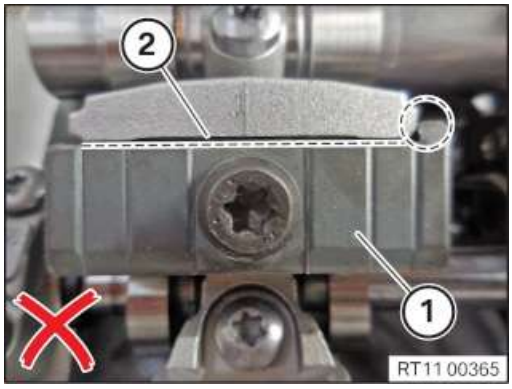
- Press the special tool 2 359 089 onto the cylinder head.
- Tighten the bolt (1) at the same time.

Gate to bearing bracket

M8		20 Nm

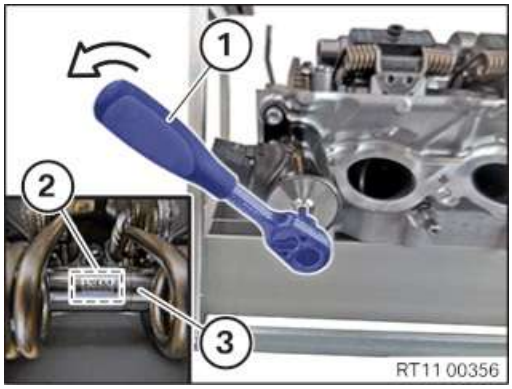


- Make sure that gate (1) rests correctly against bearing bracket (2).
  Gate (1) is installed correctly in the marked area.



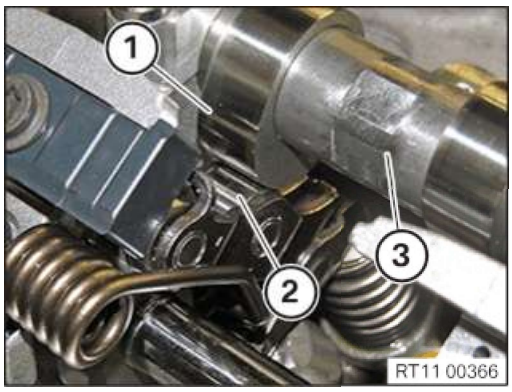
- Make sure that gate (1) rests correctly against bearing bracket (2).
  Gate (1) is installed incorrectly in the marked area.
- Repeat the procedure for all gates.

26 – Adjusting eccentric shaft to minimum lift (cylinder head removed)



- With the help of the servomotor, use a standard hexagon socket wrench (1) to slowly adjust eccentric shaft (3) to the minimum lift at **4 mm** in the **direction of the arrow**.
- Make sure that the mark (2) on the eccentric shaft (3) points upwards.

27 – Checking the position of the intake camshaft (cylinder head removed)



Check

- Check position of the intake camshaft on the respective cylinders.

Result

» Cam (1) of the intake camshaft runs on the intermediate lever (2).

Measure

- Turn intake camshaft (3) further using a standard open-end spanner until the cam (1) does not override on the intermediate lever (2).

28 – Installing all torsion springs (cylinder head removed)

CAUTION

Spring preload.

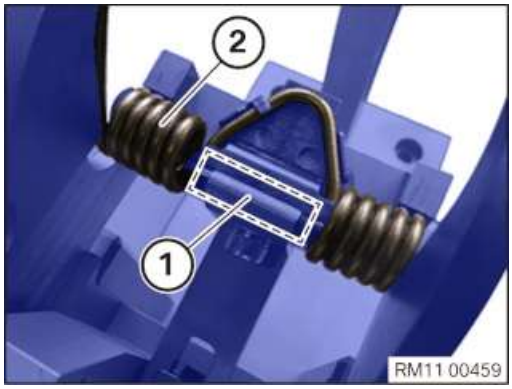
Danger of injury!

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

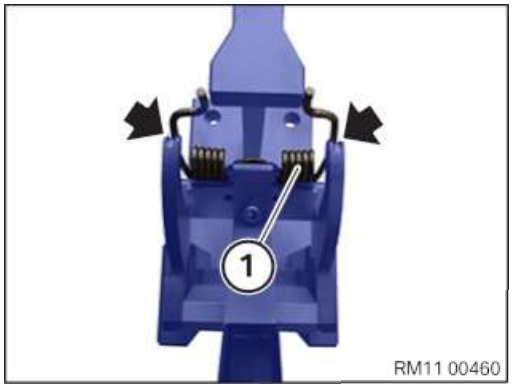
TECHNICAL INFORMATION

- Wear safety goggles.

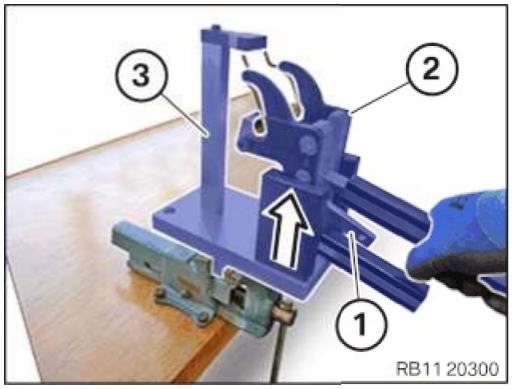
cardiagn.com



- 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.

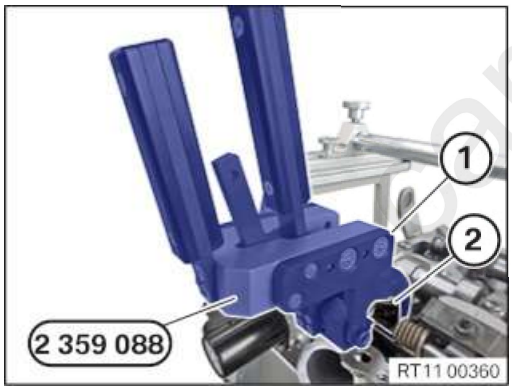


- Carefully close the clamping lever of the special tool 2 359 088 in the accompanying fixture until the retaining hook engages.
- Ensure that the torsion spring (1) lies correctly in the lateral guides (arrows) of the special tool 2 359 088 during tensioning.

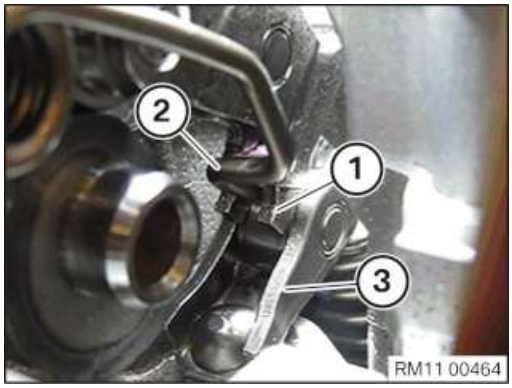


- Carefully close the clamping lever (2) of the special tool 2 359 088 in the fixture (3) until the retaining hook (1) audibly engages.

  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.

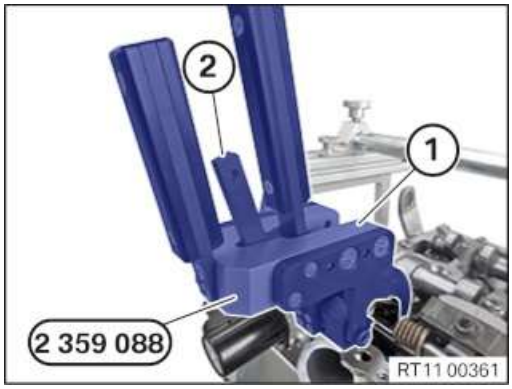


- Feed in clamping lever (1) from the special tool with the pre-tensioned torsion spring (2) and position it.

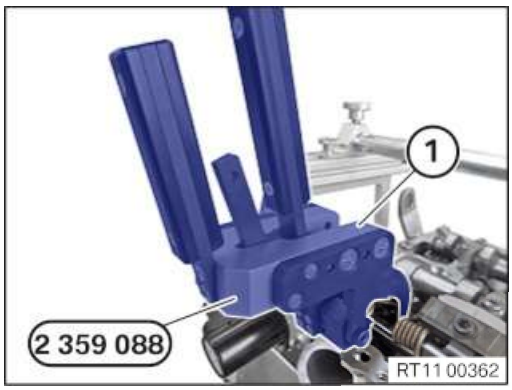


- Ensure that the torsion spring (2) is positioned correctly in the intermediate lever (1).
- Check all roller cam followers (3) for correct installation position.

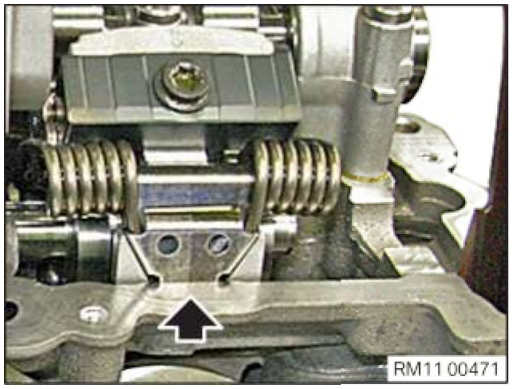
bardiagn.com



- Press the clamping lever (1) of the special tool 2 359 088 together until the retaining hook (2) unlocks.
- Carefully open the clamping lever (1) of the special tool 2 359 088 until the torsion spring is completely relaxed.



- Guide out and remove the clamping lever (1) of the special tool 2 359 088.



- Check for correct mounting orientation of the torsion spring (arrow) at the cylinder head.
- Repeat the operations for the remaining torsion springs.

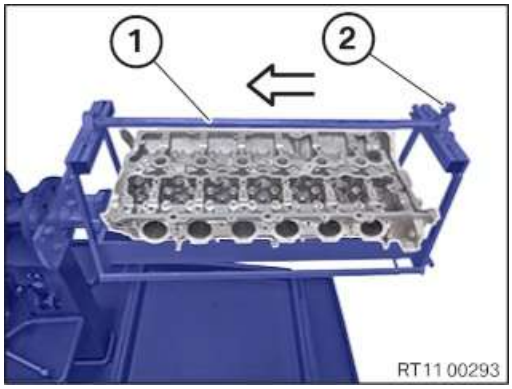
29 – Removing cylinder engine from assembly stand

CAUTION

Heavy component.

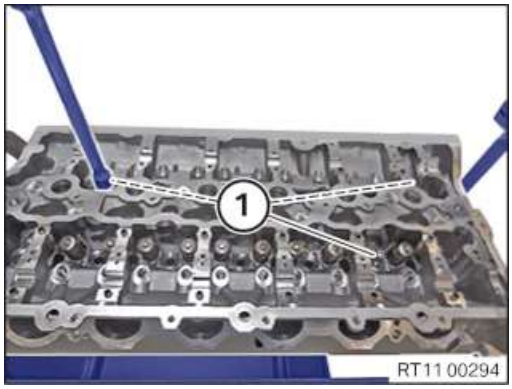
Heavy components can lead to injury or damage.

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



- Loosen screw (2).
- Pull out rod (1) in direction of arrow and set it aside.

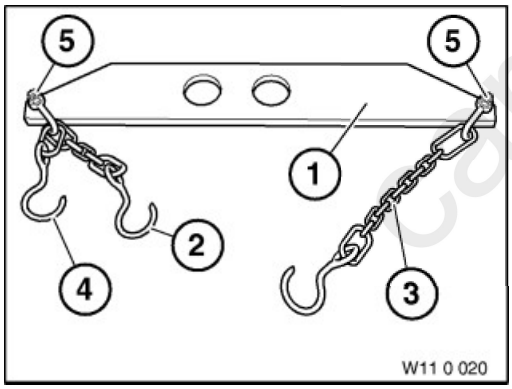
cardiagn.com



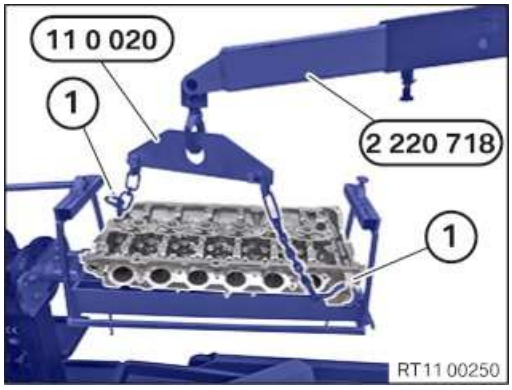
- Release screws (1) from special tool .



- Stage special tool (workshop crane) 2 220 718.

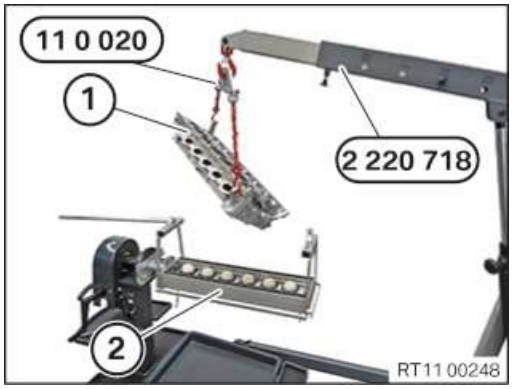


- Prepare the special tool 0 490 567 (11 0 020).



- Guide in and position special tool 0 490 567 (11 0 020) on cylinder head (1).
- Position workshop crane 2 220 718 and connect to special tool 0 490 567 (11 0 020).

carDiagn.com



- Detach cylinder head (1) with the work crane 2 220 718 and special tool 0 490 567 (11 0 020) from the device (2), pull out and remove.

30 – Installing the exhaust turbocharger (cylinder head removed)

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

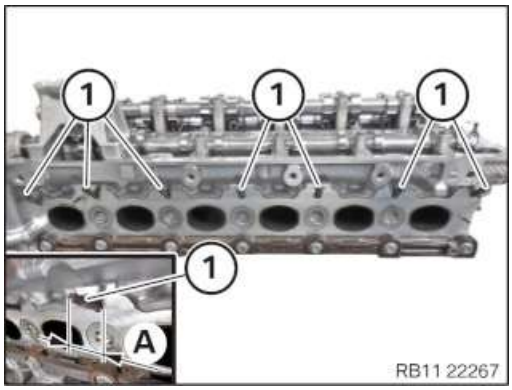
Damage to the electrical wastegate valve controller.

The electrical wastegate valve controller may be damaged as a result of the excessive forces required when removing and installing a jammed exhaust turbocharger.

- Do not pull on the electrical wastegate valve controller.
- Apply force to the turbine housing and exhaust manifold only.
  - Do not pull on the compressor housing.

TECHNICAL INFORMATION

Do not damage the thermal compensating elements. The disassembly and installation including intermediate storage of the exhaust turbocharger is only permitted with mounted special tool 2 466 919 .



- Check stud bolt (1) for damage, renew if necessary.

  Parts: Stud bolt
- Check screw-in depth (A) of the upper stud bolt (1).

Screw-in depth of upper stud bolt on cylinder head

Dimension A	30 mm

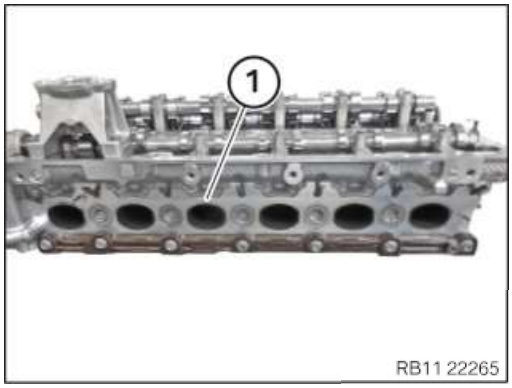
- If necessary, screw the stud bolts in further or unscrew.

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- Check stud bolts in the **marked area** for damage and replace if necessary.

  Parts: Stud bolt



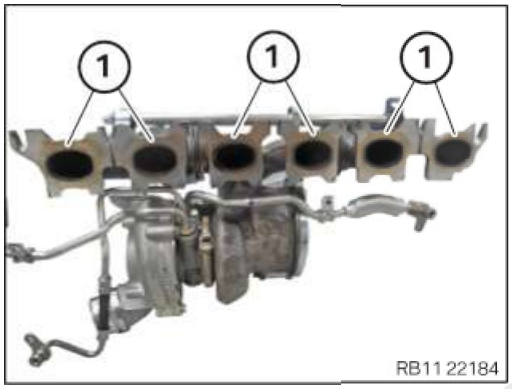
RISK OF DAMAGE

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 the sealing surfaces (1) on the cylinder head using special tool 0 495 102 (11 4 470).



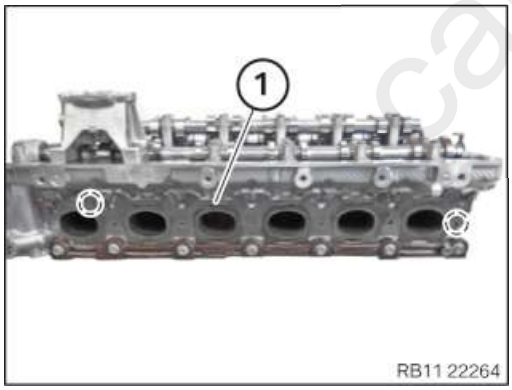
RISK OF DAMAGE

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 the sealing surfaces (1) on the exhaust turbocharger using the special tool 0 495 102 (11 4 470).

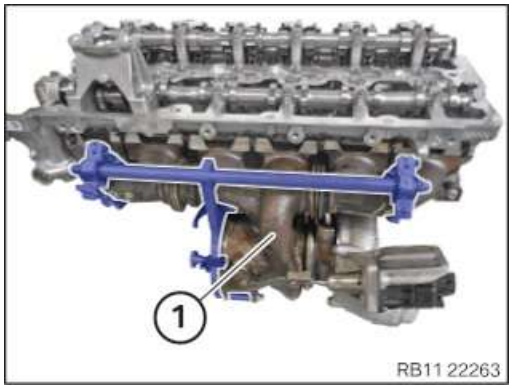


- Renew the gasket (1).

  Parts: Gasket

- Guide seal (1) into the **marked area** and install it.

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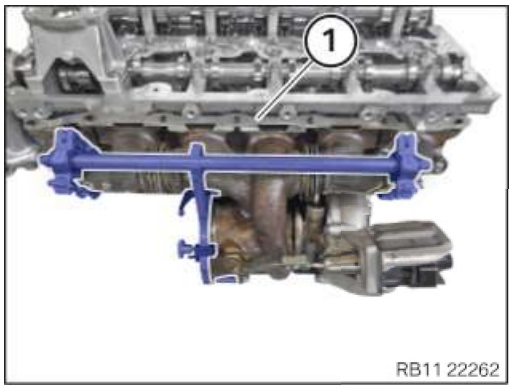
CAUTION

Heavy component.

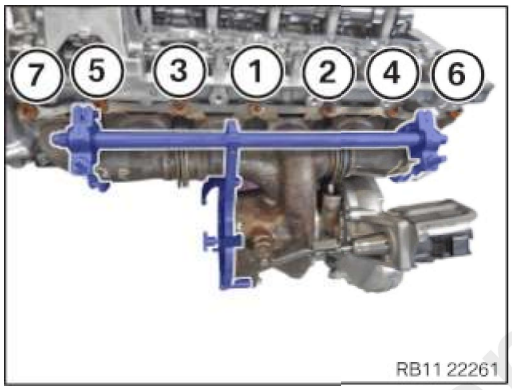
Heavy components can lead to injury or damage.

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

- Insert and install the exhaust turbocharger (1).
- Thermal compensating elements of the exhaust turbocharger (1) or exhaust manifold should **not** be bent or deformed.



- Feed in and install the sliding rail (1).
- Install sliding rail (1) so that the part number is **seen**.

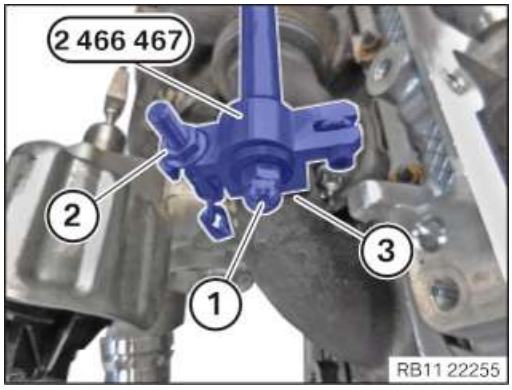


- Tighten nuts in sequence (1) to (7).

Exhaust manifold to cylinder head

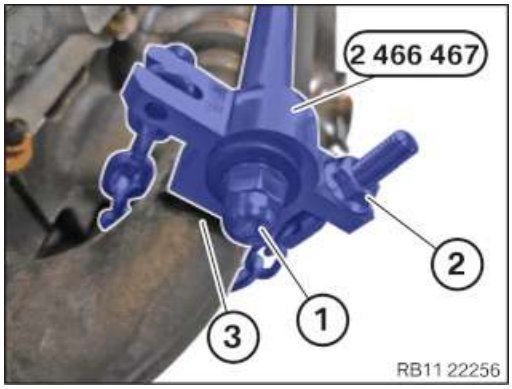
Flange nutM7	*Replace flange nuts*	1. Jointing torque	10 Nm
		2. Jointing torque	10 Nm
		3. Jointing torque	16 Nm
		4. Jointing torque	16 Nm
		5. Jointing torque	16 Nm

- Make sure the thermal compensating elements (A) have **not** been damaged.

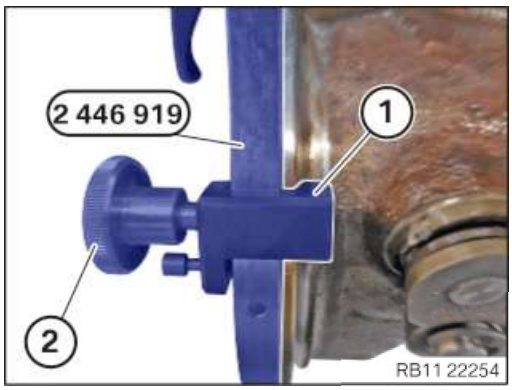


- Loosen nuts (1) and (2).
- Pull out special tool 2 466 467 at the exhaust turbocharger (3) and remove.

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- Release the nut (1) and (2).
- Pull out special tool 2 466 467 at the exhaust turbocharger (3) and remove.



- Loosen screw (2).
- Feed out the bracket (1) of the special tool 2 446 919 and set it aside.



- Release clamping lever (1) of the special tool 2 446 919 in the **direction of arrow**.



- Loosen screw (1).
- Pull out special tool 2 446 919 at the exhaust turbocharger and remove.

Additional Information

Overview of Tightening Torques

Special tool 2 466 467 to special tool 2 446 919			Used in step 1
M8		Tightening torque	5 Nm

Flange to assembly stand			Used in step 2
M14X30		Tightening torque	135 Nm

Cylinder head on device			Used in step 2
M10X90x1.5		Tightening torque	30 Nm

mdiagn.com

Exhaust camshaft to cylinder head			Used in step 19
M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

Eccentric shaft to bearing support/cylinder head			Used in step 20
M6			10 Nm

Electrical servomotor to cylinder head			Used in step 21
M6		Tightening torque	8 Nm

Intake camshaft to cylinder head			Used in step 22
M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque.	10 Nm

Gate to bearing bracket			Used in step 25
M8			20 Nm

Exhaust manifold to cylinder head			Used in step 30
Flange nutM7	*Replace flange nuts*	1. Jointing torque	10 Nm
		2. Jointing torque	10 Nm
		3. Jointing torque	16 Nm
		4. Jointing torque	16 Nm
		5. Jointing torque	16 Nm

Overview of Special Tools

2 446 919 Locating fixture



Common	Used in step 130
Usage	For installation and de-installation of the exhaust turbocharger module. Engine: B58.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 08 16 (383)

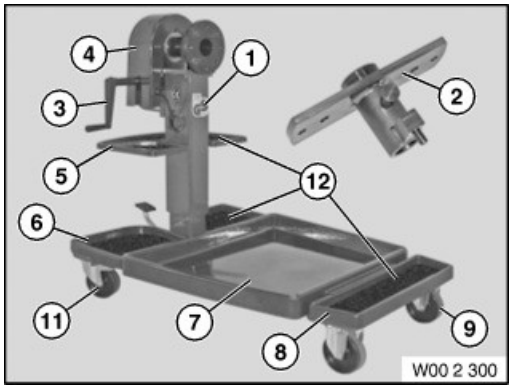
2 466 467 Device



Common	Used in step 130
Usage	For removing and installing the exhaust turbocharger. Engine: B58O1.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 18 (545)

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0 495 187 (00 2 300) Assembly stand



Common

Used in step 2

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)

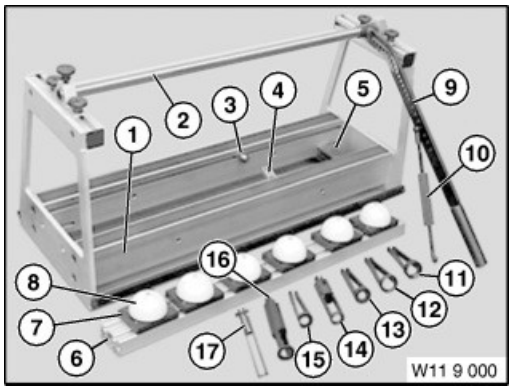
Consisting of

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)	

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2	2 299 563		**Adapter** New adapter for the engine assembly stand. Replacement for 83 30 0 495 189 - 00 2 302.

0 494 362 (11 9 000) Device



Common Used in step 212

Usage	(Cylinder head expander tool)
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	002300 = 0495187
SI-Number	01 03 02 (833)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 494 366 (11 9 001)		**Device**	
6	0 494 371 (11 9 006)		**Insert** (Aluminium strip)	
11	0 494 376 (11 9 012)		**Basket** (Valve spring cage) Engine M41, M51, S50	
17	0 495 028 (11 9 017)		**Basket** (Valve spring cage) Engine N52	
2	0 494 367 (11 9 002)		**Rod**	
3	0 494 368 (11 9 003)		**Adapter** (Sliding block)	
4	0 494 369 (11 9 004)		**Tab**	
5	0 494 370 (11 9 005)		**Quick fastener**	
7	0 494 372 (11 9 007)		**Shaped part** (shaped part)	
8	0 494 373 (11 9 008)		**Shaped part** (Shaped part) Shaped part made of plastic	
9	0 494 374 (11 9 009)		**Lever**	
10	0 494 375 (11 9 011)		**Hook**	
12	0 494 377 (11 9 013)		**Basket** (Valve spring cage) Engine M43, M73	
13	0 494 378 (11 9 014)		**Basket** (Valve spring cage) Engine M44, M52, M54, M56, M62, S52, S54, S62	

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14	0 494 379 (11 9 015)		**Basket** (Valve spring cage) Engine M47, M47TU, M57, M57TU, N40, N42, N62, N73	
15	0 494 380 (11 9 016)		**Basket** (Valve spring cage) Engine M21, M40	

2 220 718 Workshop crane

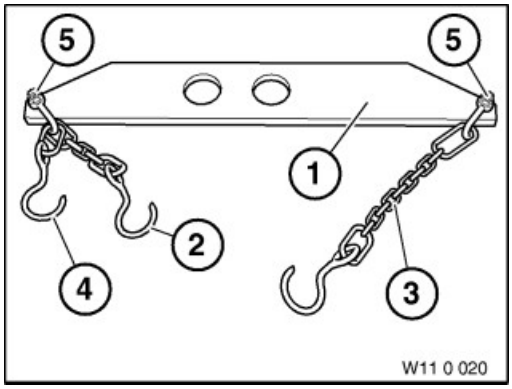


Common	Used in step 229
Usage	WSK 1000
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	06 01 11 (701)

0 490 567 (11 0 020) Lifting gear

Used in step 229

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Common

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.	

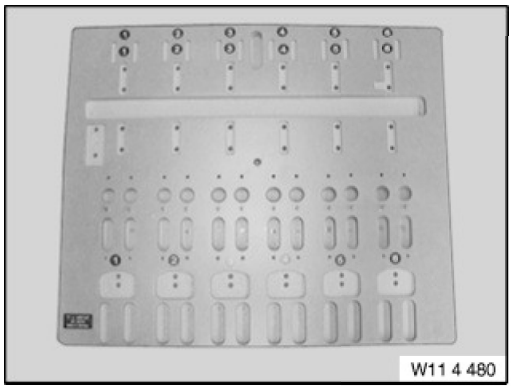
cardiagn.com

2 359 088 Device



Common	Used in step 428
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 4567910111214
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	

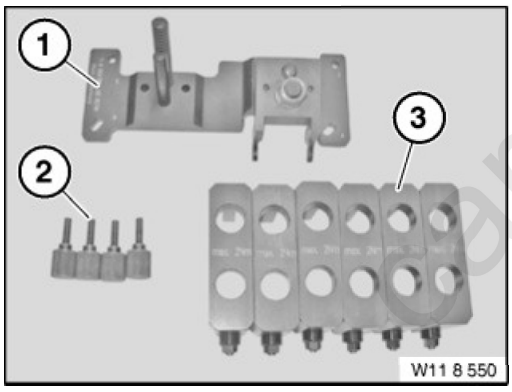
cardiagn.com

2 410 670 Device



Common	Used in step 1019
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)

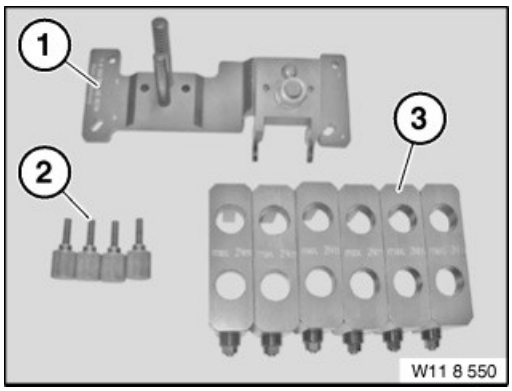
0 495 741 (11 8 552) Screw



Common	Used in step 1019
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 10

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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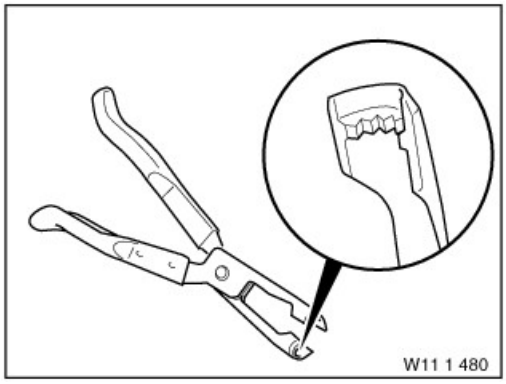
0 496 143 (11 8 840) Basket



Common Used in step 1217

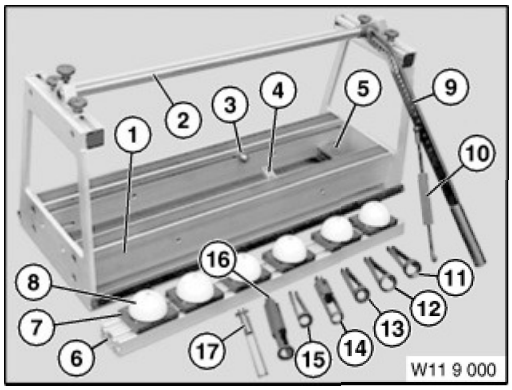
Usage	(Valve spring cage) For removing and fitting the valves.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

0 490 796 (11 1 480) Pliers



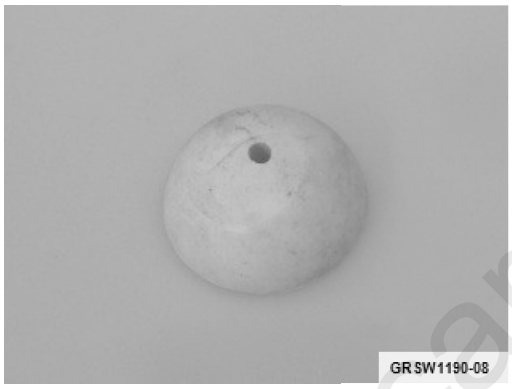
Common	Used in step 13
Usage	For removing valve stem seal
Included in the tool or work	
Storage location	A10
Replaced by	
In connection with	
SI-Number	01 01 93 (621)

0 494 370 (11 9 005) Quick fastener



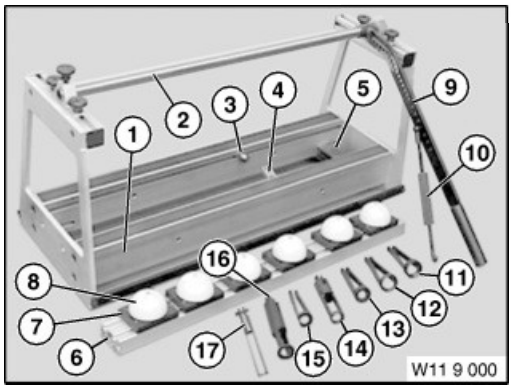
Common	Used in step 1415
Usage	
Included in the tool or work	0 494 362
Storage location	
Replaced by	
In connection with	
SI-Number	

0 494 373 (11 9 008) Shaped part



Common	Used in step 1415
Usage	(Shaped part) Shaped part made of plastic
Included in the tool or work	0 494 362
Storage location	
Replaced by	
In connection with	
SI-Number	

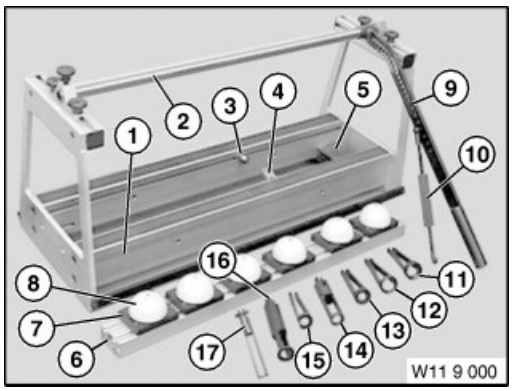
0 494 371 (11 9 006) Insert



Common	Used in step 1415
Usage	(Aluminium strip)
Included in the tool or work	0 494 362
Storage location	
Replaced by	
In connection with	
SI-Number	

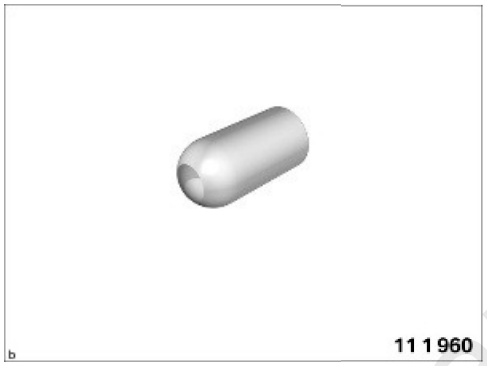
cardiagn.com

0 494 372 (11 9 007) Shaped part



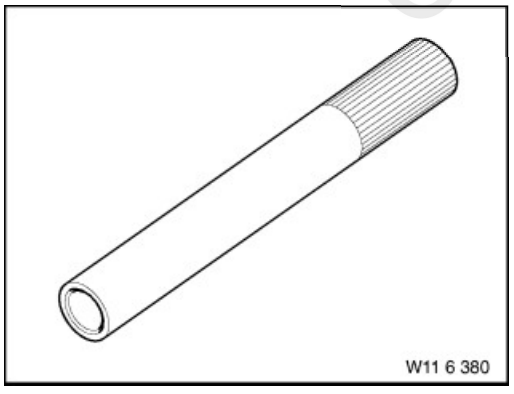
Common	Used in step 1415
Usage	(Shaped part)
Included in the tool or work	0 494 362
Storage location	
Replaced by	
In connection with	
SI-Number	

0 490 797 (11 1 960) Holding sleeve



Common	Used in step 16
Usage	(Assembly sleeve) For fitting valve stem seals, 6 mm diameter
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	

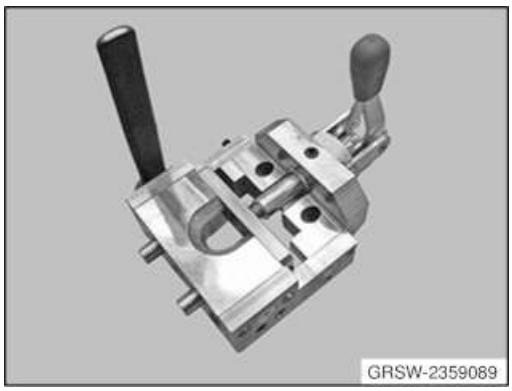
0 493 249 (11 6 380) Bush



Common	Used in step 16
Usage	For fitting valve stem seal
Included in the tool or work	
Storage location	A9
Replaced by	
In connection with	
SI-Number	01 06 98 (306)

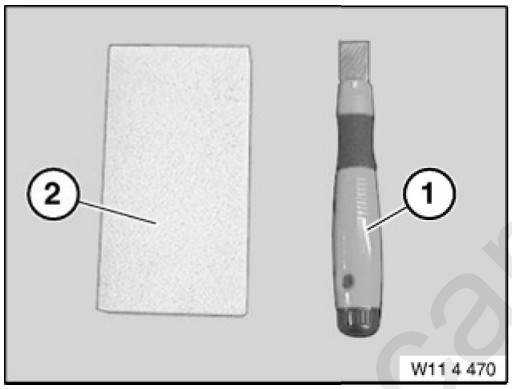
carflag.com

2 359 089 Device



Common	Used in step 25
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)

0 495 102 (11 4 470) Tool



Common	Used in step 30
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)

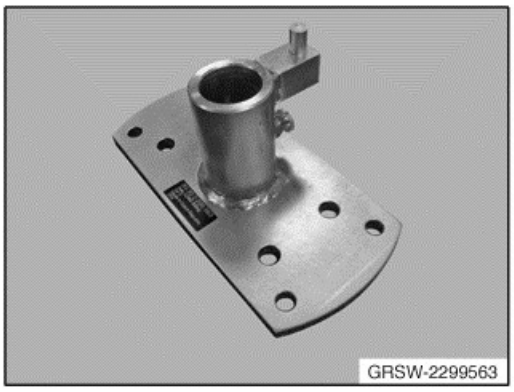
Consisting of

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)	

Replacement tools:

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2 299 563 Adapter



Common	Used in step 2
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	

Overview Technical Data

Screw-in depth of upper stud bolt on cylinder head	Used in step 30
Dimension A	30 mm

Links

Repair instructions	**Used in step**
61 35 ... Notes on ESD protection (Electro Static Discharge)	8

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11 34 715 Replace all valve springs

PRELIMINARY WORK

1 – Removing the exhaust turbocharger (cylinder head removed)

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

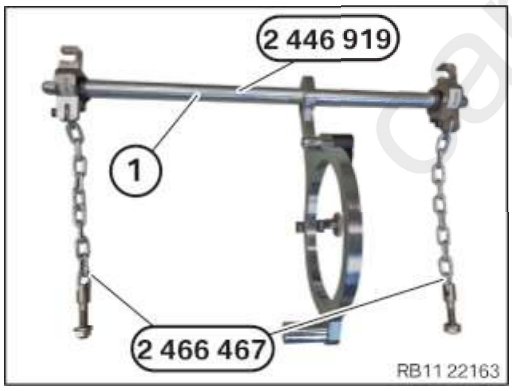
Damage to the electrical wastegate valve controller.

The electrical wastegate valve controller may be damaged as a result of the excessive forces required when removing and installing a jammed exhaust turbocharger.

- Do not pull on the electrical wastegate valve controller.
- Apply force to the turbine housing and exhaust manifold only.
  - Do not pull on the compressor housing.

TECHNICAL INFORMATION

Do not damage the thermal compensating elements. The disassembly and installation including intermediate storage of the exhaust turbocharger is only permitted with mounted special tool 2 466 919 .



- Have the special tool 2 446 919 and the special tool 2 466 467 ready.



- Install the special tool 2 446 919 on the exhaust turbocharger and secure it with the bolt (1).

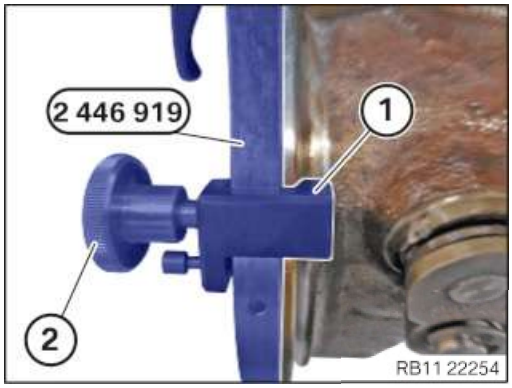
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- Fix the special tool 2 446 919 by turning the clamping lever (1) in the **direction** of the arrow.

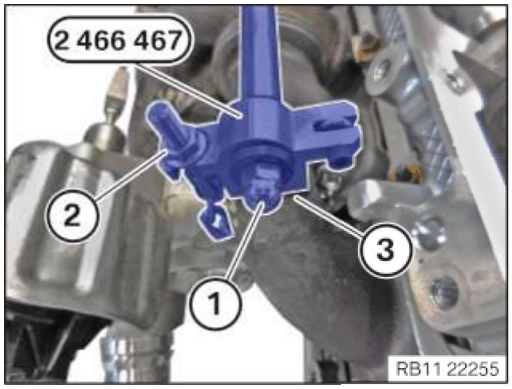
Note: The clamping lever that is shown in the graphic is already in its end position.

- Make sure that the special tool 2 446 919 is flush with the exhaust turbocharger in the **marked area**.

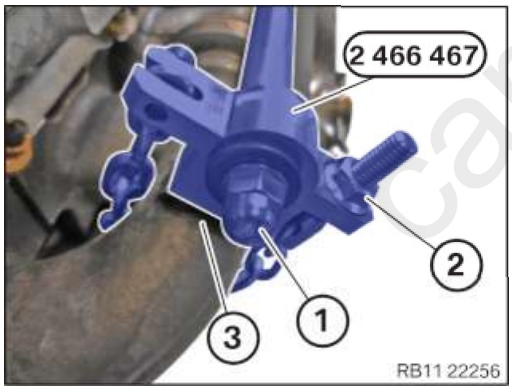


- Position the holder (1) and fasten it with the bolt (2).

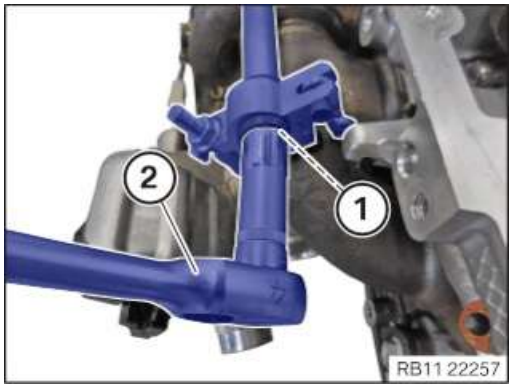
Note: The holder is used for the final mounting of the special tool **2 446 919**.



- Tighten the nut (1) hand-tight.
- Tighten the nut (2) hand-tight.
- Ensure that the special tool 2 466 467 rests correctly on the exhaust turbocharger (3).



- Tighten the nut (1) hand-tight.
- Tighten the nut (2) hand-tight.
- Ensure that the special tool 2 466 467 rests correctly on the exhaust turbocharger (3).

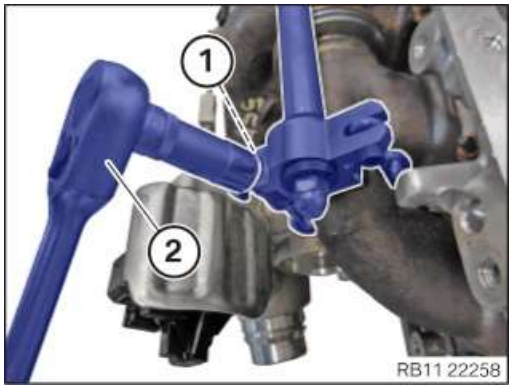


- Tighten the nut (1) using commercially available tools (2).

Special tool 2 466 467 to special tool 2 446 919

M8		Tightening torque	5 Nm

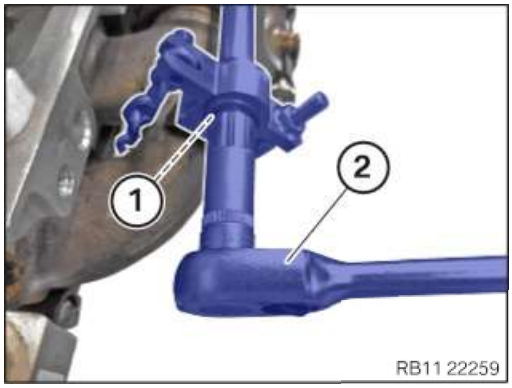
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- Tighten the nut (1) using commercially available tools (2).

Special tool 2 466 467 to special tool 2 446 919

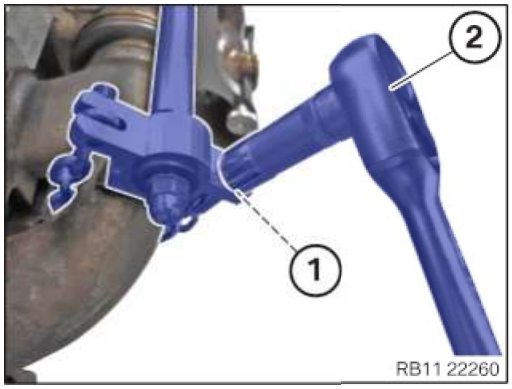
M8		Tightening torque	5 Nm



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

Special tool 2 466 467 to special tool 2 446 919

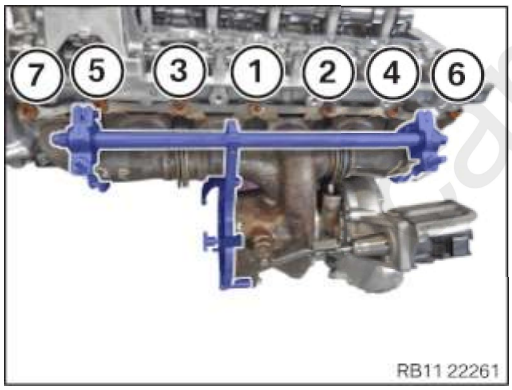
M8		Tightening torque	5 Nm



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

Special tool 2 466 467 to special tool 2 446 919

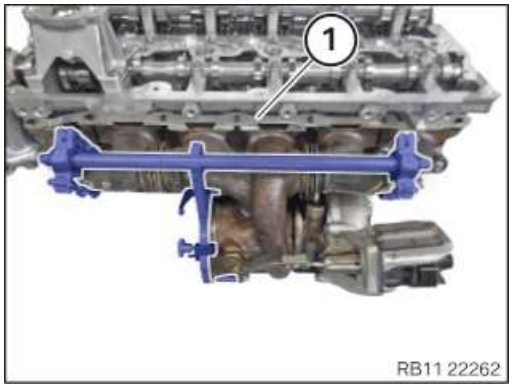
M8		Tightening torque	5 Nm



TECHNICAL INFORMATION

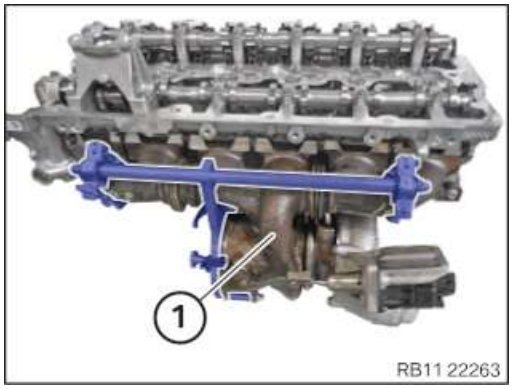
Exhaust manifold/exhaust turbocharger is not bolted to the underside, but clamped instead. When removing/replacing the exhaust manifold/exhaust turbocharger, the clamping strip remains screwed on.

- Unscrew the nuts in sequence (7) to (1).
- Secure exhaust turbocharger against falling down.



- Slide the slide rail (1) out and remove.

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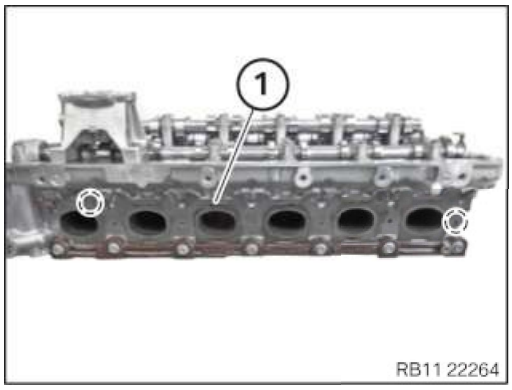
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

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

- Carefully guide out and remove the exhaust turbocharger (1).
- Thermal compensating elements of the exhaust turbocharger (1) or exhaust manifold should **not** be bent or deformed.



- Feed out and remove seal (1) in the **marked area.**

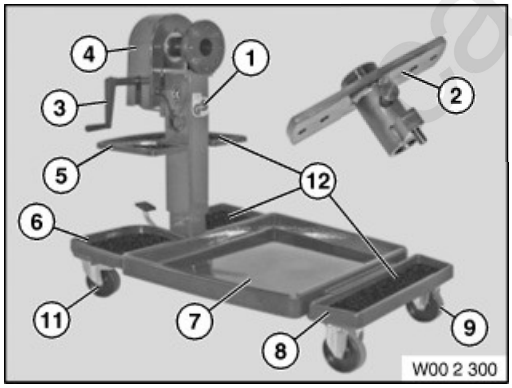
2 – Installing cylinder head on the assembly stand

CAUTION

Heavy component.

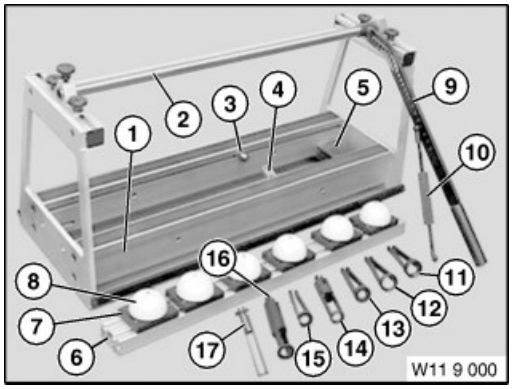
Heavy components can lead to injury or damage.

- 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



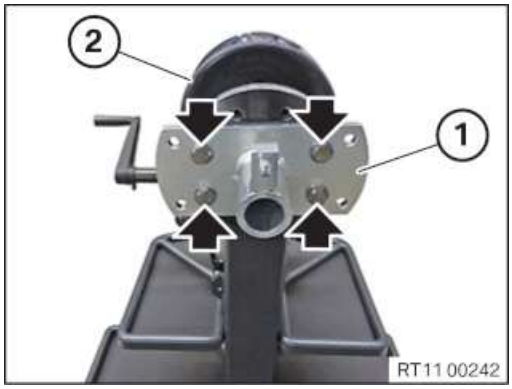
- Have the set of special tools 0 494 362 (11 9 000) ready.

Number	Description
1	Device
2	Rod
3	Adapter
4	Tab
5	Quick fastener
6	Aluminum strip
7	Shaped part
8	Shaped part made of plastic
9	Lever
10	Hook
11	Valve spring cage
12	Valve spring cage
13	Valve spring cage
14	Valve spring cage
15	Valve spring cage
16	Valve spring cage
17	Valve spring cage



- Stage special tool (workshop crane) 2 220 718.

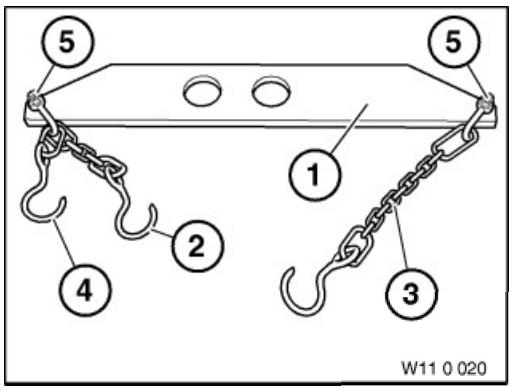
cardiagn.com



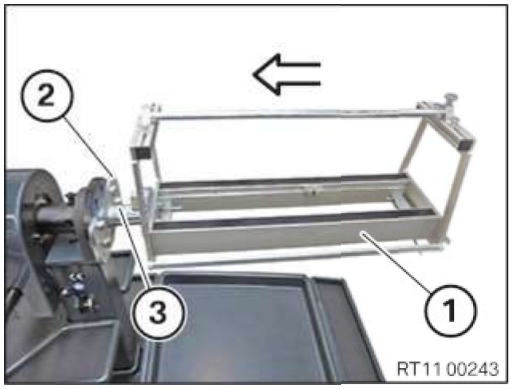
- Position flange (1) on assembly stand (2).
- Tighten screws (arrows).

Flange to assembly stand

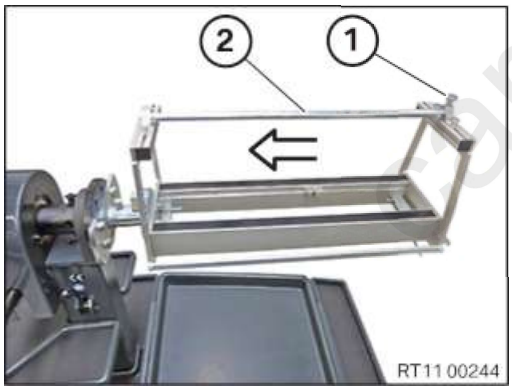
M14X30		Tightening torque	135 Nm



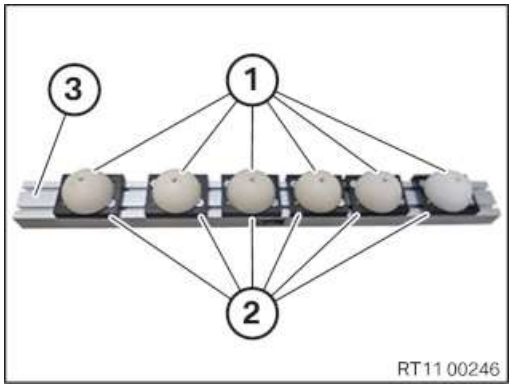
- Prepare the special tool 0 490 567 (11 0 020).



- Fit device (1) onto the flange (2) in the direction of the arrow and install.
- Make sure that the lock (3) engages audibly.

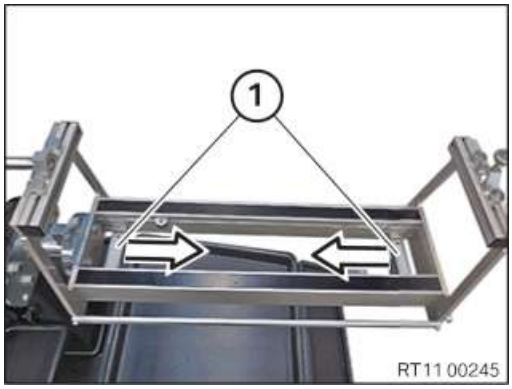


- Loosen screw (1).
- Pull out rod (2) in direction of arrow and set it aside.

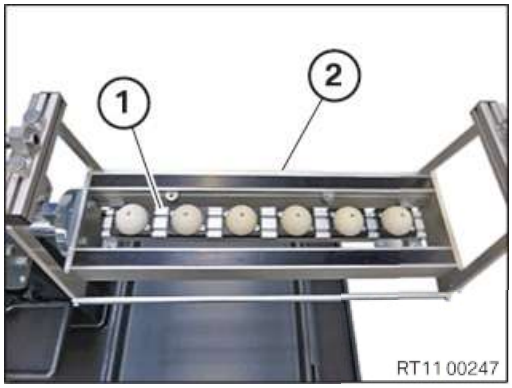


- Prepare plastic shaped part (1) with the shaped parts (2) and the aluminium strip (3).

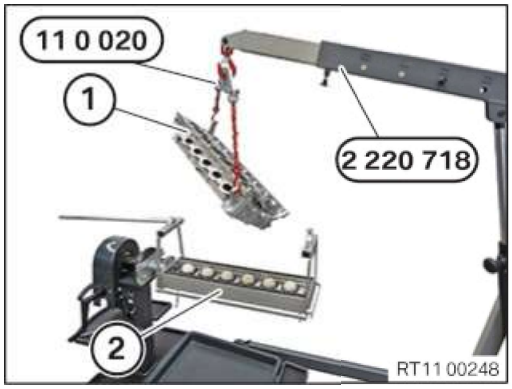
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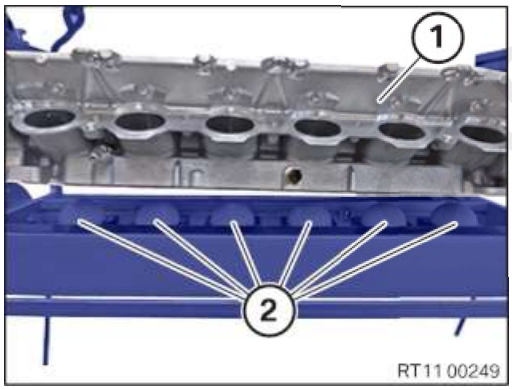
- Slide quick fastener (1) in the direction of the arrow to the limit position.



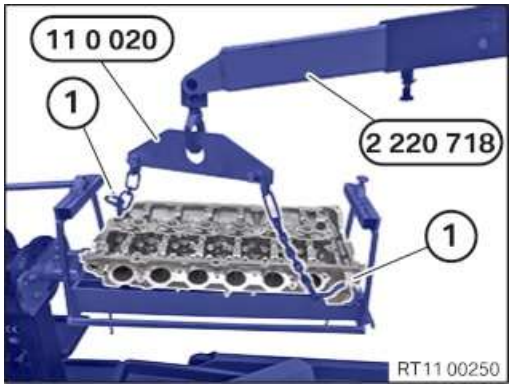
- Position completed aluminium strip (1) **centred** on the device (2).



- Position cylinder head (1) with the work crane 2 220 718 and special tool 0 490 567 (11 0 020) on the device (2).

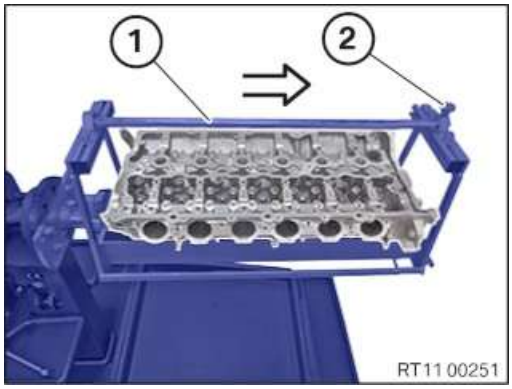


- Position cylinder head (1) correctly on the completed aluminium strip (2).

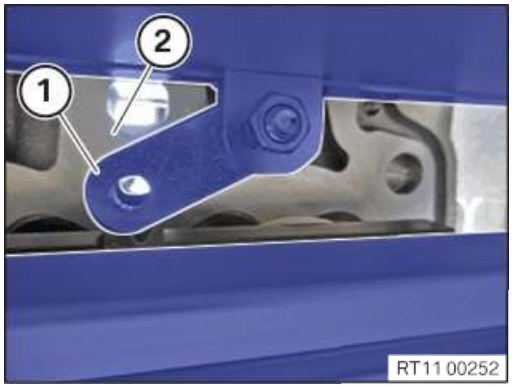


- Lower workshop crane 2 220 718.
- Pull out special tool 0 490 567 (11 0 020) at the cylinder head (1) and remove.
- Remove workshop crane 2 220 718 and set aside.

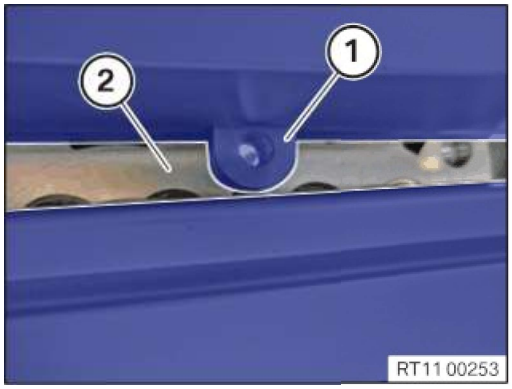
mdiagn.com



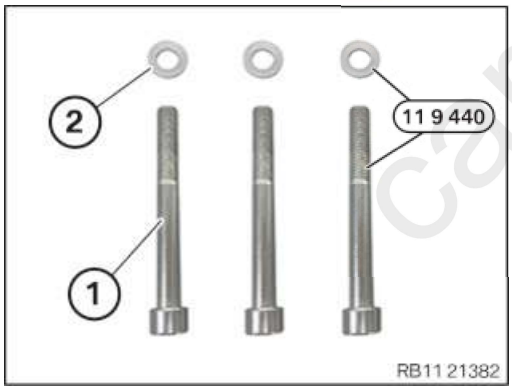
- Pull in rod (1) in the direction of the arrow and install.
- Hand-tighten the bolt (2).



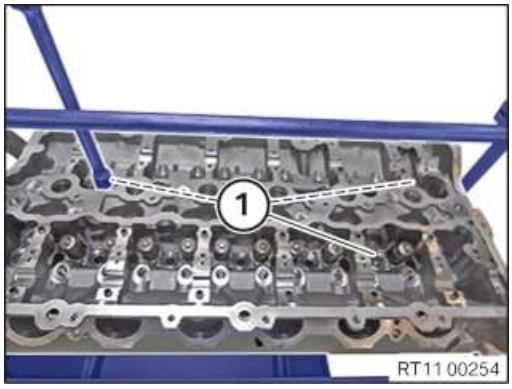
- Position screw connection (1) on cylinder head (2).



- Position screw connection (1) on cylinder head (2).



- Keep **M10x90** screws (1) from special tool ready.
- Keep washers (2) from special tool ready.

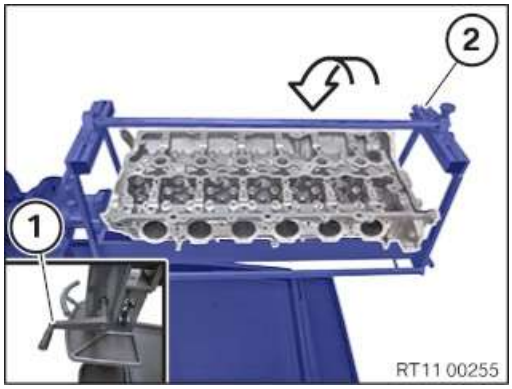


- Tighten screws (1) from special tool.

Cylinder head on device

M10X90x1.5		Tightening torque	30 Nm

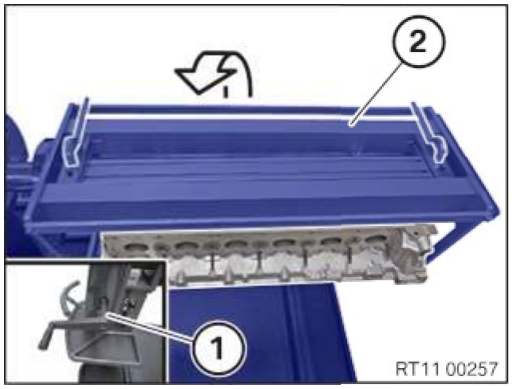
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- Turn device (2) on the crank (1) by 180° in direction of arrow.

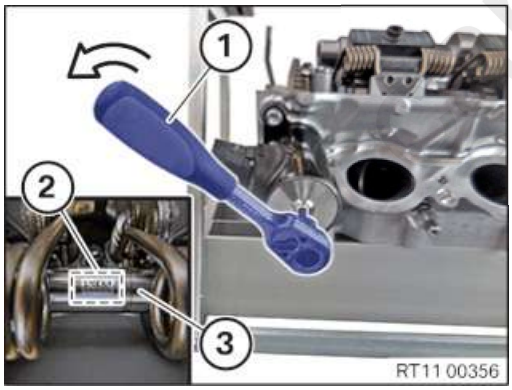


- Lock quick fastener (1) in direction of arrow.



- Turn device (2) on the crank (1) by 180° in direction of arrow.

3 – Adjusting eccentric shaft to minimum lift (cylinder head removed)



- With the help of the servomotor, use a standard hexagon socket wrench (1) to slowly adjust eccentric shaft (3) to the minimum lift at **4 mm** in the **direction of the arrow**.
- Make sure that the mark (2) on the eccentric shaft (3) points upwards.

4 – Removing all torsion springs (cylinder head removed)

CAUTION

Spring preload.

Danger of injury!

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

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TECHNICAL INFORMATION

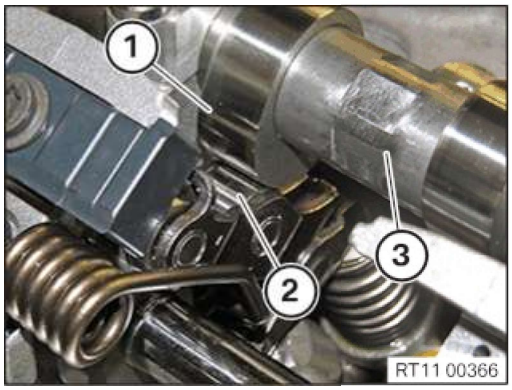
- Wear safety goggles.



- Have the set of special tools 2 359 088 ready.

Number	Description
1	Clamping lever
2	Mounting for clamping lever (fitting aid)

▸ Checking the position of the intake camshaft (cylinder head removed)



Check

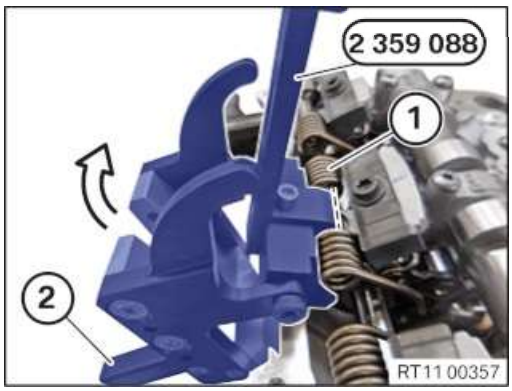
- Check position of the intake camshaft on the respective cylinders.

Result

» Cam (1) of the intake camshaft runs on the intermediate lever (2).

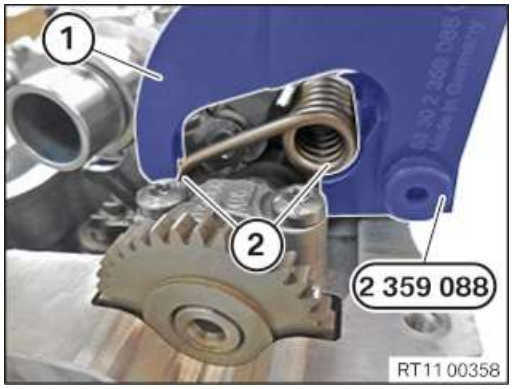
Measure

- Turn intake camshaft (3) further using a standard open-end spanner until the cam (1) does not override on the intermediate lever (2).

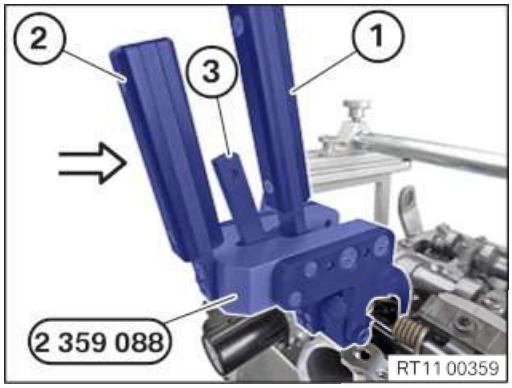


- Open the special tool 2 359 088 and position it at the torsion spring (1).
- Position retaining hook (2) of the special tool 2 359 088 in the direction of arrow.

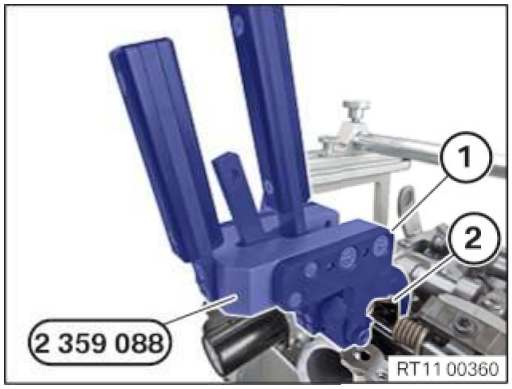
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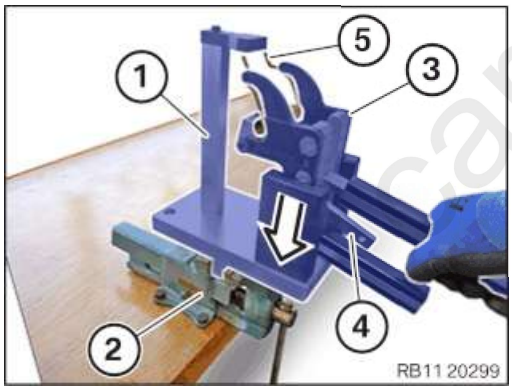
- Make sure that the torsion spring (2) is correctly positioned in the clamping lever (1) of the special tool 2 359 088.



- Hold down lever (1) of special tool 2 359 088.
- Close lever (2) of the special tool 2 359 088 carefully in the **direction of arrow** until the retaining hook (3) engages audibly.



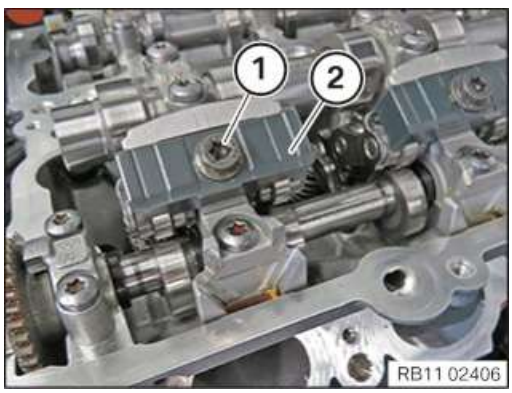
- Guide out and remove clamping lever (1) of special tool 2 359 088 with preloaded spring (2) **carefully**.



- 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.

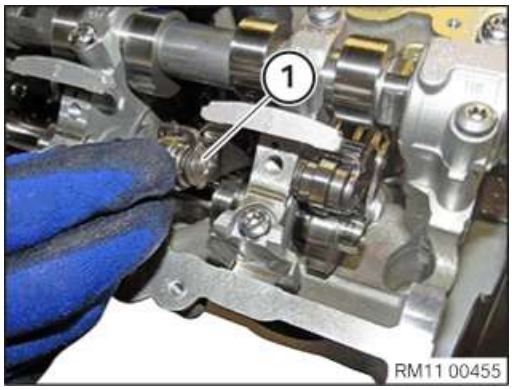
5 – Removing all gates



- 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.

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6 – 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).

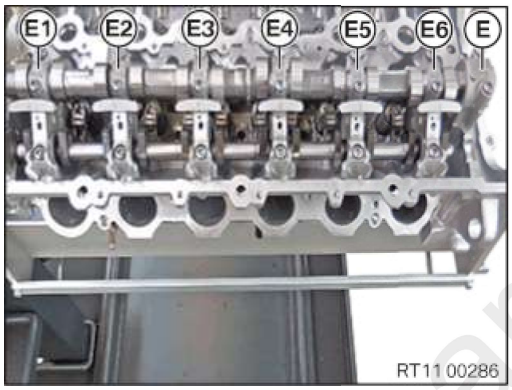
7 – Removing intake camshaft (cylinder head removed)

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

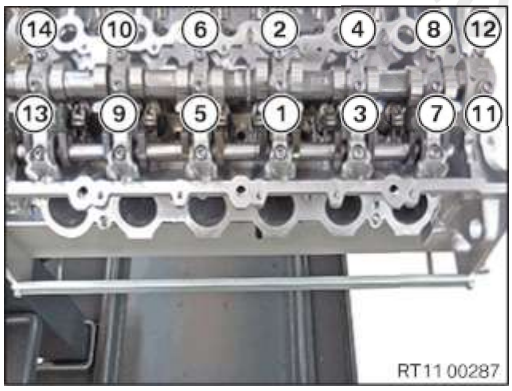
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.



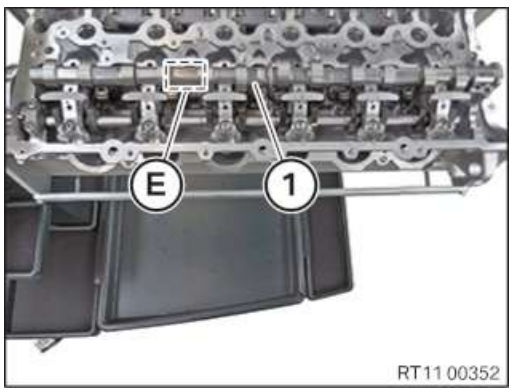
- Observe the numbering of the intake camshaft bearing caps.

  The intake camshaft bearing caps are numbered from (E1) to (E6) and are laid down according to their numbering in the special tool 0 495 105 (11 4 480).

  The intake camshaft bearing cap (E) is a thrust bearing.



- Release screws in the right sequence (14) till (1) in semi circle pattern.
- Set all intake camshaft bearing caps neatly in the special tool 0 495 105 (11 4 480).



- Guide out intake camshaft (1) toward the top and remove it.

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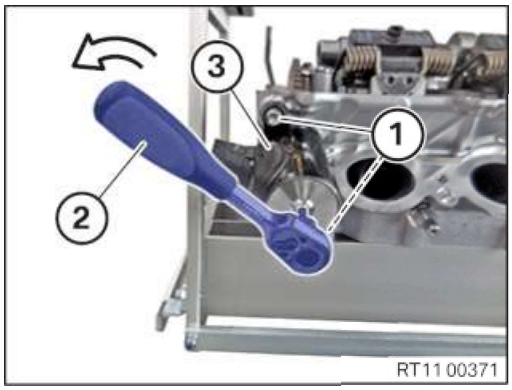
8 – Remove the servomotor for the eccentric shaft (cylinder head removed)

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.

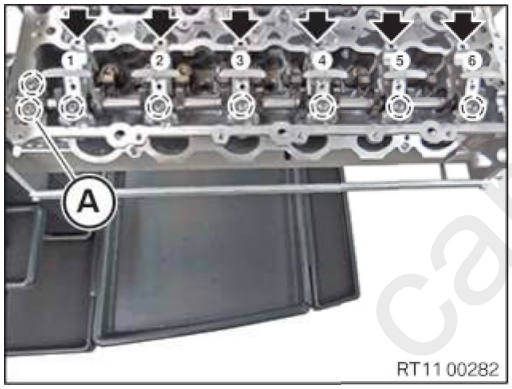


- Loosen screws (1).
- Use a standard hexagon socket wrench (2) to slowly adjust the servomotor for eccentric shaft (3) to the minimum lift at **4 mm** in direction of arrow.

  This releases the tension of the eccentric shaft.

  Do **not** turn the eccentric shaft beyond the end stop.
- Guide out and remove the servomotor for eccentric shaft (3).

9 – Removing the eccentric shaft (cylinder head removed)



RISK OF DAMAGE

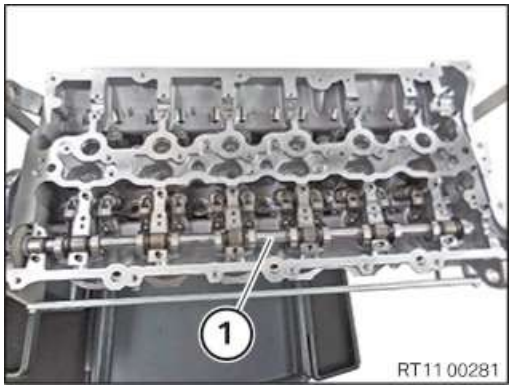
Contaminant or foreign body.

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.

- Unscrew all bolts (markings).
- Work mounting brackets (1) to (6) (arrowed) out and remove.
- Place mounting brackets (1) to (6) in order in the special tool 0 495 105 (11 4 480).
- Work bearing caps (A) out and remove.
- Place the bearing cap (A) in the special tool 0 495 105 (11 4 480) in order.

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- Guide out the eccentric shaft (1) toward the top and remove it.

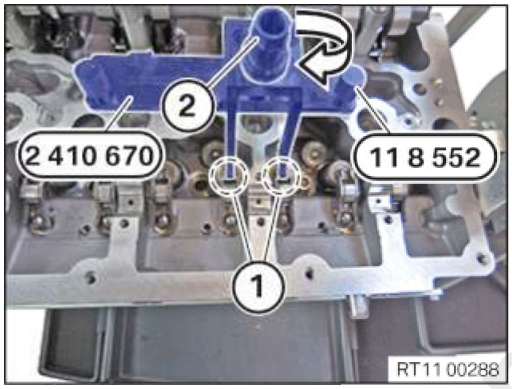
10 – Removing exhaust camshaft (cylinder head removed)

RISK OF DAMAGE

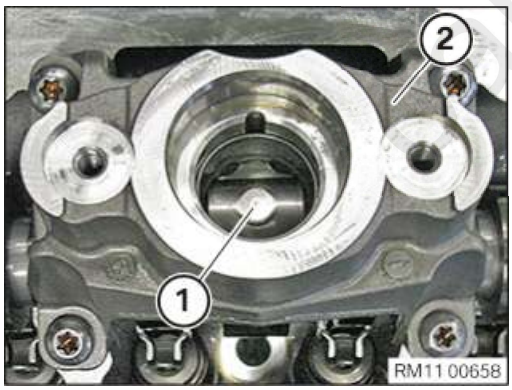
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

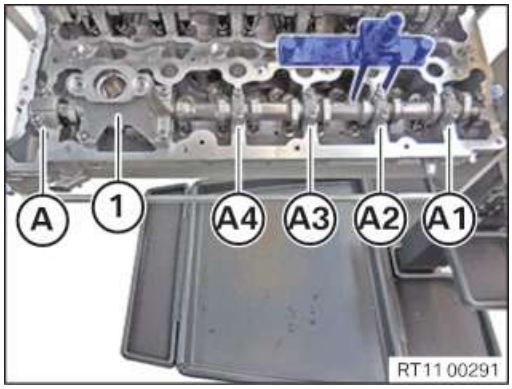
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.



- 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 the 2nd cylinder using the spindle nut (2) of the special tool 2 410 670 in direction of arrow up to the limit position.



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

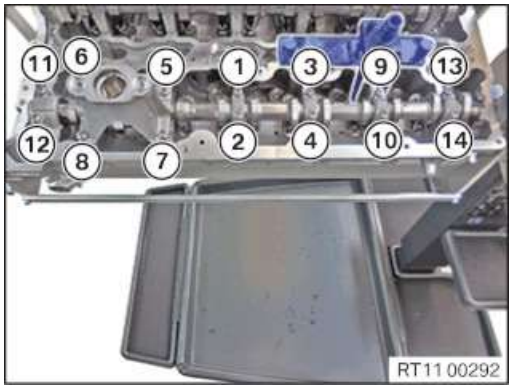


- Observe the numbering of the exhaust camshaft bearing caps.

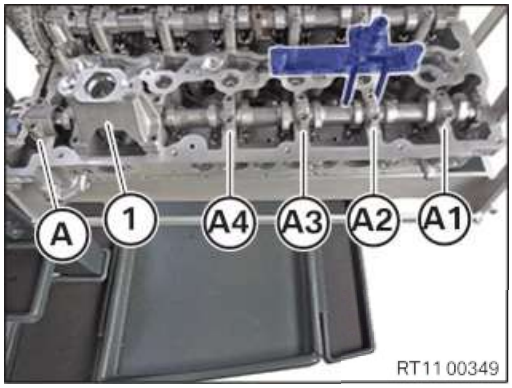
  The exhaust camshaft bearing caps are numbered from (A1) to (A4) and are placed in the special tool 0 495 105 (11 4 480) according to their numbering.

  The exhaust camshaft bearing caps can be read from the intake side.

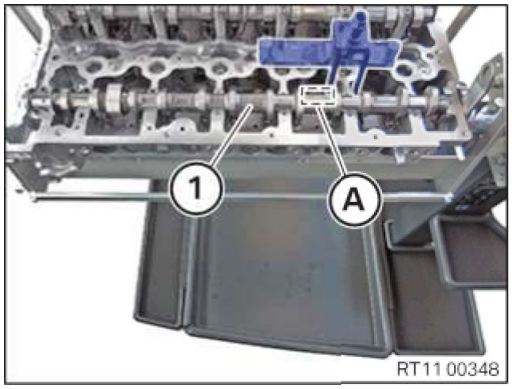
  The exhaust camshaft bearing cap (A) is a thrust bearing.



- Release screws in the right sequence (14) till (1) in semi circle pattern.

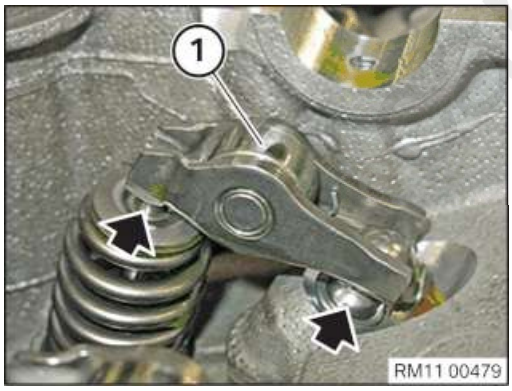


- Pull out all exhaust camshaft bearing caps (A1) to(A4) and the exhaust camshaft bearing cap (A) and remove.
- Place all exhaust camshaft bearing cap in order in special tool 0 495 105 (11 4 480).
- Thread the high pressure pump bracket (1) out and remove.

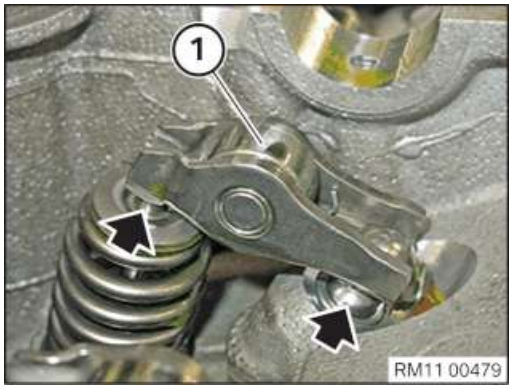


- (1)Remove exhaust camshaft in upward direction.

11 – 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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12 – Remove all valve springs

CAUTION

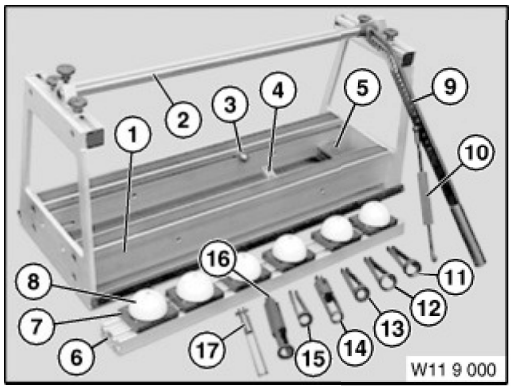
Spring preload.

Danger of injury!

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

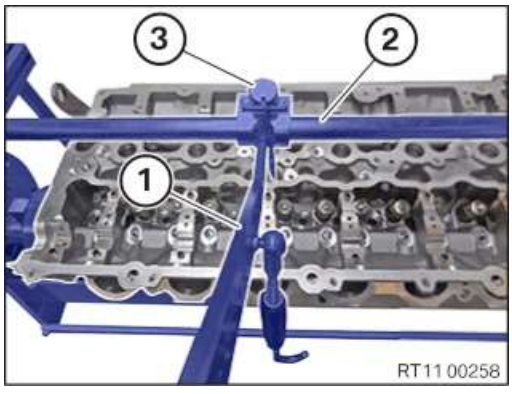
NOTICE

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



- Have the set of special tools 0 494 362 (11 9 000) ready.

Number	Description
1	Device
2	Rod
3	Adapter
4	Tab
5	Quick fastener
6	Aluminum strip
7	Shaped part
8	Shaped part made of plastic
9	Lever
10	Hook
11	Valve spring cage
12	Valve spring cage
13	Valve spring cage
14	Valve spring cage
15	Valve spring cage
16	Valve spring cage
17	Valve spring cage



- Feed in and install lever (1) on the rod (2).
- Guide in and install lock (3).

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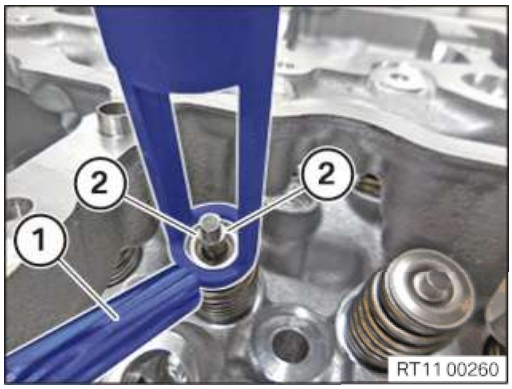


TECHNICAL INFORMATION

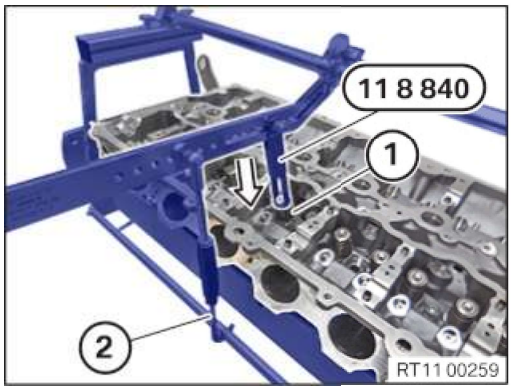


- Wear safety goggles.

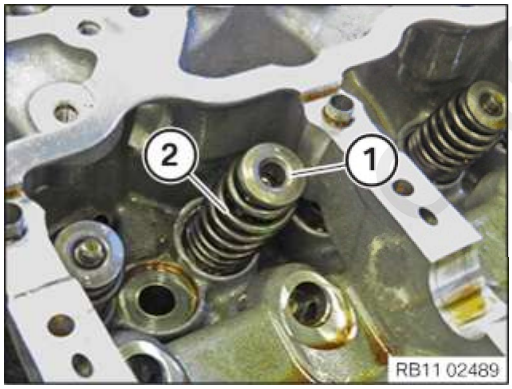
- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in direction of arrow.
- Hold valve spring (1) **pressed down** using the hook (2).



- Remove valve shims (2) with a magnet (1).



- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in **direction of arrow**.
- Thread out hook (2) and place to the side.
- Relieve the valve spring (1) **carefully**.



- Remove the spring cup (1) and the valve spring (2) and position neatly in the special tool 0 495 105 (11 4 480).

13 – Renewing valve stem seals

► **Remove valve stem seals**

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RISK OF DAMAGE

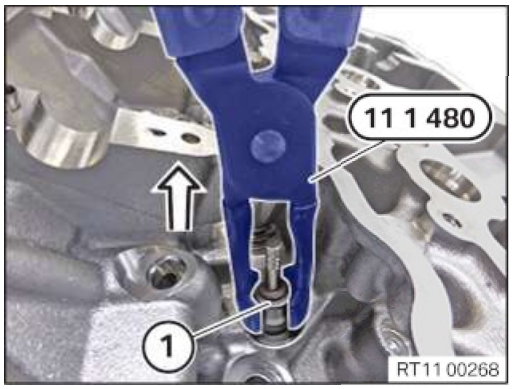
Contaminant or foreign body.

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.

NOTICE

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

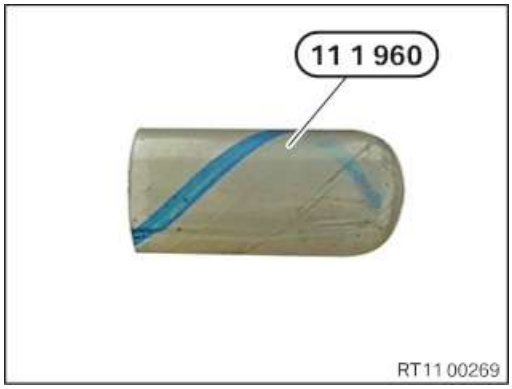


- Remove the valve stem seal (1) in the **direction of arrow** using the special tool 0 490 796 (11 1 480).

▸ **Installing valve stem seals**

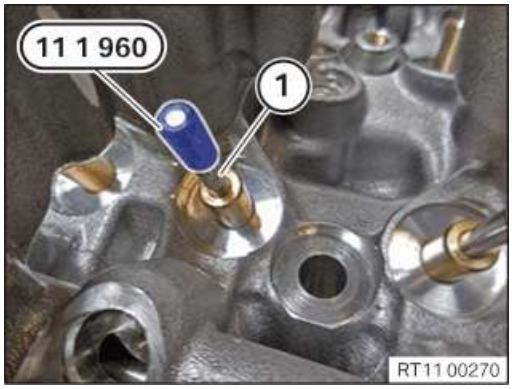


- Remove oil and dirt from the contact surface (1).



- Make sure that the special tool 0 490 797 (11 1 960) is used when installing the valve stem seal.

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- Guide in and install the special tool 0 490 797 (11 1 960) on valve (1).



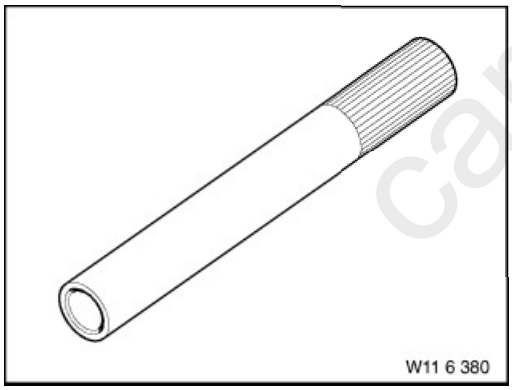
- Renew the valve stem seal (1).

  Parts: Valve stem seal

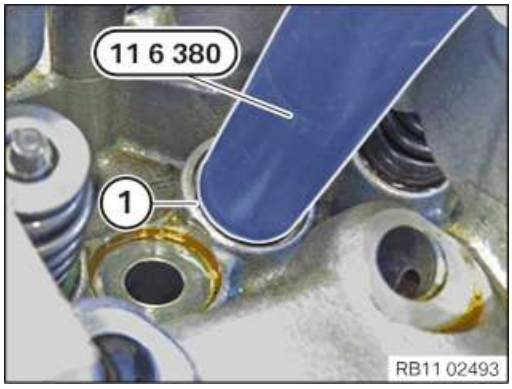
- Guide in and install valve stem seal (1) on the special tool 0 490 797 (11 1 960).



- Guide the special tool 0 490 797 (11 1 960) out and remove.

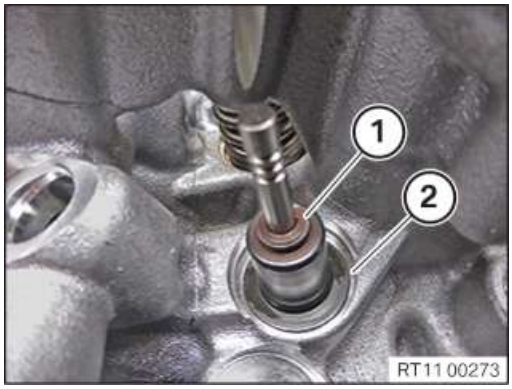


- Prepare special tool 0 493 249 (11 6 380).



- Press the valve stem seal (1) onto the cylinder head till the limit position using special tool 0 493 249 (11 6 380).

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- Make sure that valve stem seal (1) is positioned correctly on cylinder head (2).

14 – Install all valve springs

CAUTION

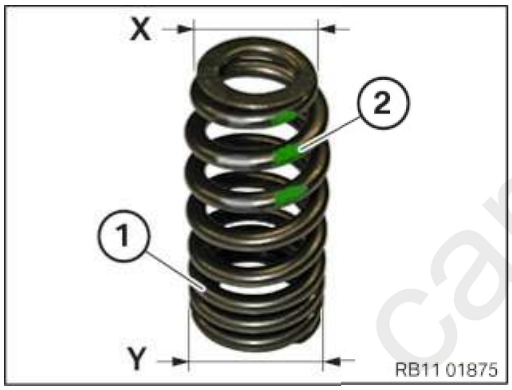
Spring preload.

Danger of injury!

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

NOTICE

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

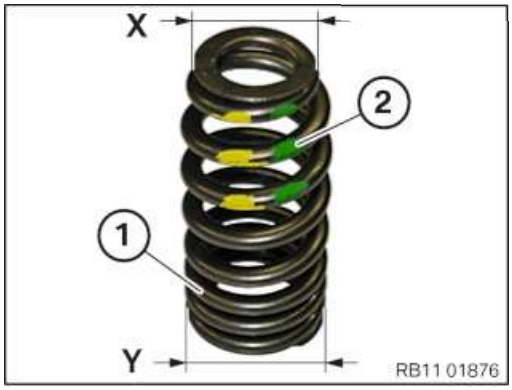


- Note the installation position of the valve spring.

Note: Install the valve spring so that the larger diameter (Y) points to the bottom spring cup.

- Make sure that the intake valves are not switched with the exhaust valves.

Note: Valve springs (1) are marked in colour (2). Colour for the intake valves: Green



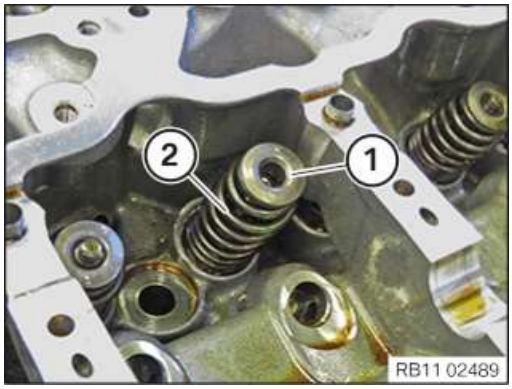
- Note the installation position of the valve spring.

Note: Install the valve spring so that the larger diameter (Y) points to the bottom spring cup.

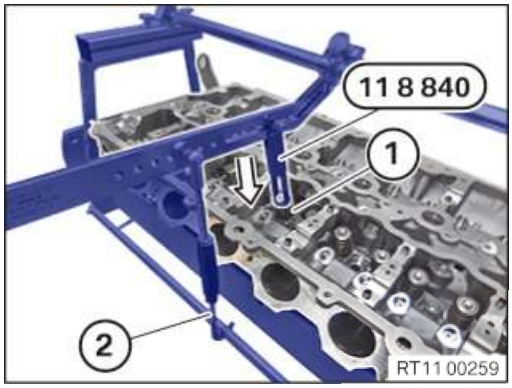
- Make sure that the intake valves are not switched with the exhaust valves.

Note: Valve springs (1) are marked in colour (2). Colour for the exhaust valves: green/yellow

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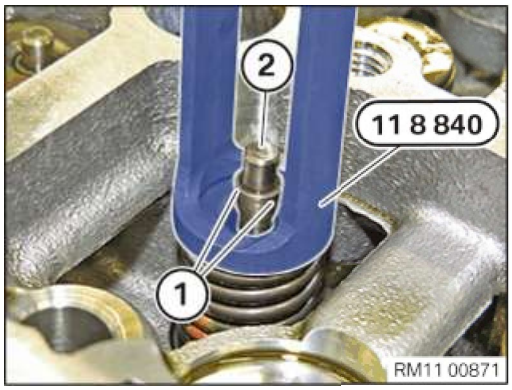
- Install the valve spring (2) and the spring cup (1).



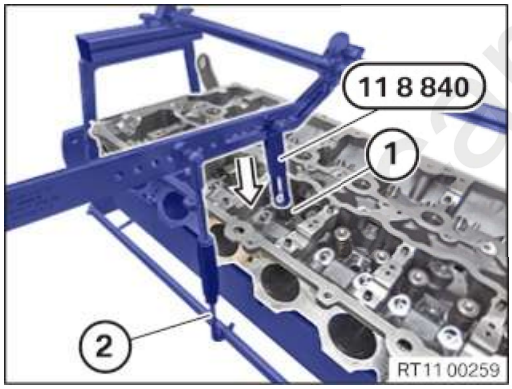
TECHNICAL INFORMATION

- Wear safety goggles.

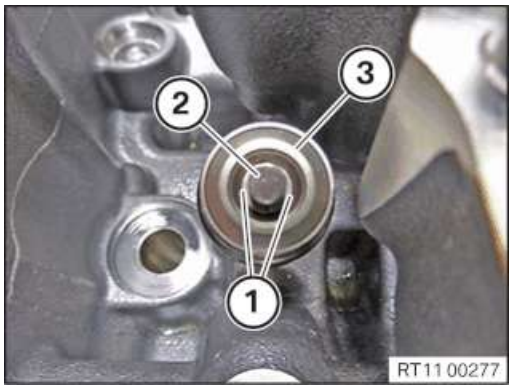
- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in direction of arrow.
- Hold valve spring (1) **pressed down** using the hook (2).



- Position the valve shims (1) on the valve (2).



- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in **direction of arrow**.
- Thread out hook (2) and place to the side.
- Relieve the valve spring (1) **carefully**.



- Make sure that the valve shims (1) are positioned correctly on the valve (2) and on the valve spring (3).

POSTPROCESSES

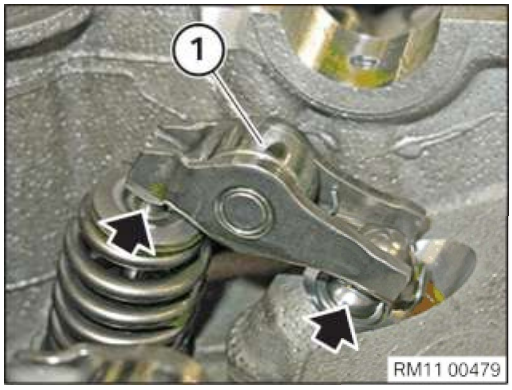
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15 – Install all roller cam followers

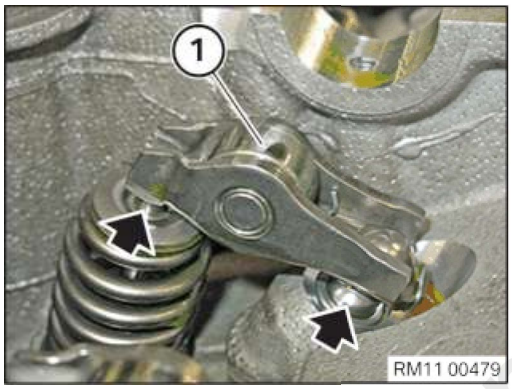


- The classification in digits from 1 to 5 has been printed on the roller cam follower.

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

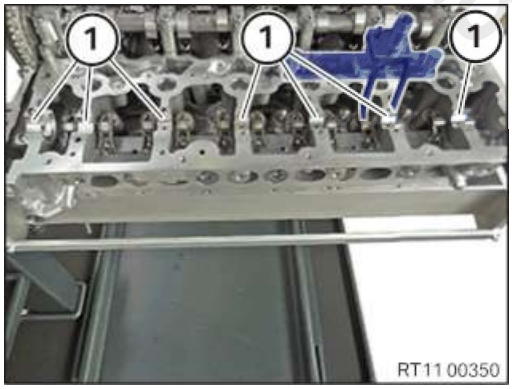


- Install the roller cam follower (1) on the intake side.
- Make sure the roller cam followers are correctly positioned on the hydraulic valve clearance compensating elements (arrows) and on the intake valves.

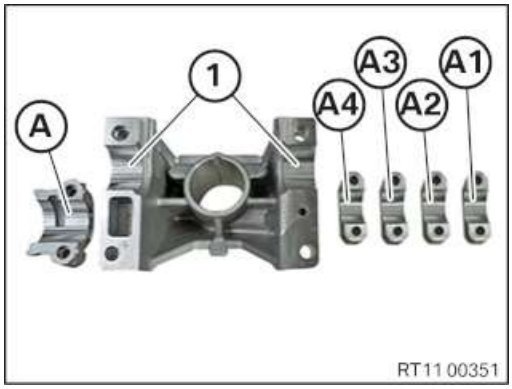


- Install the roller cam followers (1) on the exhaust side.
- Make sure the roller cam followers are correctly positioned on the hydraulic valve clearance compensating elements (arrows) and on the exhaust valves.

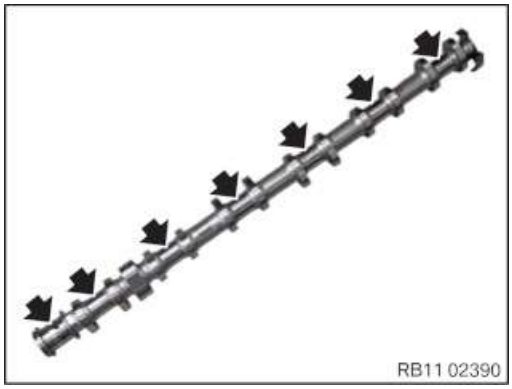
16 – Mount exhaust camshaft (cylinder head removed)



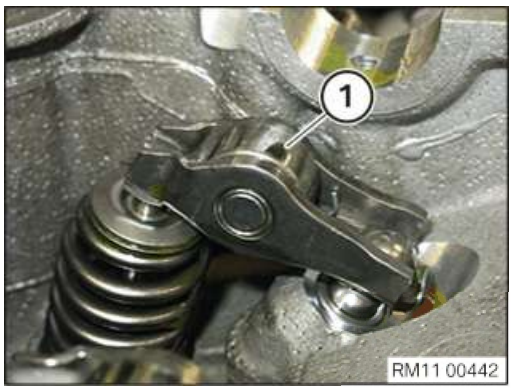
- Clean all bearing positions (1) and coat with engine oil.



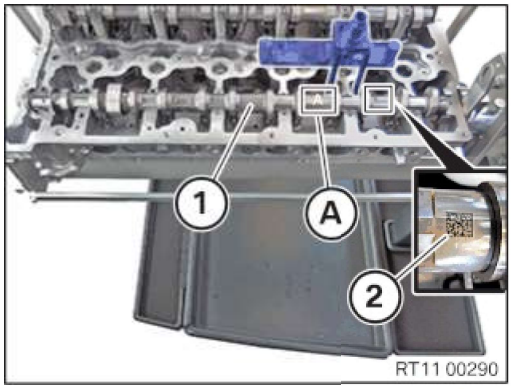
- Clean all bearing positions of exhaust camshaft bearing caps (A1), (A2), (A3), (A4) and (A) and coat with engine oil.
- Clean bearing positions (1) of the high pressure pump bracket and coat with engine oil.



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



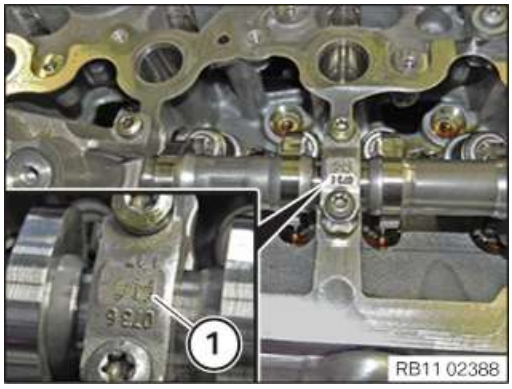
- Check all roller cam follower (1) of the exhaust side for correct fit.



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

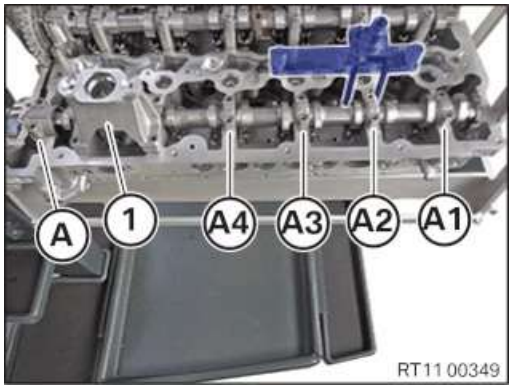
Engine damage caused by incorrectly installed bearing shells and bearing supports.

Engine damage may result from incorrectly installing bearing shells and bearing supports.

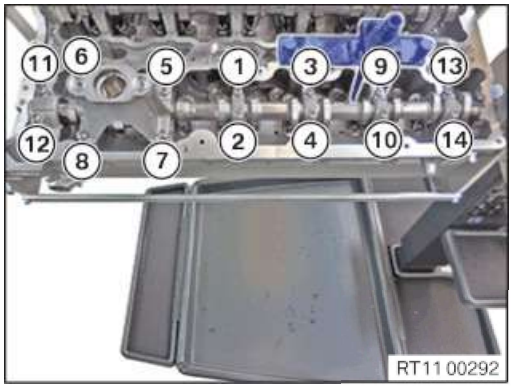
- Always install all bearing shells and bearing supports in the same position from which they were removed.

- Replace all exhaust camshaft bearing cap , that the labelling(1) from the intake side are readable.

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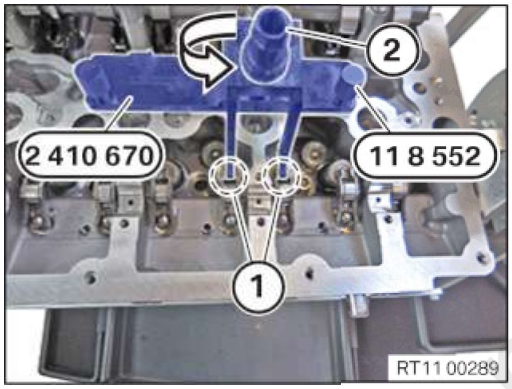
- Feed in all exhaust camshaft bearing cap (A1) until (A4) and the exhaust camshaft bearing cap (A) and position.
- Pull in the high pressure pump bracket (1) and position.



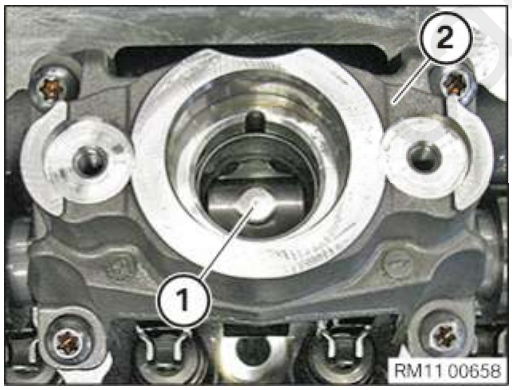
- Press down the exhaust camshaft bearing caps and hand-tighten the bolts incrementally in the sequence(1) to (14).
- Move up all screws in the sequence (1) to (14) **in half rotations.**
- **Adhere to the jointing torque.**
- Tighten all screws in a sequence from (1) to (14) .

Exhaust camshaft to cylinder head

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

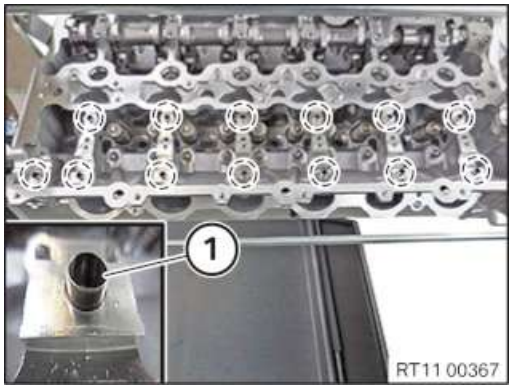


- Twist special tool 2 410 670 using the spindle nut (2) in direction of arrow and relax.
- Release special tool 0 495 741 (11 8 552) and remove special tool 2 410 670.

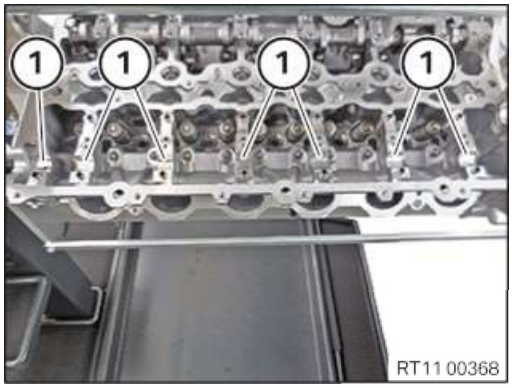


- Install roller tappet (1) into the high pressure pump bracket (2).

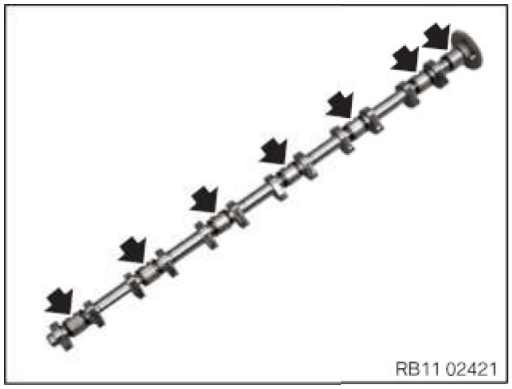
17 – Mounting eccentric shaft (cylinder head removed)



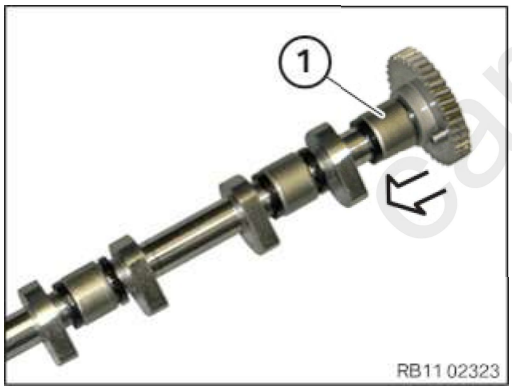
- Check all guide bushes (marks) (1) for damage and renew them if necessary.



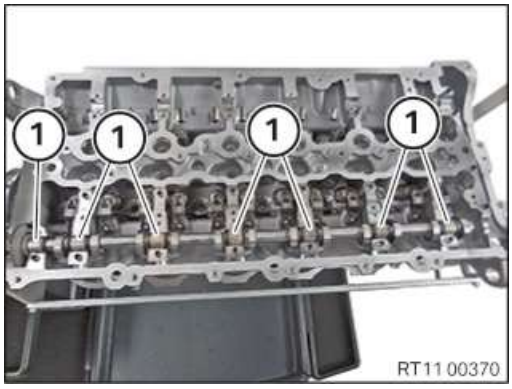
- Clean all the bearing positions (arrows) in the cylinder head and coat them with engine oil.



- Check all the needle bearings (arrows) of the eccentric shaft for ease of movement.
- Renew the eccentric shaft in case of tight needle bearings.

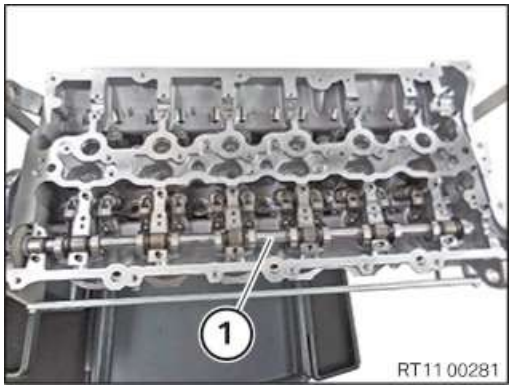


- Push needle bearing (1) up to the limit position in direction of arrow before installing the eccentric shaft.

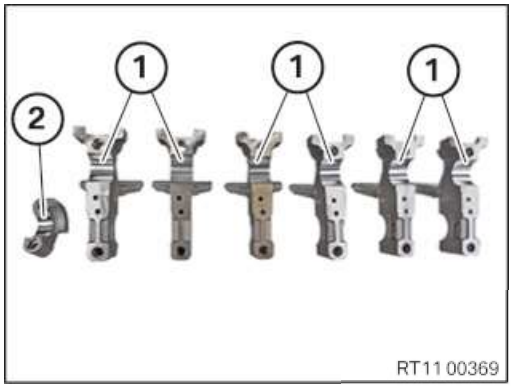


- Clean all needle bearings of the eccentric shaft (arrows) and coat with engine oil.

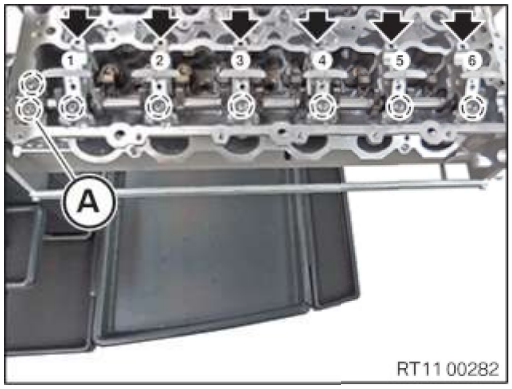
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- Pull in eccentric shaft (1) and install.



- Clean bearing positions (1) of the bearing supports and coat with engine oil.
- Clean bearing position (2) of the bearing cap and coat with engine oil.



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.

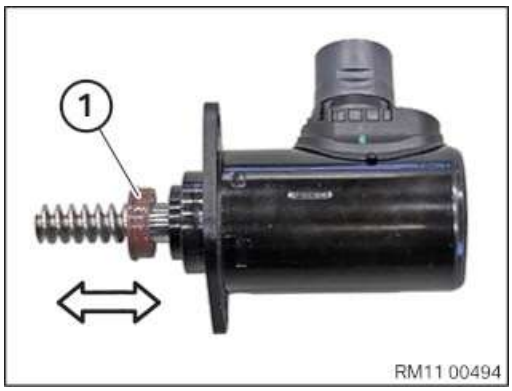
- Pull bearing supports (1) to (6) (arrows) in and install.

  The bearing supports (1) to (6) **must** each be installed again in the **position** from where they were removed.
- Pull in bearing cap (A) and install.
- Tighten the bolts (marks).

Eccentric shaft to bearing support/cylinder head

M6		10 Nm

18 – Install the servomotor for the eccentric shaft (cylinder head removed)



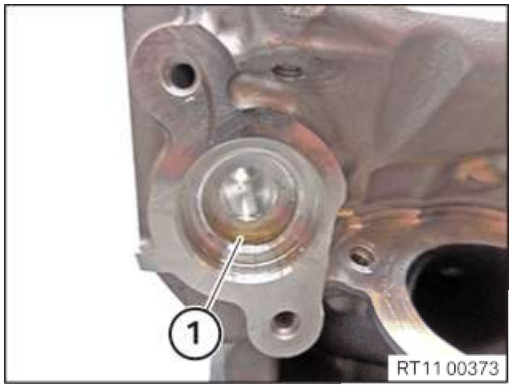
- Renew gasket (1).

  Parts: Gasket

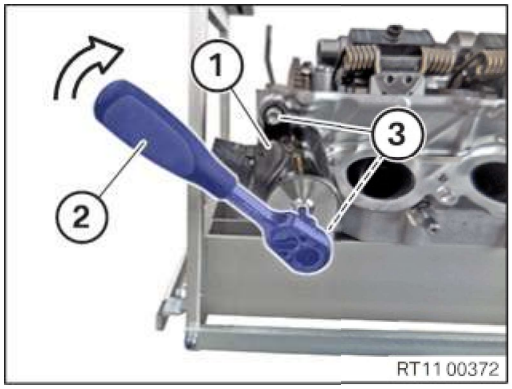
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- Press the gasket (1) in to the limit position on the housing.



- Clean sealing surface (1).



- Slide servomotor for the eccentric shaft (1) up to the limit position and install it.
- Turn servomotor for the eccentric shaft (1) using a standard hexagon socket wrench (2) of **4 mm** in the **direction of arrow** until the servomotor for the eccentric shaft (1) lies on the cylinder head.
- Tighten down screws (3).

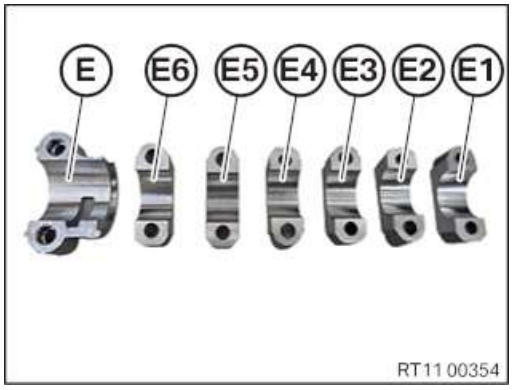
Electrical servomotor to cylinder head

M6		Tightening torque	8 Nm

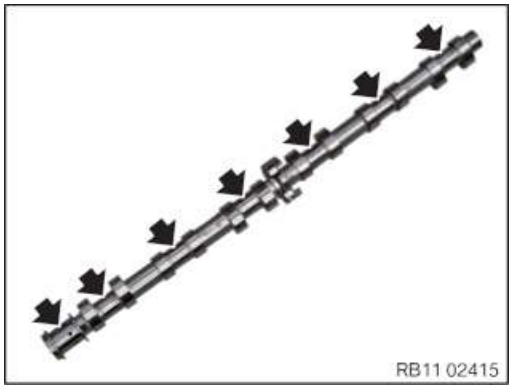
19 – Mounting intake camshaft (cylinder head removed)



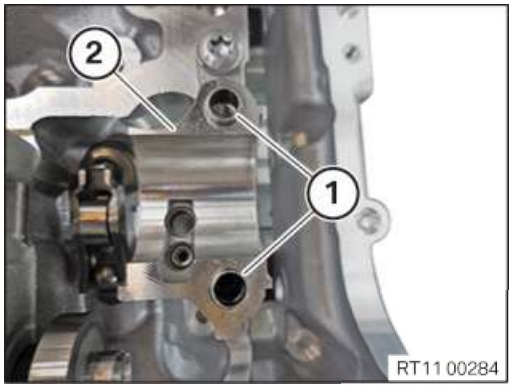
- Clean all bearing positions (arrows) and coat with engine oil.



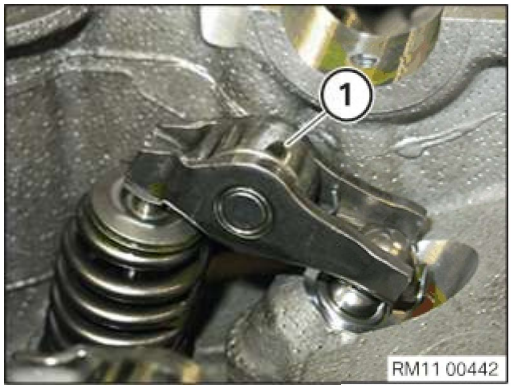
- Clean all bearing positions of intake camshaft bearing caps (E1),(E2),(E3),(E4),(E5),(E6) and (E) and coat with engine oil.



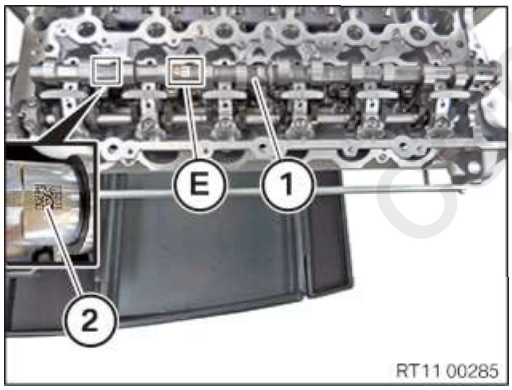
- Clean all bearing positions (arrows) of the intake camshaft and coat with engine oil.



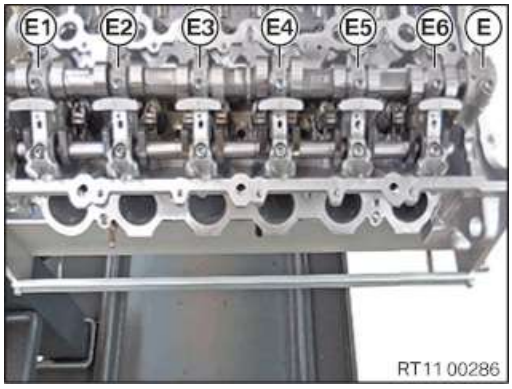
- Check the fitting sleeves (1) of the thrust bearing (2) for damage and renew if necessary.



- Check all roller cam followers(1) of the intake side for correct fit.



- Insert the intake camshaft (1) into the cylinder head so that the mark (2) points up.



RISK OF DAMAGE

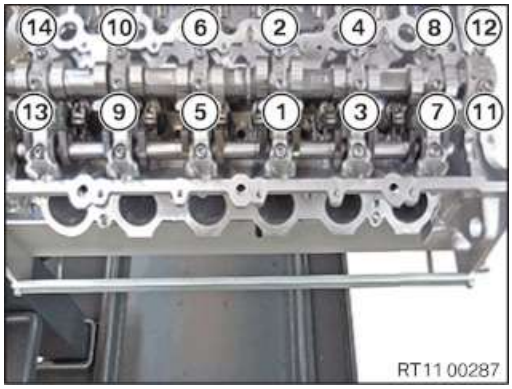
Engine damage caused by incorrectly installed bearing shells and bearing supports.

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.

- Feed in all intake camshaft bearing caps (E1) to (E6) and the intake camshaft bearing cap (E) and position.

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- Press down the intake 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 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

20 – Checking the intermediate lever classification



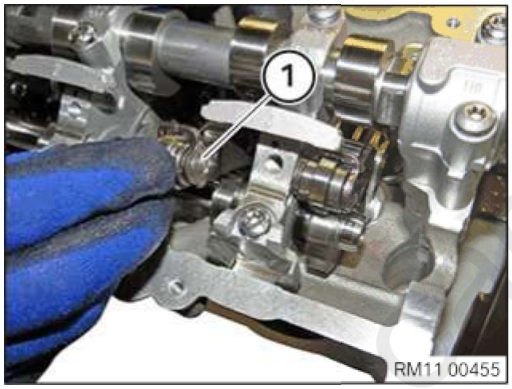
TECHNICAL INFORMATION

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.

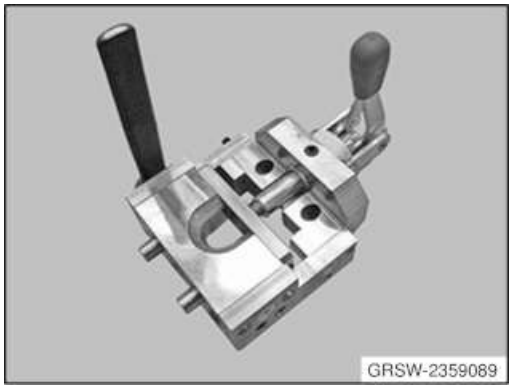
- Checking the intermediate lever classification.

21 – Installing all intermediate levers



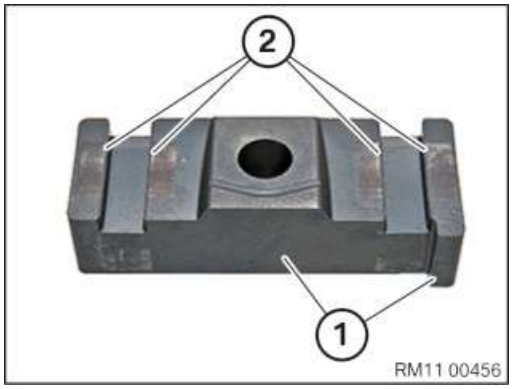
- Install intermediate lever (1).
- Repeat the step for all intermediate levers (1).

22 – Installing all gates

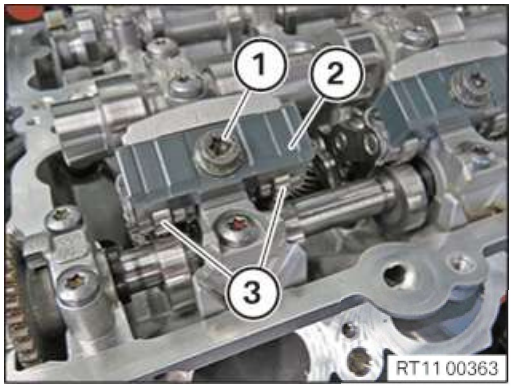


- Have the special tool 2 359 089 ready.

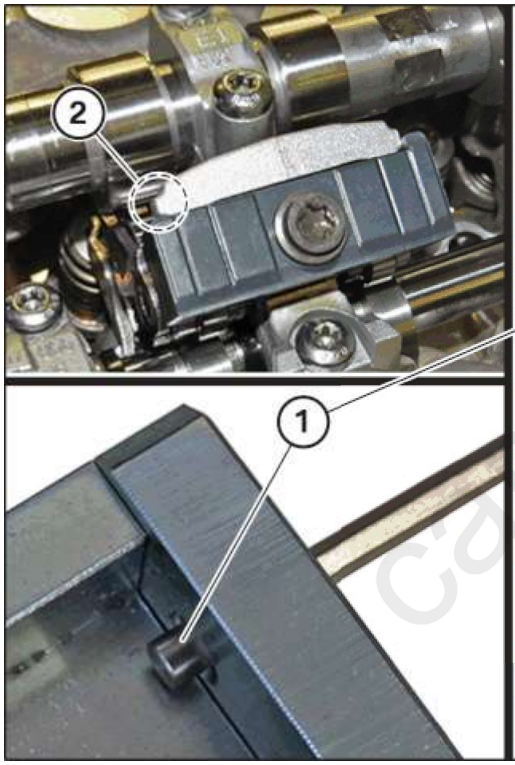
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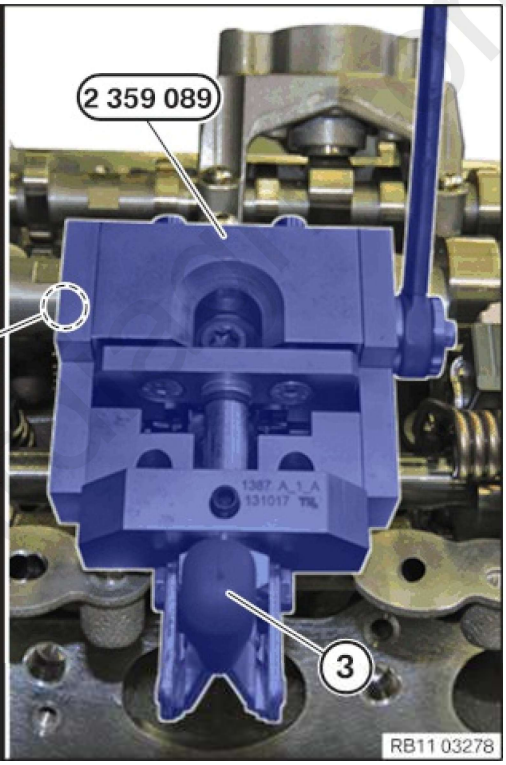


- Clean contact surfaces (1) and (2) off oil, grease and dirt.

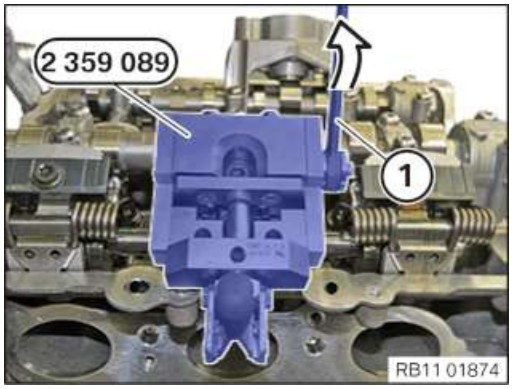


- Position the gate (2) and hand-tighten the bolt (1).
- Check that the intermediate lever (3) is in the correct mounting orientation.

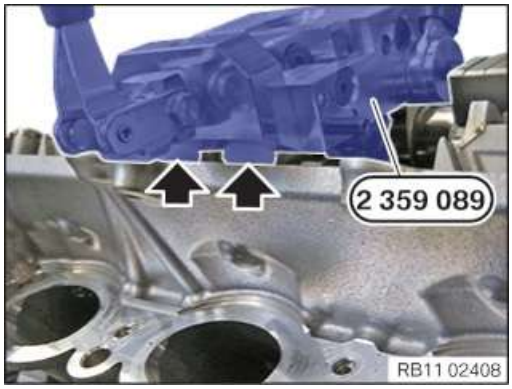




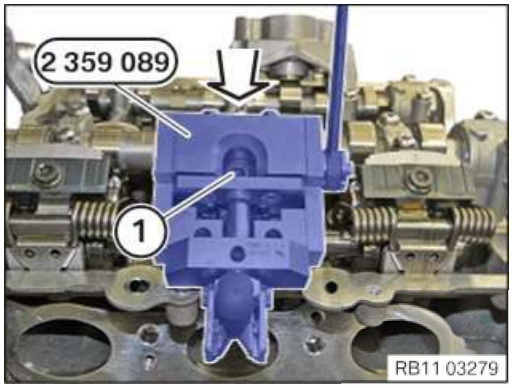
- Position the special tool 2 359 089 on the cylinder head.
- Pre-tension the gate with the lever (3).
- Abut the bolt (1) in the area (2).
- Make sure that the special tool 2 359 089 does not rotate during this process.



- Secure the gate with the lever (1).



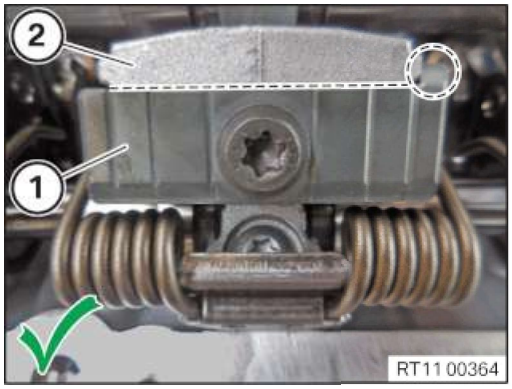
- Ensure that the special tool 2 359 089 lies flat on the cylinder head.



- Press the special tool 2 359 089 onto the cylinder head.
- Tighten the bolt (1) at the same time.

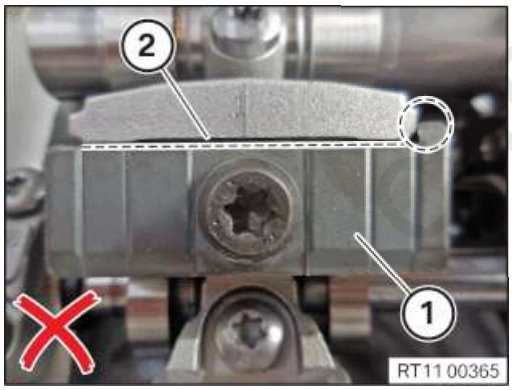
Gate to bearing bracket

M8		20 Nm



- Make sure that gate (1) rests correctly against bearing bracket (2).

  Gate (1) is installed correctly in the marked area.

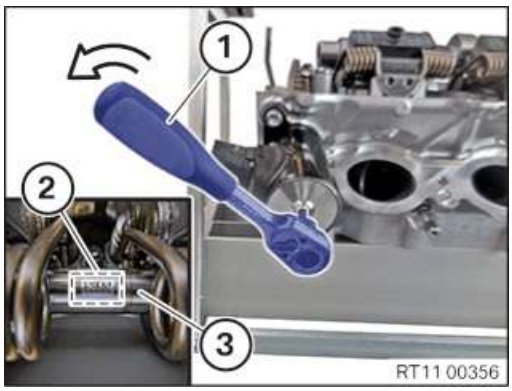


- Make sure that gate (1) rests correctly against bearing bracket (2).

  Gate (1) is installed incorrectly in the marked area.

- Repeat the procedure for all gates.

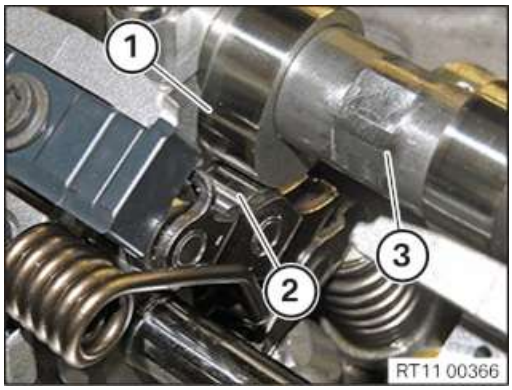
23 – Adjusting eccentric shaft to minimum lift (cylinder head removed)



- With the help of the servomotor, use a standard hexagon socket wrench (1) to slowly adjust eccentric shaft (3) to the minimum lift at **4 mm** in the **direction of the arrow**.
- Make sure that the mark (2) on the eccentric shaft (3) points upwards.

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24 – Checking the position of the intake camshaft (cylinder head removed)



Check

- Check position of the intake camshaft on the respective cylinders.

Result

» Cam (1) of the intake camshaft runs on the intermediate lever (2).

Measure

- Turn intake camshaft (3) further using a standard open-end spanner until the cam (1) does not override on the intermediate lever (2).

25 – Installing all torsion springs (cylinder head removed)

CAUTION

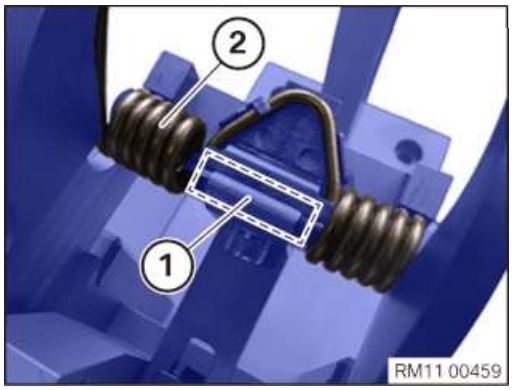
Spring preload.

Danger of injury!

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

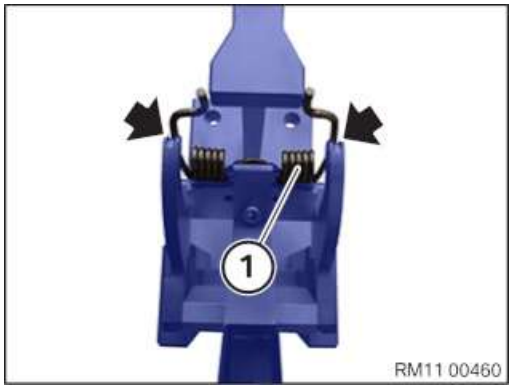
TECHNICAL INFORMATION

- Wear safety goggles.

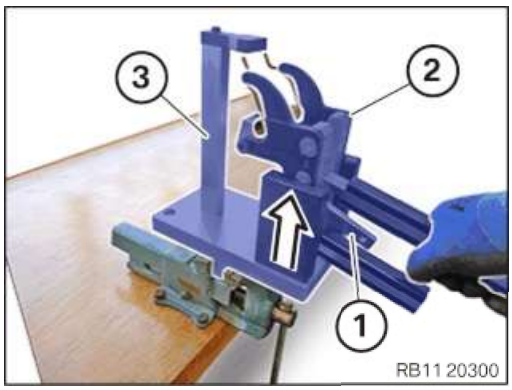


- Insert the torsion spring (2) in the clamping lever of the special tool 2 359 088.
- Make sure that the torsion spring (2) is correctly positioned in the marked area (1) of the special tool 2 359 088.

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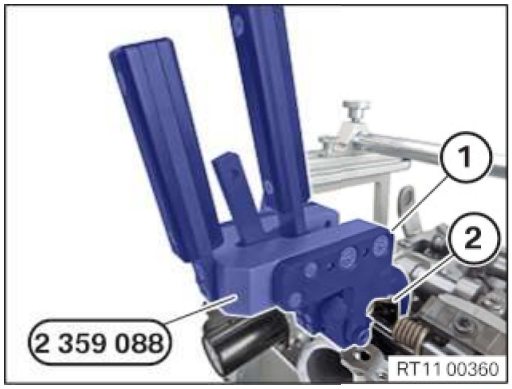


- Carefully close the clamping lever of the special tool 2 359 088 in the accompanying fixture until the retaining hook engages.
- Ensure that the torsion spring (1) lies correctly in the lateral guides (arrows) of the special tool 2 359 088 during tensioning.

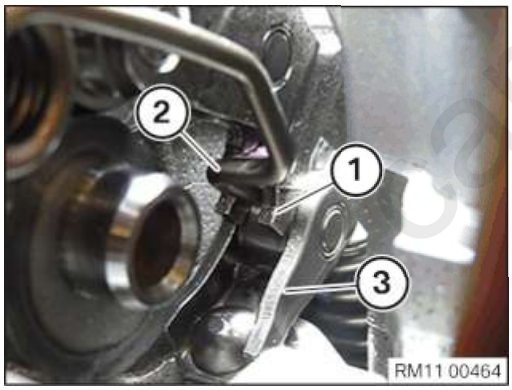


- Carefully close the clamping lever (2) of the special tool 2 359 088 in the fixture (3) until the retaining hook (1) audibly engages.

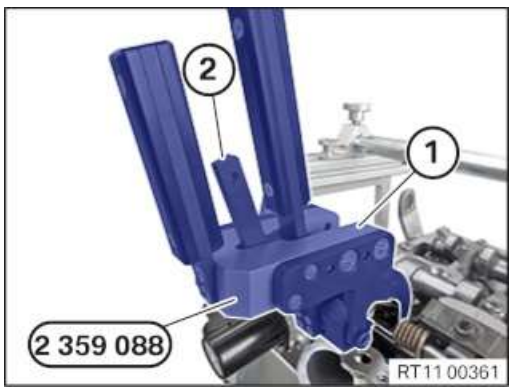
  The torsion spring is tensioned.
- **Carefully** take the clamping lever (2) of the special tool 2 359 088 with the stretched torsion spring out of the fixture (3) of the special tool 2 359 088 in the direction of arrow.



- Feed in clamping lever (1) from the special tool with the pre-tensioned torsion spring (2) and position it.

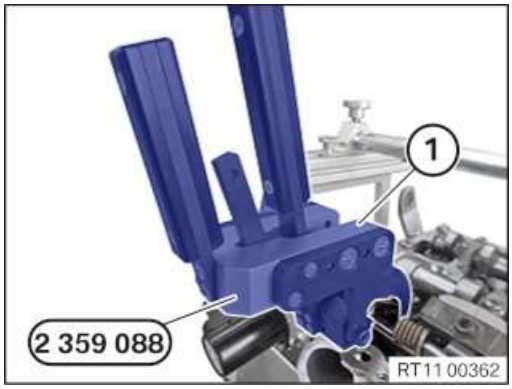


- Ensure that the torsion spring (2) is positioned correctly in the intermediate lever (1).
- Check all roller cam followers (3) for correct installation position.

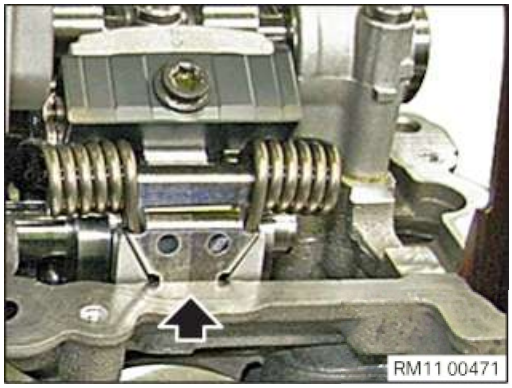


- Press the clamping lever (1) of the special tool 2 359 088 together until the retaining hook (2) unlocks.
- Carefully open the clamping lever (1) of the special tool 2 359 088 until the torsion spring is completely relaxed.

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- Guide out and remove the clamping lever (1) of the special tool 2 359 088.



- Check for correct mounting orientation of the torsion spring (arrow) at the cylinder head.
- Repeat the operations for the remaining torsion springs.

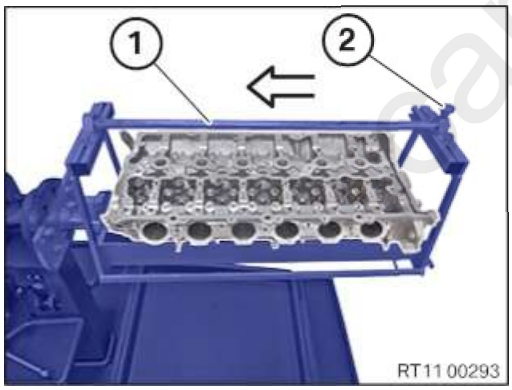
26 – Removing cylinder engine from assembly stand

CAUTION

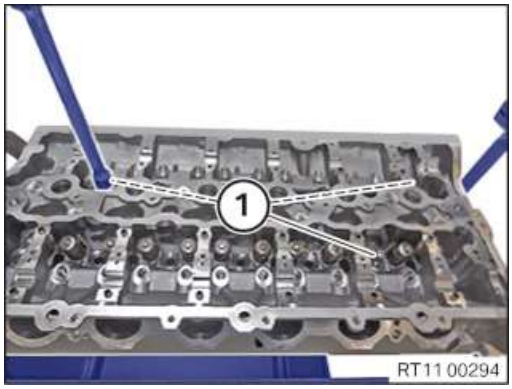
Heavy component.

Heavy components can lead to injury or damage.

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



- Loosen screw (2).
- Pull out rod (1) in direction of arrow and set it aside.

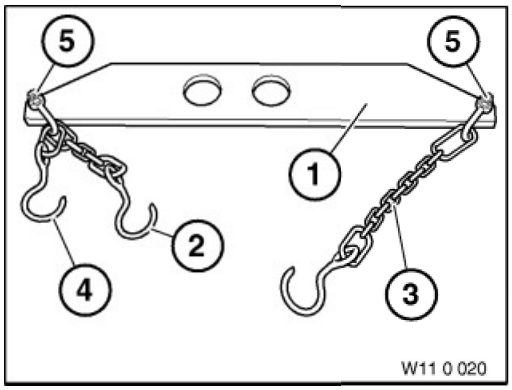


- Release screws (1) from special tool .

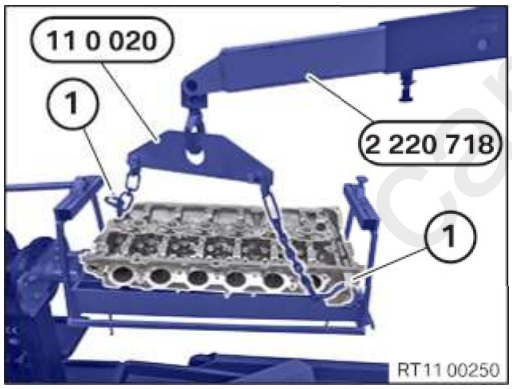
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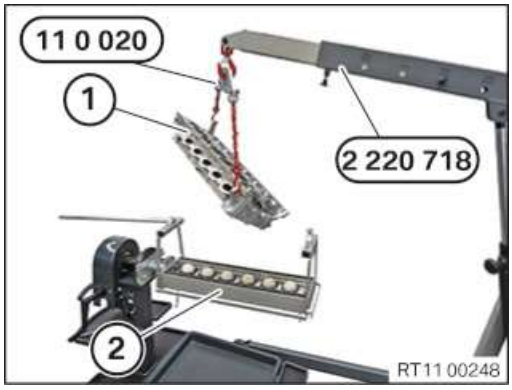
- Stage special tool (workshop crane) 2 220 718.



- Prepare the special tool 0 490 567 (11 0 020).



- Guide in and position special tool 0 490 567 (11 0 020) on cylinder head (1).
- Position workshop crane 2 220 718 and connect to special tool 0 490 567 (11 0 020).



- Detach cylinder head (1) with the work crane 2 220 718 and special tool 0 490 567 (11 0 020) from the device (2), pull out and remove.

27 – Installing the exhaust turbocharger (cylinder head removed)

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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

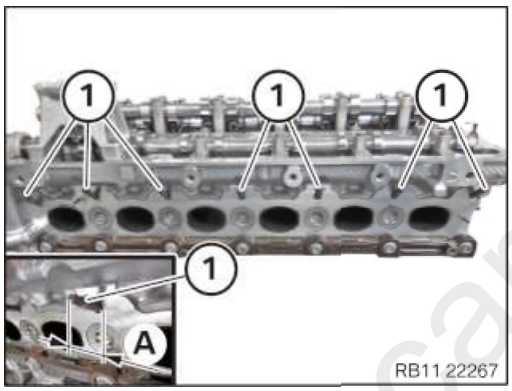
Damage to the electrical wastegate valve controller.

The electrical wastegate valve controller may be damaged as a result of the excessive forces required when removing and installing a jammed exhaust turbocharger.

- Do not pull on the electrical wastegate valve controller.
- Apply force to the turbine housing and exhaust manifold only.
  - Do not pull on the compressor housing.

TECHNICAL INFORMATION

Do not damage the thermal compensating elements. The disassembly and installation including intermediate storage of the exhaust turbocharger is only permitted with mounted special tool 2 466 919 .



- Check stud bolt (1) for damage, renew if necessary.

  Parts: Stud bolt
- Check screw-in depth (A) of the upper stud bolt (1).

Screw-in depth of upper stud bolt on cylinder head

Dimension A	30 mm

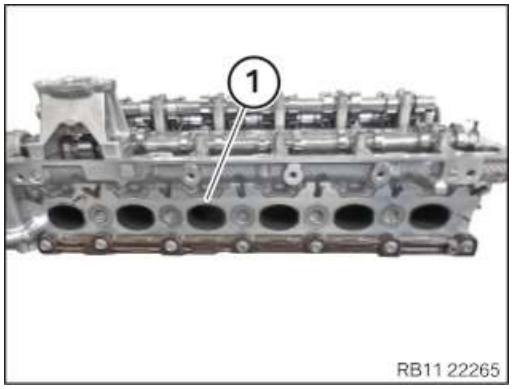
- If necessary, screw the stud bolts in further or unscrew.



- Check stud bolts in the **marked area** for damage and replace if necessary.

  Parts: Stud bolt

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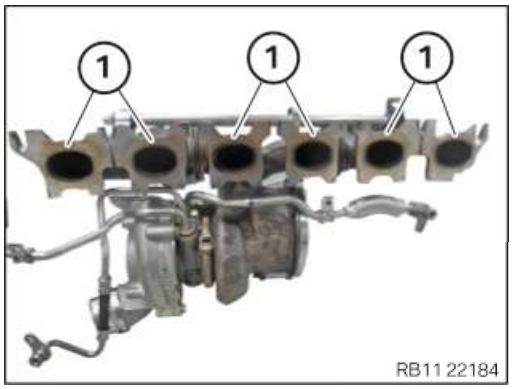
RISK OF DAMAGE

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.

- Clean the sealing surfaces (1) on the cylinder head using special tool 0 495 102 (11 4 470).



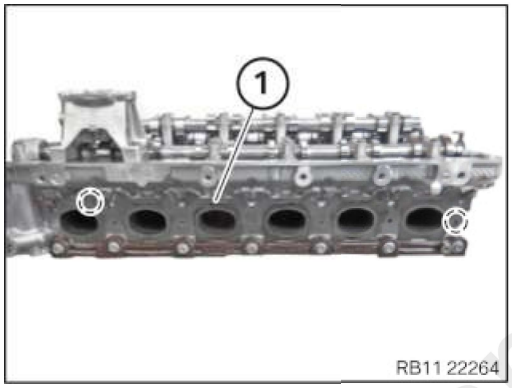
RISK OF DAMAGE

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.

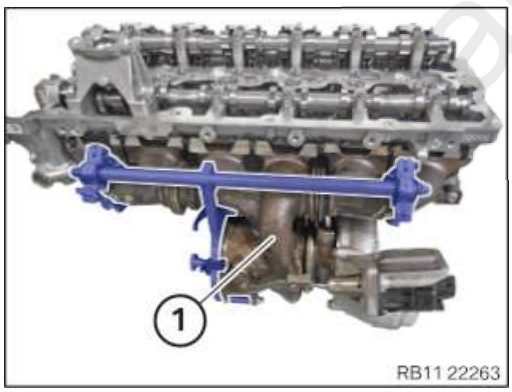
- Clean the sealing surfaces (1) on the exhaust turbocharger using the special tool 0 495 102 (11 4 470).



- Renew the gasket (1).

  Parts: Gasket

- Guide seal (1) into the **marked area** and install it.



CAUTION

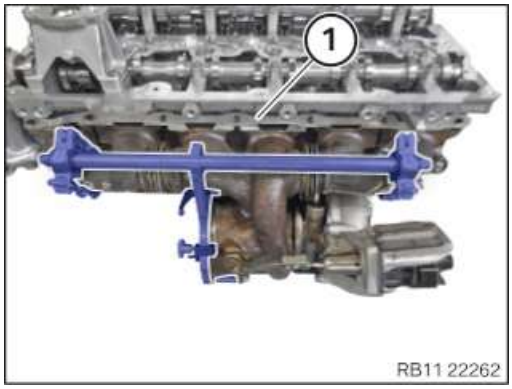
Heavy component.

Heavy components can lead to injury or damage.

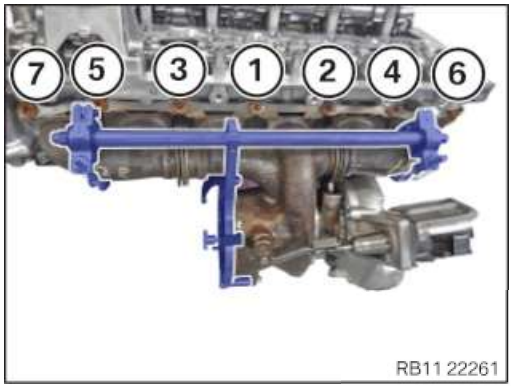
- Remove and install heavy components with the aid of another person/other persons.

- Insert and install the exhaust turbocharger (1).
- Thermal compensating elements of the exhaust turbocharger (1) or exhaust manifold should **not** be bent or deformed.

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- Feed in and install the sliding rail (1).
- Install sliding rail (1) so that the part number is **seen**.

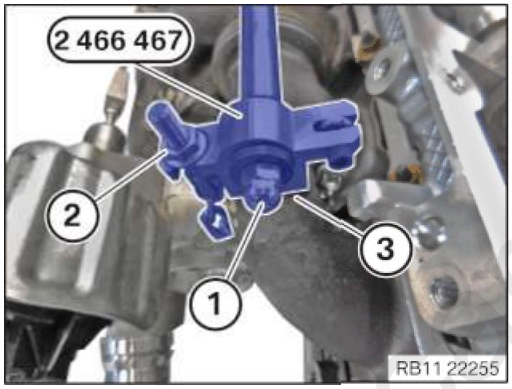


- Tighten nuts in sequence (1) to (7).

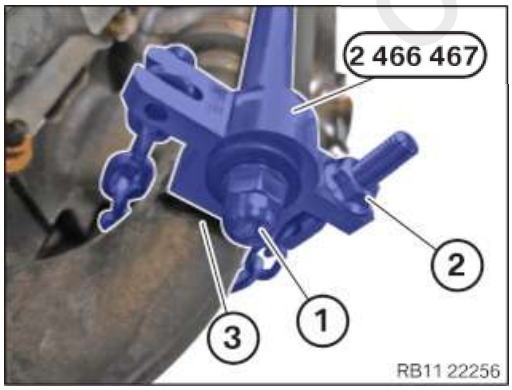
Exhaust manifold to cylinder head

Flange nutM7	*Replace flange nuts*	1. Jointing torque	10 Nm
		2. Jointing torque	10 Nm
		3. Jointing torque	16 Nm
		4. Jointing torque	16 Nm
		5. Jointing torque	16 Nm

- Make sure the thermal compensating elements (A) have **not** been damaged.

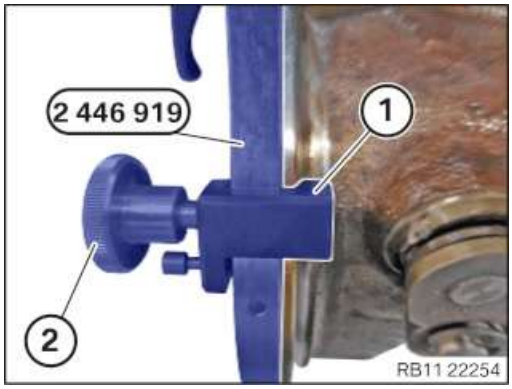


- Loosen nuts (1) and (2).
- Pull out special tool 2 466 467 at the exhaust turbocharger (3) and remove.



- Release the nut (1) and (2).
- Pull out special tool 2 466 467 at the exhaust turbocharger (3) and remove.

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- Loosen screw (2).
- Feed out the bracket (1) of the special tool 2 446 919 and set it aside.



- Release clamping lever (1) of the special tool 2 446 919 in the **direction of arrow**.



- Loosen screw (1).
- Pull out special tool 2 446 919 at the exhaust turbocharger and remove.

Additional Information

Overview of Tightening Torques

Special tool 2 466 467 to special tool 2 446 919 — Used in step 1

M8		Tightening torque	5 Nm

Flange to assembly stand — Used in step 2

M14X30		Tightening torque	135 Nm

Cylinder head on device — Used in step 2

M10X90x1.5		Tightening torque	30 Nm

Exhaust camshaft to cylinder head — Used in step 16

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

Eccentric shaft to bearing support/cylinder head — Used in step 17

M6			10 Nm

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Electrical servomotor to cylinder head — Used in step 18

M6		Tightening torque	8 Nm

Intake camshaft to cylinder head — Used in step 19

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque.	10 Nm

Gate to bearing bracket — Used in step 22

M8			20 Nm

Exhaust manifold to cylinder head — Used in step 27

Flange nutM7	*Replace flange nuts*	1. Jointing torque	10 Nm
		2. Jointing torque	10 Nm
		3. Jointing torque	16 Nm
		4. Jointing torque	16 Nm
		5. Jointing torque	16 Nm

Overview of Special Tools

2 446 919 Locating fixture



Common — Used in step 127

Usage	For installation and de-installation of the exhaust turbocharger module. Engine: B58.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 08 16 (383)

2 466 467 Device



Common — Used in step 127

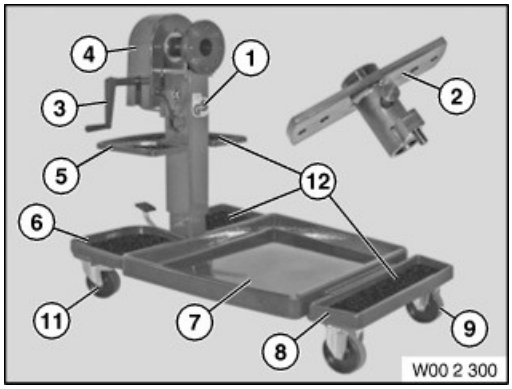
Usage	For removing and installing the exhaust turbocharger. Engine: B58O1.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 18 (545)

0 495 187 (00 2 300) Assembly stand

Common — Used in step 2

Usage	Assembly stand with universal flange for mounting engines from S85
Included in the tool or work	
Storage location	Individual

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Replaced by	
In connection with	
SI-Number	01 25 04 (155)

Consisting of

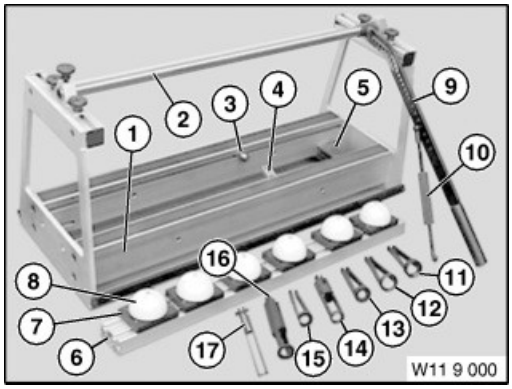
Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 188 (00 2 301)		**Assembly stand** available only as complete assembly stand 83 30 0 495 187.	
2	0 495 189 (00 2 302)	2 299 563	**Tool** (Universal flange). Do not use any more!!! Technically locked. Replaced with a new flange with 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.	

0 494 362 (11 9 000) Device

Common Used in step 212

Usage	(Cylinder head expander tool)

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Included in the tool or work

Storage location	Individual
Replaced by	
In connection with	002300 = 0495187
SI-Number	01 03 02 (833)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 494 366 (11 9 001)		**Device**	
6	0 494 371 (11 9 006)		**Insert** (Aluminium strip)	
11	0 494 376 (11 9 012)		**Basket** (Valve spring cage) Engine M41, M51, S50	
17	0 495 028 (11 9 017)		**Basket** (Valve spring cage) Engine N52	
2	0 494 367 (11 9 002)		**Rod**	
3	0 494 368 (11 9 003)		**Adapter** (Sliding block)	
4	0 494 369 (11 9 004)		**Tab**	
5	0 494 370 (11 9 005)		**Quick fastener**	
7	0 494 372 (11 9 007)		**Shaped part** (shaped part)	
8	0 494 373 (11 9 008)		**Shaped part** (Shaped part) Shaped part made of plastic	
9	0 494 374 (11 9 009)		**Lever**	
10	0 494 375 (11 9 011)		**Hook**	
12	0 494 377 (11 9 013)		**Basket** (Valve spring cage) Engine M43, M73	
13	0 494 378 (11 9 014)		**Basket** (Valve spring cage) Engine M44, M52, M54, M56, M62, S52, S54, S62	
14	0 494 379 (11 9 015)		**Basket** (Valve spring cage) Engine M47, M47TU, M57, M57TU, N40, N42, N62, N73	
15	0 494 380 (11 9 016)		**Basket** (Valve spring cage) Engine M21, M40	

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2 220 718 Workshop crane

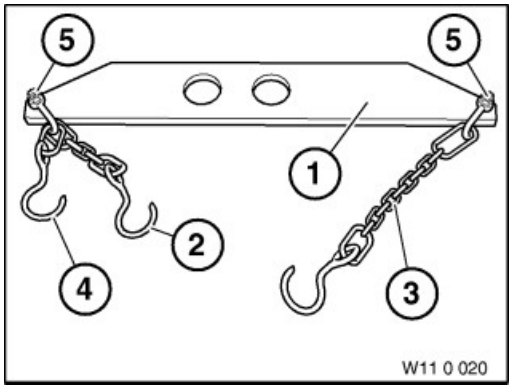


Common	Used in step 226
Usage	WSK 1000
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	06 01 11 (701)

0 490 567 (11 0 020) Lifting gear

Used in step 226

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Common

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.	

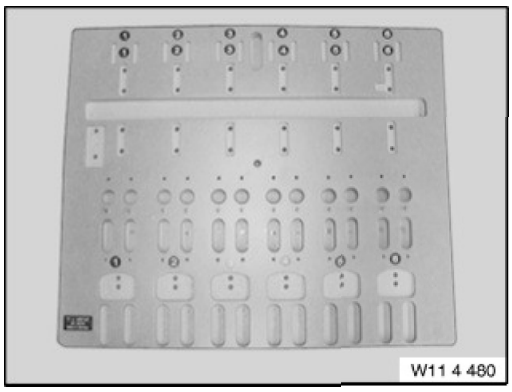
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2 359 088 Device



Common	Used in step 425
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 45679101112
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	

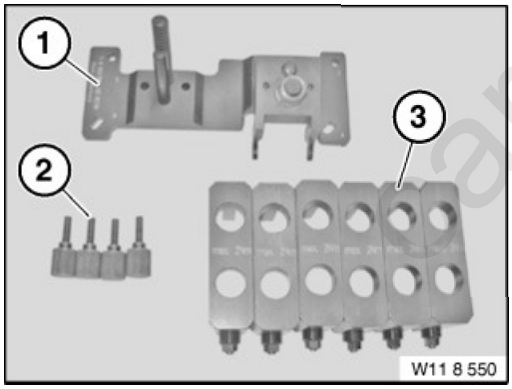
cardiagn.com

2 410 670 Device



Common	Used in step 1016
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)

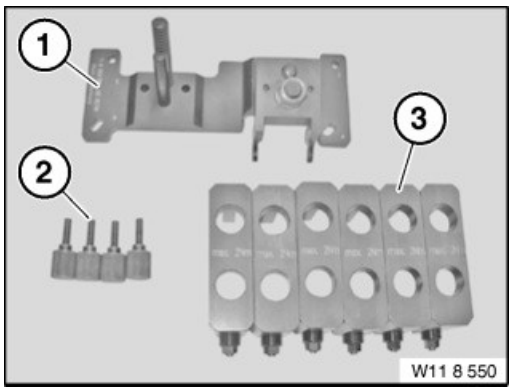
0 495 741 (11 8 552) Screw



Common	Used in step 1016
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 10

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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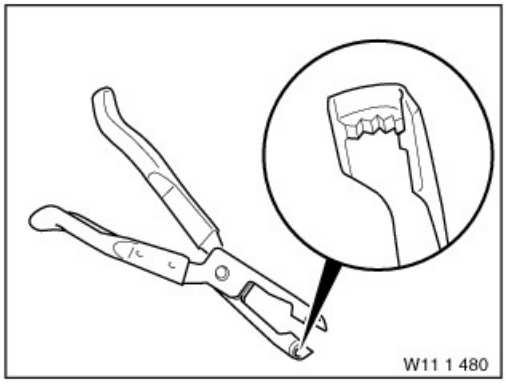
0 496 143 (11 8 840) Basket



Common Used in step 1214

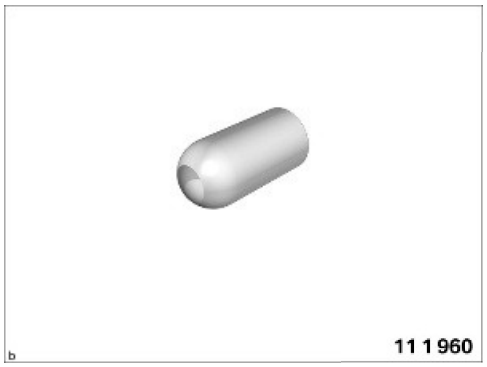
Usage	(Valve spring cage) For removing and fitting the valves.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

0 490 796 (11 1 480) Pliers



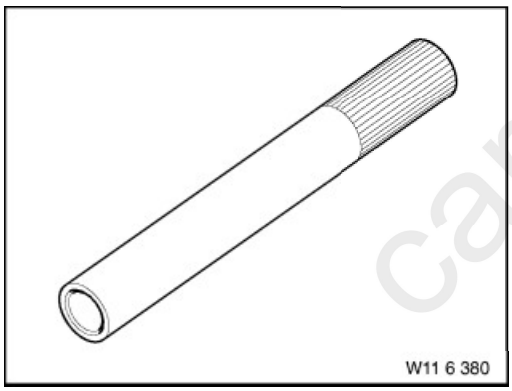
Common	Used in step 13
Usage	For removing valve stem seal
Included in the tool or work	
Storage location	A10
Replaced by	
In connection with	
SI-Number	01 01 93 (621)

0 490 797 (11 1 960) Holding sleeve



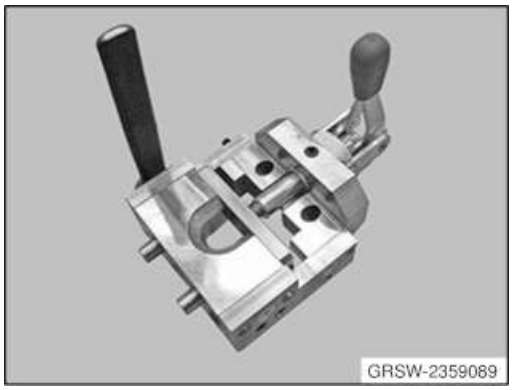
Common	Used in step 13
Usage	(Assembly sleeve) For fitting valve stem seals, 6 mm diameter
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	

0 493 249 (11 6 380) Bush



Common	Used in step 13
Usage	For fitting valve stem seal
Included in the tool or work	
Storage location	A9
Replaced by	
In connection with	
SI-Number	01 06 98 (306)

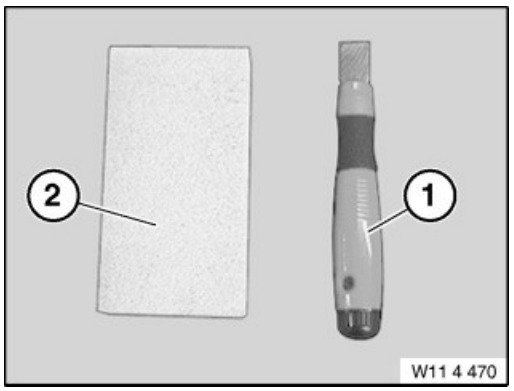
2 359 089 Device



Common	Used in step 22
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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0 495 102 (11 4 470) Tool



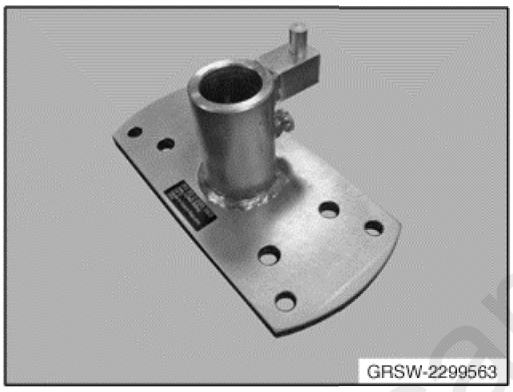
Common	Used in step 27
Usage	(cleaning kit) For cleaning sealing surfaces on magnesium crankcase/cylinder head.
Included in the tool or work	
Storage location	C52
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

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)	

Replacement tools:

2 299 563 Adapter



Common	Used in step 2
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	

Overview Technical Data

Screw-in depth of upper stud bolt on cylinder head	Used in step 27
Dimension A	30 mm

Links

Repair instructions	Used in step
61 35 ... Notes on ESD protection (Electro Static Discharge)	8

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11 34 560 Replacing all valve stem seals

PRELIMINARY WORK

1 – Removing the exhaust turbocharger (cylinder head removed)

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

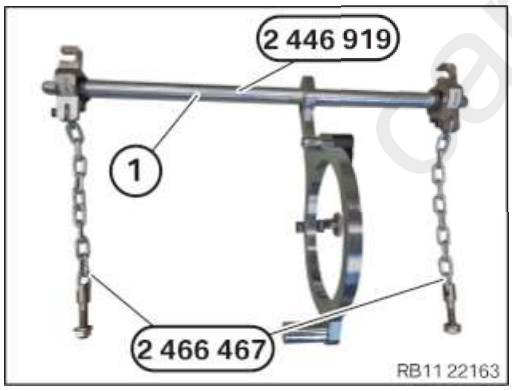
Damage to the electrical wastegate valve controller.

The electrical wastegate valve controller may be damaged as a result of the excessive forces required when removing and installing a jammed exhaust turbocharger.

- Do not pull on the electrical wastegate valve controller.
- Apply force to the turbine housing and exhaust manifold only.
  - Do not pull on the compressor housing.

TECHNICAL INFORMATION

Do not damage the thermal compensating elements. The disassembly and installation including intermediate storage of the exhaust turbocharger is only permitted with mounted special tool 2 466 919 .



- Have the special tool 2 446 919 and the special tool 2 466 467 ready.



- Install the special tool 2 446 919 on the exhaust turbocharger and secure it with the bolt (1).

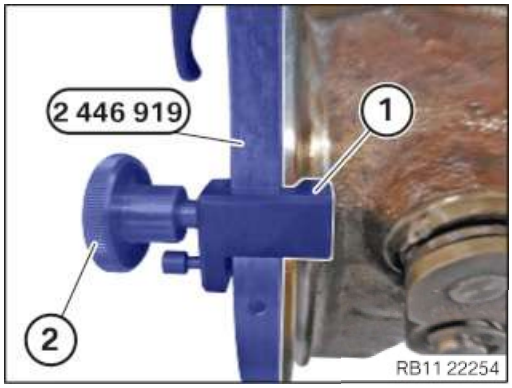
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- Fix the special tool 2 446 919 by turning the clamping lever (1) in the **direction** of the arrow.

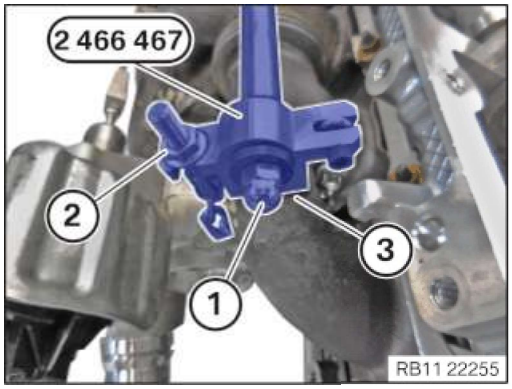
Note: The clamping lever that is shown in the graphic is already in its end position.

- Make sure that the special tool 2 446 919 is flush with the exhaust turbocharger in the **marked area**.

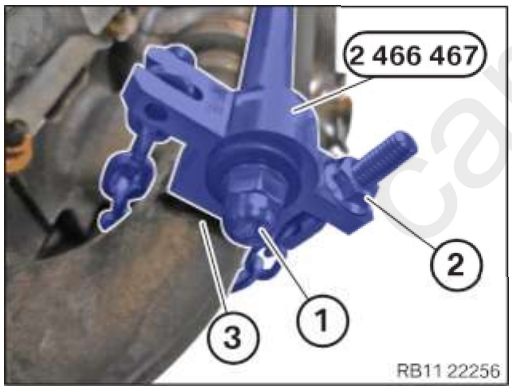


- Position the holder (1) and fasten it with the bolt (2).

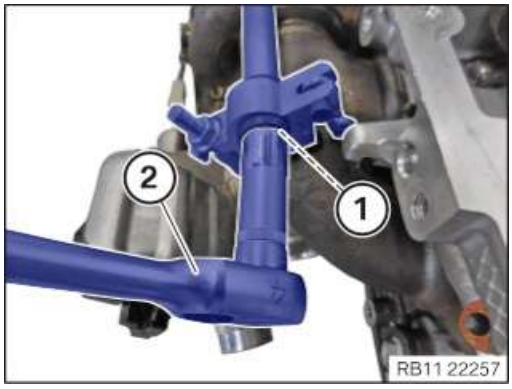
Note: The holder is used for the final mounting of the special tool **2 446 919**.



- Tighten the nut (1) hand-tight.
- Tighten the nut (2) hand-tight.
- Ensure that the special tool 2 466 467 rests correctly on the exhaust turbocharger (3).



- Tighten the nut (1) hand-tight.
- Tighten the nut (2) hand-tight.
- Ensure that the special tool 2 466 467 rests correctly on the exhaust turbocharger (3).

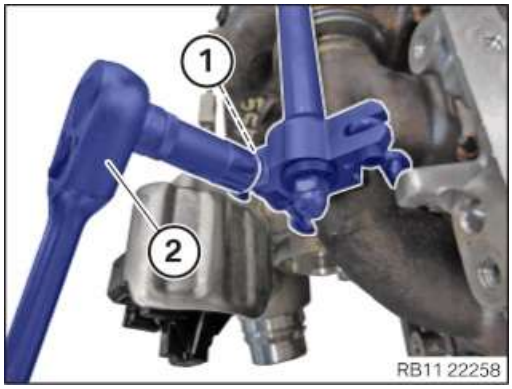


- Tighten the nut (1) using commercially available tools (2).

Special tool 2 466 467 to special tool 2 446 919

M8		Tightening torque	5 Nm

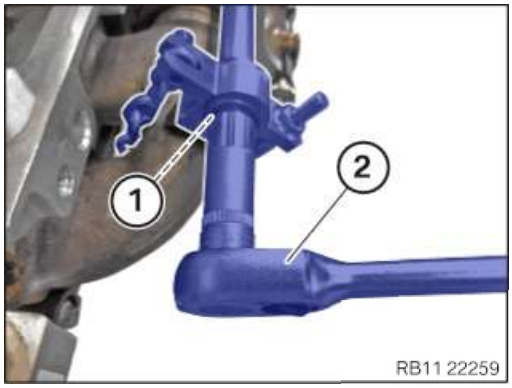
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- Tighten the nut (1) using commercially available tools (2).

Special tool 2 466 467 to special tool 2 446 919

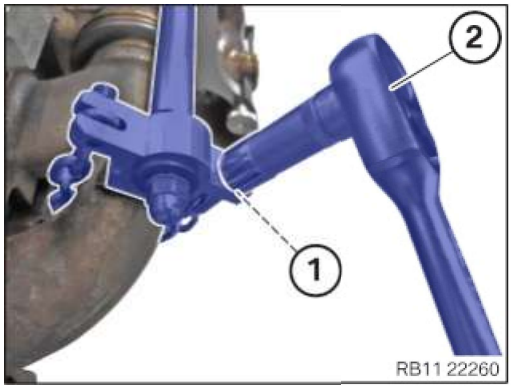
M8		Tightening torque	5 Nm



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

Special tool 2 466 467 to special tool 2 446 919

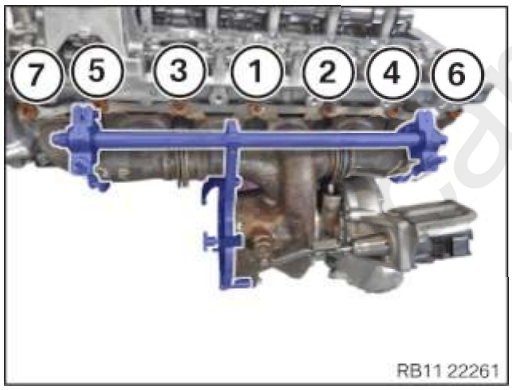
M8		Tightening torque	5 Nm



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

Special tool 2 466 467 to special tool 2 446 919

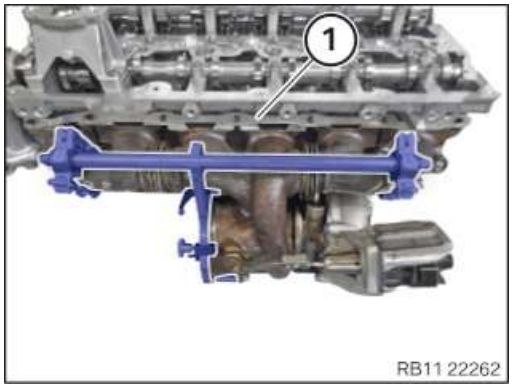
M8		Tightening torque	5 Nm



TECHNICAL INFORMATION

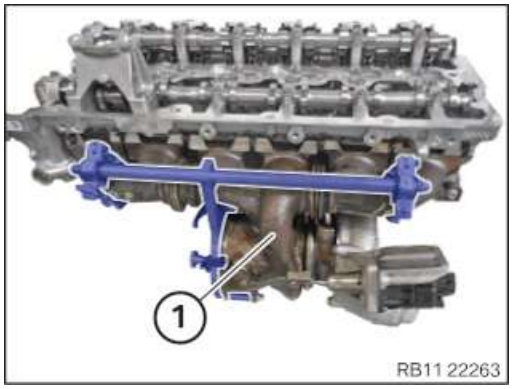
Exhaust manifold/exhaust turbocharger is not bolted to the underside, but clamped instead. When removing/replacing the exhaust manifold/exhaust turbocharger, the clamping strip remains screwed on.

- Unscrew the nuts in sequence (7) to (1).
- Secure exhaust turbocharger against falling down.



- Slide the slide rail (1) out and remove.

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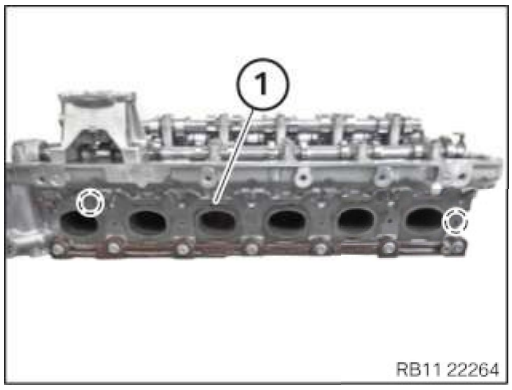
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

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

- Carefully guide out and remove the exhaust turbocharger (1).
- Thermal compensating elements of the exhaust turbocharger (1) or exhaust manifold should **not** be bent or deformed.



- Feed out and remove seal (1) in the **marked area.**

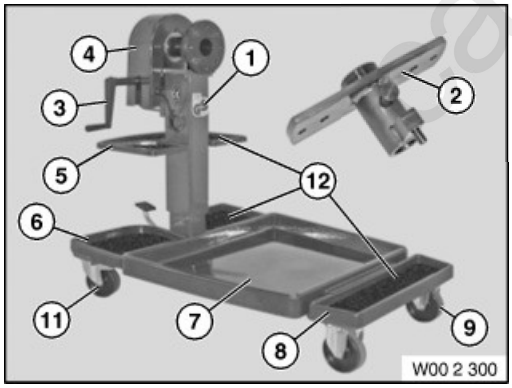
2 – Installing cylinder head on the assembly stand

CAUTION

Heavy component.

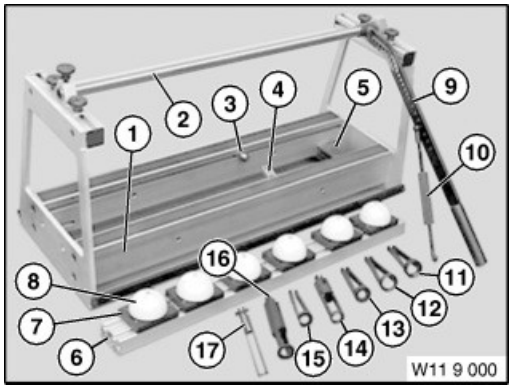
Heavy components can lead to injury or damage.

- 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



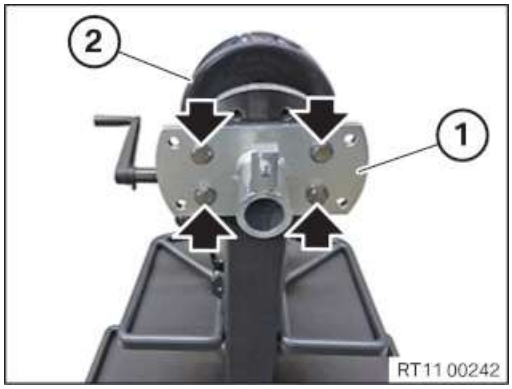
- Have the set of special tools 0 494 362 (11 9 000) ready.

