This documentation refers to special tools that were not yet available when going to press.

11 24 571 Replace all conrod bearing shells.

CAUTION

Component with heavy weight.

Danger of injury!

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

CAUTION

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

Danger of injury!

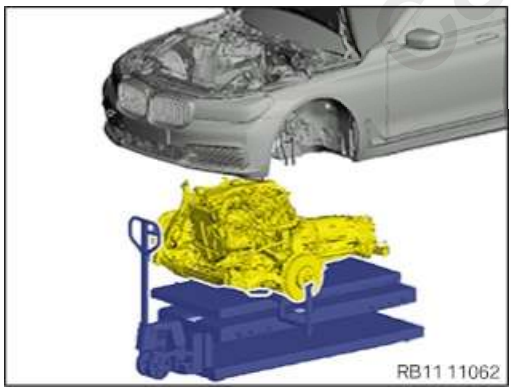
- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

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

PRELIMINARY WORK

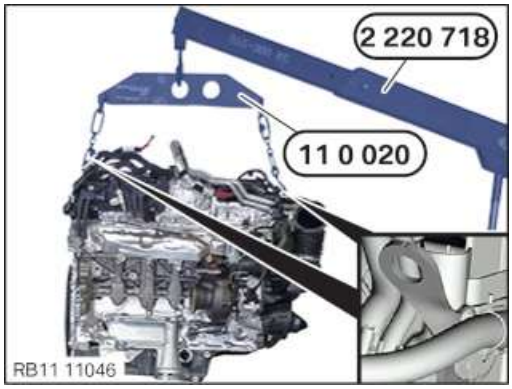
1 – Remove the front axle completely with the engine and transmission



- See additional information.

2 – Remove engine from front axle

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- See additional information.

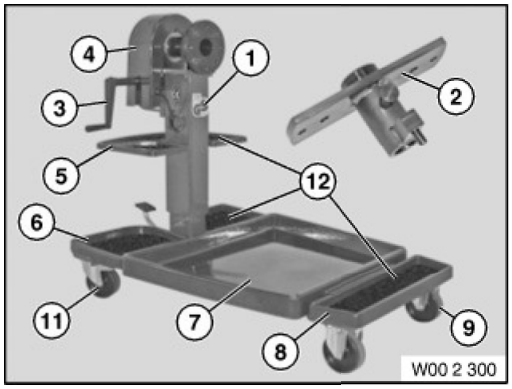
3 – Install the engine on the assembly stand

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

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



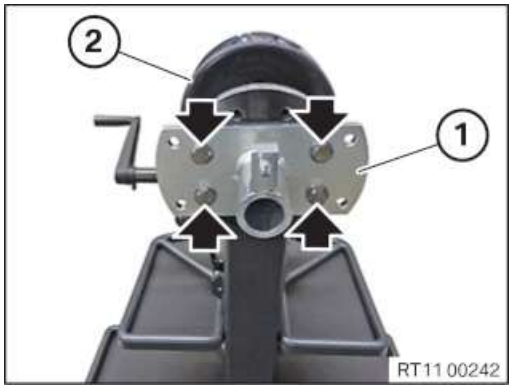
- Have the set of special tools 0 495 187 (00 2 300) ready.

Number	Description
1	Assembly stand
2	Flange
3	Crank
4	Cover
5	oddments tray
6	Shaped element rear
7	Collection pan
8	Shaped element front
9	Front wheel
10	Rear wheel with stop
11	Mat



- Have the special tool 2 411 718 ready.

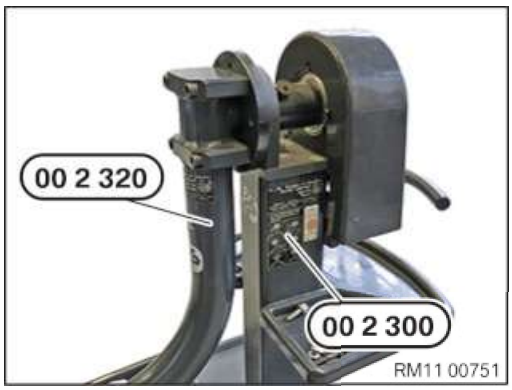
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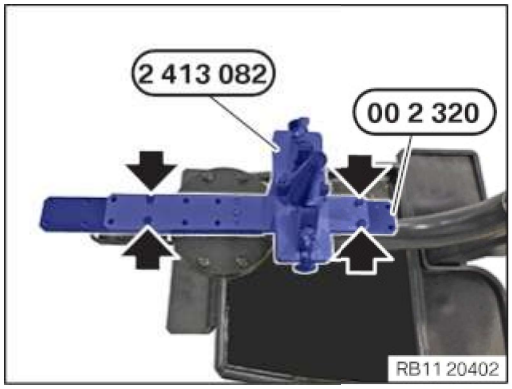
- Position flange (1) on assembly stand (2).
- Tighten screws (arrows).

Flange to assembly stand

M14X30		Tightening torque	135 Nm



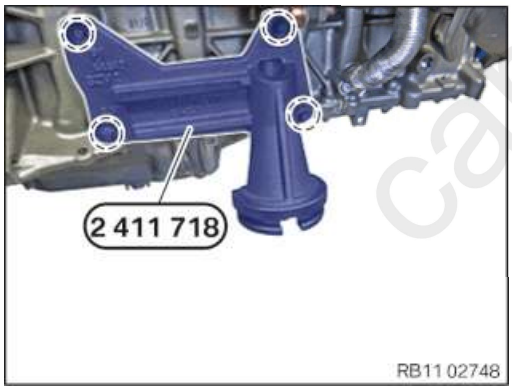
- Prepare the assembly stand 0 495 187 (00 2 300) with the special tool 0 495 196 (00 2 320).



- Screw the special tool 2 413 082 to the 0 495 196 (00 2 320) special tool.
- Tighten screws (arrows).

Special tool 11 8 930 to special tool 00 2 320

M14x35		Tightening torque	160 Nm



- Position and secure special tool (engine fixture) 2 411 718 on the engine.
- Tighten the bolts (marks).

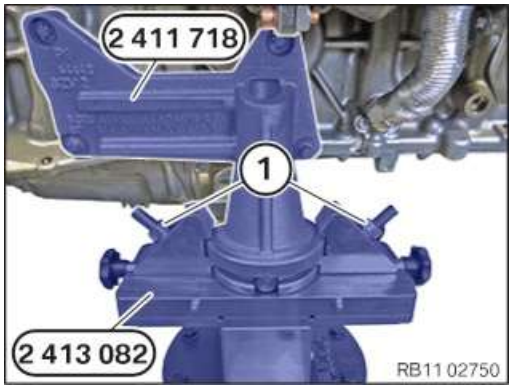
Special tool 2 411 718 to crankcase

M10x30		Tightening torque	38 Nm



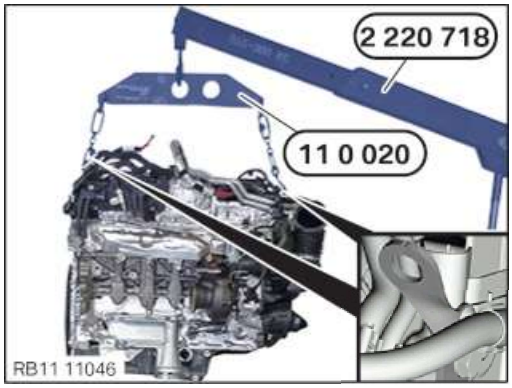
- Lower engine slowly.

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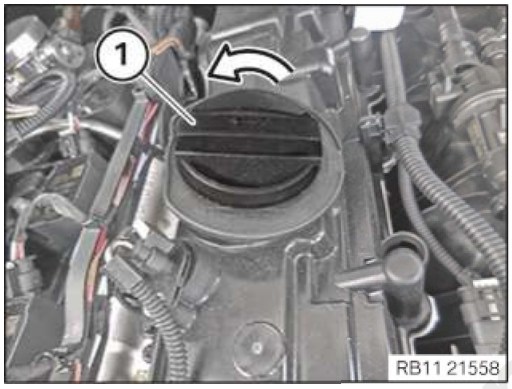
- Make sure special tool 2 411 718 engages with special tool 2 413 082.
- Tighten nuts (1) by hand.

  The clamping jaws must fit completely.



- Release both hooks of the special tool (lifting gear) 0 490 567 (11 0 020) at the front and back of the engine from the mounting brackets.
- Remove the workshop crane 2 220 718.

4 – Removing the oil filler cap



- Open the oil filler cap (1) in the direction of arrow.

5 – Releasing the oil drain plug

WARNING

Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

TECHNICAL INFORMATION

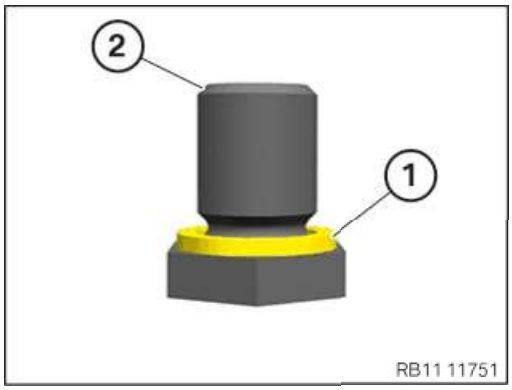
Catch and dispose of drained engine oil in a suitable collecting vessel. Observe country-specific waste disposal regulations.

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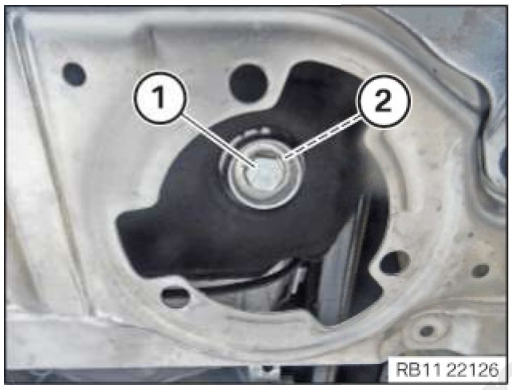
- Release oil drain plug (1).
- Feed out the oil drain plug (1) using sealing ring (2) and remove.
- Allow the engine oil to drain out fully.

6 – Tightening the oil drain plug



- Renew sealing ring (1) on the oil drain plug (2).

  Parts: Sealing ring
- Guide in the sealing ring (1) on the oil drain plug (2) and install.



- Feed in the oil drain plug (1) with the sealing ring (2) and install.
- Tighten oil drain plug (1).

Oil drain plug

M12x16	Replace sealing ring.	Tightening torque	25 Nm

7 – Removing engine ventilation line

WARNING

Hot surfaces.

Risk of burning!

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

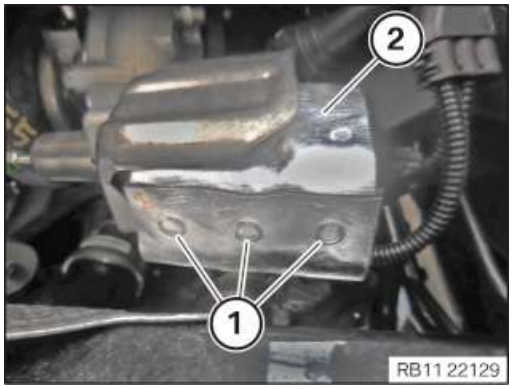
RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

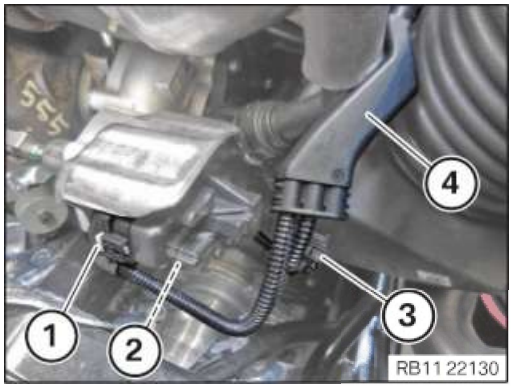
Sheared wires can cause a short circuit.

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

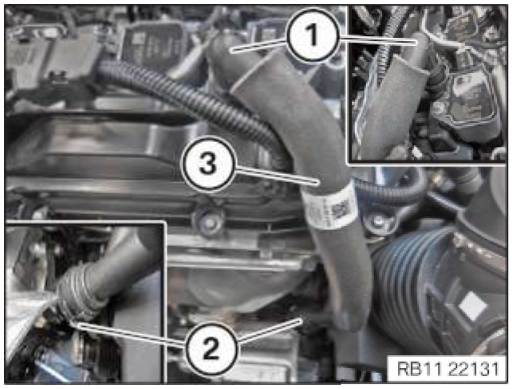
cardiagn.com



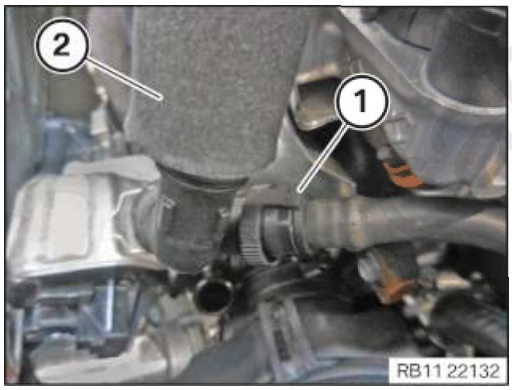
- Unlock the locks (1).
- Feed out and remove heat protection (2).



- Unlock and disconnect the plug connection (1).
- Unlock and disconnect the plug connection (2).
- Loosen clamp (3).
- Feed out wiring harness section for sensor system **2** (4) and set it aside.



- Unlock and loosen the locks (1).
- Unlock and loosen lock (2).
- Feed the engine ventilation line (3) out and set it aside.



- Unlock and release tank ventilation line (1).
- Feed out the engine ventilation line (2) and remove.

8 – Removing acoustic cover at rear



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

9 – Remove the front oxygen sensor

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WARNING

Hot surfaces.

Risk of burning!

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

RISK OF DAMAGE

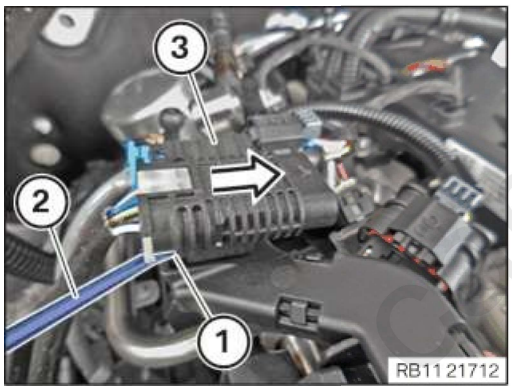
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

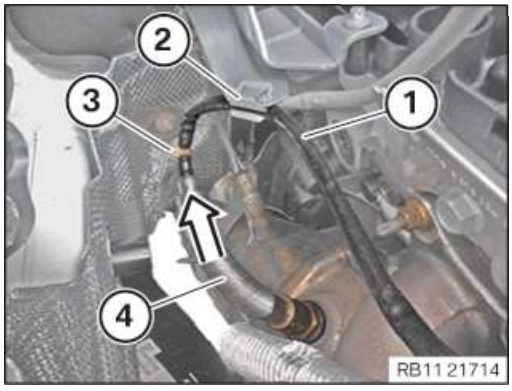
- Do not pull on the wires when disconnecting connectors and plug connections.



- Unlock and loosen connector (1).



- Unlock the locks (1) with a conventional screwdriver (2) and release.
- Feed out the connector (3) in **the direction of arrow** and set aside.



- Detach the line of the front oxygen sensor (1) from the holder (2).
- Unfasten cable strap (3).
- Feed out the heat shield (4) **in direction of arrow** and set it aside.

carsdiagn.com



- Release and remove the control sensor (1) with the special tool .

10 – Remove the monitoring oxygen sensor

WARNING

Hot surfaces.

Risk of burning!

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

RISK OF DAMAGE

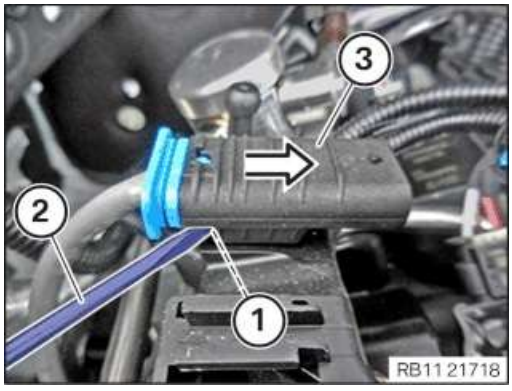
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

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

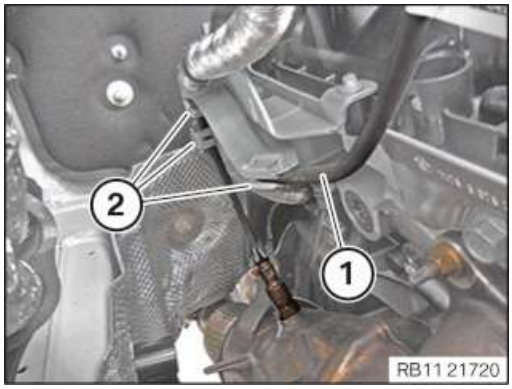


- Unlock and loosen connector (1).

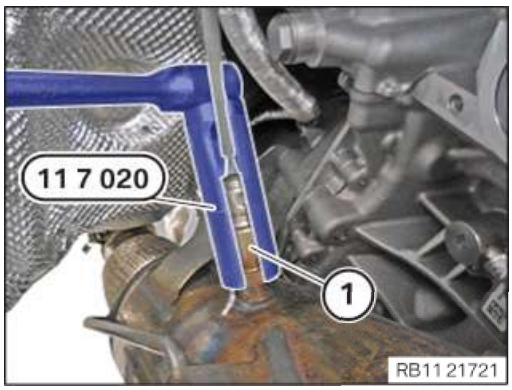


- Unlock the lock (1) with a suitable screwdriver (2).
- Feed out the connector (3) in the direction of the **arrow** and set it aside.

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- Detach the line of the monitoring oxygen sensor (1) from the holder (2).



- Release the monitoring oxygen sensor (1) using special tool .
- Remove the monitoring sensor (1).

11 – Remove catalytic converter

WARNING

Hot surfaces.

Risk of burning!

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

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

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

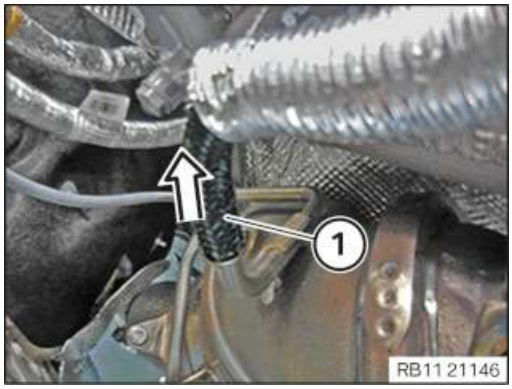
CAUTION

Component with heavy weight.

Danger of injury!

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

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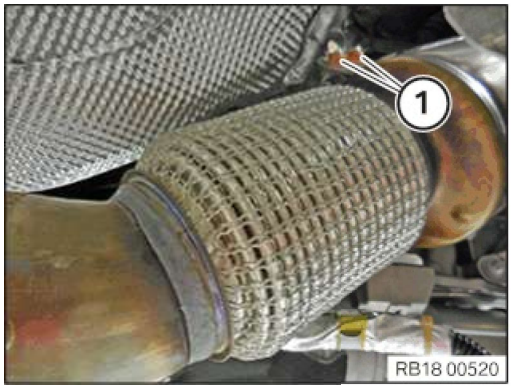


- **If installed: Disconnect pressure hose.**

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



- Loosen V-band clamp (1).



- Loosen nuts (1).



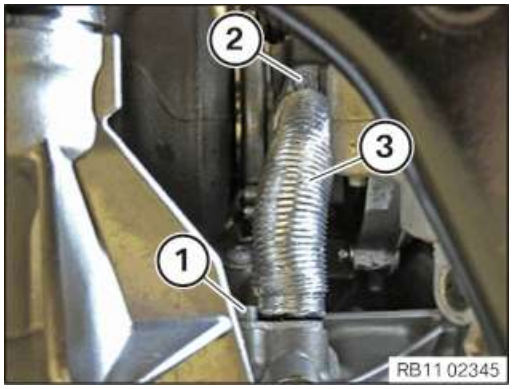
- Unlock and loosen clamp (1).
- Feed out catalytic converter and remove.

12 – Removing the oil return line for the exhaust turbocharger

TECHNICAL INFORMATION

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

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- Have cleaning rags ready for any escaping engine oil.
- Loosen screws (1) and (2).
- Guide out and remove the oil return line (3).

13 – Remove the coolant line between the cylinder head and the coolant pump

WARNING

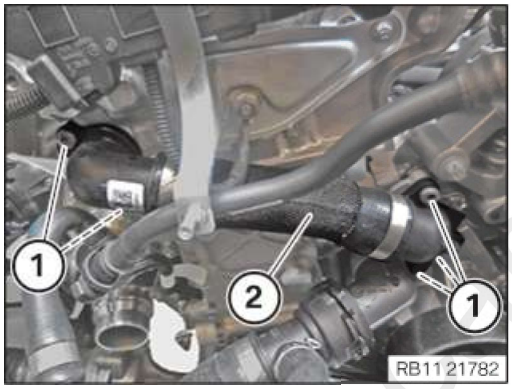
Hot surfaces.

Risk of burning!

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

TECHNICAL INFORMATION

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



- Loosen screws (1).
- Remove the coolant line (2).
- Catch and dispose of escaping coolant.

14 – Remove all ignition coils.

NOTICE

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

▸ **Removing the ignition coil**

WARNING

Hot surfaces.

Risk of burning!

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

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RISK OF DAMAGE

Damage to the ignition coil.

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

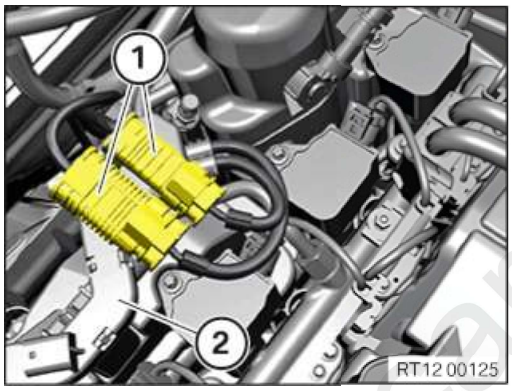
- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

RISK OF DAMAGE

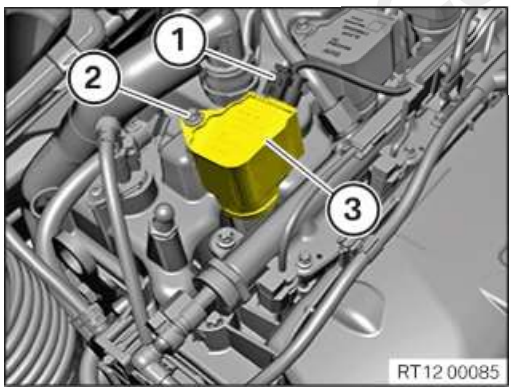
Electrostatic discharge.

Damage to or destruction of electrical components.

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



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



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

15 – Removing all spark plugs

WARNING

Hot surfaces.

Risk of burning!

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

CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

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



- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

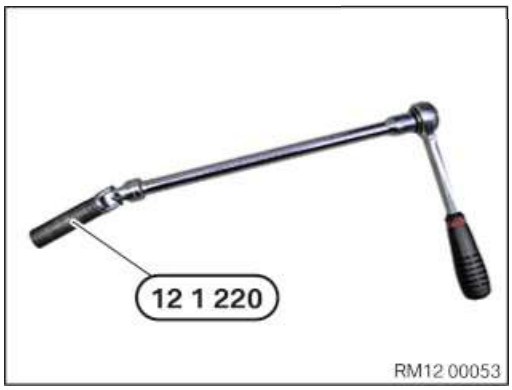
The spark plug shaft must be cleaned using compressed air after having removed the ignition coils and before removing the spark plugs. After having removed the spark plugs, once again check the sealing surface for contamination and (if necessary) clean using a moist cloth or clean using compressed air.

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

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

NOTICE

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



TECHNICAL INFORMATION

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

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

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

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

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

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

CAUTION

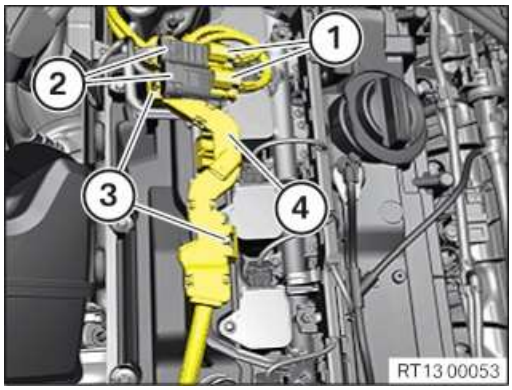
On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

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

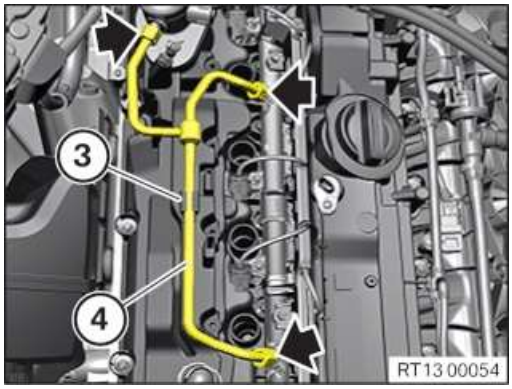
TECHNICAL INFORMATION

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



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

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

17 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

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

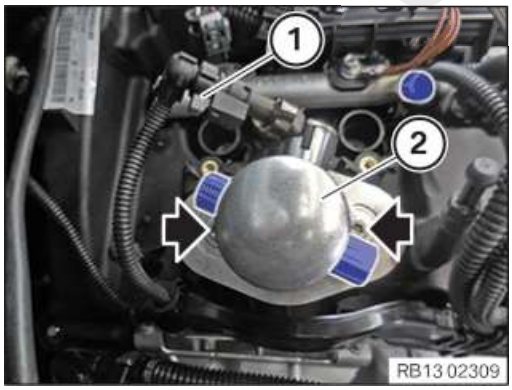
TECHNICAL INFORMATION

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

TECHNICAL INFORMATION

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

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



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

18 – Removing rail with injectors of cylinders 1 to 3

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

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

RISK OF DAMAGE

Damage to the ignition coil.

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

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

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

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

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

RISK OF DAMAGE

Damage to injectors.

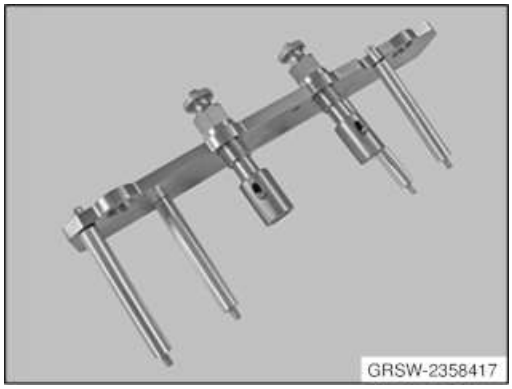
Excessive force may damage the injector and this means having to renew the injector.

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



- Prepare special tool .

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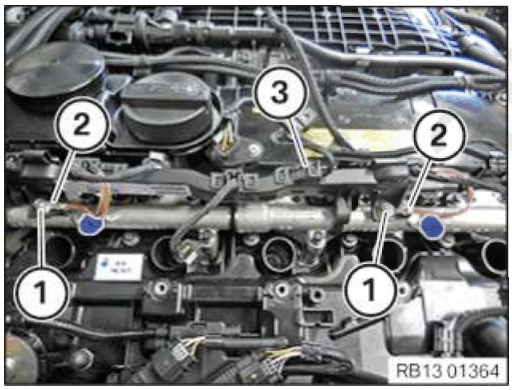
- Prepare special tool 2 358 417.



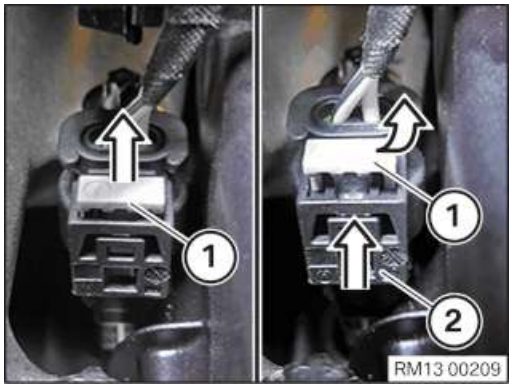
- Prepare special tool .



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

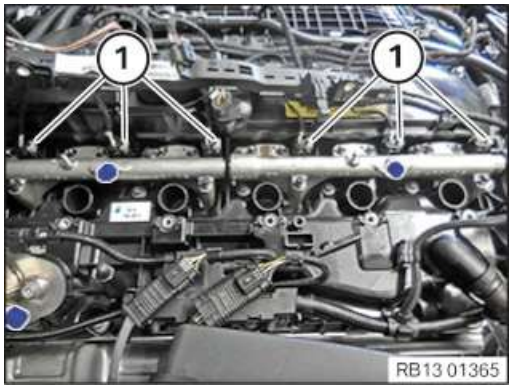


- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.

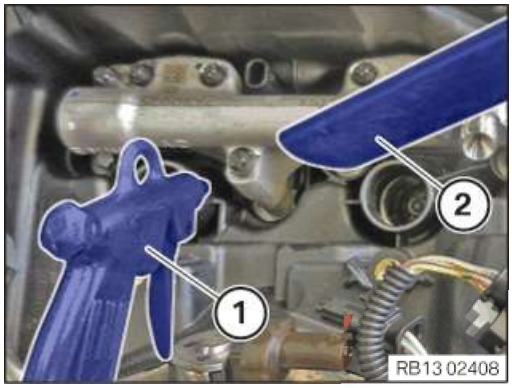


- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull out the connector (2) from the injectors.

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

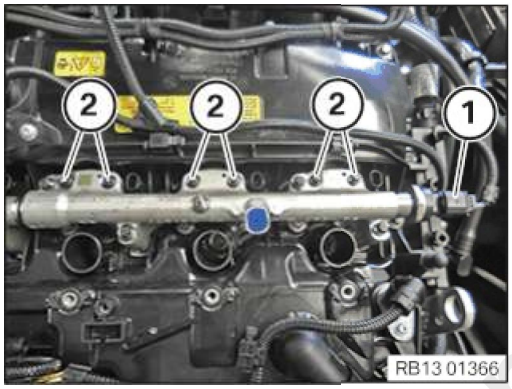


TECHNICAL INFORMATION

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

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

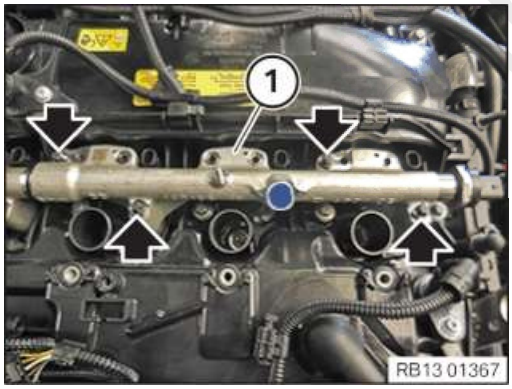
- Before releasing the high pressure lines: Blow out the injector shafts with an air gun(1) with less pressure.
- Simultaneously, draw off the dirt particles with an **explosion proof** vacuum cleaner (2).



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

  Do not reuse the bolts (2).

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

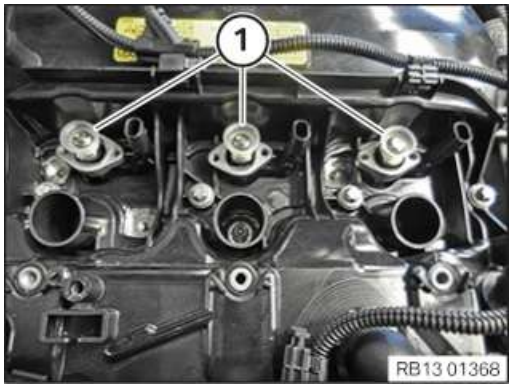


- Unscrew the screws (M6x30) (arrows).

  The screws may not be reused!
- Renew screws.

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

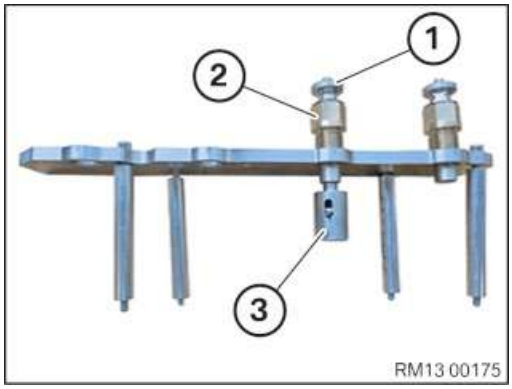
  The injectors remain in the cylinder head.



- Remove the gaskets (1).

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

mdiagn.com



RISK OF DAMAGE

Damage to injectors.

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

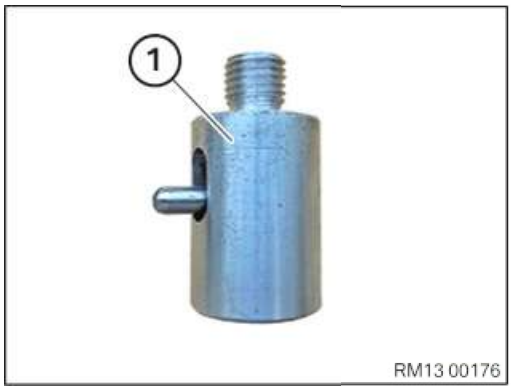
- Twist the injectors with a maximum torsional movement of 13 Nm.

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

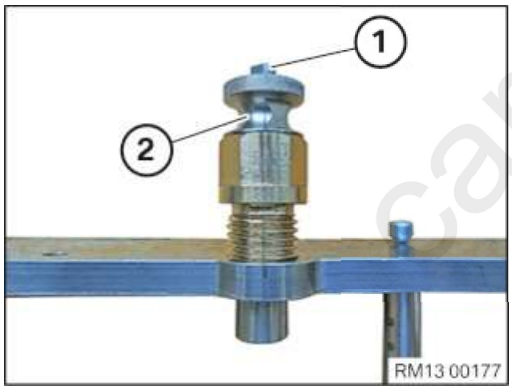
  The special tool 2 358 417 is used to ensure that the tensile force is not exceeded.

  Special tool 2 358 417 consists of:

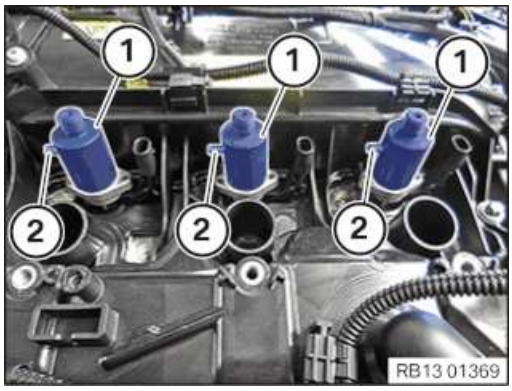
  - **(1)** Threaded sleeves
  - **(2)** Pull-out thread (left-hand thread)
  - **(3)** Mounting for the injectors



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



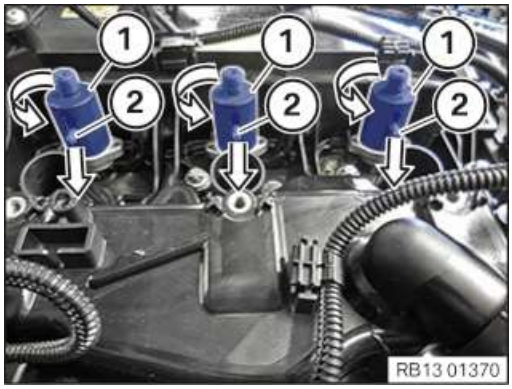
- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.



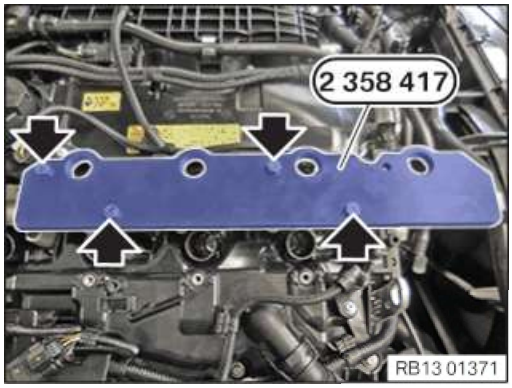
- Install all fixtures (1) for the injectors.

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

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



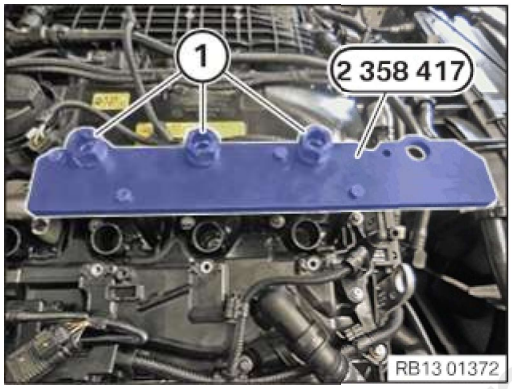
RISK OF DAMAGE

Damage to injectors.

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

- Do not use the puller plate as a support.

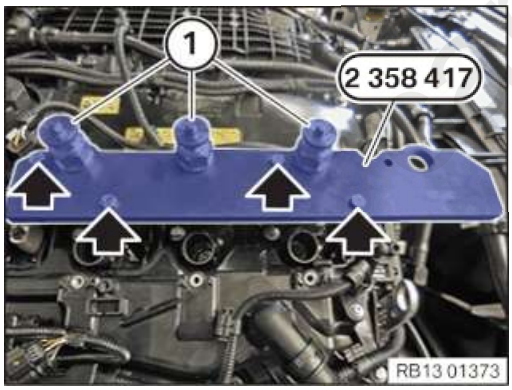
- Attach special tool 2 358 417 to cylinder head.
- Hand-tighten the bolts (arrows).