Number	Description
1	Device
2	Rod
3	Adapter
4	Tab
5	Quick fastener
6	Aluminum strip
7	Shaped part
8	Shaped part made of plastic
9	Lever
10	Hook
11	Valve spring cage
12	Valve spring cage
13	Valve spring cage
14	Valve spring cage
15	Valve spring cage
16	Valve spring cage
17	Valve spring cage



- Stage special tool (workshop crane) 2 220 718.

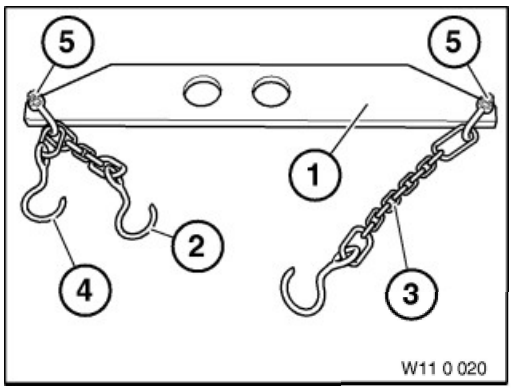
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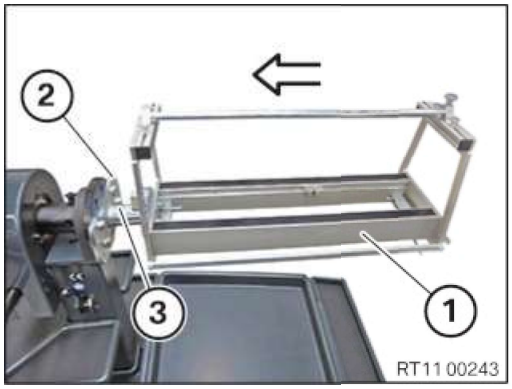
- Position flange (1) on assembly stand (2).
- Tighten screws (arrows).

Flange to assembly stand

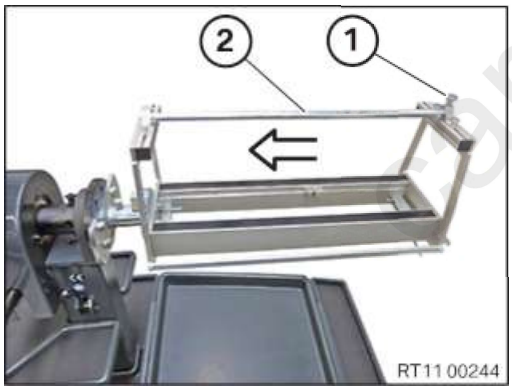
M14X30		Tightening torque	135 Nm



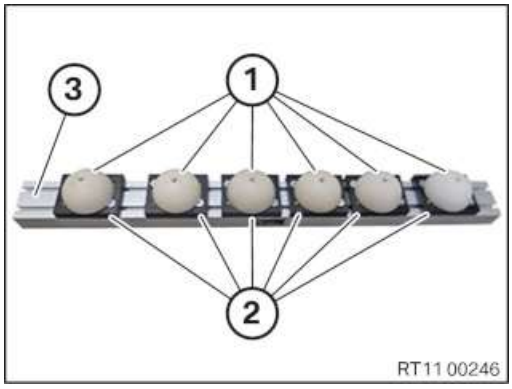
- Prepare the special tool 0 490 567 (11 0 020).



- Fit device (1) onto the flange (2) in the direction of the arrow and install.
- Make sure that the lock (3) engages audibly.

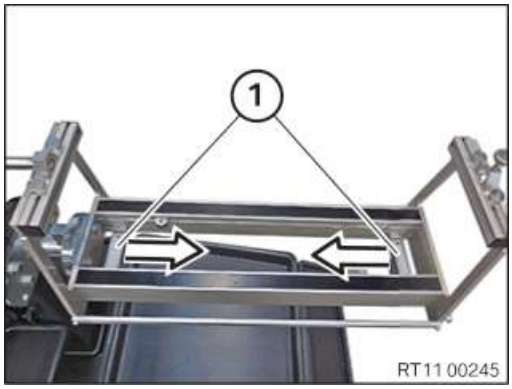


- Loosen screw (1).
- Pull out rod (2) in direction of arrow and set it aside.

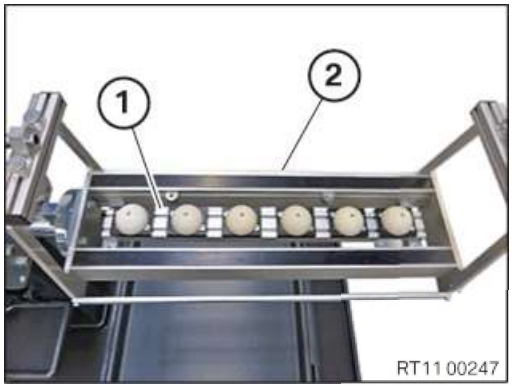


- Prepare plastic shaped part (1) with the shaped parts (2) and the aluminium strip (3).

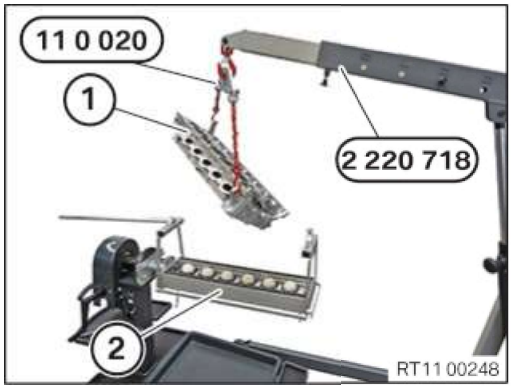
ardiagn.com



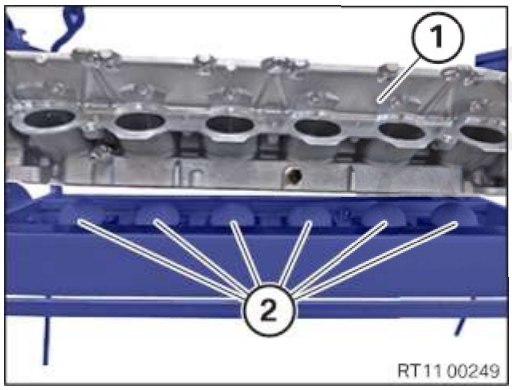
- Slide quick fastener (1) in the direction of the arrow to the limit position.



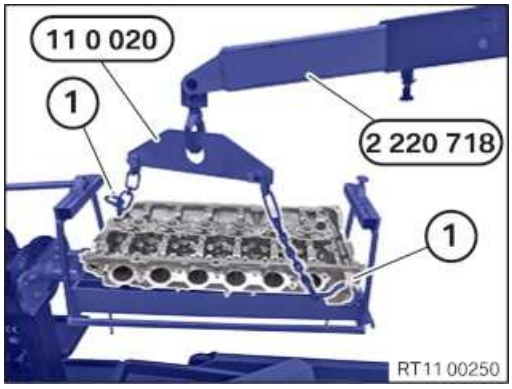
- Position completed aluminium strip (1) **centred** on the device (2).



- Position cylinder head (1) with the work crane 2 220 718 and special tool 0 490 567 (11 0 020) on the device (2).

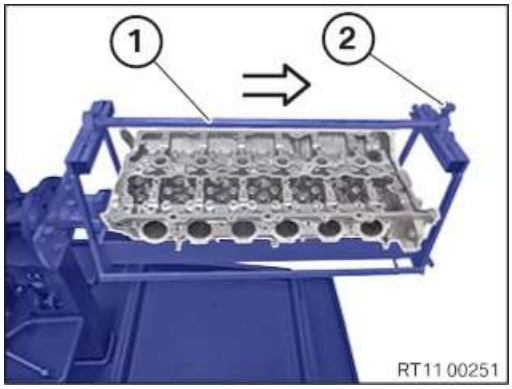


- Position cylinder head (1) correctly on the completed aluminium strip (2).

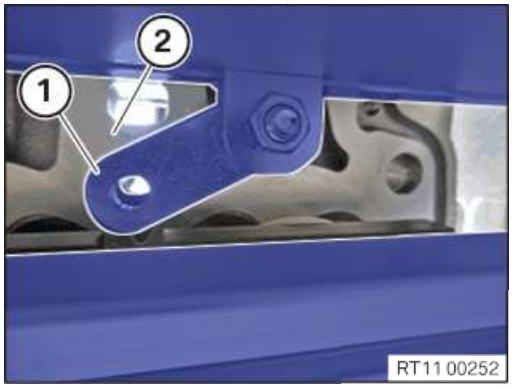


- Lower workshop crane 2 220 718.
- Pull out special tool 0 490 567 (11 0 020) at the cylinder head (1) and remove.
- Remove workshop crane 2 220 718 and set aside.

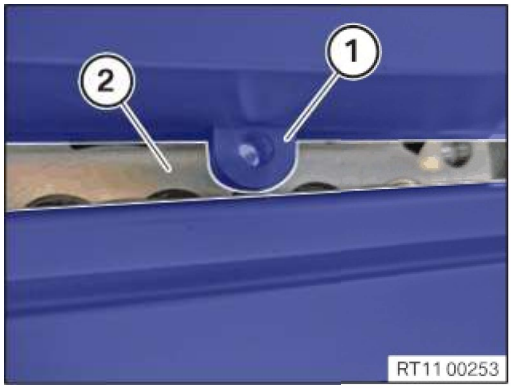
mdiagn.com



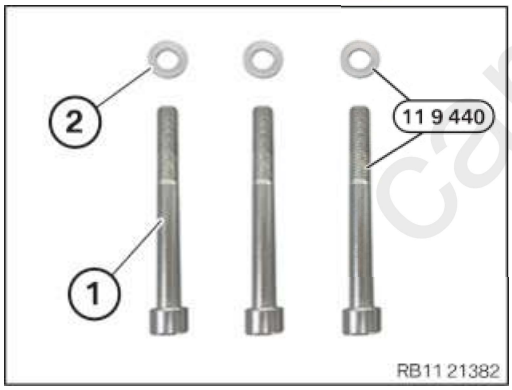
- Pull in rod (1) in the direction of the arrow and install.
- Hand-tighten the bolt (2).



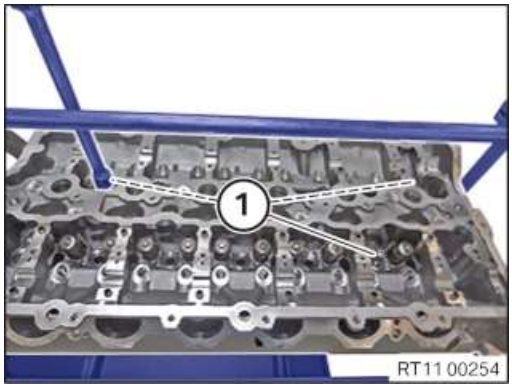
- Position screw connection (1) on cylinder head (2).



- Position screw connection (1) on cylinder head (2).



- Keep **M10x90** screws (1) from special tool ready.
- Keep washers (2) from special tool ready.

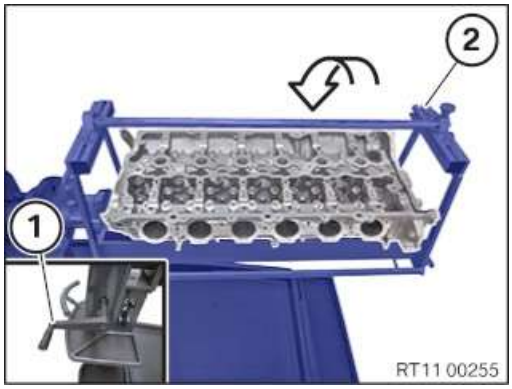


- Tighten screws (1) from special tool.

Cylinder head on device

M10X90x1.5		Tightening torque	30 Nm

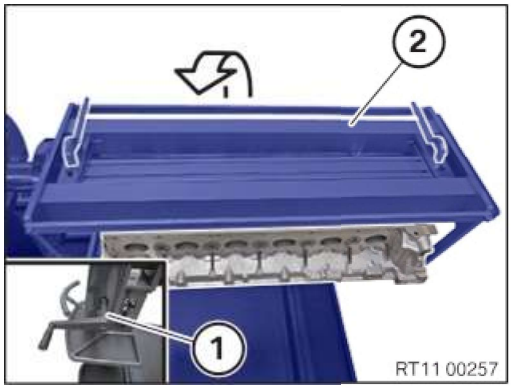
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- Turn device (2) on the crank (1) by 180° in direction of arrow.

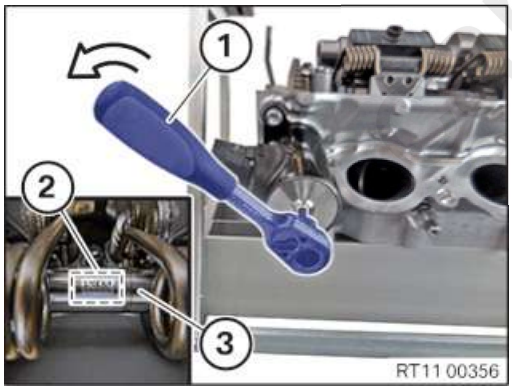


- Lock quick fastener (1) in direction of arrow.



- Turn device (2) on the crank (1) by 180° in direction of arrow.

3 – Adjusting eccentric shaft to minimum lift (cylinder head removed)



- With the help of the servomotor, use a standard hexagon socket wrench (1) to slowly adjust eccentric shaft (3) to the minimum lift at **4 mm** in the **direction of the arrow**.
- Make sure that the mark (2) on the eccentric shaft (3) points upwards.

4 – Removing all torsion springs (cylinder head removed)

CAUTION

Spring preload.

Danger of injury!

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

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TECHNICAL INFORMATION

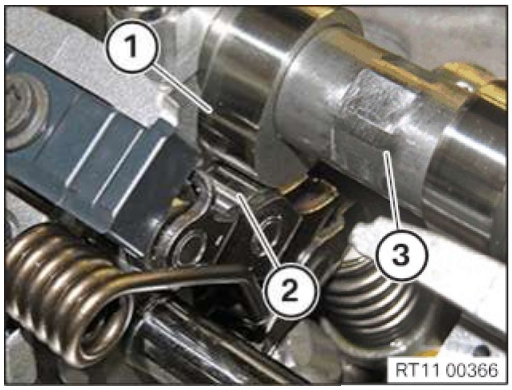
- Wear safety goggles.



- Have the set of special tools 2 359 088 ready.

Number	Description
1	Clamping lever
2	Mounting for clamping lever (fitting aid)

▸ Checking the position of the intake camshaft (cylinder head removed)



Check

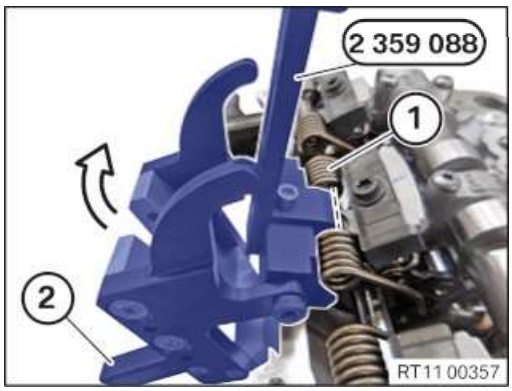
- Check position of the intake camshaft on the respective cylinders.

Result

» Cam (1) of the intake camshaft runs on the intermediate lever (2).

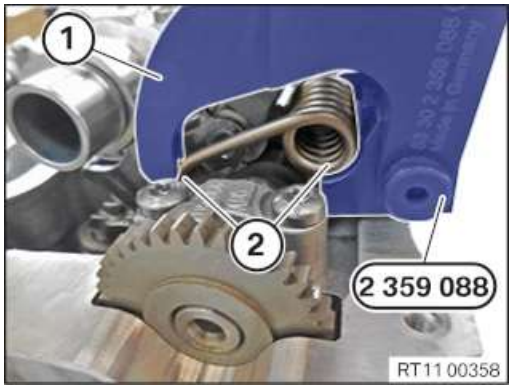
Measure

- Turn intake camshaft (3) further using a standard open-end spanner until the cam (1) does not override on the intermediate lever (2).

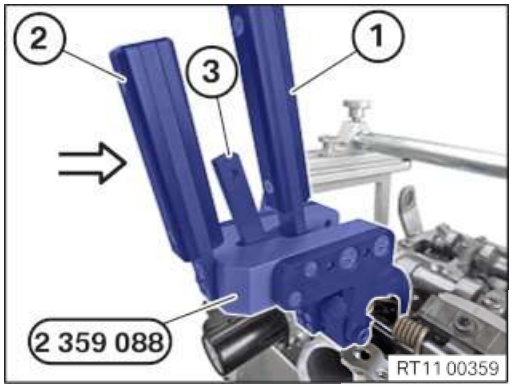


- Open the special tool 2 359 088 and position it at the torsion spring (1).
- Position retaining hook (2) of the special tool 2 359 088 in the direction of arrow.

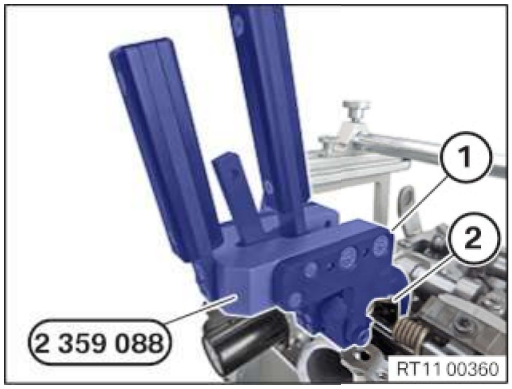
cardiagn.com



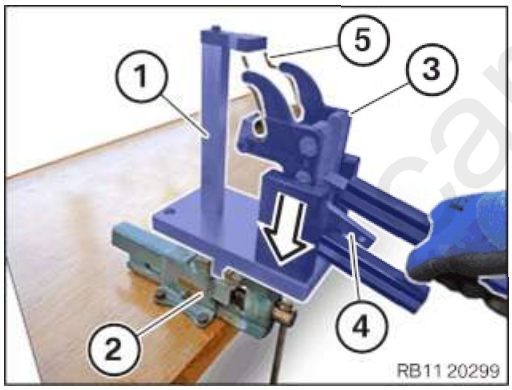
- Make sure that the torsion spring (2) is correctly positioned in the clamping lever (1) of the special tool 2 359 088.



- Hold down lever (1) of special tool 2 359 088.
- Close lever (2) of the special tool 2 359 088 carefully in the **direction of arrow** until the retaining hook (3) engages audibly.



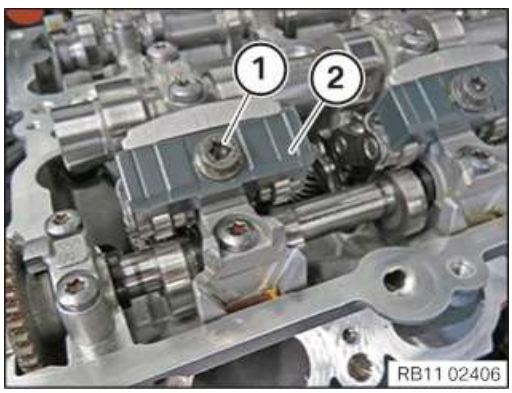
- Guide out and remove clamping lever (1) of special tool 2 359 088 with preloaded spring (2) **carefully**.



- 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.

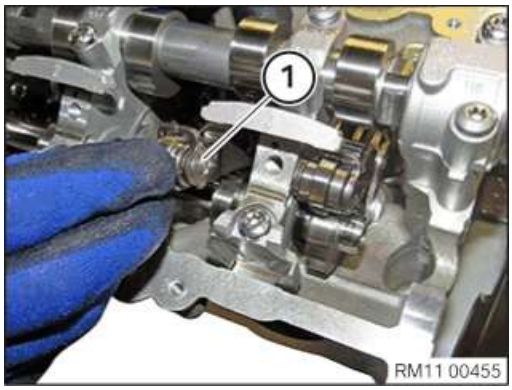
5 – Removing all gates



- 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.

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6 – 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).

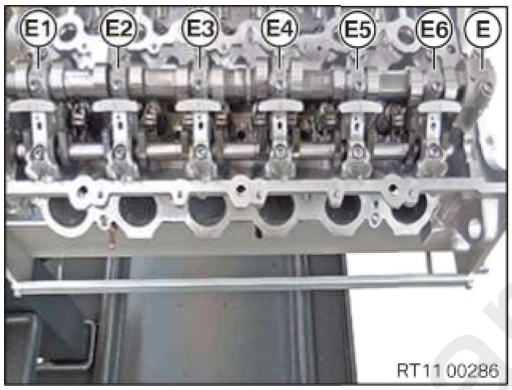
7 – Removing intake camshaft (cylinder head removed)

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

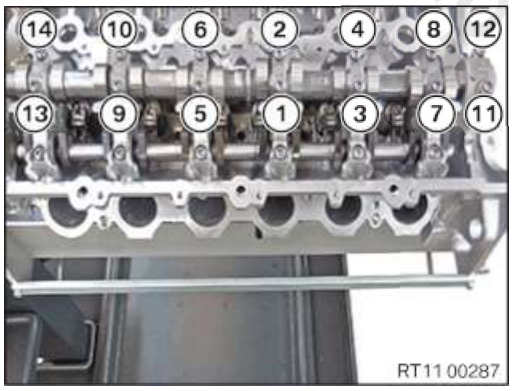
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.



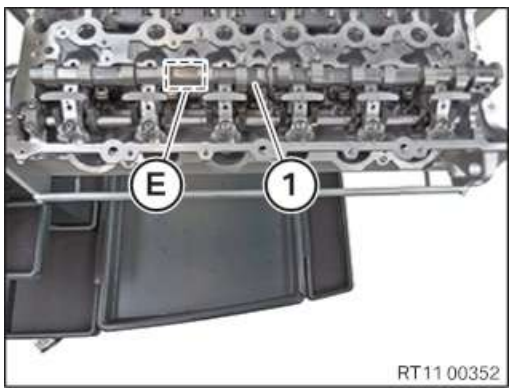
- Observe the numbering of the intake camshaft bearing caps.

  The intake camshaft bearing caps are numbered from (E1) to (E6) and are laid down according to their numbering in the special tool 0 495 105 (11 4 480).

  The intake camshaft bearing cap (E) is a thrust bearing.



- Release screws in the right sequence (14) till (1) in semi circle pattern.
- Set all intake camshaft bearing caps neatly in the special tool 0 495 105 (11 4 480).



- Guide out intake camshaft (1) toward the top and remove it.

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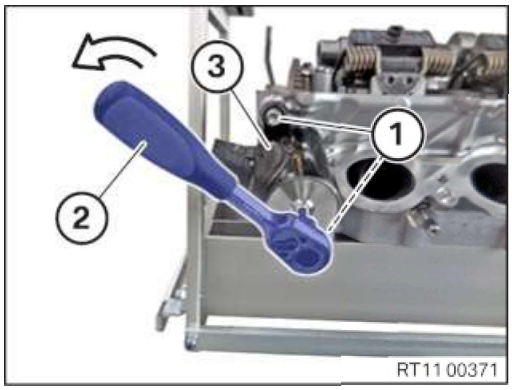
8 – Remove the servomotor for the eccentric shaft (cylinder head removed)

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.

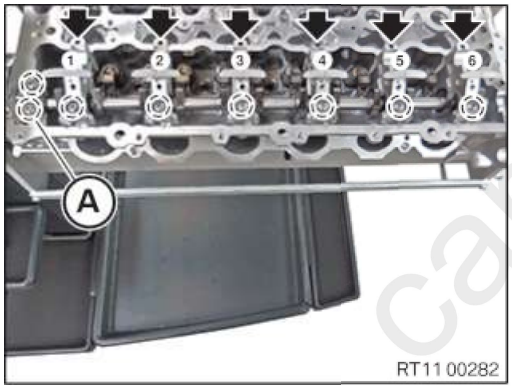


- Loosen screws (1).
- Use a standard hexagon socket wrench (2) to slowly adjust the servomotor for eccentric shaft (3) to the minimum lift at **4 mm** in direction of arrow.

  This releases the tension of the eccentric shaft.

  Do **not** turn the eccentric shaft beyond the end stop.
- Guide out and remove the servomotor for eccentric shaft (3).

9 – Removing the eccentric shaft (cylinder head removed)



RISK OF DAMAGE

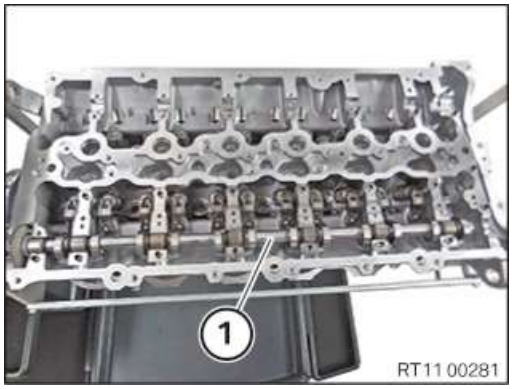
Contaminant or foreign body.

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.

- Unscrew all bolts (markings).
- Work mounting brackets (1) to (6) (arrowed) out and remove.
- Place mounting brackets (1) to (6) in order in the special tool 0 495 105 (11 4 480).
- Work bearing caps (A) out and remove.
- Place the bearing cap (A) in the special tool 0 495 105 (11 4 480) in order.

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- Guide out the eccentric shaft (1) toward the top and remove it.

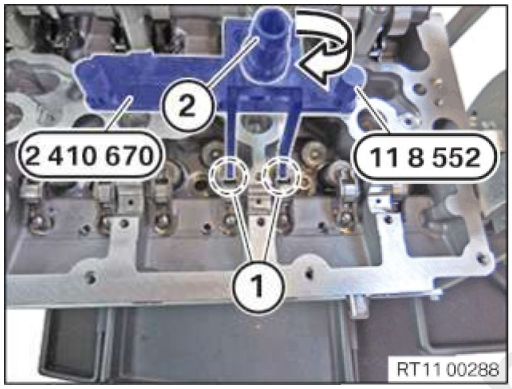
10 – Removing exhaust camshaft (cylinder head removed)

RISK OF DAMAGE

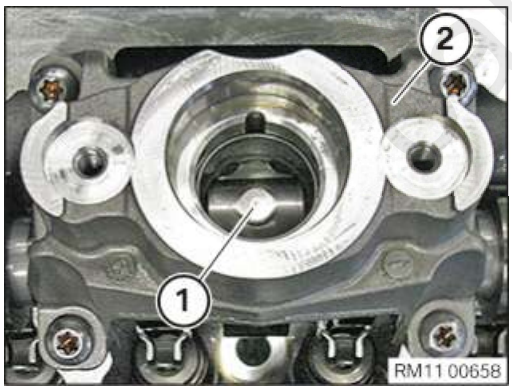
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

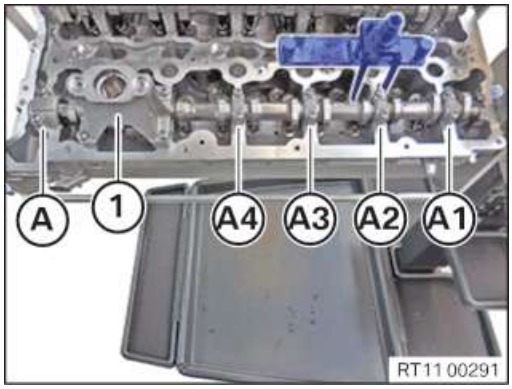
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.



- 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 the 2nd cylinder using the spindle nut (2) of the special tool 2 410 670 in direction of arrow up to the limit position.



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

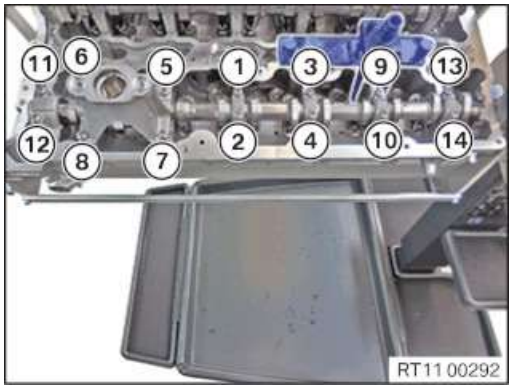


- Observe the numbering of the exhaust camshaft bearing caps.

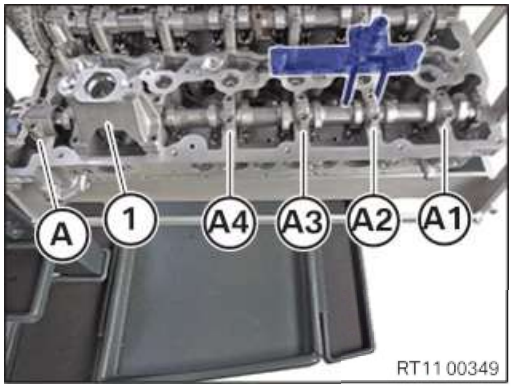
  The exhaust camshaft bearing caps are numbered from (A1) to (A4) and are placed in the special tool 0 495 105 (11 4 480) according to their numbering.

  The exhaust camshaft bearing caps can be read from the intake side.

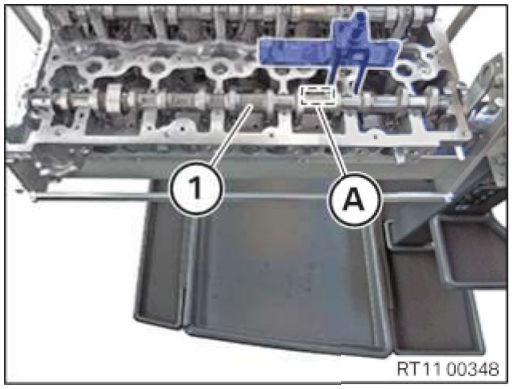
  The exhaust camshaft bearing cap (A) is a thrust bearing.



- Release screws in the right sequence (14) till (1) in semi circle pattern.

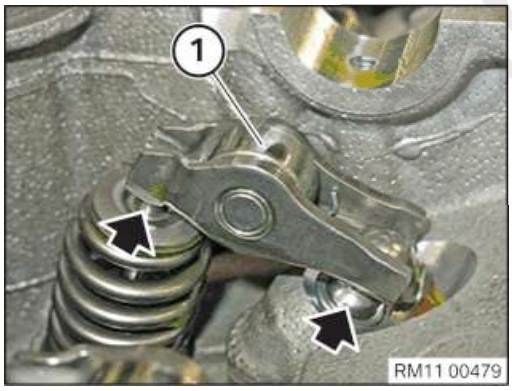


- Pull out all exhaust camshaft bearing caps (A1) to(A4) and the exhaust camshaft bearing cap (A) and remove.
- Place all exhaust camshaft bearing cap in order in special tool 0 495 105 (11 4 480).
- Thread the high pressure pump bracket (1) out and remove.

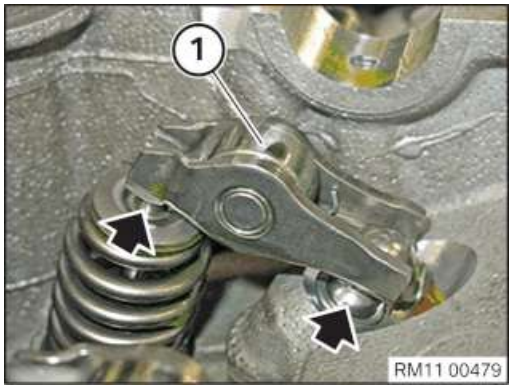


- (1)Remove exhaust camshaft in upward direction.

11 – 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).

12 – Remove all valve springs

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CAUTION

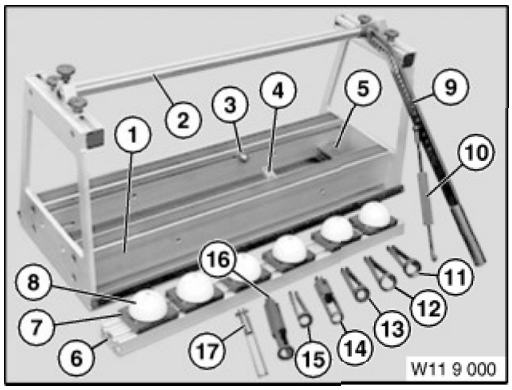
Spring preload.

Danger of injury!

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

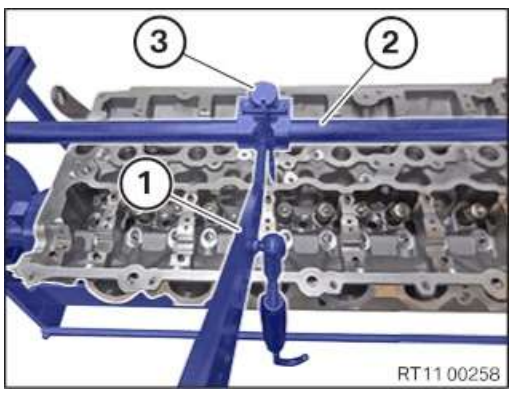
NOTICE

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



- Have the set of special tools 0 494 362 (11 9 000) ready.

Number	Description
1	Device
2	Rod
3	Adapter
4	Tab
5	Quick fastener
6	Aluminum strip
7	Shaped part
8	Shaped part made of plastic
9	Lever
10	Hook
11	Valve spring cage
12	Valve spring cage
13	Valve spring cage
14	Valve spring cage
15	Valve spring cage
16	Valve spring cage
17	Valve spring cage



- Feed in and install lever (1) on the rod (2).
- Guide in and install lock (3).

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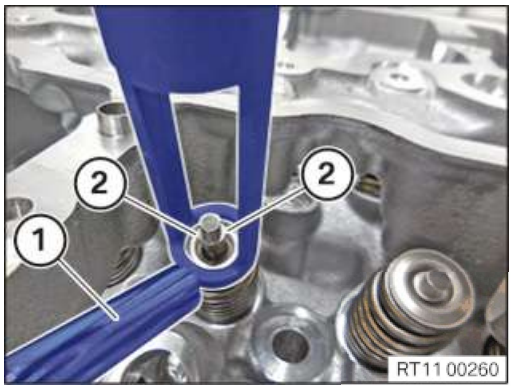


TECHNICAL INFORMATION

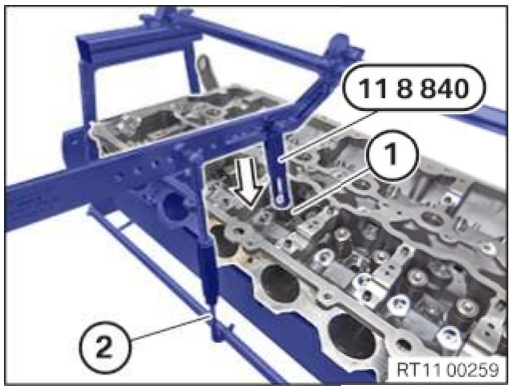


- Wear safety goggles.

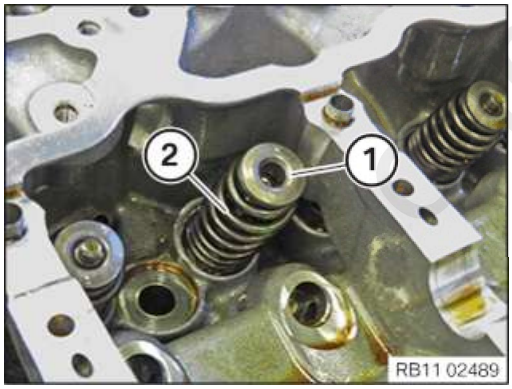
- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in direction of arrow.
- Hold valve spring (1) **pressed down** using the hook (2).



- Remove valve shims (2) with a magnet (1).



- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in **direction of arrow**.
- Thread out hook (2) and place to the side.
- Relieve the valve spring (1) **carefully**.



- Remove the spring cup (1) and the valve spring (2) and position neatly in the special tool 0 495 105 (11 4 480).

MAIN WORK

13 – Renewing valve stem seals

▸ **Remove valve stem seals**

RISK OF DAMAGE

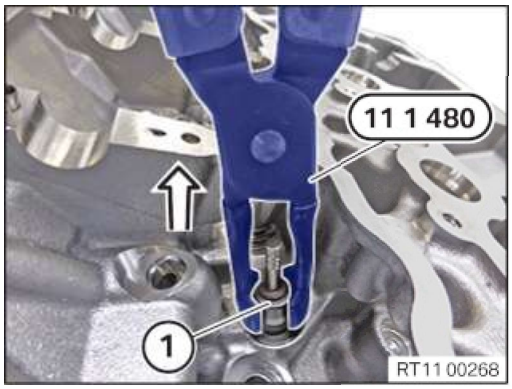
Contaminant or foreign body.

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.

NOTICE

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

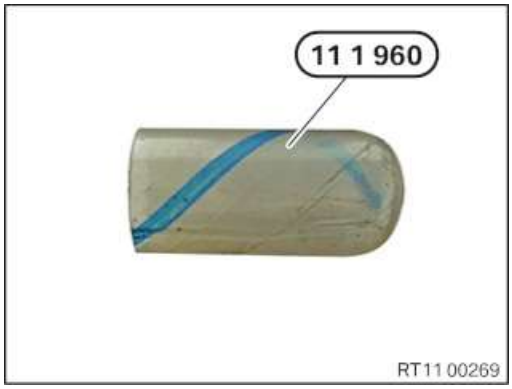


- Remove the valve stem seal (1) in the **direction of arrow** using the special tool 0 490 796 (11 1 480).

▸ **Installing valve stem seals**

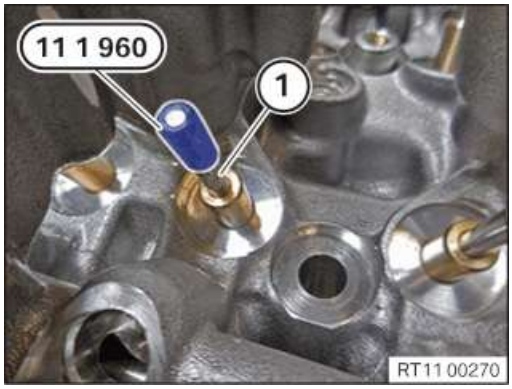


- Remove oil and dirt from the contact surface (1).



- Make sure that the special tool 0 490 797 (11 1 960) is used when installing the valve stem seal.

erdiagn.com



- Guide in and install the special tool 0 490 797 (11 1 960) on valve (1).



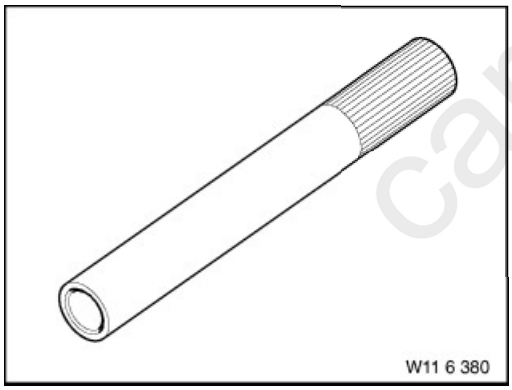
- Renew the valve stem seal (1).

  Parts: Valve stem seal

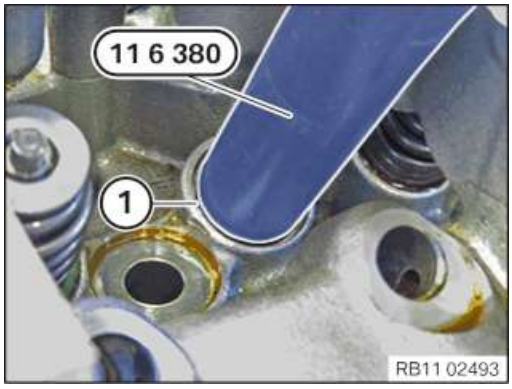
- Guide in and install valve stem seal (1) on the special tool 0 490 797 (11 1 960).



- Guide the special tool 0 490 797 (11 1 960) out and remove.

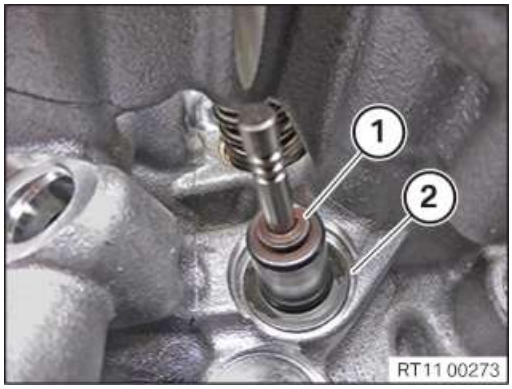


- Prepare special tool 0 493 249 (11 6 380).



- Press the valve stem seal (1) onto the cylinder head till the limit position using special tool 0 493 249 (11 6 380).

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- Make sure that valve stem seal (1) is positioned correctly on cylinder head (2).

POSTPROCESSES

14 – Install all valve springs

CAUTION

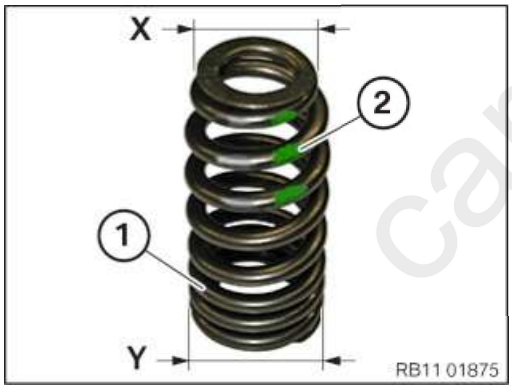
Spring preload.

Danger of injury!

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

NOTICE

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

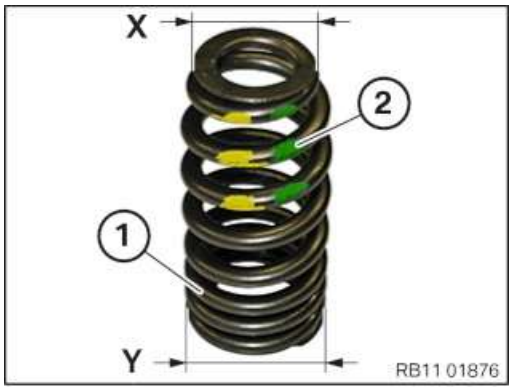


- Note the installation position of the valve spring.

Note: Install the valve spring so that the larger diameter (Y) points to the bottom spring cup.

- Make sure that the intake valves are not switched with the exhaust valves.

Note: Valve springs (1) are marked in colour (2). Colour for the intake valves: Green



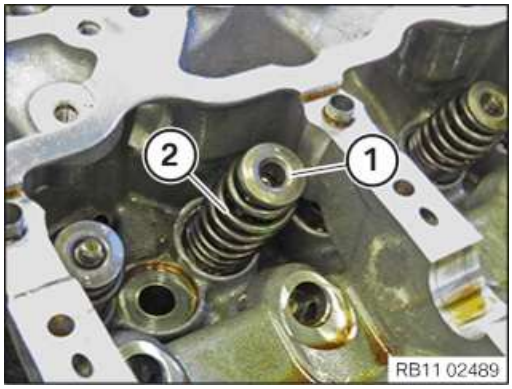
- Note the installation position of the valve spring.

Note: Install the valve spring so that the larger diameter (Y) points to the bottom spring cup.

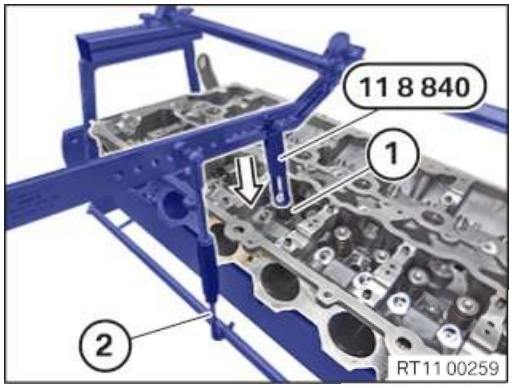
- Make sure that the intake valves are not switched with the exhaust valves.

Note: Valve springs (1) are marked in colour (2). Colour for the exhaust valves: green/yellow

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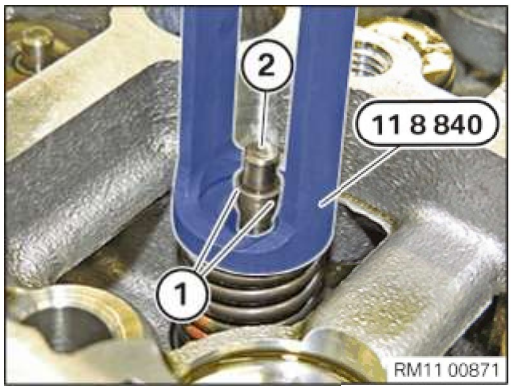
- Install the valve spring (2) and the spring cup (1).



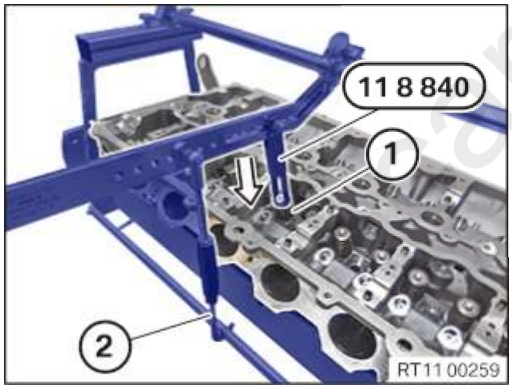
TECHNICAL INFORMATION

- Wear safety goggles.

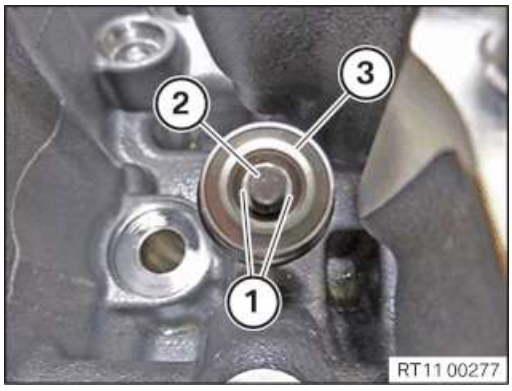
- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in direction of arrow.
- Hold valve spring (1) **pressed down** using the hook (2).



- Position the valve shims (1) on the valve (2).



- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in **direction of arrow**.
- Thread out hook (2) and place to the side.
- Relieve the valve spring (1) **carefully**.



- Make sure that the valve shims (1) are positioned correctly on the valve (2) and on the valve spring (3).

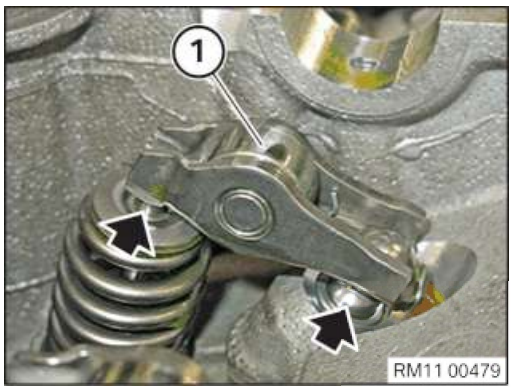
15 – Install all roller cam followers

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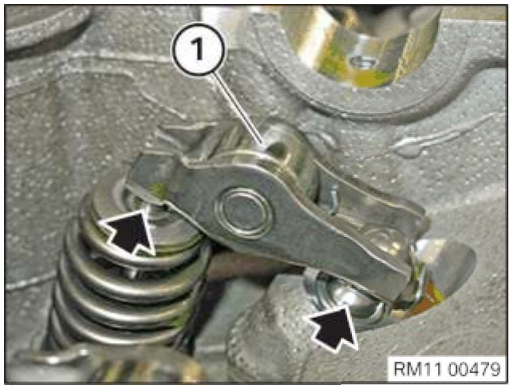


- The classification in digits from 1 to 5 has been printed on the roller cam follower.

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

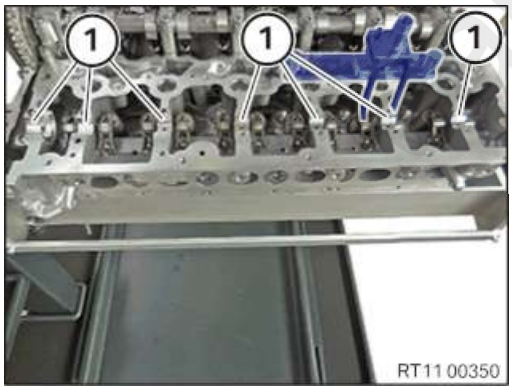


- Install the roller cam follower (1) on the intake side.
- Make sure the roller cam followers are correctly positioned on the hydraulic valve clearance compensating elements (arrows) and on the intake valves.

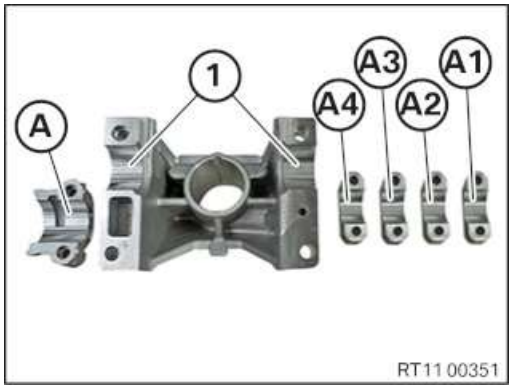


- Install the roller cam followers (1) on the exhaust side.
- Make sure the roller cam followers are correctly positioned on the hydraulic valve clearance compensating elements (arrows) and on the exhaust valves.

16 – Mount exhaust camshaft (cylinder head removed)

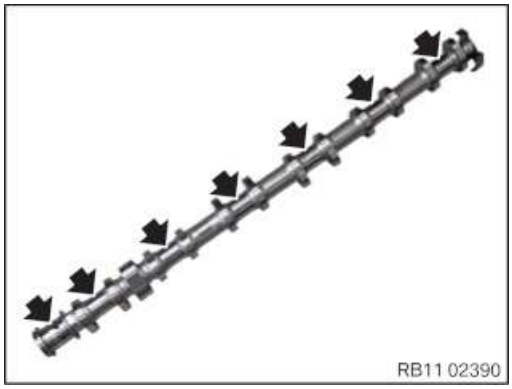


- Clean all bearing positions (1) and coat with engine oil.

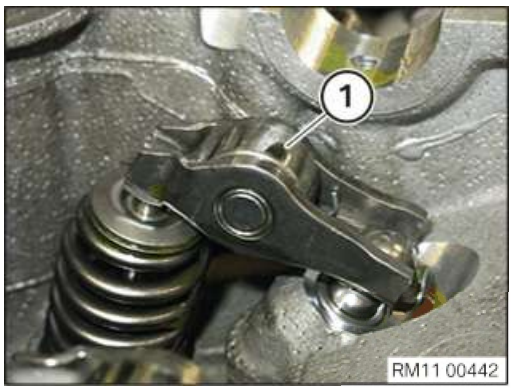


- Clean all bearing positions of exhaust camshaft bearing caps (A1), (A2), (A3), (A4) and (A) and coat with engine oil.
- Clean bearing positions (1) of the high pressure pump bracket and coat with engine oil.

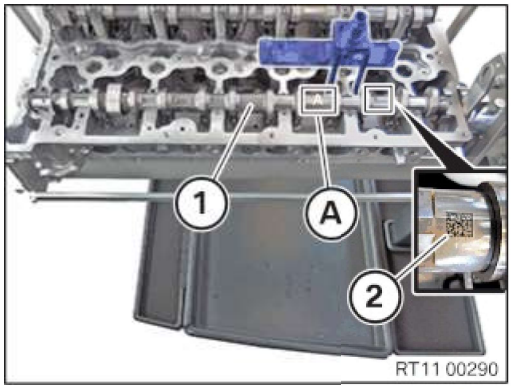
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- Clean all bearing positions (arrows) of the exhaust camshaft and coat with engine oil.



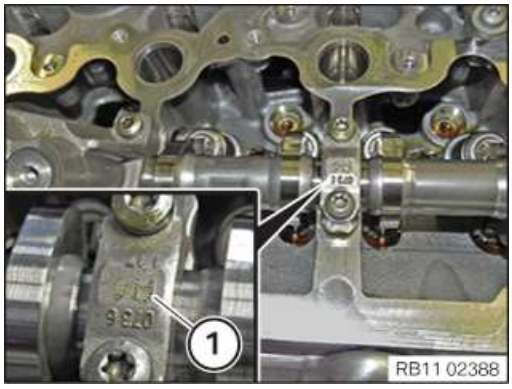
- Check all roller cam follower (1) of the exhaust side for correct fit.



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

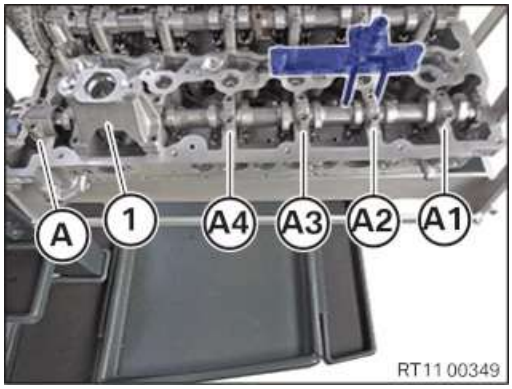
Engine damage caused by incorrectly installed bearing shells and bearing supports.

Engine damage may result from incorrectly installing bearing shells and bearing supports.

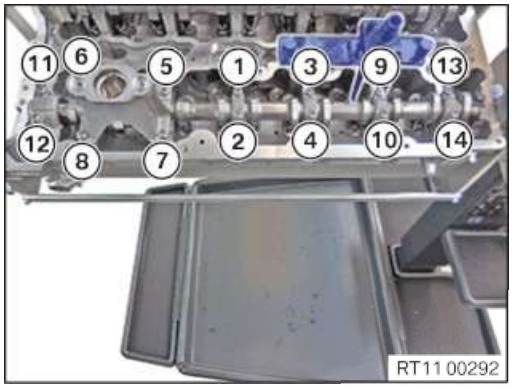
- Always install all bearing shells and bearing supports in the same position from which they were removed.

- Replace all exhaust camshaft bearing cap , that the labelling(1) from the intake side are readable.

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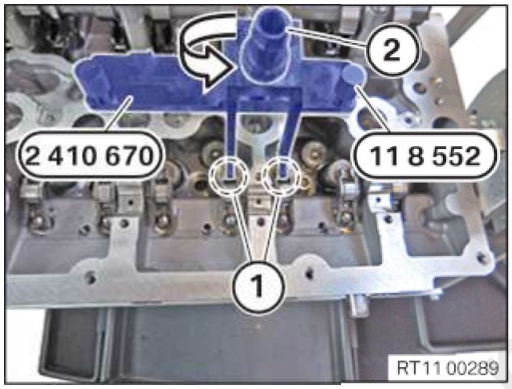
- Feed in all exhaust camshaft bearing cap (A1) until (A4) and the exhaust camshaft bearing cap (A) and position.
- Pull in the high pressure pump bracket (1) and position.



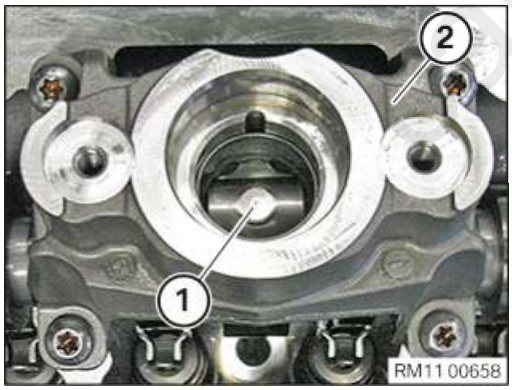
- Press down the exhaust camshaft bearing caps and hand-tighten the bolts incrementally in the sequence(1) to (14).
- Move up all screws in the sequence (1) to (14) **in half rotations.**
- **Adhere to the jointing torque.**
- Tighten all screws in a sequence from (1) to (14) .

Exhaust camshaft to cylinder head

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

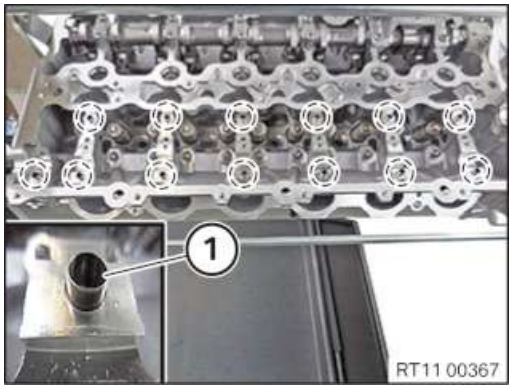


- Twist special tool 2 410 670 using the spindle nut (2) in direction of arrow and relax.
- Release special tool 0 495 741 (11 8 552) and remove special tool 2 410 670.

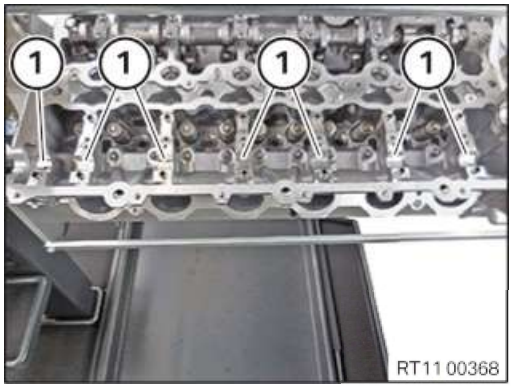


- Install roller tappet (1) into the high pressure pump bracket (2).

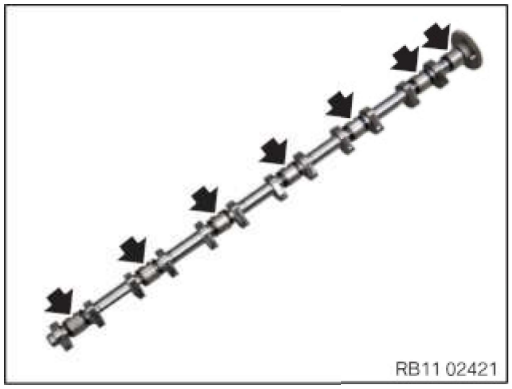
17 – Mounting eccentric shaft (cylinder head removed)



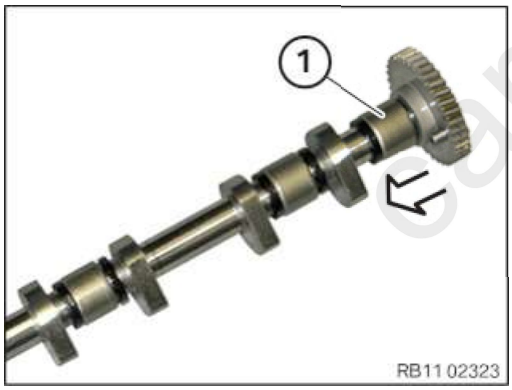
- Check all guide bushes (marks) (1) for damage and renew them if necessary.



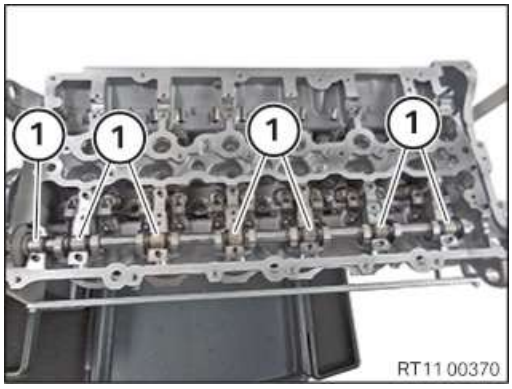
- Clean all the bearing positions (arrows) in the cylinder head and coat them with engine oil.



- Check all the needle bearings (arrows) of the eccentric shaft for ease of movement.
- Renew the eccentric shaft in case of tight needle bearings.

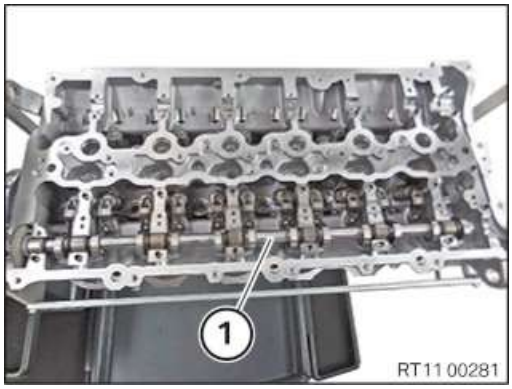


- Push needle bearing (1) up to the limit position in direction of arrow before installing the eccentric shaft.

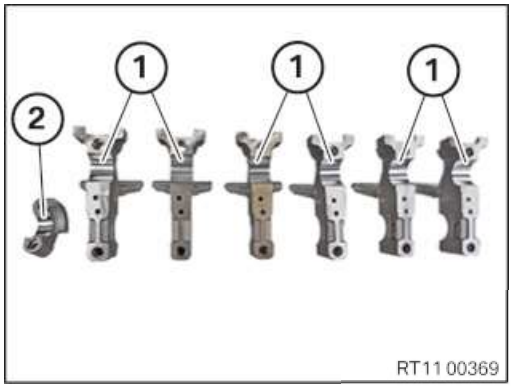


- Clean all needle bearings of the eccentric shaft (arrows) and coat with engine oil.

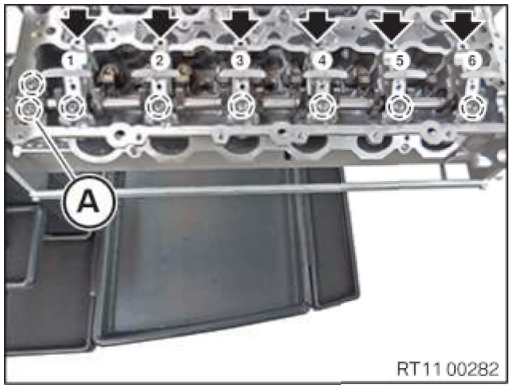
cardiagn.com



- Pull in eccentric shaft (1) and install.



- Clean bearing positions (1) of the bearing supports and coat with engine oil.
- Clean bearing position (2) of the bearing cap and coat with engine oil.



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.

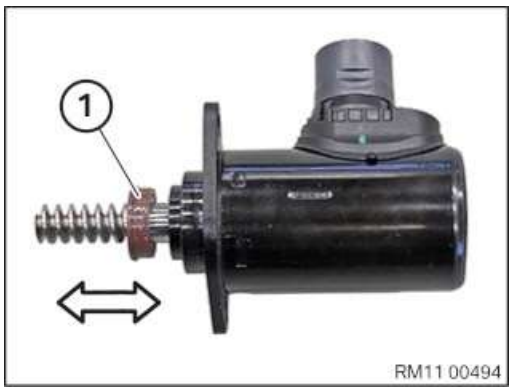
- Pull bearing supports (1) to (6) (arrows) in and install.

  The bearing supports (1) to (6) **must** each be installed again in the **position** from where they were removed.
- Pull in bearing cap (A) and install.
- Tighten the bolts (marks).

Eccentric shaft to bearing support/cylinder head

M6		10 Nm

18 – Install the servomotor for the eccentric shaft (cylinder head removed)



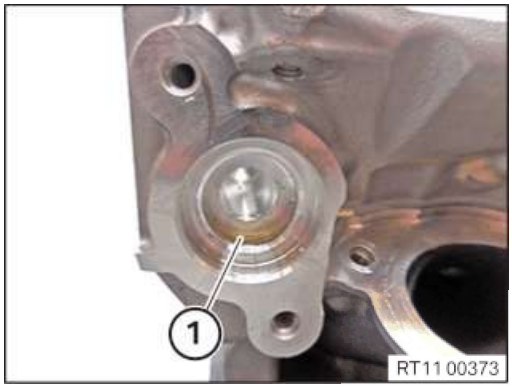
- Renew gasket (1).

  Parts: Gasket

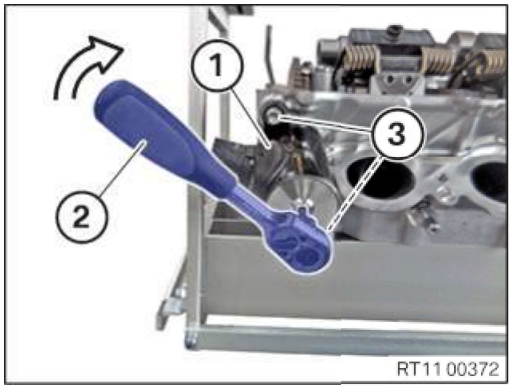
cardiagn.com



- Press the gasket (1) in to the limit position on the housing.



- Clean sealing surface (1).



- Slide servomotor for the eccentric shaft (1) up to the limit position and install it.
- Turn servomotor for the eccentric shaft (1) using a standard hexagon socket wrench (2) of **4 mm** in the **direction of arrow** until the servomotor for the eccentric shaft (1) lies on the cylinder head.
- Tighten down screws (3).

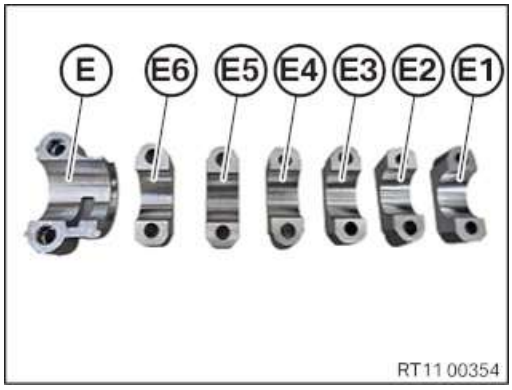
Electrical servomotor to cylinder head

M6		Tightening torque	8 Nm

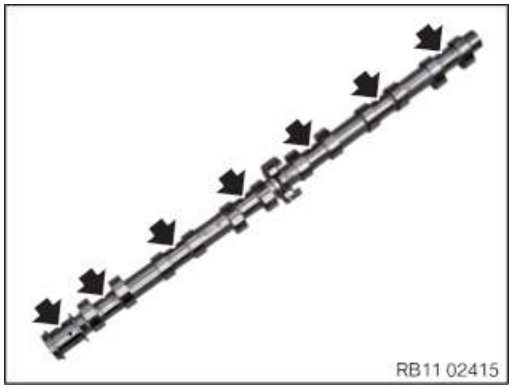
19 – Mounting intake camshaft (cylinder head removed)



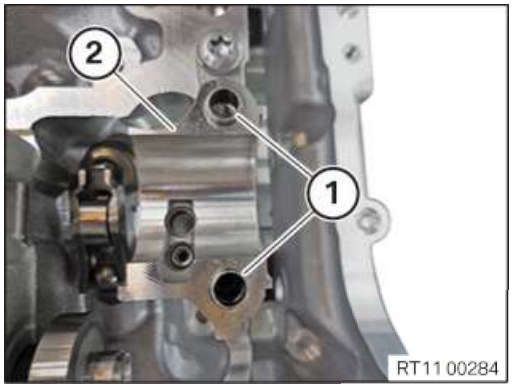
- Clean all bearing positions (arrows) and coat with engine oil.



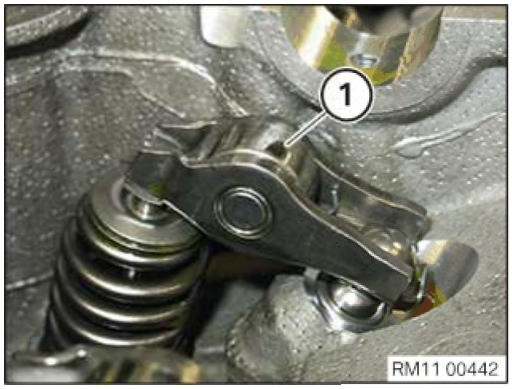
- Clean all bearing positions of intake camshaft bearing caps (E1),(E2),(E3),(E4),(E5),(E6) and (E) and coat with engine oil.



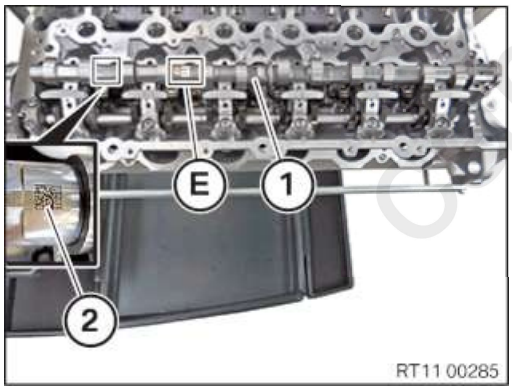
- Clean all bearing positions (arrows) of the intake camshaft and coat with engine oil.



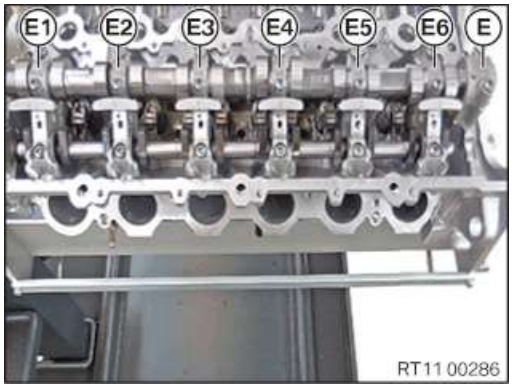
- Check the fitting sleeves (1) of the thrust bearing (2) for damage and renew if necessary.



- Check all roller cam followers(1) of the intake side for correct fit.



- Insert the intake camshaft (1) into the cylinder head so that the mark (2) points up.



RISK OF DAMAGE

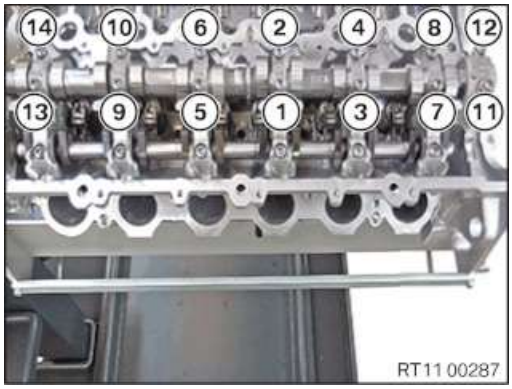
Engine damage caused by incorrectly installed bearing shells and bearing supports.

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.

- Feed in all intake camshaft bearing caps (E1) to (E6) and the intake camshaft bearing cap (E) and position.

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- Press down the intake 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 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

20 – Checking the intermediate lever classification



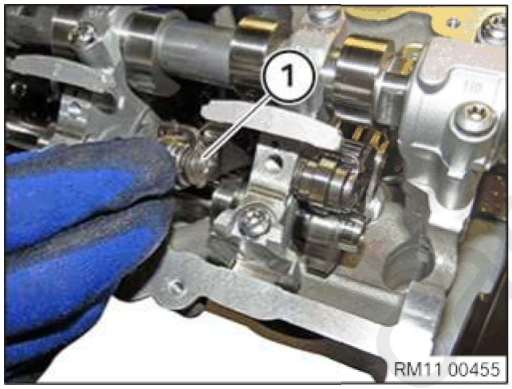
TECHNICAL INFORMATION

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.

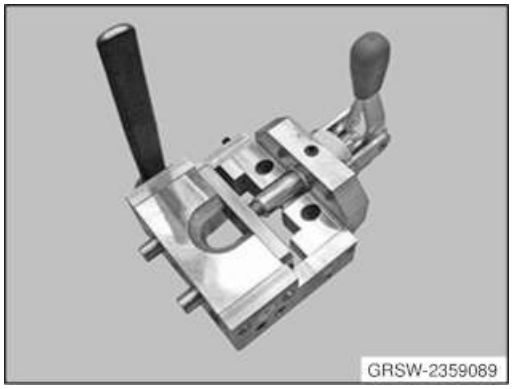
- Checking the intermediate lever classification.

21 – Installing all intermediate levers



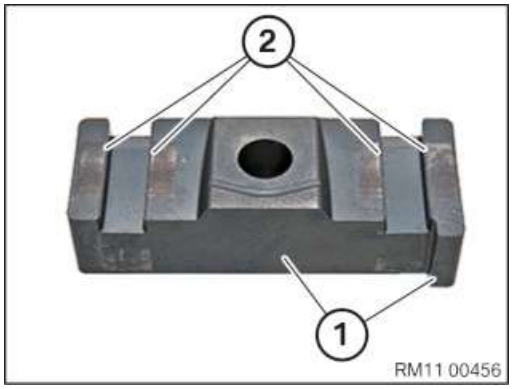
- Install intermediate lever (1).
- Repeat the step for all intermediate levers (1).

22 – Installing all gates

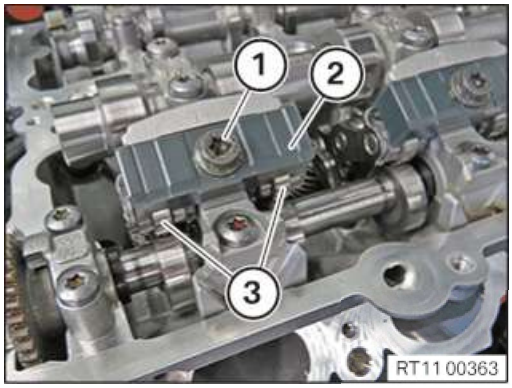


- Have the special tool 2 359 089 ready.

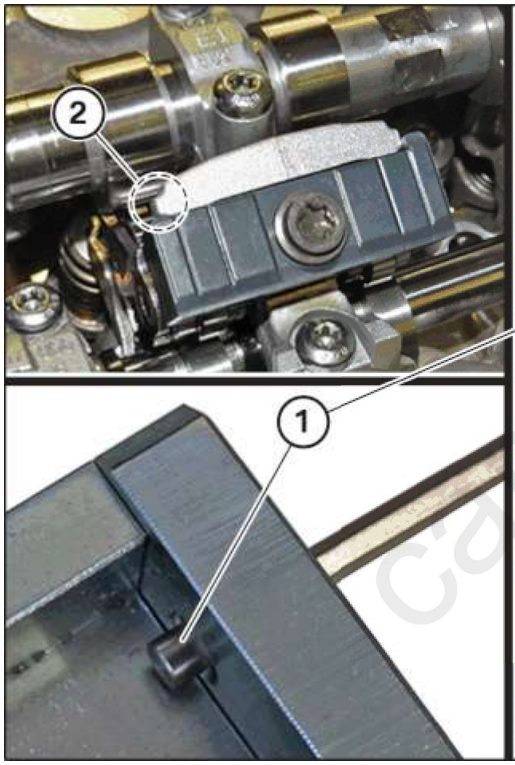
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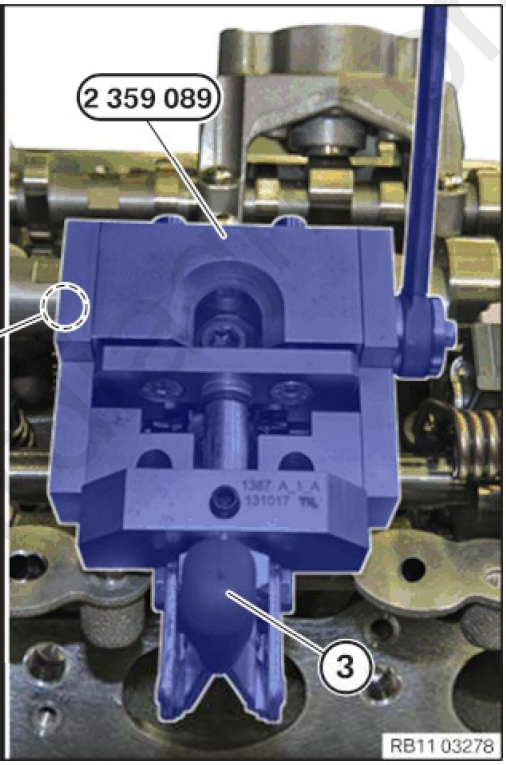


- Clean contact surfaces (1) and (2) off oil, grease and dirt.

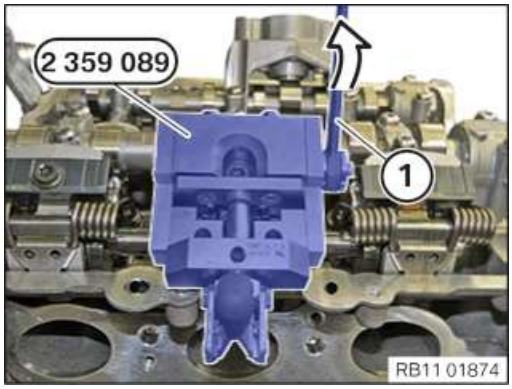


- Position the gate (2) and hand-tighten the bolt (1).
- Check that the intermediate lever (3) is in the correct mounting orientation.

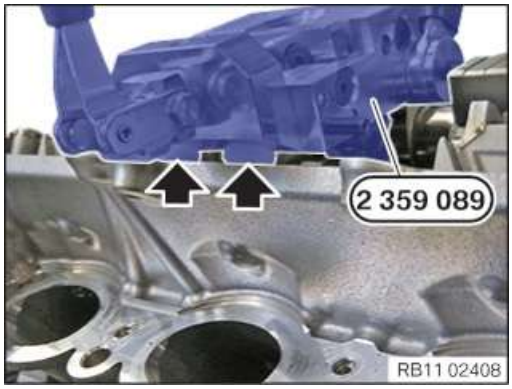




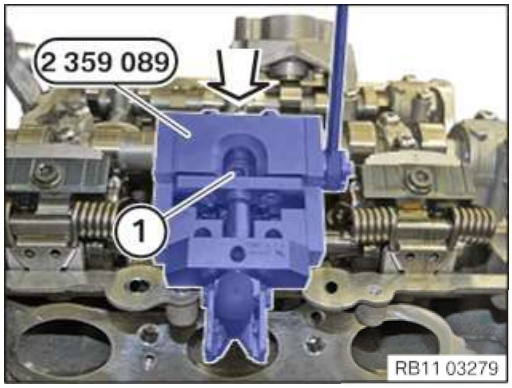
- Position the special tool 2 359 089 on the cylinder head.
- Pre-tension the gate with the lever (3).
- Abut the bolt (1) in the area (2).
- Make sure that the special tool 2 359 089 does not rotate during this process.



- Secure the gate with the lever (1).



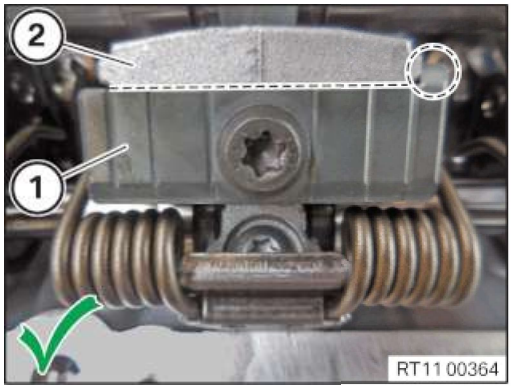
- Ensure that the special tool 2 359 089 lies flat on the cylinder head.



- Press the special tool 2 359 089 onto the cylinder head.
- Tighten the bolt (1) at the same time.

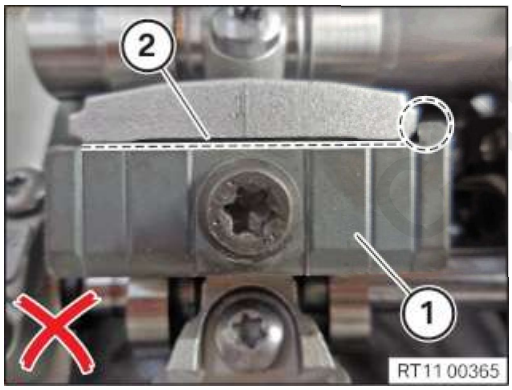
Gate to bearing bracket

M8		20 Nm



- Make sure that gate (1) rests correctly against bearing bracket (2).

  Gate (1) is installed correctly in the marked area.

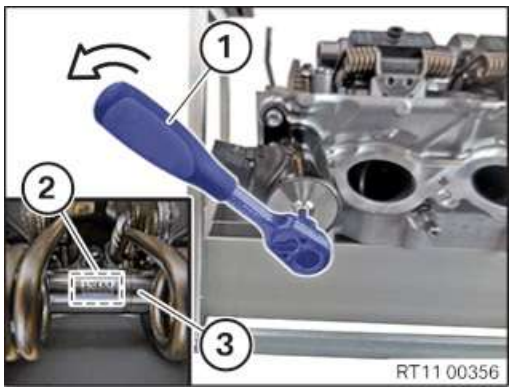


- Make sure that gate (1) rests correctly against bearing bracket (2).

  Gate (1) is installed incorrectly in the marked area.

- Repeat the procedure for all gates.

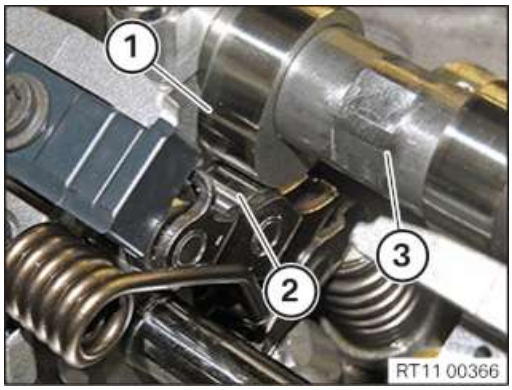
23 – Adjusting eccentric shaft to minimum lift (cylinder head removed)



- With the help of the servomotor, use a standard hexagon socket wrench (1) to slowly adjust eccentric shaft (3) to the minimum lift at **4 mm** in the **direction of the arrow**.
- Make sure that the mark (2) on the eccentric shaft (3) points upwards.

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24 – Checking the position of the intake camshaft (cylinder head removed)



Check

- Check position of the intake camshaft on the respective cylinders.

Result

» Cam (1) of the intake camshaft runs on the intermediate lever (2).

Measure

- Turn intake camshaft (3) further using a standard open-end spanner until the cam (1) does not override on the intermediate lever (2).

25 – Installing all torsion springs (cylinder head removed)

CAUTION

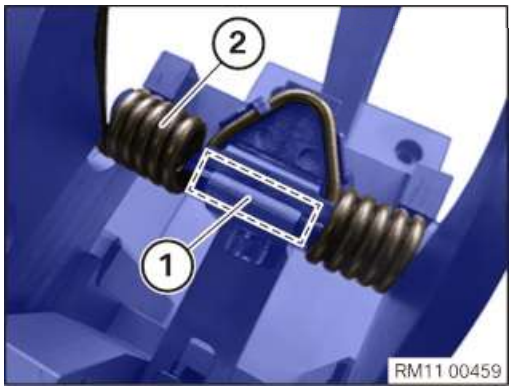
Spring preload.

Danger of injury!

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

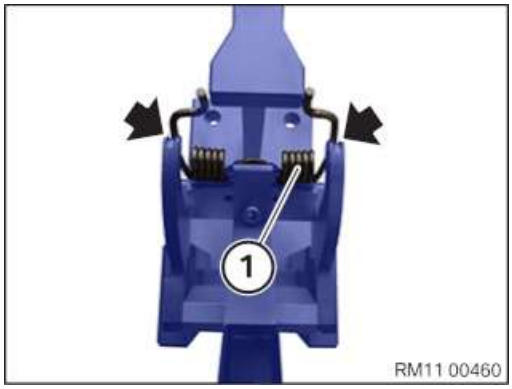
TECHNICAL INFORMATION

- Wear safety goggles.

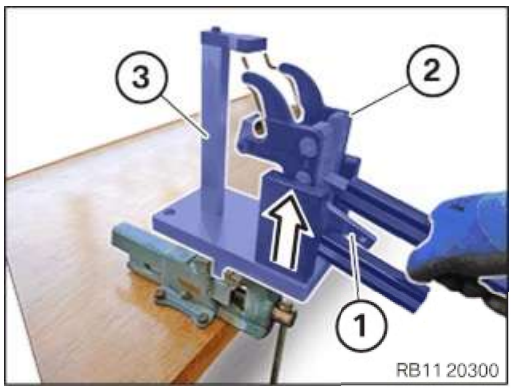


- Insert the torsion spring (2) in the clamping lever of the special tool 2 359 088.
- Make sure that the torsion spring (2) is correctly positioned in the marked area (1) of the special tool 2 359 088.

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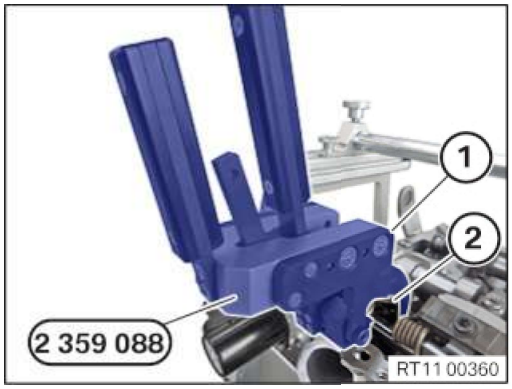


- Carefully close the clamping lever of the special tool 2 359 088 in the accompanying fixture until the retaining hook engages.
- Ensure that the torsion spring (1) lies correctly in the lateral guides (arrows) of the special tool 2 359 088 during tensioning.

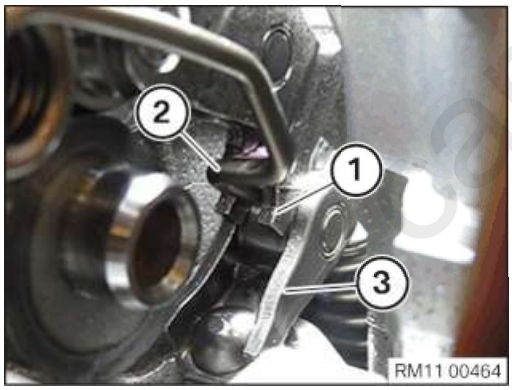


- Carefully close the clamping lever (2) of the special tool 2 359 088 in the fixture (3) until the retaining hook (1) audibly engages.

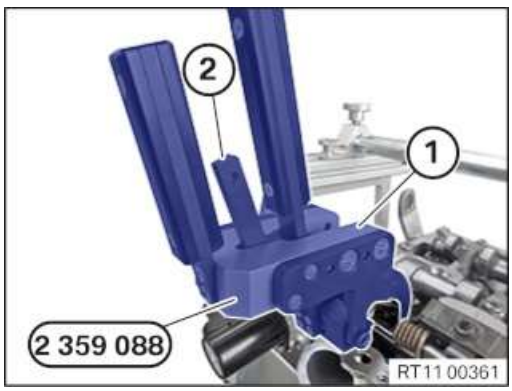
  The torsion spring is tensioned.
- **Carefully** take the clamping lever (2) of the special tool 2 359 088 with the stretched torsion spring out of the fixture (3) of the special tool 2 359 088 in the direction of arrow.



- Feed in clamping lever (1) from the special tool with the pre-tensioned torsion spring (2) and position it.

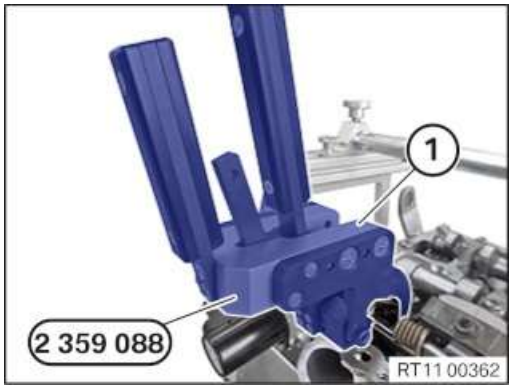


- Ensure that the torsion spring (2) is positioned correctly in the intermediate lever (1).
- Check all roller cam followers (3) for correct installation position.

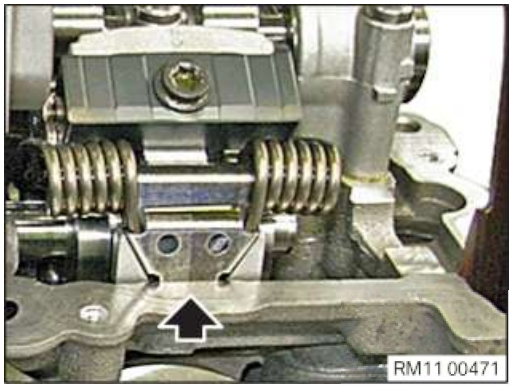


- Press the clamping lever (1) of the special tool 2 359 088 together until the retaining hook (2) unlocks.
- Carefully open the clamping lever (1) of the special tool 2 359 088 until the torsion spring is completely relaxed.

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- Guide out and remove the clamping lever (1) of the special tool 2 359 088.



- Check for correct mounting orientation of the torsion spring (arrow) at the cylinder head.
- Repeat the operations for the remaining torsion springs.

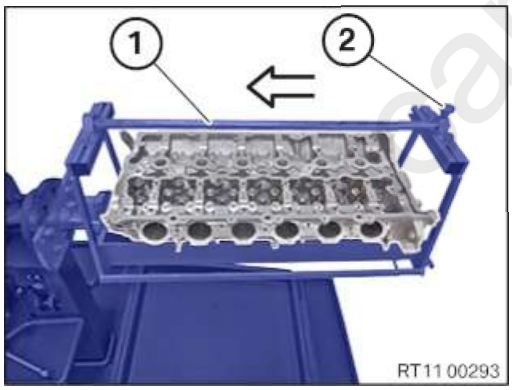
26 – Removing cylinder engine from assembly stand

CAUTION

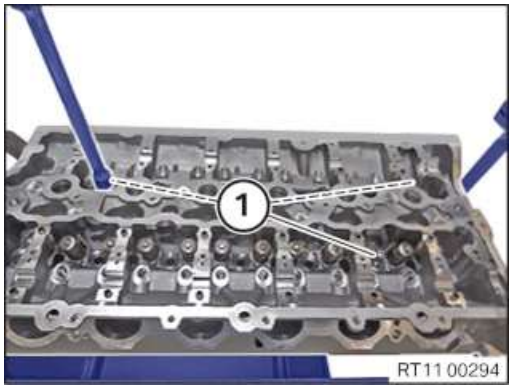
Heavy component.

Heavy components can lead to injury or damage.

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



- Loosen screw (2).
- Pull out rod (1) in direction of arrow and set it aside.

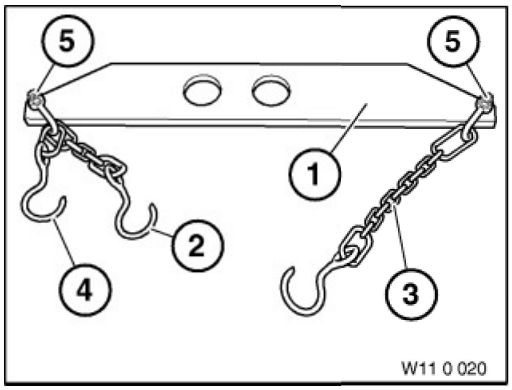


- Release screws (1) from special tool .

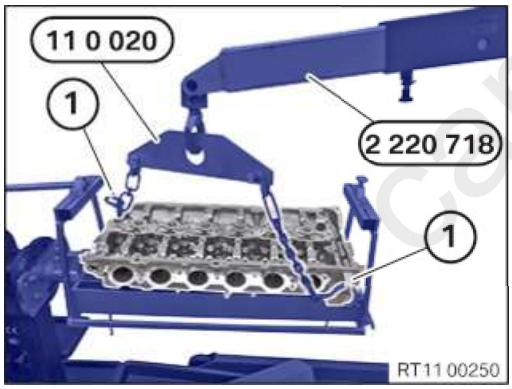
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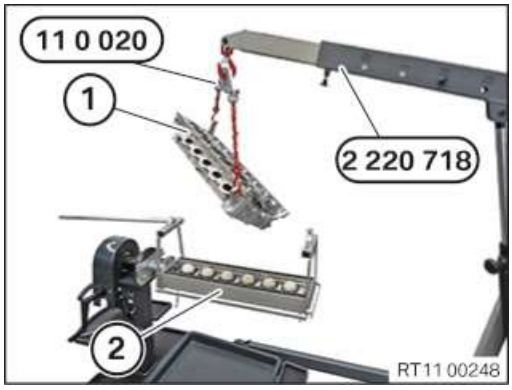
- Stage special tool (workshop crane) 2 220 718.



- Prepare the special tool 0 490 567 (11 0 020).



- Guide in and position special tool 0 490 567 (11 0 020) on cylinder head (1).
- Position workshop crane 2 220 718 and connect to special tool 0 490 567 (11 0 020).



- Detach cylinder head (1) with the work crane 2 220 718 and special tool 0 490 567 (11 0 020) from the device (2), pull out and remove.

27 – Installing the exhaust turbocharger (cylinder head removed)

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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

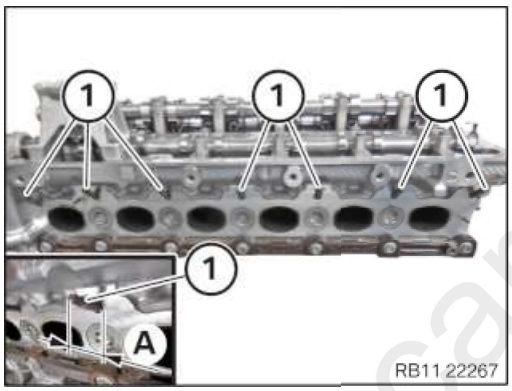
Damage to the electrical wastegate valve controller.

The electrical wastegate valve controller may be damaged as a result of the excessive forces required when removing and installing a jammed exhaust turbocharger.

- Do not pull on the electrical wastegate valve controller.
- Apply force to the turbine housing and exhaust manifold only.
  - Do not pull on the compressor housing.

TECHNICAL INFORMATION

Do not damage the thermal compensating elements. The disassembly and installation including intermediate storage of the exhaust turbocharger is only permitted with mounted special tool 2 466 919 .



- Check stud bolt (1) for damage, renew if necessary.

  Parts: Stud bolt
- Check screw-in depth (A) of the upper stud bolt (1).

Screw-in depth of upper stud bolt on cylinder head

Dimension A	30 mm

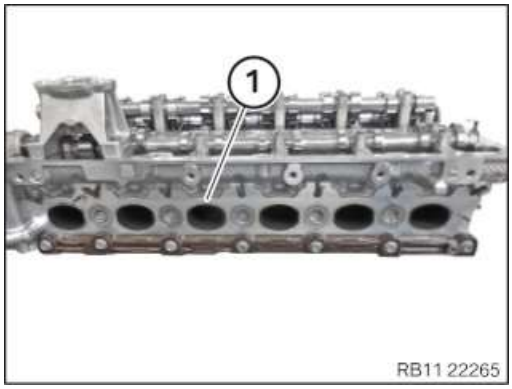
- If necessary, screw the stud bolts in further or unscrew.



- Check stud bolts in the **marked area** for damage and replace if necessary.

  Parts: Stud bolt

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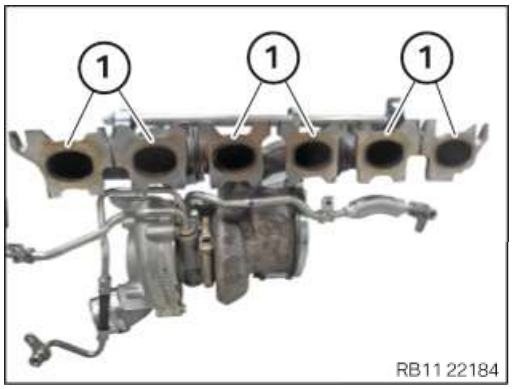
RISK OF DAMAGE

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.

- Clean the sealing surfaces (1) on the cylinder head using special tool 0 495 102 (11 4 470).



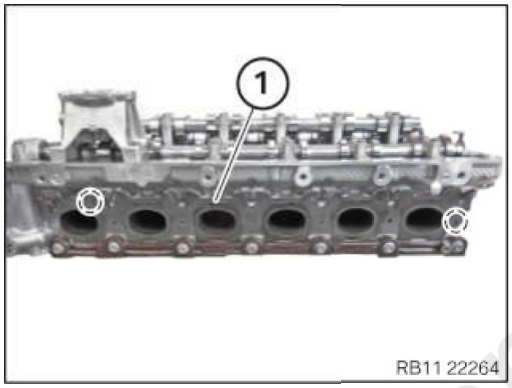
RISK OF DAMAGE

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.

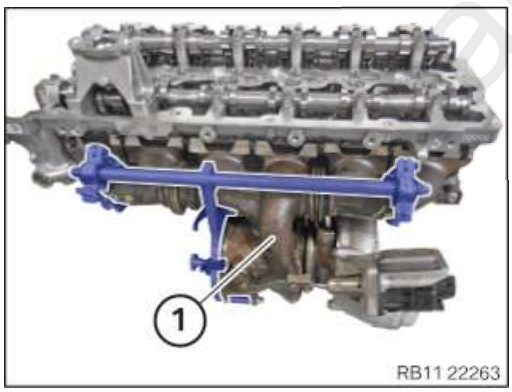
- Clean the sealing surfaces (1) on the exhaust turbocharger using the special tool 0 495 102 (11 4 470).



- Renew the gasket (1).

  Parts: Gasket

- Guide seal (1) into the **marked area** and install it.



CAUTION

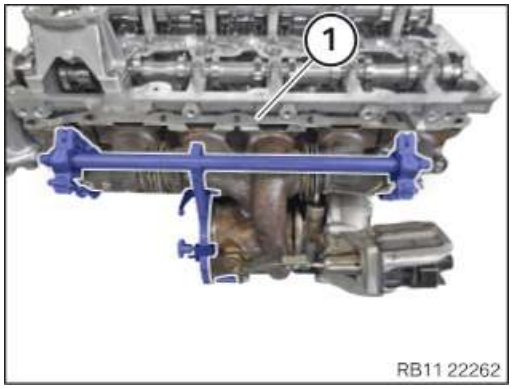
Heavy component.

Heavy components can lead to injury or damage.

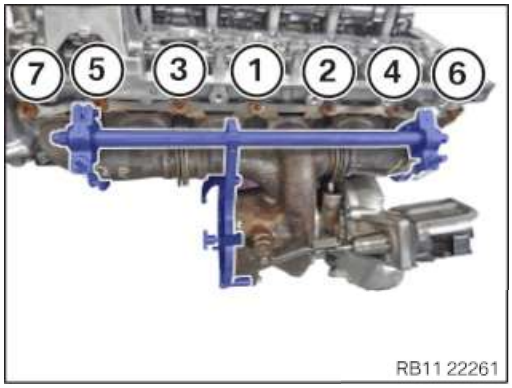
- Remove and install heavy components with the aid of another person/other persons.

- Insert and install the exhaust turbocharger (1).
- Thermal compensating elements of the exhaust turbocharger (1) or exhaust manifold should **not** be bent or deformed.

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- Feed in and install the sliding rail (1).
- Install sliding rail (1) so that the part number is **seen**.

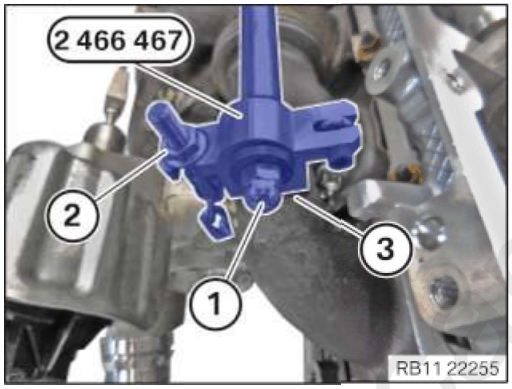


- Tighten nuts in sequence (1) to (7).

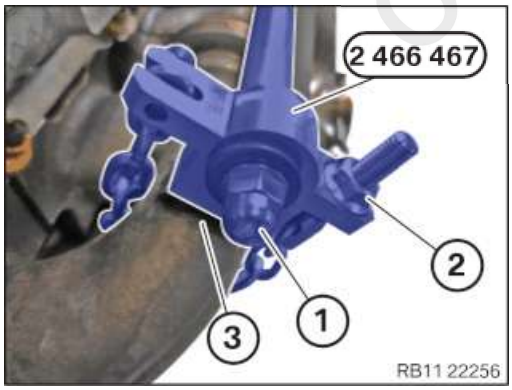
Exhaust manifold to cylinder head

Flange nutM7	*Replace flange nuts*	1. Jointing torque	10 Nm
		2. Jointing torque	10 Nm
		3. Jointing torque	16 Nm
		4. Jointing torque	16 Nm
		5. Jointing torque	16 Nm

- Make sure the thermal compensating elements (A) have **not** been damaged.

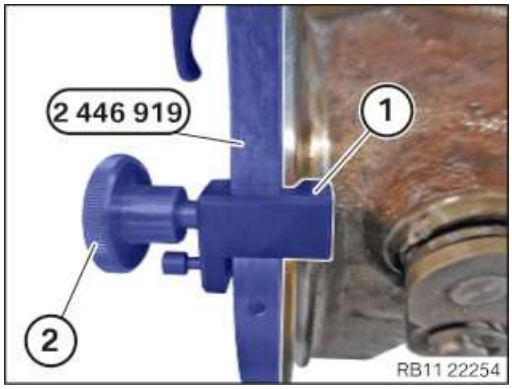


- Loosen nuts (1) and (2).
- Pull out special tool 2 466 467 at the exhaust turbocharger (3) and remove.



- Release the nut (1) and (2).
- Pull out special tool 2 466 467 at the exhaust turbocharger (3) and remove.

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- Loosen screw (2).
- Feed out the bracket (1) of the special tool 2 446 919 and set it aside.



- Release clamping lever (1) of the special tool 2 446 919 in the **direction of arrow**.



- Loosen screw (1).
- Pull out special tool 2 446 919 at the exhaust turbocharger and remove.

Additional Information

Overview of Tightening Torques

Special tool 2 466 467 to special tool 2 446 919 — Used in step 1

M8		Tightening torque	5 Nm

Flange to assembly stand — Used in step 2

M14X30		Tightening torque	135 Nm

Cylinder head on device — Used in step 2

M10X90x1.5		Tightening torque	30 Nm

Exhaust camshaft to cylinder head — Used in step 16

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

Eccentric shaft to bearing support/cylinder head — Used in step 17

M6			10 Nm

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Electrical servomotor to cylinder head — Used in step 18

M6		Tightening torque	8 Nm

Intake camshaft to cylinder head — Used in step 19

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque.	10 Nm

Gate to bearing bracket — Used in step 22

M8			20 Nm

Exhaust manifold to cylinder head — Used in step 27

Flange nutM7	*Replace flange nuts*	1. Jointing torque	10 Nm
		2. Jointing torque	10 Nm
		3. Jointing torque	16 Nm
		4. Jointing torque	16 Nm
		5. Jointing torque	16 Nm

Overview of Special Tools

2 446 919 Locating fixture



Common — Used in step 127

Usage	For installation and de-installation of the exhaust turbocharger module. Engine: B58.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 08 16 (383)

2 466 467 Device



Common — Used in step 127

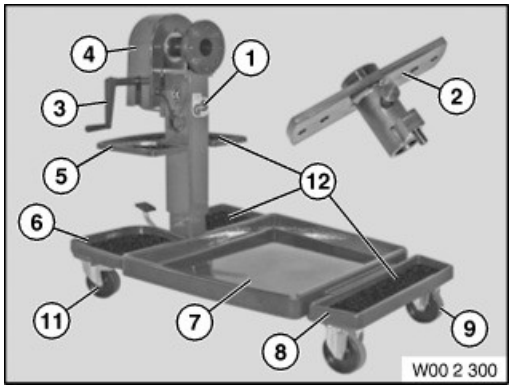
Usage	For removing and installing the exhaust turbocharger. Engine: B58O1.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 18 (545)

0 495 187 (00 2 300) Assembly stand

Common — Used in step 2

Usage	Assembly stand with universal flange for mounting engines from S85
Included in the tool or work	
Storage location	Individual

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Replaced by	
In connection with	
SI-Number	01 25 04 (155)

Consisting of

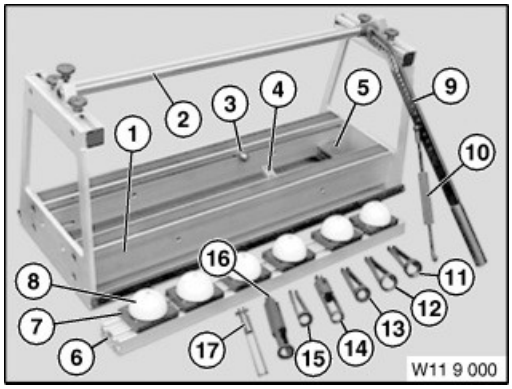
Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 188 (00 2 301)		**Assembly stand** available only as complete assembly stand 83 30 0 495 187.	
2	0 495 189 (00 2 302)	2 299 563	**Tool** (Universal flange). Do not use any more!!! Technically locked. Replaced with a new flange with 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.	

0 494 362 (11 9 000) Device

Common Used in step 212

Usage	(Cylinder head expander tool)

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Included in the tool or work

Storage location	Individual
Replaced by	
In connection with	002300 = 0495187
SI-Number	01 03 02 (833)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 494 366 (11 9 001)		**Device**	
6	0 494 371 (11 9 006)		**Insert** (Aluminium strip)	
11	0 494 376 (11 9 012)		**Basket** (Valve spring cage) Engine M41, M51, S50	
17	0 495 028 (11 9 017)		**Basket** (Valve spring cage) Engine N52	
2	0 494 367 (11 9 002)		**Rod**	
3	0 494 368 (11 9 003)		**Adapter** (Sliding block)	
4	0 494 369 (11 9 004)		**Tab**	
5	0 494 370 (11 9 005)		**Quick fastener**	
7	0 494 372 (11 9 007)		**Shaped part** (shaped part)	
8	0 494 373 (11 9 008)		**Shaped part** (Shaped part) Shaped part made of plastic	
9	0 494 374 (11 9 009)		**Lever**	
10	0 494 375 (11 9 011)		**Hook**	
12	0 494 377 (11 9 013)		**Basket** (Valve spring cage) Engine M43, M73	
13	0 494 378 (11 9 014)		**Basket** (Valve spring cage) Engine M44, M52, M54, M56, M62, S52, S54, S62	
14	0 494 379 (11 9 015)		**Basket** (Valve spring cage) Engine M47, M47TU, M57, M57TU, N40, N42, N62, N73	
15	0 494 380 (11 9 016)		**Basket** (Valve spring cage) Engine M21, M40	

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2 220 718 Workshop crane

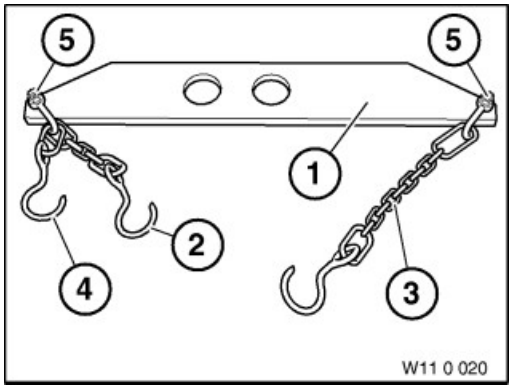


Common	Used in step 226
Usage	WSK 1000
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	06 01 11 (701)

0 490 567 (11 0 020) Lifting gear

Used in step 226

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Common

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.	

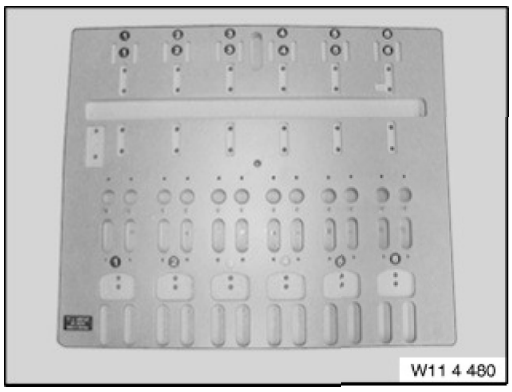
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2 359 088 Device



Common	Used in step 425
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 45679101112
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	

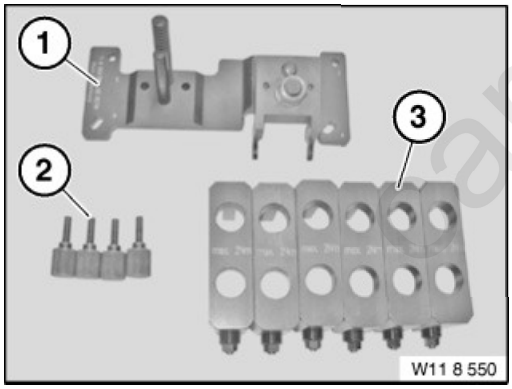
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2 410 670 Device



Common	Used in step 1016
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)

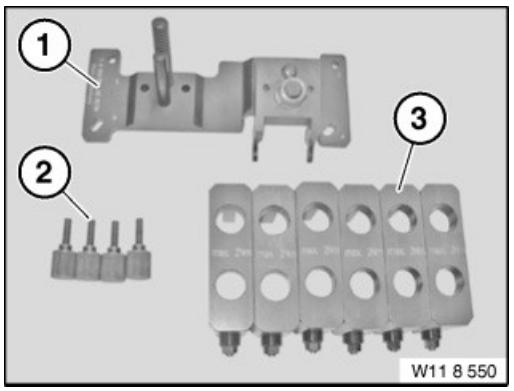
0 495 741 (11 8 552) Screw



Common	Used in step 1016
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 10

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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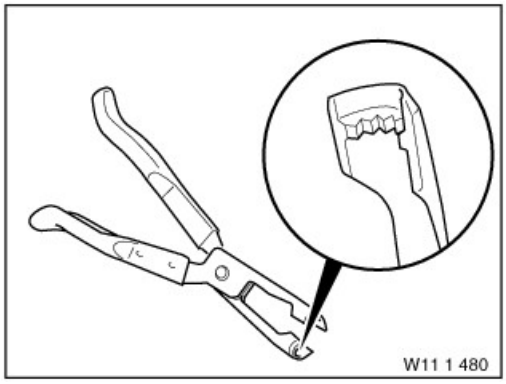
0 496 143 (11 8 840) Basket



Common Used in step 1214

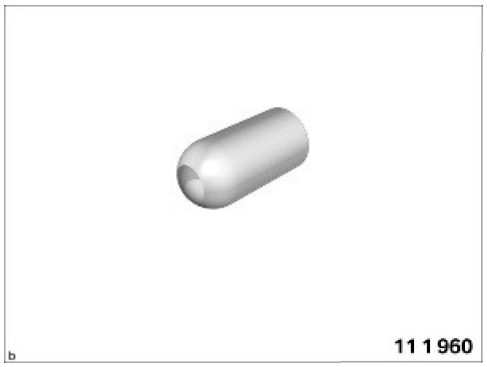
Usage	(Valve spring cage) For removing and fitting the valves.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

0 490 796 (11 1 480) Pliers



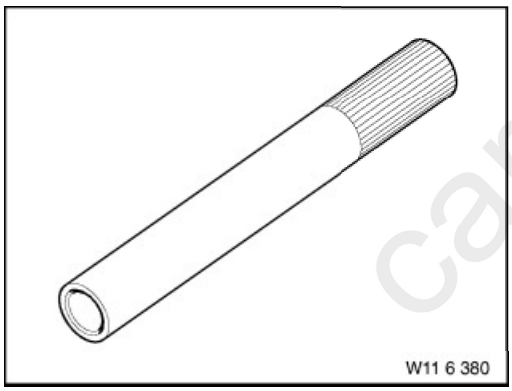
Common	Used in step 13
Usage	For removing valve stem seal
Included in the tool or work	
Storage location	A10
Replaced by	
In connection with	
SI-Number	01 01 93 (621)

0 490 797 (11 1 960) Holding sleeve



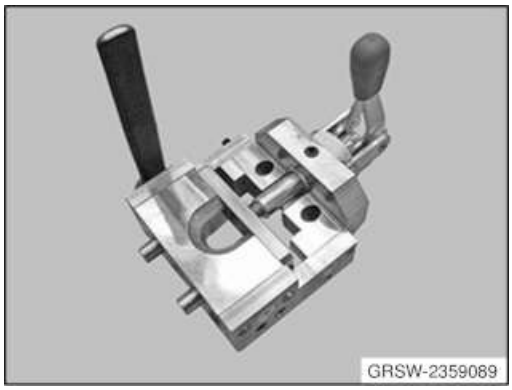
Common	Used in step 13
Usage	(Assembly sleeve) For fitting valve stem seals, 6 mm diameter
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	

0 493 249 (11 6 380) Bush



Common	Used in step 13
Usage	For fitting valve stem seal
Included in the tool or work	
Storage location	A9
Replaced by	
In connection with	
SI-Number	01 06 98 (306)

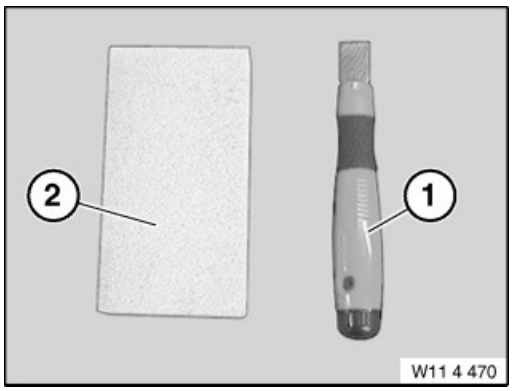
2 359 089 Device



Common	Used in step 22
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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0 495 102 (11 4 470) Tool



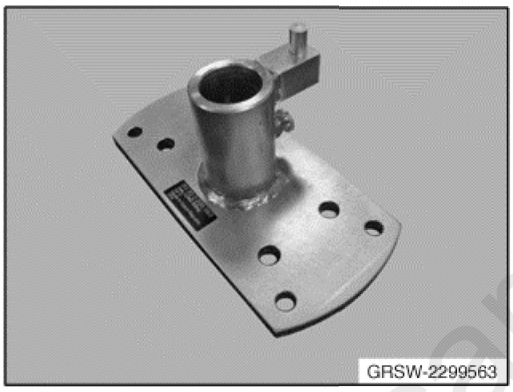
Common	Used in step 27
Usage	(cleaning kit) For cleaning sealing surfaces on magnesium crankcase/cylinder head.
Included in the tool or work	
Storage location	C52
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

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)	

Replacement tools:

2 299 563 Adapter



Common	Used in step 2
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	

Overview Technical Data

Screw-in depth of upper stud bolt on cylinder head	Used in step 27
Dimension A	30 mm

Links

Repair instructions	Used in step
61 35 ... Notes on ESD protection (Electro Static Discharge)	8

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11 36 044 Remove and install/replace the exhaust camshaft adjuster

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

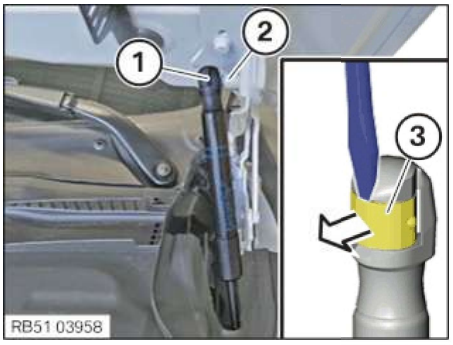
Engine compartment lid is open.

CAUTION

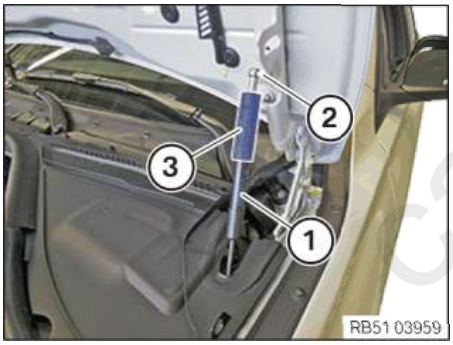
Shutting bonnet or tailgate.

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.

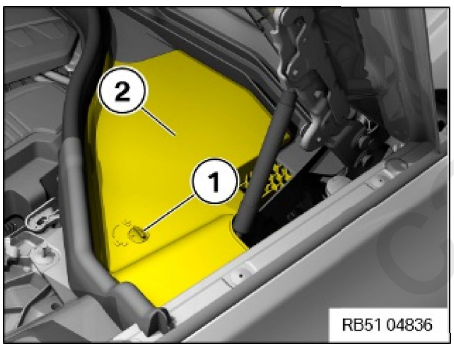
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- 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.



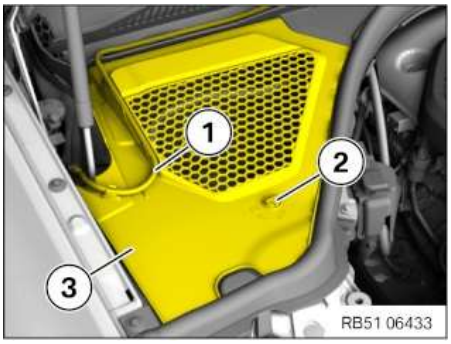
- Release the acoustic cover (1) towards the top from the rubber mounts (marks).

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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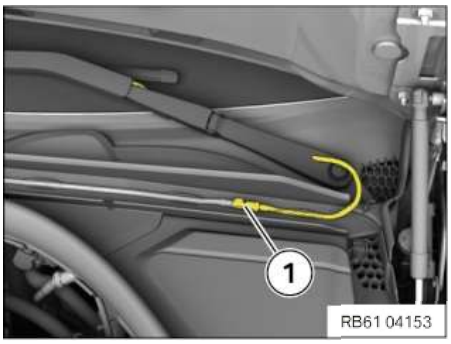
▸ **Remove the wiper arm**

RISK OF DAMAGE

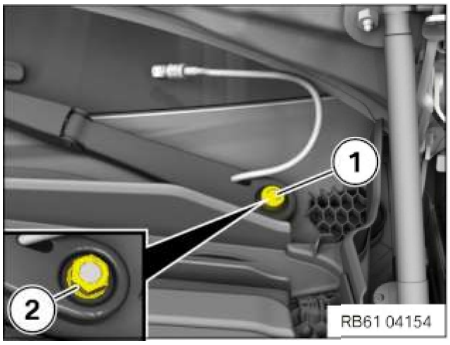
Damage to wiper console

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

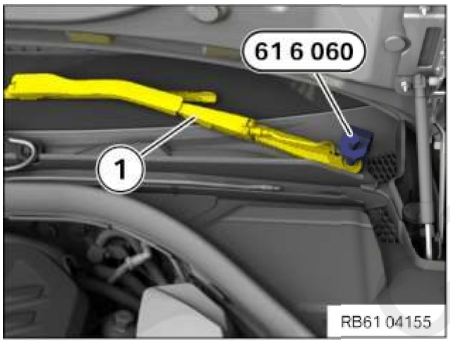
- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.



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

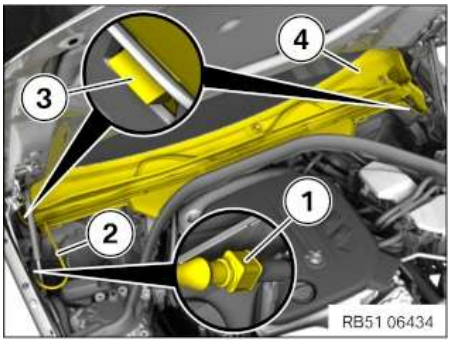


- Remove the protective cap (1).
- Loosen nut (2).



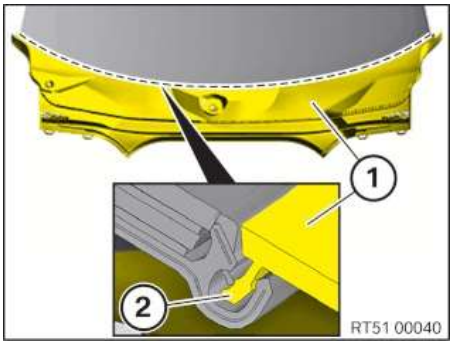
- Pull off the wiper arm (1) using special tool .

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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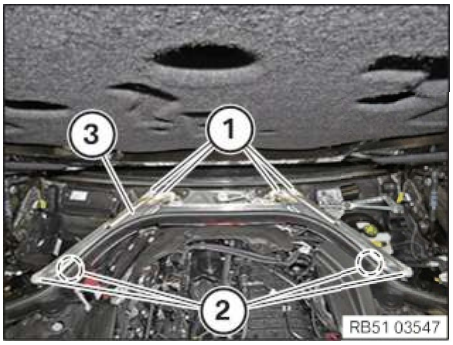


- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

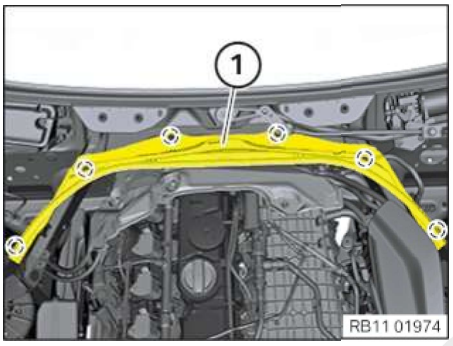
9 – Removing the centre bulkhead upper part

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.



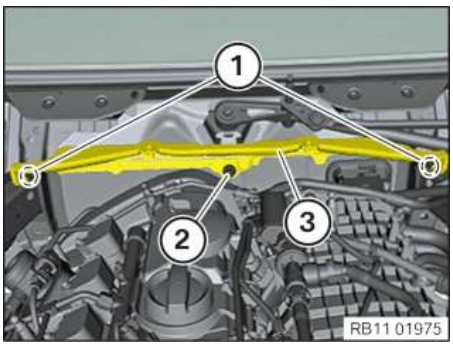
- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

10 – Removing acoustic cover at rear



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

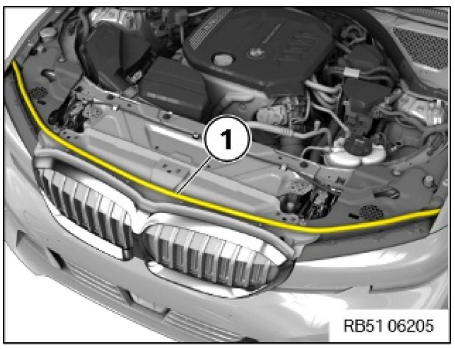
11 – Removing the centre bulkhead lower section



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

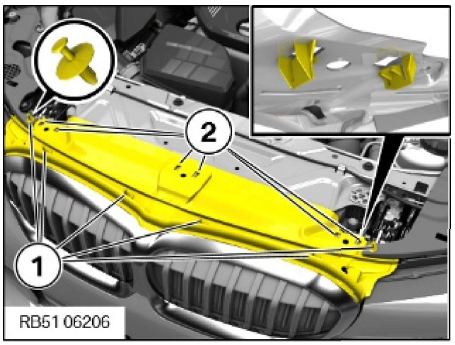
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12 – Remove the seal for the bonnet in front



- Pull off front bonnet seal (1) upwards.

13 – Removing the centre engine compartment cover



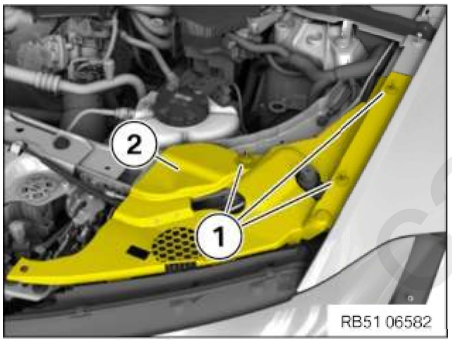
- Detach all expanding rivets (1).
- Release the cover of the centre engine compartment with the latch mechanisms (2) .
- Feed the cover for the centre engine compartment out to the rear.

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**



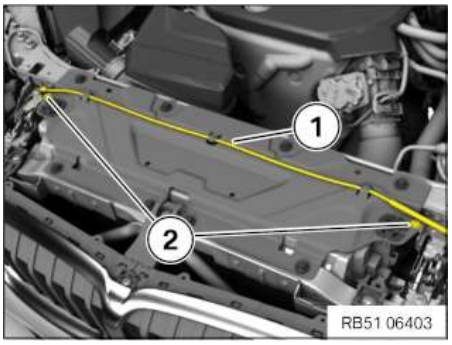
- Loosen the expanding rivet (1).
- Remove the cover in the engine compartment on top (2) partially.

15 – Removing the top cross connection

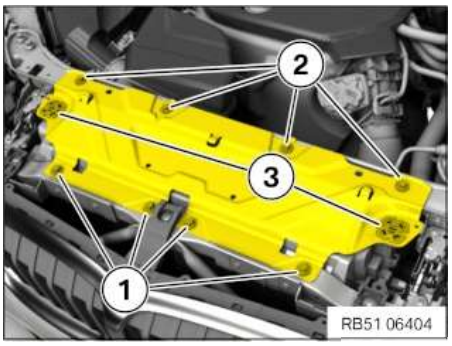


- Release the housing for the coupling of the Bowden cables (1) from the body.

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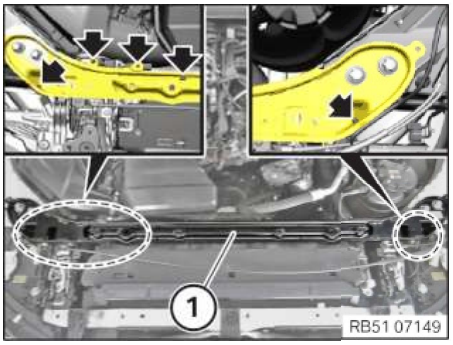


- Detach Bowden cable (1) at the top cross connection.
- Loosen screws (2).

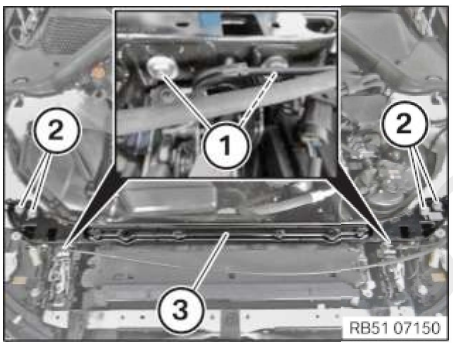


- Loosen screws (1) and (2).
- Remove the top cross connection with the holders(3) towards the top.

16 – Remove the rear top cross connection



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

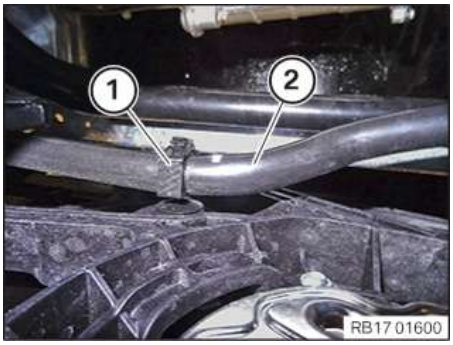


- Loosen screws (1).
- Loosen screws (2).
- Guide out and remove top rear cross connection (3).

17 – Remove fan cowl.

TECHNICAL INFORMATION

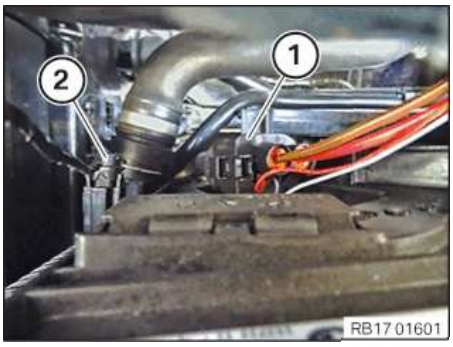
- When the engine is stopped after the end of the journey, it may be necessary to run the electric fan. In rare cases, operation of the electric fan can last up to 11 min. This protects the components. In this case, replacing the electric fan will not remedy the problem!



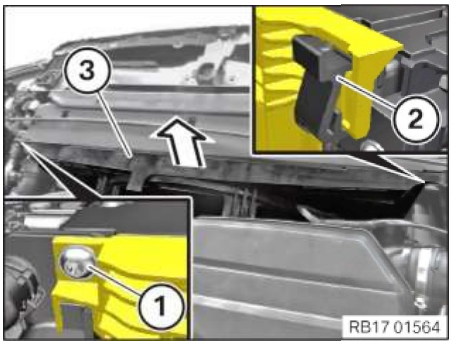
- **If installed:** Release transmission oil line (2).

  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.

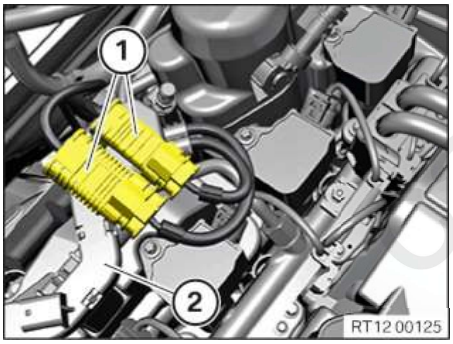
- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

RISK OF DAMAGE

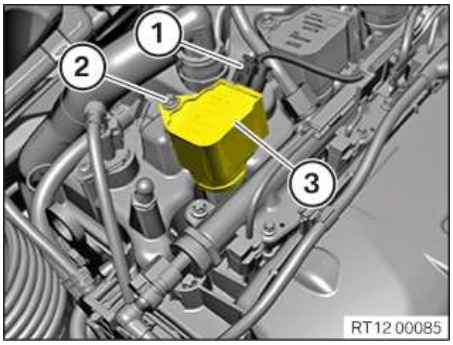
Electrostatic discharge.

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

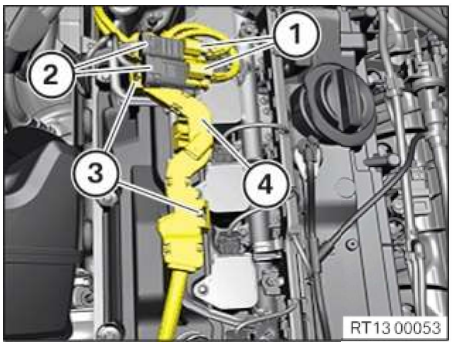
On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

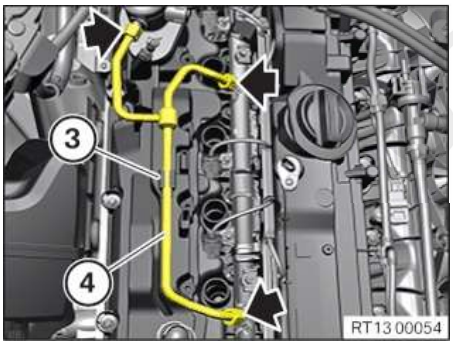
- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

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

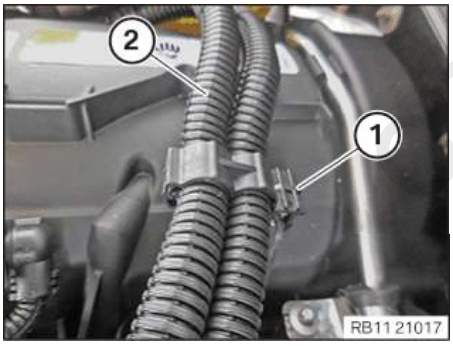
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

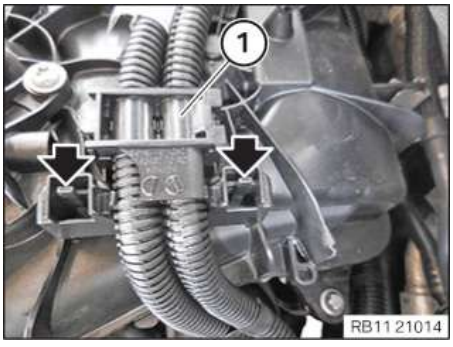
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

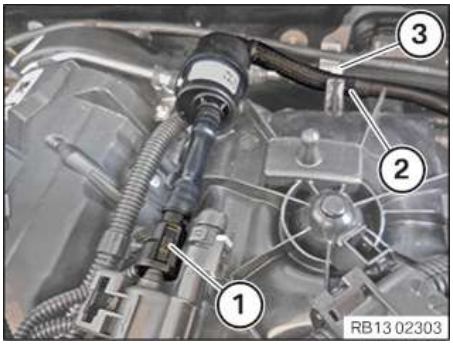
Reset special tool in early to avoid bending pressure lines.



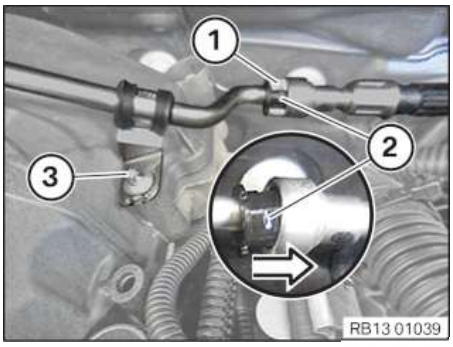
- Loosen clamp (1).
- Guide out wiring harness section (2) for the injectors and ignition coils and place it aside.



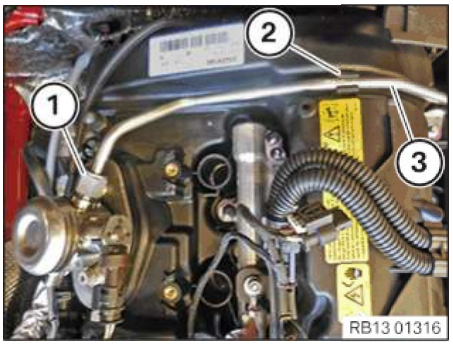
- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.



- 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

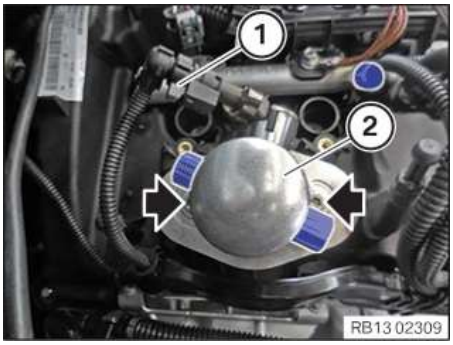
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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.

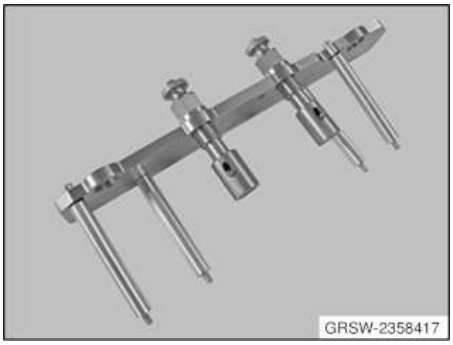
Excessive force may damage the injector and this means having to renew the injector.

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



- Prepare special tool .

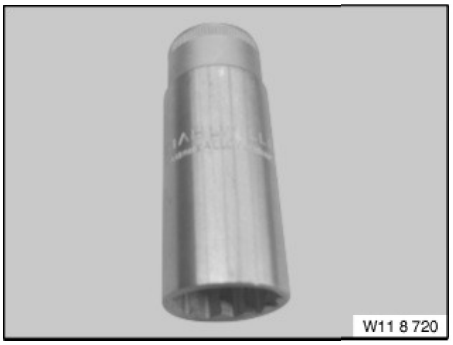
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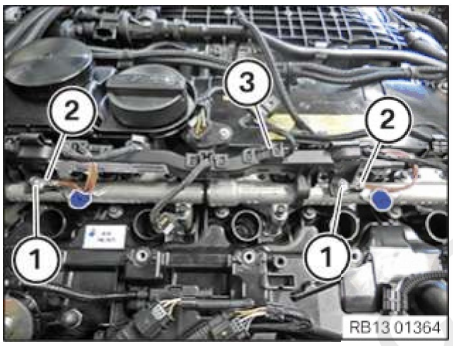
- Prepare special tool 2 358 417.



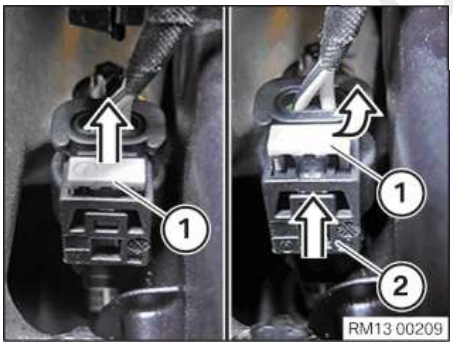
- Prepare special tool .



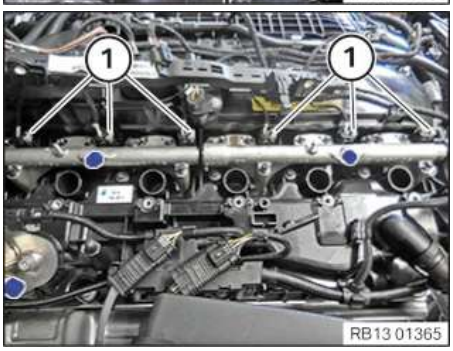
- Prepare special tool 0 496 106 (11 8 720).



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

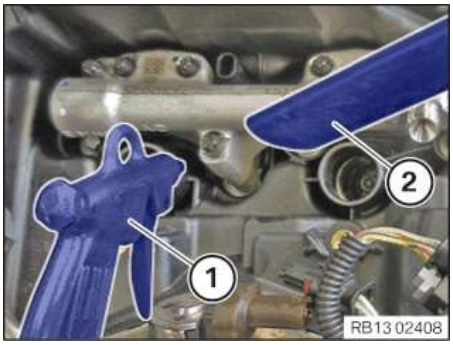


- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull out the connector (2) from the injectors.



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

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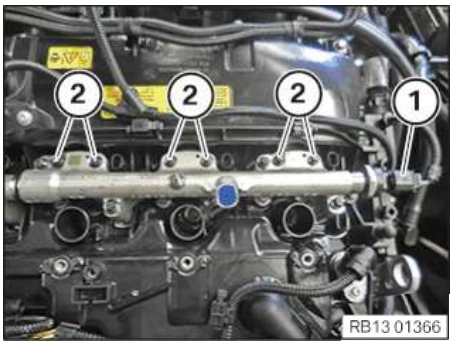


TECHNICAL INFORMATION

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

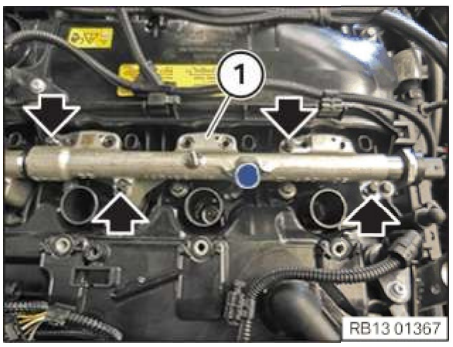
- Before releasing the high pressure lines: Blow out the injector shafts with an air gun(1) with less pressure.
- Simultaneously, draw off the dirt particles with an **explosion proof** vacuum cleaner (2).



- 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.

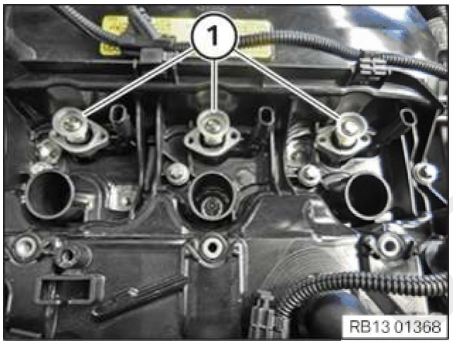


- Unscrew the screws (M6x30) (arrows).

  The screws may not be reused!
- Renew screws.

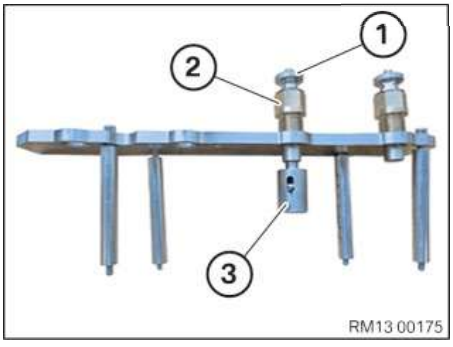
  Parts: Screws (M6x30)
- Remove rail (1) in upward direction.

  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.

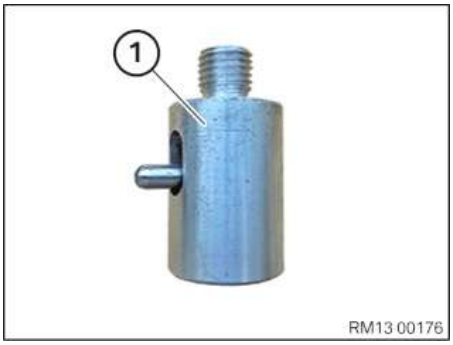
- Twist the injectors with a maximum torsional movement of 13 Nm.
- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use the special tool 2 358 417to remove the injectors.

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

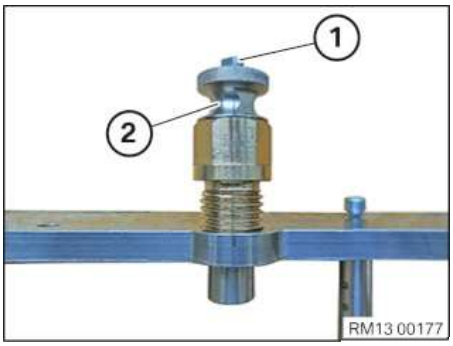
  Special tool 2 358 417 consists of:

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

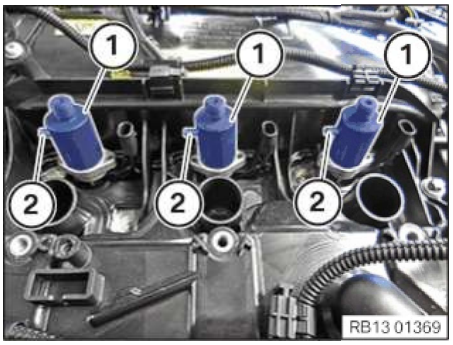
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- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.

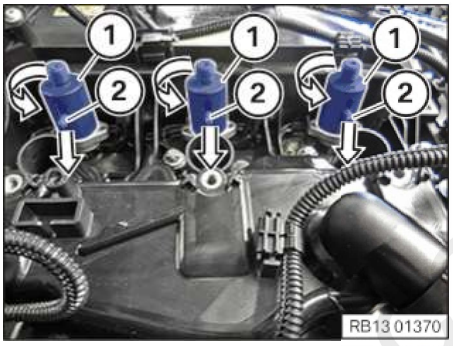


- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.

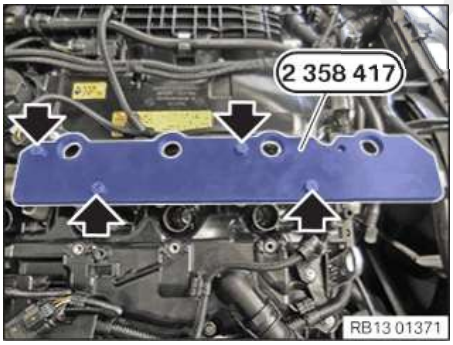


- Install all fixtures (1) for the injectors.

  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

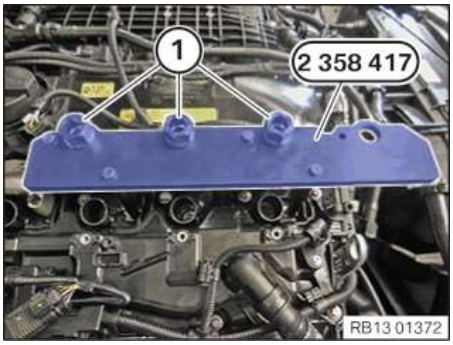
Damage to injectors.

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).

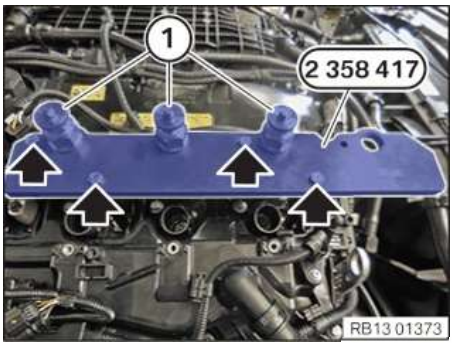
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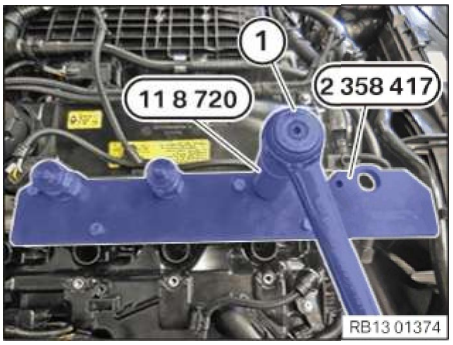
TECHNICAL INFORMATION

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.

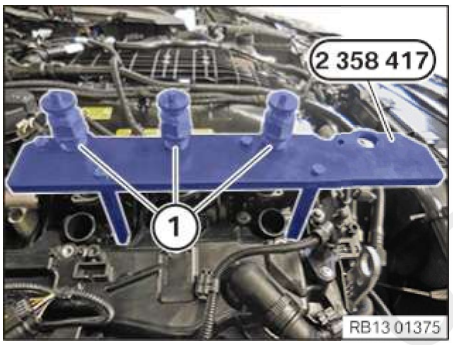


- Adjust torque wrench to 13 Nm **clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720)until the injector is pulled out.

TECHNICAL INFORMATION

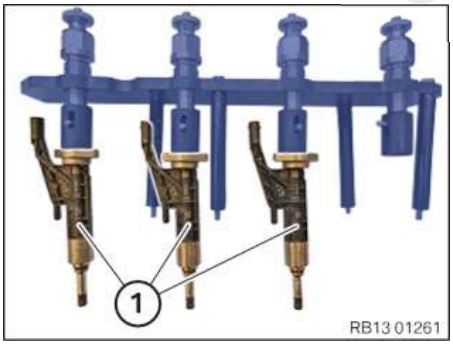
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

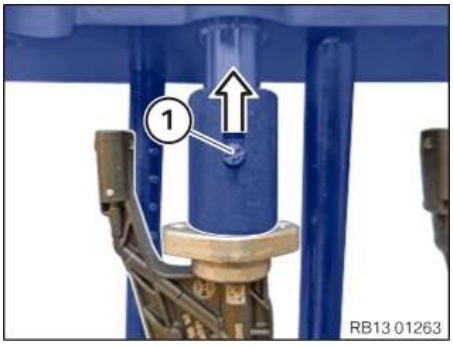


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  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.

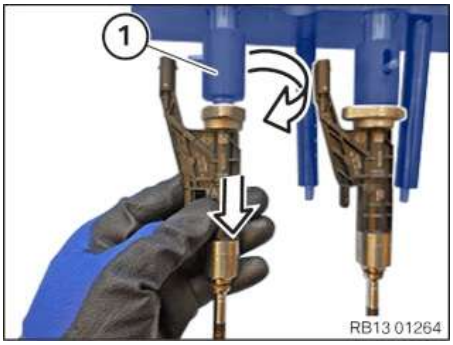


NOTICE

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.

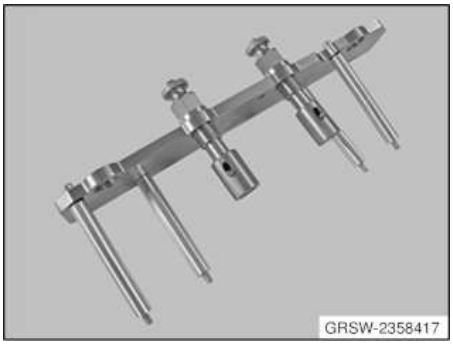
Excessive force may damage the injector and this means having to renew the injector.

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



- Prepare special tool .

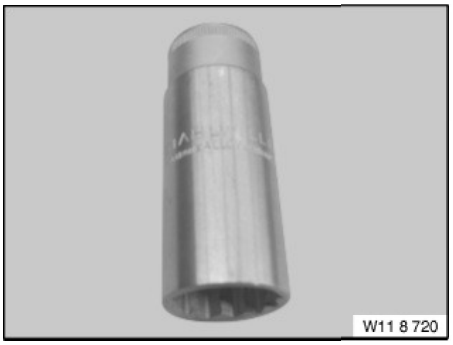
cardiagn.com



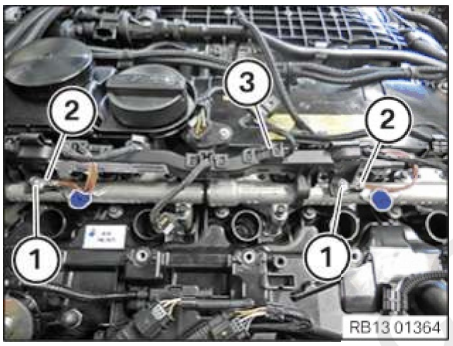
- Prepare special tool 2 358 417.



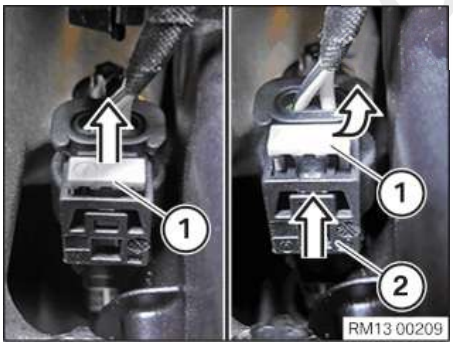
- Prepare special tool .



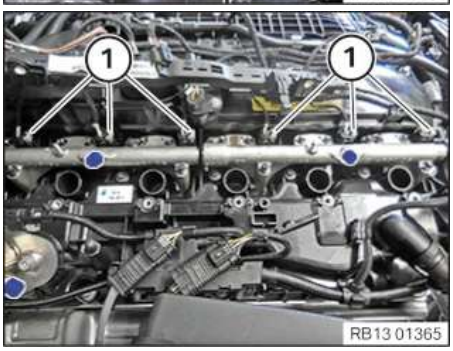
- Prepare special tool 0 496 106 (11 8 720).



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

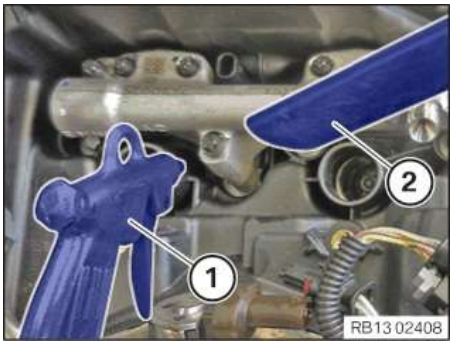


- Unlock lock (1) in direction of arrow upwards.
- Press lock (1) together and release.
- Disconnect the connector (2) from the injectors in the direction of the arrow.



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

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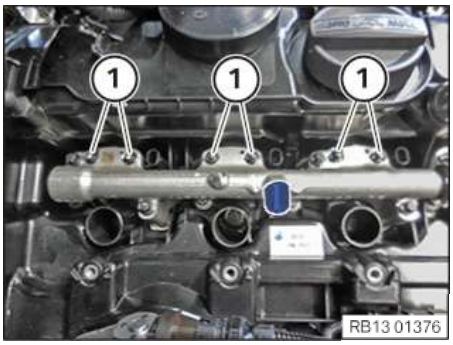


TECHNICAL INFORMATION

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

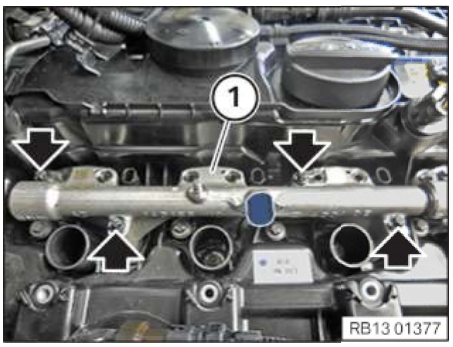
For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

- 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) .

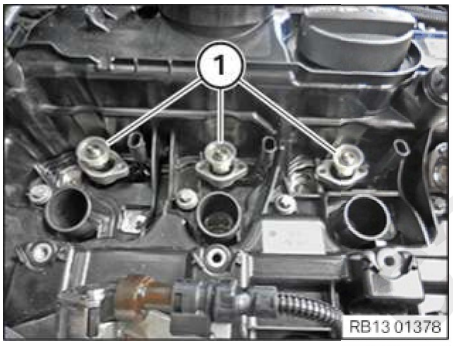
  Do **not** reuse screws (M5x30) (1).
- Catch and dispose of escaping fuel with suitable materials.



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

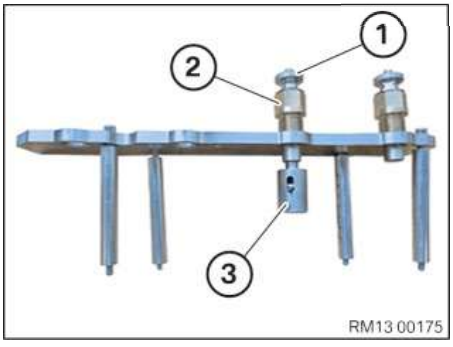
  Do **not** reuse the screws (M6x30).
- Remove rail (1) upwards.

  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.

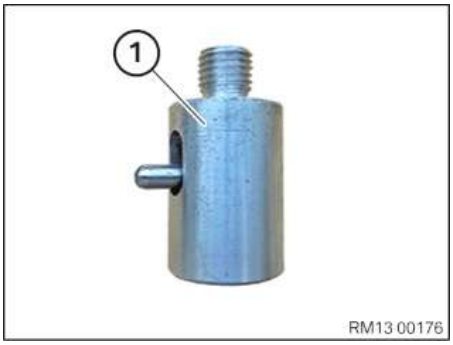
- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use the special tool 2 358 417 to remove the injectors.

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

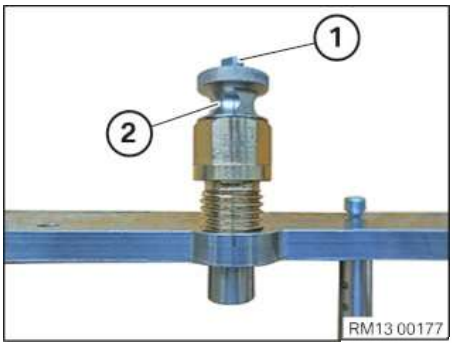
  The special tool 2 358 417 consists of:

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

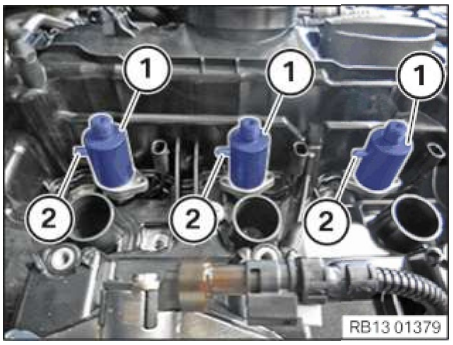
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- Unscrew the fixture for injectors (1) from special tool 2 358 417.

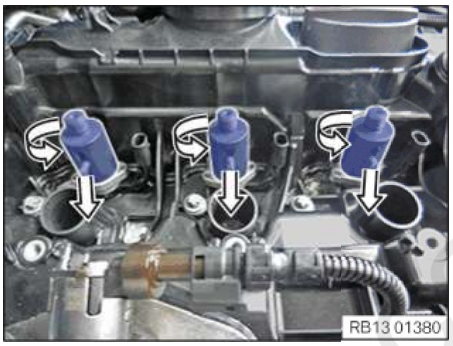


- Press lock (1) in and remove the threaded sleeve (2) from the special tool 2 358 417.



- 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

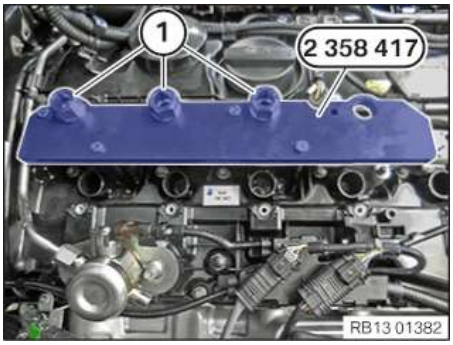
Damage to injectors.

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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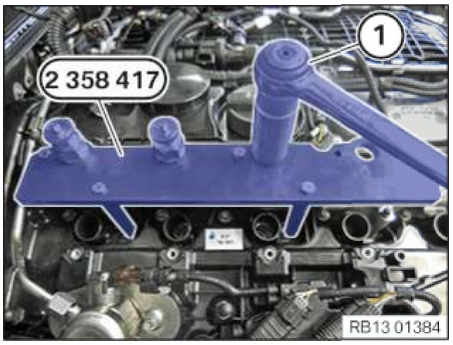
TECHNICAL INFORMATION

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.

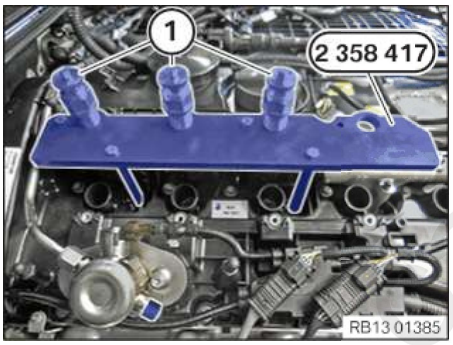


- Adjust torque wrench to 13 Nm **in clockwise** direction.
- Turn the torque wrench (1) with the special tool 0 496 106 (11 8 720) **clockwise**, until the injector is pulled out.

TECHNICAL INFORMATION

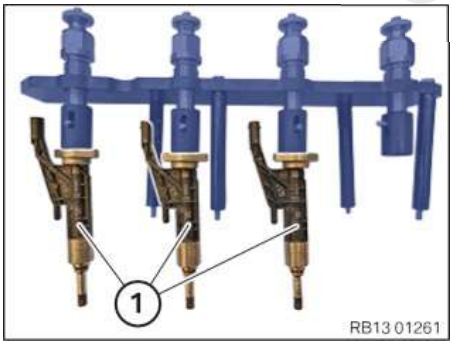
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

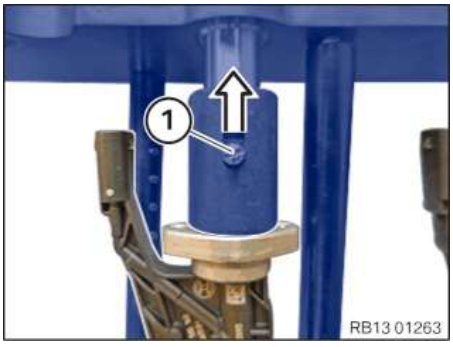


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  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.

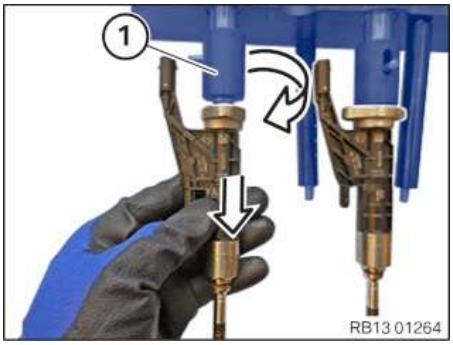


NOTICE

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.

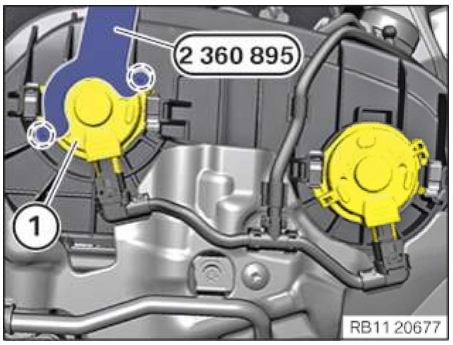
26 – Removing both actuators

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

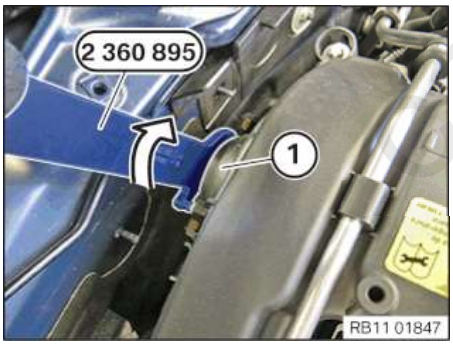
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the 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.



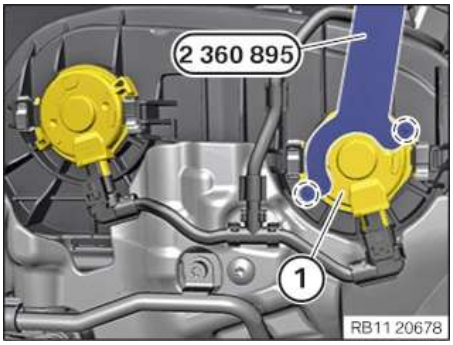
NOTICE

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.

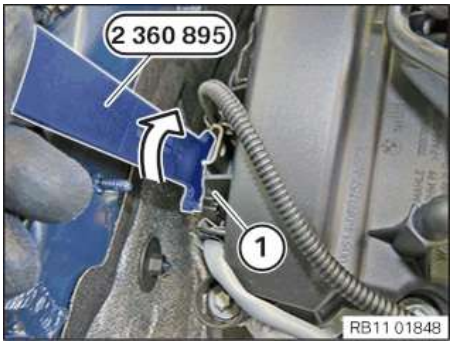


NOTICE

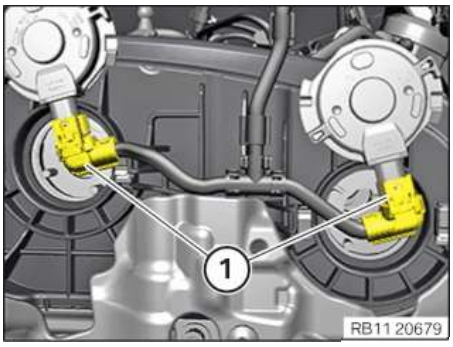
The figure shows the rear side of the engine.

- 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.



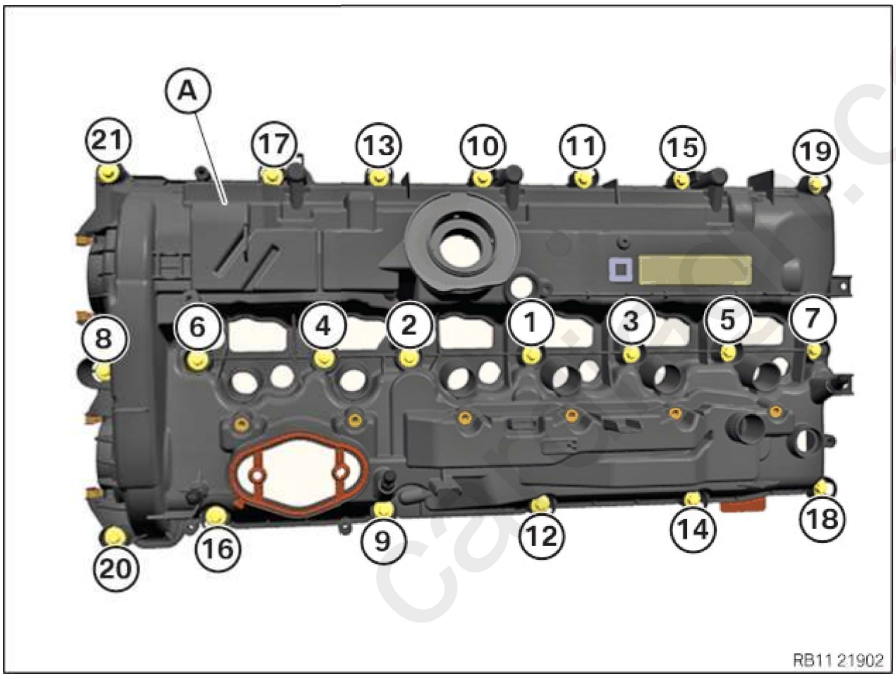
NOTICE

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

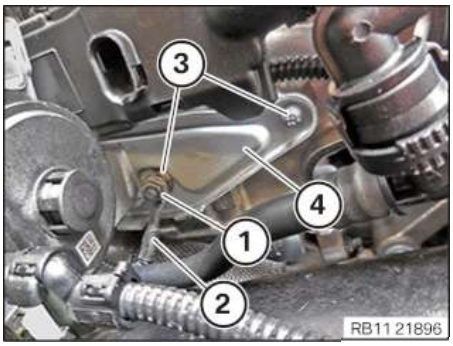
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

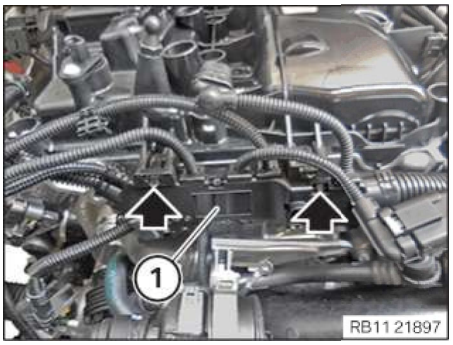
- Do not pull on the wires when disconnecting connectors and plug connections.



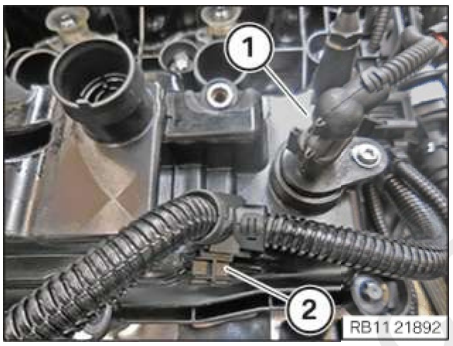
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



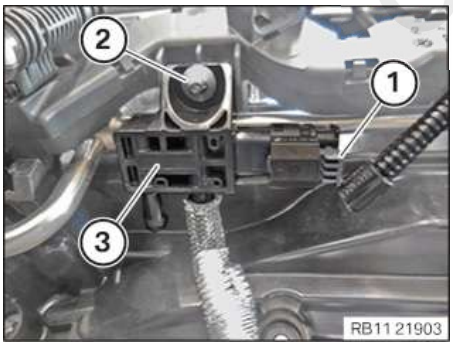
- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Loosen screws (3).
- Thread out holder (4) and set aside.



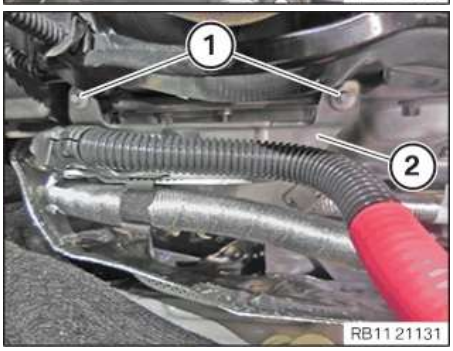
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for the sensor system **2** and place to one side.



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

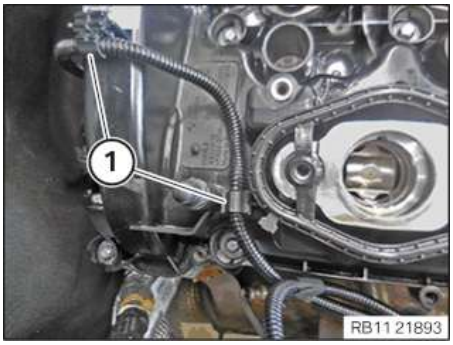


- **If installed:**
- Unlock and loosen connector (1).
- Loosen screw (2).
- Remove the differential pressure sensor (3) and put it to one side.

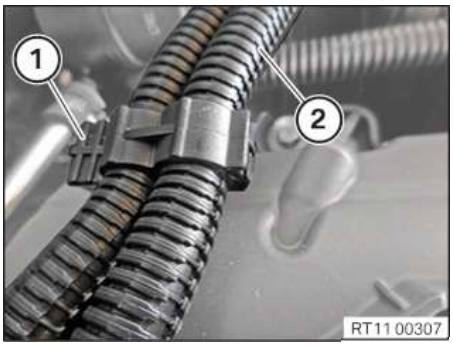


- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

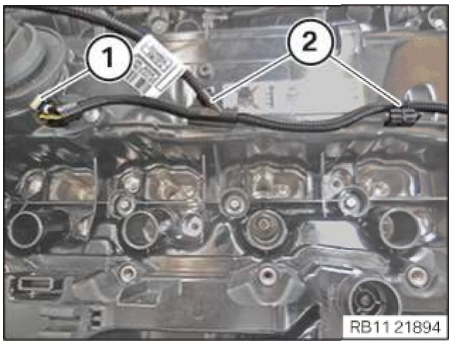
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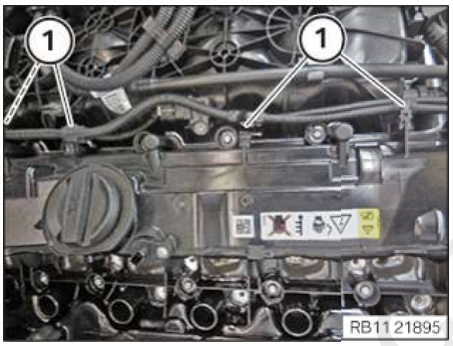
- Loosen clamps (1).



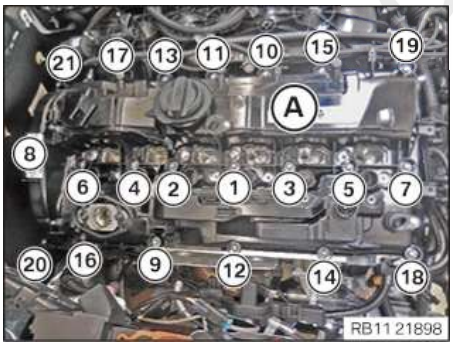
- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



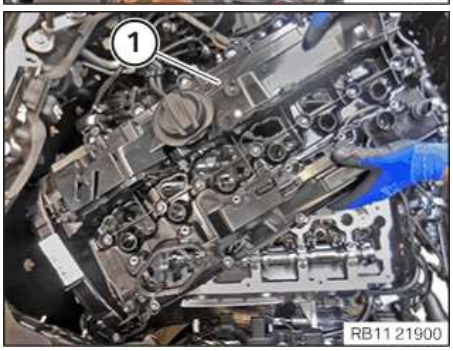
- Unlock and detach connector (1) on the intake camshaft sensor.
- Loosen clamps (2).



- Loosen clamps (1).



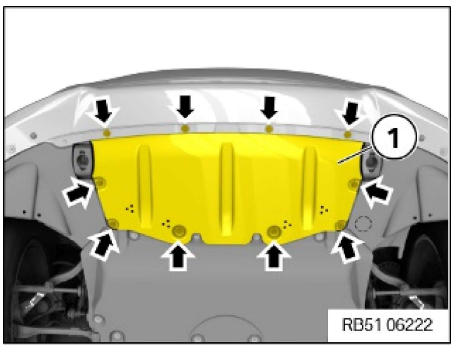
- Release all screws on the cylinder head cover (A) in the sequence (21) to (1).



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

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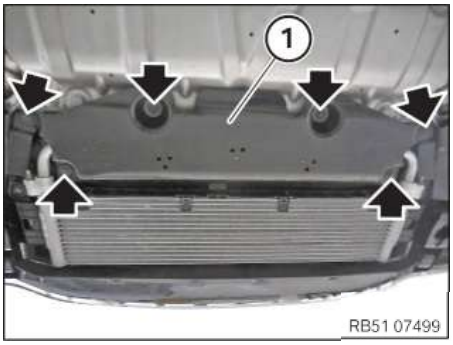
28 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

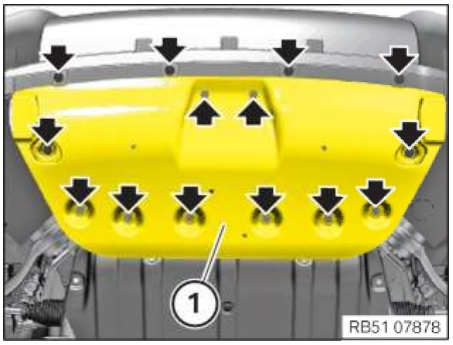
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

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

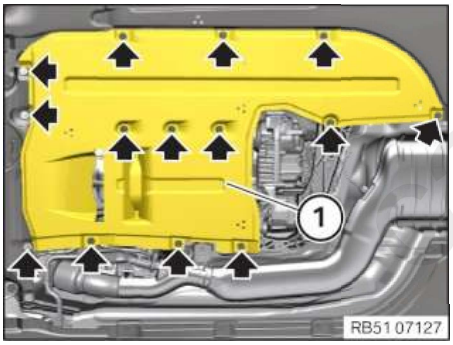


- **Version 3:**

  Remove screws (arrows).

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

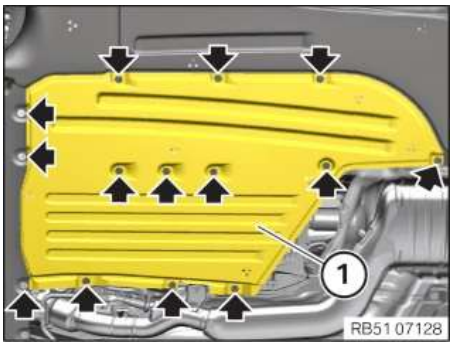
29 – Remove rear underbody protection



- **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

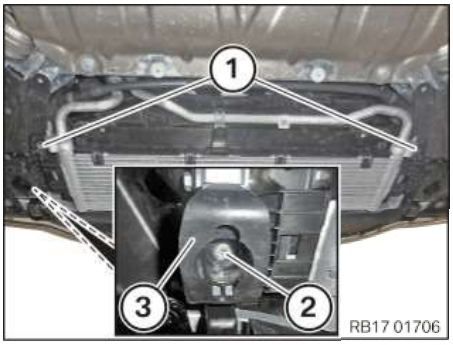
Hot surfaces.

Risk of burning!

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

TECHNICAL INFORMATION

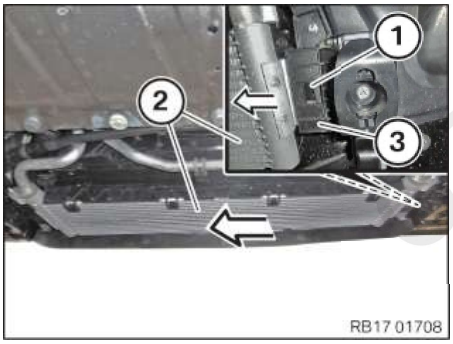
The work must be performed with care to prevent component damage.



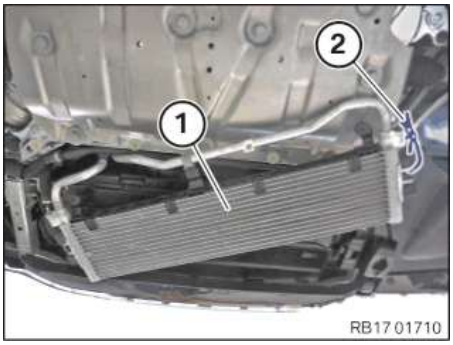
- Loosen screws (1).
- Drill out rivet on the left (2).
- Remove the left-hand damper (3).



- 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.



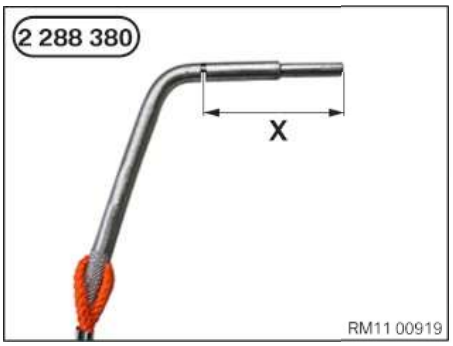
RISK OF DAMAGE

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.

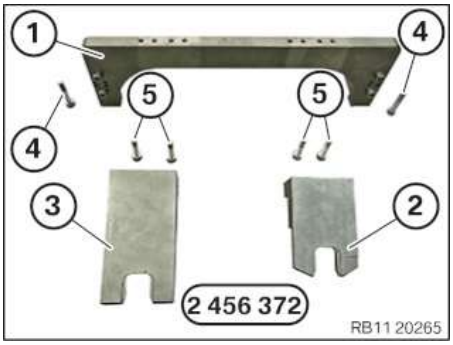


- **Vehicles with automatic transmission:**

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

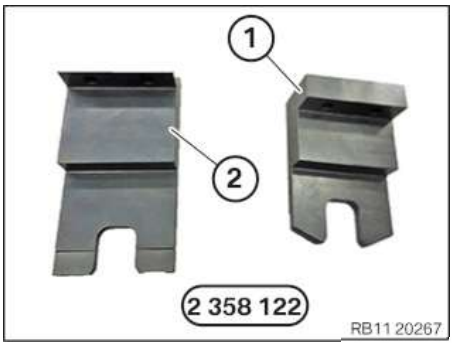
  The engine is in the TDC firing position of cylinder 1.