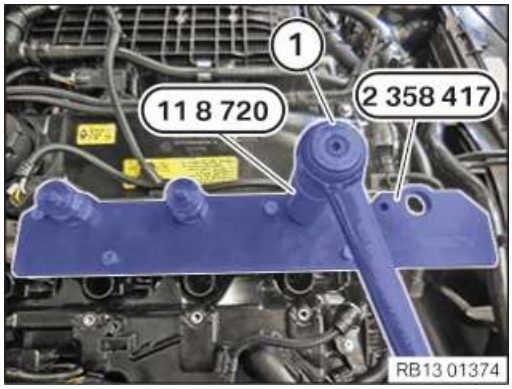
TECHNICAL INFORMATION

The extraction thread is a left-hand thread.

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



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



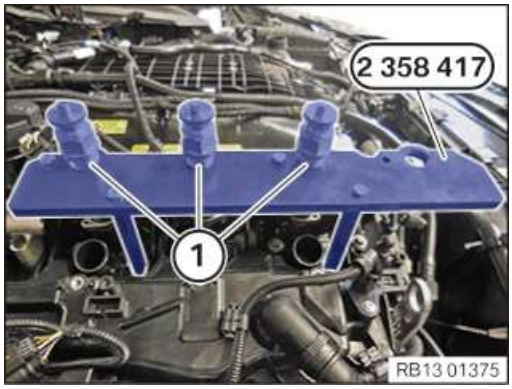
- Adjust torque wrench to 13 Nm **clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720)until the injector is pulled out.

TECHNICAL INFORMATION

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

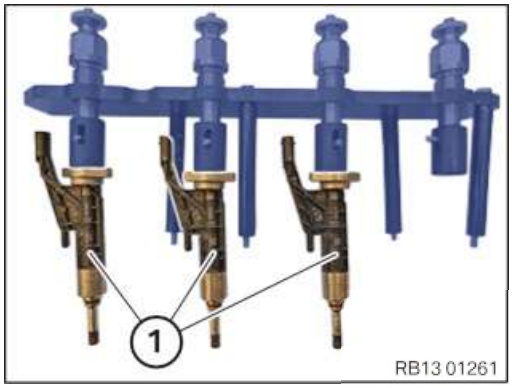
- Disassemble all injectors individually.

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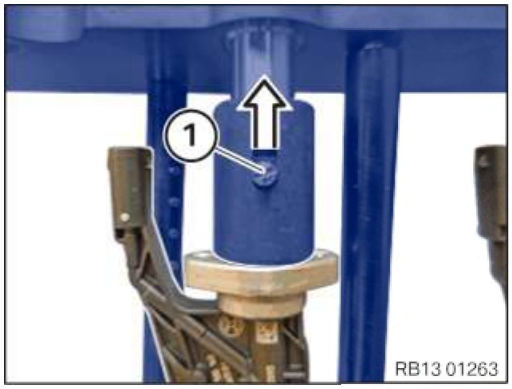


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

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



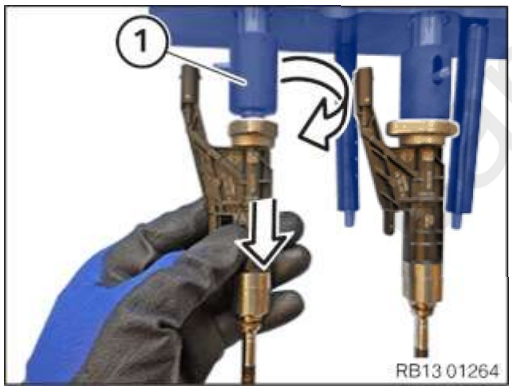
- Carefully remove the special tool 2 358 417with injectors (1) from the cylinder head vertically upwards.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat on a clean table.



NOTICE

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

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



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

19 – Removing rail with injectors of cylinders 4 to 6

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

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

RISK OF DAMAGE

Damage to the ignition coil.

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

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

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

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

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

RISK OF DAMAGE

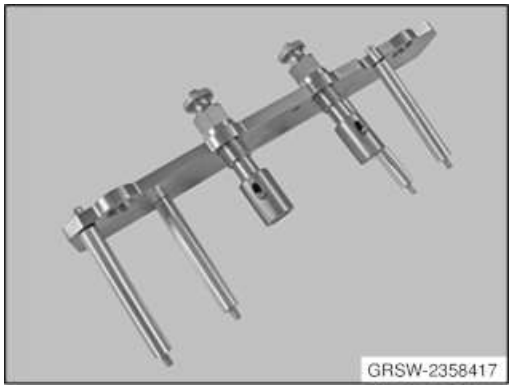
Damage to injectors.

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

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



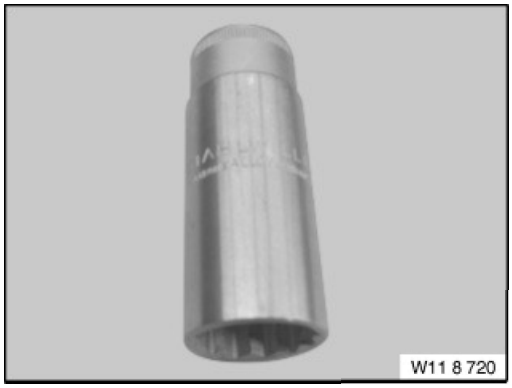
- Prepare special tool .



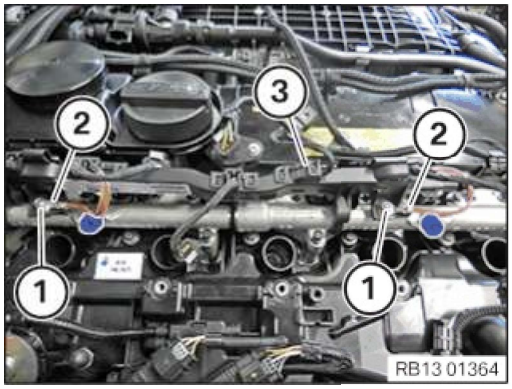
- Prepare special tool 2 358 417.



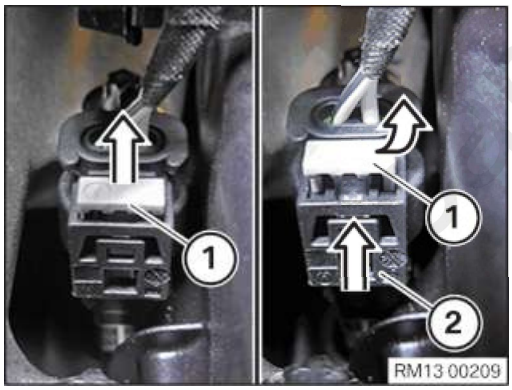
- Prepare special tool .



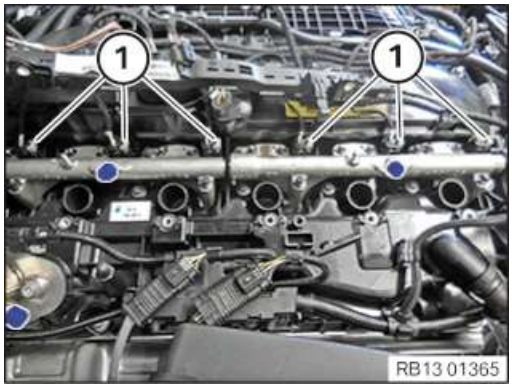
- Prepare special tool 0 496 106 (11 8 720).



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

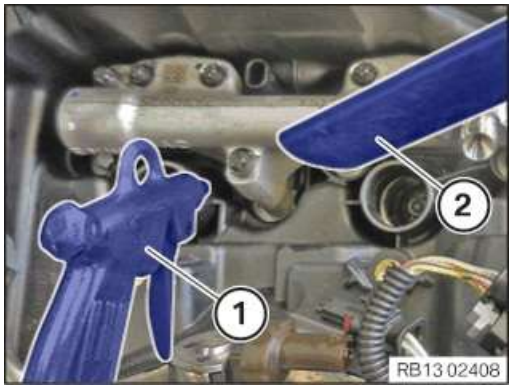


- Unlock lock (1) in direction of arrow upwards.
- Press lock (1) together and release.
- Disconnect the connector (2) from the injectors in the direction of the arrow.



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

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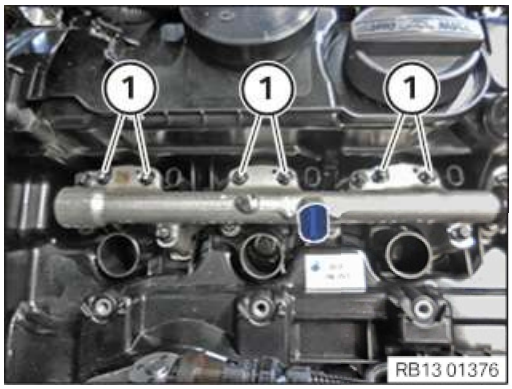


TECHNICAL INFORMATION

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

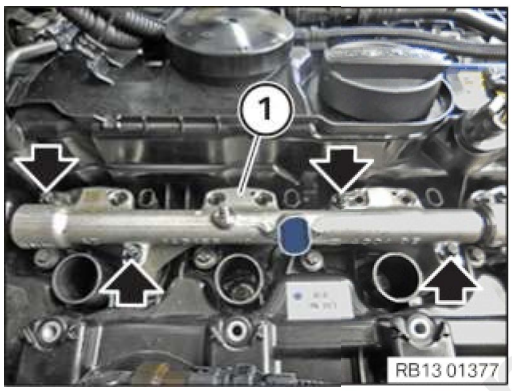
For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

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



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

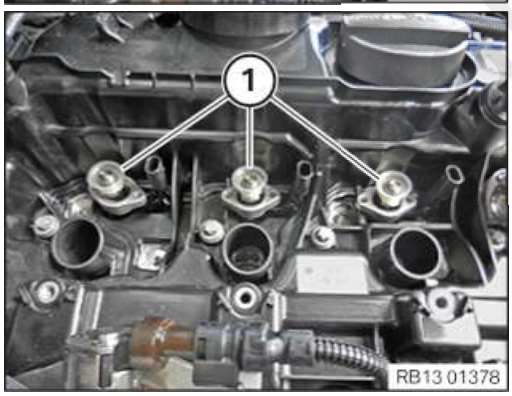
  Do **not** reuse screws (M5x30) (1).
- Catch and dispose of escaping fuel with suitable materials.



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

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

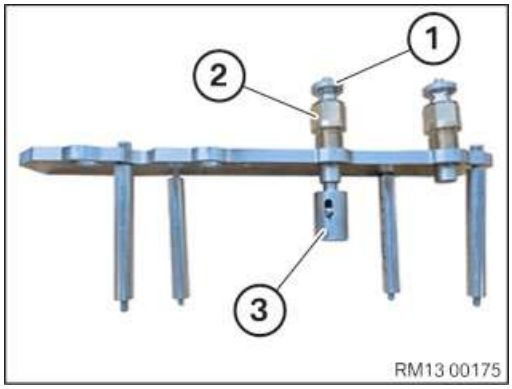
  The injectors remain in the cylinder head.



- Remove seals (1) .

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

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RISK OF DAMAGE

Damage to injectors.

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

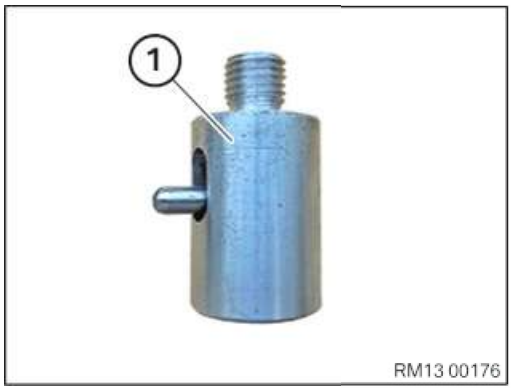
- Twist the injectors with a maximum torsional movement of 13 Nm.

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

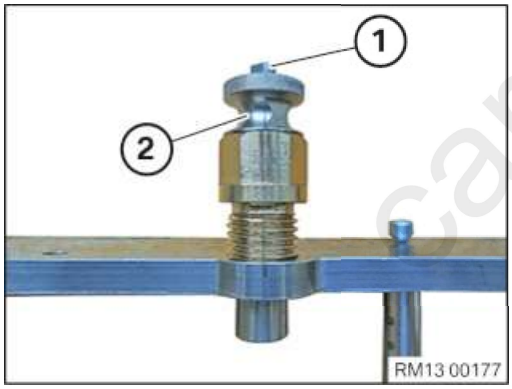
  The special tool 2 358 417 is used to ensure that the tensile force is not exceeded.

  The special tool 2 358 417 consists of:

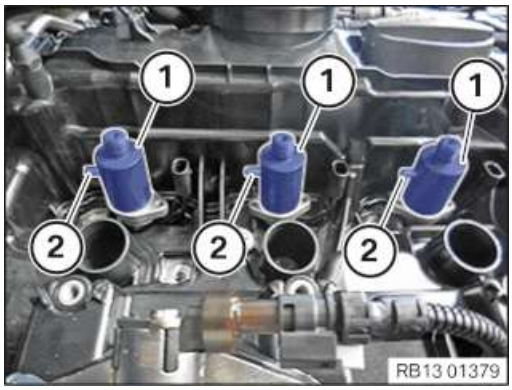
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Mounting for the injectors



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



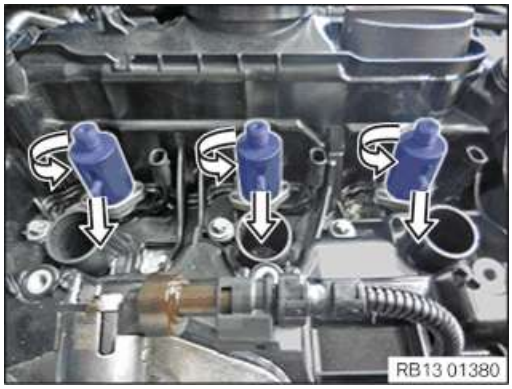
- Press lock (1) in and remove the threaded sleeve (2) from the special tool 2 358 417.



- Install all fixtures (1) for the injectors.

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

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



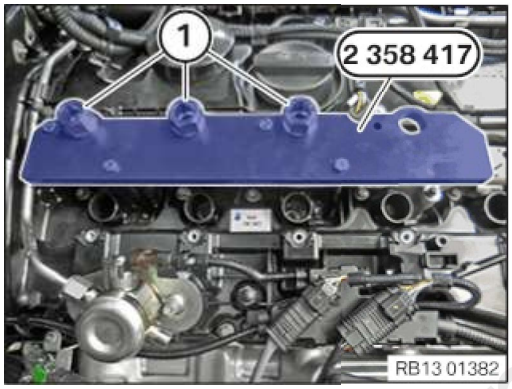
RISK OF DAMAGE

Damage to injectors.

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

- Do not use the puller plate as a support.

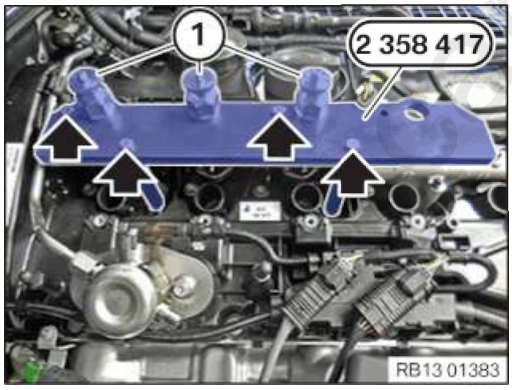
- Attach special tool 2 358 417 to cylinder head.
- Hand-tighten the bolts (arrows).



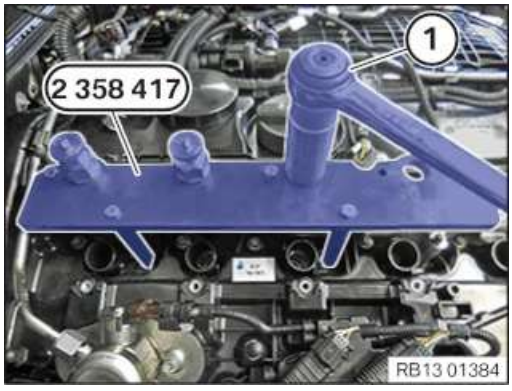
TECHNICAL INFORMATION

The extraction thread is a left-hand thread.

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



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



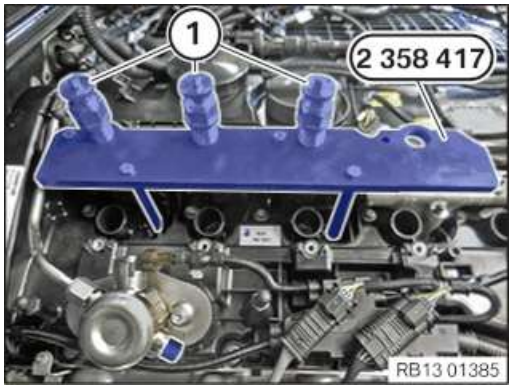
- Adjust torque wrench to 13 Nm **in clockwise** direction.
- Turn the torque wrench (1) with the special tool 0 496 106 (11 8 720) **clockwise**, until the injector is pulled out.

TECHNICAL INFORMATION

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

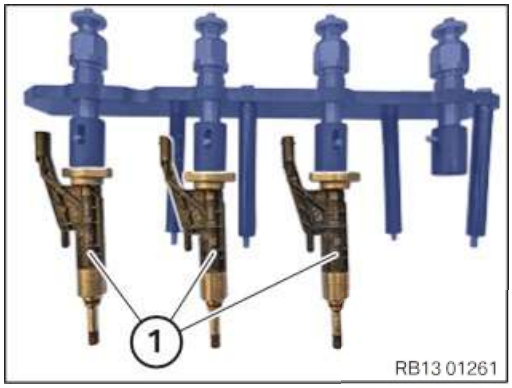
- Disassemble all injectors individually.

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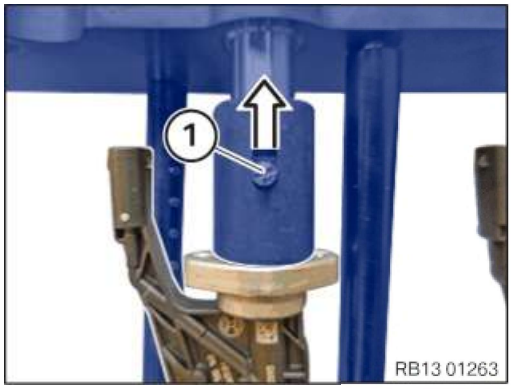


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

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



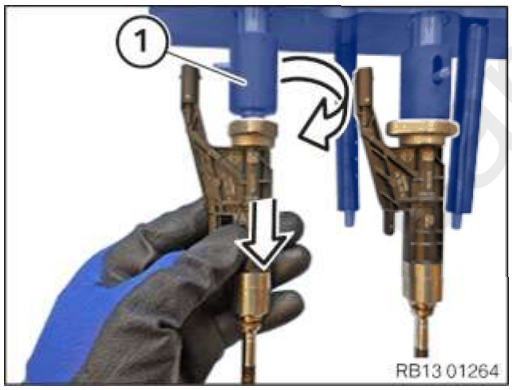
- Carefully remove the special tool 2 358 417 with the injectors (1) vertically straight up from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.



NOTICE

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

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



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

20 – Removing both actuators

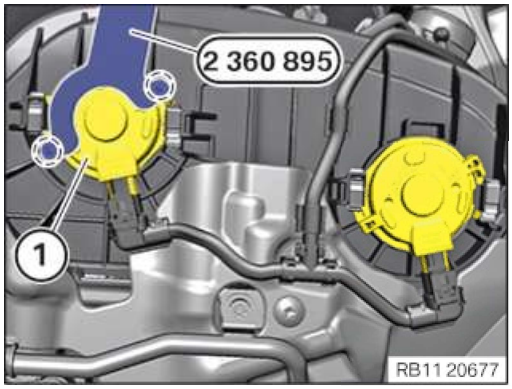
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RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

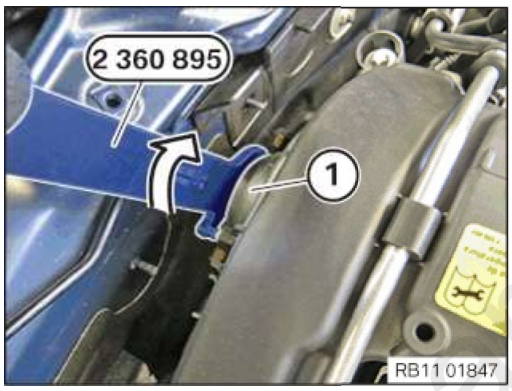
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the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



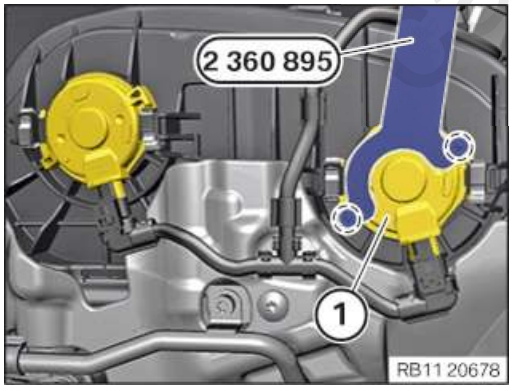
NOTICE

The figure shows the rear side of the engine.

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



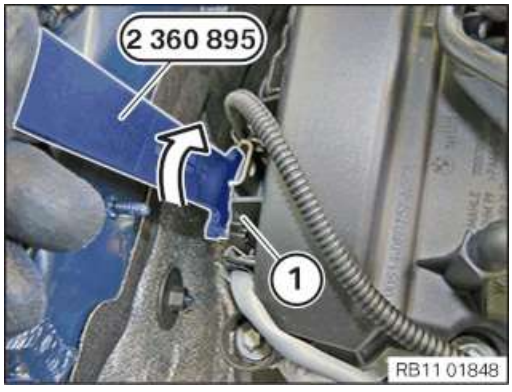
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



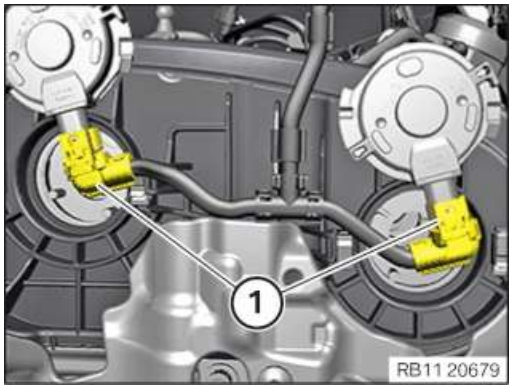
NOTICE

The figure shows the rear side of the engine.

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



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



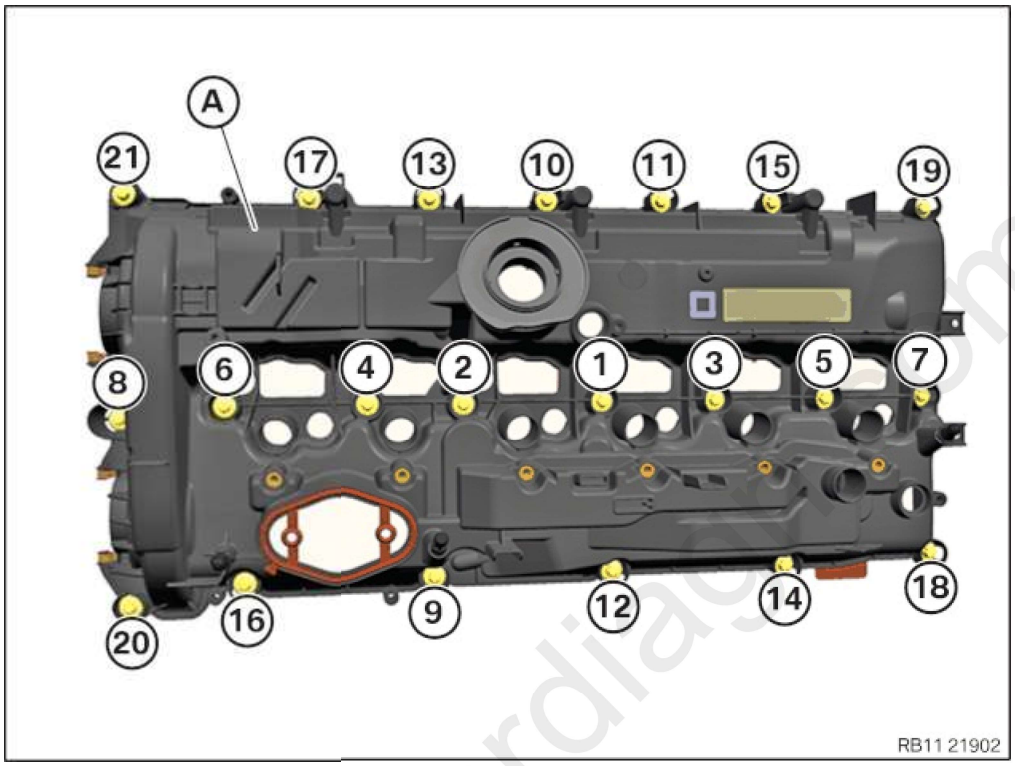
NOTICE

The figure shows the rear side of the engine.

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

21 – Removing the cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 21 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

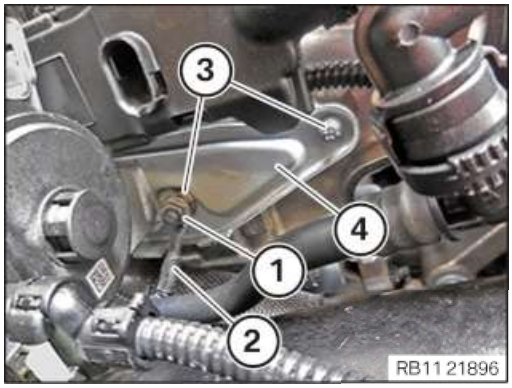
Sheared wires can cause a short circuit.

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

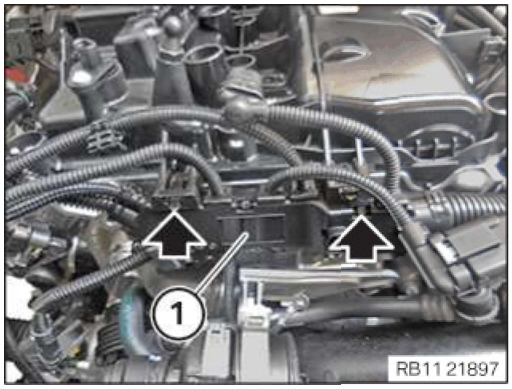
cardiagn.com



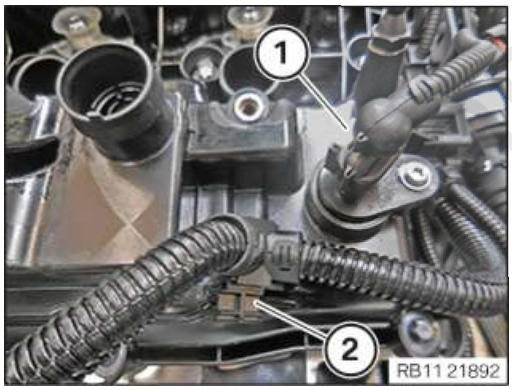
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



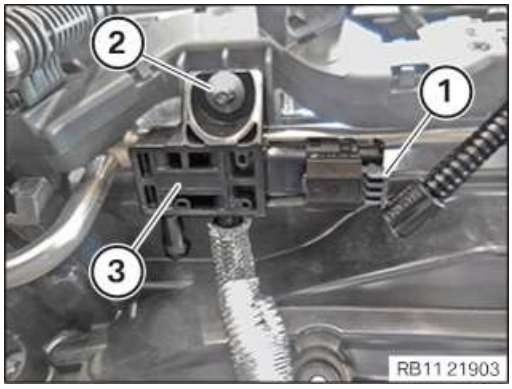
- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Loosen screws (3).
- Thread out holder (4) and set aside.



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

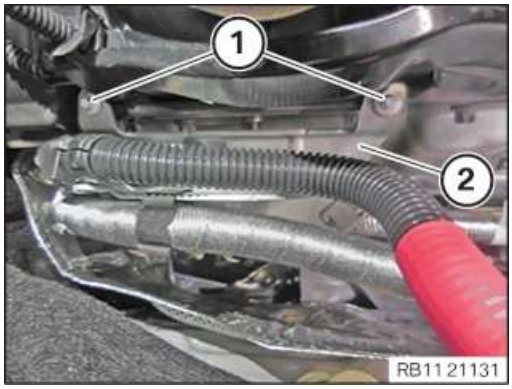


- Unlock and detach connector (1) on exhaust camshaft sensor .
- Loosen clamp (2).

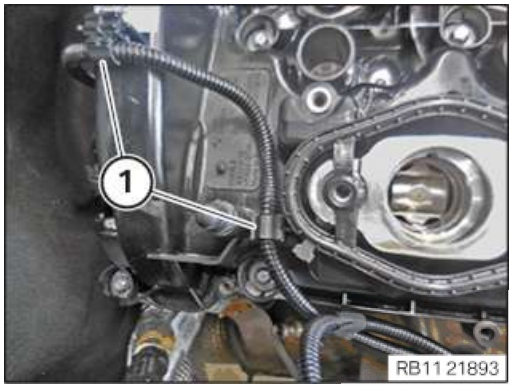


- **If installed:**
- Unlock and loosen connector (1).
- Loosen screw (2).
- Remove the differential pressure sensor (3) and put it to one side.

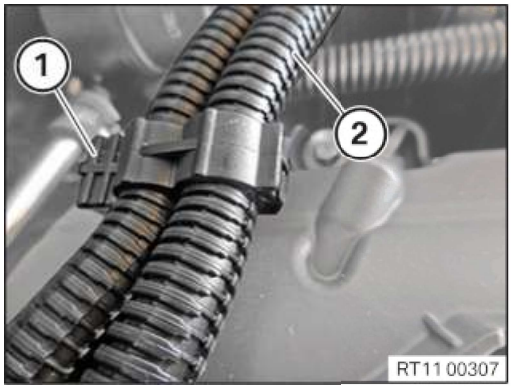
rdiagn.com



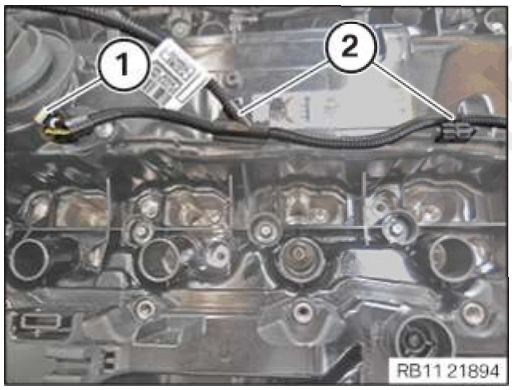
- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.



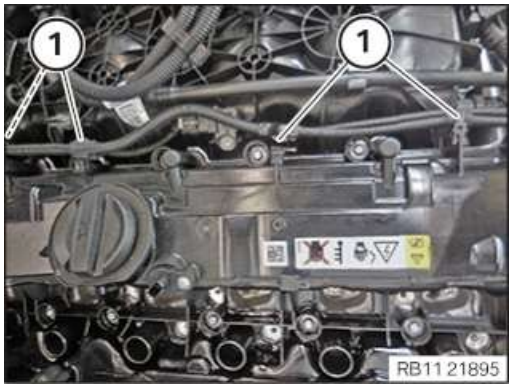
- Loosen clamps (1).



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

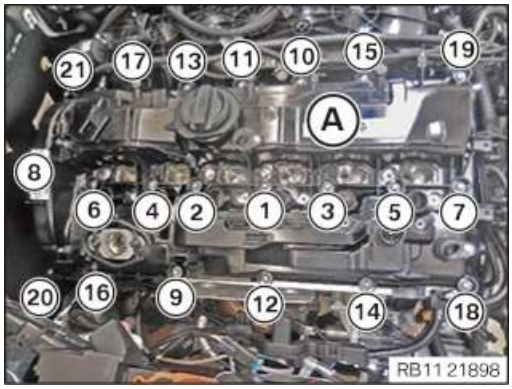


- Unlock and detach connector (1) on the intake camshaft sensor.
- Loosen clamps (2).

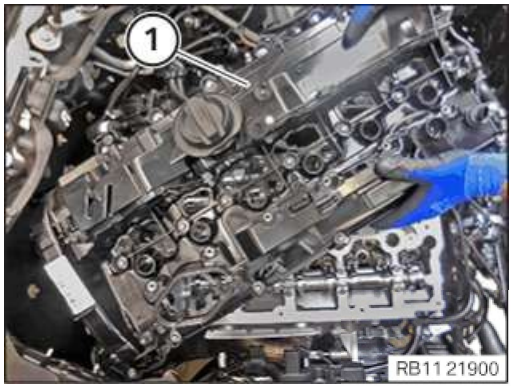


- Loosen clamps (1).

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



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

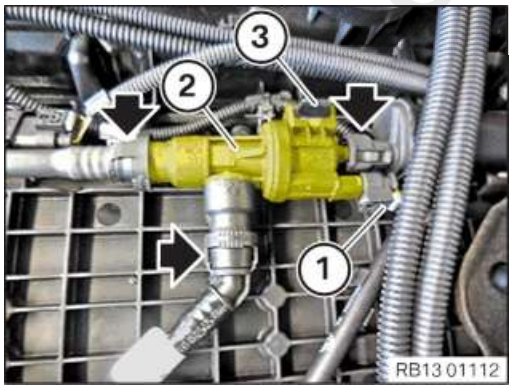
22 – Remove tank vent valve

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

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



- Unlock and disconnect connector (1).
- Unlock and disconnect the tank ventilation lines (arrows).
- Detach and remove the tank vent valve (2) from the holder (3).

23 – Removing the intake plenum

carlagn.com

RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

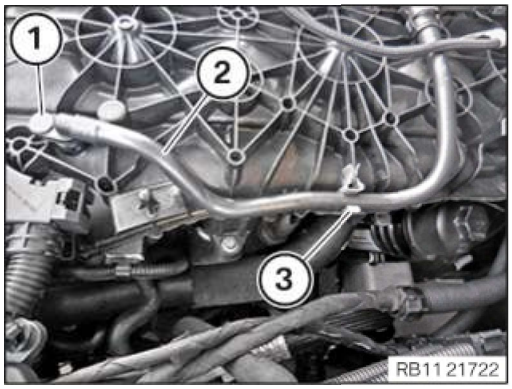
- Do not pull on the wires when disconnecting connectors and plug connections.

TECHNICAL INFORMATION

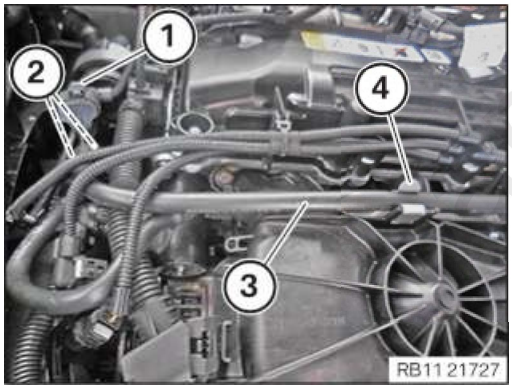
Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

TECHNICAL INFORMATION

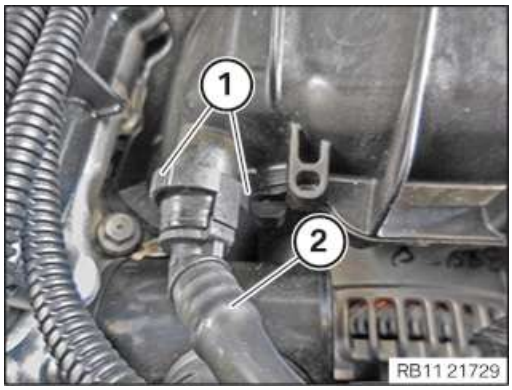
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screw (1).
- Guide tank ventilation line (2) out of clamp (3) and remove it.

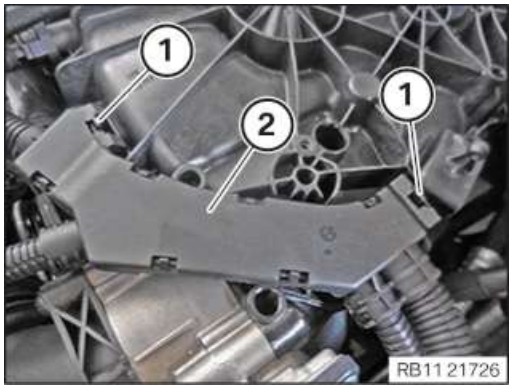


- Unlock and loosen connector (1).
- Unlock the locks (2).
- Guide tank ventilation line (3) out of clamp (4) and remove it.

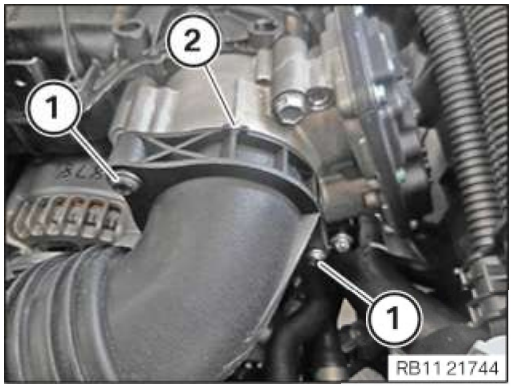


- Unlock the locks (1).
- Feed the tank ventilation line (2) out and set it aside.

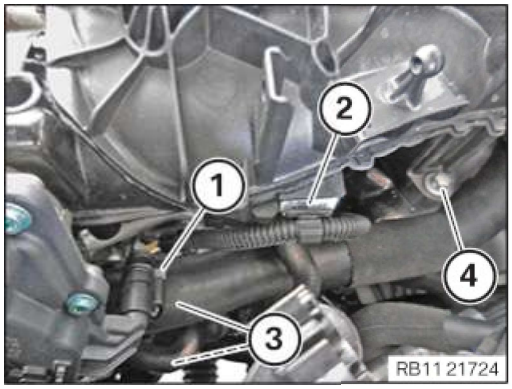
rdiagn.com



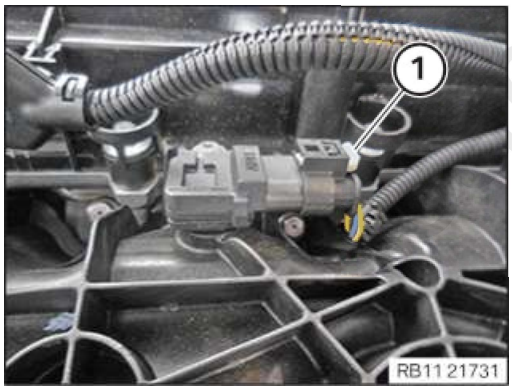
- Unlock the locks (1).
- Guide out the wiring harness section (2) for the sensor system **2** and place to one side.



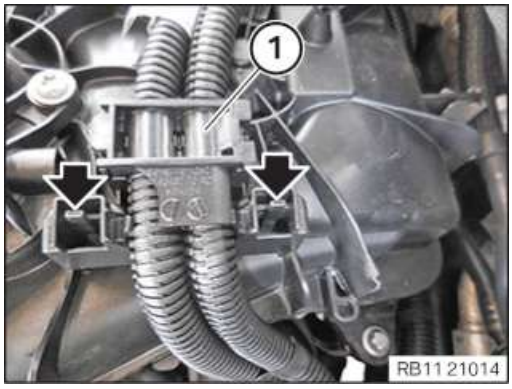
- Loosen screws (1).
- Feed out charge air line (2) and place to one side.



- Unlock and loosen connector (1).
- Loosen clamp (2).
- Thread off coolant line (3) and place to the side.
- Loosen screw (4).

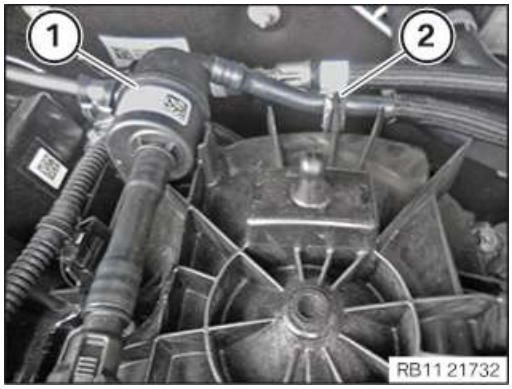


- Unlock and loosen connector (1).

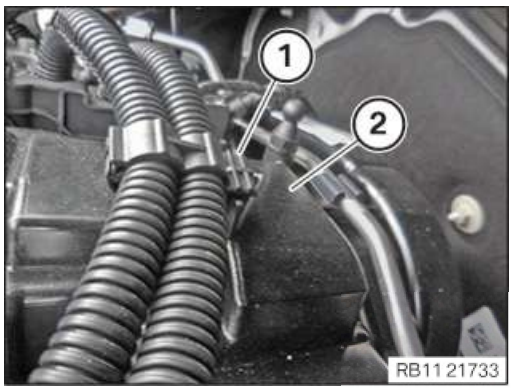


- Unlock the locks (arrows).
- Thread out the wiring harness section (1) for the injectors and ignition coils and set it aside.

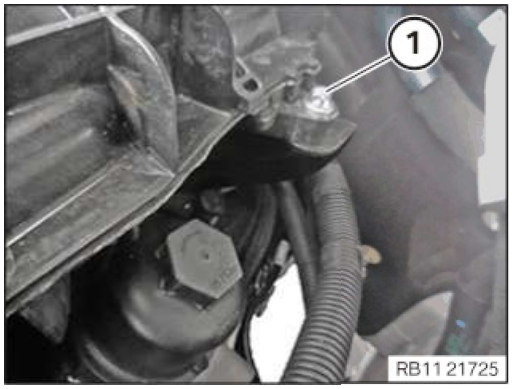
fdiagn.com



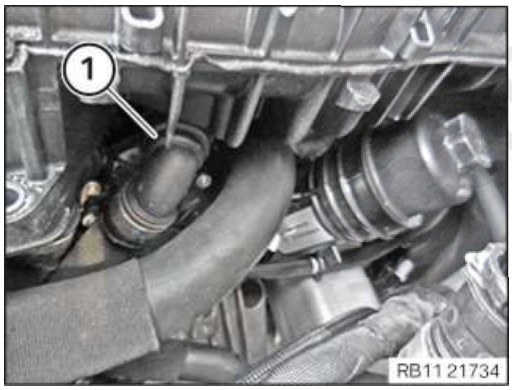
- Guide tank ventilation line (1) out of clamp (2) and place it aside.



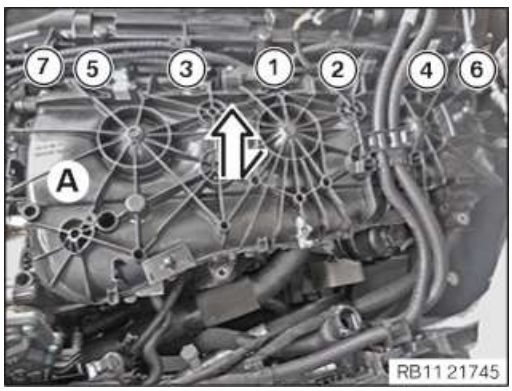
- Guide out the wiring harness section (1) for the injectors and ignition coils of the cylinder head cover (2) and set it aside.



- Loosen screw (1).

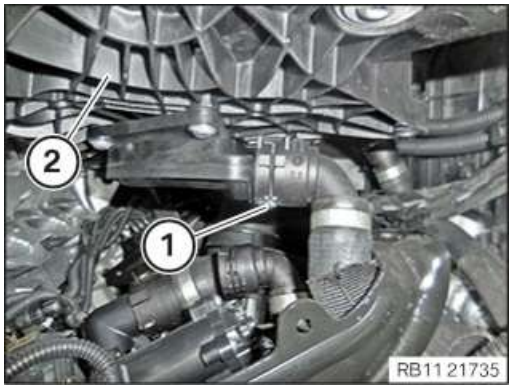


- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.



- Loosen screws in the order (7) to (1).
- Slightly raise intake plenum (A) in direction of arrow.

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TECHNICAL INFORMATION

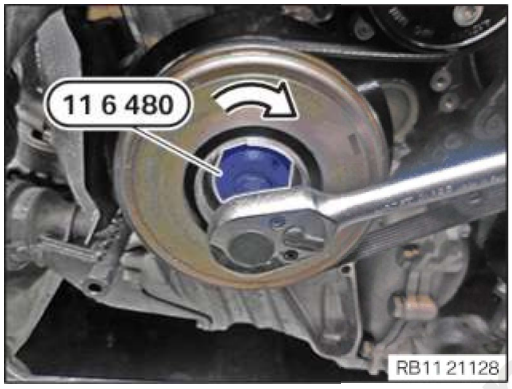
Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Unlock and release coolant line (1) below the intake plenum (2).
- Catch and dispose of escaping coolant.
- Thread out intake plenum (2) and remove.

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



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



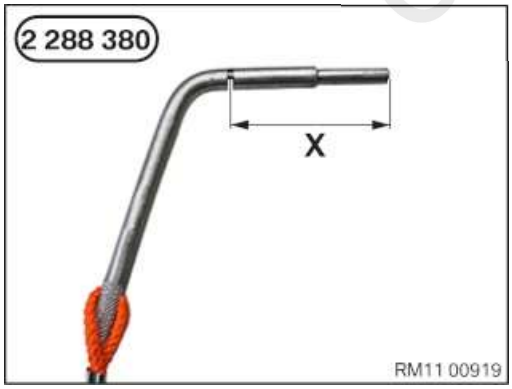
RISK OF DAMAGE

Damage to the engine.

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

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

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



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

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

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- **Vehicles with automatic transmission:**

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

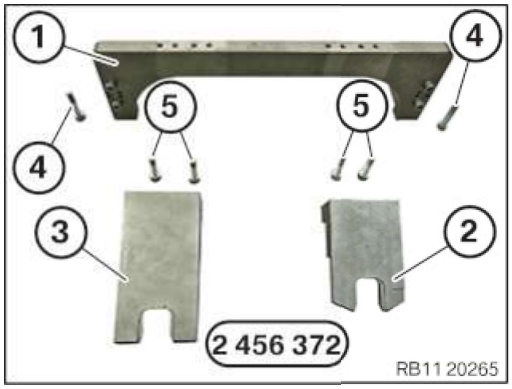
  The TDC firing position of cylinder 1 was **not** reached.



- **Vehicles with automatic transmission:**

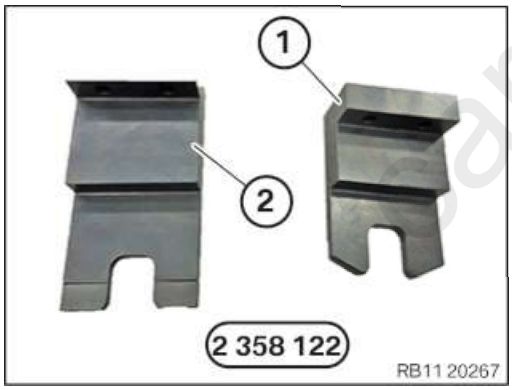
  Special tool 2 288 380 **correctly** positioned.

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



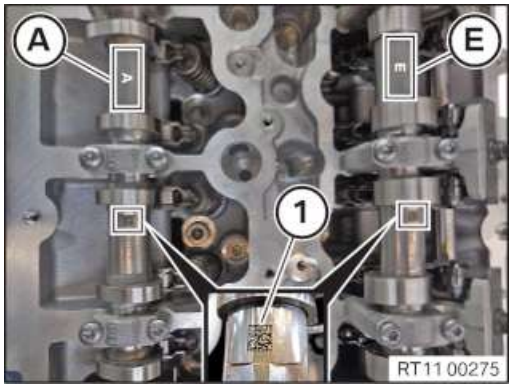
- Overview of the set of special tools 2 456 372:

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



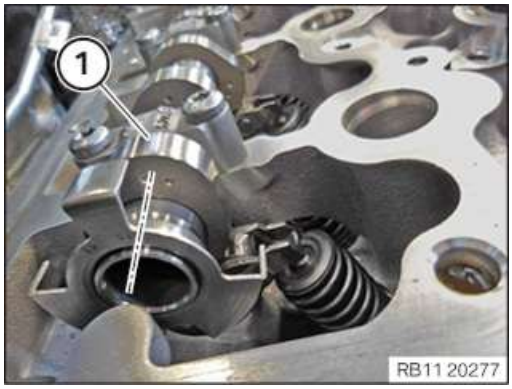
- Overview of the test gauges from the set of special tools 2 358 122:

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



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

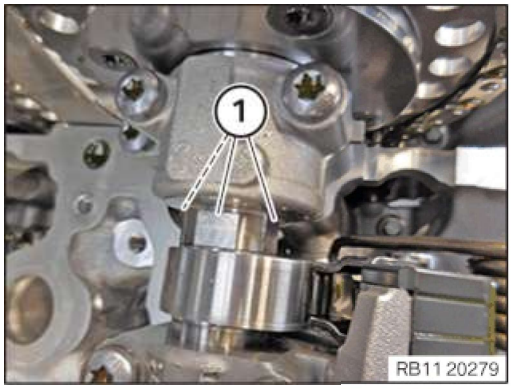
carldiag.com



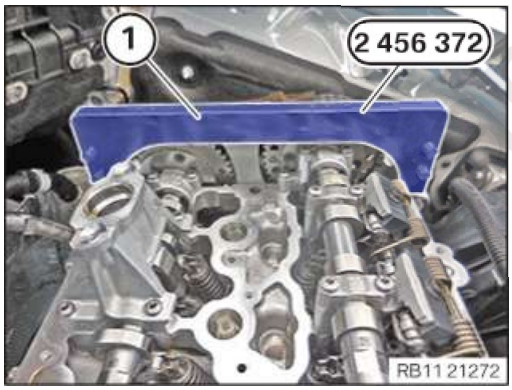
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



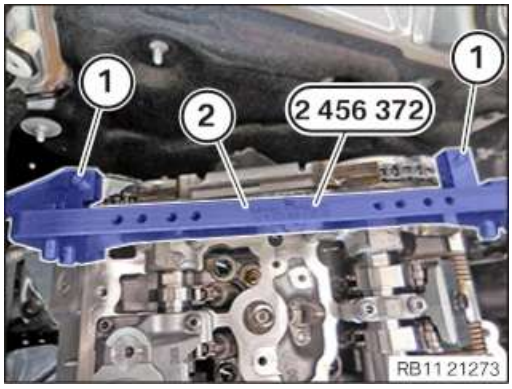
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.



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



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

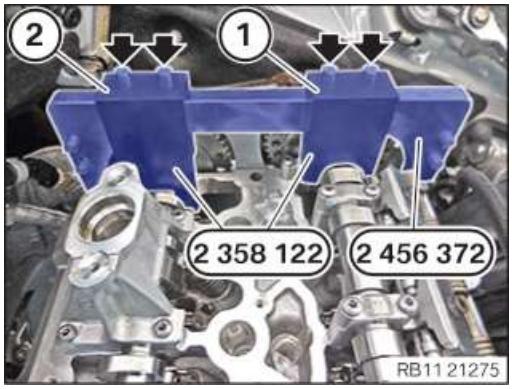


- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm

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

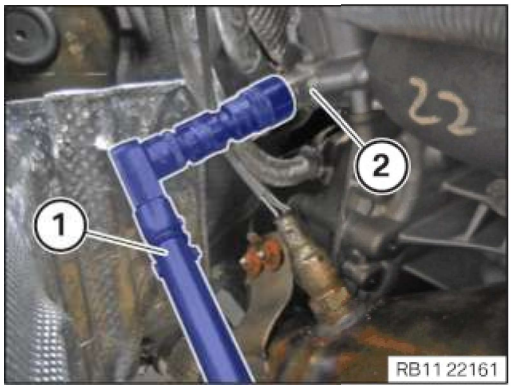
Test gauge to basic carrier

M6		Tightening torque	8 Nm

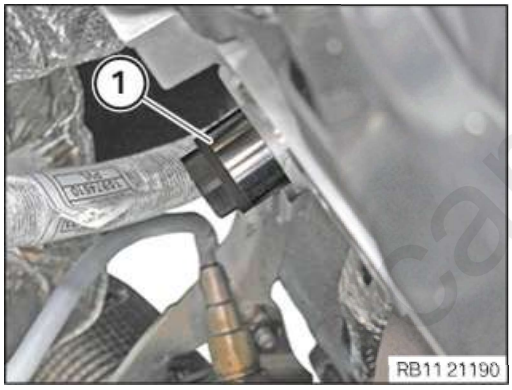
25 – Removing chain tensioner

TECHNICAL INFORMATION

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



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



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

26 – Releasing the VANOS central valve of the intake adjuster



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

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NOTICE

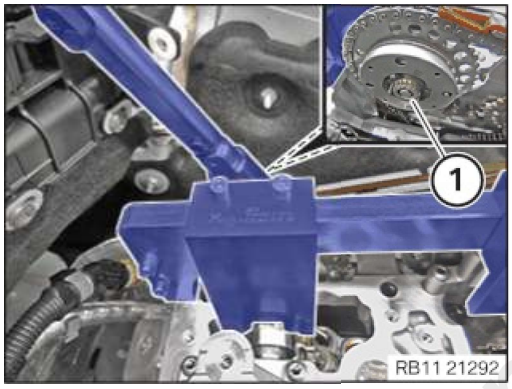
The figure shows the rear side of the engine.

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

27 – Releasing VANOS central valve of the exhaust camshaft adjuster



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

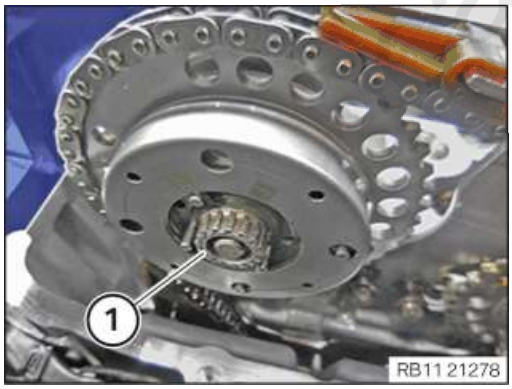


NOTICE

The figure shows the rear side of the engine.

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

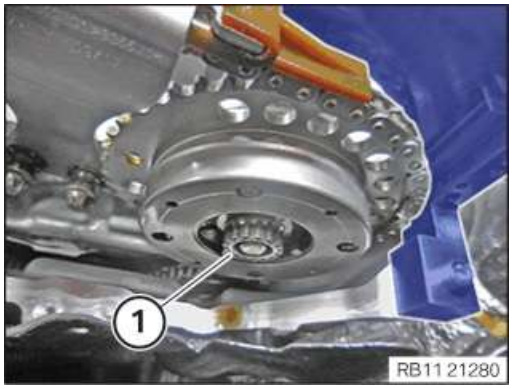
28 – Removing the VANOS central valve of the intake adjuster



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

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

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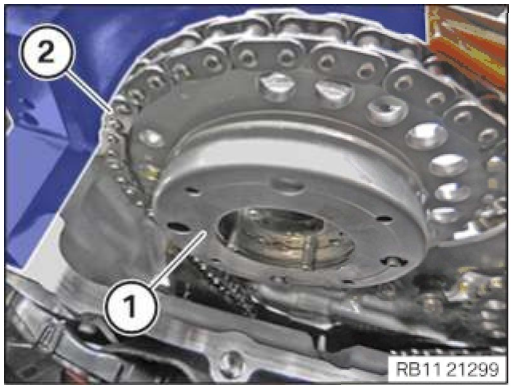


- Guide out and remove the VANOS central valve (1) of the exhaust camshaft adjuster.

30 – Removing intake adjuster

NOTICE

The figure shows the rear side of the engine.

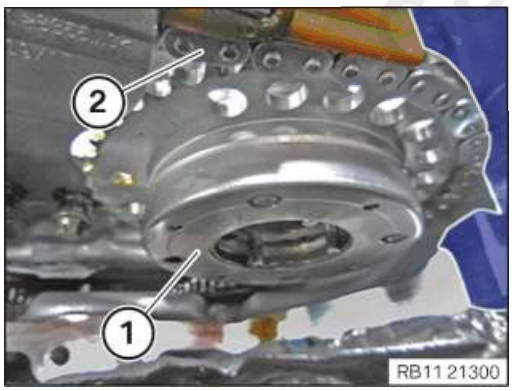


- Guide out the intake adjuster (1) from the timing chain (2) and remove.

31 – Remove exhaust camshaft adjuster

NOTICE

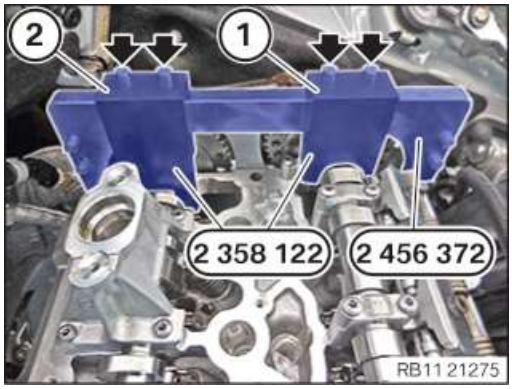
The figure shows the rear side of the engine.



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

32 – Remove the test gauges to fix the camshafts

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

33 – Remove cylinder head.

CAUTION

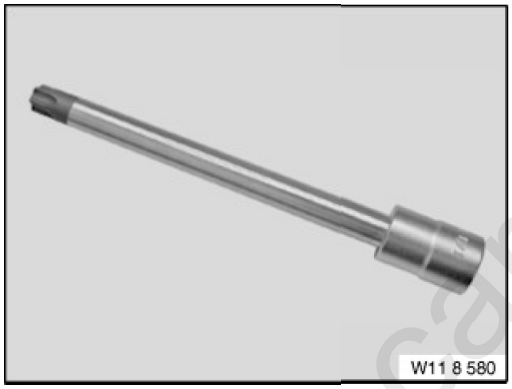
Heavy component.

Heavy components can lead to injury or damage.

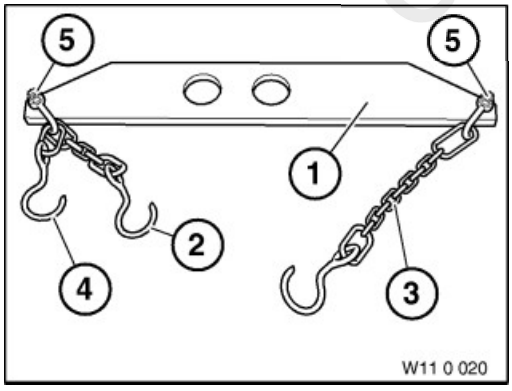
- Remove and install heavy components with the aid of another person/other persons.

TECHNICAL INFORMATION

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



- Prepare special tool 0 495 747 (11 8 580).

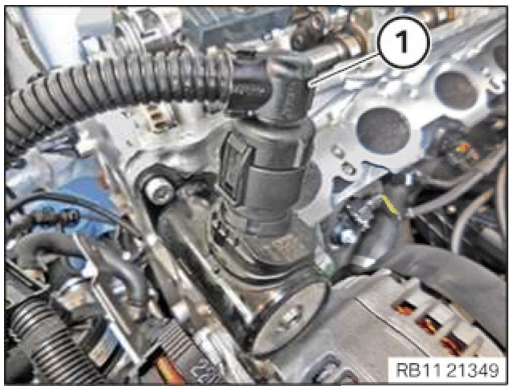


- Prepare special tool 0 490 567 (11 0 020).

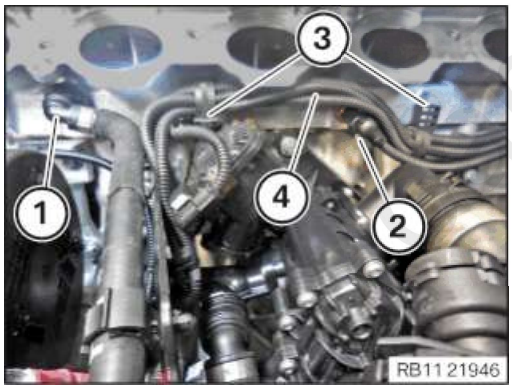
cardiagn.com



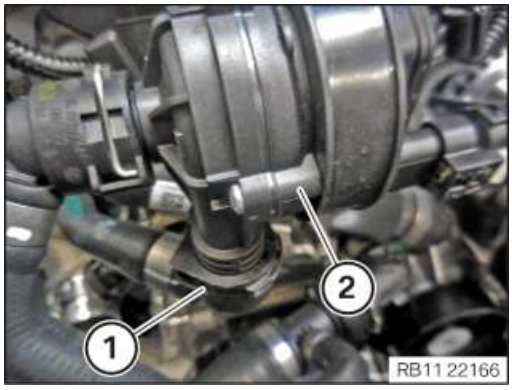
- Prepare the workshop crane 2 220 718.



- Unlock plug connection (1) and disconnect.

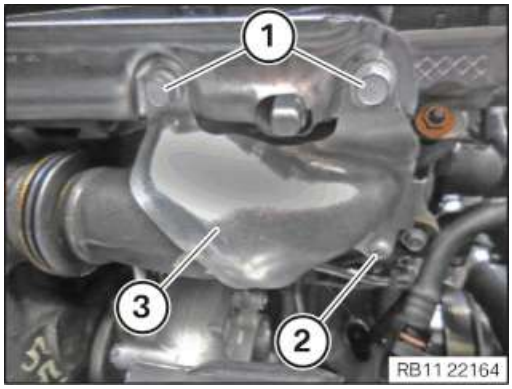


- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.
- Unlock plug connection (2) and disconnect.
- Loosen clamps (3).
- Feed out wiring harness section (4) for sensor system **1** and set it aside.



- Unlock and release coolant return line (1) on coolant pump (2) for the exhaust turbocharger.
- Catch and dispose of escaping coolant.

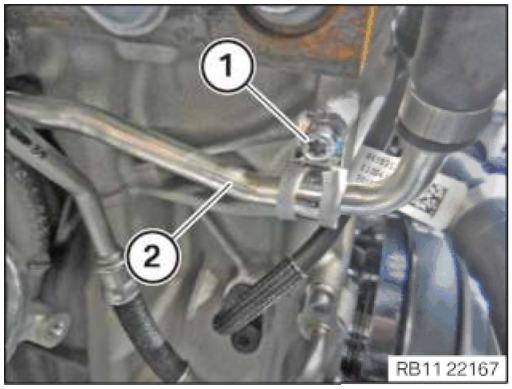
rdiagn.com



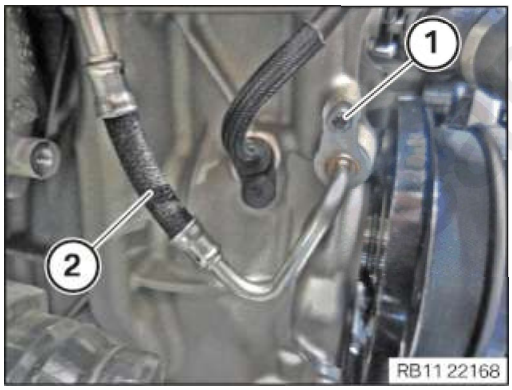
- Loosen screws (1).
- Loosen screw (2).
- Feed out and remove the heat shield (3).



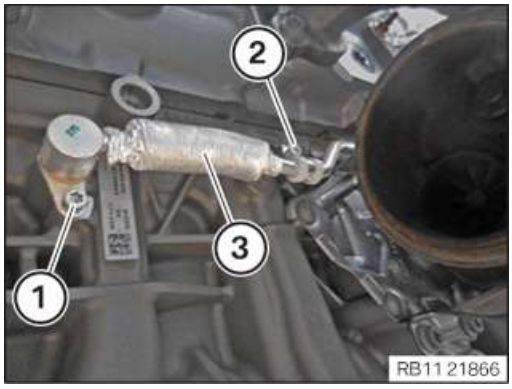
- Loosen screws (1).
- Feed out and remove the heat shield (2).



- Release screw (1) on coolant return line (2).

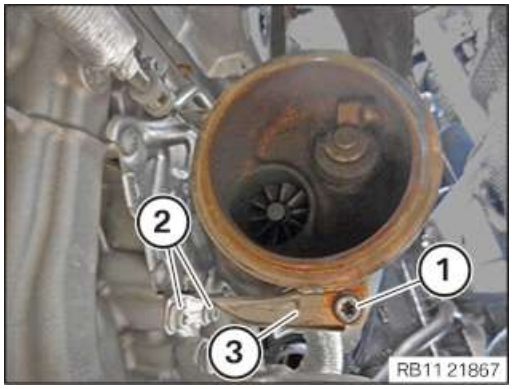


- Loosen screw (1).
- Guide out oil feed line (2) for the exhaust turbocharger and place it aside.
- Catch and dispose of emerging engine oil.

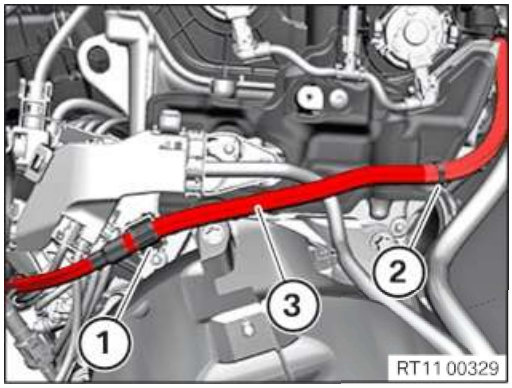


- Loosen screws (1) and (2).
- Guide the coolant feed line for exhaust turbocharger (3) from the crankcase and place it aside.
- Catch and dispose of escaping coolant.

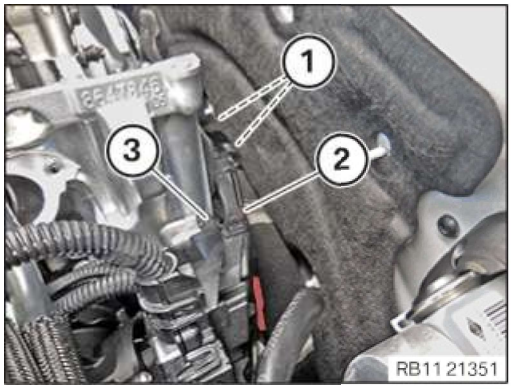
rdiagn.com



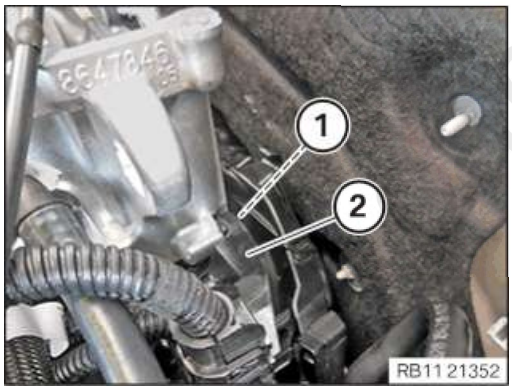
- Loosen screws (1) and (2).
- Feed the support (3) out and remove.



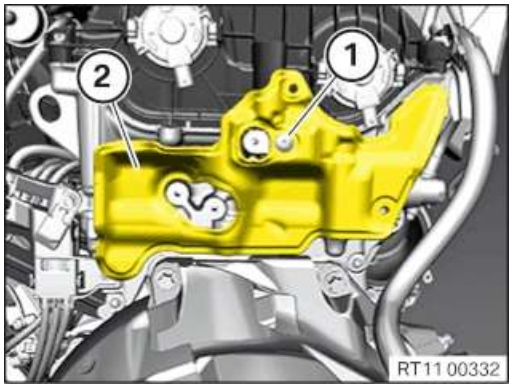
- Unlock and release clamps (1) and (2).
- Feed out positive battery cable (3) and put to one side.



- Loosen screws (1).
- Guide out transmission wiring harness (2) on wiring harness section (3) for sensor system 1 and set it aside.



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

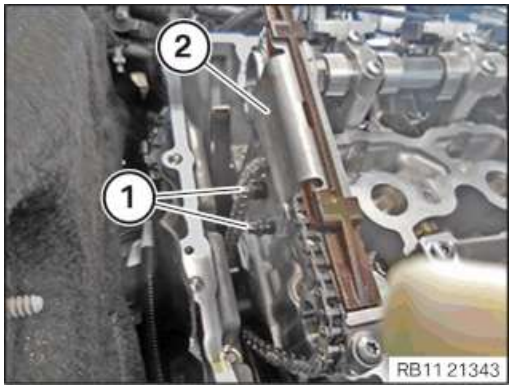


NOTICE

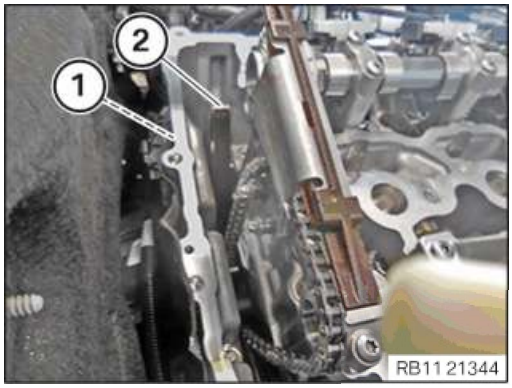
The figure shows the rear side of the engine.

- Loosen screw (1).
- Guide out and remove the cover (2).

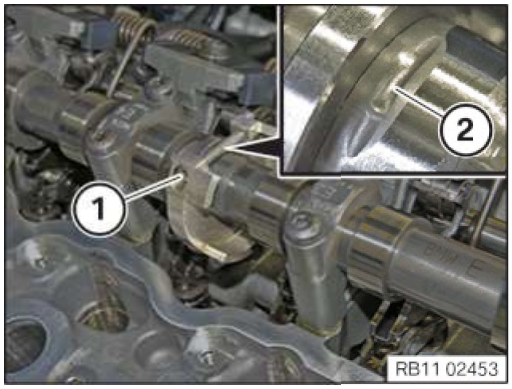
mdiagn.com



- Loosen screws (1).
- Guide out the slide rail (2) and remove.

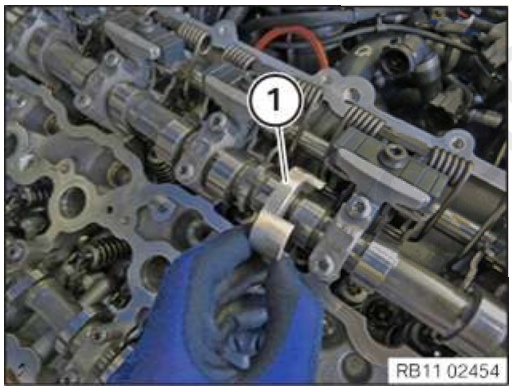


- Release the bearing journal (1) from the guide rail (2).



- Rotate intake camshaft, if necessary in the position shown.

  The recess (2) must point upwards.
- Loosen screw (1).



- Slide camshaft sensor wheel (1) in the direction of cylinder 1 and guide it out from the intake camshaft.

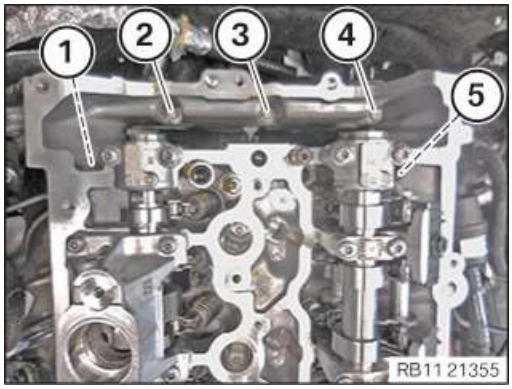


- Guide in and position special tool on the cylinder head.
- Tighten the screws (1) of special tool .

Special tool to cylinder head

M8		Tightening torque	21,5 Nm

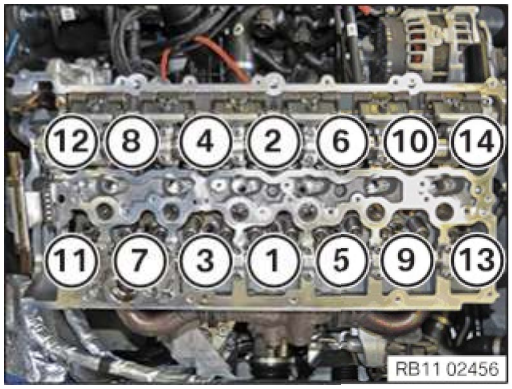
rdiagn.com



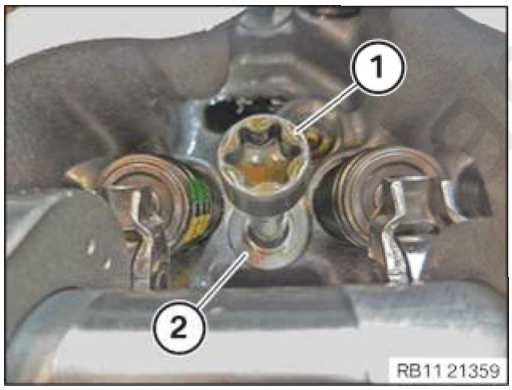
- Loosen the cylinder head bolts in the sequence from (5) to (1).



- Release cylinder head bolts with the special tool 0 495 747 (11 8 580).

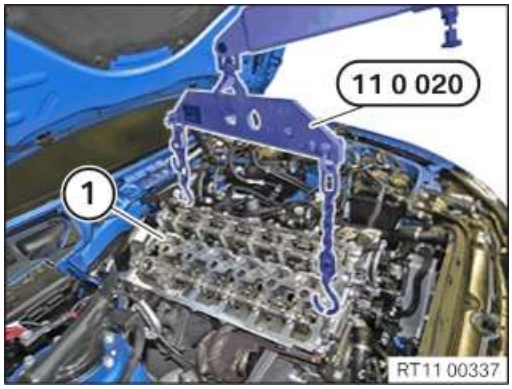


- Undo the screws using the special tool 0 495 747 (11 8 580) in the order (14) to (1) .



- Feed out and remove all the cylinder head bolts (1).
- Feed out and remove all the washers (2).

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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

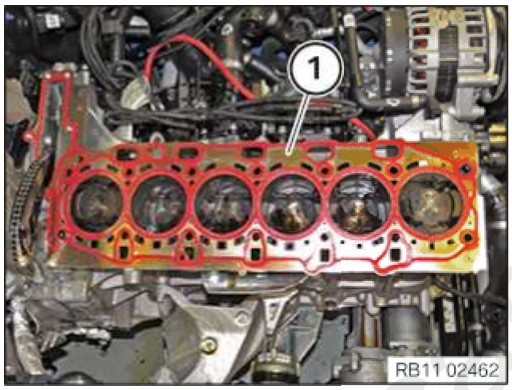
Damage to the guide rails.

Large amounts of force may damage the guide rails of the timing chain.

- Make sure not to damage the guide rail with the cylinder head when removing and installing the cylinder head.

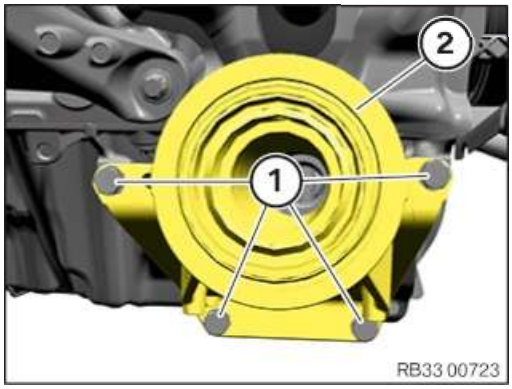
- Attach special tool 0 490 567 (11 0 020) to workshop crane.
- Lift out cylinder head (1) and the exhaust turbocharger with an auxiliary person, the workshop crane and special tool 0 490 567 (11 0 020).