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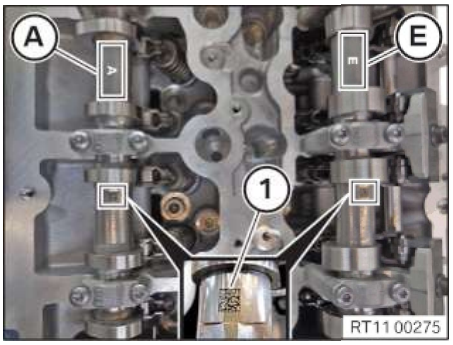
- Overview of the set of special tools 2 456 372:

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

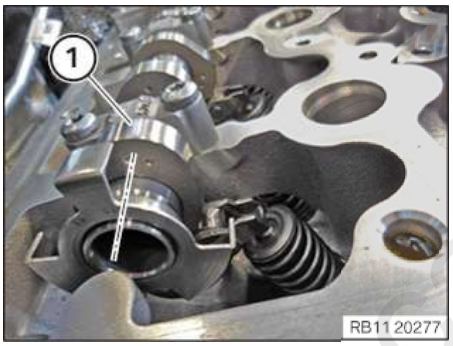


- Overview of the test gauges from the set of special tools 2 358 122:

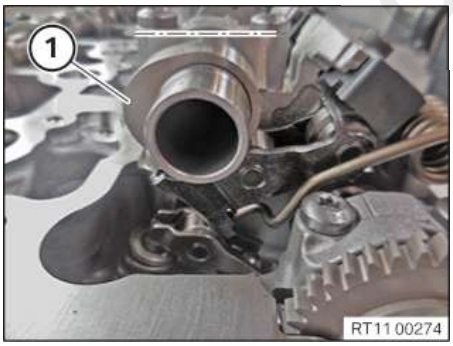
Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



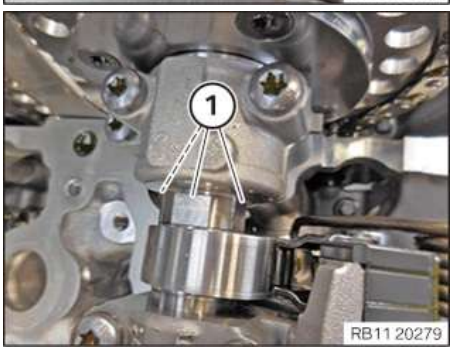
- Turn intake camshaft (E) and exhaust camshaft (A) until marks (1) can be read from the top.



- 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.

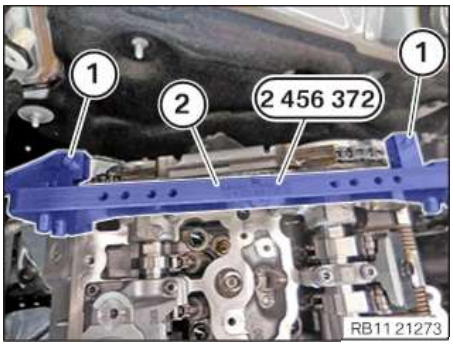


- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.

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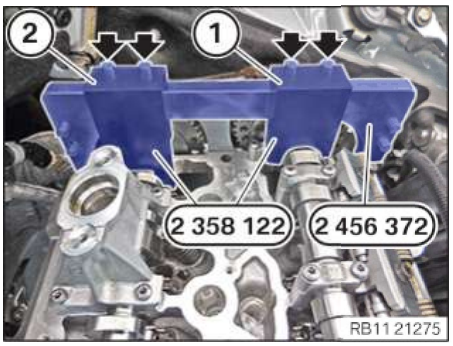
- Position basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- 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).

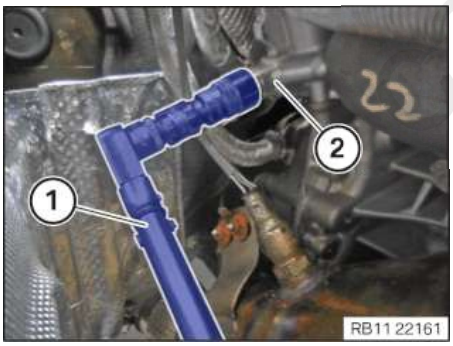
Test gauge to basic carrier

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).



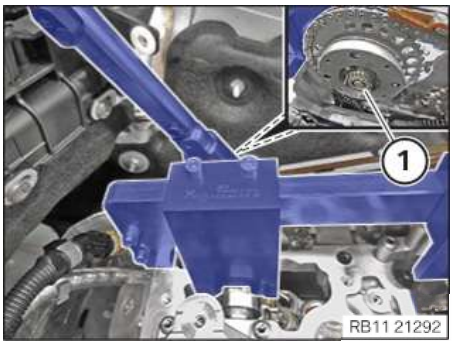
- Feed out and remove the chain tensioner (1).

MAIN WORK

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.

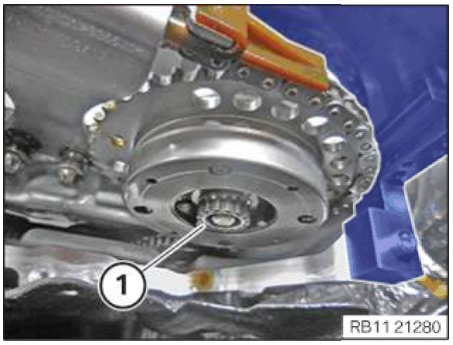


NOTICE

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

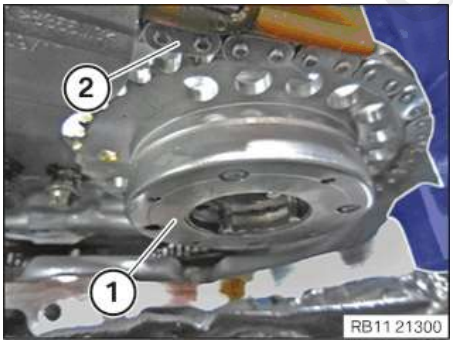


- Guide out and remove the VANOS central valve (1) of the exhaust camshaft adjuster.

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 – Install exhaust camshaft adjuster

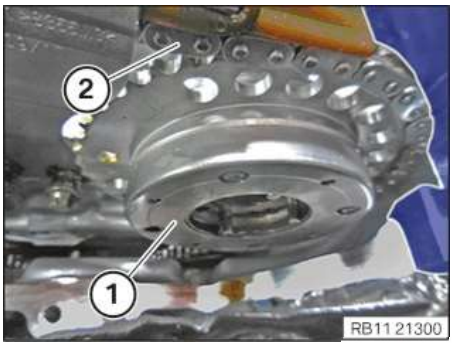
NOTICE

The figure shows the rear side of the engine.

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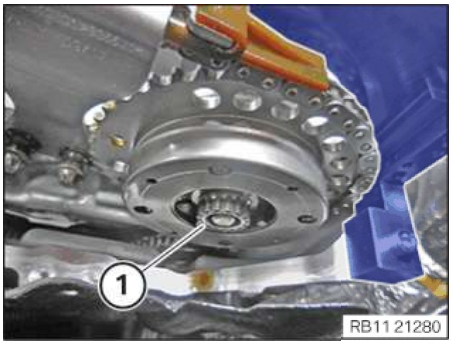


- Keep exhaust camshaft adjuster (1) marked EX ready.

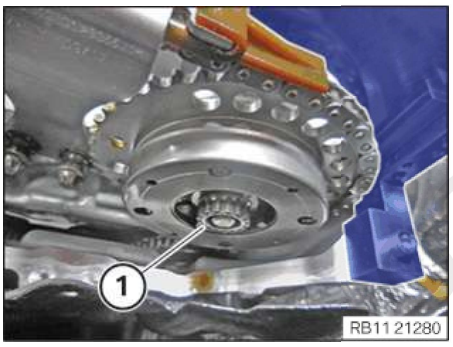


- Feed in exhaust camshaft adjuster (1) in the timing chain (2) and position on the exhaust camshaft .

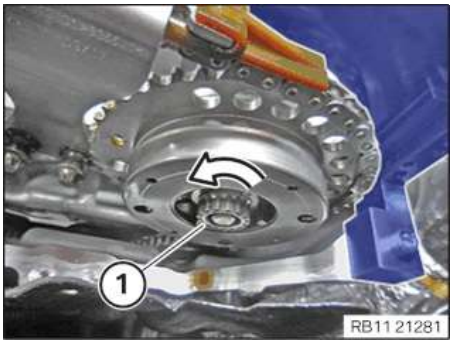
37 – Installing the VANOS central valve of the exhaust camshaft adjuster



- 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 °.

38 – Releasing the VANOS central valve of the intake adjuster

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- 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.

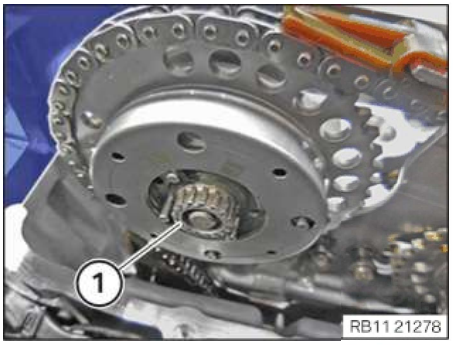


NOTICE

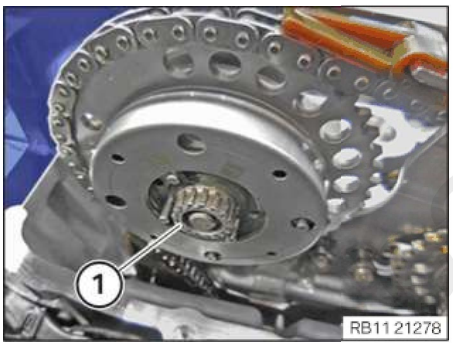
The figure shows the rear side of the engine.

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

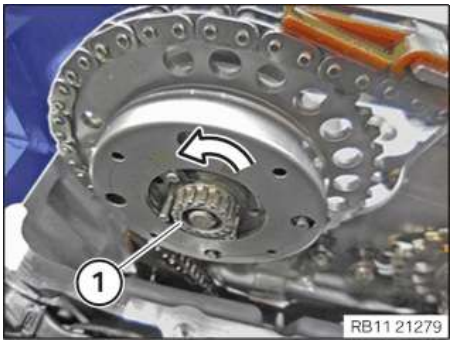
39 – Install the VANOS central valve of the intake adjuster



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



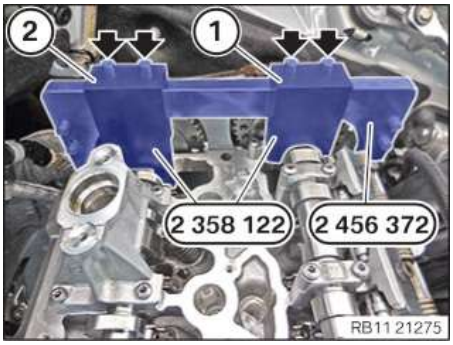
- Hand-tighten the VANOS central valve (1) of the intake adjuster.



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

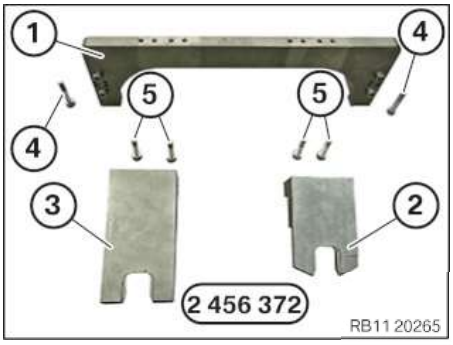
40 – Remove the test gauges to fix the camshafts

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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.

41 – Adjust the camshafts with the special tool

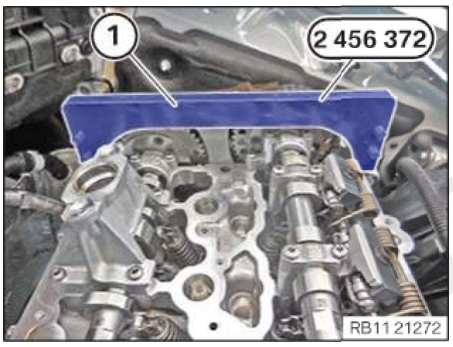


- Overview of the set of special tools 2 456 372:

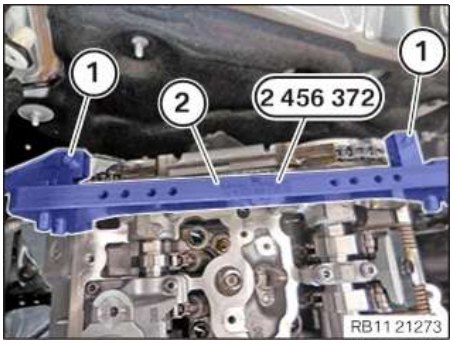
Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- 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.

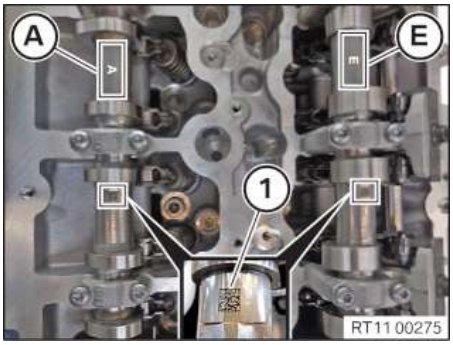


- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

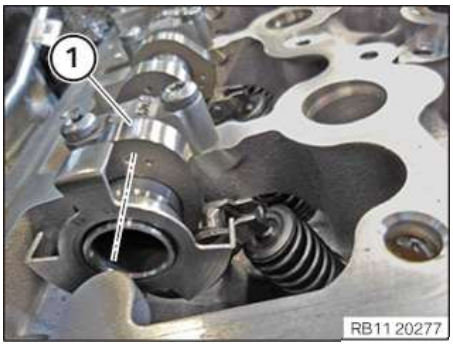
Basic carrier to cylinder head

M6		Tightening torque	8 Nm

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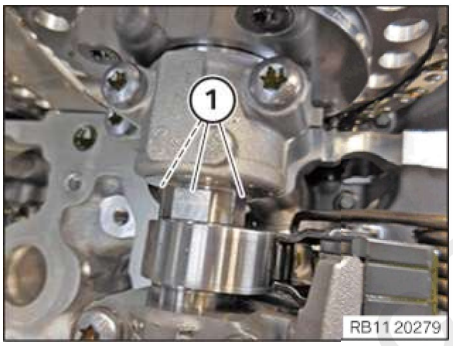
- Turn the intake camshaft (E) and the exhaust camshaft (A) such that the marks (1) can be read from the top.



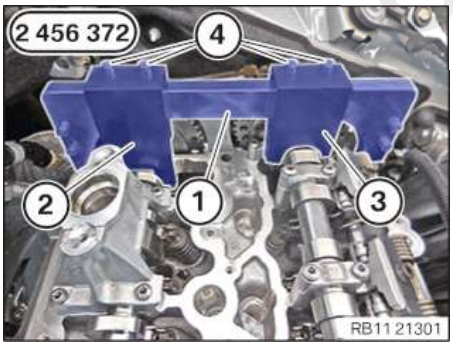
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- 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.



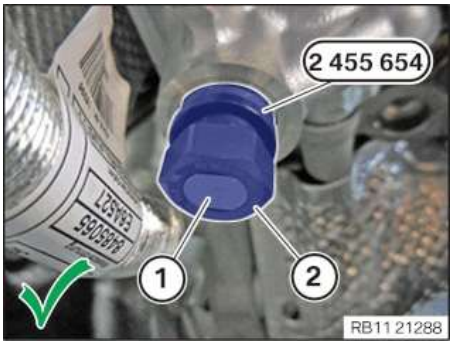
- Position the setting gauge 0.5° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten the screws (4).

Test gauge to basic carrier

M6		Tightening torque	8 Nm

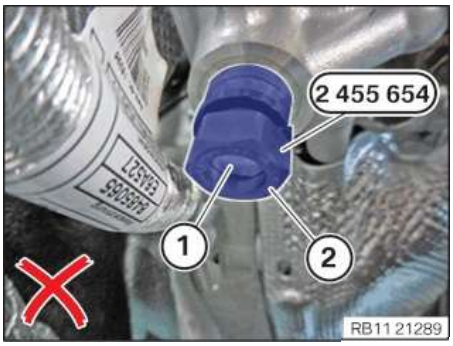
42 – Pretension the timing chain with the special tool

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

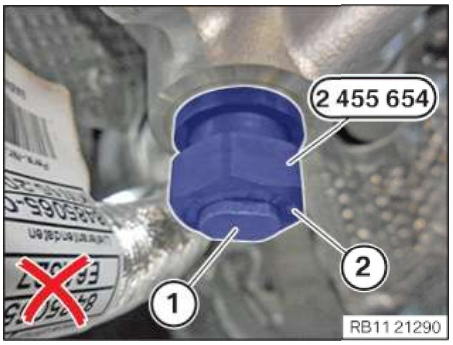
  The pin (1) must align **precisely** with housing (2).



- 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**.

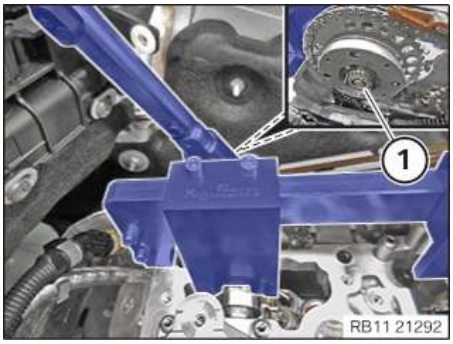
  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

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

43 – 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 °

44 – 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.



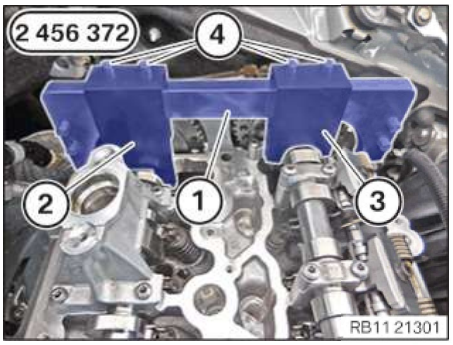
- Tighten the VANOS central valve (1) of the intake adjuster.

VANOS central valve to camshaft

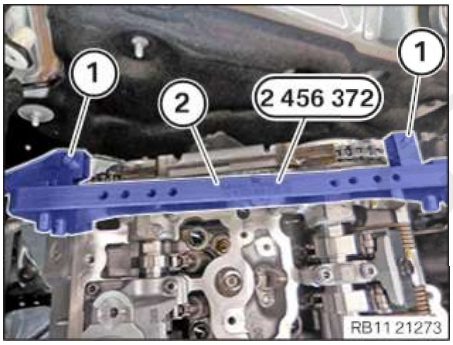
M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

POSTPROCESSES

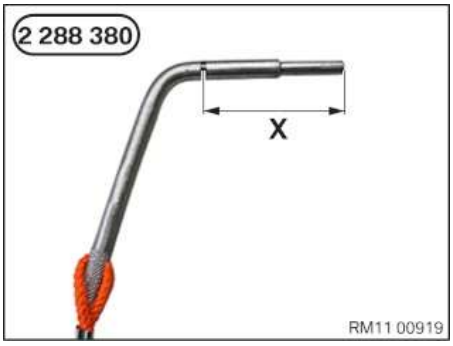
45 – Disassembling all special tools



- 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.

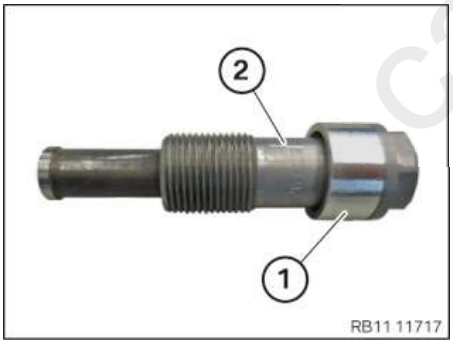
46 – Install chain tensioner

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.



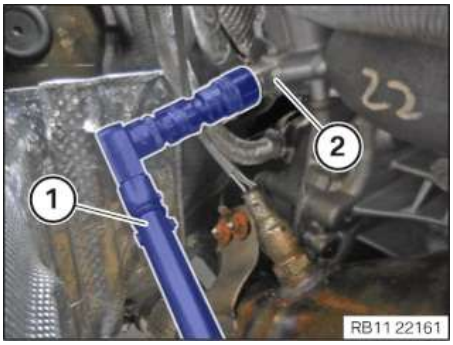
- Renew the sealing sleeve (1).

  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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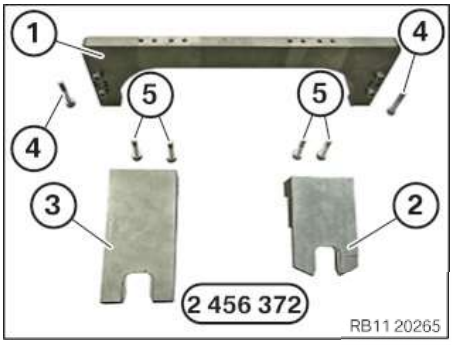


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

47 – 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

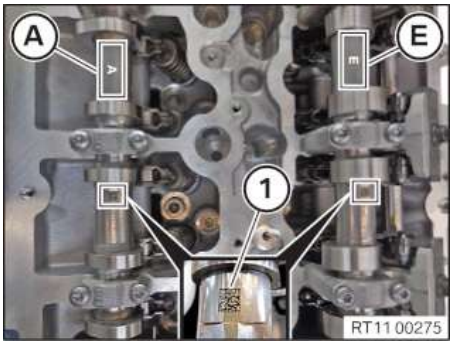
Damage to the engine.

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

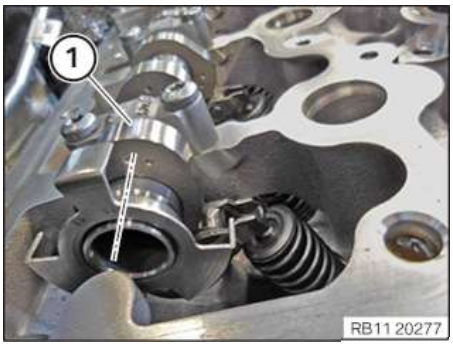
- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

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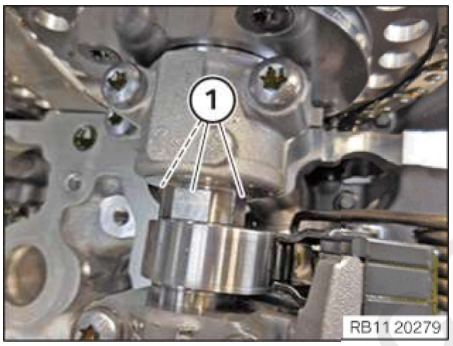
- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.



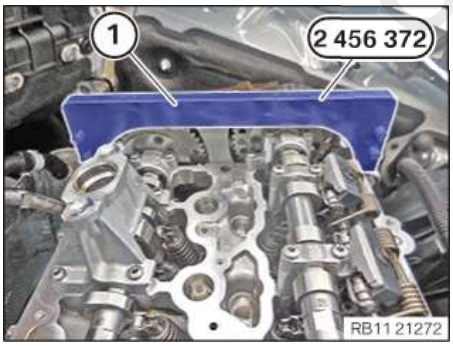
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



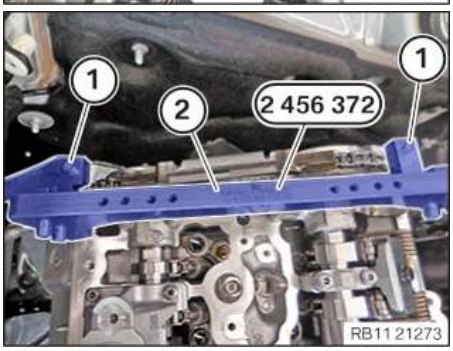
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.



- 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.

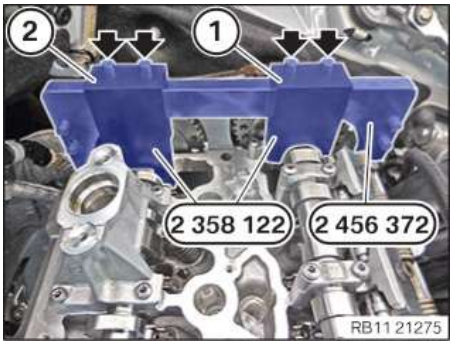


- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm

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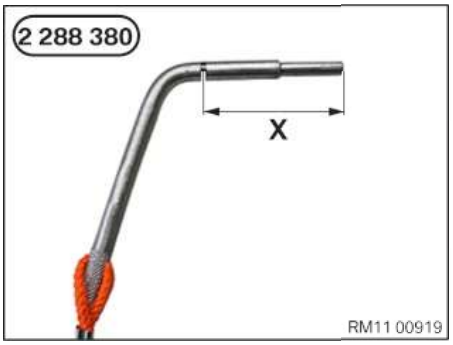
- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special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



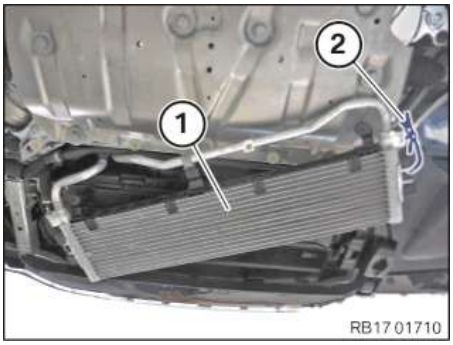
- **Vehicles with automatic transmission:**

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

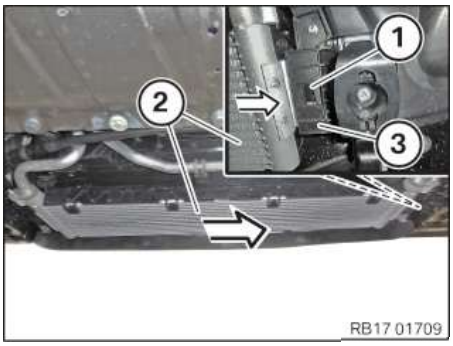
  The engine **is in the** TDC firing position of cylinder 1.

48 – If installed: Secure engine oil cooler

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



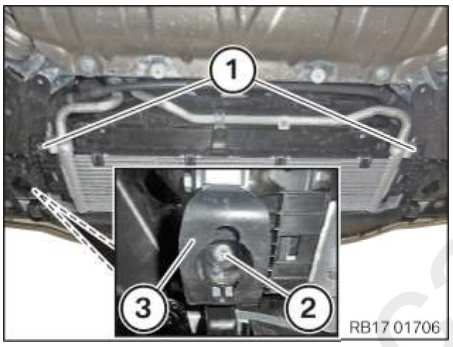
- Feed in and install the engine oil cooler (2) on the holder (3) in the direction of the arrow.
- Ensure that the lock (1)engages audibly.



- 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).

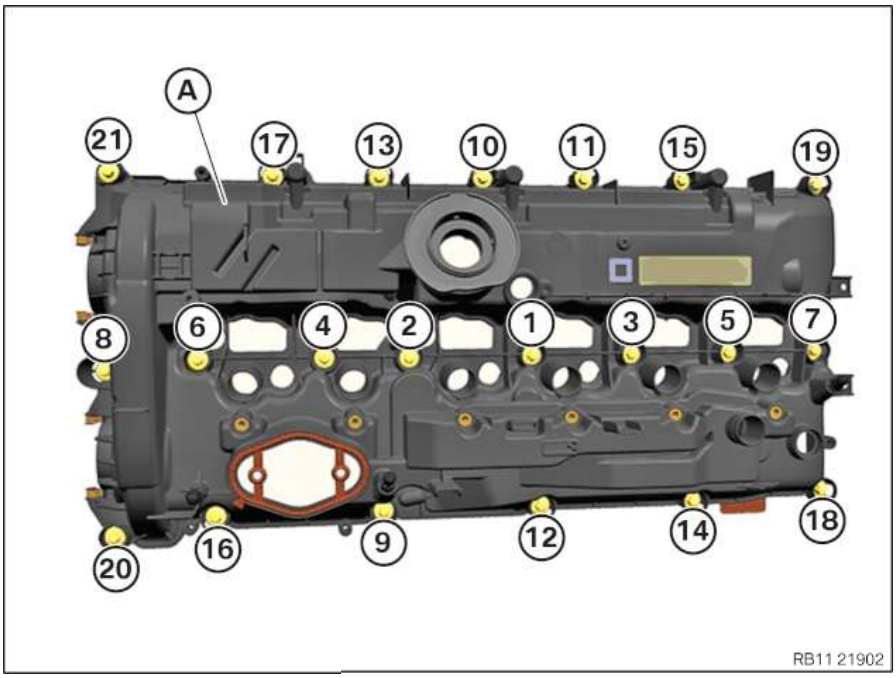
Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

49 – 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

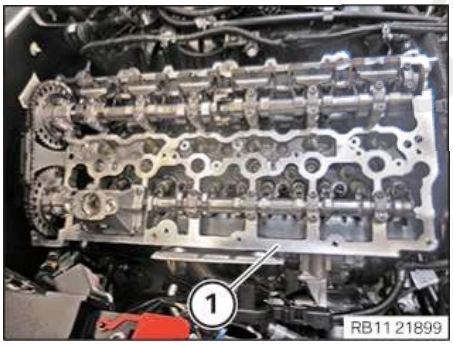
Improper routing of cables and wiring harnesses.

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

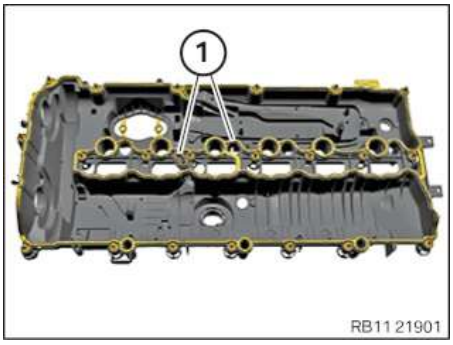
- Route all cables without abrasions, do not trap and crush.

TECHNICAL INFORMATION

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



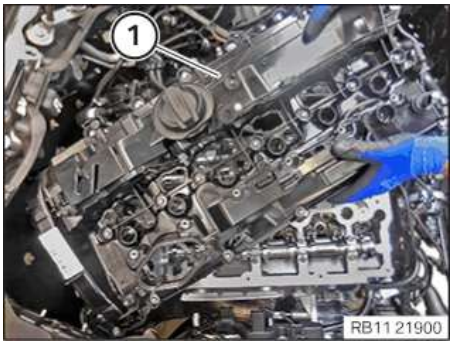
- Contact surface (1) must be free from oil and grease.



- Replace the seals (1).

  Parts: Seals

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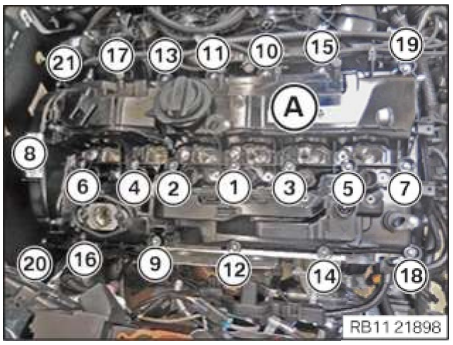


- Insert and install cylinder head cover (1).



- 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

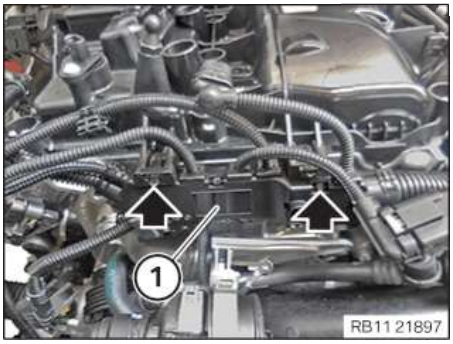
- Tighten all screws in a sequence from (1) to (21).

Cylinder head cover to cylinder head

M6X30		Tightening torque	11 Nm

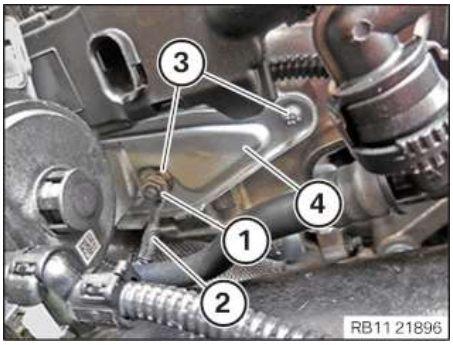


- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.



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

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

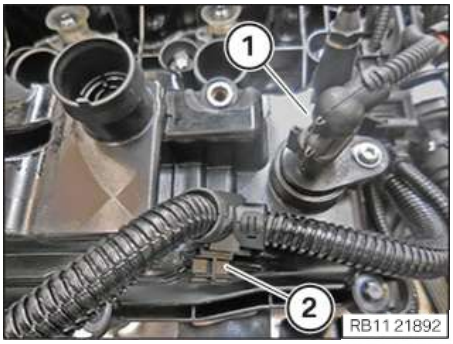
Auxiliary coolant pump holder to cylinder head

M6		Tightening torque	7 Nm

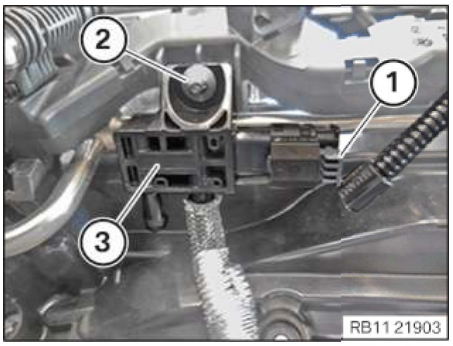
- Thread in ground cable (2) and install.
- Tighten nut (1).

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).

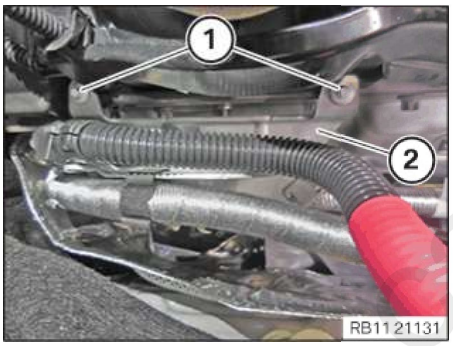


- **If installed:**
- Feed in and install the differential pressure sensor (3).
- Tighten down screw (2).

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.

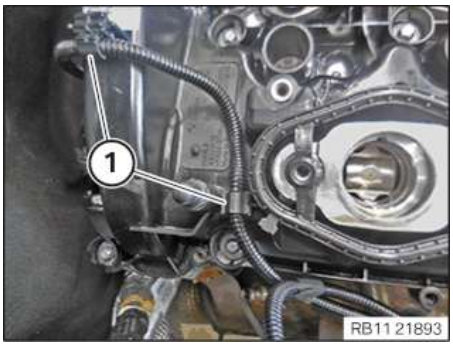
Risk of short circuits!

- 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).

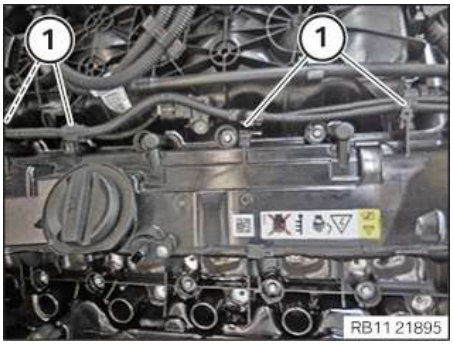
Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

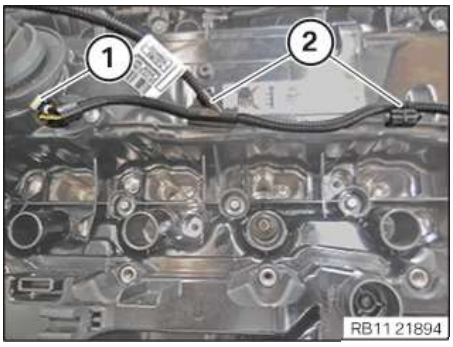


- Secure clamps (1).

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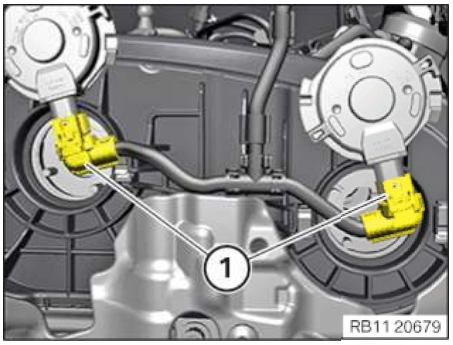


- Secure clamps (1).



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

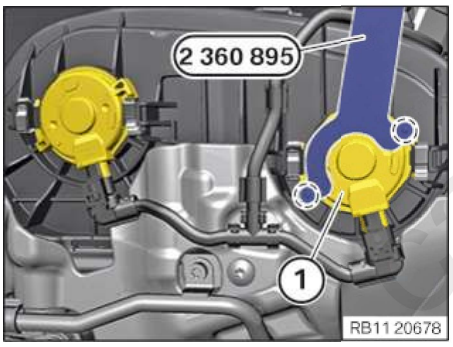
50 – Installing both actuators



NOTICE

The figure shows the rear side of the engine.

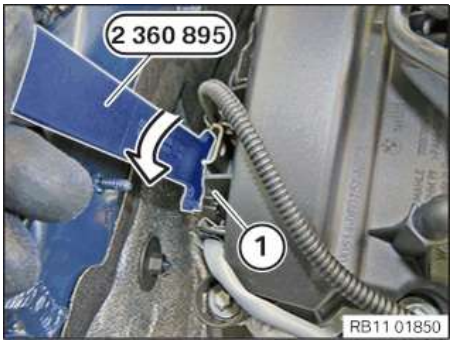
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



NOTICE

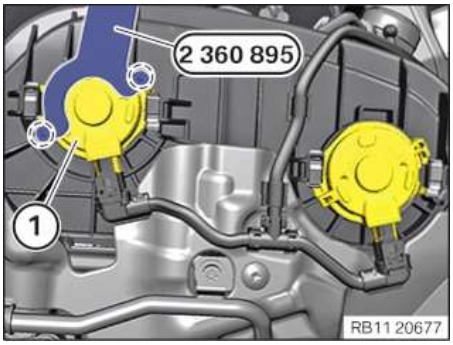
The figure shows the rear side of the engine.

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



- 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.

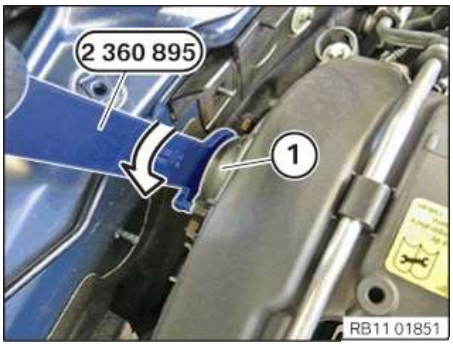
carjiagn.com



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.

51 – 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

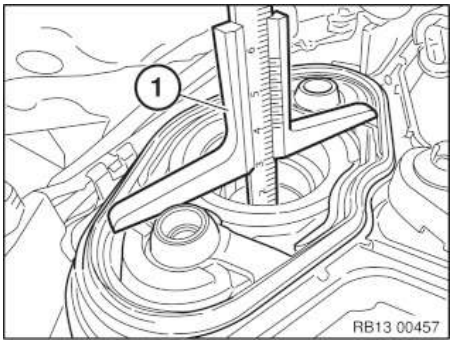
In vehicles with active anti-roll bar (ARS) the fan cowl must be removed in order to spin the engine.

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.

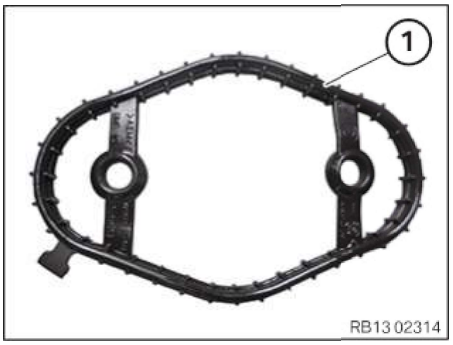
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- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- 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).



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

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RISK OF DAMAGE

Damage to the surface.

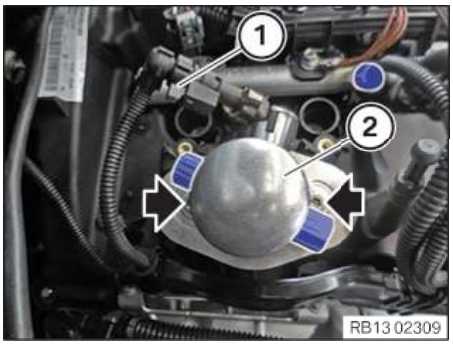
The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

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

- Clean sealing 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.

52 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

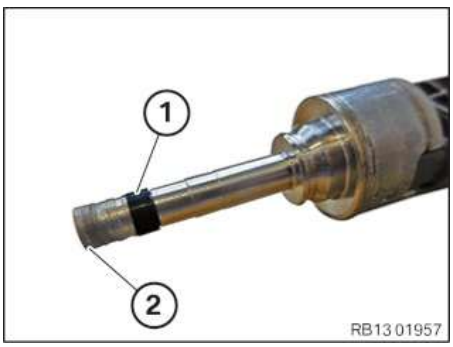
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- 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.

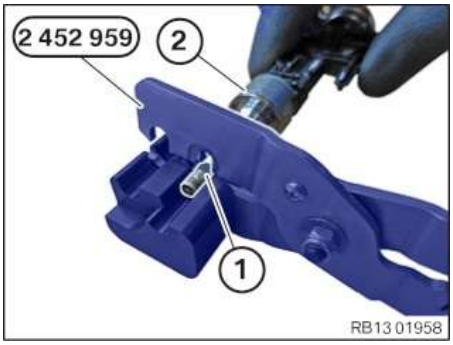
After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.



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

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

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- 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.

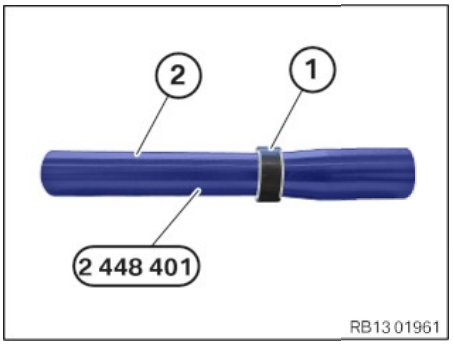


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

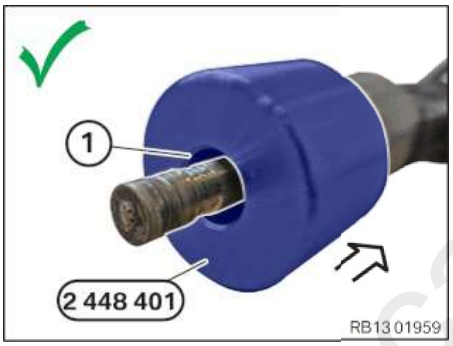
  (1) Installation cone

  (2) Sliding sleeve

  (3) Assembly sleeve

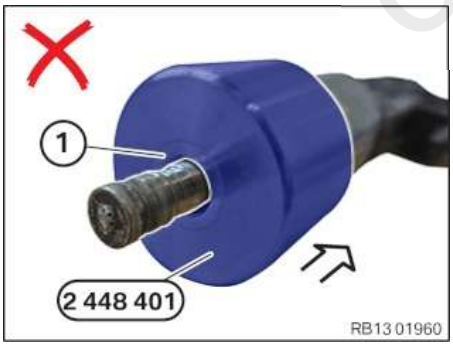


- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



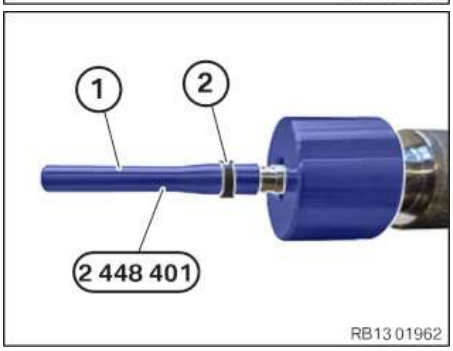
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

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



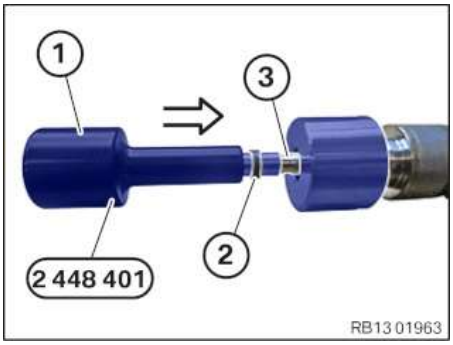
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

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

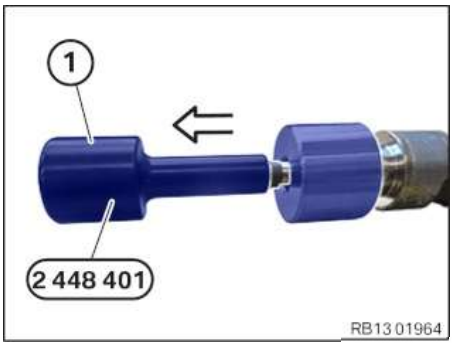


- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .

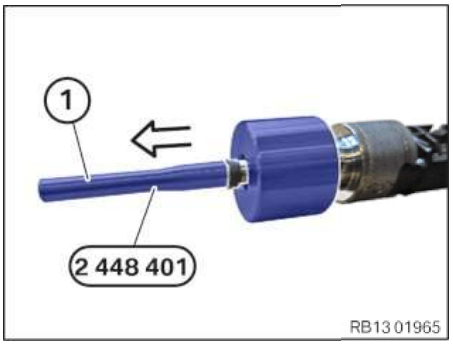
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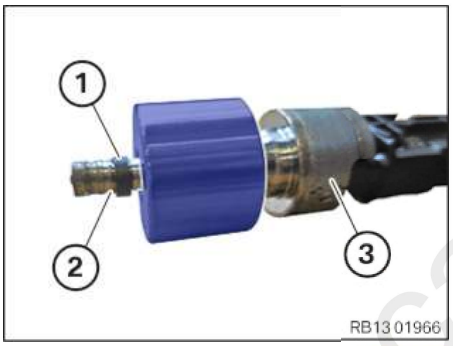
- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.



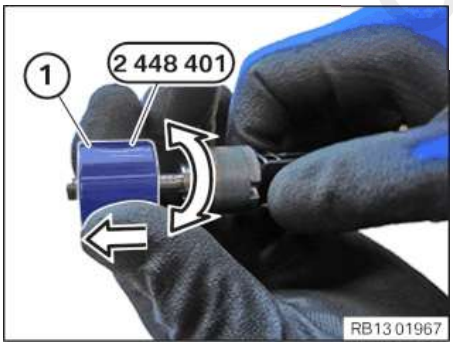
- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



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

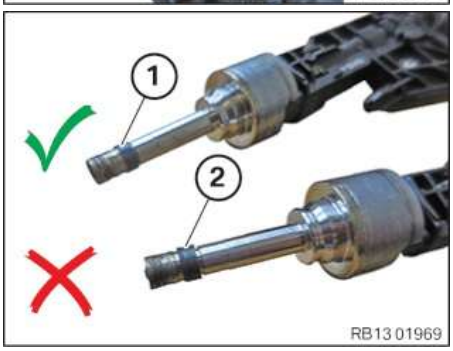


- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.



- 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).



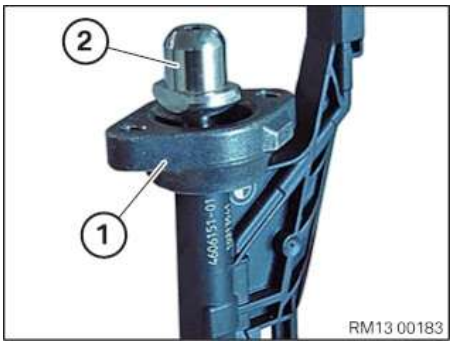
- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

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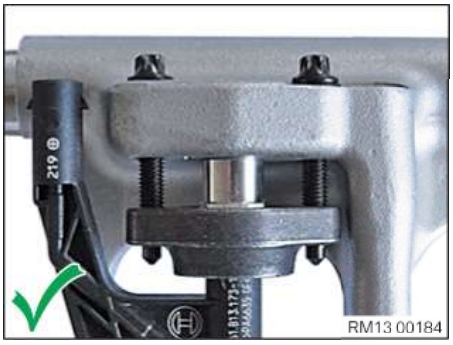
53 – Installing the high-pressure rail with injectors of the cylinders 4 to 6

TECHNICAL INFORMATION

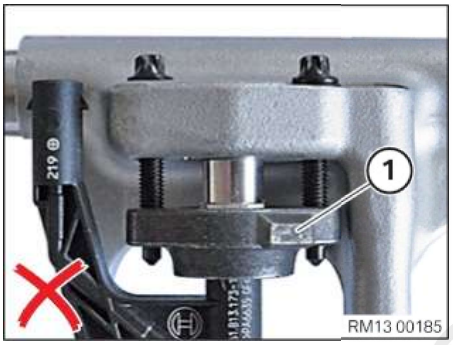
When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



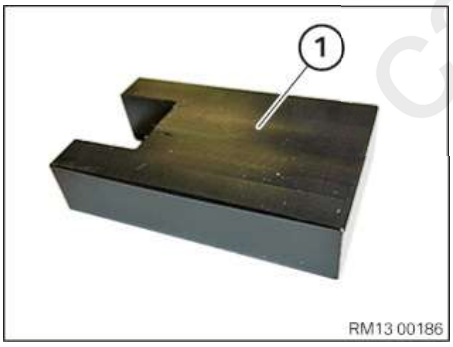
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder**(1) **has a cast lug**: Make sure that the holder is installed in the correct position.



- 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

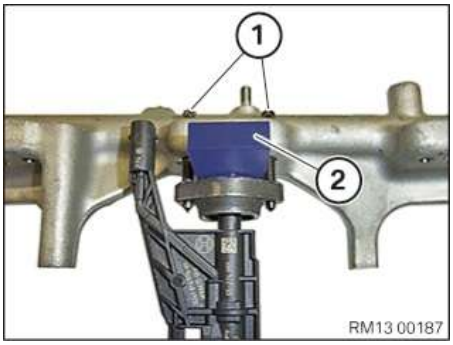
Damage to injectors.

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).

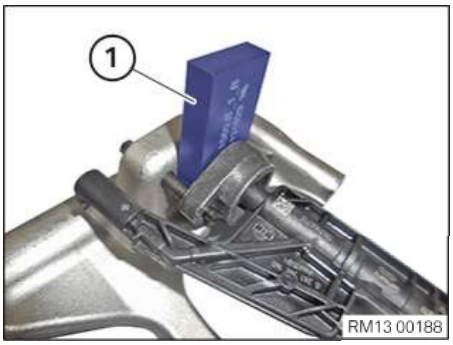
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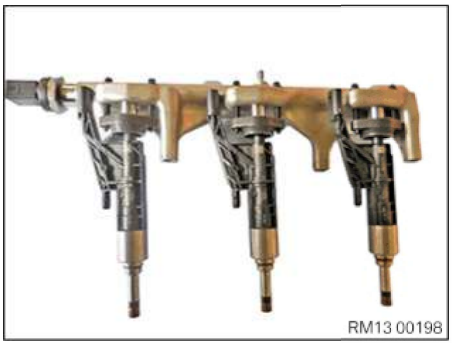
- Replace (M5x30) screws.

  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.



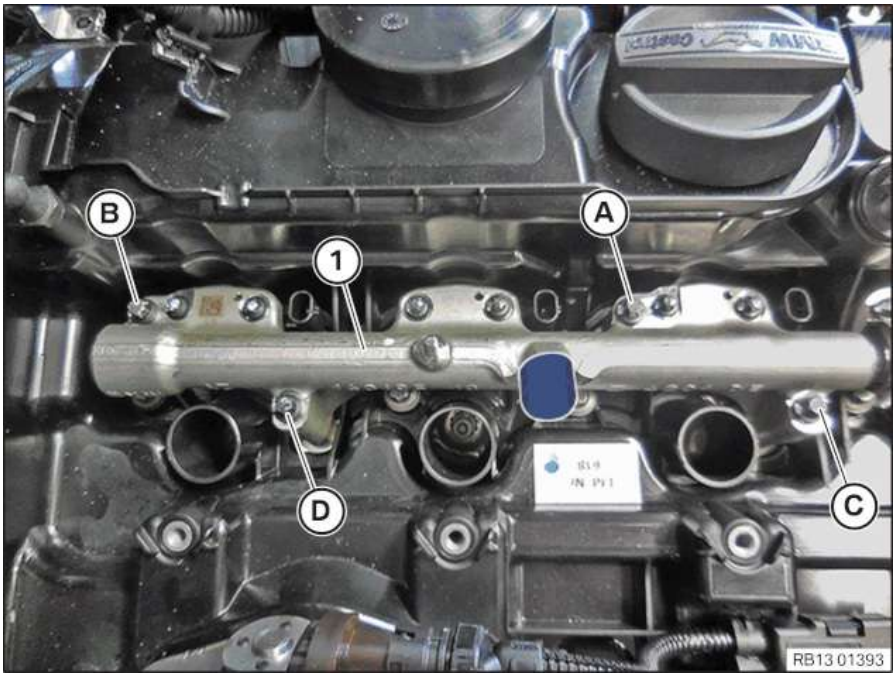
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.



- 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.

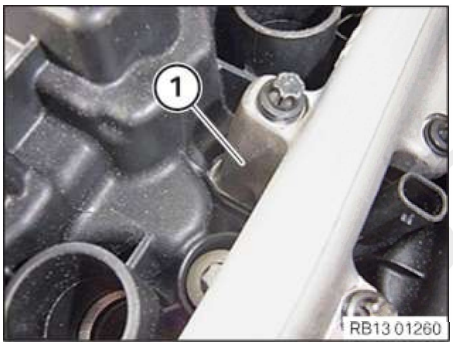
  The figure shows the rail resting flat against the cylinder head.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

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

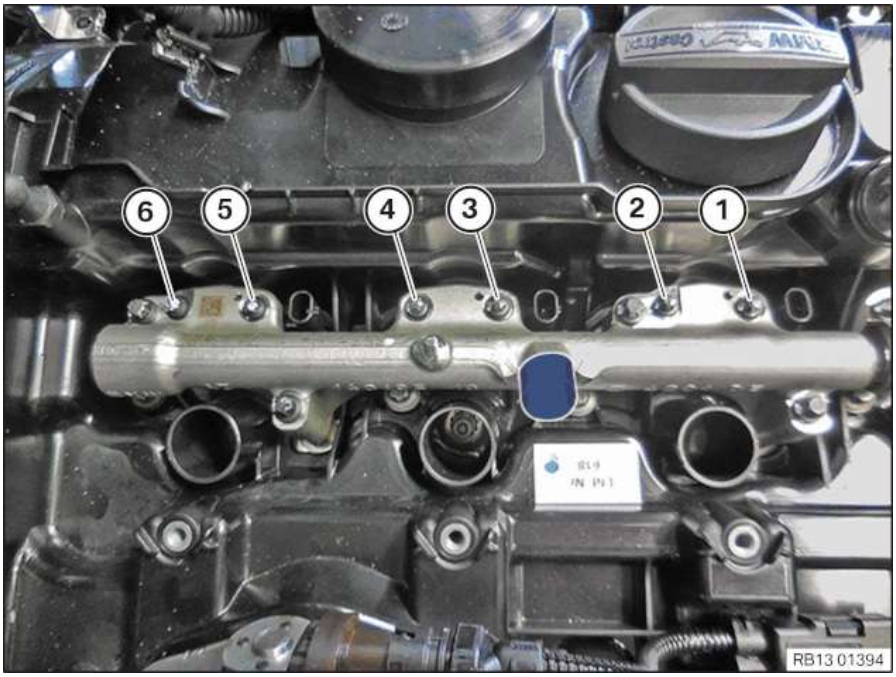
Non-observance of these requirements may result in leaks and damage.

- 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.

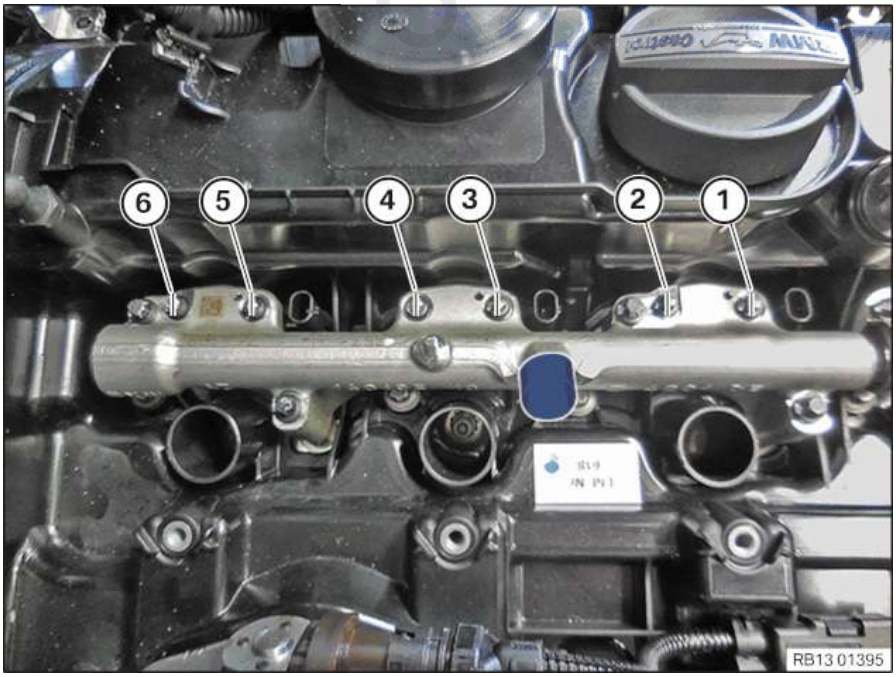
  Do not use a reversible ratchet or torque wrench.
- Tighten the bolts (M5x30) in pairs ((1) with (2), (3) with (4), (5) with (6)) in alternating order **90° hand-tight**.
- Set the torque wrench to 5 Nm.

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.



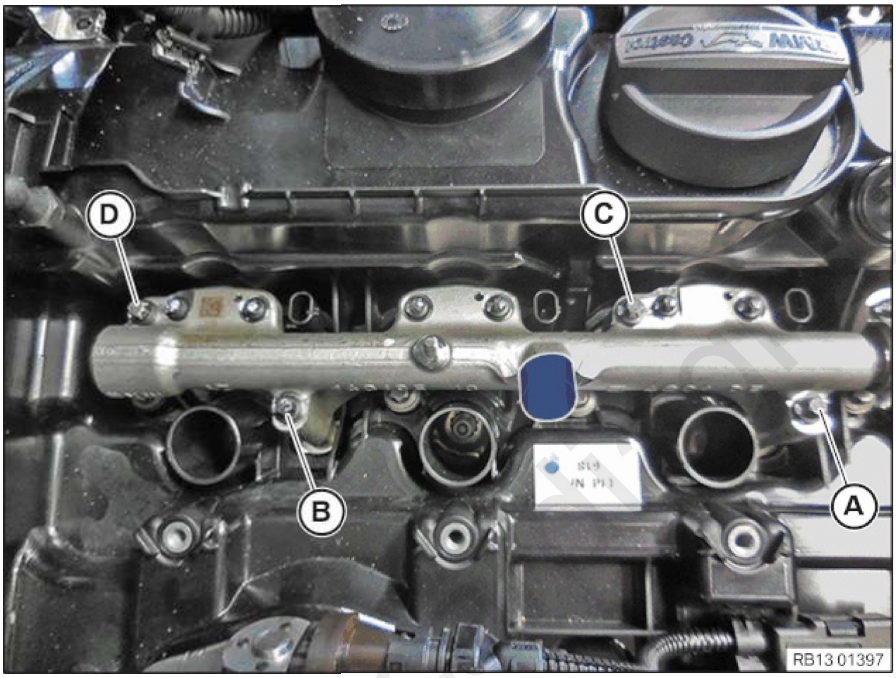
- Mark all bolts (1) to (6) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the screw (1) with an angle of rotation of 90° ±15°.
  - Tighten the screw (2) with an angle of rotation of 90° ±15°.
  - Tighten the screw (3) with an angle of rotation of 90°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

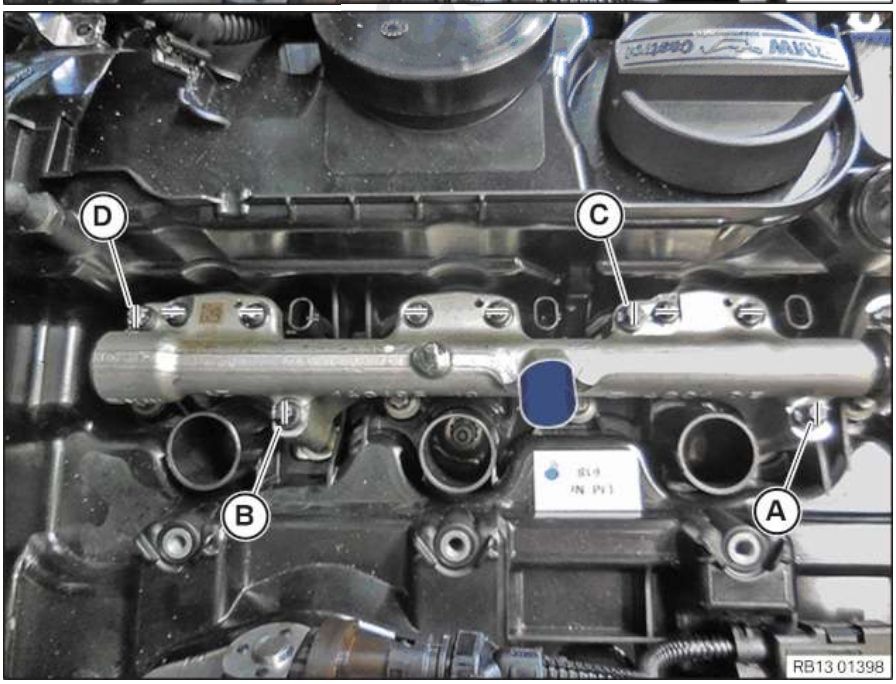
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

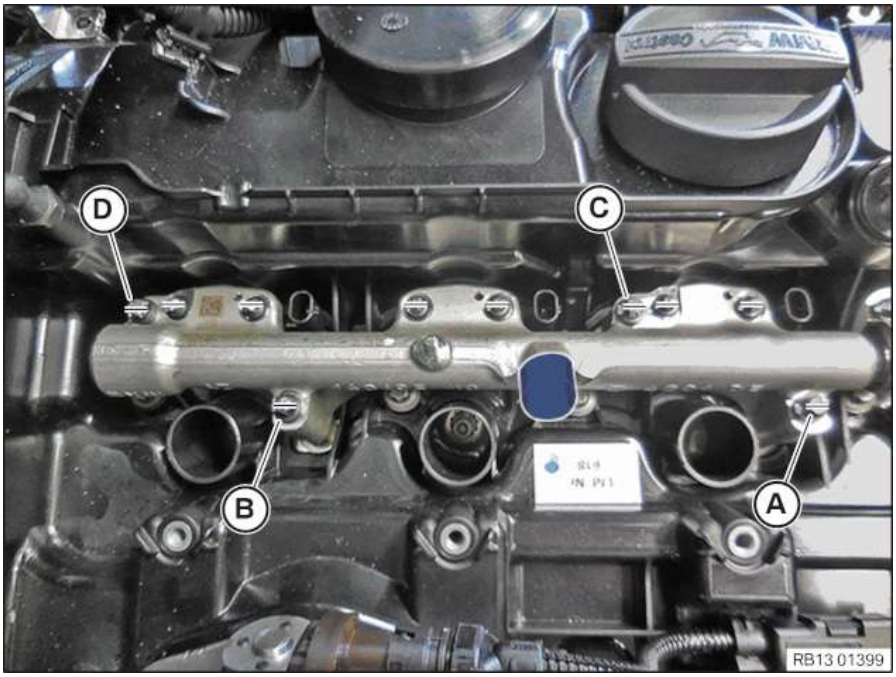
When assembling, it is essential to observe screwing sequences and tightening torques.

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.

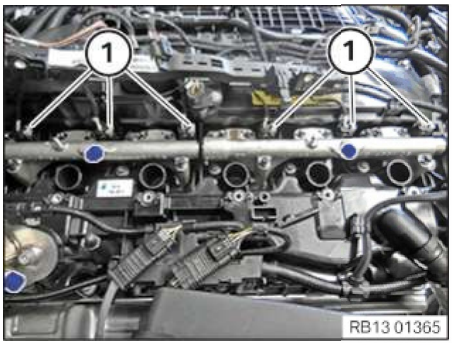


- Mark all bolts (A) to (D) with a vertical line (see figure).
- Tighten bolts (M6x70) (A) to (D) to a 90° angle of rotation.



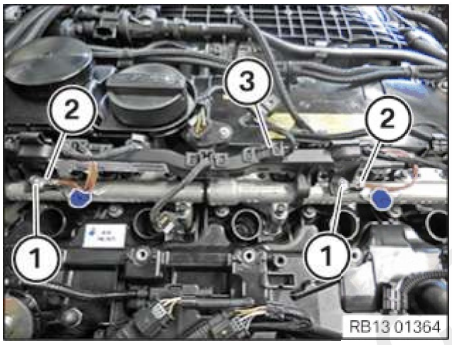
- Check if all bolts (A) to (D) have been tightened with a 90° angle of rotation.

  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).

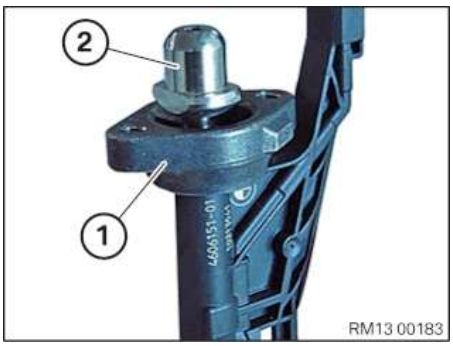
Ground cable to rail

M6			5 Nm

54 – Installing rail with injectors of cylinders 1 to 3

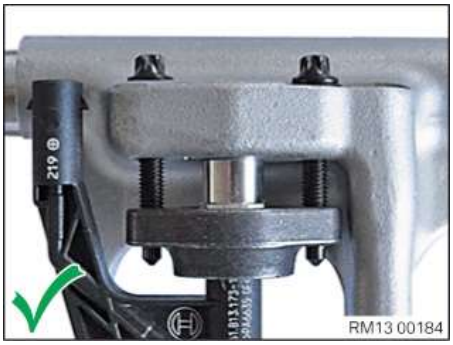
TECHNICAL INFORMATION

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



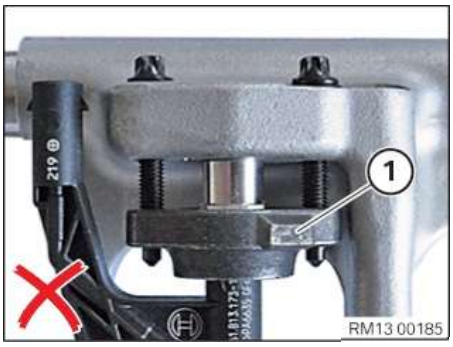
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If there is a cast lug on the holder** (1) **:** Make sure that the holder is installed in the correct position.

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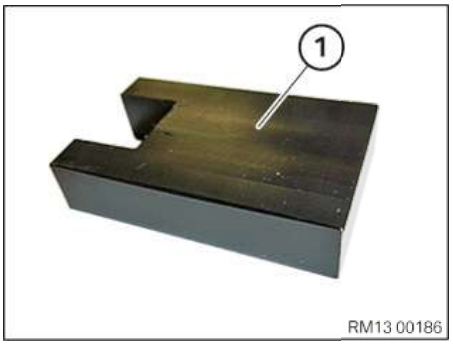
- Observe position of cast lug:

  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.



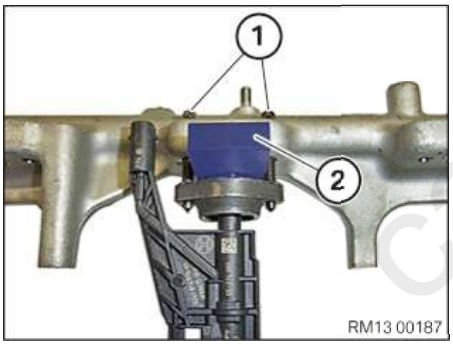
RISK OF DAMAGE

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.



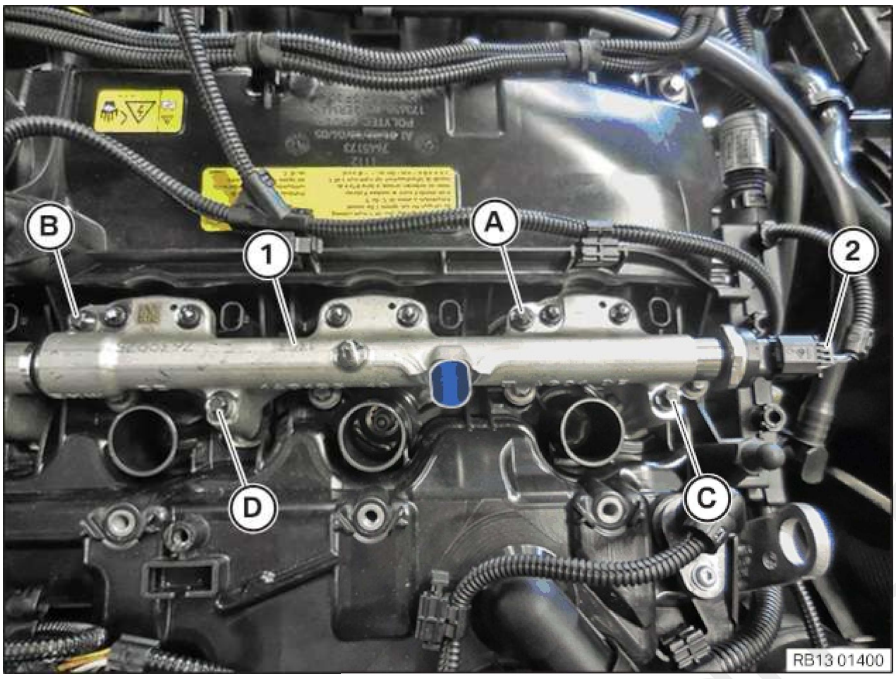
- Remove special tool 2 358 022(1) .
- Repeat this operation for all injectors.

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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.

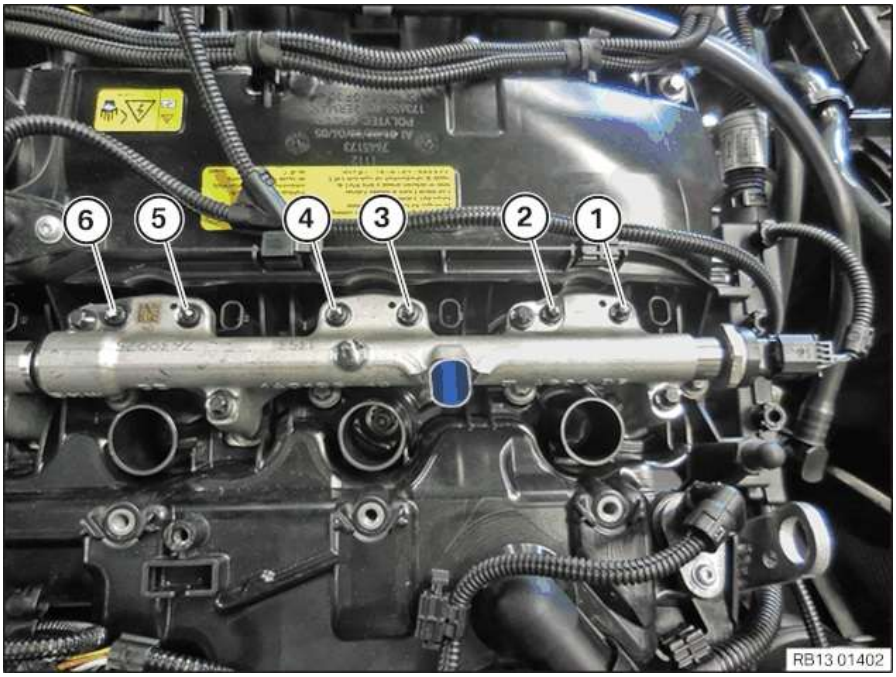
- Tighten screw (A) to 5 Nm.
- Tighten screw (D) to 5 Nm.
- Tighten screw (B) to 5 Nm.
- Tighten screw (C) to 5 Nm.
- Connect and lock the connector (2).

  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.

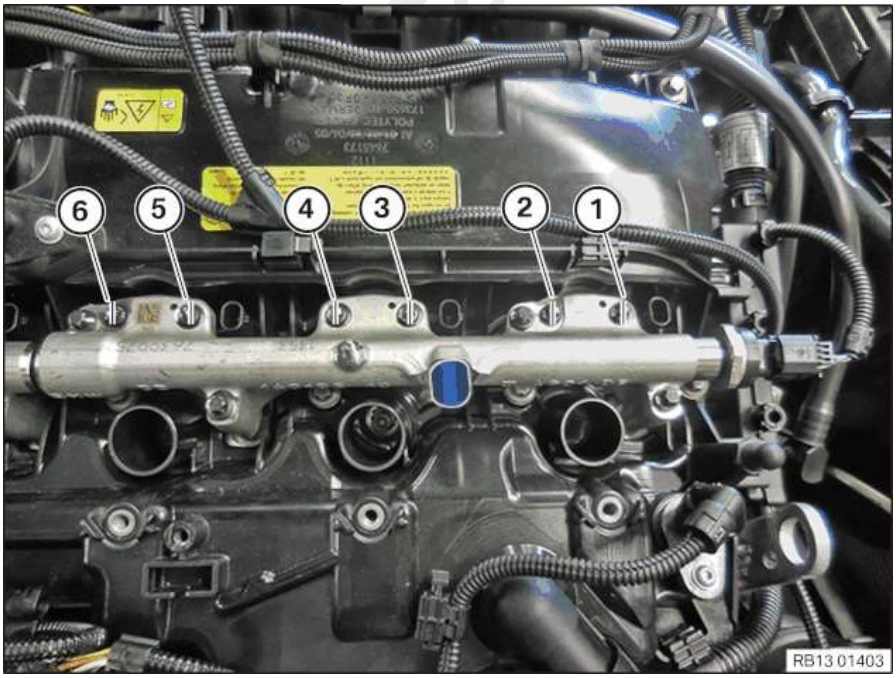
  Do not use a reversible ratchet or torque wrench.
- Hand-tighten screws (M5x30) in pairs ((1) with (2), (3) with (4), (5) with (6)) alternately by **90°**.
- Set torque wrench to 5 Nm.

TECHNICAL INFORMATION

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

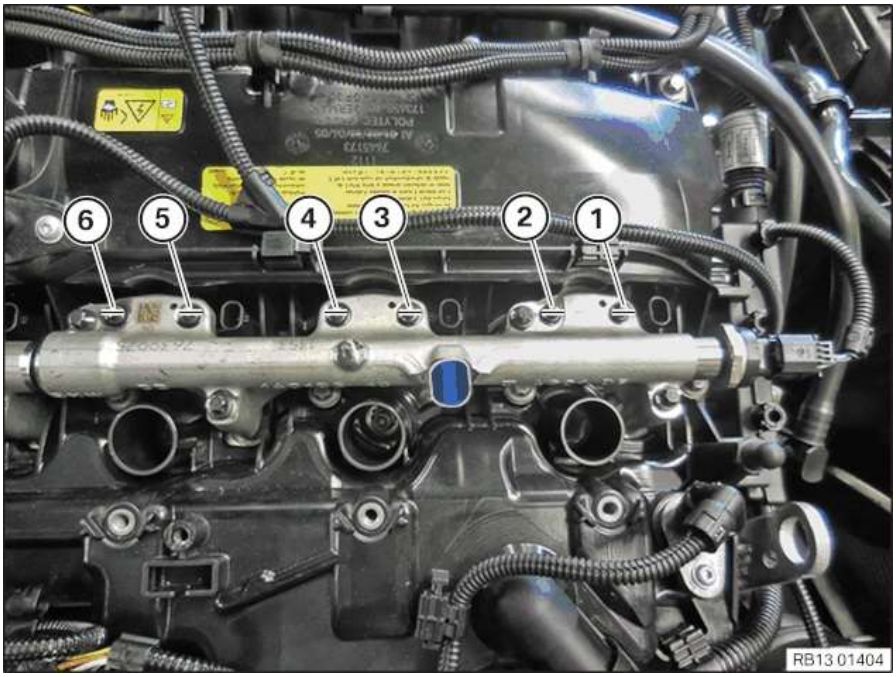
Non-observance of these requirements may result in leaks and damage.

- **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.



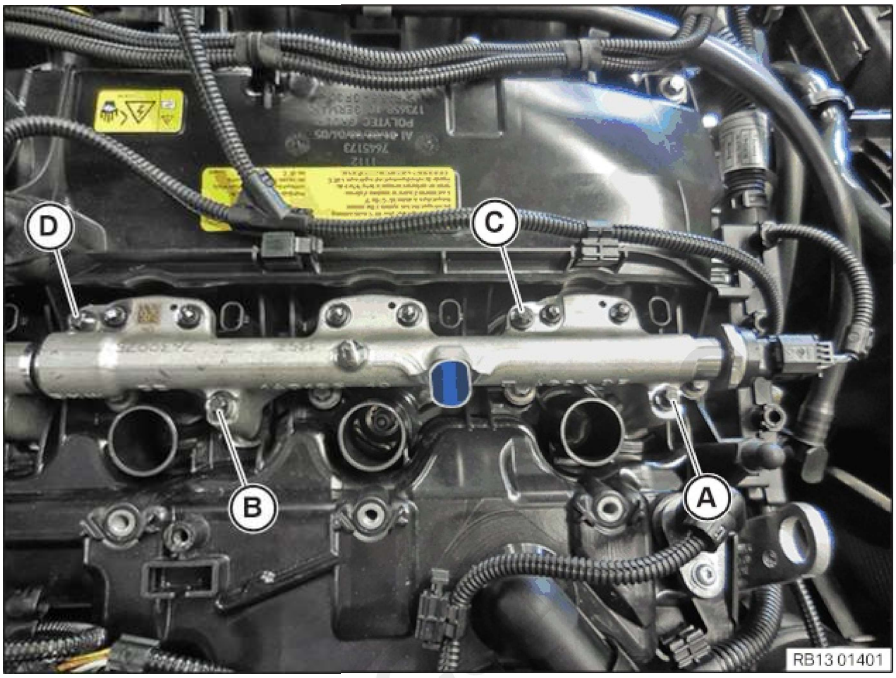
- Mark all bolts (1) to (6) with a line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the screw (1) with an angle of rotation of 90° ±15°.
  - Tighten the screw (2) with an angle of rotation of 90° ±15°.
  - Tighten the screw (3) with an angle of rotation of 90° ±15°.
  -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

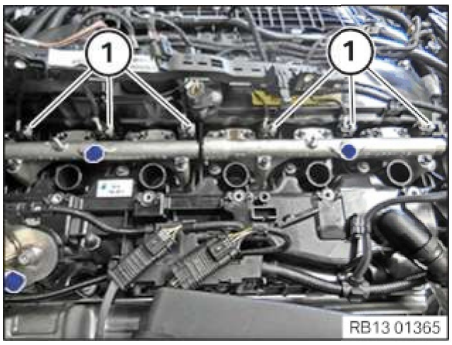


- Mark all the bolts (A) to (D) with a vertical line (see Figure).
- Tighten bolts (M6x70) (A) to (D) with an angle of rotation of 90°.



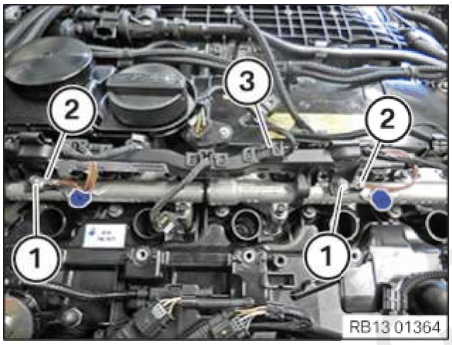
- Check whether all screws (A) to (D) have been tightened with an angle of rotation of 90°.

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



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

  All connectors (1) must engage audibly.

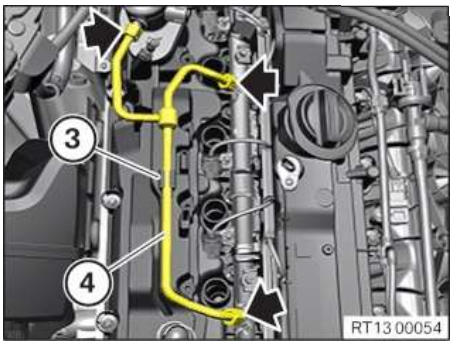


- Thread the cable channel (3) in and install.
- Thread in ground cable (2) and install.
- Tighten nuts (1).

Ground cable to rail

M6			5 Nm

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

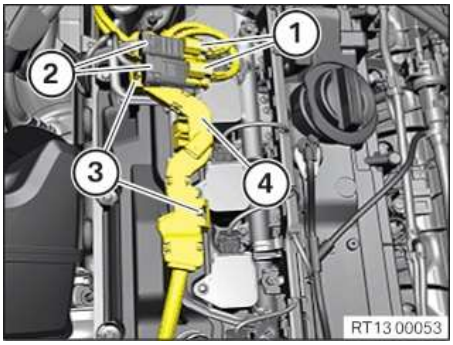


- Insert the high pressure line (4) into the holder (3) and install.
- Tighten union nuts (arrows) with the special tool .

High pressure line between rail and high pressure pump

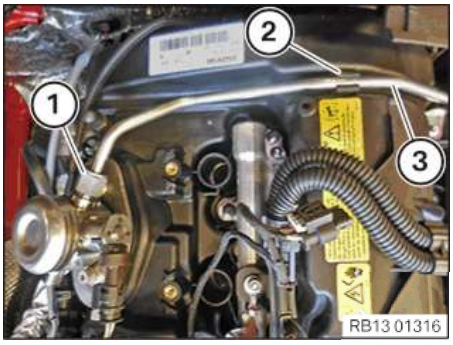
M14x1,5		Tightening torque	33 Nm

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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.

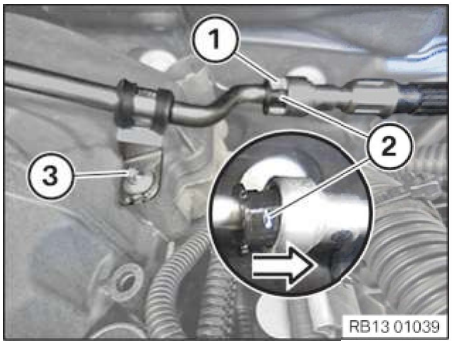
56 – Installing fuel delivery line



- 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

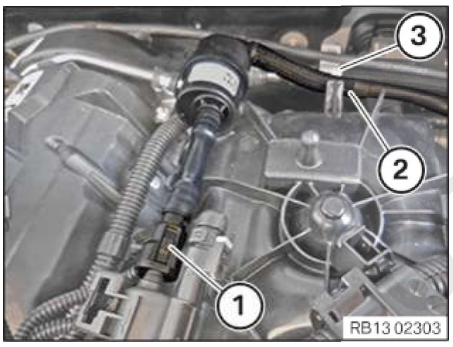
M14		Tightening torque	31 Nm



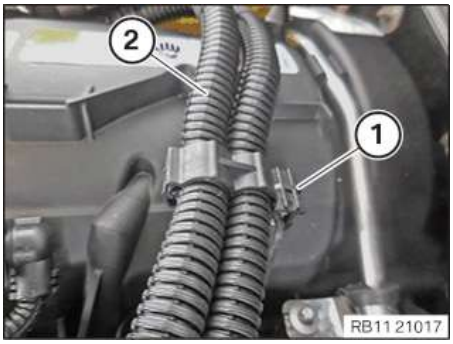
- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure clamps (1).
- Tighten down screw (3).

Fuel line to cylinder head cover

6x18		Tightening torque	6,5 Nm

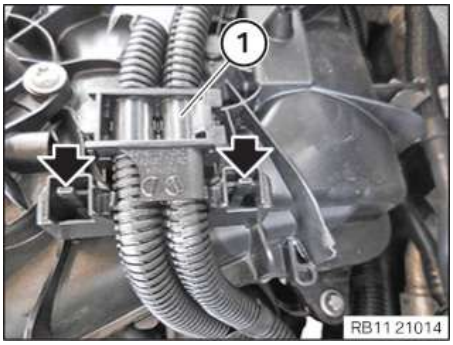


- Insert and install the tank ventilation line (2).
- Lock (1) must engage audibly.
- Secure the tank ventilation line (2) to the clamp (3).



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

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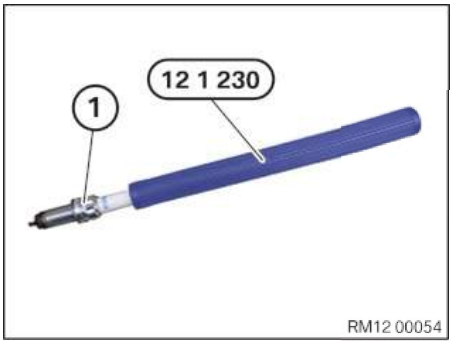


- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

57 – 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

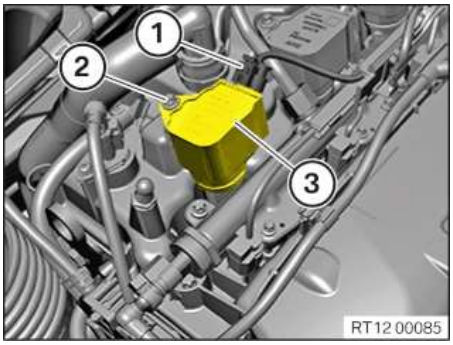
M12x1.25		Tightening torque	23 Nm

58 – Install all ignition coils

NOTICE

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

▸ **Install ignition coil.**



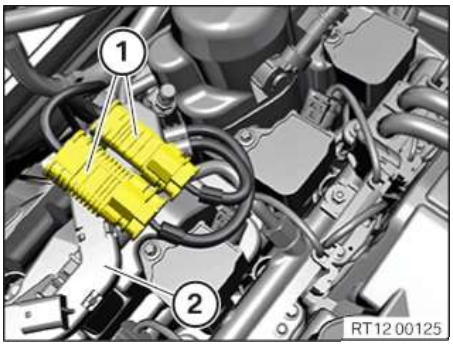
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

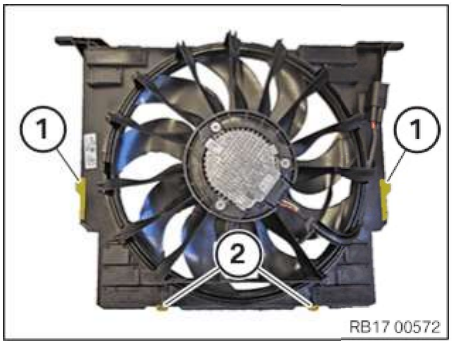
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

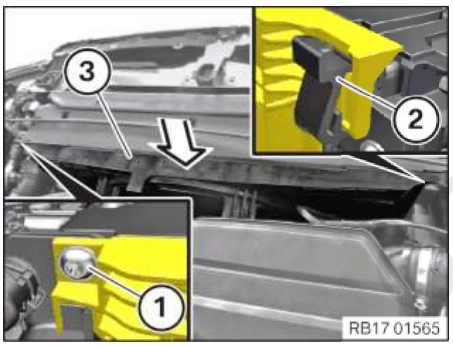


- Connect the connector (1) of the front oxygen sensor and the monitoring oxygen sensor on the cable shaft (2).

59 – Install fan cowl



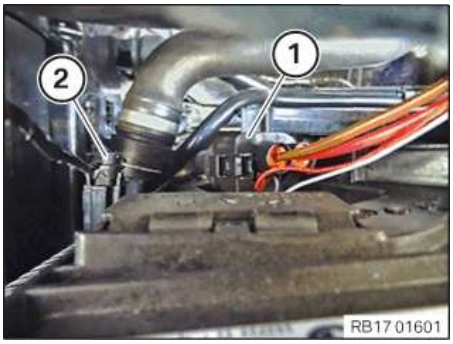
- Feed guides (1) into the radiator.
- Feed guides (2) into the charge air cooler.



- 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

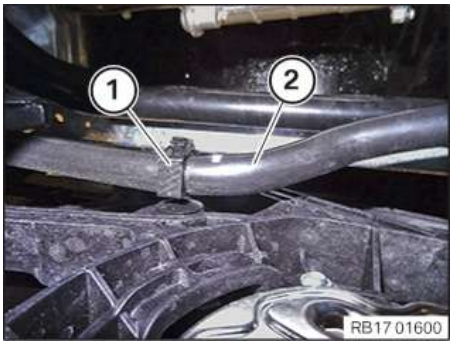


- Connect connectors (2) and lock.

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

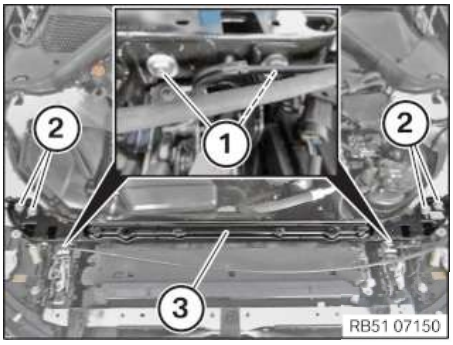
  The connector (1) must engage audibly.

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

60 – Install the rear top cross connection



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

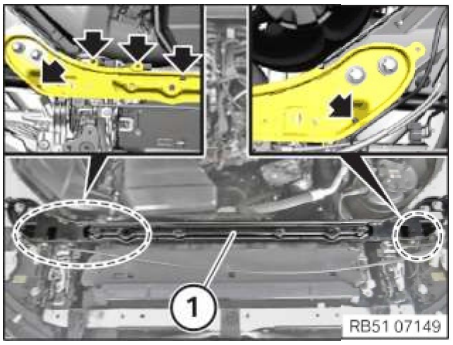
Top rear cross connection to bonnet catch support

Flat-head screw M6x20		Tightening torque	11,8 Nm

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

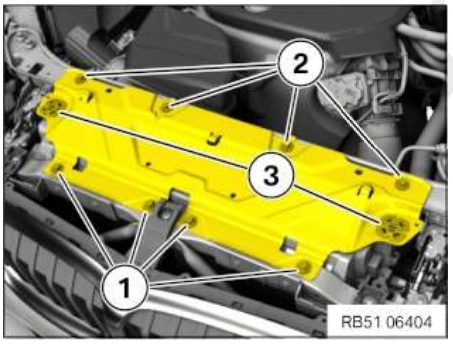
Rear top cross connection to wheel arch carrier support

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).

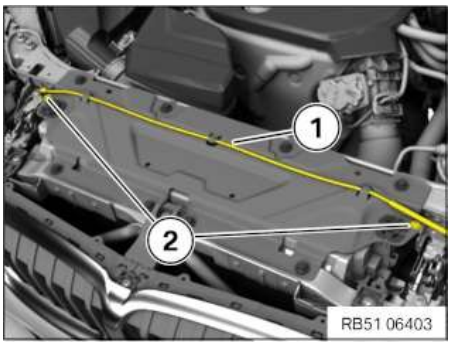
61 – Installing the top cross connection



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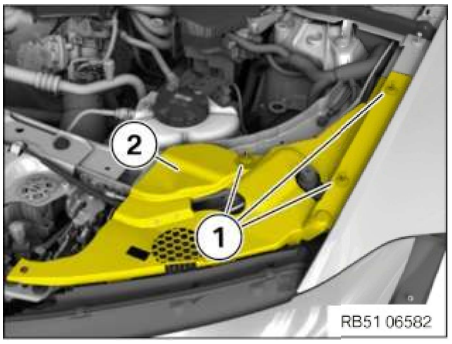
- Clip in the housing for the coupling of the Bowden cables (1).

62 – 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.

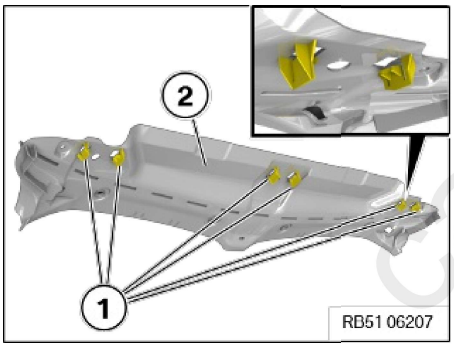
▶ Installing the cover in the engine compartment on top partially



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

63 – Installing cover for engine compartment centre

Check



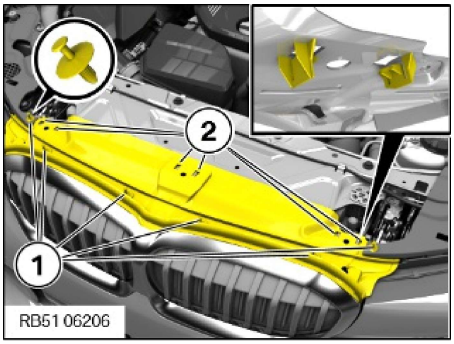
- Check latch mechanisms (1) of cover for engine compartment centre (2) for damage.

Result

» The latch mechanism (1) is damaged.

Measure

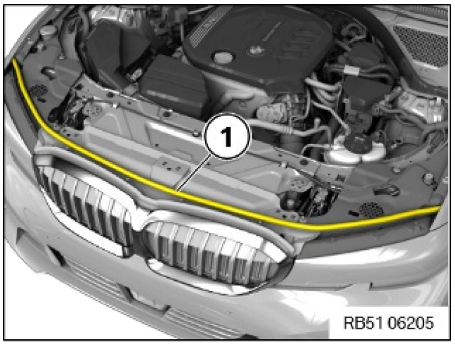
- Renew cover for engine compartment centre (2).



- 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).

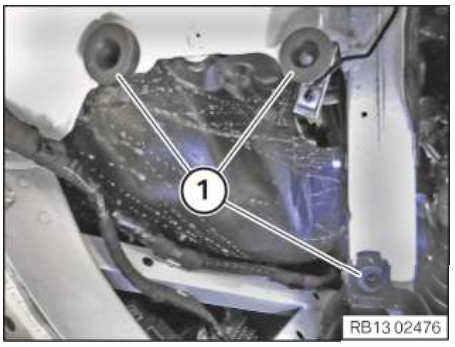
64 – Install the seal for the front bonnet

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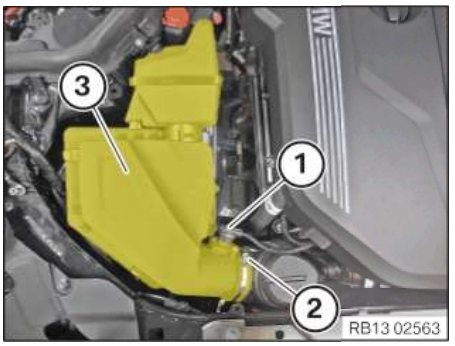


- Position the bonnet seal(1) and connect it on the mounting on the bumper and on the headlights.

65 – 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.

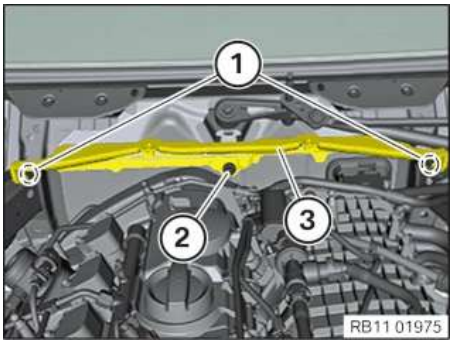
  The connector (1) must engage audibly.

66 – Disconnecting all battery earth leads



- See additional information.

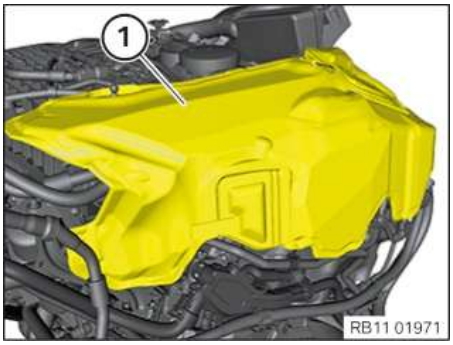
67 – Installing centre bulkhead lower section



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

68 – Installing acoustic cover at rear

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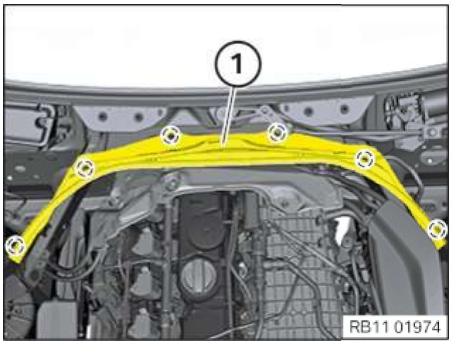


- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



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

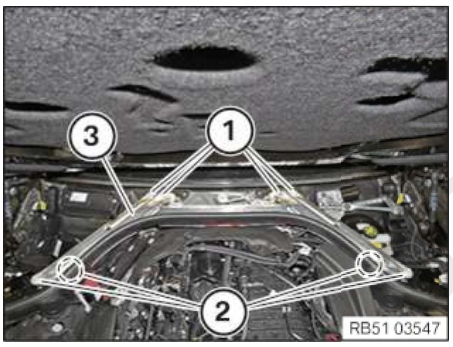
69 – Installing the centre bulkhead upper part



- 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 °

70 – Installing cowl panel cover

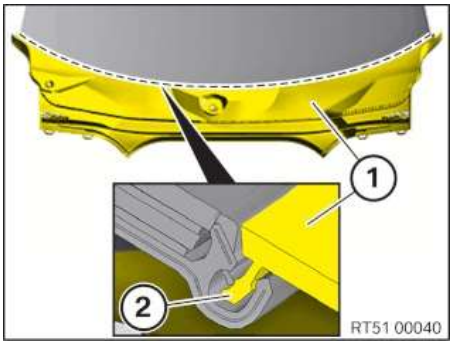
RISK OF DAMAGE

Damage caused by water ingress into the vehicle.

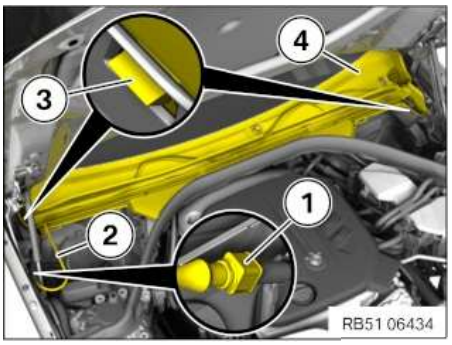
Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

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

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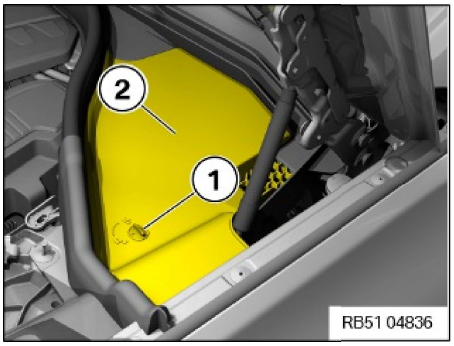


- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



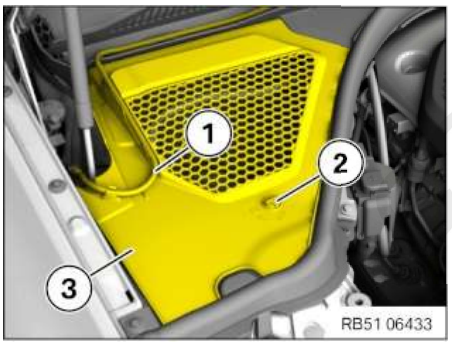
- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

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



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

72 – 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.

73 – Installing both wiper arms

NOTICE

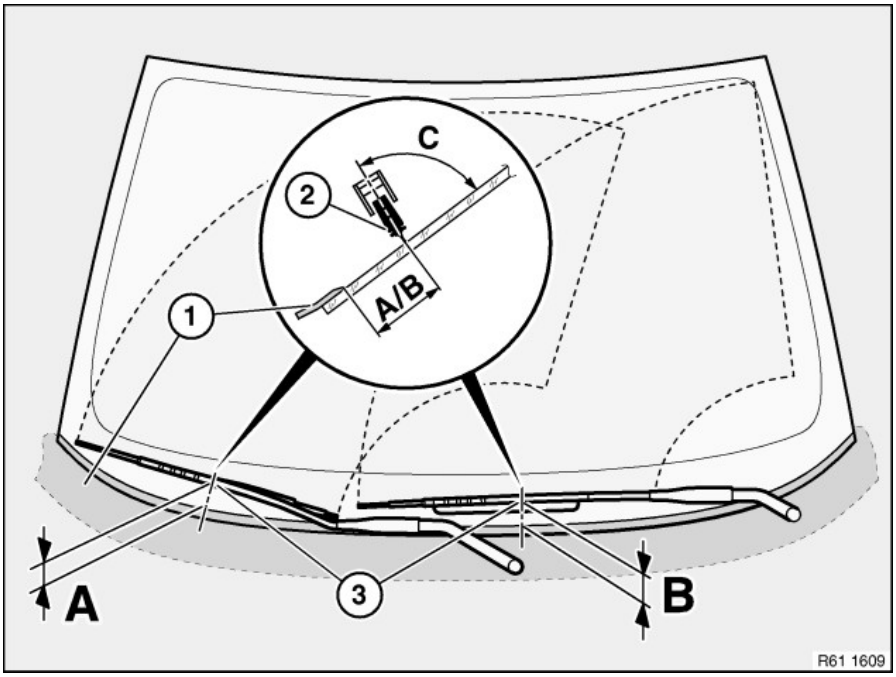
Description is for left component only. Procedure on the right side is identical.

▸ **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.

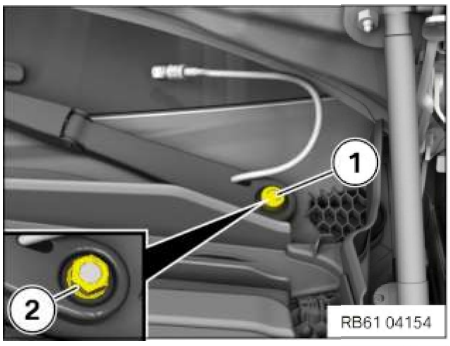
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- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

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

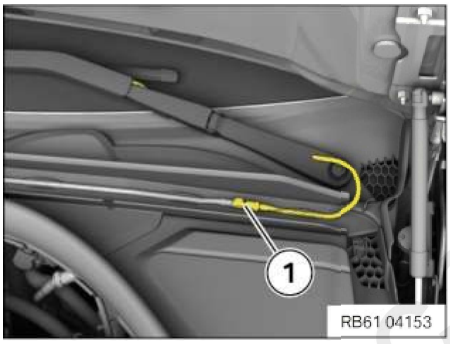


- Tighten nut (2).

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.

74 – Install acoustic cover

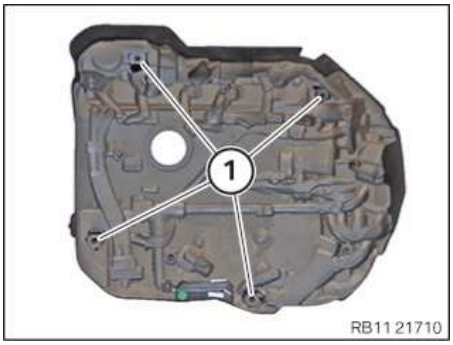
RISK OF DAMAGE

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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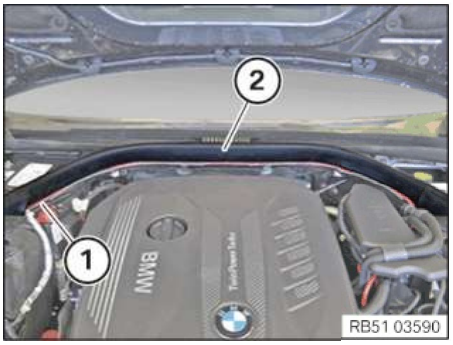


- Check the rubber mount (1) for correct fit in the acoustic cover.



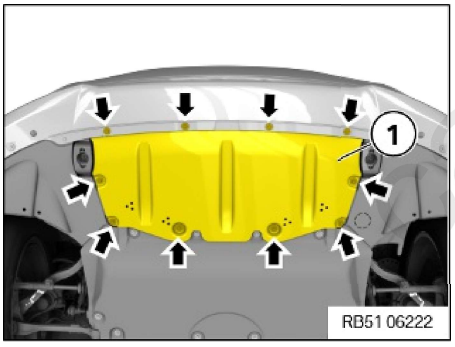
- Install acoustic cover (1) and fix in the rubber mounts (marks).

75 – 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.

76 – Installing the front underbody protection



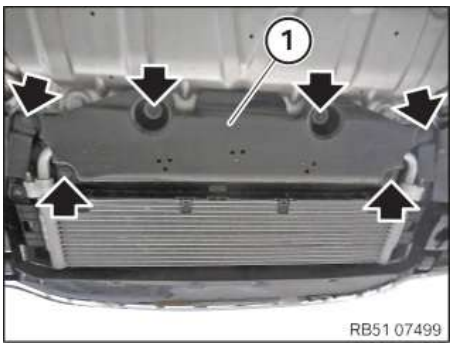
- **Version 1:**

  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:**

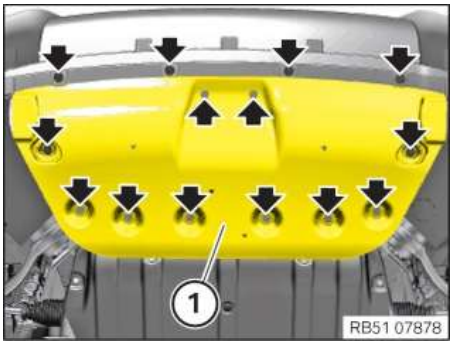
  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

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

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- **Version 3:**

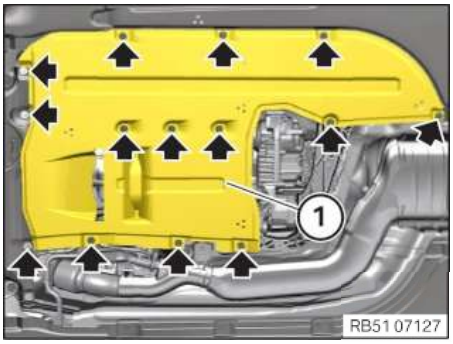
  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

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

77 – Installing underbody protection at rear



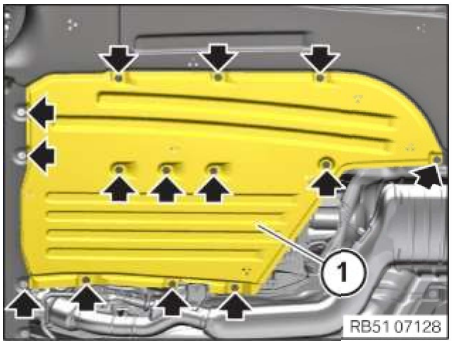
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

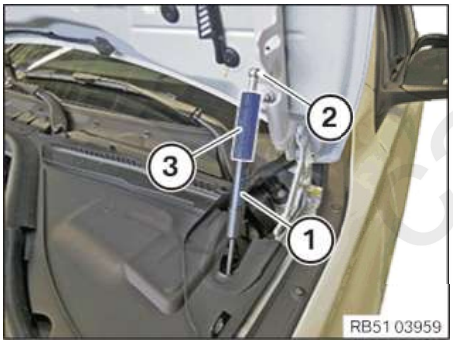
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

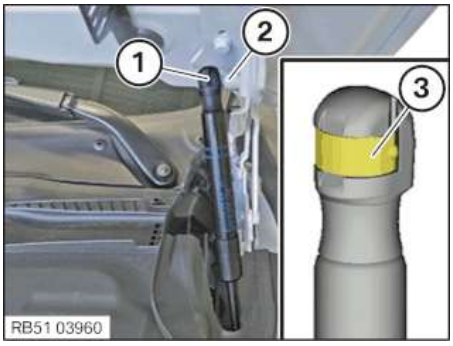
Underbody protection

Hexagon screw		Tightening torque	3 Nm

78 – 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 314147

M6		Tightening torque	8 Nm

Test gauge to basic carrier — Used in step 314147

M6		Tightening torque	8 Nm

VANOS central valve to camshaft — Used in step 4344

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 46

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Engine oil cooler to bumper support — Used in step 48

M6X25		Tightening torque	8 Nm

Cover, front bottom on side — Used in step 48

Hexagon screw for thermoplastic		Tightening torque	3 Nm

Cylinder head cover to cylinder head — Used in step 49

M6X30		Jointing torque	8 Nm

Cylinder head cover to cylinder head — Used in step 49

M6X30		Tightening torque	11 Nm

Auxiliary coolant pump holder to cylinder head — Used in step 49

M6		Tightening torque	7 Nm

Standard screw connection M6 — Used in step 49

M6			8 Nm

Differential pressure sensor to holder — Used in step 49

TS6X18		Tightening torque	3,5 Nm

Holder, positive battery cable to cylinder head cover — Used in step 49

6X18		Tightening torque	6 Nm

High pressure pump to high pressure pump flange — Used in step 51

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

Ground cable to rail — Used in step 5354

M6			5 Nm

High pressure line between rail and high pressure pump — Used in step 55

M14x1,5		Tightening torque	33 Nm

Fuel delivery line to high pressure pump — Used in step 56

M14		Tightening torque	31 Nm

Fuel line to cylinder head cover — Used in step 56

6x18		Tightening torque	6,5 Nm

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Spark plugs			Used in step 57
M12x1.25		Tightening torque	23 Nm

Ignition coil			Used in step 58
Screw		Tightening torque	8 Nm

Fan cowl with electric fan on radiator			Used in step 59
TS6x20		Tightening torque	6,5 Nm

Top rear cross connection to bonnet catch support			Used in step 60
Flat-head screw M6x20		Tightening torque	11,8 Nm

Rear top cross connection to wheel arch carrier support			Used in step 60
M10x20 screw	Renew screw.	Jointing torque	56 Nm
		Angle of rotation	90 °

Cross connection, top			Used in step 61
M8x20		Tightening torque	28 Nm

Cross connection, top			Used in step 61
M6x20		Tightening torque	11,8 Nm

Clean air pipe to upper section of intake filter housing			Used in step 65
Clamp		Tightening torque	3 Nm

Bulkhead upper part to bottom bulkhead			Used in step 69
		Tightening torque	3 Nm

Tension strut on bulkhead			Used in step 69
M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome			Used in step 69
Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

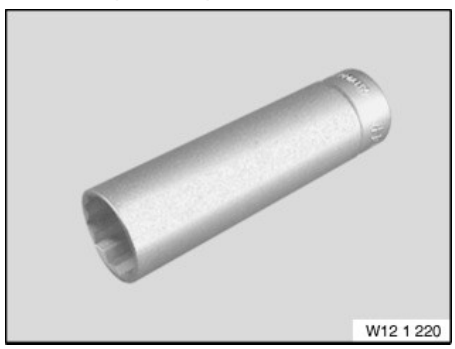
Windscreen wiper arm			Used in step 73
Combination hexagon nut		Tightening torque	35 Nm

Underbody protection front			Used in step 76
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Underbody protection			Used in step 77
Hexagon screw		Tightening torque	3 Nm

Overview of Special Tools

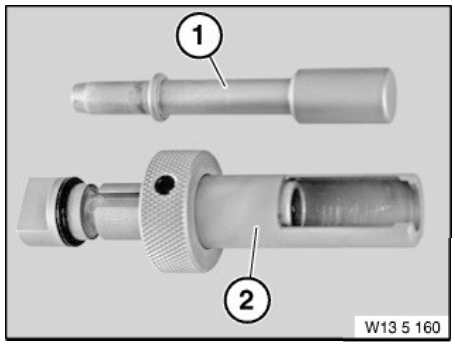
0 495 560 (12 1 220) Socket



Common		Used in step 2057
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)	

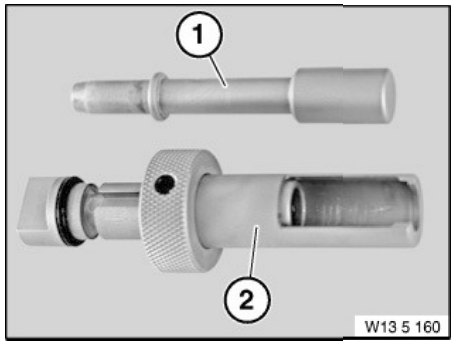
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0 496 567 (13 5 161) Fastener



Common	Used in step 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	

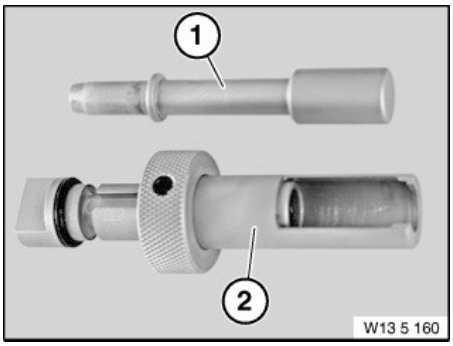
0 496 568 (13 5 162) Fastener



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



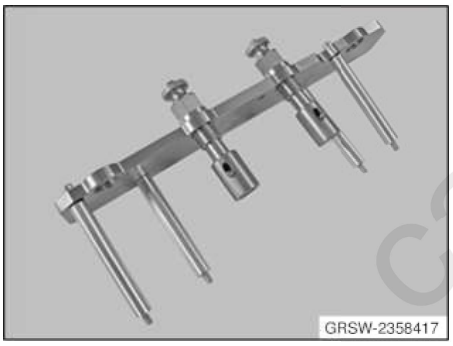
Common Used in step 22

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	

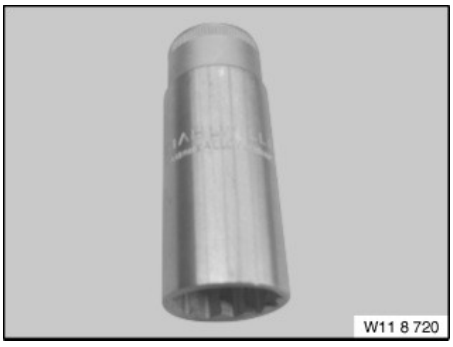
2 358 417 Device



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)

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)

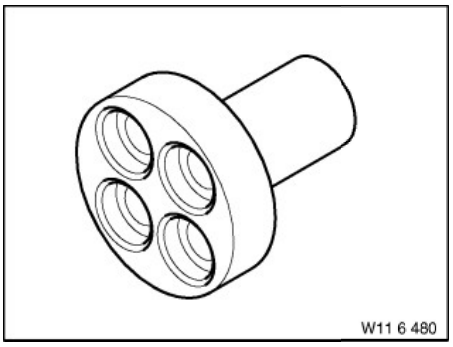
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2 360 895 Pin wrench



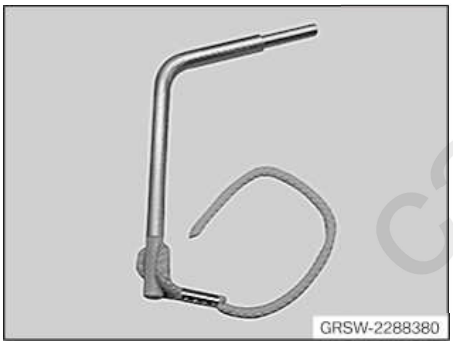
Common	Used in step 2650
Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 493 380 (11 6 480) Connector



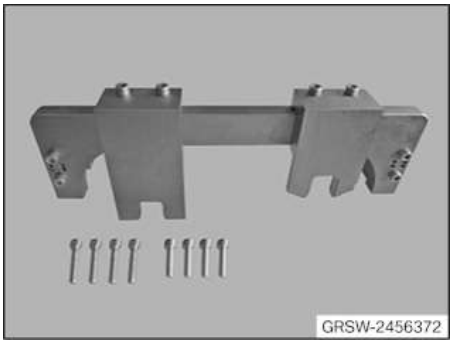
Common	Used in step 31454751
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

2 288 380 Locating stud



Common	Used in step 314547
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 3140414547
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 314047
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 33384344
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 33384344
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 4245
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 52
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 52
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)

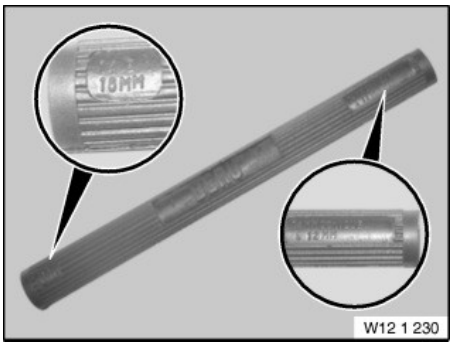
2 358 022 Gauge



Common	Used in step 5354
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 57
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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Overview Technical Data

Distance from window pane edge to wiper blade	Used in step 73
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	166
61 20 900 Disconnecting and connecting battery earth lead	166
61 20 900 Disconnecting and connecting battery earth lead	166
61 20 900 Disconnecting and connecting battery earth lead	166
61 20 900 Disconnecting and connecting battery earth lead	166
61 20 900 Disconnecting and connecting battery earth lead	166
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	166
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	166
61 20 900 Disconnecting and connecting battery earth lead	166
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	166
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	166
61 20 900 Disconnecting and connecting battery earth lead	166
61 20 900 Disconnecting and connecting battery earth lead	166
61 20 900 Disconnecting and connecting battery earth lead	166
61 20 900 Disconnecting and connecting battery earth lead	166
61 20 900 Disconnecting and connecting battery earth lead	166
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61 20 900 Disconnecting and connecting battery earth lead	166
61 20 900 Disconnecting and connecting battery earth lead	166
61 20 900 Disconnecting and connecting battery earth lead	166
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	166
61 20 900 Disconnecting and connecting battery earth lead	166
61 20 900 Disconnecting and connecting battery earth lead	166
61 20 900 Disconnecting and connecting battery earth lead	166
61 20 900 Disconnecting and connecting battery earth lead	166
61 20 900 Disconnecting and connecting battery earth lead	166
61 20 900 Disconnecting and connecting battery earth lead	166
61 20 900 Disconnecting and connecting battery earth lead	166
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	51

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11 36 658 Removing and installing / replacing both actuators

WARNING

Hot surfaces.

Risk of burning!

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

PRELIMINARY WORK

1 – Bring front compartment lid in the service position

Prerequisite

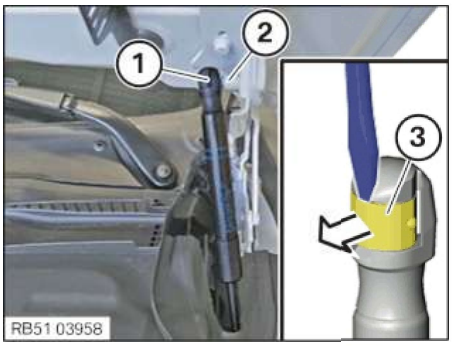
Engine compartment lid is open.

CAUTION

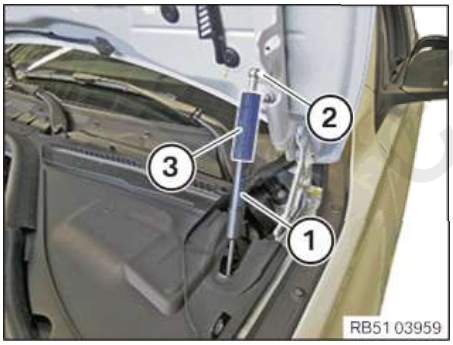
Shutting bonnet or tailgate.

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.

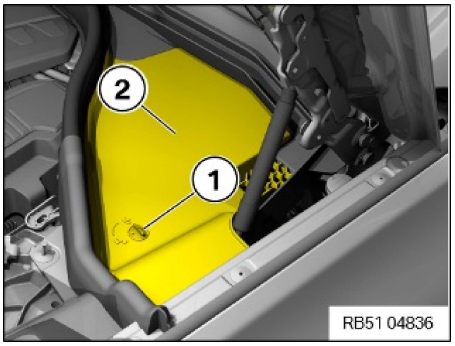
- Remove the bonnet support and open the bonnet further.
- Push special tool or (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

2 – Remove the seal for the rear bonnet



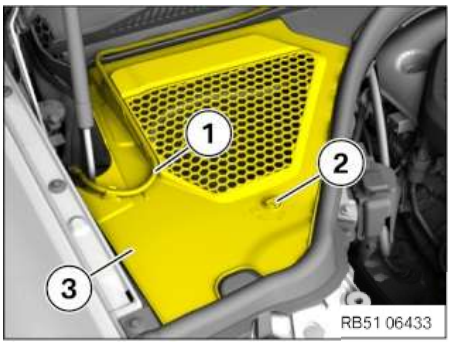
- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

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



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

4 – 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).

5 – Removing both wiper arms

NOTICE

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

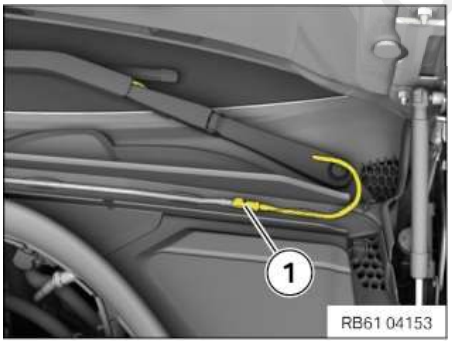
▸ **Remove the wiper arm**

RISK OF DAMAGE

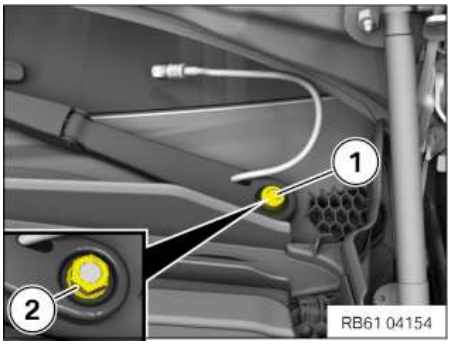
Damage to wiper console

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.

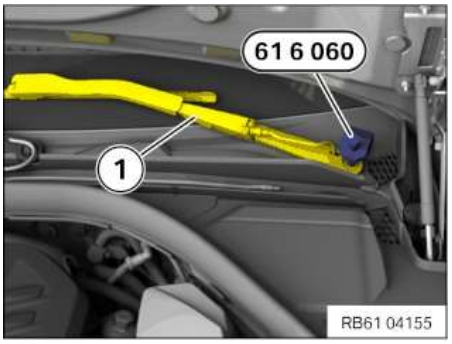


- Disconnect the windscreen wash hose(1) at the separation point and remove from the cowl guide.



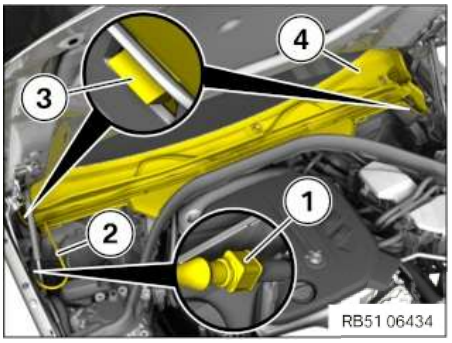
- Remove the protective cap (1).
- Loosen nut (2).

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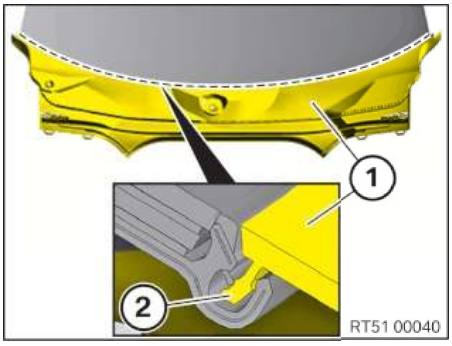


- Pull off the wiper arm (1) using special tool .

6 – 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).



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

7 – Removing the acoustic cover

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.

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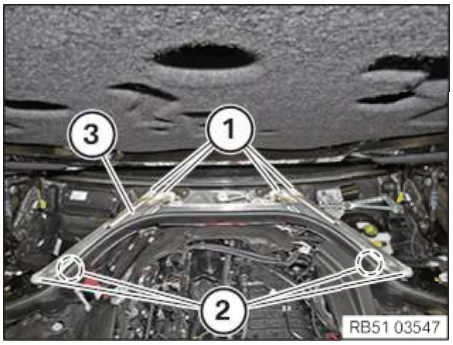


- Release the acoustic cover (1) towards the top from the rubber mounts (marks).

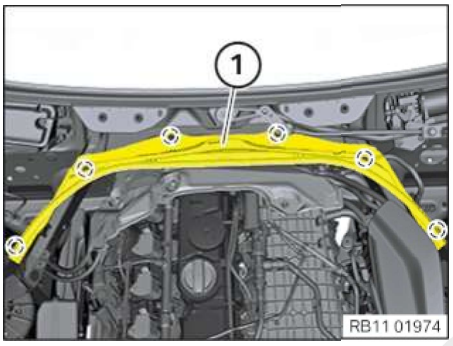
8 – Removing the centre bulkhead upper part

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.



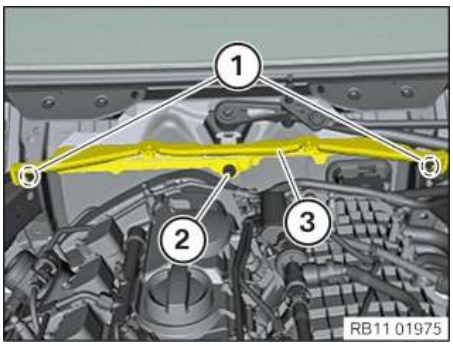
- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

9 – Removing acoustic cover at rear



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

10 – Removing the centre bulkhead lower section



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

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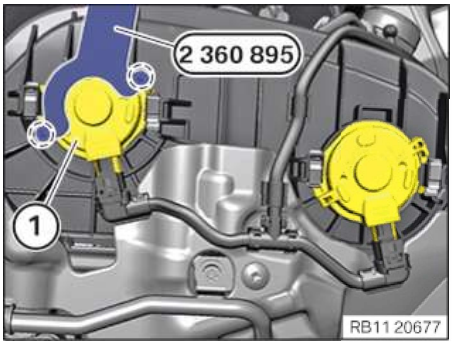
11 – Removing both actuators

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

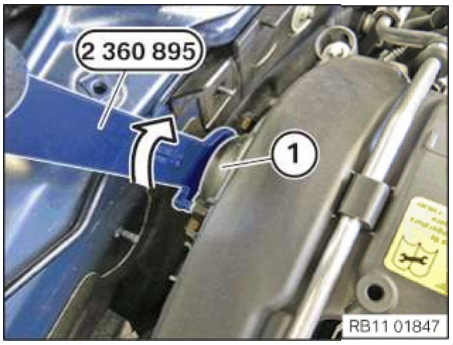
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the 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.



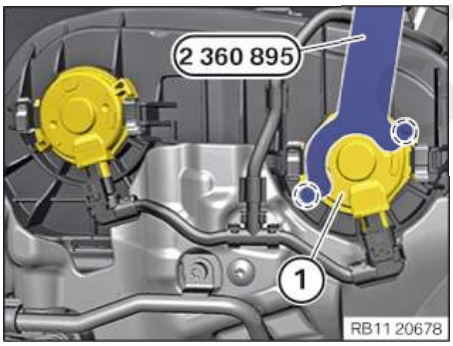
NOTICE

The figure shows the rear side of the engine.

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



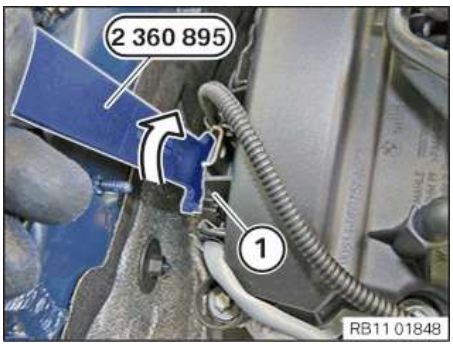
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



NOTICE

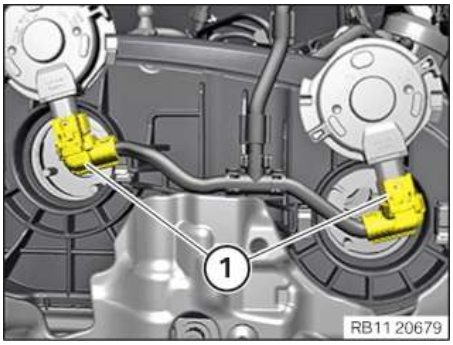
The figure shows the rear side of the engine.

- 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.

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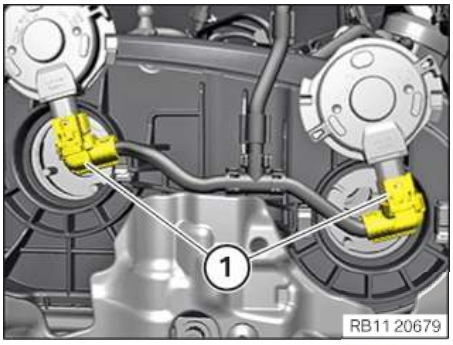


NOTICE

The figure shows the rear side of the engine.

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

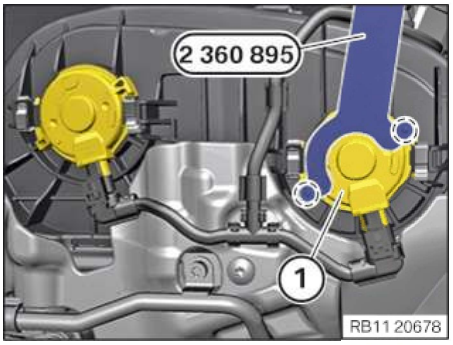
12 – Installing both actuators



NOTICE

The figure shows the rear side of the engine.

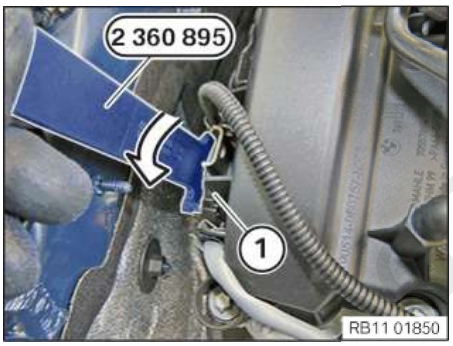
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



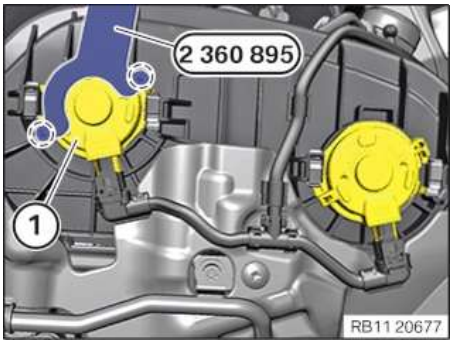
NOTICE

The figure shows the rear side of the engine.

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



- 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.

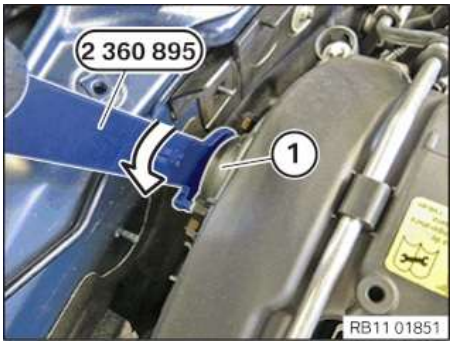


NOTICE

The figure shows the rear side of the engine.

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

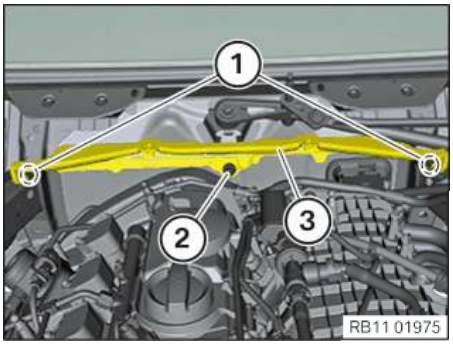
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- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

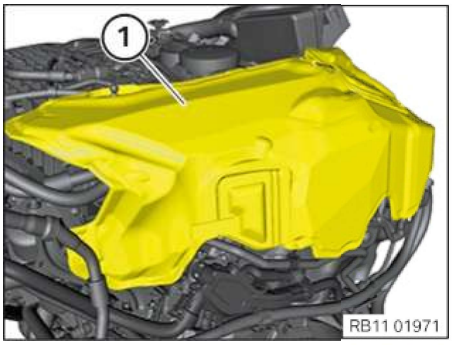
POSTPROCESSES

13 – Installing centre bulkhead lower section

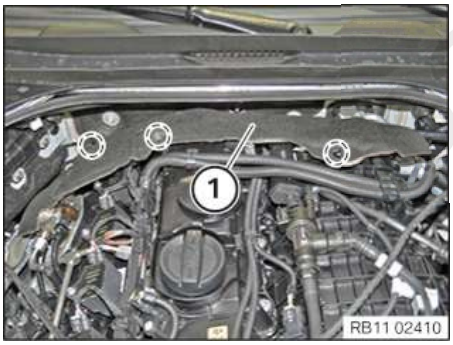


- Position the centre bulkhead lower part (3).
- Tighten nut (2) and screws (1).

14 – Installing acoustic cover at rear

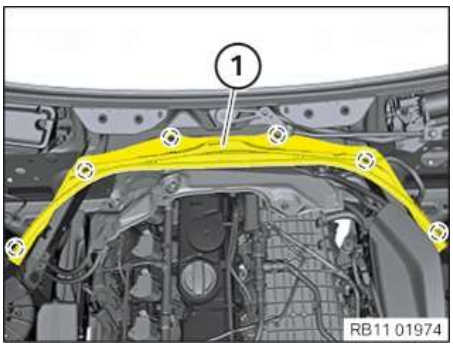


- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



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

15 – Installing the centre bulkhead upper part

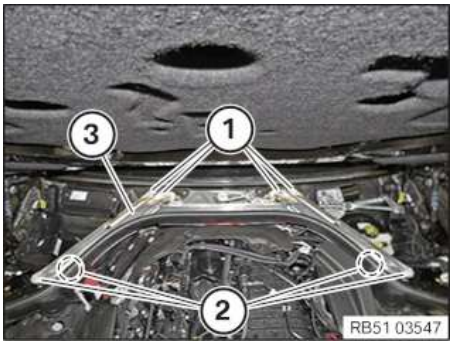


- Position the centre bulkhead upper part (1).
- Tighten the bolts in the marked areas.

Bulkhead upper part to bottom bulkhead

	Tightening torque	3 Nm

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- **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 °

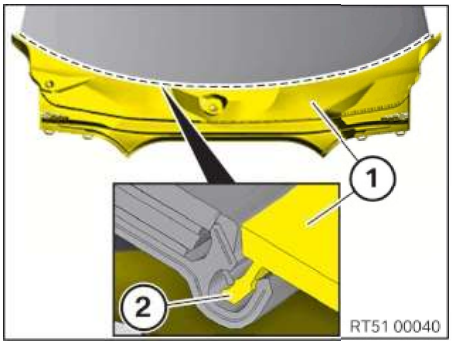
16 – Installing cowl panel cover

RISK OF DAMAGE

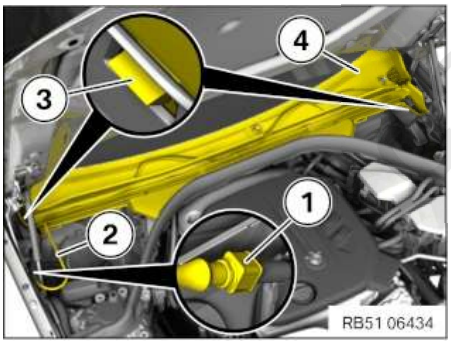
Damage caused by water ingress into the vehicle.

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.

17 – Installing both wiper arms

NOTICE

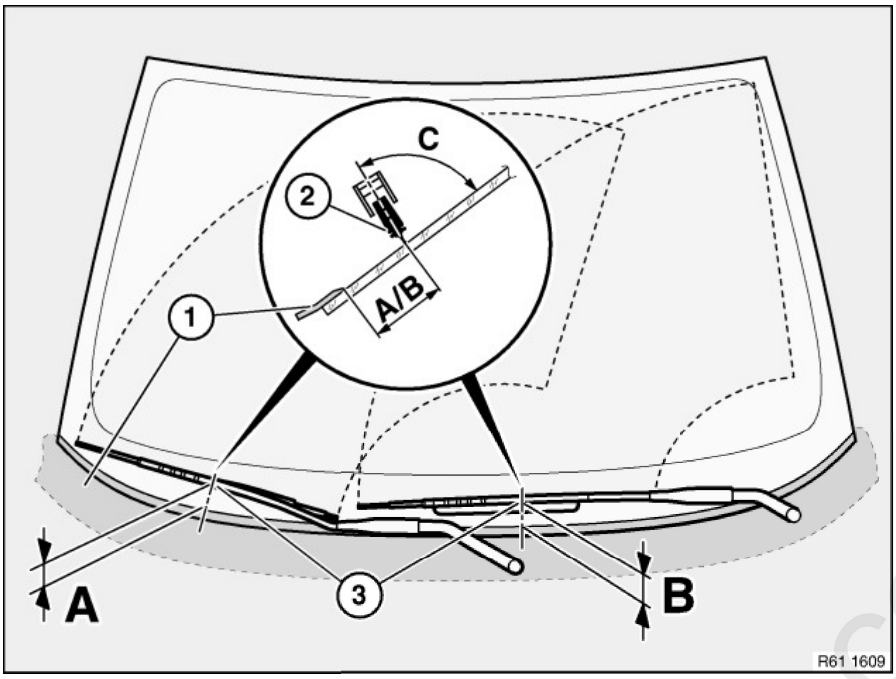
Description is for left component only. Procedure on the right side is identical.

▸ **Install the wiper arm**

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TECHNICAL INFORMATION

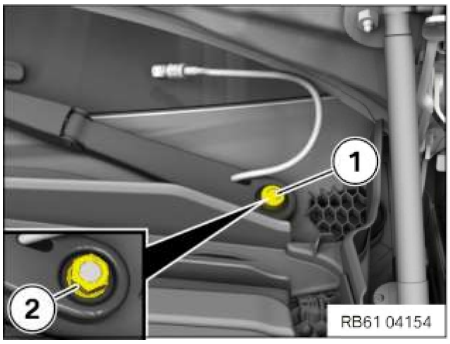
The wiper system must be in zero position.
After installing the cowl panel cover and before fitting the wiper arm:
Activate the wiper system once to ensure that it has the correct installation position.



- 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

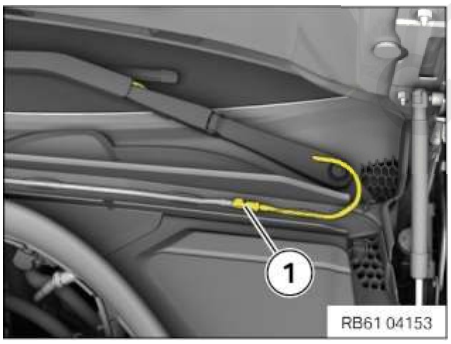


- Tighten nut (2).

Windscreen wiper arm

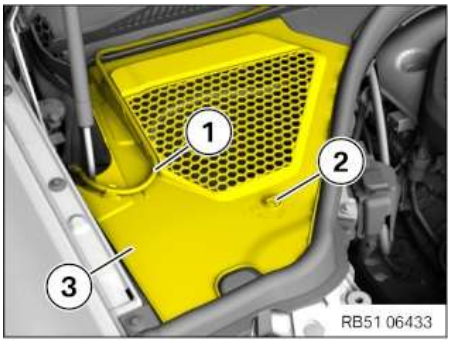
Combination hexagon nut		Tightening torque	35 Nm

- Connect the protective cap (1).



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

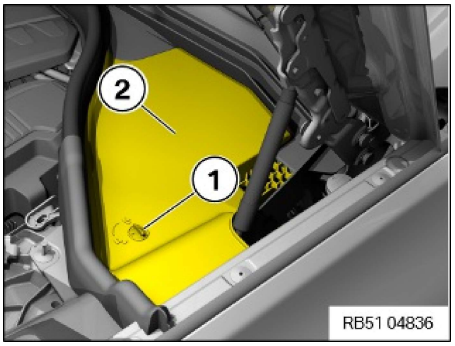
18 – Install the rear right engine compartment cover



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

19 – 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).

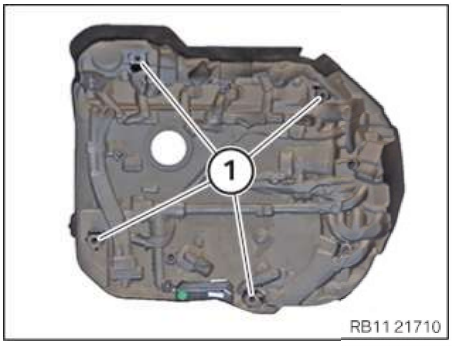
20 – Install acoustic cover

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).

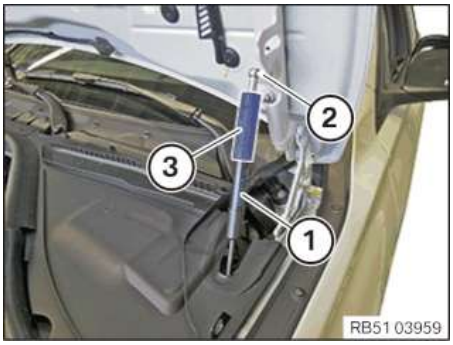
21 – Install the seal for the bonnet



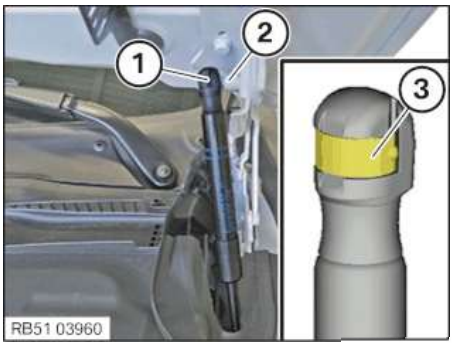
- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

22 – 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

Bulkhead upper part to bottom bulkhead — Used in step 15

		Tightening torque	3 Nm

Tension strut on bulkhead — Used in step 15

M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome — Used in step 15

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

Windscreen wiper arm — Used in step 17

Combination hexagon nut		Tightening torque	35 Nm

Overview of Special Tools

2 360 895 Pin wrench



Common — Used in step 1112

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)

Overview Technical Data

Distance from window pane edge to wiper blade — Used in step 17

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

Links

Repair instructions	Used in step
61 35 ... Notes on ESD protection (Electro Static Discharge)	11
61 35 ... Notes on ESD protection (Electro Static Discharge)	11

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11 36 127 Removing and installing/replacing both Vanos central valves

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

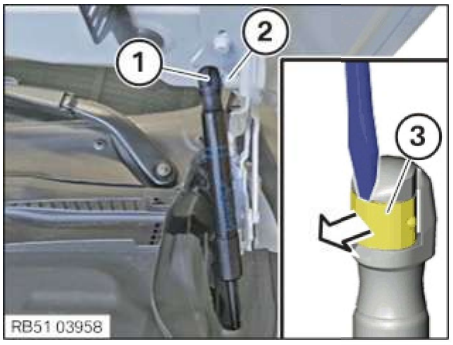
Engine compartment lid is open.

CAUTION

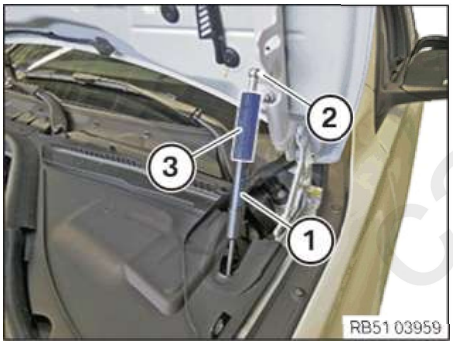
Shutting bonnet or tailgate.

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.

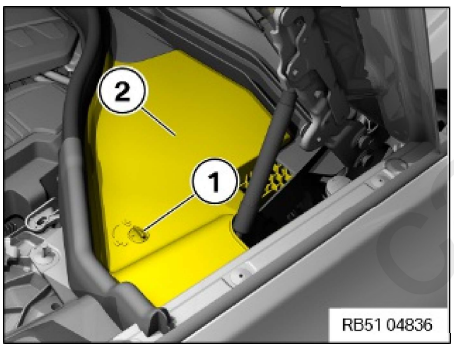
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- 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.



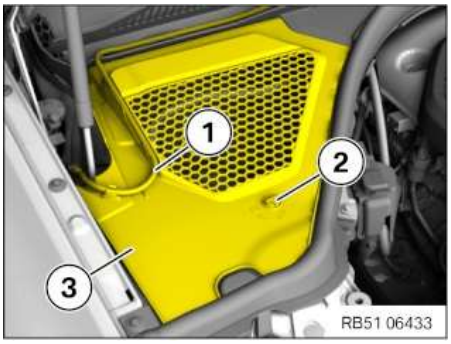
- Release the acoustic cover (1) towards the top from the rubber mounts (marks).

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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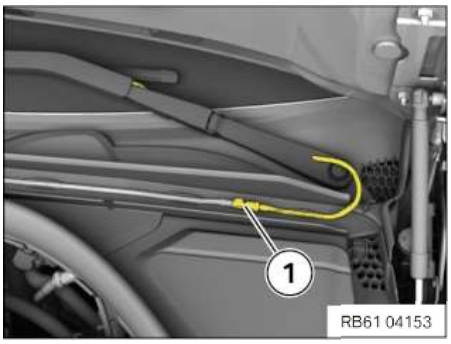
▸ **Remove the wiper arm**

RISK OF DAMAGE

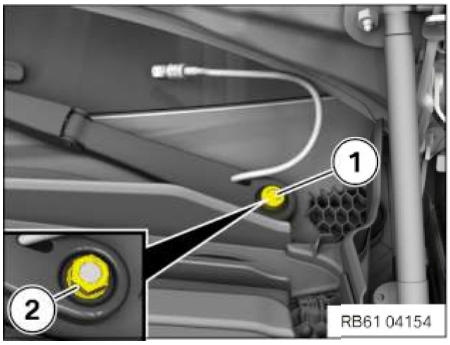
Damage to wiper console

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

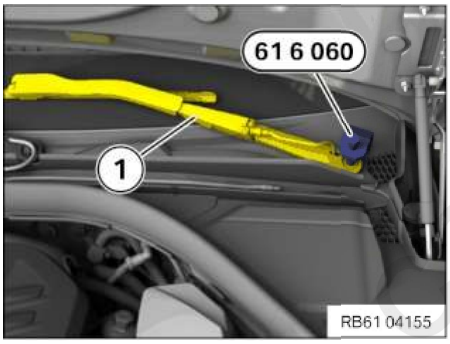
- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.



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

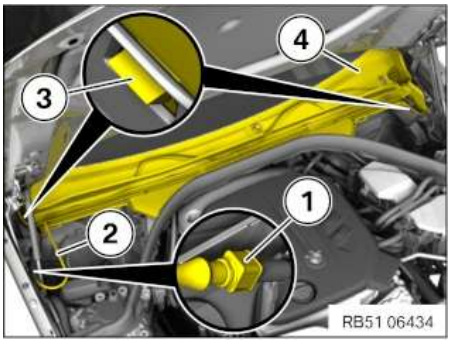


- Remove the protective cap (1).
- Loosen nut (2).



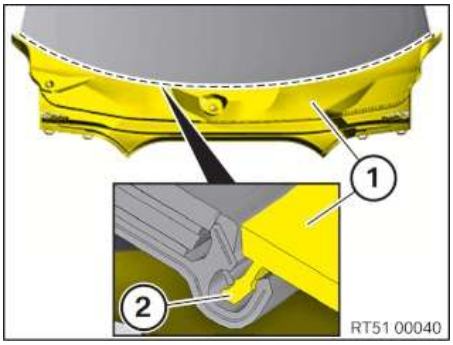
- Pull off the wiper arm (1) using special tool .

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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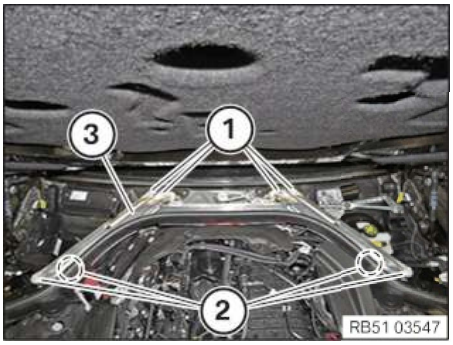


- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

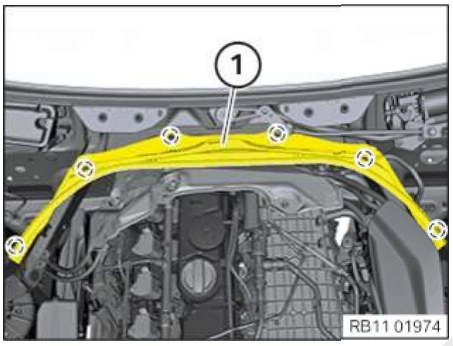
9 – Removing the centre bulkhead upper part

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.



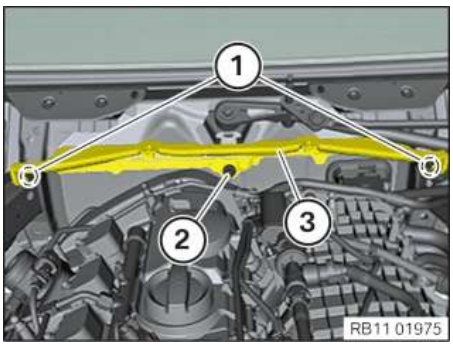
- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

10 – Removing acoustic cover at rear



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

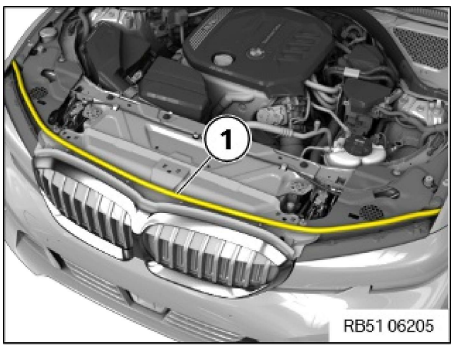
11 – Removing the centre bulkhead lower section



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

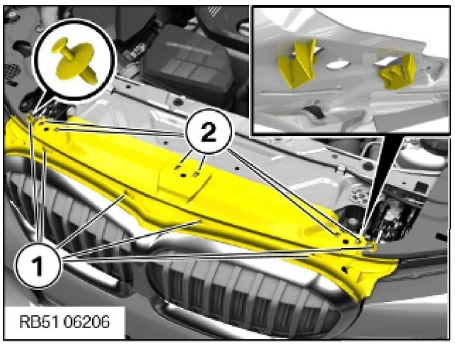
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12 – Remove the seal for the bonnet in front



- Pull off front bonnet seal (1) upwards.

13 – Removing the centre engine compartment cover



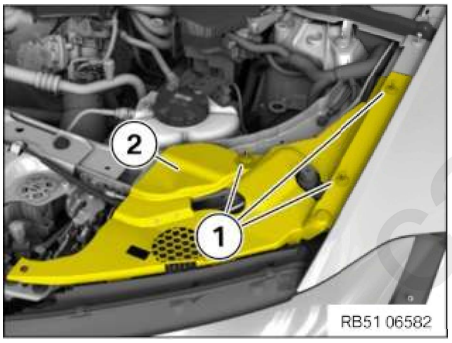
- Detach all expanding rivets (1).
- Release the cover of the centre engine compartment with the latch mechanisms (2) .
- Feed the cover for the centre engine compartment out to the rear.

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**



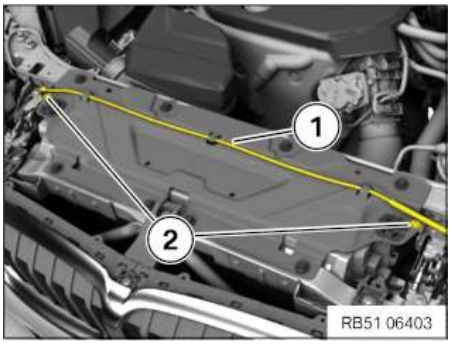
- Loosen the expanding rivet (1).
- Remove the cover in the engine compartment on top (2) partially.

15 – Removing the top cross connection

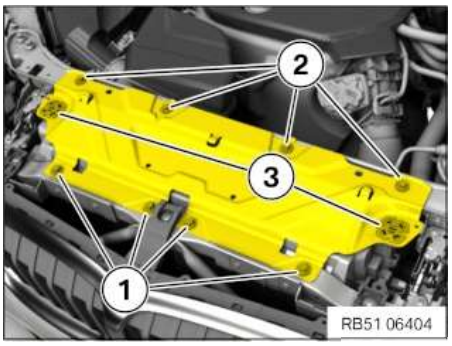


- Release the housing for the coupling of the Bowden cables (1) from the body.

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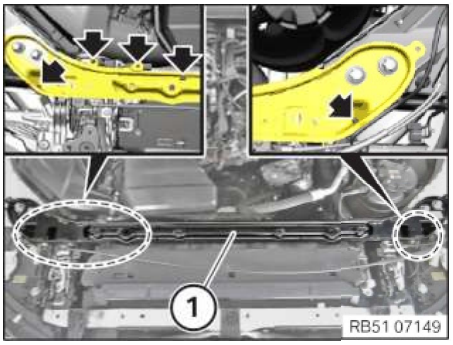


- Detach Bowden cable (1) at the top cross connection.
- Loosen screws (2).

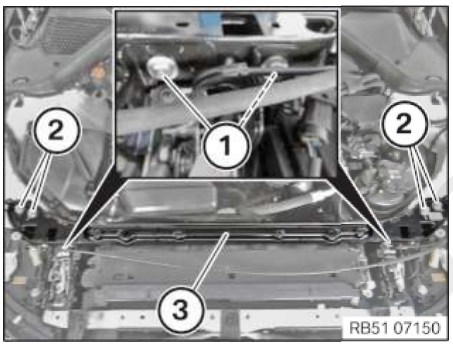


- Loosen screws (1) and (2).
- Remove the top cross connection with the holders(3) towards the top.

16 – Remove the rear top cross connection



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

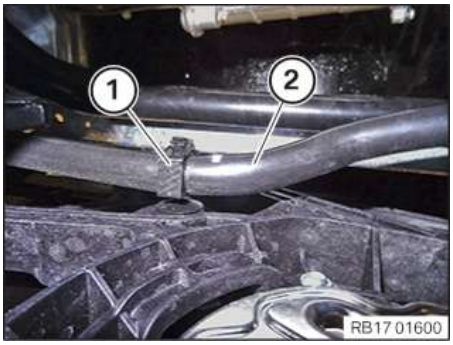


- Loosen screws (1).
- Loosen screws (2).
- Guide out and remove top rear cross connection (3).

17 – Remove fan cowl.

TECHNICAL INFORMATION

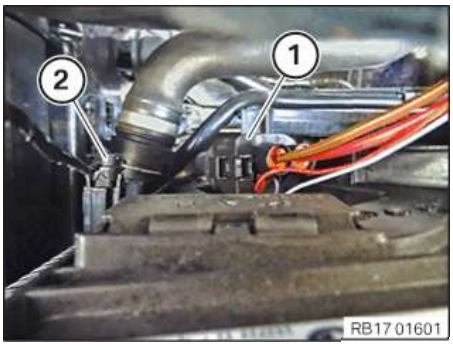
- When the engine is stopped after the end of the journey, it may be necessary to run the electric fan. In rare cases, operation of the electric fan can last up to 11 min. This protects the components. In this case, replacing the electric fan will not remedy the problem!



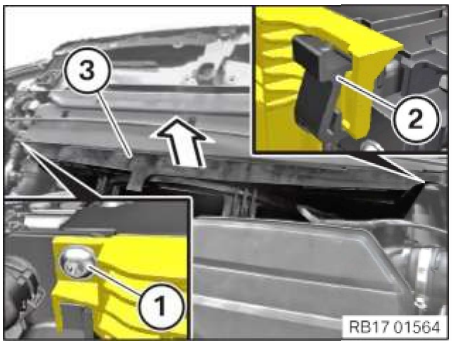
- **If installed:** Release transmission oil line (2).

  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.

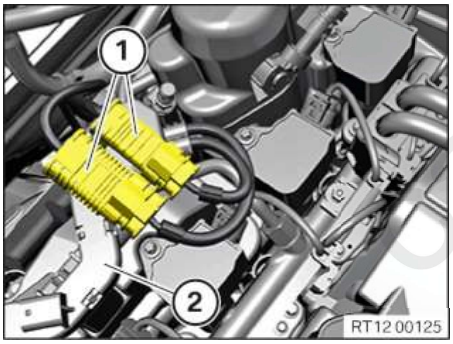
- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

RISK OF DAMAGE

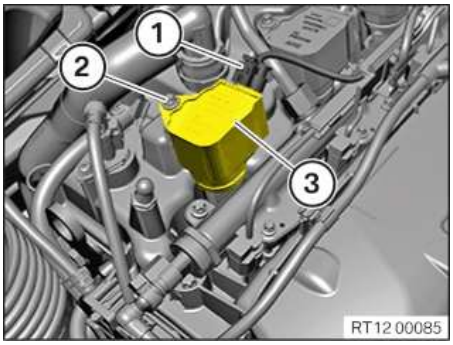
Electrostatic discharge.

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

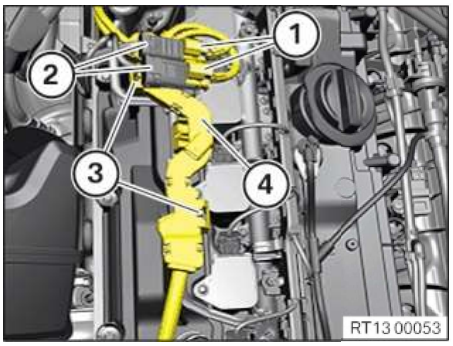
On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

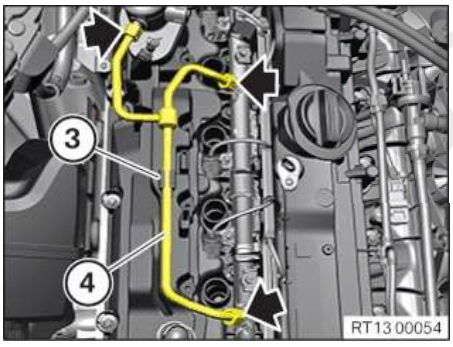
- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

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

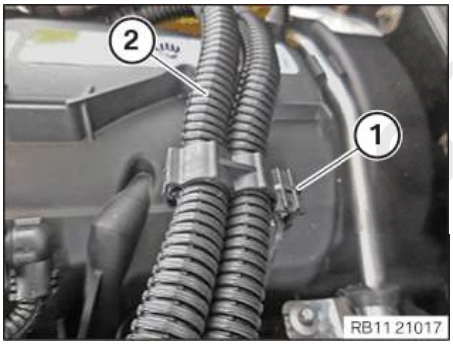
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

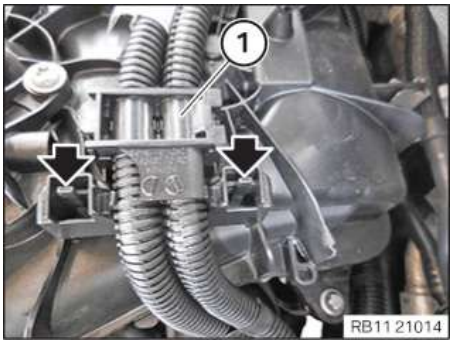
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

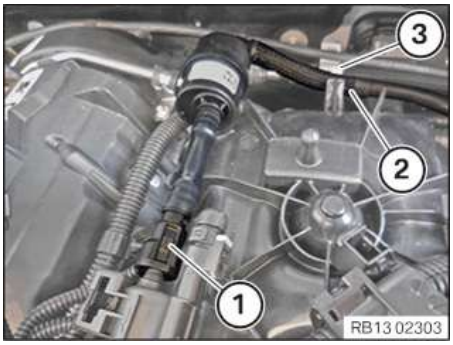
Reset special tool in early to avoid bending pressure lines.



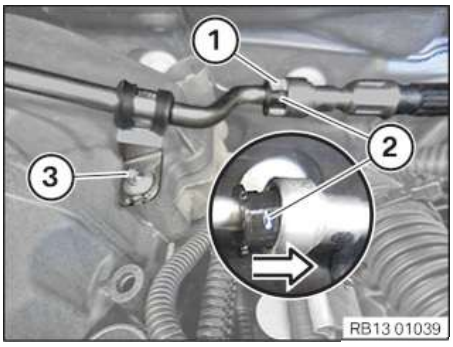
- Loosen clamp (1).
- Guide out wiring harness section (2) for the injectors and ignition coils and place it aside.



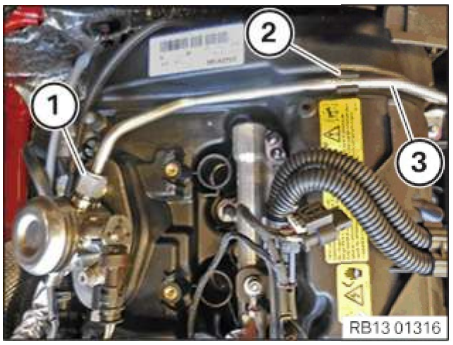
- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.



- 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

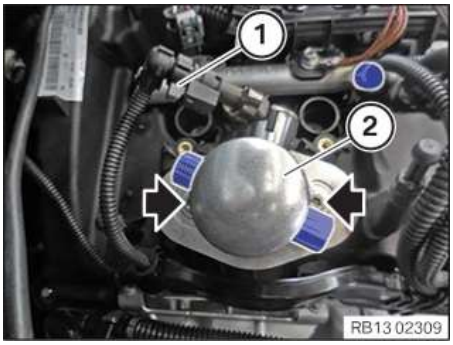
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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.

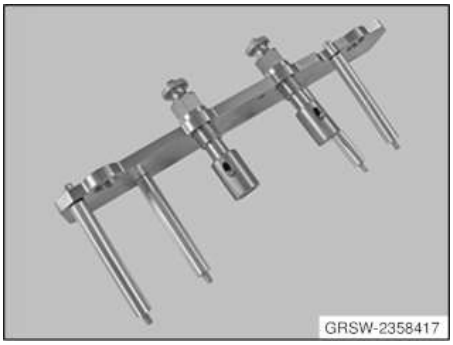
Excessive force may damage the injector and this means having to renew the injector.

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



- Prepare special tool .

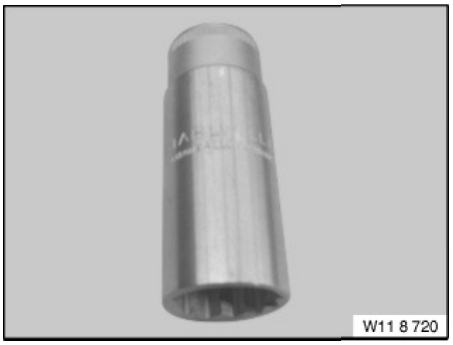
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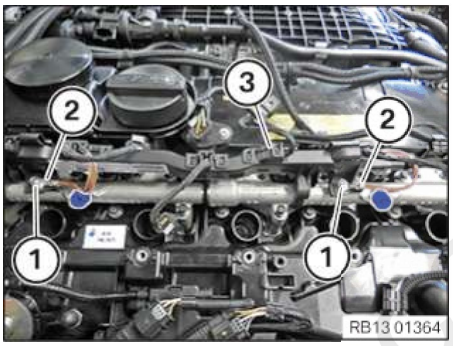
- Prepare special tool 2 358 417.



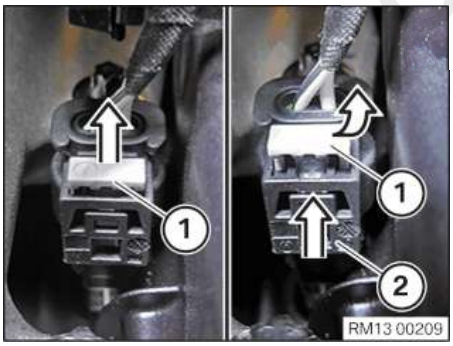
- Prepare special tool .



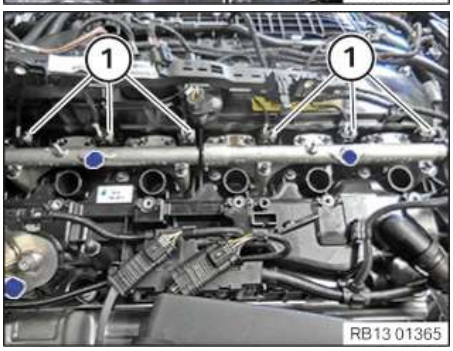
- Prepare special tool 0 496 106 (11 8 720).



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

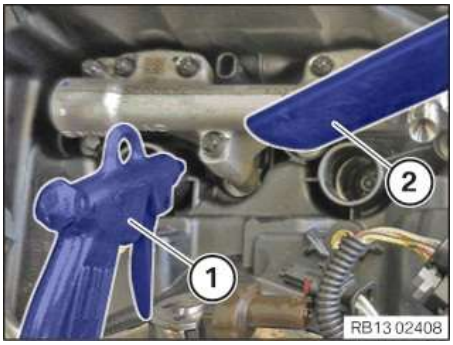


- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull out the connector (2) from the injectors.



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

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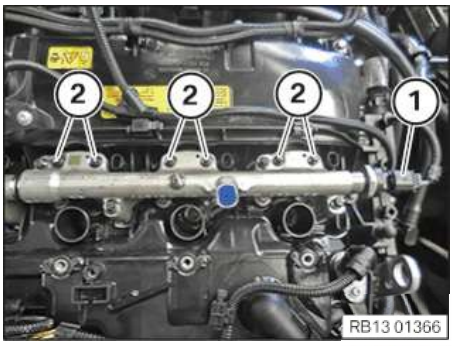


TECHNICAL INFORMATION

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

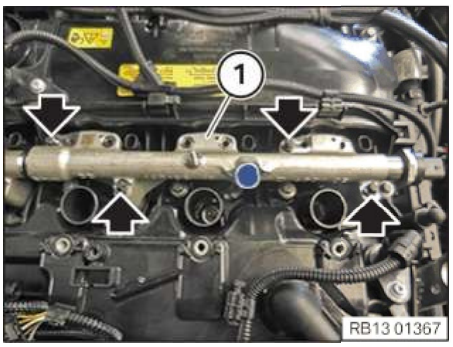
- Before releasing the high pressure lines: Blow out the injector shafts with an air gun(1) with less pressure.
- Simultaneously, draw off the dirt particles with an **explosion proof** vacuum cleaner (2).



- 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.

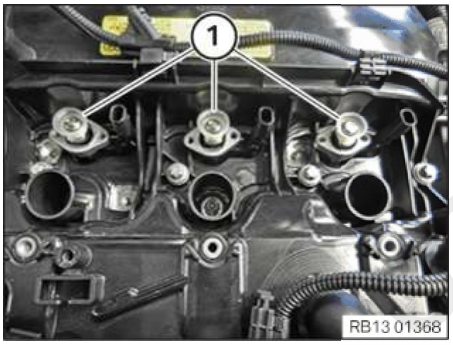


- Unscrew the screws (M6x30) (arrows).

  The screws may not be reused!
- Renew screws.

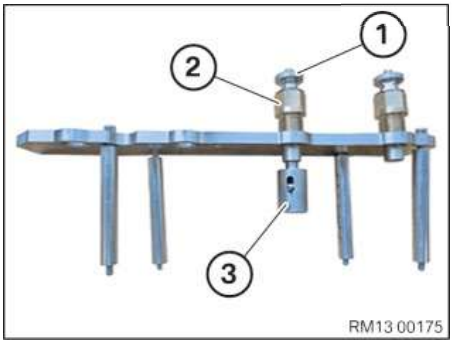
  Parts: Screws (M6x30)
- Remove rail (1) in upward direction.

  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.

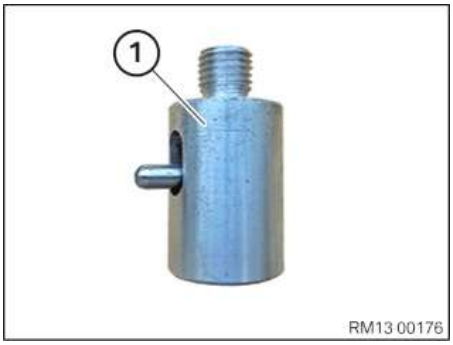
- Twist the injectors with a maximum torsional movement of 13 Nm.
- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use the special tool 2 358 417to remove the injectors.

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

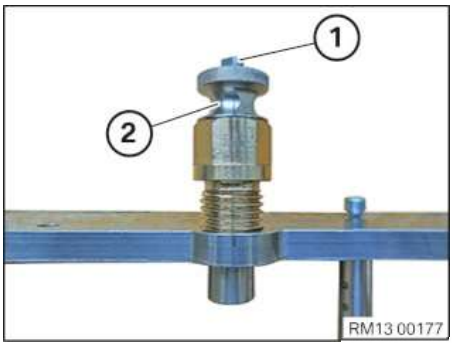
  Special tool 2 358 417 consists of:

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

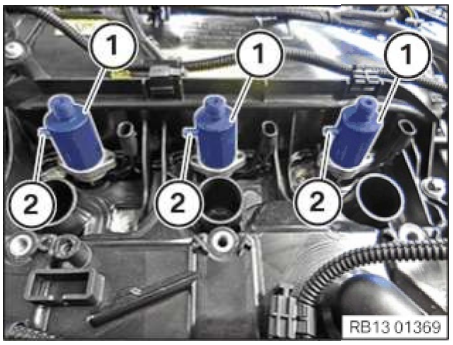
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- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.

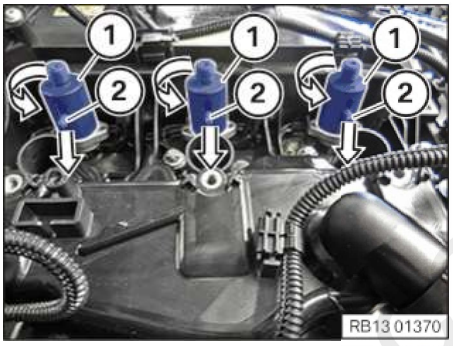


- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.

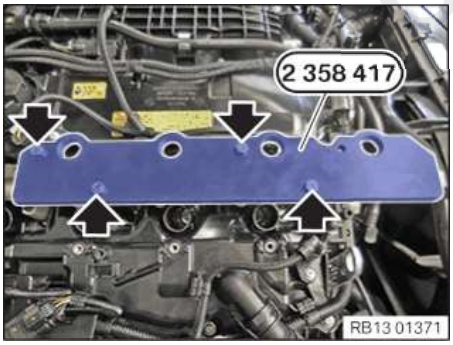


- Install all fixtures (1) for the injectors.

  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

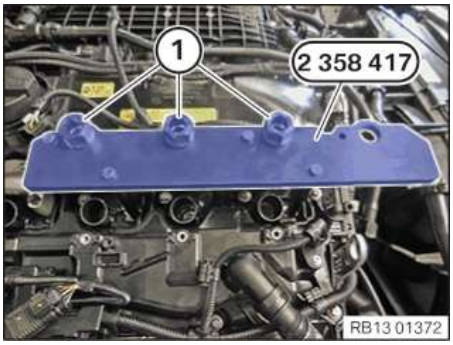
Damage to injectors.

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).

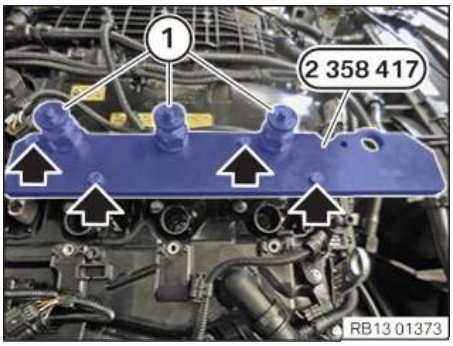
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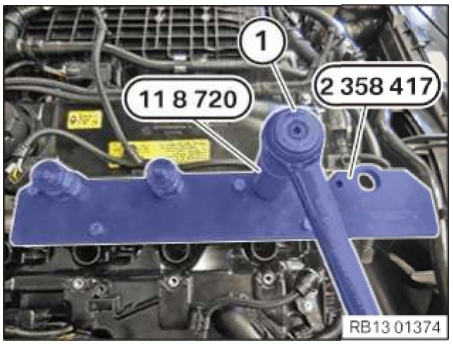
TECHNICAL INFORMATION

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.

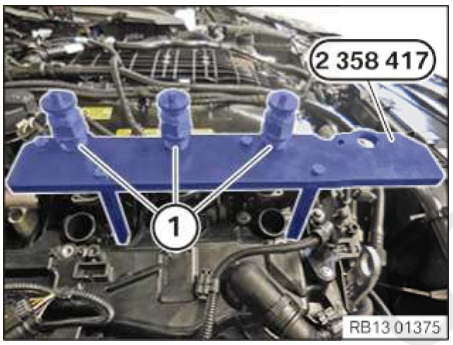


- Adjust torque wrench to 13 Nm **clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720)until the injector is pulled out.

TECHNICAL INFORMATION

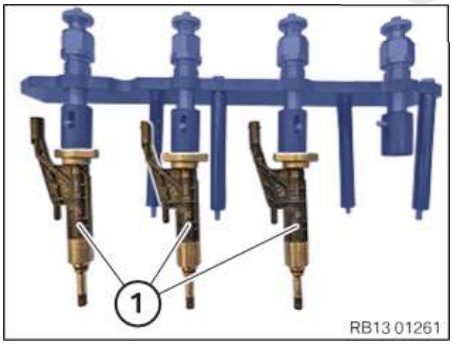
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

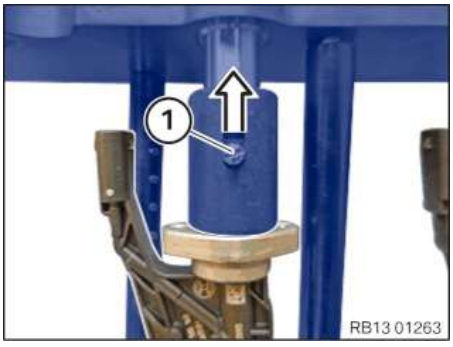


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  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.

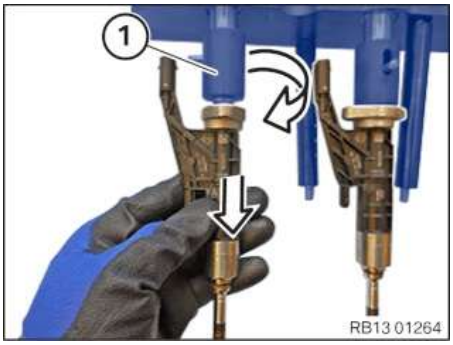


NOTICE

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.

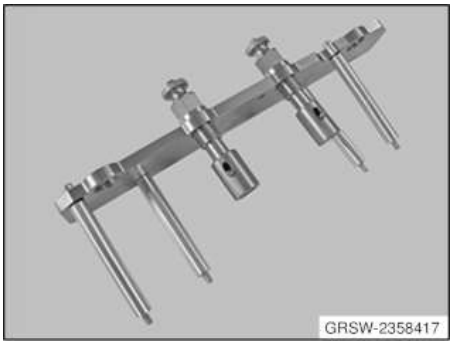
Excessive force may damage the injector and this means having to renew the injector.

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



- Prepare special tool .

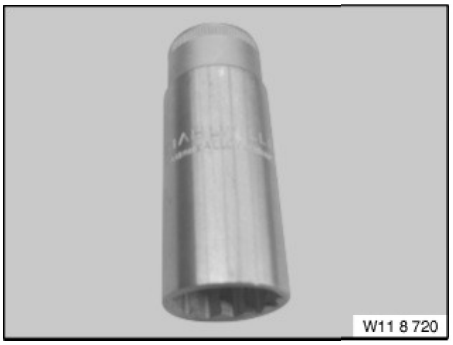
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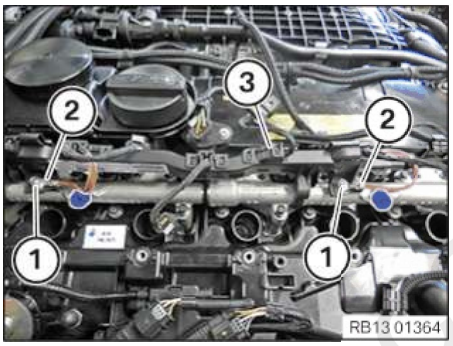
- Prepare special tool 2 358 417.



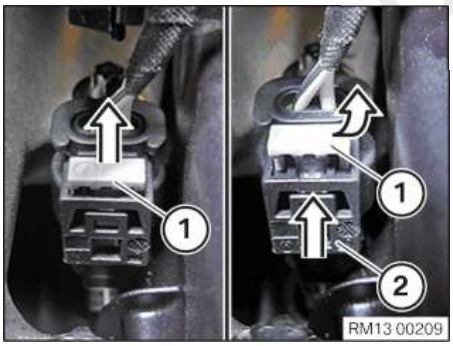
- Prepare special tool .



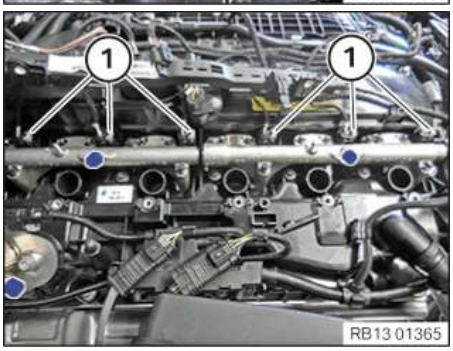
- Prepare special tool 0 496 106 (11 8 720).