34 – Removing the cylinder head gasket



- Thread out and remove cylinder head gasket (1).

35 – Remove bearing support



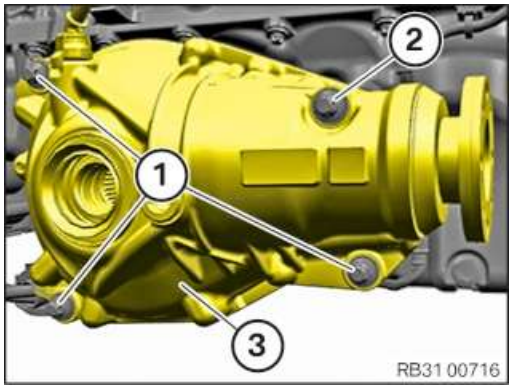
- Loosen screws (1).
- Remove the bearing support (2).

36 – Remove front axle differential

TECHNICAL INFORMATION

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

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- Mark installation location of the screws (1) and (2).
  - Screws (1) M12x55
  - Screw (2) M12x105
- Loosen screws (1) and (2).
- Remove front axle differential (3).

37 – Remove oil sump

RISK OF DAMAGE

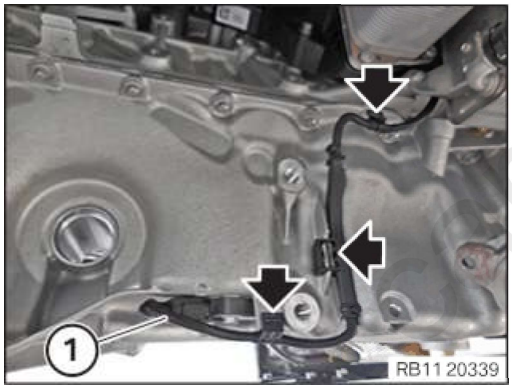
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

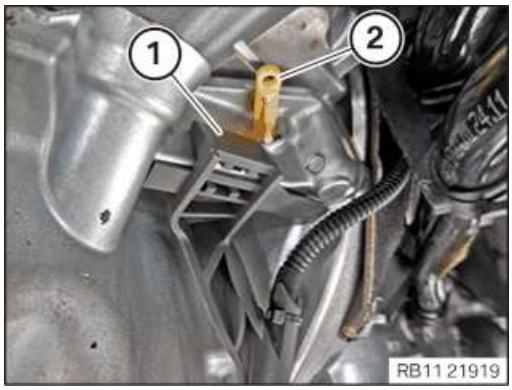
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

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



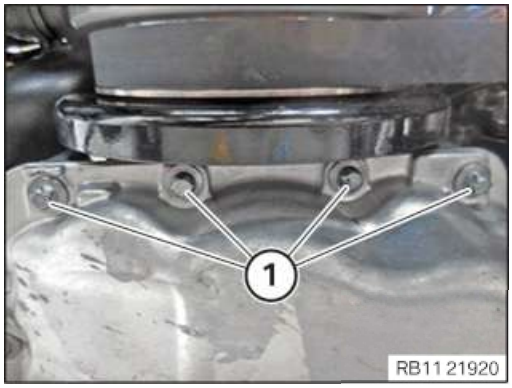
- Unlock clamps (arrows) and disconnect.
- Unlock and loosen connector (1).



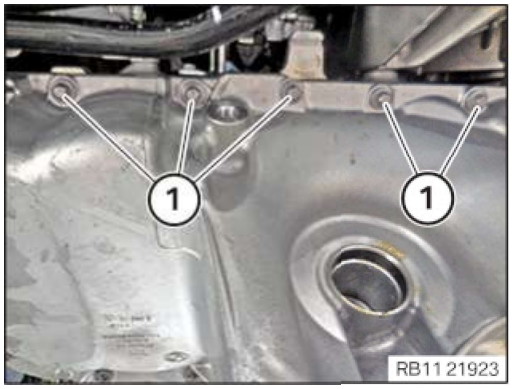
- Loosen clamp (1).
- Thread the sealing cap (2) out and remove.



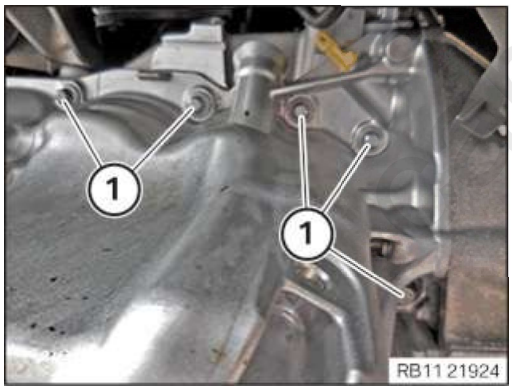
- Unscrew the transmission bolts (1).



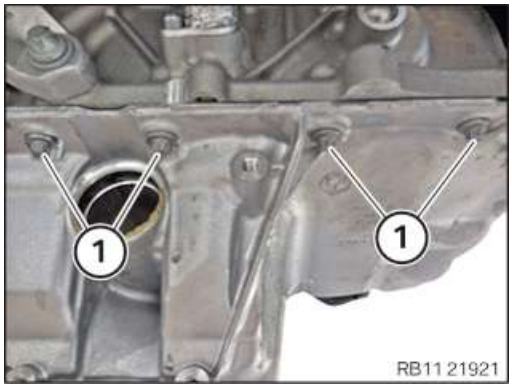
- Loosen screws (1).



- Loosen screws (1).

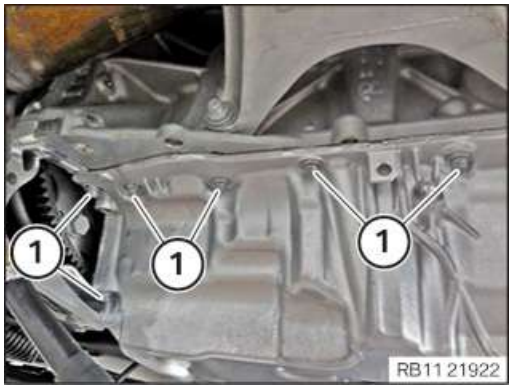


- Loosen screws (1).

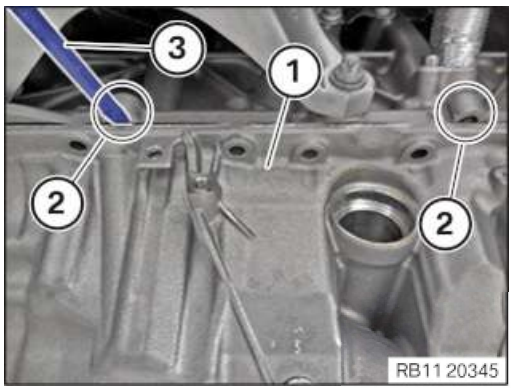


- Loosen screws (1).

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- Loosen screws (1).



TECHNICAL INFORMATION

Increased force may be necessary during disassembly because the component is bonded with liquid sealing compound.

- Release the oil sump (1) in the **marked** areas (2) using suitable tools (3).
- Guide out the oil sump (1) downwards to the rear and remove.

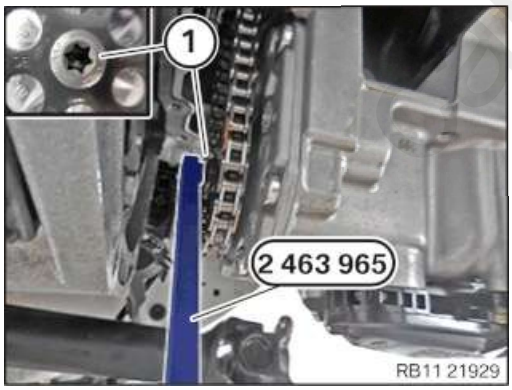
38 – Remove oil vacuum pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

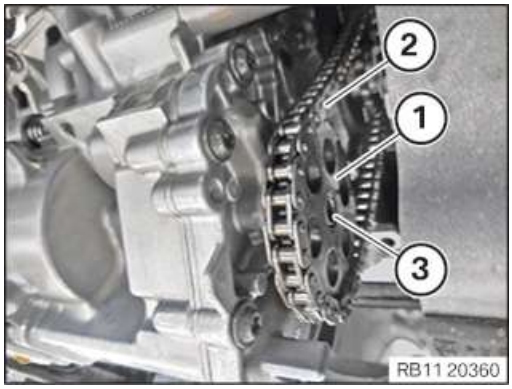
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.



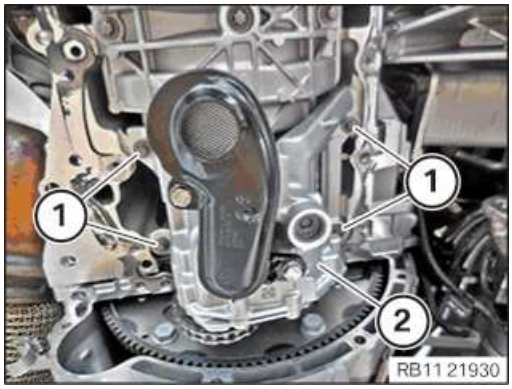
TECHNICAL INFORMATION

The thread is a left-hand thread.

- Release the screw (1) using the special tool 2 463 965.
- Thread out the bolt (1) and remove it.



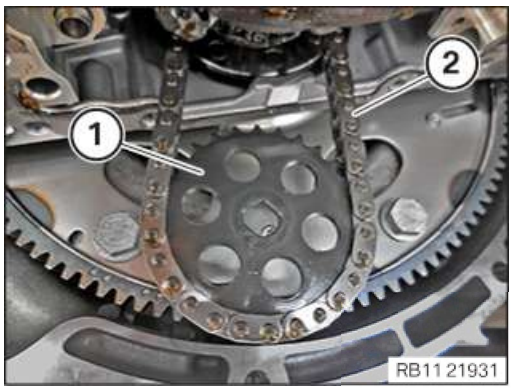
- Release the camshaft sprocket (1) from the oil vacuum pump (3).
- Feed the camshaft sprocket (1) out of the drive chain (2) and remove it.



TECHNICAL INFORMATION

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

- Release screws (1) on the oil vacuum pump (2).
- Feed out the oil vacuum pump (2) and remove it.



- Feed the camshaft sprocket (1) out of the drive chain (2) and remove it.

39 – Removing the oil deflector



- Release all the screws (marks).
- Guide out and remove the oil deflector (1).

40 – Removing all pistons with connecting rod

NOTICE

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

▸ **Removing the piston and connecting rod**

TECHNICAL INFORMATION

Piston, gudgeon pin, connecting rod and connecting rod bearing shells are matched to each other and balanced.

Always install the piston, gudgeon pin, connecting rod and connecting rod bearing shells in the cylinder from which they were removed.

TECHNICAL INFORMATION

The connecting rods of the engine are balanced and are matched to each other.

A single connecting rod is not permitted to be replaced. Always replace all connecting rods.

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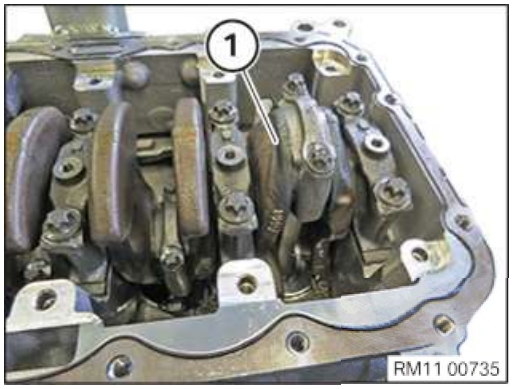
▷ **Detach the lower connecting rod bearing**

RISK OF DAMAGE

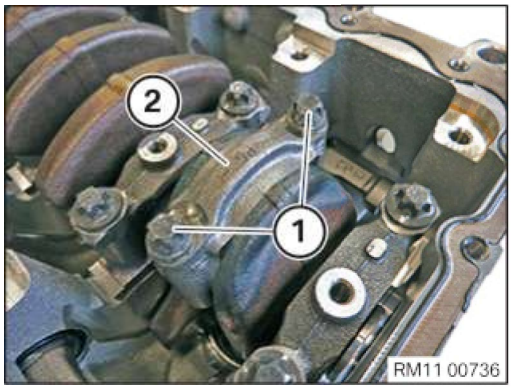
Damage on the cylinder wall and oil spray nozzles.

Major force can scratch the cylinder wall and bend the oil spray nozzles.

- Carefully move the piston and connecting rod in the engine block.



- Turn the crankshaft until the connecting rod bearing journal (1) reaches a vertical position.



RISK OF DAMAGE

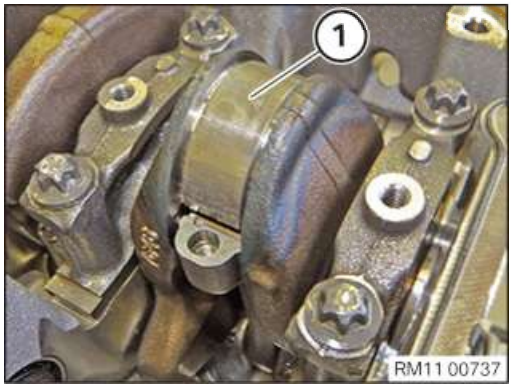
Engine damage caused by incorrectly installed bearing shells and bearing supports.

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.

- Unscrew the connecting rod bolts (1).
- Remove the connecting rod bearing cap (2) and put to one side in the correct order.

  Make sure that the connecting rod bearing cap (2) can be re-installed in the correct position.



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.

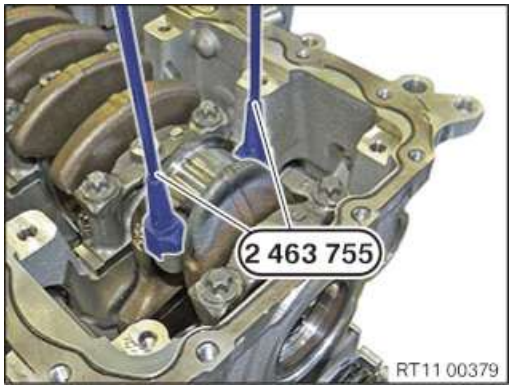
- Always install all bearing shells and bearing supports in the same position from which they were removed.

- Remove the connecting rod bearing (1).

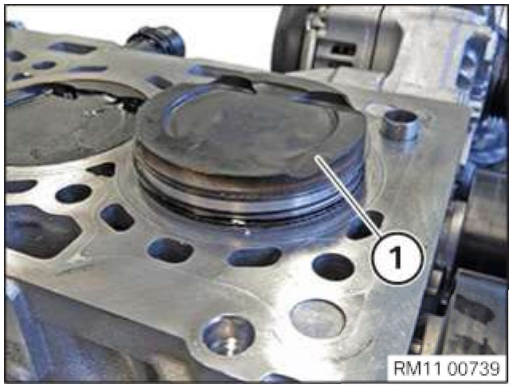
  Make sure that the connecting rod bearing (1) can be re-installed in the correct position.

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- Screw special tool 2 463 755 in at large connecting rod eye.



- Push the piston (1) and the connecting rod upwards out of the crankcase.

MAIN WORK

41 – Renewing all connecting rod bearing shells

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.

TECHNICAL INFORMATION

Piston, gudgeon pin, connecting rod and connecting rod bearing shells are matched to each other and balanced.

Always install the piston, gudgeon pin, connecting rod and connecting rod bearing shells in the cylinder from which they were removed.

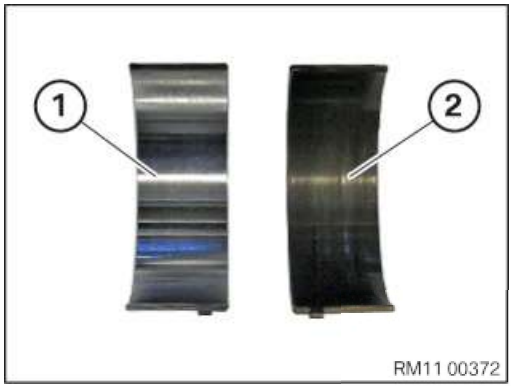


- Thread out and remove connecting rod bearing shell (2) from the connecting rod (1).

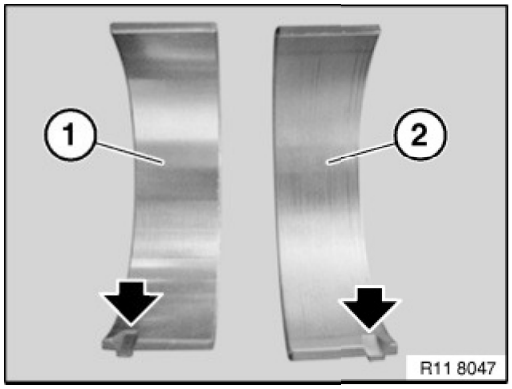
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- Thread out and remove connecting rod bearing shell (2) from the connecting rod bearing cap (1).

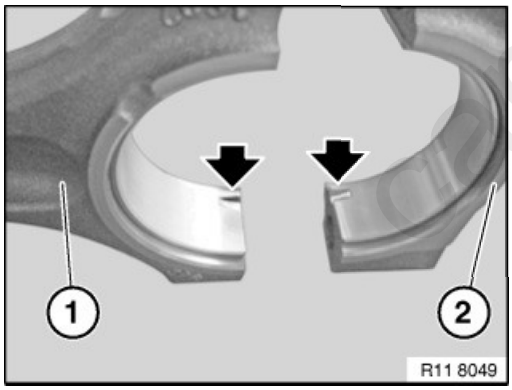


- Ensure that the connecting rod bearing shell (1) and connecting rod bearing shell (2) are different



- To avoid incorrect assembly: Pay attention to marks (arrows).

  The connecting rod bearing shell (1) and the connecting rod bearing shell (2) are equipped **with a fuse each to act** against incorrect assembly.



- To avoid incorrect assembly: Pay attention to marks (arrows).

  The connecting rod bearing cap (2) and the connecting rod (1) are equipped with **a fuse each to act** against incorrect assembly.



- Insert the dark connecting rod bearing shell (2) into the connecting rod (1).

  Parts: Connecting rod bearing shell

- Oil the connecting rod bearing shell (2).

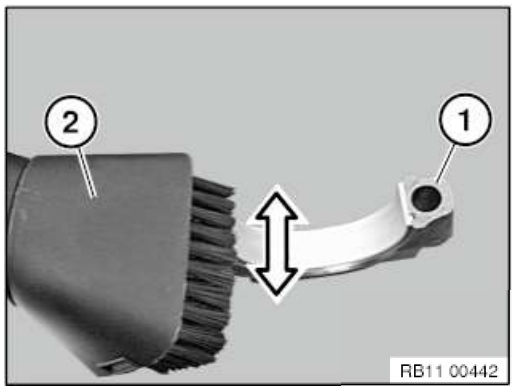
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- Insert the connecting rod bearing shell (2) into the connecting rod bearing cap (1).

  Parts: Connecting rod bearing shell

- Oil the connecting rod bearing shell (2).



- Vacuum the crack surfaces (1) with a conventional vacuum cleaner (2).

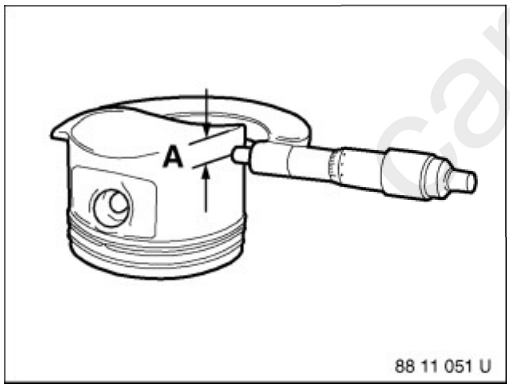
  Do not blow off the crack surfaces (1) **using** compressed air.

POSTPROCESSES

42 – Measuring piston

NOTICE

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



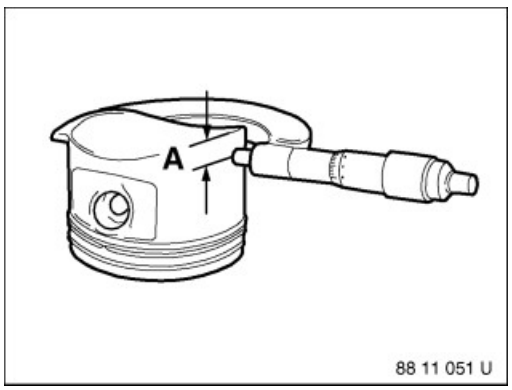
Check

- Position measuring bolt in area (A) and measure piston installation clearance transversely to gudgeon pin.

Piston diameter

Measure the piston diameter at distance (A) from the lower end of the piston skirt.

Distance (A) to the lower end of the piston skirt	10 mm
Nominal dimension of piston diameter	81,958 mm ... 81,996 mm



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Result

» Piston does not correspond to the specifications.

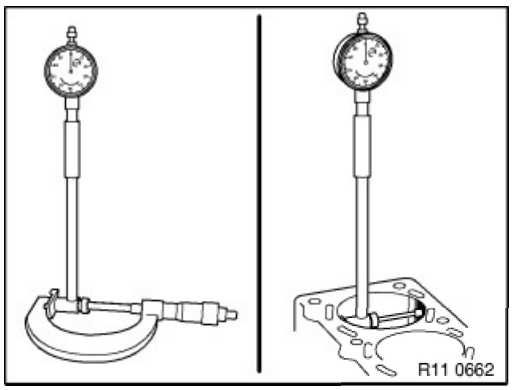
Measure

- Renew the piston.

43 – Measuring a cylinder

Prerequisite

Cylinder barrel is cleaned.



Check

- Carry out a measurement at all cylinders.
- Adjusting measuring screw to nominal dimension of cylinder bore.

Cylinder bore B38/B46/B48/B58

Diameter of cylinder bore	82,000 mm ... 82,014 mm
Permitted irregularity of the cylinder bore	0,01 mm
Permitted conicity of the cylinder bore	0,01 mm
Permissible total wear tolerance between piston and cylinder bore (engine operated)	0,15 mm

- Insert internal measuring device into measuring screw and set to zero.
- With the internal measuring device, measure the cylinder at the following points and check the deviations from the nominal dimension.
  - Lower third of the cylinder bore in direction of travel,
  - Lower third of the cylinder bore transversely to direction of travel,
  - Middle third of the cylinder bore in direction of travel,
  - Middle third of the cylinder bore transversely to direction of travel,
  - Upper third of the cylinder bore in direction of travel,
  - Upper third of the cylinder bore transversely to direction of travel.

Cylinder bore B38/B46/B48/B58

Diameter of cylinder bore	82,000 mm ... 82,014 mm
Permitted irregularity of the cylinder bore	0,01 mm
Permitted conicity of the cylinder bore	0,01 mm
Permissible total wear tolerance between piston and cylinder bore (engine operated)	0,15 mm

Result

» Cylinder does not correspond to the specifications.

Measure

- Renew the crankcase.

44 – Installing all pistons with connecting rod

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NOTICE

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

▶ **Installing piston with the connecting rod**

RISK OF DAMAGE

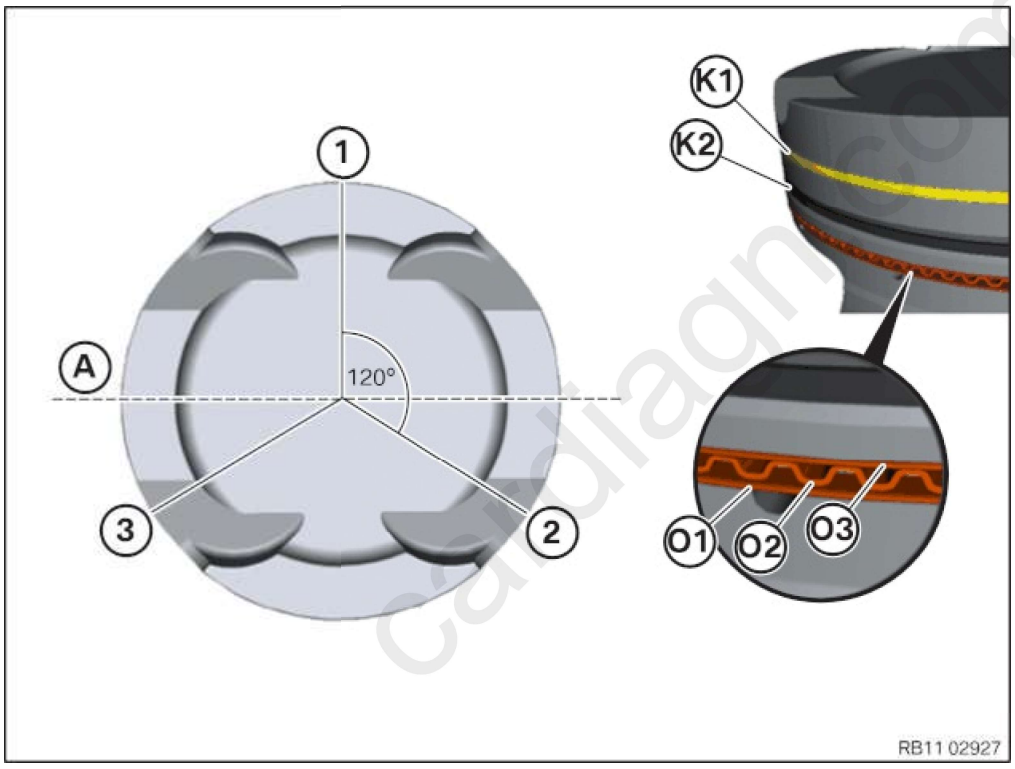
Damage on the cylinder wall and oil spray nozzles.

Major force can scratch the cylinder wall and bend the oil spray nozzles.

- Carefully move the piston and connecting rod in the engine block.

▷ **Aligning piston rings**

Aligning piston rings



1 12 o'clock position

2 4 o'clock position

3 8 o'clock position

A Axis of gudgeon pin

K1 Upper piston ring

K2 Middle piston ring

O1 Lower oil scraper ring

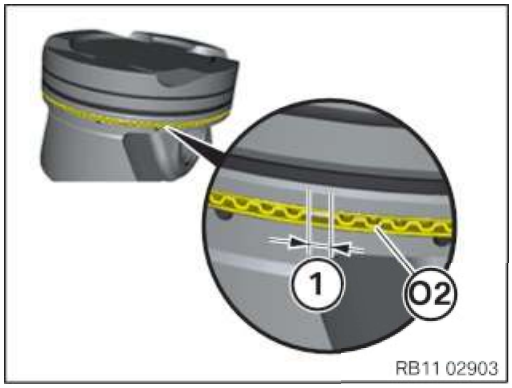
O2 Spring

O3 Upper oil scraper ring

- Align the contact points of all piston rings rotated by 120° each.

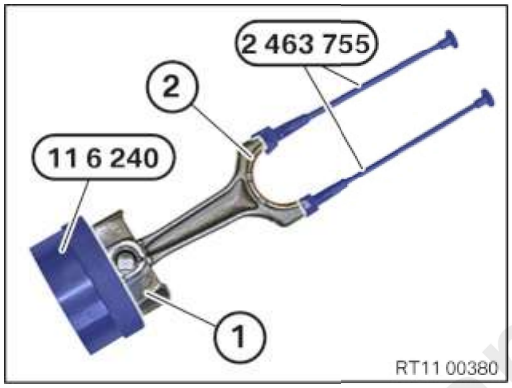
  Do not position contact points over axis of gudgeon pin (A).

Piston ring	Align at the following position
Lower oil scraper ring (O3)	Align at the 12 o'clock position (1)
Spring (O2)	Align at the 4 o'clock position (2)
Upper oil scraper ring (O1)	Align at the 8 o'clock position (3)
Middle piston ring (K2)	Align at the 12 o'clock position (1)
Upper piston ring (K1)	Align at the 4 o'clock position (2)



- Make sure that contact point (1) does not overlap spring (O2).

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- Coat the pistons (1) and piston rings lightly with oil.
- Insert the piston (1) with the piston rings into the special tool (bush) 0 495 373 (11 6 240).
- Screw special tool 2 463 755 on at large connecting rod eye (2).



- Align the piston so that the arrow (1) points to cylinder 1.
- Insert piston with the connecting rod into the special tool 0 495 373 (11 6 240) and guide it into the cylinder.

RISK OF DAMAGE

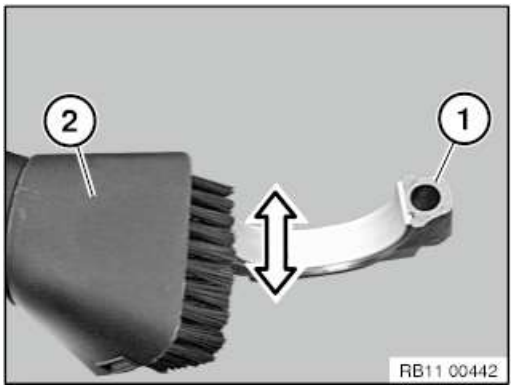
Damage on the cylinder wall and oil spray nozzles.

Major force can scratch the cylinder wall and bend the oil spray nozzles.

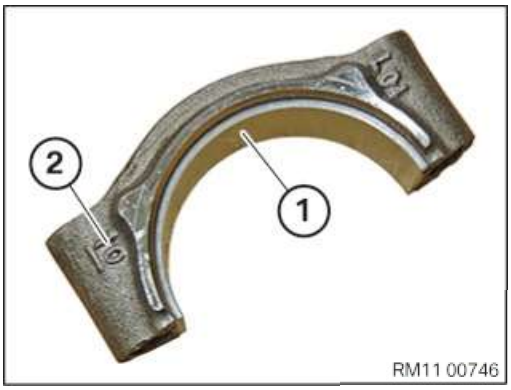
- Carefully move the piston and connecting rod in the engine block.

- Push in piston by hand with only little force. Do not use striking tools.

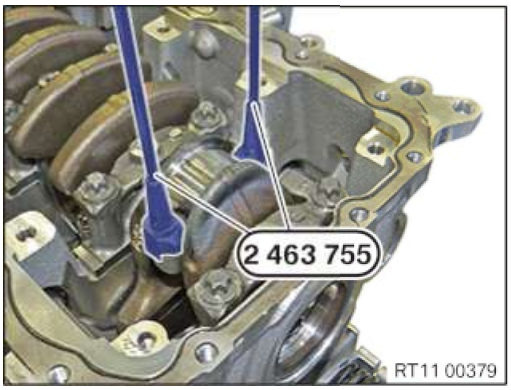
▷ **Install the lower connecting rod bearing**



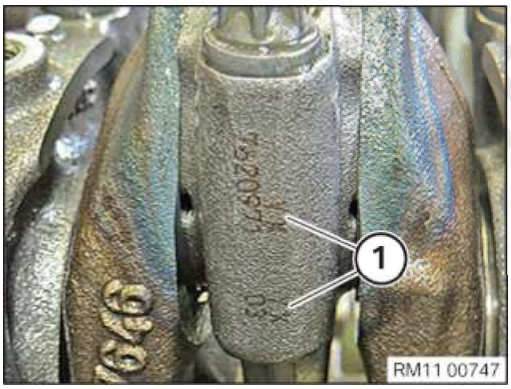
- Vacuum the connecting rod bearing shell and cracked surface (1) with a vacuum cleaner (2).



- Insert the connecting rod bearing shell (1) into the connecting rod bearing cap (2).
- Apply a light coat of oil to the connecting rod bearing shell (1).



- If necessary, screw the special tool (assembly tool) 2 463 755 into the large connecting rod eye.
- Pull the connecting rod up to the connecting rod bearing journal.



RISK OF DAMAGE

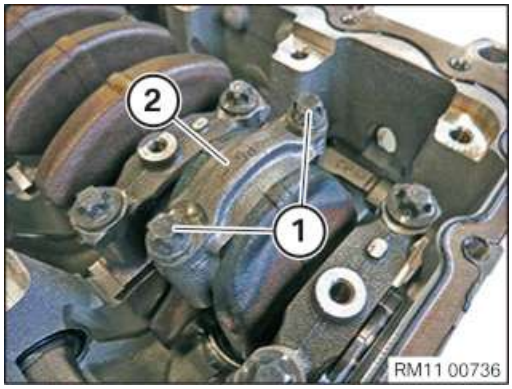
Engine damage caused by incorrectly installed bearing shells and bearing supports.

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.

- Attach the connecting rod bearing caps to the connecting rod until the designations (1) match.

mdiagn.com



- Renew screws (1).

  Parts: Bolts

- Tighten the bolts with the special tool 0 490 504 (00 9 120).

Connecting rod bearing cap to connecting rod

Renew screws.

Tighten screws crosswise.	Jointing torque	20 Nm
	1. Angle of rotation	70 °
	2. Angle of rotation	70 °

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45 – Installing the oil deflector



- Renew bolts (markings).

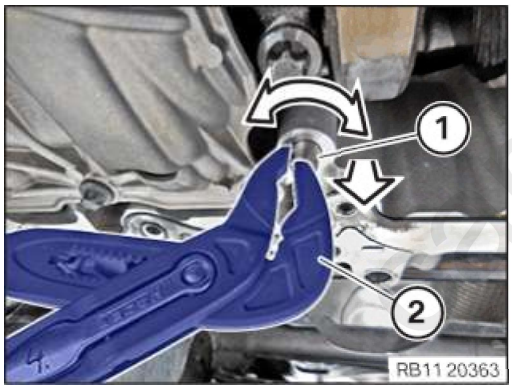
  Parts: Bolts

- Insert oil deflector (1) and position.
- Tighten bolts (markings) in a crosswise pattern using the special tool 0 490 504 (00 9 120).

Oil deflector to crankcase

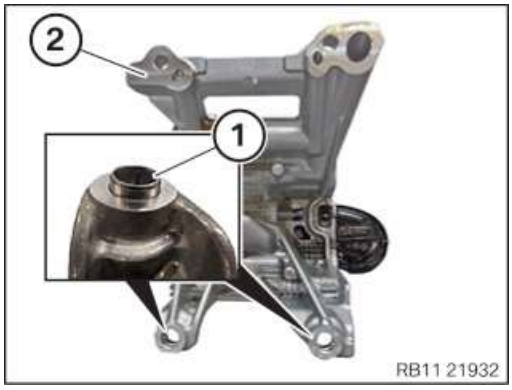
M8 x 35	Replace screws.	Jointing torque	15 Nm
		Angle of rotation	45 °

46 – Install the oil vacuum pump



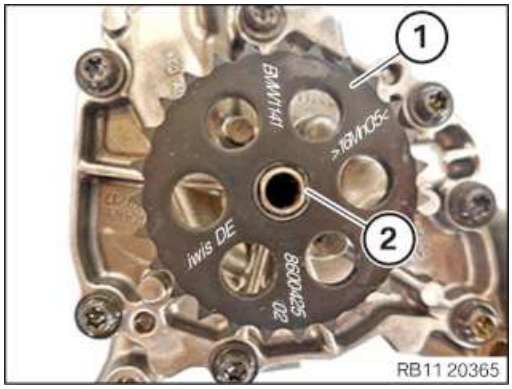
- Work centring sleeves (1) out of the crankcase in the direction of the arrow using conventional tools (2) and remove.
- Renew the centring sleeves (1).

  Parts: Centring sleeves



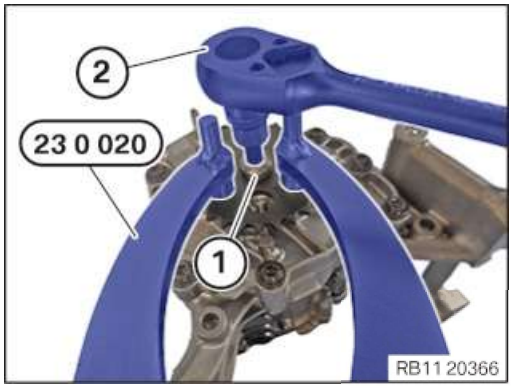
- Insert and install centring sleeves (1) at the oil vacuum pump (2).

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- Position the camshaft sprocket (1) at the oil vacuum pump (2).

  The labelling on the camshaft sprocket (1) must face away from the oil vacuum pump (2).



- Renew the screw (1).

  Parts: Screw

TECHNICAL INFORMATION

The thread is a left-hand thread.

- Insert bolt (1) and fit.

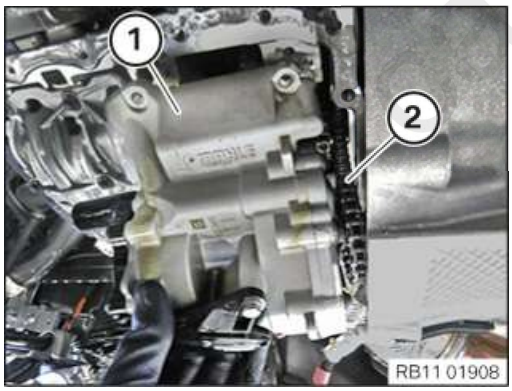
TECHNICAL INFORMATION

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

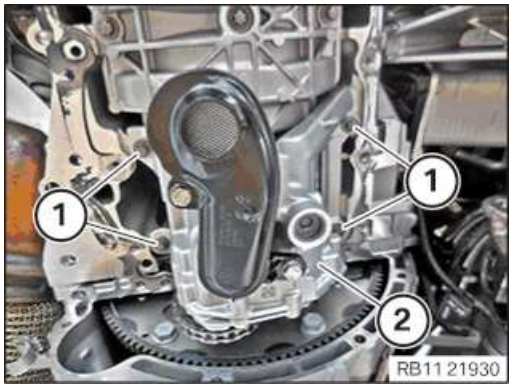
- Hold camshaft sprocket with special tool 0 491 440 (23 0 020) and tighten bolt (1) with conventional tools (2).

Camshaft sprocket to oil vacuum pump

M8	Important - left-hand thread Renew screw.	1. Jointing torque 2. Angle of rotation	5 Nm 90 °



- Insert and position the oil vacuum pump (1) in the drive chain (2).



- Renew screws (1).

  Parts: Bolts

- Tighten the screws (1).

Oil vacuum pump to crankcase

M8	Renew screw.	1. Tightening torque 2. Angle of rotation	15 Nm 45 °

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

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

RISK OF DAMAGE

Damage to the surface.

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

- Do not use any metal-cutting tools.



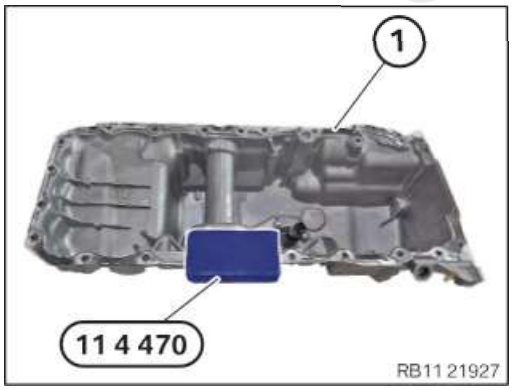
TECHNICAL INFORMATION

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

- Remove the coarse sealing residue on sealing surface (1) on the crankcase with special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215



TECHNICAL INFORMATION

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

- Remove the fine seal remains on the sealing surface (1) of the oil sump with the special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215

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- Have the special tool ready.

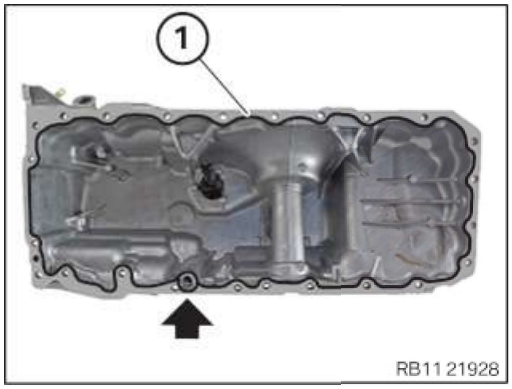


TECHNICAL INFORMATION

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

- Position the sealing compound (1) on special tool as shown.

  Parts: Sealing compound



TECHNICAL INFORMATION

The maximum application time of the liquid sealing compound is 12 minutes.

- Apply sealing bead (1) with the sealing compound in the **marked** area along the inner edge.

Sealing compound

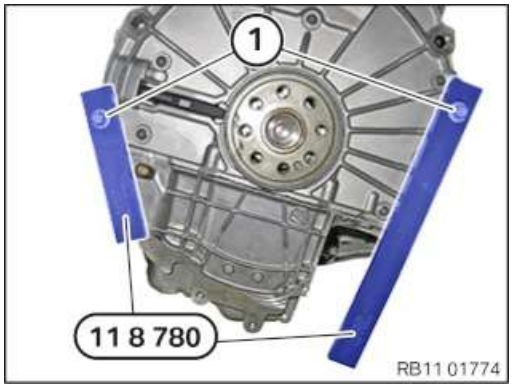
Loctite 5970 liquid sealing compound	50 ml, Cartridge	83190404517

Overview of consumables (Electronic Parts Catalogue)

Height of the sealing bead

	2,0 mm ... 2,5 mm

- Completely encircle the oil return orifice (arrow) with the sealing compound.



TECHNICAL INFORMATION

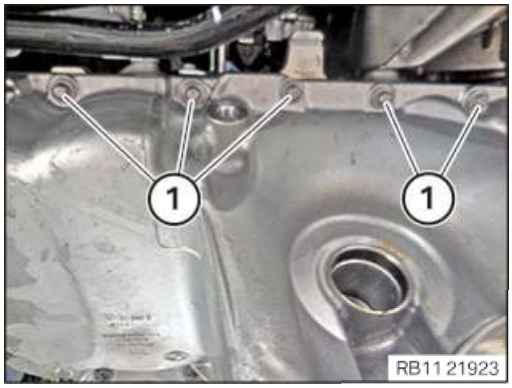
The special tool 11 8 780 is only required when the transmission is removed.

- Position the special tool 0 496 120 (11 8 780) with the transmission bolts (1) so that the oil sump is exactly flush with the timing case cover.
- Renew the centring sleeves where required.

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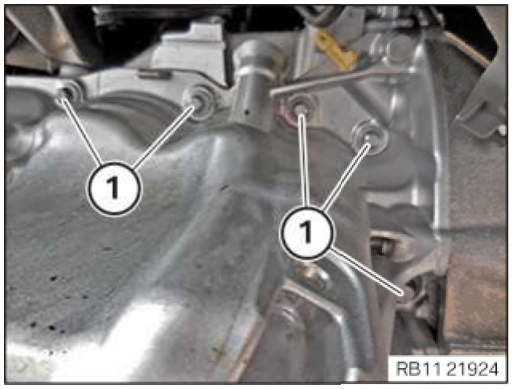
- Insert oil sump (1) upwards and forwards and position.



- Tighten the screws (1).

Oil sump to crankcase

M8 x 30		Tightening torque	24 Nm



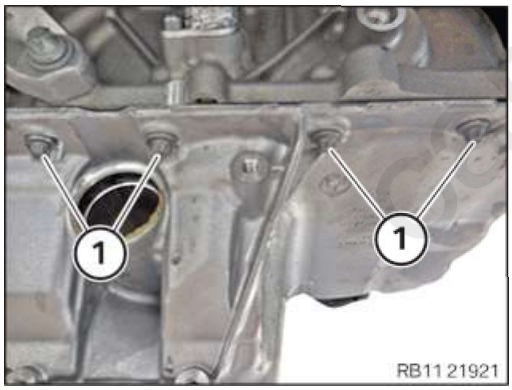
- Tighten the screws (1).

Oil sump to crankcase

M8 x 30		Tightening torque	24 Nm

Oil sump to crankcase

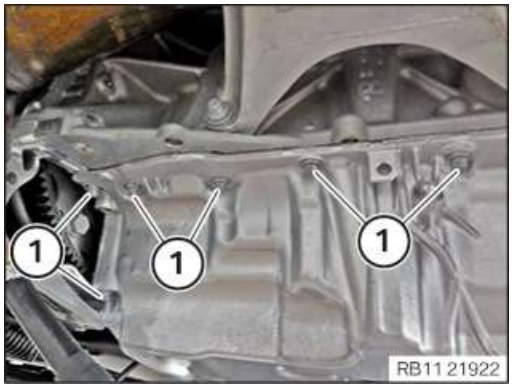
M8 x 110		Tightening torque	24 Nm



- Tighten the screws (1).

Oil sump to crankcase

M8 x 30		Tightening torque	24 Nm



- Tighten the screws (1).

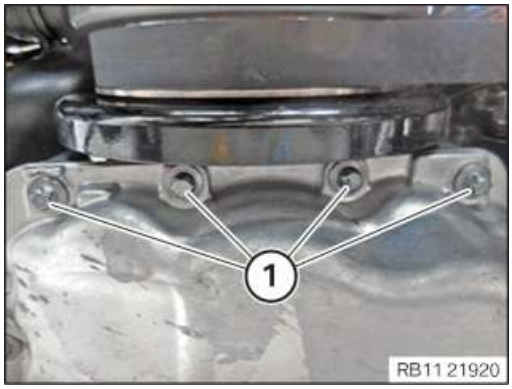
Oil sump to crankcase

M8 x 30		Tightening torque	24 Nm

Oil sump to crankcase

M8 x 110		Tightening torque	24 Nm

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- Tighten the screws (1).

Oil sump to crankcase

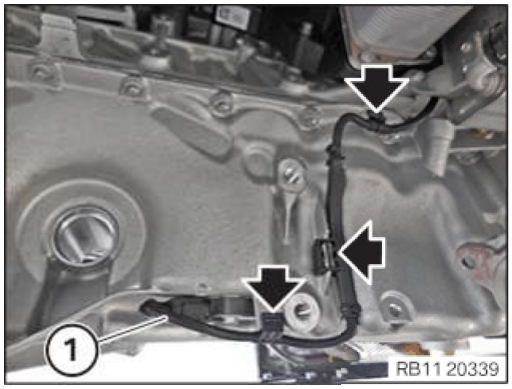
M8 x 30		Tightening torque	24 Nm



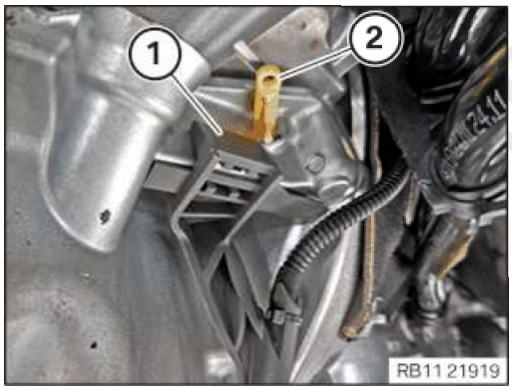
- Tighten transmission screws (1).

Transmission to oil sump (manual gearbox and automatic transmission)

M8 x 50		Tightening torque	19 Nm

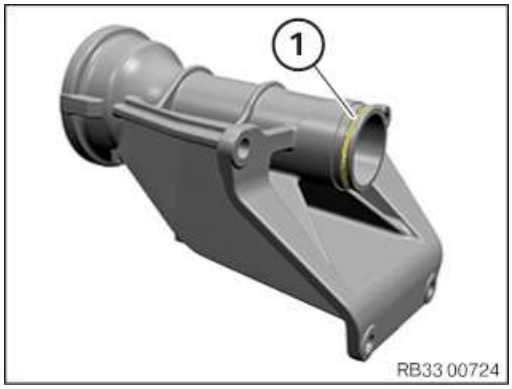


- Secure the clamps (arrows).
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.



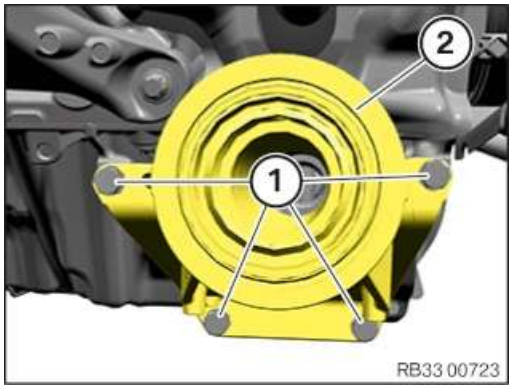
- Secure clamps (1).
- Guide in and install sealing cap (2).

48 – Install bearing support



- Coat the O-ring (1) with front axle transmission oil.

rdiagn.com

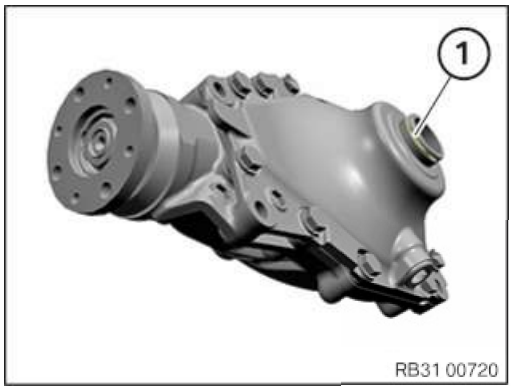


- Position the bearing support (2) at the engine oil sump.
- Tighten the screws (1).

Bearing support to oil sump

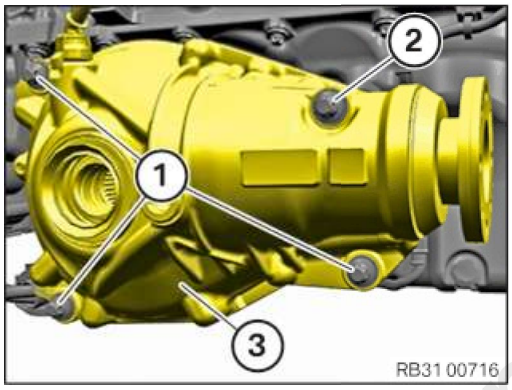
M8		Tightening torque	19 Nm

49 – Install front axle differential



- Renew O-ring (1).

  Parts: O-ring
- Coat the O-ring (1) with front axle transmission oil.



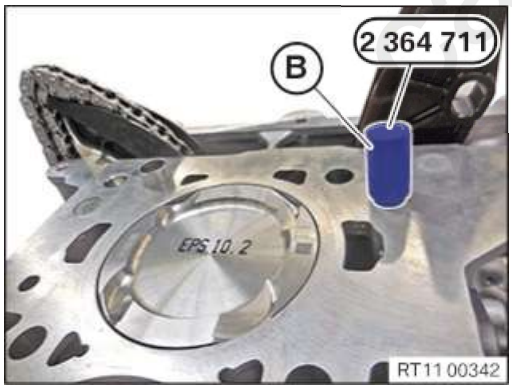
- Position front axle differential (3).

  Make sure marked screws are installed in correct installation locations:
  - Screws (1) M12x55
  - Screw (2) M12x105
- Tighten down screws (1) and (2).

Front axle final drive to engine oil pan

M12		Tightening torque	140 Nm

50 – Sealing the oil duct



- Seal the oil duct using special tool (B) from the set of special tools 2 364 711.

51 – Clean sealing surfaces

RISK OF DAMAGE

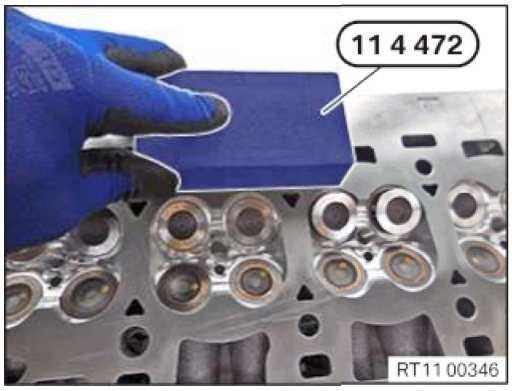
Damage to the surface.

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

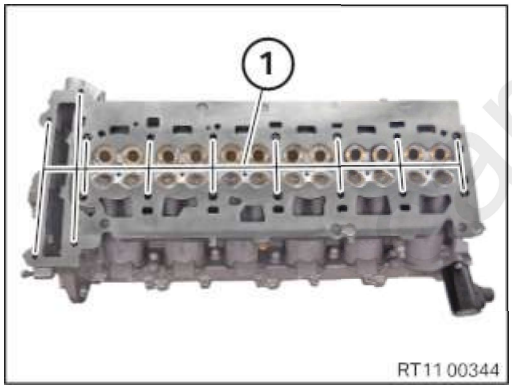
- Do not use any metal-cutting tools.



- Remove coarse backlogs from the sealing surfaces of the cylinder head using special tool 0 495 103 (11 4 471).



- Remove fine residues from the sealing surfaces of the cylinder head using special tool 0 495 104 (11 4 472).



- Clean all blind holes (1) of the cylinder head.

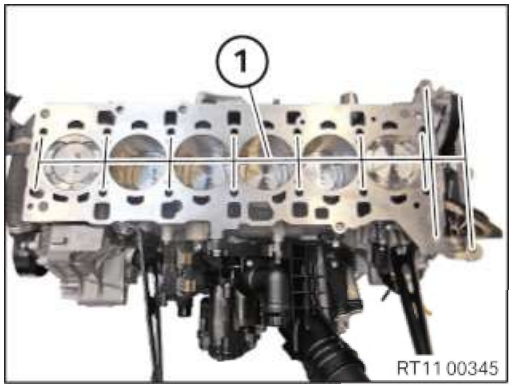


- Remove coarse backlogs from the sealing surfaces of the crankcase using special tool 0 495 103 (11 4 471).

grdiagn.com



- Remove fine backlogs from the sealing surfaces of the crankcase using special tool 0 495 104 (11 4 472).
- Clean all blind holes of the crankcase.



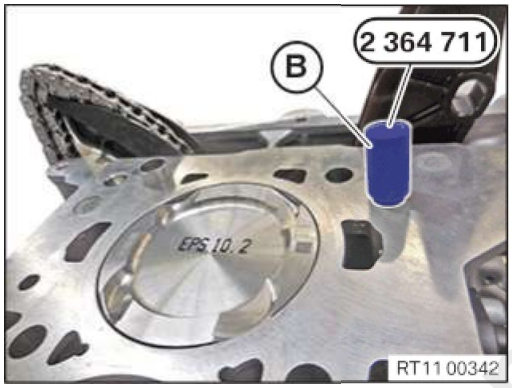
CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

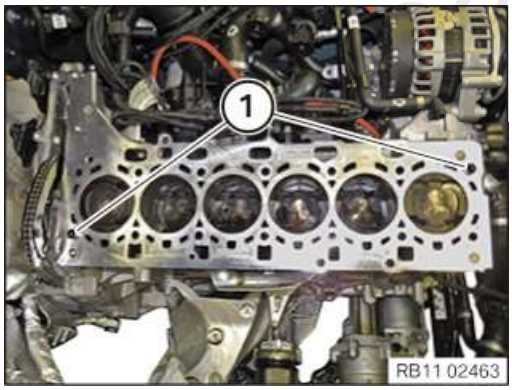
- Collect dirt particles, e.g. when blowing out, use cloth to do so.

- Wear safety goggles.
- Clean all threaded holes (1) of the crankcase with compressed air.

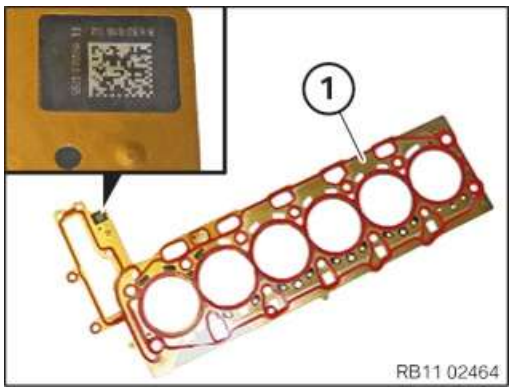


- Remove special tool (B) contained in the set of special tools 2 364 711.

52 – Installing the cylinder head gasket



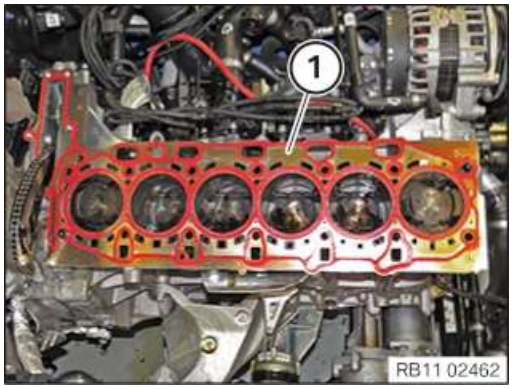
- Check the fitting sleeves (1) for damage and renew if necessary.



- Renew cylinder head gasket (1).

  Parts: Cylinder head gasket
- Install a thicker cylinder head gasket (1) with +0.3 mm in rebuilt cylinder heads.
- Check cylinder head gasket (1) using the part number.

carldiagn.com



- Install cylinder head gasket (1) and place it correctly on the fitting sleeves.

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



RISK OF DAMAGE

Damage to the engine.

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

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

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



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

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



- **Vehicles with automatic transmission:**

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

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

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- **Vehicles with automatic transmission:**

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

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

54 – Installing the cylinder head

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

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

RISK OF DAMAGE

Damage to threads.

Fluid in the threaded hole may damage the thread when screws are tightened in the threads.

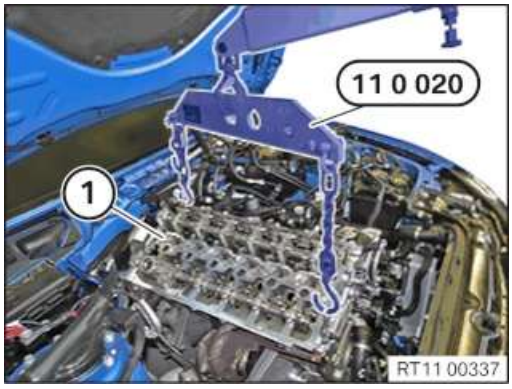
- Dry threaded holes (e.g. using compressed air).

TECHNICAL INFORMATION

Do not remove bolt coating.

TECHNICAL INFORMATION

When replacing the cylinder head: The complete valve control and the Valvetronic servomotor are already pre-assembled for new cylinder heads.



RISK OF DAMAGE

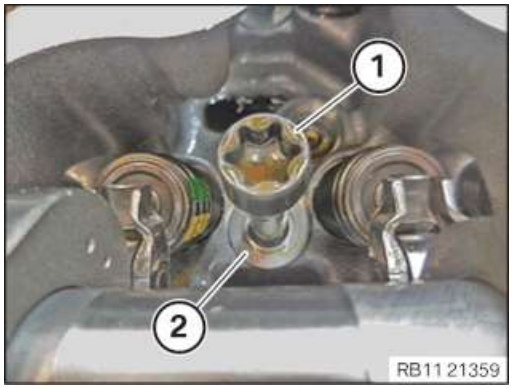
Damage to the guide rails.

Large amounts of force may damage the guide rails of the timing chain.

- Make sure not to damage the guide rail with the cylinder head when removing and installing the cylinder head.

- Feed in, position and install cylinder head (1) and exhaust turbocharger with the help of an auxiliary person, the workshop crane and the special tool 0 490 567 (11 0 020).
- Ensure that the **guide rails** of the timing chain are **not** damaged.

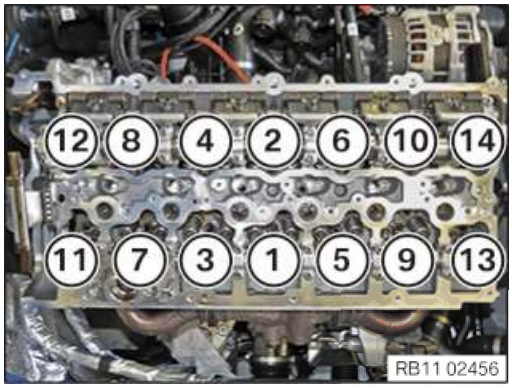
cardiagn.com



- Insert and install washer (2).
- Renew the cylinder head bolts (1).

  Parts: Cylinder head bolts
- Do not wash off the coating (1) **of the cylinder head bolts** .
- **Lightly** oil contact surfaces of cylinder head bolt screw heads.

  No coolant, water or engine oil must be present in threaded holes of crankcase.
- Guide in and install cylinder head bolts (1).



TECHNICAL INFORMATION

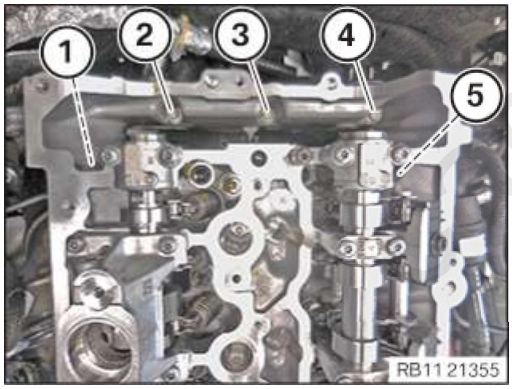
When assembling, it is essential to observe screwing sequences and tightening torques.

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

- Screw in the cylinder head bolts in the sequence (1) to (14).
- Tighten the cylinder head bolts using the special tool 0 495 747 (11 8 580) and 0 490 504 (00 9 120) in the sequence (1) to (14).

Cylinder head to crankcase

M11	Observe tightening sequence. Fit new cylinder head bolts.	1. Jointing torque 2. Angle of rotation 3. Angle of rotation	30 Nm 90 ° 180 °

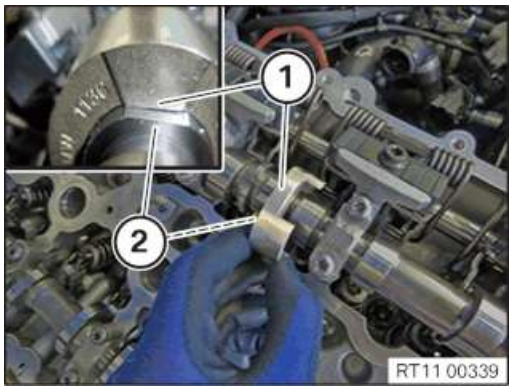


- Renew cylinder head bolts (1) to (5).

  Parts: Cylinder head bolts
- Make sure that there is **no** coolant, water or engine oil in the threaded holes of the timing case cover.
- Screw in cylinder head bolts (1) to (5).
- Tighten the cylinder head bolts in the order (1) to (5).

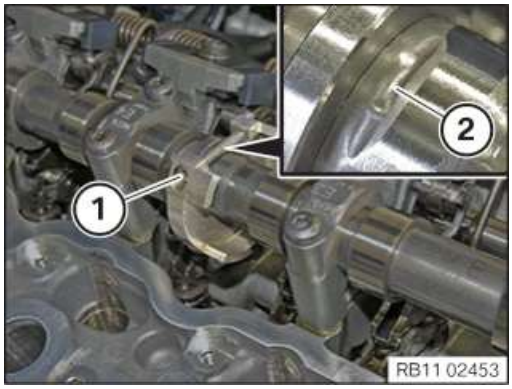
Cylinder head bolt to timing case cover

M8x40	Renew screws.	Tightening torque	19 Nm



- Feed in and position camshaft sensor wheel (1) on the intake camshaft (2).

tdiagn.com



- Rotate intake camshaft, if necessary in the position shown.

  The recess (2) must point upwards.
- Tighten down screw (1).

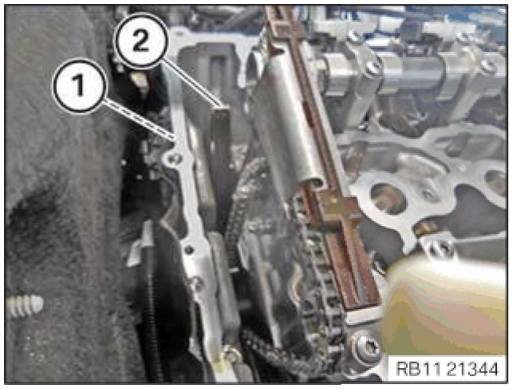
Camshaft sensor wheel to intake camshaft

M4 x35		4,5 Nm



- Renew bearing journal (1).

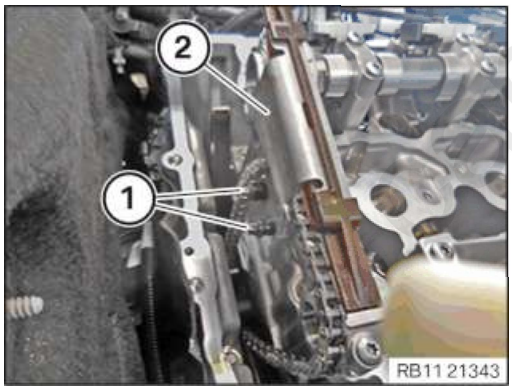
  Parts: Bearing journal



- Feed in and install bearing journal (1) on the guide rail (2).
- Tighten the bearing journals (1).

Bearing journal to cylinder head

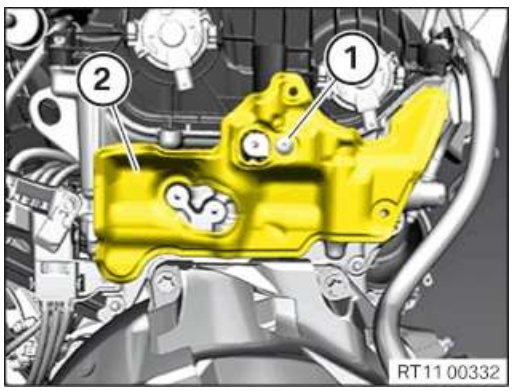
Bearing journal	Renew the bearing journal!	Tightening torque	20 Nm



- Insert slide rail (2) and install.
- Tighten the screws (1).

Sliding rail to cylinder head

M6x16			8 Nm

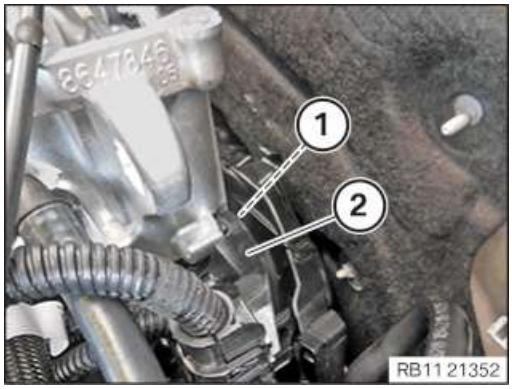


- Guide in and install cover (2).
- Tighten down screw (1).

Cover on rear cylinder head

M6		Tightening torque	8 Nm

ardiagn.com



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

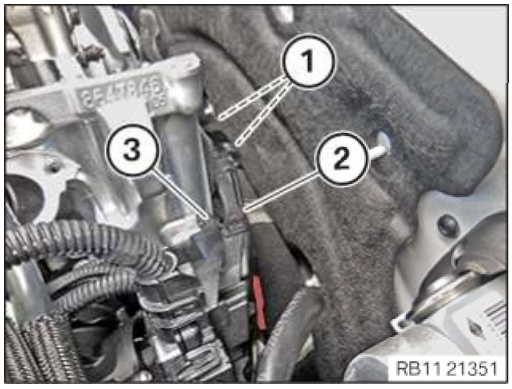
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

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

- Guide in and install wiring harness section (2) for sensor system 1.
- Tighten down screw (1).

Cable routing to cylinder head, rear

M6 x 20		Tightening torque	8 Nm



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

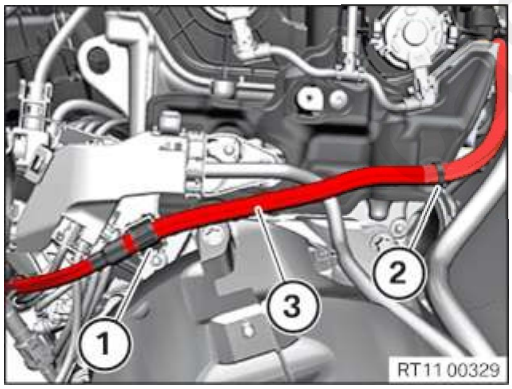
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

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

- Guide in and install transmission wiring harness (2) on wiring harness section (3) for sensor system 1.
- Tighten the screws (1).

Cable routing to cylinder head, rear

M6 x 20		Tightening torque	8 Nm



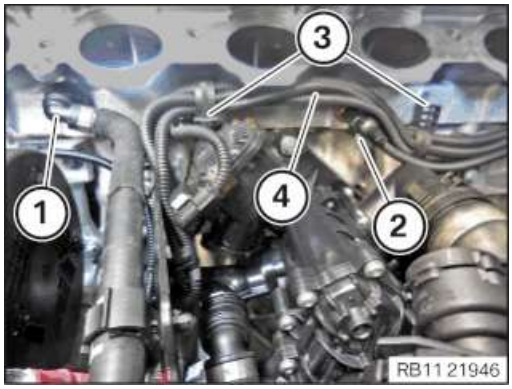
CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

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

- Insert and install the positive battery cable (3).
- Secure clamps (1) and (2).



RISK OF DAMAGE

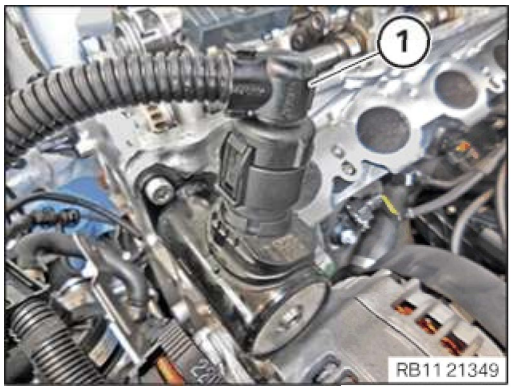
Improper routing of cables and wiring harnesses.

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

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

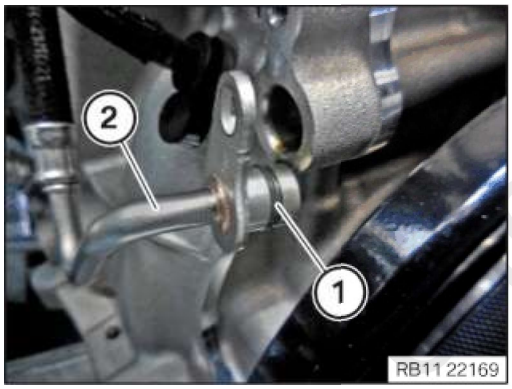
- Connect connectors (2) and lock.

  The connector must engage audibly.
- Guide in and position the wiring harness section (4) of sensor system **1**.
- Secure clamps (3).
- Connect and lock coolant line (1).
- Make sure that the cooling line (1) engages audibly.



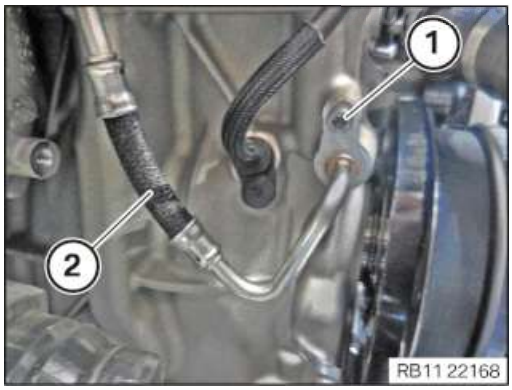
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Renew sealing ring (1) on the oil feed line (2) of the exhaust turbocharger with special tool 0 496 714 (00 9 030).

  Parts: Sealing ring

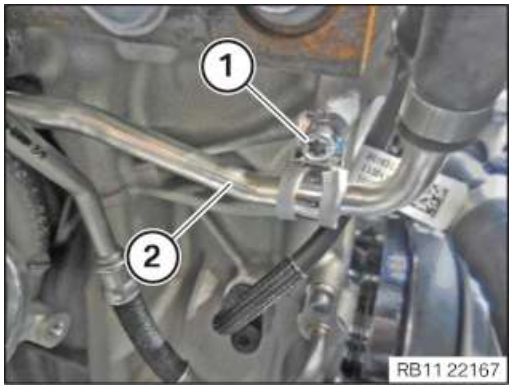


- Feed in and install the oil feed line (2) for the exhaust turbocharger.
- Tighten down screw (1).

Oil feed line for exhaust turbocharger to crankcase

M6 x 12	Replace sealing ring.	Tightening torque	8 Nm

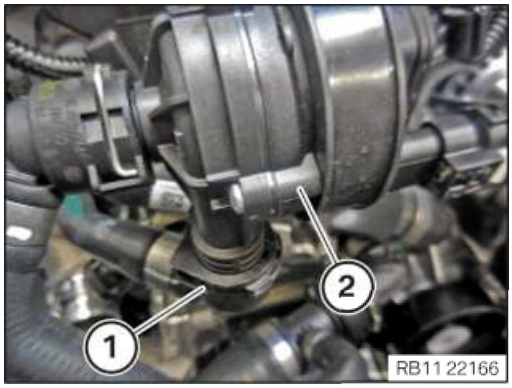
tdiagn.com



- Tighten screw (1) on the coolant return line (2).

Coolant return line holder bracket to crankcase

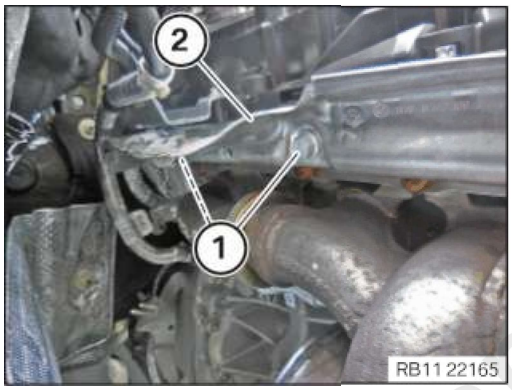
M6X12		Tightening torque	8 Nm



- Connect coolant return line (1) to the coolant pump (2) for the exhaust turbocharger and lock.

  The coolant return line (1) must engage audibly.

- Connect coolant return line (1) for the exhaust turbocharger and lock.
- Ensure the coolant return line (1) audibly engages.



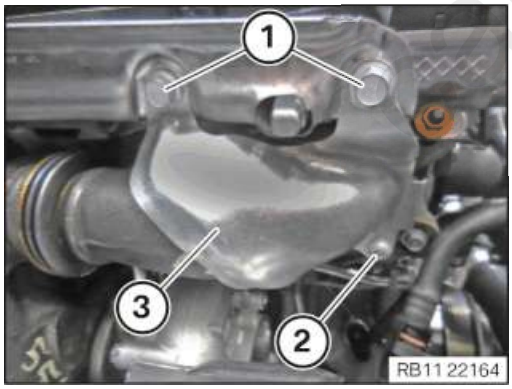
- Feed in and install the heat shield (2).
- Renew screws (1).

  Parts: Bolts

  Tighten the screws (1).

Heat shield to cylinder head

M8X12	Renew screws.	Tightening torque	19 Nm



- Feed in and install the heat shield (3).
- Renew screws (1).

  Parts: Bolts

  Tighten the screws (1).

Heat shield to cylinder head

M8X12	Renew screws.	Tightening torque	19 Nm

- Renew the screw (2).

  Parts: Screw

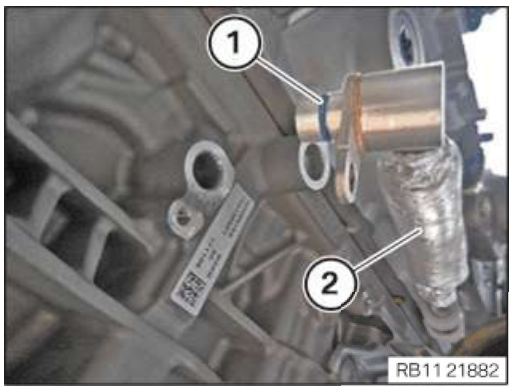
  Tighten down screw (2).

Heat shield to clamping strip

M6X16	Renew screw.	Tightening torque	8 Nm

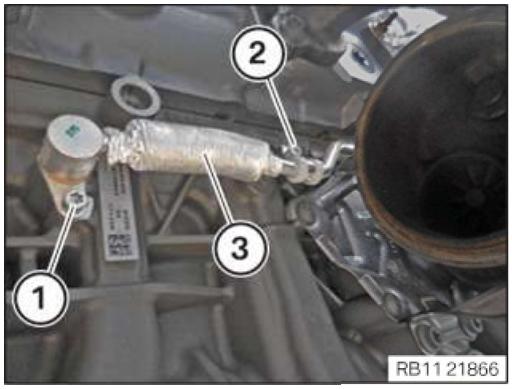


- Unscrew the bolts (1) of the special tool .
- Feed out the special tool at the cylinder head and remove.