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

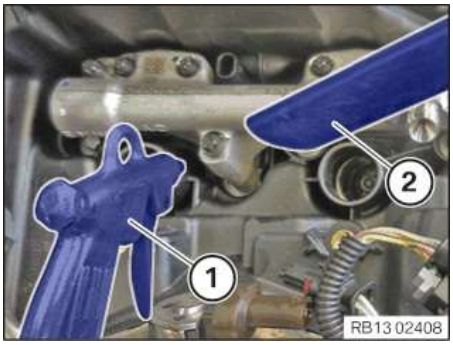


- Unlock lock (1) in direction of arrow upwards.
- Press lock (1) together and release.
- Disconnect the connector (2) from the injectors in the direction of the arrow.



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

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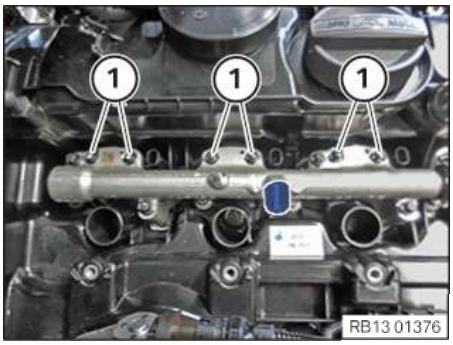


TECHNICAL INFORMATION

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

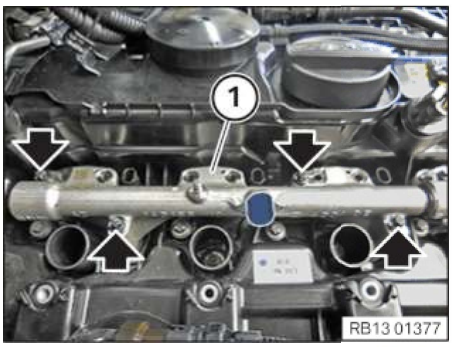
For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

- 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) .

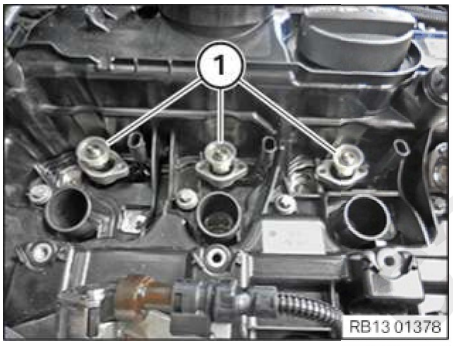
  Do **not** reuse screws (M5x30) (1).
- Catch and dispose of escaping fuel with suitable materials.



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

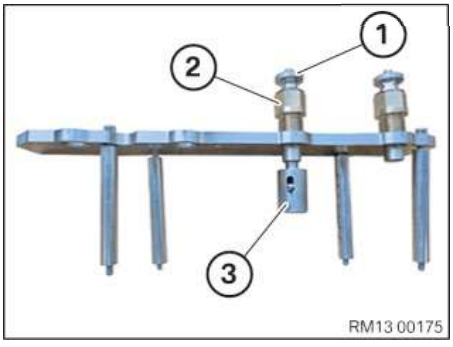
  Do **not** reuse the screws (M6x30).
- Remove rail (1) upwards.

  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.

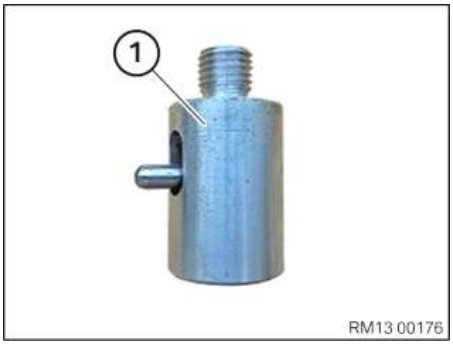
- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use the special tool 2 358 417 to remove the injectors.

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

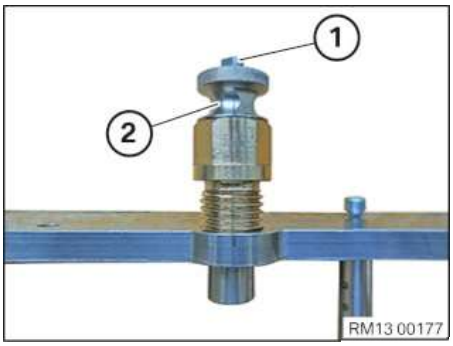
  The special tool 2 358 417 consists of:

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

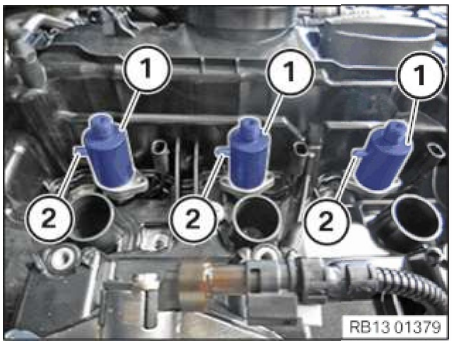
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- Unscrew the fixture for injectors (1) from special tool 2 358 417.

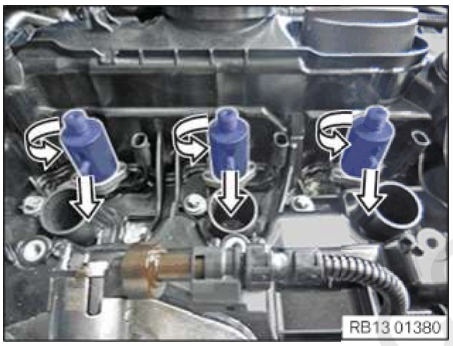


- Press lock (1) in and remove the threaded sleeve (2) from the special tool 2 358 417.



- 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

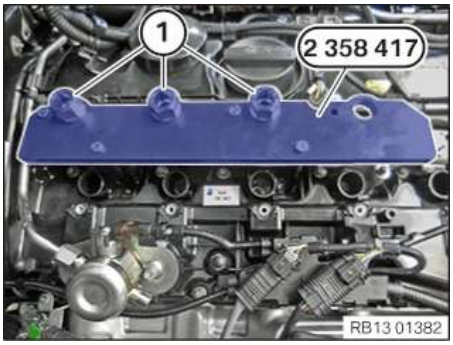
Damage to injectors.

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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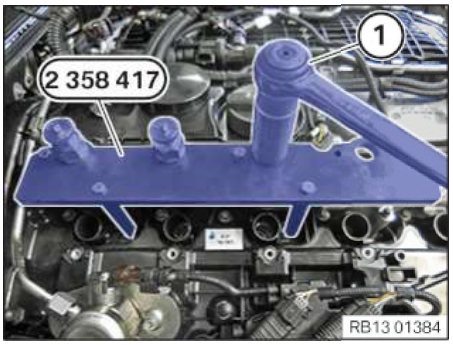
TECHNICAL INFORMATION

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.

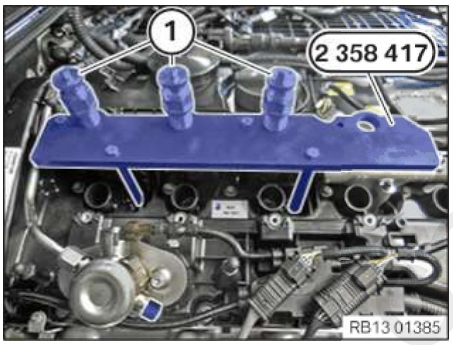


- Adjust torque wrench to 13 Nm **in clockwise** direction.
- Turn the torque wrench (1) with the special tool 0 496 106 (11 8 720) **clockwise**, until the injector is pulled out.

TECHNICAL INFORMATION

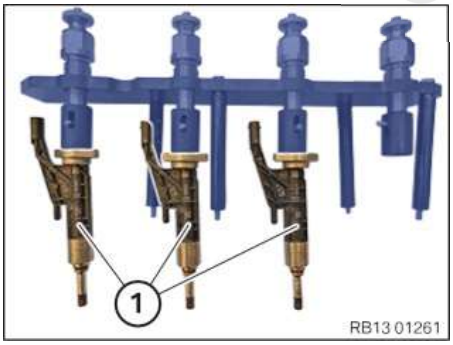
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

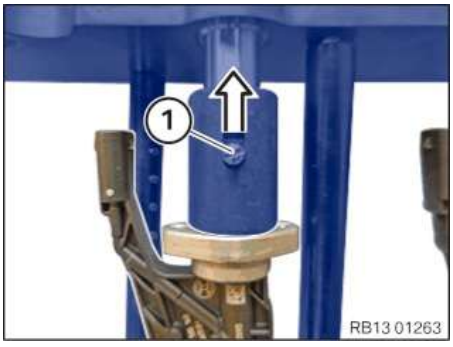


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  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.

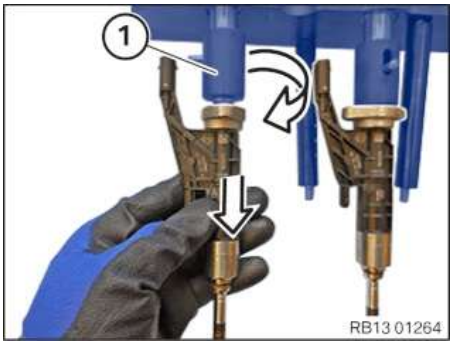


NOTICE

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.

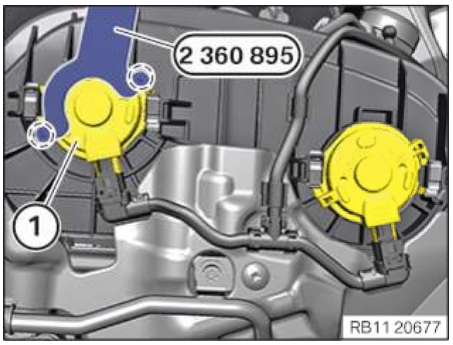
26 – Removing both actuators

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

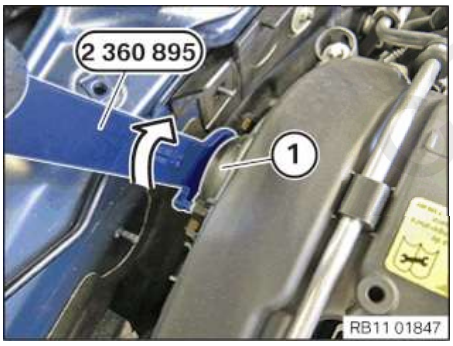
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the 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.



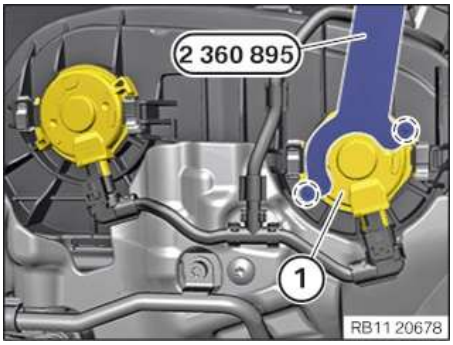
NOTICE

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.

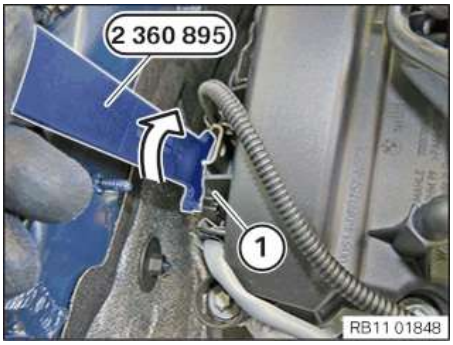


NOTICE

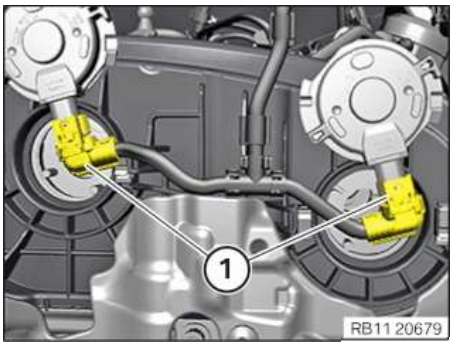
The figure shows the rear side of the engine.

- 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.



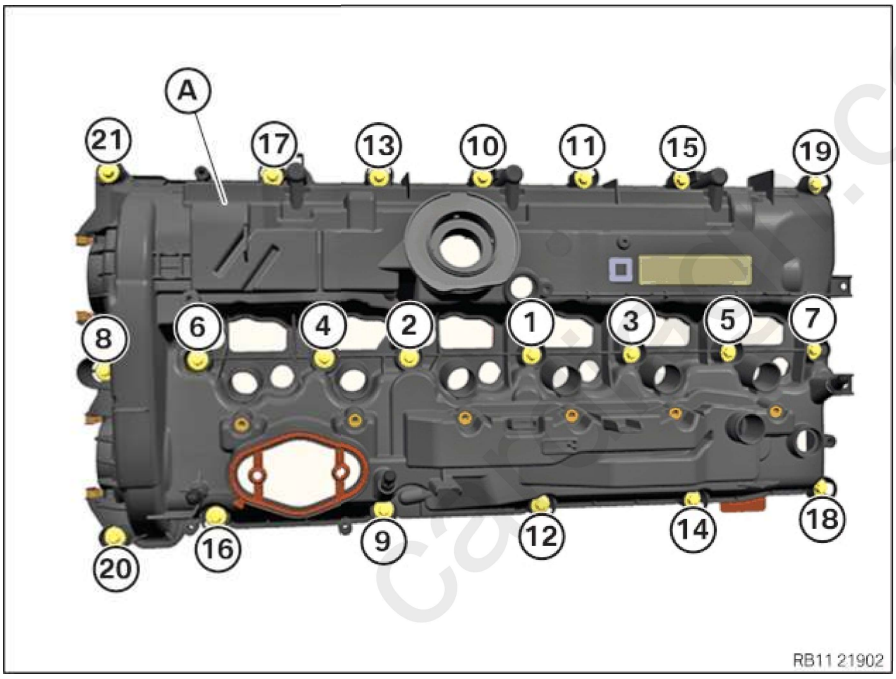
NOTICE

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

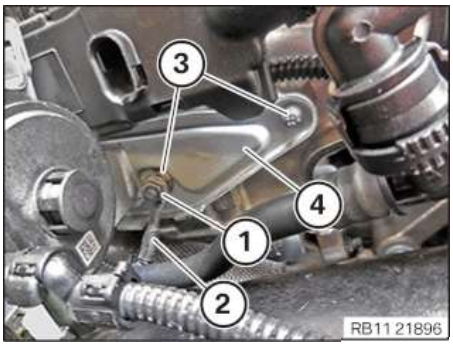
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

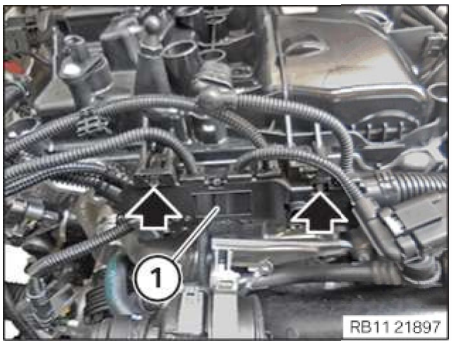
- Do not pull on the wires when disconnecting connectors and plug connections.



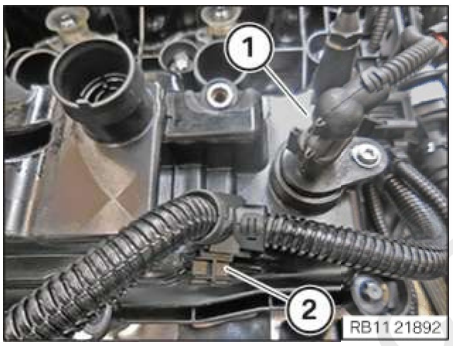
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



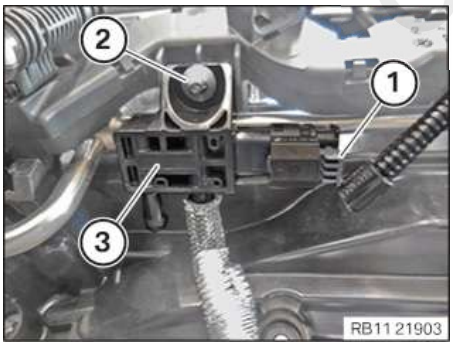
- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Loosen screws (3).
- Thread out holder (4) and set aside.



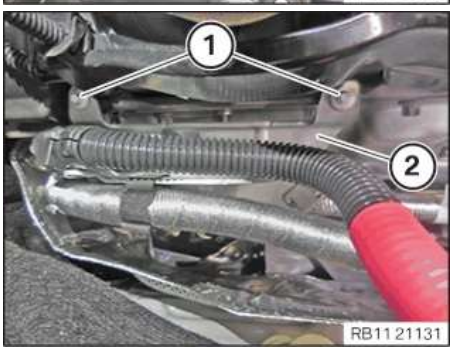
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for the sensor system **2** and place to one side.



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

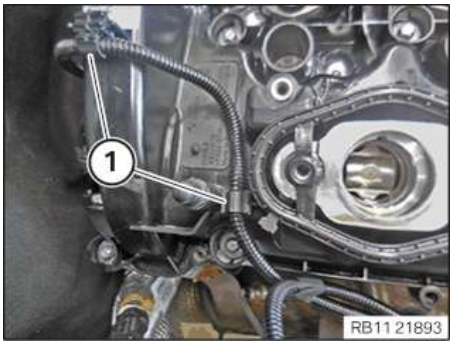


- **If installed:**
- Unlock and loosen connector (1).
- Loosen screw (2).
- Remove the differential pressure sensor (3) and put it to one side.

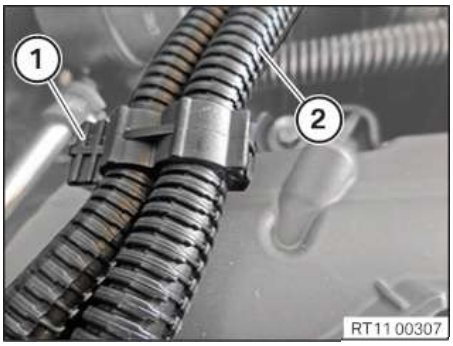


- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

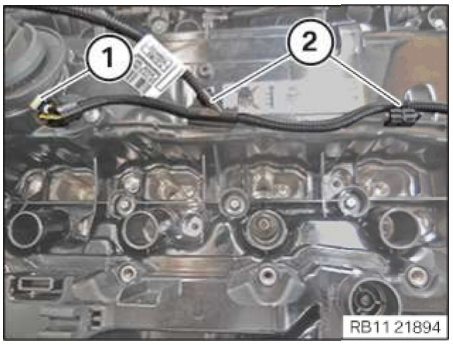
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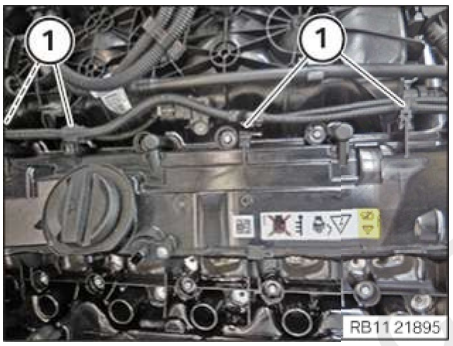
- Loosen clamps (1).



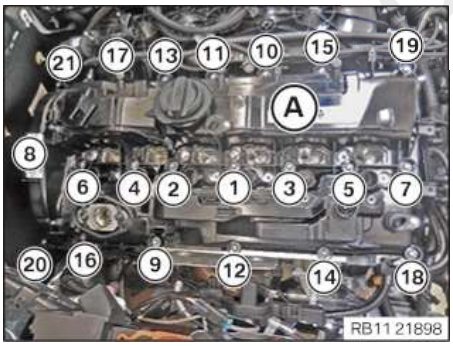
- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



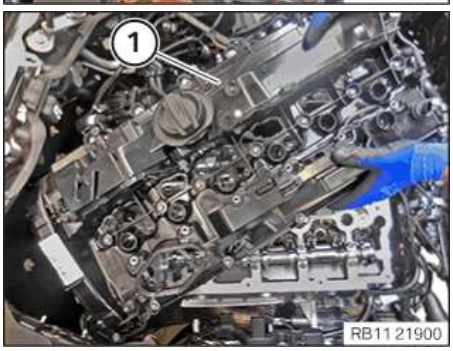
- Unlock and detach connector (1) on the intake camshaft sensor.
- Loosen clamps (2).



- Loosen clamps (1).



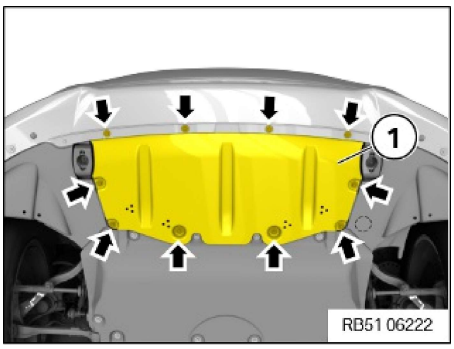
- Release all screws on the cylinder head cover (A) in the sequence (21) to (1).



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

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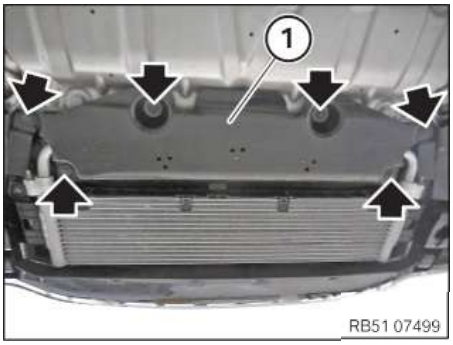
28 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

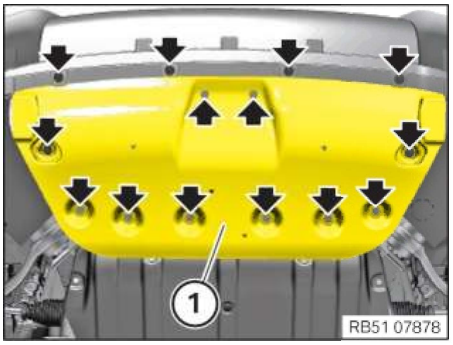
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

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

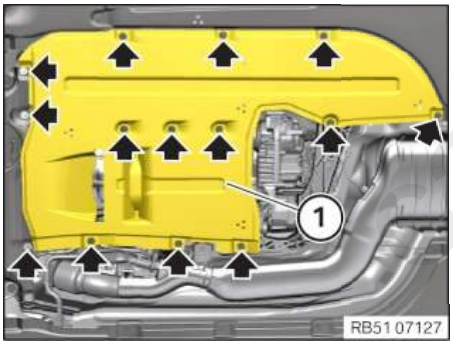


- **Version 3:**

  Remove screws (arrows).

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

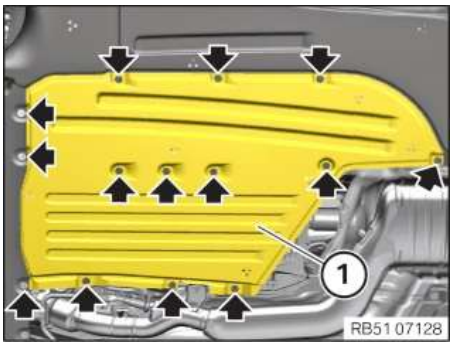
29 – Remove rear underbody protection



- **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

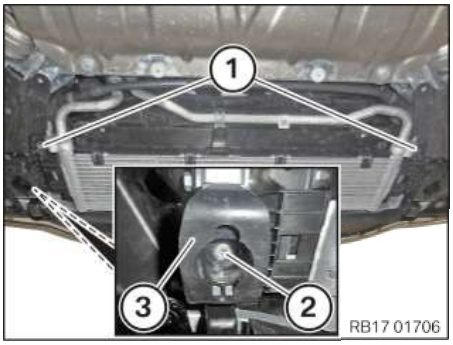
Hot surfaces.

Risk of burning!

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

TECHNICAL INFORMATION

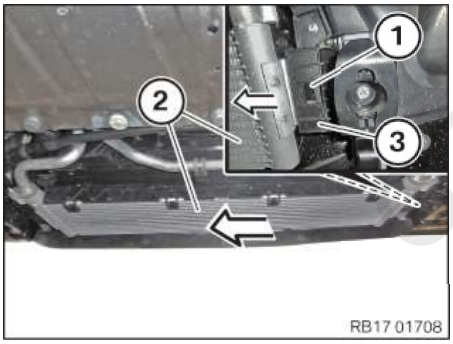
The work must be performed with care to prevent component damage.



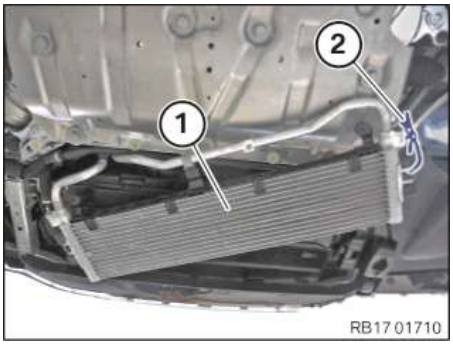
- Loosen screws (1).
- Drill out rivet on the left (2).
- Remove the left-hand damper (3).



- 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.



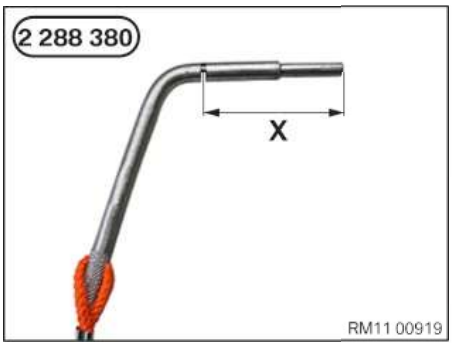
RISK OF DAMAGE

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.

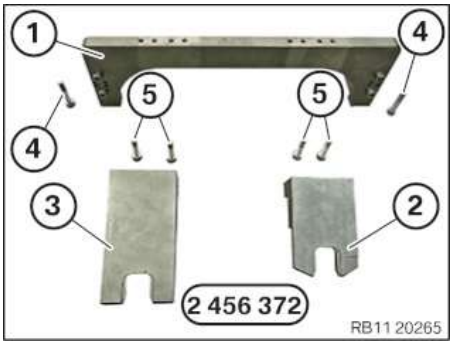


- **Vehicles with automatic transmission:**

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

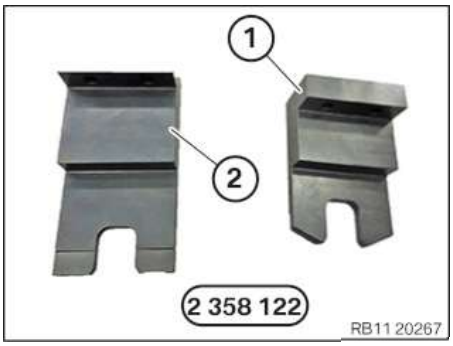
  The engine is in the TDC firing position of cylinder 1.

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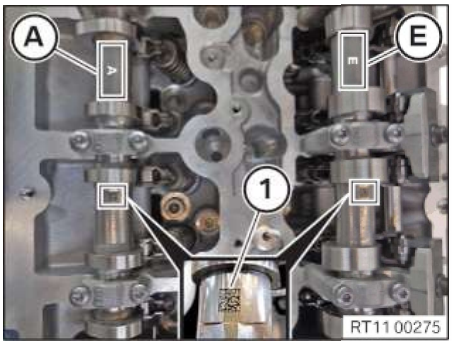
- Overview of the set of special tools 2 456 372:

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

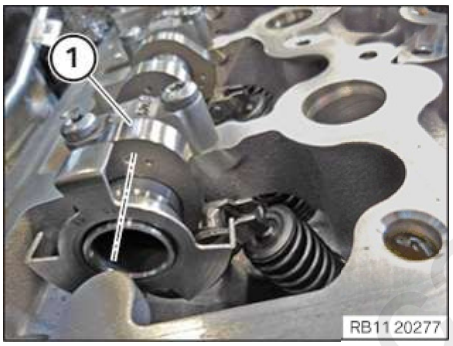


- Overview of the test gauges from the set of special tools 2 358 122:

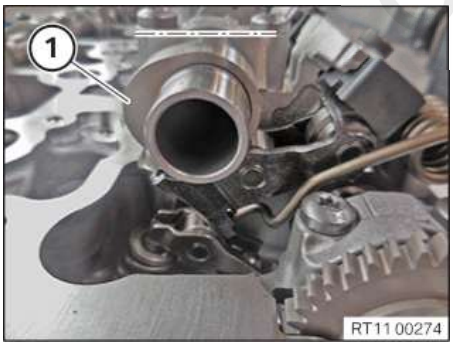
Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



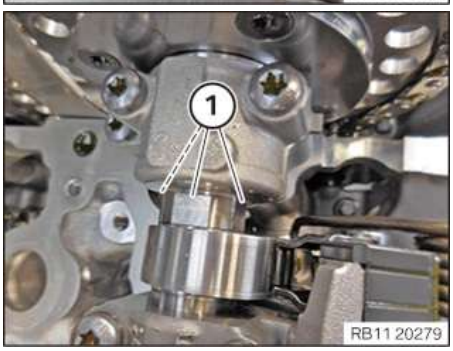
- Turn intake camshaft (E) and exhaust camshaft (A) until marks (1) can be read from the top.



- 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.

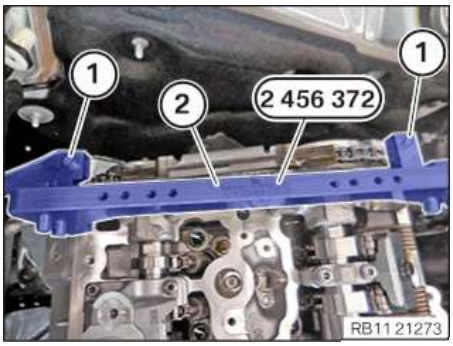


- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.

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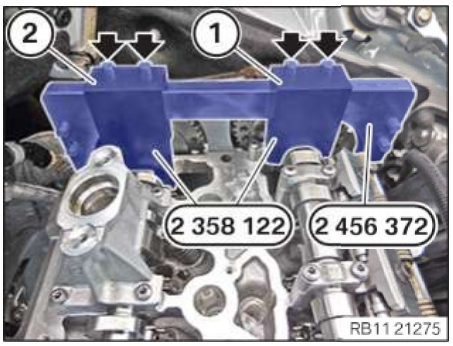
- Position basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- 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).

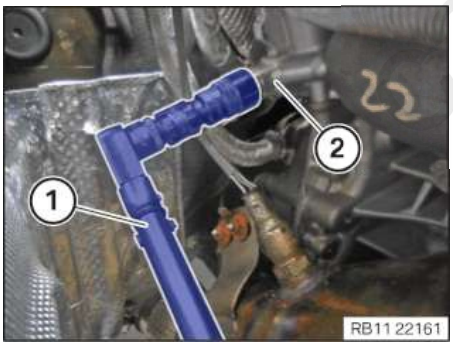
Test gauge to basic carrier

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).

MAIN WORK

33 – 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

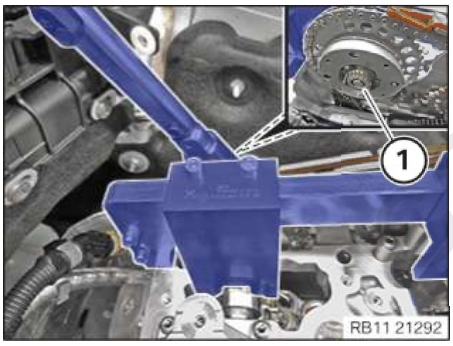
The figure shows the rear side of the engine.

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

34 – 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.

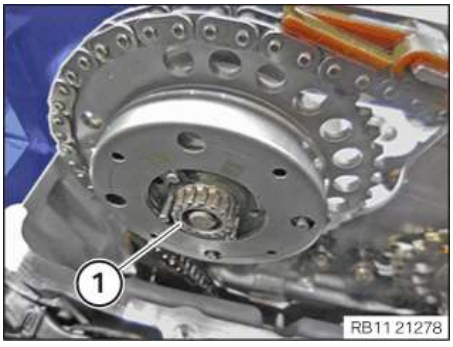


NOTICE

The figure shows the rear side of the engine.

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

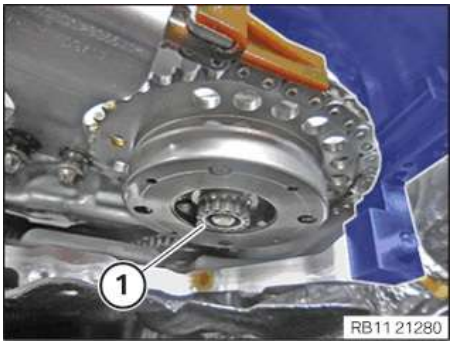
35 – Removing the VANOS central valve of the intake adjuster



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

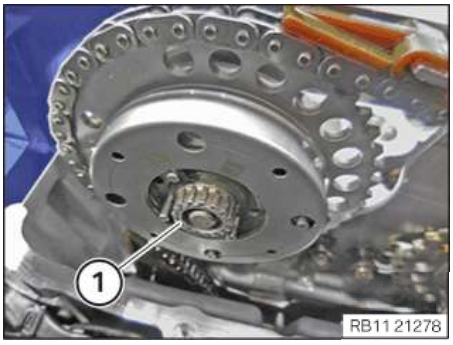
36 – Remove the VANOS central valve of the exhaust camshaft adjuster

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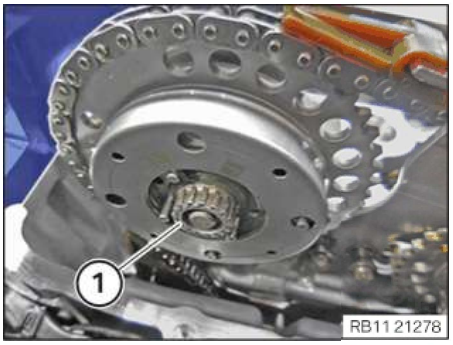


- Guide out and remove the VANOS central valve (1) of the exhaust camshaft adjuster.

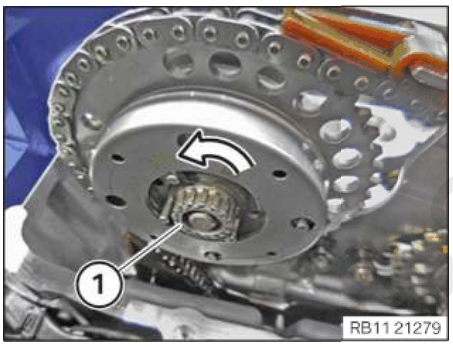
37 – Install the VANOS central valve of the intake adjuster



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

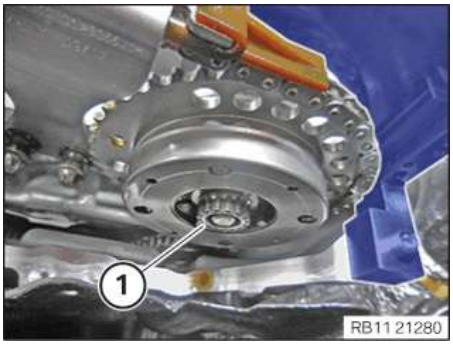


- Hand-tighten the VANOS central valve (1) of the intake adjuster.



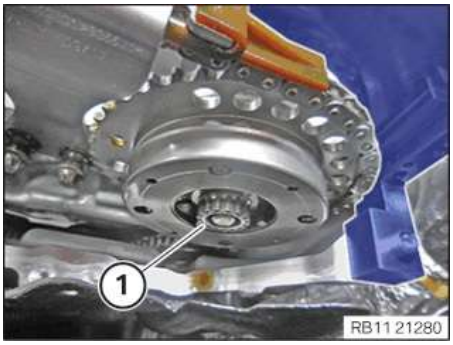
- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

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

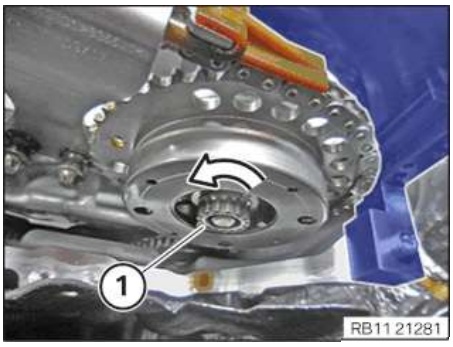


- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.

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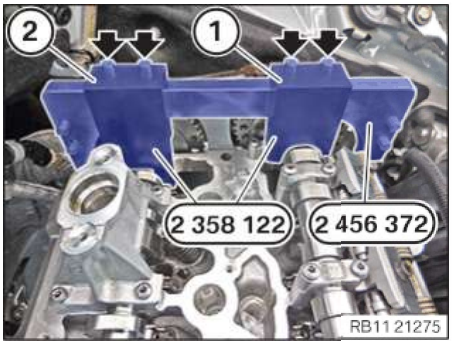


- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.



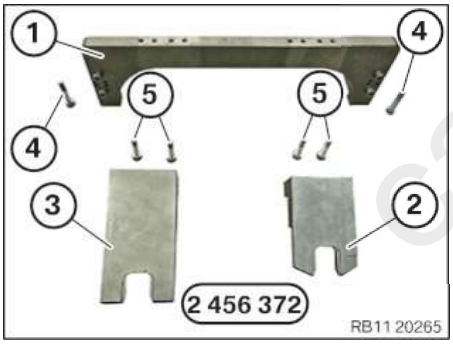
- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

39 – 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.

40 – 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

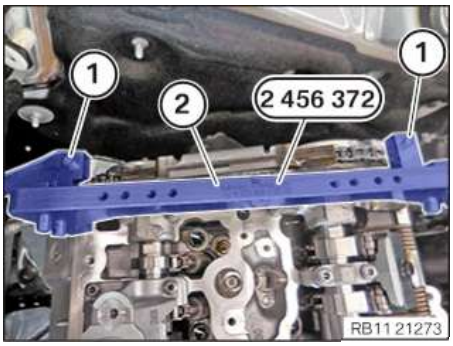


- Use the setting gauge 0.7 ° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.

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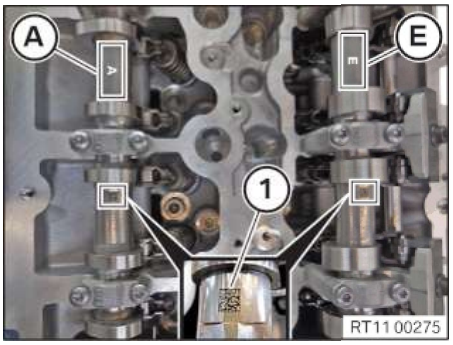
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



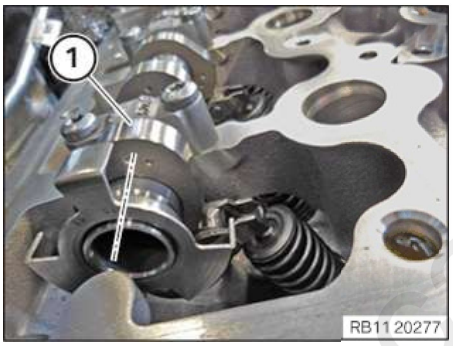
- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

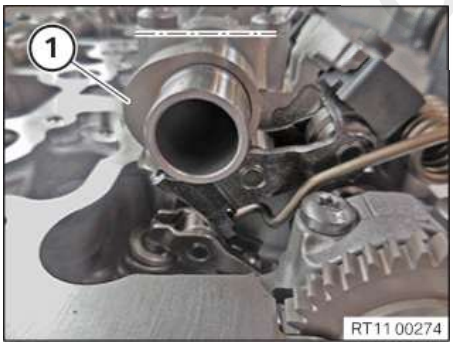
M6		Tightening torque	8 Nm



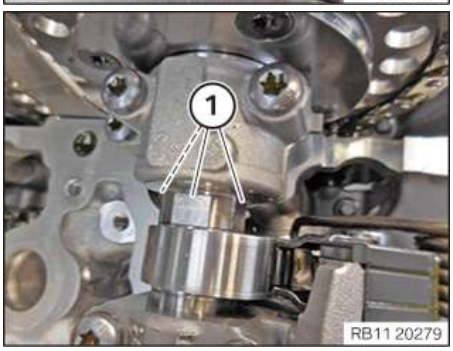
- Turn the intake camshaft (E) and the exhaust camshaft (A) such that the marks (1) can be read from the top.



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

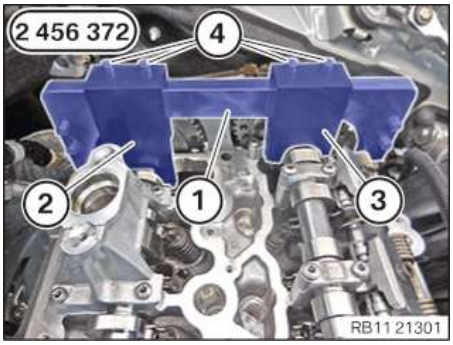


- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.



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

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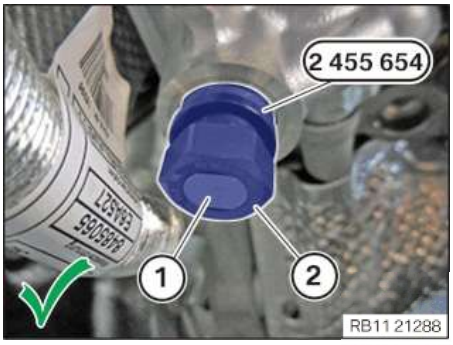


- Position the setting gauge 0.5° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten the screws (4).

Test gauge to basic carrier

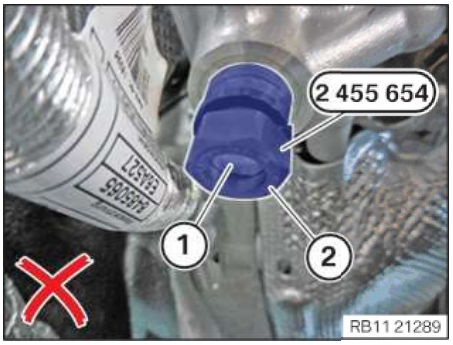
M6		Tightening torque	8 Nm

41 – 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.

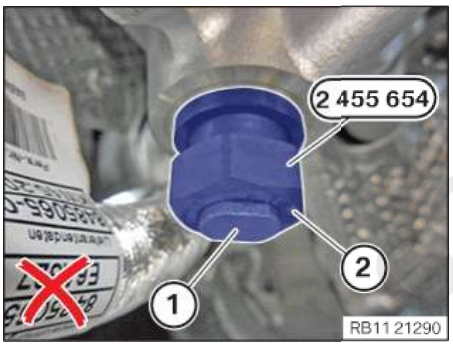
  The pin (1) must align **precisely** with housing (2).



- 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).

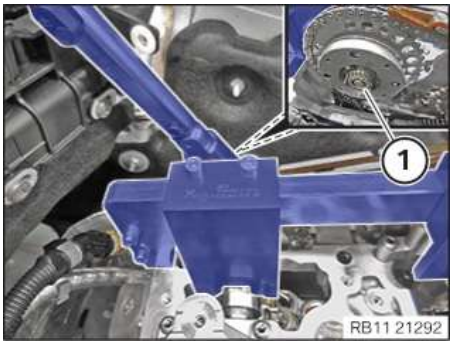
  The timing chain is **not correctly** pre-tensioned.

42 – 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.

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- 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 °

43 – 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.



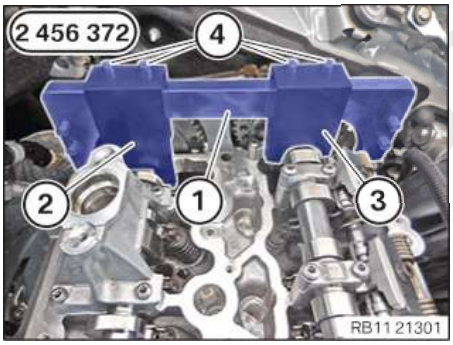
- Tighten the VANOS central valve (1) of the intake adjuster.

VANOS central valve to camshaft

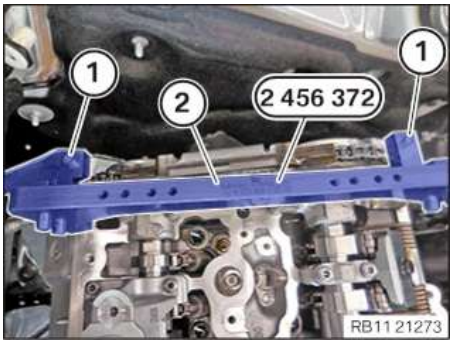
M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

POSTPROCESSES

44 – Disassembling all special tools

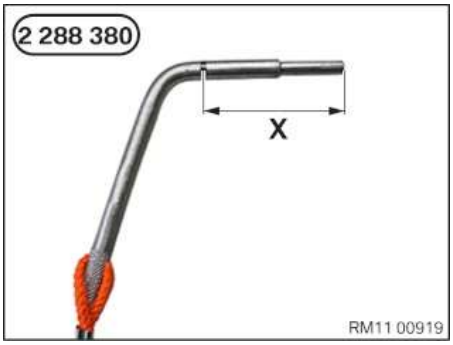


- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the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

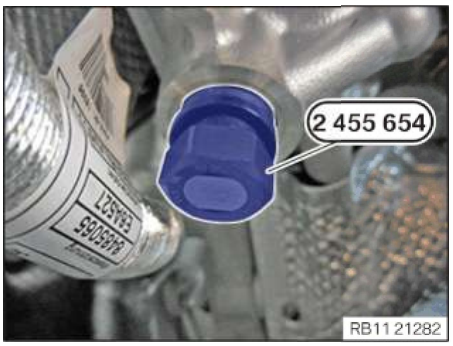
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- Guide the special tool 2 288 380 out and remove.



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



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

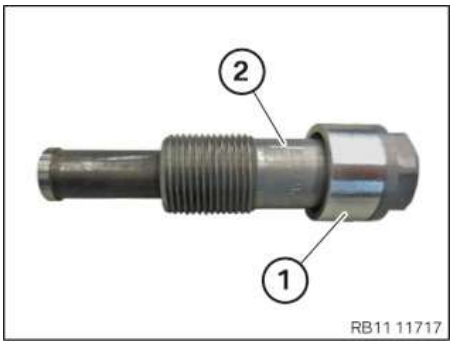
45 – Install chain tensioner

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.



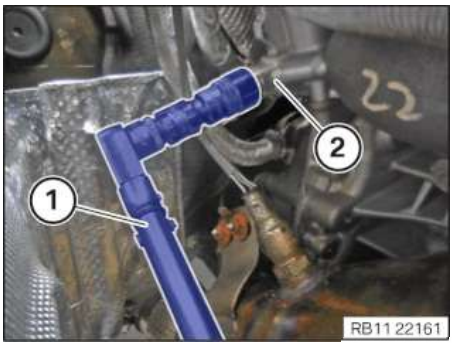
- Renew the sealing sleeve (1).

  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).

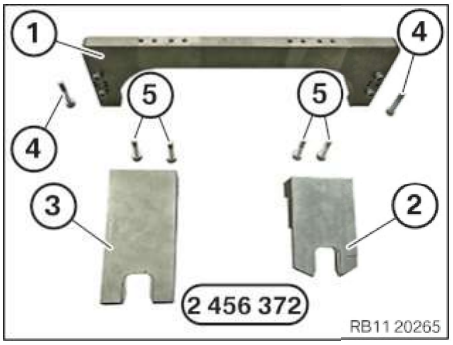


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

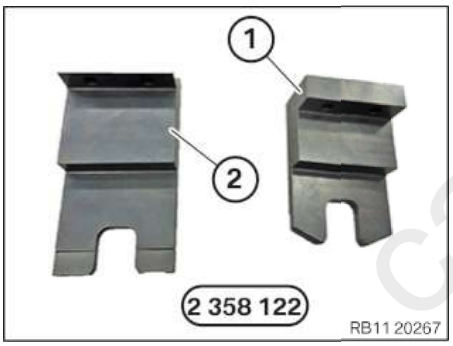
Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

46 – Checking camshaft timing



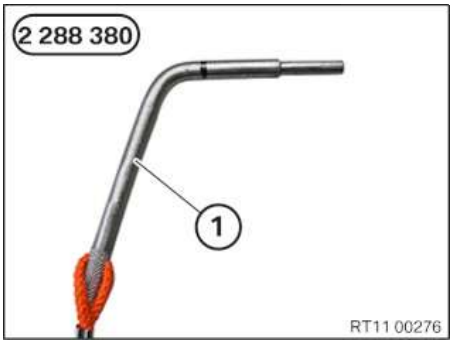
- Have the set of special tools 2 456 372 ready.

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

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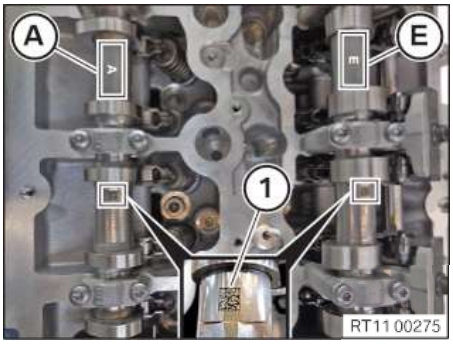
RISK OF DAMAGE

Damage to the engine.

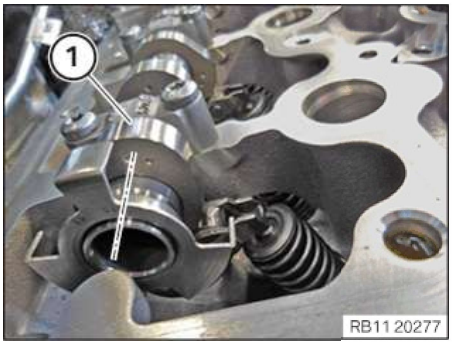
The engine may be damaged if it is manually rotated in the wrong direction.

- 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**.



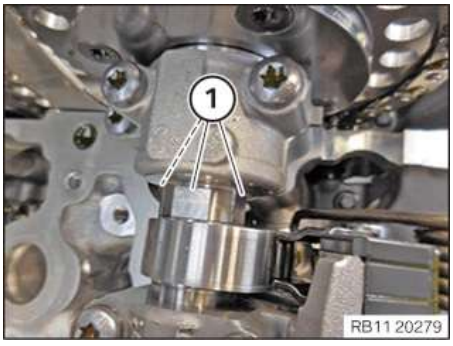
- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.



- 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.

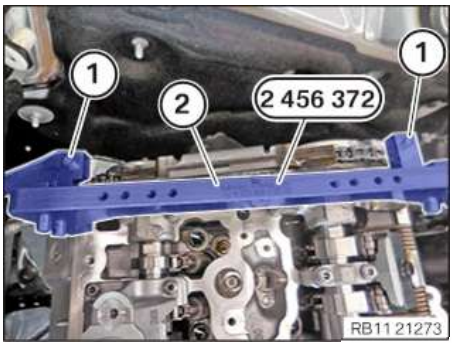


- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.

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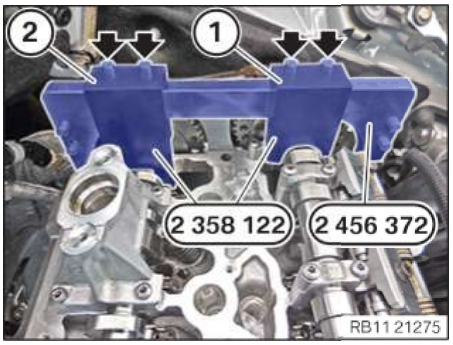
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



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

Basic carrier to cylinder head

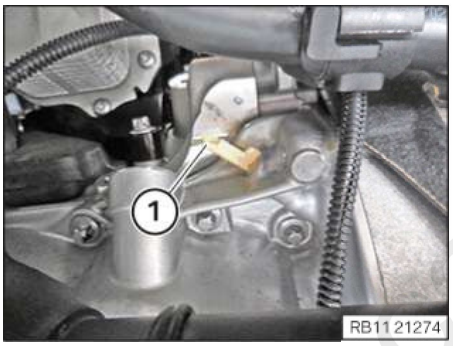
M6		Tightening torque	8 Nm



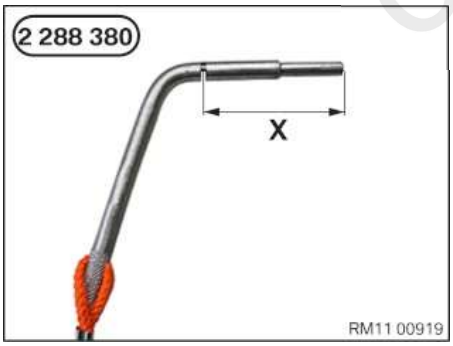
- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special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

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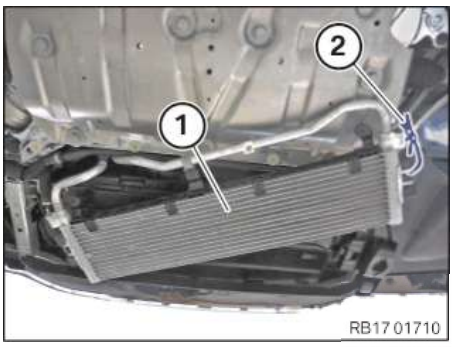


- **Vehicles with automatic transmission:**

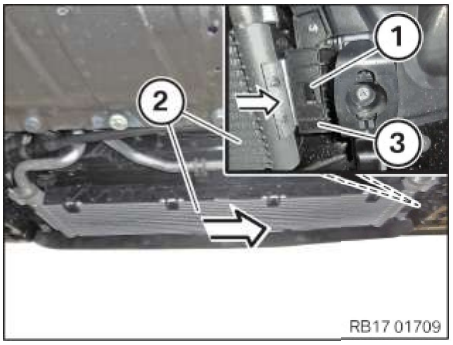
  Special tool 2 288 380 has been **correctly** positioned.

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

47 – If installed: Secure engine oil cooler



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



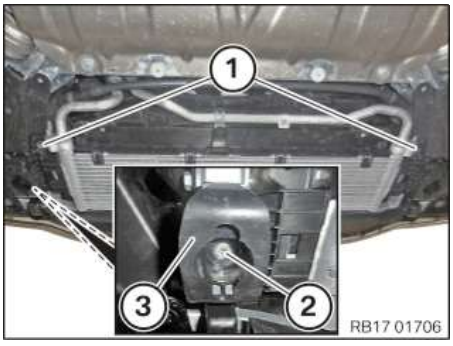
- Feed in and install the engine oil cooler (2) on the holder (3) in the direction of the arrow.
- Ensure that the lock (1)engages audibly.



- 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).

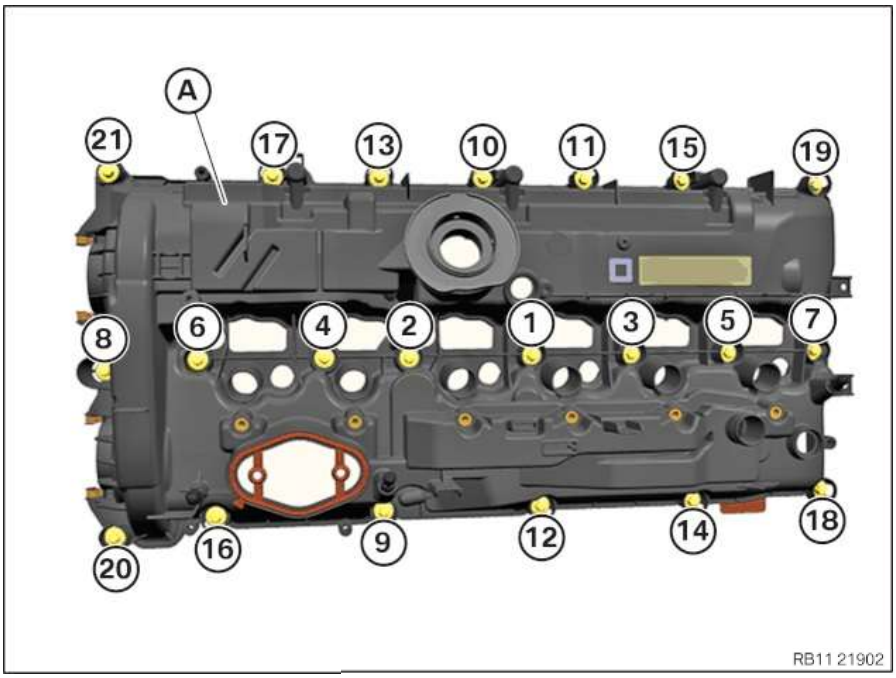
Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

48 – 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

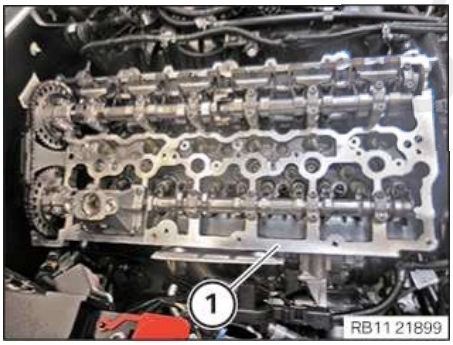
Improper routing of cables and wiring harnesses.

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

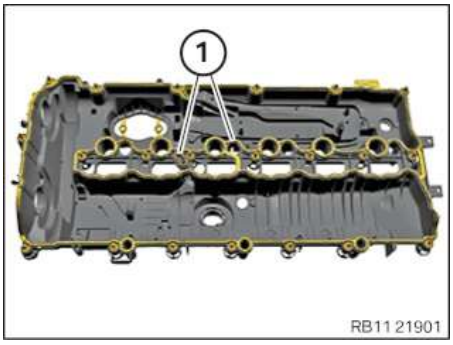
- Route all cables without abrasions, do not trap and crush.

TECHNICAL INFORMATION

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

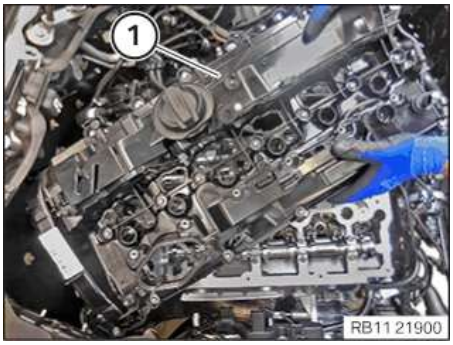


- Contact surface (1) must be free from oil and grease.



- Replace the seals (1).

  Parts: Seals

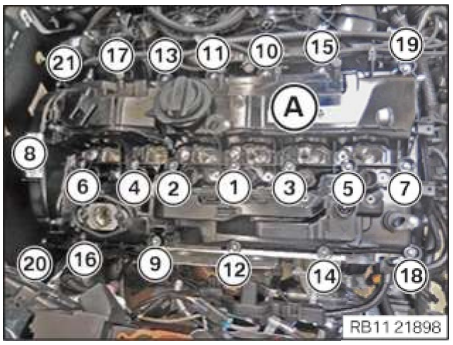


- Insert and install cylinder head cover (1).



- 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

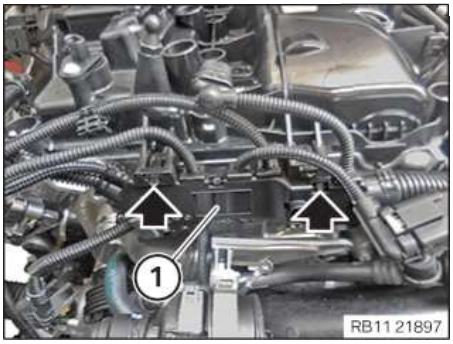
- Tighten all screws in a sequence from (1) to (21).

Cylinder head cover to cylinder head

M6X30		Tightening torque	11 Nm

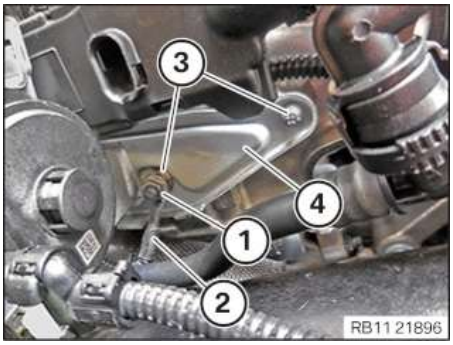


- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.



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

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

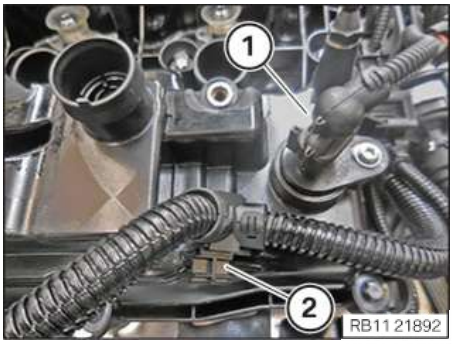
Auxiliary coolant pump holder to cylinder head

M6		Tightening torque	7 Nm

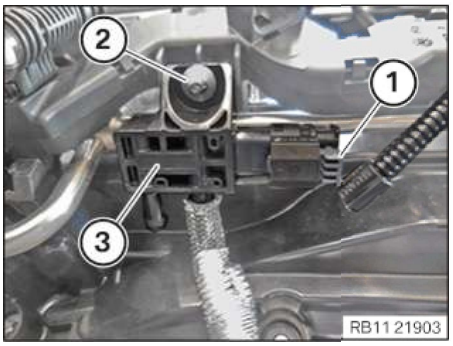
- Thread in ground cable (2) and install.
- Tighten nut (1).

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).

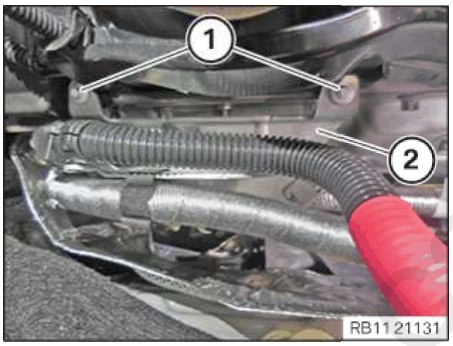


- **If installed:**
- Feed in and install the differential pressure sensor (3).
- Tighten down screw (2).

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.

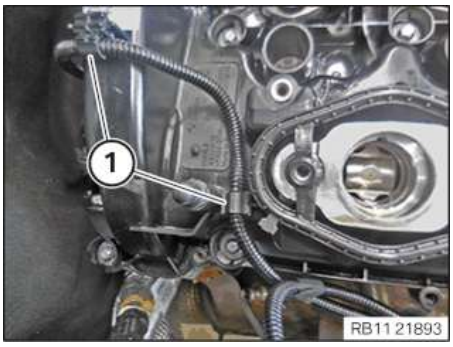
Risk of short circuits!

- 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).

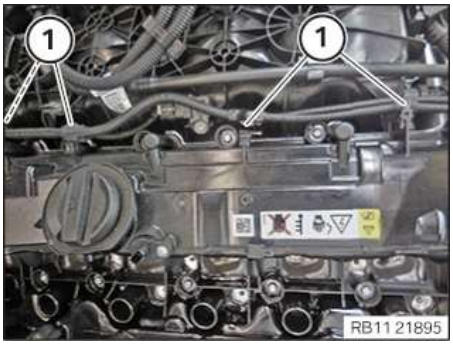
Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

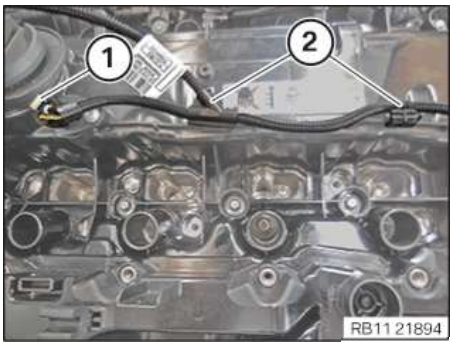


- Secure clamps (1).

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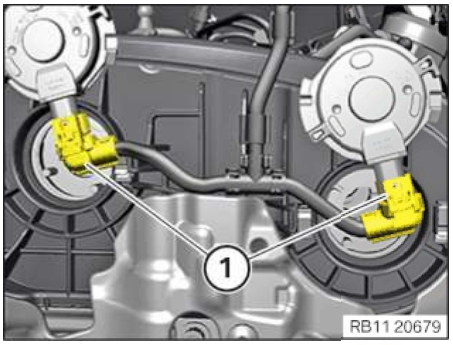


- Secure clamps (1).



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

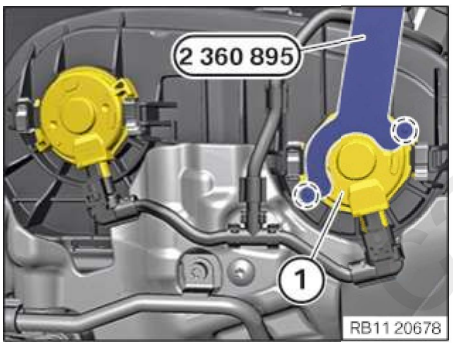
49 – Installing both actuators



NOTICE

The figure shows the rear side of the engine.

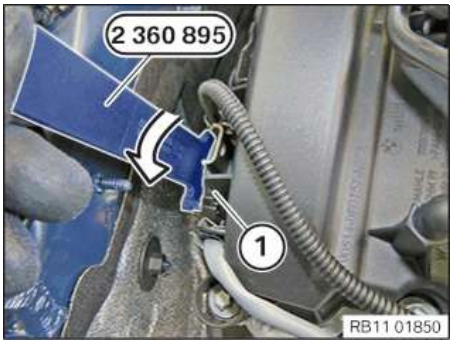
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



NOTICE

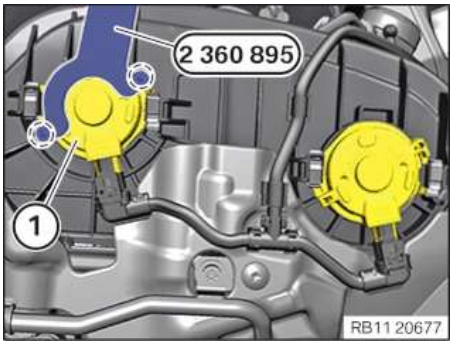
The figure shows the rear side of the engine.

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



- 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.

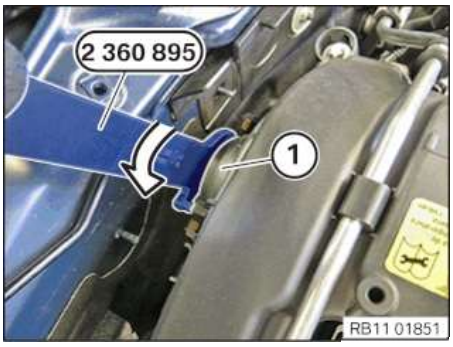
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NOTICE

The figure shows the rear side of the engine.

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

50 – 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

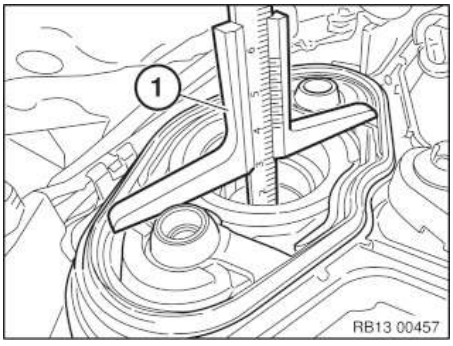
In vehicles with active anti-roll bar (ARS) the fan cowl must be removed in order to spin the engine.

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.

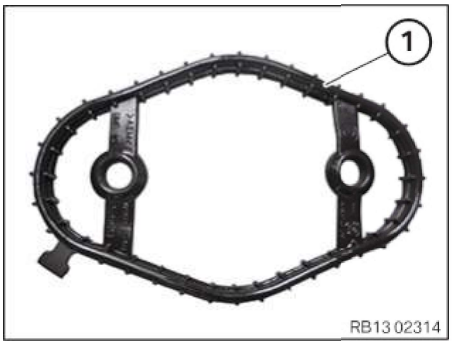
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- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- 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).



- 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.

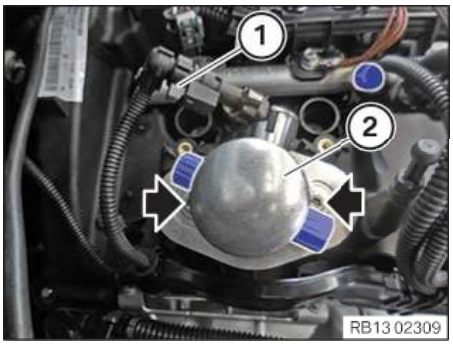
The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- 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.

51 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

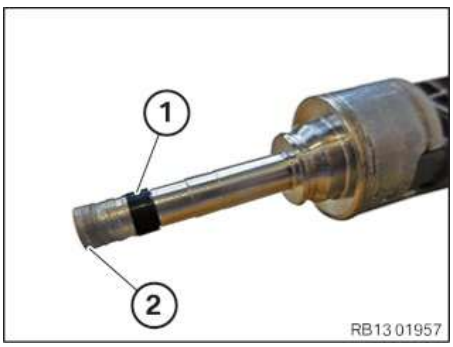
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- 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.

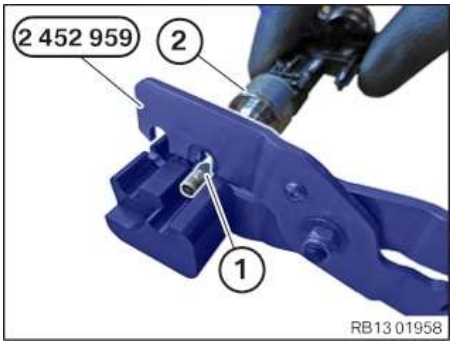
After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.



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

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

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- 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.

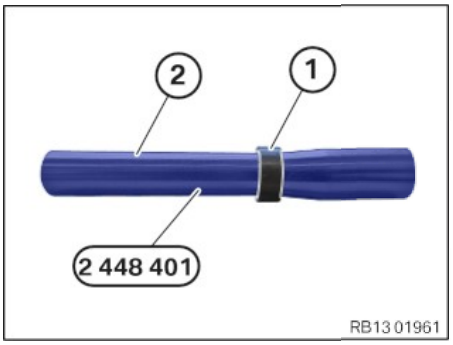


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

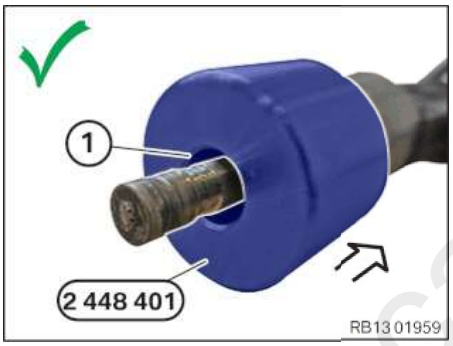
  (1) Installation cone

  (2) Sliding sleeve

  (3) Assembly sleeve

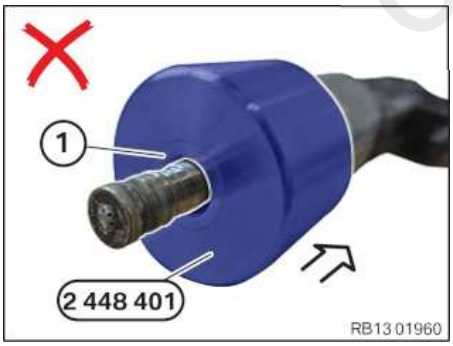


- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



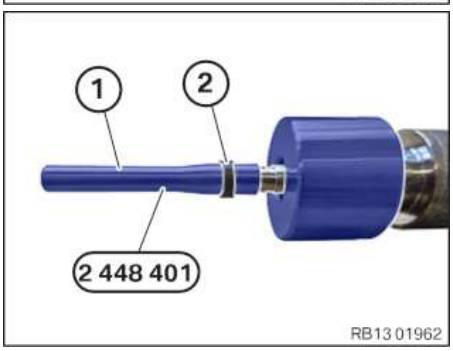
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

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



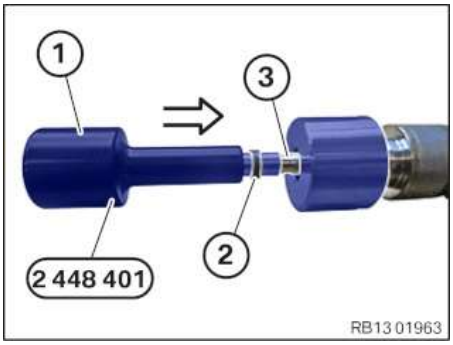
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

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

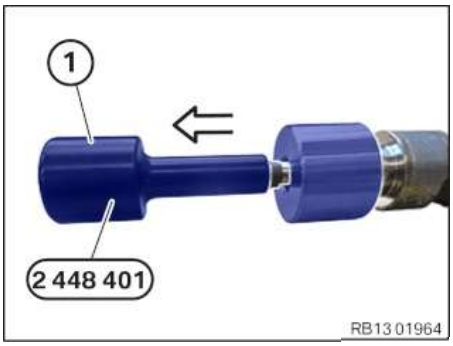


- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .

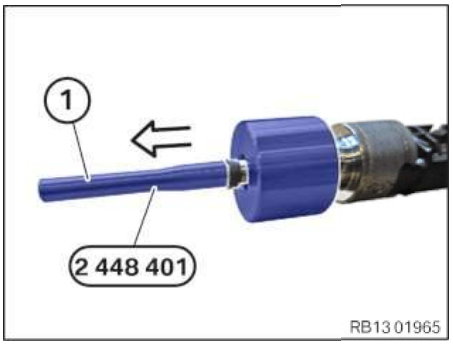
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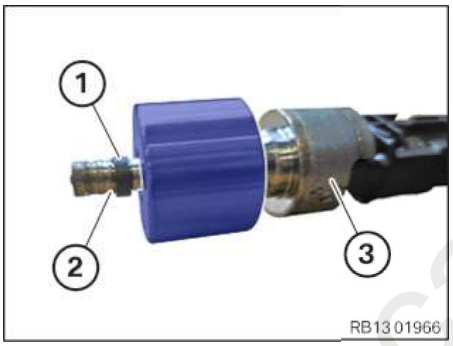
- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.



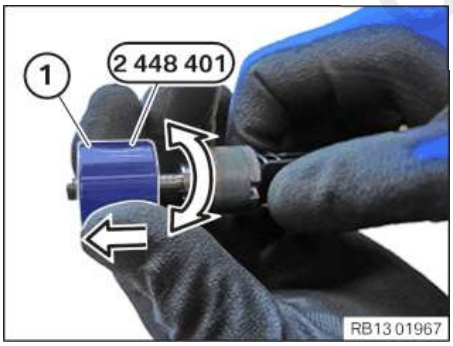
- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



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

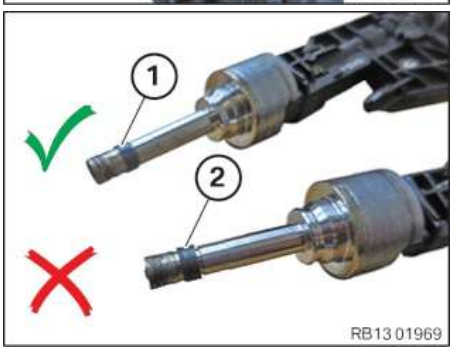


- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.



- 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).



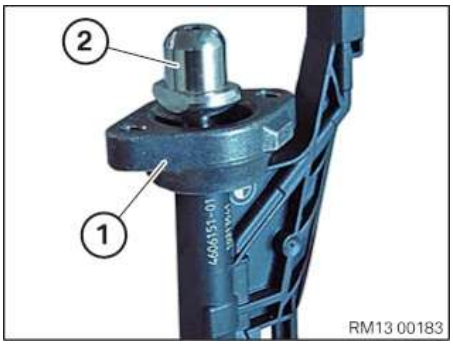
- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

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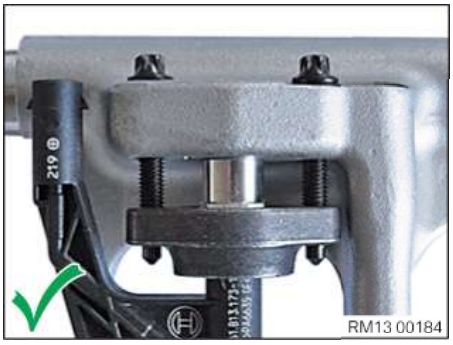
52 – Installing the high-pressure rail with injectors of the cylinders 4 to 6

TECHNICAL INFORMATION

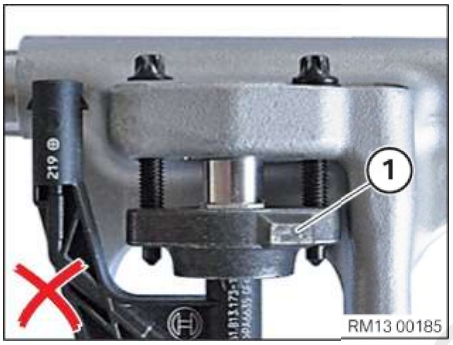
When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



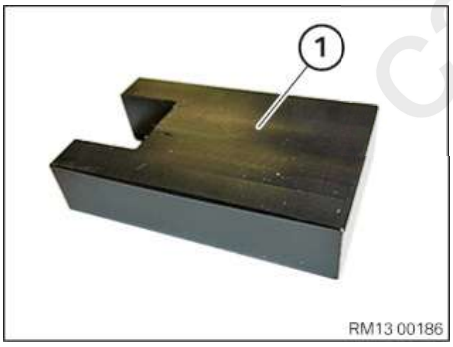
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder**(1) **has a cast lug**: Make sure that the holder is installed in the correct position.



- 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

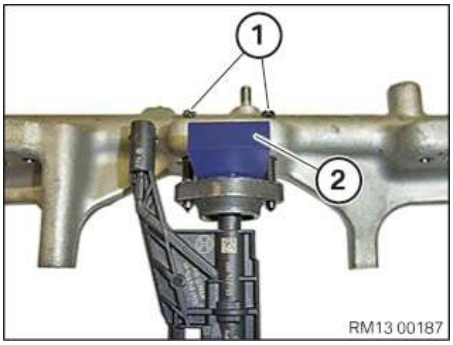
Damage to injectors.

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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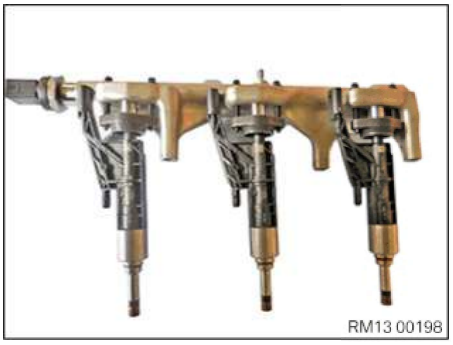
- Replace (M5x30) screws.

  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.



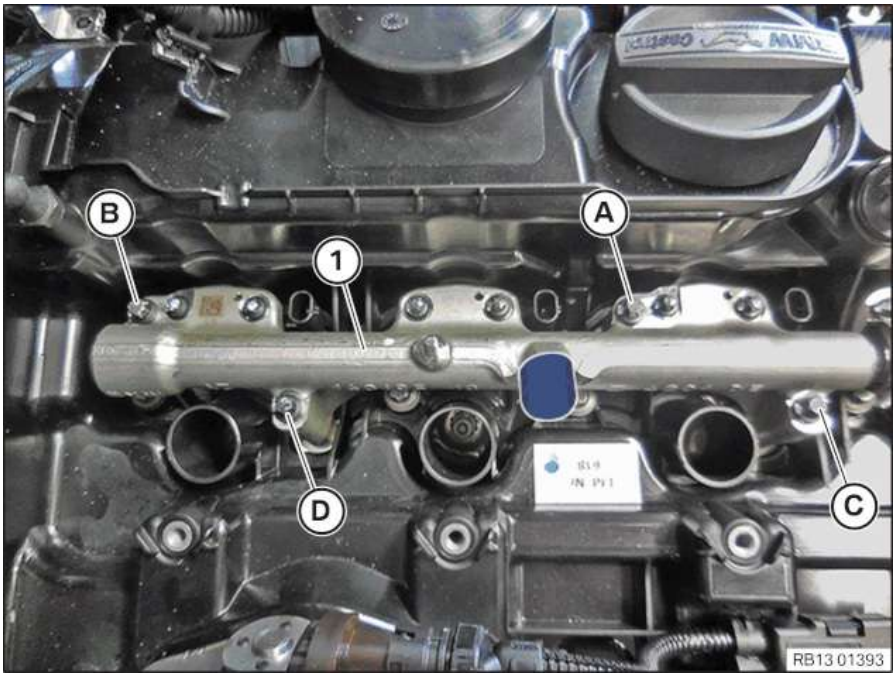
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.



- 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.

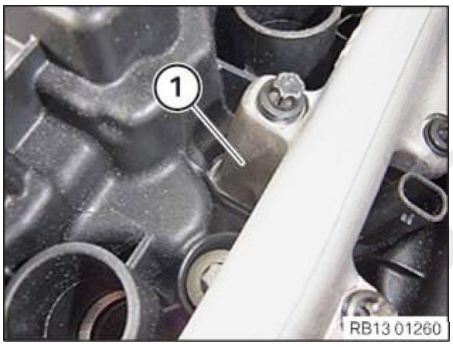
  The figure shows the rail resting flat against the cylinder head.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

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

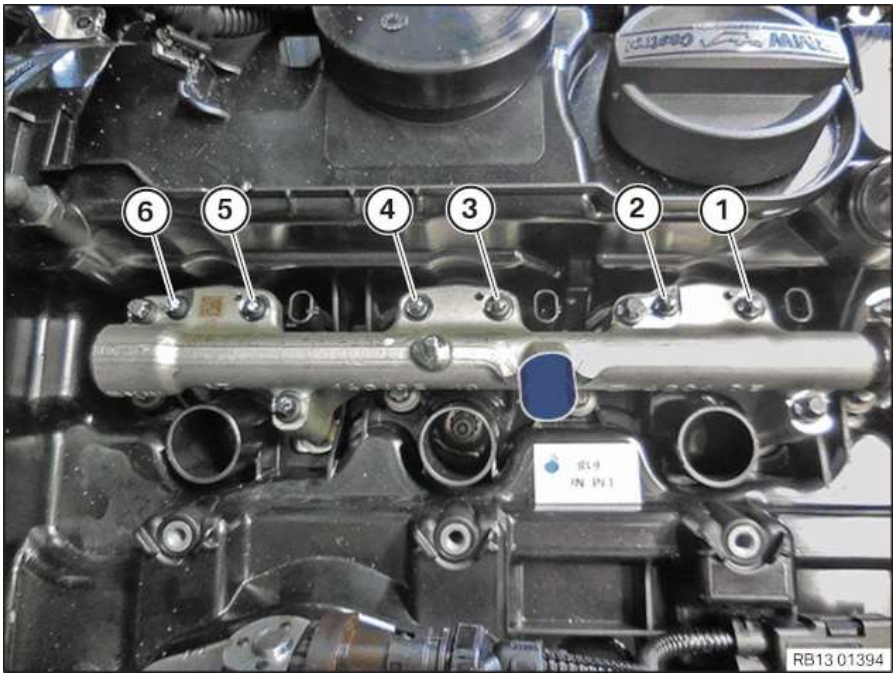
Non-observance of these requirements may result in leaks and damage.

- 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.

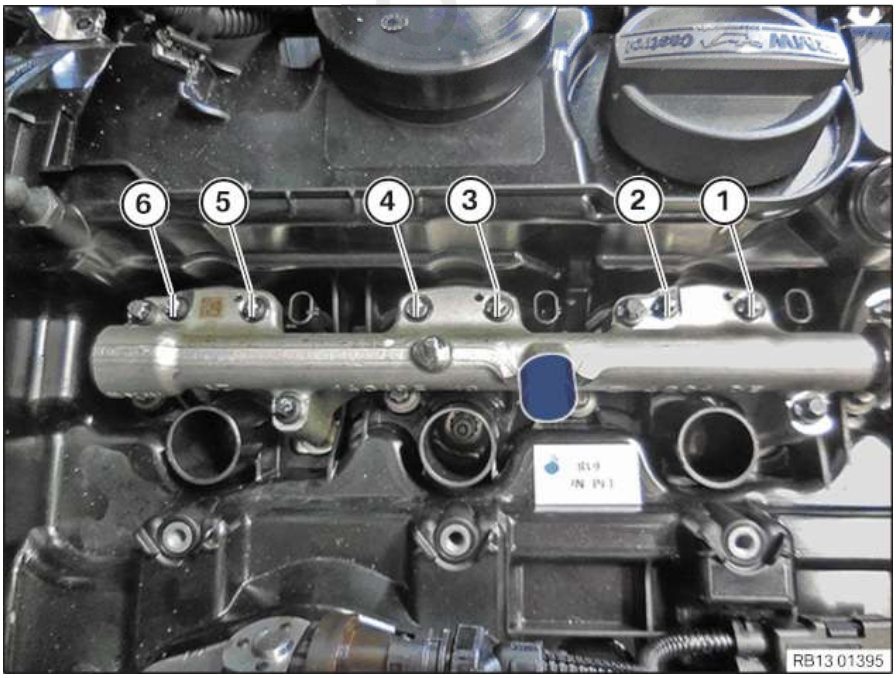
  Do not use a reversible ratchet or torque wrench.
- Tighten the bolts (M5x30) in pairs ((1) with (2), (3) with (4), (5) with (6)) in alternating order **90° hand-tight**.
- Set the torque wrench to 5 Nm.

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.



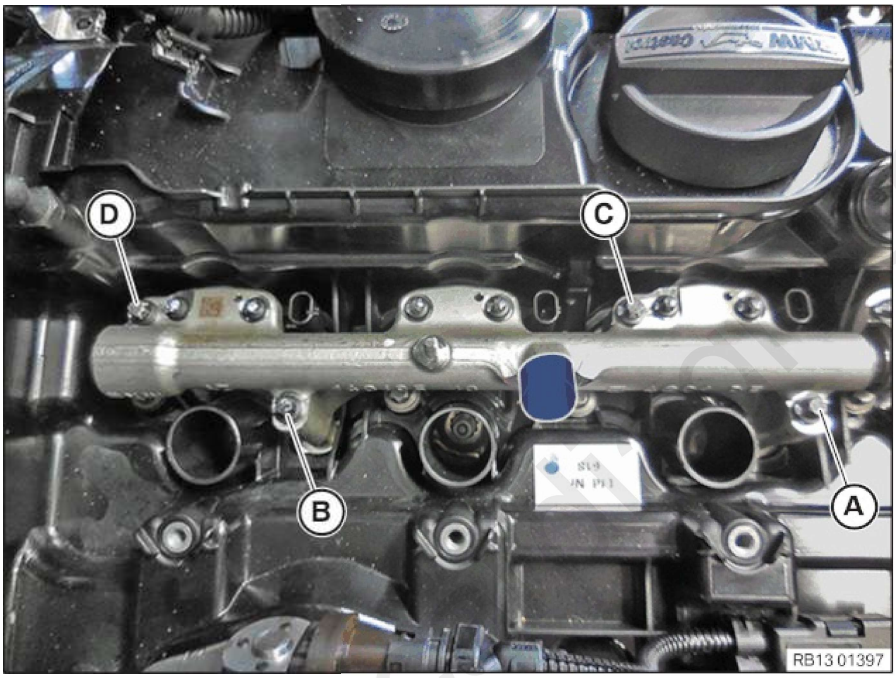
- Mark all bolts (1) to (6) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the screw (1) with an angle of rotation of 90° ±15°.
  - Tighten the screw (2) with an angle of rotation of 90° ±15°.
  - Tighten the screw (3) with an angle of rotation of 90°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

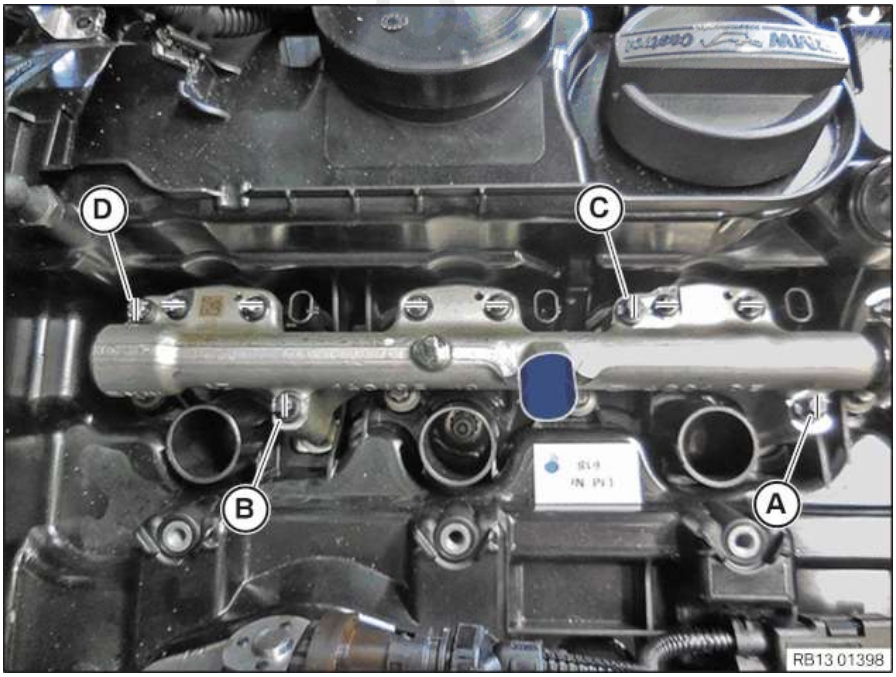
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

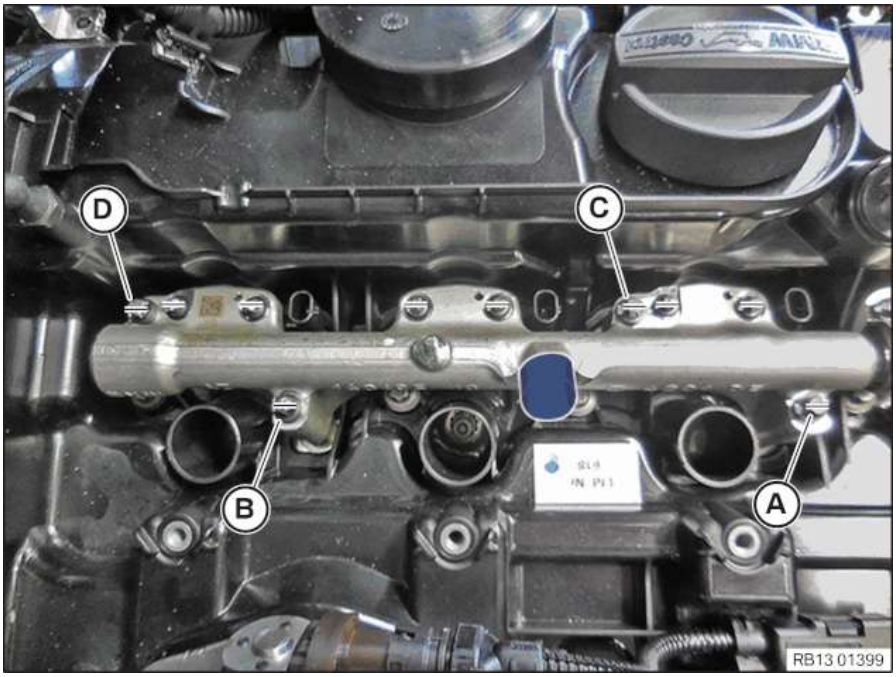
When assembling, it is essential to observe screwing sequences and tightening torques.

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.

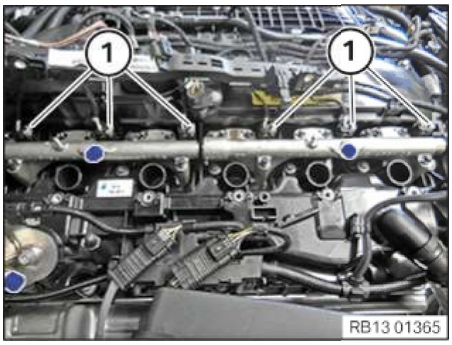


- Mark all bolts (A) to (D) with a vertical line (see figure).
- Tighten bolts (M6x70) (A) to (D) to a 90° angle of rotation.



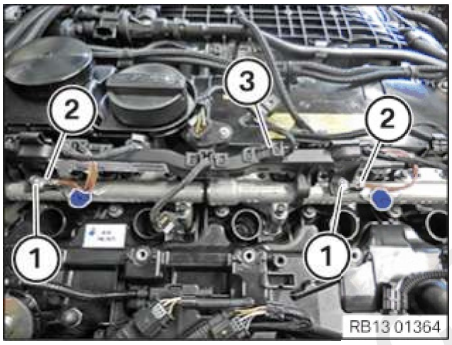
- Check if all bolts (A) to (D) have been tightened with a 90° angle of rotation.

  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).

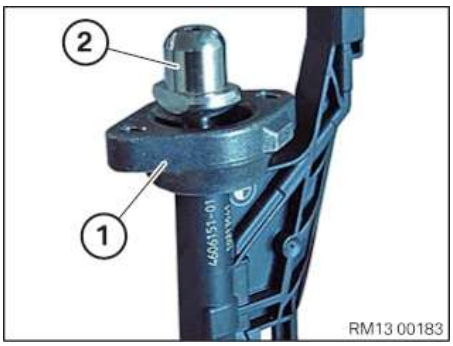
Ground cable to rail

M6			5 Nm

53 – Installing rail with injectors of cylinders 1 to 3

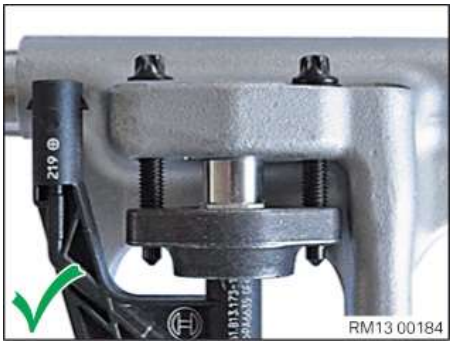
TECHNICAL INFORMATION

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



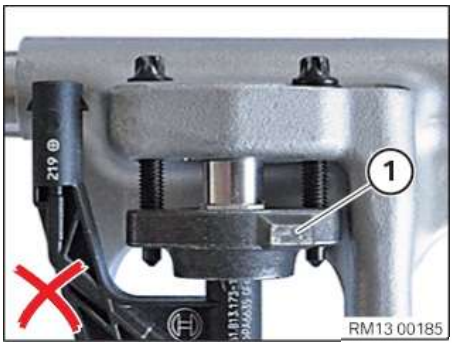
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If there is a cast lug on the holder** (1) **:** Make sure that the holder is installed in the correct position.

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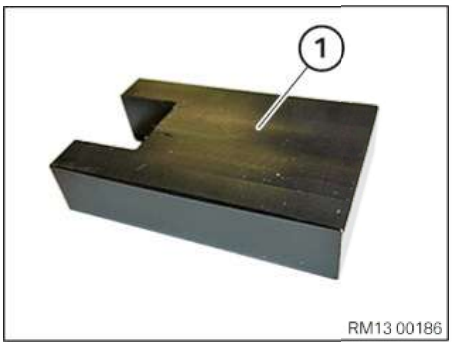
- Observe position of cast lug:

  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.



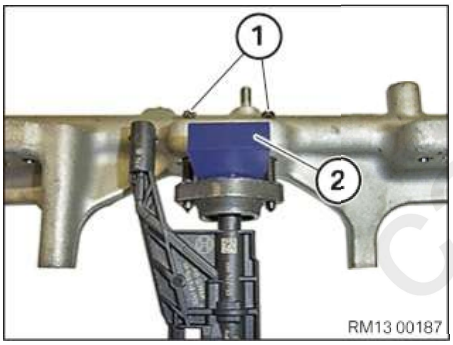
RISK OF DAMAGE

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.



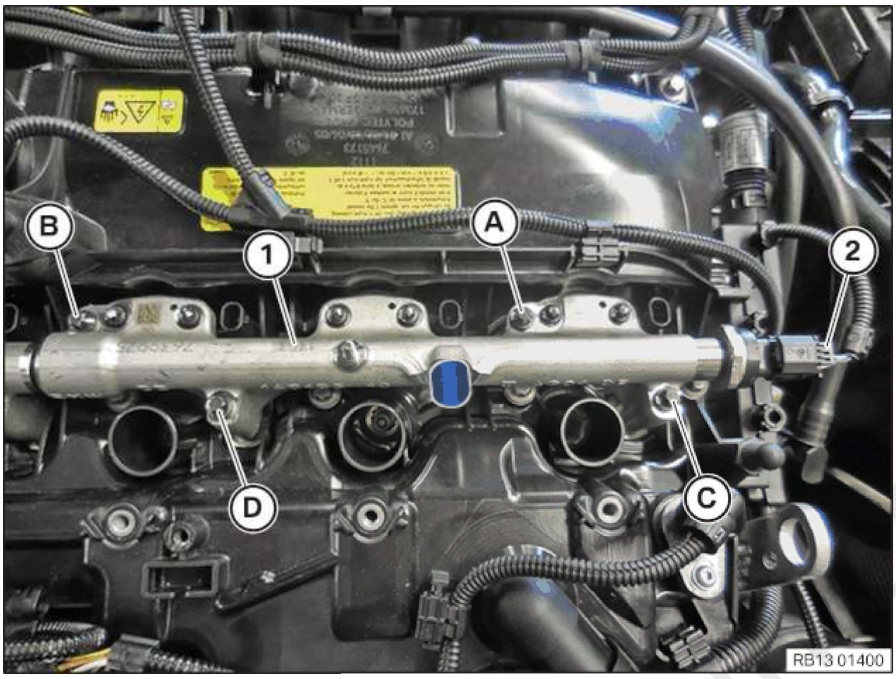
- Remove special tool 2 358 022(1) .
- Repeat this operation for all injectors.

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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.

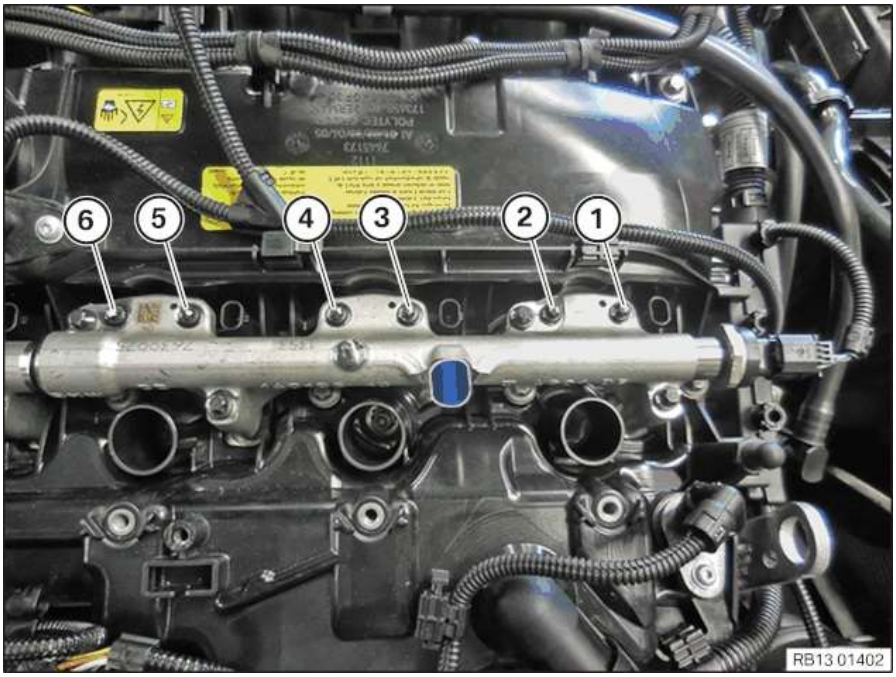
- Tighten screw (A) to 5 Nm.
- Tighten screw (D) to 5 Nm.
- Tighten screw (B) to 5 Nm.
- Tighten screw (C) to 5 Nm.
- Connect and lock the connector (2).

  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.

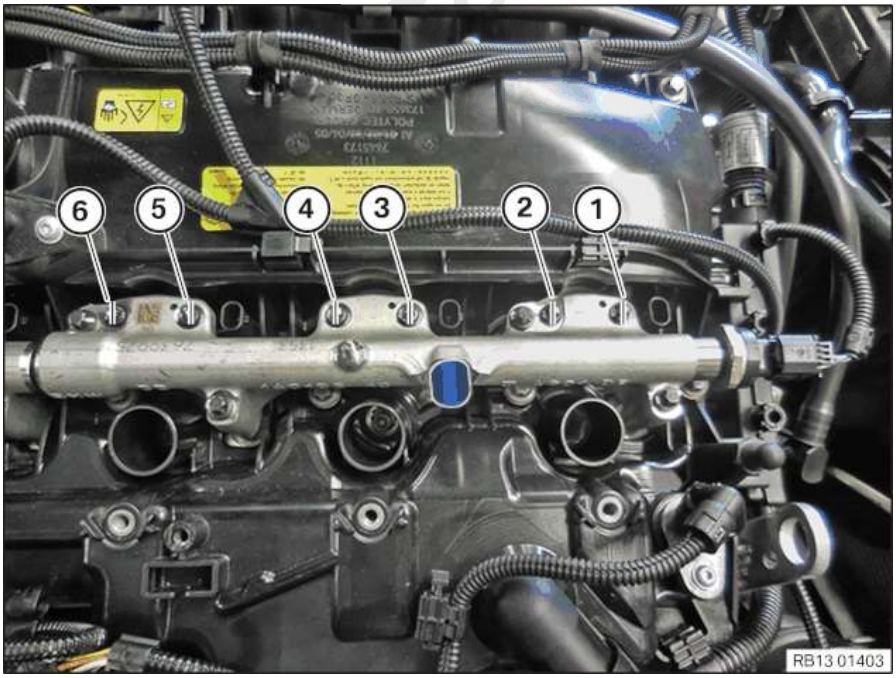
  Do not use a reversible ratchet or torque wrench.
- Hand-tighten screws (M5x30) in pairs ((1) with (2), (3) with (4), (5) with (6)) alternately by **90°**.
- Set torque wrench to 5 Nm.

TECHNICAL INFORMATION

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

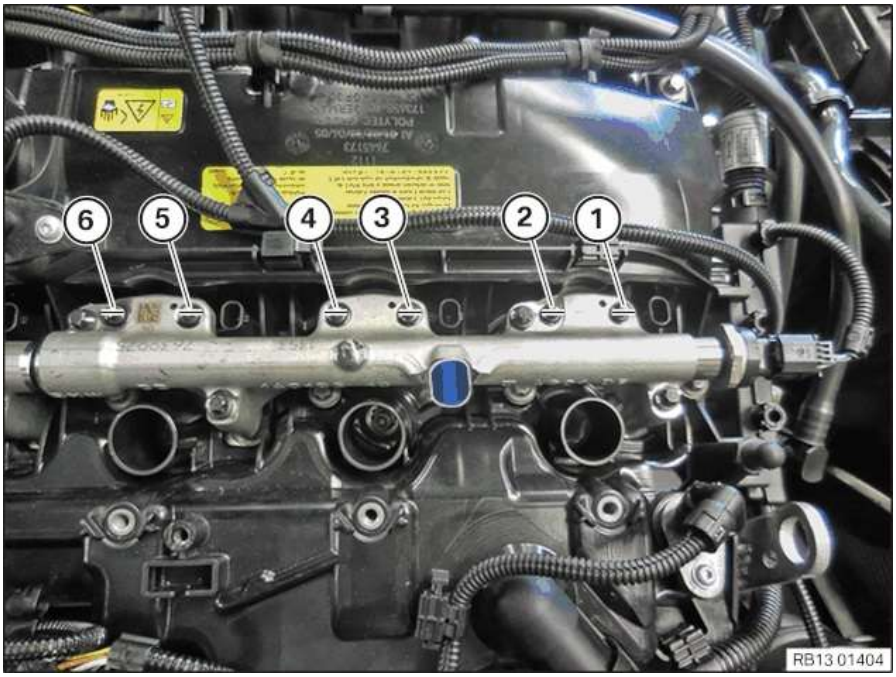
Non-observance of these requirements may result in leaks and damage.

- **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.



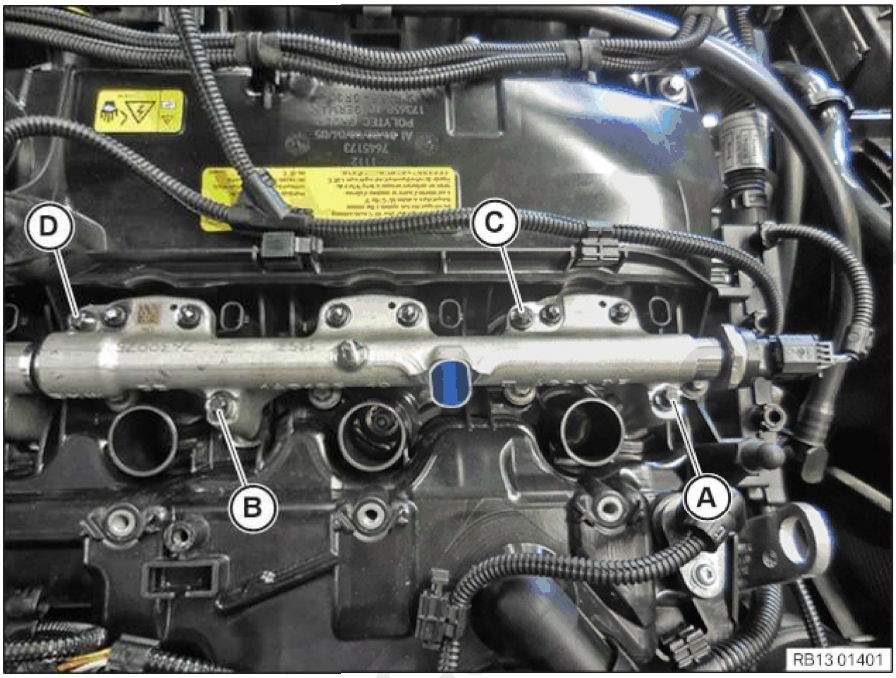
- Mark all bolts (1) to (6) with a line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the screw (1) with an angle of rotation of 90° ±15°.
  - Tighten the screw (2) with an angle of rotation of 90° ±15°.
  - Tighten the screw (3) with an angle of rotation of 90° ±15°.
  -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

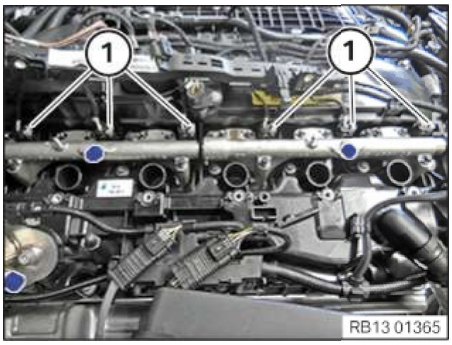


- Mark all the bolts (A) to (D) with a vertical line (see Figure).
- Tighten bolts (M6x70) (A) to (D) with an angle of rotation of 90°.



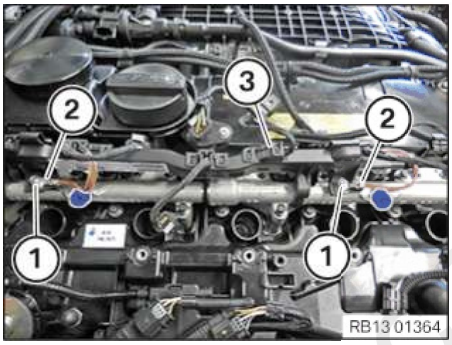
- Check whether all screws (A) to (D) have been tightened with an angle of rotation of 90°.

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



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

  All connectors (1) must engage audibly.

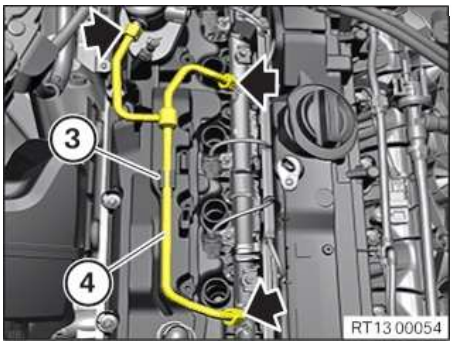


- Thread the cable channel (3) in and install.
- Thread in ground cable (2) and install.
- Tighten nuts (1).

Ground cable to rail

M6			5 Nm

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

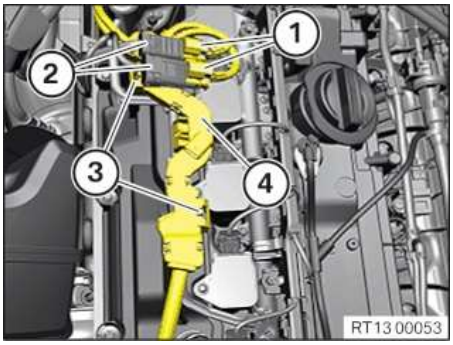


- Insert the high pressure line (4) into the holder (3) and install.
- Tighten union nuts (arrows) with the special tool .

High pressure line between rail and high pressure pump

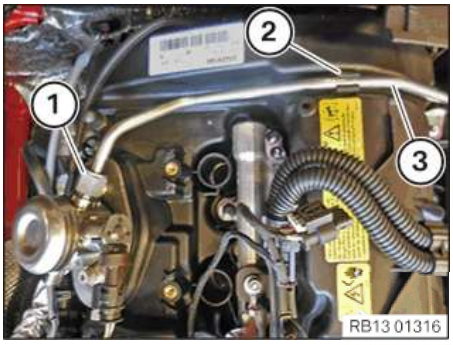
M14x1,5		Tightening torque	33 Nm

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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.

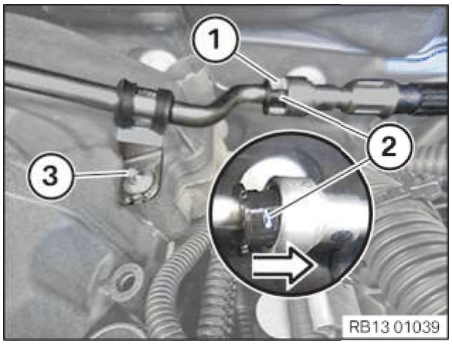
55 – Installing fuel delivery line



- 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

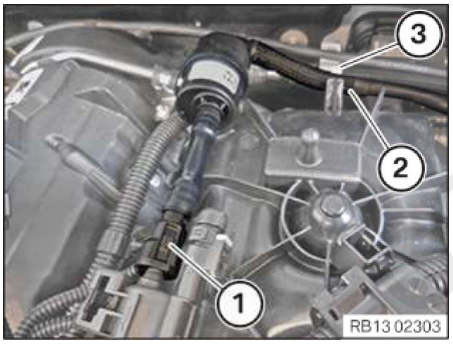
M14		Tightening torque	31 Nm



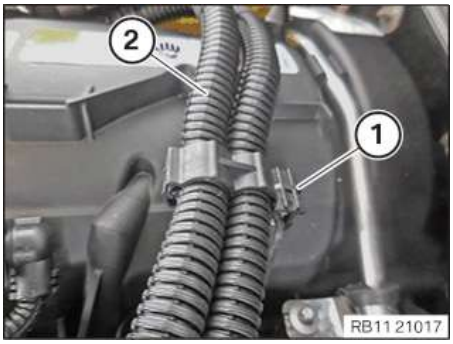
- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure clamps (1).
- Tighten down screw (3).

Fuel line to cylinder head cover

6x18		Tightening torque	6,5 Nm

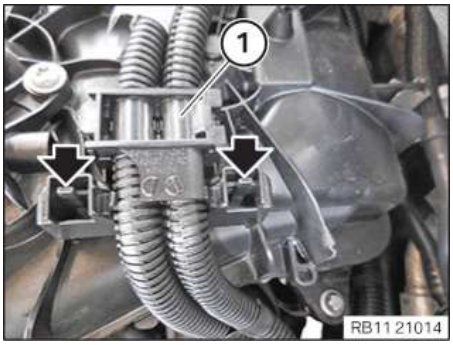


- Insert and install the tank ventilation line (2).
- Lock (1) must engage audibly.
- Secure the tank ventilation line (2) to the clamp (3).



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

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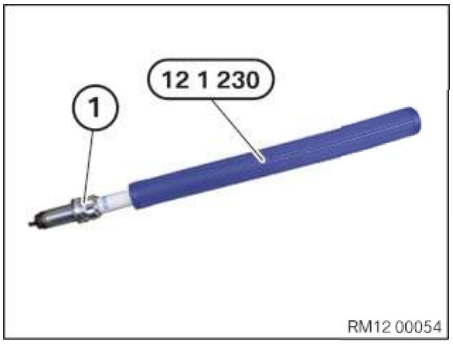


- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

56 – 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

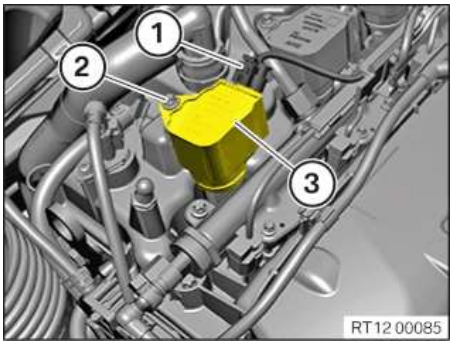
M12x1.25		Tightening torque	23 Nm

57 – Install all ignition coils

NOTICE

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

▸ **Install ignition coil.**



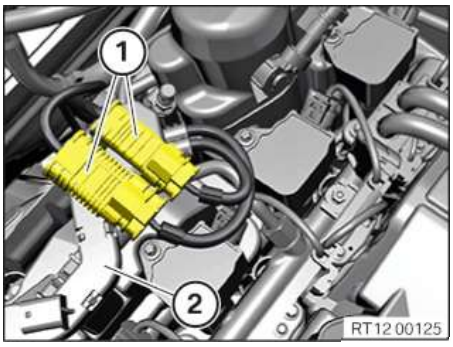
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

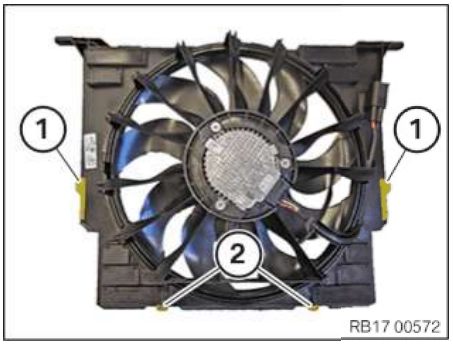
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

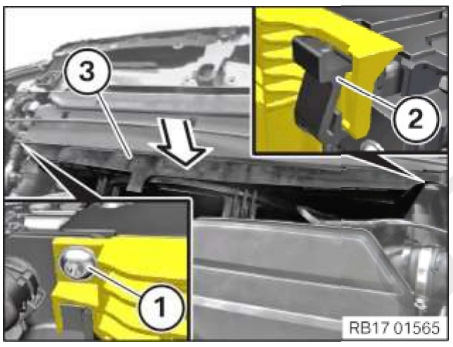


- Connect the connector (1) of the front oxygen sensor and the monitoring oxygen sensor on the cable shaft (2).

58 – Install fan cowl



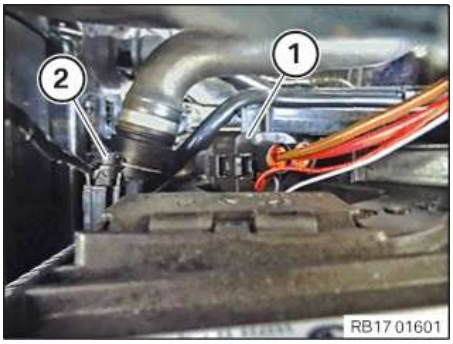
- Feed guides (1) into the radiator.
- Feed guides (2) into the charge air cooler.



- 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

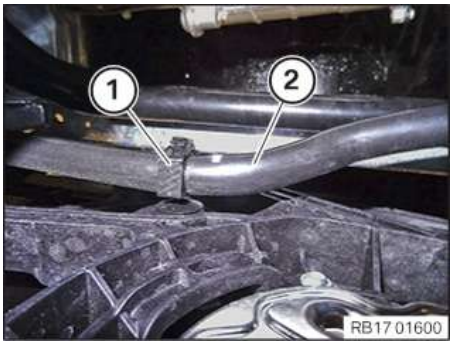


- Connect connectors (2) and lock.

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

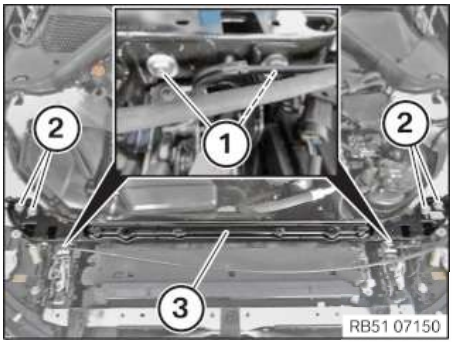
  The connector (1) must engage audibly.

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

59 – Install the rear top cross connection



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

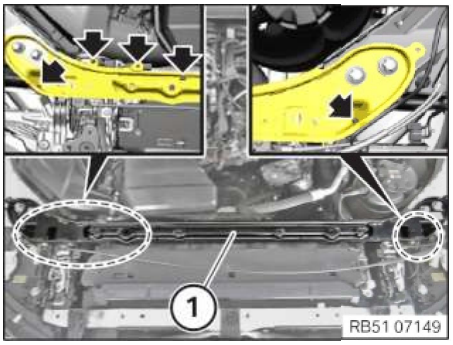
Top rear cross connection to bonnet catch support

Flat-head screw M6x20		Tightening torque	11,8 Nm

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

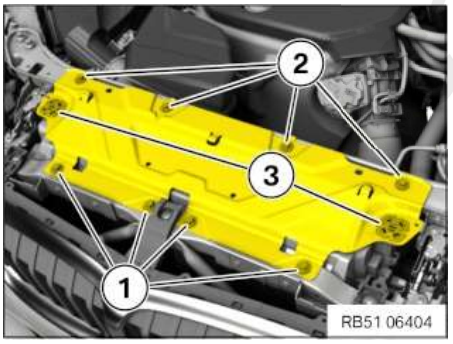
Rear top cross connection to wheel arch carrier support

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).

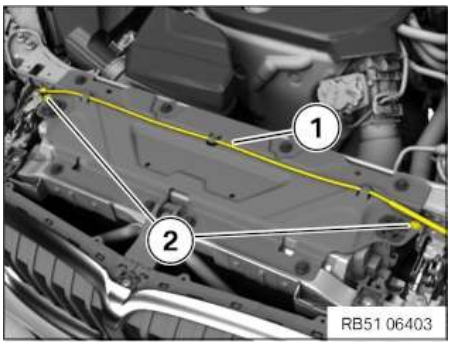
60 – Installing the top cross connection



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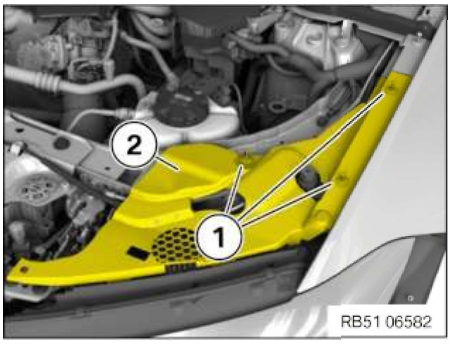
- Clip in the housing for the coupling of the Bowden cables (1).

61 – 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.

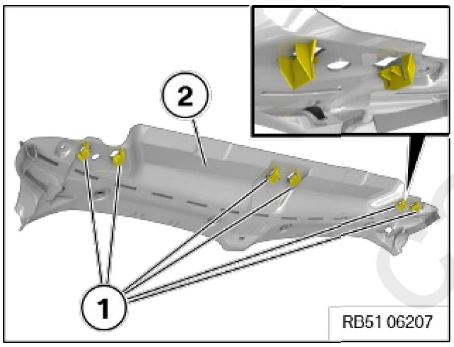
▶ Installing the cover in the engine compartment on top partially



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

62 – Installing cover for engine compartment centre

Check



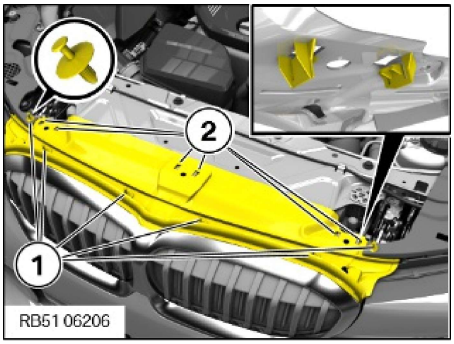
- Check latch mechanisms (1) of cover for engine compartment centre (2) for damage.

Result

» The latch mechanism (1) is damaged.

Measure

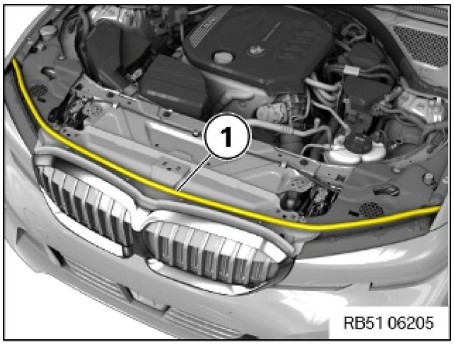
- Renew cover for engine compartment centre (2).



- 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).

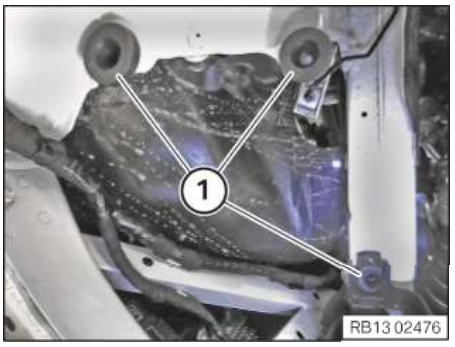
63 – Install the seal for the front bonnet

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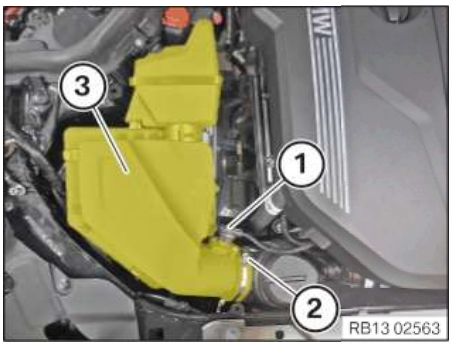


- Position the bonnet seal(1) and connect it on the mounting on the bumper and on the headlights.

64 – 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.

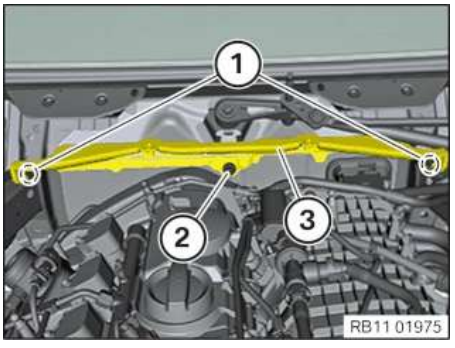
  The connector (1) must engage audibly.

65 – Disconnecting all battery earth leads



- See additional information.

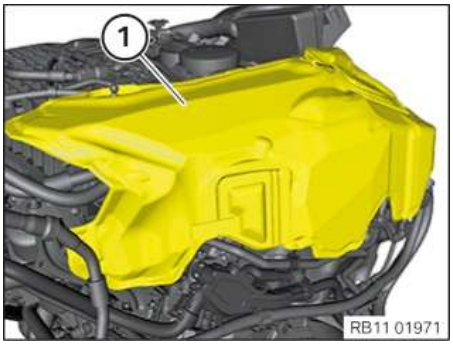
66 – Installing centre bulkhead lower section



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

67 – Installing acoustic cover at rear

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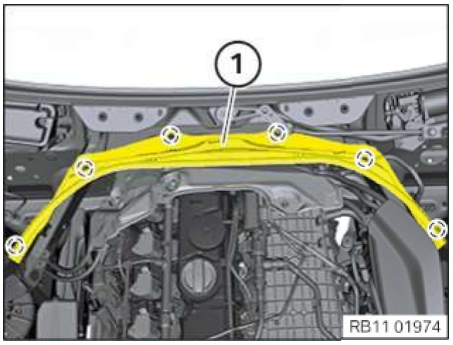


- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



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

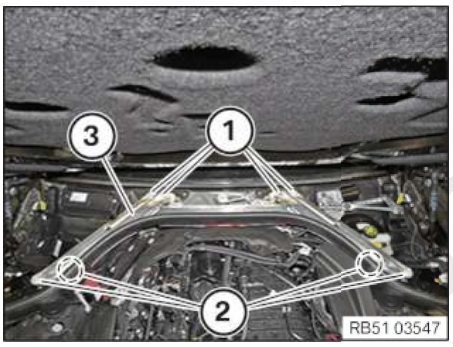
68 – Installing the centre bulkhead upper part



- 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 °

69 – Installing cowl panel cover

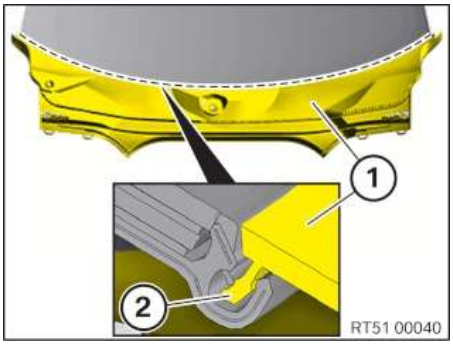
RISK OF DAMAGE

Damage caused by water ingress into the vehicle.

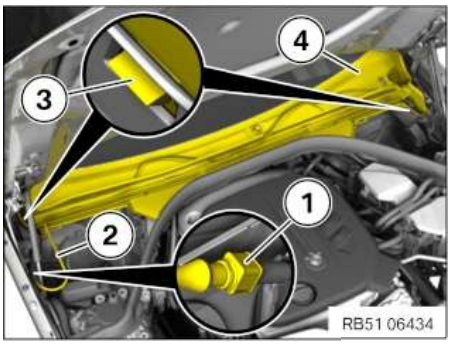
Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

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

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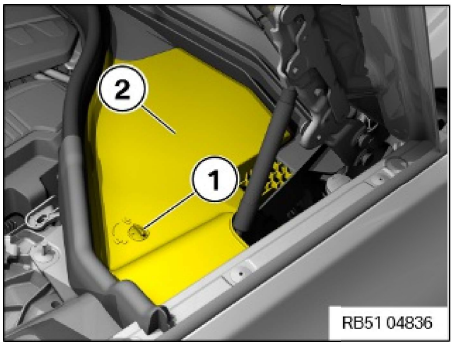


- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



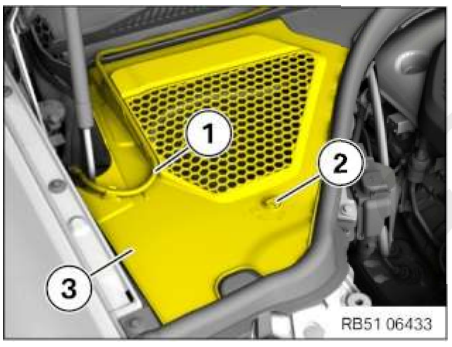
- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

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



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

71 – 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.

72 – Installing both wiper arms

NOTICE

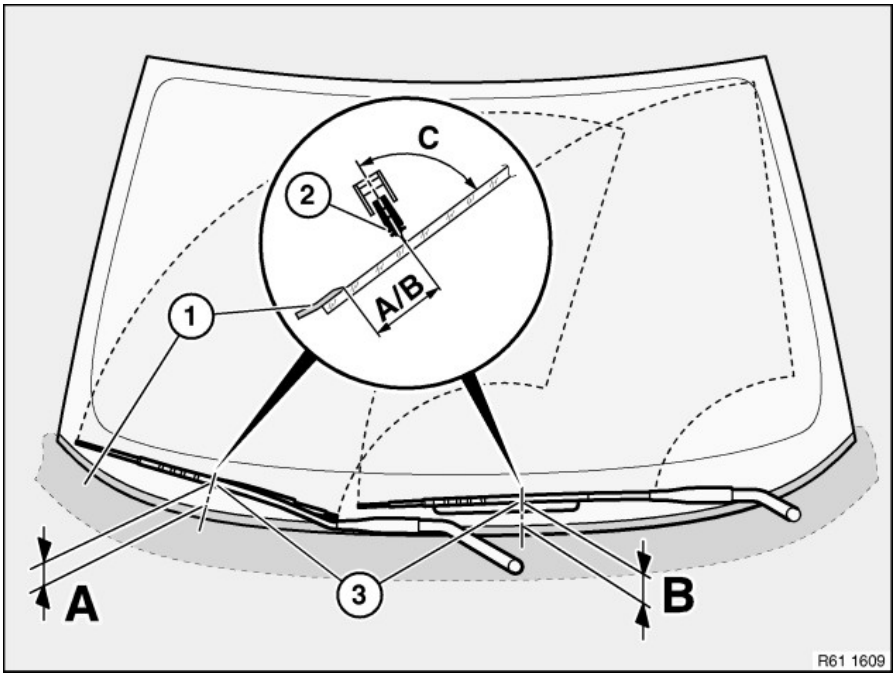
Description is for left component only. Procedure on the right side is identical.

▸ **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.

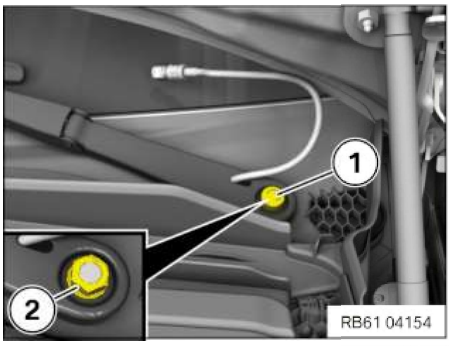
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- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

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

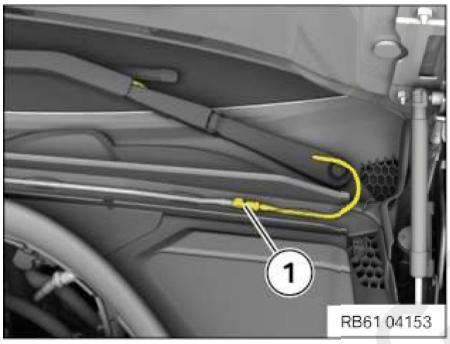


- Tighten nut (2).

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.

73 – Install acoustic cover

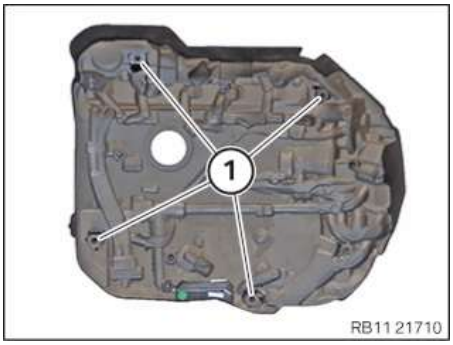
RISK OF DAMAGE

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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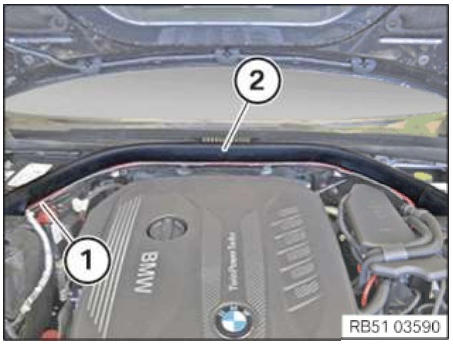


- Check the rubber mount (1) for correct fit in the acoustic cover.



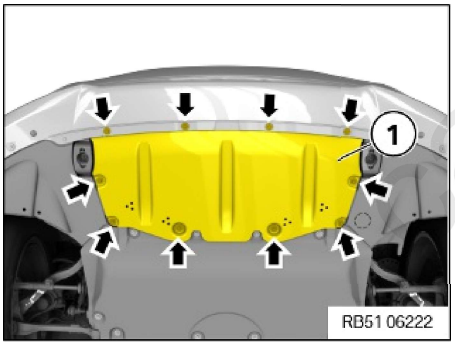
- Install acoustic cover (1) and fix in the rubber mounts (marks).

74 – 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.

75 – Installing the front underbody protection



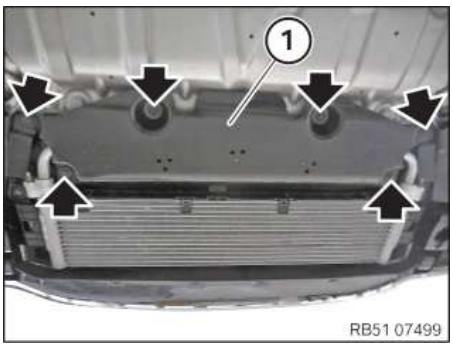
- **Version 1:**

  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:**

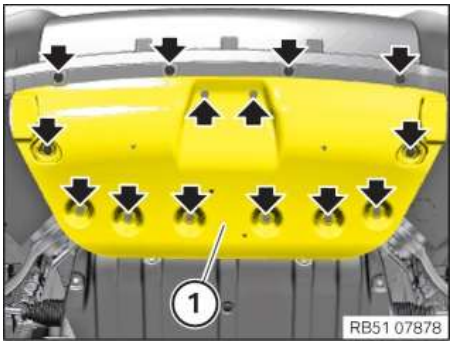
  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

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

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- **Version 3:**

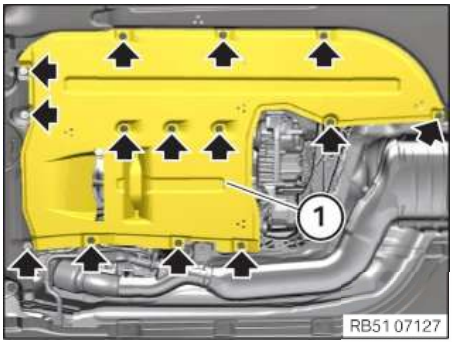
  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

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

76 – Installing underbody protection at rear



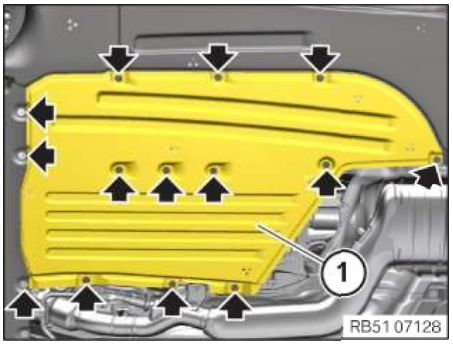
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

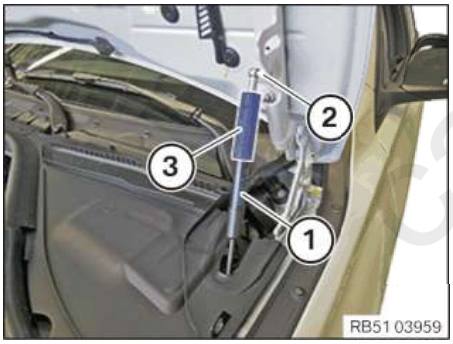
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

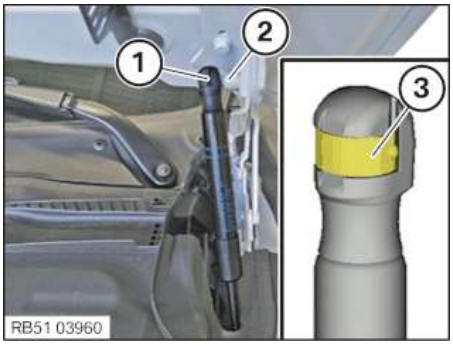
Underbody protection

Hexagon screw		Tightening torque	3 Nm

77 – 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 314046

M6		Tightening torque	8 Nm

Test gauge to basic carrier — Used in step 314046

M6		Tightening torque	8 Nm

VANOS central valve to camshaft — Used in step 4243

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 45

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Engine oil cooler to bumper support — Used in step 47

M6X25		Tightening torque	8 Nm

Cover, front bottom on side — Used in step 47

Hexagon screw for thermoplastic		Tightening torque	3 Nm

Cylinder head cover to cylinder head — Used in step 48

M6X30		Jointing torque	8 Nm

Cylinder head cover to cylinder head — Used in step 48

M6X30		Tightening torque	11 Nm

Auxiliary coolant pump holder to cylinder head — Used in step 48

M6		Tightening torque	7 Nm

Standard screw connection M6 — Used in step 48

M6			8 Nm

Differential pressure sensor to holder — Used in step 48

TS6X18		Tightening torque	3,5 Nm

Holder, positive battery cable to cylinder head cover — Used in step 48

6X18		Tightening torque	6 Nm

High pressure pump to high pressure pump flange — Used in step 50

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

Ground cable to rail — Used in step 5253

M6			5 Nm

High pressure line between rail and high pressure pump — Used in step 54

M14x1,5		Tightening torque	33 Nm

Fuel delivery line to high pressure pump — Used in step 55

M14		Tightening torque	31 Nm

Fuel line to cylinder head cover — Used in step 55

6x18		Tightening torque	6,5 Nm

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Spark plugs			Used in step 56
M12x1.25		Tightening torque	23 Nm

Ignition coil			Used in step 57
Screw		Tightening torque	8 Nm

Fan cowl with electric fan on radiator			Used in step 58
TS6x20		Tightening torque	6,5 Nm

Top rear cross connection to bonnet catch support			Used in step 59
Flat-head screw M6x20		Tightening torque	11,8 Nm

Rear top cross connection to wheel arch carrier support			Used in step 59
M10x20 screw	Renew screw.	Jointing torque	56 Nm
		Angle of rotation	90 °

Cross connection, top			Used in step 60
M8x20		Tightening torque	28 Nm

Cross connection, top			Used in step 60
M6x20		Tightening torque	11,8 Nm

Clean air pipe to upper section of intake filter housing			Used in step 64
Clamp		Tightening torque	3 Nm

Bulkhead upper part to bottom bulkhead			Used in step 68
		Tightening torque	3 Nm

Tension strut on bulkhead			Used in step 68
M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome			Used in step 68
Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

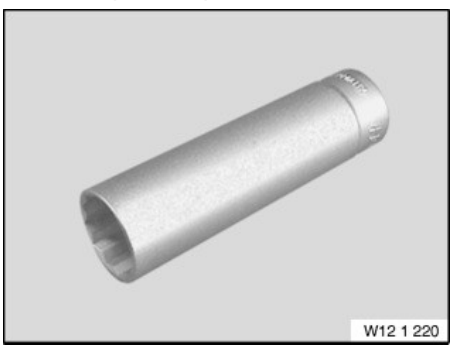
Windscreen wiper arm			Used in step 72
Combination hexagon nut		Tightening torque	35 Nm

Underbody protection front			Used in step 75
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Underbody protection			Used in step 76
Hexagon screw		Tightening torque	3 Nm

Overview of Special Tools

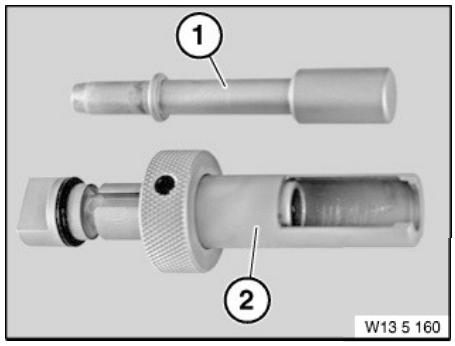
0 495 560 (12 1 220) Socket



Common		Used in step 2056
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)	

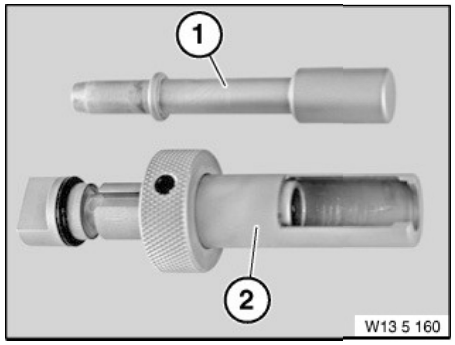
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0 496 567 (13 5 161) Fastener



Common	Used in step 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	

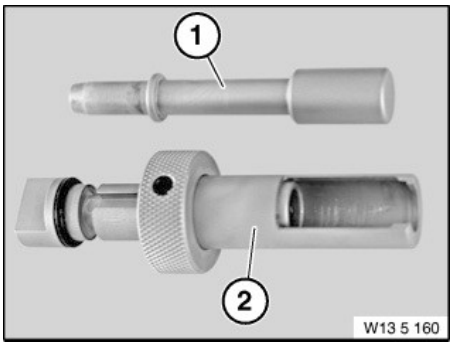
0 496 568 (13 5 162) Fastener



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



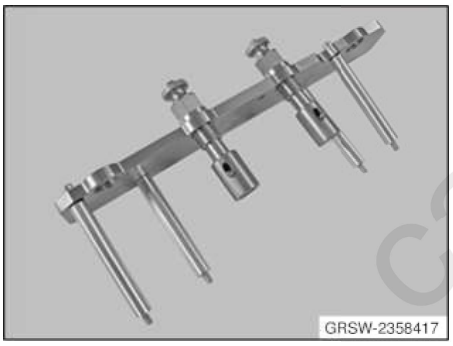
Common Used in step 22

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	

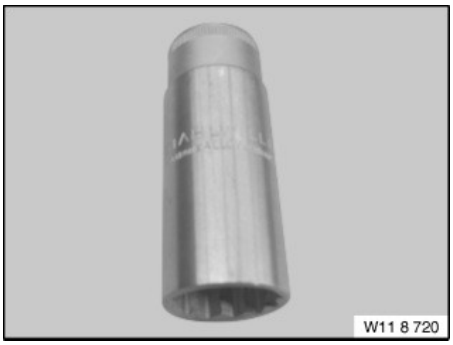
2 358 417 Device



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)

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)

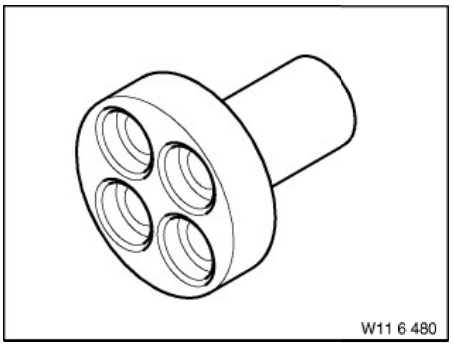
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2 360 895 Pin wrench



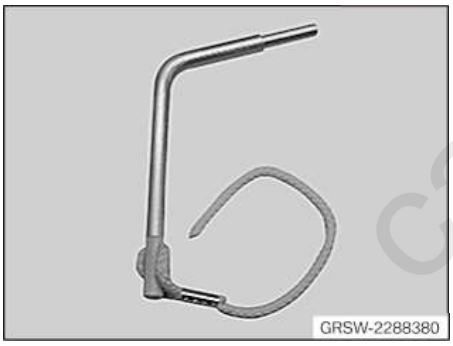
Common	Used in step 2649
Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 493 380 (11 6 480) Connector



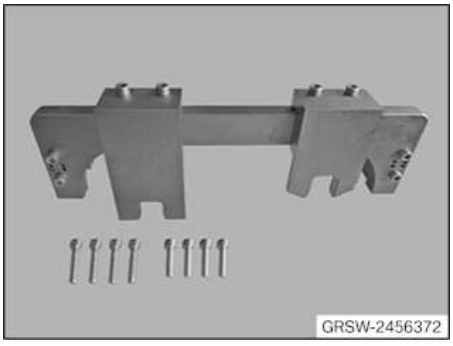
Common	Used in step 31444650
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

2 288 380 Locating stud



Common	Used in step 314446
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 3139404446
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 313946
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 33344243
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 33344243
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 4144
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 51
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 51
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)

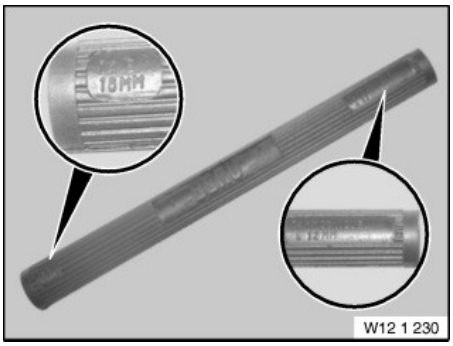
2 358 022 Gauge



Common	Used in step 5253
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 56
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 72
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	165
61 20 900 Disconnecting and connecting battery earth lead	165
61 20 900 Disconnecting and connecting battery earth lead	165
61 20 900 Disconnecting and connecting battery earth lead	165
61 20 900 Disconnecting and connecting battery earth lead	165
61 20 900 Disconnecting and connecting battery earth lead	165
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	165
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	165
61 20 900 Disconnecting and connecting battery earth lead	165
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	165
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	165
61 20 900 Disconnecting and connecting battery earth lead	165
61 20 900 Disconnecting and connecting battery earth lead	165
61 20 900 Disconnecting and connecting battery earth lead	165
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61 20 900 Disconnecting and connecting battery earth lead	165
61 20 900 Disconnecting and connecting battery earth lead	165
61 20 900 Disconnecting and connecting battery earth lead	165
61 20 900 Disconnecting and connecting battery earth lead	165
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	165
61 20 900 Disconnecting and connecting battery earth lead	165
61 20 900 Disconnecting and connecting battery earth lead	165
61 20 900 Disconnecting and connecting battery earth lead	165
61 20 900 Disconnecting and connecting battery earth lead	165
61 20 900 Disconnecting and connecting battery earth lead	165
61 20 900 Disconnecting and connecting battery earth lead	165
61 20 900 Disconnecting and connecting battery earth lead	165
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	50

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11 36 042 Removing and installing/replacing intake adjuster

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

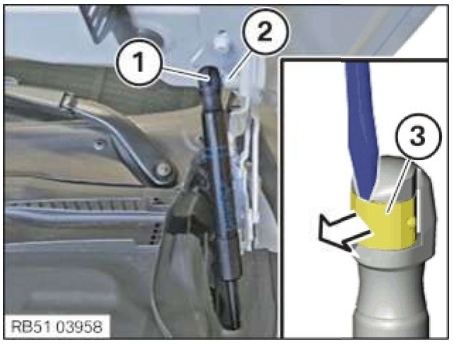
Engine compartment lid is open.

CAUTION

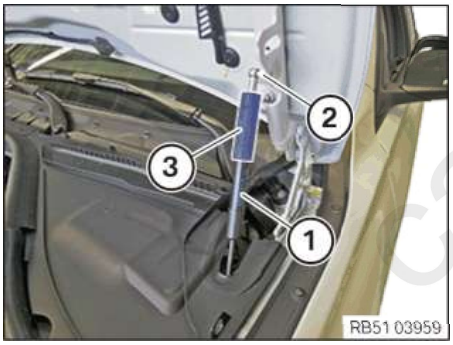
Shutting bonnet or tailgate.

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.

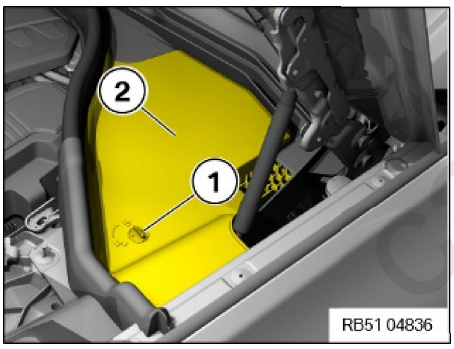
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- 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.



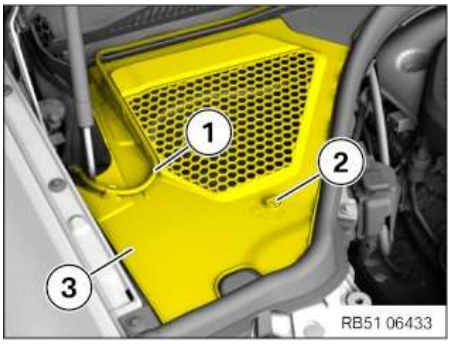
- Release the acoustic cover (1) towards the top from the rubber mounts (marks).

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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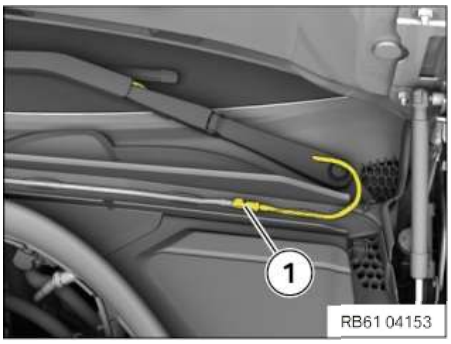
▸ **Remove the wiper arm**

RISK OF DAMAGE

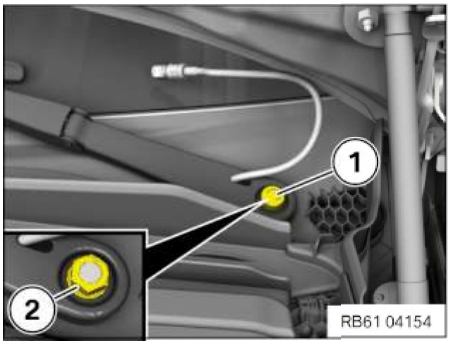
Damage to wiper console

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

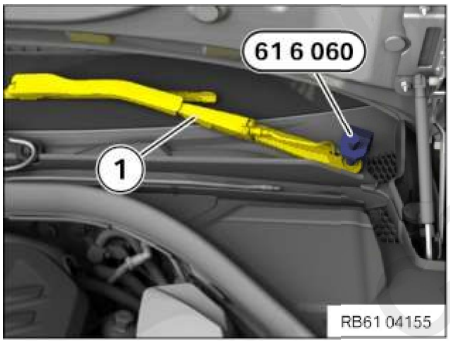
- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.



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

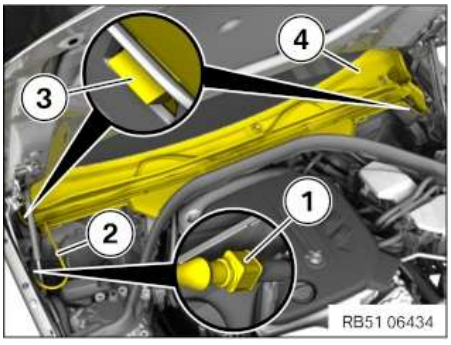


- Remove the protective cap (1).
- Loosen nut (2).



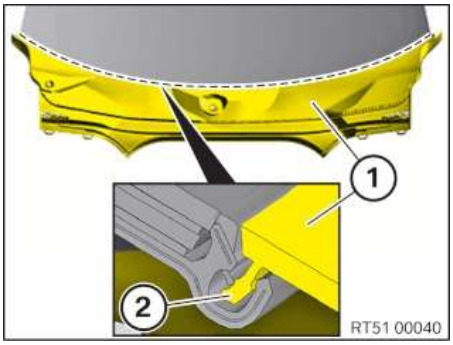
- Pull off the wiper arm (1) using special tool .

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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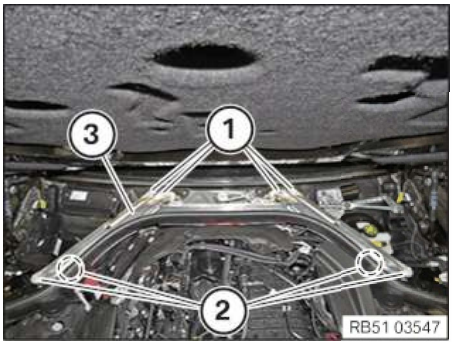


- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

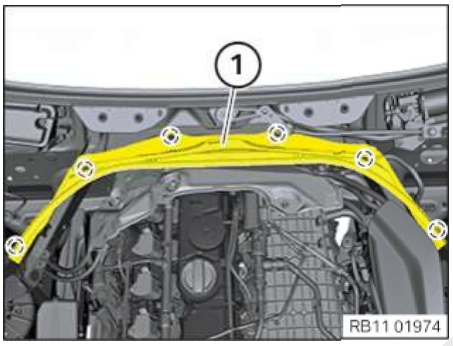
9 – Removing the centre bulkhead upper part

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.



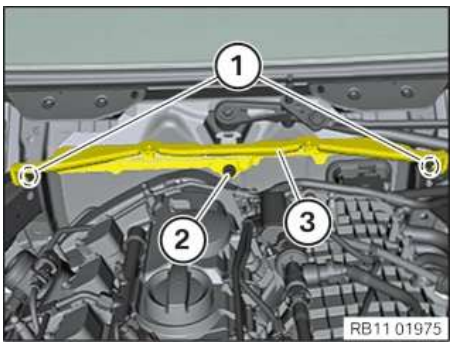
- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

10 – Removing acoustic cover at rear



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

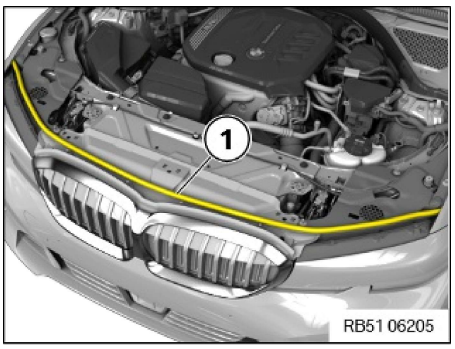
11 – Removing the centre bulkhead lower section



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

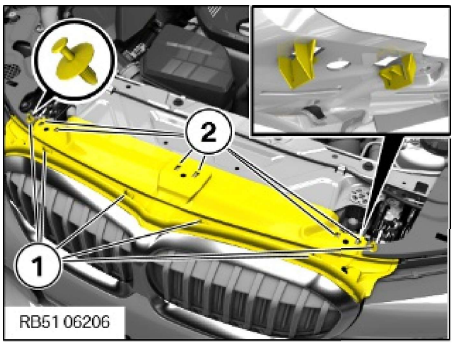
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12 – Remove the seal for the bonnet in front



- Pull off front bonnet seal (1) upwards.

13 – Removing the centre engine compartment cover



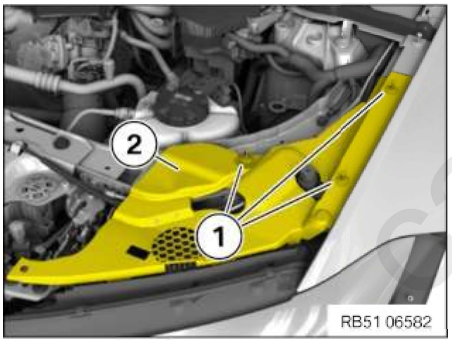
- Detach all expanding rivets (1).
- Release the cover of the centre engine compartment with the latch mechanisms (2) .
- Feed the cover for the centre engine compartment out to the rear.

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**



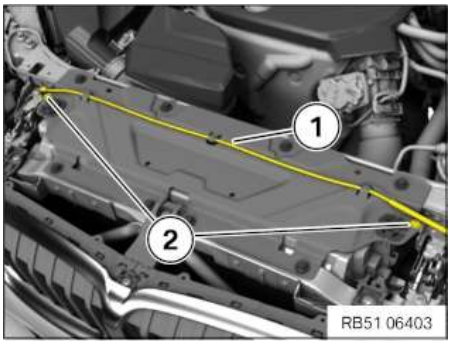
- Loosen the expanding rivet (1).
- Remove the cover in the engine compartment on top (2) partially.

15 – Removing the top cross connection

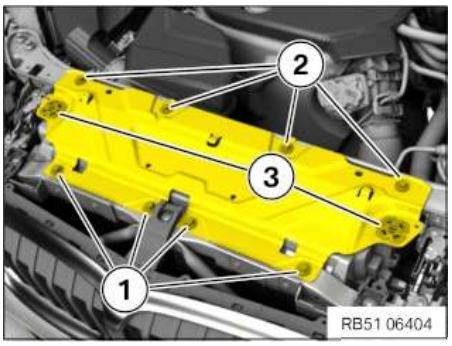


- Release the housing for the coupling of the Bowden cables (1) from the body.

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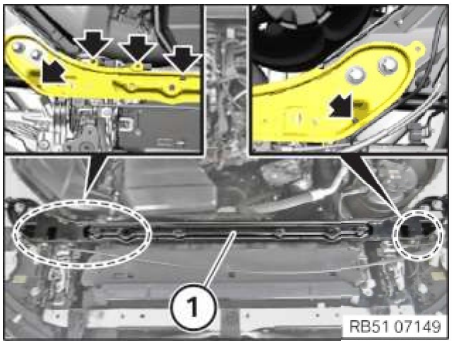


- Detach Bowden cable (1) at the top cross connection.
- Loosen screws (2).

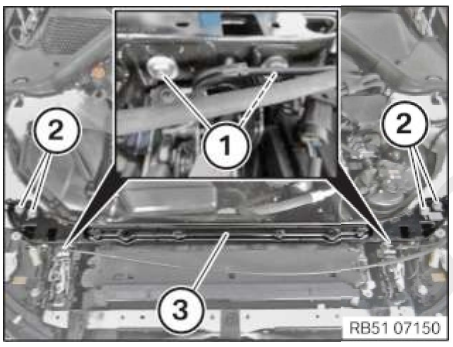


- Loosen screws (1) and (2).
- Remove the top cross connection with the holders(3) towards the top.

16 – Remove the rear top cross connection



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

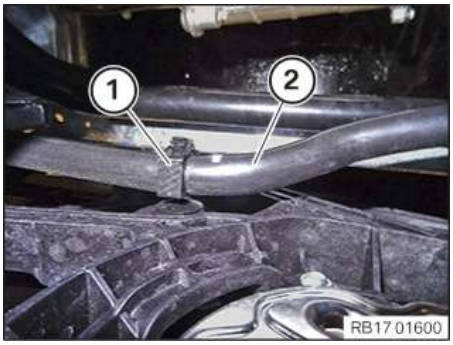


- Loosen screws (1).
- Loosen screws (2).
- Guide out and remove top rear cross connection (3).

17 – Remove fan cowl.

TECHNICAL INFORMATION

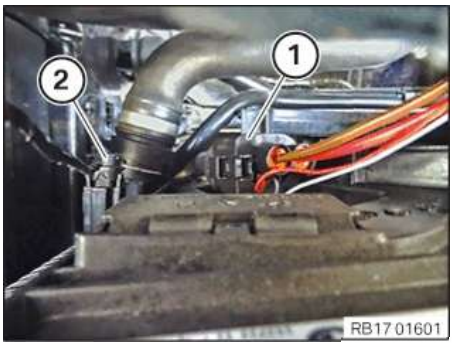
- When the engine is stopped after the end of the journey, it may be necessary to run the electric fan. In rare cases, operation of the electric fan can last up to 11 min. This protects the components. In this case, replacing the electric fan will not remedy the problem!



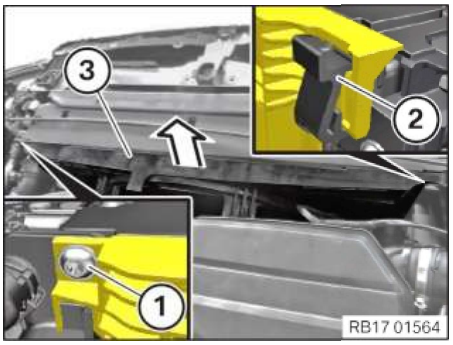
- **If installed:** Release transmission oil line (2).

  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.

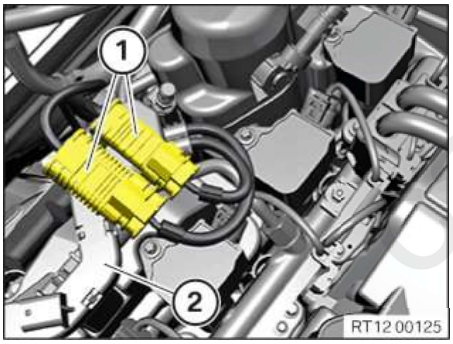
- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

RISK OF DAMAGE

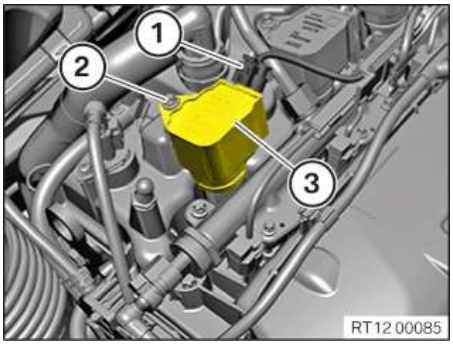
Electrostatic discharge.

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

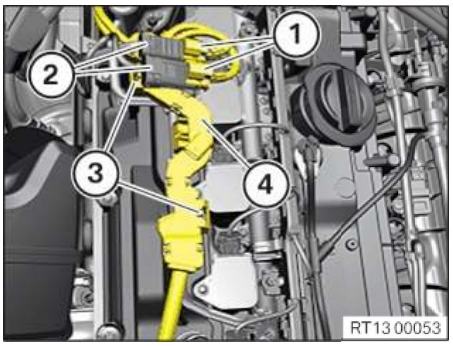
On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

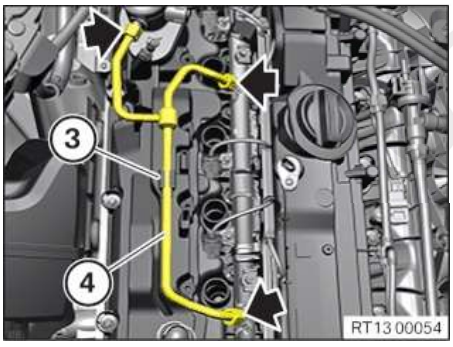
- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

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

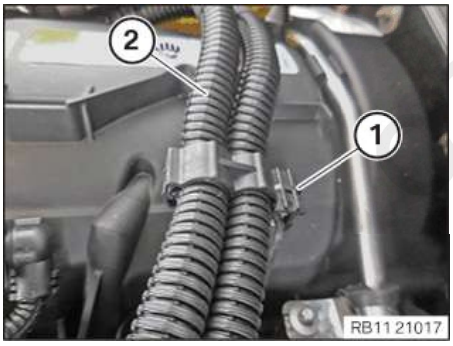
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

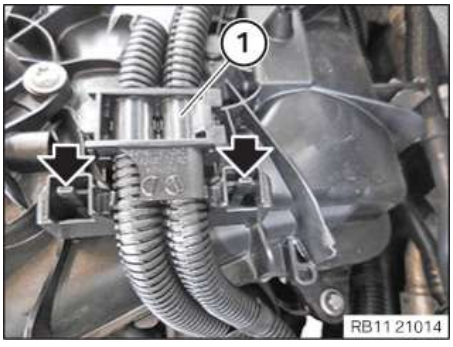
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

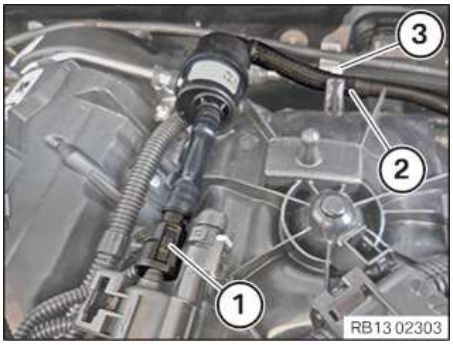
Reset special tool in early to avoid bending pressure lines.



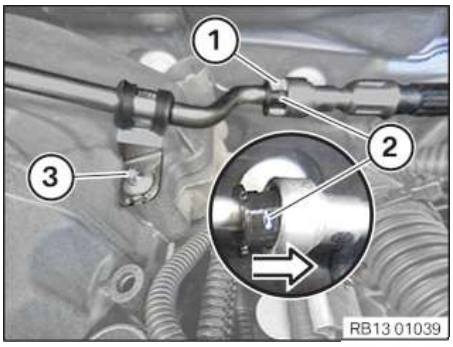
- Loosen clamp (1).
- Guide out wiring harness section (2) for the injectors and ignition coils and place it aside.



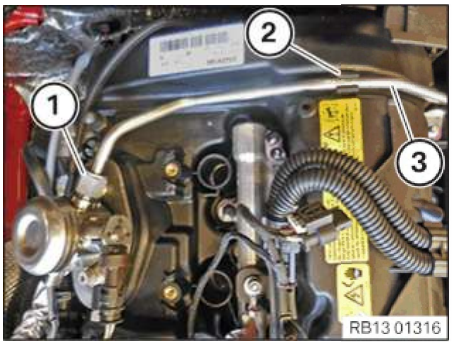
- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.



- 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

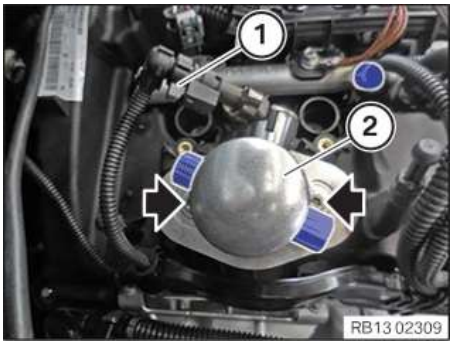
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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.

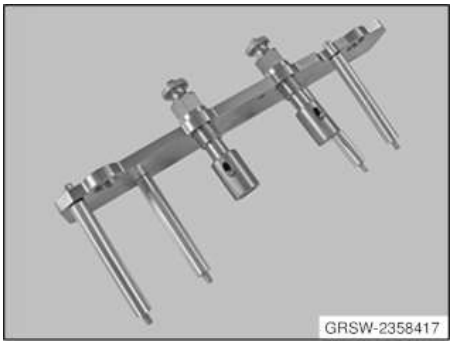
Excessive force may damage the injector and this means having to renew the injector.

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



- Prepare special tool .

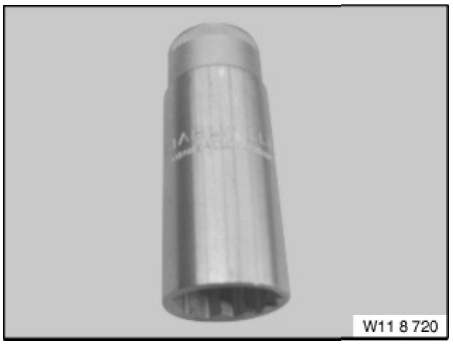
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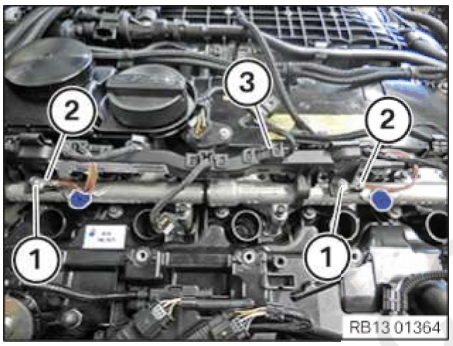
- Prepare special tool 2 358 417.



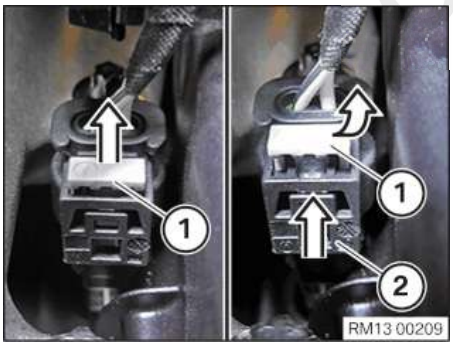
- Prepare special tool .



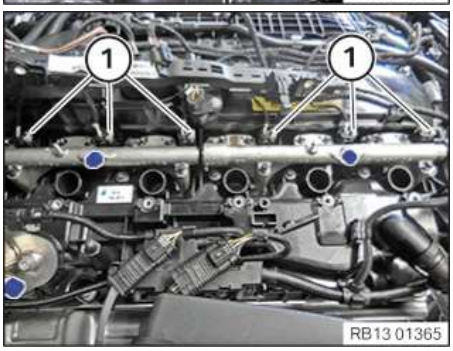
- Prepare special tool 0 496 106 (11 8 720).



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

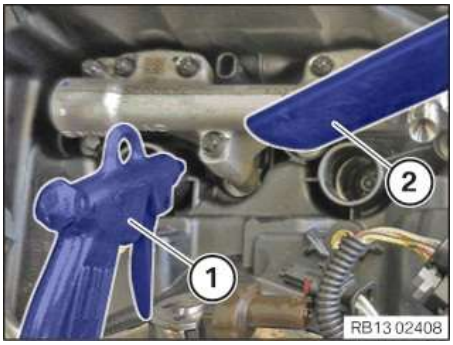


- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull out the connector (2) from the injectors.



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

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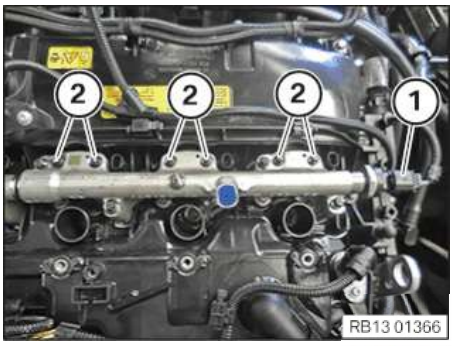


TECHNICAL INFORMATION

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

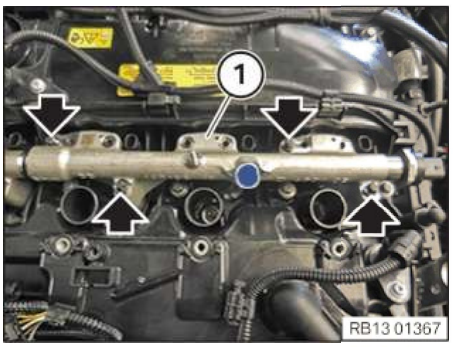
- Before releasing the high pressure lines: Blow out the injector shafts with an air gun(1) with less pressure.
- Simultaneously, draw off the dirt particles with an **explosion proof** vacuum cleaner (2).



- 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.

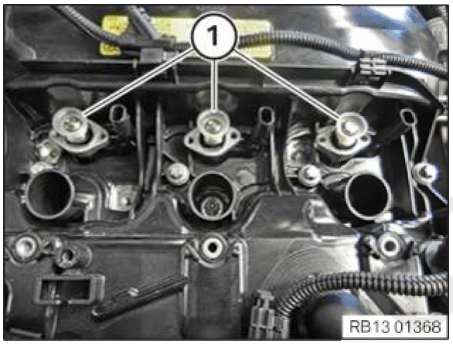


- Unscrew the screws (M6x30) (arrows).

  The screws may not be reused!
- Renew screws.

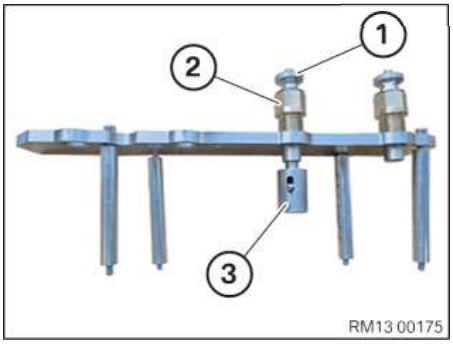
  Parts: Screws (M6x30)
- Remove rail (1) in upward direction.

  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.

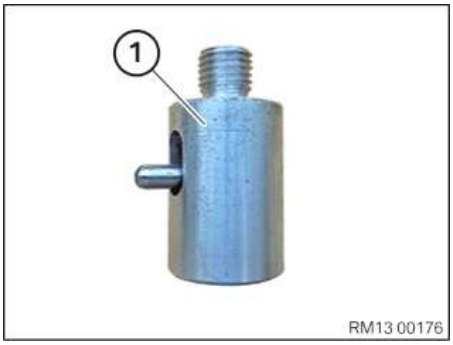
- Twist the injectors with a maximum torsional movement of 13 Nm.
- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use the special tool 2 358 417to remove the injectors.

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

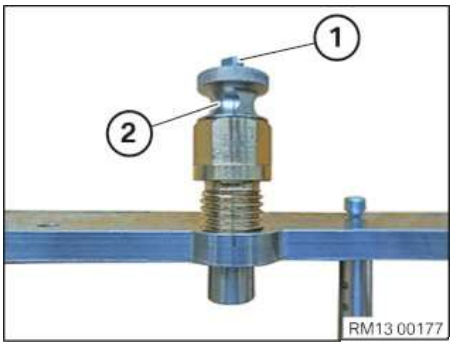
  Special tool 2 358 417 consists of:

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

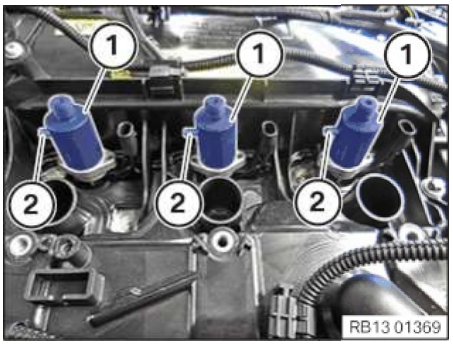
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- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.

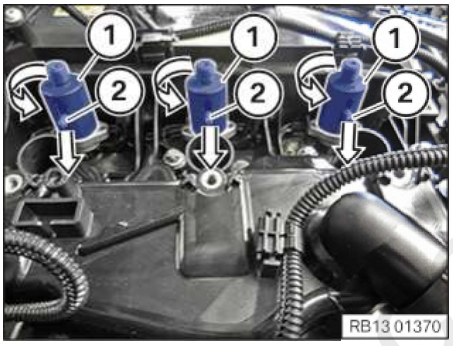


- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.

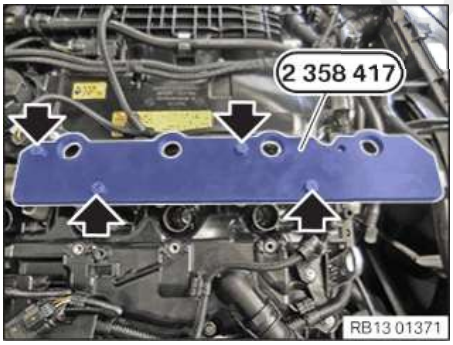


- Install all fixtures (1) for the injectors.

  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

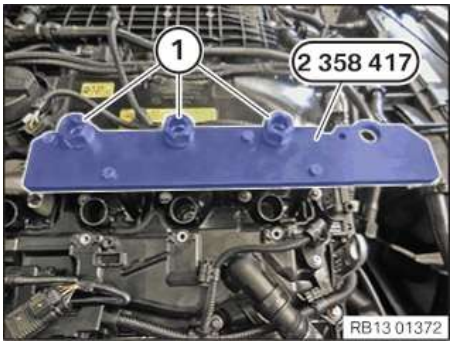
Damage to injectors.

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).

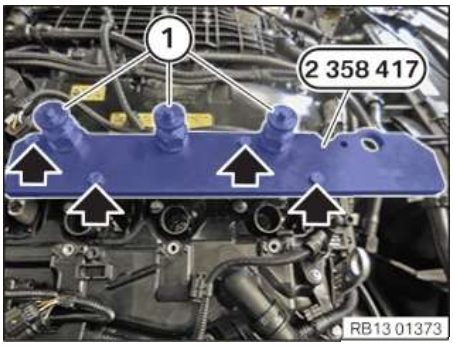
cardiagn.com



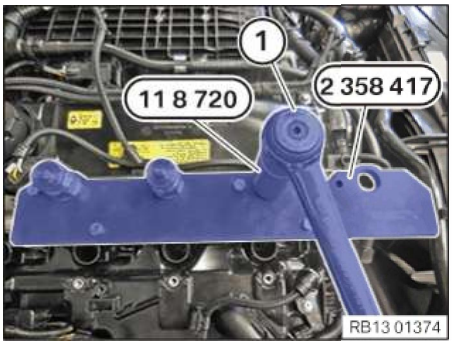
TECHNICAL INFORMATION

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.

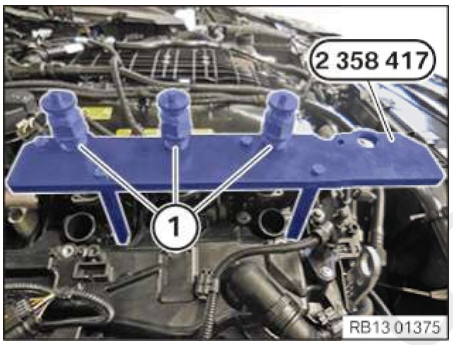


- Adjust torque wrench to 13 Nm **clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720)until the injector is pulled out.

TECHNICAL INFORMATION

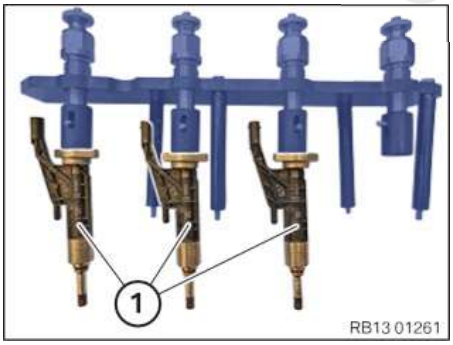
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

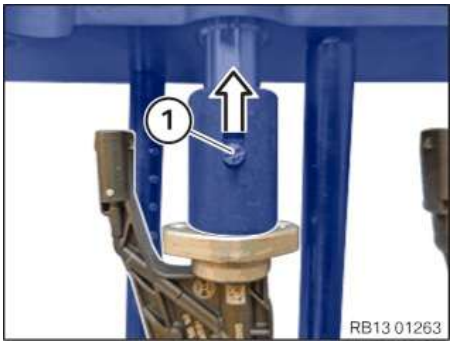


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  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.