- Renew sealing ring (1) on the coolant feed line (2) of the exhaust turbocharger with special tool 0 496 714 (00 9 030).

  Parts: Sealing ring



- Feed in and install coolant feed line for the exhaust turbocharger (3).
- Tighten down screw (1).

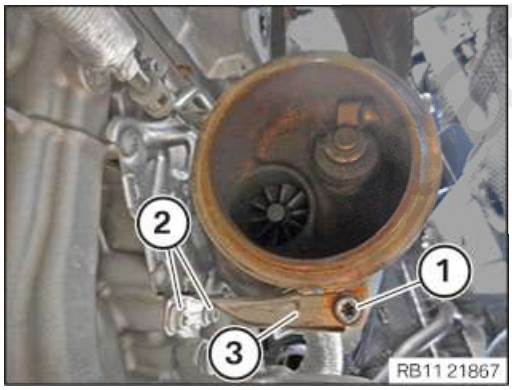
Coolant feed line to crankcase

M6X12		Tightening torque	8 Nm

- Tighten down screw (2).

Coolant feed line to crankcase

M6X12		Tightening torque	8 Nm



- Renew screws (1) and (2).

  Parts: Bolts
- Feed in and install support (3).
- Tighten the screws (2).

Exhaust turbocharger support to crankcase

M8 x 20	Renew screws.	19 Nm

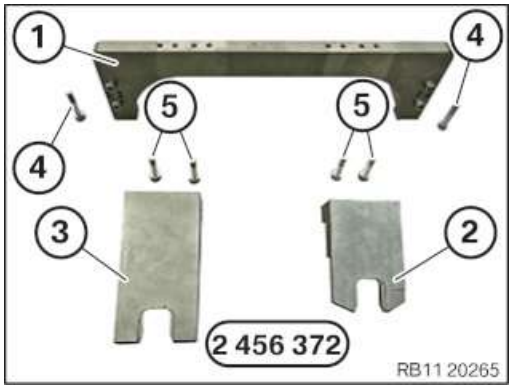
- Tighten the screws (1).

Exhaust turbocharger to support

M8 x 25	Renew screw.	19 Nm

55 – Adjust the camshafts with the special tool

manualslib.com



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

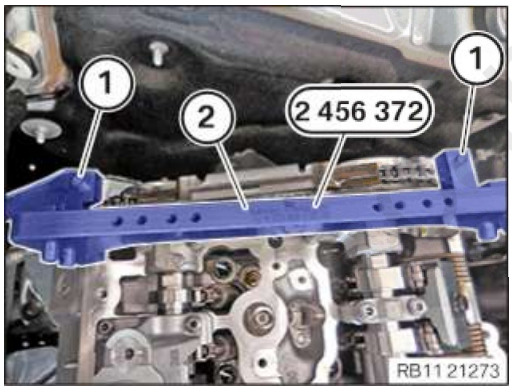
Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



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



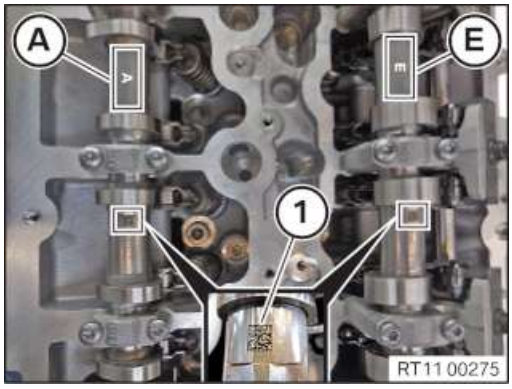
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



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

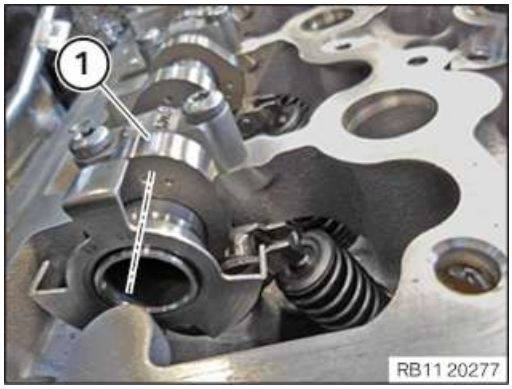
Basic carrier to cylinder head

M6		Tightening torque	8 Nm



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

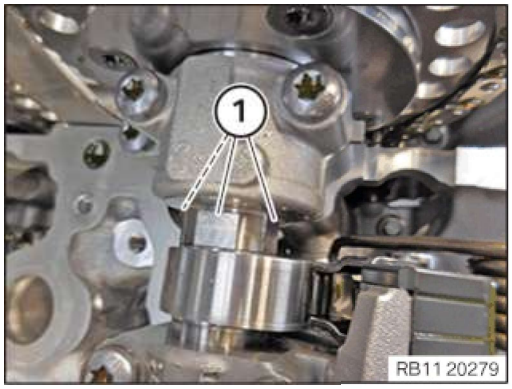
.diagn.com



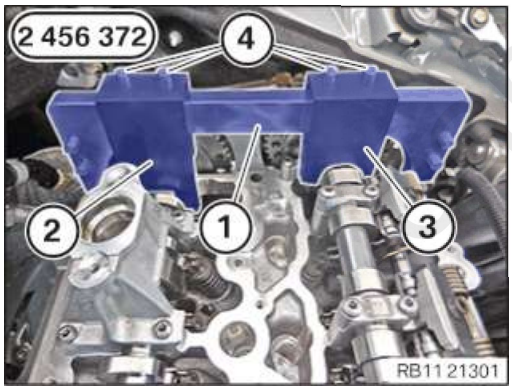
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



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



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



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

Test gauge to basic carrier

M6		Tightening torque	8 Nm

56 – Installing the intake adjuster

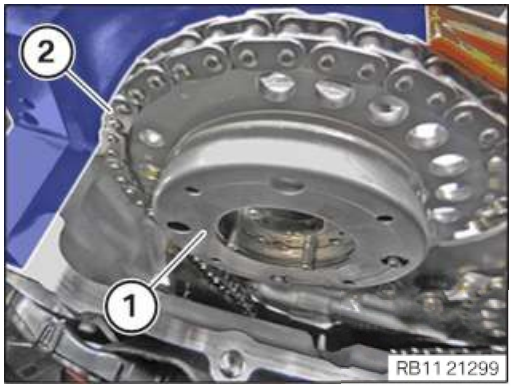
NOTICE

The figure shows the rear side of the engine.

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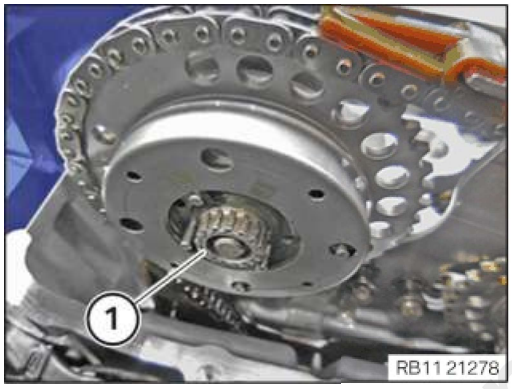


- Keep intake adjuster (1) marked IN ready.

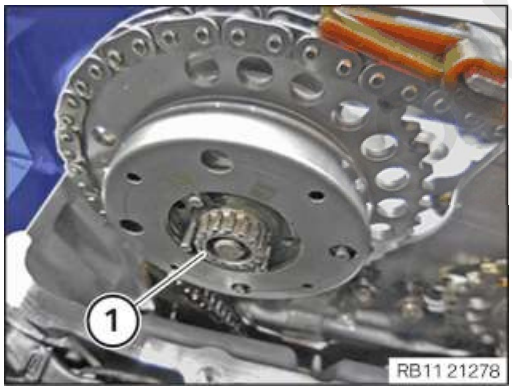


- Feed in intake adjuster (1) in the timing chain (2) and position on the intake camshaft .

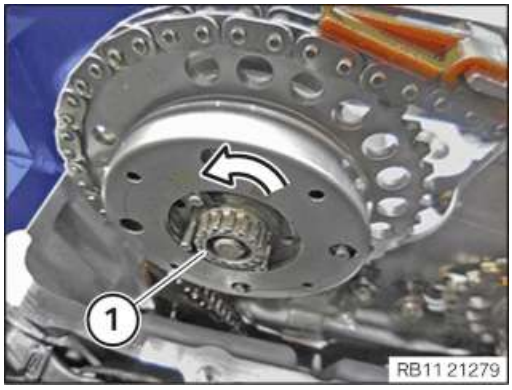
57 – Install the VANOS central valve of the intake adjuster



- 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 °.

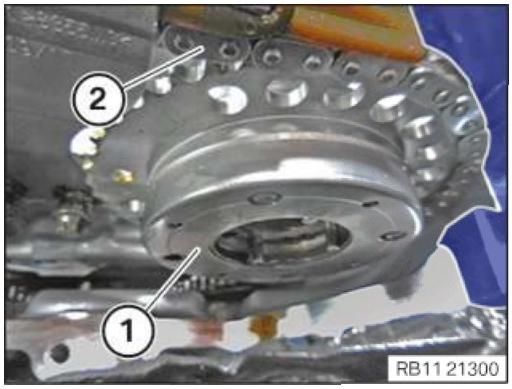
58 – Install exhaust camshaft adjuster

NOTICE

The figure shows the rear side of the engine.

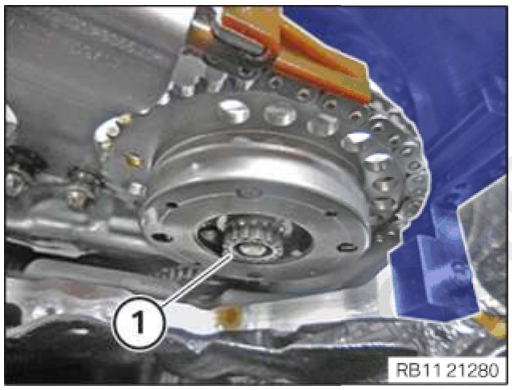


- Keep exhaust camshaft adjuster (1) marked EX ready.

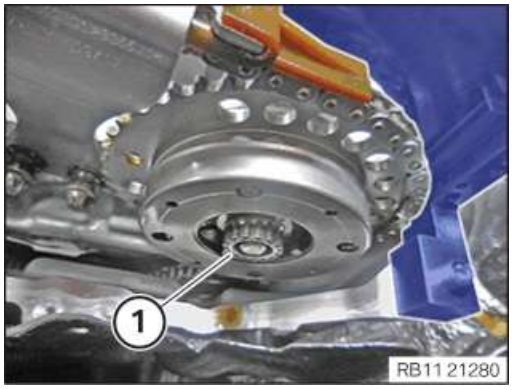


- Feed in exhaust camshaft adjuster (1) in the timing chain (2) and position on the exhaust camshaft .

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

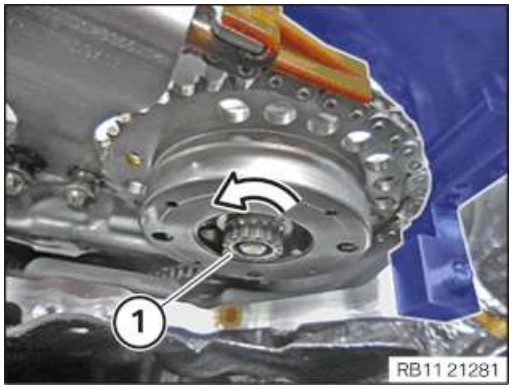


- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.



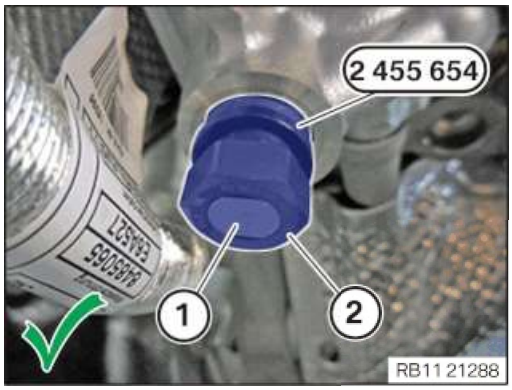
- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

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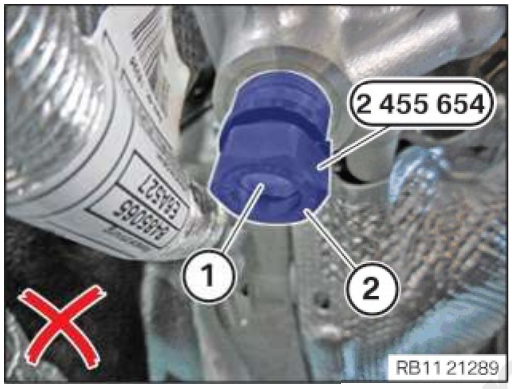
- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

60 – 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.

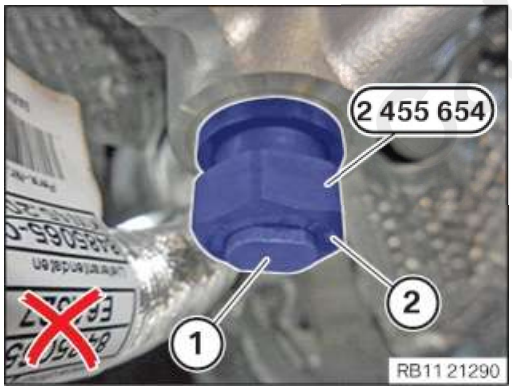
  The pin (1) must align **precisely** with housing (2).



- 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**.

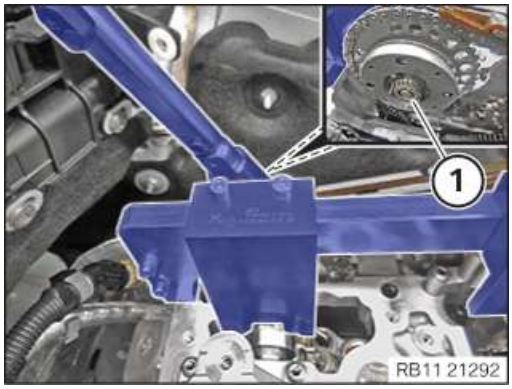
  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

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

61 – 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 °

62 – 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.

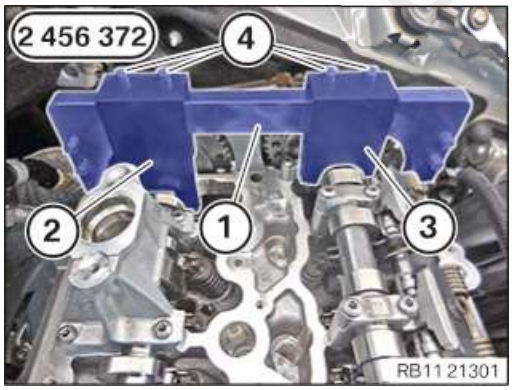


- Tighten the VANOS central valve (1) of the intake adjuster.

VANOS central valve to camshaft

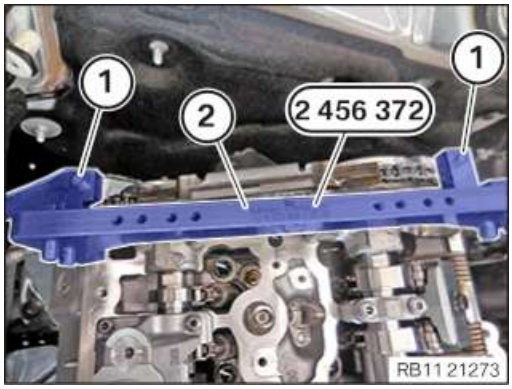
M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

63 – Disassembling all special tools

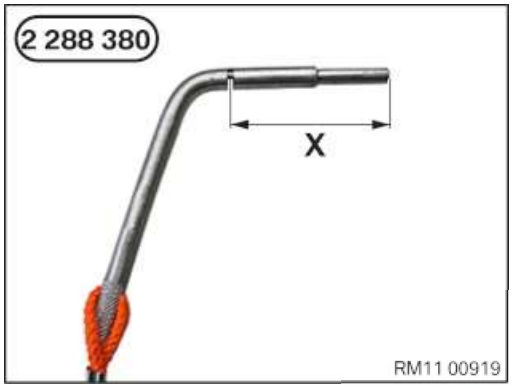


- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the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

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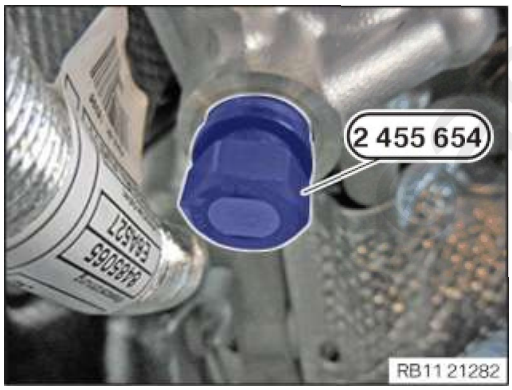
- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.



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



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



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

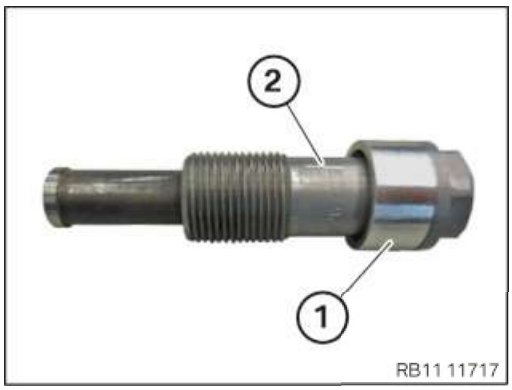
64 – Install chain tensioner

TECHNICAL INFORMATION

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

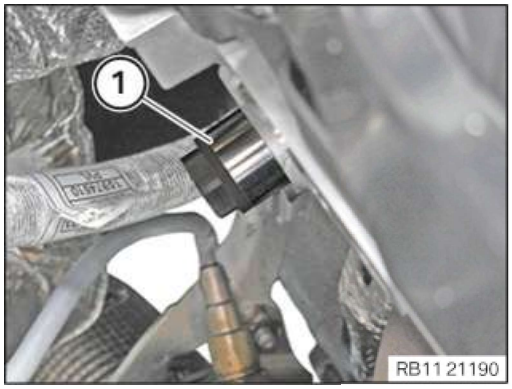


- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.

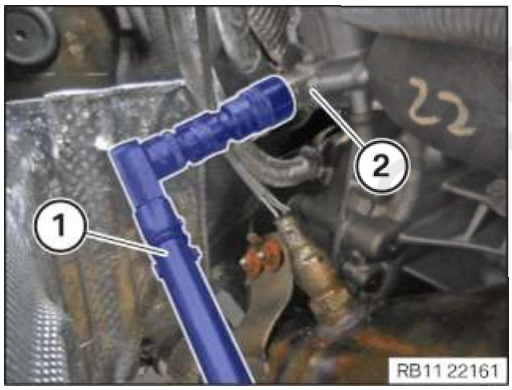


- Renew the sealing sleeve (1).

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



- Insert and install the chain tensioner (1).

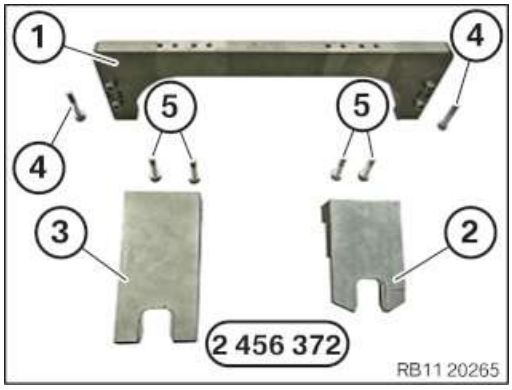


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

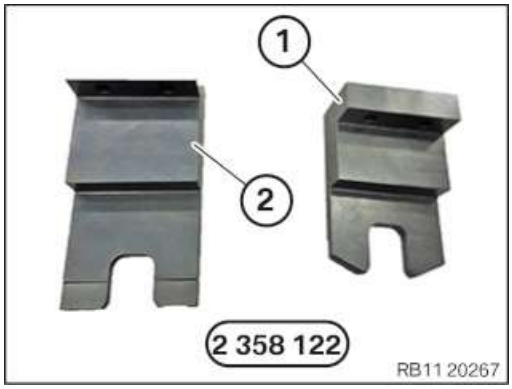
65 – Checking camshaft timing



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

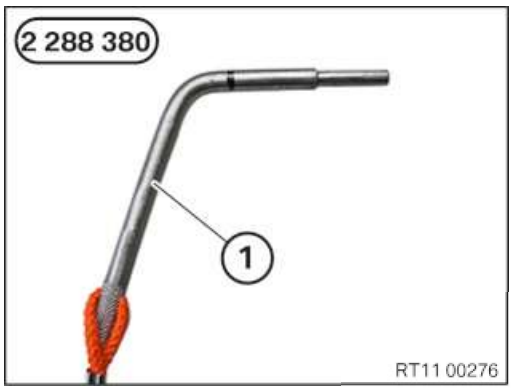
Number	Description
1	Basic carrier
2	0.7° setting gauge to adjust the intake camshaft
3	0.5° setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

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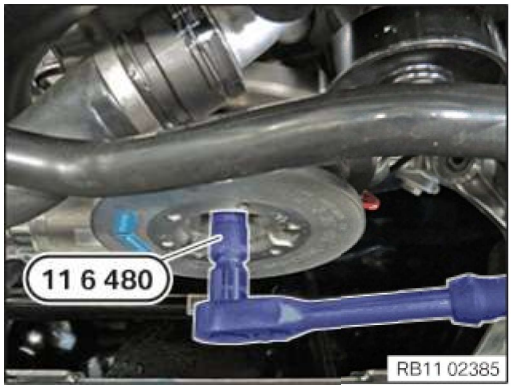
- Keep the test gauge from the set of special tools 2 358 122 ready.

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



- Have the special tool 2 288 380 ready.

Number	Description
1	Locating stud



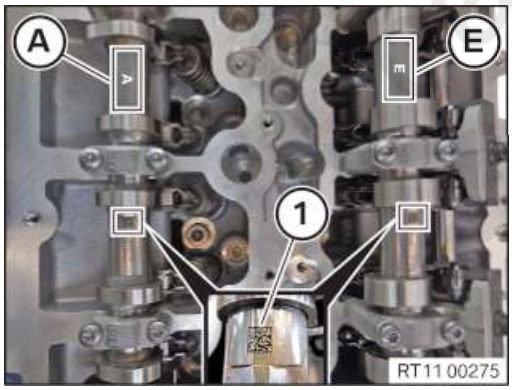
RISK OF DAMAGE

Damage to the engine.

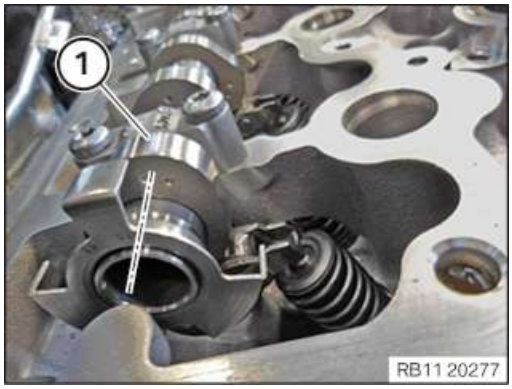
The engine may be damaged if it is manually rotated in the wrong direction.

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

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



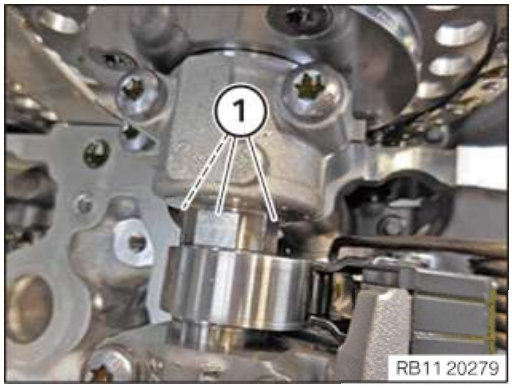
- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.



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



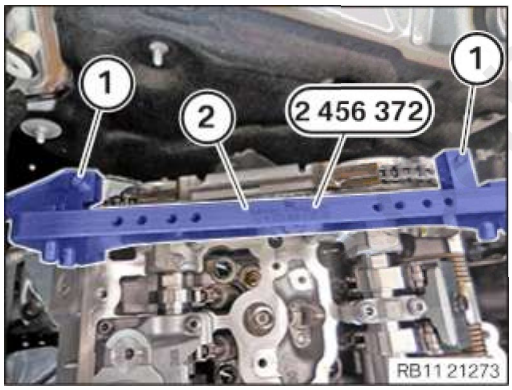
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.



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



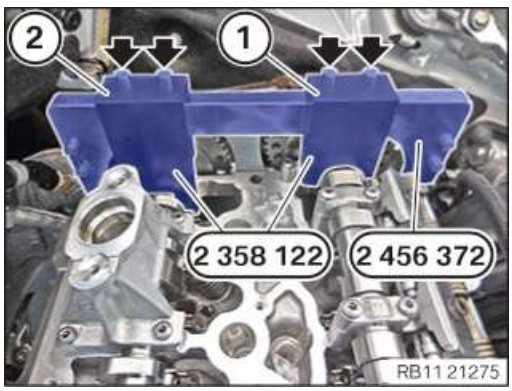
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



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

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



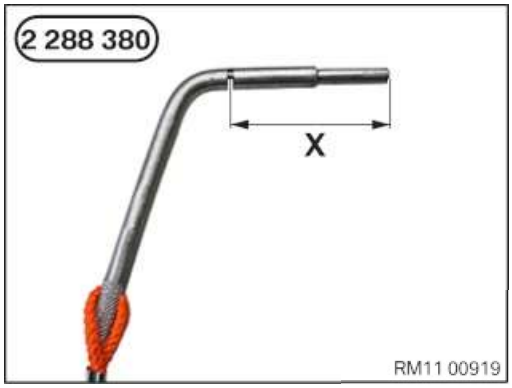
- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special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

Test gauge to basic carrier

M6		Tightening torque	8 Nm



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



- **Vehicles with automatic transmission:**

  Dimensions (X) = 66 mm

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



- **Vehicles with automatic transmission:**

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

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

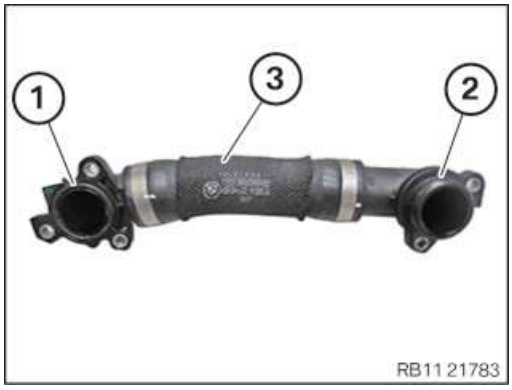


- **Vehicles with automatic transmission:**

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

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

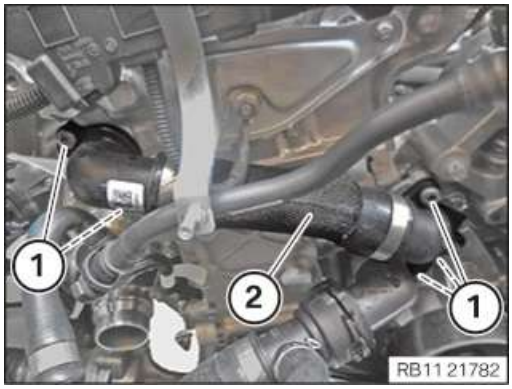
66 – Install the coolant line between the cylinder head and the coolant pump



- Check sealing rings (1) and (2) for damage; renew coolant line (3) if necessary.

  Parts: Sealing ring

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TECHNICAL INFORMATION

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

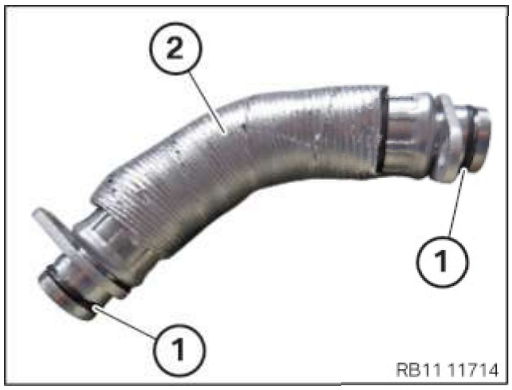
Non-observance of these requirements may result in leaks and damage.

- Feed in and install coolant line (2).
- Hand-tighten the bolts (1).
- Tighten the screws (1).

Coolant line to coolant pump/cylinder head

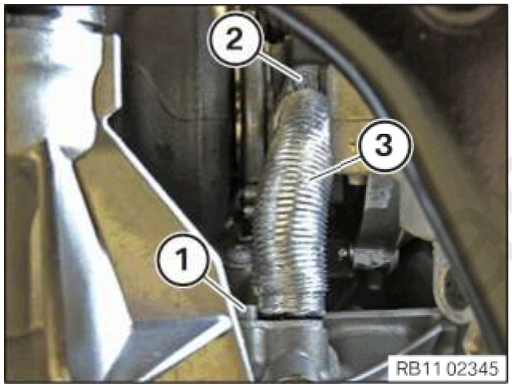
M6x20		Tightening torque	8 Nm

67 – Installing the oil return line for the exhaust turbocharger



- Renew the sealing rings (1) on the oil return line (2).

  Parts: Sealing ring



- Feed in and install the oil return line (3).
- Tighten down screw (2).

Oil return line to turbocharger

M6 x 12		8 Nm

- Tighten down screw (1).

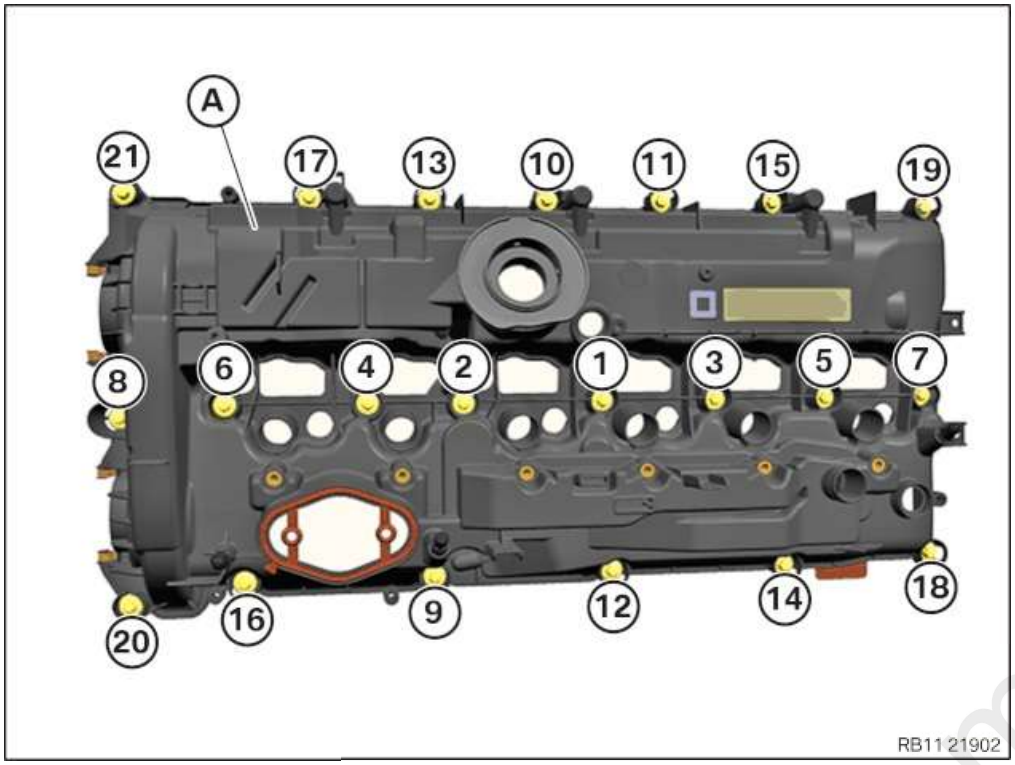
Oil return line to crankcase

M6 x 12		8 Nm

68 – Installing cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 21 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

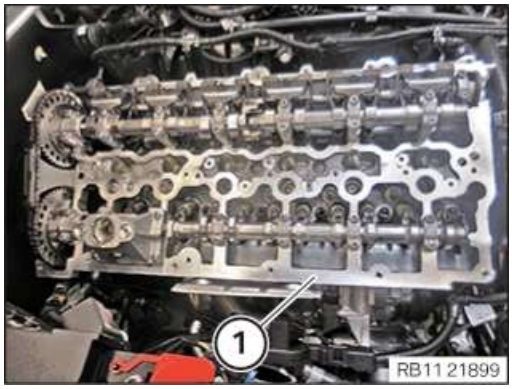
Improper routing of cables and wiring harnesses.

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

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

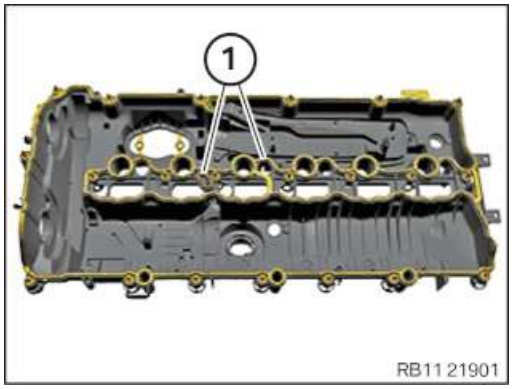
TECHNICAL INFORMATION

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



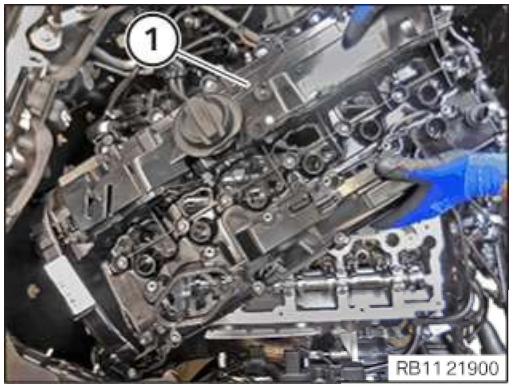
- Contact surface (1) must be free from oil and grease.

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- Replace the seals (1).

  Parts: Seals

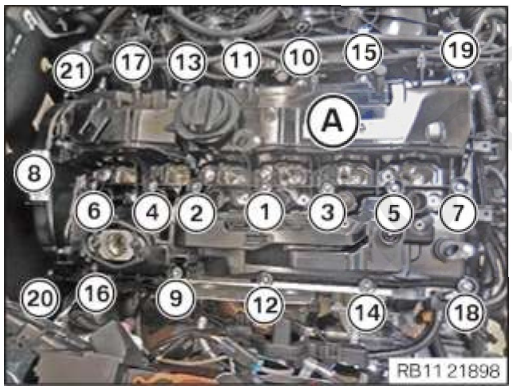


- Insert and install cylinder head cover (1).



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

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



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

Cylinder head cover to cylinder head

M6X30		Jointing torque	8 Nm

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

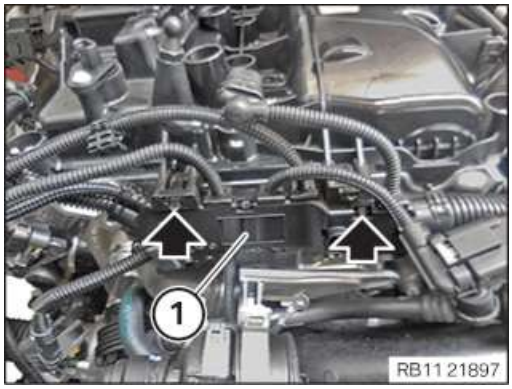
Cylinder head cover to cylinder head

M6X30		Tightening torque	11 Nm

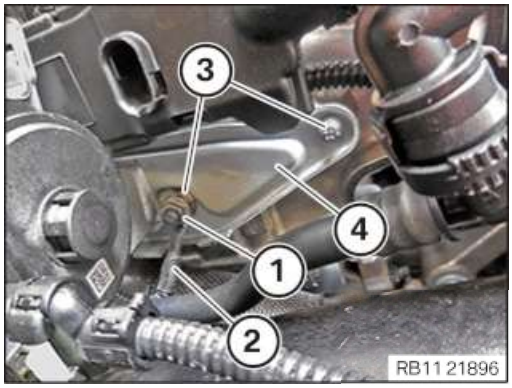


- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

rdiagn.com



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



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

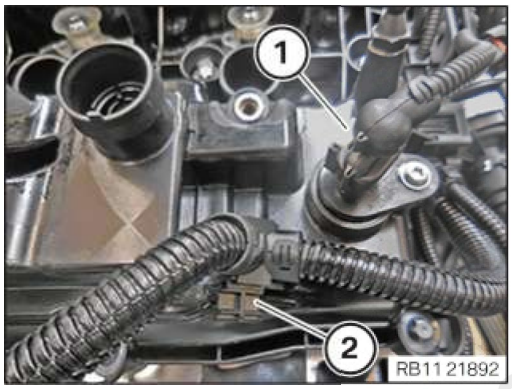
Auxiliary coolant pump holder to cylinder head

M6		Tightening torque	7 Nm

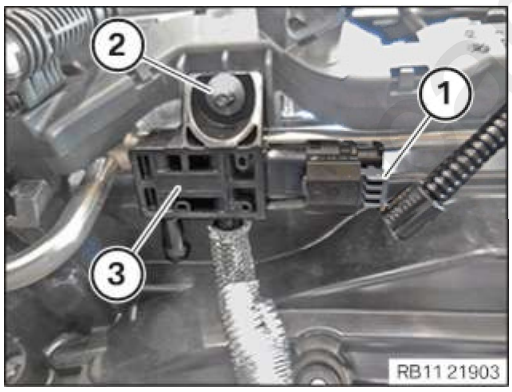
- Thread in ground cable (2) and install.
- Tighten nut (1).

Standard screw connection M6

M6			8 Nm



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



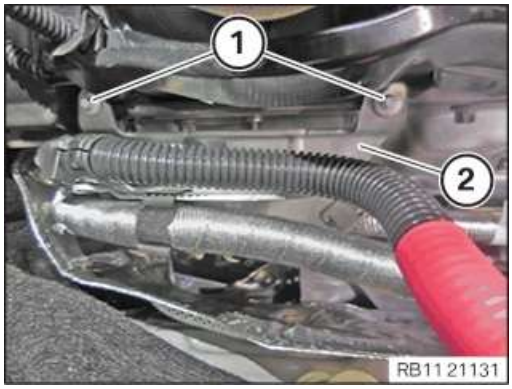
- **If installed:**
- Feed in and install the differential pressure sensor (3).
- Tighten down screw (2).

Differential pressure sensor to holder

TS6X18		Tightening torque	3,5 Nm

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

mdiagn.com



CAUTION

Improper routing of the positive battery cable.

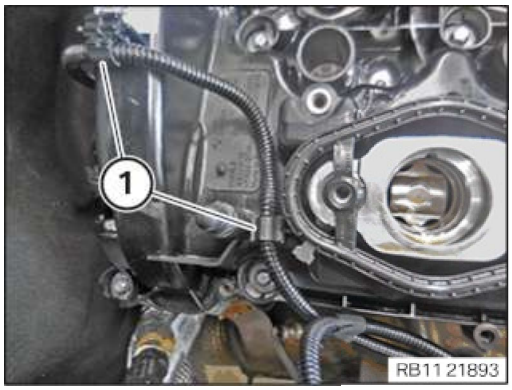
Risk of short circuits!

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

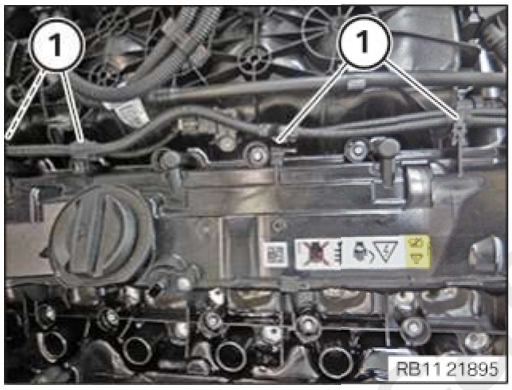
- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

Holder, positive battery cable to cylinder head cover

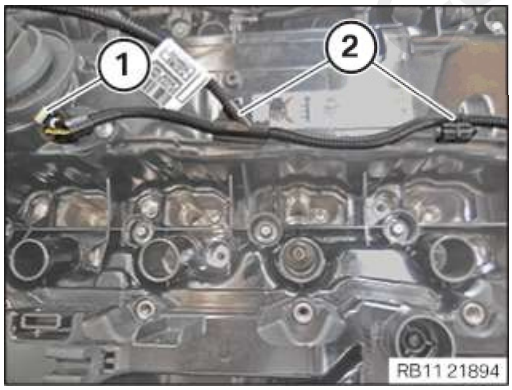
6X18		Tightening torque	6 Nm



- Secure clamps (1).



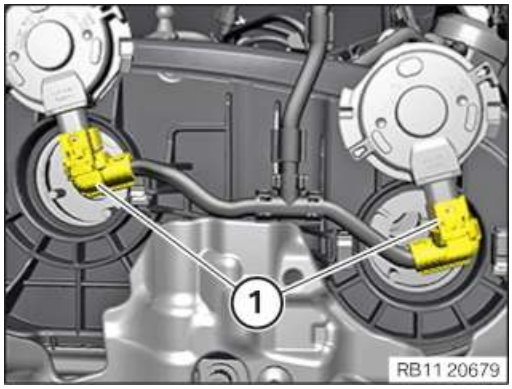
- Secure clamps (1).



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

69 – Installing both actuators

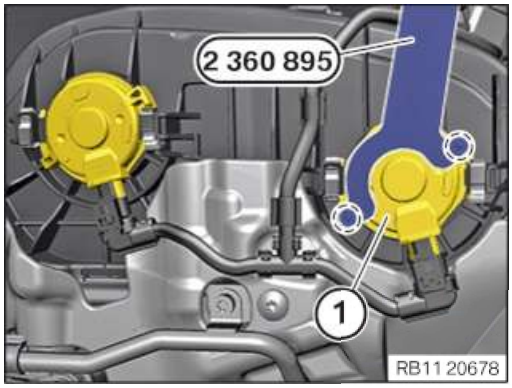
carmanualsdiagn.com



NOTICE

The figure shows the rear side of the engine.

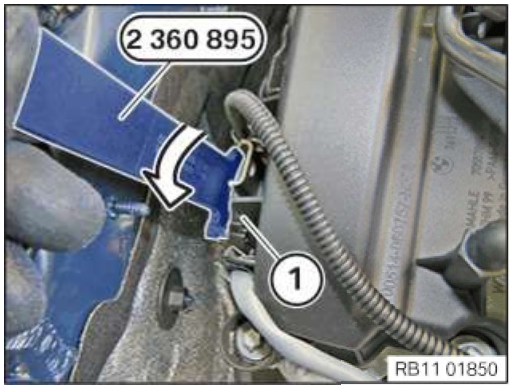
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



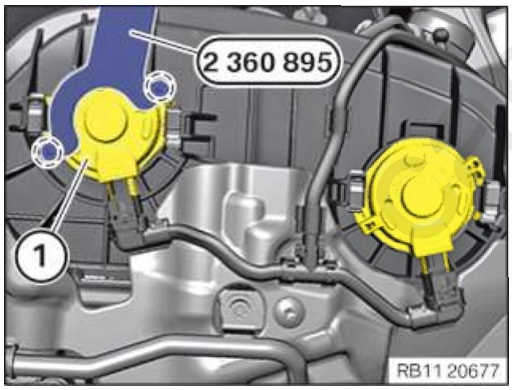
NOTICE

The figure shows the rear side of the engine.

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



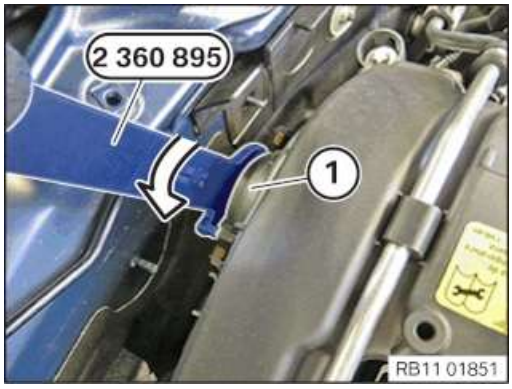
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.



NOTICE

The figure shows the rear side of the engine.

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



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

70 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

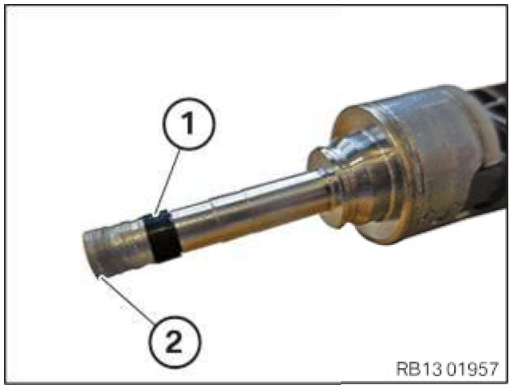
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

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

TECHNICAL INFORMATION

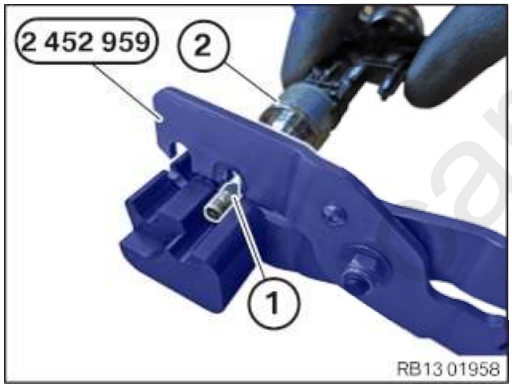
Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

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



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

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



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



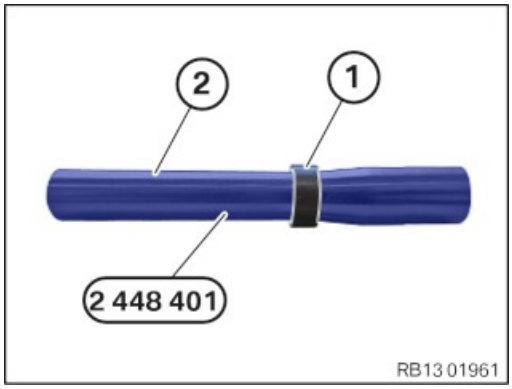
- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

  (1) Installation cone

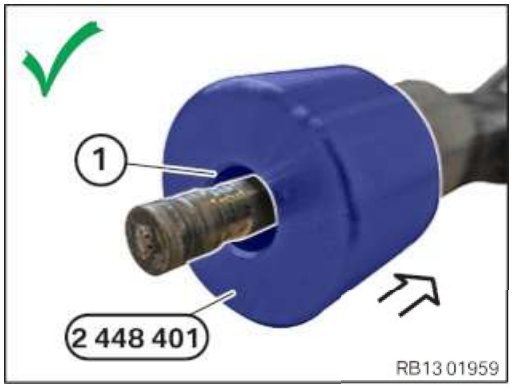
  (2) Sliding sleeve

  (3) Assembly sleeve

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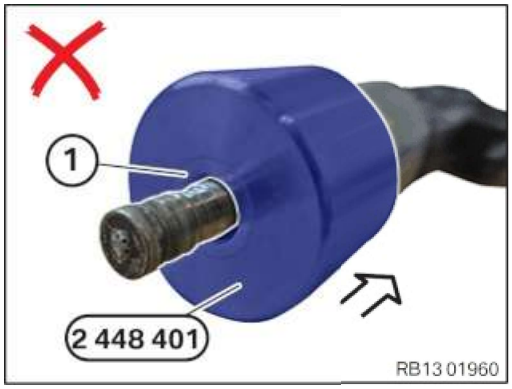


- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



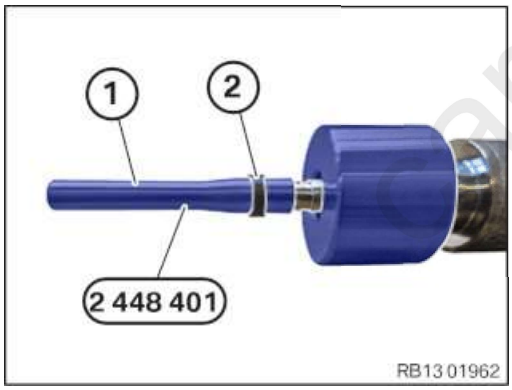
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

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

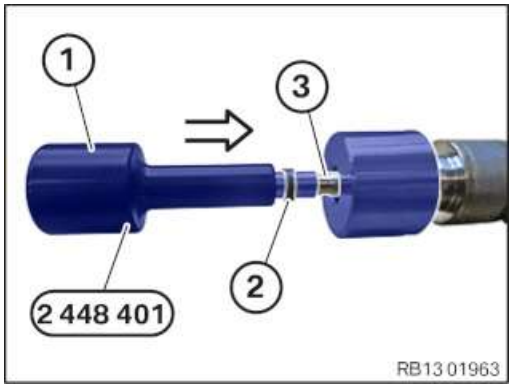


- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

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

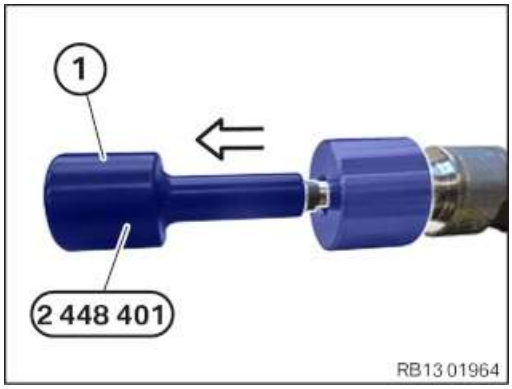


- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .

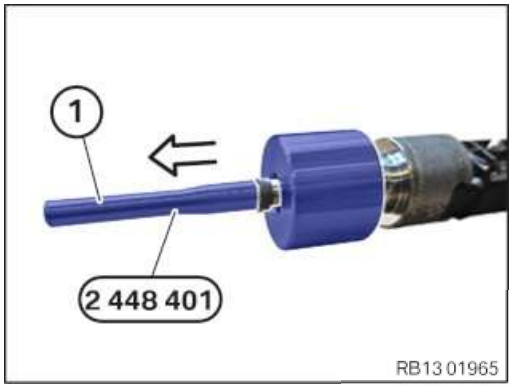


- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.

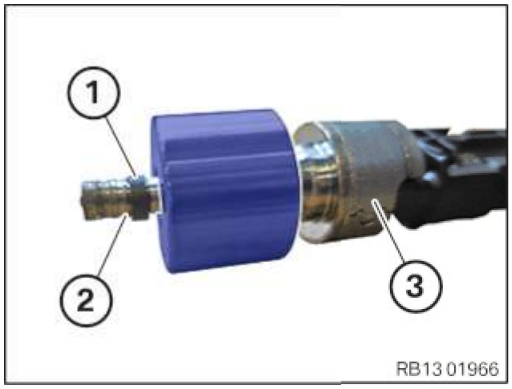
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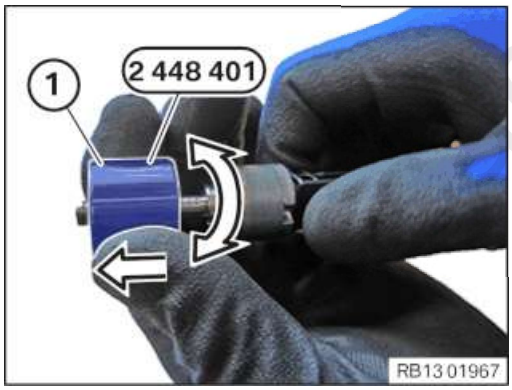
- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



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

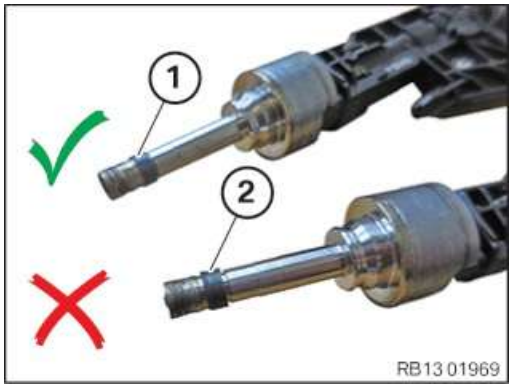


- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.



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

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

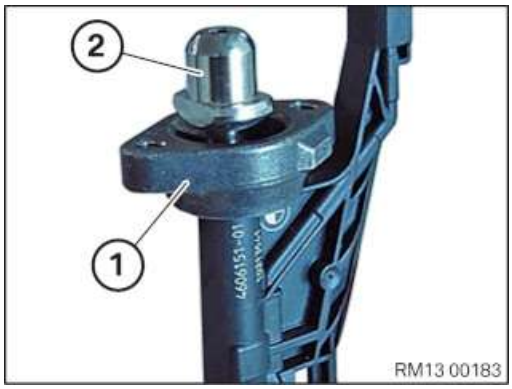


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

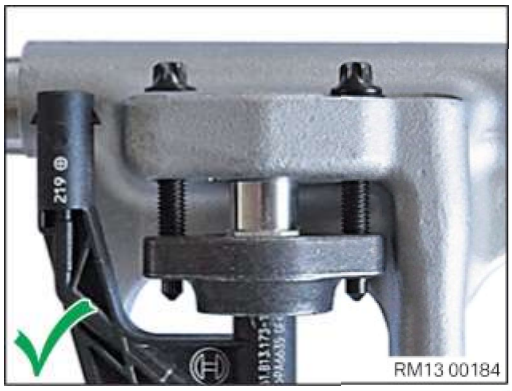
71 – Installing the high-pressure rail with injectors of the cylinders 4 to 6

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.

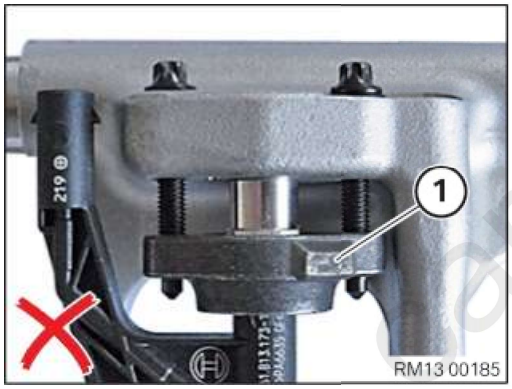


- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder**(1) **has a cast lug**: Make sure that the holder is installed in the correct position.



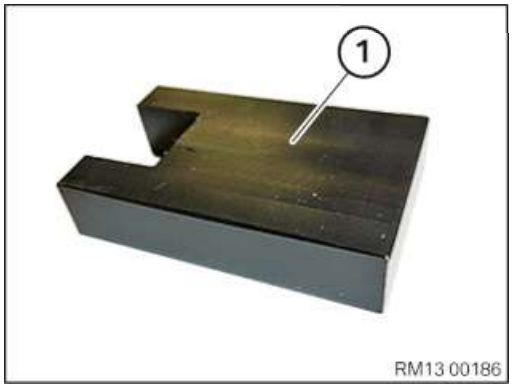
- If applicable, note the position of the cast lug:

  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

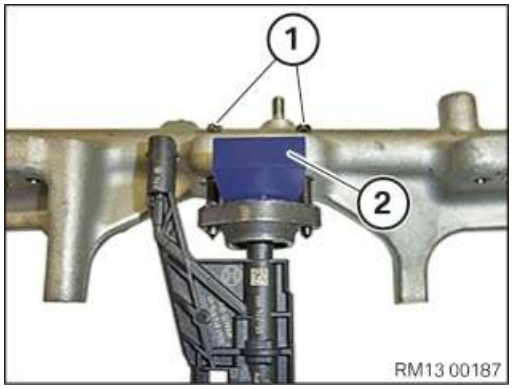
Damage to injectors.

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).

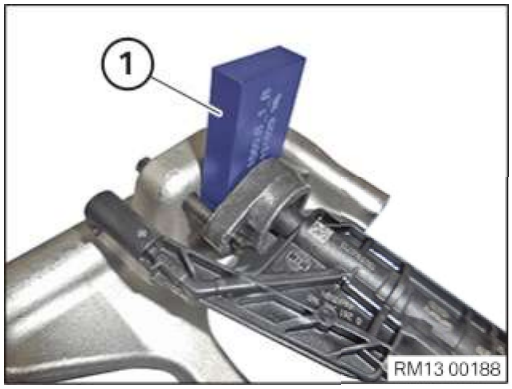
carldiagn.com



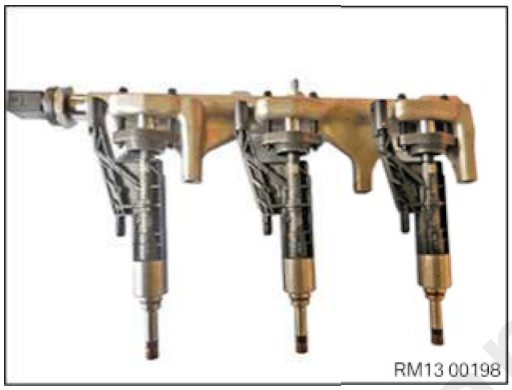
- Replace (M5x30) screws.

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

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



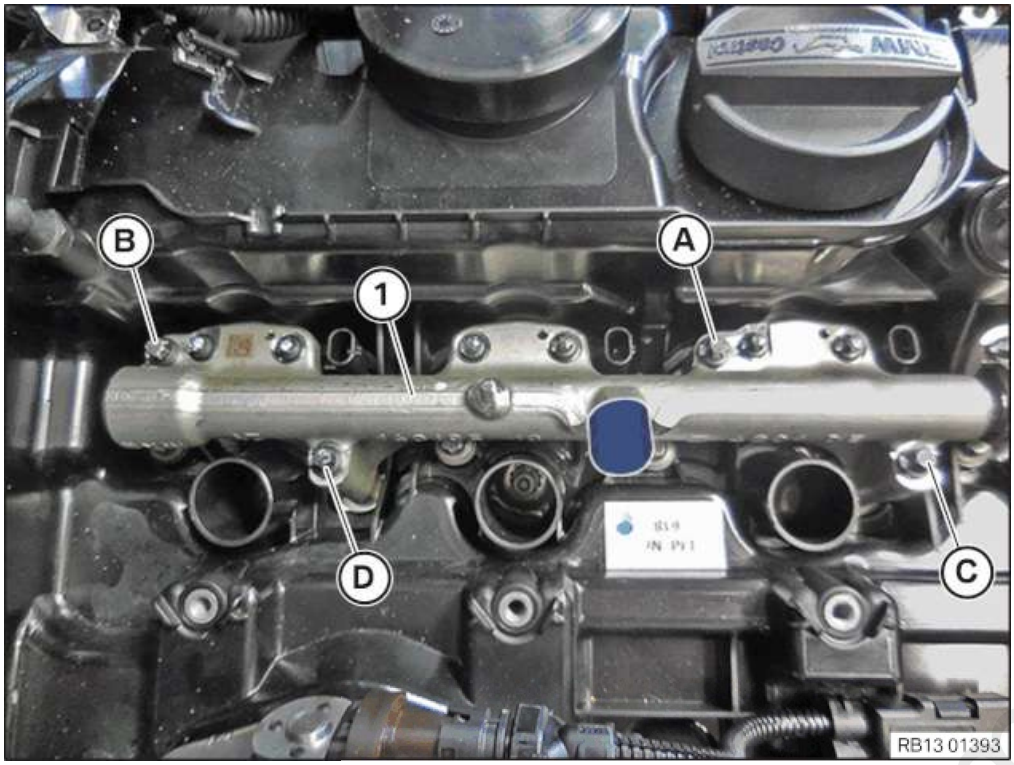
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.



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

  The injectors must move freely.

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- Renew screws (A) to (D).

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

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

TECHNICAL INFORMATION

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

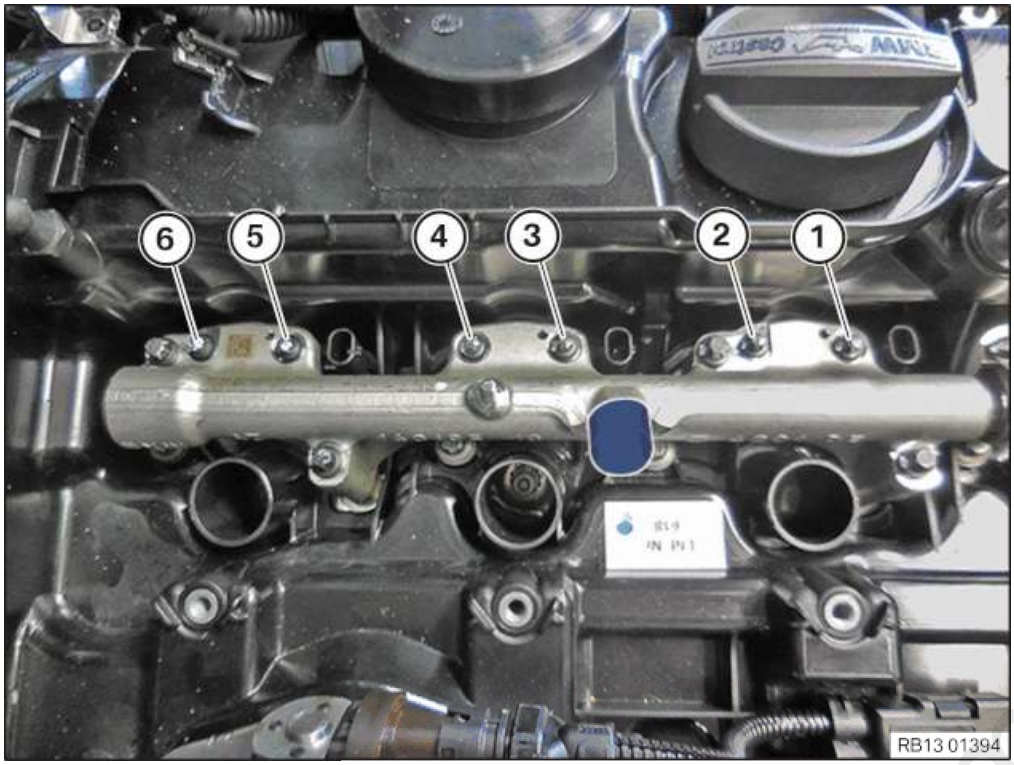
Non-observance of these requirements may result in leaks and damage.

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



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

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- Attach a socket to an extension.

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

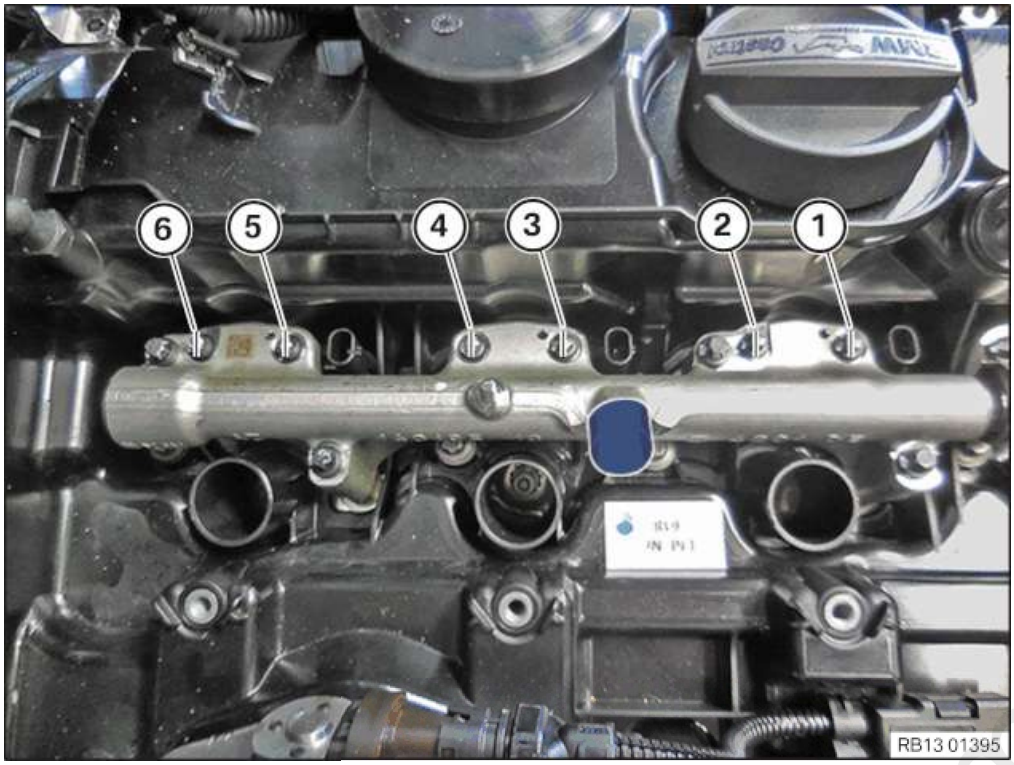
TECHNICAL INFORMATION

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

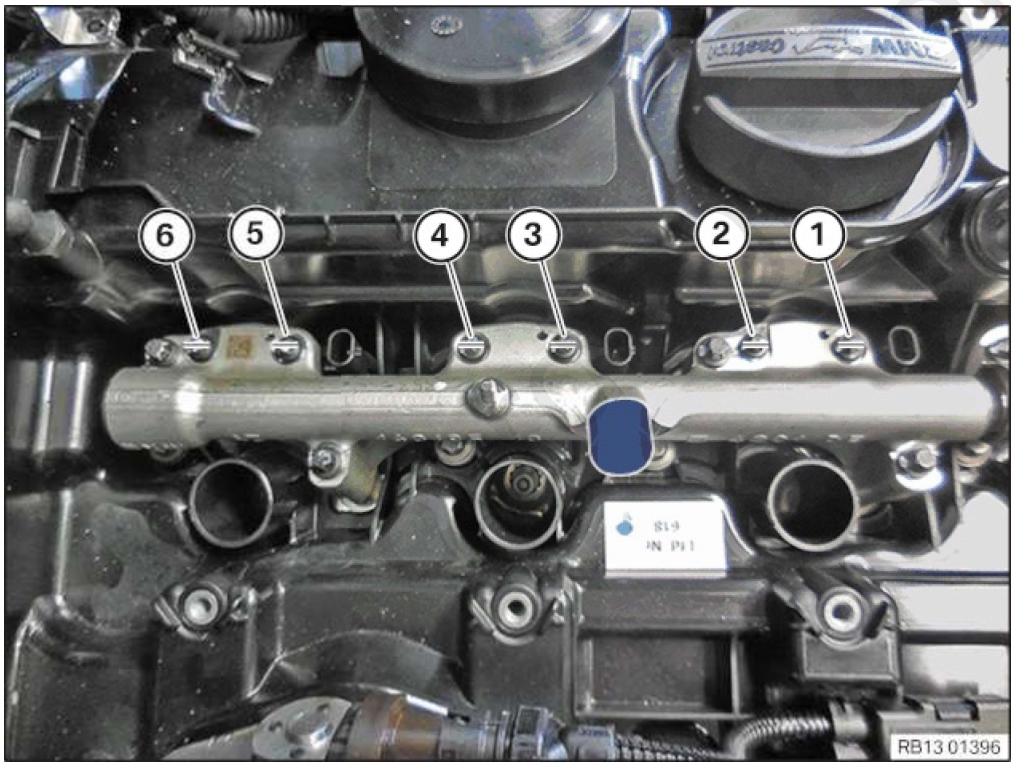
Non-observance of these requirements may result in leaks and damage.

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

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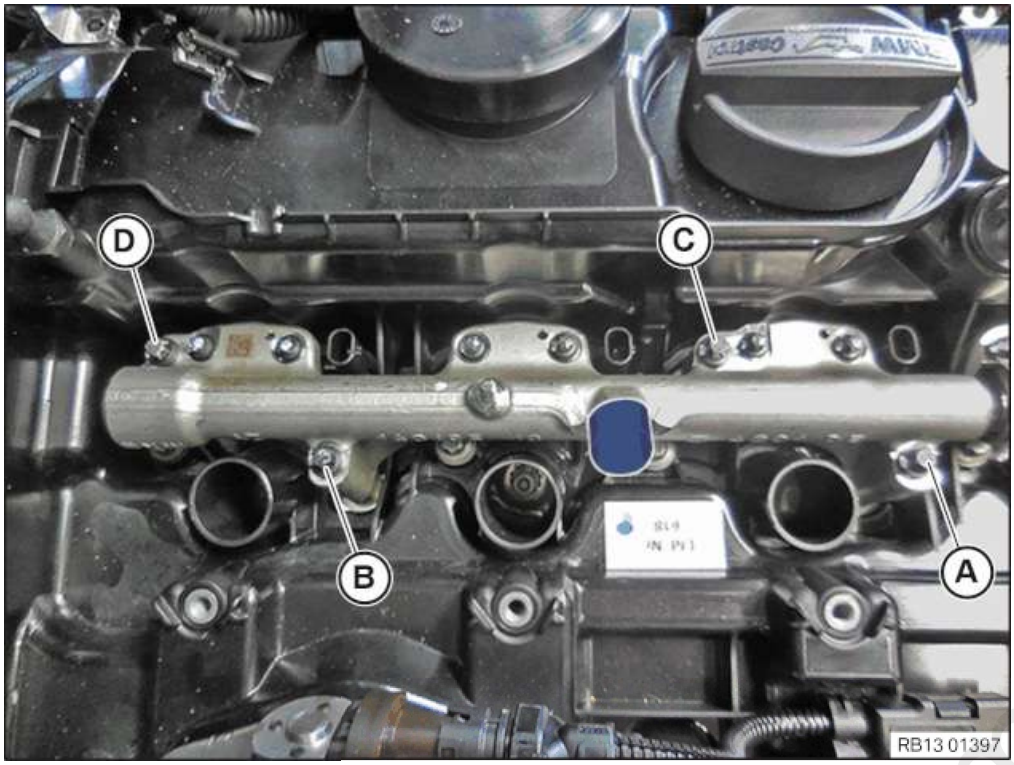


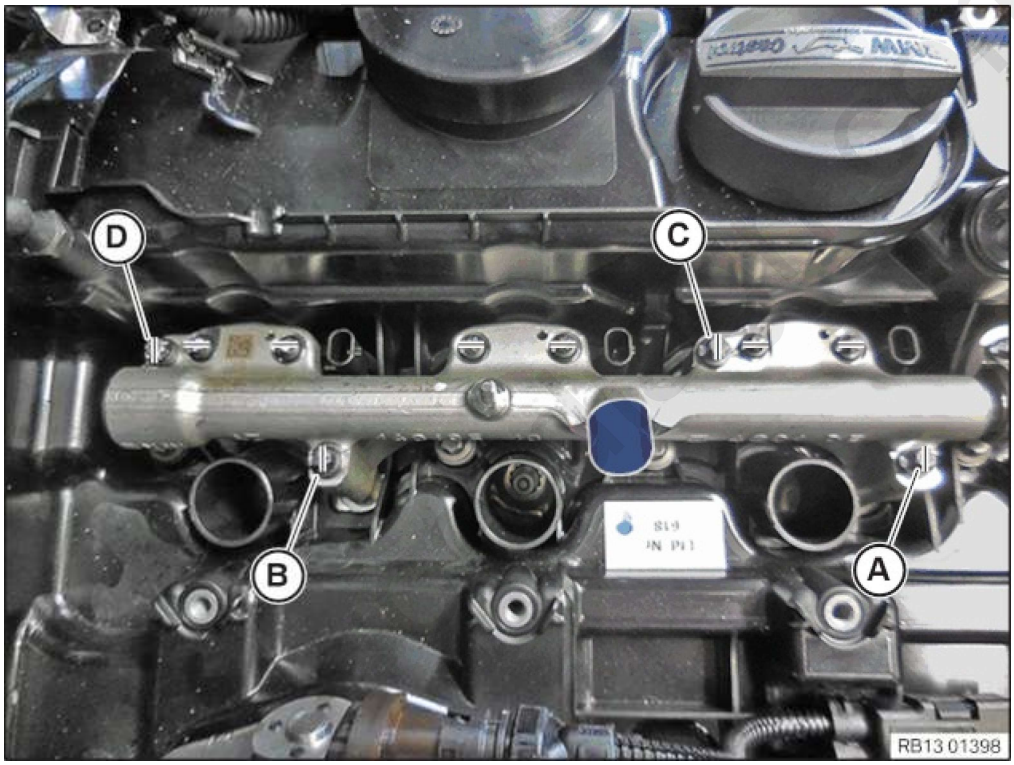
- Mark all bolts (1) to (6) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the screw (1) with an angle of rotation of 90° ±15°.
  - Tighten the screw (2) with an angle of rotation of 90° ±15°.
  - Tighten the screw (3) with an angle of rotation of 90°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



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

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





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

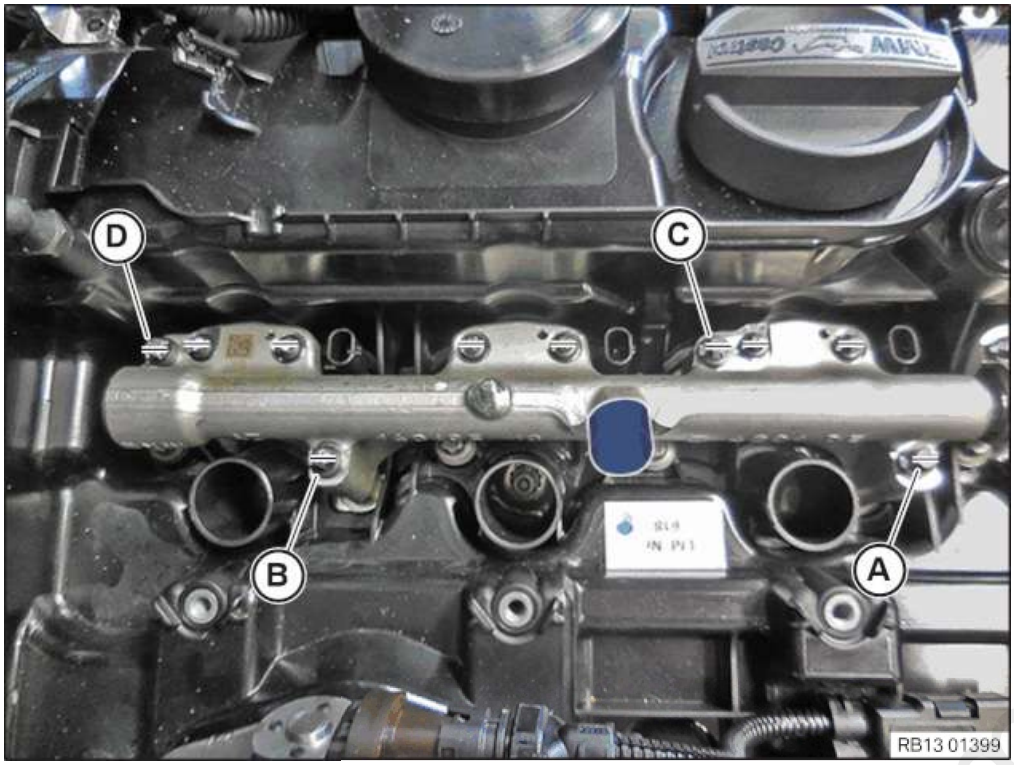
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

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

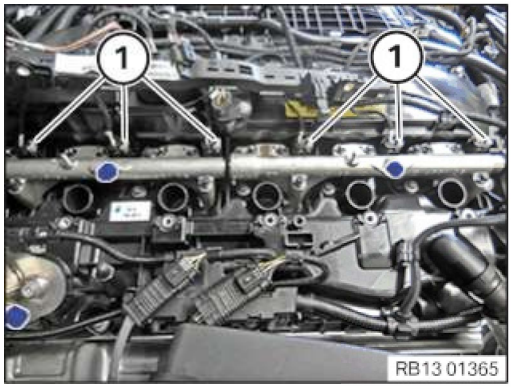
Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.
- Mark all bolts (A) to (D) with a vertical line (see figure).
- Tighten bolts (M6x70) (A) to (D) to a 90° angle of rotation.