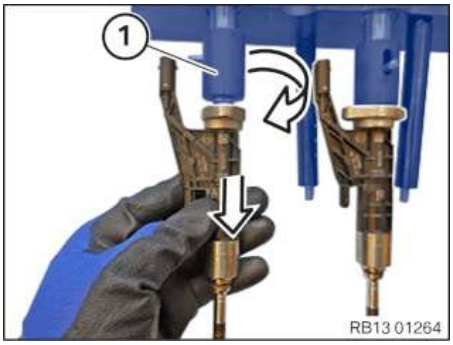


NOTICE

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.

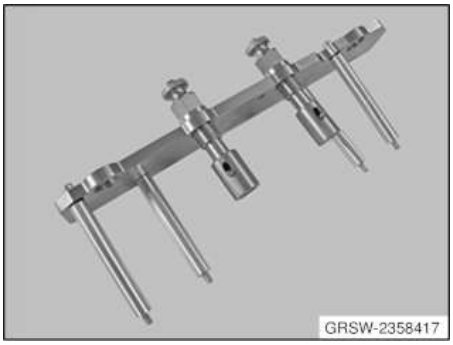
Excessive force may damage the injector and this means having to renew the injector.

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



- Prepare special tool .

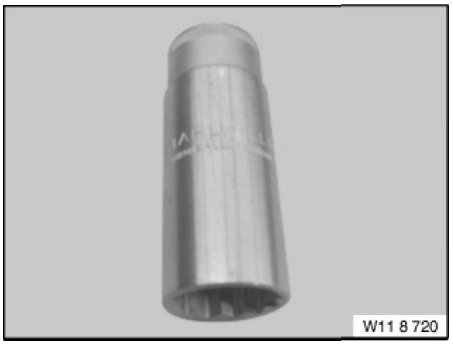
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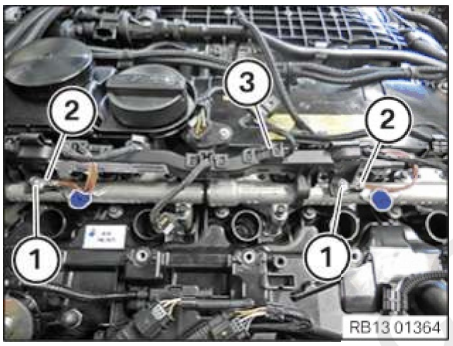
- Prepare special tool 2 358 417.



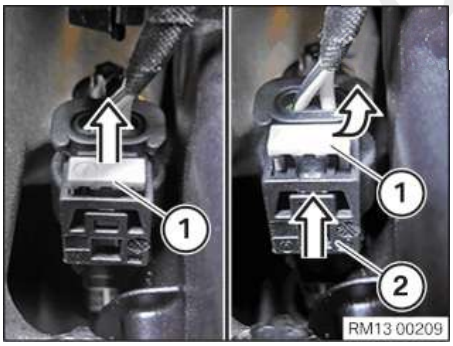
- Prepare special tool .



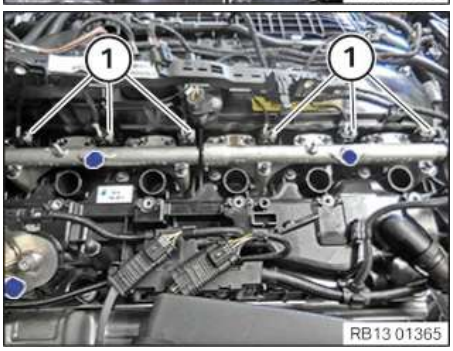
- Prepare special tool 0 496 106 (11 8 720).



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

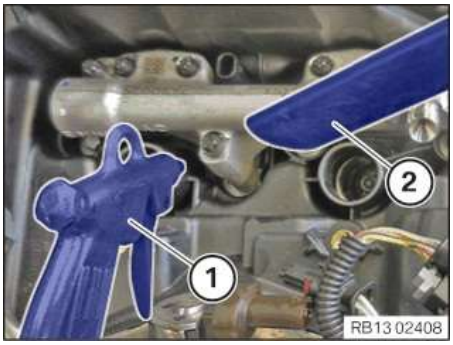


- Unlock lock (1) in direction of arrow upwards.
- Press lock (1) together and release.
- Disconnect the connector (2) from the injectors in the direction of the arrow.



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

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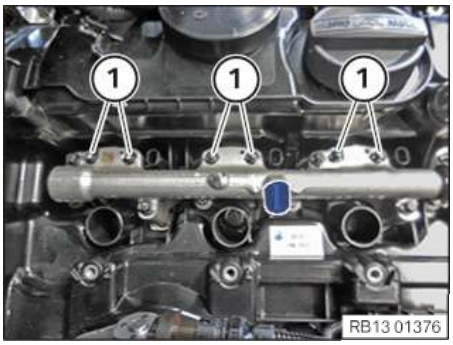


TECHNICAL INFORMATION

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

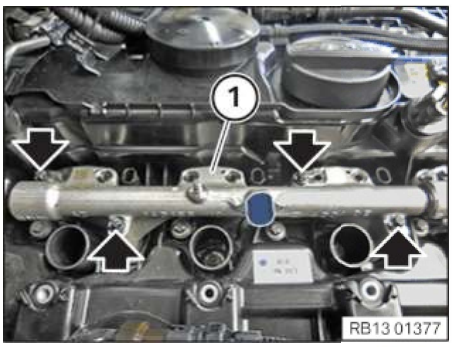
For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

- 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) .

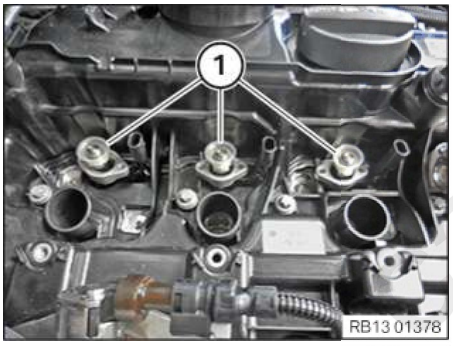
  Do **not** reuse screws (M5x30) (1).
- Catch and dispose of escaping fuel with suitable materials.



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

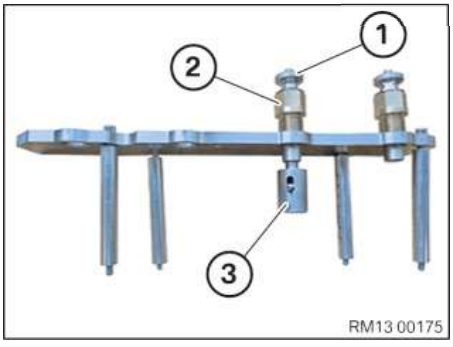
  Do **not** reuse the screws (M6x30).
- Remove rail (1) upwards.

  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.

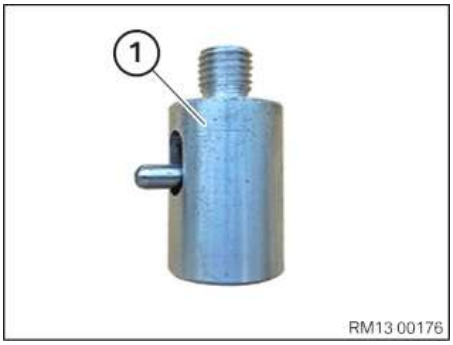
- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use the special tool 2 358 417 to remove the injectors.

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

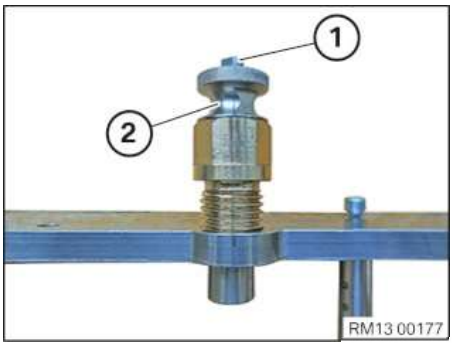
  The special tool 2 358 417 consists of:

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

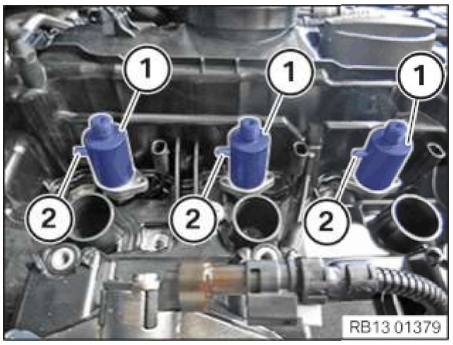
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- Unscrew the fixture for injectors (1) from special tool 2 358 417.

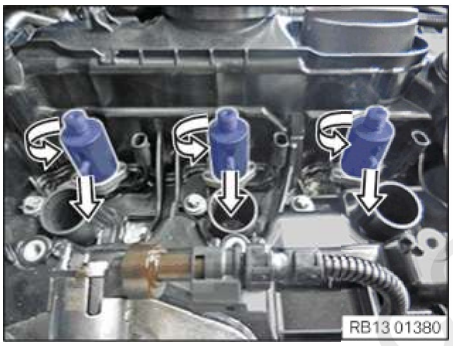


- Press lock (1) in and remove the threaded sleeve (2) from the special tool 2 358 417.



- 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

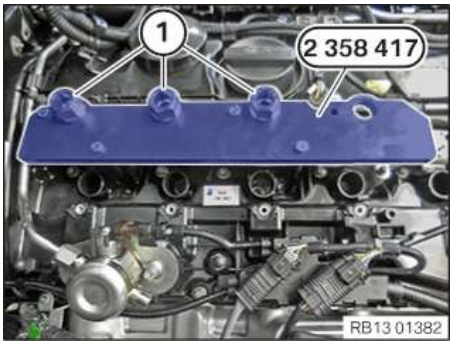
Damage to injectors.

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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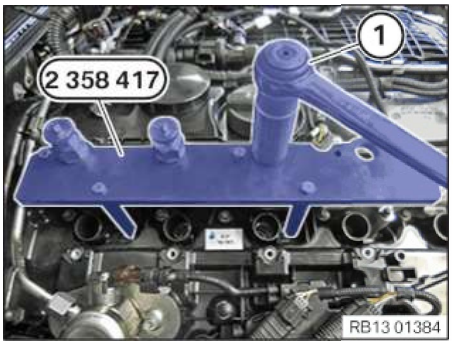
TECHNICAL INFORMATION

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.

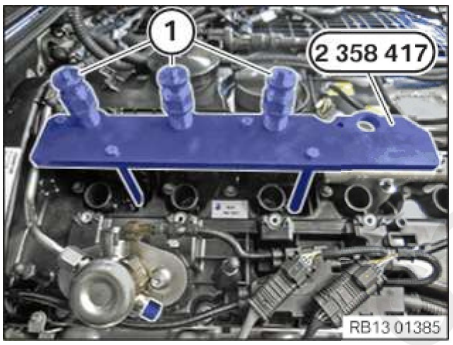


- Adjust torque wrench to 13 Nm **in clockwise** direction.
- Turn the torque wrench (1) with the special tool 0 496 106 (11 8 720) **clockwise**, until the injector is pulled out.

TECHNICAL INFORMATION

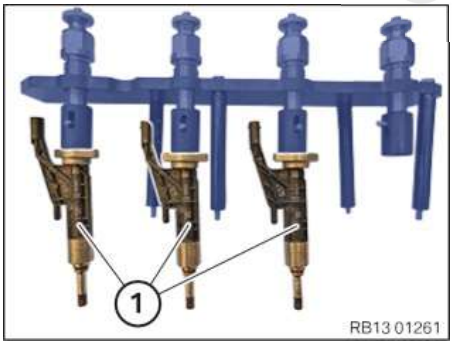
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

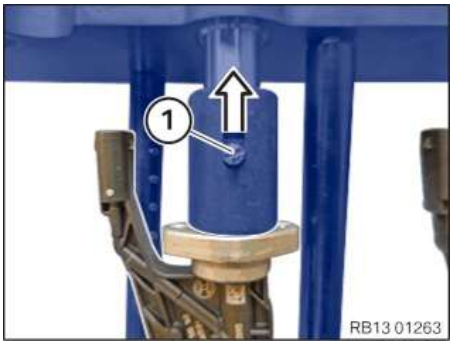


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  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.

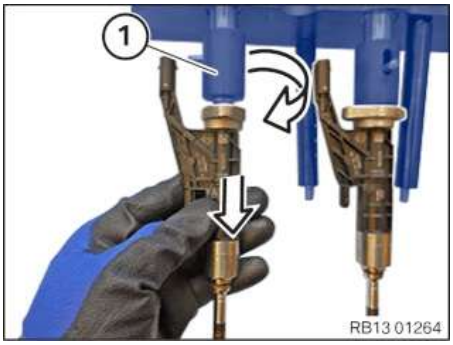


NOTICE

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.

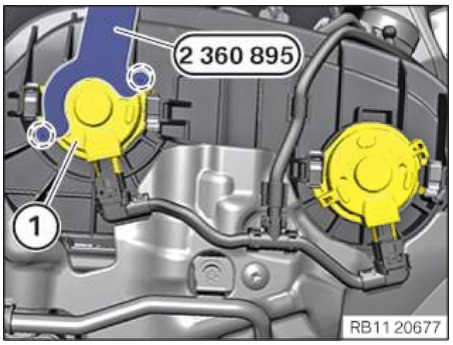
26 – Removing both actuators

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

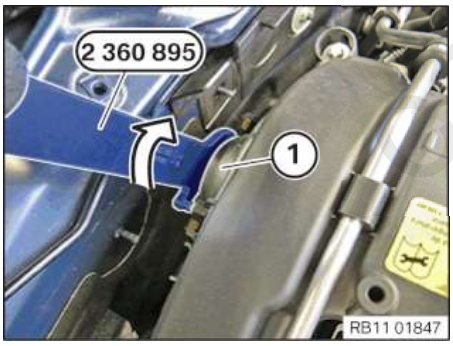
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the 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.



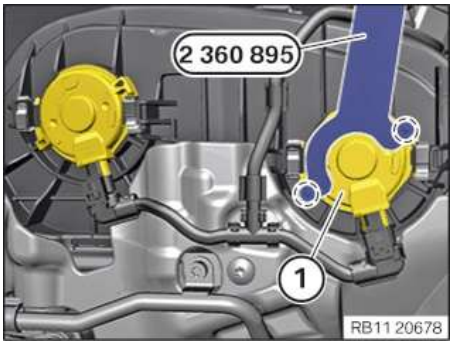
NOTICE

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.

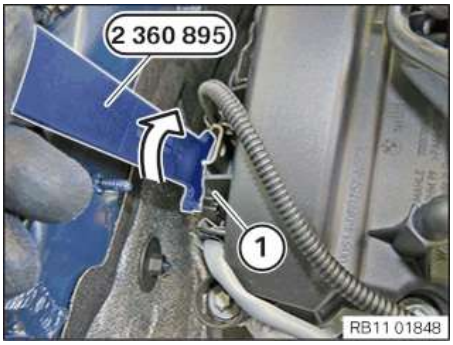


NOTICE

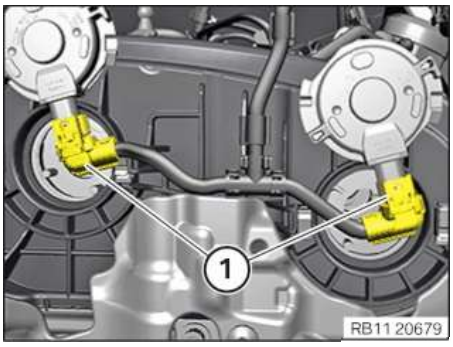
The figure shows the rear side of the engine.

- 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.



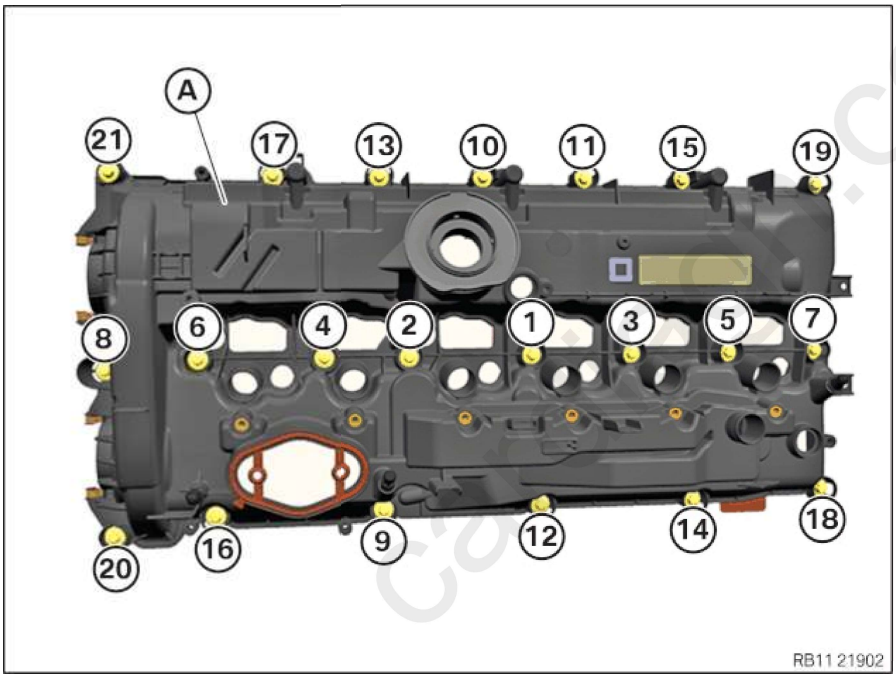
NOTICE

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

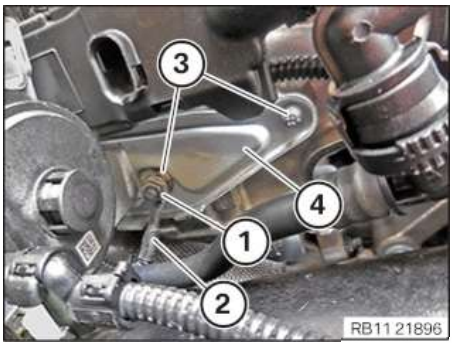
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

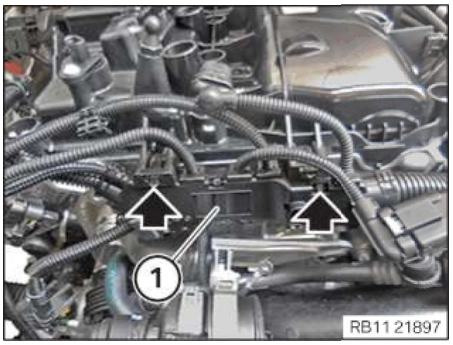
- Do not pull on the wires when disconnecting connectors and plug connections.



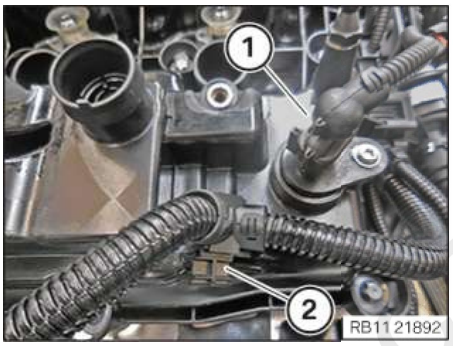
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



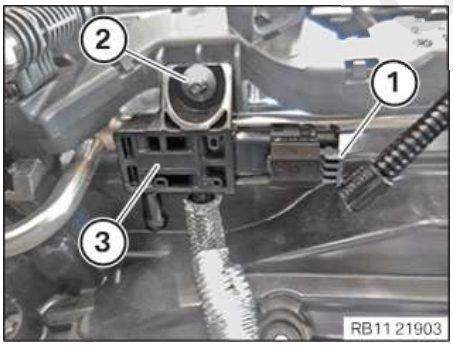
- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Loosen screws (3).
- Thread out holder (4) and set aside.



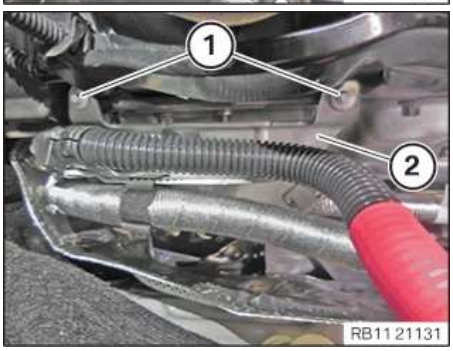
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for the sensor system **2** and place to one side.



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

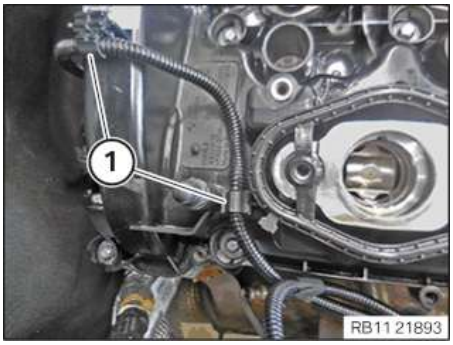


- **If installed:**
- Unlock and loosen connector (1).
- Loosen screw (2).
- Remove the differential pressure sensor (3) and put it to one side.

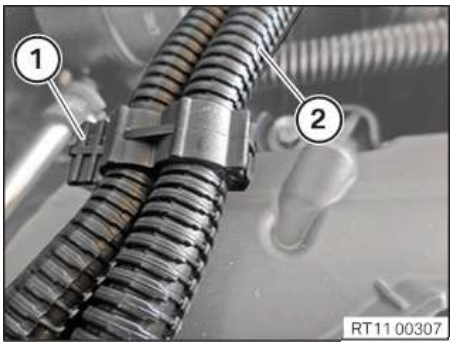


- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

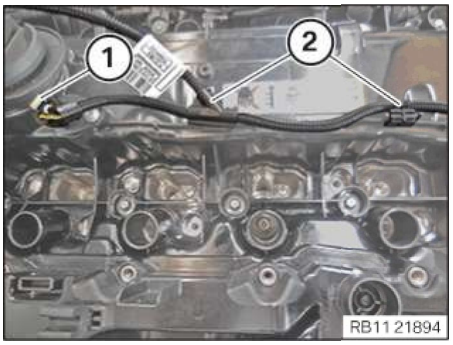
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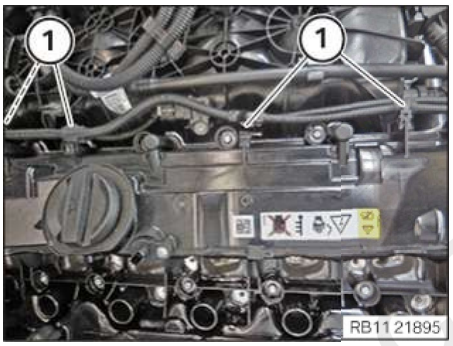
- Loosen clamps (1).



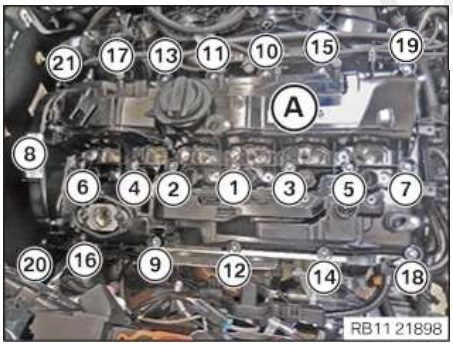
- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



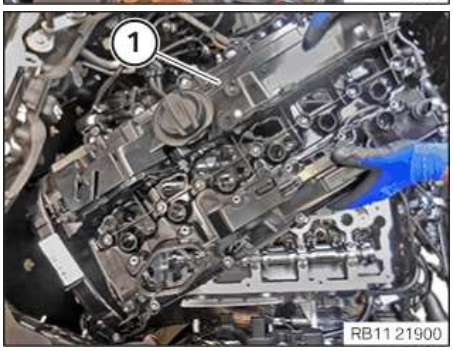
- Unlock and detach connector (1) on the intake camshaft sensor.
- Loosen clamps (2).



- Loosen clamps (1).



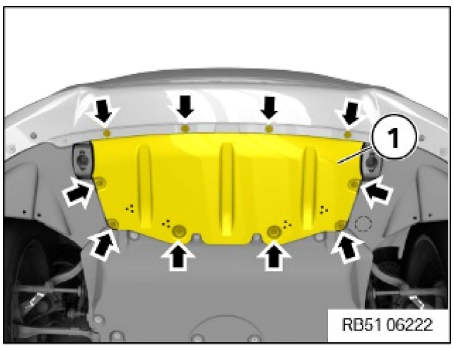
- Release all screws on the cylinder head cover (A) in the sequence (21) to (1).



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

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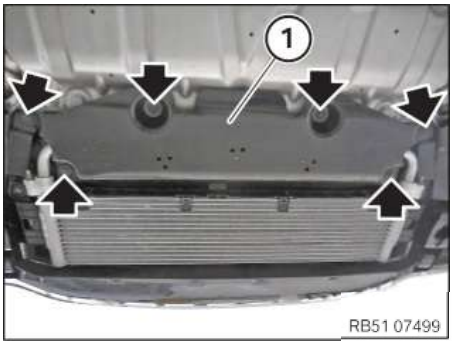
28 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

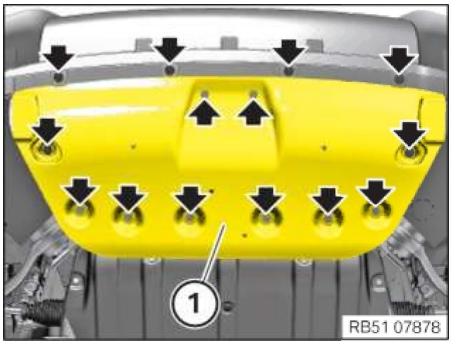
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

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

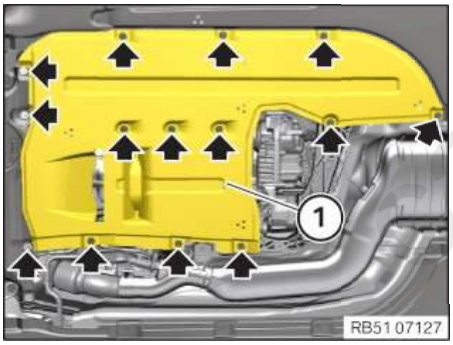


- **Version 3:**

  Remove screws (arrows).

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

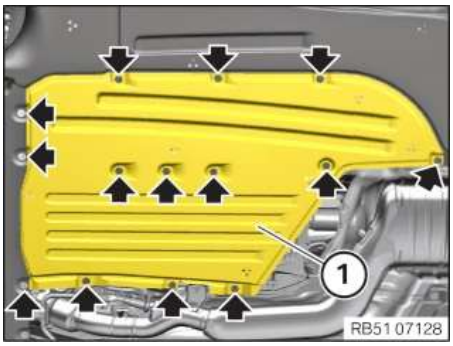
29 – Remove rear underbody protection



- **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

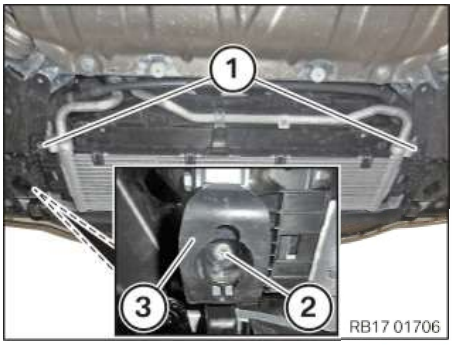
Hot surfaces.

Risk of burning!

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

TECHNICAL INFORMATION

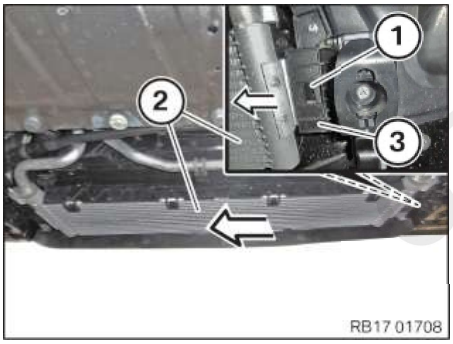
The work must be performed with care to prevent component damage.



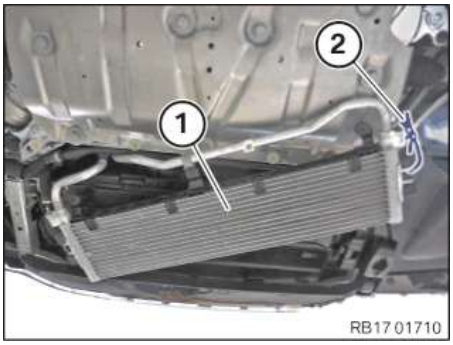
- Loosen screws (1).
- Drill out rivet on the left (2).
- Remove the left-hand damper (3).



- 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.



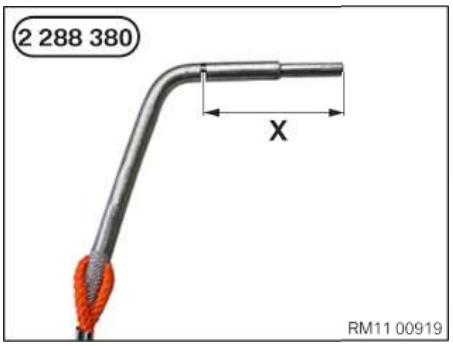
RISK OF DAMAGE

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.

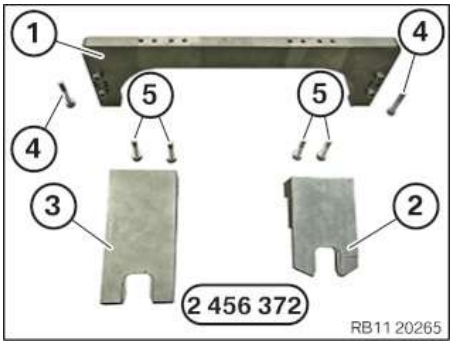


- **Vehicles with automatic transmission:**

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

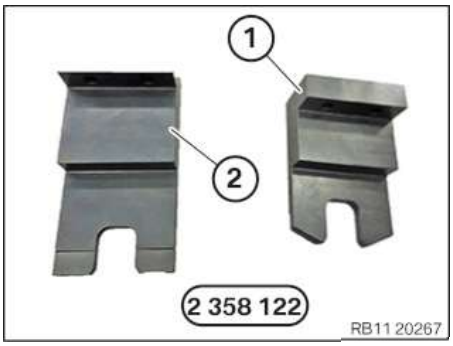
  The engine is in the TDC firing position of cylinder 1.

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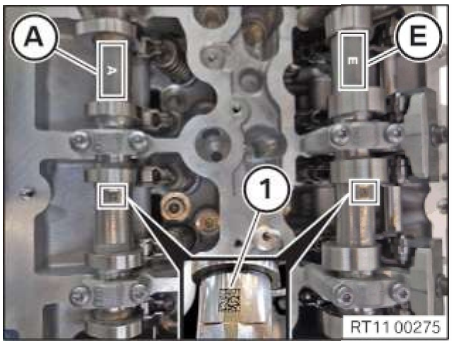
- Overview of the set of special tools 2 456 372:

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

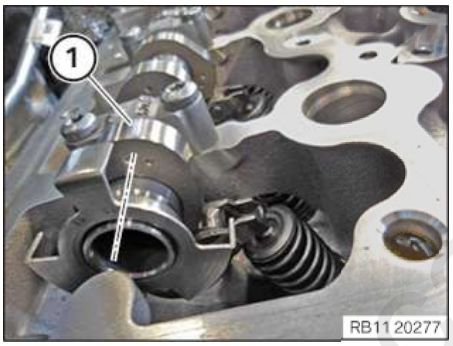


- Overview of the test gauges from the set of special tools 2 358 122:

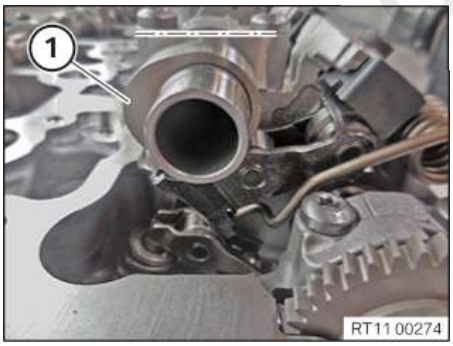
Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



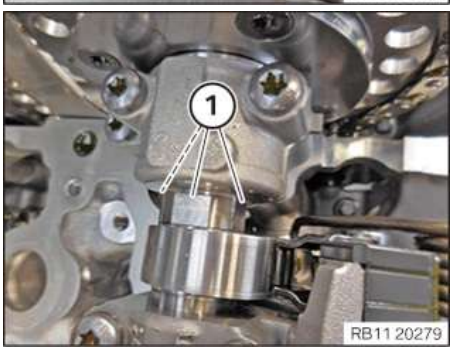
- Turn intake camshaft (E) and exhaust camshaft (A) until marks (1) can be read from the top.



- 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.

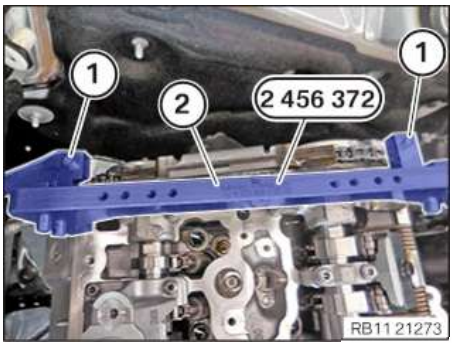


- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.

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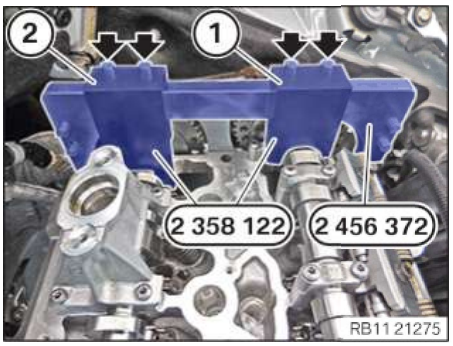
- Position basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- 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).

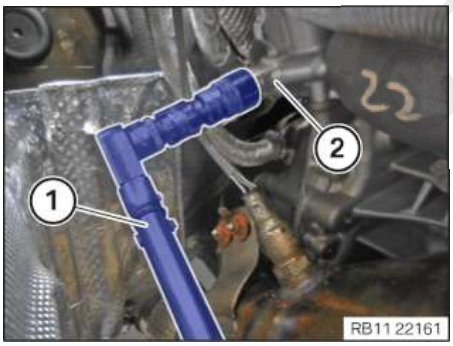
Test gauge to basic carrier

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).

MAIN WORK

33 – 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.

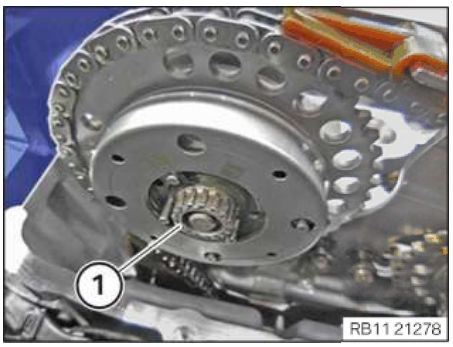


NOTICE

The figure shows the rear side of the engine.

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

34 – Removing the VANOS central valve of the intake adjuster

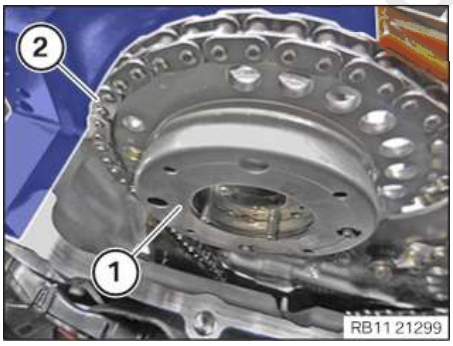


- Guide out and remove the VANOS central valve (1) of the intake adjuster.

35 – 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.

36 – Installing the intake adjuster

NOTICE

The figure shows the rear side of the engine.

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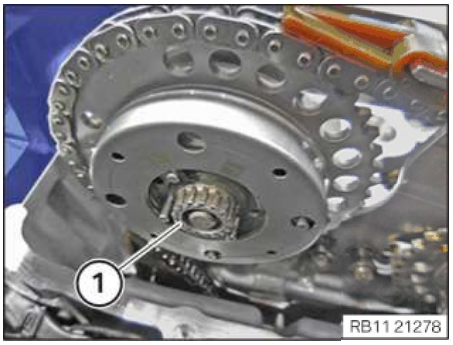


- Keep intake adjuster (1) marked IN ready.

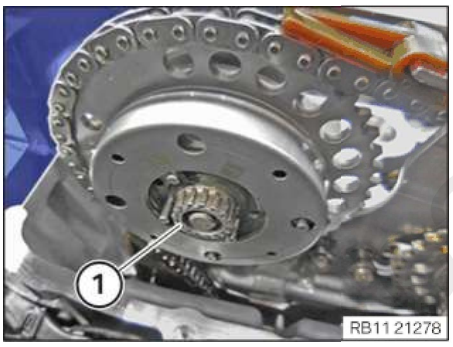


- Feed in intake adjuster (1) in the timing chain (2) and position on the intake camshaft .

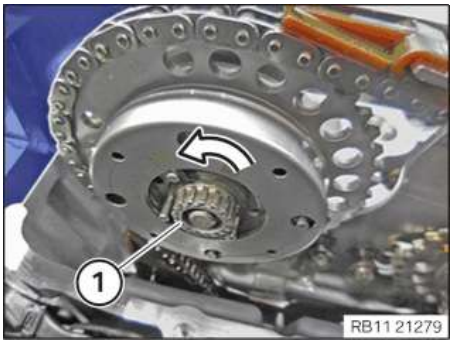
37 – Install the VANOS central valve of the intake adjuster



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



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



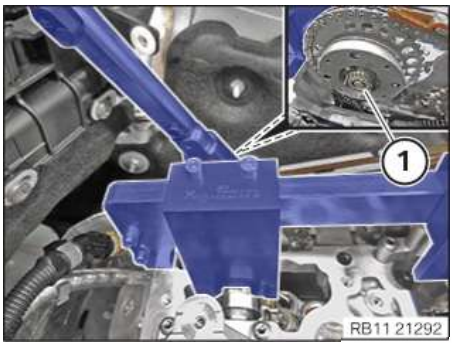
- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

38 – Releasing VANOS central valve of the exhaust camshaft adjuster

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- 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.

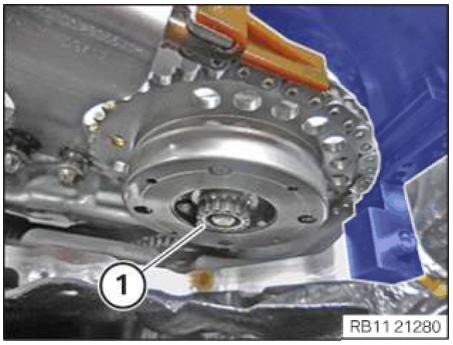


NOTICE

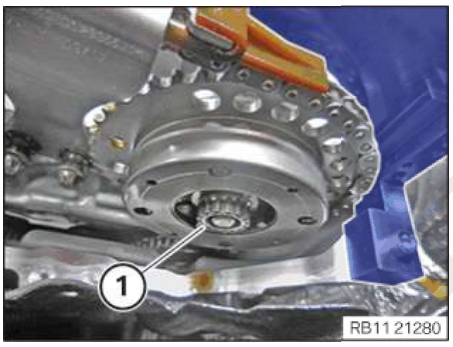
The figure shows the rear side of the engine.

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

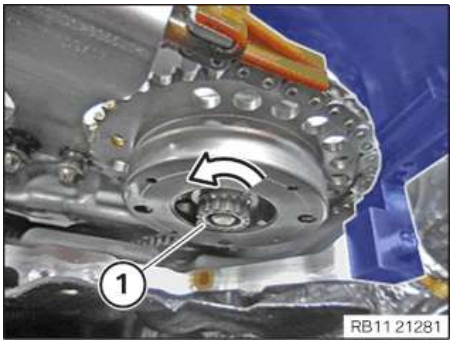
39 – Installing the VANOS central valve of the exhaust camshaft adjuster



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



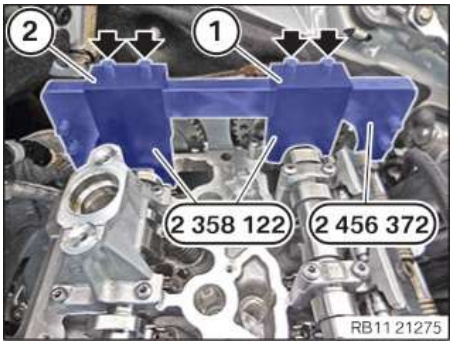
- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.



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

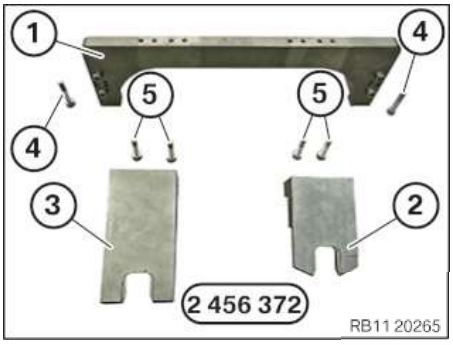
40 – Remove the test gauges to fix the camshafts

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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.

41 – Adjust the camshafts with the special tool

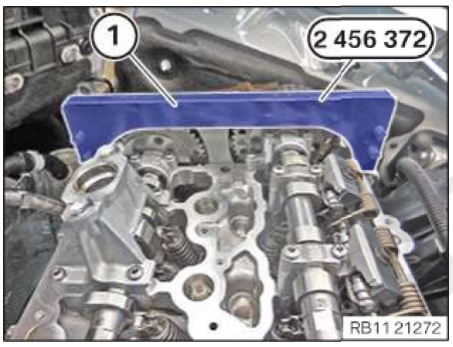


- Overview of the set of special tools 2 456 372:

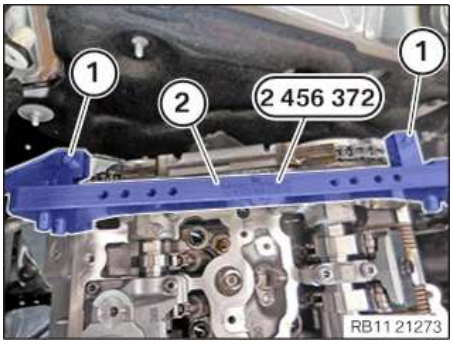
Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- 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.

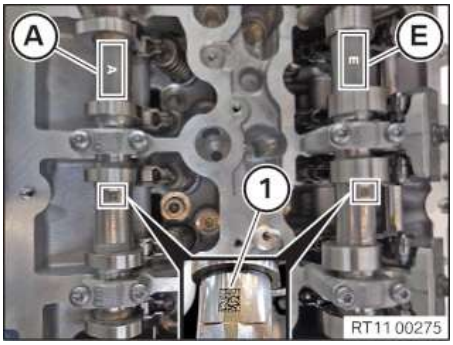


- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

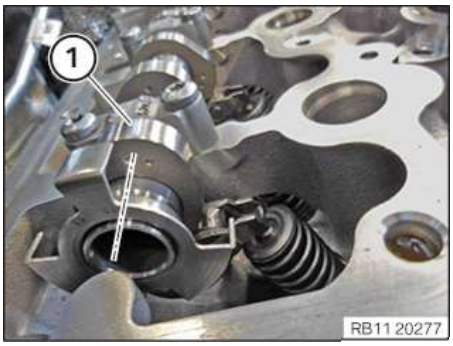
Basic carrier to cylinder head

M6		Tightening torque	8 Nm

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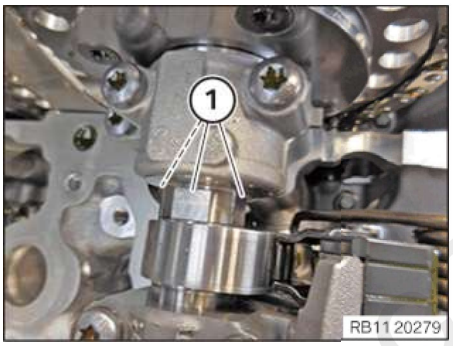
- Turn the intake camshaft (E) and the exhaust camshaft (A) such that the marks (1) can be read from the top.



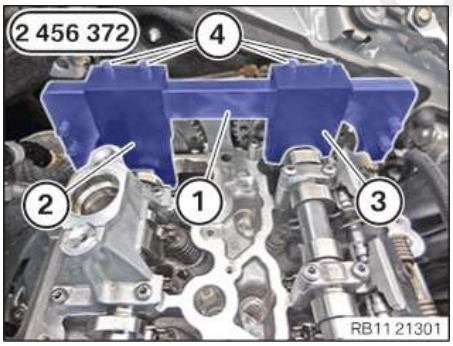
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- 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.



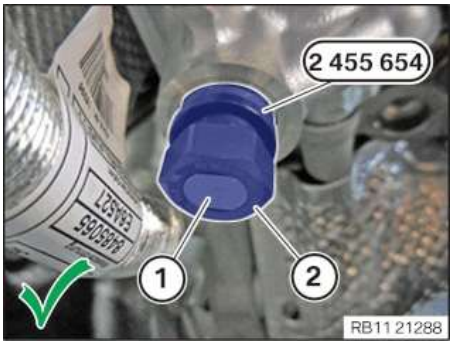
- Position the setting gauge 0.5° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten the screws (4).

Test gauge to basic carrier

M6		Tightening torque	8 Nm

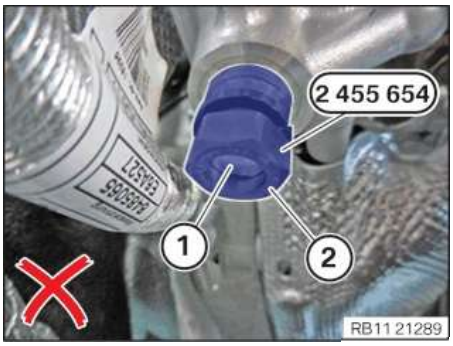
42 – Pretension the timing chain with the special tool

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

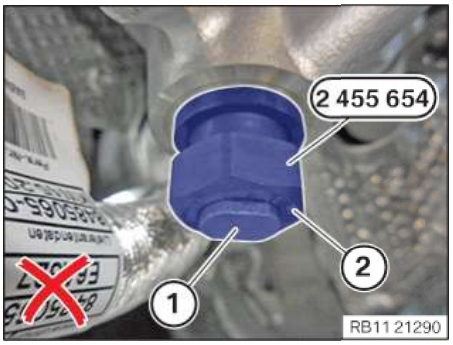
  The pin (1) must align **precisely** with housing (2).



- 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**.

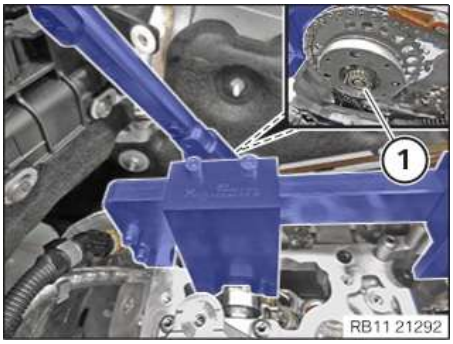
  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

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

43 – 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 °

44 – 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.



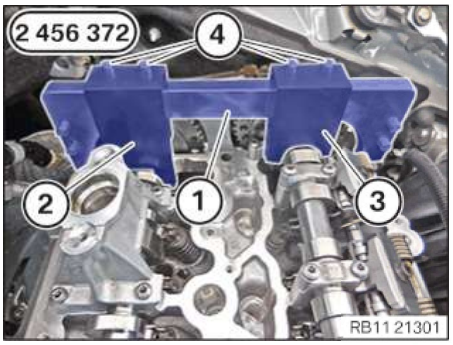
- Tighten the VANOS central valve (1) of the intake adjuster.

VANOS central valve to camshaft

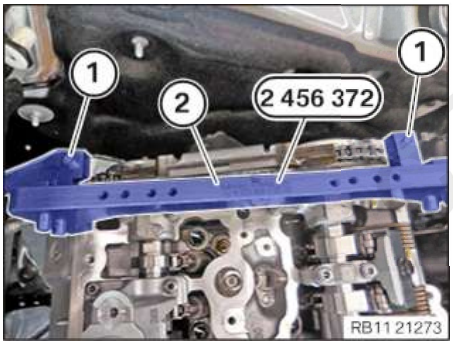
M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

POSTPROCESSES

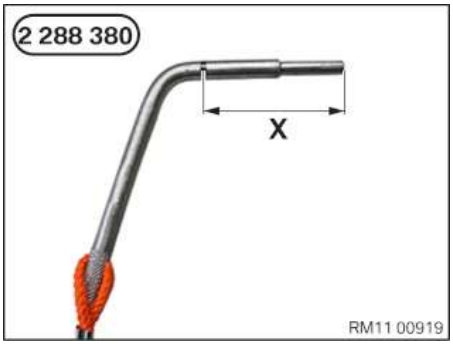
45 – Disassembling all special tools



- 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.

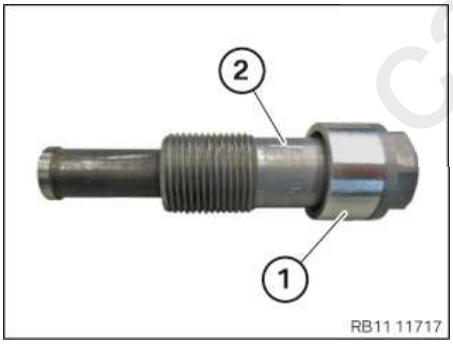
46 – Install chain tensioner

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.



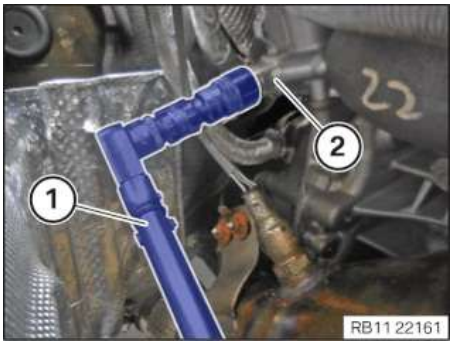
- Renew the sealing sleeve (1).

  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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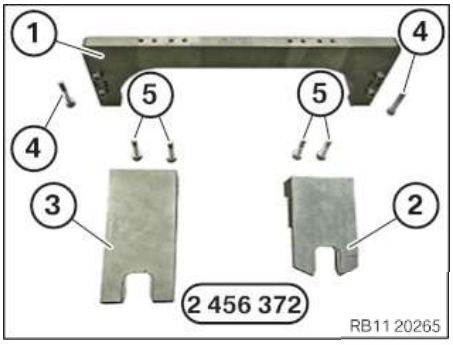


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

47 – 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

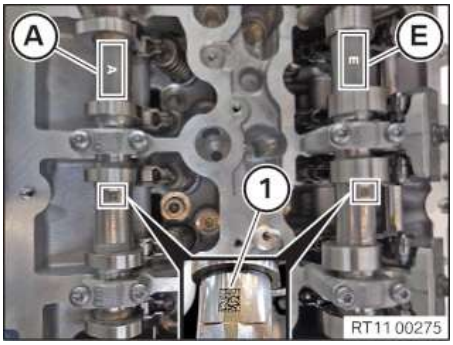
Damage to the engine.

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

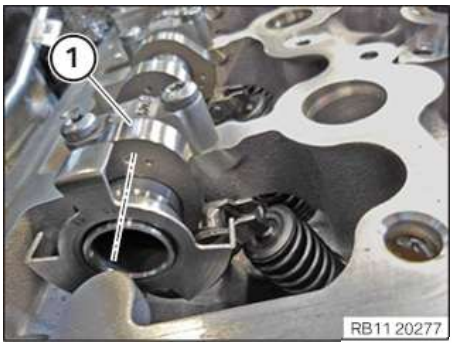
- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

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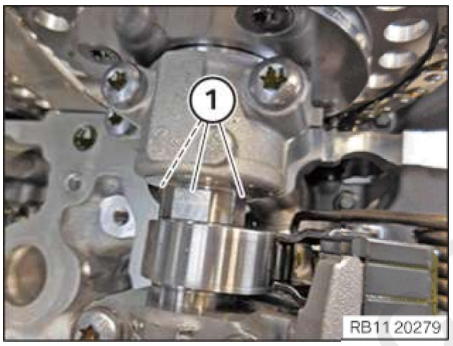
- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.



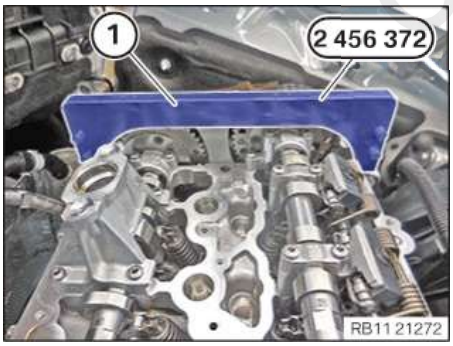
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



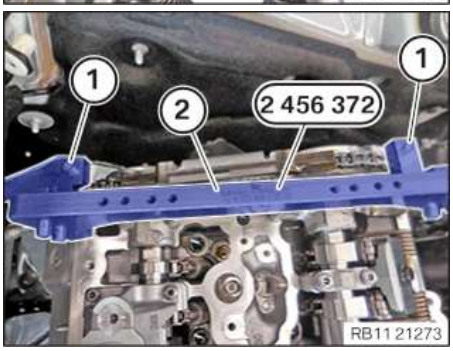
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.



- 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.

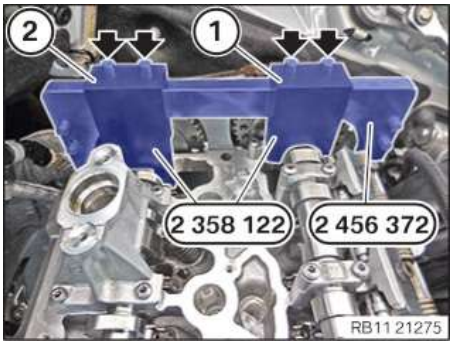


- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm

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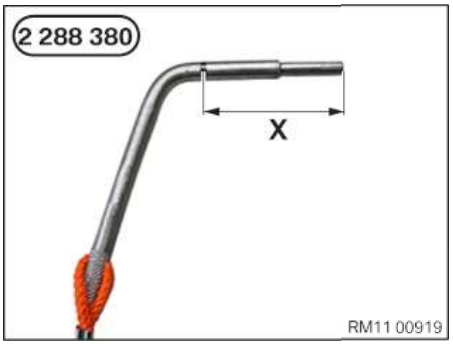
- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special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



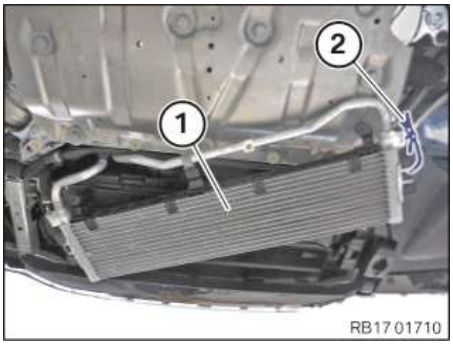
- **Vehicles with automatic transmission:**

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

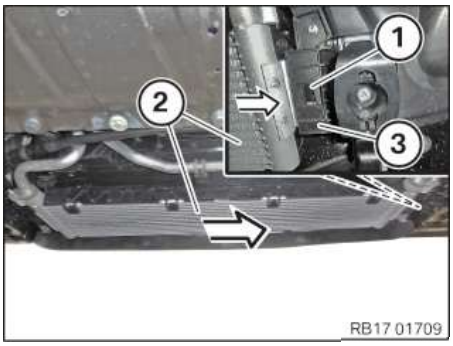
  The engine **is in the** TDC firing position of cylinder 1.

48 – If installed: Secure engine oil cooler

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



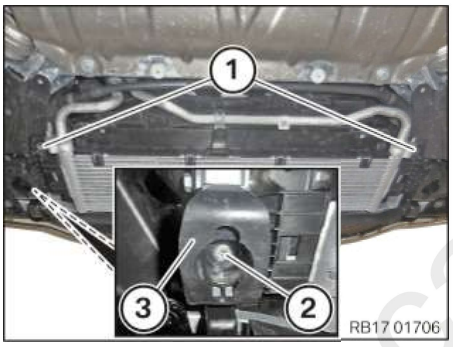
- Feed in and install the engine oil cooler (2) on the holder (3) in the direction of the arrow.
- Ensure that the lock (1)engages audibly.



- 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).

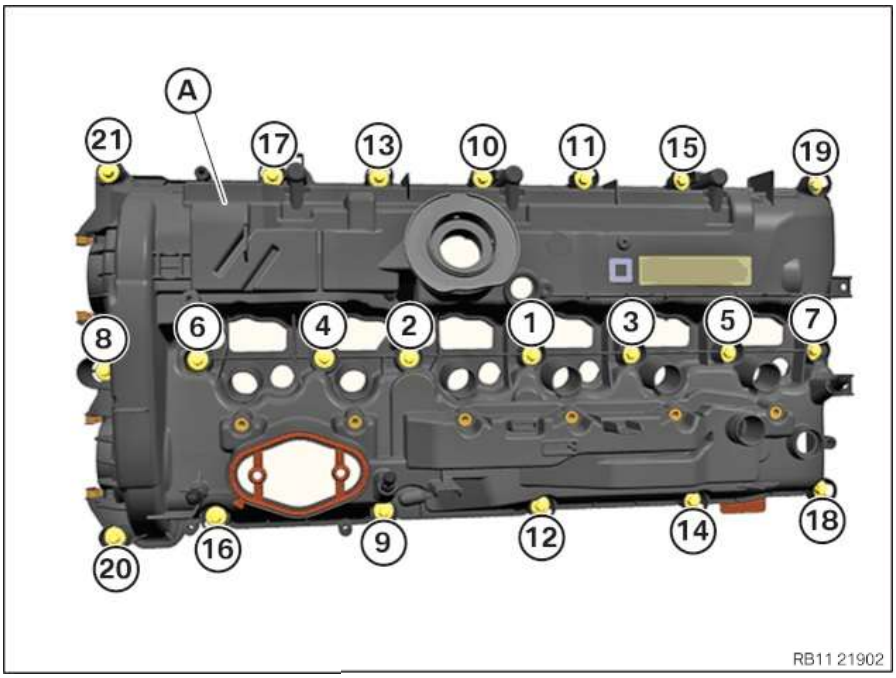
Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

49 – 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

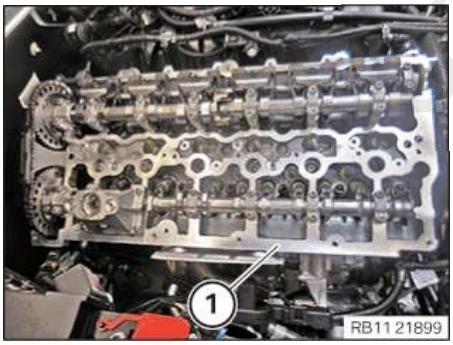
Improper routing of cables and wiring harnesses.

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

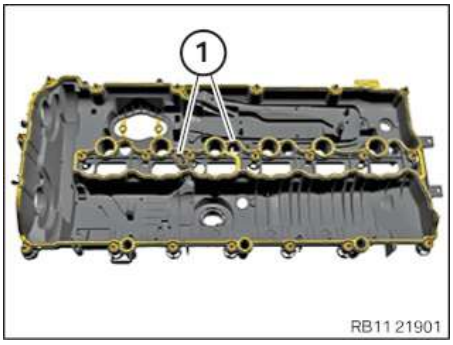
- Route all cables without abrasions, do not trap and crush.

TECHNICAL INFORMATION

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



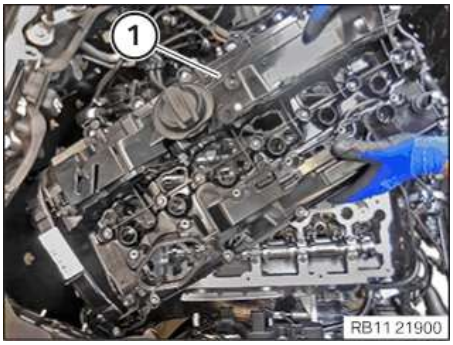
- Contact surface (1) must be free from oil and grease.



- Replace the seals (1).

  Parts: Seals

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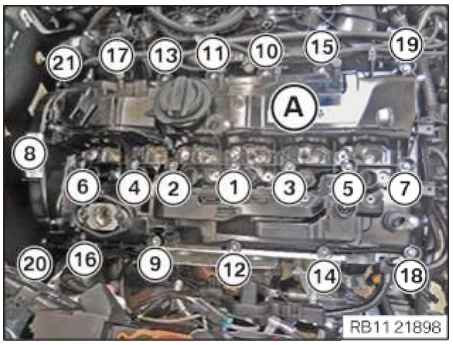


- Insert and install cylinder head cover (1).



- 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

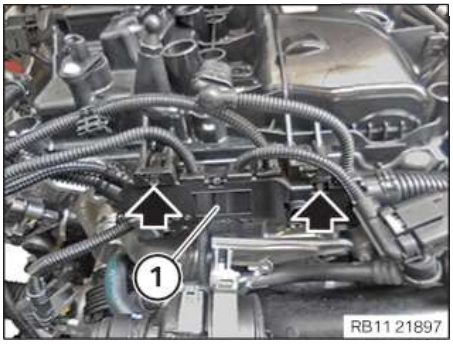
- Tighten all screws in a sequence from (1) to (21).

Cylinder head cover to cylinder head

M6X30		Tightening torque	11 Nm

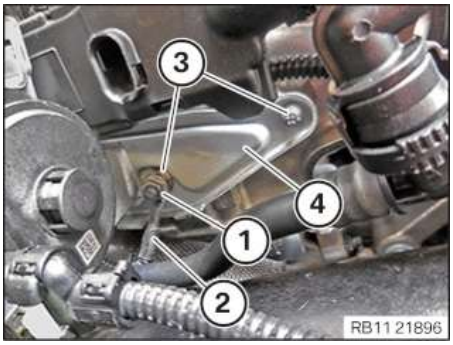


- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.



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

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

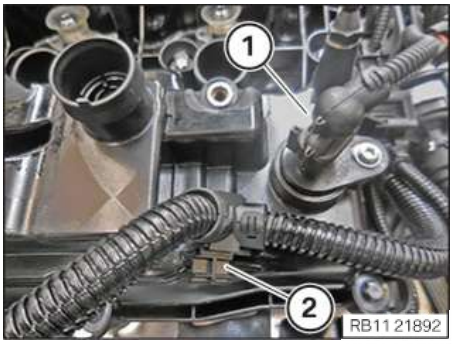
Auxiliary coolant pump holder to cylinder head

M6		Tightening torque	7 Nm

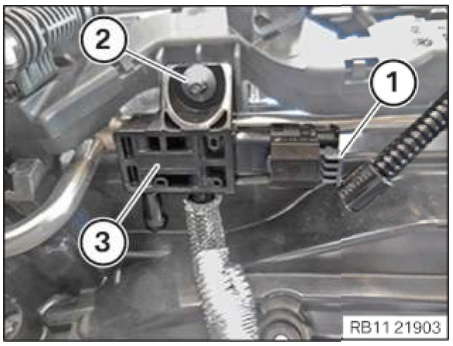
- Thread in ground cable (2) and install.
- Tighten nut (1).

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).

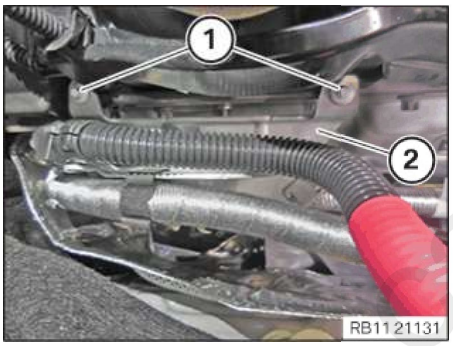


- **If installed:**
- Feed in and install the differential pressure sensor (3).
- Tighten down screw (2).

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.

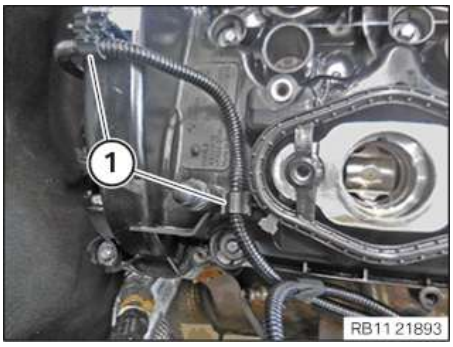
Risk of short circuits!

- 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).

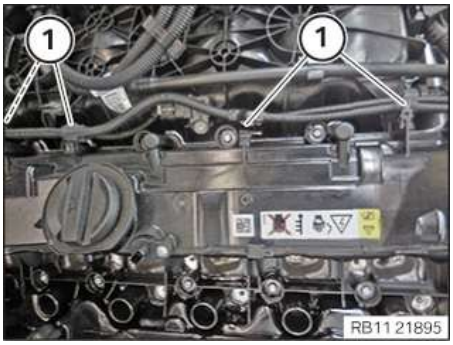
Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

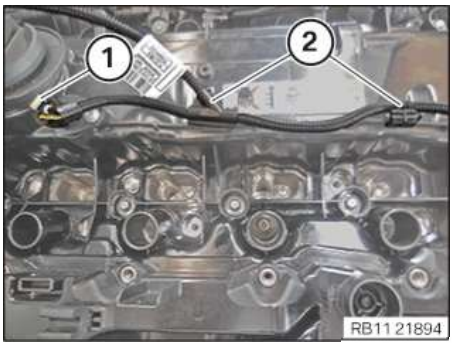


- Secure clamps (1).

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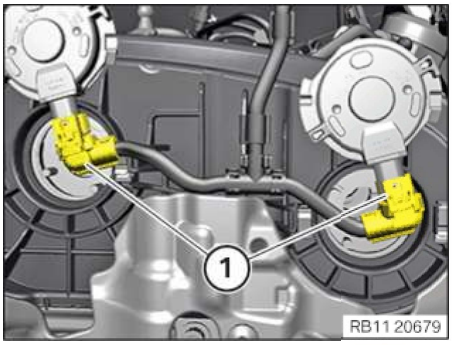


- Secure clamps (1).



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

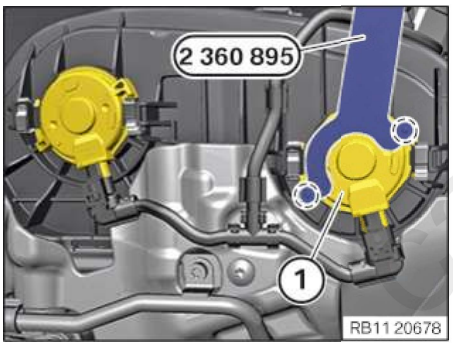
50 – Installing both actuators



NOTICE

The figure shows the rear side of the engine.

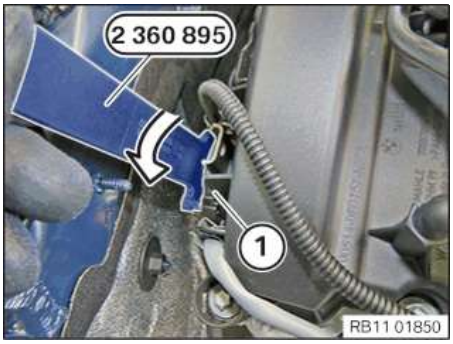
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



NOTICE

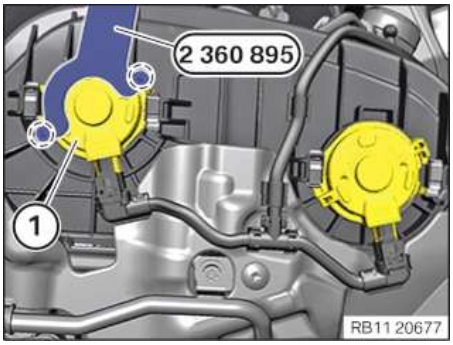
The figure shows the rear side of the engine.

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



- 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.

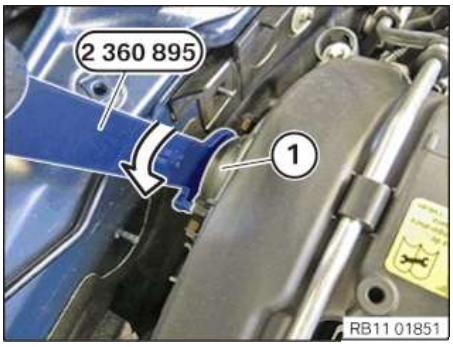
carjiagn.com



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.

51 – 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

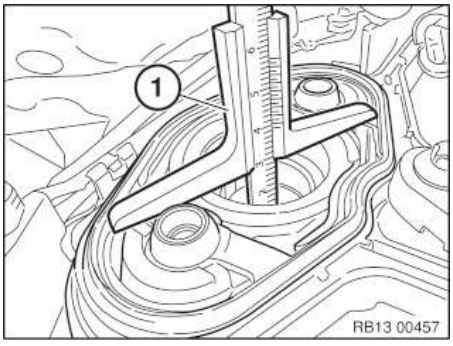
In vehicles with active anti-roll bar (ARS) the fan cowl must be removed in order to spin the engine.

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.

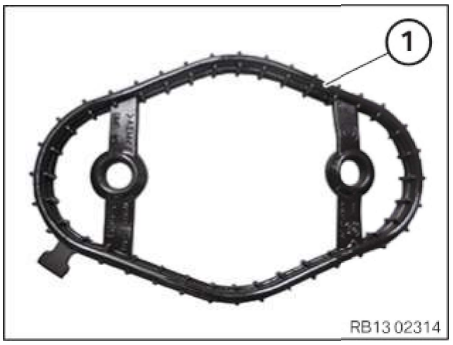
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- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- 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).



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

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RISK OF DAMAGE

Damage to the surface.

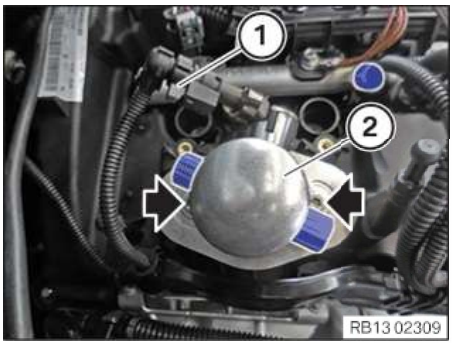
The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

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

- Clean sealing 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.

52 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

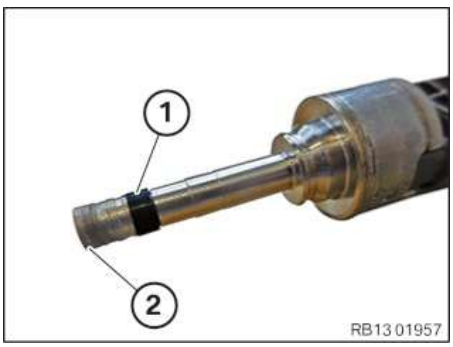
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- 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.

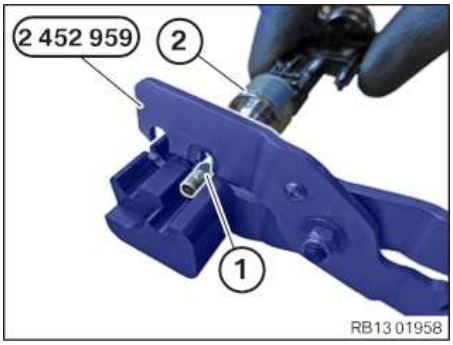
After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.



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

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

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- 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.

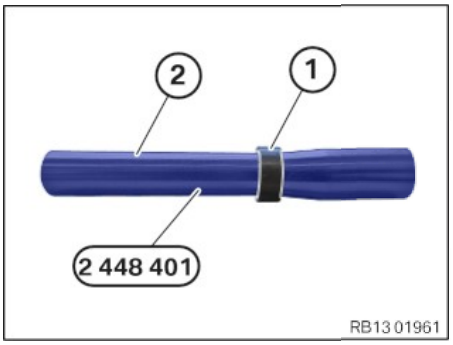


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

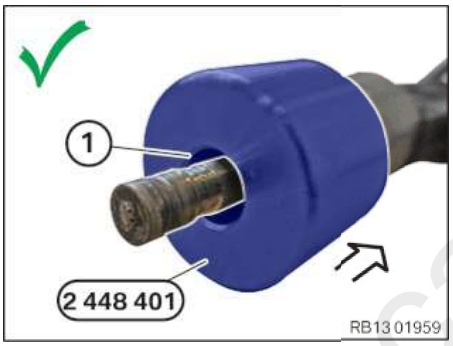
  (1) Installation cone

  (2) Sliding sleeve

  (3) Assembly sleeve

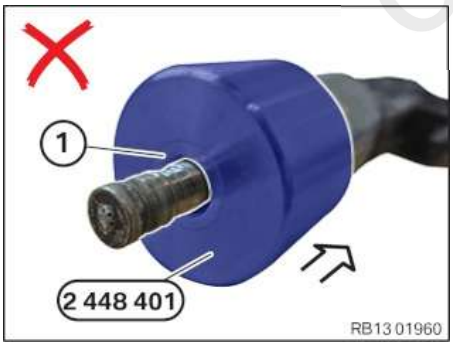


- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



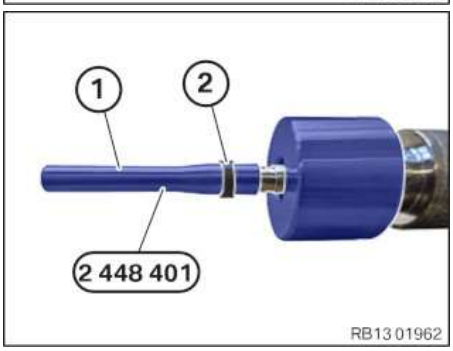
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

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



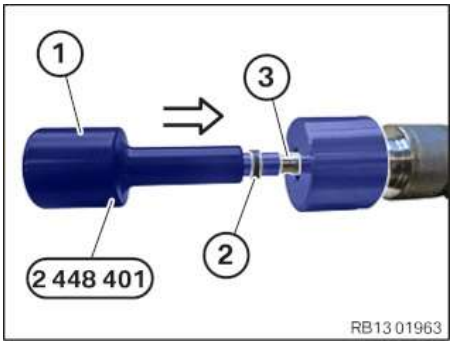
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

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

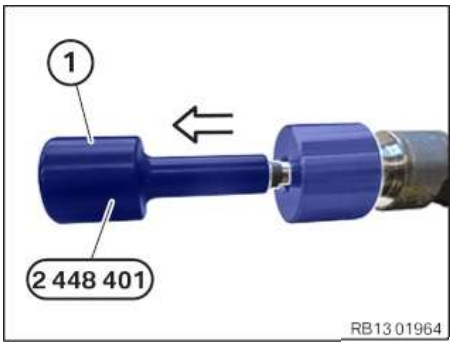


- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .

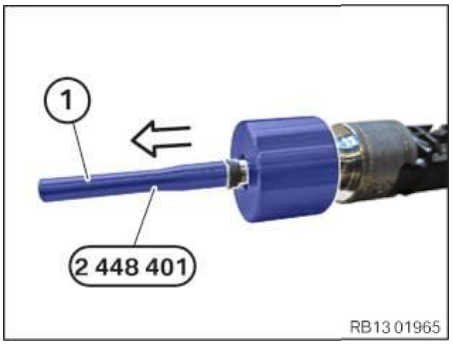
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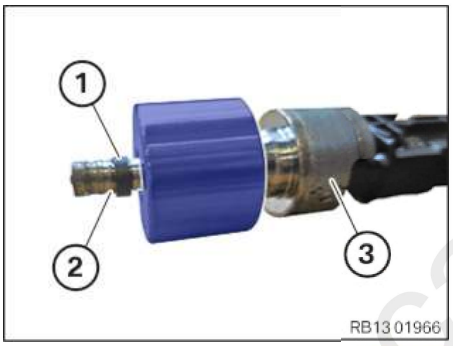
- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.



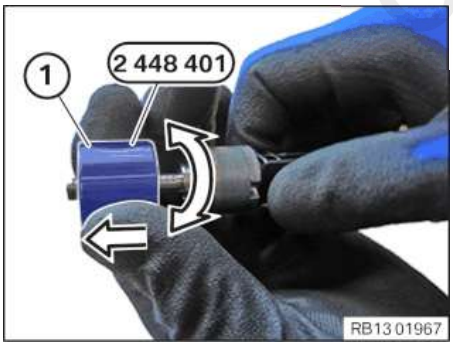
- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



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

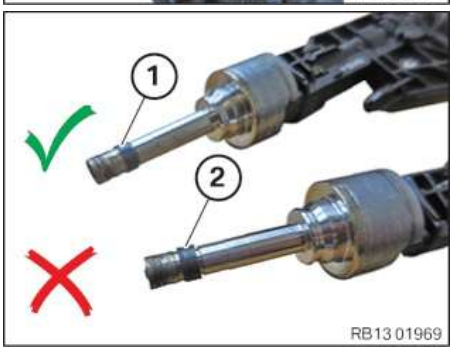


- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.



- 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).



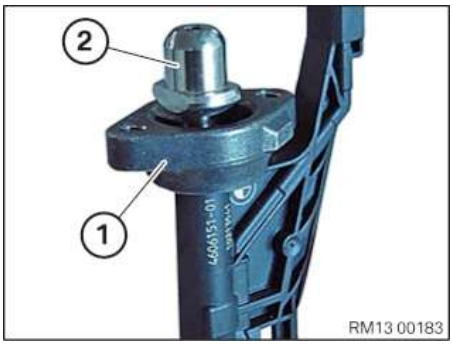
- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

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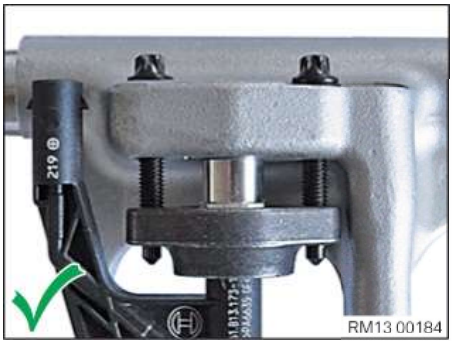
53 – Installing the high-pressure rail with injectors of the cylinders 4 to 6

TECHNICAL INFORMATION

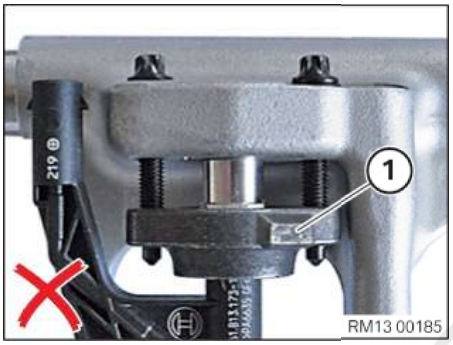
When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



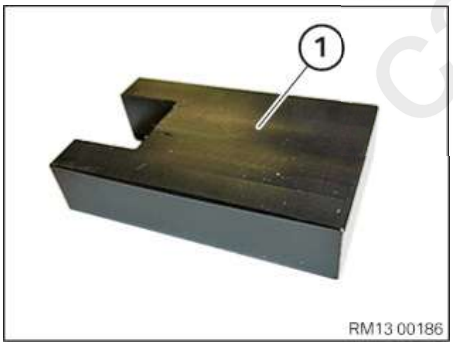
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder**(1) **has a cast lug**: Make sure that the holder is installed in the correct position.



- 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

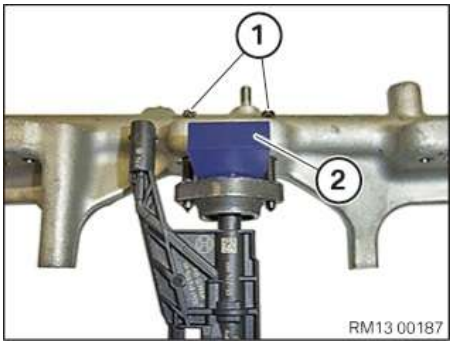
Damage to injectors.

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).

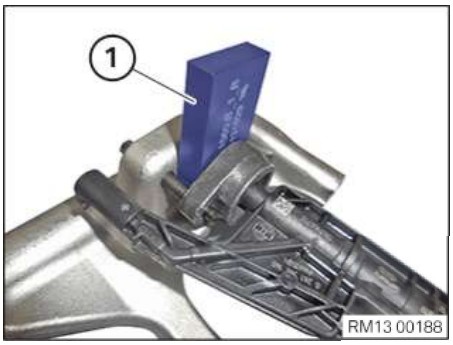
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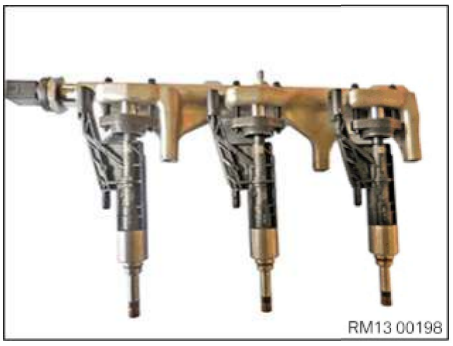
- Replace (M5x30) screws.

  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.



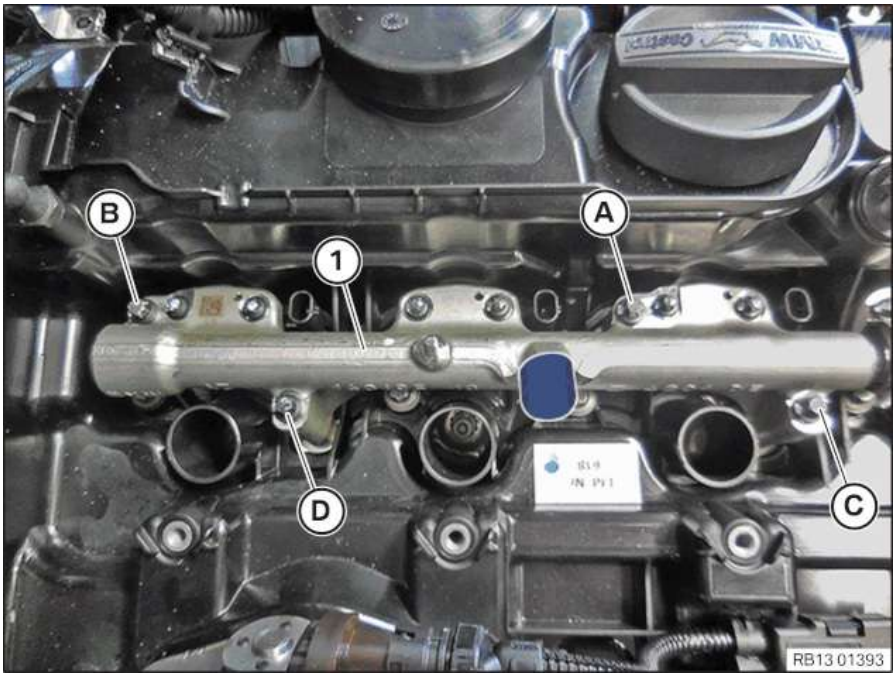
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.



- 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.

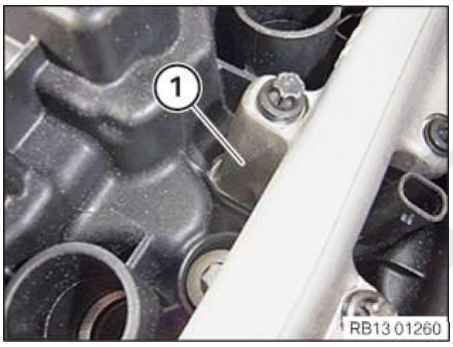
  The figure shows the rail resting flat against the cylinder head.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

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

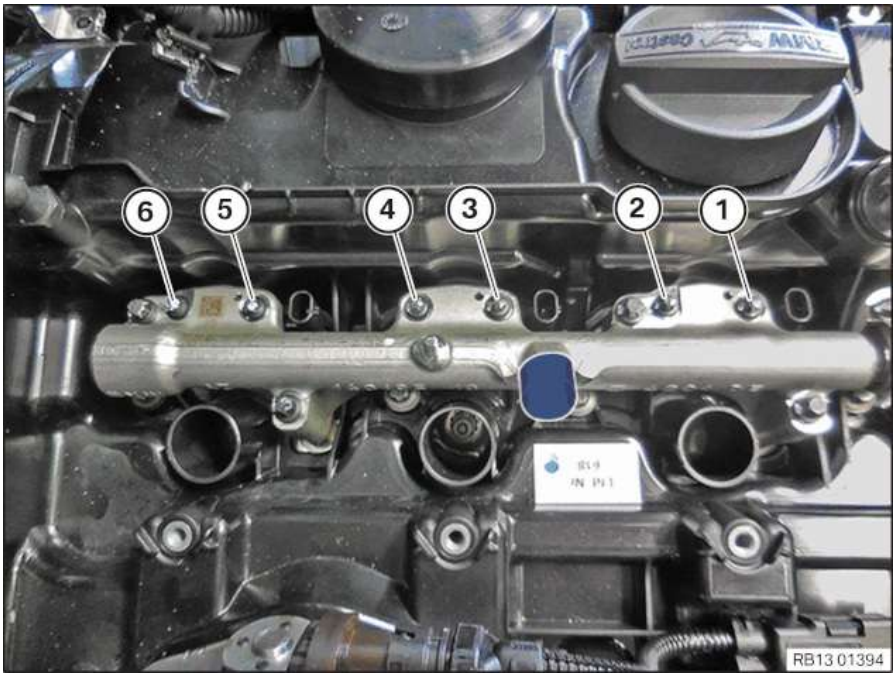
Non-observance of these requirements may result in leaks and damage.

- 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.

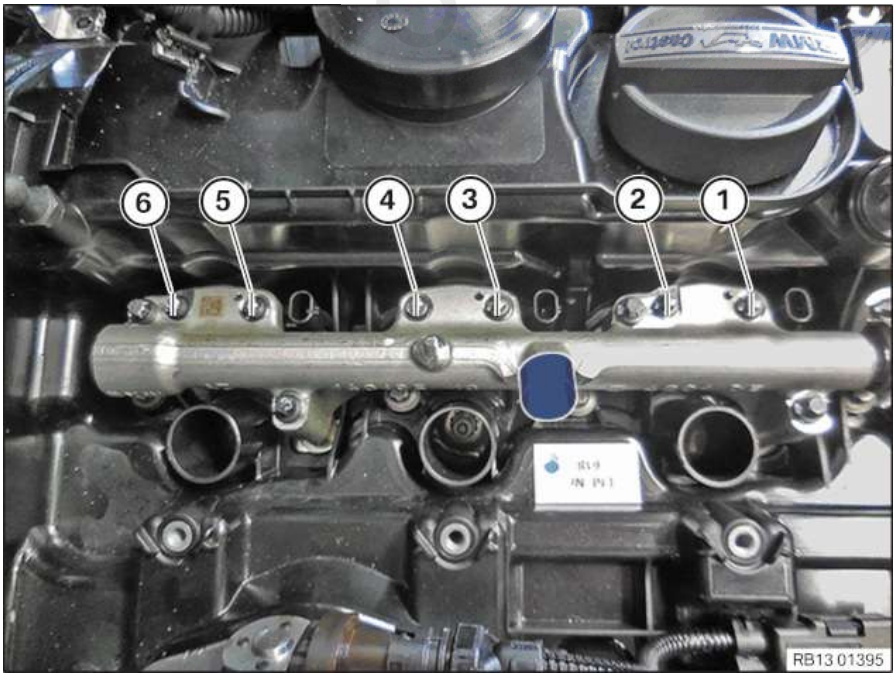
  Do not use a reversible ratchet or torque wrench.
- Tighten the bolts (M5x30) in pairs ((1) with (2), (3) with (4), (5) with (6)) in alternating order **90° hand-tight**.
- Set the torque wrench to 5 Nm.

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.



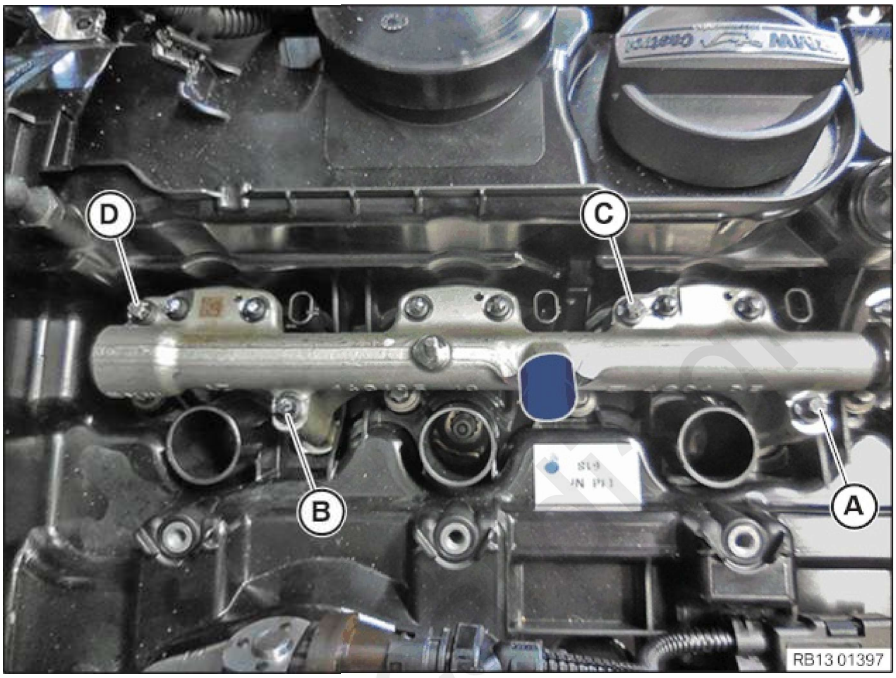
- Mark all bolts (1) to (6) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the screw (1) with an angle of rotation of 90° ±15°.
  - Tighten the screw (2) with an angle of rotation of 90° ±15°.
  - Tighten the screw (3) with an angle of rotation of 90°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

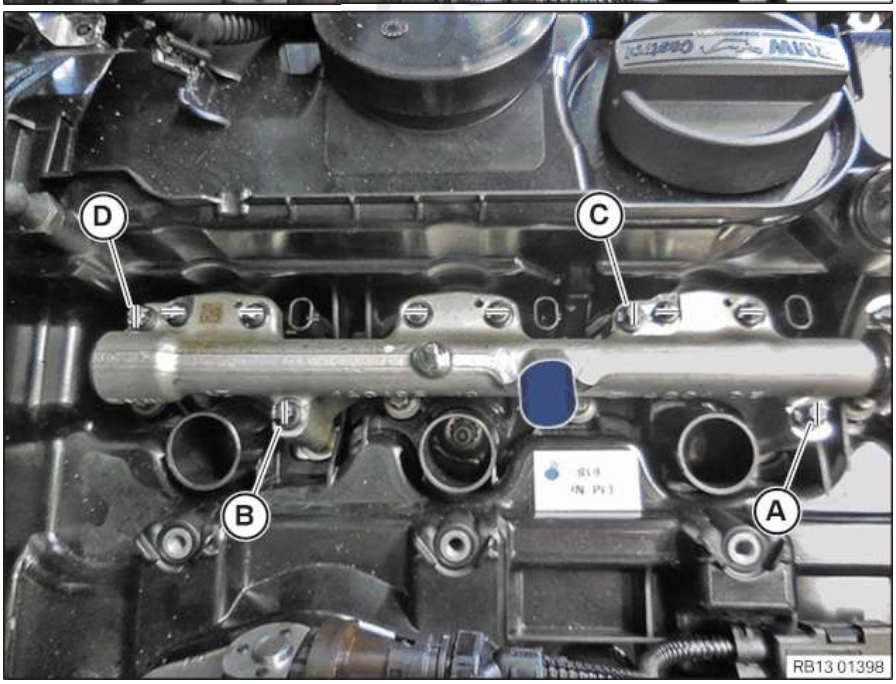
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

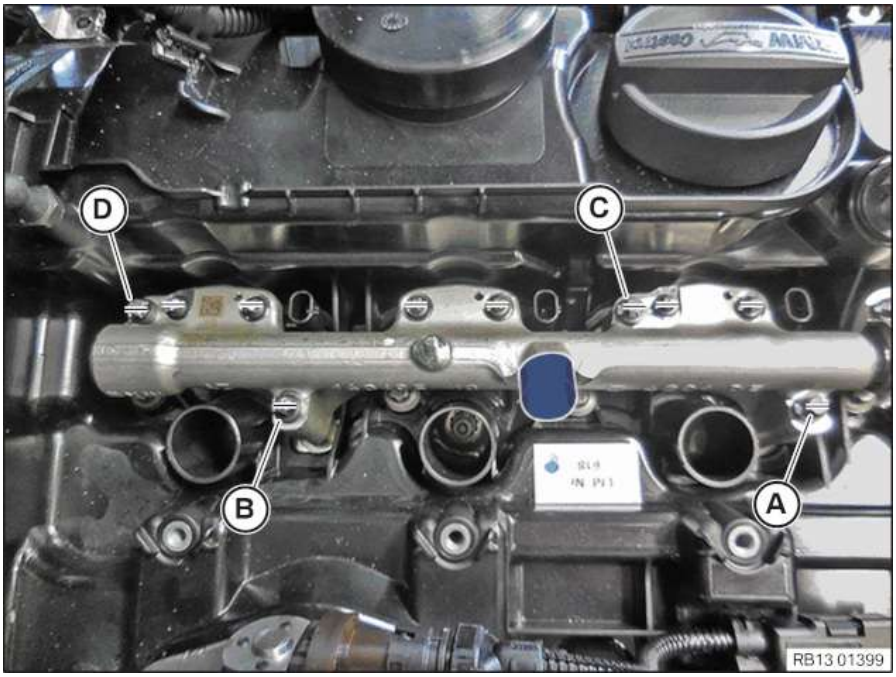
When assembling, it is essential to observe screwing sequences and tightening torques.

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.

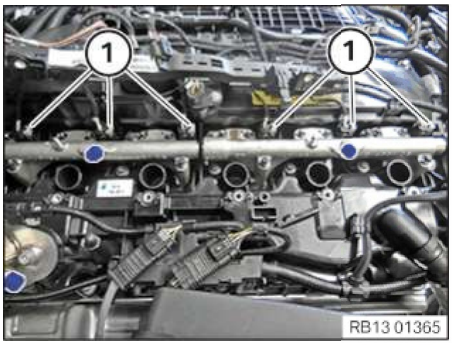


- Mark all bolts (A) to (D) with a vertical line (see figure).
- Tighten bolts (M6x70) (A) to (D) to a 90° angle of rotation.



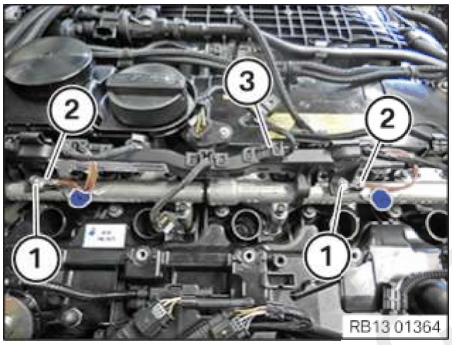
- Check if all bolts (A) to (D) have been tightened with a 90° angle of rotation.

  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).

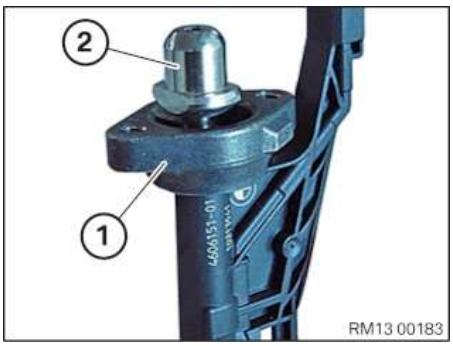
Ground cable to rail

M6			5 Nm

54 – Installing rail with injectors of cylinders 1 to 3

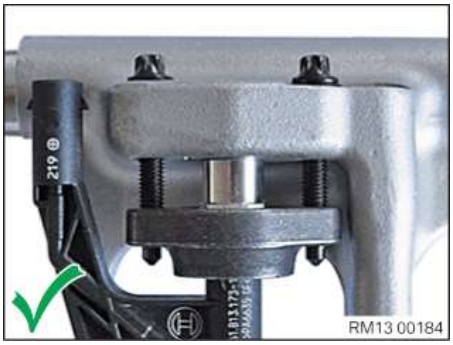
TECHNICAL INFORMATION

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



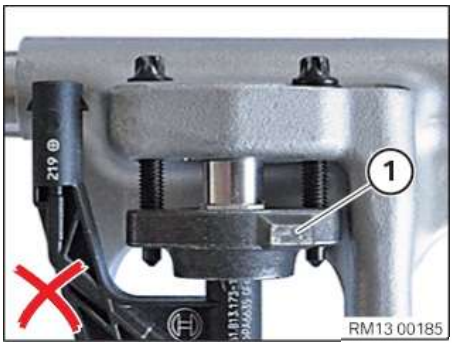
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If there is a cast lug on the holder** (1) **:** Make sure that the holder is installed in the correct position.

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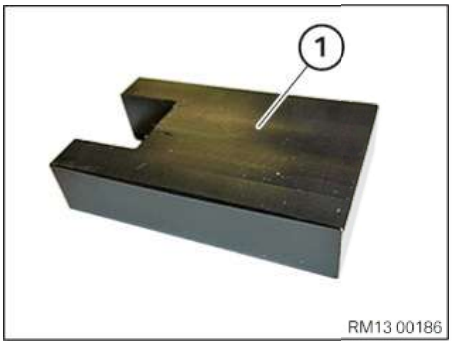
- Observe position of cast lug:

  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.



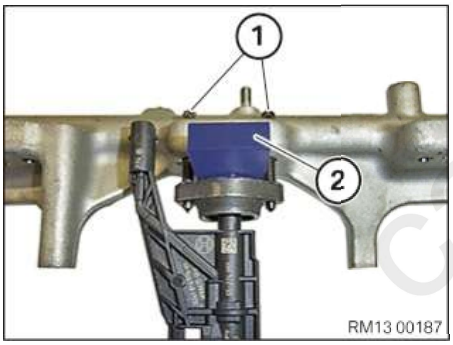
RISK OF DAMAGE

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.



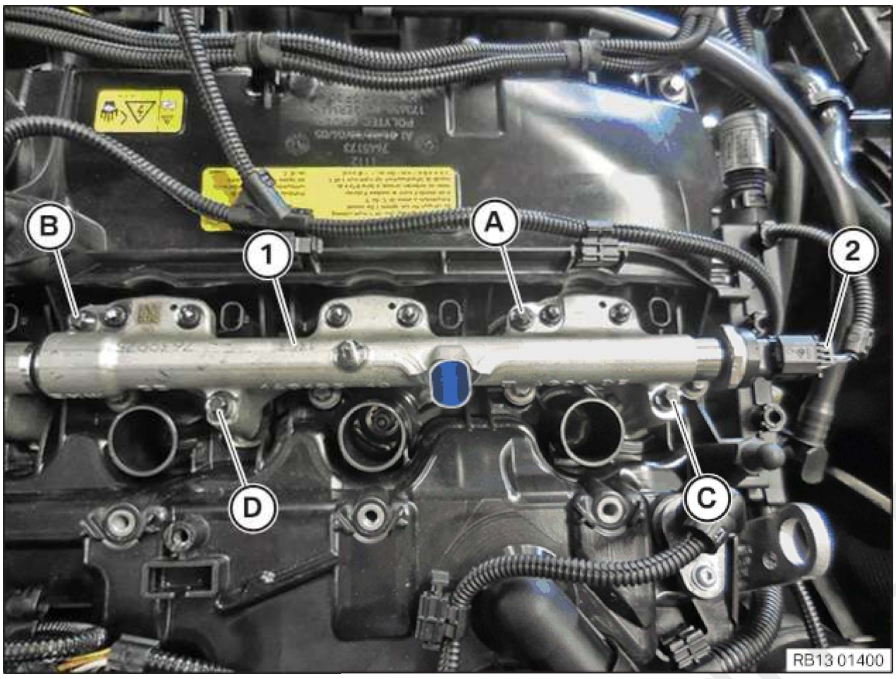
- Remove special tool 2 358 022(1) .
- Repeat this operation for all injectors.

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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.

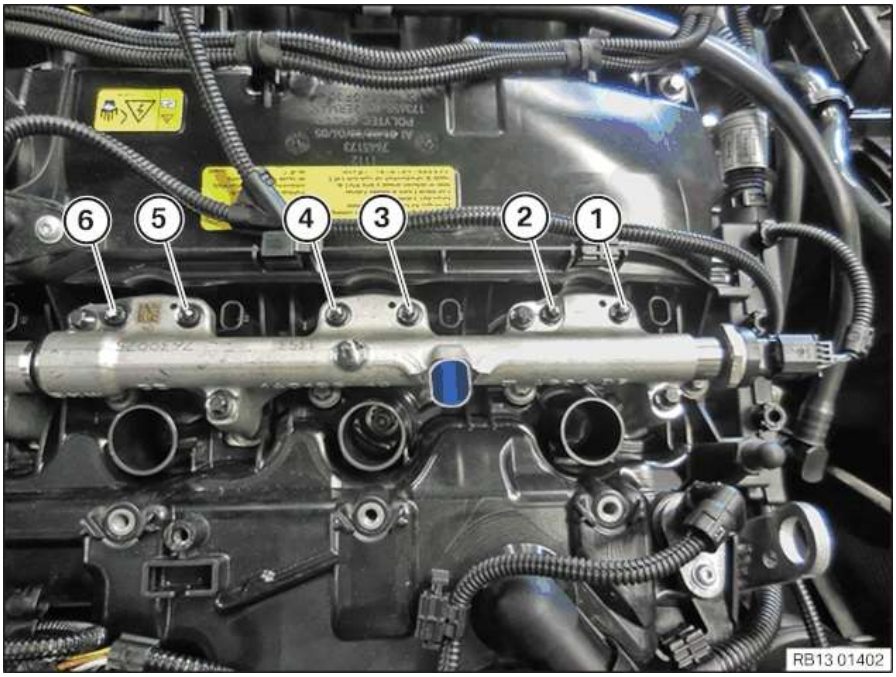
- Tighten screw (A) to 5 Nm.
- Tighten screw (D) to 5 Nm.
- Tighten screw (B) to 5 Nm.
- Tighten screw (C) to 5 Nm.
- Connect and lock the connector (2).

  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.

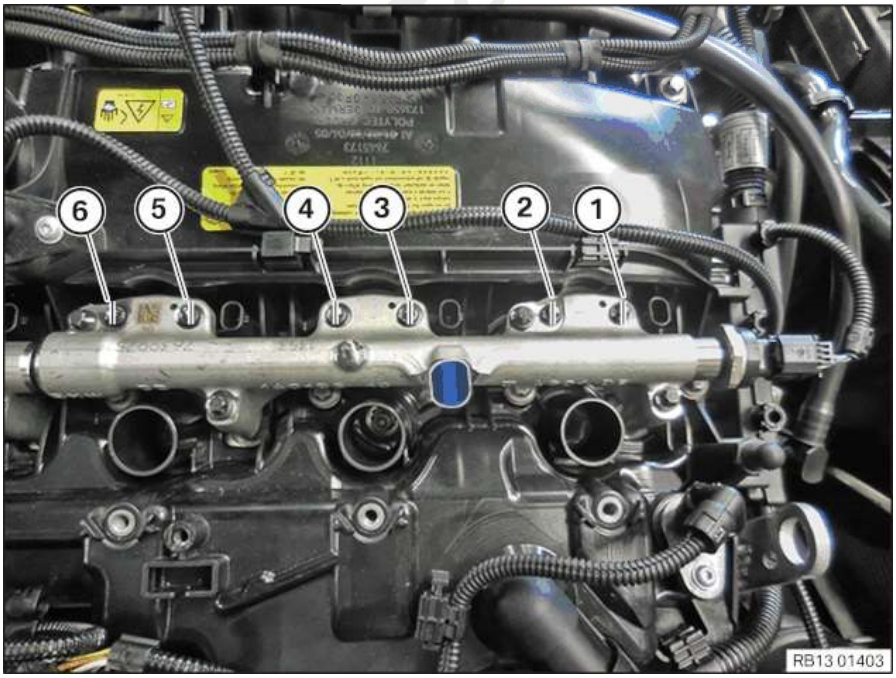
  Do not use a reversible ratchet or torque wrench.
- Hand-tighten screws (M5x30) in pairs ((1) with (2), (3) with (4), (5) with (6)) alternately by **90°**.
- Set torque wrench to 5 Nm.

TECHNICAL INFORMATION

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

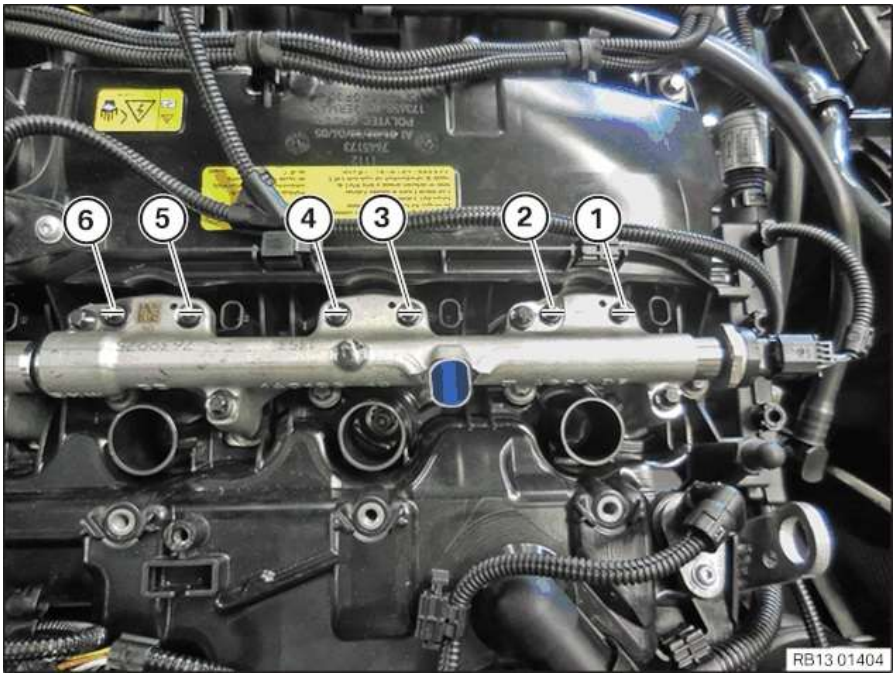
Non-observance of these requirements may result in leaks and damage.

- **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.



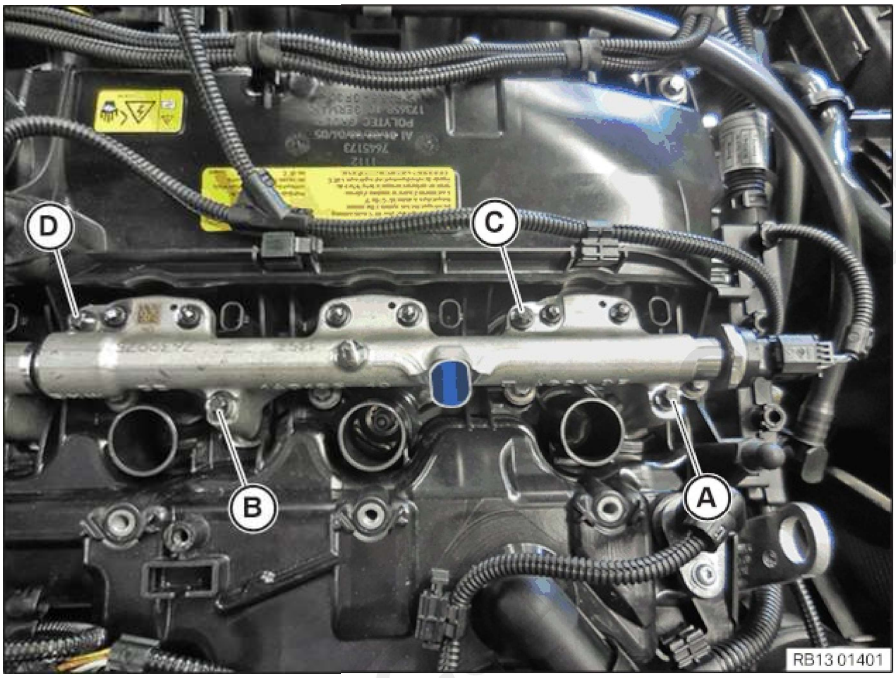
- Mark all bolts (1) to (6) with a line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the screw (1) with an angle of rotation of 90° ±15°.
  - Tighten the screw (2) with an angle of rotation of 90° ±15°.
  - Tighten the screw (3) with an angle of rotation of 90° ±15°.
  -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

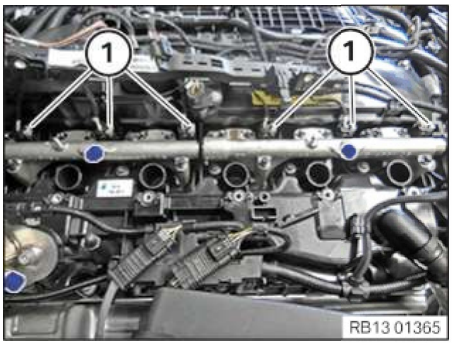


- Mark all the bolts (A) to (D) with a vertical line (see Figure).
- Tighten bolts (M6x70) (A) to (D) with an angle of rotation of 90°.



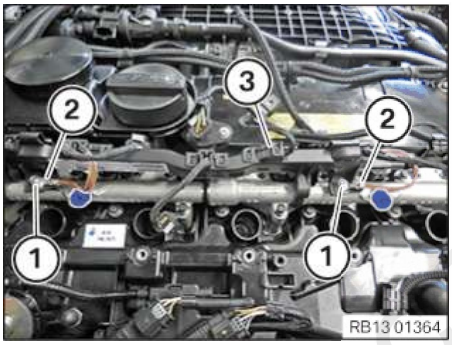
- Check whether all screws (A) to (D) have been tightened with an angle of rotation of 90°.

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



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

  All connectors (1) must engage audibly.

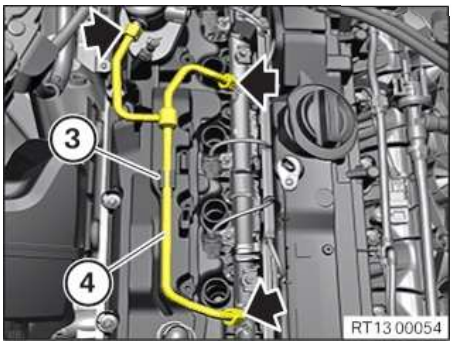


- Thread the cable channel (3) in and install.
- Thread in ground cable (2) and install.
- Tighten nuts (1).

Ground cable to rail

M6			5 Nm

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

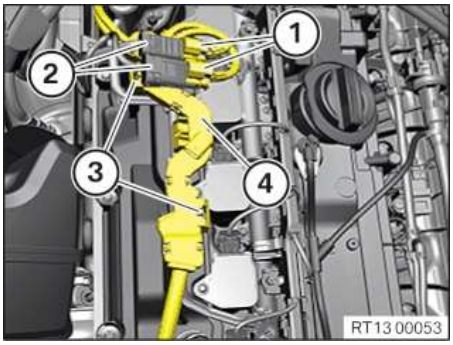


- Insert the high pressure line (4) into the holder (3) and install.
- Tighten union nuts (arrows) with the special tool .

High pressure line between rail and high pressure pump

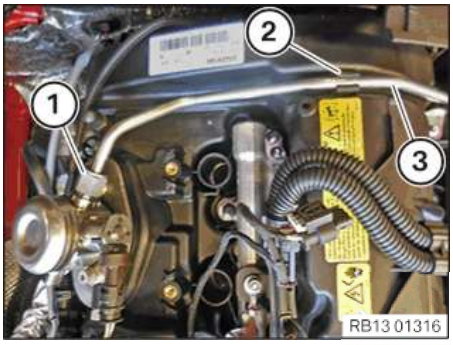
M14x1,5		Tightening torque	33 Nm

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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.

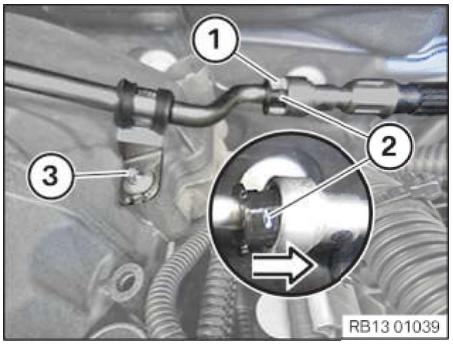
56 – Installing fuel delivery line



- 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

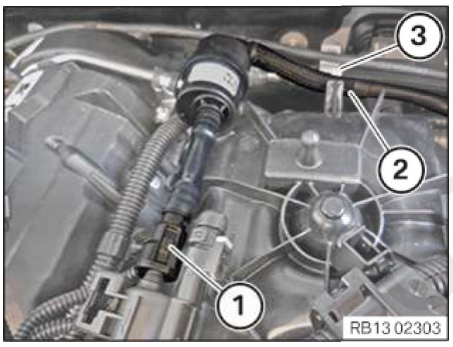
M14		Tightening torque	31 Nm



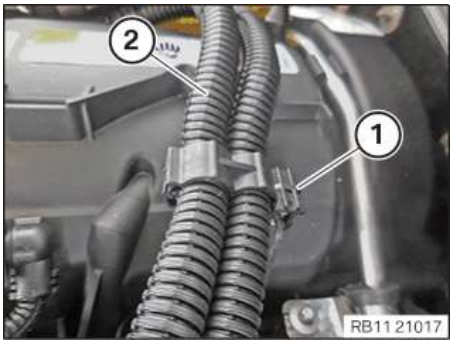
- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure clamps (1).
- Tighten down screw (3).

Fuel line to cylinder head cover

6x18		Tightening torque	6,5 Nm

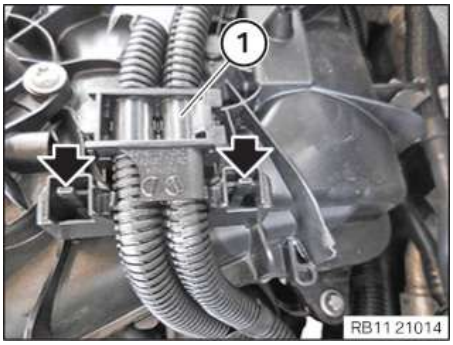


- Insert and install the tank ventilation line (2).
- Lock (1) must engage audibly.
- Secure the tank ventilation line (2) to the clamp (3).



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

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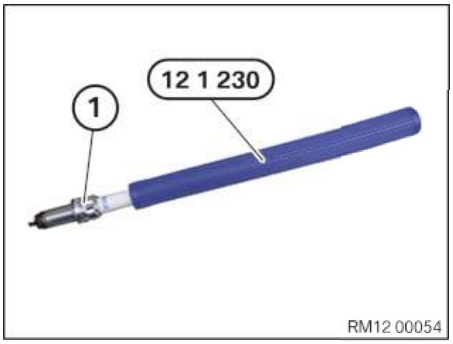


- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

57 – 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

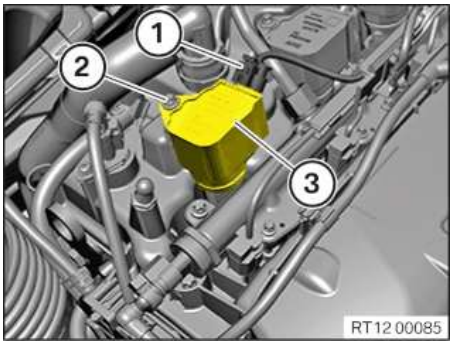
M12x1.25		Tightening torque	23 Nm

58 – Install all ignition coils

NOTICE

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

▸ **Install ignition coil.**



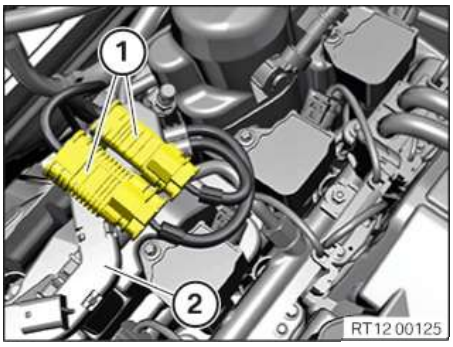
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

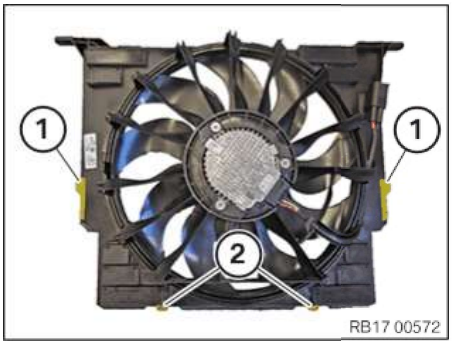
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

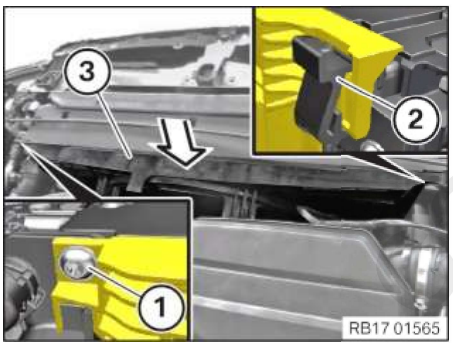


- Connect the connector (1) of the front oxygen sensor and the monitoring oxygen sensor on the cable shaft (2).

59 – Install fan cowl



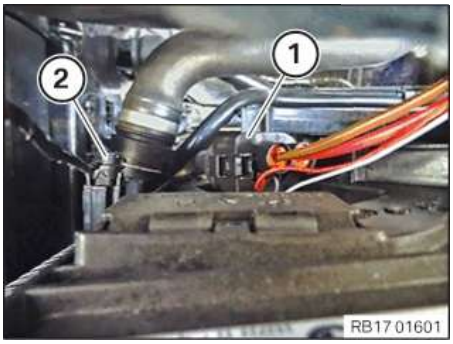
- Feed guides (1) into the radiator.
- Feed guides (2) into the charge air cooler.



- 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

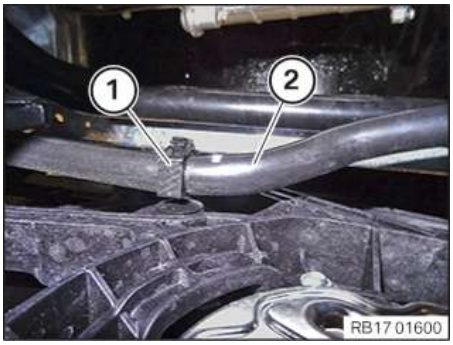


- Connect connectors (2) and lock.

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

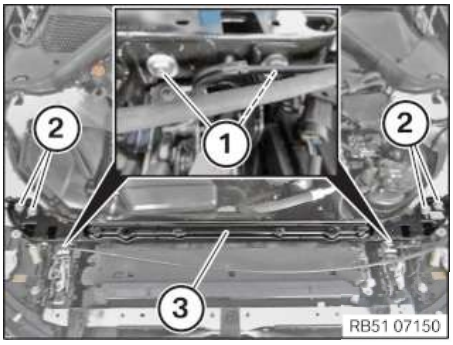
  The connector (1) must engage audibly.

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

60 – Install the rear top cross connection



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

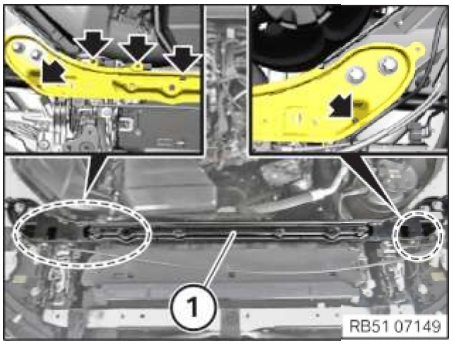
Top rear cross connection to bonnet catch support

Flat-head screw M6x20		Tightening torque	11,8 Nm

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

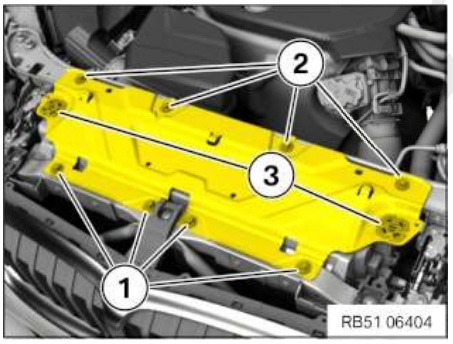
Rear top cross connection to wheel arch carrier support

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).

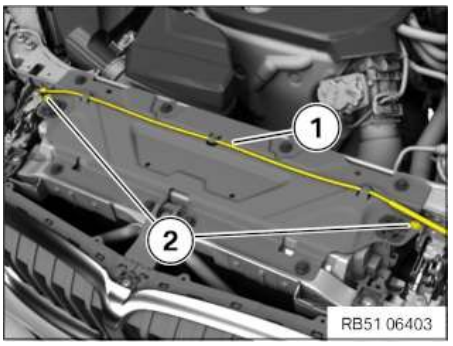
61 – Installing the top cross connection



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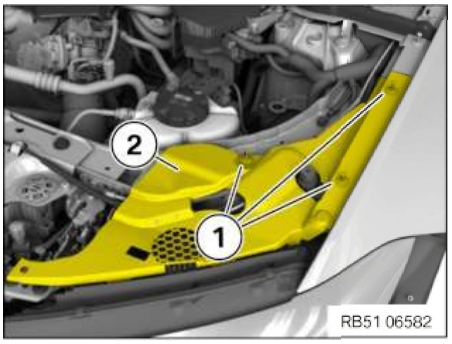
- Clip in the housing for the coupling of the Bowden cables (1).

62 – 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.

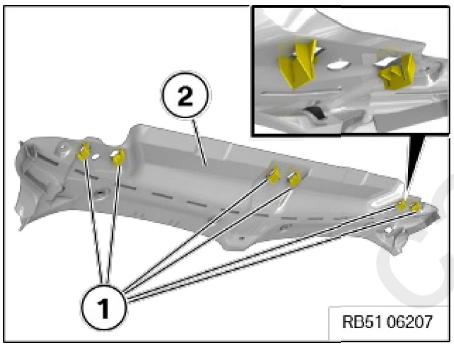
▶ Installing the cover in the engine compartment on top partially



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

63 – Installing cover for engine compartment centre

Check



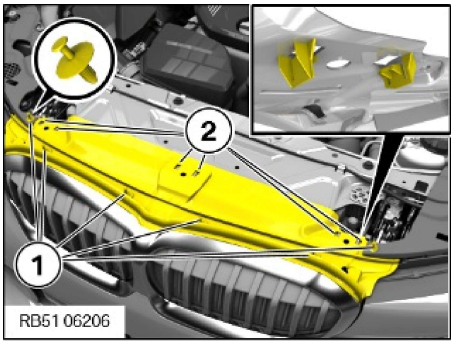
- Check latch mechanisms (1) of cover for engine compartment centre (2) for damage.

Result

» The latch mechanism (1) is damaged.

Measure

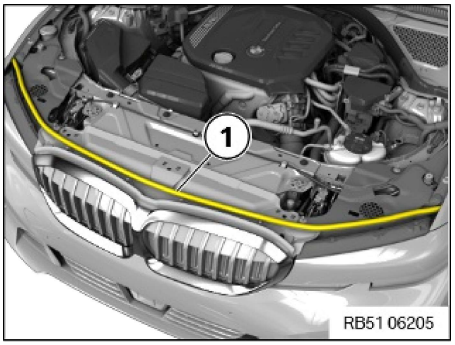
- Renew cover for engine compartment centre (2).



- 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).

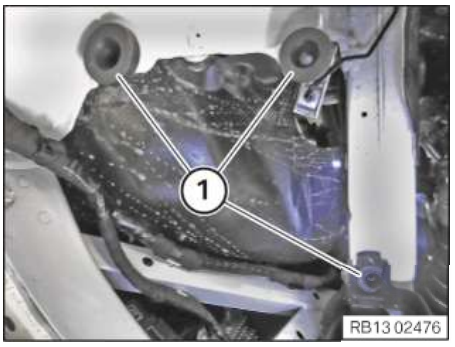
64 – Install the seal for the front bonnet

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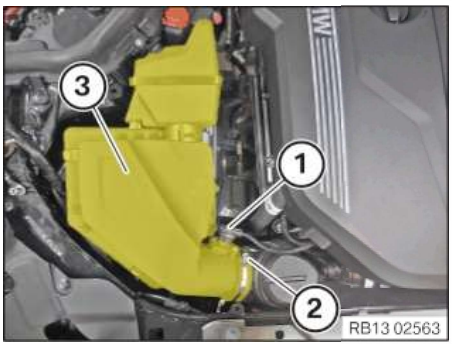


- Position the bonnet seal(1) and connect it on the mounting on the bumper and on the headlights.

65 – 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.

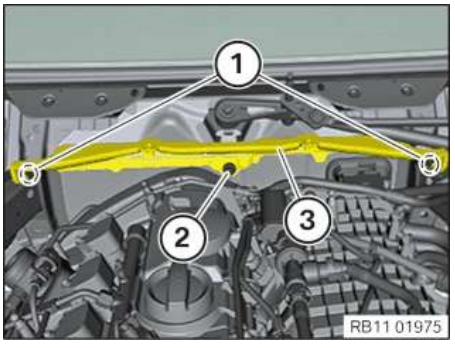
  The connector (1) must engage audibly.

66 – Disconnecting all battery earth leads



- See additional information.

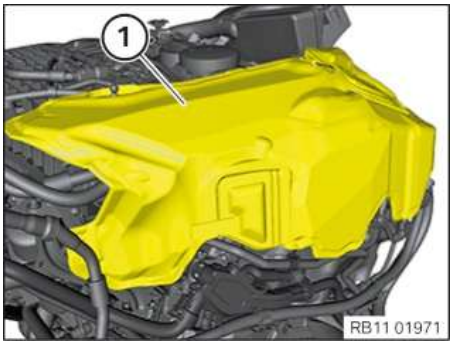
67 – Installing centre bulkhead lower section



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

68 – Installing acoustic cover at rear

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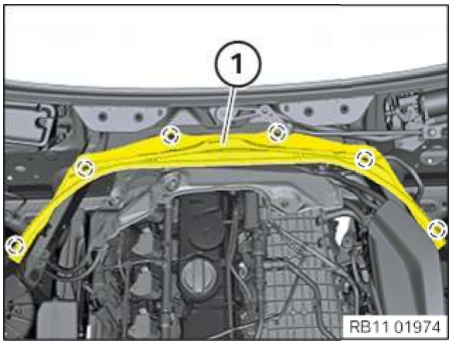


- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



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

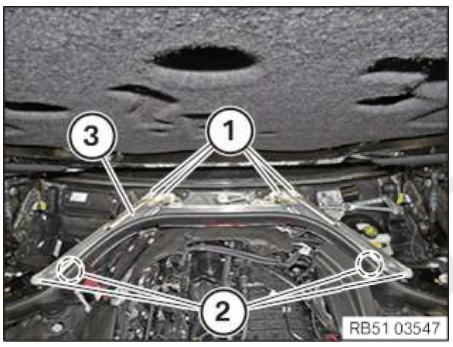
69 – Installing the centre bulkhead upper part



- 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 °

70 – Installing cowl panel cover

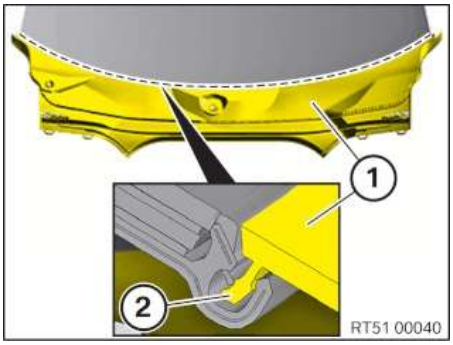
RISK OF DAMAGE

Damage caused by water ingress into the vehicle.

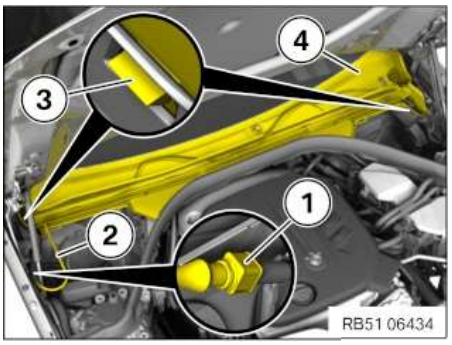
Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

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

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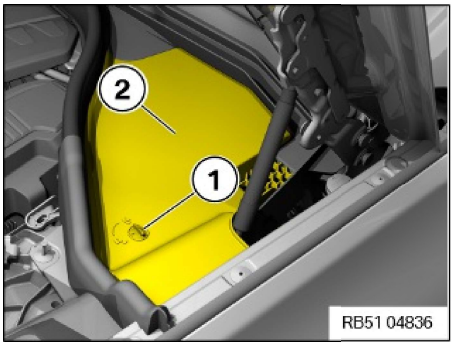


- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



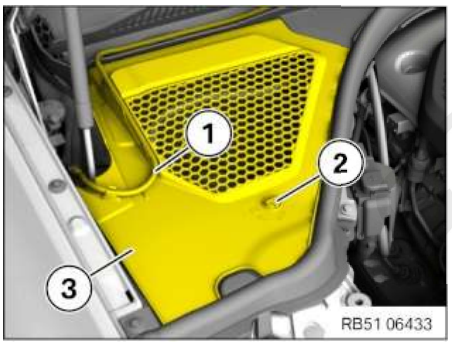
- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

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



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

72 – 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.

73 – Installing both wiper arms

NOTICE

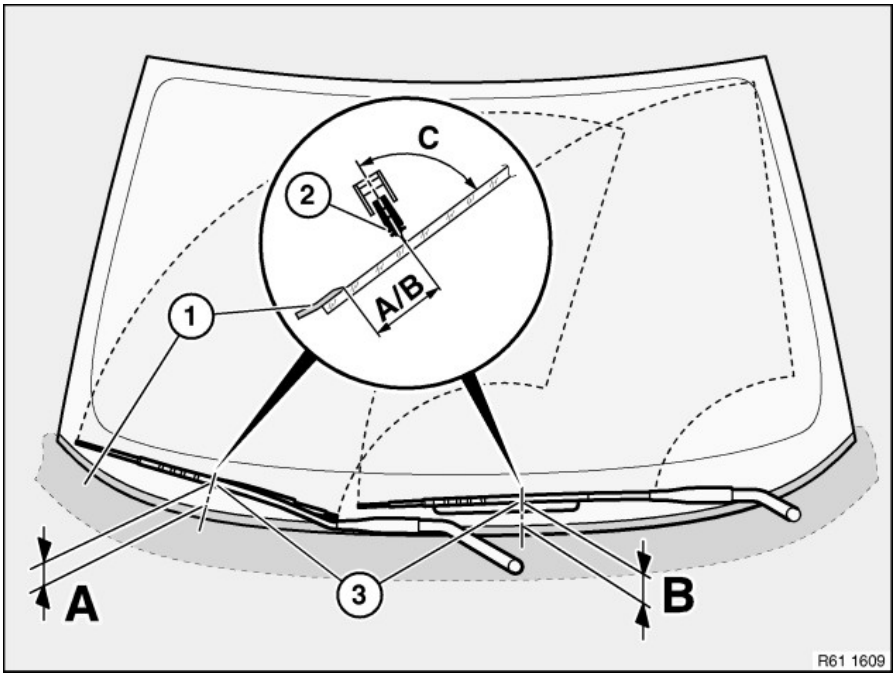
Description is for left component only. Procedure on the right side is identical.

▸ **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.

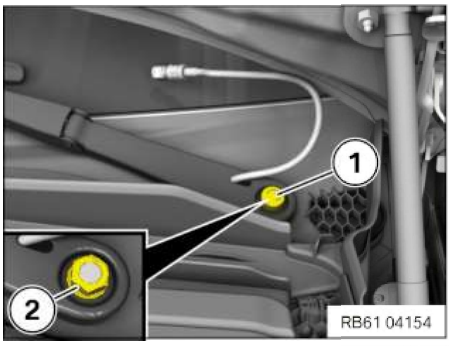
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- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

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

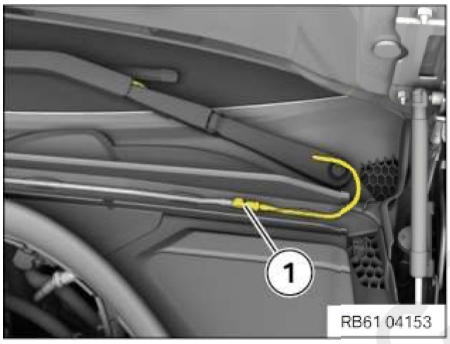


- Tighten nut (2).

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.

74 – Install acoustic cover

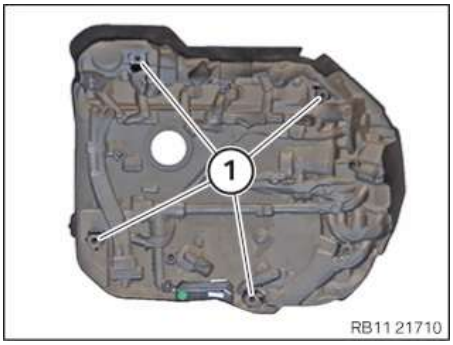
RISK OF DAMAGE

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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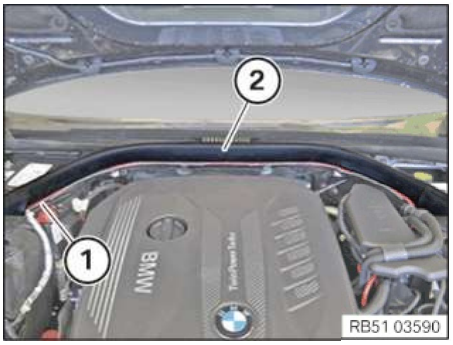


- Check the rubber mount (1) for correct fit in the acoustic cover.



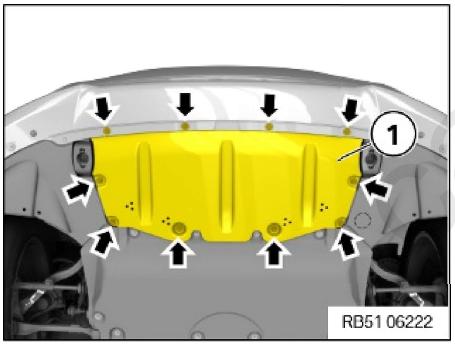
- Install acoustic cover (1) and fix in the rubber mounts (marks).

75 – 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.

76 – Installing the front underbody protection



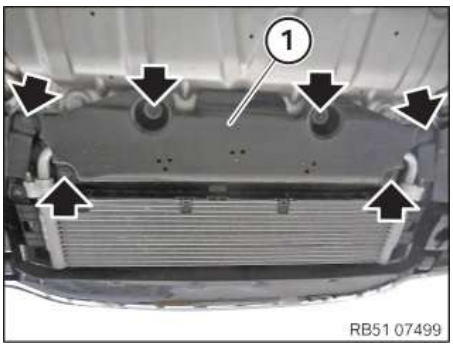
- **Version 1:**

  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:**

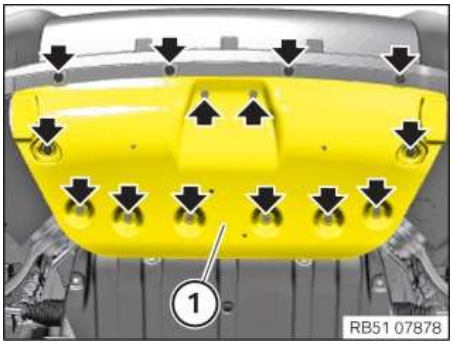
  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

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

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- **Version 3:**

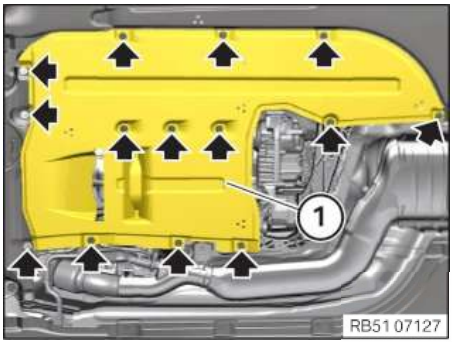
  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

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

77 – Installing underbody protection at rear



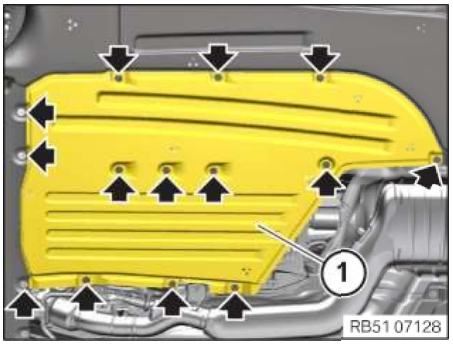
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

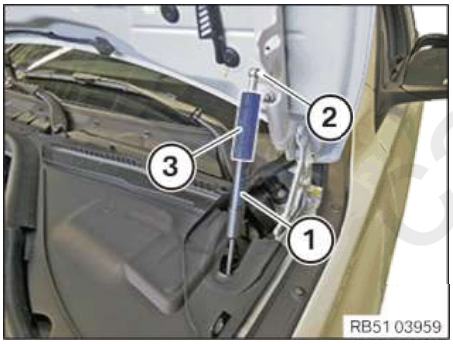
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

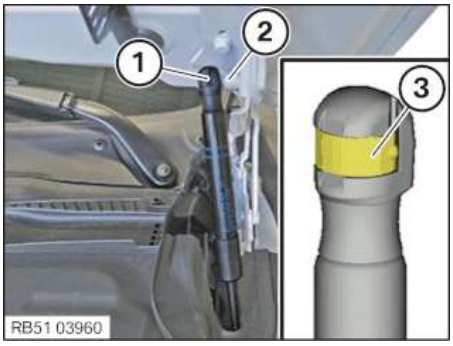
Underbody protection

Hexagon screw		Tightening torque	3 Nm

78 – 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 314147

M6		Tightening torque	8 Nm

Test gauge to basic carrier — Used in step 314147

M6		Tightening torque	8 Nm

VANOS central valve to camshaft — Used in step 4344

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 46

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Engine oil cooler to bumper support — Used in step 48

M6X25		Tightening torque	8 Nm

Cover, front bottom on side — Used in step 48

Hexagon screw for thermoplastic		Tightening torque	3 Nm

Cylinder head cover to cylinder head — Used in step 49

M6X30		Jointing torque	8 Nm

Cylinder head cover to cylinder head — Used in step 49

M6X30		Tightening torque	11 Nm

Auxiliary coolant pump holder to cylinder head — Used in step 49

M6		Tightening torque	7 Nm

Standard screw connection M6 — Used in step 49

M6			8 Nm

Differential pressure sensor to holder — Used in step 49

TS6X18		Tightening torque	3,5 Nm

Holder, positive battery cable to cylinder head cover — Used in step 49

6X18		Tightening torque	6 Nm

High pressure pump to high pressure pump flange — Used in step 51

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

Ground cable to rail — Used in step 5354

M6			5 Nm

High pressure line between rail and high pressure pump — Used in step 55

M14x1,5		Tightening torque	33 Nm

Fuel delivery line to high pressure pump — Used in step 56

M14		Tightening torque	31 Nm

Fuel line to cylinder head cover — Used in step 56

6x18		Tightening torque	6,5 Nm

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Spark plugs			Used in step 57
M12x1.25		Tightening torque	23 Nm

Ignition coil			Used in step 58
Screw		Tightening torque	8 Nm

Fan cowl with electric fan on radiator			Used in step 59
TS6x20		Tightening torque	6,5 Nm

Top rear cross connection to bonnet catch support			Used in step 60
Flat-head screw M6x20		Tightening torque	11,8 Nm

Rear top cross connection to wheel arch carrier support			Used in step 60
M10x20 screw	Renew screw.	Jointing torque	56 Nm
		Angle of rotation	90 °

Cross connection, top			Used in step 61
M8x20		Tightening torque	28 Nm

Cross connection, top			Used in step 61
M6x20		Tightening torque	11,8 Nm

Clean air pipe to upper section of intake filter housing			Used in step 65
Clamp		Tightening torque	3 Nm

Bulkhead upper part to bottom bulkhead			Used in step 69
		Tightening torque	3 Nm

Tension strut on bulkhead			Used in step 69
M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome			Used in step 69
Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

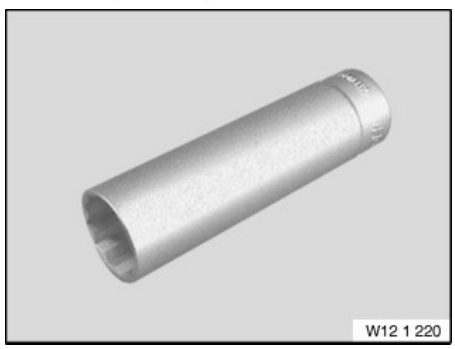
Windscreen wiper arm			Used in step 73
Combination hexagon nut		Tightening torque	35 Nm

Underbody protection front			Used in step 76
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Underbody protection			Used in step 77
Hexagon screw		Tightening torque	3 Nm

Overview of Special Tools

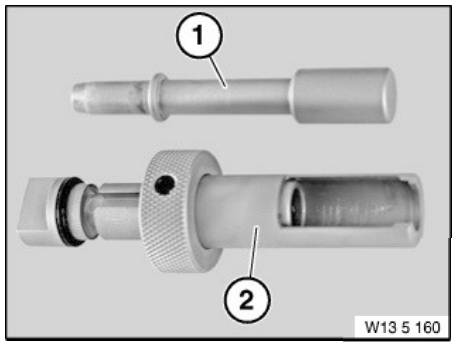
0 495 560 (12 1 220) Socket



Common		Used in step 2057
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)	

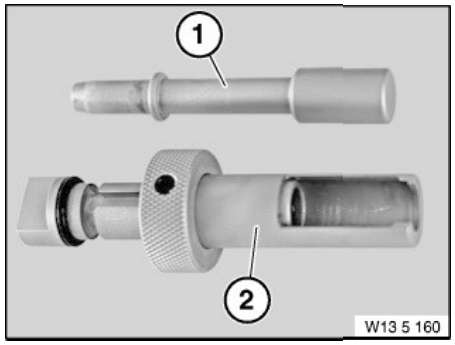
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0 496 567 (13 5 161) Fastener



Common	Used in step 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	

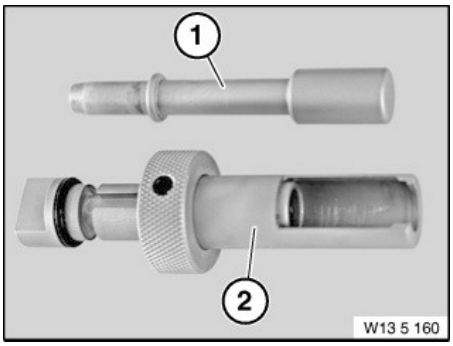
0 496 568 (13 5 162) Fastener



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



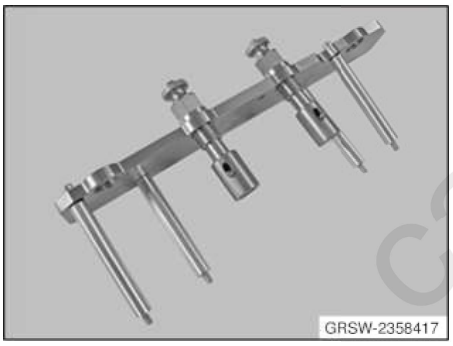
Common Used in step 22

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	

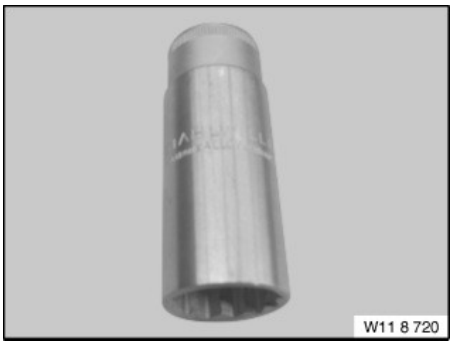
2 358 417 Device



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)

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)

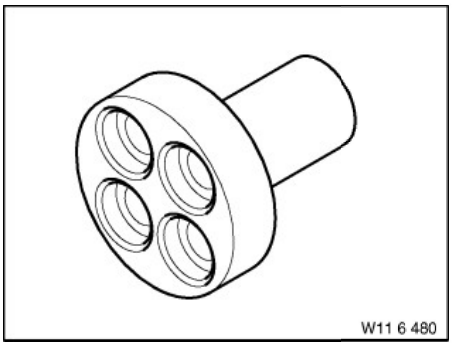
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2 360 895 Pin wrench



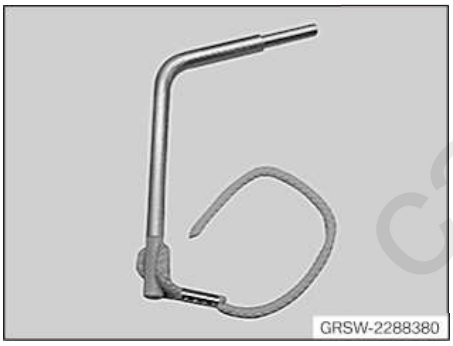
Common	Used in step 2650
Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 493 380 (11 6 480) Connector



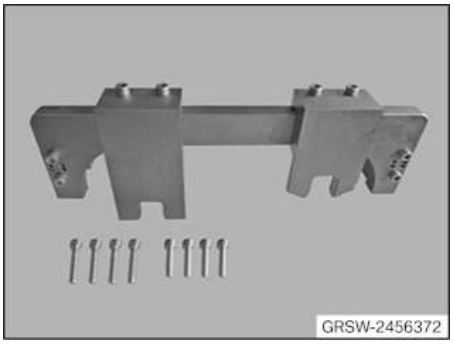
Common	Used in step 31454751
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

2 288 380 Locating stud



Common	Used in step 314547
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 3140414547
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 314047
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 33384344
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 33384344
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 4245
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 52
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 52
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)

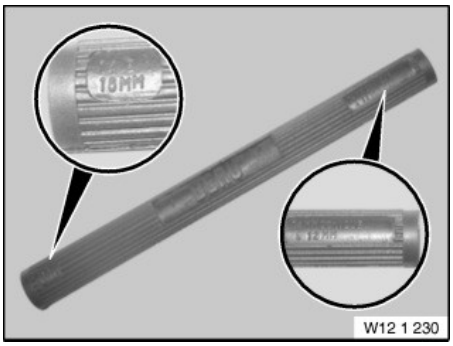
2 358 022 Gauge



Common	Used in step 5354
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 57
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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Overview Technical Data

Distance from window pane edge to wiper blade	Used in step 73
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	166
61 20 900 Disconnecting and connecting battery earth lead	166
61 20 900 Disconnecting and connecting battery earth lead	166
61 20 900 Disconnecting and connecting battery earth lead	166
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61 20 900 Disconnecting and connecting battery earth lead	166
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	166
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	166
61 20 900 Disconnecting and connecting battery earth lead	166
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	166
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	166
61 20 900 Disconnecting and connecting battery earth lead	166
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61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	166
61 20 900 Disconnecting and connecting battery earth lead	166
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61 20 900 Disconnecting and connecting battery earth lead	166
61 20 900 Disconnecting and connecting battery earth lead	166
61 20 900 Disconnecting and connecting battery earth lead	166
61 20 900 Disconnecting and connecting battery earth lead	166
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	51

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11 36 125 Removing and installing/replacing intake VANOS central valve

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

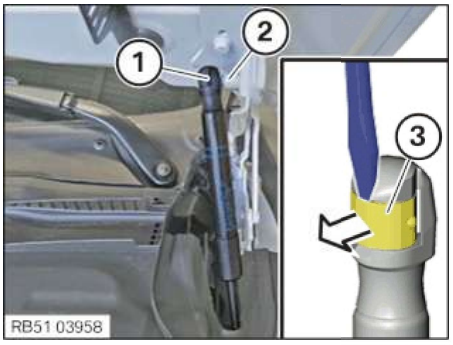
Engine compartment lid is open.

CAUTION

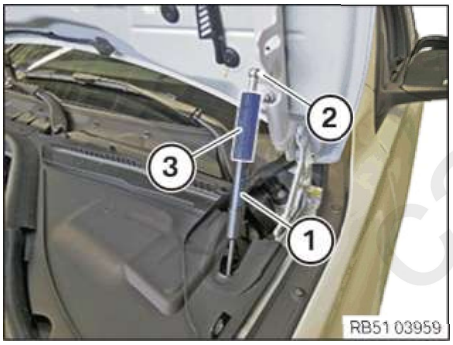
Shutting bonnet or tailgate.

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.

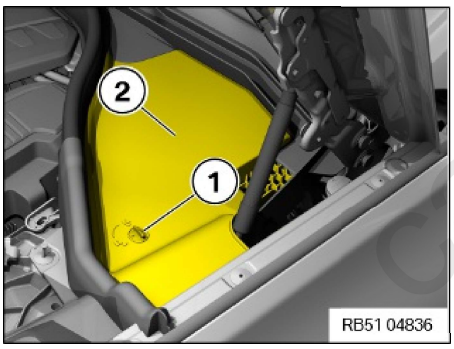
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- 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.



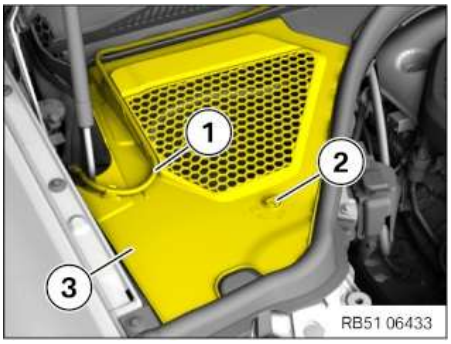
- Release the acoustic cover (1) towards the top from the rubber mounts (marks).

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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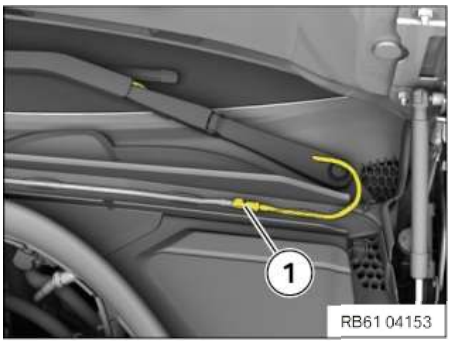
▸ **Remove the wiper arm**

RISK OF DAMAGE

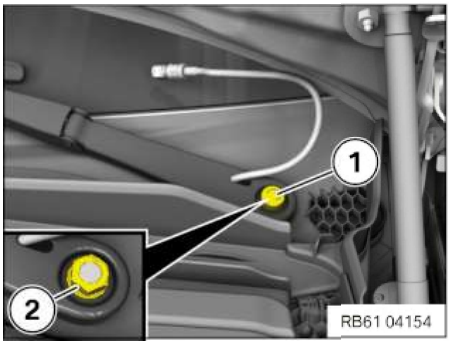
Damage to wiper console

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

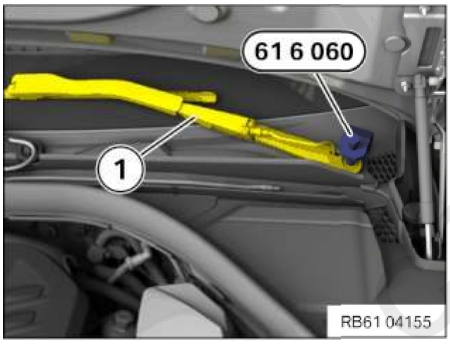
- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.



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

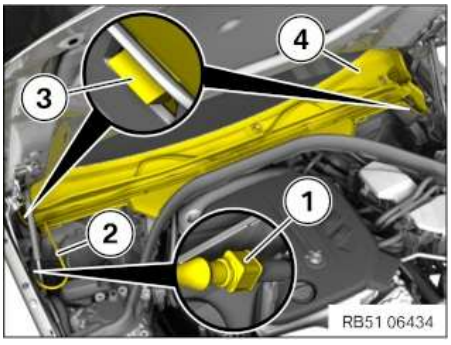


- Remove the protective cap (1).
- Loosen nut (2).



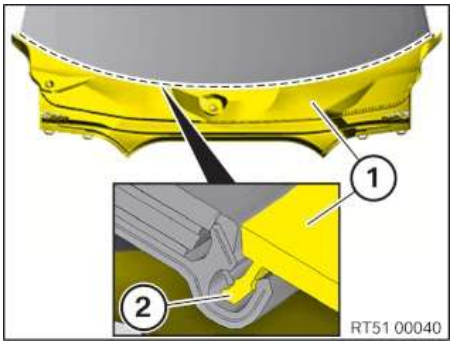
- Pull off the wiper arm (1) using special tool .

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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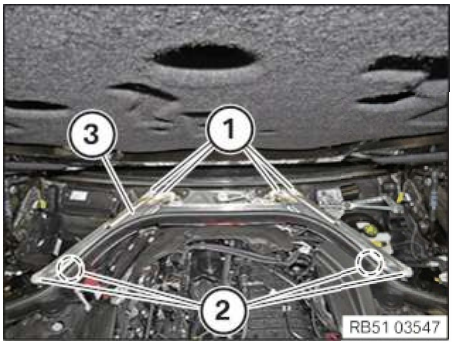


- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

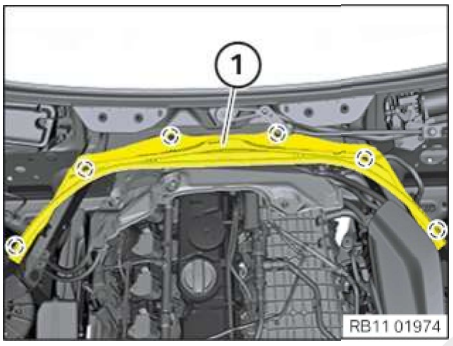
9 – Removing the centre bulkhead upper part

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.



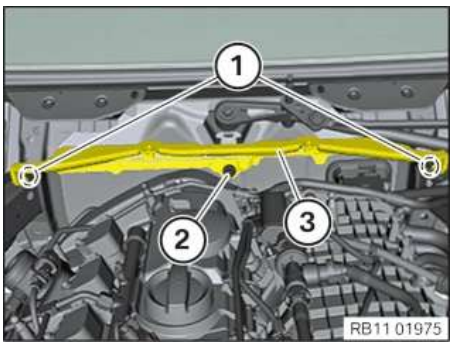
- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

10 – Removing acoustic cover at rear



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

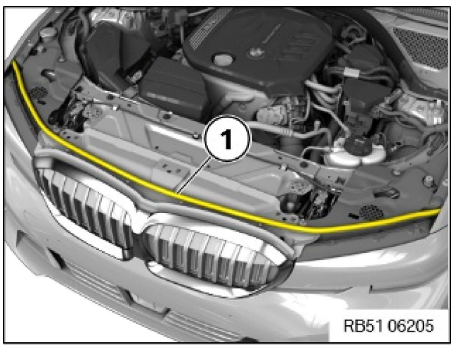
11 – Removing the centre bulkhead lower section



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

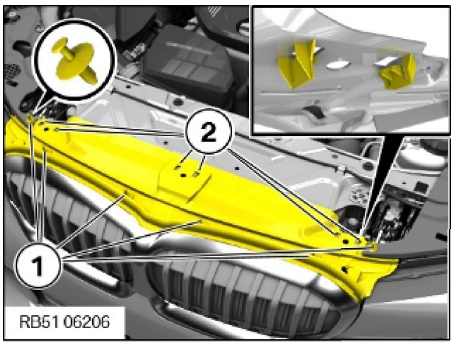
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12 – Remove the seal for the bonnet in front



- Pull off front bonnet seal (1) upwards.

13 – Removing the centre engine compartment cover



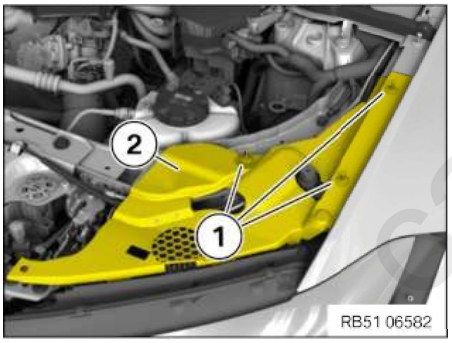
- Detach all expanding rivets (1).
- Release the cover of the centre engine compartment with the latch mechanisms (2) .
- Feed the cover for the centre engine compartment out to the rear.

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**



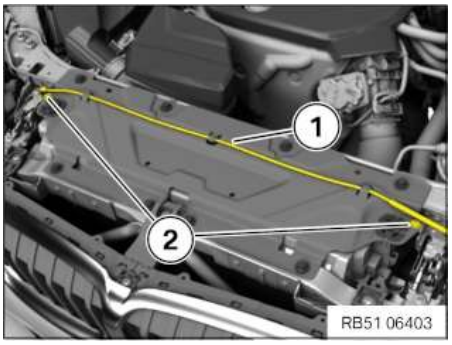
- Loosen the expanding rivet (1).
- Remove the cover in the engine compartment on top (2) partially.

15 – Removing the top cross connection

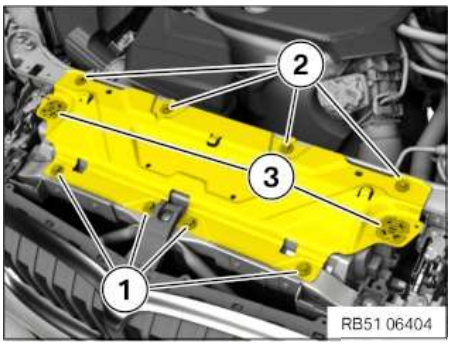


- Release the housing for the coupling of the Bowden cables (1) from the body.

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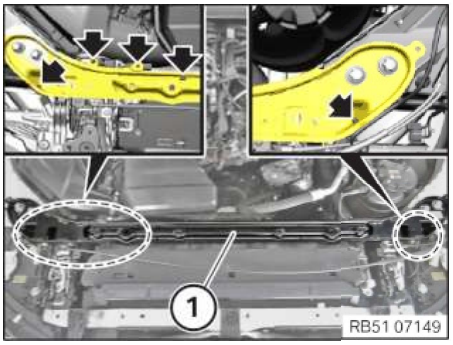


- Detach Bowden cable (1) at the top cross connection.
- Loosen screws (2).

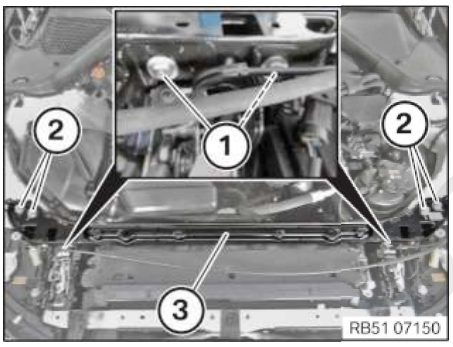


- Loosen screws (1) and (2).
- Remove the top cross connection with the holders(3) towards the top.

16 – Remove the rear top cross connection



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

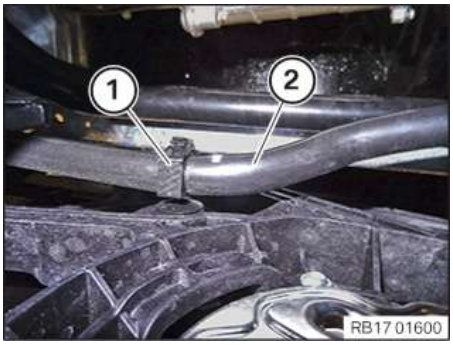


- Loosen screws (1).
- Loosen screws (2).
- Guide out and remove top rear cross connection (3).

17 – Remove fan cowl.

TECHNICAL INFORMATION

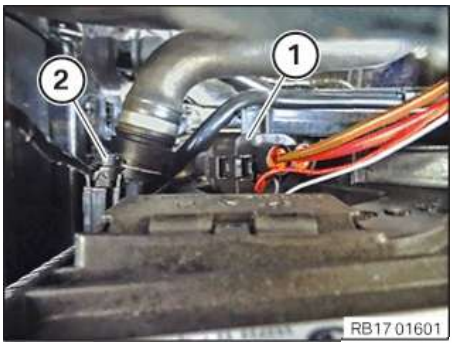
- When the engine is stopped after the end of the journey, it may be necessary to run the electric fan. In rare cases, operation of the electric fan can last up to 11 min. This protects the components. In this case, replacing the electric fan will not remedy the problem!



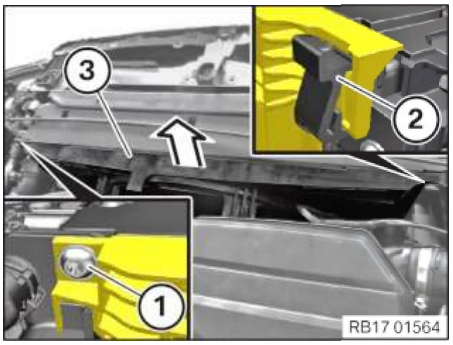
- **If installed:** Release transmission oil line (2).

  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.

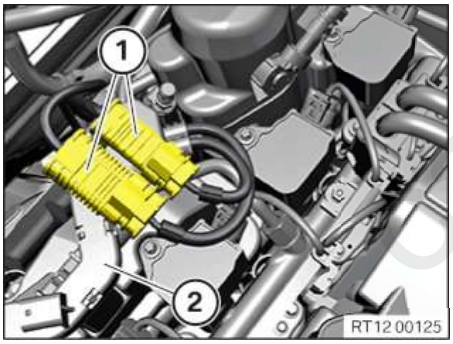
- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

RISK OF DAMAGE

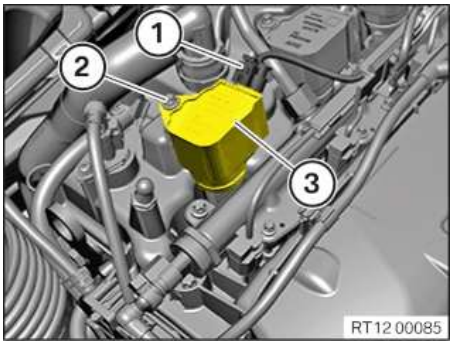
Electrostatic discharge.

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

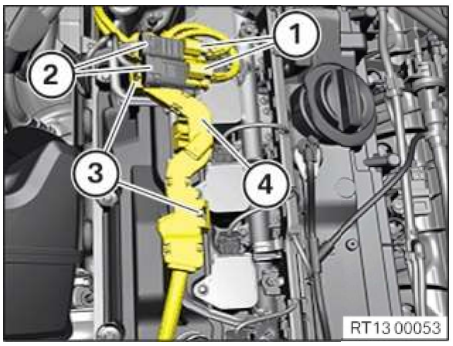
On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

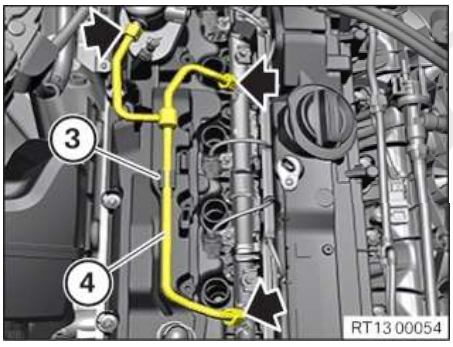
- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

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

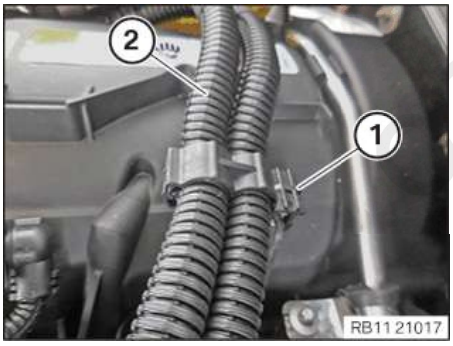
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

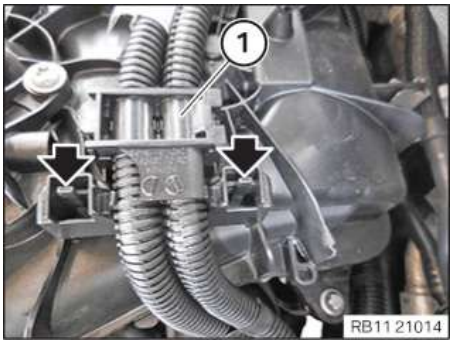
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

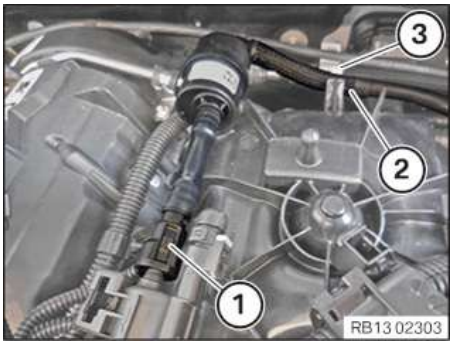
Reset special tool in early to avoid bending pressure lines.



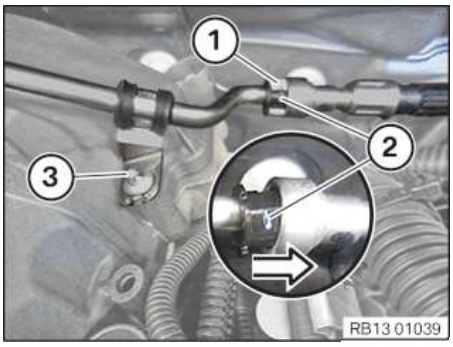
- Loosen clamp (1).
- Guide out wiring harness section (2) for the injectors and ignition coils and place it aside.



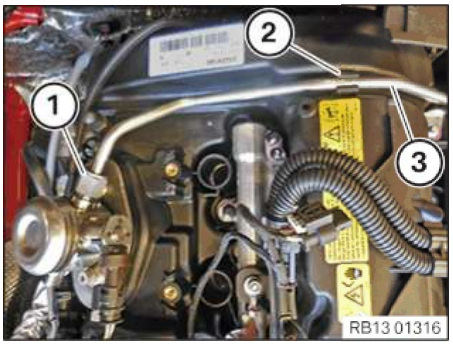
- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.



- 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

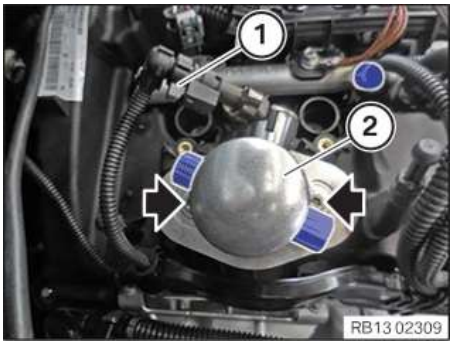
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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.

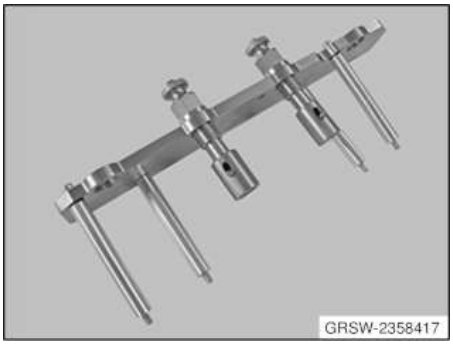
Excessive force may damage the injector and this means having to renew the injector.

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



- Prepare special tool .

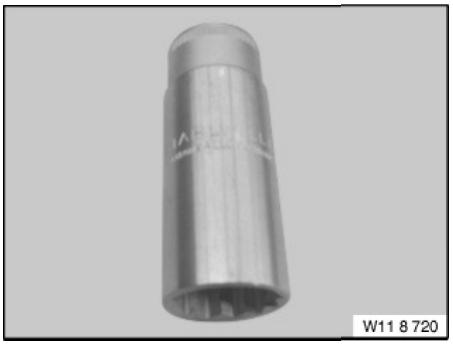
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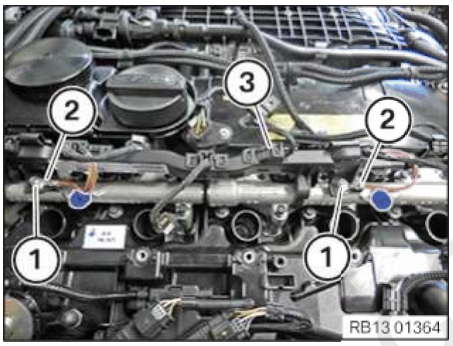
- Prepare special tool 2 358 417.



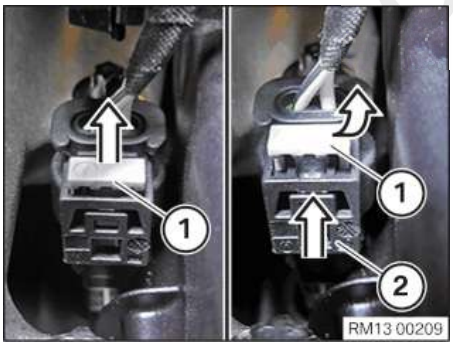
- Prepare special tool .



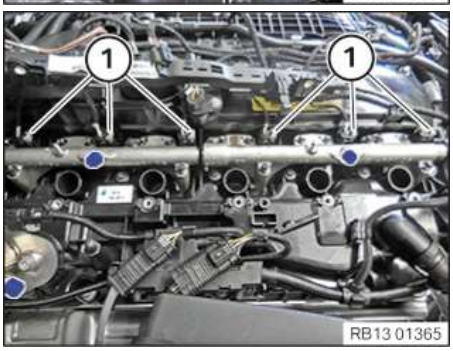
- Prepare special tool 0 496 106 (11 8 720).



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

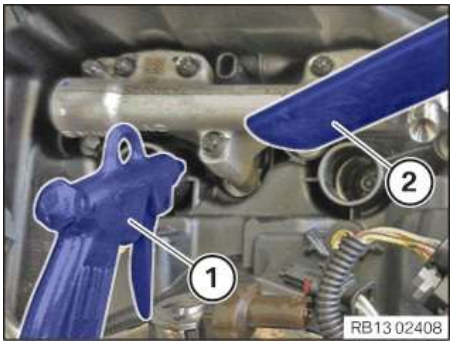


- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull out the connector (2) from the injectors.



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

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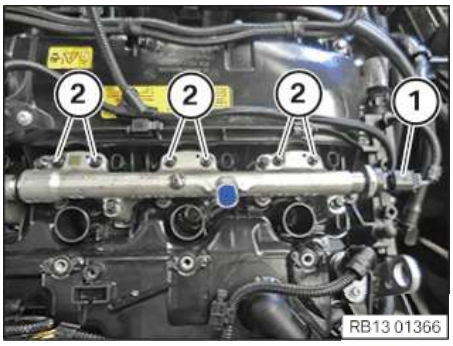


TECHNICAL INFORMATION

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

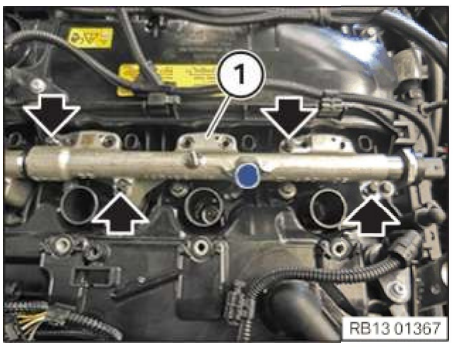
- Before releasing the high pressure lines: Blow out the injector shafts with an air gun(1) with less pressure.
- Simultaneously, draw off the dirt particles with an **explosion proof** vacuum cleaner (2).



- 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.

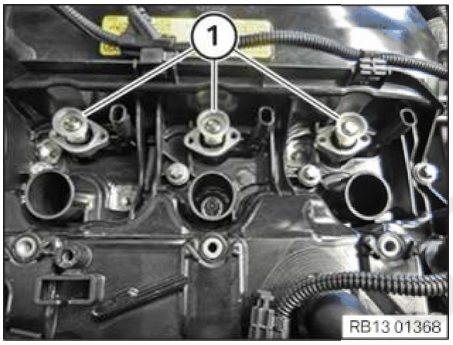


- Unscrew the screws (M6x30) (arrows).

  The screws may not be reused!
- Renew screws.

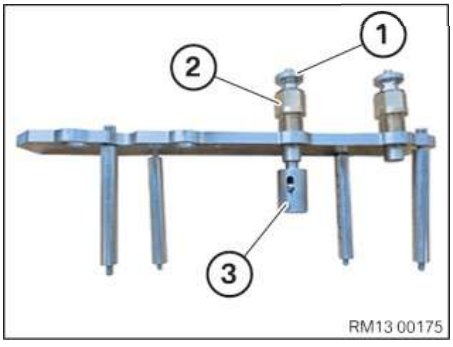
  Parts: Screws (M6x30)
- Remove rail (1) in upward direction.

  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.

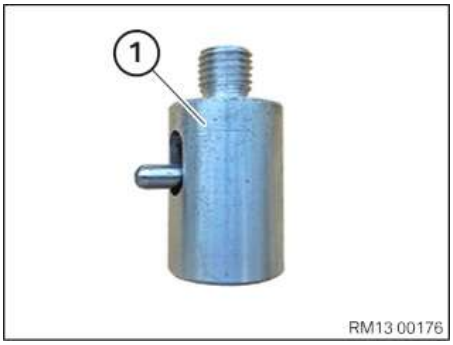
- Twist the injectors with a maximum torsional movement of 13 Nm.
- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use the special tool 2 358 417to remove the injectors.

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

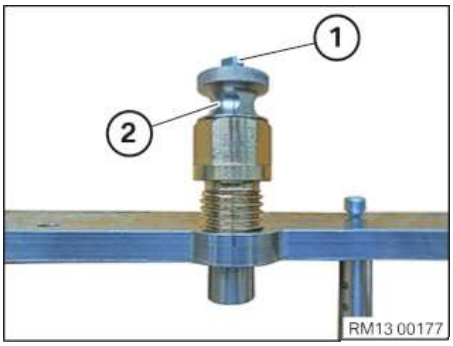
  Special tool 2 358 417 consists of:

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

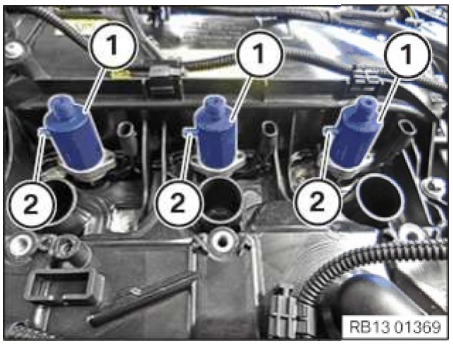
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- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.

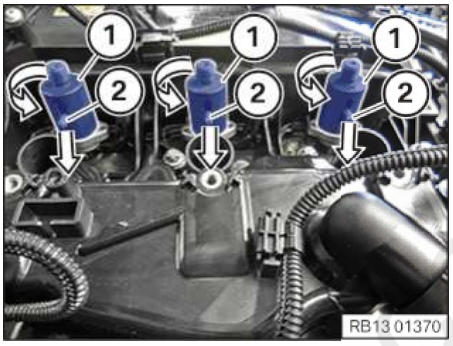


- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.

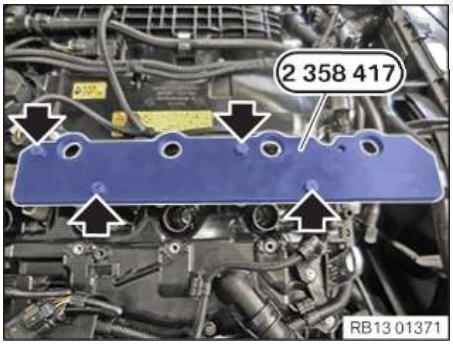


- Install all fixtures (1) for the injectors.

  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

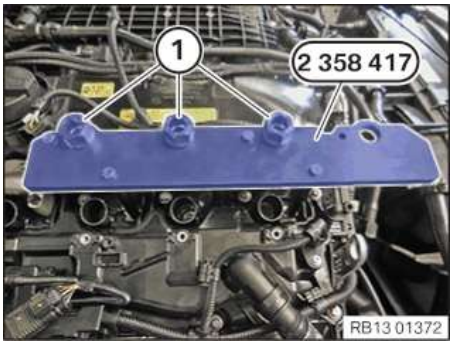
Damage to injectors.

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).

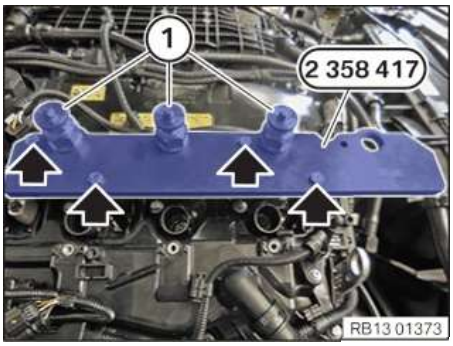
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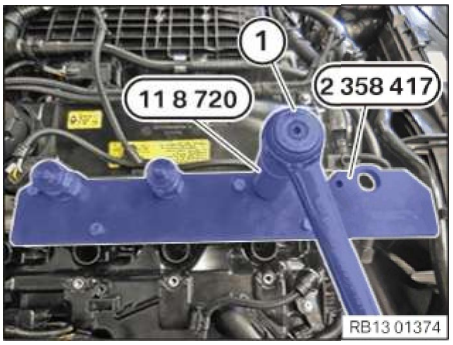
TECHNICAL INFORMATION

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.

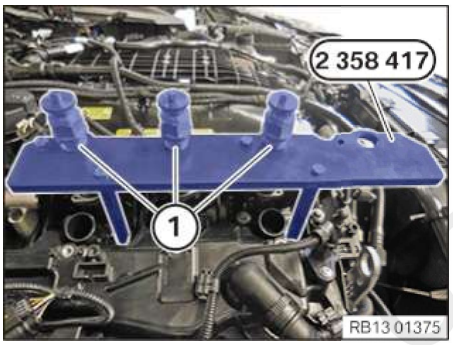


- Adjust torque wrench to 13 Nm **clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720)until the injector is pulled out.

TECHNICAL INFORMATION

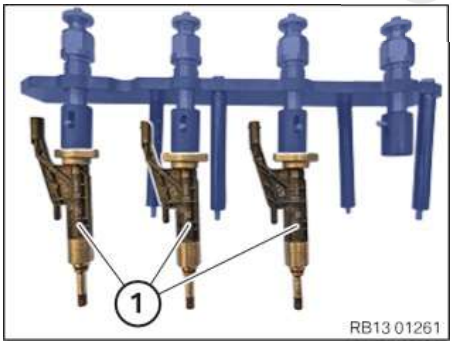
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

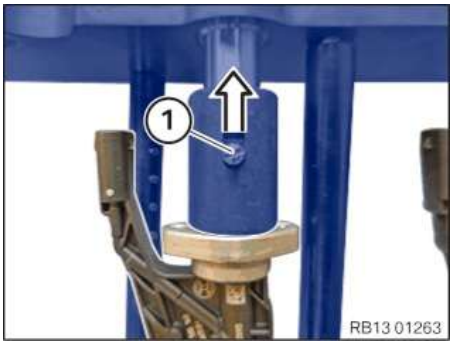


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  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.

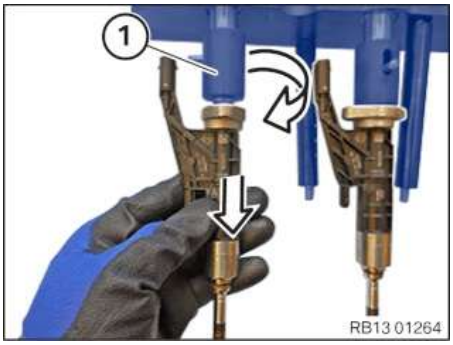


NOTICE

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.

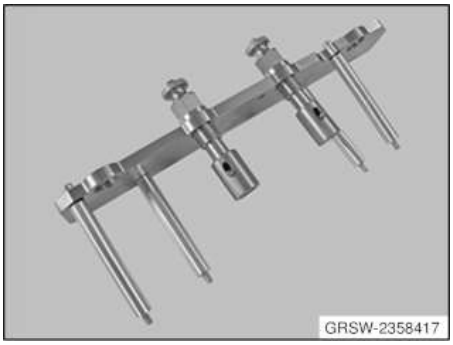
Excessive force may damage the injector and this means having to renew the injector.

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



- Prepare special tool .

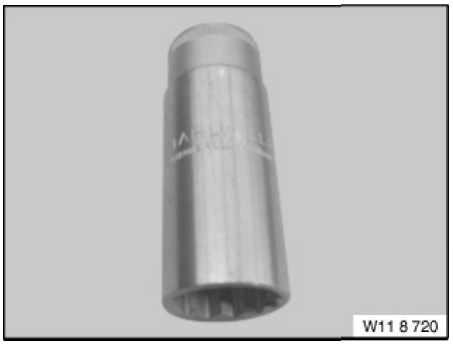
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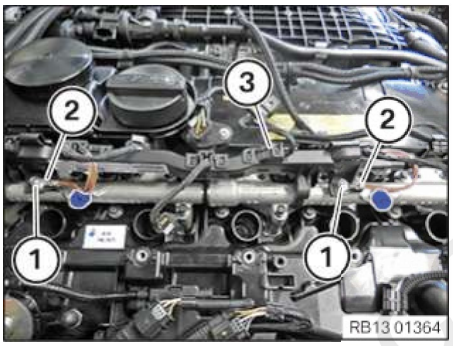
- Prepare special tool 2 358 417.



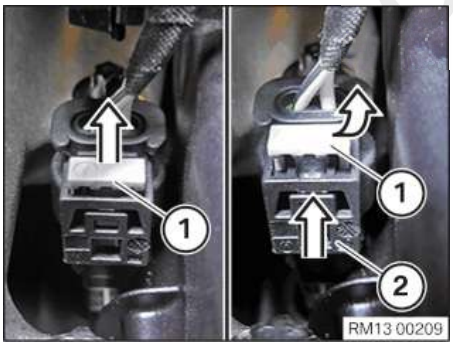
- Prepare special tool .



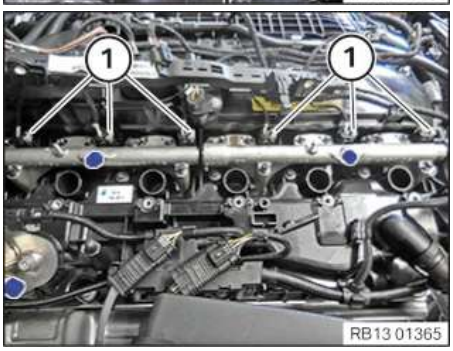
- Prepare special tool 0 496 106 (11 8 720).



- Release nuts (1) .
- Feed out ground cable (2) and set aside.
- Feed out cable channel (3) and set it aside.

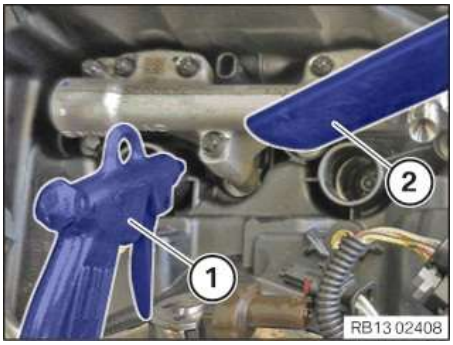


- Unlock lock (1) in direction of arrow upwards.
- Press lock (1) together and release.
- Disconnect the connector (2) from the injectors in the direction of the arrow.



- Unlock and release all connectors (1) of the injectors.

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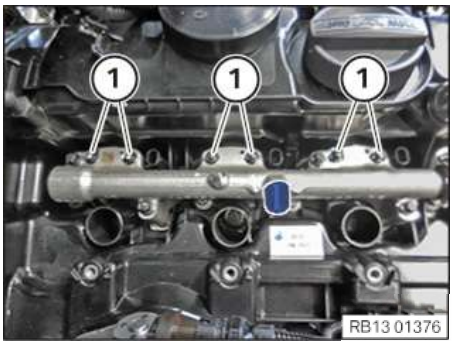


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

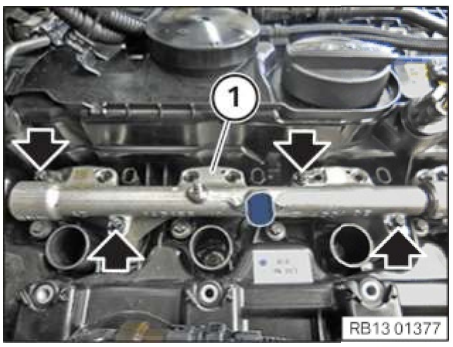
For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

- 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) .

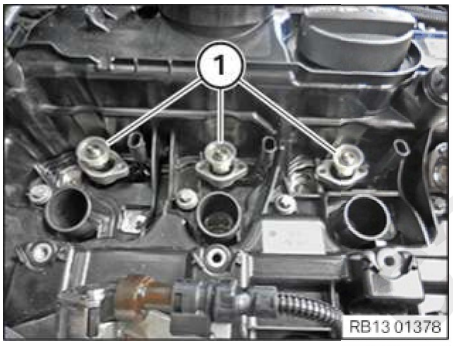
  Do **not** reuse screws (M5x30) (1).
- Catch and dispose of escaping fuel with suitable materials.



- Release screws (M6x30) (arrow).
- Remove screws (M6x30) (arrows).

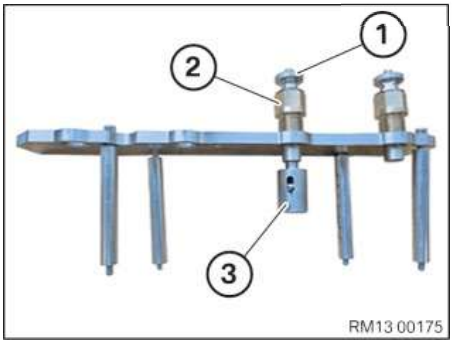
  Do **not** reuse the screws (M6x30).
- Remove rail (1) upwards.

  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.

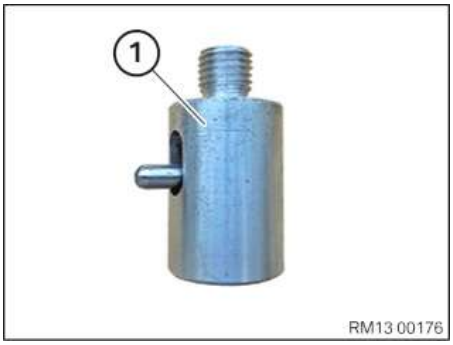
- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use the special tool 2 358 417 to remove the injectors.

  The special tool 2 358 417 is used to ensure that the tensile force is not exceeded.

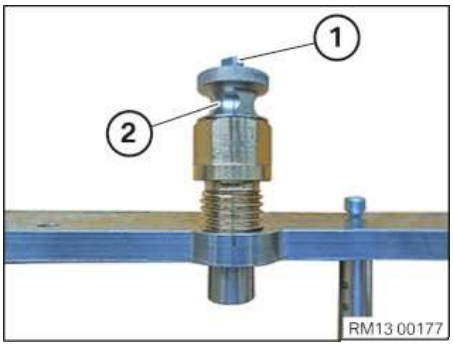
  The special tool 2 358 417 consists of:

  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Mounting for the injectors

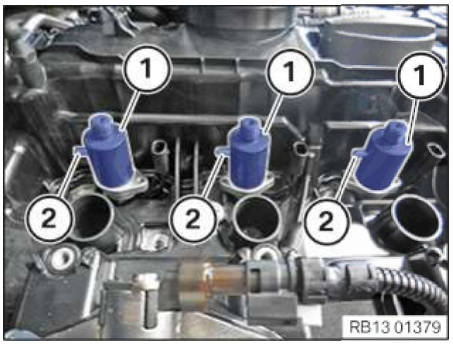
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- Unscrew the fixture for injectors (1) from special tool 2 358 417.

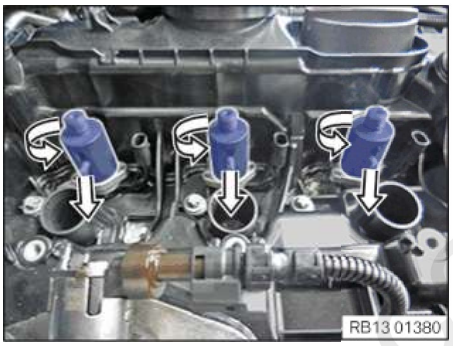


- Press lock (1) in and remove the threaded sleeve (2) from the special tool 2 358 417.



- 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

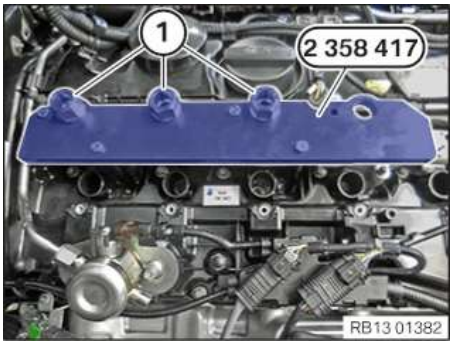
Damage to injectors.

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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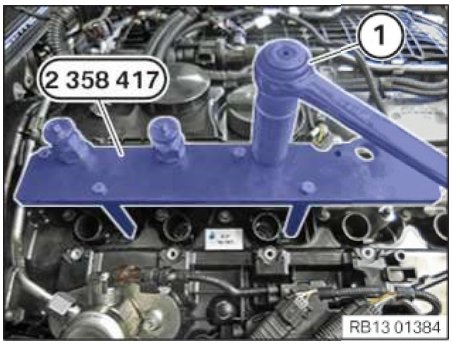
TECHNICAL INFORMATION

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.

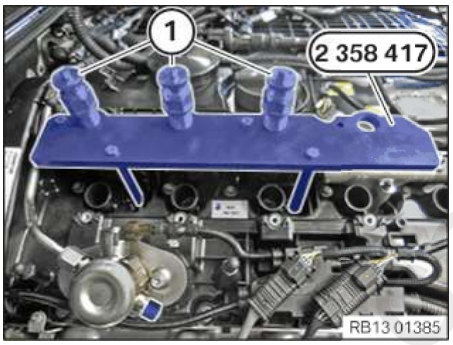


- Adjust torque wrench to 13 Nm **in clockwise** direction.
- Turn the torque wrench (1) with the special tool 0 496 106 (11 8 720) **clockwise**, until the injector is pulled out.

TECHNICAL INFORMATION

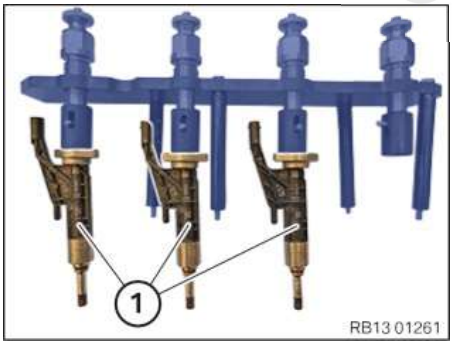
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

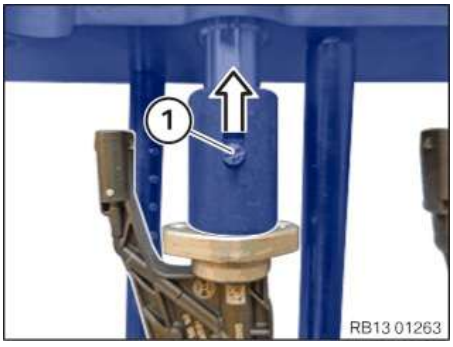


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  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.

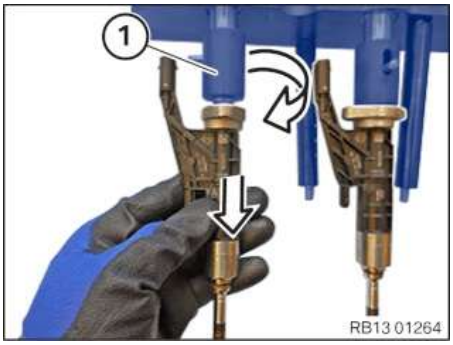


NOTICE

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.

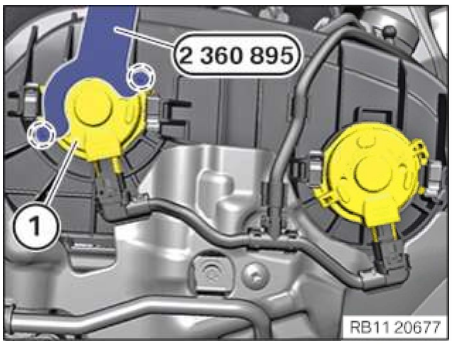
26 – Removing both actuators

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

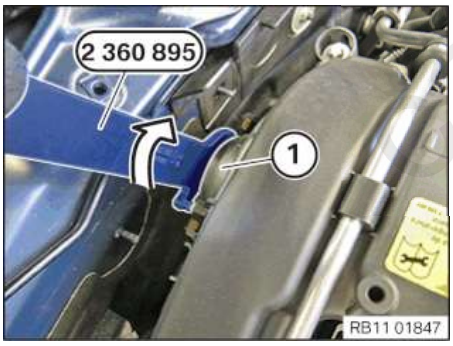
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the 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.



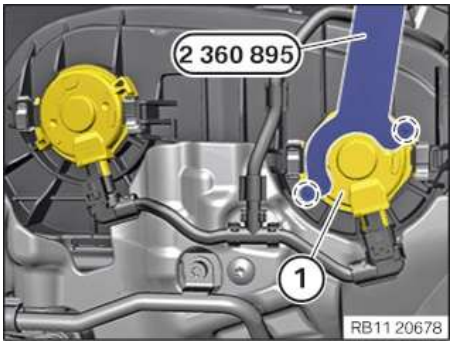
NOTICE

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.

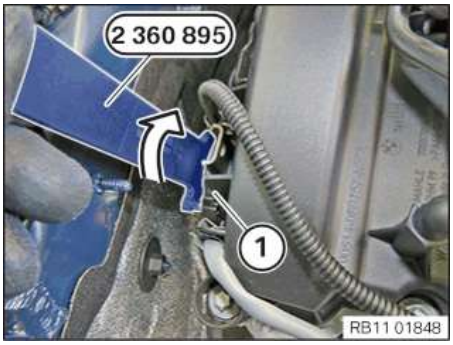


NOTICE

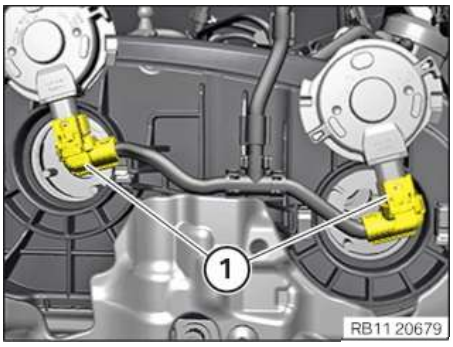
The figure shows the rear side of the engine.

- 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.



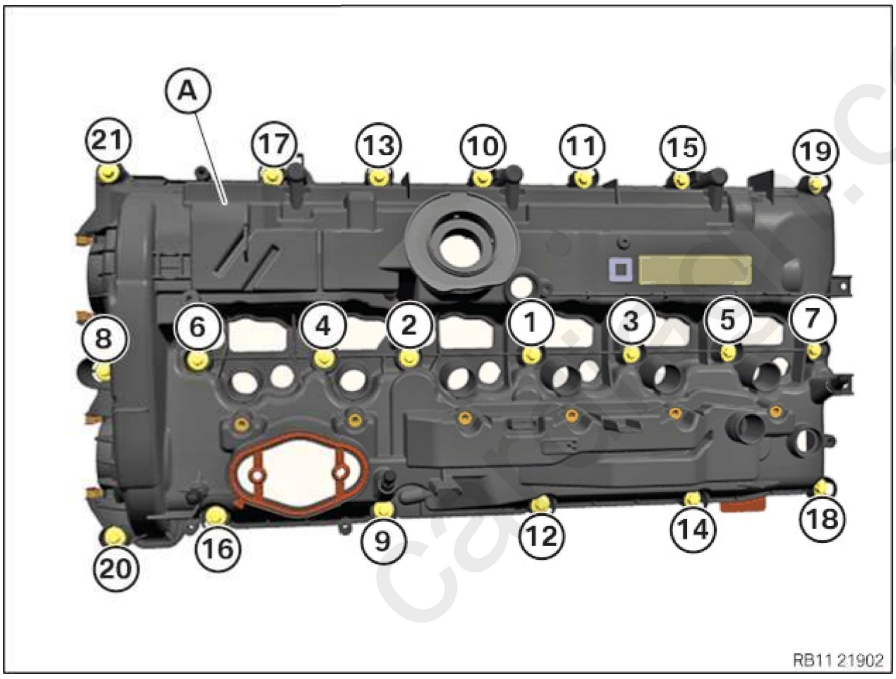
NOTICE

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

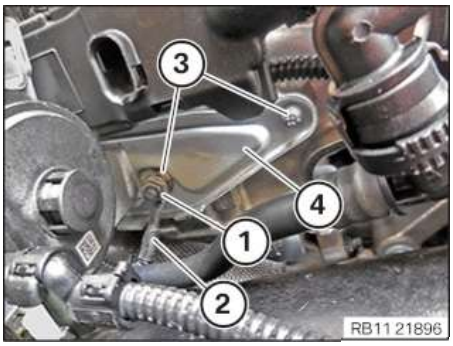
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

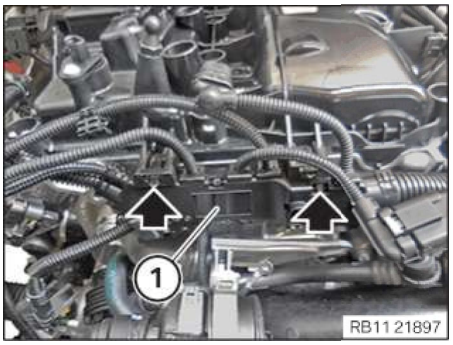
- Do not pull on the wires when disconnecting connectors and plug connections.



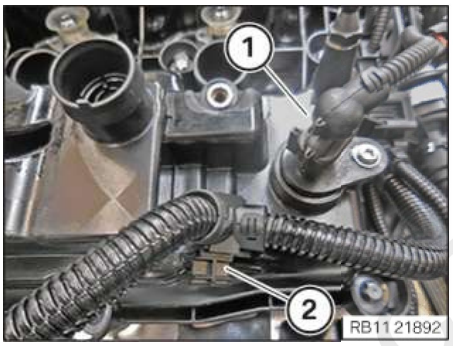
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



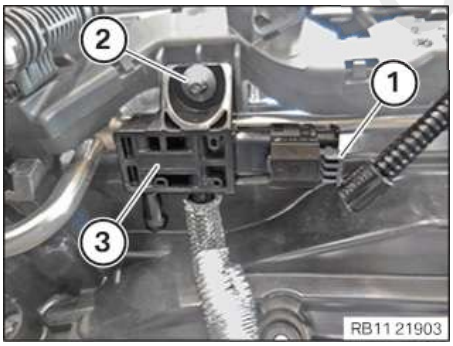
- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Loosen screws (3).
- Thread out holder (4) and set aside.



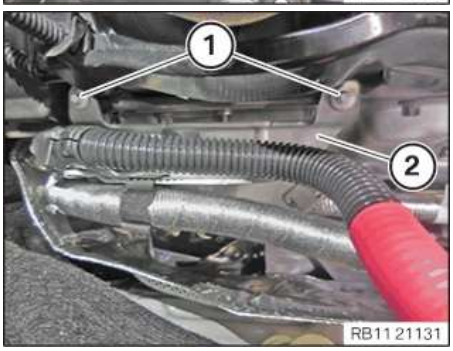
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for the sensor system **2** and place to one side.



- Unlock and detach connector (1) on exhaust camshaft sensor .
- Loosen clamp (2).

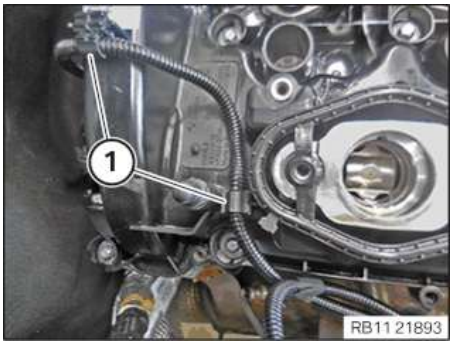


- **If installed:**
- Unlock and loosen connector (1).
- Loosen screw (2).
- Remove the differential pressure sensor (3) and put it to one side.

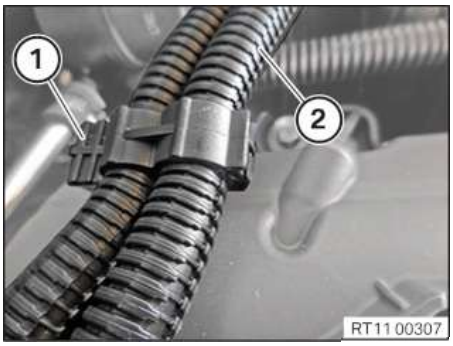


- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

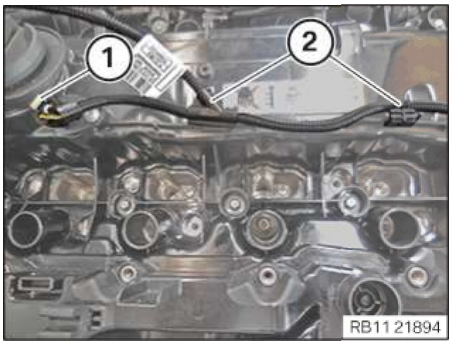
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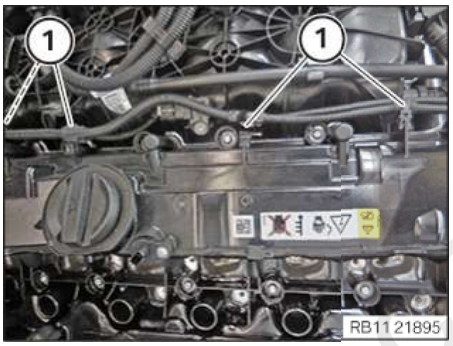
- Loosen clamps (1).



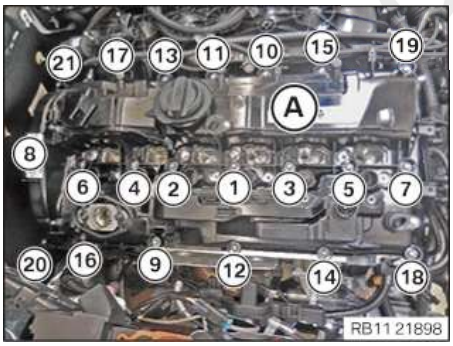
- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



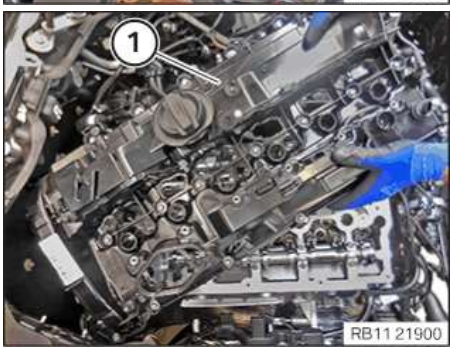
- Unlock and detach connector (1) on the intake camshaft sensor.
- Loosen clamps (2).



- Loosen clamps (1).



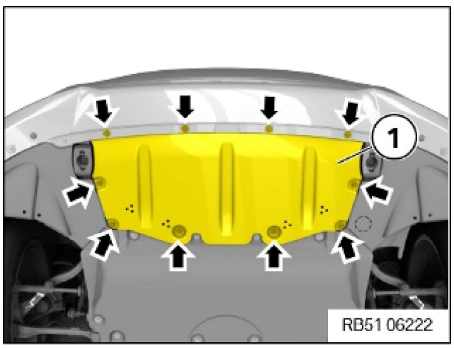
- Release all screws on the cylinder head cover (A) in the sequence (21) to (1).



- Guide the cylinder head cover (1) out and remove it.

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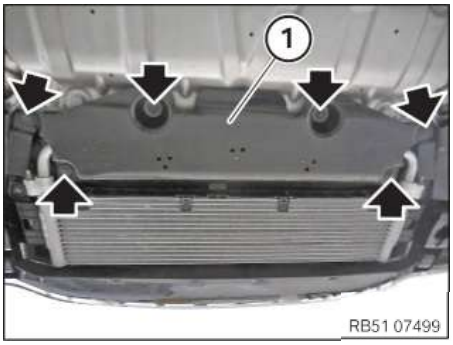
28 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

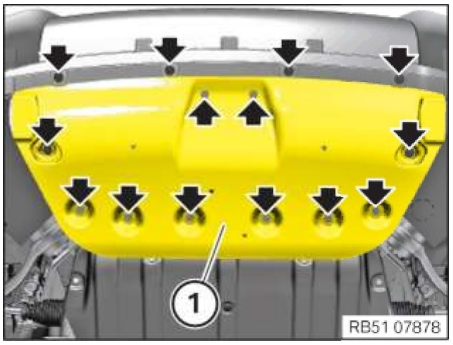
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

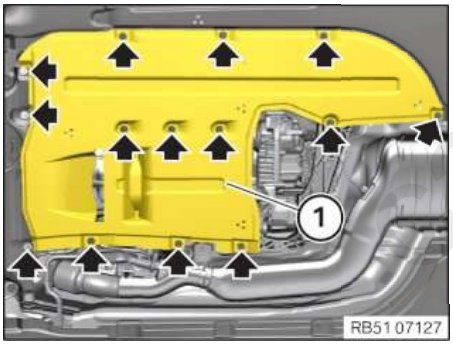


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

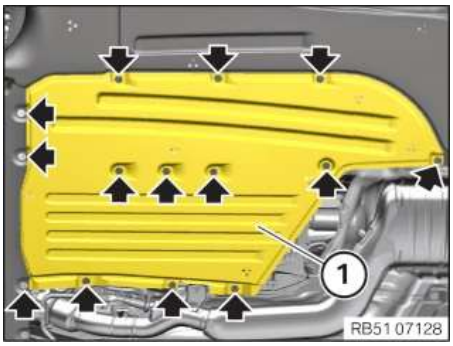
29 – Remove rear underbody protection



- **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

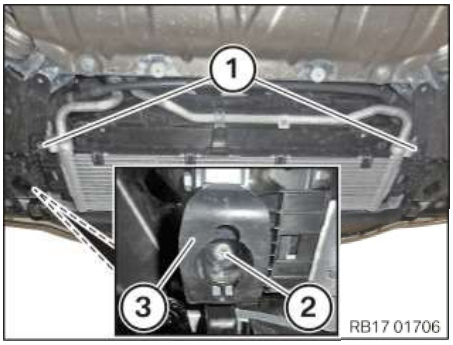
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

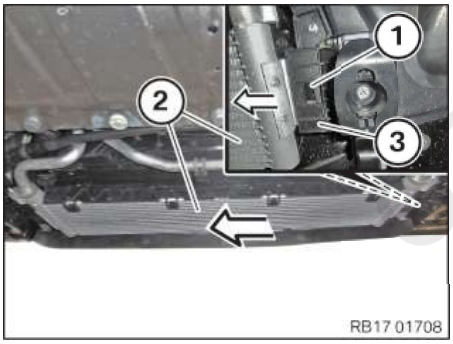
The work must be performed with care to prevent component damage.



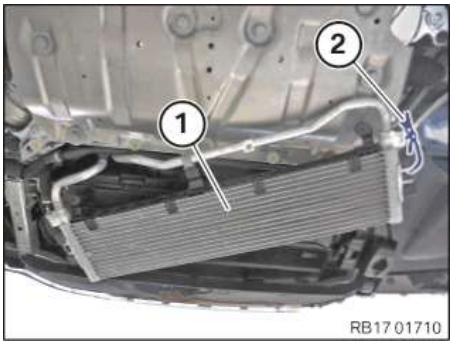
- Loosen screws (1).
- Drill out rivet on the left (2).
- Remove the left-hand damper (3).



- 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.



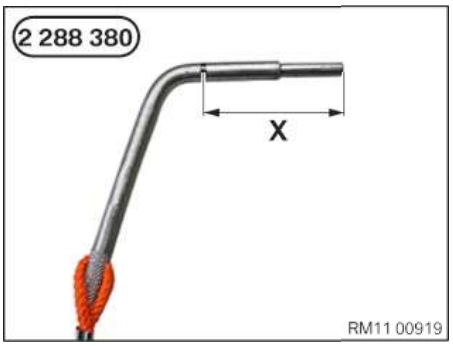
RISK OF DAMAGE

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.

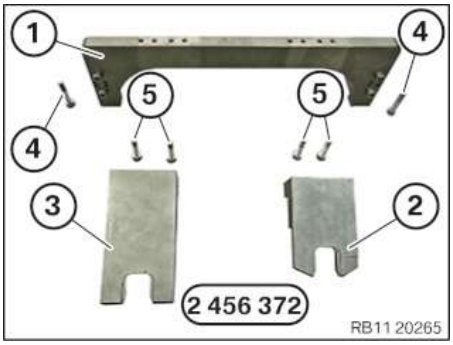


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **correctly** positioned.

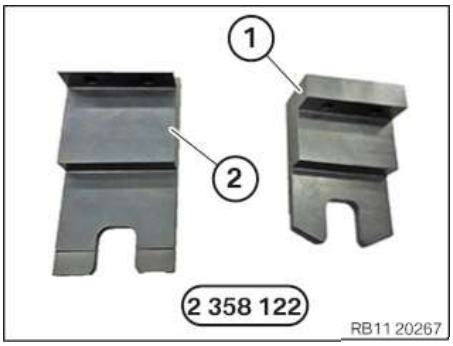
  The engine is in the TDC firing position of cylinder 1.

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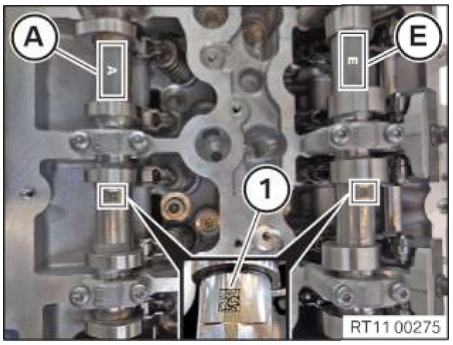
- Overview of the set of special tools 2 456 372:

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

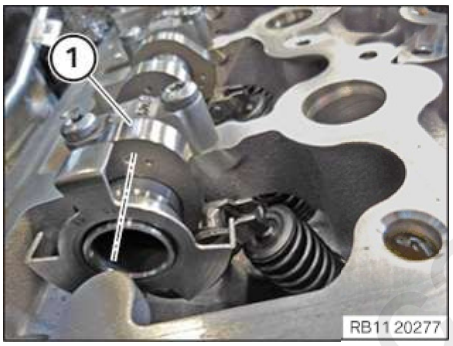


- Overview of the test gauges from the set of special tools 2 358 122:

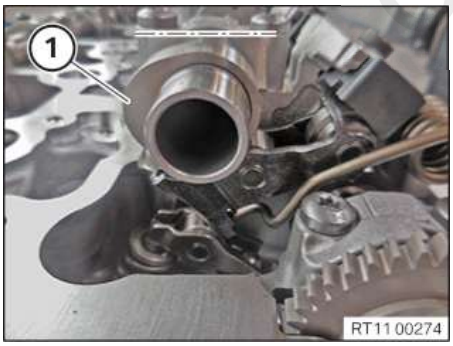
Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



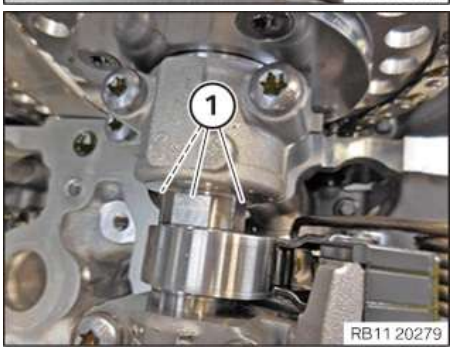
- Turn intake camshaft (E) and exhaust camshaft (A) until marks (1) can be read from the top.



- 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.

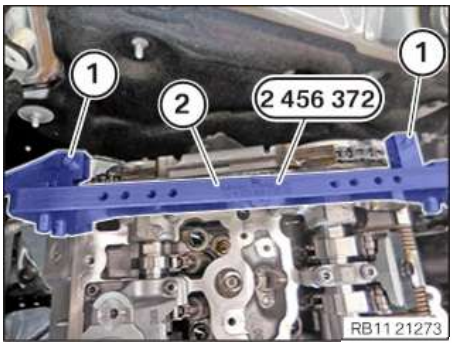


- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.

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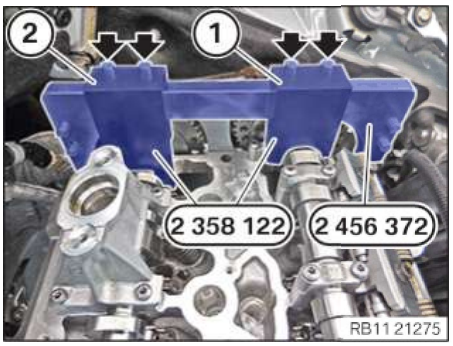
- Position basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- 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).

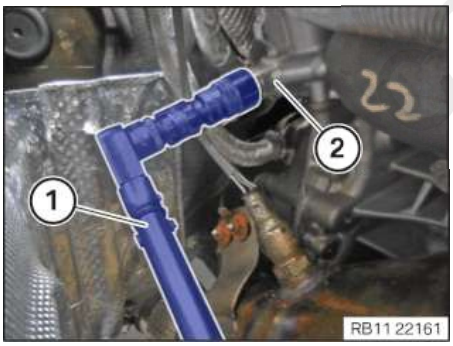
Test gauge to basic carrier

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).

MAIN WORK

33 – 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.

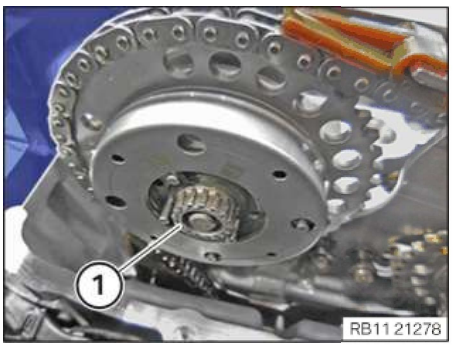


NOTICE

The figure shows the rear side of the engine.

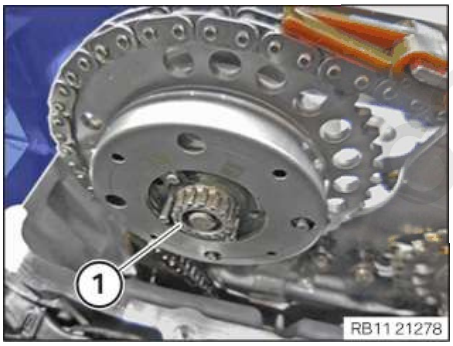
- Release the VANOS central valve (1) of the intake adjuster.

34 – Removing the VANOS central valve of the intake adjuster

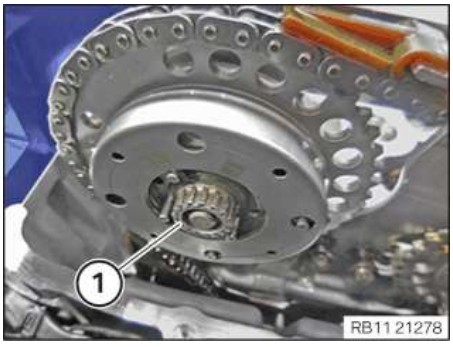


- Guide out and remove the VANOS central valve (1) of the intake adjuster.

35 – Install the VANOS central valve of the intake adjuster

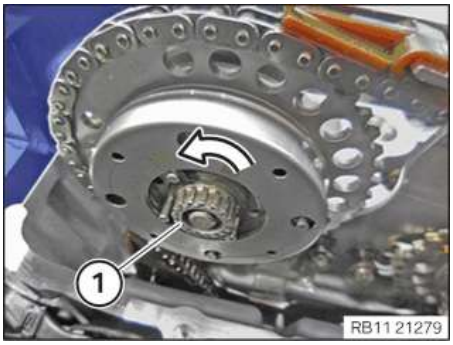


- Guide in the VANOS central valve (1) of the intake adjuster and install.



- Hand-tighten the VANOS central valve (1) of the intake adjuster.

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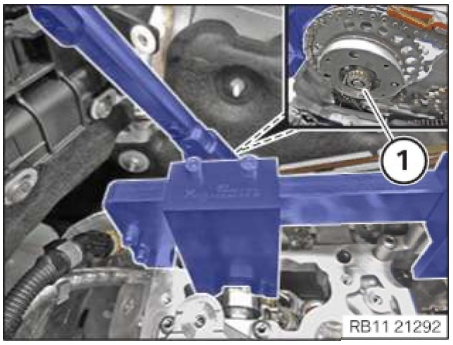


- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

36 – 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.

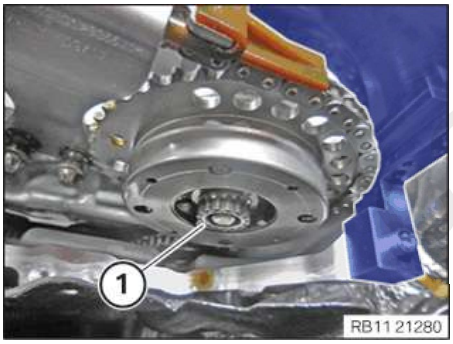


NOTICE

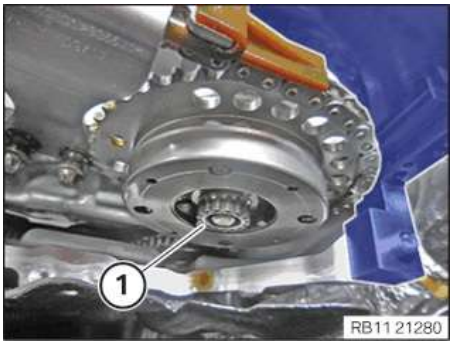
The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

37 – Installing the VANOS central valve of the exhaust camshaft adjuster

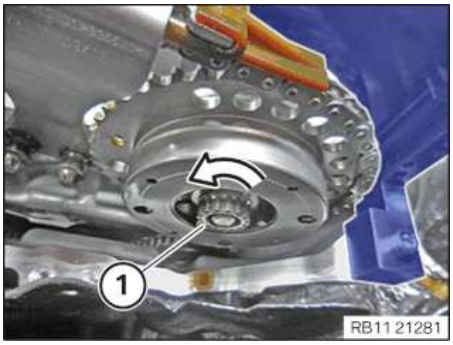


- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.



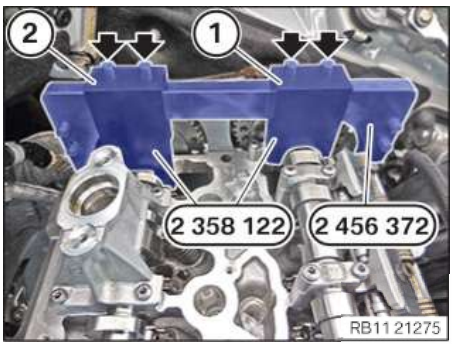
- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

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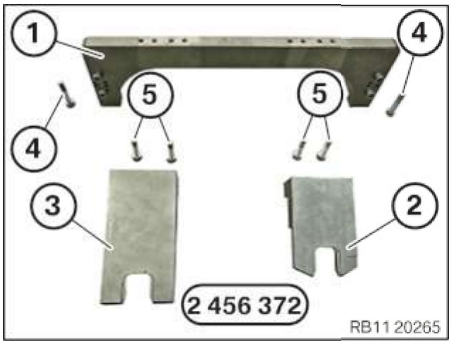
- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

38 – 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.

39 – Adjust the camshafts with the special tool

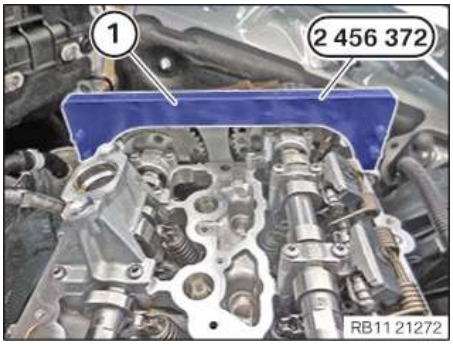


- Overview of the set of special tools 2 456 372:

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

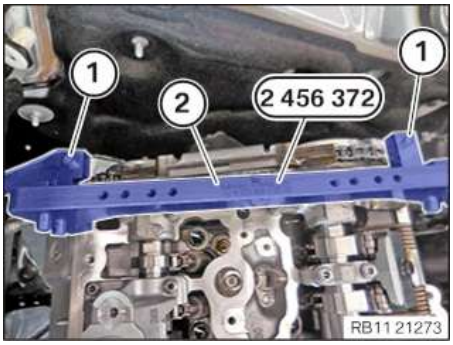


- Use the setting gauge 0.7 ° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.



- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.

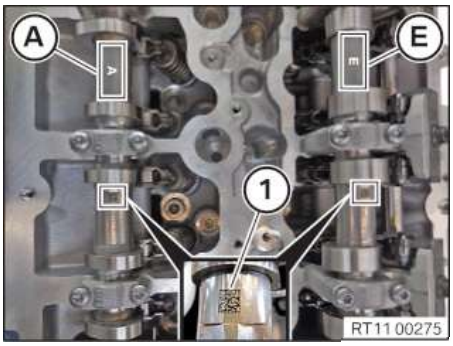
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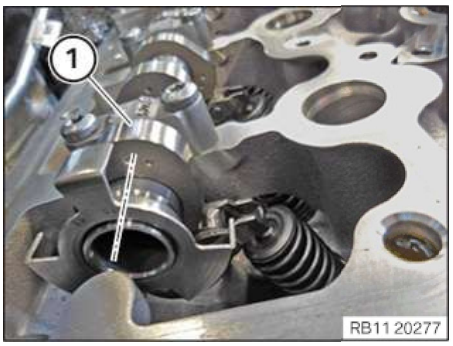
- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



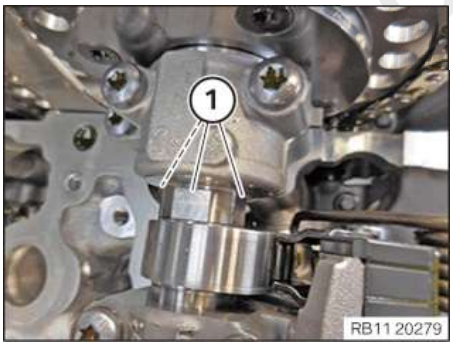
- Turn the intake camshaft (E) and the exhaust camshaft (A) such that the marks (1) can be read from the top.



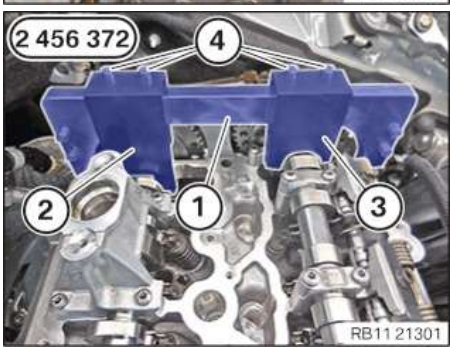
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- 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.



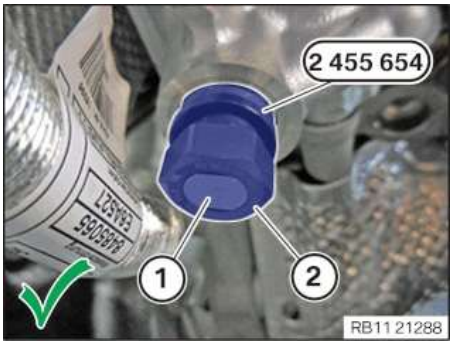
- Position the setting gauge 0.5° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten the screws (4).

Test gauge to basic carrier

M6		Tightening torque	8 Nm

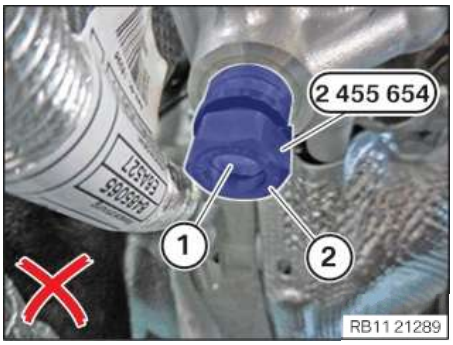
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40 – Pretension the timing chain with the special tool



- Make sure that the timing chain is **correctly** pre-tensioned with the special tool 2 455 654.

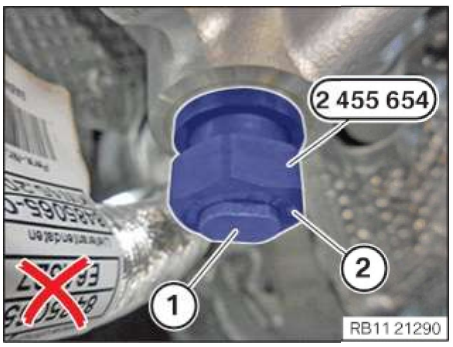
  The pin (1) must align **precisely** with housing (2).



- 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**.

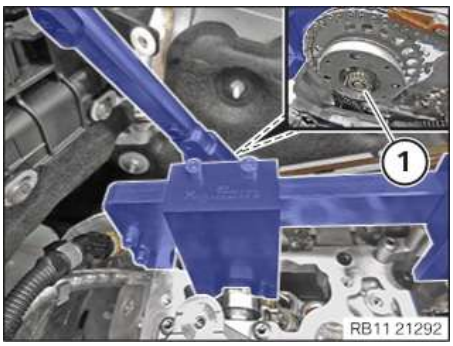
  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

41 – 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 °

42 – 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.



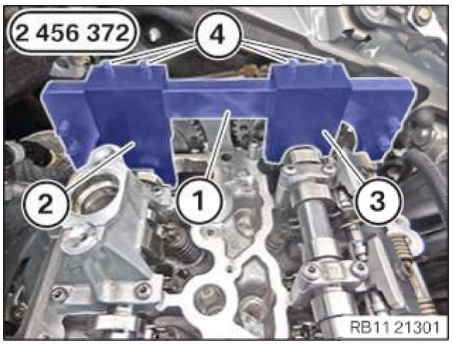
- Tighten the VANOS central valve (1) of the intake adjuster.

VANOS central valve to camshaft

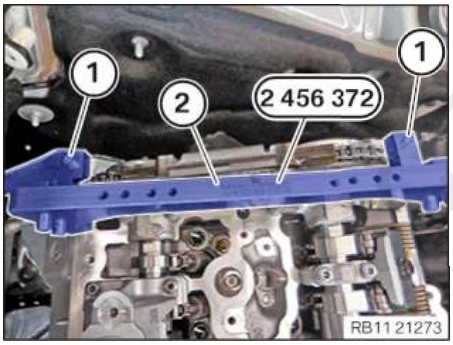
M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

POSTPROCESSES

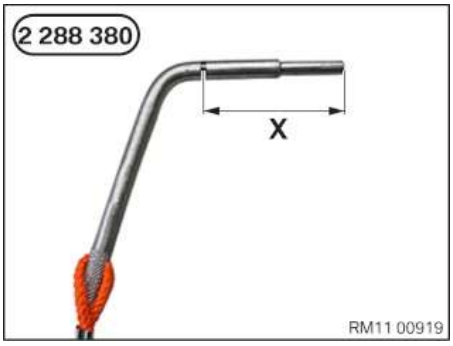
43 – Disassembling all special tools



- 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.

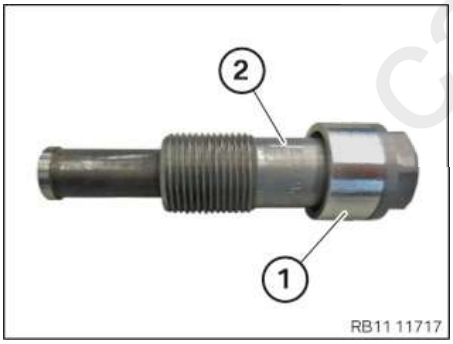
44 – Install chain tensioner

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.



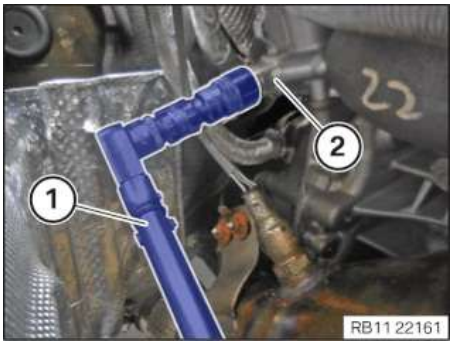
- Renew the sealing sleeve (1).

  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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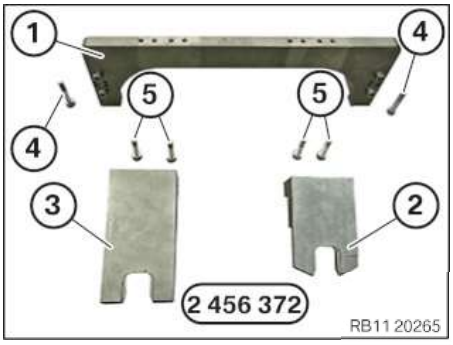


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

45 – 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

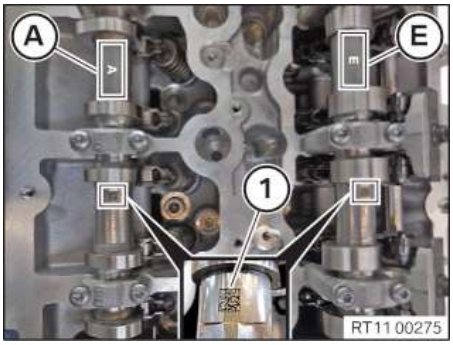
Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

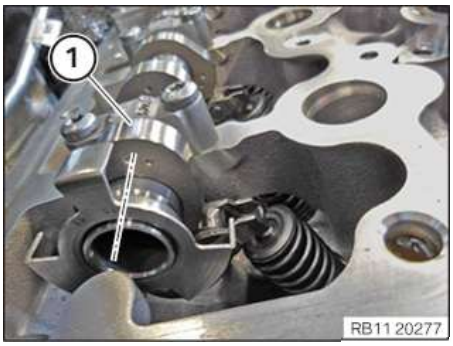
- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.

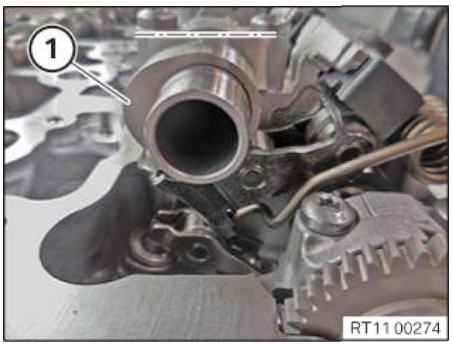
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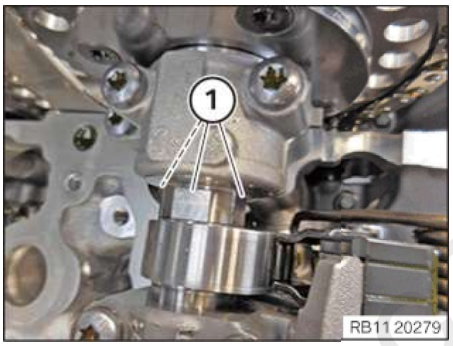
- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.



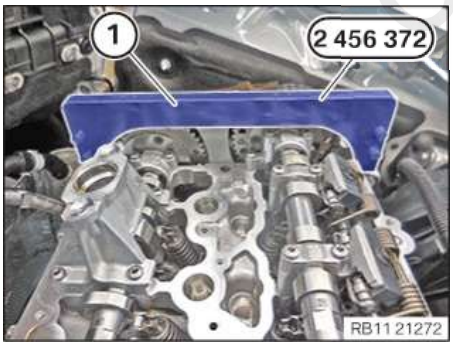
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



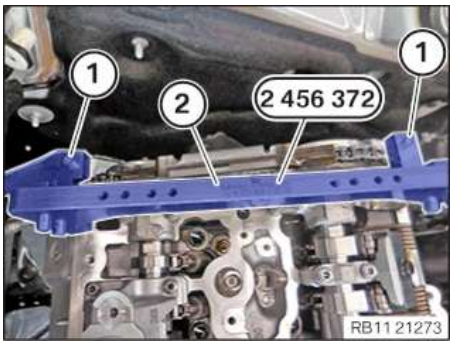
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.



- 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.

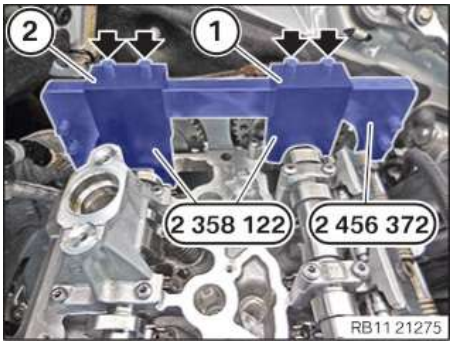


- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm

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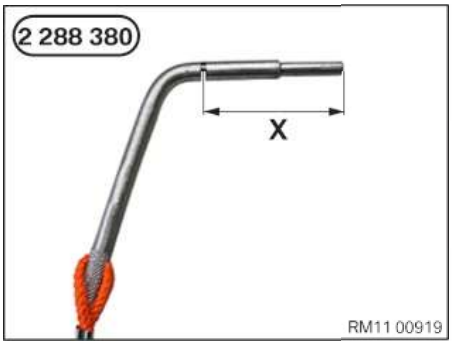
- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special 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.



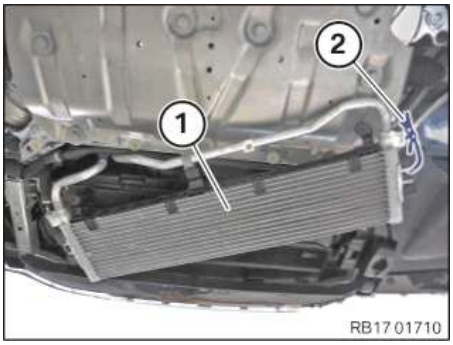
- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

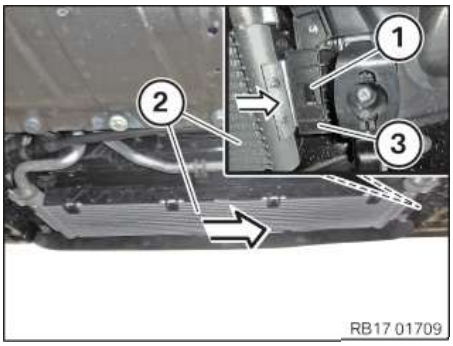
  The engine **is in the** TDC firing position of cylinder 1.

46 – If installed: Secure engine oil cooler

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- Remove the cable straps (2).
- Position engine oil cooler (1).



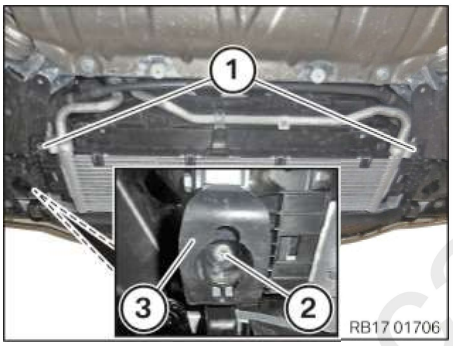
- Feed in and install the engine oil cooler (2) on the holder (3) in the direction of the arrow.
- Ensure that the lock (1)engages audibly.



- 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).

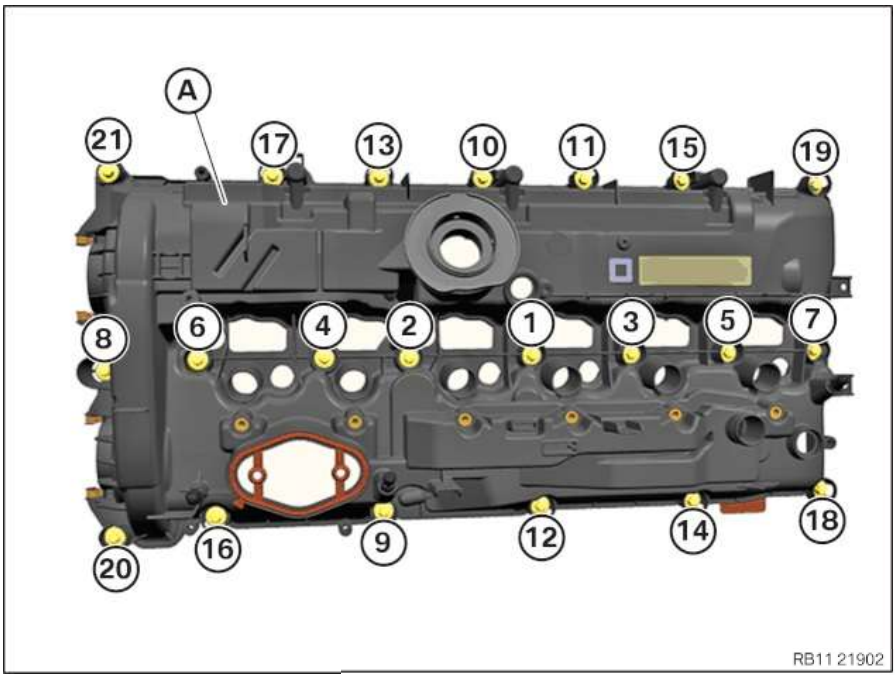
Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

47 – 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

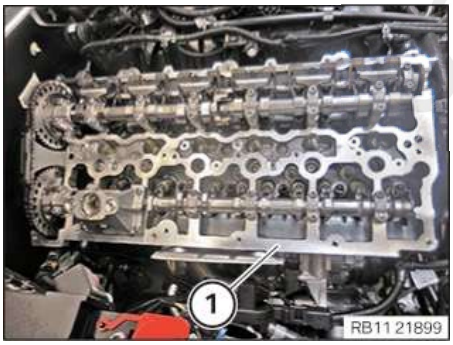
Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

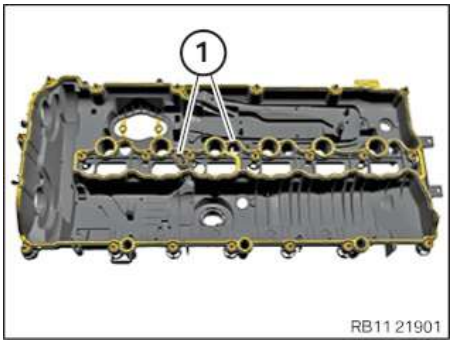
- Route all cables without abrasions, do not trap and crush.

TECHNICAL INFORMATION

Latch mechanisms, guides and mounting elements must not be damaged or missing.

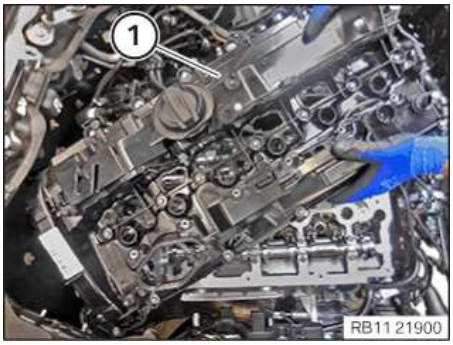


- Contact surface (1) must be free from oil and grease.



- Replace the seals (1).

  Parts: Seals

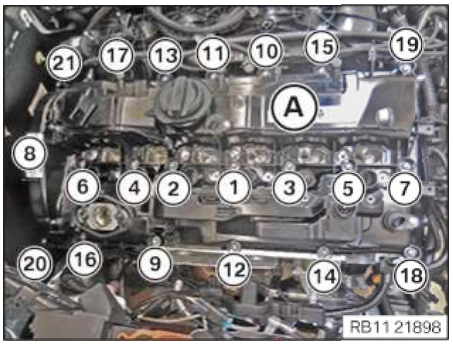


- Insert and install cylinder head cover (1).



- 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

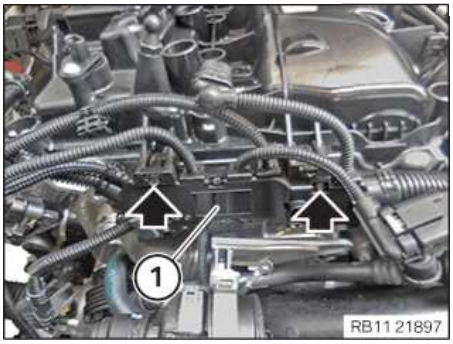
- Tighten all screws in a sequence from (1) to (21).

Cylinder head cover to cylinder head

M6X30		Tightening torque	11 Nm

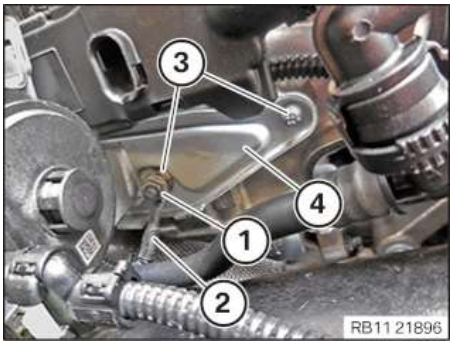


- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.



- Feed in and install wiring harness section (1) for sensor system **2**.
- Make sure that you can hear the locks (arrows) engage.

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- Insert and position the holders (4).
- Tighten the screws (3).

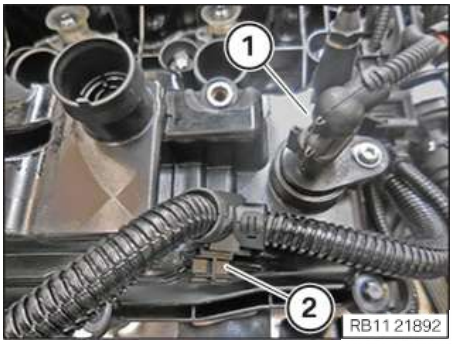
Auxiliary coolant pump holder to cylinder head

M6		Tightening torque	7 Nm

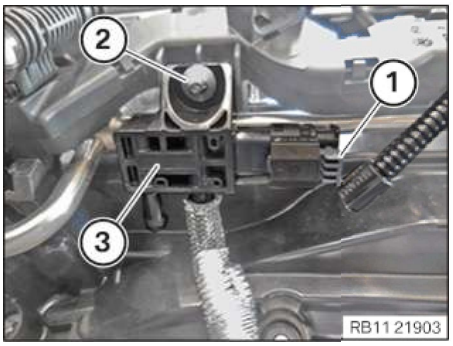
- Thread in ground cable (2) and install.
- Tighten nut (1).

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).

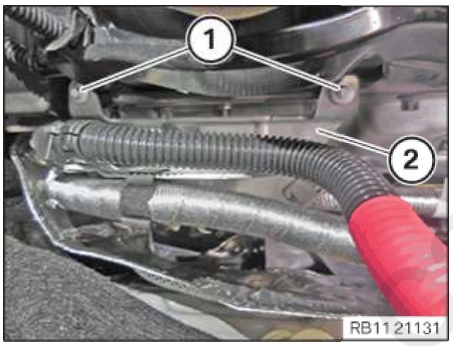


- **If installed:**
- Feed in and install the differential pressure sensor (3).
- Tighten down screw (2).

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.

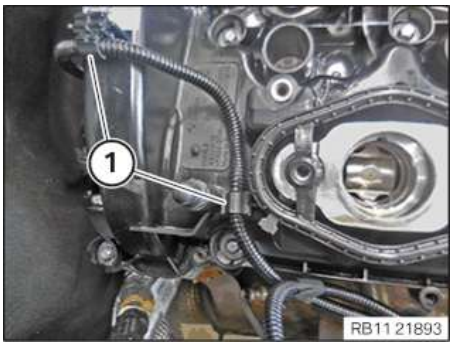
Risk of short circuits!

- 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).

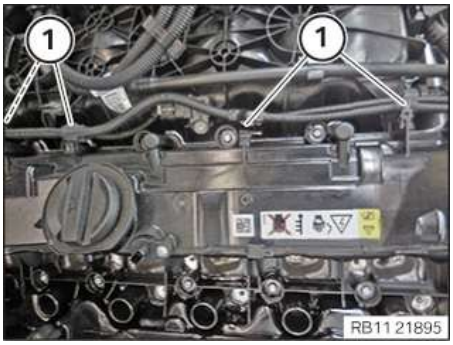
Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

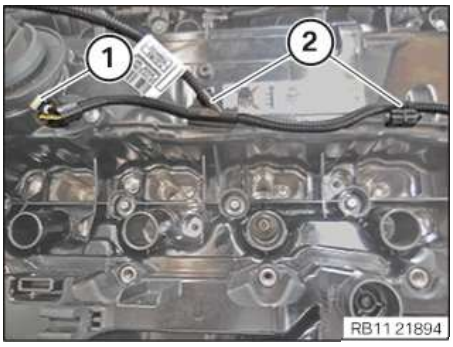


- Secure clamps (1).

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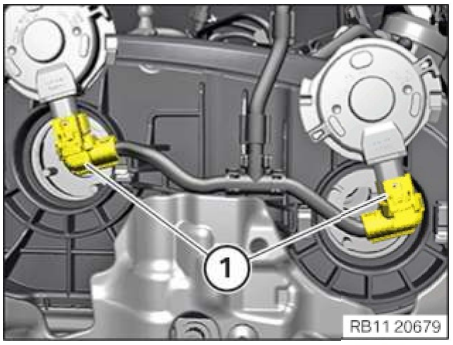


- Secure clamps (1).



- Connect connector (1) to the intake camshaft sensor and lock it.
- Make sure the connector (1) engages audibly.
- Secure clamps (2).

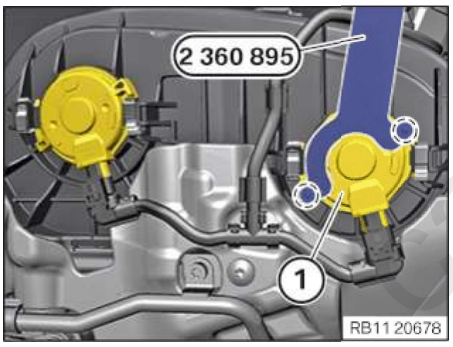
48 – Installing both actuators



NOTICE

The figure shows the rear side of the engine.

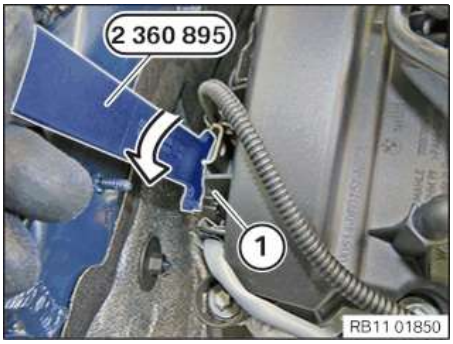
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



NOTICE

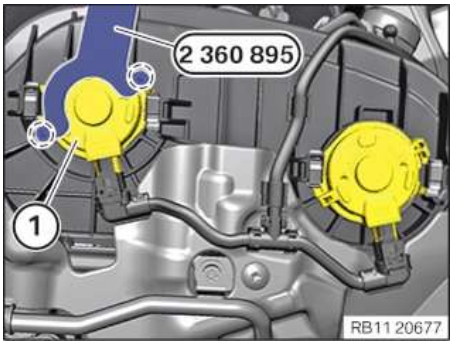
The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- 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.

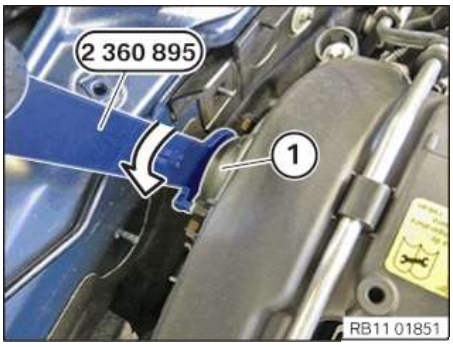
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NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the 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.

49 – 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

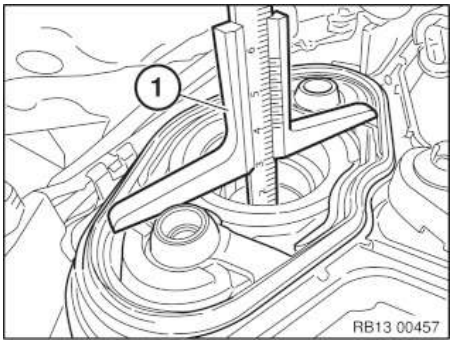
In vehicles with active anti-roll bar (ARS) the fan cowl must be removed in order to spin the engine.

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.

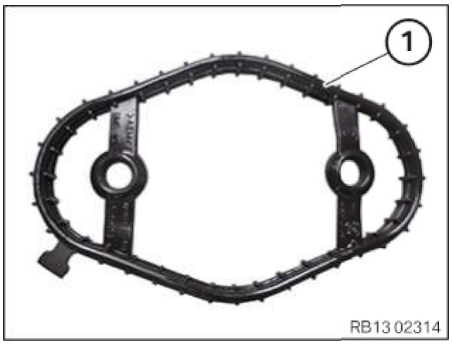
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- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- 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).



- 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.

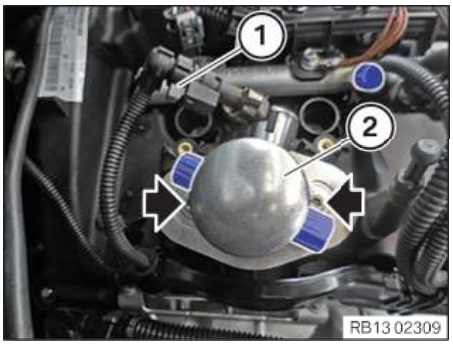
The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- 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.

50 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

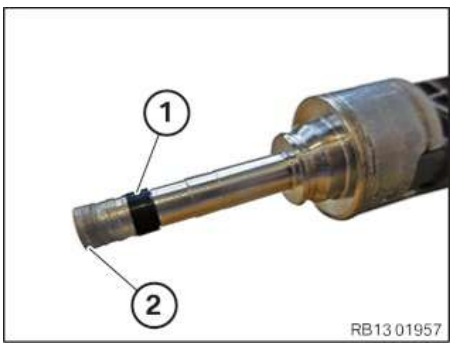
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- 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.

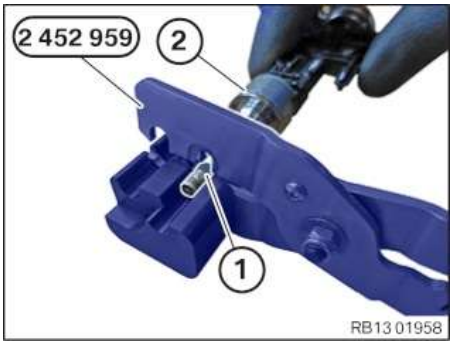
After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.



- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings
- Avoid mechanical contact with injector tip (2).

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- 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.

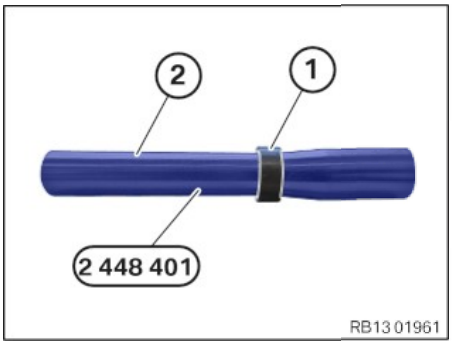


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

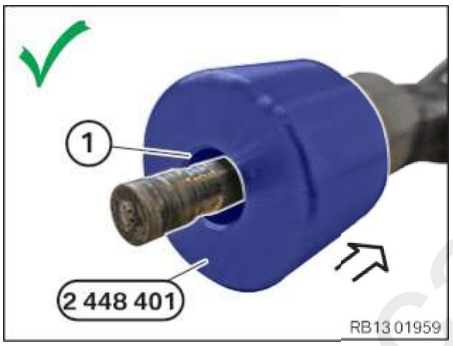
  (1) Installation cone

  (2) Sliding sleeve

  (3) Assembly sleeve

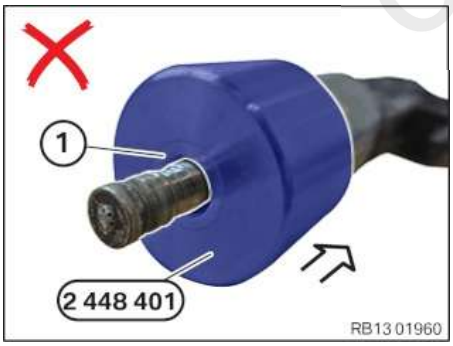


- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



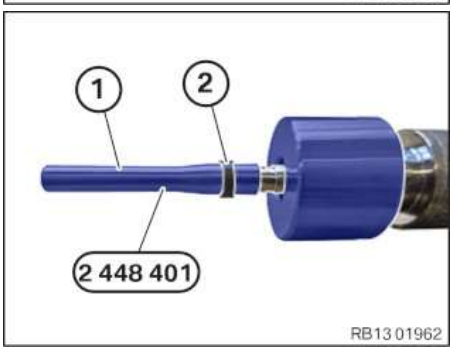
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The larger diameter of the assembly sleeve (1) must point to the injector tip.



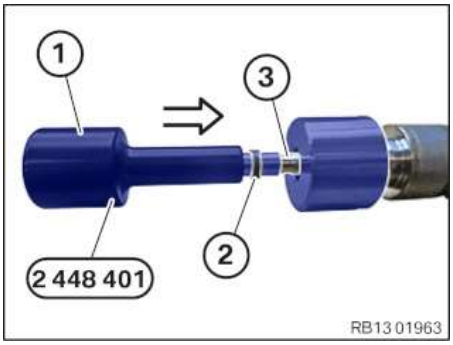
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.

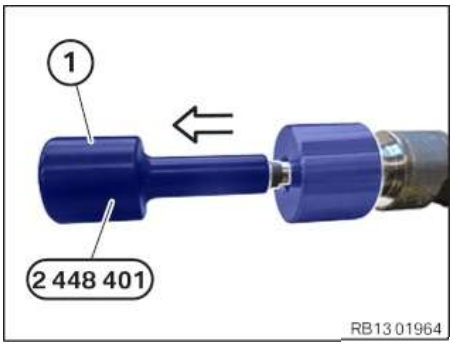


- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .

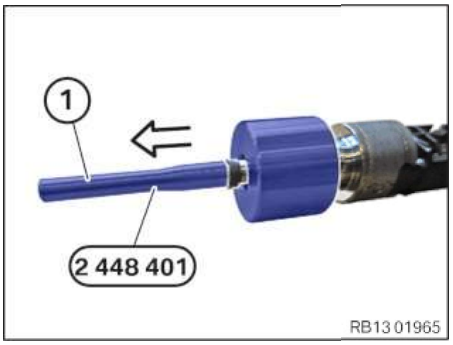
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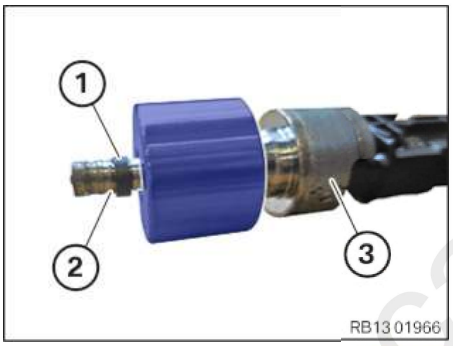
- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.



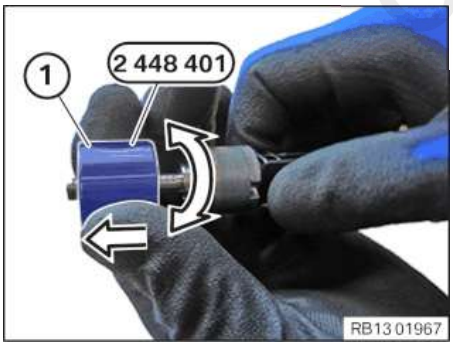
- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

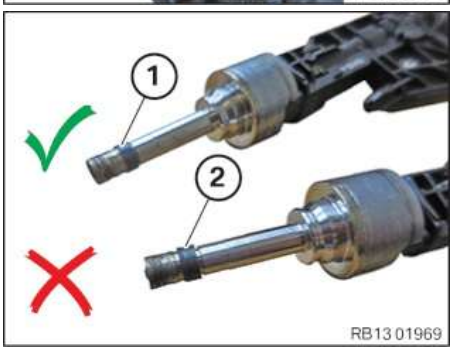


- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.



- 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).



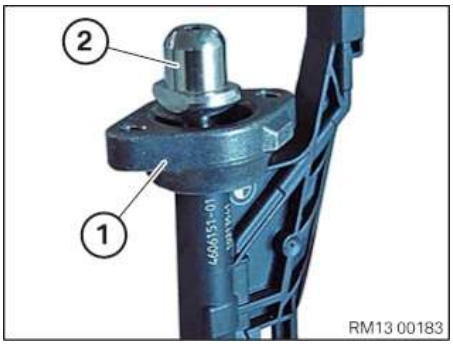
- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

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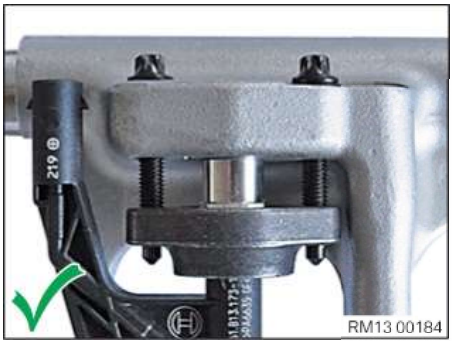
51 – Installing the high-pressure rail with injectors of the cylinders 4 to 6

TECHNICAL INFORMATION

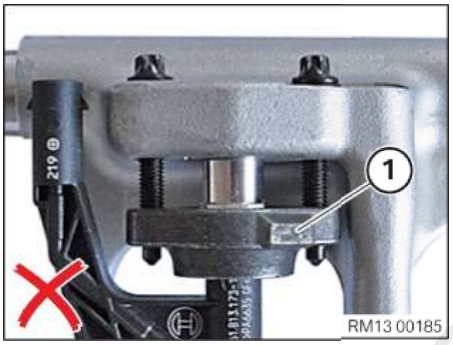
When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



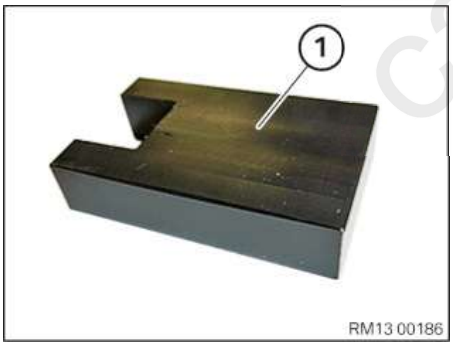
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder**(1) **has a cast lug**: Make sure that the holder is installed in the correct position.



- 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

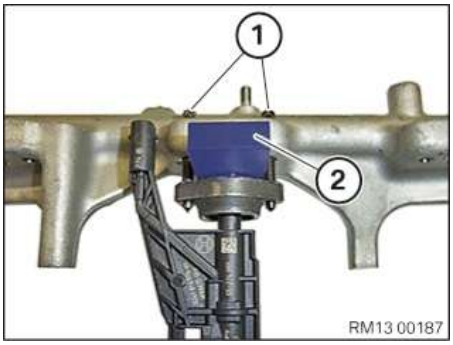
Damage to injectors.

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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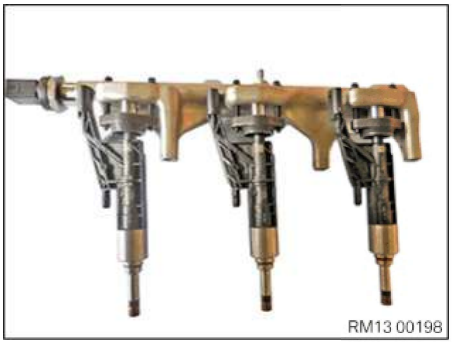
- Replace (M5x30) screws.

  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.



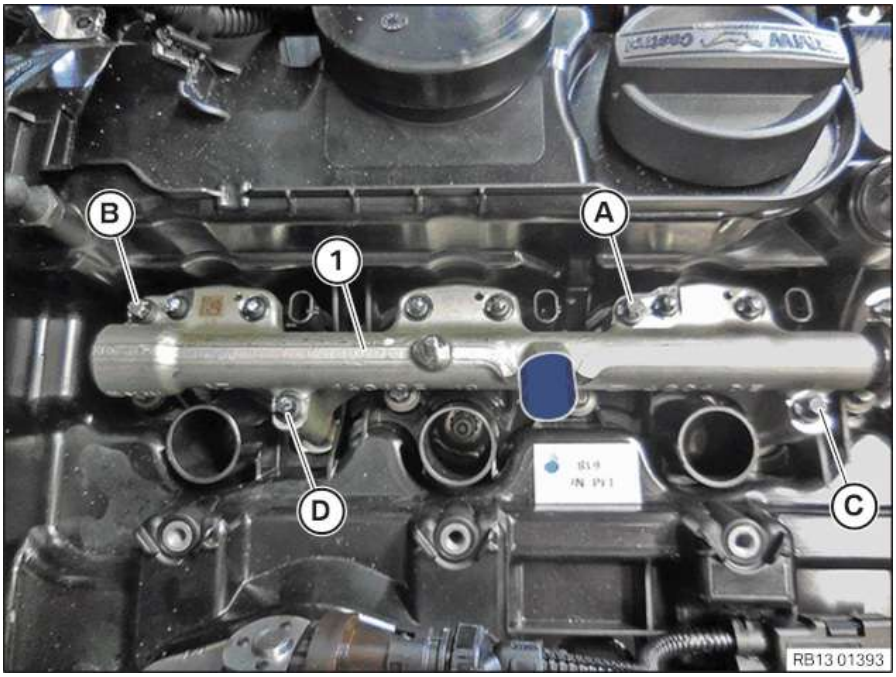
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.



- 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.

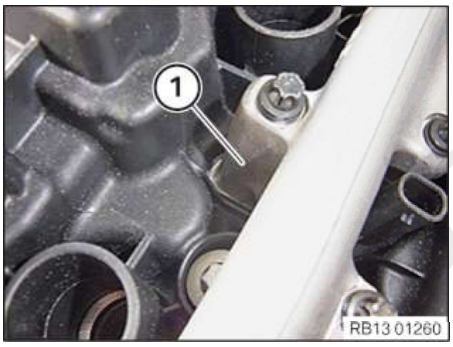
  The figure shows the rail resting flat against the cylinder head.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

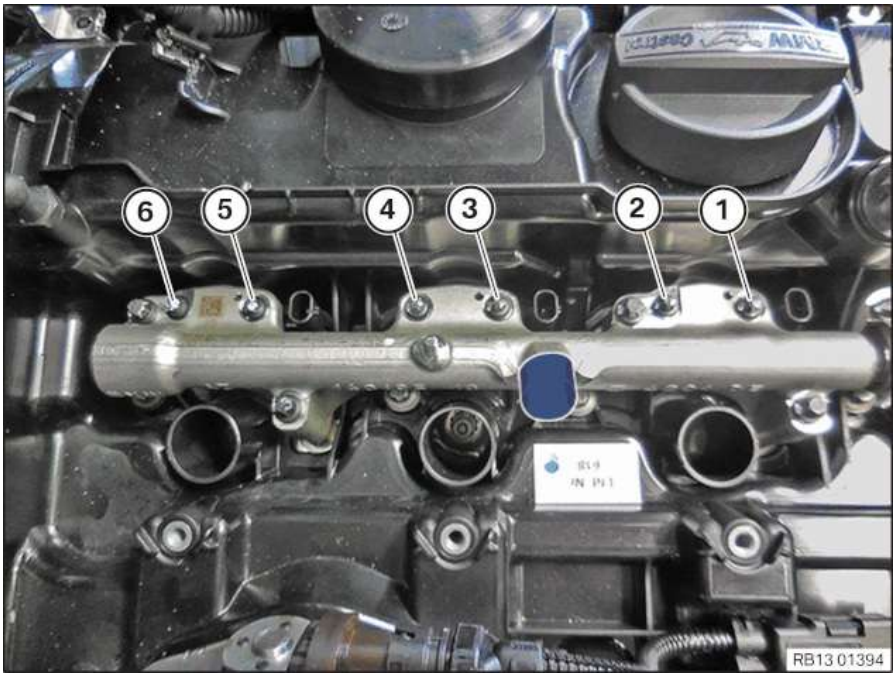
Non-observance of these requirements may result in leaks and damage.

- 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.

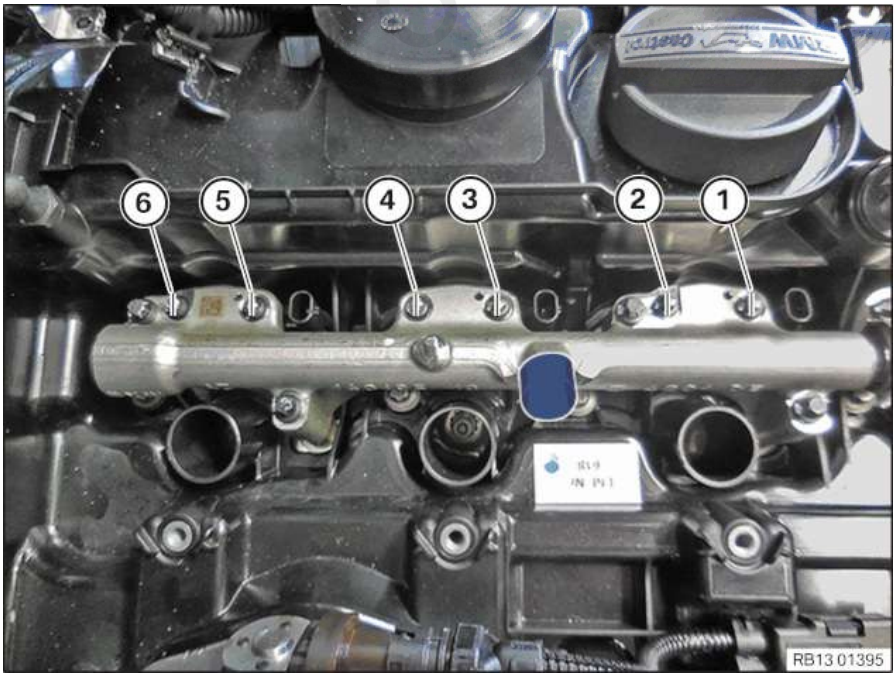
  Do not use a reversible ratchet or torque wrench.
- Tighten the bolts (M5x30) in pairs ((1) with (2), (3) with (4), (5) with (6)) in alternating order **90° hand-tight**.
- Set the torque wrench to 5 Nm.

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.



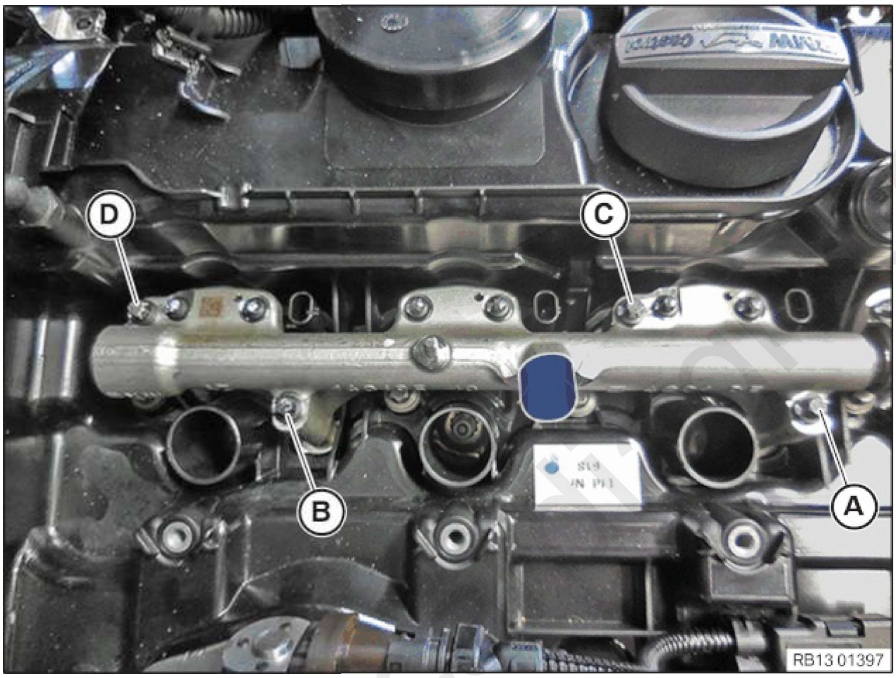
- Mark all bolts (1) to (6) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the screw (1) with an angle of rotation of 90° ±15°.
  - Tighten the screw (2) with an angle of rotation of 90° ±15°.
  - Tighten the screw (3) with an angle of rotation of 90° ±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).

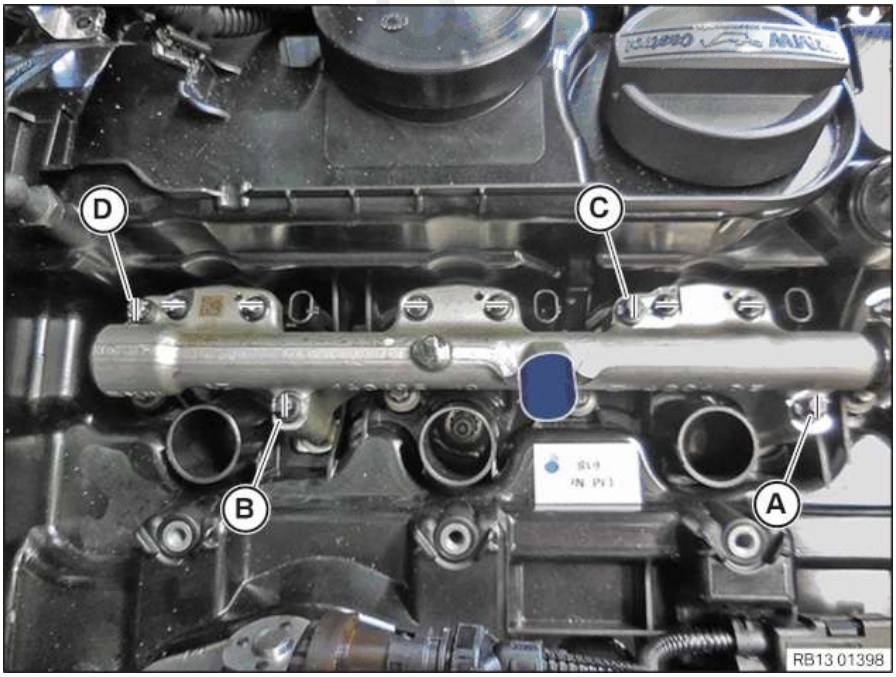
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

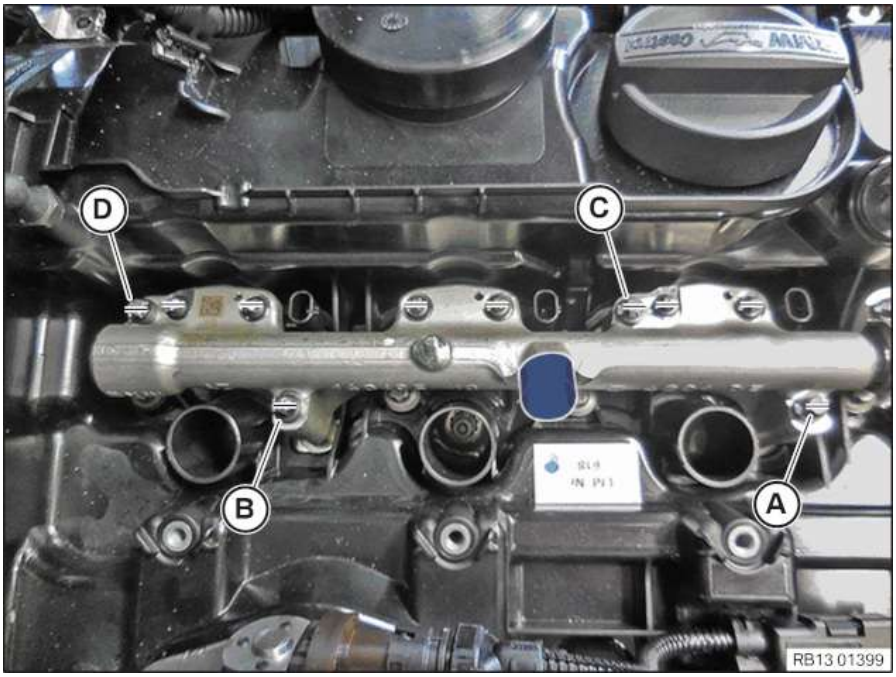
When assembling, it is essential to observe screwing sequences and tightening torques.

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.

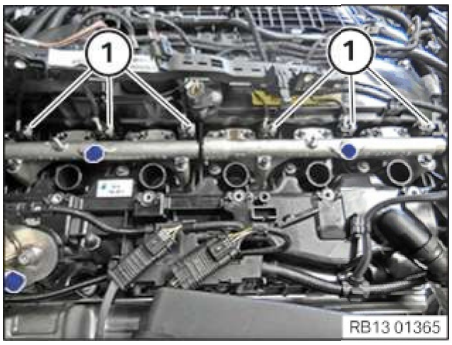


- Mark all bolts (A) to (D) with a vertical line (see figure).
- Tighten bolts (M6x70) (A) to (D) to a 90° angle of rotation.



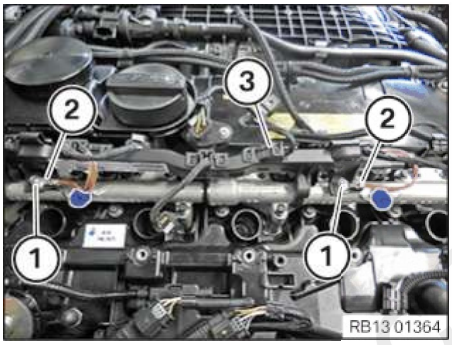
- Check if all bolts (A) to (D) have been tightened with a 90° angle of rotation.

  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).

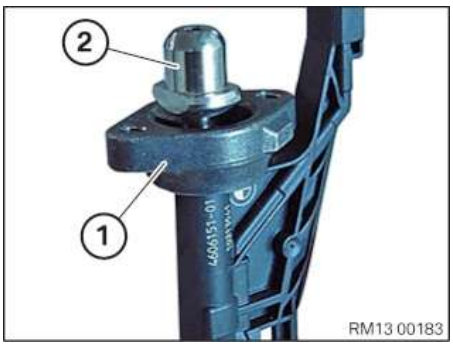
Ground cable to rail

M6			5 Nm

52 – Installing rail with injectors of cylinders 1 to 3

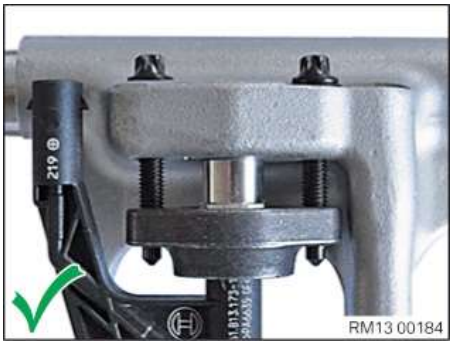
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



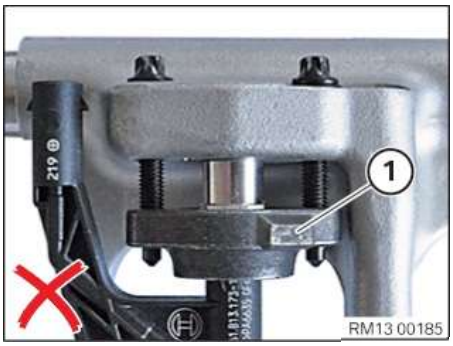
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If there is a cast lug on the holder** (1) **:** Make sure that the holder is installed in the correct position.

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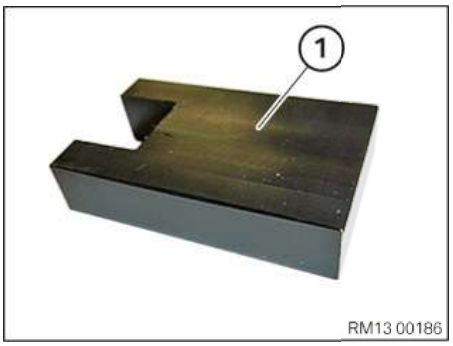
- Observe position of cast lug:

  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.



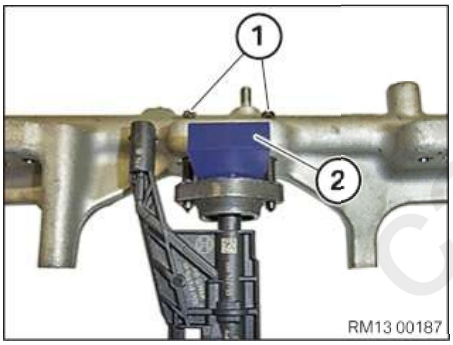
RISK OF DAMAGE

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.



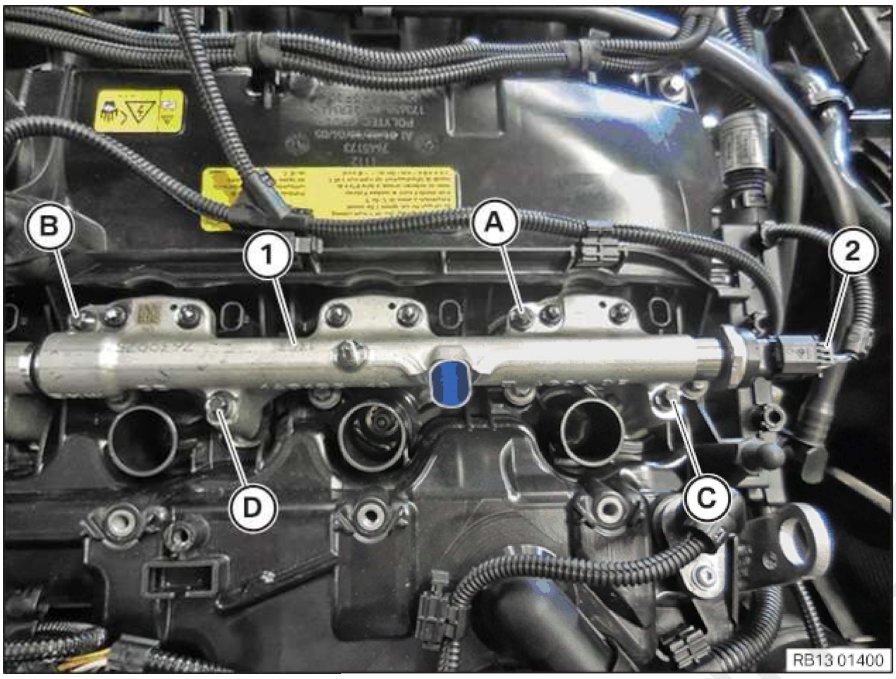
- Remove special tool 2 358 022(1) .
- Repeat this operation for all injectors.

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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.

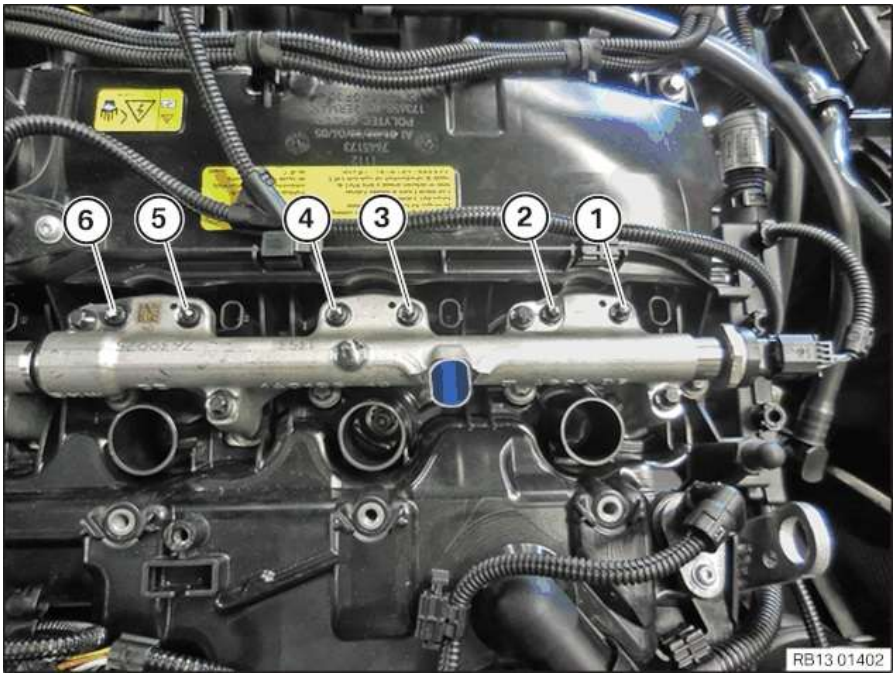
- Tighten screw (A) to 5 Nm.
- Tighten screw (D) to 5 Nm.
- Tighten screw (B) to 5 Nm.
- Tighten screw (C) to 5 Nm.
- Connect and lock the connector (2).

  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.

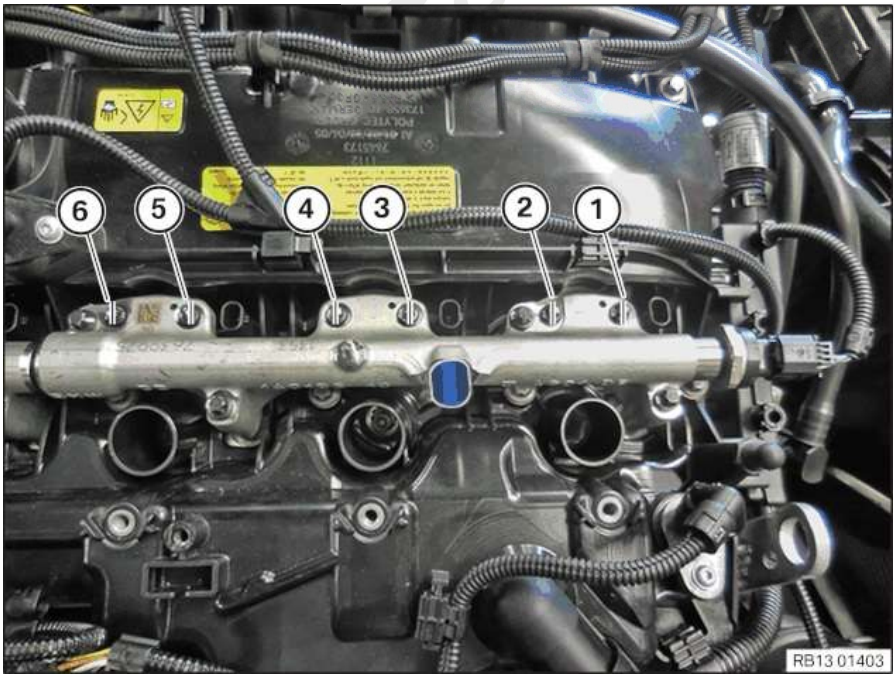
  Do not use a reversible ratchet or torque wrench.
- Hand-tighten screws (M5x30) in pairs ((1) with (2), (3) with (4), (5) with (6)) alternately by **90°**.
- Set torque wrench to 5 Nm.

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

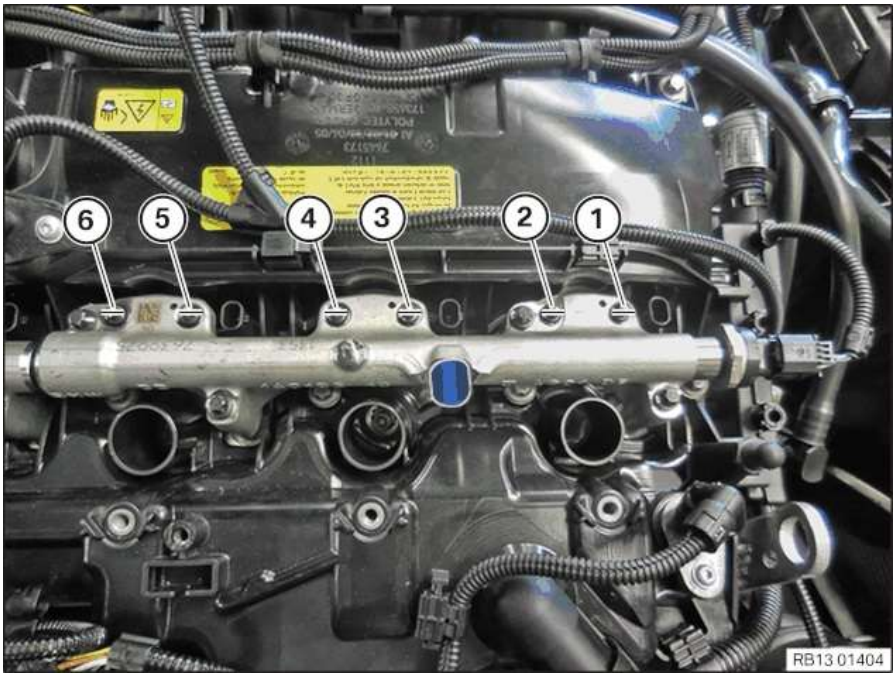
Non-observance of these requirements may result in leaks and damage.

- **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.



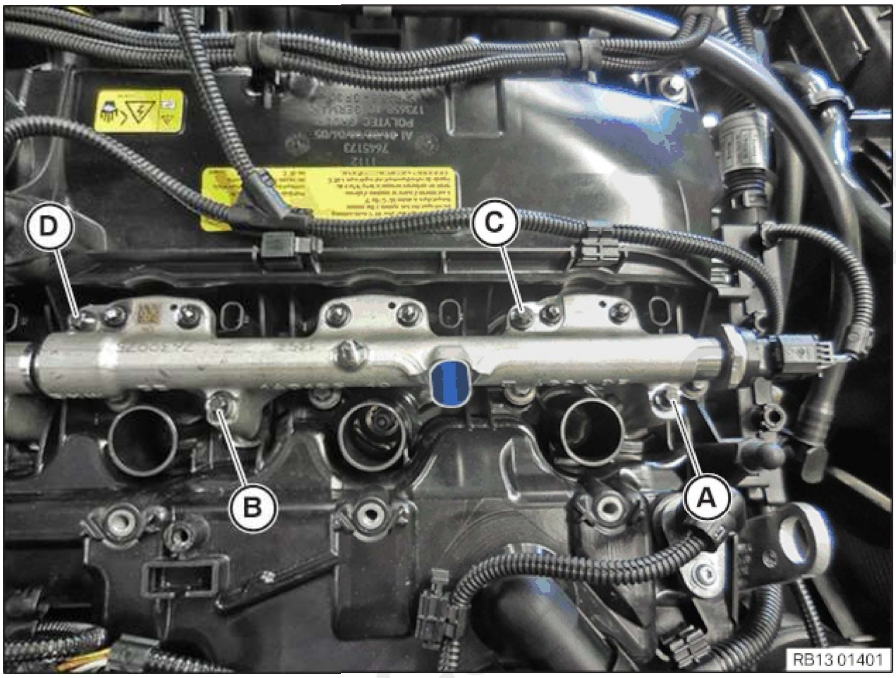
- Mark all bolts (1) to (6) with a line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the screw (1) with an angle of rotation of 90° ±15°.
  - Tighten the screw (2) with an angle of rotation of 90° ±15°.
  - Tighten the screw (3) with an angle of rotation of 90° ±15°.
  - 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.

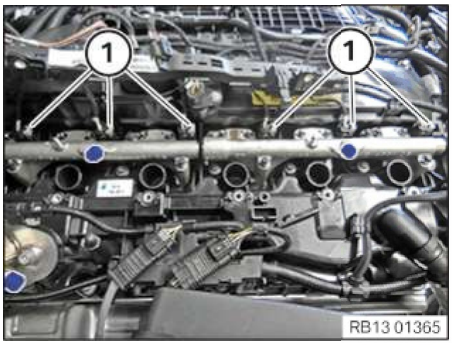


- Mark all the bolts (A) to (D) with a vertical line (see Figure).
- Tighten bolts (M6x70) (A) to (D) with an angle of rotation of 90°.



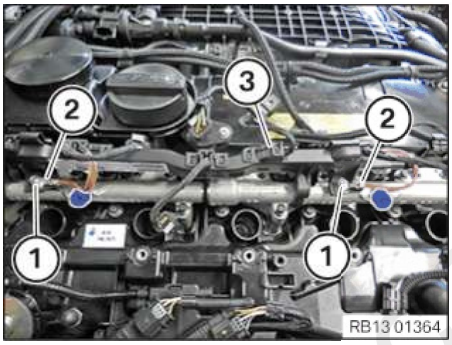
- Check whether all screws (A) to (D) have been tightened with an angle of rotation of 90°.

  All marks (lines) must be horizontal (see figure).



- Connect and lock all the connectors (1) to the injectors.

  All connectors (1) must engage audibly.

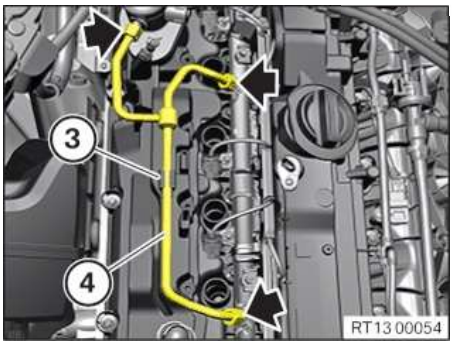


- Thread the cable channel (3) in and install.
- Thread in ground cable (2) and install.
- Tighten nuts (1).

Ground cable to rail

M6			5 Nm

53 – Installing high pressure line between rail and high pressure pump

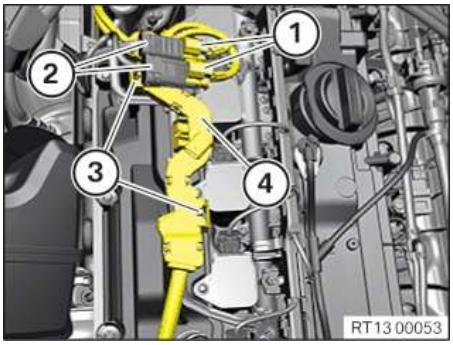


- Insert the high pressure line (4) into the holder (3) and install.
- Tighten union nuts (arrows) with the special tool .

High pressure line between rail and high pressure pump

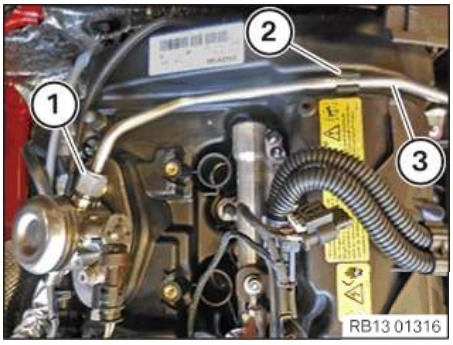
M14x1,5		Tightening torque	33 Nm

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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.

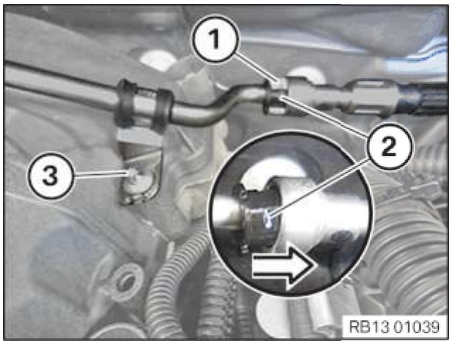
54 – Installing fuel delivery line



- 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

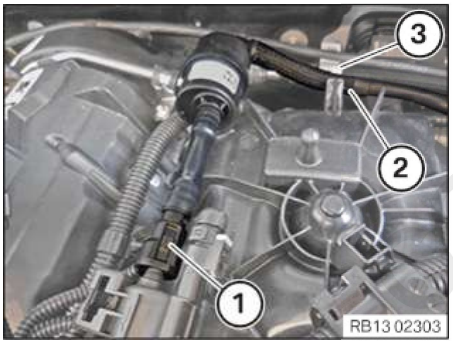
M14		Tightening torque	31 Nm



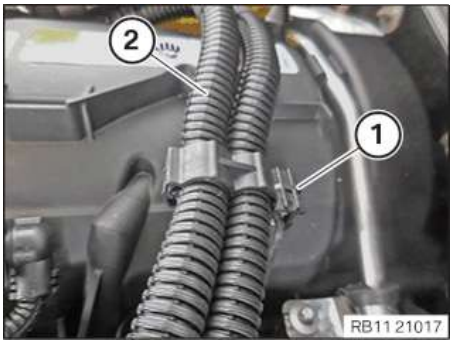
- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure clamps (1).
- Tighten down screw (3).

Fuel line to cylinder head cover

6x18		Tightening torque	6,5 Nm

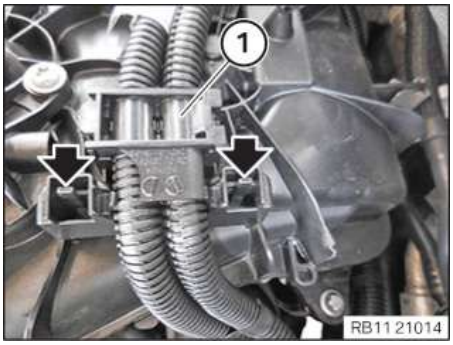


- Insert and install the tank ventilation line (2).
- Lock (1) must engage audibly.
- Secure the tank ventilation line (2) to the clamp (3).



- Insert and install wiring harness section (2) for injectors and ignition coils.
- Secure clamps (1).

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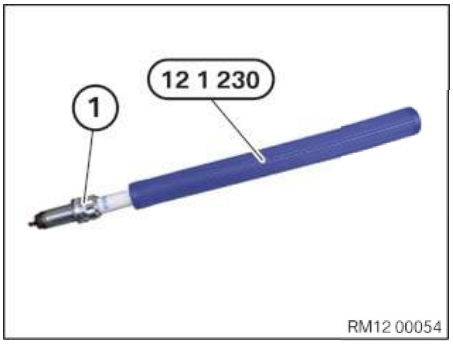


- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

55 – 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

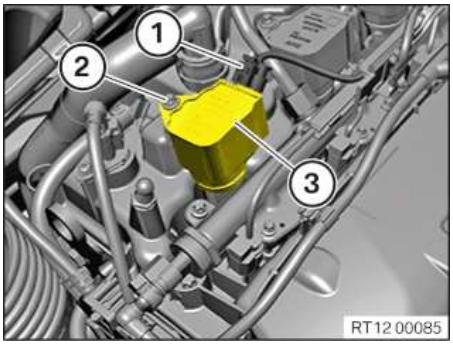
M12x1.25		Tightening torque	23 Nm

56 – Install all ignition coils

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Install ignition coil.**



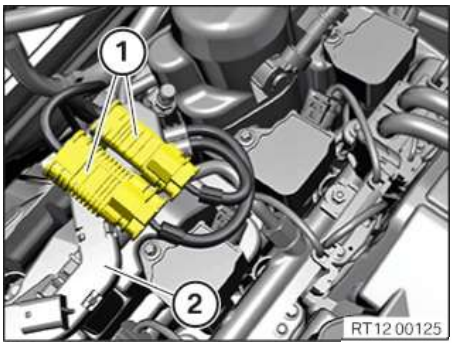
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

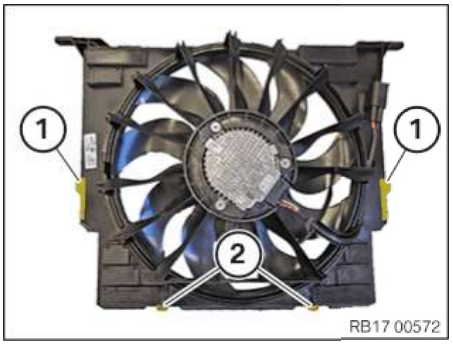
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

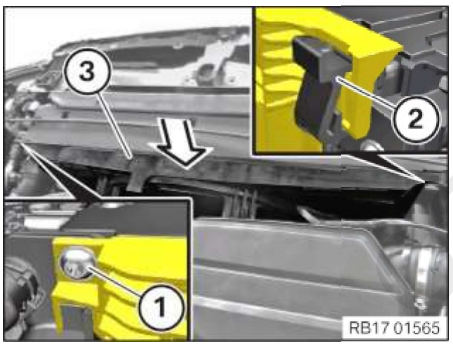


- Connect the connector (1) of the front oxygen sensor and the monitoring oxygen sensor on the cable shaft (2).

57 – Install fan cowl



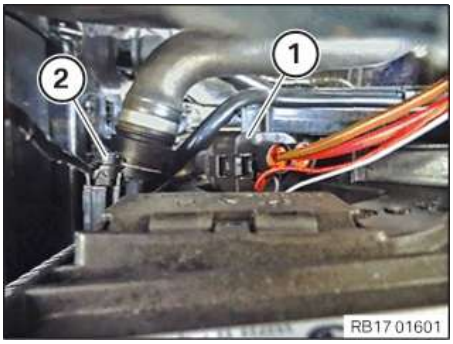
- Feed guides (1) into the radiator.
- Feed guides (2) into the charge air cooler.



- 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

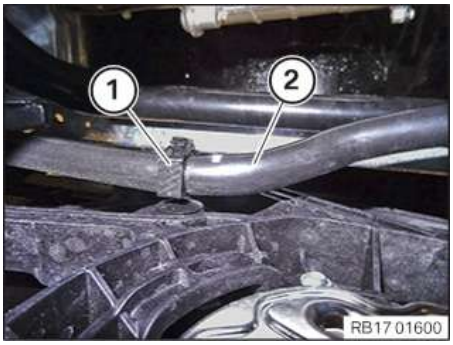


- Connect connectors (2) and lock.

  The connector (2) must engage audibly.
- Connect connectors (1) and lock.

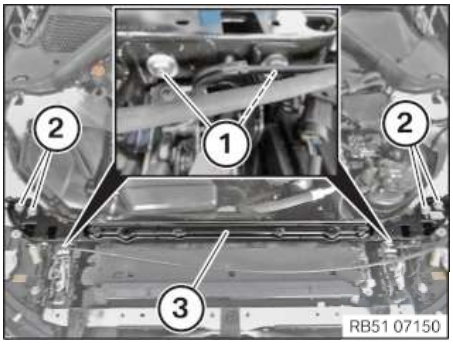
  The connector (1) must engage audibly.

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- **If installed:** Secure the transmission oil line (2).
  Insert and install the transmission oil line (2).
  Lock holder (1).

58 – Install the rear top cross connection



- Guide in and position the top rear cross connection (3).
- Tighten the screws (1).

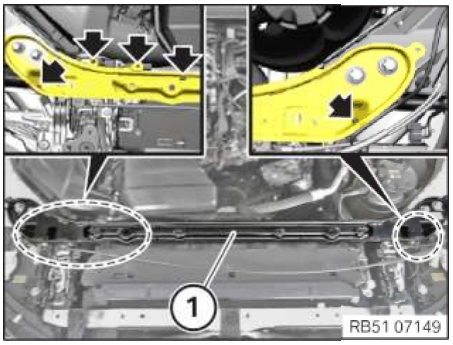
Top rear cross connection to bonnet catch support

Flat-head screw M6x20		Tightening torque	11,8 Nm

- Renew screws (2).
  Parts: Bolts
- Tighten the screws (2).

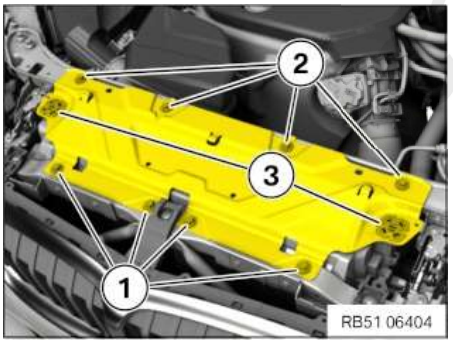
Rear top cross connection to wheel arch carrier support

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).

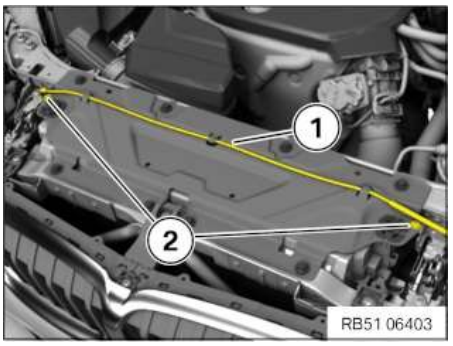
59 – Installing the top cross connection



- 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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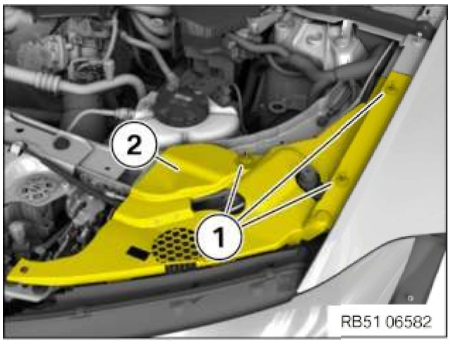
- Clip in the housing for the coupling of the Bowden cables (1).

60 – 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.

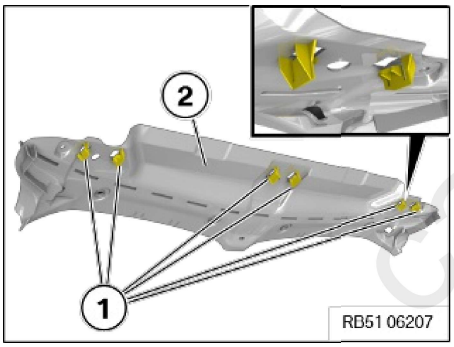
▶ Installing the cover in the engine compartment on top partially



- Install the cover in the engine compartment on top (2).
- Secure expanding rivet (1).

61 – Installing cover for engine compartment centre

Check



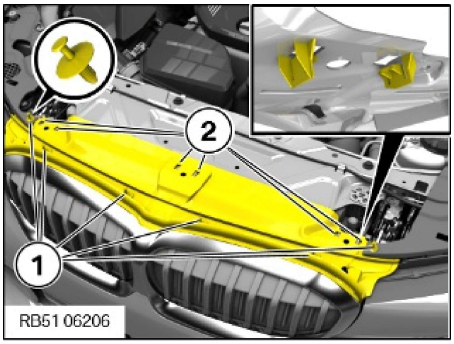
- Check latch mechanisms (1) of cover for engine compartment centre (2) for damage.

Result

» The latch mechanism (1) is damaged.

Measure

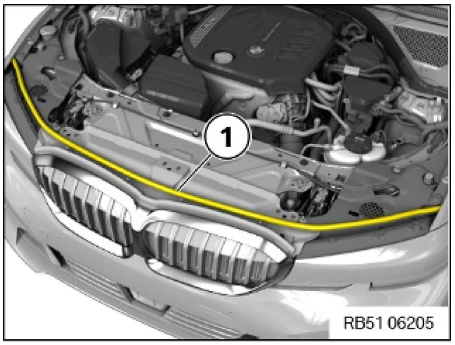
- Renew cover for engine compartment centre (2).



- 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).

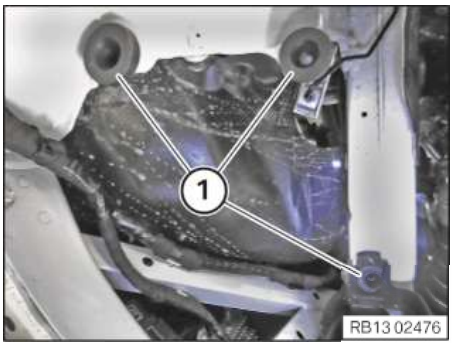
62 – Install the seal for the front bonnet

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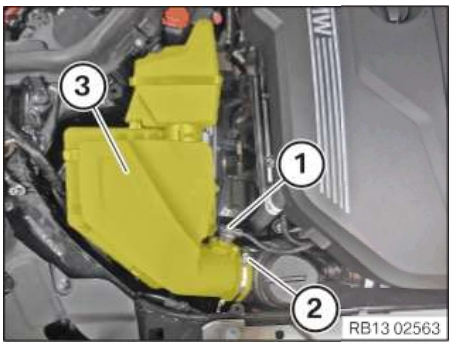


- Position the bonnet seal(1) and connect it on the mounting on the bumper and on the headlights.

63 – 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.

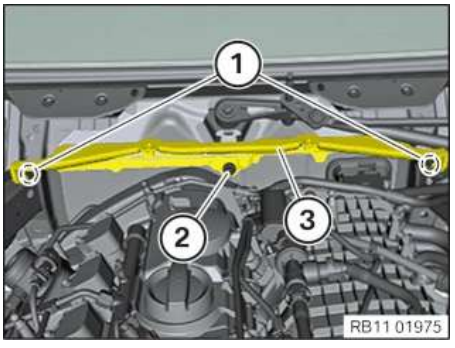
  The connector (1) must engage audibly.

64 – Disconnecting all battery earth leads



- See additional information.

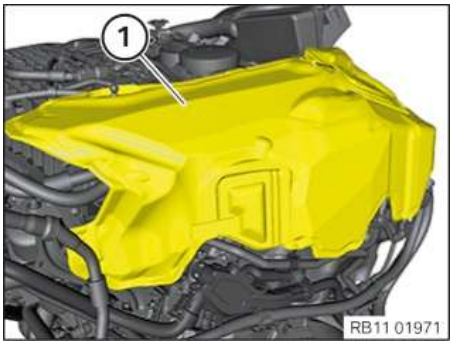
65 – Installing centre bulkhead lower section



- Position the centre bulkhead lower part (3).
- Tighten nut (2) and screws (1).

66 – Installing acoustic cover at rear

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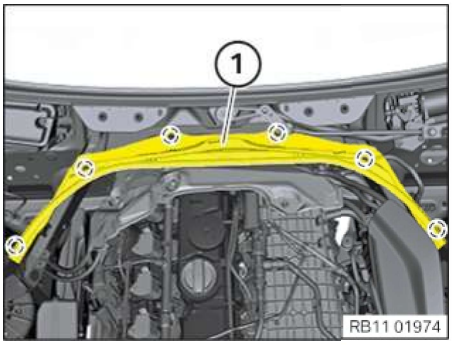


- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

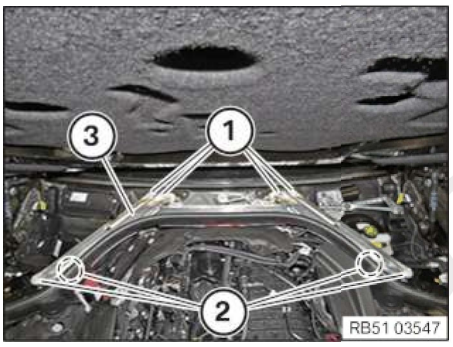
67 – Installing the centre bulkhead upper part



- 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 °

68 – Installing cowl panel cover

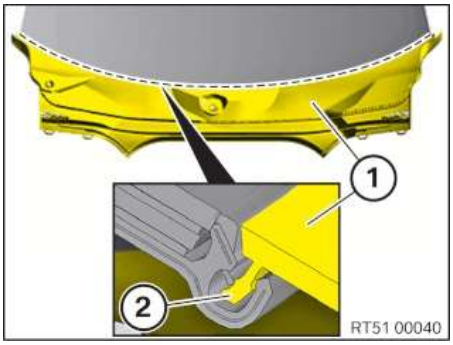
RISK OF DAMAGE

Damage caused by water ingress into the vehicle.

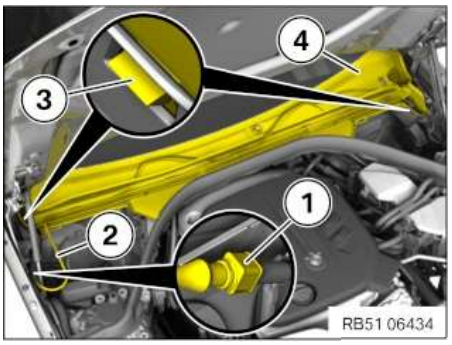
Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

- Ensure correct installation of the components.
- Only use undamaged components.

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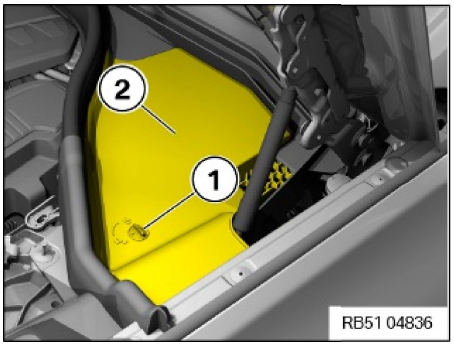


- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



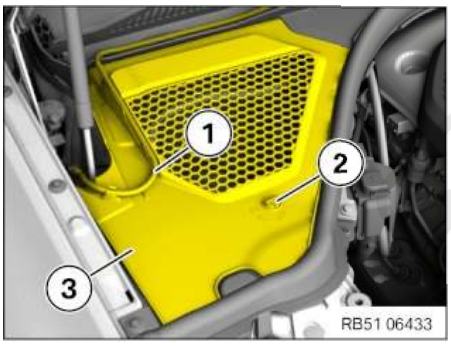
- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

69 – Install the cover of the engine compartment on the rear left



- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

70 – 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.

71 – Installing both wiper arms

NOTICE

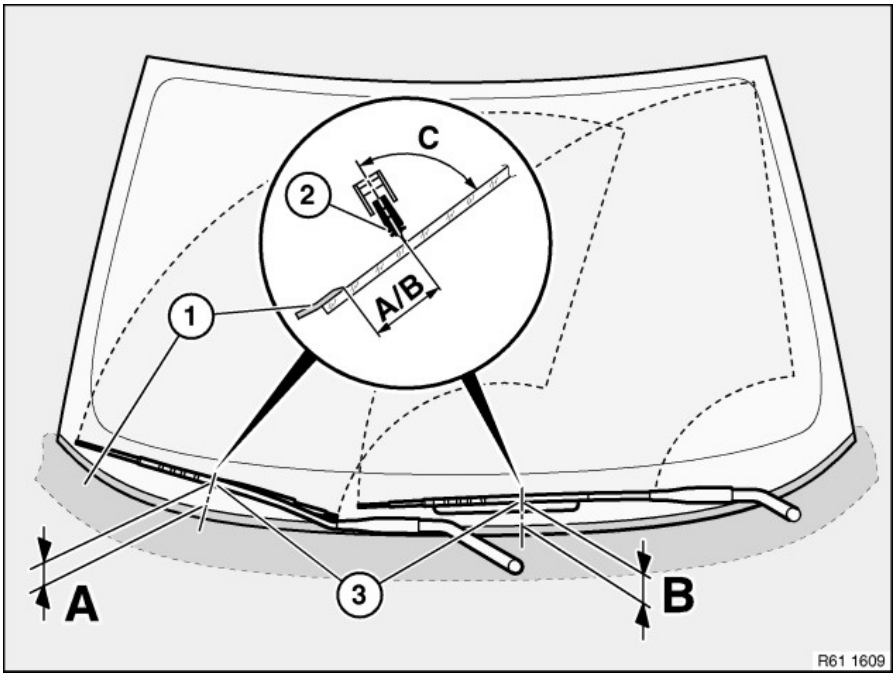
Description is for left component only. Procedure on the right side is identical.

▸ **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.

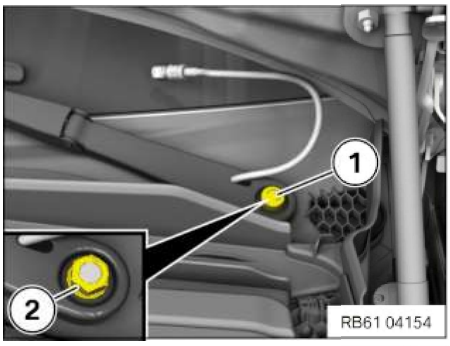
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- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

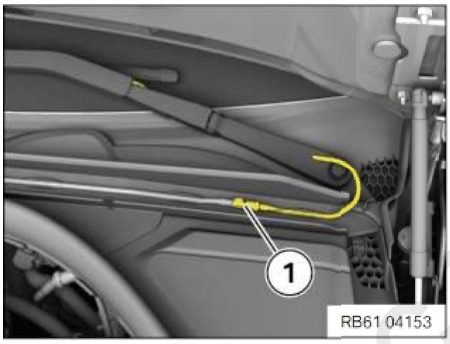


- Tighten nut (2).

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.

72 – Install acoustic cover

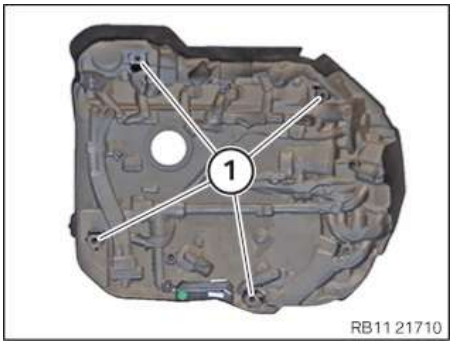
RISK OF DAMAGE

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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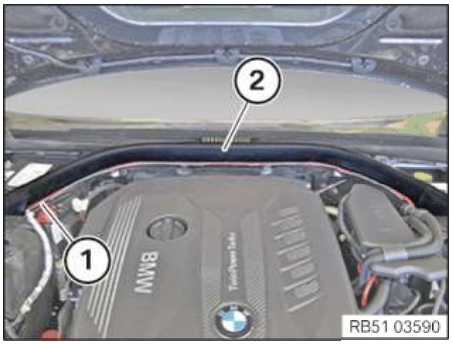


- Check the rubber mount (1) for correct fit in the acoustic cover.



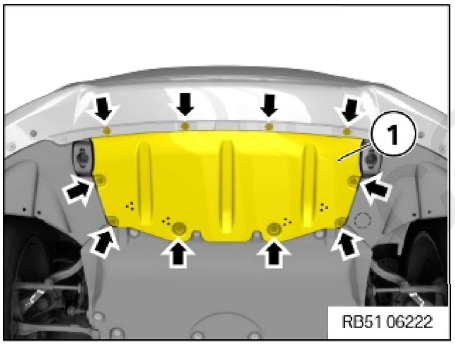
- Install acoustic cover (1) and fix in the rubber mounts (marks).

73 – 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.

74 – Installing the front underbody protection



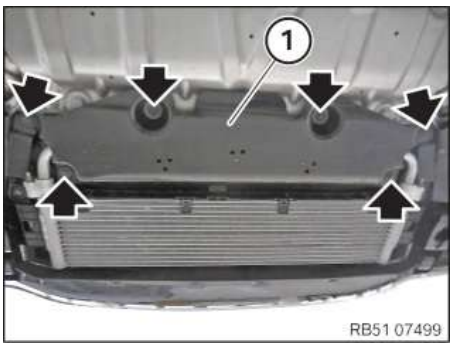
- **Version 1:**

  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:**

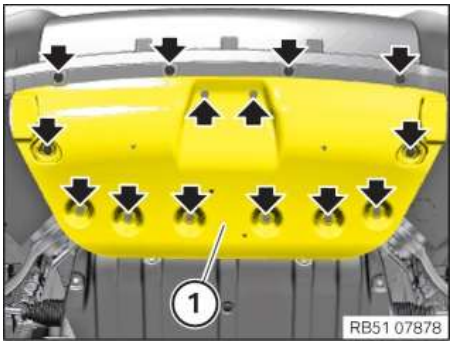
  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

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- **Version 3:**

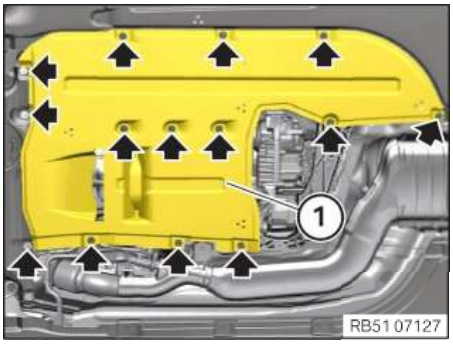
  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

75 – Installing underbody protection at rear



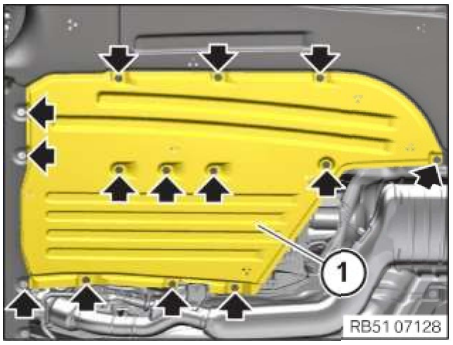
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

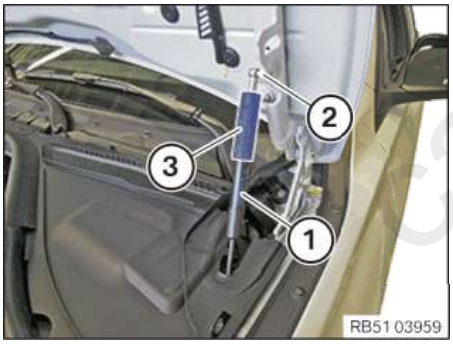
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

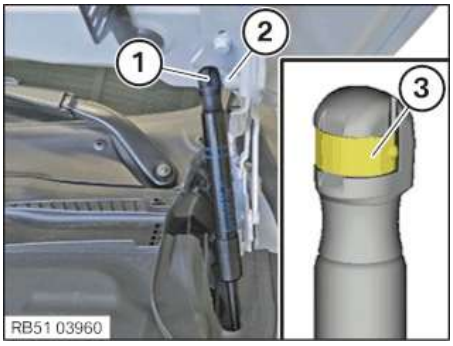
Underbody protection

Hexagon screw		Tightening torque	3 Nm

76 – 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 313945

M6		Tightening torque	8 Nm

Test gauge to basic carrier — Used in step 313945

M6		Tightening torque	8 Nm

VANOS central valve to camshaft — Used in step 4142

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 44

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Engine oil cooler to bumper support — Used in step 46

M6X25		Tightening torque	8 Nm

Cover, front bottom on side — Used in step 46

Hexagon screw for thermoplastic		Tightening torque	3 Nm

Cylinder head cover to cylinder head — Used in step 47

M6X30		Jointing torque	8 Nm

Cylinder head cover to cylinder head — Used in step 47

M6X30		Tightening torque	11 Nm

Auxiliary coolant pump holder to cylinder head — Used in step 47

M6		Tightening torque	7 Nm

Standard screw connection M6 — Used in step 47

M6			8 Nm

Differential pressure sensor to holder — Used in step 47

TS6X18		Tightening torque	3,5 Nm

Holder, positive battery cable to cylinder head cover — Used in step 47

6X18		Tightening torque	6 Nm

High pressure pump to high pressure pump flange — Used in step 49

M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

Ground cable to rail — Used in step 5152

M6			5 Nm

High pressure line between rail and high pressure pump — Used in step 53

M14x1,5		Tightening torque	33 Nm

Fuel delivery line to high pressure pump — Used in step 54

M14		Tightening torque	31 Nm

Fuel line to cylinder head cover — Used in step 54

6x18		Tightening torque	6,5 Nm

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Spark plugs			Used in step 55
M12x1.25		Tightening torque	23 Nm

Ignition coil			Used in step 56
Screw		Tightening torque	8 Nm

Fan cowl with electric fan on radiator			Used in step 57
TS6x20		Tightening torque	6,5 Nm

Top rear cross connection to bonnet catch support			Used in step 58
Flat-head screw M6x20		Tightening torque	11,8 Nm

Rear top cross connection to wheel arch carrier support			Used in step 58
M10x20 screw	Renew screw.	Jointing torque	56 Nm
		Angle of rotation	90 °

Cross connection, top			Used in step 59
M8x20		Tightening torque	28 Nm

Cross connection, top			Used in step 59
M6x20		Tightening torque	11,8 Nm

Clean air pipe to upper section of intake filter housing			Used in step 63
Clamp		Tightening torque	3 Nm

Bulkhead upper part to bottom bulkhead			Used in step 67
		Tightening torque	3 Nm

Tension strut on bulkhead			Used in step 67
M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome			Used in step 67
Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

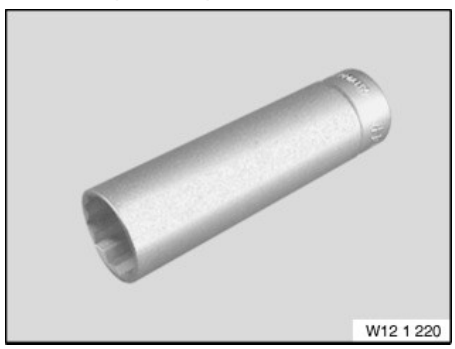
Windscreen wiper arm			Used in step 71
Combination hexagon nut		Tightening torque	35 Nm

Underbody protection front			Used in step 74
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Underbody protection			Used in step 75
Hexagon screw		Tightening torque	3 Nm

Overview of Special Tools

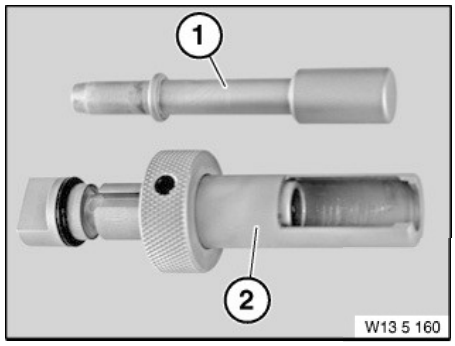
0 495 560 (12 1 220) Socket



Common		Used in step 2055
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)	

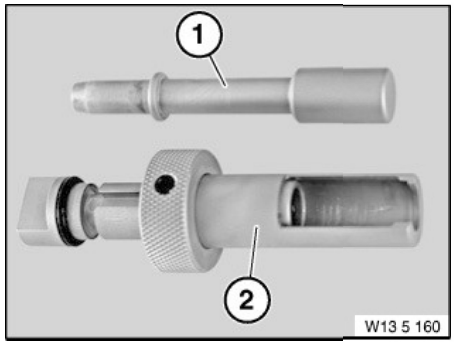
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0 496 567 (13 5 161) Fastener



Common	Used in step 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	

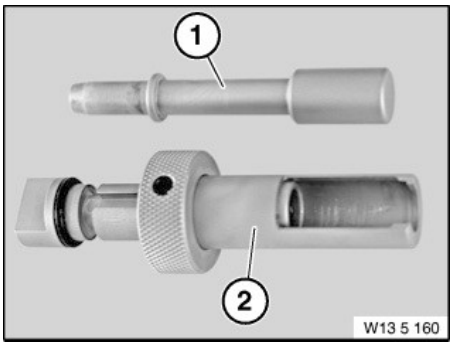
0 496 568 (13 5 162) Fastener



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



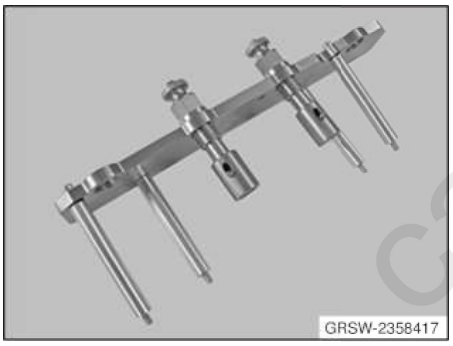
Common Used in step 22

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	

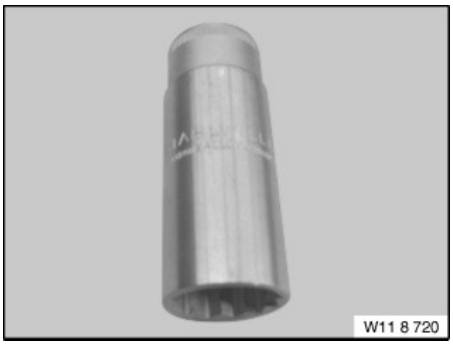
2 358 417 Device



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)

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)

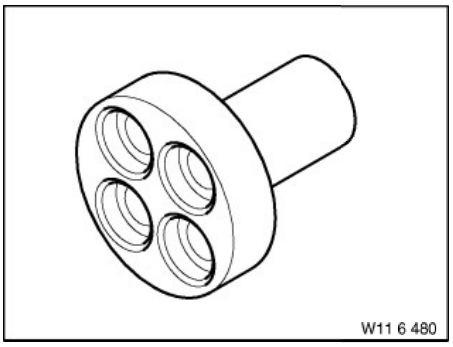
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2 360 895 Pin wrench



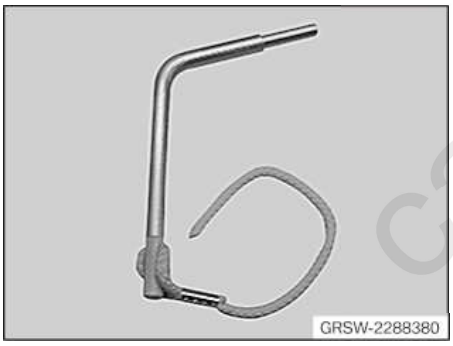
Common	Used in step 2648
Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 493 380 (11 6 480) Connector



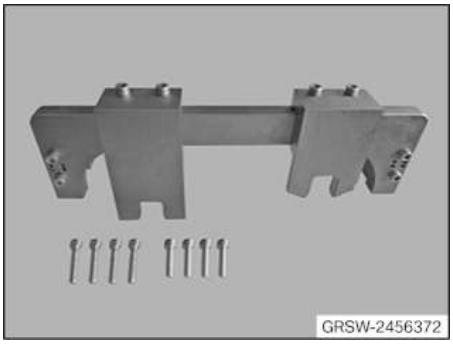
Common	Used in step 31434549
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

2 288 380 Locating stud



Common	Used in step 314345
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 3138394345
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 313845
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 33364142
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 33364142
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 4043
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 50
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 50
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)

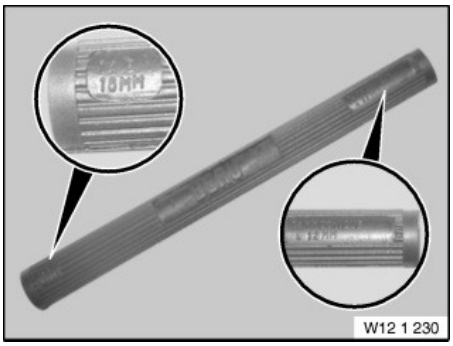
2 358 022 Gauge



Common	Used in step 5152
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 55
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 71
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	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	164
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	164
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	164
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61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting battery earth lead	164
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61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting battery earth lead	164
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	49

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11 36 046 Removing and installing/replacing the intake and exhaust camshaft adjusters

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

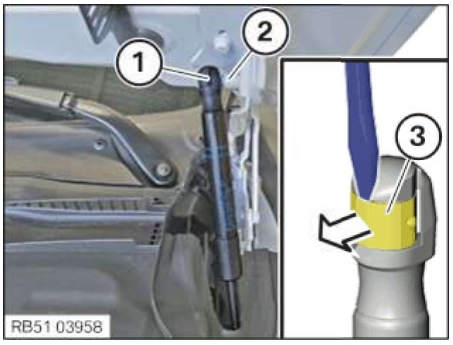
Engine compartment lid is open.

CAUTION

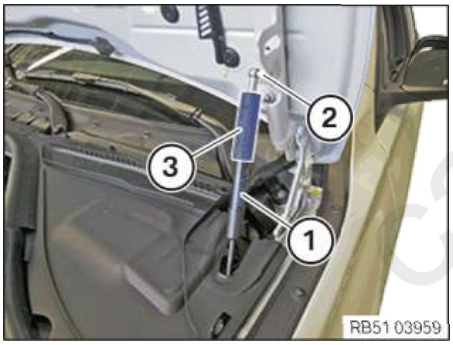
Shutting bonnet or tailgate.

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.

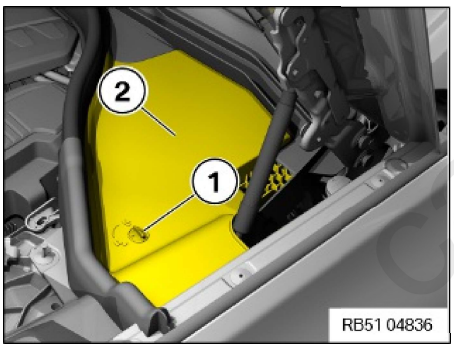
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- 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.



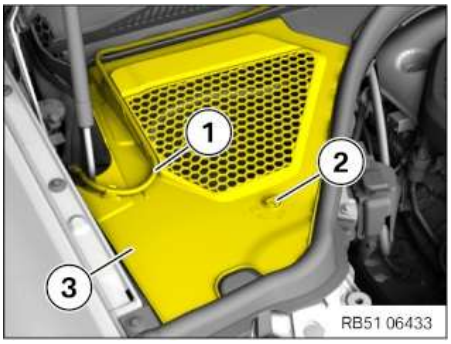
- Release the acoustic cover (1) towards the top from the rubber mounts (marks).

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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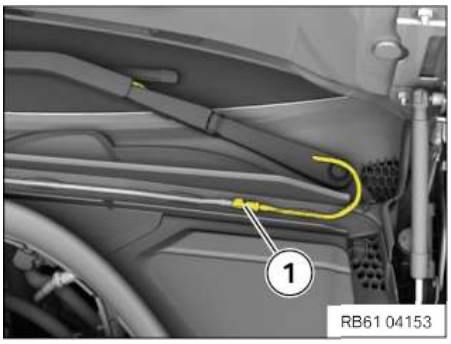
▸ **Remove the wiper arm**

RISK OF DAMAGE

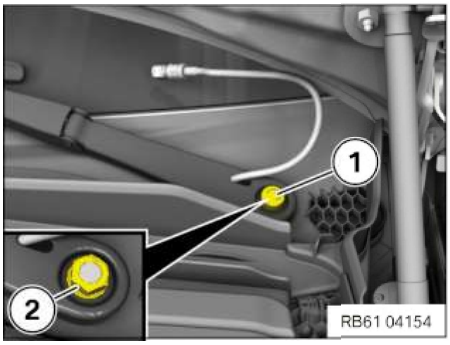
Damage to wiper console

While removing the wiper arms without using special tool, the wiper console can break.

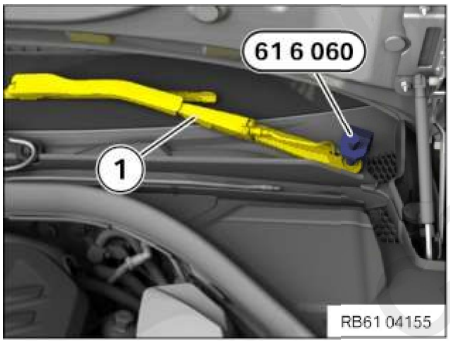
- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.



- Disconnect the windscreen wash hose(1) at the separation point and remove from the cowl guide.

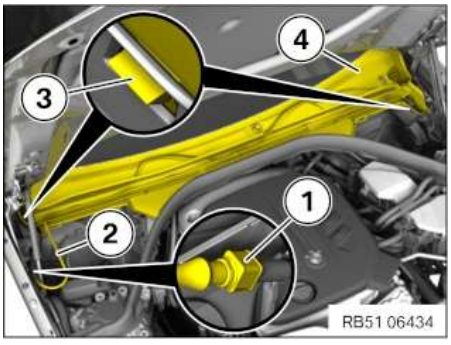


- Remove the protective cap (1).
- Loosen nut (2).



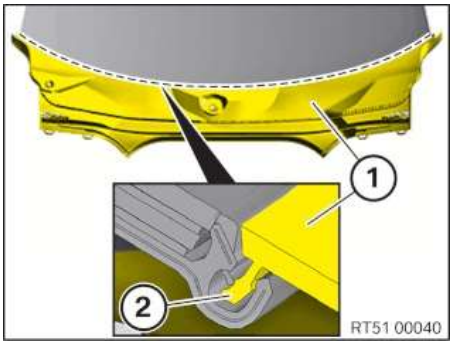
- Pull off the wiper arm (1) using special tool .

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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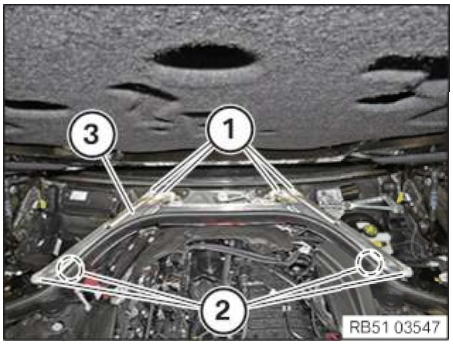


- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

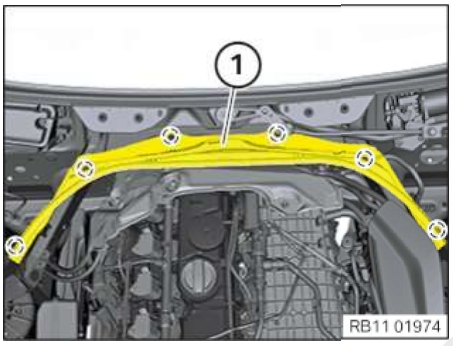
9 – Removing the centre bulkhead upper part

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.



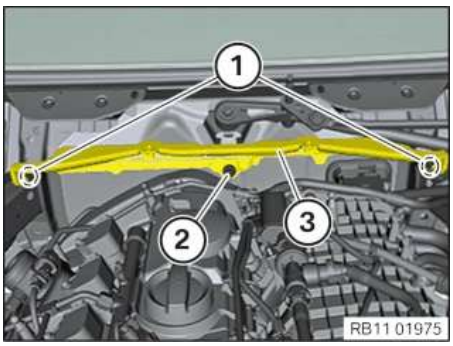
- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

10 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

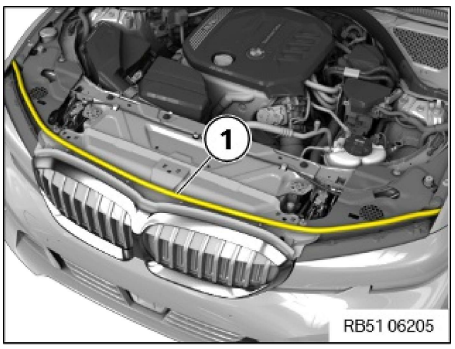
11 – Removing the centre bulkhead lower section



- Loosen screws (1).
- Loosen nut (2).
- Remove the centre bulkhead lower part (3).

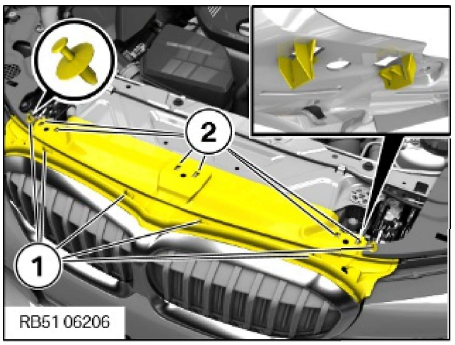
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12 – Remove the seal for the bonnet in front



- Pull off front bonnet seal (1) upwards.

13 – Removing the centre engine compartment cover



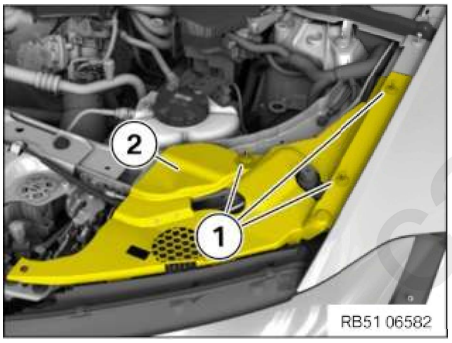
- Detach all expanding rivets (1).
- Release the cover of the centre engine compartment with the latch mechanisms (2) .
- Feed the cover for the centre engine compartment out to the rear.

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**



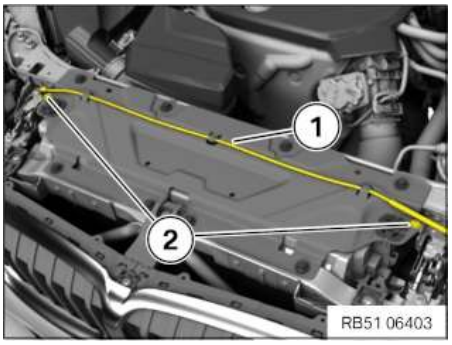
- Loosen the expanding rivet (1).
- Remove the cover in the engine compartment on top (2) partially.

15 – Removing the top cross connection

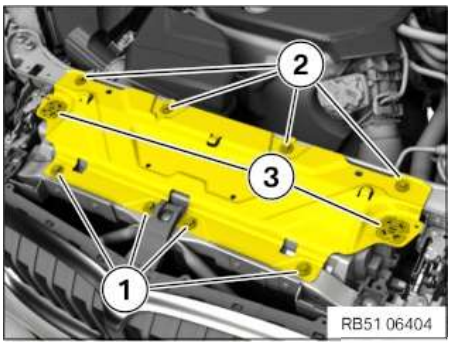


- Release the housing for the coupling of the Bowden cables (1) from the body.

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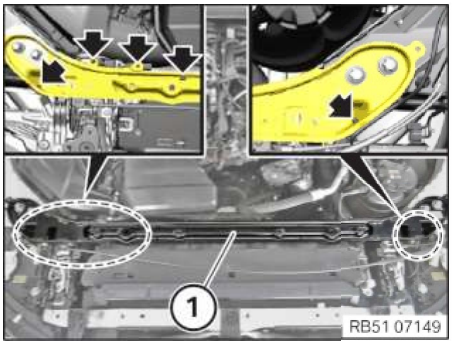


- Detach Bowden cable (1) at the top cross connection.
- Loosen screws (2).

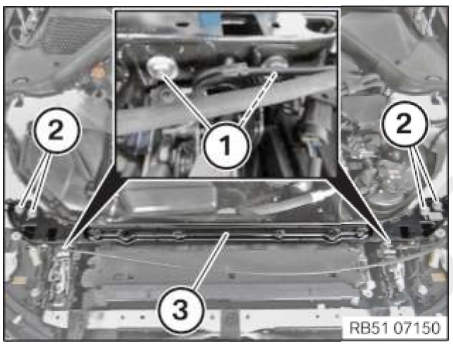


- Loosen screws (1) and (2).
- Remove the top cross connection with the holders(3) towards the top.

16 – Remove the rear top cross connection



- Release the clips (arrows) in the marked areas from the top rear cross connection (1).

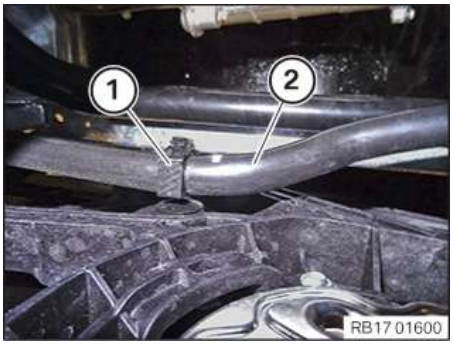


- Loosen screws (1).
- Loosen screws (2).
- Guide out and remove top rear cross connection (3).

17 – Remove fan cowl.

TECHNICAL INFORMATION

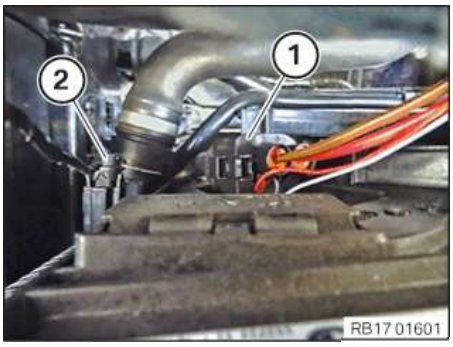
- When the engine is stopped after the end of the journey, it may be necessary to run the electric fan. In rare cases, operation of the electric fan can last up to 11 min. This protects the components. In this case, replacing the electric fan will not remedy the problem!



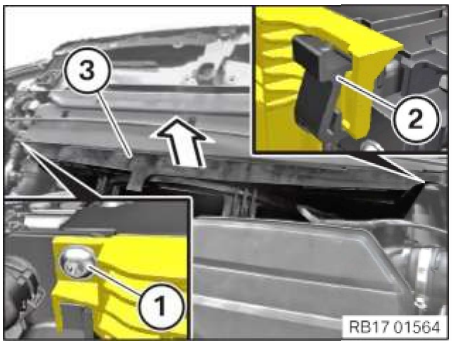
- **If installed:** Release transmission oil line (2).

  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.

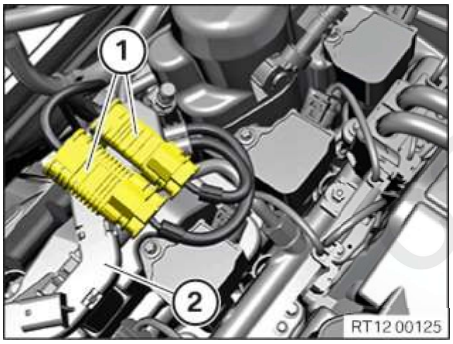
- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

RISK OF DAMAGE

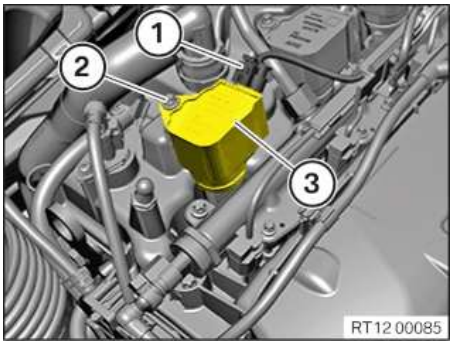
Electrostatic discharge.

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

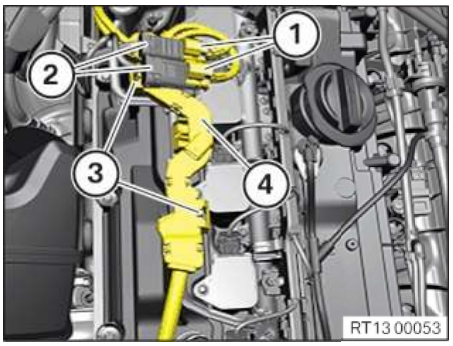
On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

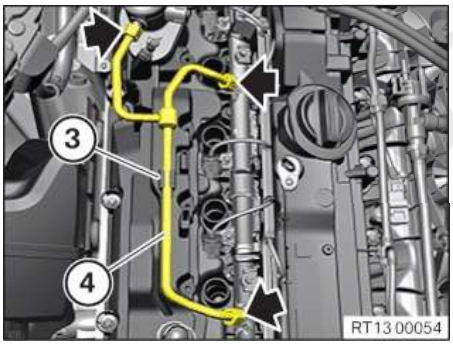
- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

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

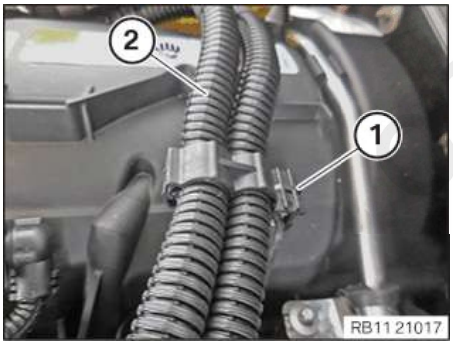
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

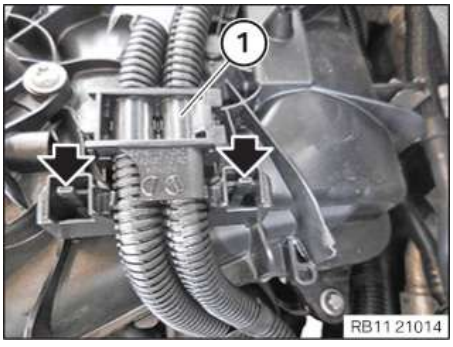
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

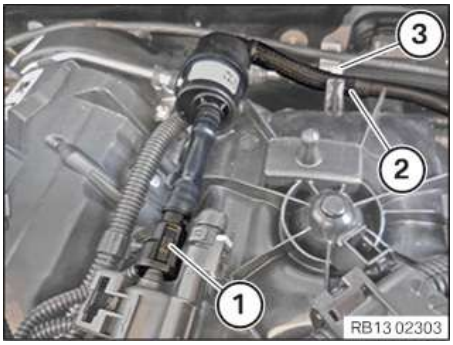
Reset special tool in early to avoid bending pressure lines.



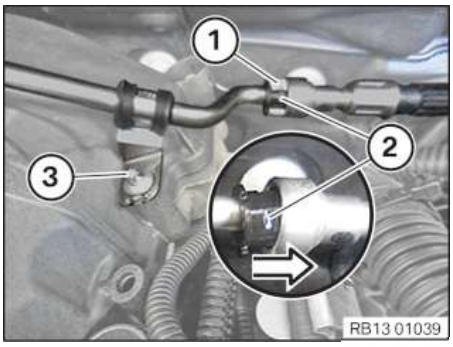
- Loosen clamp (1).
- Guide out wiring harness section (2) for the injectors and ignition coils and place it aside.



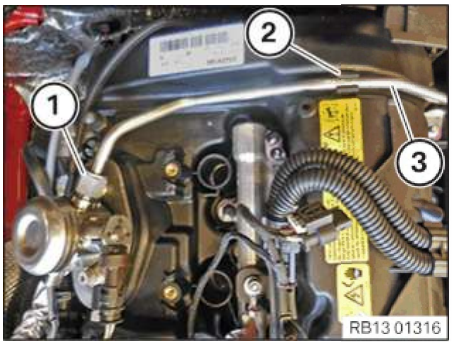
- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.



- 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

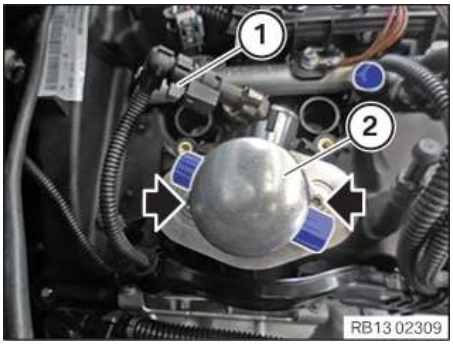
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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.

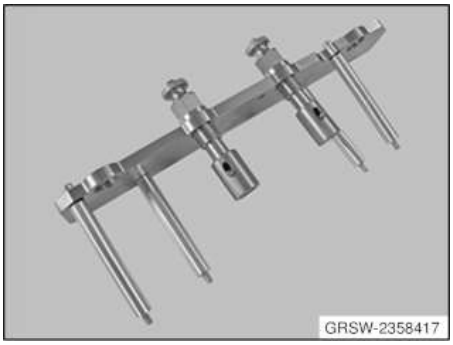
Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.



- Prepare special tool .

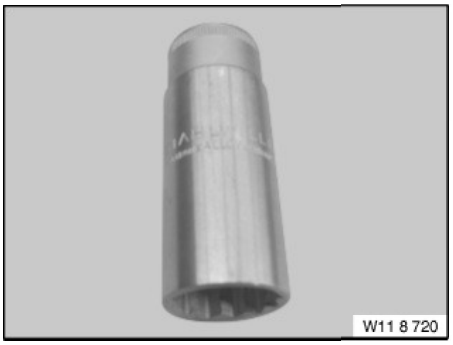
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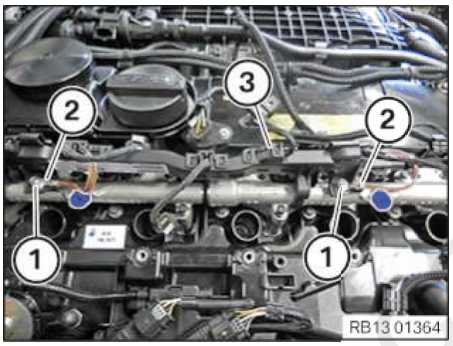
- Prepare special tool 2 358 417.



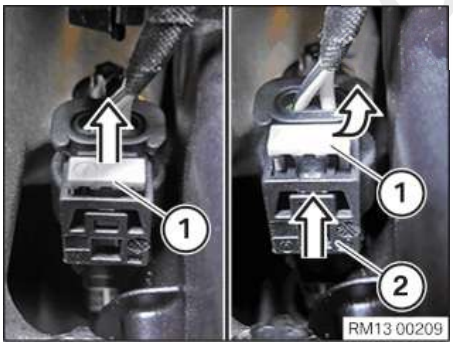
- Prepare special tool .



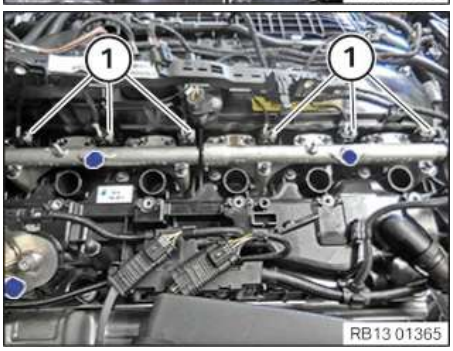
- Prepare special tool 0 496 106 (11 8 720).



- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.

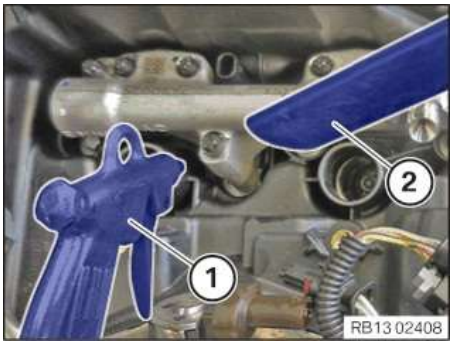


- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull out the connector (2) from the injectors.



- Unlock and release all connectors (1) of the injectors.

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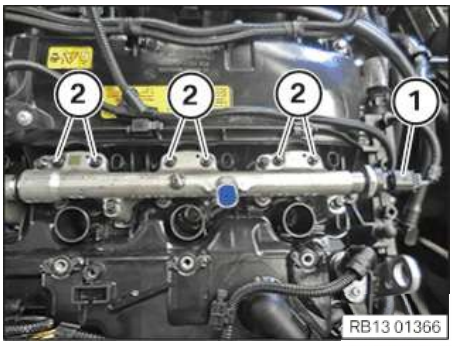


TECHNICAL INFORMATION

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

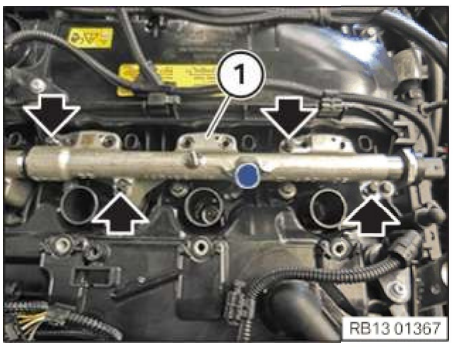
- Before releasing the high pressure lines: Blow out the injector shafts with an air gun(1) with less pressure.
- Simultaneously, draw off the dirt particles with an **explosion proof** vacuum cleaner (2).



- 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.

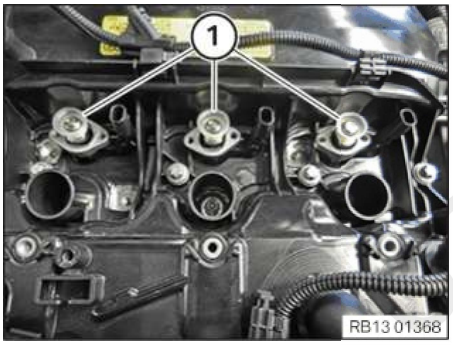


- Unscrew the screws (M6x30) (arrows).

  The screws may not be reused!
- Renew screws.

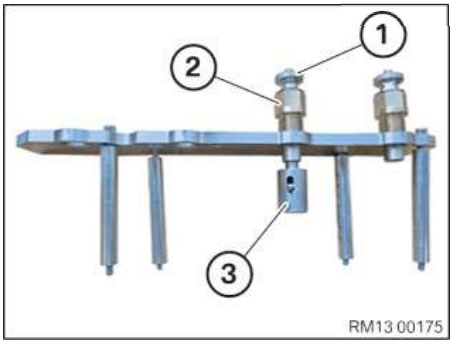
  Parts: Screws (M6x30)
- Remove rail (1) in upward direction.

  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.

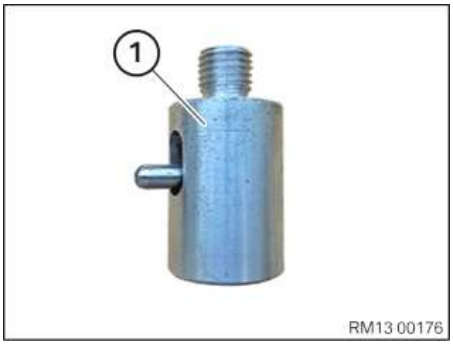
- Twist the injectors with a maximum torsional movement of 13 Nm.
- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use the special tool 2 358 417to remove the injectors.

  The special tool 2 358 417 is used to ensure that the tensile force is not exceeded.

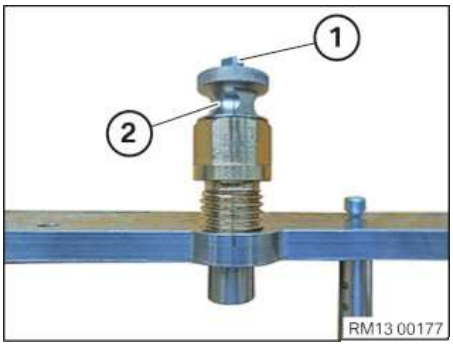
  Special tool 2 358 417 consists of:

  - **(1)** Threaded sleeves
  - **(2)** Pull-out thread (left-hand thread)
  - **(3)** Mounting for the injectors

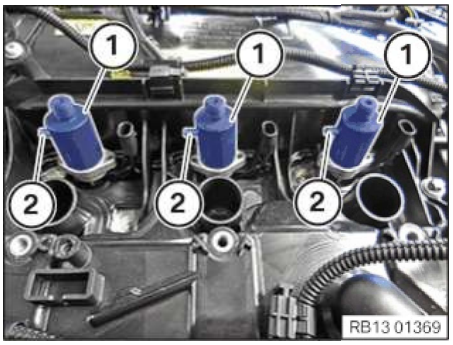
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- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.

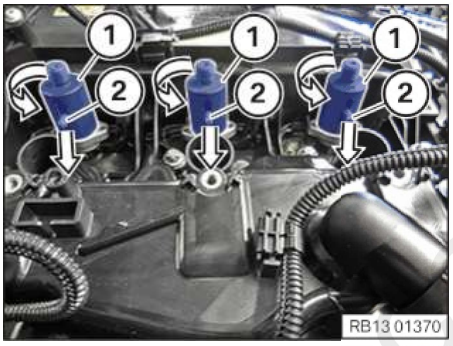


- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.

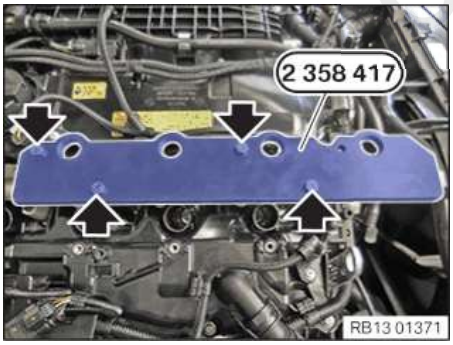


- Install all fixtures (1) for the injectors.

  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

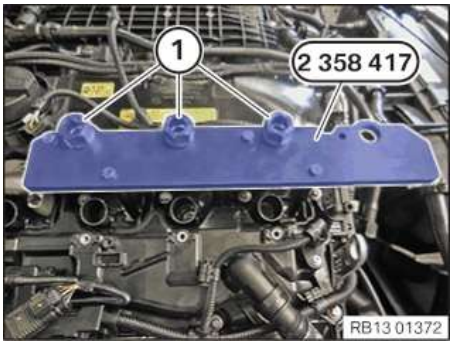
Damage to injectors.

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).

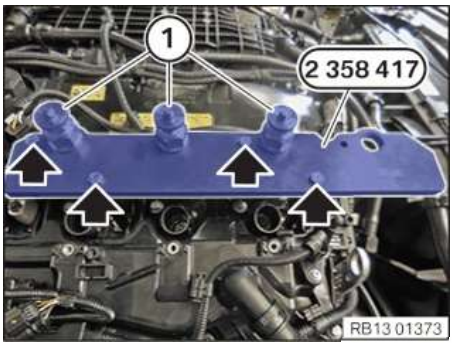
cardiagn.com



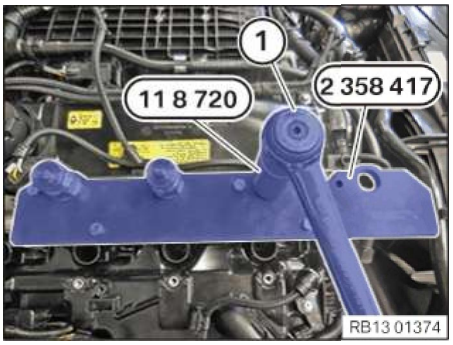
TECHNICAL INFORMATION

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.

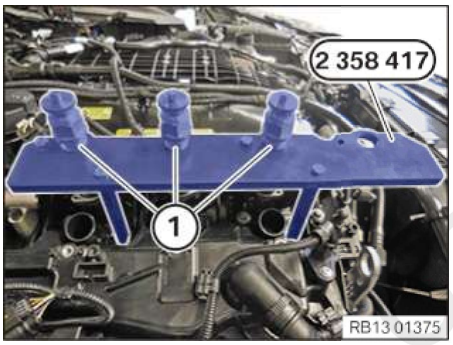


- Adjust torque wrench to 13 Nm **clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720)until the injector is pulled out.

TECHNICAL INFORMATION

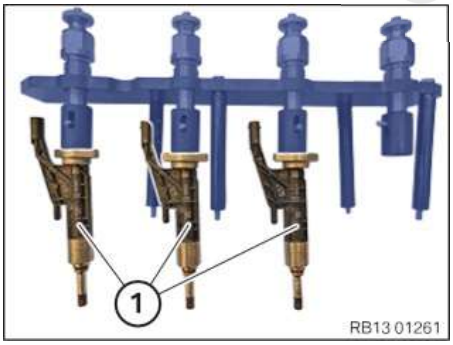
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

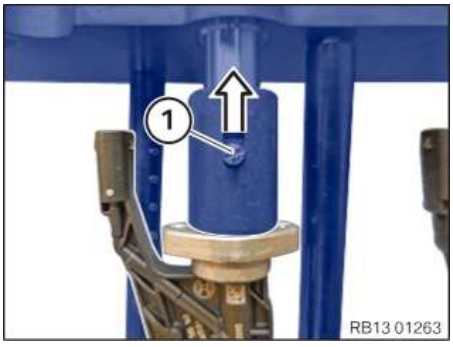


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  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.

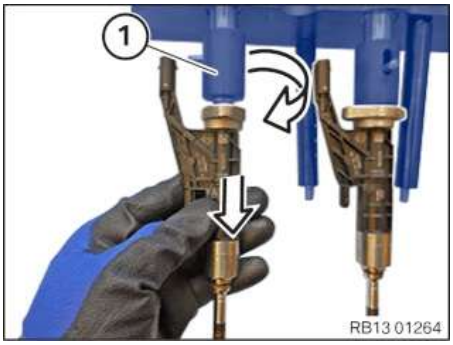


NOTICE

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.

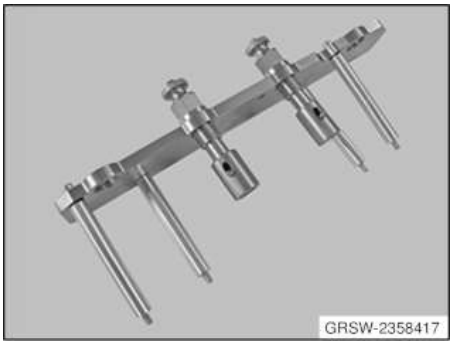
Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.



- Prepare special tool .

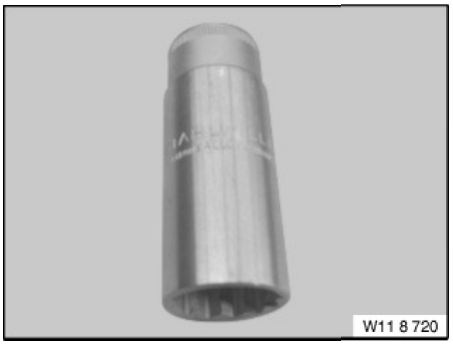
cardiagn.com



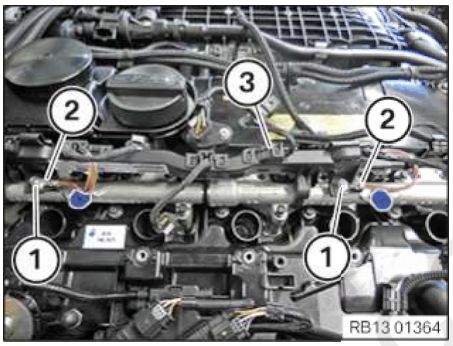
- Prepare special tool 2 358 417.



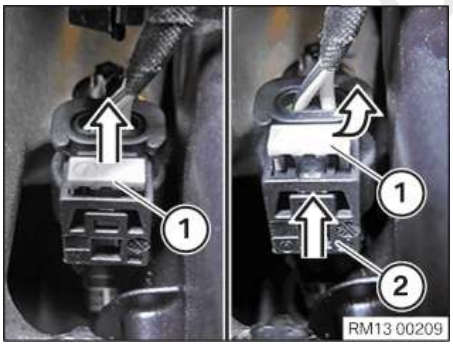
- Prepare special tool .



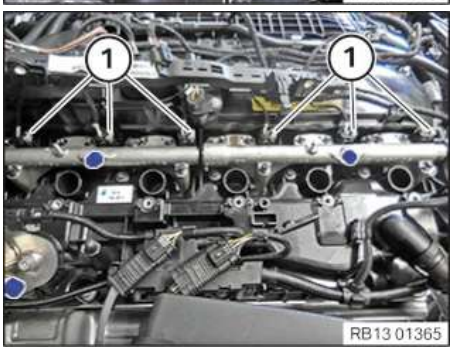
- Prepare special tool 0 496 106 (11 8 720).



- Release nuts (1) .
- Feed out ground cable (2) and set aside.
- Feed out cable channel (3) and set it aside.

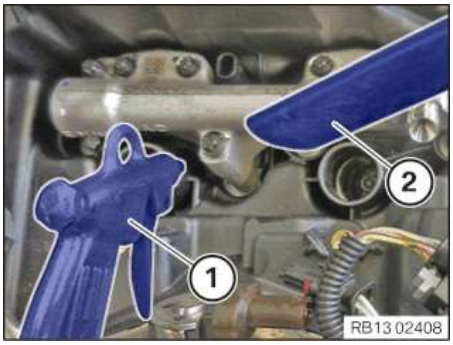


- Unlock lock (1) in direction of arrow upwards.
- Press lock (1) together and release.
- Disconnect the connector (2) from the injectors in the direction of the arrow.



- Unlock and release all connectors (1) of the injectors.

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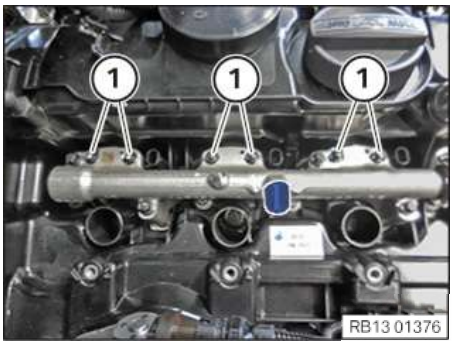


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

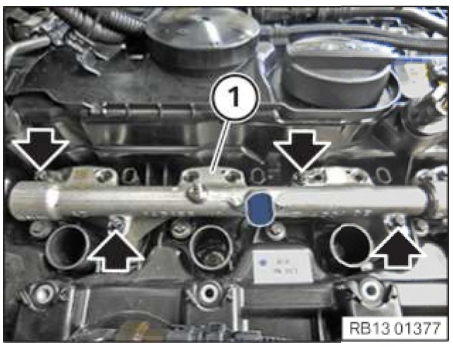
For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

- 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) .

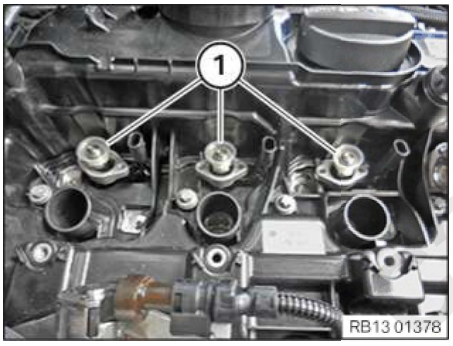
  Do **not** reuse screws (M5x30) (1).
- Catch and dispose of escaping fuel with suitable materials.



- Release screws (M6x30) (arrow).
- Remove screws (M6x30) (arrows).

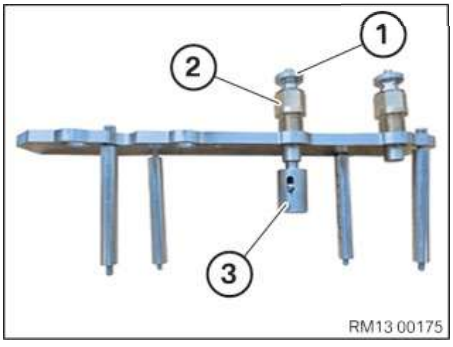
  Do **not** reuse the screws (M6x30).
- Remove rail (1) upwards.

  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.

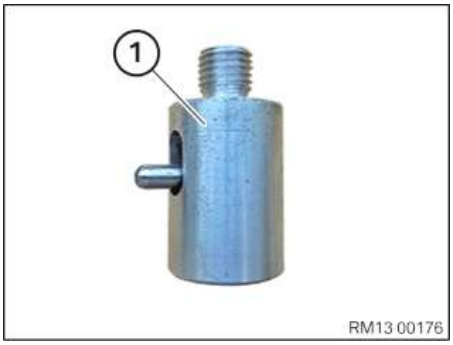
- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use the special tool 2 358 417 to remove the injectors.

  The special tool 2 358 417 is used to ensure that the tensile force is not exceeded.

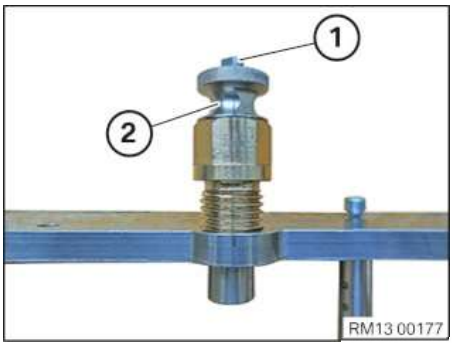
  The special tool 2 358 417 consists of:

  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Mounting for the injectors

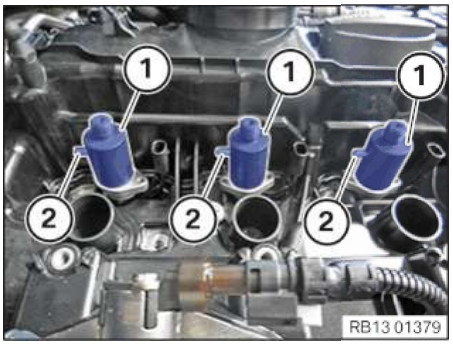
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- Unscrew the fixture for injectors (1) from special tool 2 358 417.

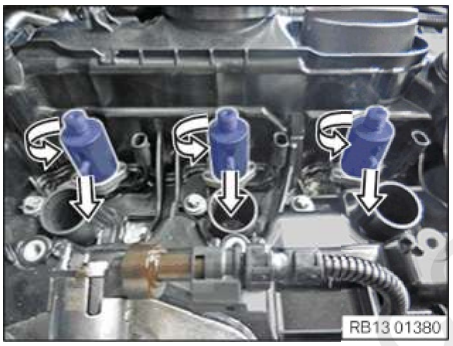


- Press lock (1) in and remove the threaded sleeve (2) from the special tool 2 358 417.



- 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

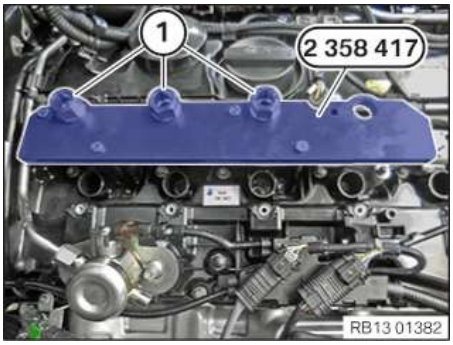
Damage to injectors.

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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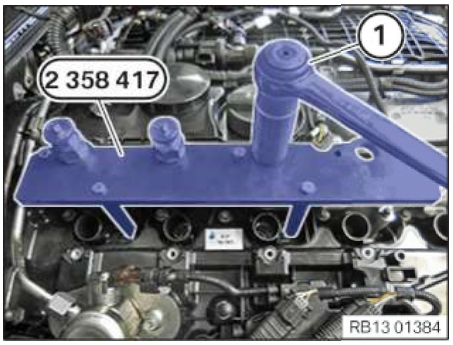
TECHNICAL INFORMATION

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.

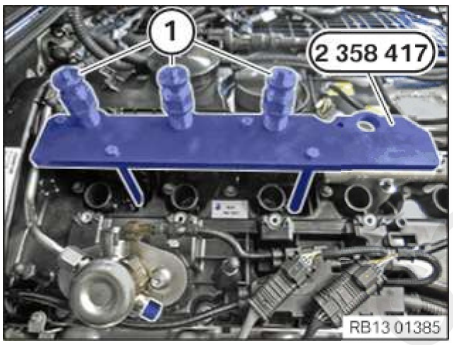


- Adjust torque wrench to 13 Nm **in clockwise** direction.
- Turn the torque wrench (1) with the special tool 0 496 106 (11 8 720) **clockwise**, until the injector is pulled out.

TECHNICAL INFORMATION

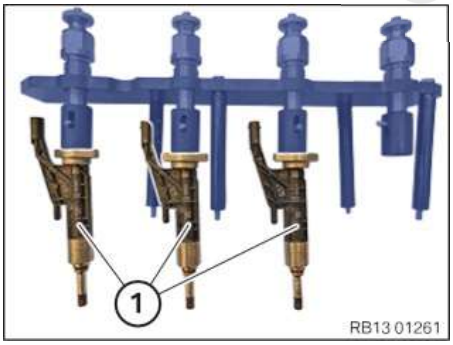
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

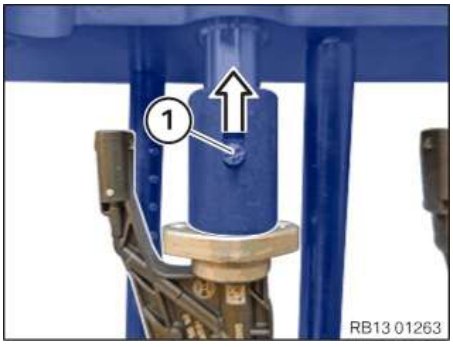


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  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.

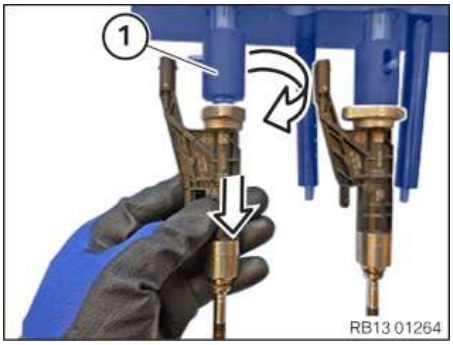


NOTICE

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.

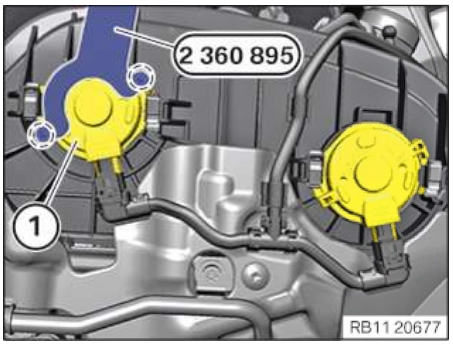
26 – Removing both actuators

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

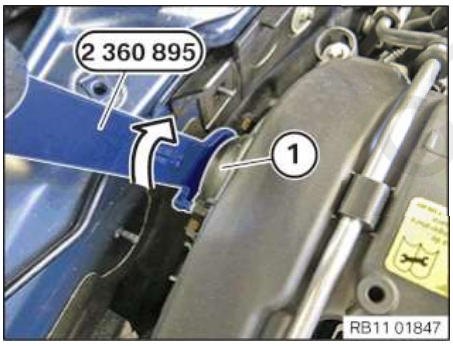
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the 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.



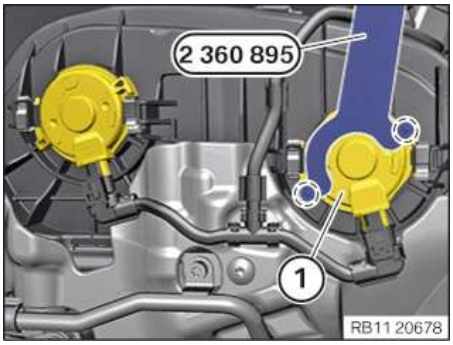
NOTICE

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.

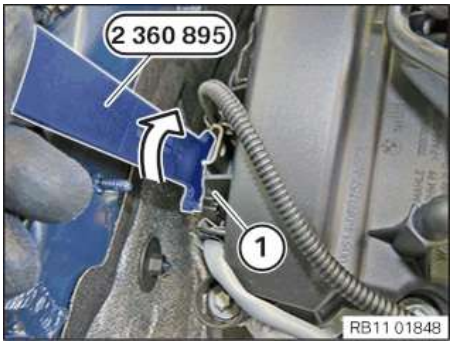


NOTICE

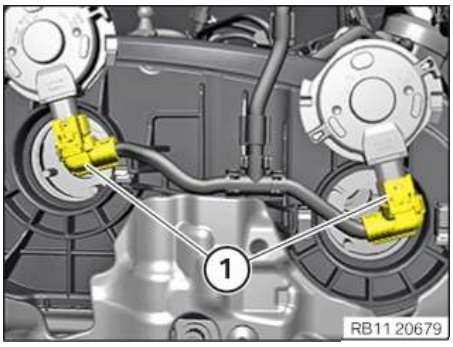
The figure shows the rear side of the engine.

- 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.



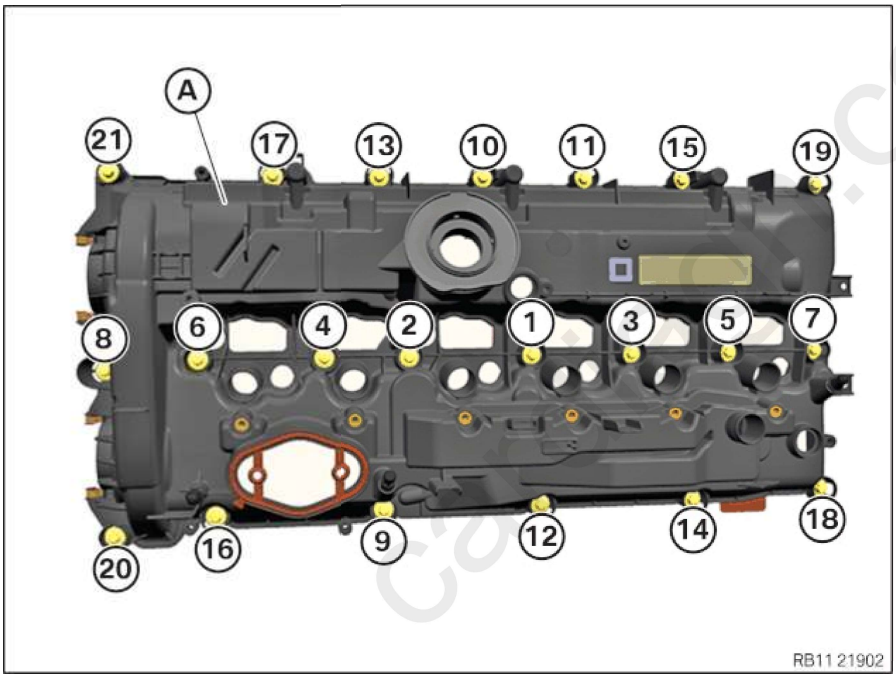
NOTICE

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

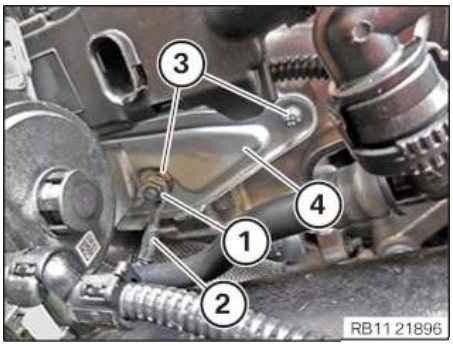
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

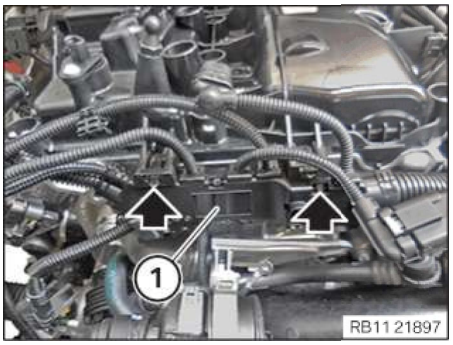
- Do not pull on the wires when disconnecting connectors and plug connections.



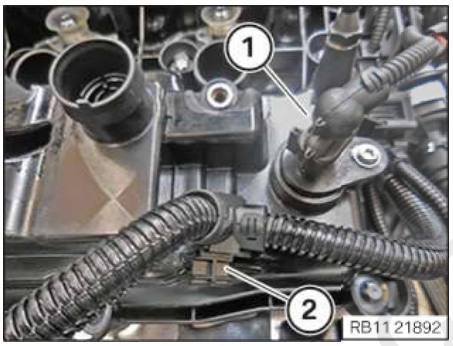
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



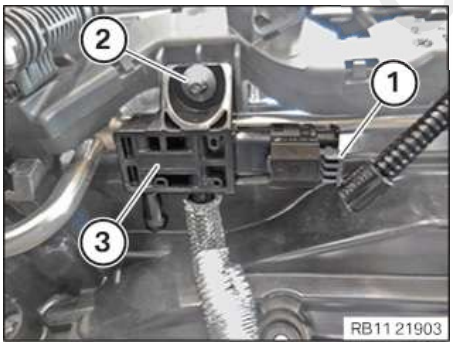
- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Loosen screws (3).
- Thread out holder (4) and set aside.



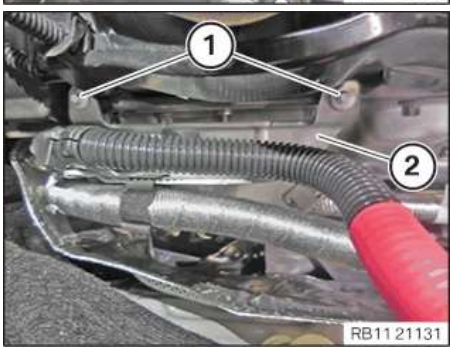
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for the sensor system **2** and place to one side.



- Unlock and detach connector (1) on exhaust camshaft sensor .
- Loosen clamp (2).

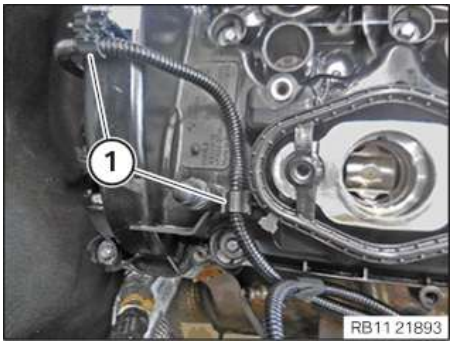


- **If installed:**
- Unlock and loosen connector (1).
- Loosen screw (2).
- Remove the differential pressure sensor (3) and put it to one side.

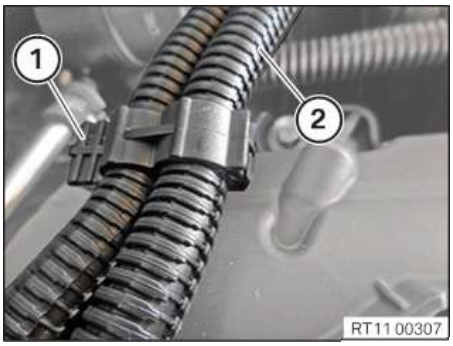


- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

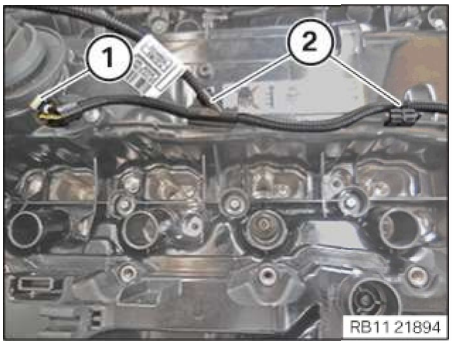
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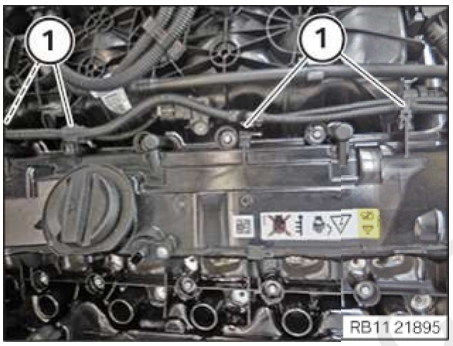
- Loosen clamps (1).



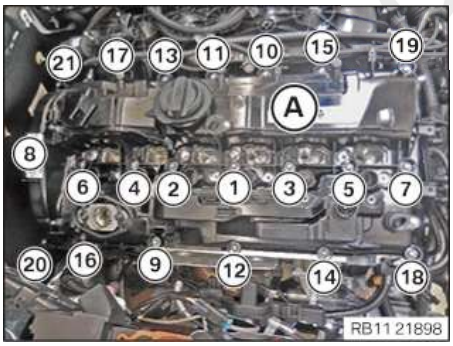
- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



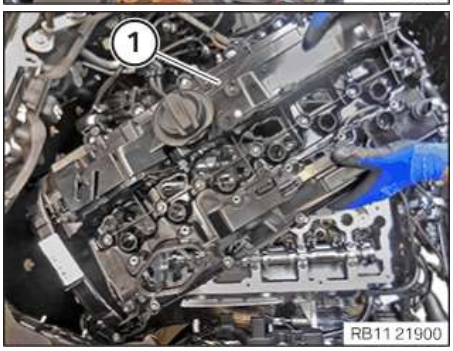
- Unlock and detach connector (1) on the intake camshaft sensor.
- Loosen clamps (2).



- Loosen clamps (1).



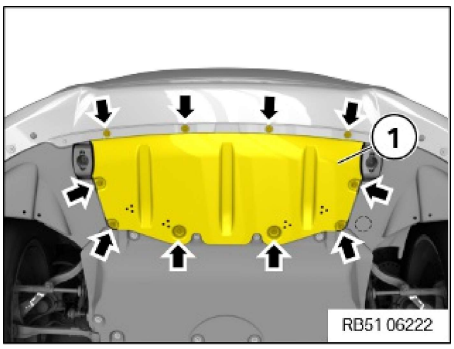
- Release all screws on the cylinder head cover (A) in the sequence (21) to (1).



- Guide the cylinder head cover (1) out and remove it.

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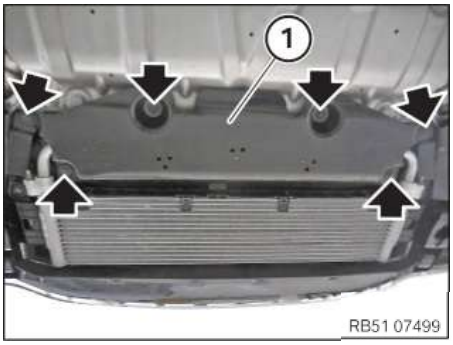
28 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

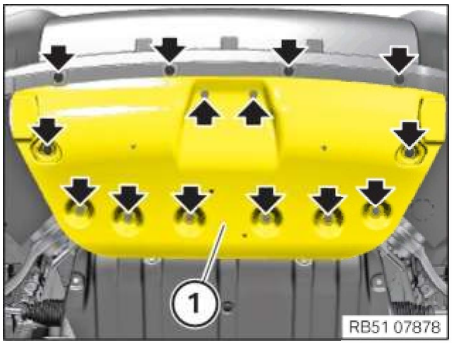
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

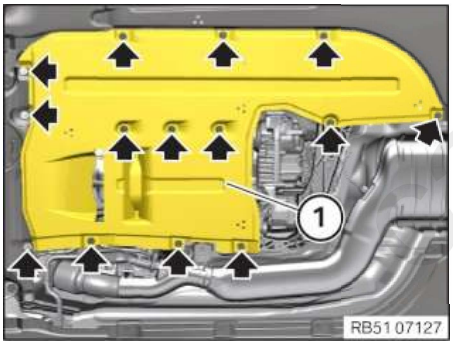


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

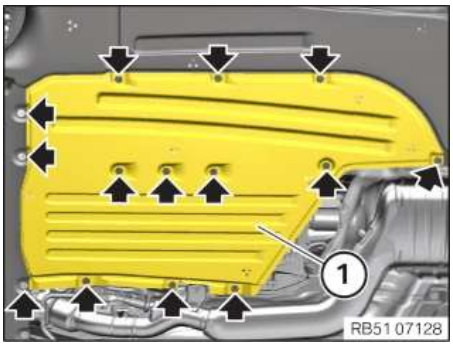
29 – Remove rear underbody protection



- **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

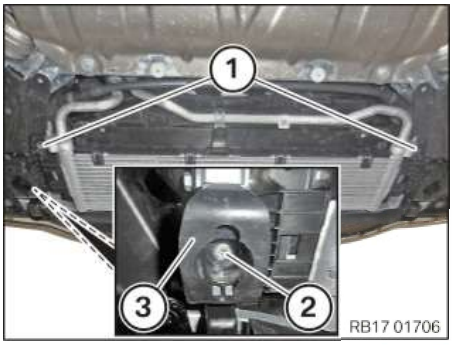
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

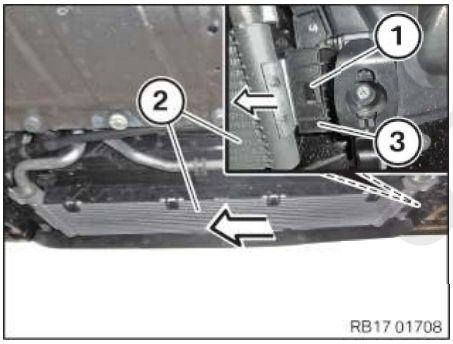
The work must be performed with care to prevent component damage.



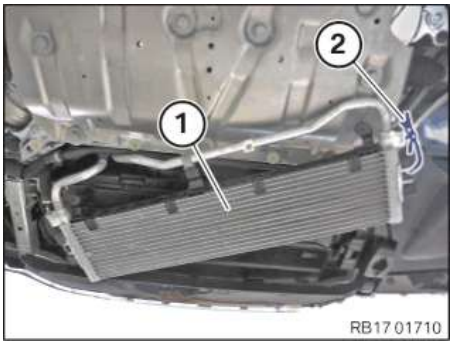
- Loosen screws (1).
- Drill out rivet on the left (2).
- Remove the left-hand damper (3).



- 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.



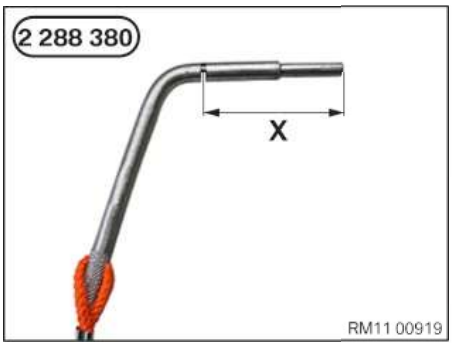
RISK OF DAMAGE

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.

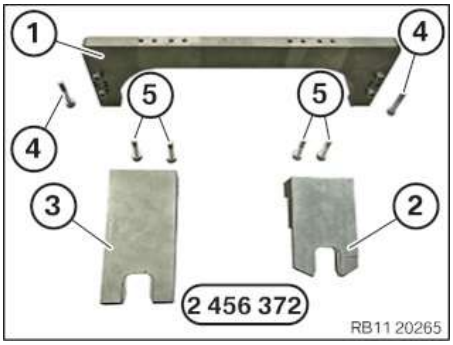


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **correctly** positioned.

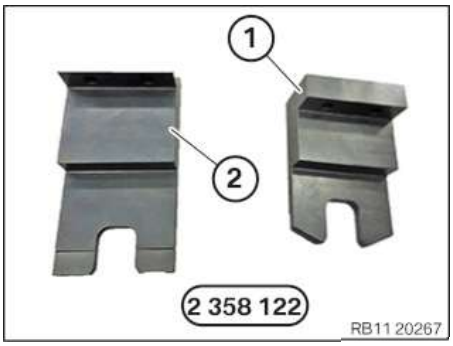
  The engine is in the TDC firing position of cylinder 1.

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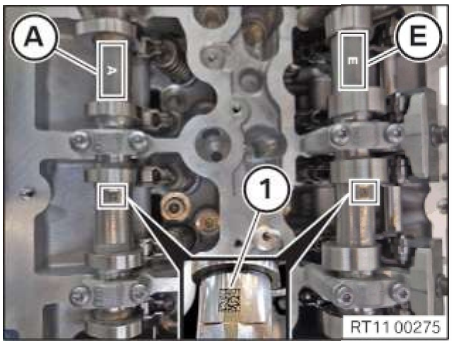
- Overview of the set of special tools 2 456 372:

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

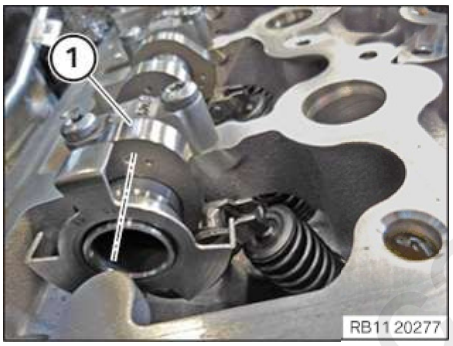


- Overview of the test gauges from the set of special tools 2 358 122:

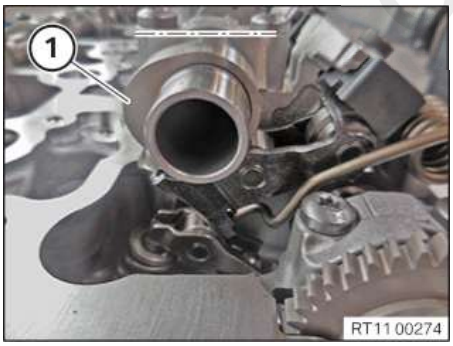
Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



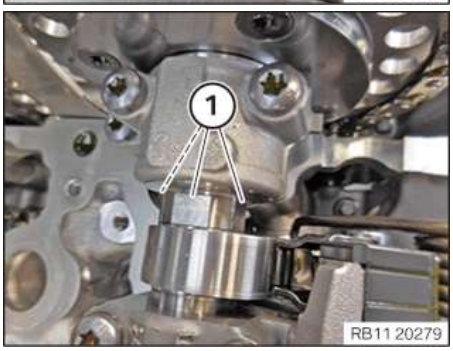
- Turn intake camshaft (E) and exhaust camshaft (A) until marks (1) can be read from the top.



- 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.

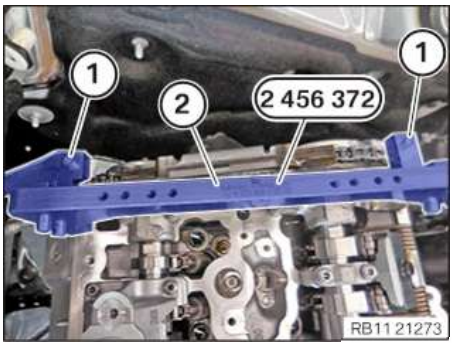


- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.

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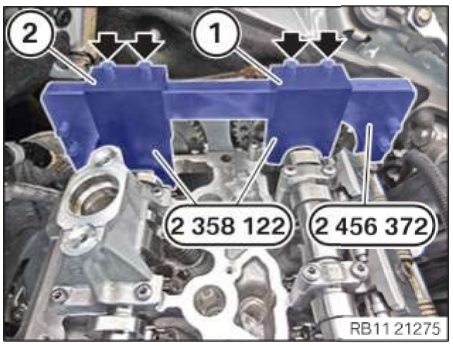
- Position basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- 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).

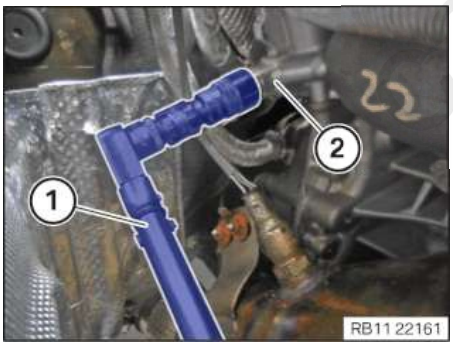
Test gauge to basic carrier

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).

MAIN WORK

33 – 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

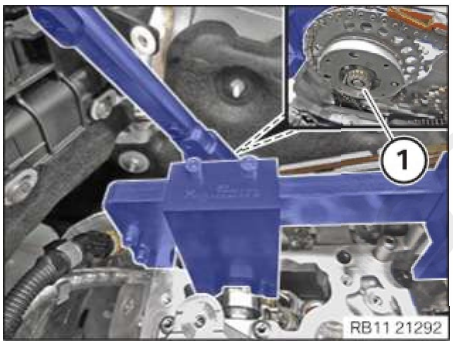
The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the intake adjuster.

34 – 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.

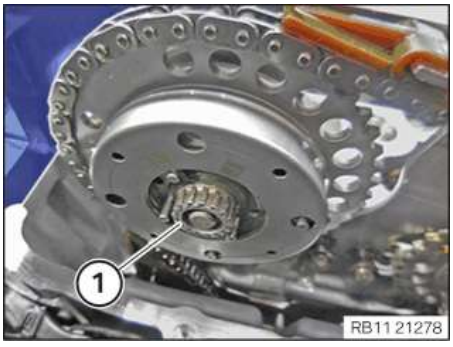


NOTICE

The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

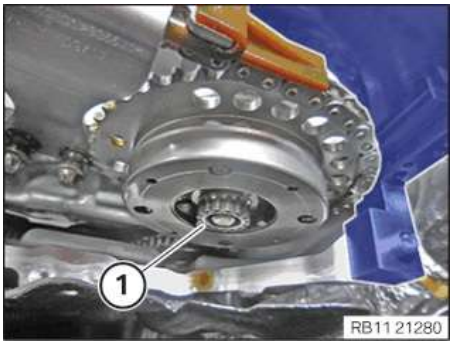
35 – Removing the VANOS central valve of the intake adjuster



- Guide out and remove the VANOS central valve (1) of the intake adjuster.

36 – Remove the VANOS central valve of the exhaust camshaft adjuster

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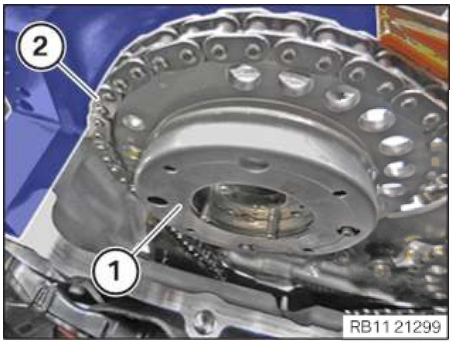


- Guide out and remove the VANOS central valve (1) of the exhaust camshaft adjuster.

37 – Removing intake adjuster

NOTICE

The figure shows the rear side of the engine.

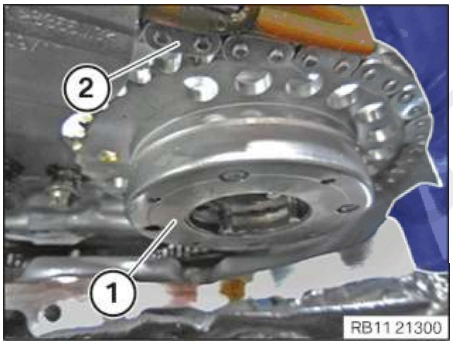


- Guide out the intake adjuster (1) from the timing chain (2) and remove.

38 – 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.

39 – Installing the intake adjuster

NOTICE

The figure shows the rear side of the engine.

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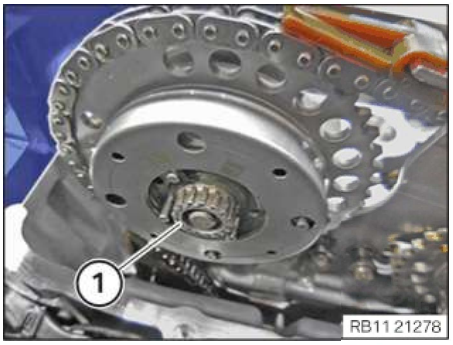


- Keep intake adjuster (1) marked IN ready.

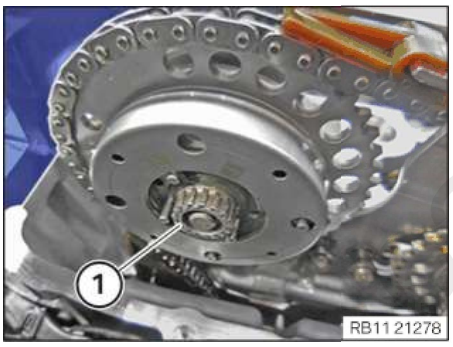


- Feed in intake adjuster (1) in the timing chain (2) and position on the intake camshaft .

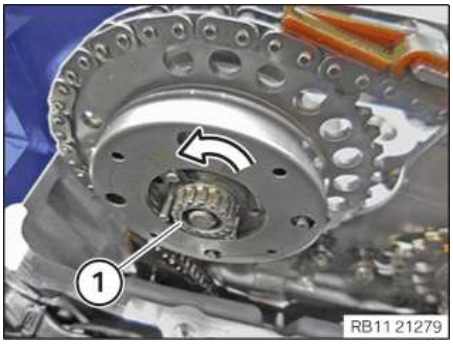
40 – Install the VANOS central valve of the intake adjuster



- 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 °.

41 – Install exhaust camshaft adjuster

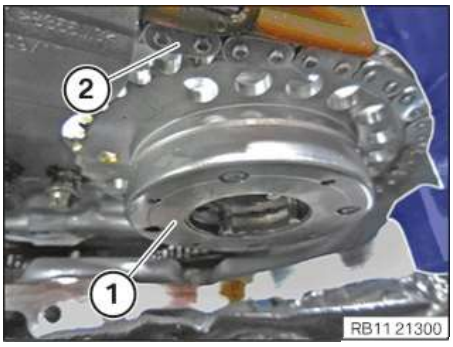
NOTICE

The figure shows the rear side of the engine.

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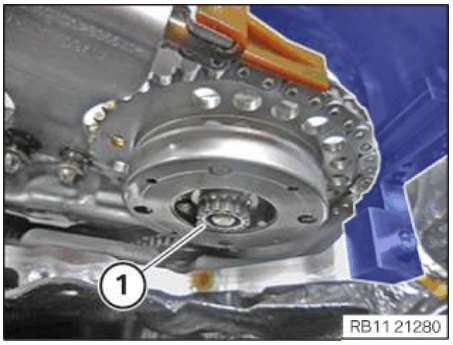


- Keep exhaust camshaft adjuster (1) marked EX ready.

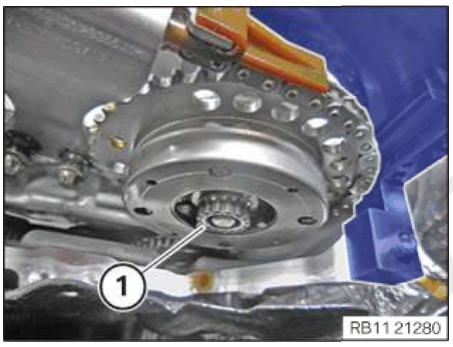


- Feed in exhaust camshaft adjuster (1) in the timing chain (2) and position on the exhaust camshaft .

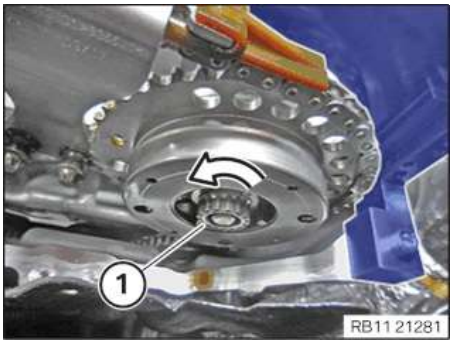
42 – Installing the VANOS central valve of the exhaust camshaft adjuster



- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.



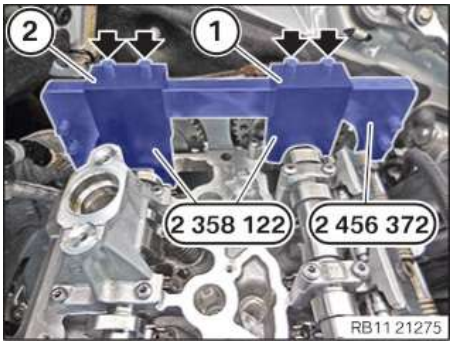
- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.



- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

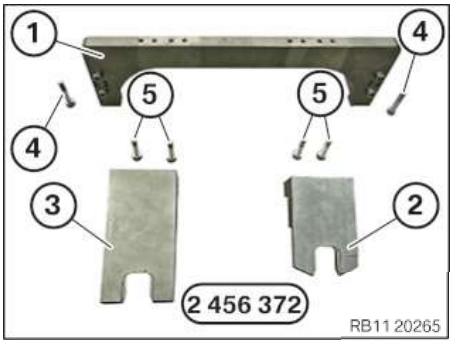
43 – Remove the test gauges to fix the camshafts

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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.

44 – Adjust the camshafts with the special tool

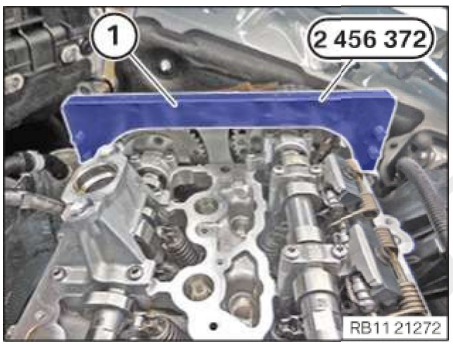


- Overview of the set of special tools 2 456 372:

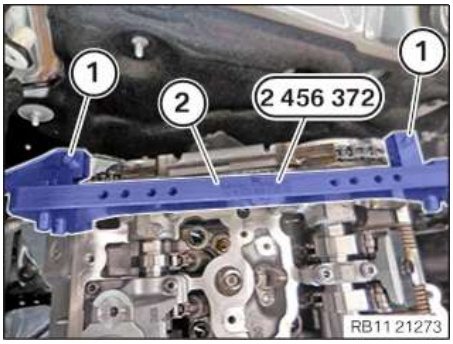
Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- 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.

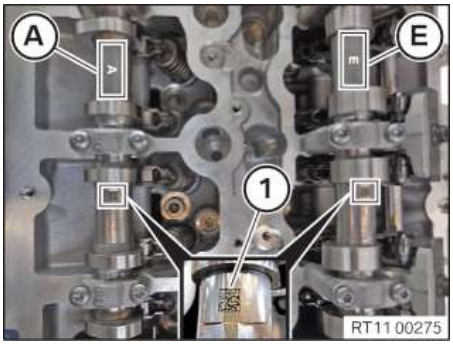


- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

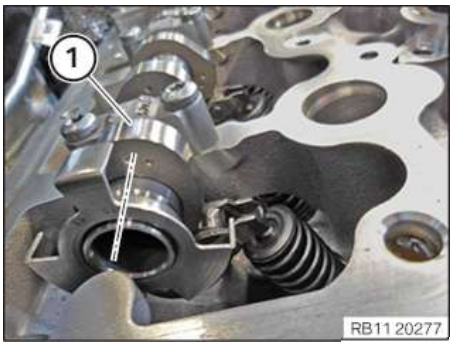
Basic carrier to cylinder head

M6		Tightening torque	8 Nm

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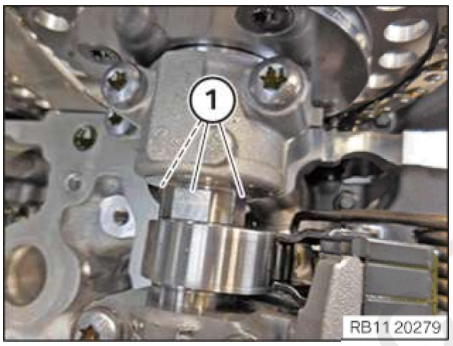
- Turn the intake camshaft (E) and the exhaust camshaft (A) such that the marks (1) can be read from the top.



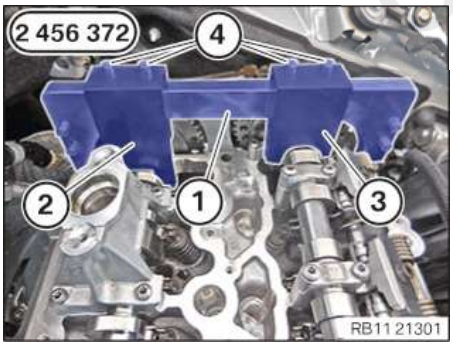
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- 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.



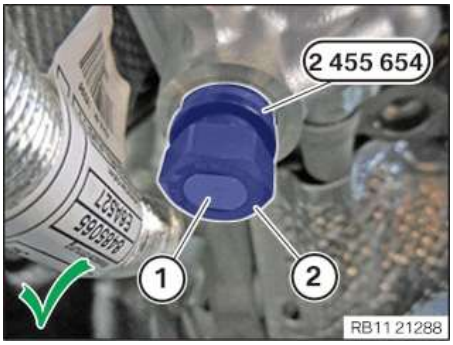
- Position the setting gauge 0.5° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten the screws (4).

Test gauge to basic carrier

M6		Tightening torque	8 Nm

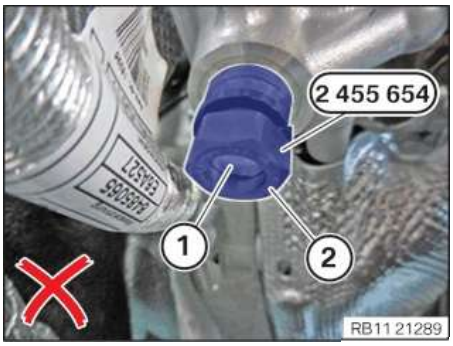
45 – Pretension the timing chain with the special tool

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- Make sure that the timing chain is **correctly** pre-tensioned with the special tool 2 455 654.

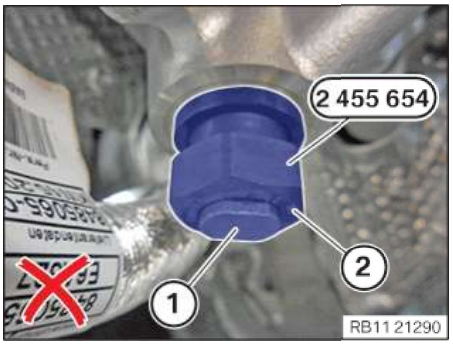
  The pin (1) must align **precisely** with housing (2).



- 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**.

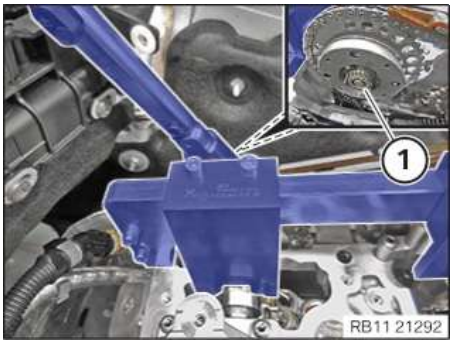
  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

46 – 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 °

47 – 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.



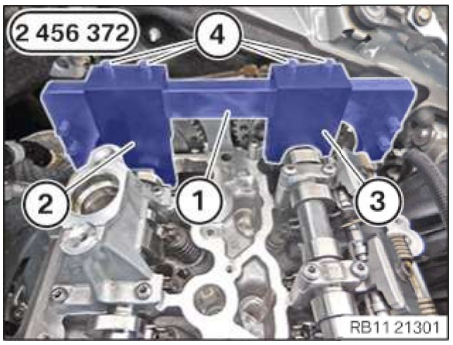
- Tighten the VANOS central valve (1) of the intake adjuster.

VANOS central valve to camshaft

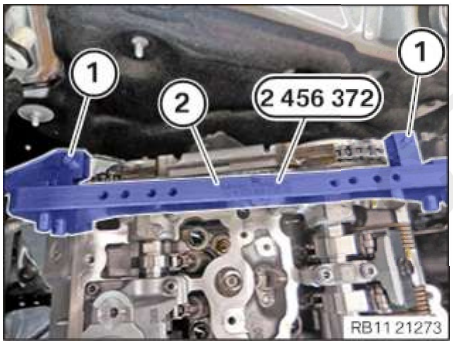
M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

POSTPROCESSES

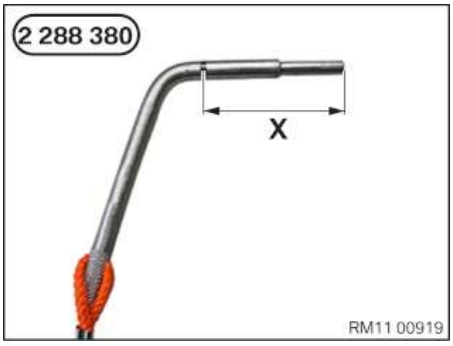
48 – Disassembling all special tools



- 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.

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- Guide the special tool 0 493 380 (11 6 480) out and remove.



- Guide the special tool (1)2 455 654 out and remove.

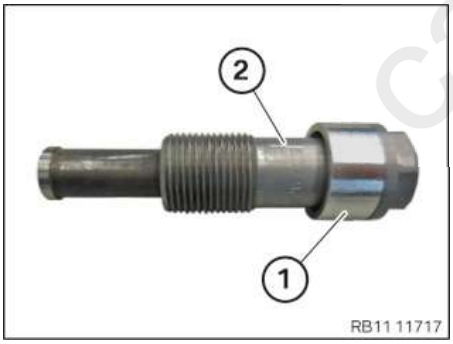
49 – Install chain tensioner

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.



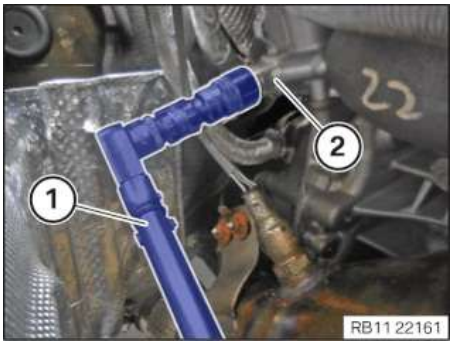
- Renew the sealing sleeve (1).

  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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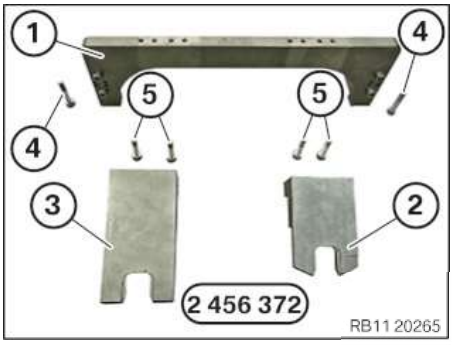


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

50 – 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

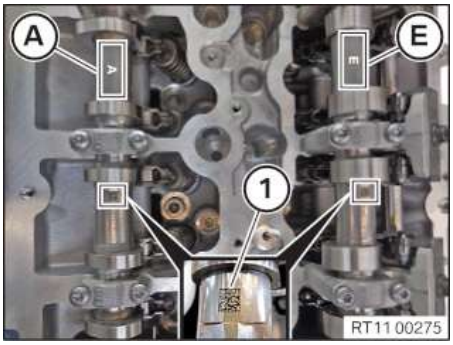
Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

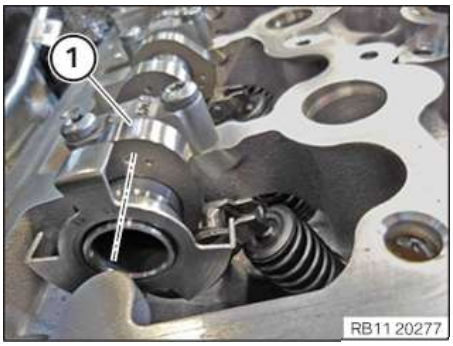
- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.

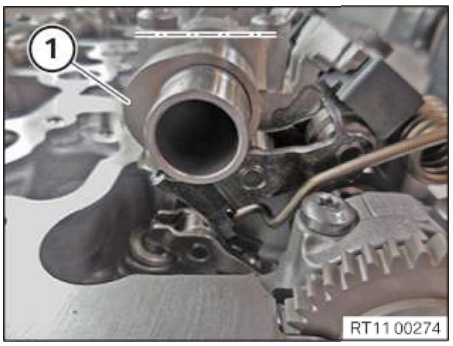
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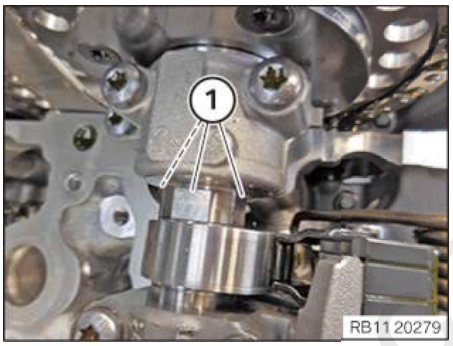
- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.



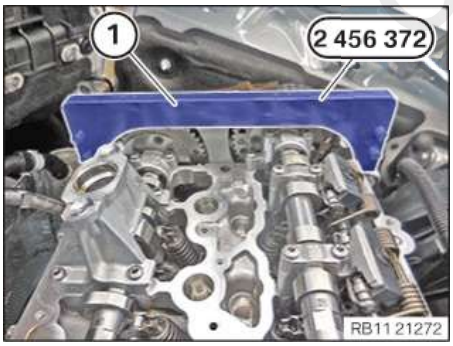
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



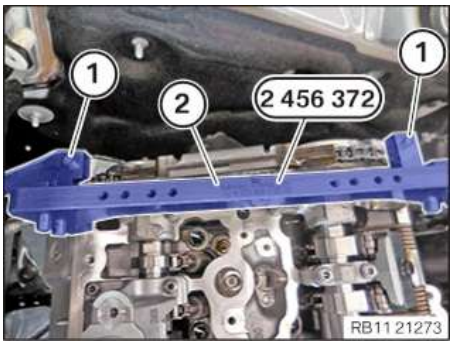
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.



- 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.

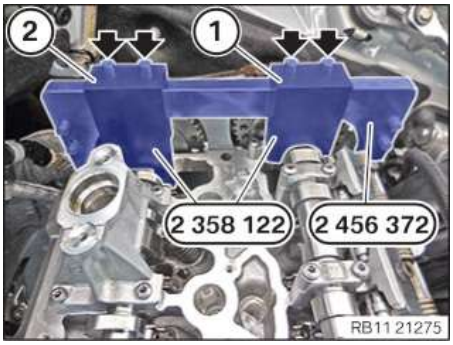


- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm

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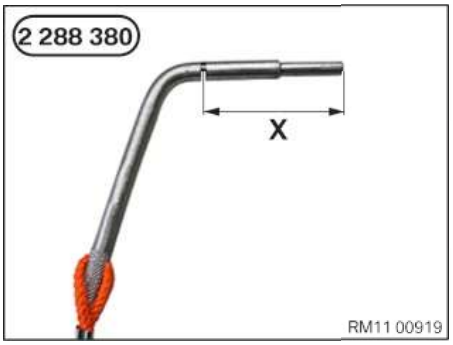
- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special 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.



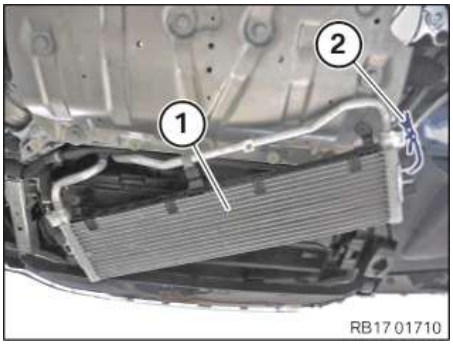
- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

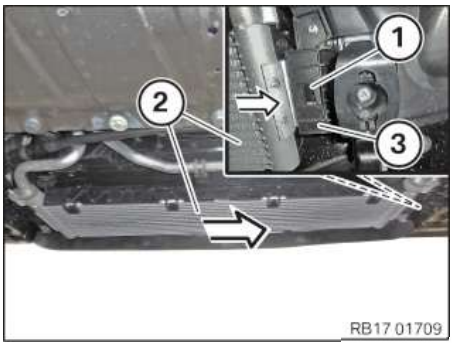
  The engine **is in the** TDC firing position of cylinder 1.

51 – If installed: Secure engine oil cooler

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- Remove the cable straps (2).
- Position engine oil cooler (1).



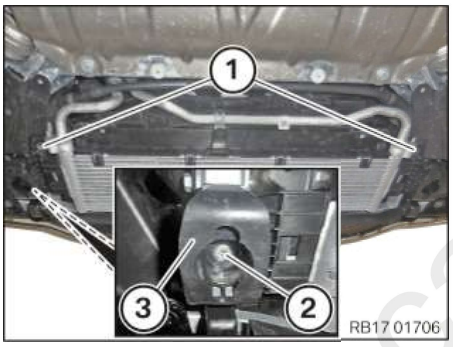
- Feed in and install the engine oil cooler (2) on the holder (3) in the direction of the arrow.
- Ensure that the lock (1)engages audibly.



- 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).

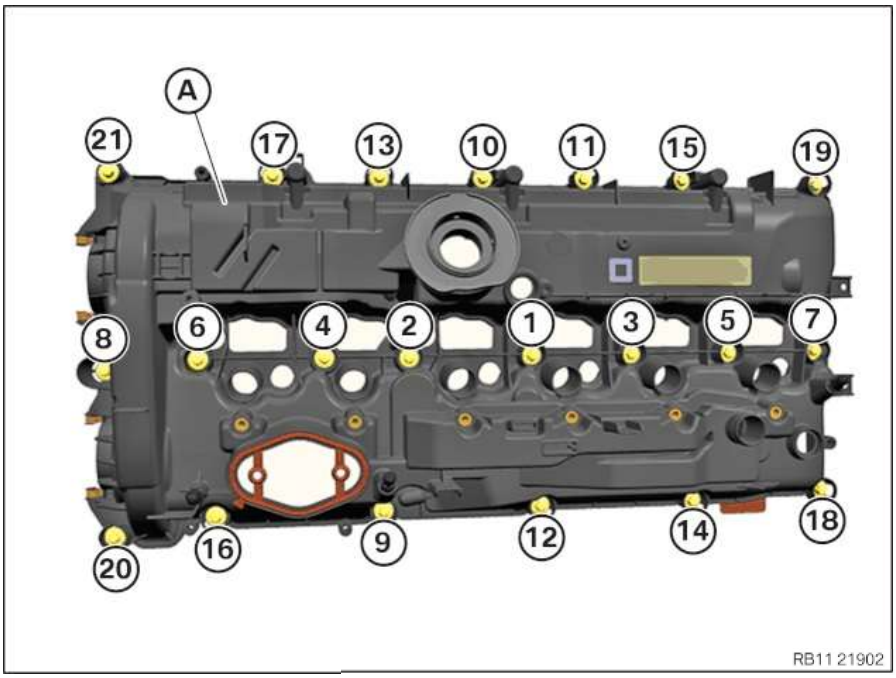
Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

52 – 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

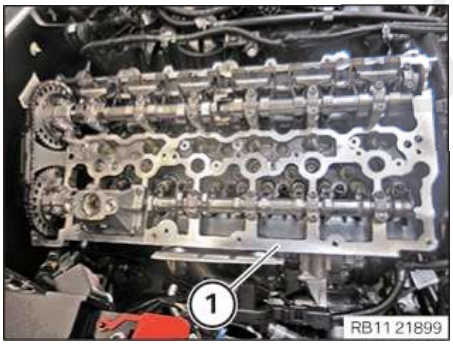
Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

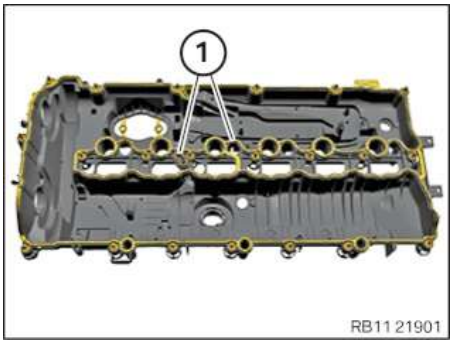
- Route all cables without abrasions, do not trap and crush.

TECHNICAL INFORMATION

Latch mechanisms, guides and mounting elements must not be damaged or missing.



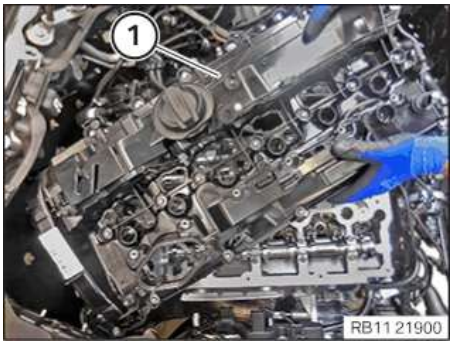
- Contact surface (1) must be free from oil and grease.



- Replace the seals (1).

  Parts: Seals

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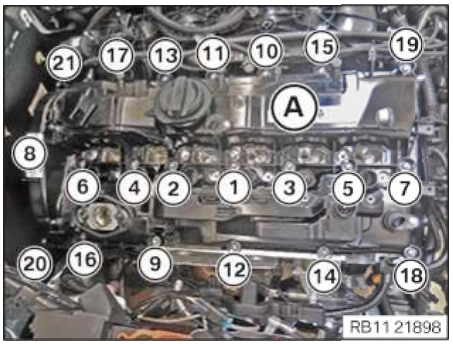


- Insert and install cylinder head cover (1).



- 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

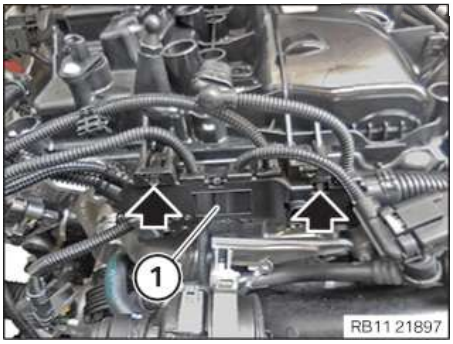
- Tighten all screws in a sequence from (1) to (21).

Cylinder head cover to cylinder head

M6X30		Tightening torque	11 Nm

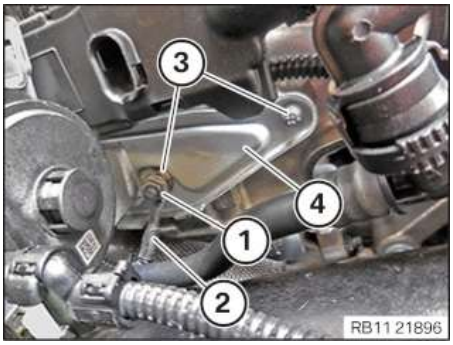


- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.



- Feed in and install wiring harness section (1) for sensor system **2**.
- Make sure that you can hear the locks (arrows) engage.

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- Insert and position the holders (4).
- Tighten the screws (3).

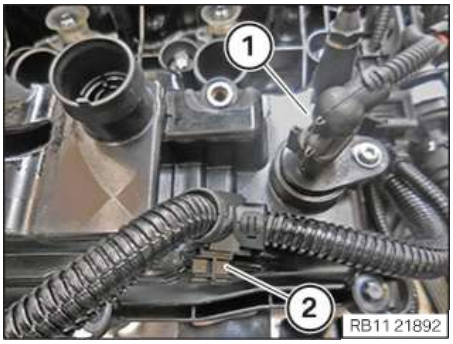
Auxiliary coolant pump holder to cylinder head

M6		Tightening torque	7 Nm

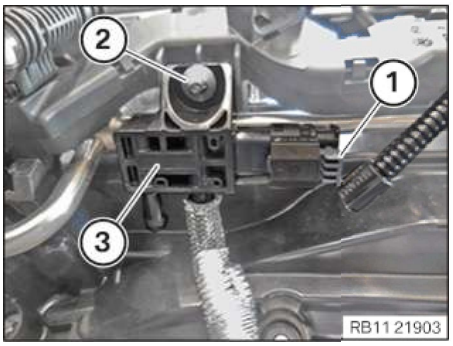
- Thread in ground cable (2) and install.
- Tighten nut (1).

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).

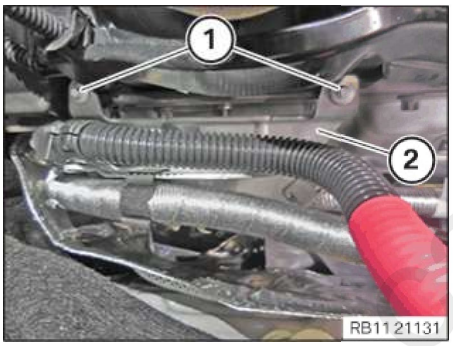


- **If installed:**
- Feed in and install the differential pressure sensor (3).
- Tighten down screw (2).

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.

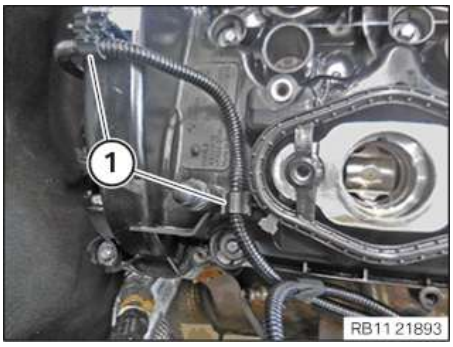
Risk of short circuits!

- 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).

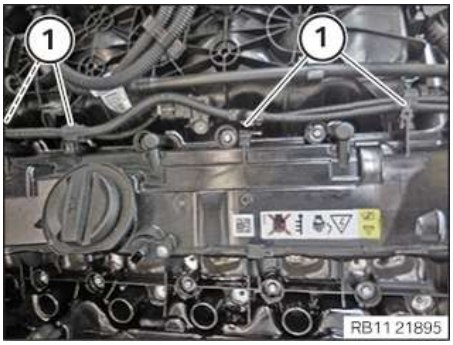
Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

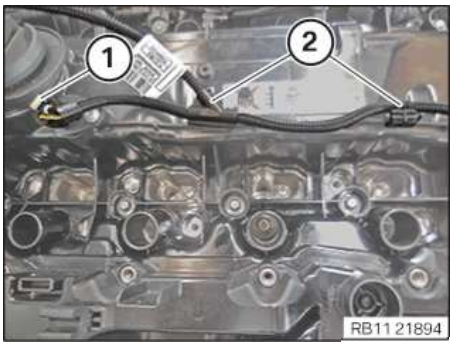


- Secure clamps (1).

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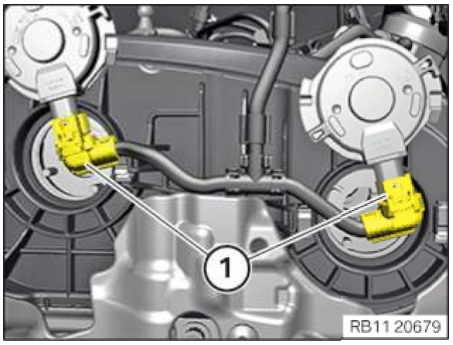


- Secure clamps (1).



- Connect connector (1) to the intake camshaft sensor and lock it.
- Make sure the connector (1) engages audibly.
- Secure clamps (2).

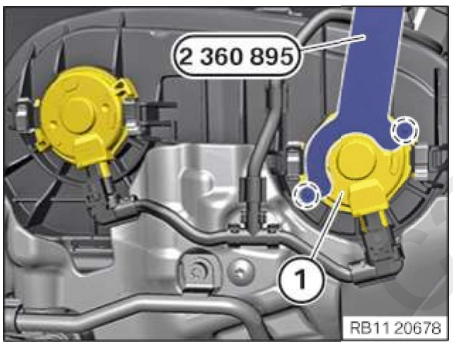
53 – Installing both actuators



NOTICE

The figure shows the rear side of the engine.

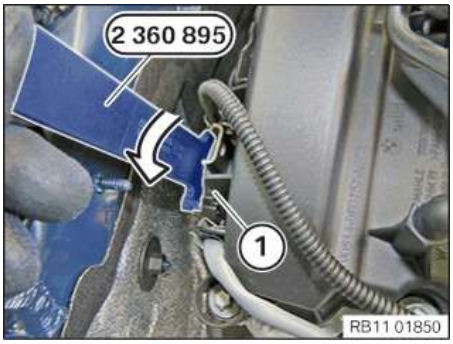
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



NOTICE

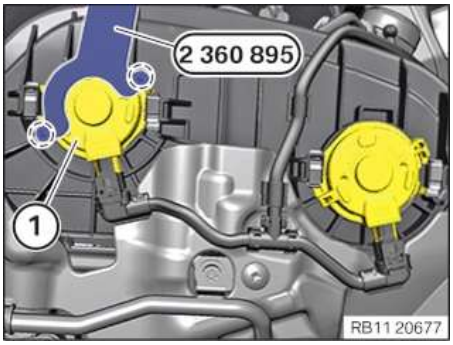
The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- 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.

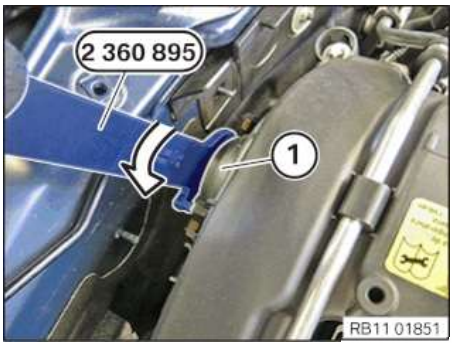
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NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the 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.

54 – 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

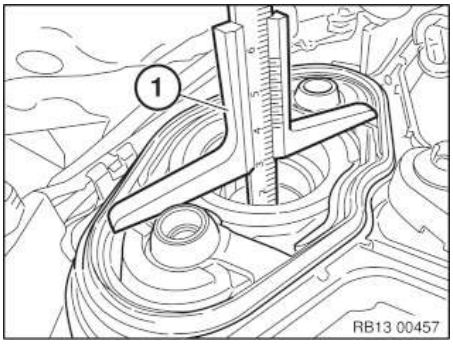
In vehicles with active anti-roll bar (ARS) the fan cowl must be removed in order to spin the engine.

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.

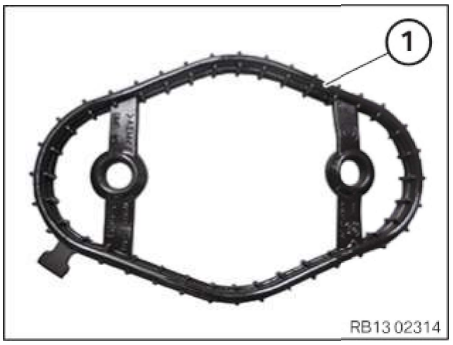
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- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- 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).



- 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.

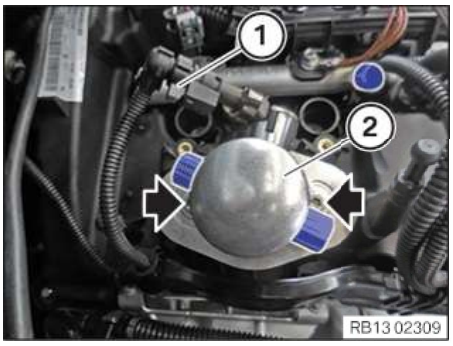
The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- 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.

55 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

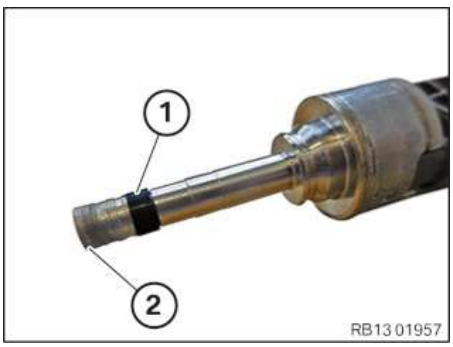
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- 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.

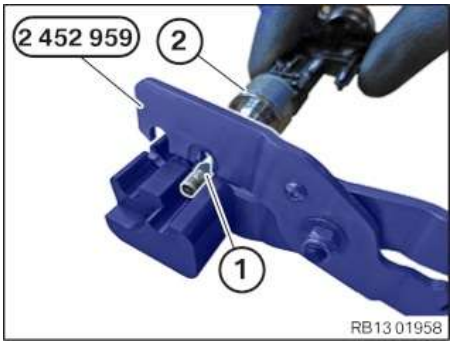
After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.



- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings
- Avoid mechanical contact with injector tip (2).

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- 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.

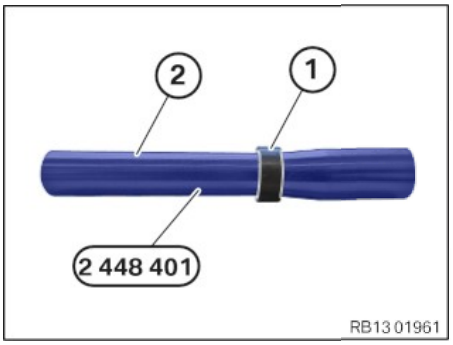


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

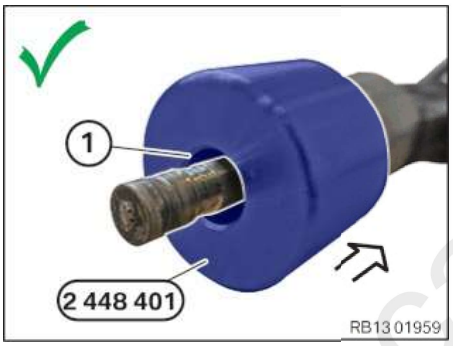
  (1) Installation cone

  (2) Sliding sleeve

  (3) Assembly sleeve

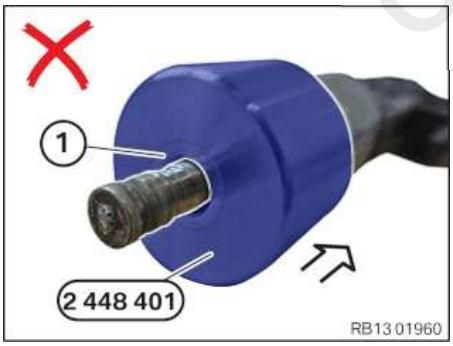


- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



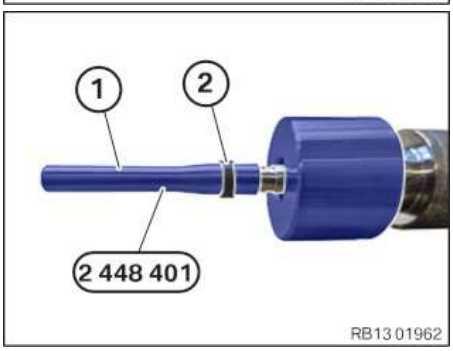
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The larger diameter of the assembly sleeve (1) must point to the injector tip.



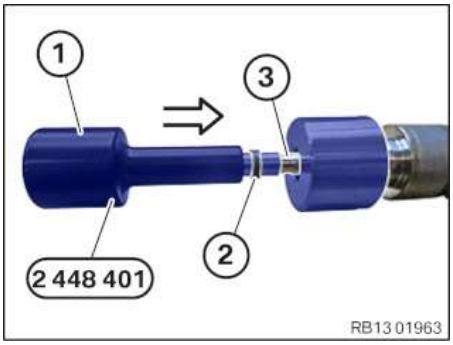
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.

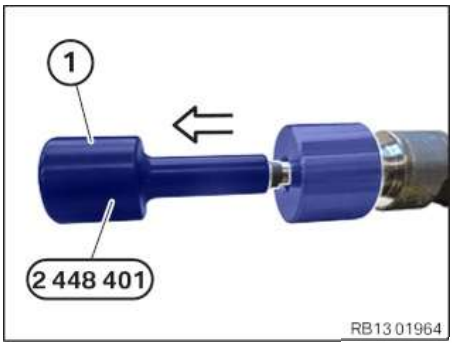


- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .

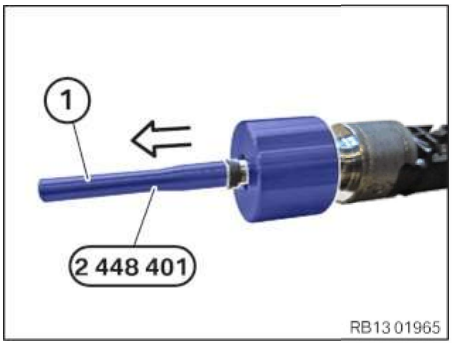
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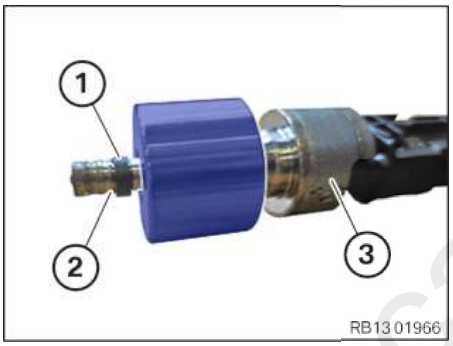
- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.



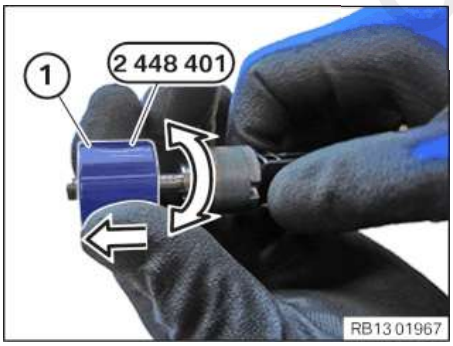
- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

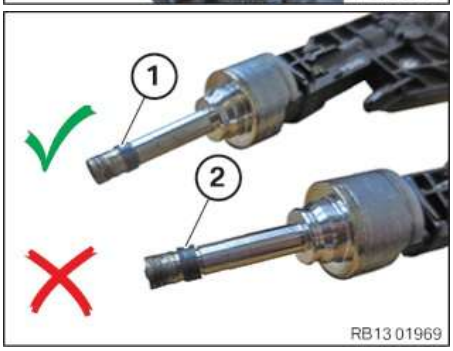


- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.



- 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).



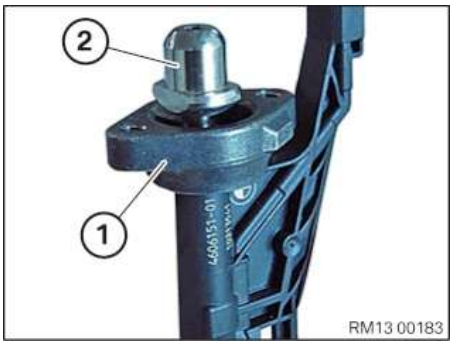
- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

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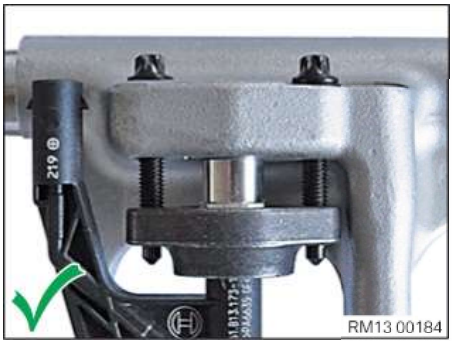
56 – Installing the high-pressure rail with injectors of the cylinders 4 to 6

TECHNICAL INFORMATION

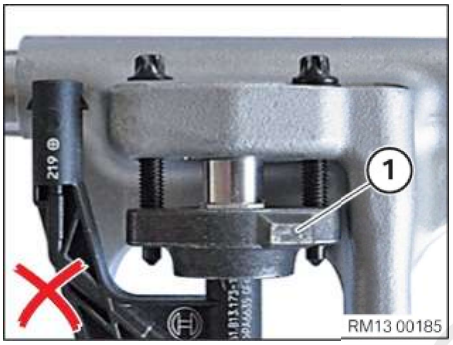
When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



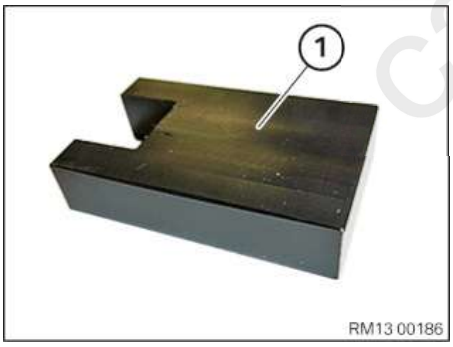
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder**(1) **has a cast lug**: Make sure that the holder is installed in the correct position.



- 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

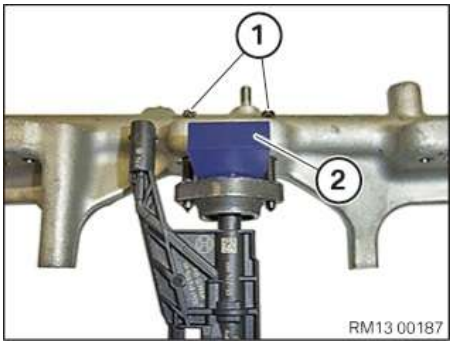
Damage to injectors.

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).

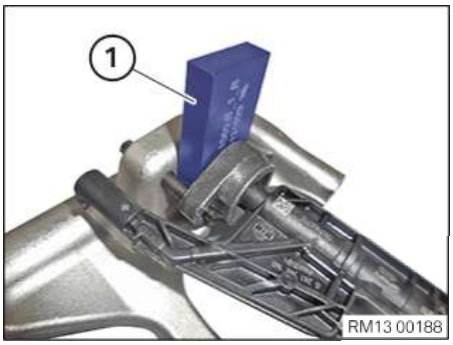
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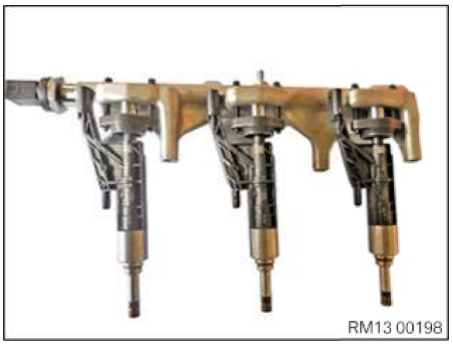
- Replace (M5x30) screws.

  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.



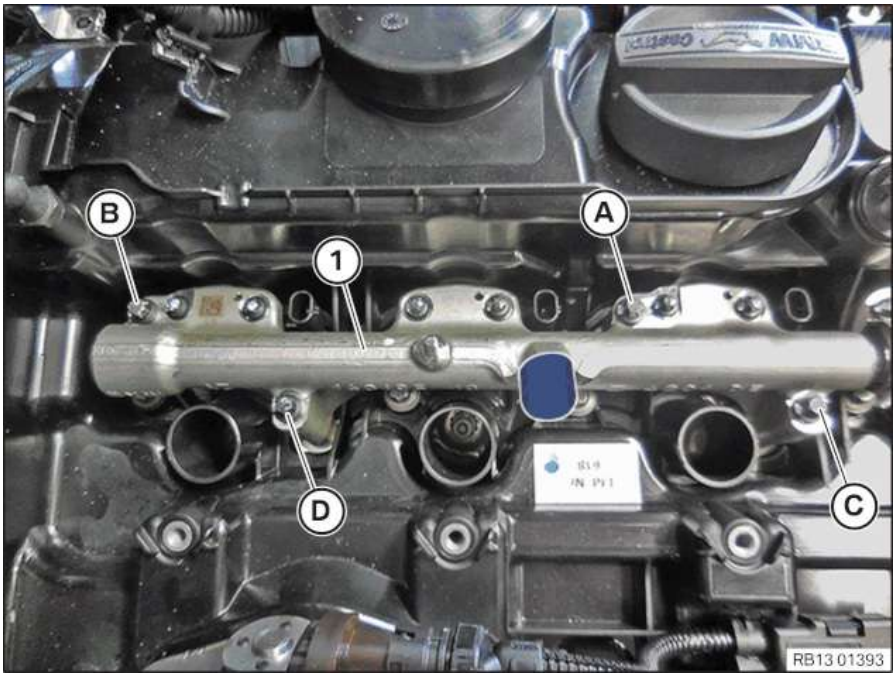
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.



- 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.

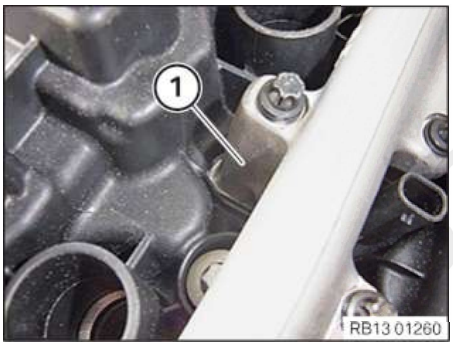
  The figure shows the rail resting flat against the cylinder head.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

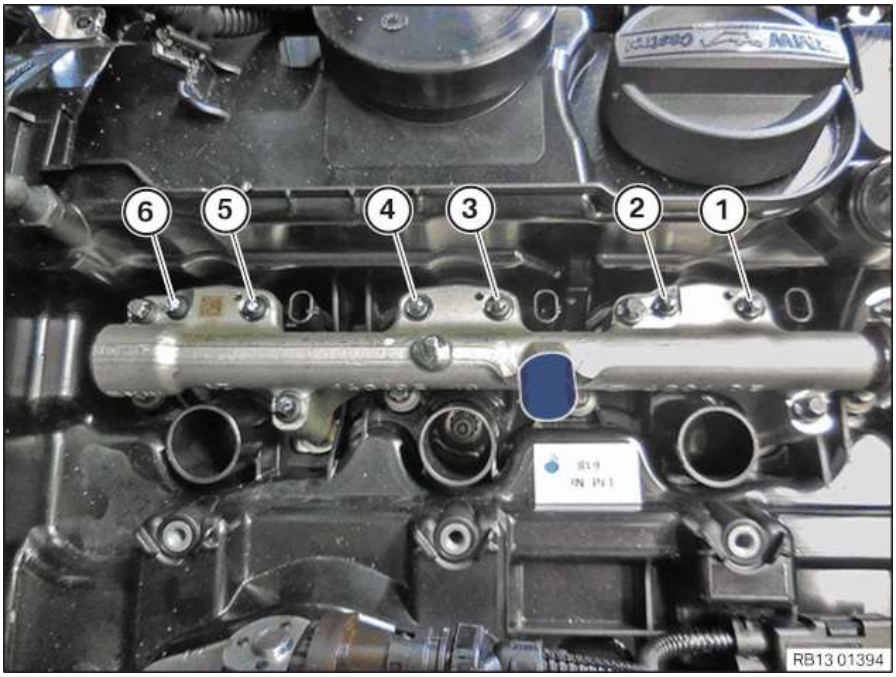
Non-observance of these requirements may result in leaks and damage.

- 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.

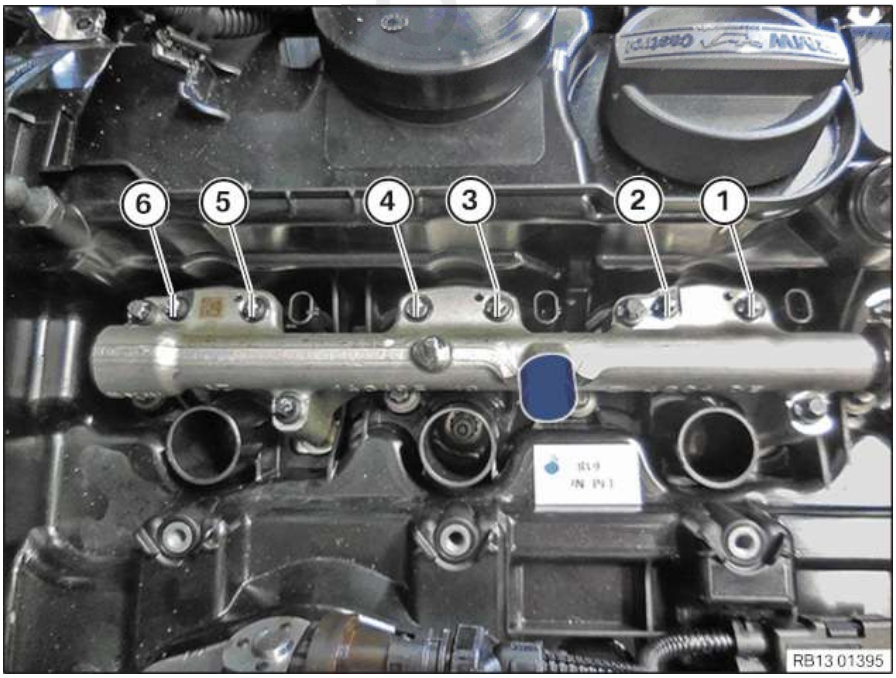
  Do not use a reversible ratchet or torque wrench.
- Tighten the bolts (M5x30) in pairs ((1) with (2), (3) with (4), (5) with (6)) in alternating order **90° hand-tight**.
- Set the torque wrench to 5 Nm.

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.



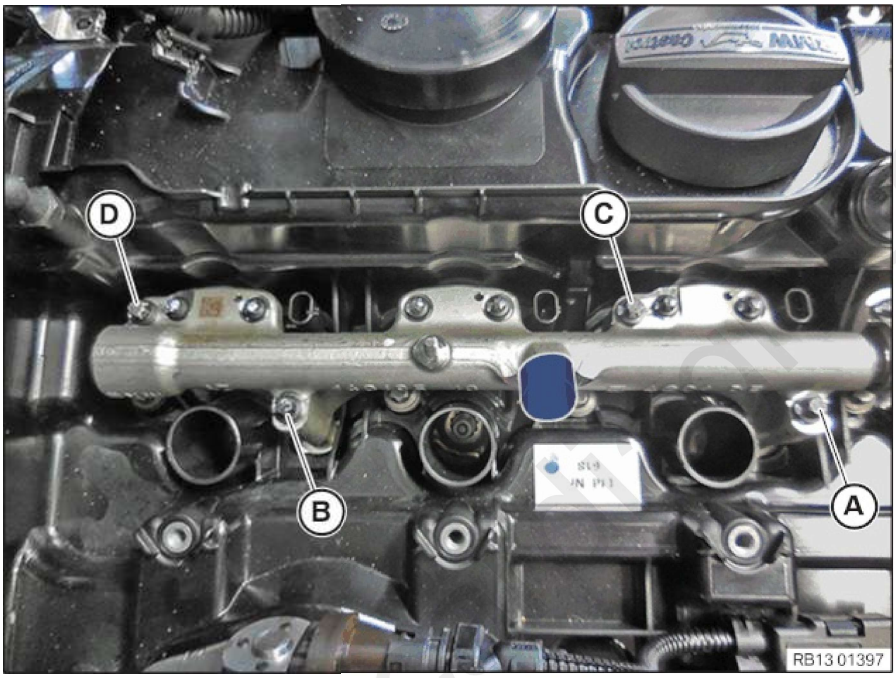
- Mark all bolts (1) to (6) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the screw (1) with an angle of rotation of 90° ±15°.
  - Tighten the screw (2) with an angle of rotation of 90° ±15°.
  - Tighten the screw (3) with an angle of rotation of 90° ±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).

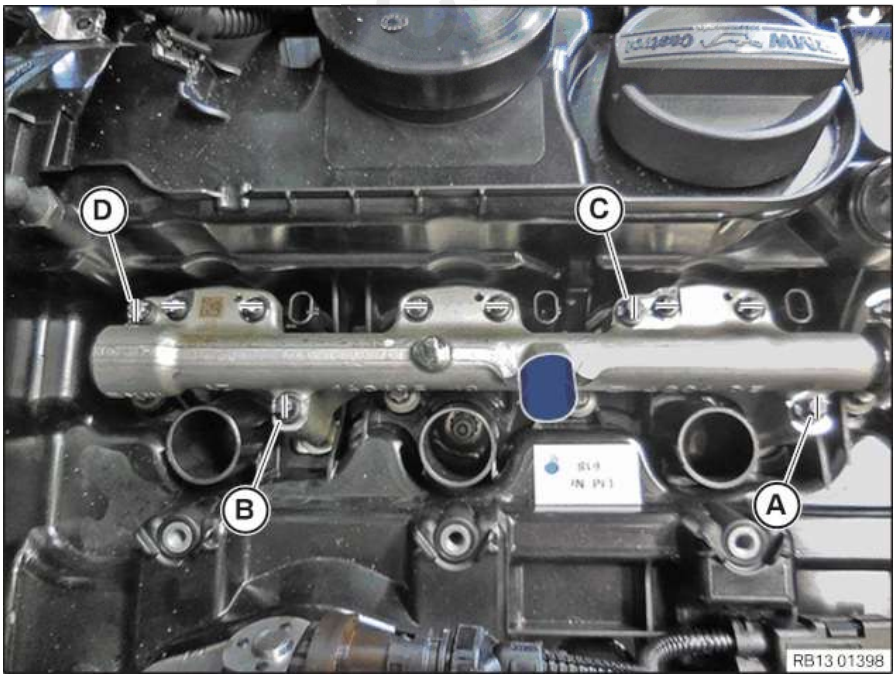
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

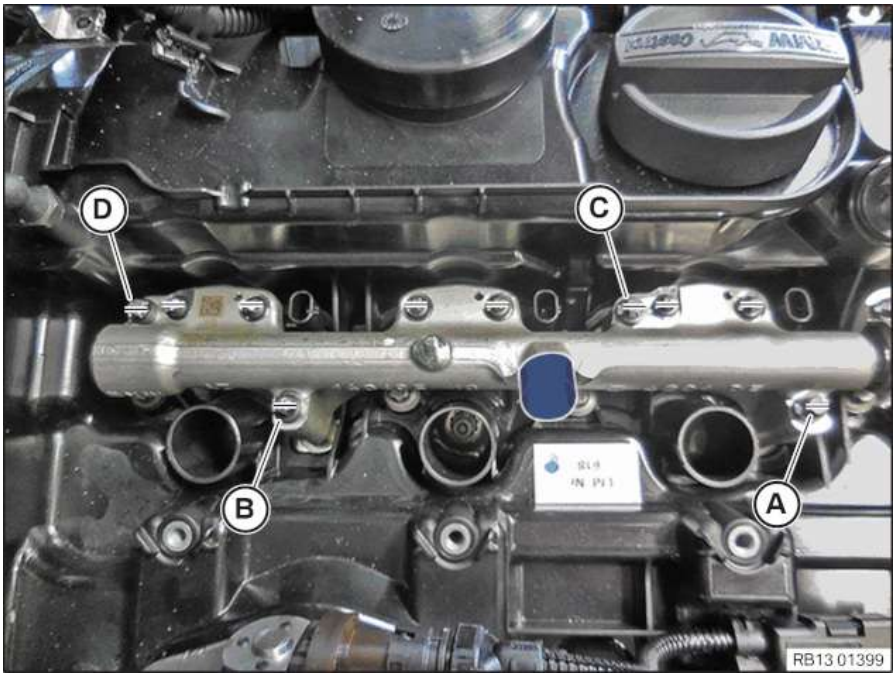
When assembling, it is essential to observe screwing sequences and tightening torques.

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.

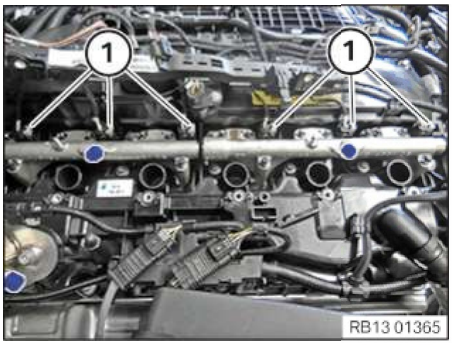


- Mark all bolts (A) to (D) with a vertical line (see figure).
- Tighten bolts (M6x70) (A) to (D) to a 90° angle of rotation.



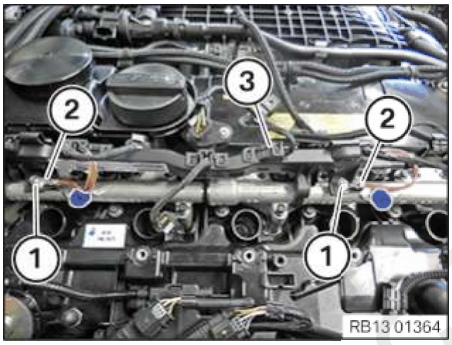
- Check if all bolts (A) to (D) have been tightened with a 90° angle of rotation.

  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).

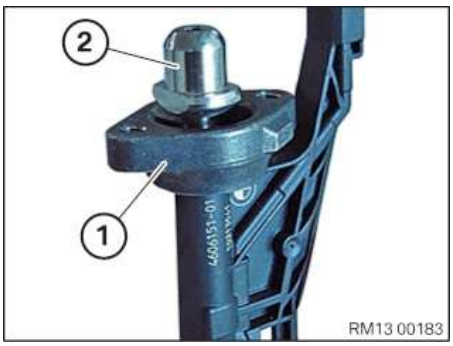
Ground cable to rail

M6			5 Nm

57 – Installing rail with injectors of cylinders 1 to 3

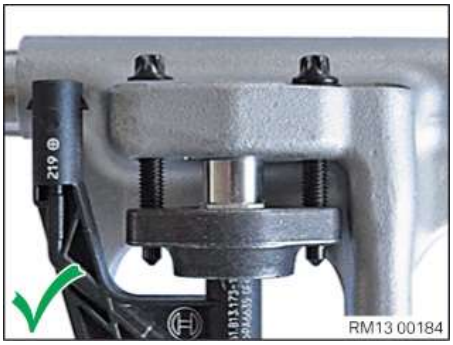
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



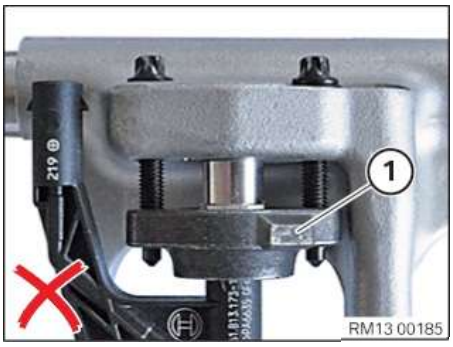
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If there is a cast lug on the holder** (1) **:** Make sure that the holder is installed in the correct position.

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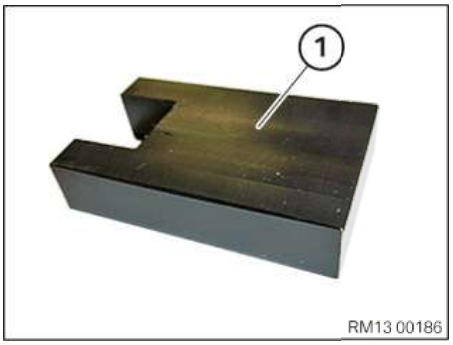
- Observe position of cast lug:

  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.



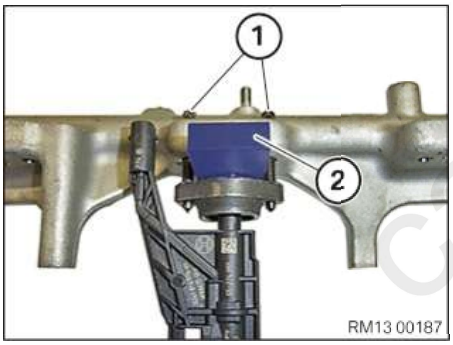
RISK OF DAMAGE

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.



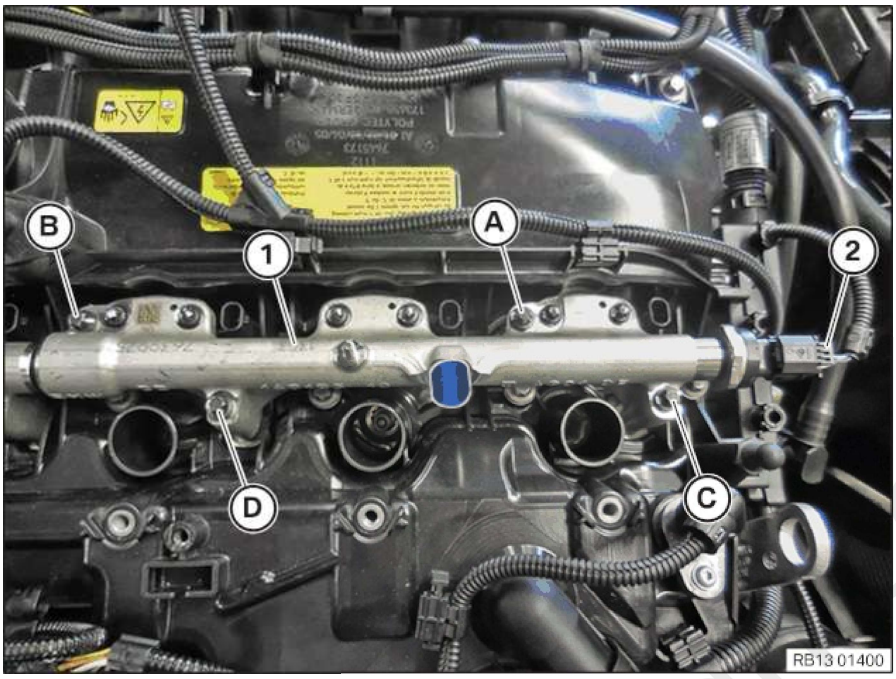
- Remove special tool 2 358 022(1) .
- Repeat this operation for all injectors.

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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.

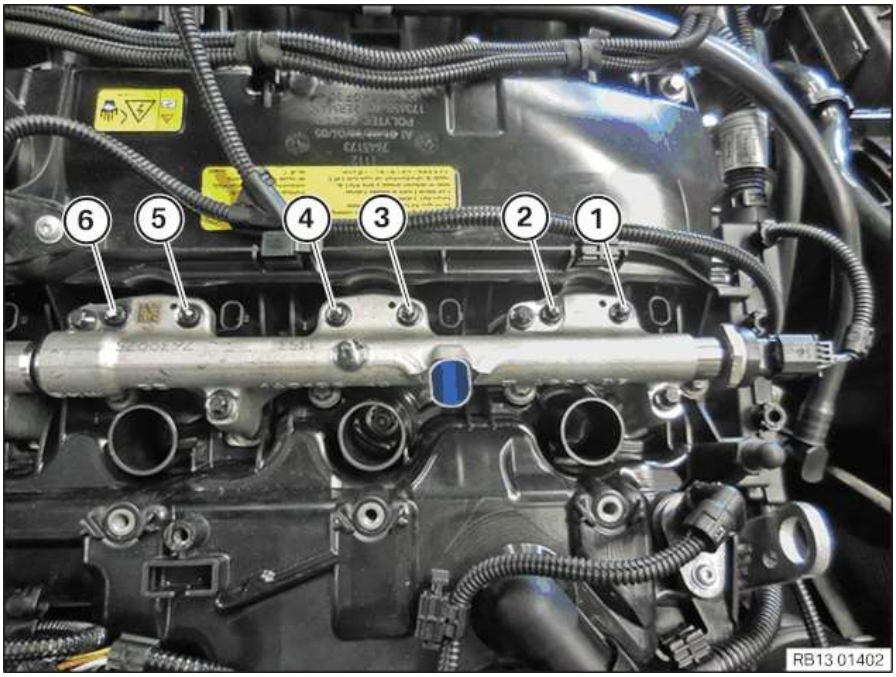
- Tighten screw (A) to 5 Nm.
- Tighten screw (D) to 5 Nm.
- Tighten screw (B) to 5 Nm.
- Tighten screw (C) to 5 Nm.
- Connect and lock the connector (2).

  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.

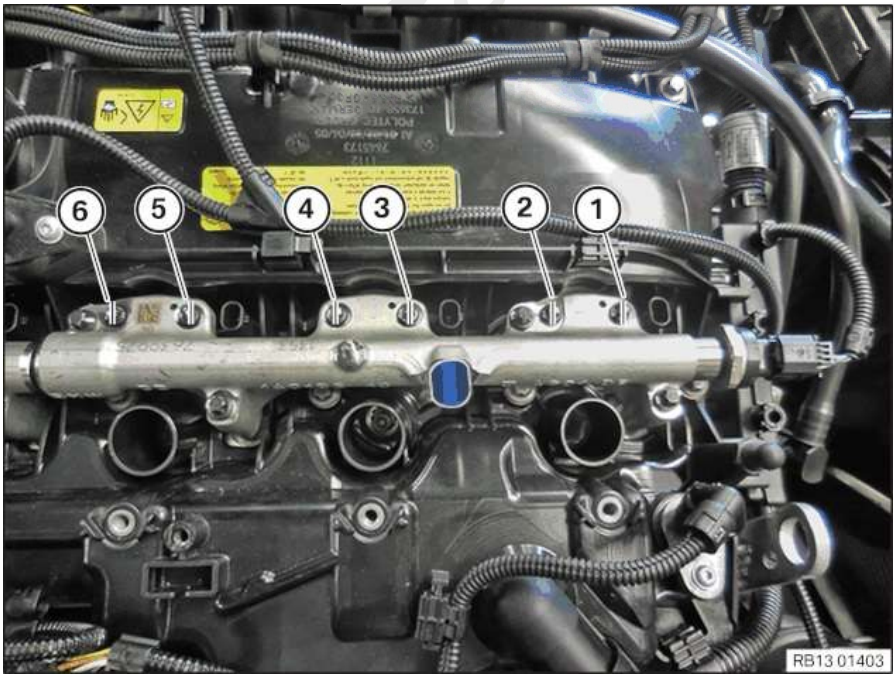
  Do not use a reversible ratchet or torque wrench.
- Hand-tighten screws (M5x30) in pairs ((1) with (2), (3) with (4), (5) with (6)) alternately by **90°**.
- Set torque wrench to 5 Nm.

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

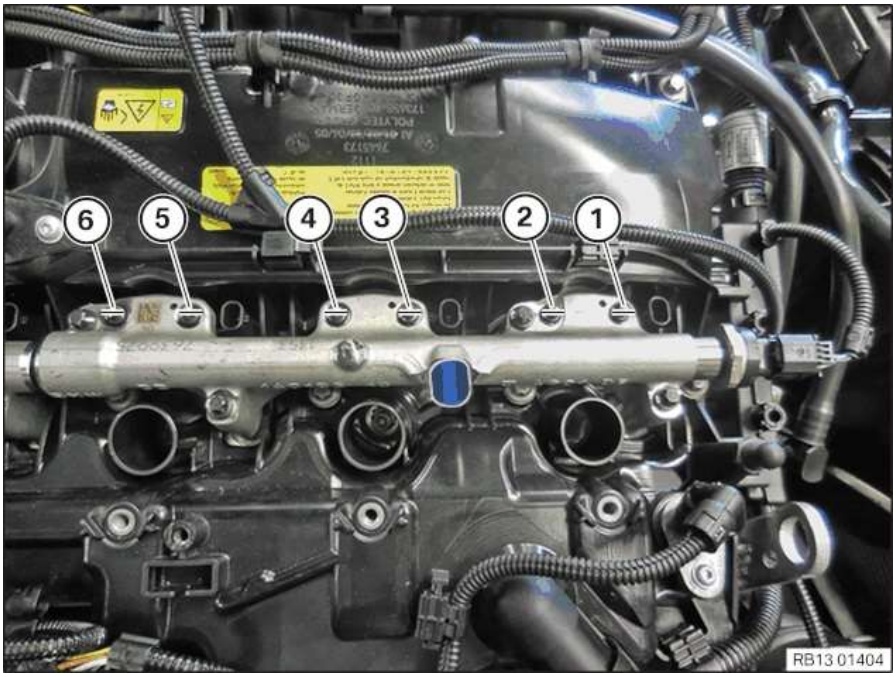
Non-observance of these requirements may result in leaks and damage.

- **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.



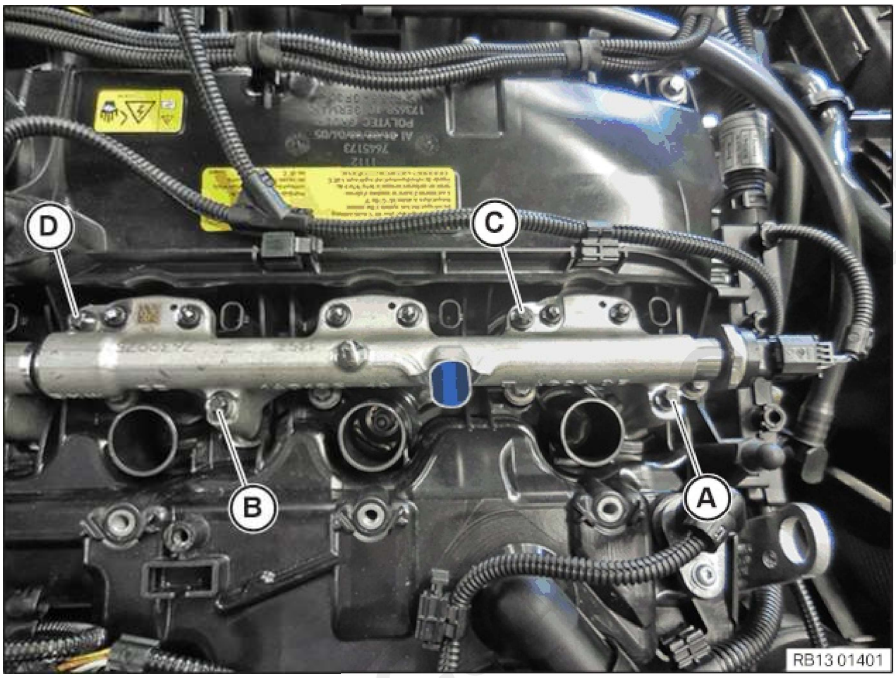
- Mark all bolts (1) to (6) with a line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the screw (1) with an angle of rotation of 90° ±15°.
  - Tighten the screw (2) with an angle of rotation of 90° ±15°.
  - Tighten the screw (3) with an angle of rotation of 90° ±15°.
  - 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.

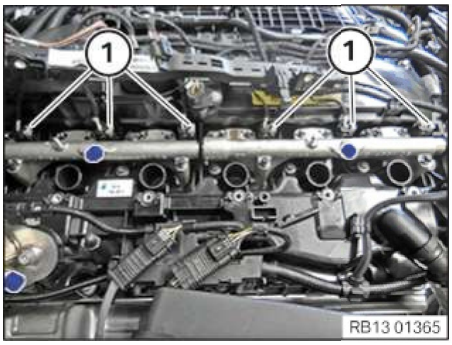


- Mark all the bolts (A) to (D) with a vertical line (see Figure).
- Tighten bolts (M6x70) (A) to (D) with an angle of rotation of 90°.



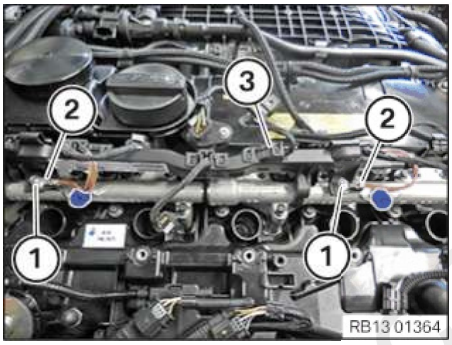
- Check whether all screws (A) to (D) have been tightened with an angle of rotation of 90°.

  All marks (lines) must be horizontal (see figure).



- Connect and lock all the connectors (1) to the injectors.

  All connectors (1) must engage audibly.

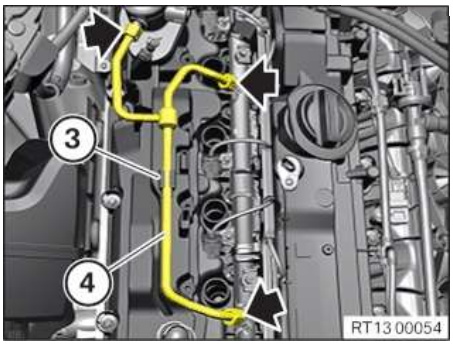


- Thread the cable channel (3) in and install.
- Thread in ground cable (2) and install.
- Tighten nuts (1).

Ground cable to rail

M6			5 Nm

58 – Installing high pressure line between rail and high pressure pump

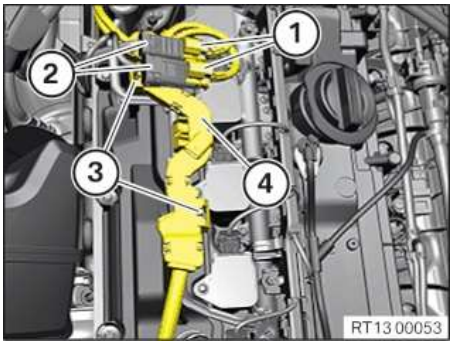


- Insert the high pressure line (4) into the holder (3) and install.
- Tighten union nuts (arrows) with the special tool .

High pressure line between rail and high pressure pump

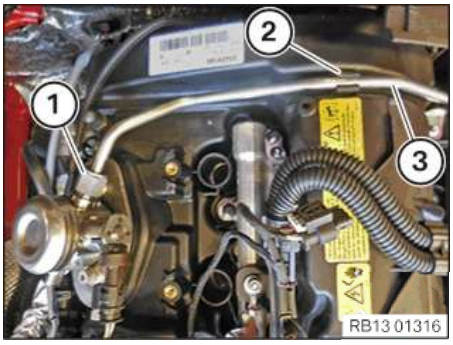
M14x1,5		Tightening torque	33 Nm

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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.

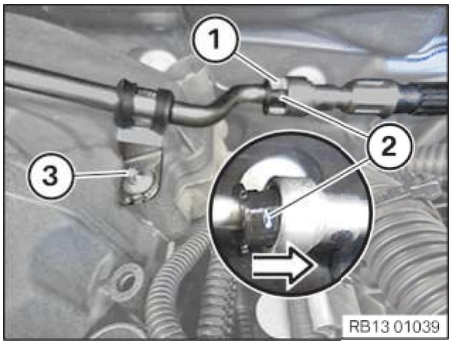
59 – Installing fuel delivery line



- 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

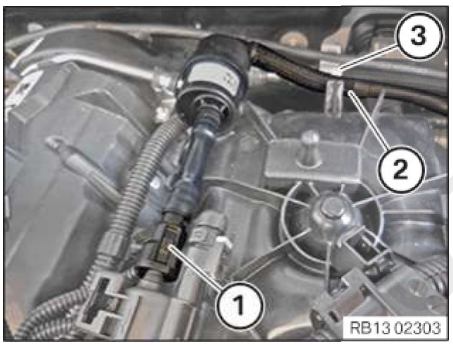
M14		Tightening torque	31 Nm



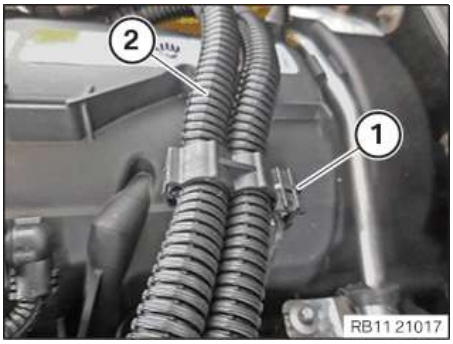
- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure clamps (1).
- Tighten down screw (3).

Fuel line to cylinder head cover

6x18		Tightening torque	6,5 Nm

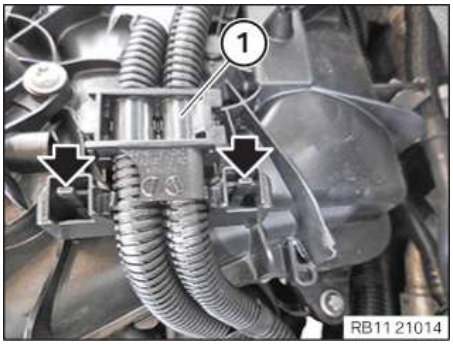


- Insert and install the tank ventilation line (2).
- Lock (1) must engage audibly.
- Secure the tank ventilation line (2) to the clamp (3).



- Insert and install wiring harness section (2) for injectors and ignition coils.
- Secure clamps (1).

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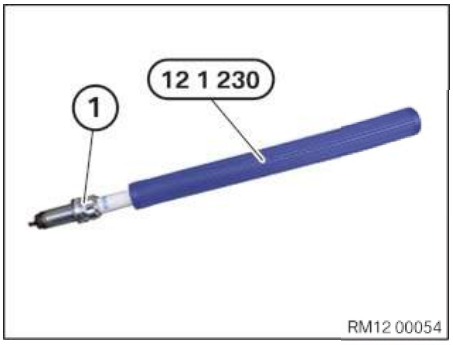


- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

60 – 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

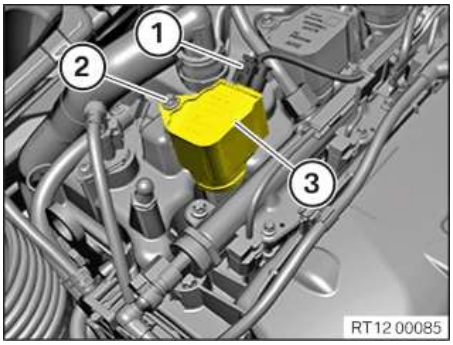
M12x1.25		Tightening torque	23 Nm

61 – Install all ignition coils

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Install ignition coil.**



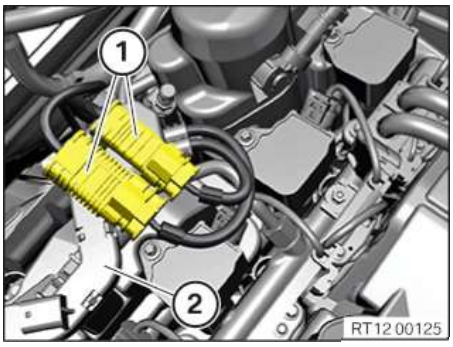
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

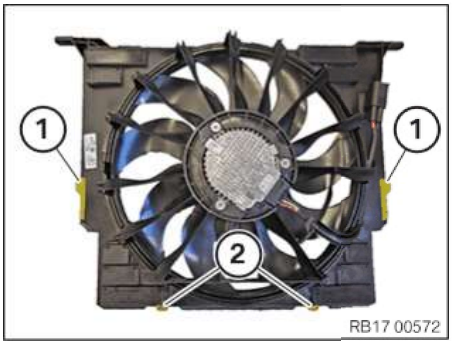
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

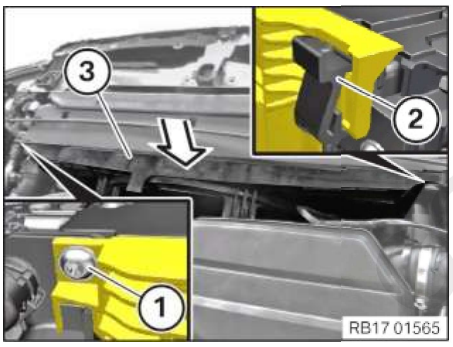


- Connect the connector (1) of the front oxygen sensor and the monitoring oxygen sensor on the cable shaft (2).

62 – Install fan cowl



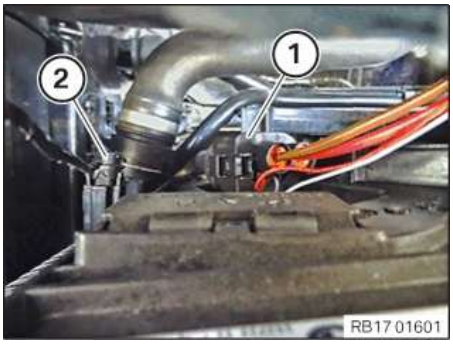
- Feed guides (1) into the radiator.
- Feed guides (2) into the charge air cooler.



- 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

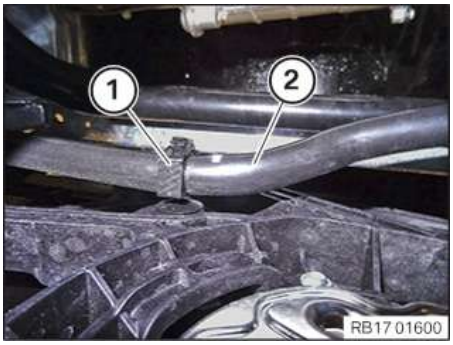


- Connect connectors (2) and lock.

  The connector (2) must engage audibly.
- Connect connectors (1) and lock.

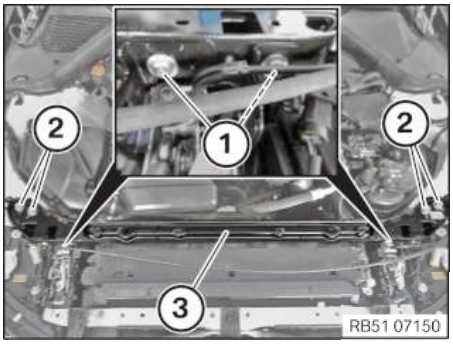
  The connector (1) must engage audibly.

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- **If installed:** Secure the transmission oil line (2).
  Insert and install the transmission oil line (2).
  Lock holder (1).

63 – Install the rear top cross connection



- Guide in and position the top rear cross connection (3).
- Tighten the screws (1).

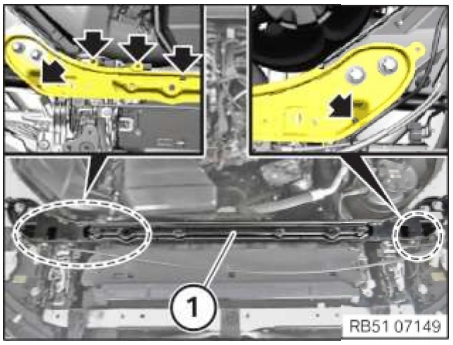
Top rear cross connection to bonnet catch support

Flat-head screw M6x20		Tightening torque	11,8 Nm

- Renew screws (2).
  Parts: Bolts
- Tighten the screws (2).

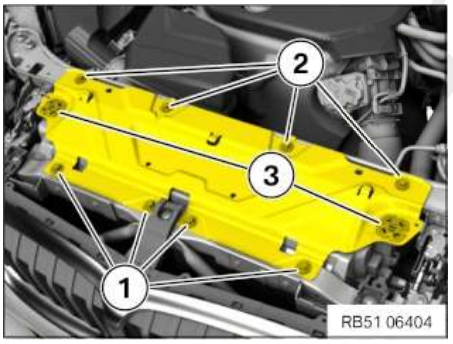
Rear top cross connection to wheel arch carrier support

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).

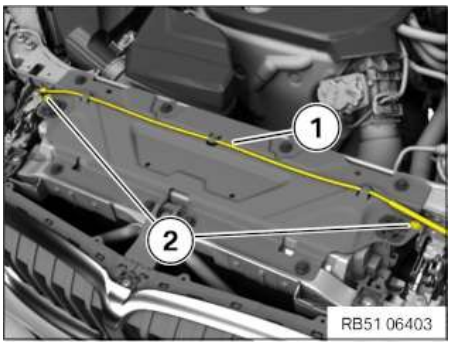
64 – Installing the top cross connection



- 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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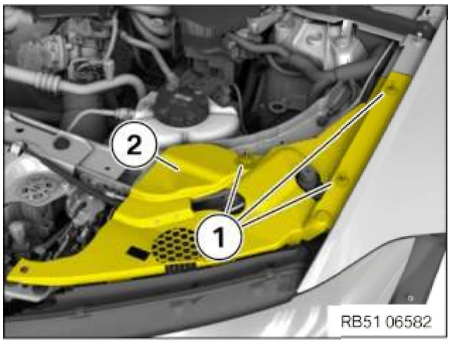
- Clip in the housing for the coupling of the Bowden cables (1).

65 – Install the cover in the engine compartment at top left and right partially

NOTICE

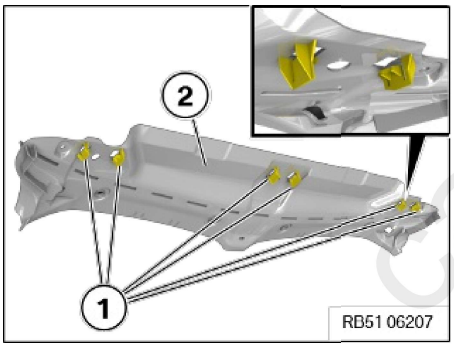
Description is for left component only. Procedure on the right side is identical.

▶ Installing the cover in the engine compartment on top partially



- Install the cover in the engine compartment on top (2).
- Secure expanding rivet (1).

66 – Installing cover for engine compartment centre



Check

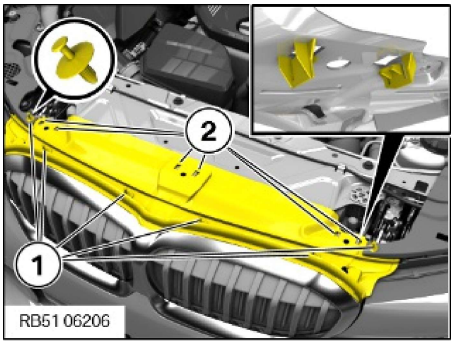
- Check latch mechanisms (1) of cover for engine compartment centre (2) for damage.

Result

» The latch mechanism (1) is damaged.

Measure

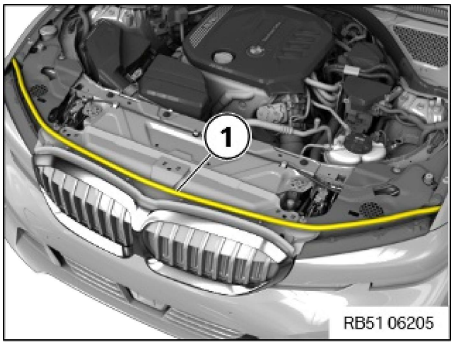
- Renew cover for engine compartment centre (2).



- 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).

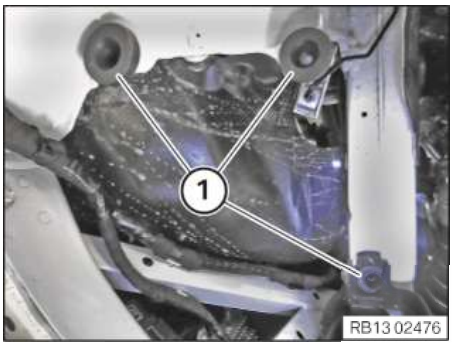
67 – Install the seal for the front bonnet

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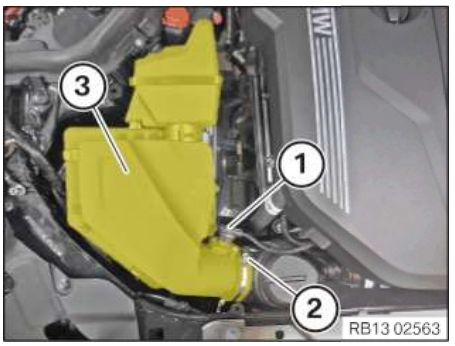


- Position the bonnet seal(1) and connect it on the mounting on the bumper and on the headlights.

68 – 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.

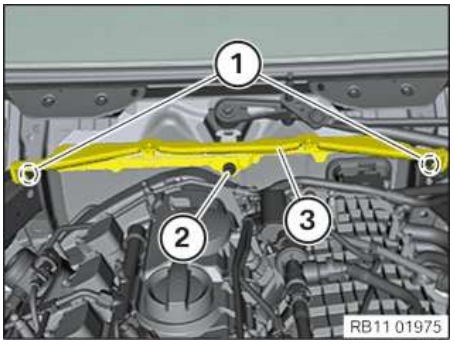
  The connector (1) must engage audibly.

69 – Disconnecting all battery earth leads



- See additional information.

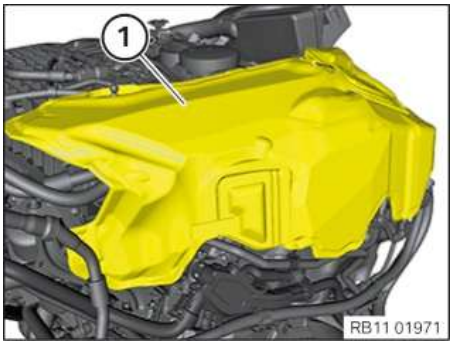
70 – Installing centre bulkhead lower section



- Position the centre bulkhead lower part (3).
- Tighten nut (2) and screws (1).

71 – Installing acoustic cover at rear

cardiagn.com

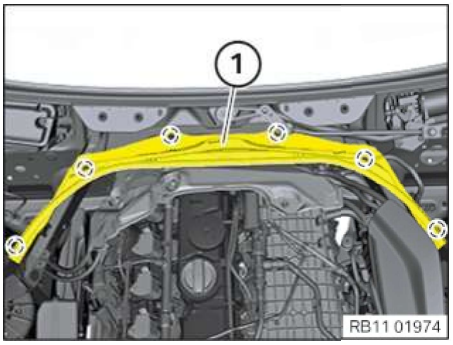


- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

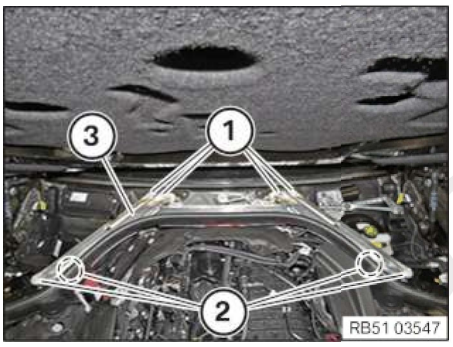
72 – Installing the centre bulkhead upper part



- 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 °

73 – Installing cowl panel cover

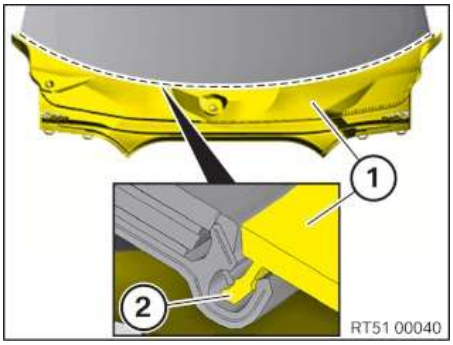
RISK OF DAMAGE

Damage caused by water ingress into the vehicle.

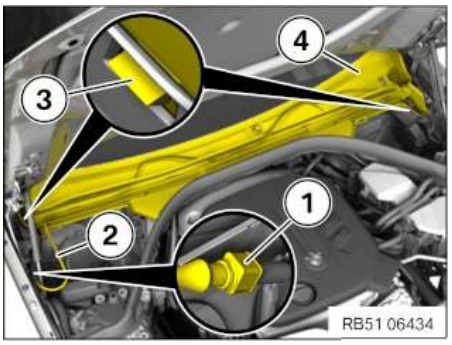
Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

- Ensure correct installation of the components.
- Only use undamaged components.

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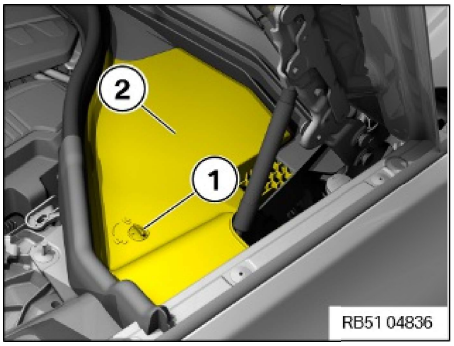


- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



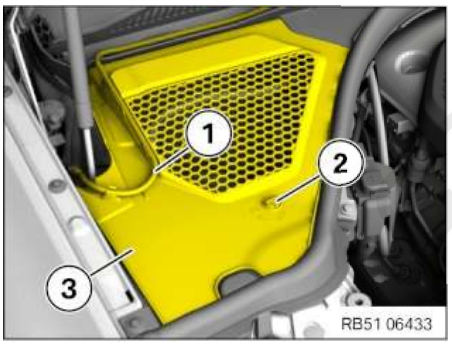
- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

74 – Install the cover of the engine compartment on the rear left



- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

75 – 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.

76 – Installing both wiper arms

NOTICE

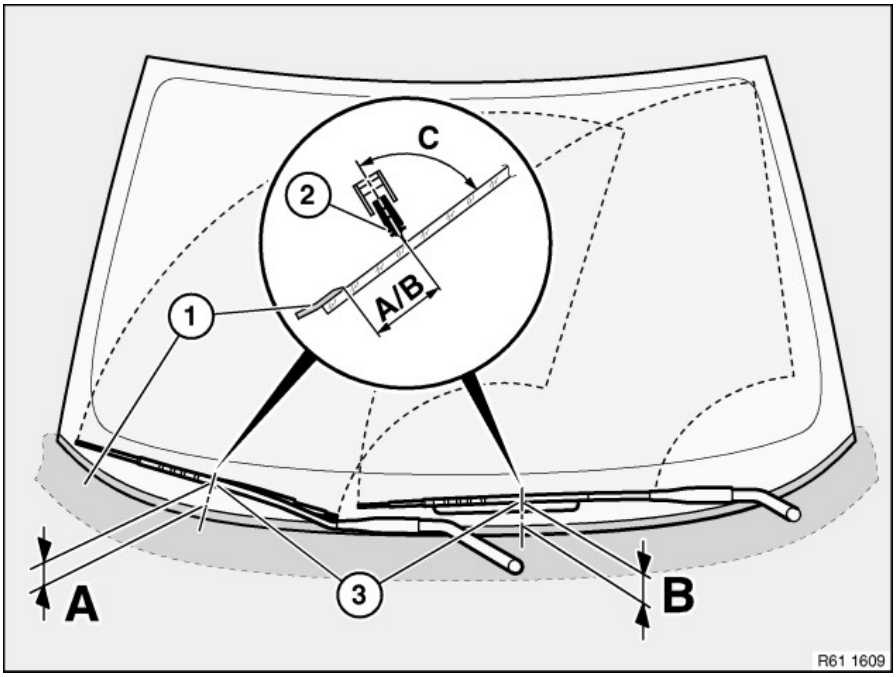
Description is for left component only. Procedure on the right side is identical.

▸ **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.

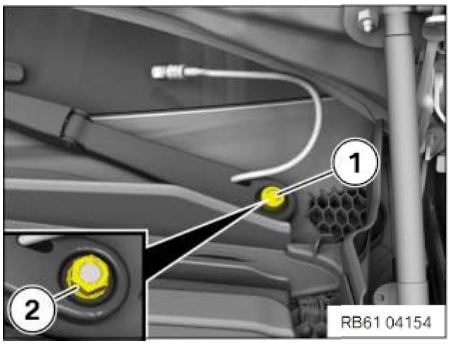
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- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

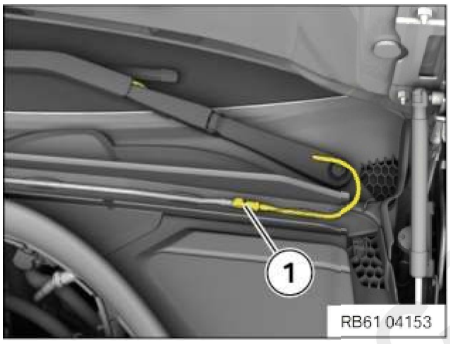


- Tighten nut (2).

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.

77 – Install acoustic cover

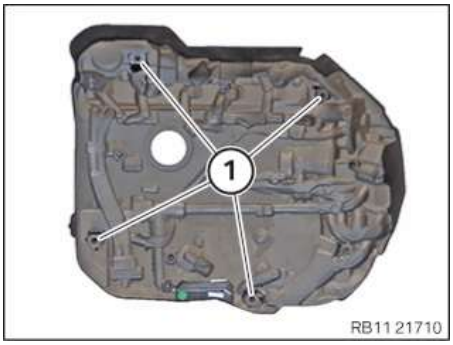
RISK OF DAMAGE

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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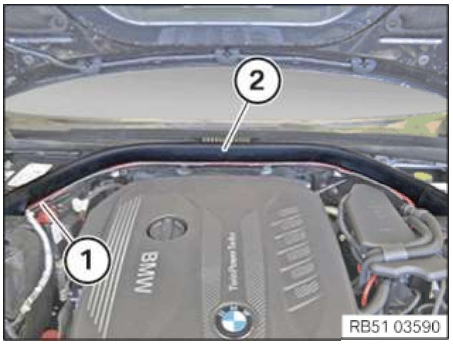


- Check the rubber mount (1) for correct fit in the acoustic cover.



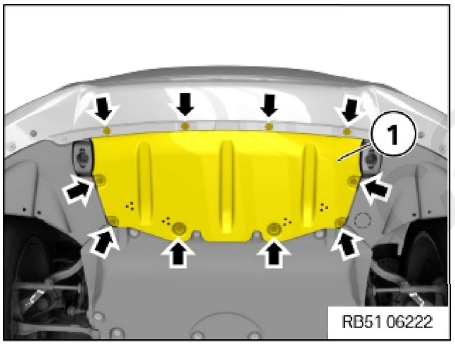
- Install acoustic cover (1) and fix in the rubber mounts (marks).

78 – 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.

79 – Installing the front underbody protection



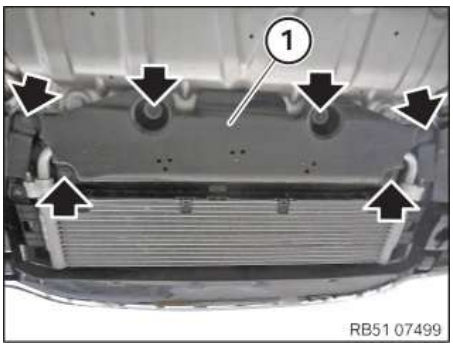
- **Version 1:**

  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:**

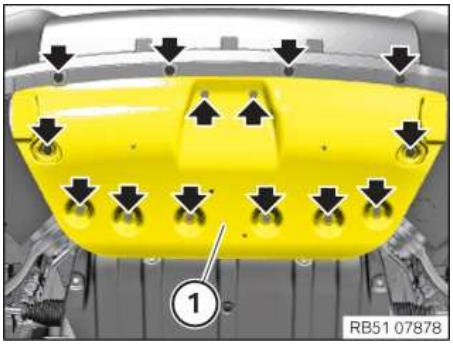
  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

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- **Version 3:**

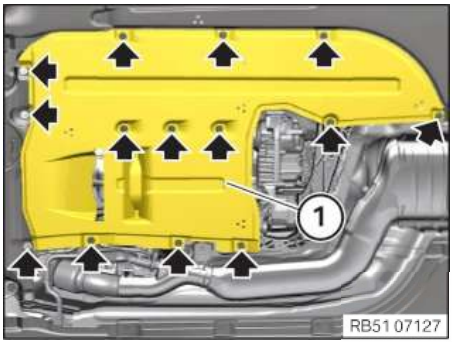
  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

80 – Installing underbody protection at rear



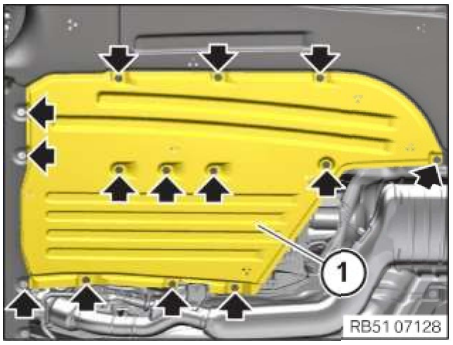
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

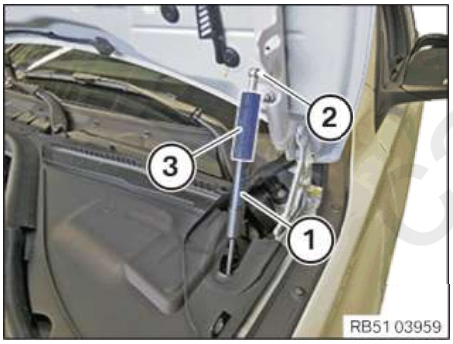
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

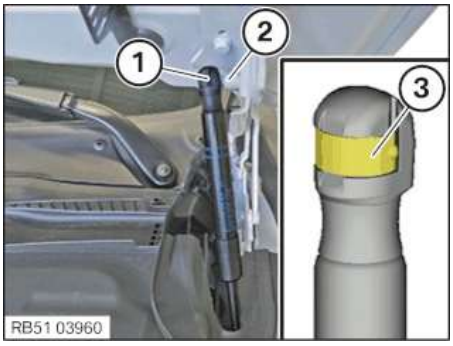
Underbody protection

Hexagon screw		Tightening torque	3 Nm

81 – 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 314450

M6		Tightening torque	8 Nm

Test gauge to basic carrier — Used in step 314450

M6		Tightening torque	8 Nm

VANOS central valve to camshaft — Used in step 4647

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 49

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Engine oil cooler to bumper support — Used in step 51

M6X25		Tightening torque	8 Nm

Cover, front bottom on side — Used in step 51

Hexagon screw for thermoplastic		Tightening torque	3 Nm

Cylinder head cover to cylinder head — Used in step 52

M6X30		Jointing torque	8 Nm

Cylinder head cover to cylinder head — Used in step 52

M6X30		Tightening torque	11 Nm

Auxiliary coolant pump holder to cylinder head — Used in step 52

M6		Tightening torque	7 Nm

Standard screw connection M6 — Used in step 52

M6			8 Nm

Differential pressure sensor to holder — Used in step 52

TS6X18		Tightening torque	3,5 Nm

Holder, positive battery cable to cylinder head cover — Used in step 52

6X18		Tightening torque	6 Nm

High pressure pump to high pressure pump flange — Used in step 54

M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

Ground cable to rail — Used in step 5657

M6			5 Nm

High pressure line between rail and high pressure pump — Used in step 58

M14x1,5		Tightening torque	33 Nm

Fuel delivery line to high pressure pump — Used in step 59

M14		Tightening torque	31 Nm

Fuel line to cylinder head cover — Used in step 59

6x18		Tightening torque	6,5 Nm

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Spark plugs			Used in step 60
M12x1.25		Tightening torque	23 Nm

Ignition coil			Used in step 61
Screw		Tightening torque	8 Nm

Fan cowl with electric fan on radiator			Used in step 62
TS6x20		Tightening torque	6,5 Nm

Top rear cross connection to bonnet catch support			Used in step 63
Flat-head screw M6x20		Tightening torque	11,8 Nm

Rear top cross connection to wheel arch carrier support			Used in step 63
M10x20 screw	Renew screw.	Jointing torque	56 Nm
		Angle of rotation	90 °

Cross connection, top			Used in step 64
M8x20		Tightening torque	28 Nm

Cross connection, top			Used in step 64
M6x20		Tightening torque	11,8 Nm

Clean air pipe to upper section of intake filter housing			Used in step 68
Clamp		Tightening torque	3 Nm

Bulkhead upper part to bottom bulkhead			Used in step 72
		Tightening torque	3 Nm

Tension strut on bulkhead			Used in step 72
M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome			Used in step 72
Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

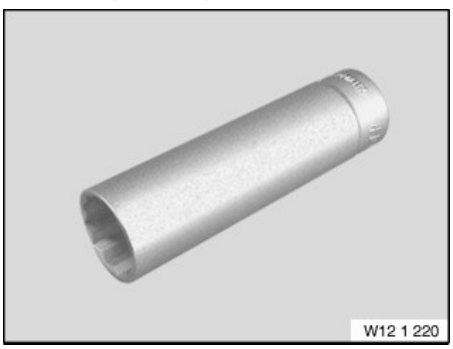
Windscreen wiper arm			Used in step 76
Combination hexagon nut		Tightening torque	35 Nm

Underbody protection front			Used in step 79
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Underbody protection			Used in step 80
Hexagon screw		Tightening torque	3 Nm

Overview of Special Tools

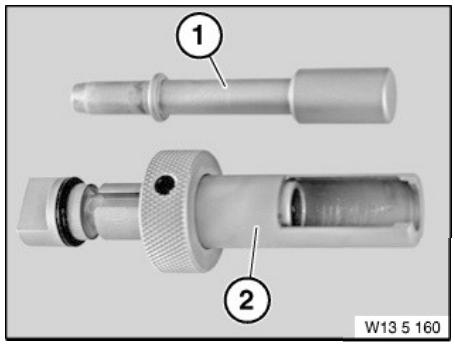
0 495 560 (12 1 220) Socket



Common		Used in step 2060
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)	

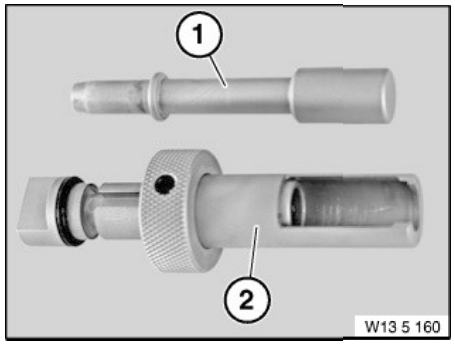
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0 496 567 (13 5 161) Fastener



Common	Used in step 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	

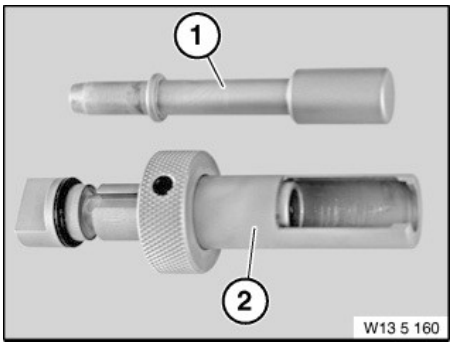
0 496 568 (13 5 162) Fastener



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



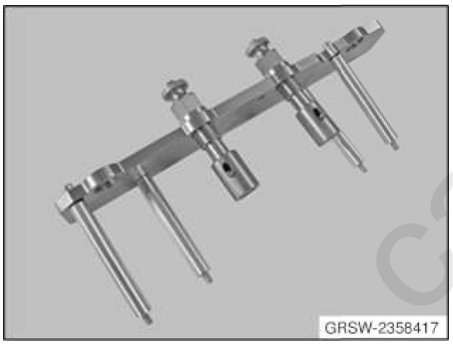
Common Used in step 22

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	

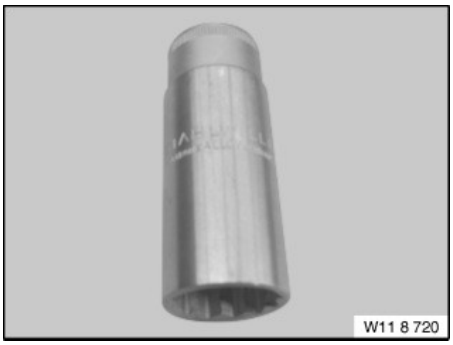
2 358 417 Device



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)

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)

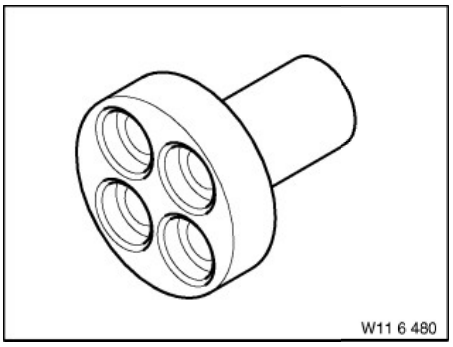
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2 360 895 Pin wrench



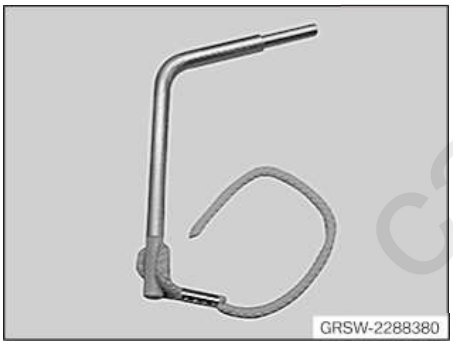
Common	Used in step 2653
Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 493 380 (11 6 480) Connector



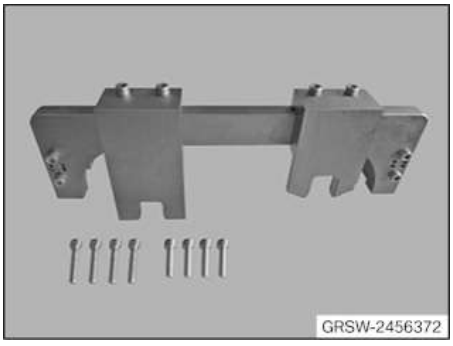
Common	Used in step 31485054
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

2 288 380 Locating stud



Common	Used in step 314850
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 3143444850
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 314350
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 33344647
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 33344647
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 4548
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 55
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 55
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)

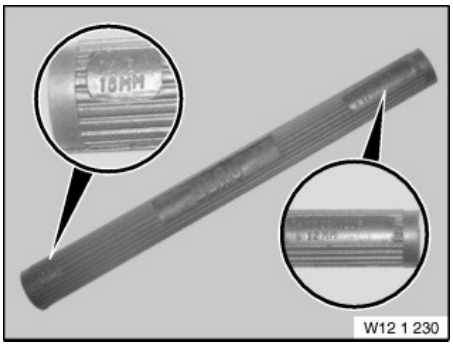
2 358 022 Gauge



Common	Used in step 5657
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 60
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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Overview Technical Data

Distance from window pane edge to wiper blade	Used in step 76
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	169
61 20 900 Disconnecting and connecting battery earth lead	169
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61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	169
61 20 900 Disconnecting and connecting battery earth lead	169
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	169
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	169
61 20 900 Disconnecting and connecting battery earth lead	169
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61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	169
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61 20 900 Disconnecting and connecting battery earth lead	169
61 20 900 Disconnecting and connecting battery earth lead	169
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	54

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11 36 126 Removing and installing/replacing the Vanos central valve on the exhaust side

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

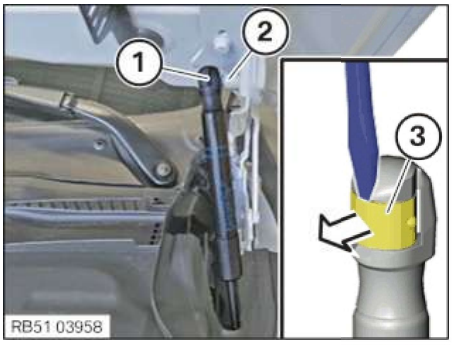
Engine compartment lid is open.

CAUTION

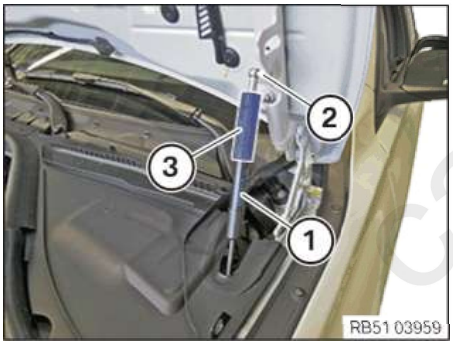
Shutting bonnet or tailgate.

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.

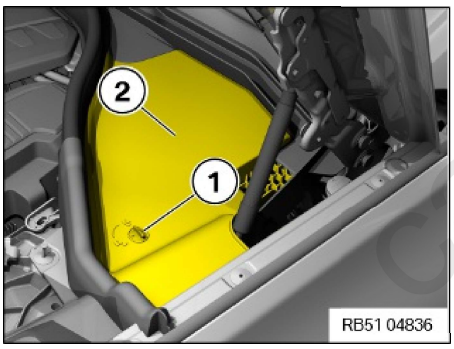
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- 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.



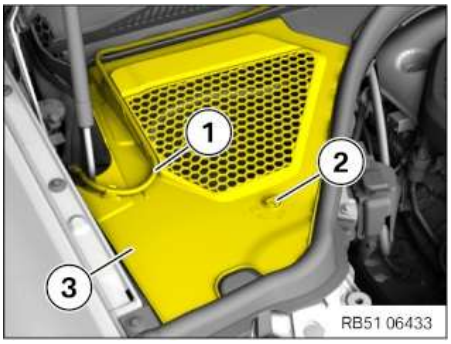
- Release the acoustic cover (1) towards the top from the rubber mounts (marks).

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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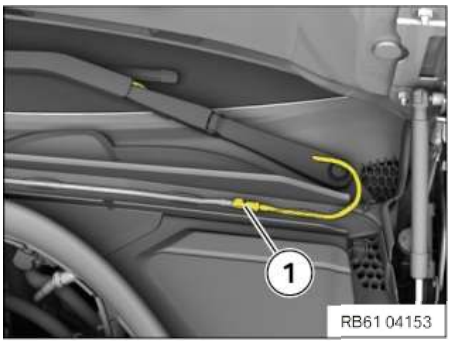
▸ **Remove the wiper arm**

RISK OF DAMAGE

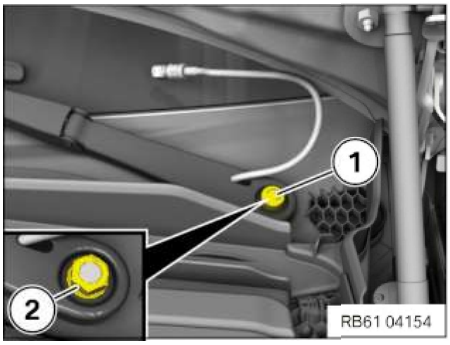
Damage to wiper console

While removing the wiper arms without using special tool, the wiper console can break.

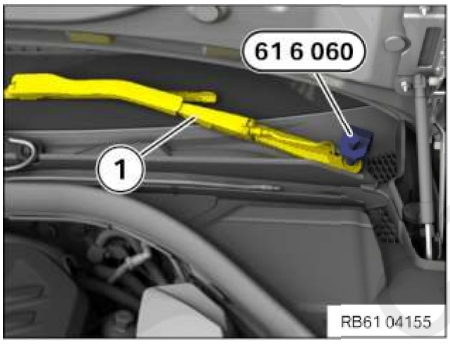
- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.



- Disconnect the windscreen wash hose(1) at the separation point and remove from the cowl guide.

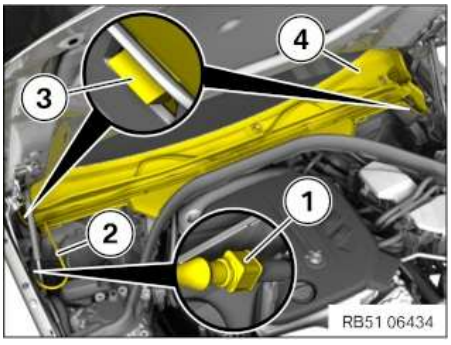


- Remove the protective cap (1).
- Loosen nut (2).



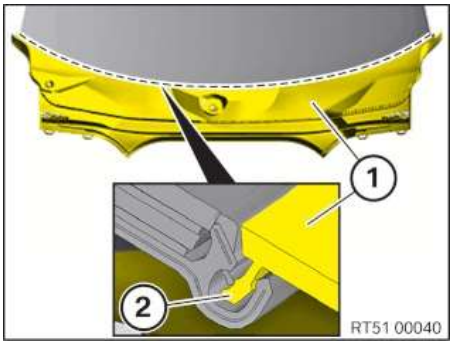
- Pull off the wiper arm (1) using special tool .

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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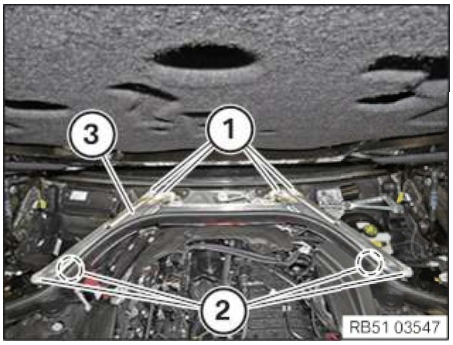


- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

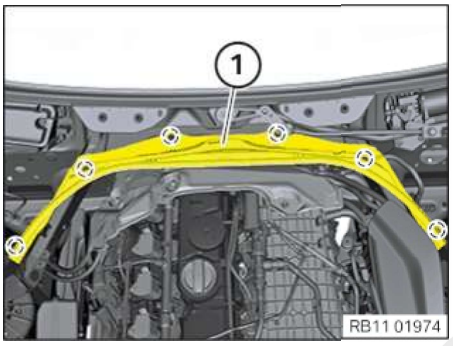
9 – Removing the centre bulkhead upper part

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.



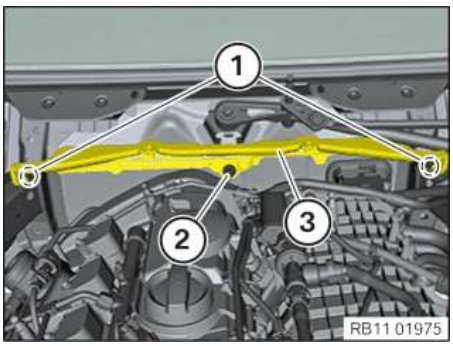
- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

10 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

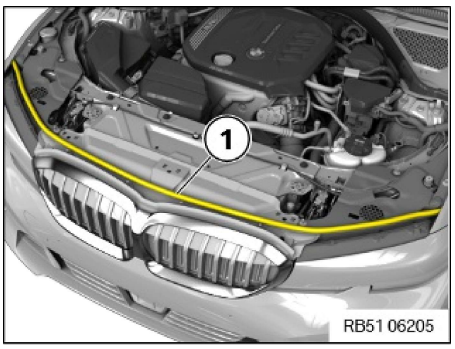
11 – Removing the centre bulkhead lower section



- Loosen screws (1).
- Loosen nut (2).
- Remove the centre bulkhead lower part (3).

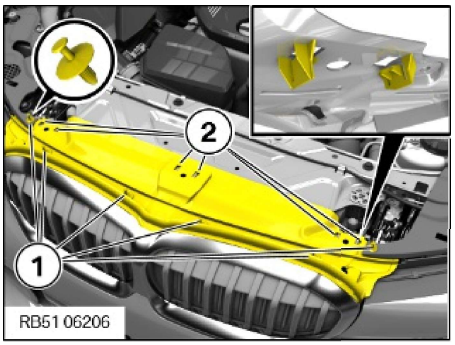
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12 – Remove the seal for the bonnet in front



- Pull off front bonnet seal (1) upwards.

13 – Removing the centre engine compartment cover



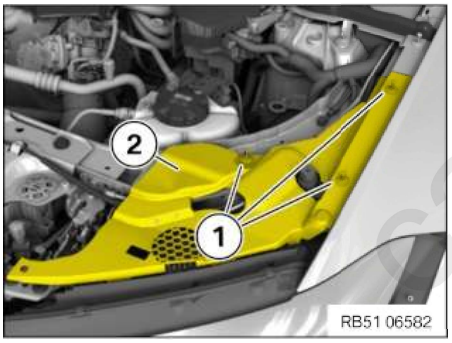
- Detach all expanding rivets (1).
- Release the cover of the centre engine compartment with the latch mechanisms (2) .
- Feed the cover for the centre engine compartment out to the rear.

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**



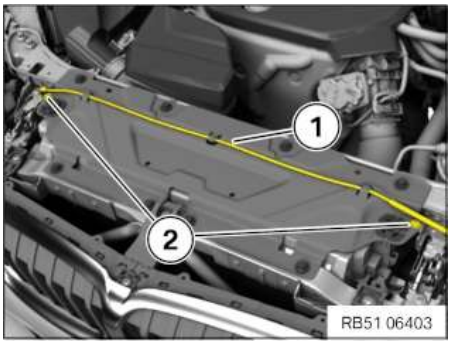
- Loosen the expanding rivet (1).
- Remove the cover in the engine compartment on top (2) partially.

15 – Removing the top cross connection

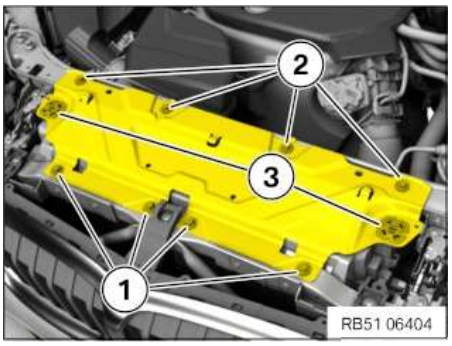


- Release the housing for the coupling of the Bowden cables (1) from the body.

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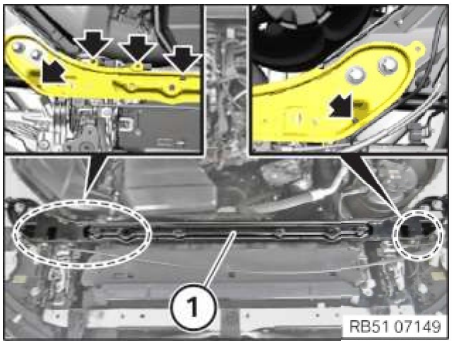


- Detach Bowden cable (1) at the top cross connection.
- Loosen screws (2).

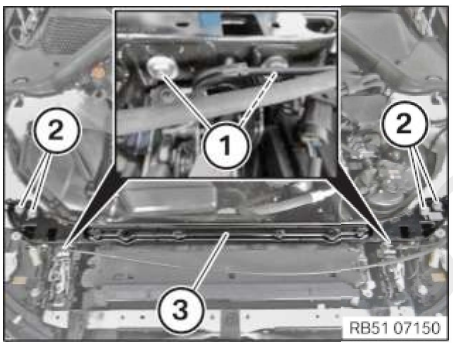


- Loosen screws (1) and (2).
- Remove the top cross connection with the holders(3) towards the top.

16 – Remove the rear top cross connection



- Release the clips (arrows) in the marked areas from the top rear cross connection (1).

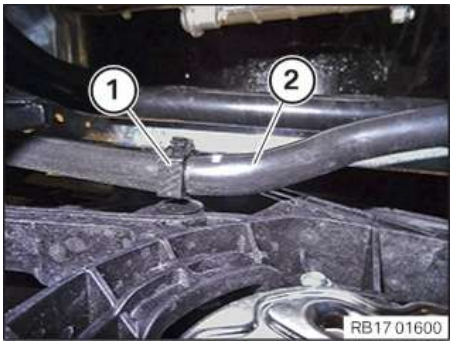


- Loosen screws (1).
- Loosen screws (2).
- Guide out and remove top rear cross connection (3).

17 – Remove fan cowl.

TECHNICAL INFORMATION

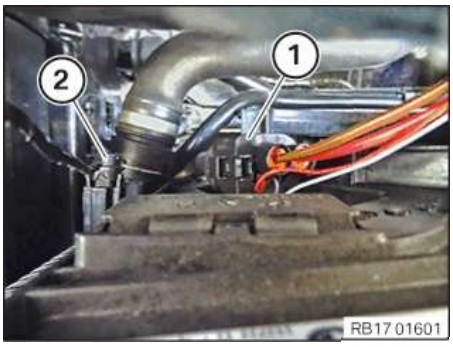
- When the engine is stopped after the end of the journey, it may be necessary to run the electric fan. In rare cases, operation of the electric fan can last up to 11 min. This protects the components. In this case, replacing the electric fan will not remedy the problem!



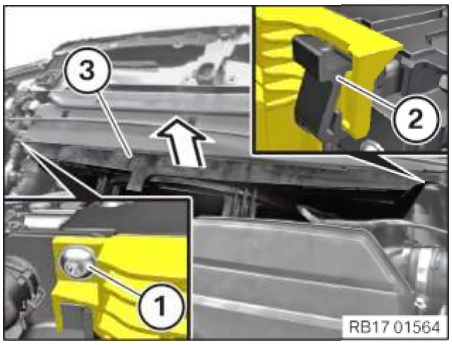
- **If installed:** Release transmission oil line (2).

  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.

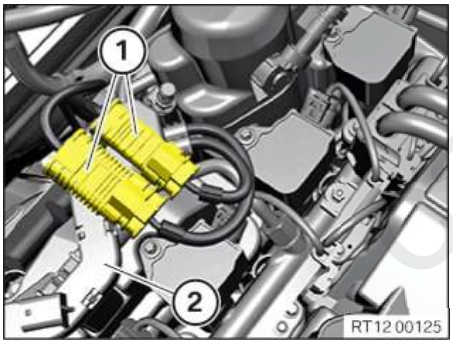
- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

RISK OF DAMAGE

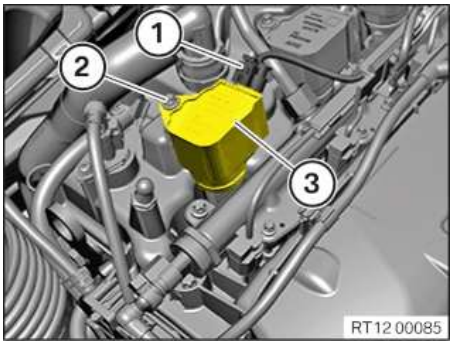
Electrostatic discharge.

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

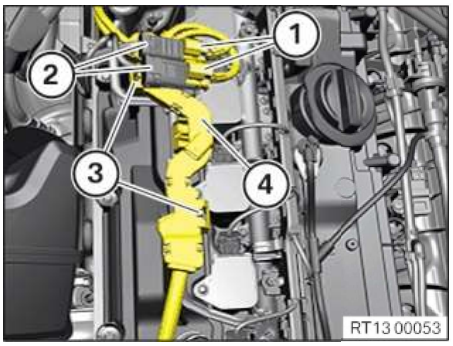
On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

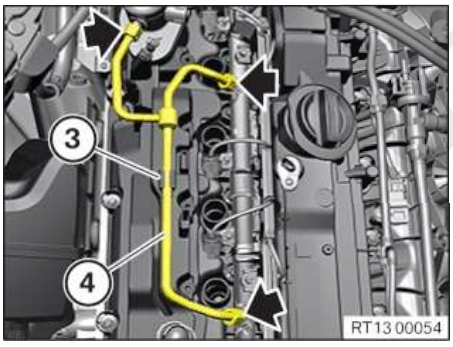
- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

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

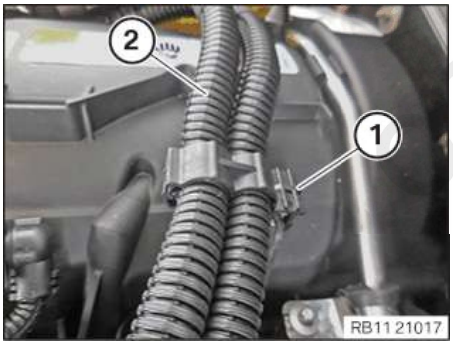
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

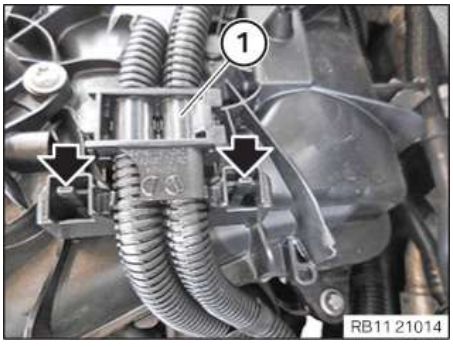
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

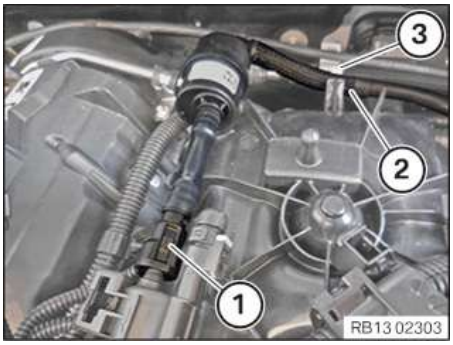
Reset special tool in early to avoid bending pressure lines.



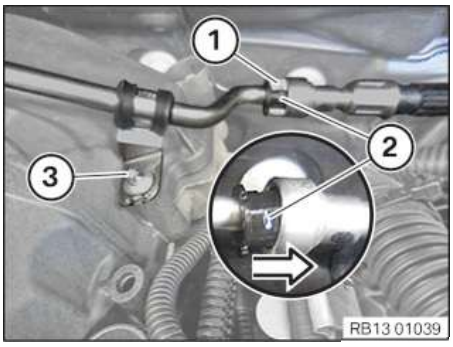
- Loosen clamp (1).
- Guide out wiring harness section (2) for the injectors and ignition coils and place it aside.



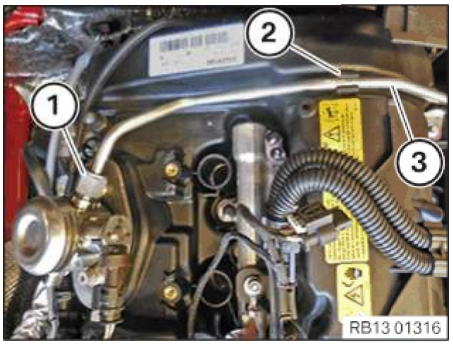
- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.



- 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

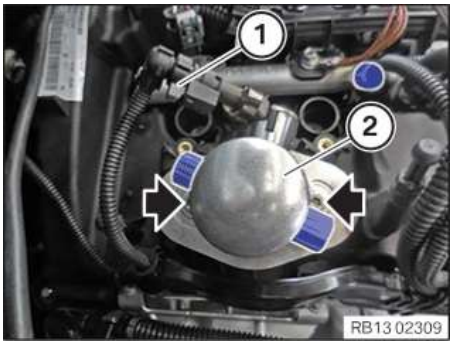
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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.

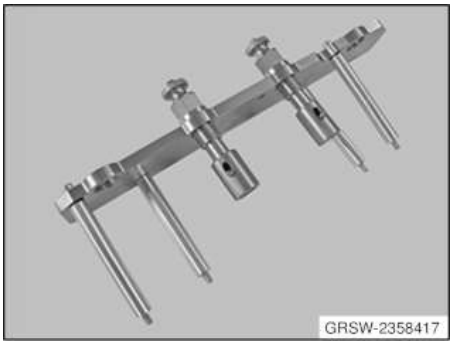
Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.



- Prepare special tool .

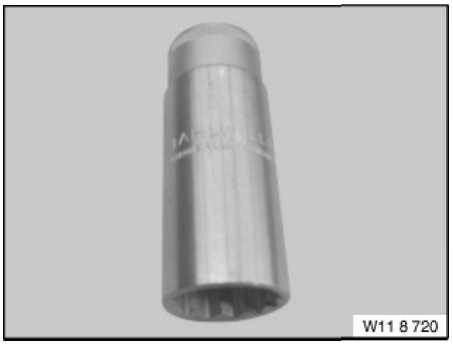
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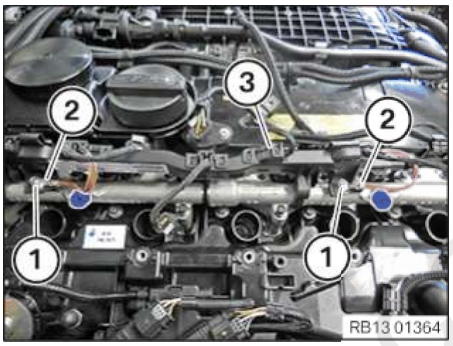
- Prepare special tool 2 358 417.



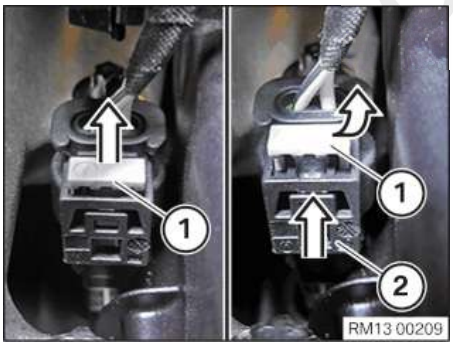
- Prepare special tool .



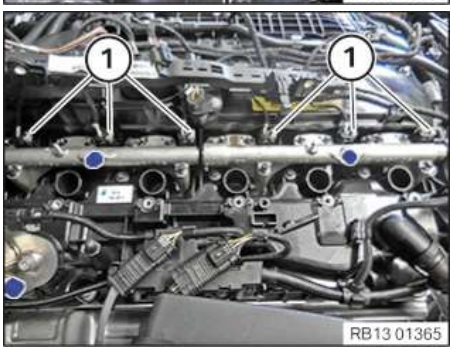
- Prepare special tool 0 496 106 (11 8 720).



- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.

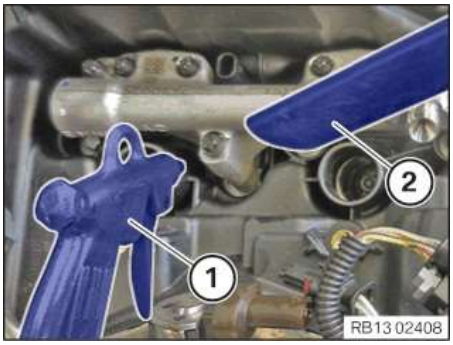


- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull out the connector (2) from the injectors.



- Unlock and release all connectors (1) of the injectors.

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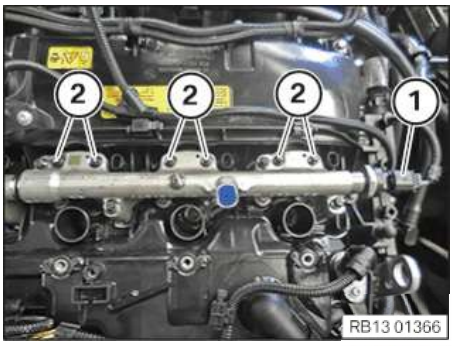


TECHNICAL INFORMATION

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

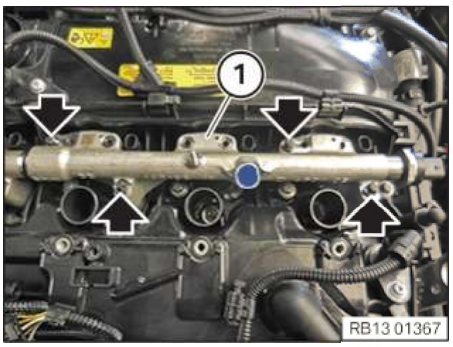
- Before releasing the high pressure lines: Blow out the injector shafts with an air gun(1) with less pressure.
- Simultaneously, draw off the dirt particles with an **explosion proof** vacuum cleaner (2).



- 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.

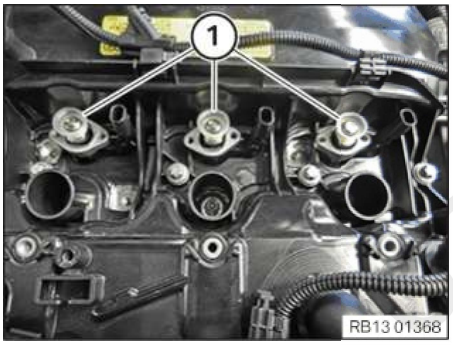


- Unscrew the screws (M6x30) (arrows).

  The screws may not be reused!
- Renew screws.

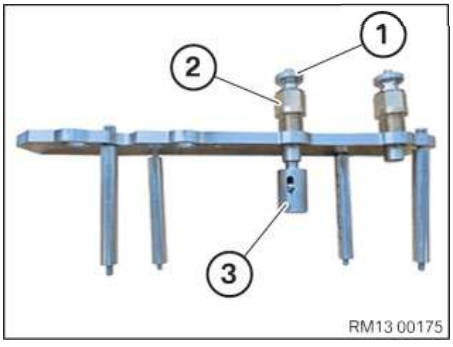
  Parts: Screws (M6x30)
- Remove rail (1) in upward direction.

  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.

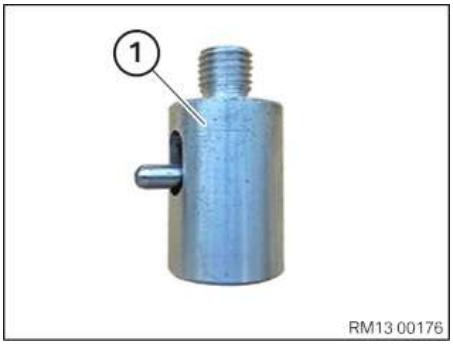
- Twist the injectors with a maximum torsional movement of 13 Nm.
- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use the special tool 2 358 417to remove the injectors.

  The special tool 2 358 417 is used to ensure that the tensile force is not exceeded.

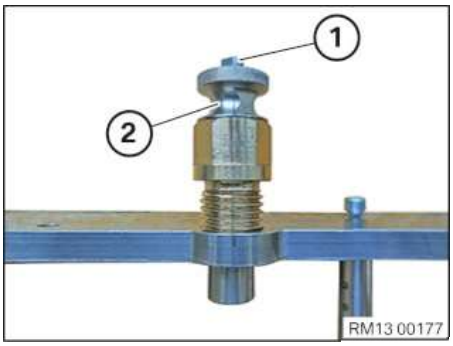
  Special tool 2 358 417 consists of:

  - **(1)** Threaded sleeves
  - **(2)** Pull-out thread (left-hand thread)
  - **(3)** Mounting for the injectors

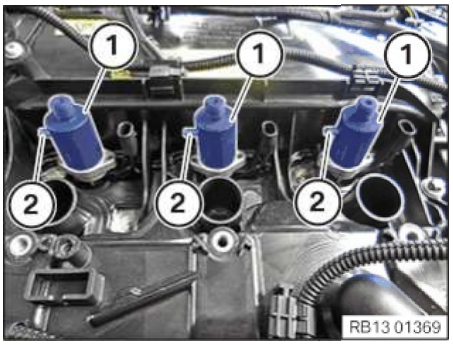
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- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.

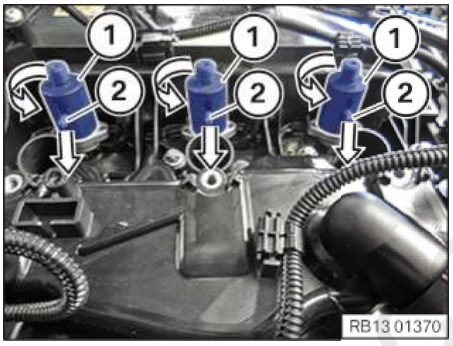


- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.

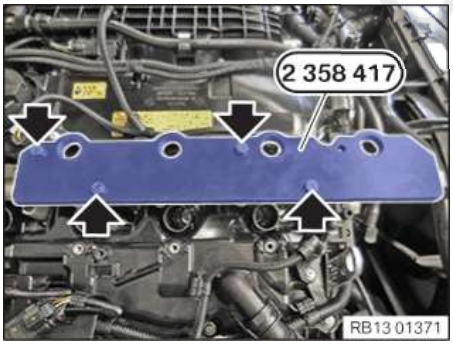


- Install all fixtures (1) for the injectors.

  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

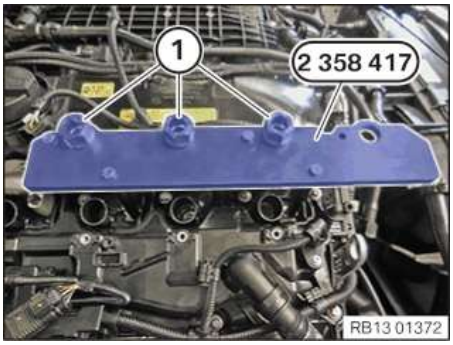
Damage to injectors.

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).

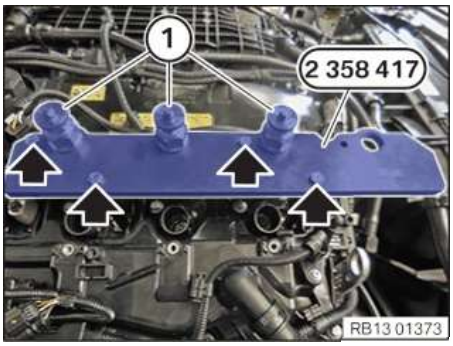
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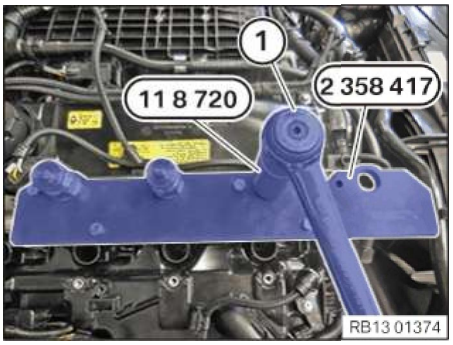
TECHNICAL INFORMATION

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.

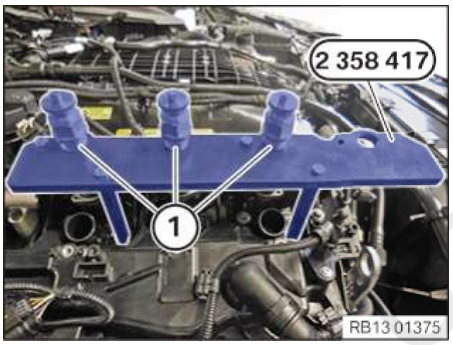


- Adjust torque wrench to 13 Nm **clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720)until the injector is pulled out.

TECHNICAL INFORMATION

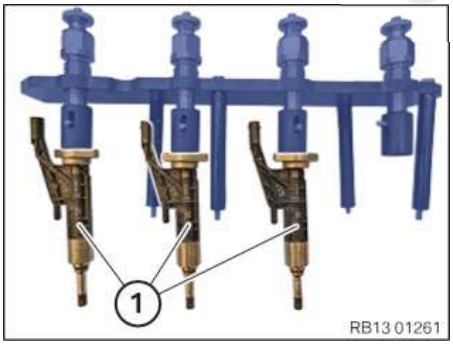
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

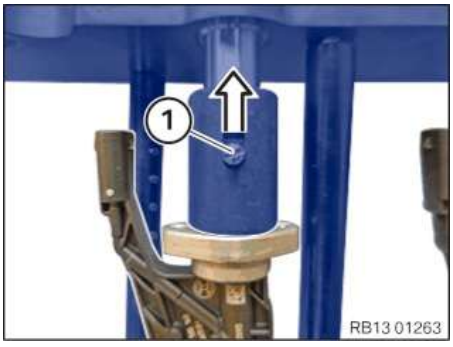


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  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.

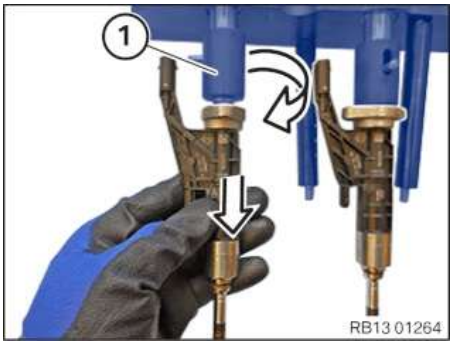


NOTICE

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.

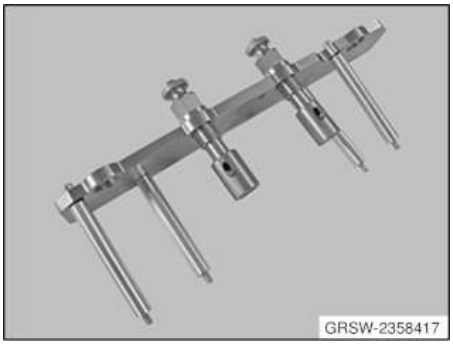
Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.



- Prepare special tool .

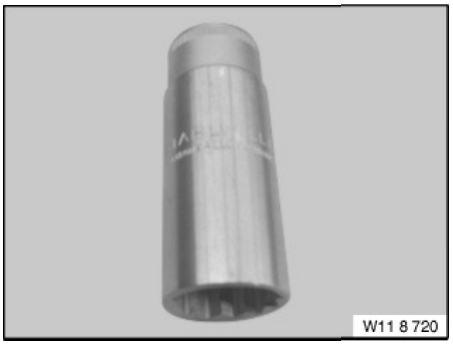
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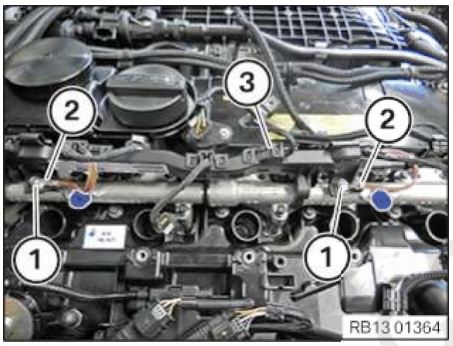
- Prepare special tool 2 358 417.



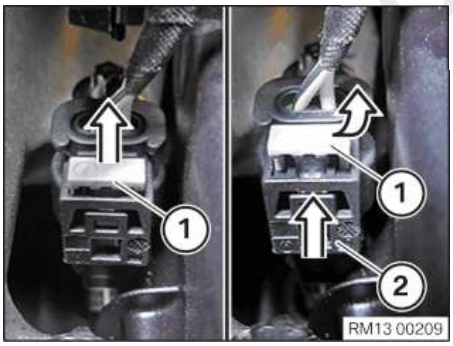
- Prepare special tool .



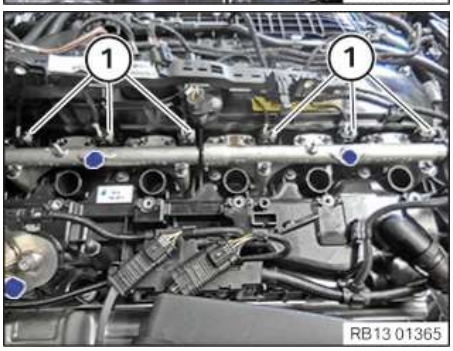
- Prepare special tool 0 496 106 (11 8 720).



- Release nuts (1) .
- Feed out ground cable (2) and set aside.
- Feed out cable channel (3) and set it aside.

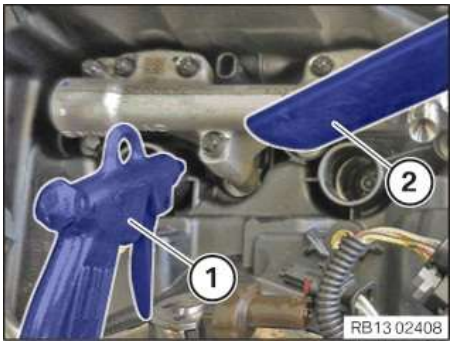


- Unlock lock (1) in direction of arrow upwards.
- Press lock (1) together and release.
- Disconnect the connector (2) from the injectors in the direction of the arrow.



- Unlock and release all connectors (1) of the injectors.

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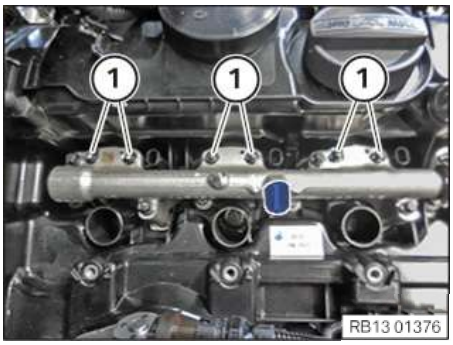


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

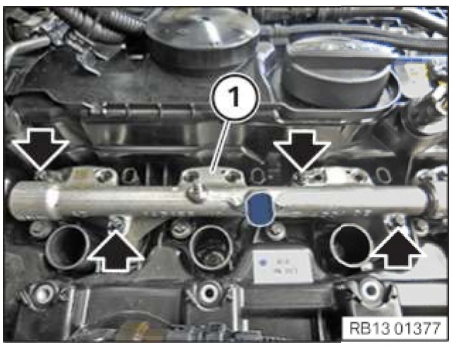
For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

- 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) .

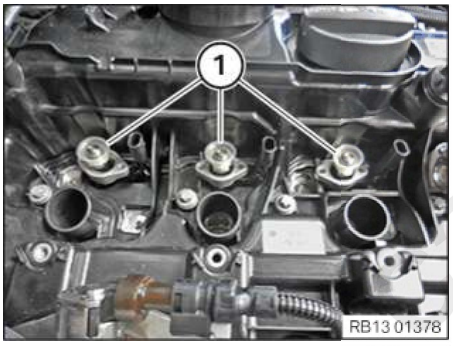
  Do **not** reuse screws (M5x30) (1).
- Catch and dispose of escaping fuel with suitable materials.



- Release screws (M6x30) (arrow).
- Remove screws (M6x30) (arrows).

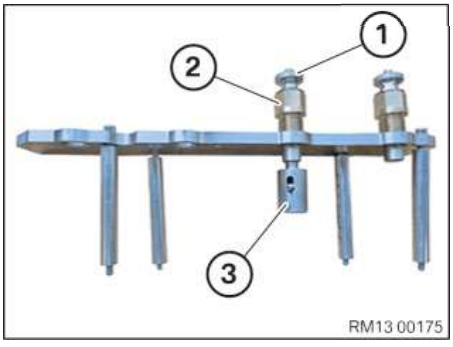
  Do **not** reuse the screws (M6x30).
- Remove rail (1) upwards.

  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.

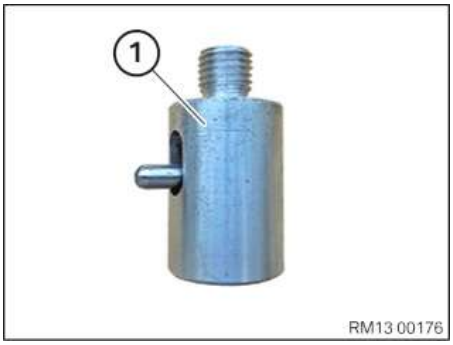
- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use the special tool 2 358 417 to remove the injectors.

  The special tool 2 358 417 is used to ensure that the tensile force is not exceeded.

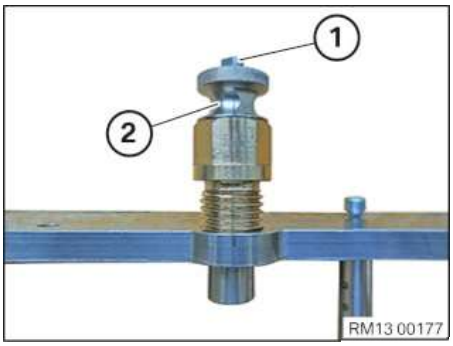
  The special tool 2 358 417 consists of:

  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Mounting for the injectors

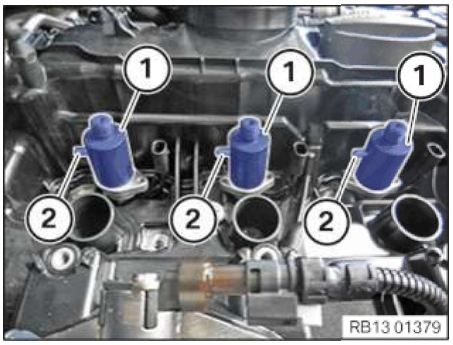
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- Unscrew the fixture for injectors (1) from special tool 2 358 417.

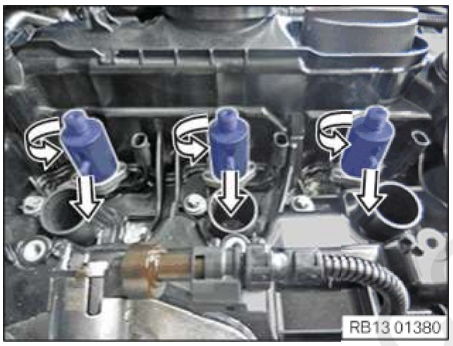


- Press lock (1) in and remove the threaded sleeve (2) from the special tool 2 358 417.



- 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

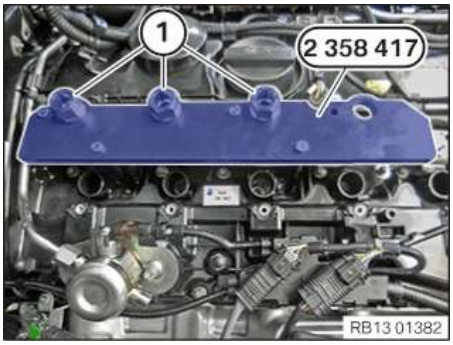
Damage to injectors.

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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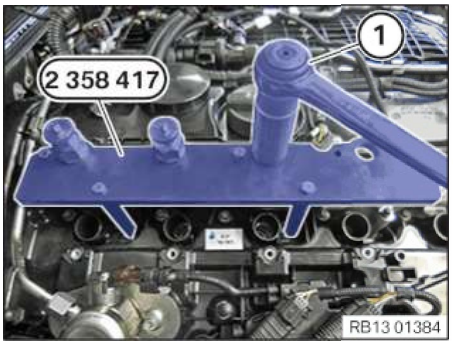
TECHNICAL INFORMATION

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.

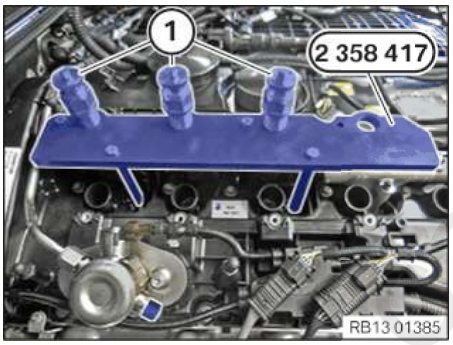


- Adjust torque wrench to 13 Nm **in clockwise** direction.
- Turn the torque wrench (1) with the special tool 0 496 106 (11 8 720) **clockwise**, until the injector is pulled out.

TECHNICAL INFORMATION

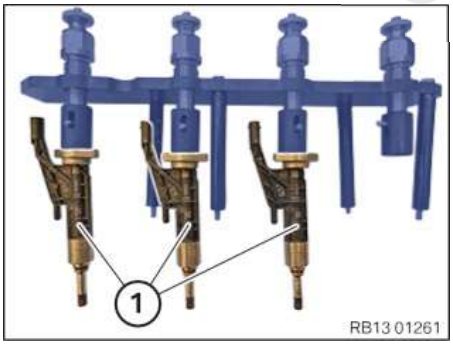
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

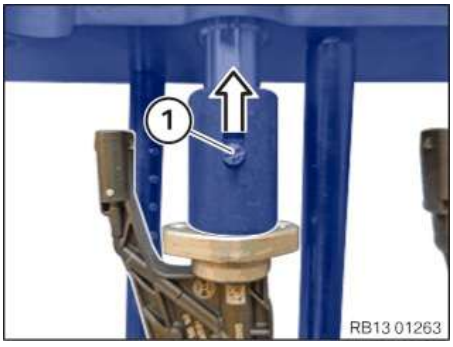


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  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.

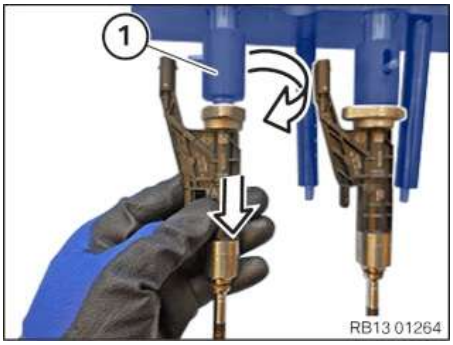


NOTICE

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.

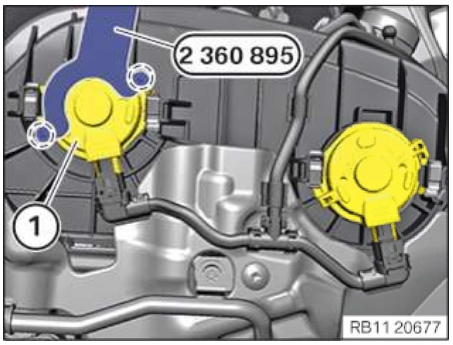
26 – Removing both actuators

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

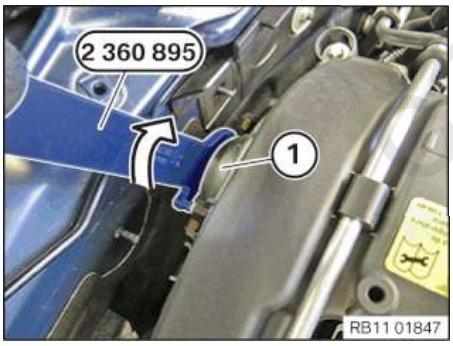
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the 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.



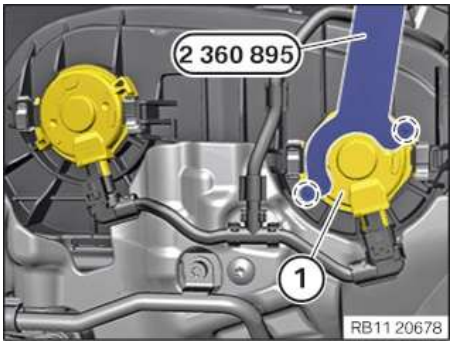
NOTICE

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.

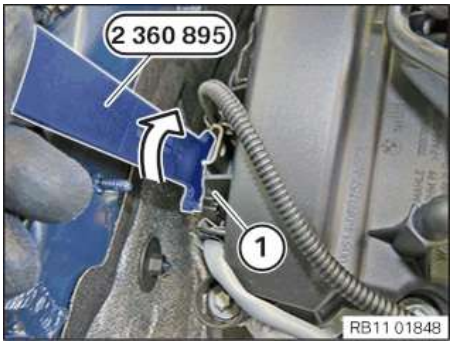


NOTICE

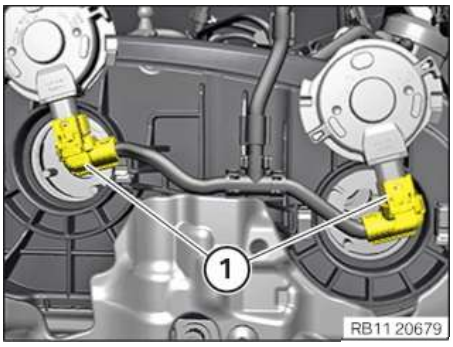
The figure shows the rear side of the engine.

- 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.



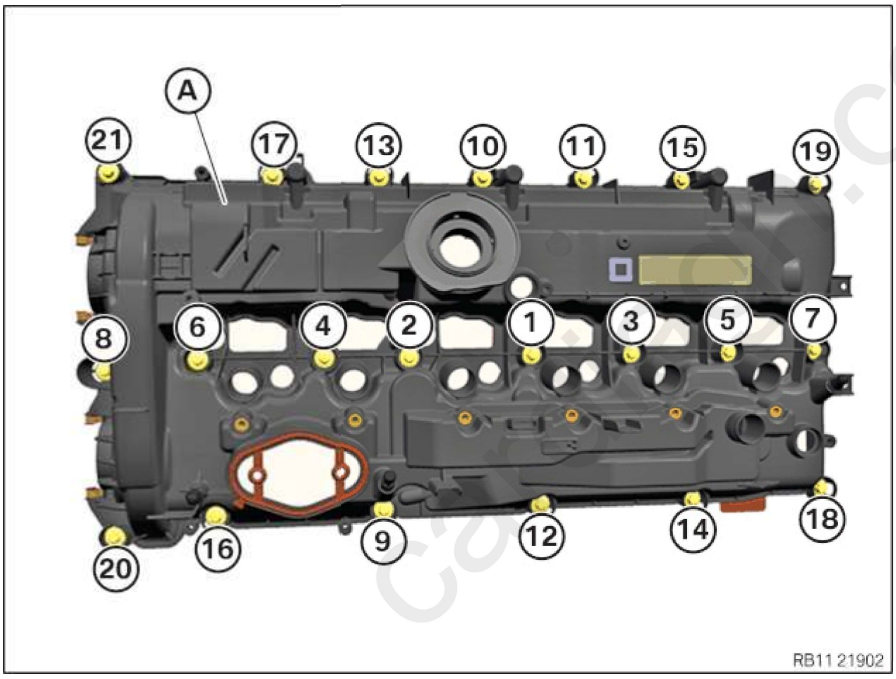
NOTICE

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

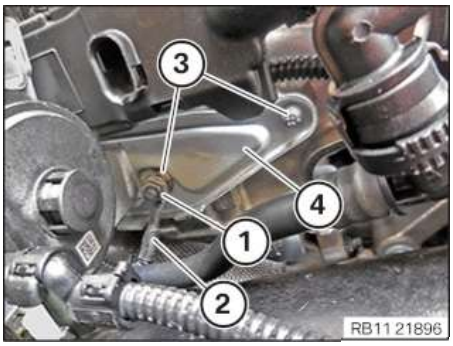
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

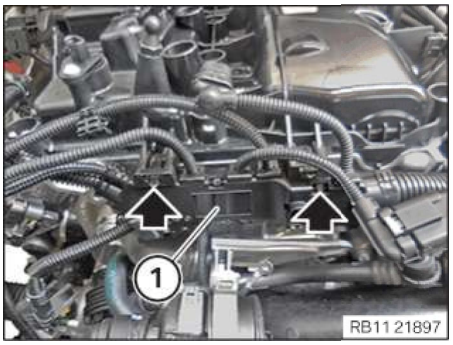
- Do not pull on the wires when disconnecting connectors and plug connections.



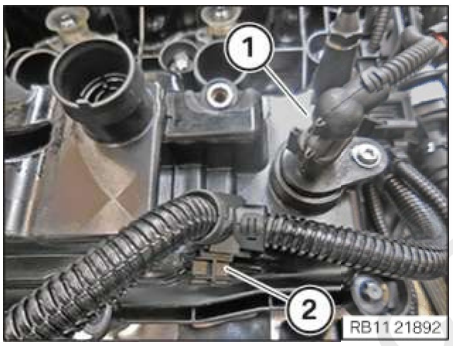
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



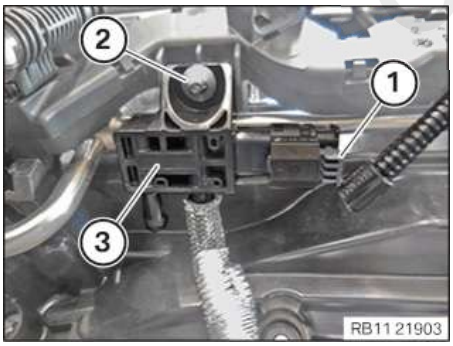
- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Loosen screws (3).
- Thread out holder (4) and set aside.



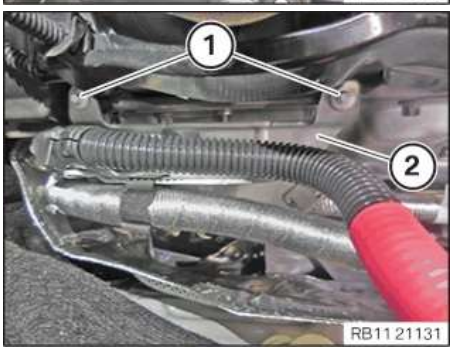
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for the sensor system **2** and place to one side.



- Unlock and detach connector (1) on exhaust camshaft sensor .
- Loosen clamp (2).

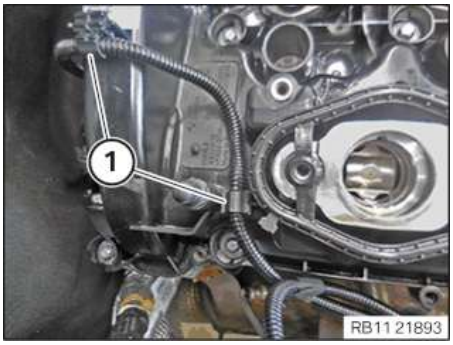


- **If installed:**
- Unlock and loosen connector (1).
- Loosen screw (2).
- Remove the differential pressure sensor (3) and put it to one side.

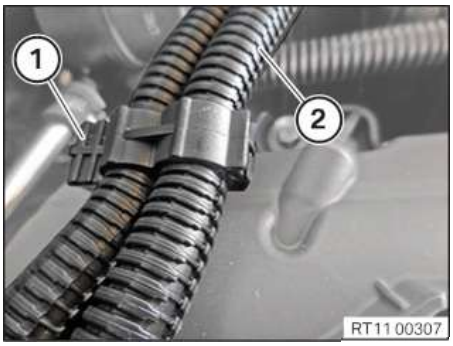


- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

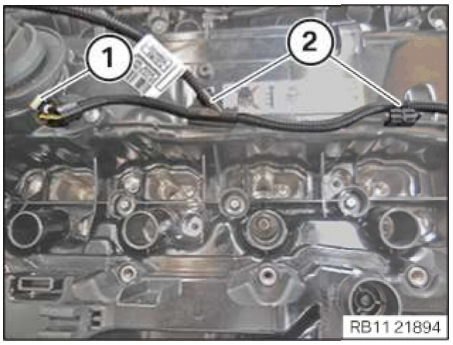
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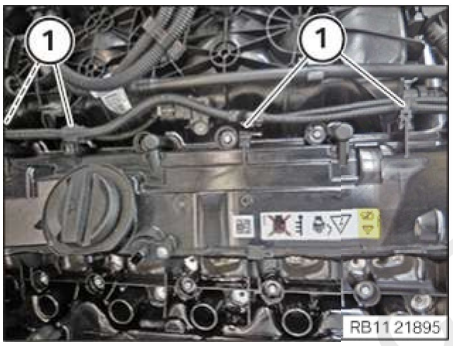
- Loosen clamps (1).



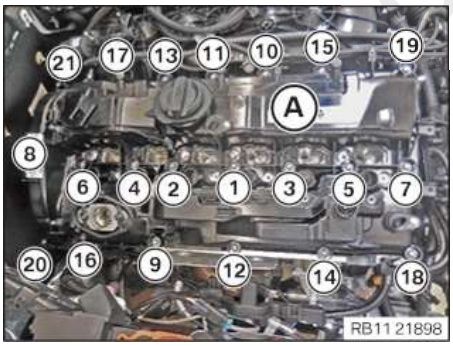
- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



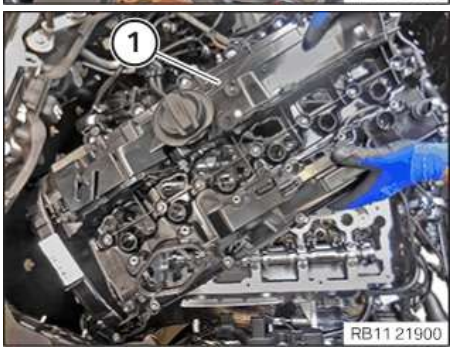
- Unlock and detach connector (1) on the intake camshaft sensor.
- Loosen clamps (2).



- Loosen clamps (1).



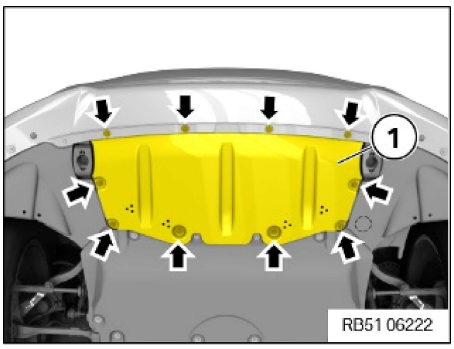
- Release all screws on the cylinder head cover (A) in the sequence (21) to (1).



- Guide the cylinder head cover (1) out and remove it.

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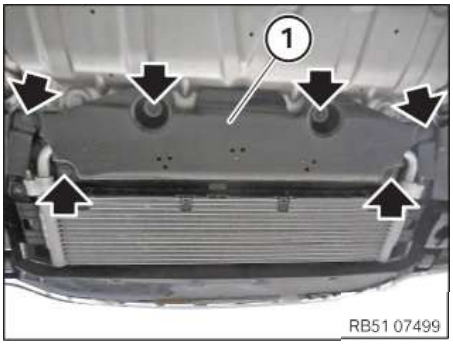
28 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

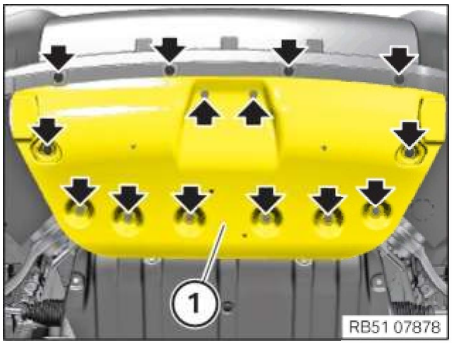
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

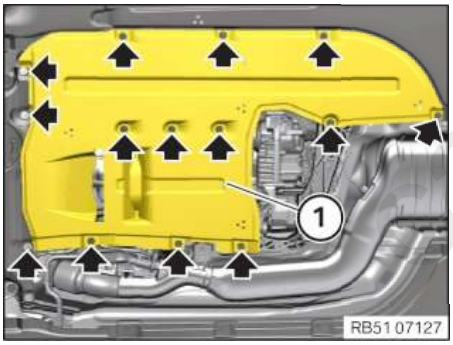


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

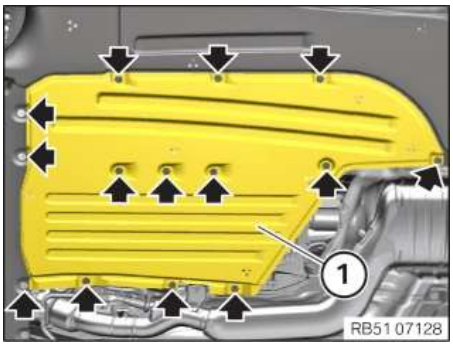
29 – Remove rear underbody protection



- **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

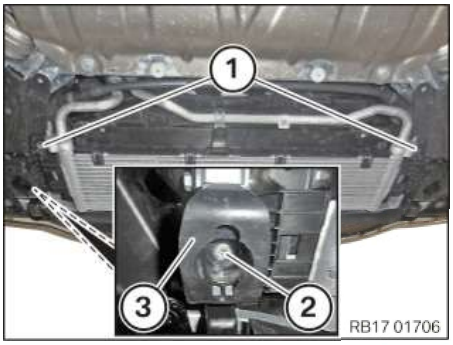
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

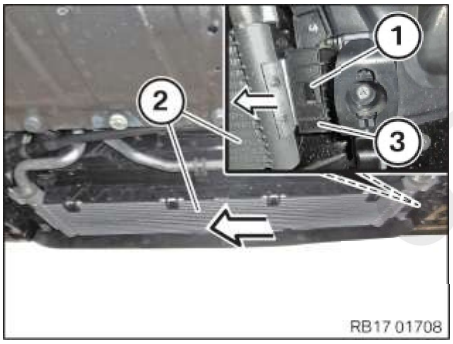
The work must be performed with care to prevent component damage.



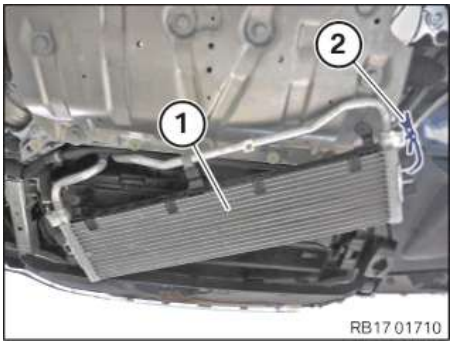
- Loosen screws (1).
- Drill out rivet on the left (2).
- Remove the left-hand damper (3).



- 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.



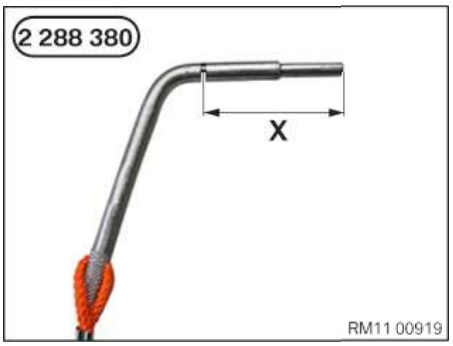
RISK OF DAMAGE

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.

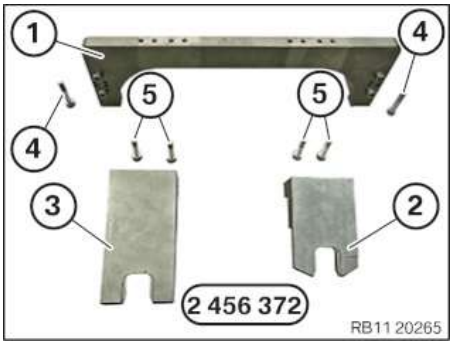


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **correctly** positioned.

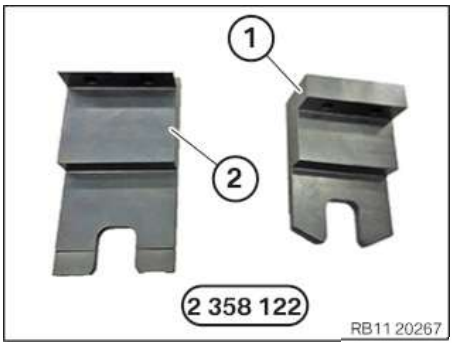
  The engine is in the TDC firing position of cylinder 1.

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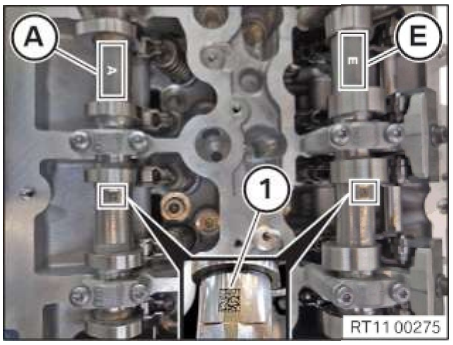
- Overview of the set of special tools 2 456 372:

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

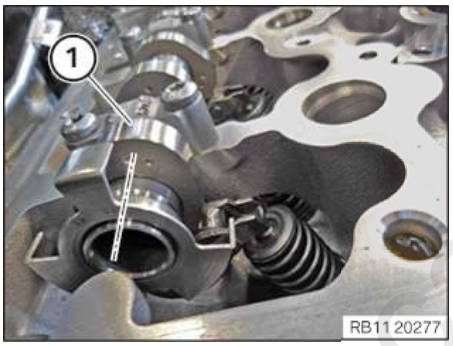


- Overview of the test gauges from the set of special tools 2 358 122:

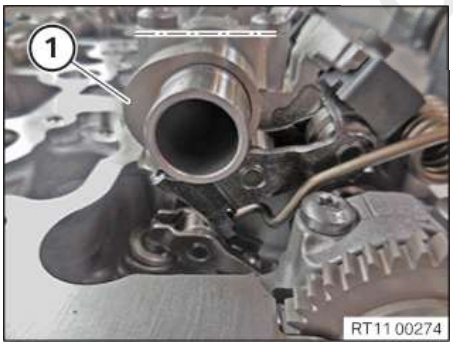
Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



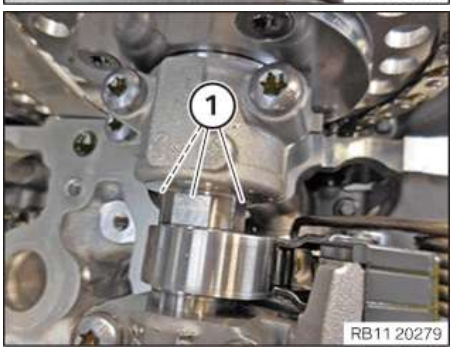
- Turn intake camshaft (E) and exhaust camshaft (A) until marks (1) can be read from the top.



- 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.

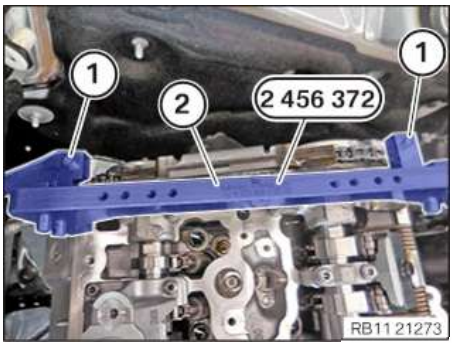


- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.

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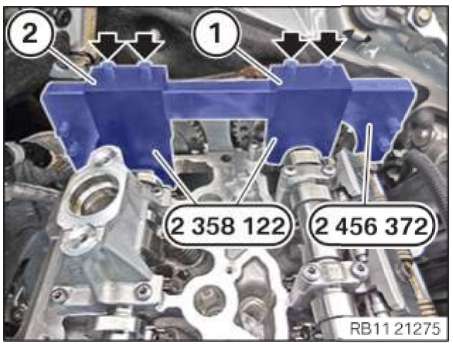
- Position basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- 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).

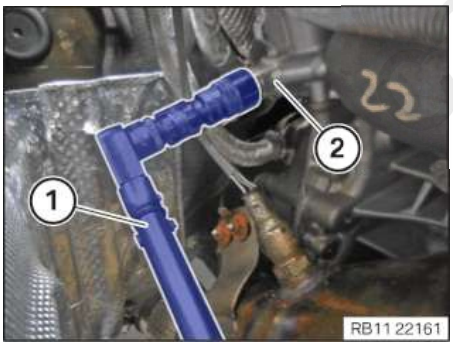
Test gauge to basic carrier

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).



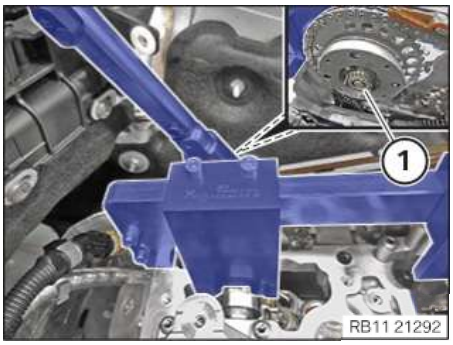
- Feed out and remove the chain tensioner (1).

MAIN WORK

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.

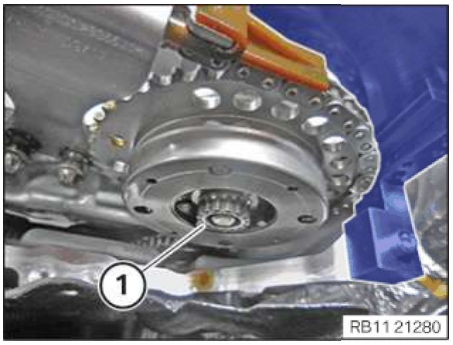


NOTICE

The figure shows the rear side of the engine.

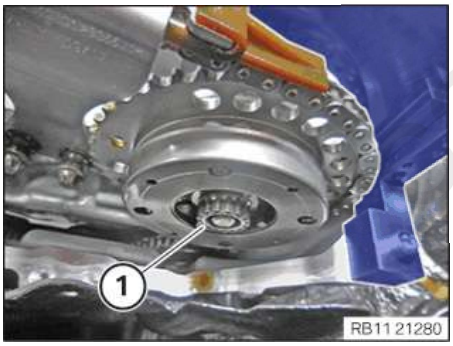
- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

34 – Remove the VANOS central valve of the exhaust camshaft adjuster

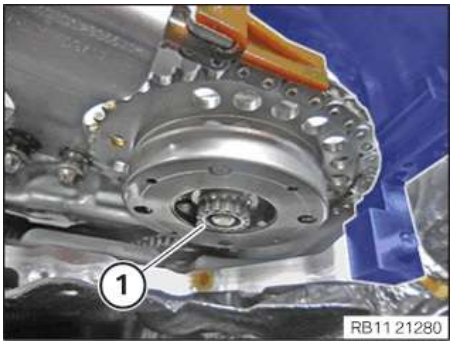


- Guide out and remove the VANOS central valve (1) of the exhaust camshaft adjuster.

35 – Installing the VANOS central valve of the exhaust camshaft adjuster

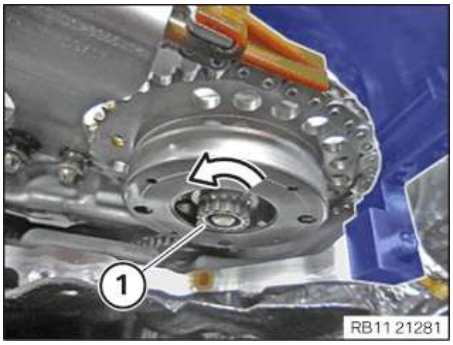


- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.



- 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 °.

36 – 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.

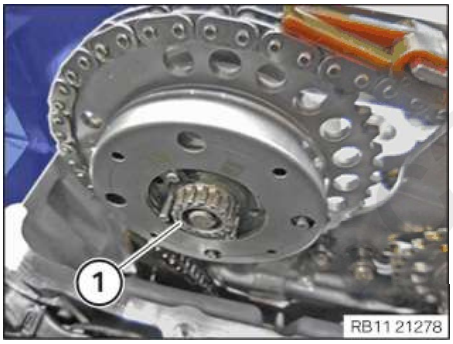


NOTICE

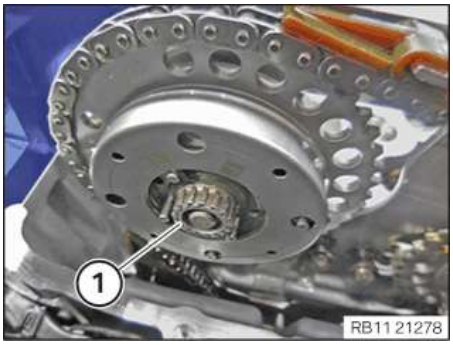
The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the intake adjuster.

37 – Install the VANOS central valve of the intake adjuster

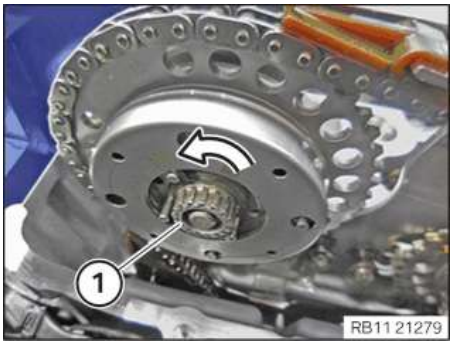


- Guide in the VANOS central valve (1) of the intake adjuster and install.



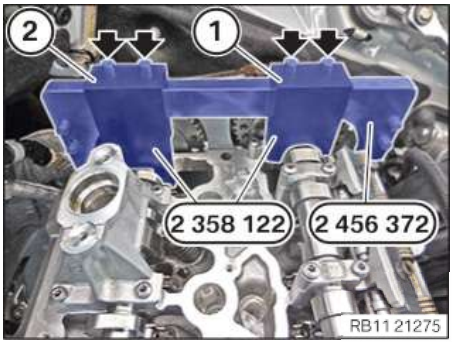
- Hand-tighten the VANOS central valve (1) of the intake adjuster.

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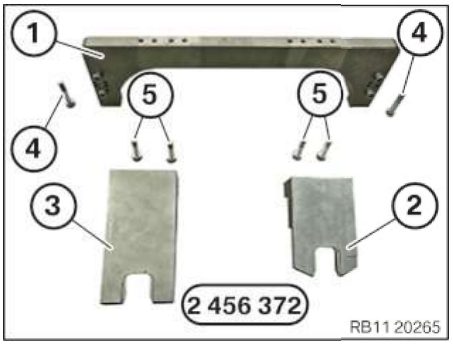
- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

38 – 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.

39 – Adjust the camshafts with the special tool

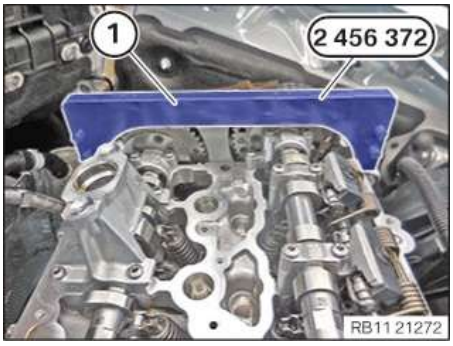


- Overview of the set of special tools 2 456 372:

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

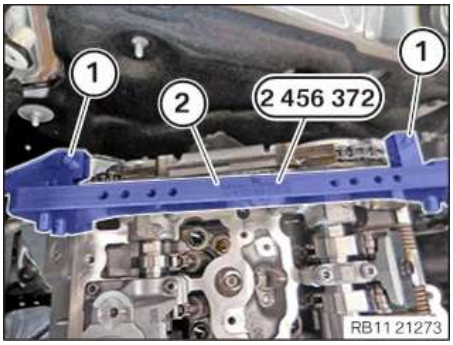


- Use the setting gauge 0.7 ° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.



- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.

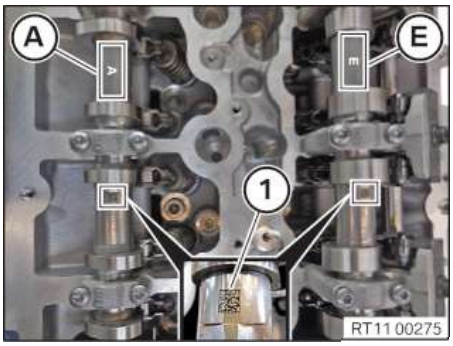
carmanuals.com



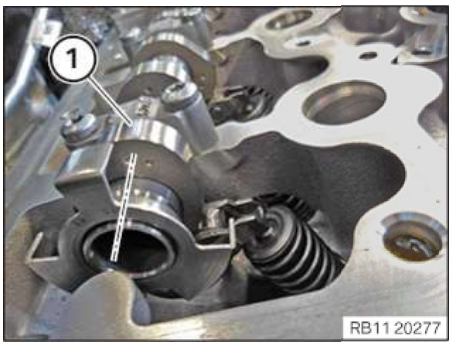
- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



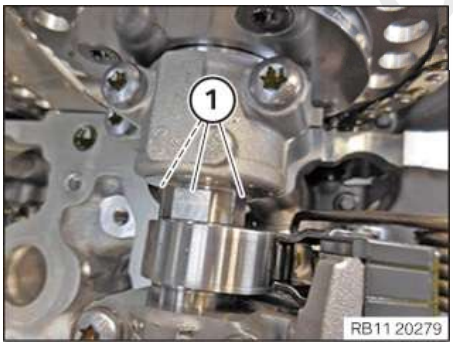
- Turn the intake camshaft (E) and the exhaust camshaft (A) such that the marks (1) can be read from the top.



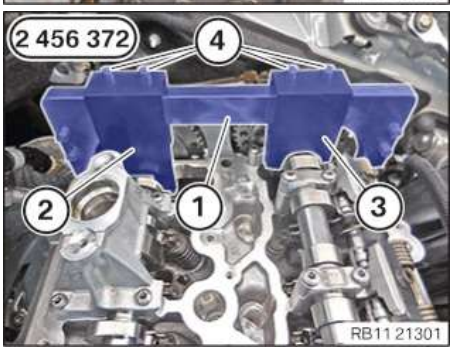
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- 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.



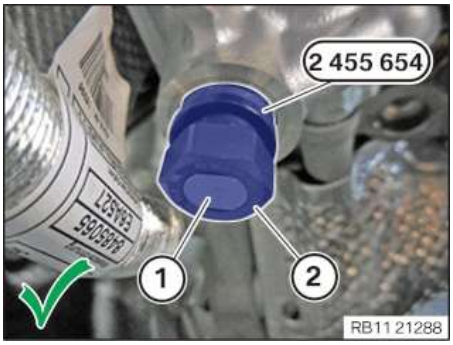
- Position the setting gauge 0.5° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten the screws (4).

Test gauge to basic carrier

M6		Tightening torque	8 Nm

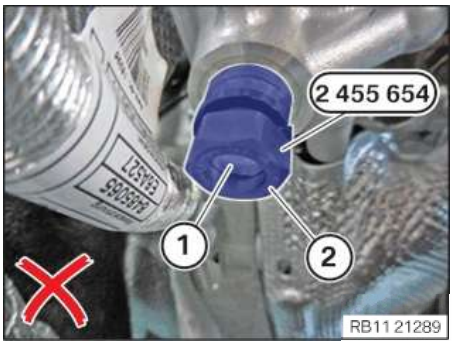
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40 – Pretension the timing chain with the special tool



- Make sure that the timing chain is **correctly** pre-tensioned with the special tool 2 455 654.

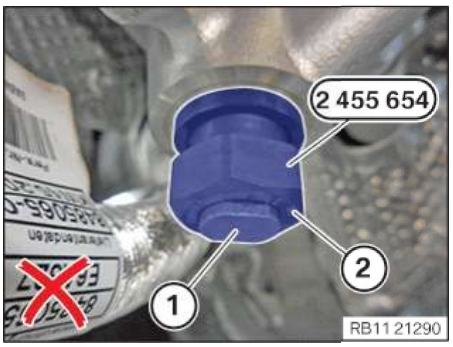
  The pin (1) must align **precisely** with housing (2).



- 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**.

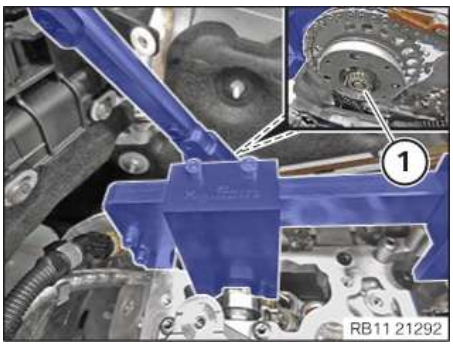
  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

41 – 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 °

42 – 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.



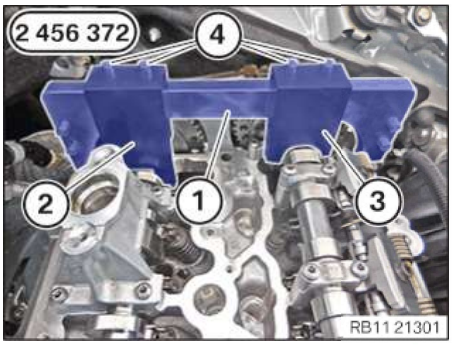
- Tighten the VANOS central valve (1) of the intake adjuster.

VANOS central valve to camshaft

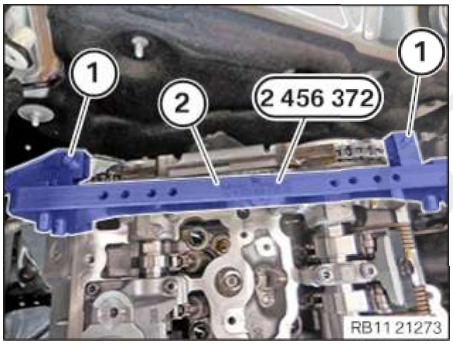
M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

POSTPROCESSES

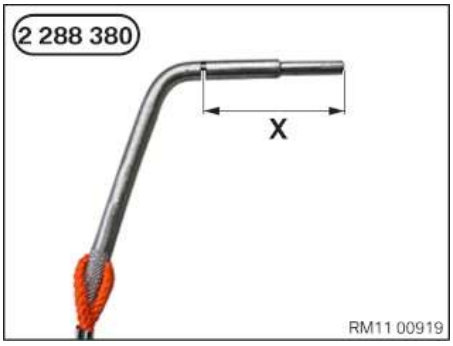
43 – Disassembling all special tools



- 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.

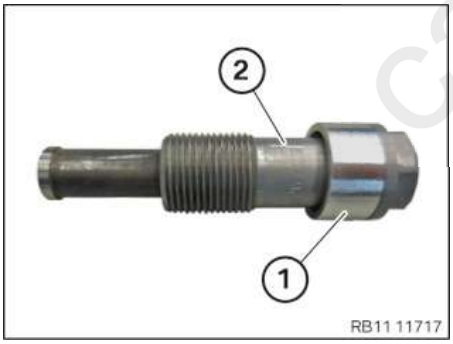
44 – Install chain tensioner

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.



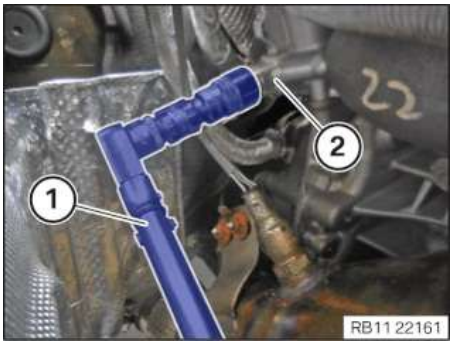
- Renew the sealing sleeve (1).

  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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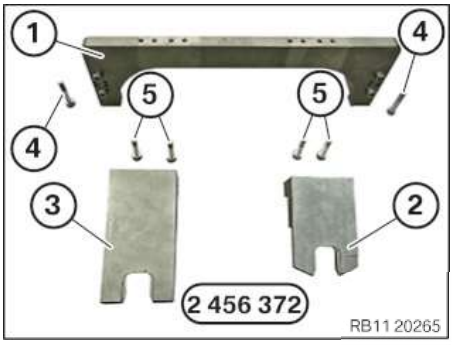


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

45 – 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

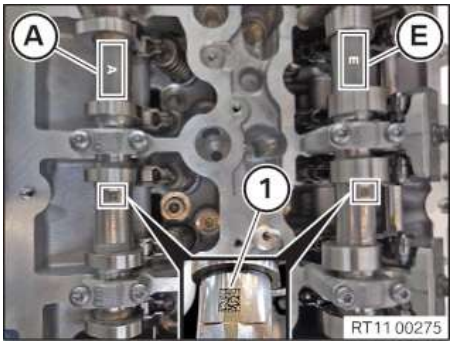
Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

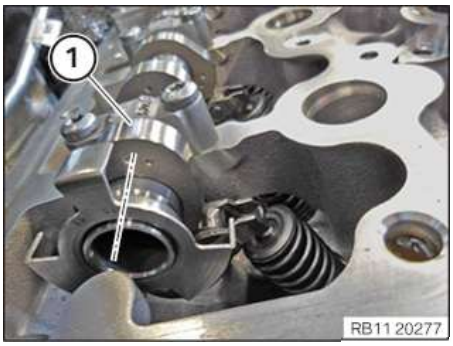
- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.

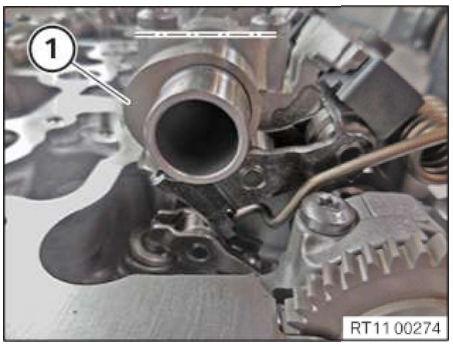
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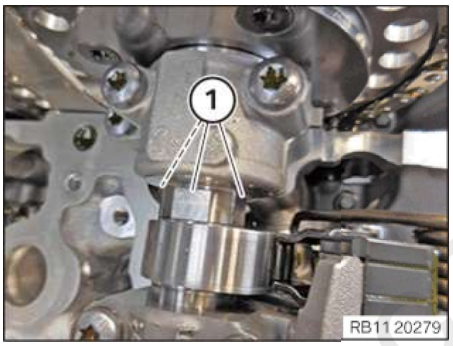
- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.



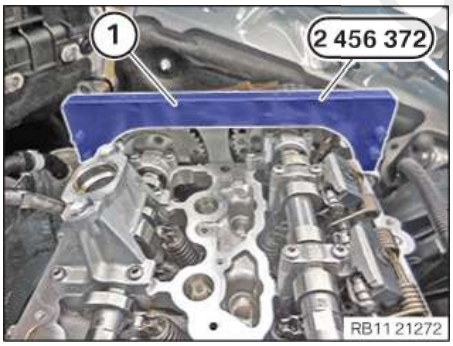
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



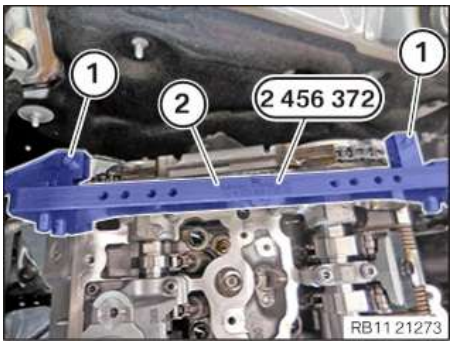
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.



- 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.

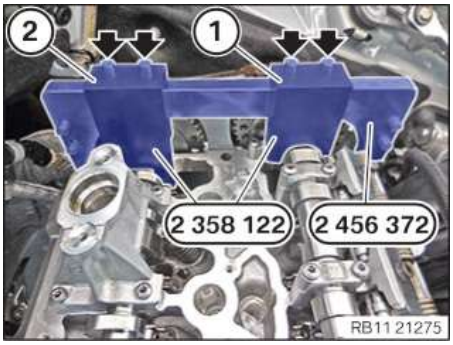


- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm

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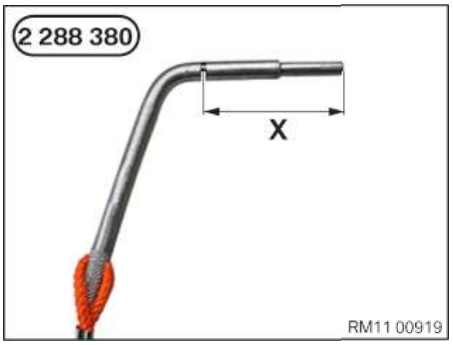
- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special 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.



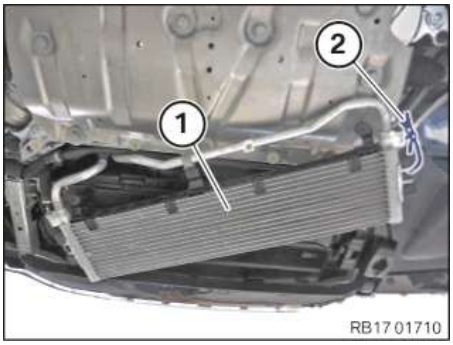
- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

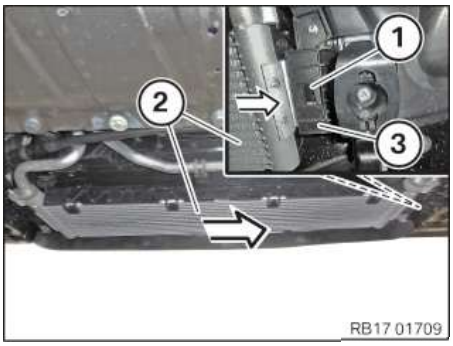
  The engine **is in the** TDC firing position of cylinder 1.

46 – If installed: Secure engine oil cooler

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- Remove the cable straps (2).
- Position engine oil cooler (1).



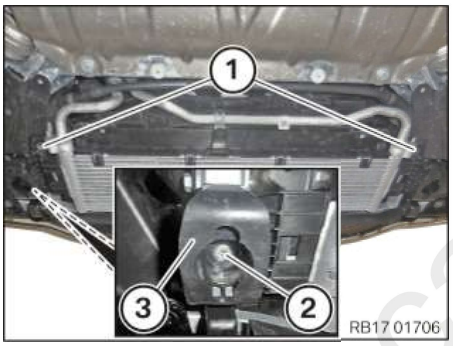
- Feed in and install the engine oil cooler (2) on the holder (3) in the direction of the arrow.
- Ensure that the lock (1)engages audibly.



- 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).

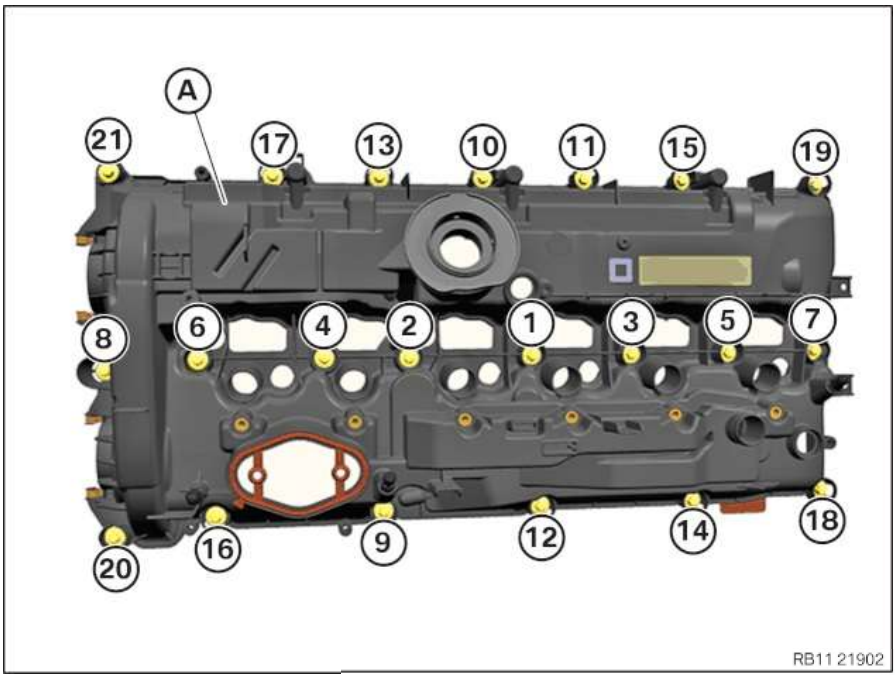
Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

47 – 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

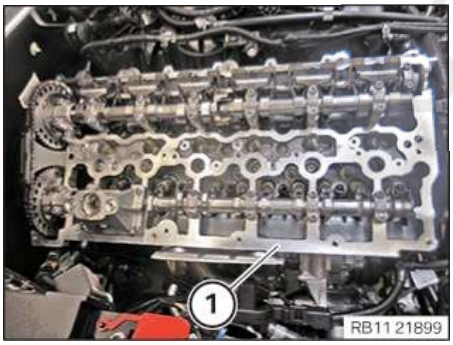
Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

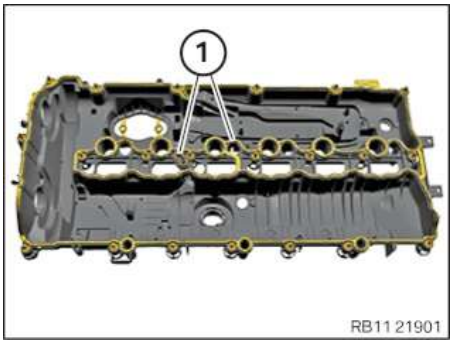
- Route all cables without abrasions, do not trap and crush.

TECHNICAL INFORMATION

Latch mechanisms, guides and mounting elements must not be damaged or missing.

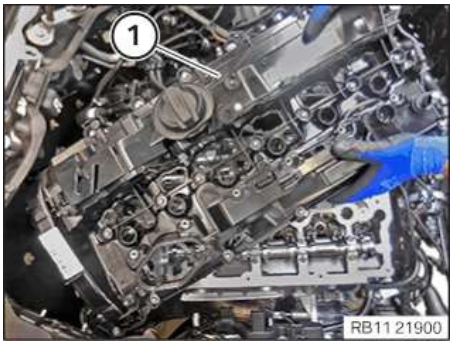


- Contact surface (1) must be free from oil and grease.



- Replace the seals (1).

  Parts: Seals

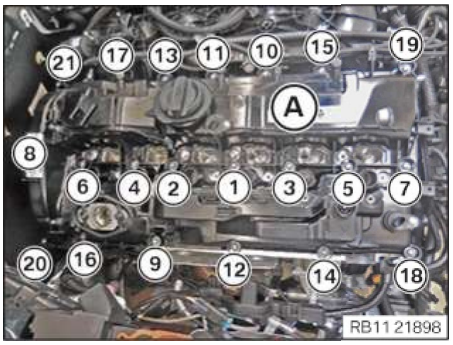


- Insert and install cylinder head cover (1).



- 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

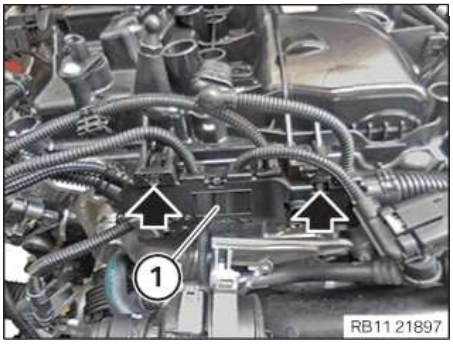
- Tighten all screws in a sequence from (1) to (21).

Cylinder head cover to cylinder head

M6X30		Tightening torque	11 Nm

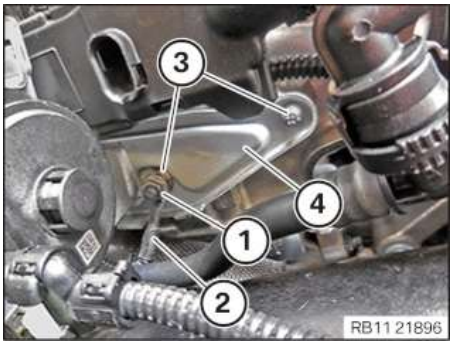


- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.



- Feed in and install wiring harness section (1) for sensor system **2**.
- Make sure that you can hear the locks (arrows) engage.

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- Insert and position the holders (4).
- Tighten the screws (3).

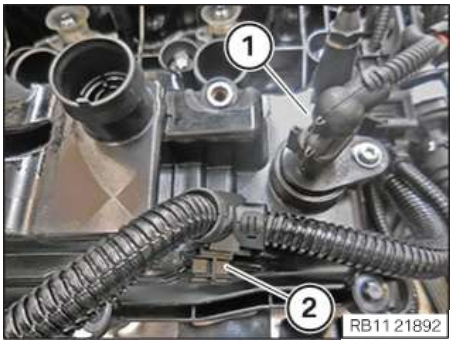
Auxiliary coolant pump holder to cylinder head

M6		Tightening torque	7 Nm

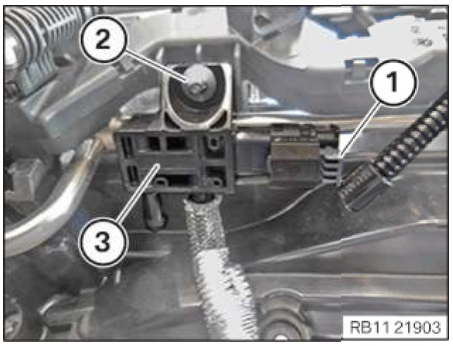
- Thread in ground cable (2) and install.
- Tighten nut (1).

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).

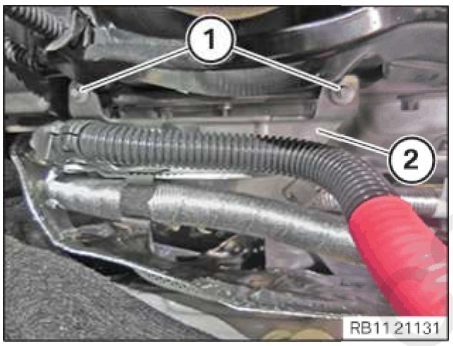


- **If installed:**
- Feed in and install the differential pressure sensor (3).
- Tighten down screw (2).

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.

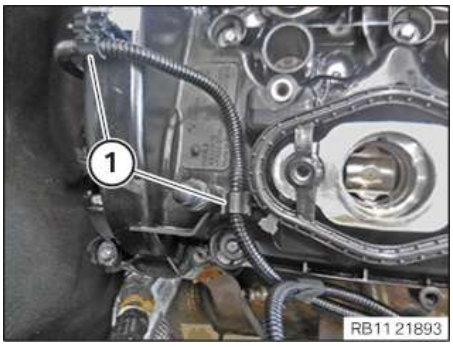
Risk of short circuits!

- 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).

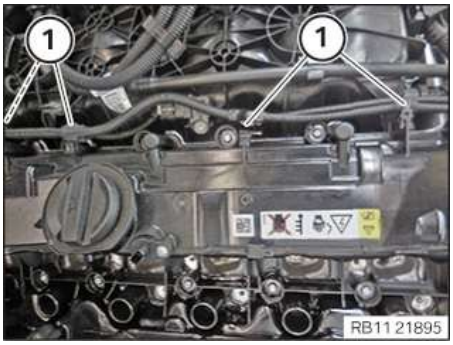
Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

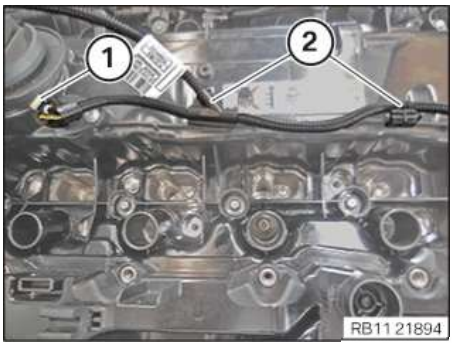


- Secure clamps (1).

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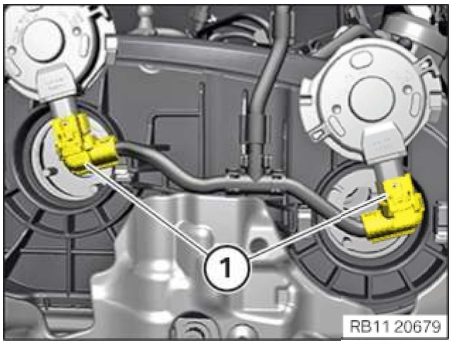


- Secure clamps (1).



- Connect connector (1) to the intake camshaft sensor and lock it.
- Make sure the connector (1) engages audibly.
- Secure clamps (2).

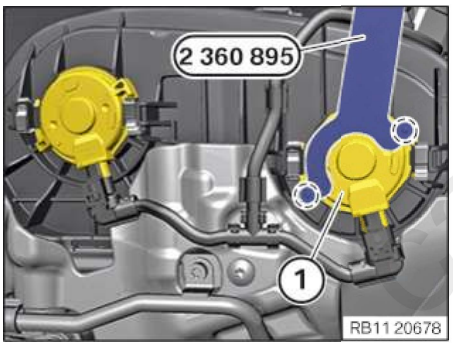
48 – Installing both actuators



NOTICE

The figure shows the rear side of the engine.

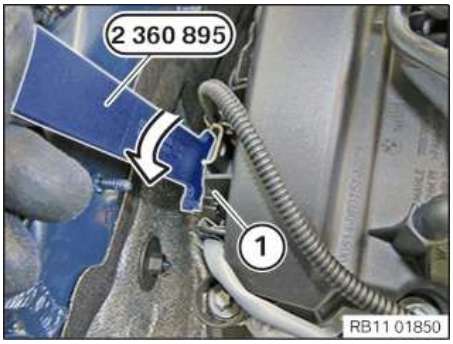
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



NOTICE

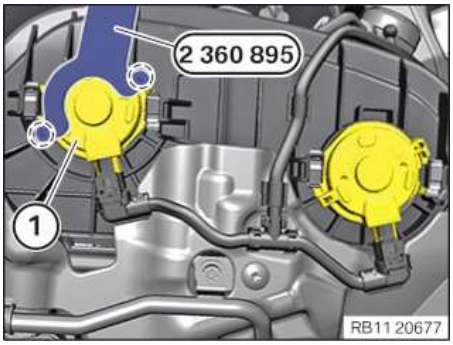
The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- 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.

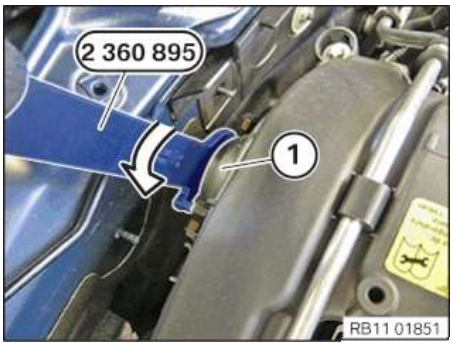
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NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the 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.

49 – 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

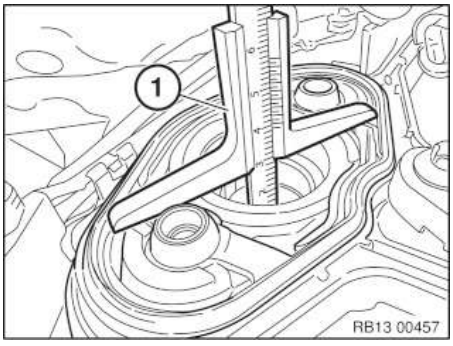
In vehicles with active anti-roll bar (ARS) the fan cowl must be removed in order to spin the engine.

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.

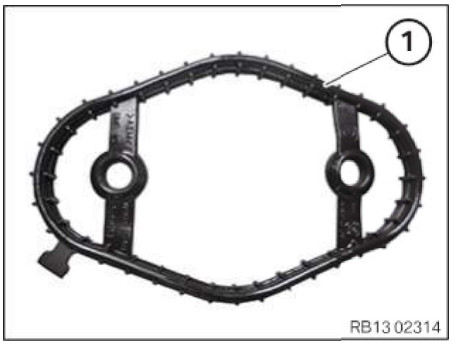
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- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- 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).



- 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.

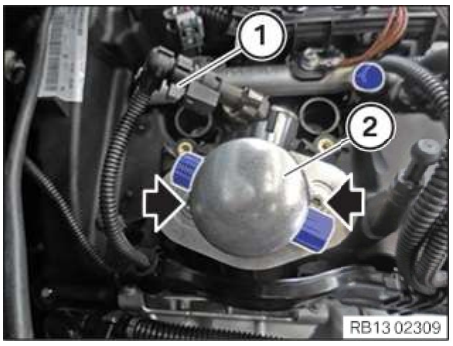
The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- 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.

50 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

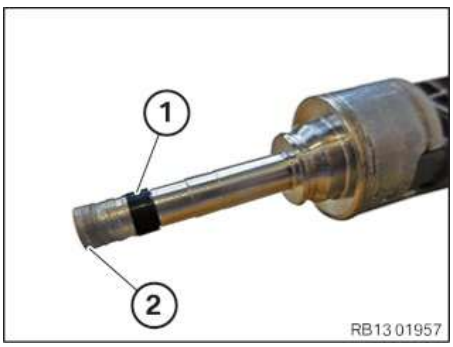
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- 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.

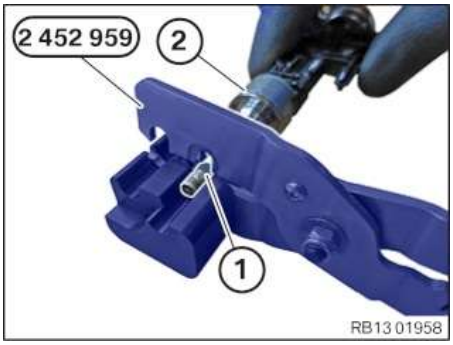
After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.



- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings
- Avoid mechanical contact with injector tip (2).

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- 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.

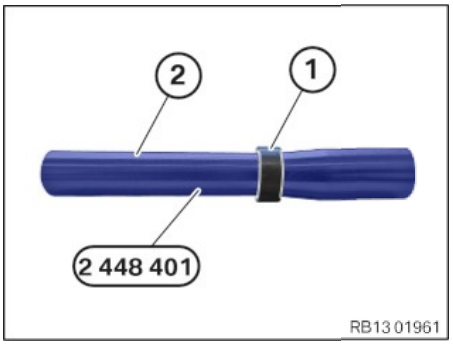


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

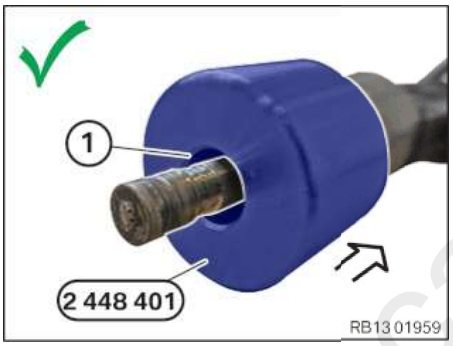
  (1) Installation cone

  (2) Sliding sleeve

  (3) Assembly sleeve

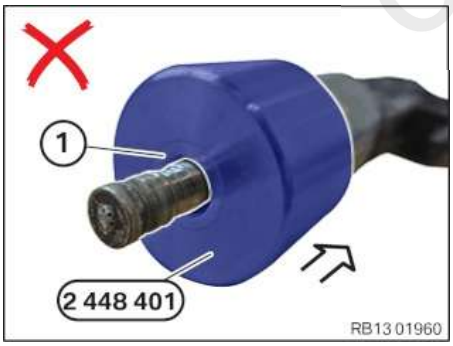


- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



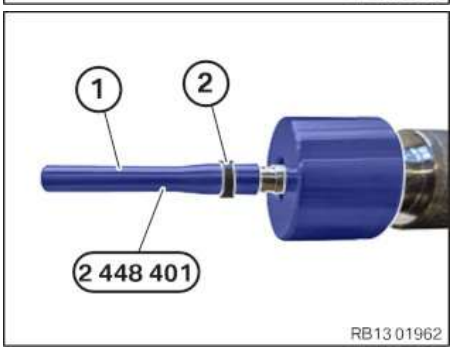
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The larger diameter of the assembly sleeve (1) must point to the injector tip.



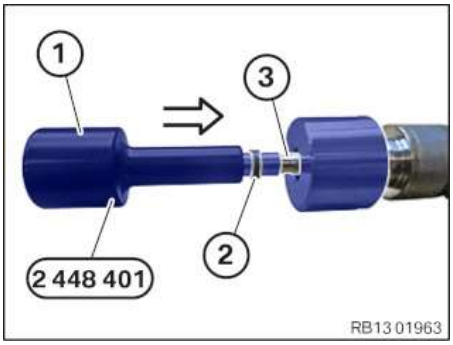
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.

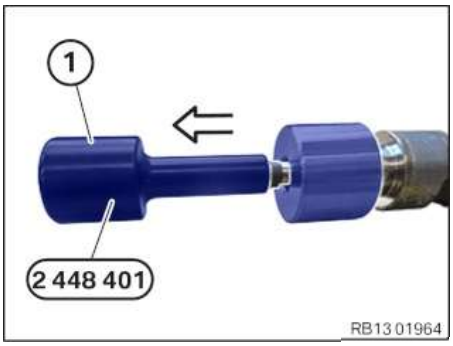


- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .

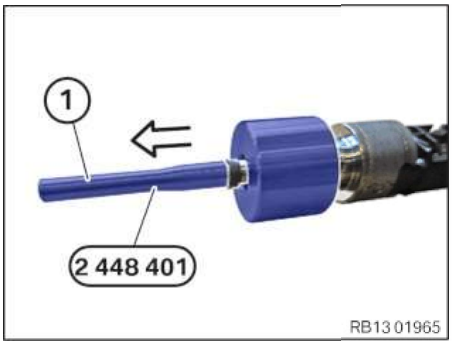
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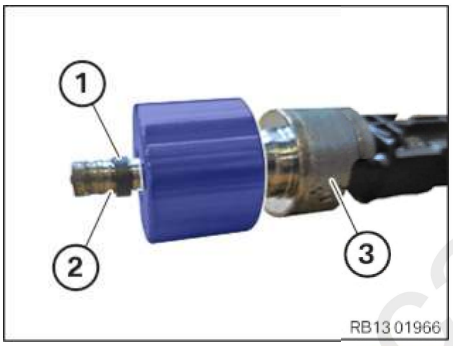
- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.



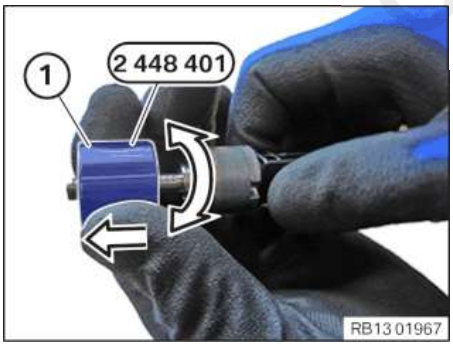
- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

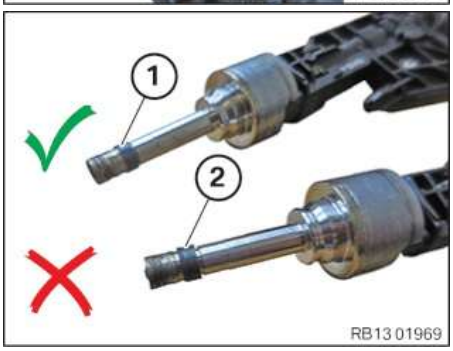


- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.



- 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).



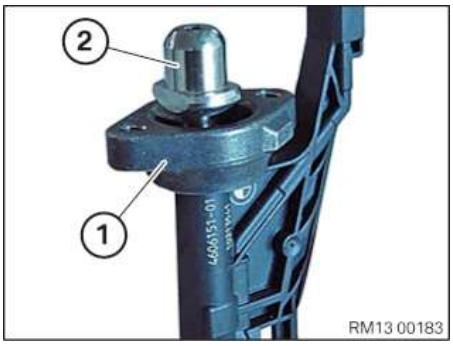
- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

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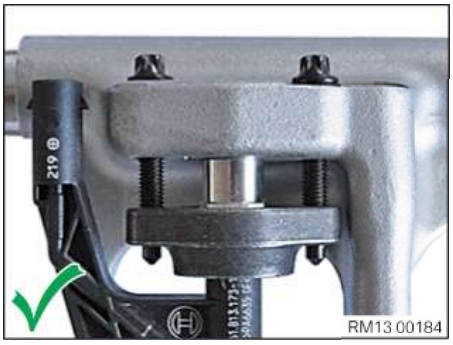
51 – Installing the high-pressure rail with injectors of the cylinders 4 to 6

TECHNICAL INFORMATION

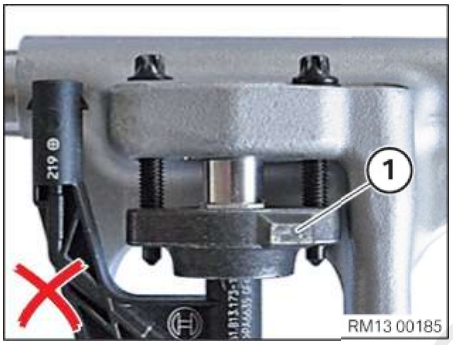
When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



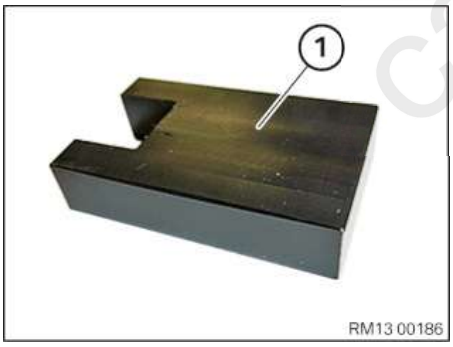
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder**(1) **has a cast lug**: Make sure that the holder is installed in the correct position.



- 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

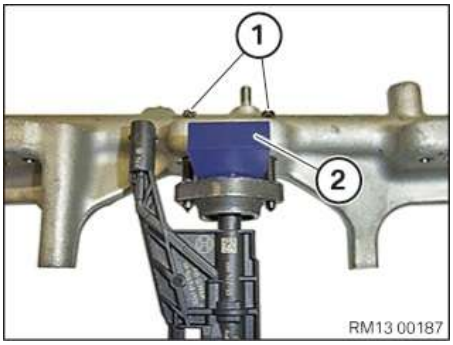
Damage to injectors.

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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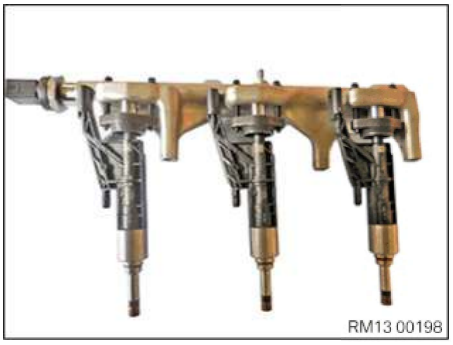
- Replace (M5x30) screws.

  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.



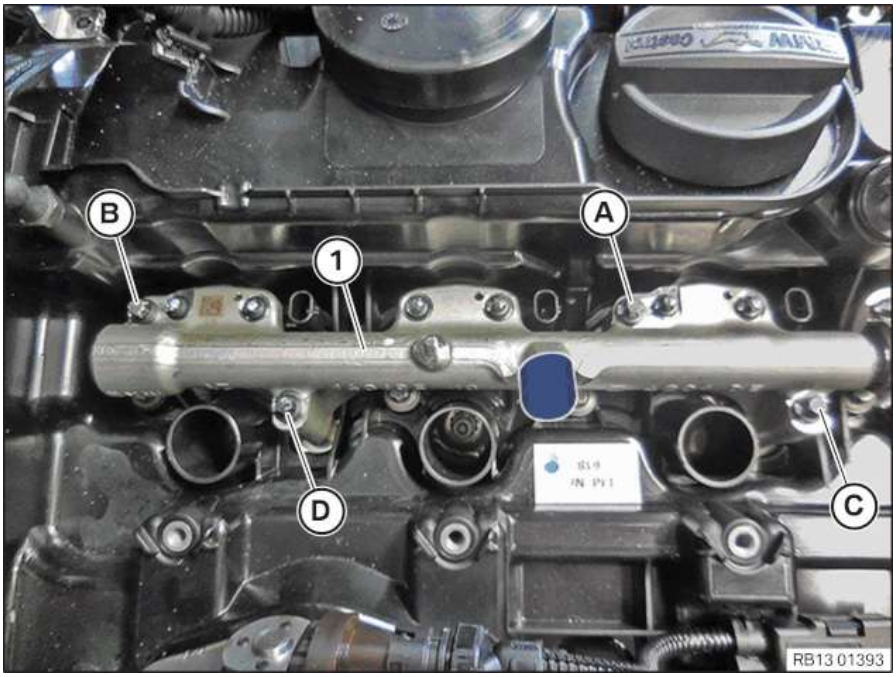
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.



- 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.

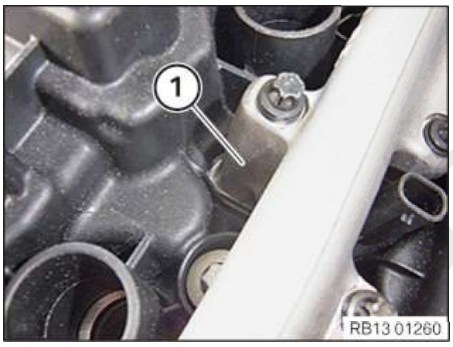
  The figure shows the rail resting flat against the cylinder head.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

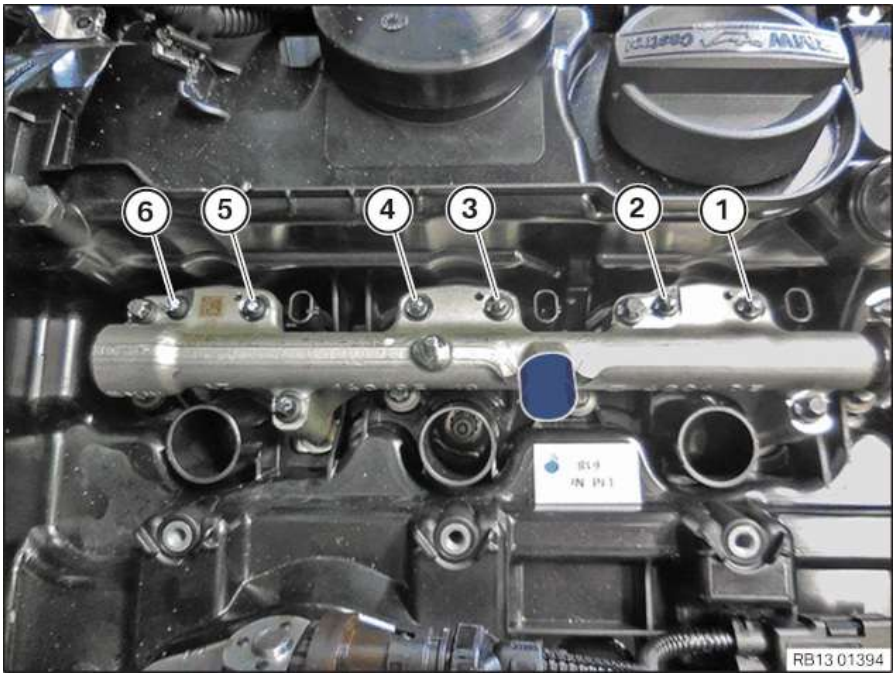
Non-observance of these requirements may result in leaks and damage.

- 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.

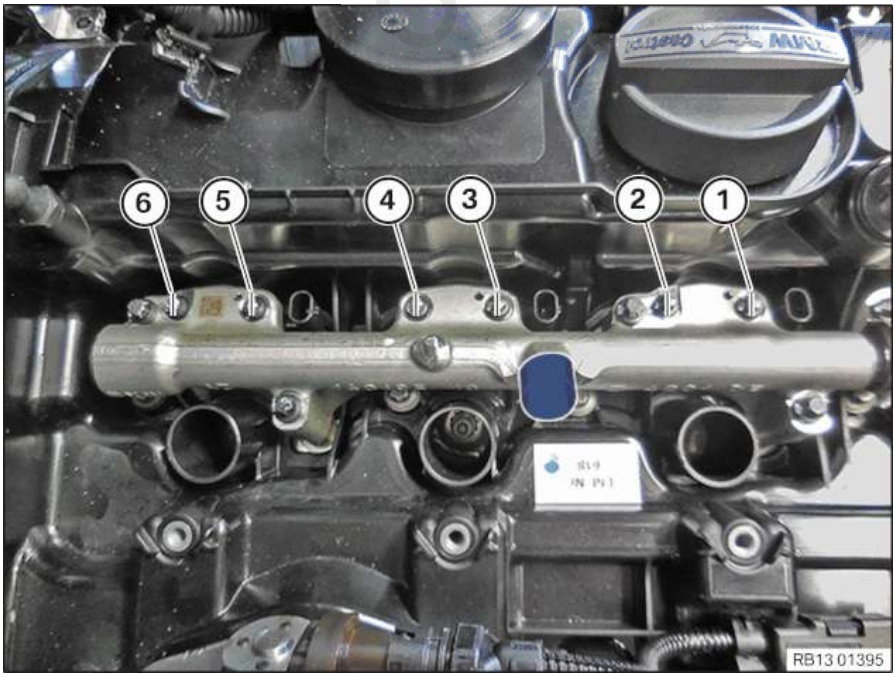
  Do not use a reversible ratchet or torque wrench.
- Tighten the bolts (M5x30) in pairs ((1) with (2), (3) with (4), (5) with (6)) in alternating order **90° hand-tight**.
- Set the torque wrench to 5 Nm.

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.



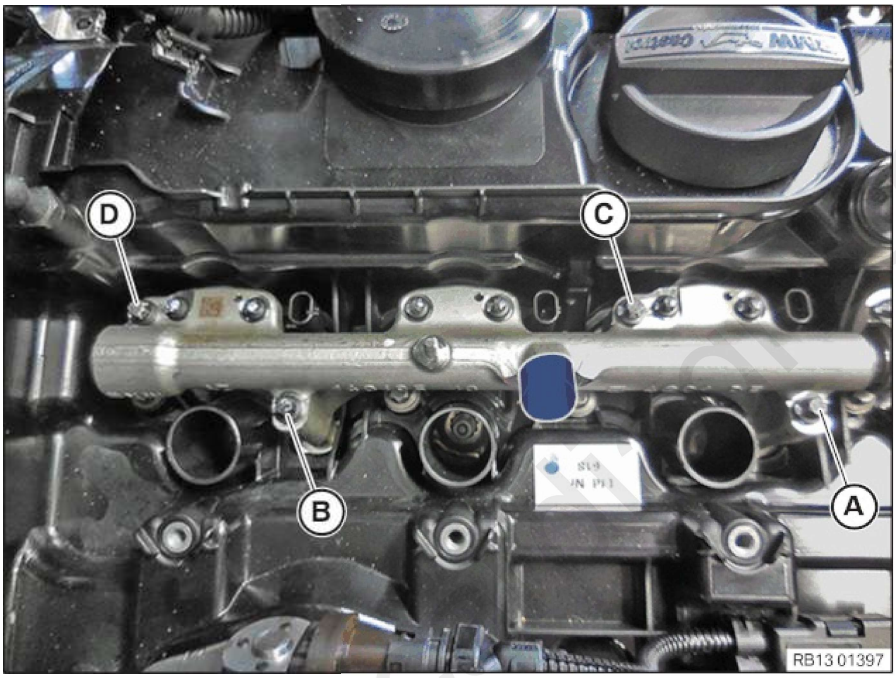
- Mark all bolts (1) to (6) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the screw (1) with an angle of rotation of 90° ±15°.
  - Tighten the screw (2) with an angle of rotation of 90° ±15°.
  - Tighten the screw (3) with an angle of rotation of 90° ±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).

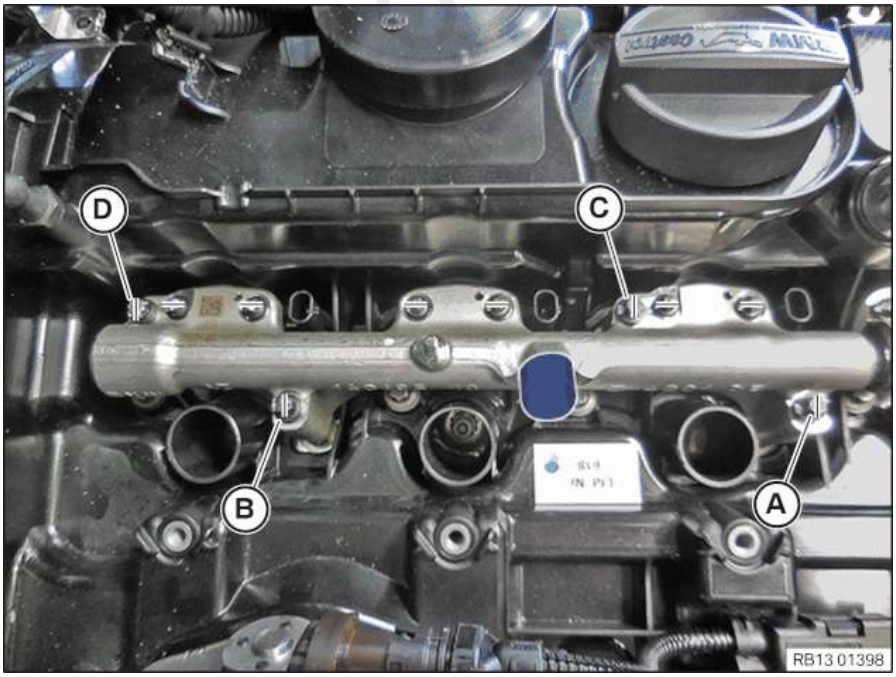
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

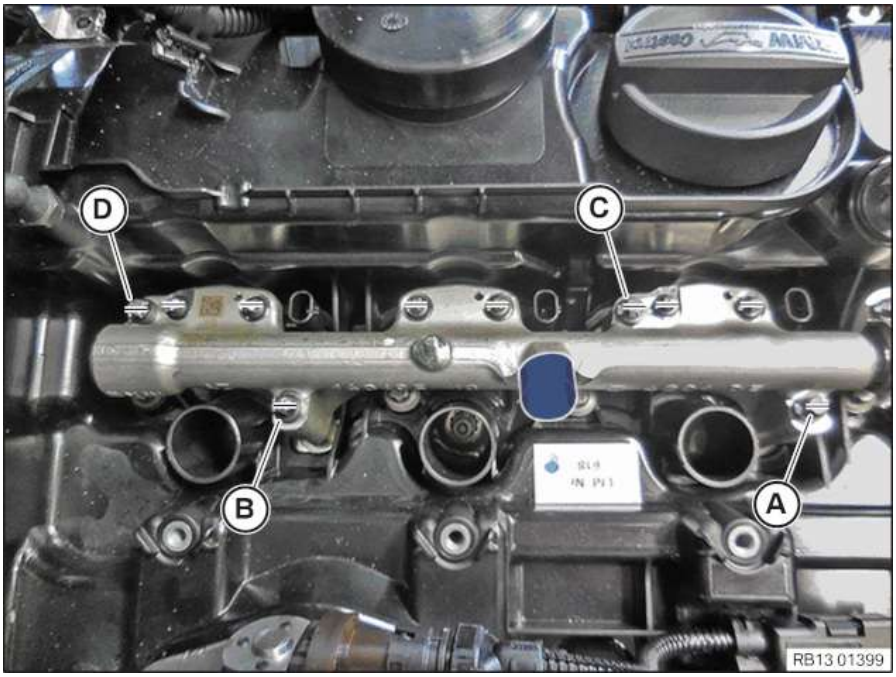
When assembling, it is essential to observe screwing sequences and tightening torques.

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.

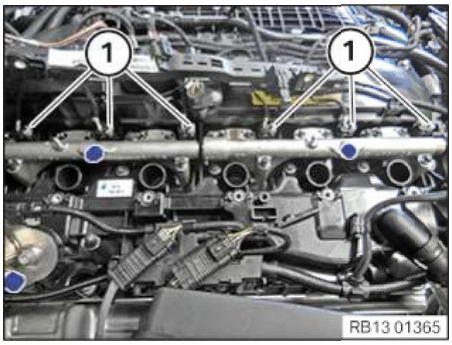


- Mark all bolts (A) to (D) with a vertical line (see figure).
- Tighten bolts (M6x70) (A) to (D) to a 90° angle of rotation.



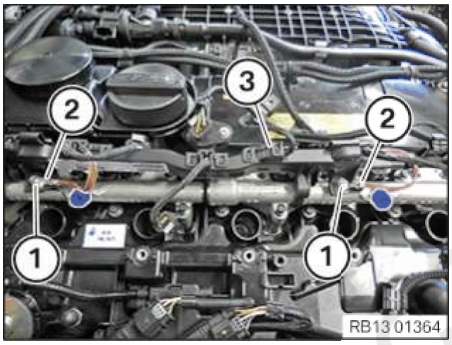
- Check if all bolts (A) to (D) have been tightened with a 90° angle of rotation.

  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).

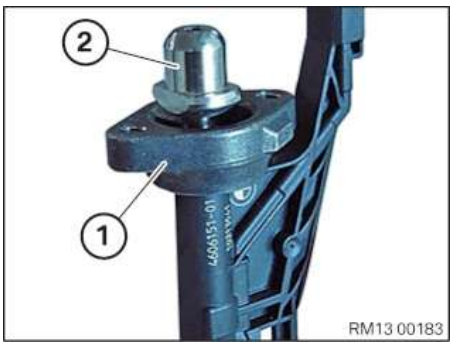
Ground cable to rail

M6			5 Nm

52 – Installing rail with injectors of cylinders 1 to 3

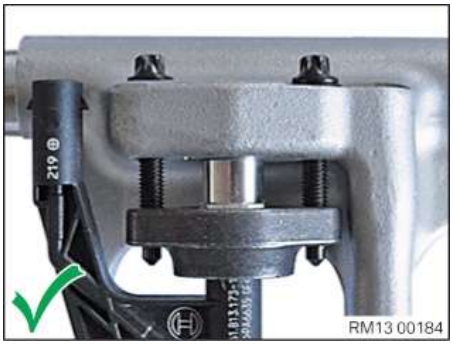
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



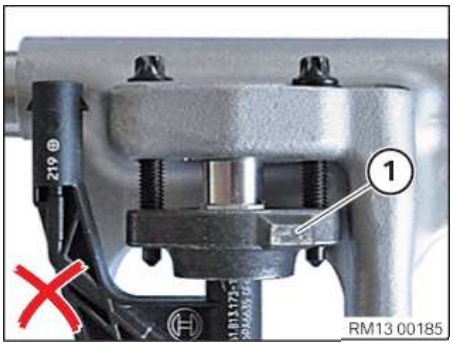
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If there is a cast lug on the holder** (1) **:** Make sure that the holder is installed in the correct position.

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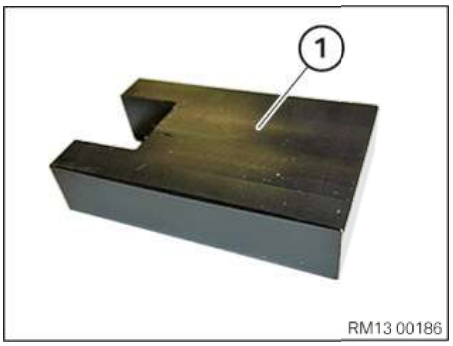
- Observe position of cast lug:

  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.



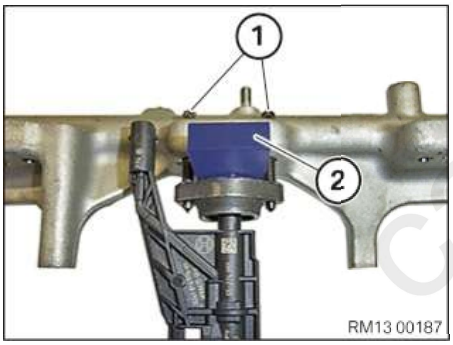
RISK OF DAMAGE

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.



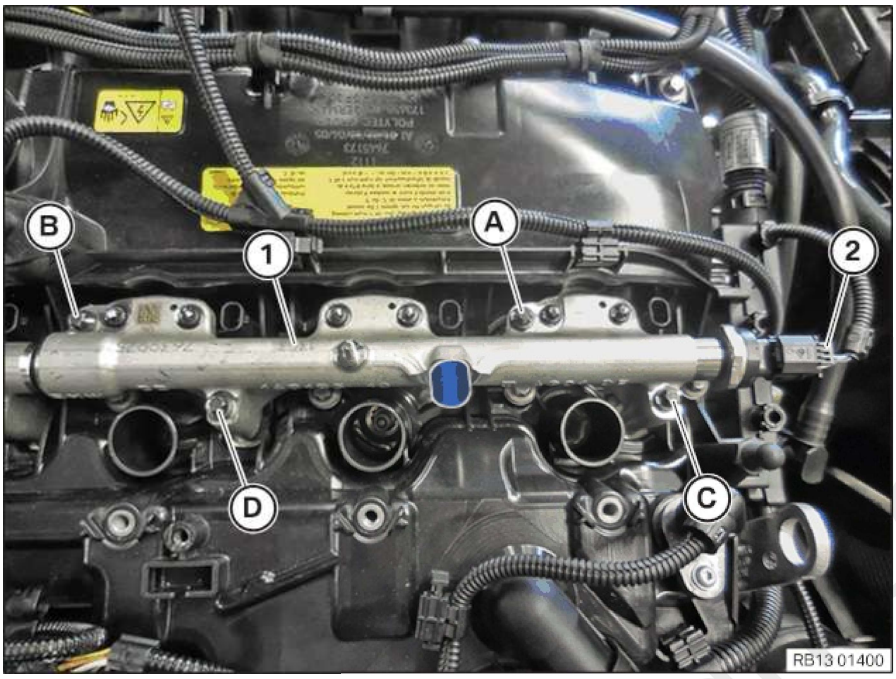
- Remove special tool 2 358 022(1) .
- Repeat this operation for all injectors.

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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.

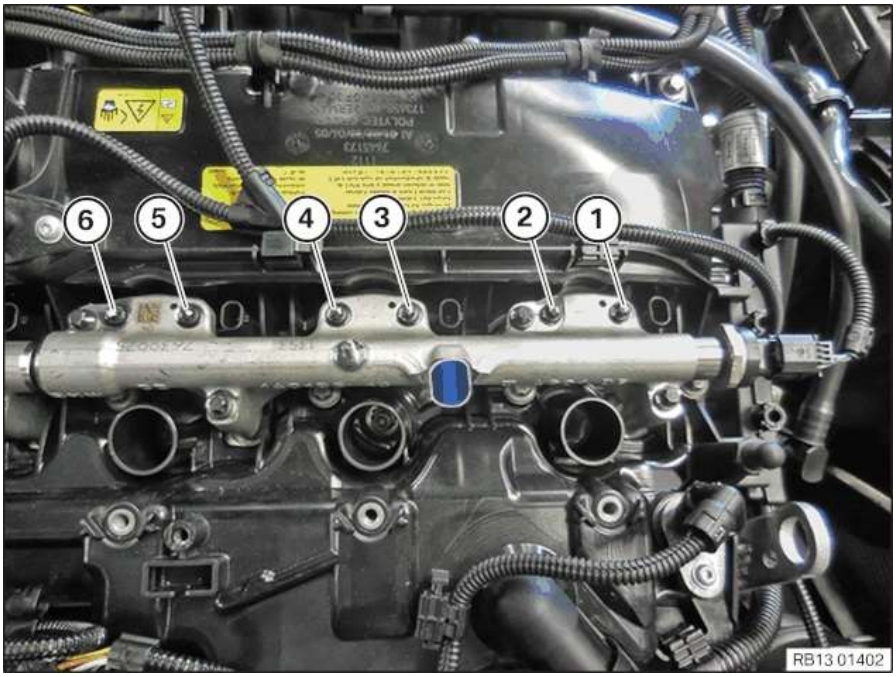
- Tighten screw (A) to 5 Nm.
- Tighten screw (D) to 5 Nm.
- Tighten screw (B) to 5 Nm.
- Tighten screw (C) to 5 Nm.
- Connect and lock the connector (2).

  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.

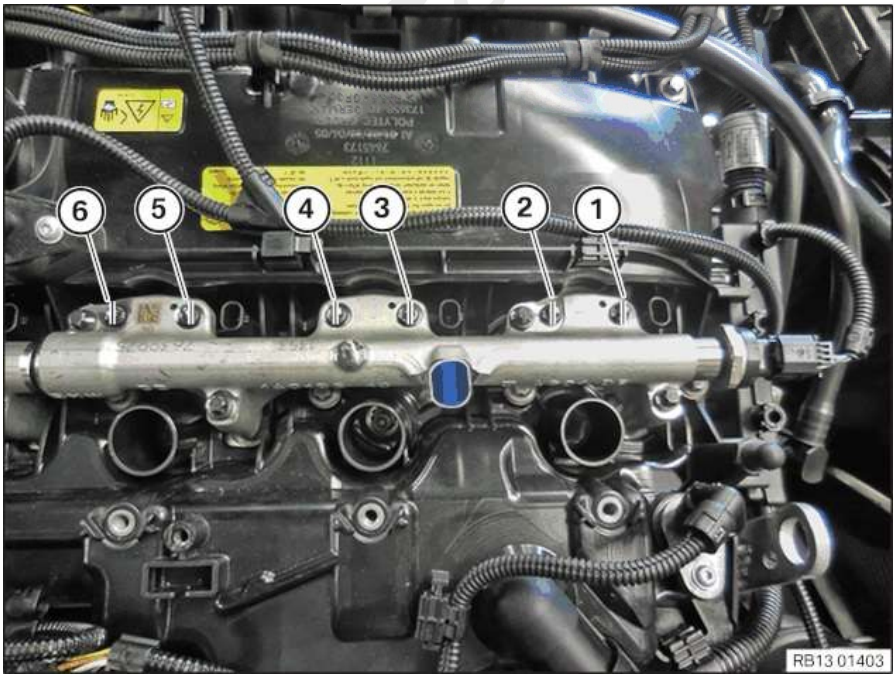
  Do not use a reversible ratchet or torque wrench.
- Hand-tighten screws (M5x30) in pairs ((1) with (2), (3) with (4), (5) with (6)) alternately by **90°**.
- Set torque wrench to 5 Nm.

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

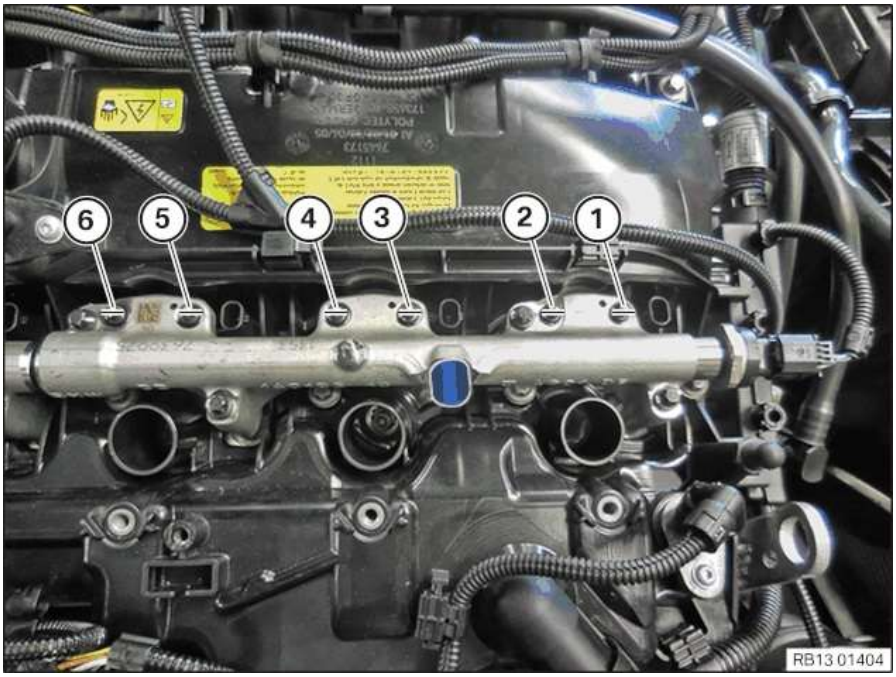
Non-observance of these requirements may result in leaks and damage.

- **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.



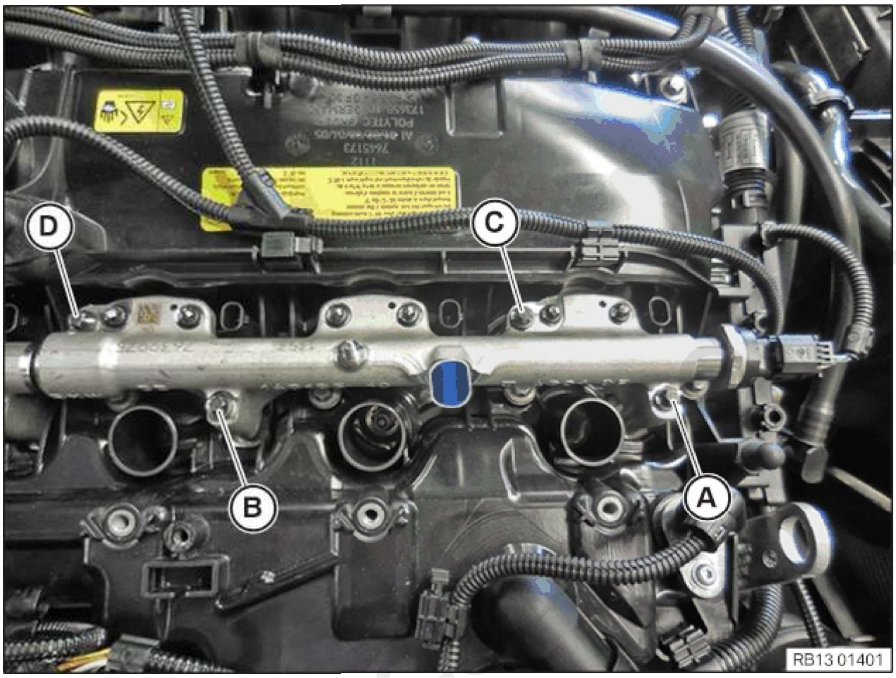
- Mark all bolts (1) to (6) with a line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the screw (1) with an angle of rotation of 90° ±15°.
  - Tighten the screw (2) with an angle of rotation of 90° ±15°.
  - Tighten the screw (3) with an angle of rotation of 90° ±15°.
  - 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.

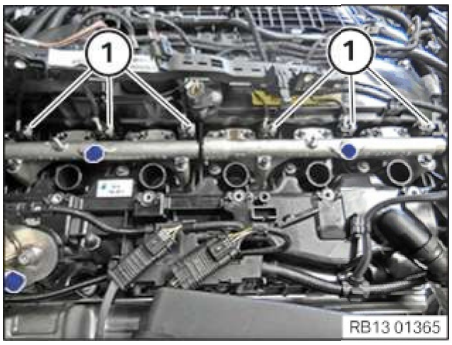


- Mark all the bolts (A) to (D) with a vertical line (see Figure).
- Tighten bolts (M6x70) (A) to (D) with an angle of rotation of 90°.



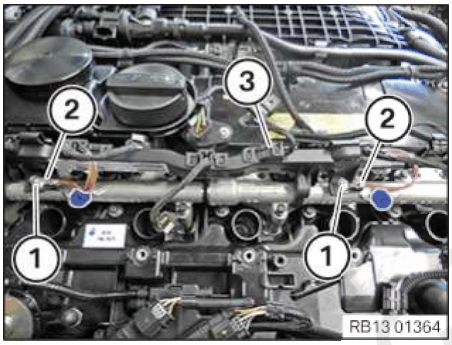
- Check whether all screws (A) to (D) have been tightened with an angle of rotation of 90°.

  All marks (lines) must be horizontal (see figure).



- Connect and lock all the connectors (1) to the injectors.

  All connectors (1) must engage audibly.

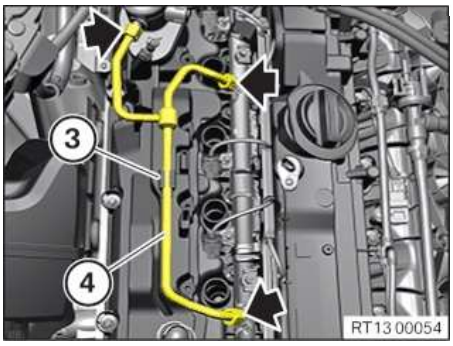


- Thread the cable channel (3) in and install.
- Thread in ground cable (2) and install.
- Tighten nuts (1).

Ground cable to rail

M6			5 Nm

53 – Installing high pressure line between rail and high pressure pump

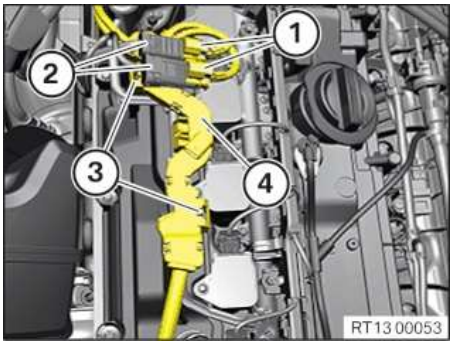


- Insert the high pressure line (4) into the holder (3) and install.
- Tighten union nuts (arrows) with the special tool .

High pressure line between rail and high pressure pump

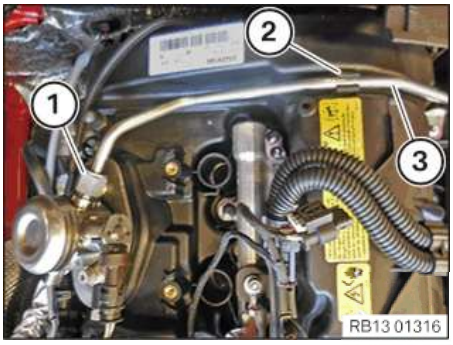
M14x1,5		Tightening torque	33 Nm

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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.

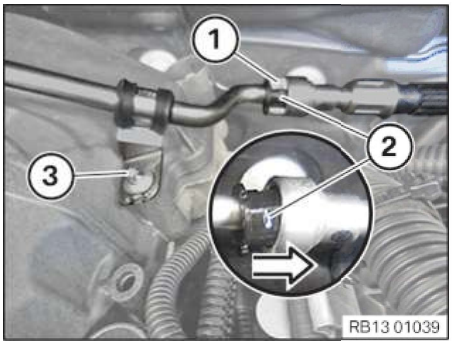
54 – Installing fuel delivery line



- 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

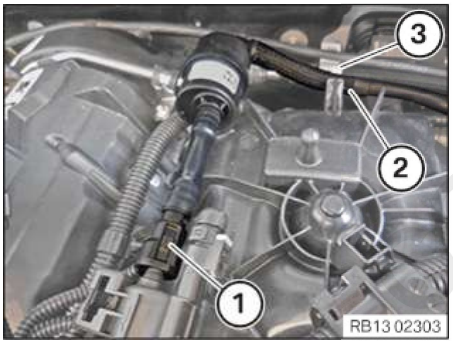
M14		Tightening torque	31 Nm



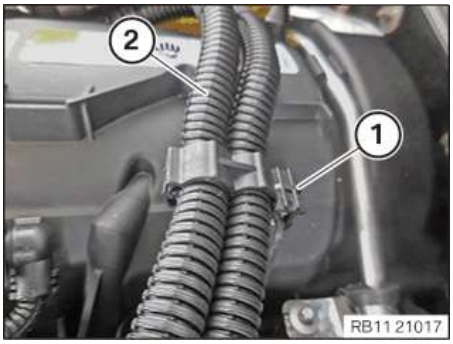
- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure clamps (1).
- Tighten down screw (3).

Fuel line to cylinder head cover

6x18		Tightening torque	6,5 Nm

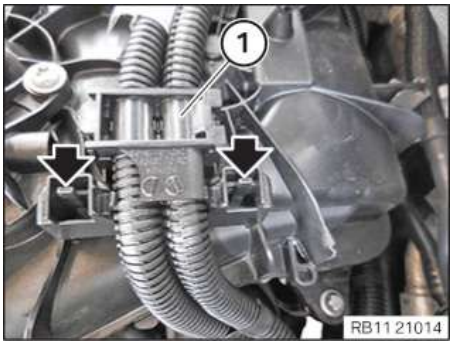


- Insert and install the tank ventilation line (2).
- Lock (1) must engage audibly.
- Secure the tank ventilation line (2) to the clamp (3).



- Insert and install wiring harness section (2) for injectors and ignition coils.
- Secure clamps (1).

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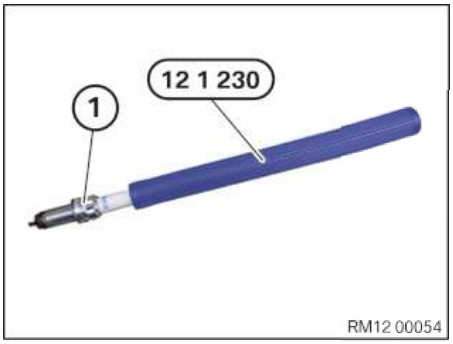


- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

55 – 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

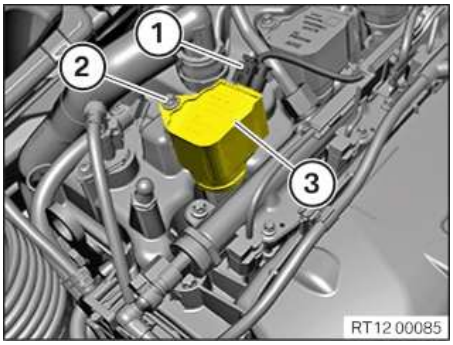
M12x1.25		Tightening torque	23 Nm

56 – Install all ignition coils

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Install ignition coil.**



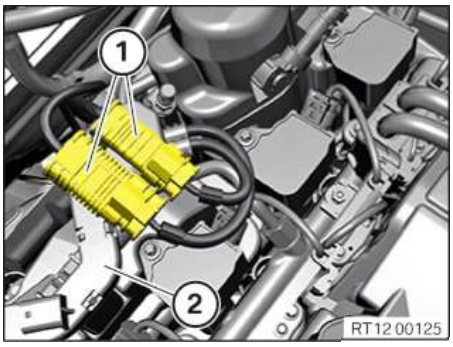
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

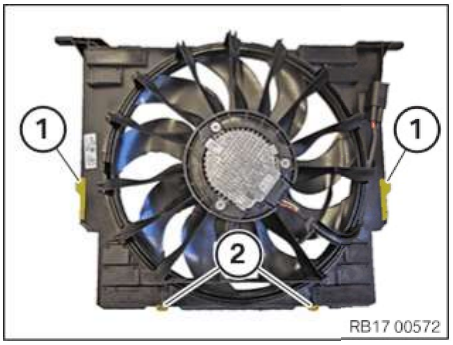
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

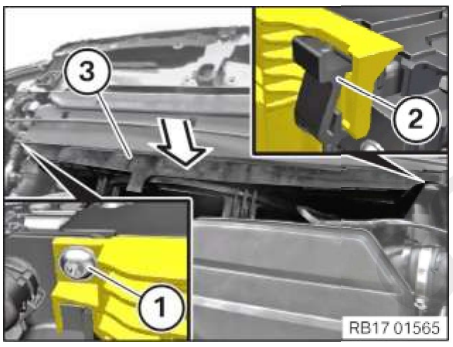


- Connect the connector (1) of the front oxygen sensor and the monitoring oxygen sensor on the cable shaft (2).

57 – Install fan cowl



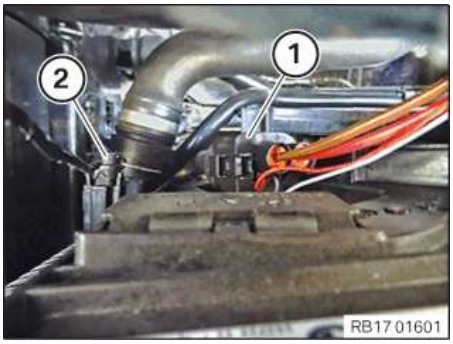
- Feed guides (1) into the radiator.
- Feed guides (2) into the charge air cooler.



- 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

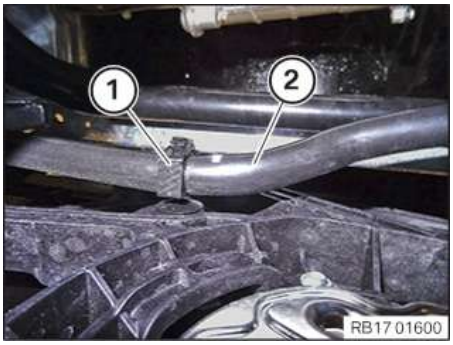


- Connect connectors (2) and lock.

  The connector (2) must engage audibly.
- Connect connectors (1) and lock.

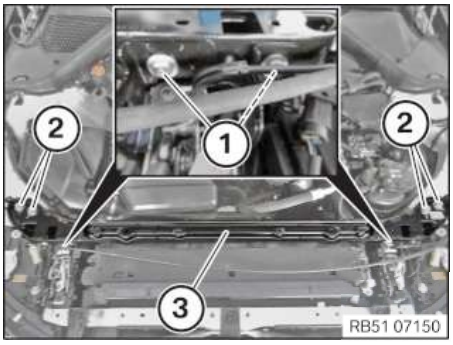
  The connector (1) must engage audibly.

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- **If installed:** Secure the transmission oil line (2).
  Insert and install the transmission oil line (2).
  Lock holder (1).

58 – Install the rear top cross connection



- Guide in and position the top rear cross connection (3).
- Tighten the screws (1).

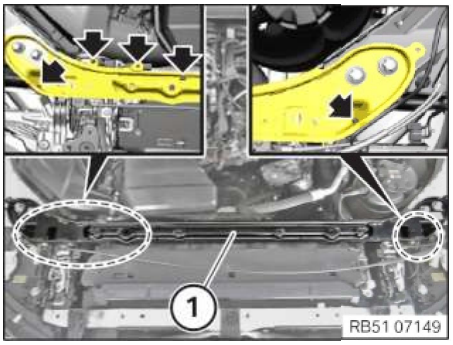
Top rear cross connection to bonnet catch support

Flat-head screw M6x20		Tightening torque	11,8 Nm

- Renew screws (2).
  Parts: Bolts
- Tighten the screws (2).

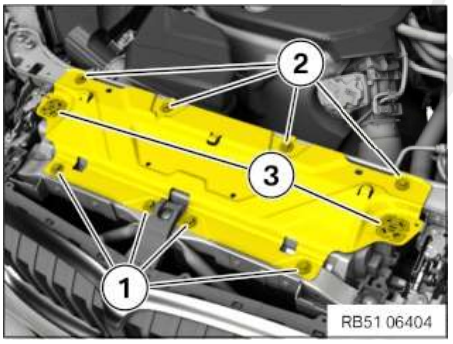
Rear top cross connection to wheel arch carrier support

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).

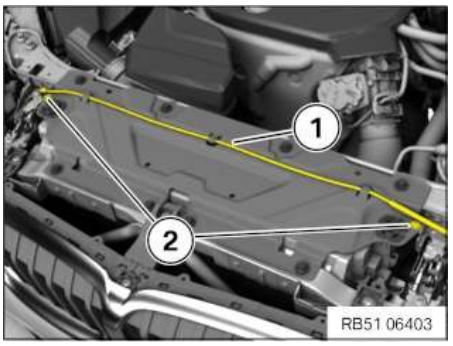
59 – Installing the top cross connection



- 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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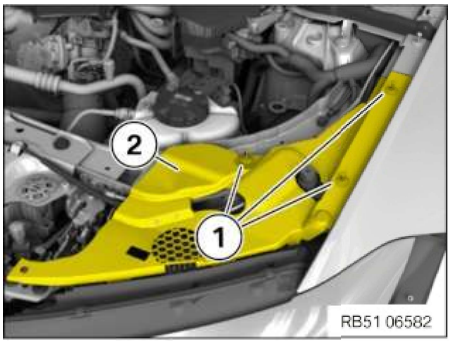
- Clip in the housing for the coupling of the Bowden cables (1).

60 – 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.

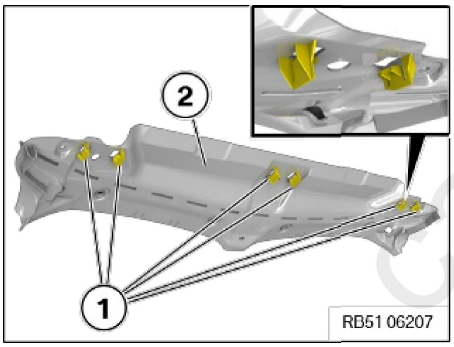
▶ Installing the cover in the engine compartment on top partially



- Install the cover in the engine compartment on top (2).
- Secure expanding rivet (1).

61 – Installing cover for engine compartment centre

Check



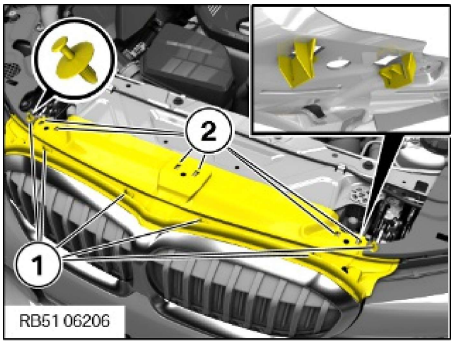
- Check latch mechanisms (1) of cover for engine compartment centre (2) for damage.

Result

» The latch mechanism (1) is damaged.

Measure

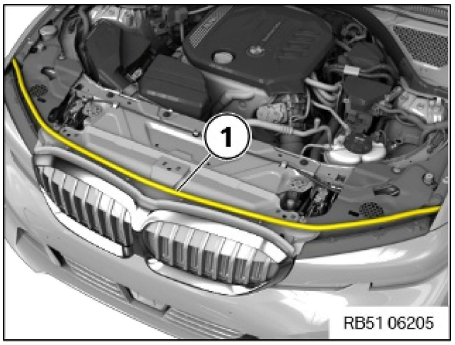
- Renew cover for engine compartment centre (2).



- 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).

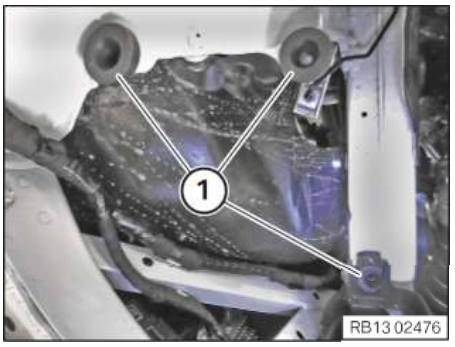
62 – Install the seal for the front bonnet

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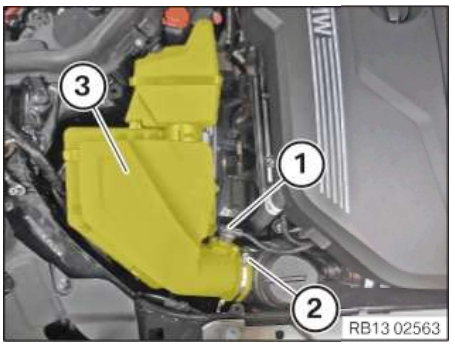


- Position the bonnet seal(1) and connect it on the mounting on the bumper and on the headlights.

63 – 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.

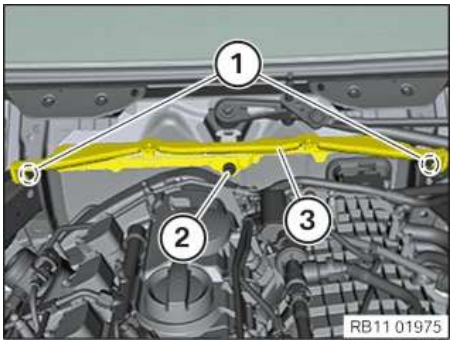
  The connector (1) must engage audibly.

64 – Disconnecting all battery earth leads



- See additional information.

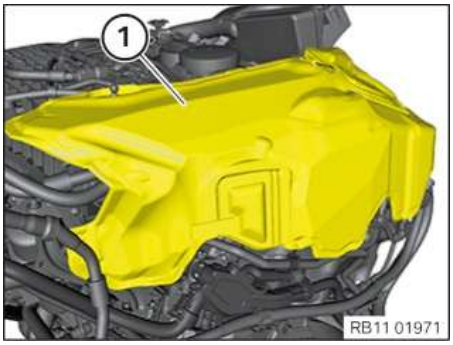
65 – Installing centre bulkhead lower section



- Position the centre bulkhead lower part (3).
- Tighten nut (2) and screws (1).

66 – Installing acoustic cover at rear

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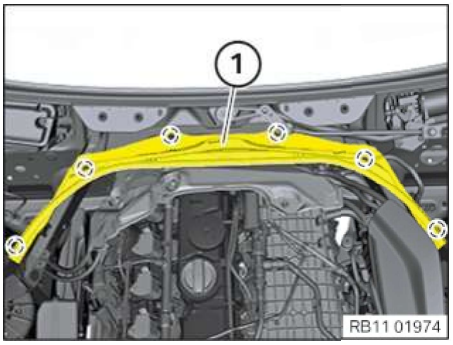


- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

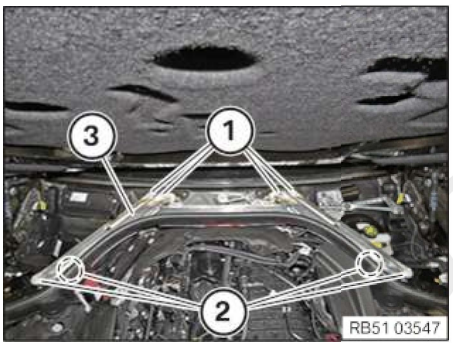
67 – Installing the centre bulkhead upper part



- 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 °

68 – Installing cowl panel cover

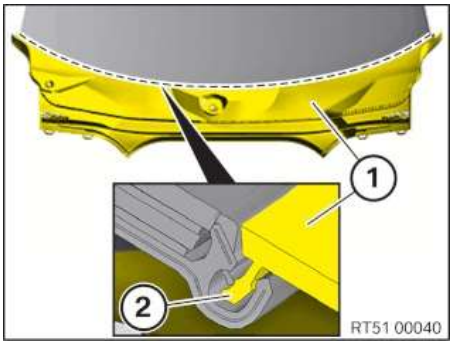
RISK OF DAMAGE

Damage caused by water ingress into the vehicle.

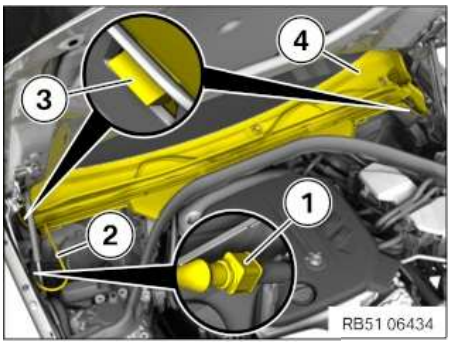
Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

- Ensure correct installation of the components.
- Only use undamaged components.

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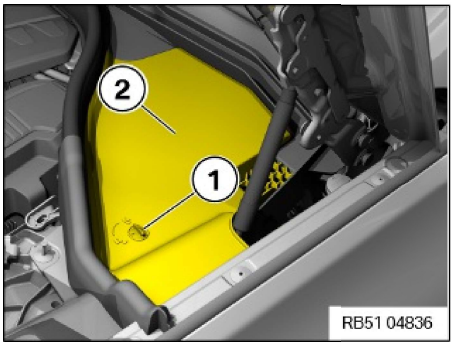


- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



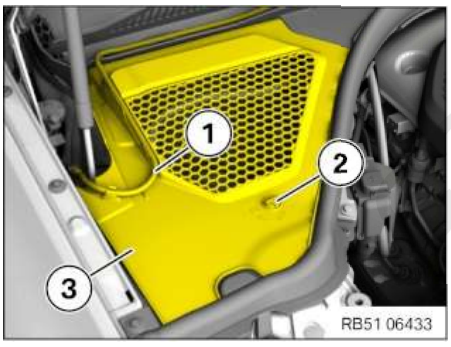
- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

69 – Install the cover of the engine compartment on the rear left



- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

70 – 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.

71 – Installing both wiper arms

NOTICE

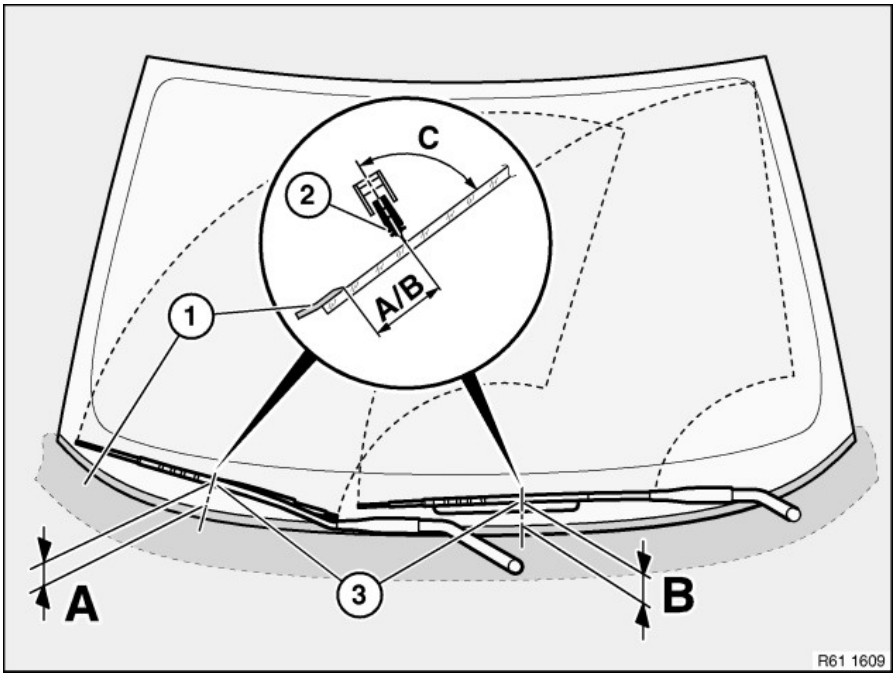
Description is for left component only. Procedure on the right side is identical.

▸ **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.

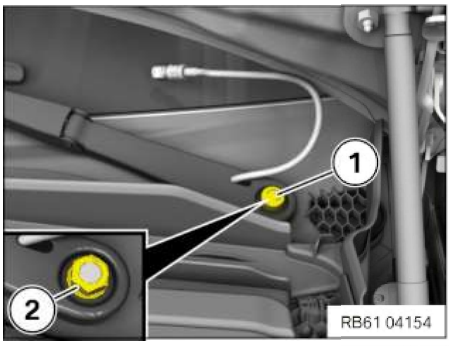
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- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

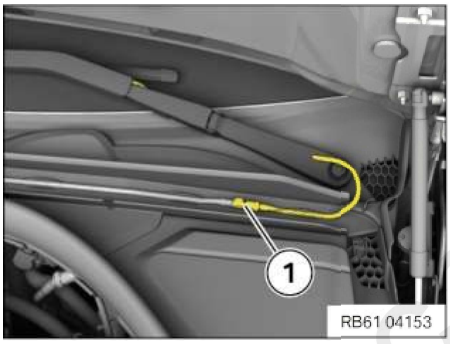


- Tighten nut (2).

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.

72 – Install acoustic cover

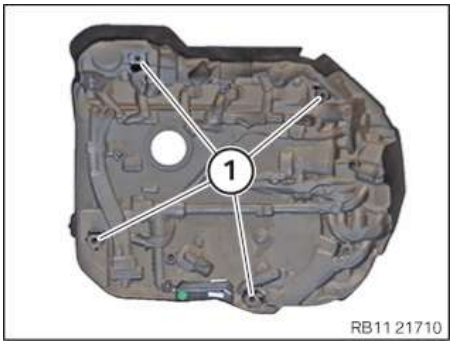
RISK OF DAMAGE

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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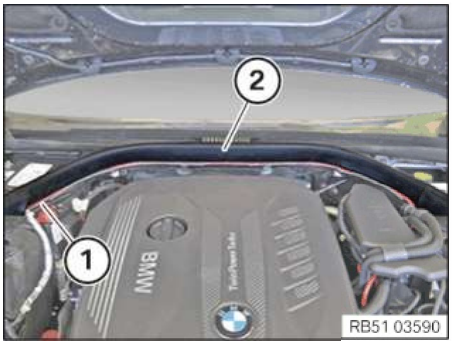


- Check the rubber mount (1) for correct fit in the acoustic cover.



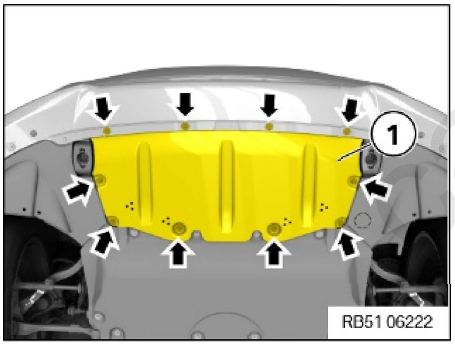
- Install acoustic cover (1) and fix in the rubber mounts (marks).

73 – 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.

74 – Installing the front underbody protection



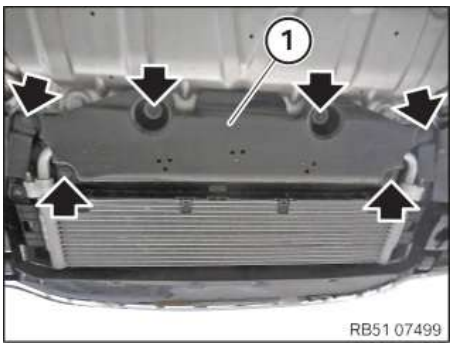
- **Version 1:**

  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:**

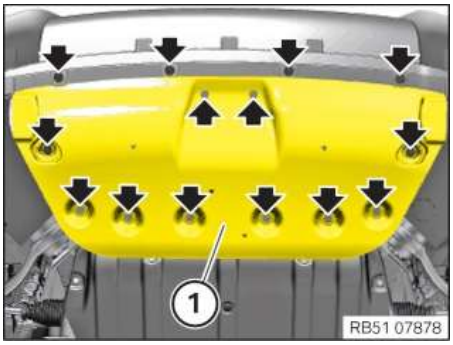
  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

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- **Version 3:**

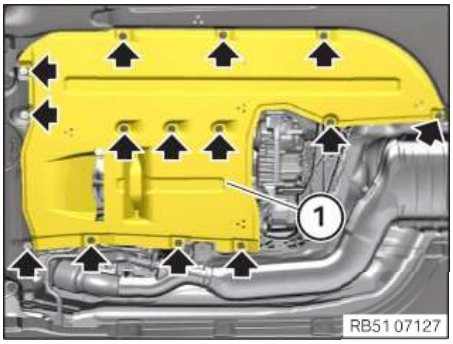
  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

75 – Installing underbody protection at rear



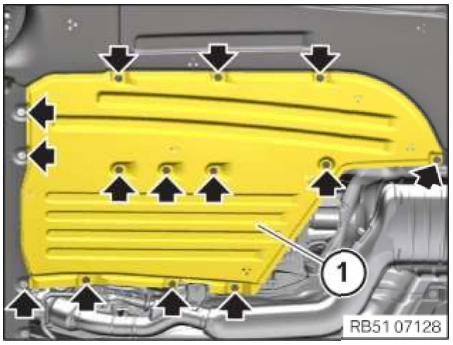
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

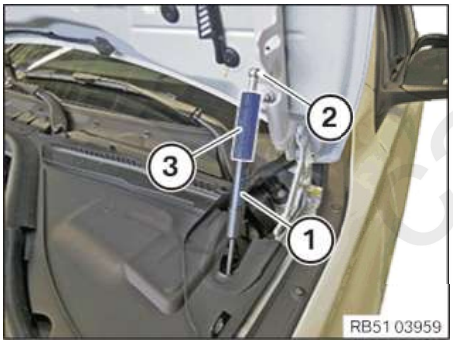
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

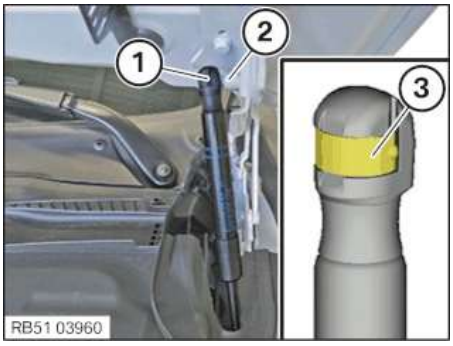
Underbody protection

Hexagon screw		Tightening torque	3 Nm

76 – 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 313945

M6		Tightening torque	8 Nm

Test gauge to basic carrier — Used in step 313945

M6		Tightening torque	8 Nm

VANOS central valve to camshaft — Used in step 4142

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 44

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Engine oil cooler to bumper support — Used in step 46

M6X25		Tightening torque	8 Nm

Cover, front bottom on side — Used in step 46

Hexagon screw for thermoplastic		Tightening torque	3 Nm

Cylinder head cover to cylinder head — Used in step 47

M6X30		Jointing torque	8 Nm

Cylinder head cover to cylinder head — Used in step 47

M6X30		Tightening torque	11 Nm

Auxiliary coolant pump holder to cylinder head — Used in step 47

M6		Tightening torque	7 Nm

Standard screw connection M6 — Used in step 47

M6			8 Nm

Differential pressure sensor to holder — Used in step 47

TS6X18		Tightening torque	3,5 Nm

Holder, positive battery cable to cylinder head cover — Used in step 47

6X18		Tightening torque	6 Nm

High pressure pump to high pressure pump flange — Used in step 49

M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

Ground cable to rail — Used in step 5152

M6			5 Nm

High pressure line between rail and high pressure pump — Used in step 53

M14x1,5		Tightening torque	33 Nm

Fuel delivery line to high pressure pump — Used in step 54

M14		Tightening torque	31 Nm

Fuel line to cylinder head cover — Used in step 54

6x18		Tightening torque	6,5 Nm

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Spark plugs			Used in step 55
M12x1.25		Tightening torque	23 Nm

Ignition coil			Used in step 56
Screw		Tightening torque	8 Nm

Fan cowl with electric fan on radiator			Used in step 57
TS6x20		Tightening torque	6,5 Nm

Top rear cross connection to bonnet catch support			Used in step 58
Flat-head screw M6x20		Tightening torque	11,8 Nm

Rear top cross connection to wheel arch carrier support			Used in step 58
M10x20 screw	Renew screw.	Jointing torque	56 Nm
		Angle of rotation	90 °

Cross connection, top			Used in step 59
M8x20		Tightening torque	28 Nm

Cross connection, top			Used in step 59
M6x20		Tightening torque	11,8 Nm

Clean air pipe to upper section of intake filter housing			Used in step 63
Clamp		Tightening torque	3 Nm

Bulkhead upper part to bottom bulkhead			Used in step 67
		Tightening torque	3 Nm

Tension strut on bulkhead			Used in step 67
M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome			Used in step 67
Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

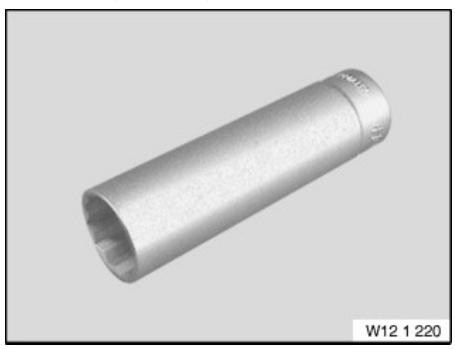
Windscreen wiper arm			Used in step 71
Combination hexagon nut		Tightening torque	35 Nm

Underbody protection front			Used in step 74
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Underbody protection			Used in step 75
Hexagon screw		Tightening torque	3 Nm

Overview of Special Tools

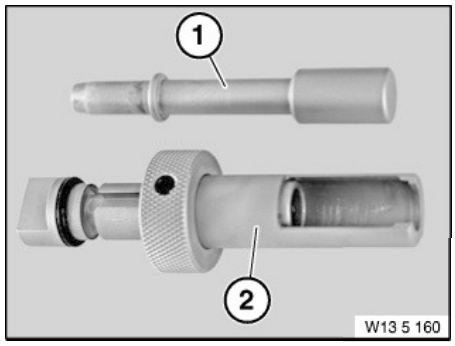
0 495 560 (12 1 220) Socket



Common		Used in step 2055
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)	

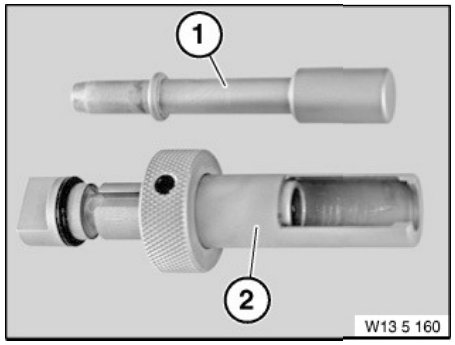
cardiagn.com

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	

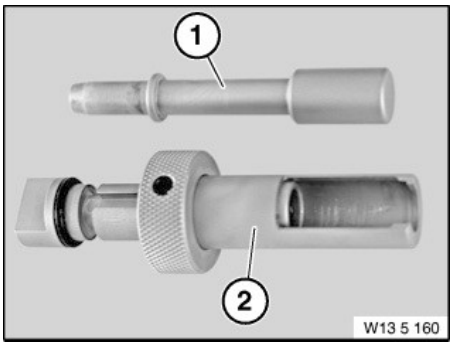
0 496 568 (13 5 162) Fastener



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



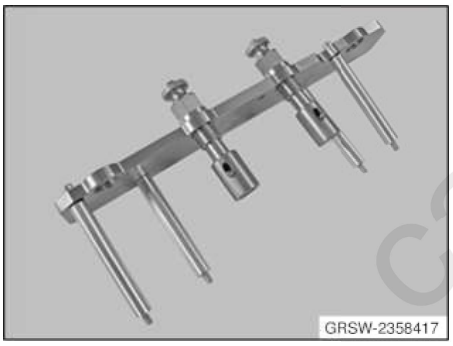
Common Used in step 22

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	

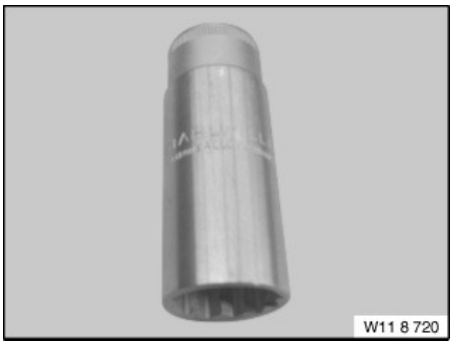
2 358 417 Device



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)

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)

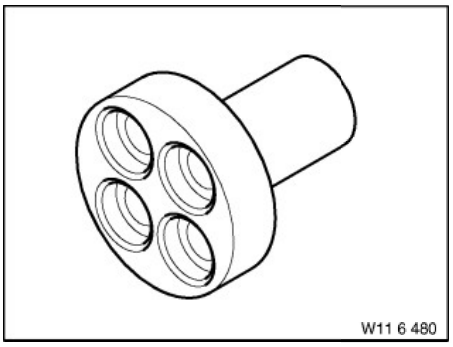
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2 360 895 Pin wrench



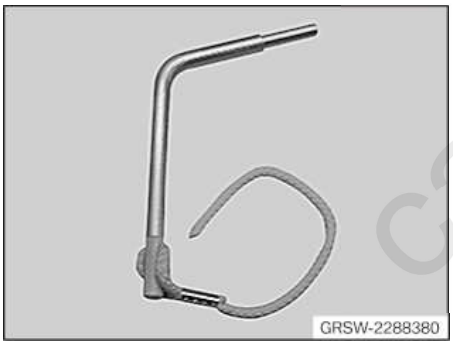
Common	Used in step 2648
Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 493 380 (11 6 480) Connector



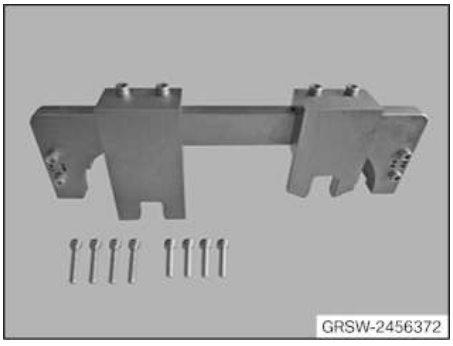
Common	Used in step 31434549
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

2 288 380 Locating stud



Common	Used in step 314345
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 3138394345
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 313845
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 33364142
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 33364142
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 4043
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 50
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 50
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)

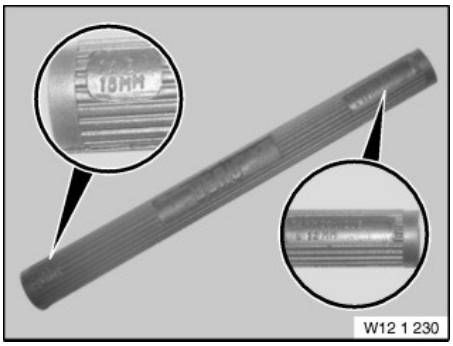
2 358 022 Gauge



Common	Used in step 5152
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 55
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 71
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	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	164
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	164
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting battery earth lead	164
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61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting battery earth lead	164

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61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting battery earth lead	164
61 20 900 Disconnecting and connecting battery earth lead	164
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	49

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11 37 020 Removing and installing/replacing servomotor for eccentric shaft

PRELIMINARY WORK

1 – Removing the acoustic cover

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).

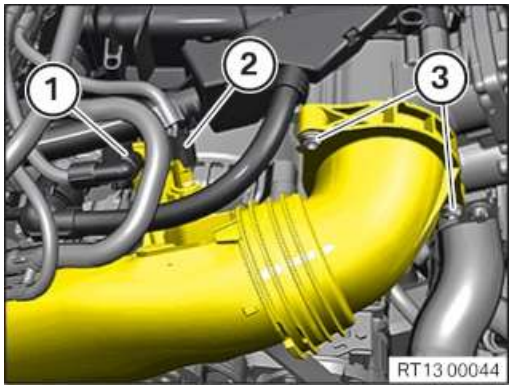
2 – Partially removing charge air line

WARNING

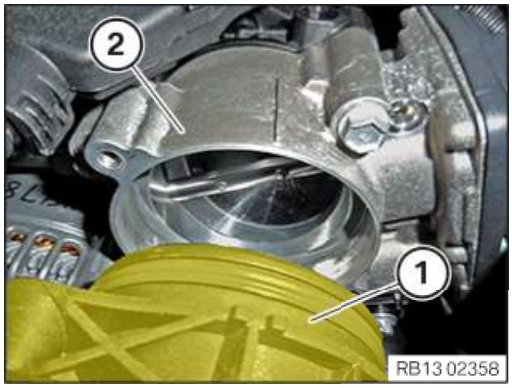
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.



- Unlock plug connection (1) and disconnect.
- Unlock plug connection (2) and disconnect.
- Loosen screws (3).



- Disconnect charge air line (1) from throttle valve (2) and set it aside.

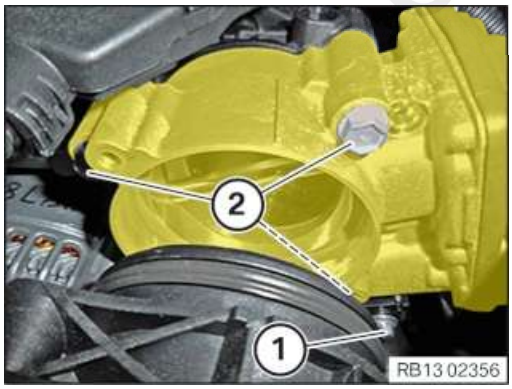
3 – Removing the throttle body

RISK OF DAMAGE

Electrostatic discharge.

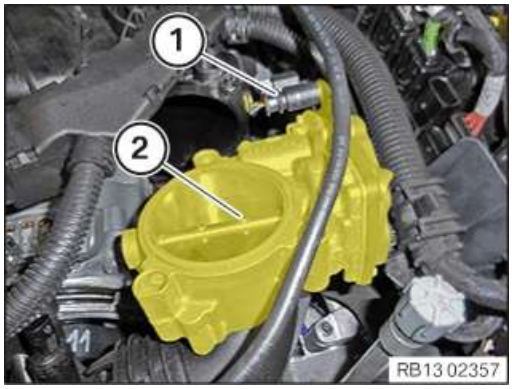
Damage to or destruction of electrical components.

- 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.



- Loosen screw (1).
- Loosen screws (2).

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- Thread the throttle body (2) a little bit out to the front.
- Unlock plug connection (1) and disconnect.
- Remove throttle body (2).

MAIN WORK

4 – Removing the servomotor for the eccentric shaft

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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.

RISK OF DAMAGE

Contaminant or foreign body.

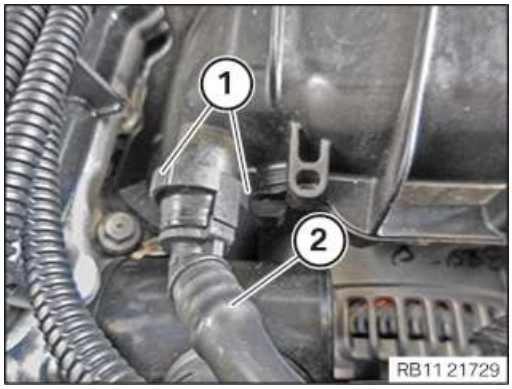
Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

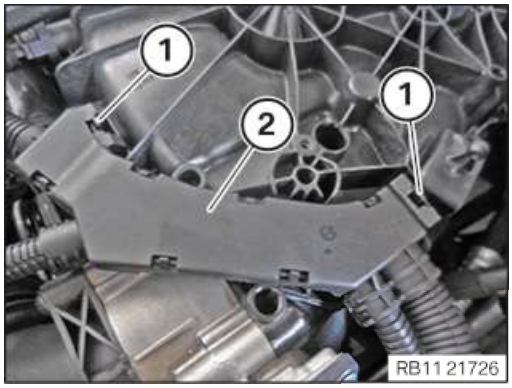
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

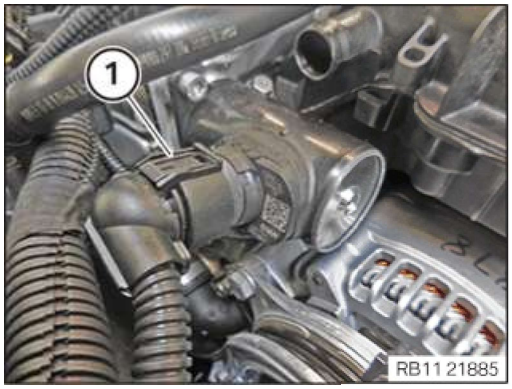
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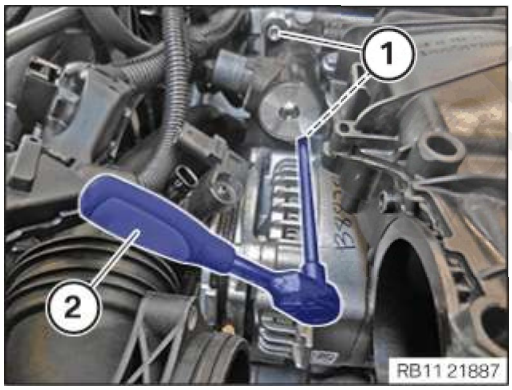
- Unlock the locks (1).
- Feed the tank ventilation line (2) out and set it aside.



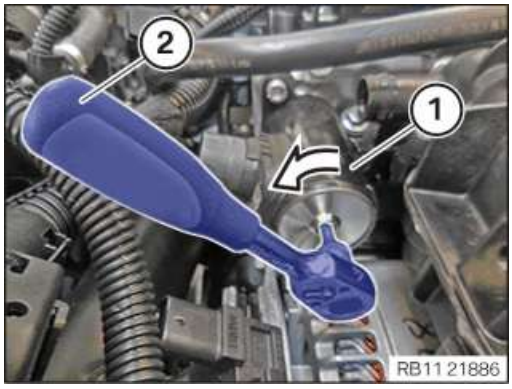
- Unlock the locks (1).
- Guide out the wiring harness section (2) for the sensor system **2** and place to one side.



- Unlock and loosen connector (1).



- Loosen screws (1) with commercial available tools (2).



- Turn the drive shaft of the servomotor (1) with a standard tool (2) in the direction of the arrow.
- Make sure that the drive shaft of the servomotor (1) is not turned beyond the end stop of the eccentric shaft.
- Guide out and remove the servomotor (1).
- Catch and dispose of emerging engine oil.

5 – Installing servomotor for the eccentric shaft

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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.

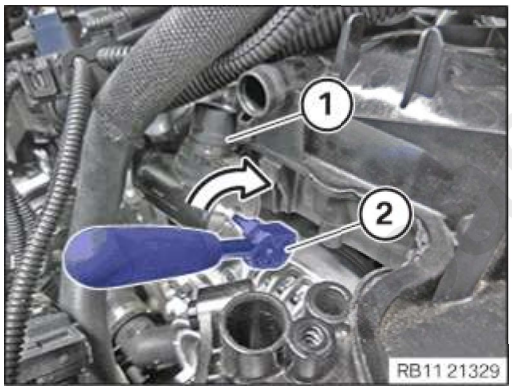


- Renew sealing ring (1).

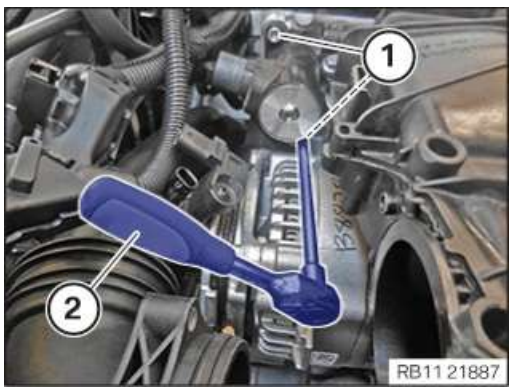
  Parts: Sealing ring
- Guide in sealing ring (1) into the housing to the limit position and install.



- Clean sealing surface (1).



- Insert the servomotor (1) to the gearing on the cylinder head.
- Turn the drive shaft of the servomotor (1) in the direction of the arrow with a standard tool (2) until the servomotor (1) is flush with the cylinder head.

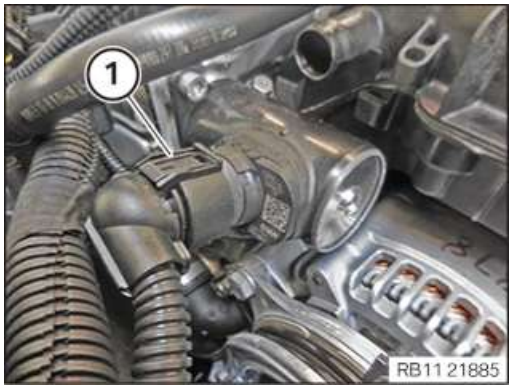


- Tighten the screws (1).

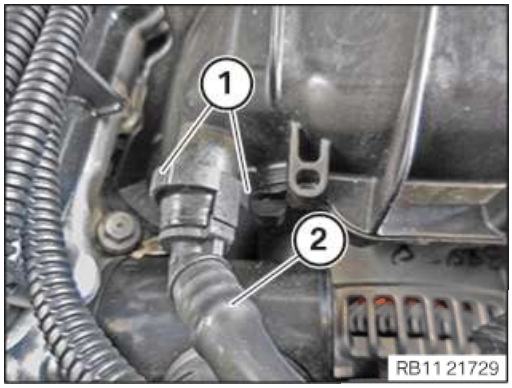
Servomotor for the eccentric shaft to cylinder head

M6 x 16		Tightening torque	8 Nm

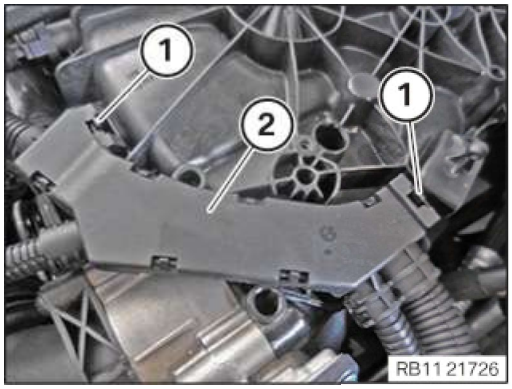
.com



- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.



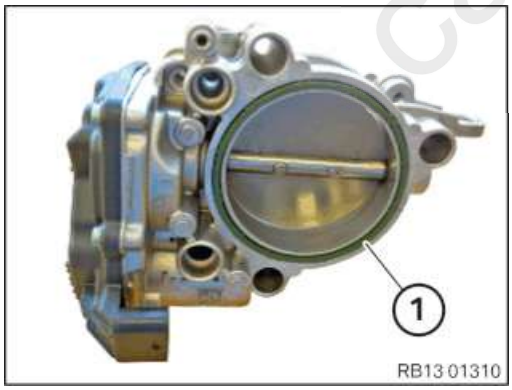
- Insert and install the tank ventilation line (2).
- Ensure that the locks (1) engage audibly.



- Feed in and install wiring harness section (2) for sensor system **2**.
- Ensure that the locks (1) engage audibly.

POSTPROCESSES

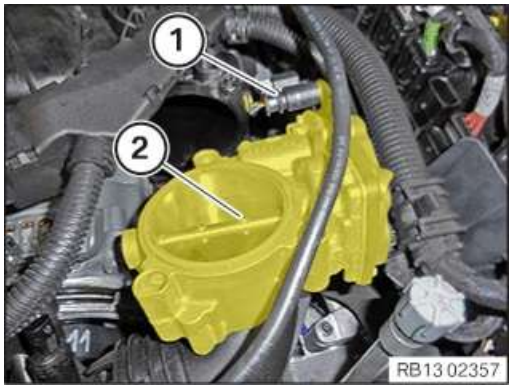
6 – Installing the throttle body



- Renew the sealing ring (1) with the special tool 0 496 714 (00 9 030).

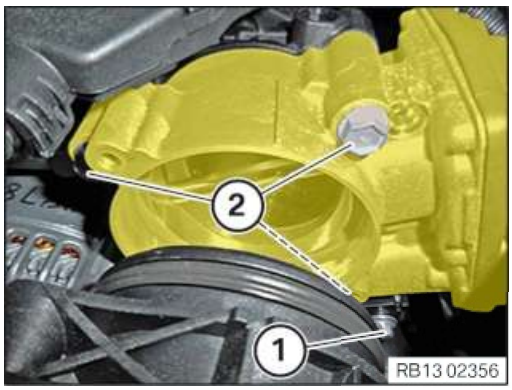
  Parts: Sealing ring

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- Position throttle body (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.
- Install throttle body (2).



- Tighten down screws (2).

Throttle body to intake plenum

6X50		Tightening torque	7 Nm

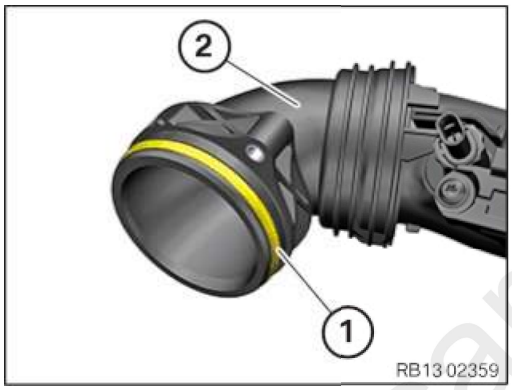
- Renew the screw (1).

  Parts: Screw
- Tighten down screw (1).

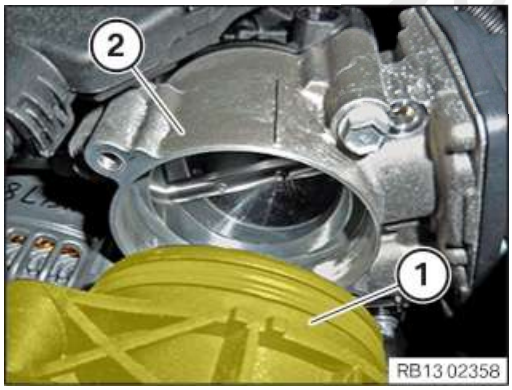
Bracket for coolant hose to throttle body

M6x16 screw	Renew screw.	Tightening torque	11,8 Nm

7 – Installing charge air line partially

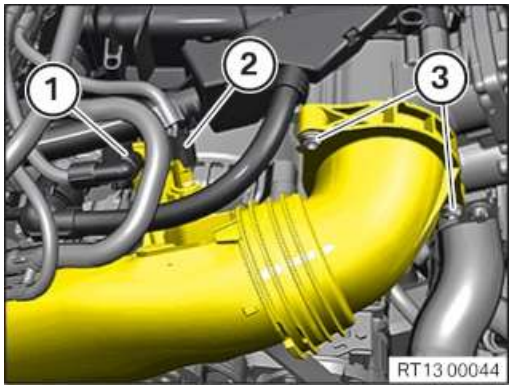


- Check the sealing ring (1) on the charge air line (3) for damage and renew if required.



- Connect charge air line (1) with the throttle valve (2).

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- Tighten down screws (3).

Charge air line to throttle valve

M6x30		Tightening torque	8 Nm

- Connect connectors (2) and lock.

  The connector (2) must engage audibly.
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

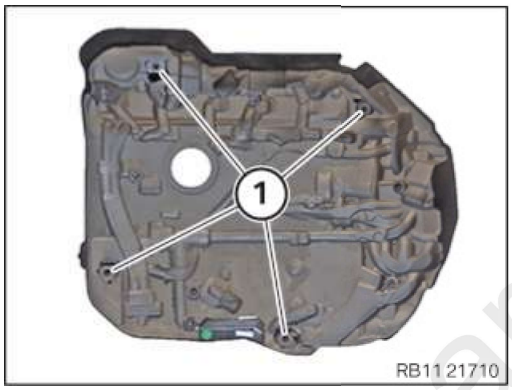
8 – Install acoustic cover

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).

Additional Information

Overview of Tightening Torques

Servomotor for the eccentric shaft to cylinder head Used in step 5

M6 x 16		Tightening torque	8 Nm

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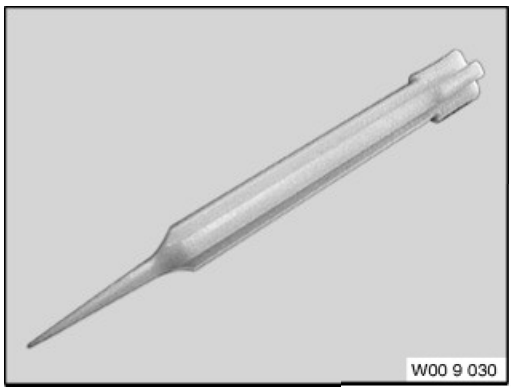
Throttle body to intake plenum			Used in step 6
6X50		Tightening torque	7 Nm

Bracket for coolant hose to throttle body			Used in step 6
M6x16 screw	Renew screw.	Tightening torque	11,8 Nm

Charge air line to throttle valve			Used in step 7
M6x30		Tightening torque	8 Nm

Overview of Special Tools

0 496 714 (00 9 030) Wedge



Common	Used in step 6
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)

Links

Repair instructions	Used in step
61 35 ... Notes on ESD protection (Electro Static Discharge)	34

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