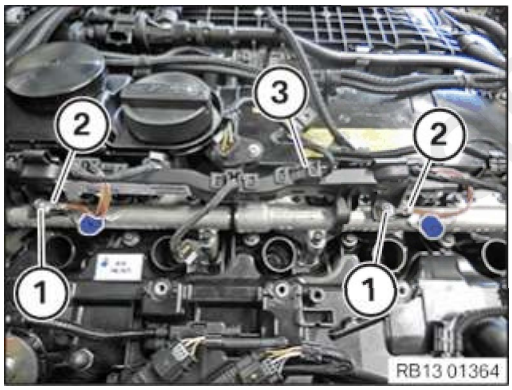
- Check if all bolts (A) to (D) have been tightened with a 90° angle of rotation.

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



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

  All connectors (1) must engage audibly.



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

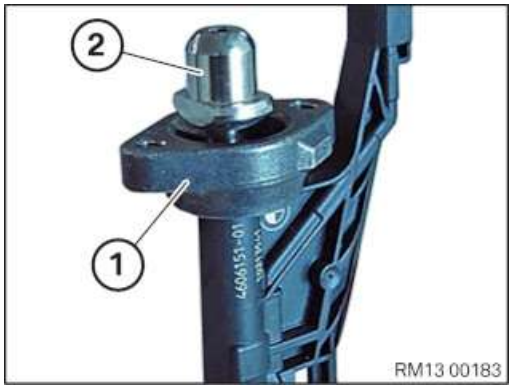
Ground cable to rail

M6			5 Nm

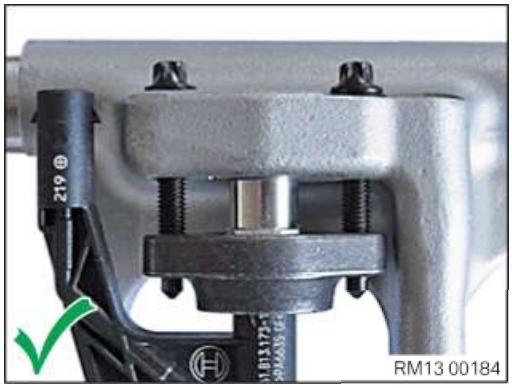
72 – Installing rail with injectors of cylinders 1 to 3

TECHNICAL INFORMATION

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

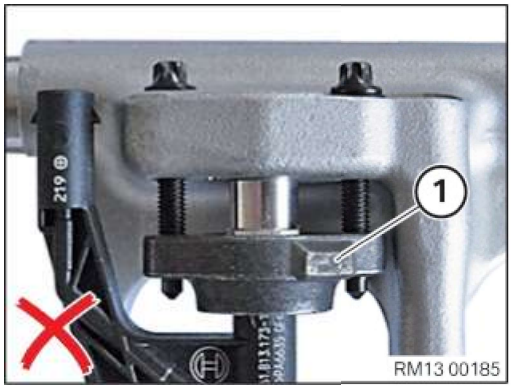


- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If there is a cast lug on the holder** (1) **:** Make sure that the holder is installed in the correct position.



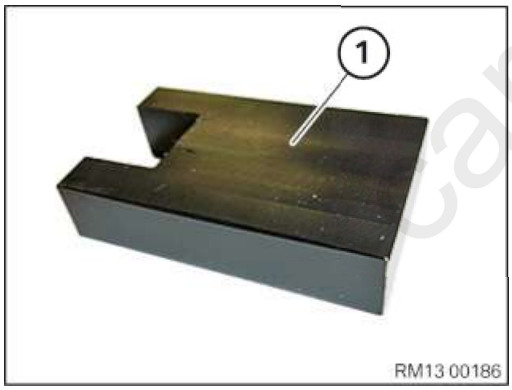
- Observe position of cast lug:

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



- Observe position of cast lug:

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



RISK OF DAMAGE

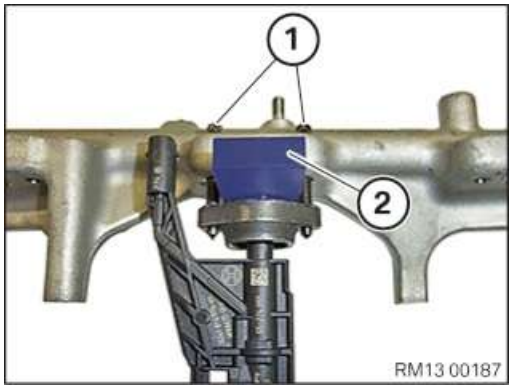
Damage to injectors.

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

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

- Use special tool 2 358 022(1) .

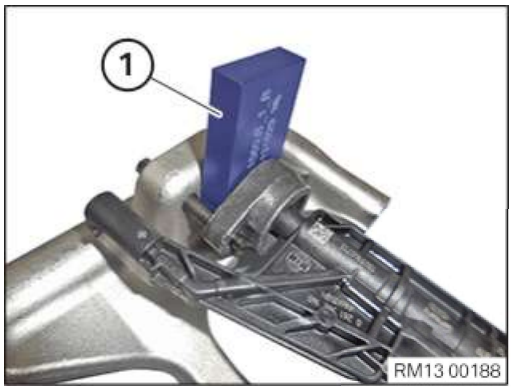
carliagn.com



- Replace (M5x30) screws.

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

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



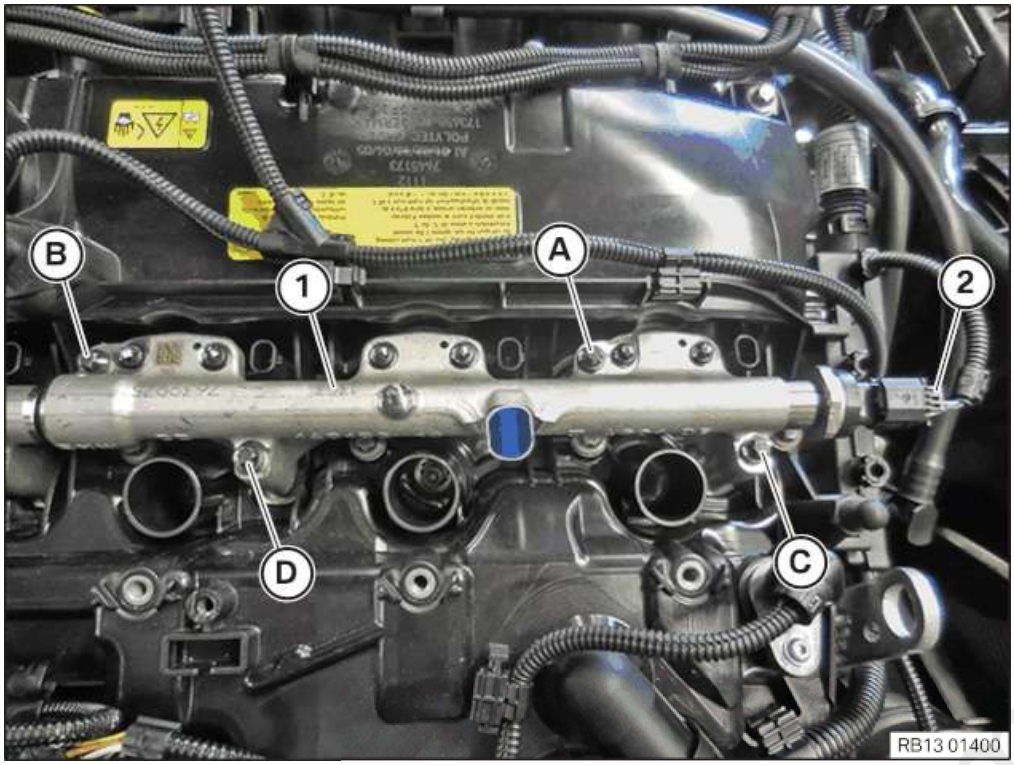
- Remove special tool 2 358 022(1) .
- Repeat this operation for all injectors.



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

  The injectors must move freely.

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- Renew screws (A) to (D).

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

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

TECHNICAL INFORMATION

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

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

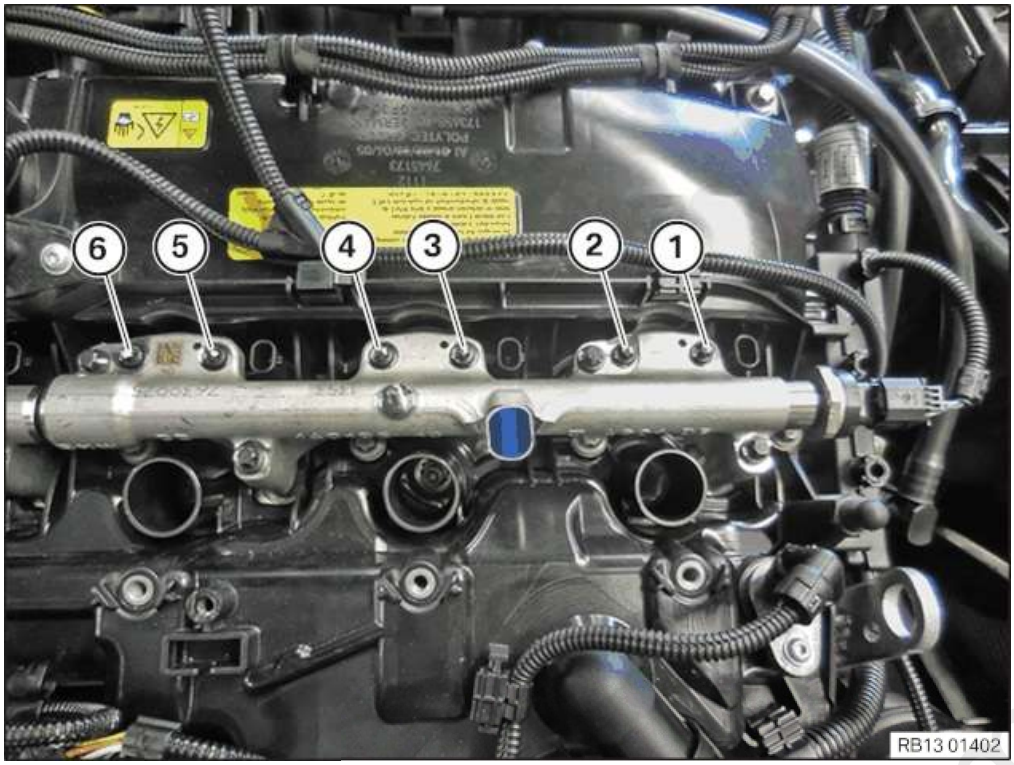
- Tighten screw (A) to 5 Nm.
- Tighten screw (D) to 5 Nm.
- Tighten screw (B) to 5 Nm.
- Tighten screw (C) to 5 Nm.
- Connect and lock the connector (2).

  The connector (2) must engage audibly.



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

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- Attach a socket to an extension.

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

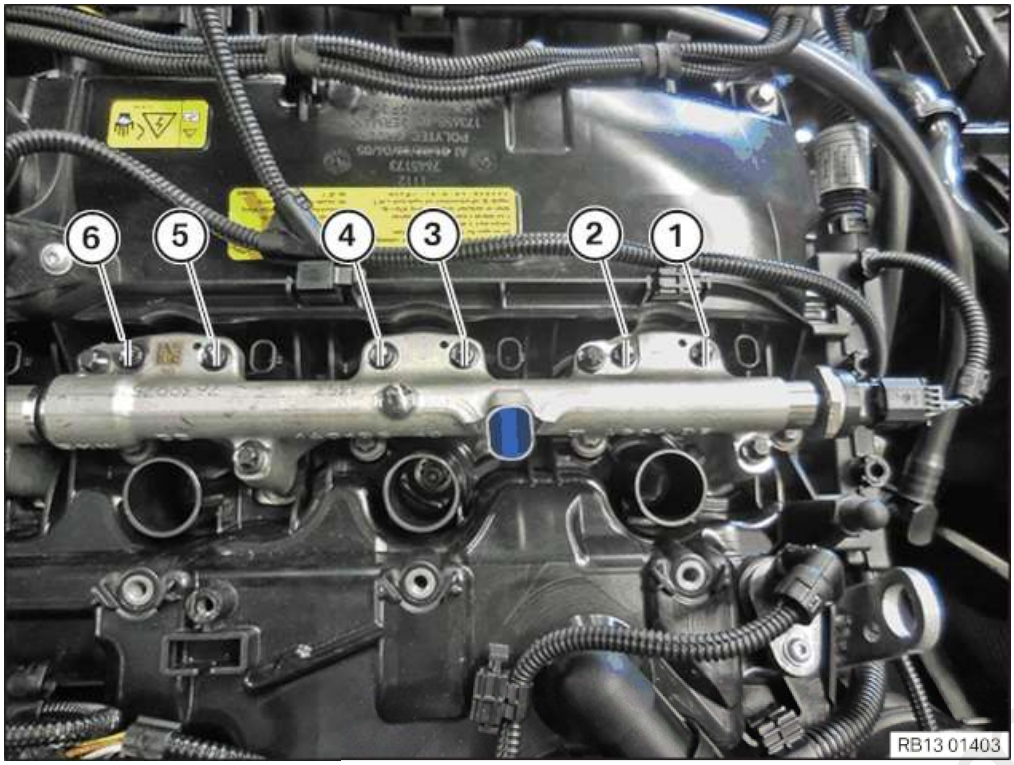
TECHNICAL INFORMATION

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

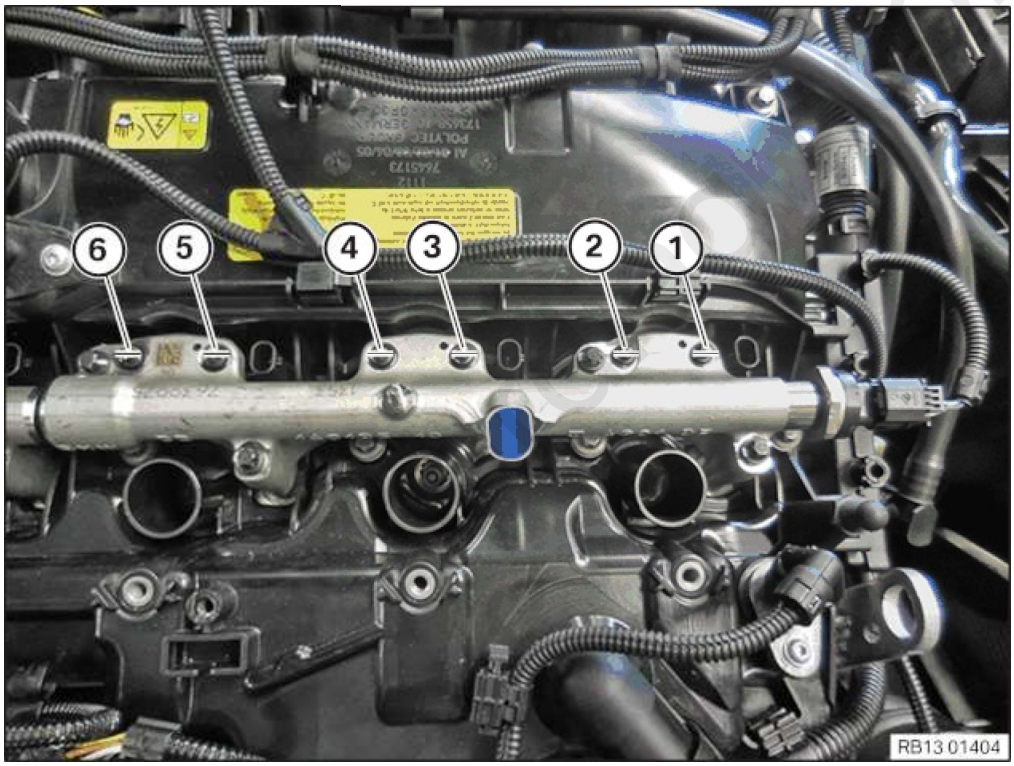
Non-observance of these requirements may result in leaks and damage.

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

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



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

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



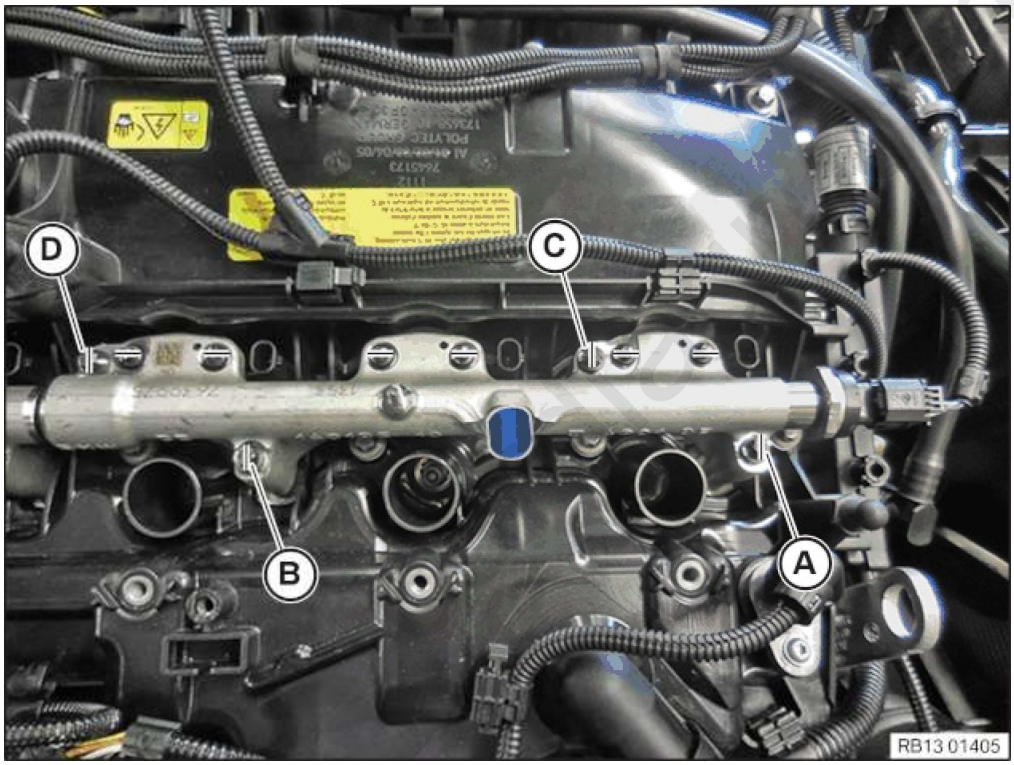
- Release screws (M6x70) (A) to (D) **without fail**.

TECHNICAL INFORMATION

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

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

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

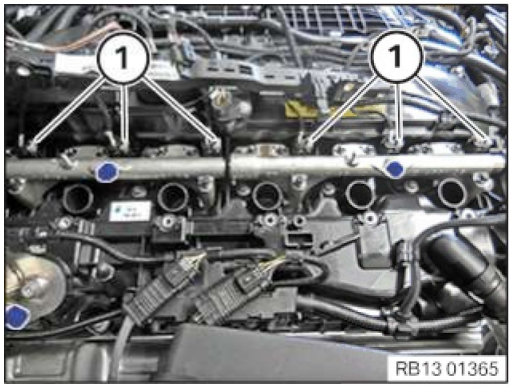


- Mark all the bolts (A) to (D) with a vertical line (see Figure).
- Tighten bolts (M6x70) (A) to (D) with an angle of rotation of 90°.



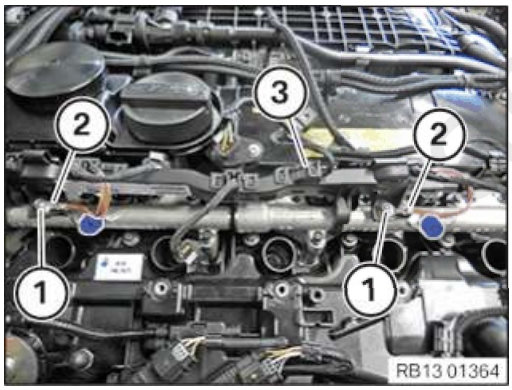
- Check whether all screws (A) to (D) have been tightened with an angle of rotation of 90°.

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



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

  All connectors (1) must engage audibly.

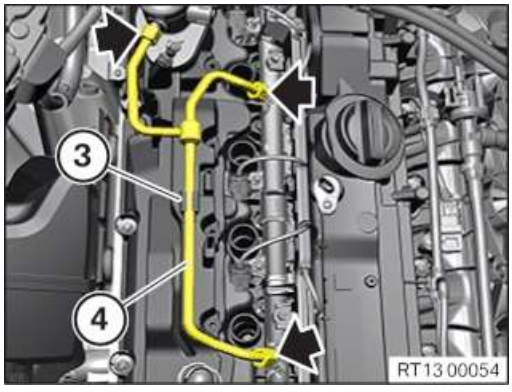


- Thread the cable channel (3) in and install.
- Thread in ground cable (2) and install.
- Tighten nuts (1).

Ground cable to rail

M6			5 Nm

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

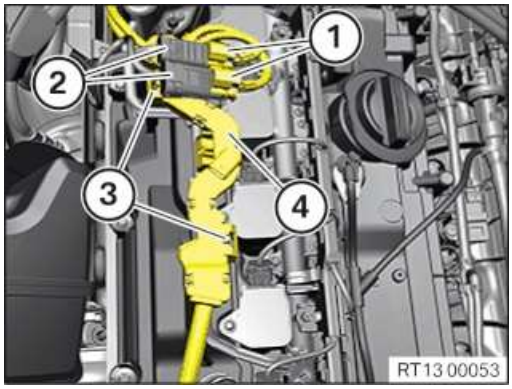


- Insert the high pressure line (4) into the holder (3) and install.
- Tighten union nuts (arrows) with the special tool .

High pressure line between rail and high pressure pump

M14x1,5		Tightening torque	33 Nm

rdiagn.com



- Insert and install the wiring harness section of the engine wiring harness (4).

  The locks (3) must engage audibly.
- Connect connectors (1) and (2) and lock.

  The connectors (1) and (2) must audibly engage.

74 – Install high pressure pump

RISK OF DAMAGE

Damage to the engine.

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

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

TECHNICAL INFORMATION

Only G05 and G07

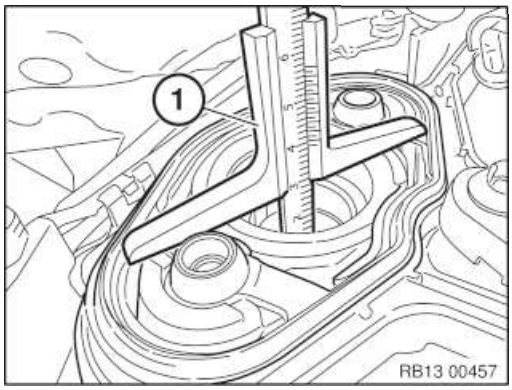
In vehicles with active anti-roll bar (ARS) the fan cowl must be removed in order to spin the engine.

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

TECHNICAL INFORMATION

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

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



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

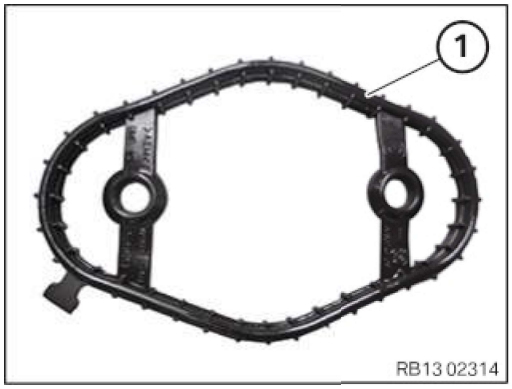
  The depth gauge (1) is in the deepest position.



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



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket



TECHNICAL INFORMATION

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

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



TECHNICAL INFORMATION

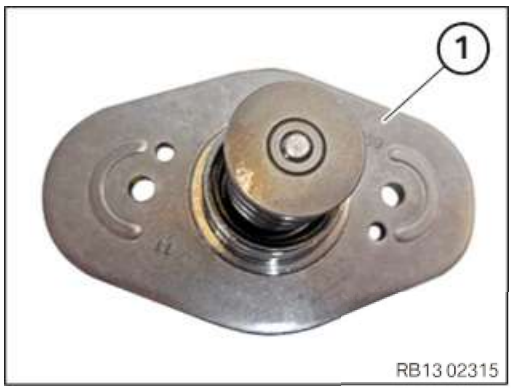
The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).

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



RISK OF DAMAGE

Damage to the surface.

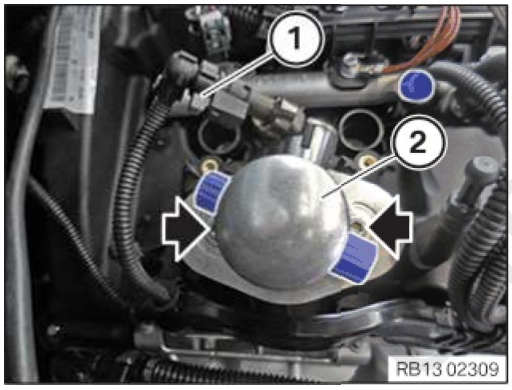
The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

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

- Clean sealing surface (1).



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

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

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

High pressure pump to high pressure pump flange

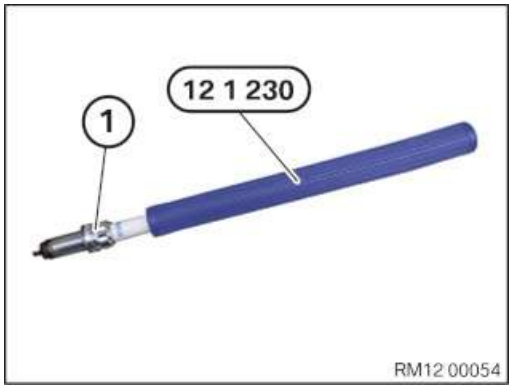
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

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

75 – 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

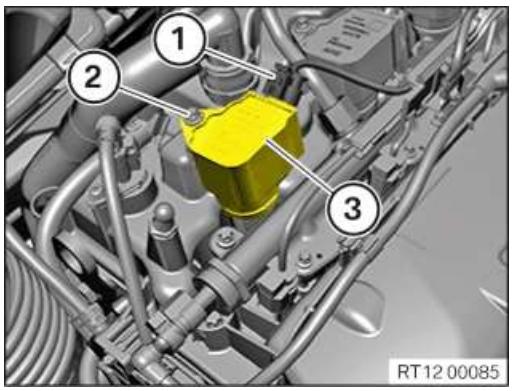
M12x1.25		Tightening torque	23 Nm

76 – Install all ignition coils

NOTICE

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

▶ **Install ignition coil.**



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

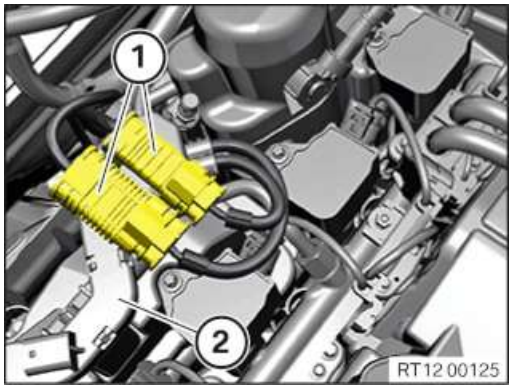
Ignition coil

Screw		Tightening torque	8 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

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

77 – Install catalytic converter



- Renew the V-clip (1).

  Parts: V-band clamp



- Renew the gasket (1).

  Parts: Gasket



- Feed in and install catalytic converter.
- Lock clamp (1).

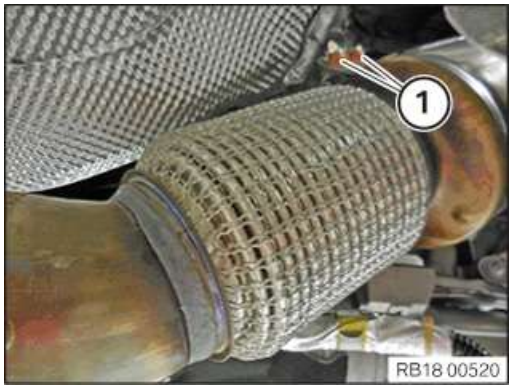
  The clamp (1) must engage audibly.



- Tighten V-band clamp (1).

Catalytic converter to turbocharger

V-band clamp	Replace V-band clamp.	Tightening torque	19 Nm



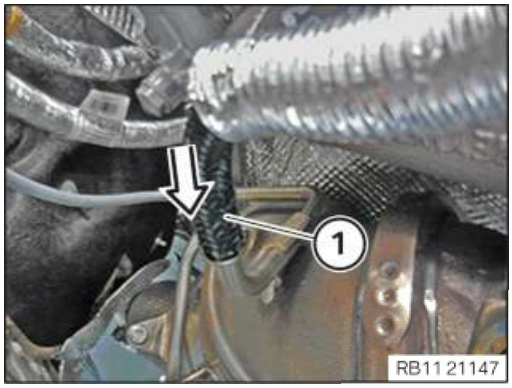
- Renew nuts (1).

  Parts: Nuts

- Tighten nuts (1).

Catalytic converter to holder

M8 nut	Renew nut.	Tightening torque	28 Nm



- **If installed: Connect pressure hose.**

  Renew pressure hose (1).

  Parts: Pressure hose

- Connect the pressure hose (1) in direction of arrow to the limit position.

78 – Install the monitoring oxygen sensor

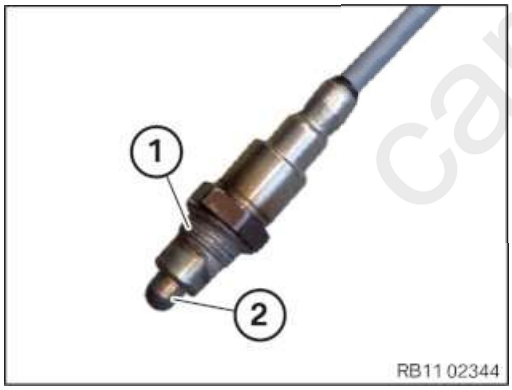
TECHNICAL INFORMATION

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

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

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

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



- Prepare the oxygen sensor.

  Do not damage the sensor ceramics.

  (1) = Thread

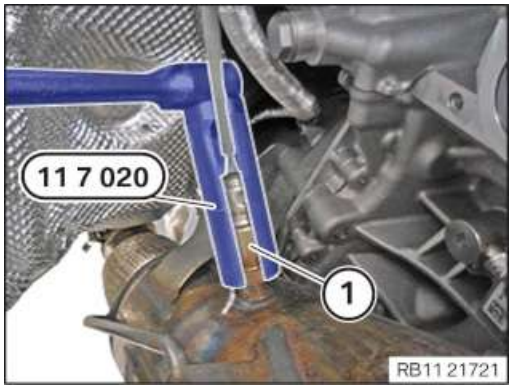
  (2) = Sensor ceramics

- Grease the thread (1) of the Lambda monitoring oxygen sensor thinly and evenly.

Expendable materials

Brake block paste * TU = Trade Unit. TU numbers cannot be ordered! For invoicing purposes only.	3 g, Bag	83192158851
	100 g, Tube	83192158852
	5 g, TU*	83230140233

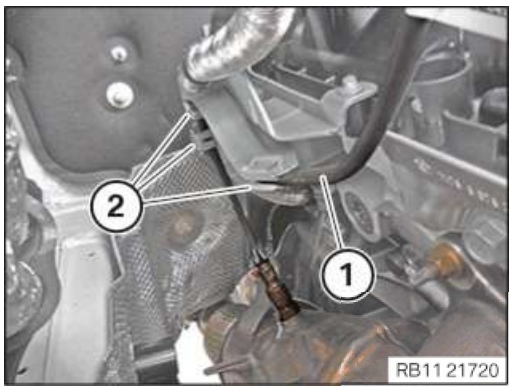
cardiagn.com



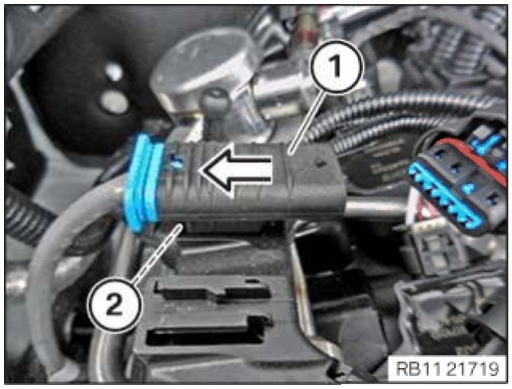
- Feed in the monitoring oxygen sensor (1) and install.
- Tighten monitoring oxygen sensor (1) using special tools 0 493 751 (11 9 150) and 0 491 075 (11 7 030) .

Monitoring oxygen sensor to catalytic converter

M18X1.5		Tightening torque	50 Nm



- Guide monitoring oxygen sensor line (1) into holder (2) and install it.



- Insert and install the connector (1) in the **direction of arrow**.
- Ensure that the lock (2)engages audibly.



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

79 – Install the front oxygen sensor

TECHNICAL INFORMATION

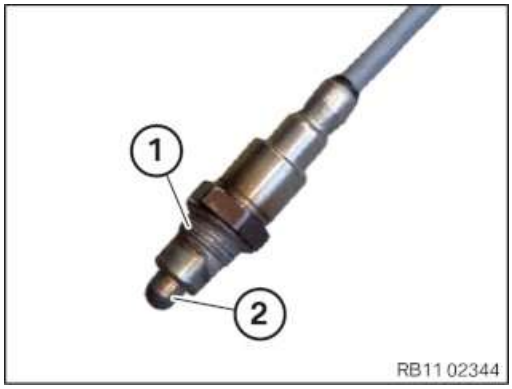
New oxygen sensors are to be greased lightly and evenly on the thread.

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

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

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

fordiagn.com



- Prepare the oxygen sensor.

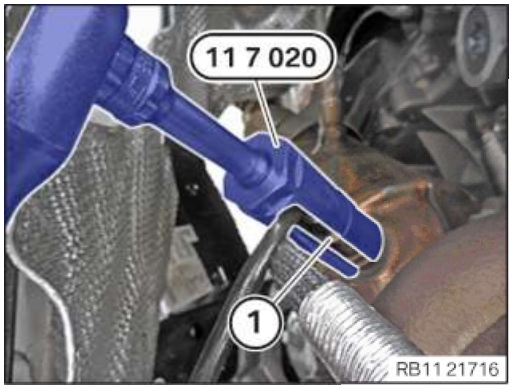
  Do not damage the sensor ceramics.

  (1) = Thread

  (2) = Sensor ceramics
- Apply a thin and even coat of grease to the thread (1) of the front oxygen sensor.

Expendable materials

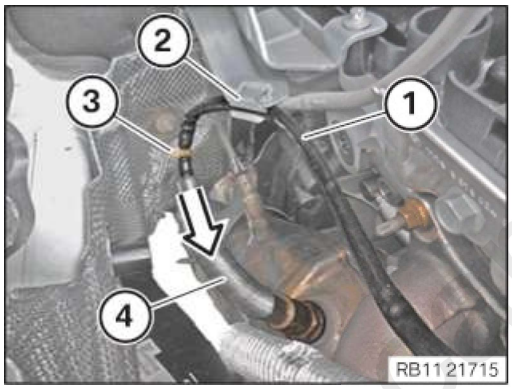
Brake block paste * TU = Trade Unit. TU numbers cannot be ordered! For invoicing purposes only.	3 g, Bag	83192158851
	100 g, Tube	83192158852
	5 g, TU*	83230140233



- Screw the control sensor (1) in and tighten it with the special tool .

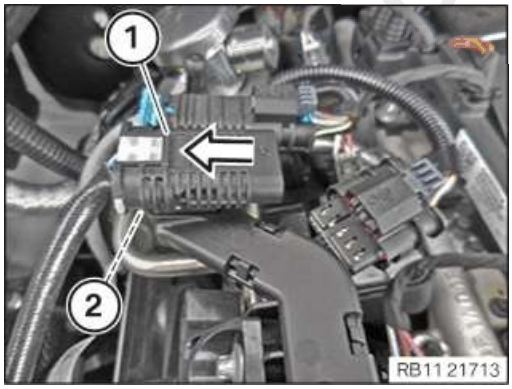
Front oxygen sensor to catalytic converter

M18X1.5		Tightening torque	50 Nm



- Guide in the heat protection (4) in the **direction of arrow** and install.
- Renew the cable straps (3).

  Parts: Cable strap
- Guide in and install the cable strap (3).
- Feed in and install the line of the front oxygen sensor (1) in the holder (2).



- Insert and install the connector (1) in the **direction of arrow**.
- Ensure that the lock (2)engages audibly.



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

80 – Installing the intake plenum

RISK OF DAMAGE

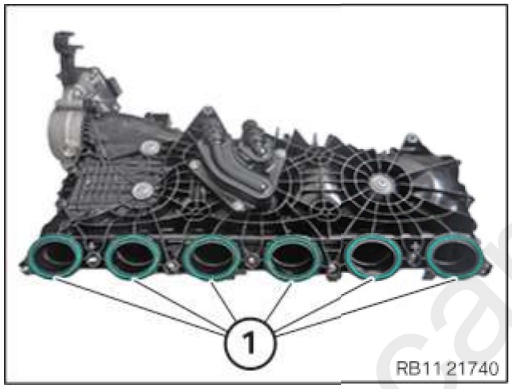
Improper routing of cables and wiring harnesses.

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

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

TECHNICAL INFORMATION

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



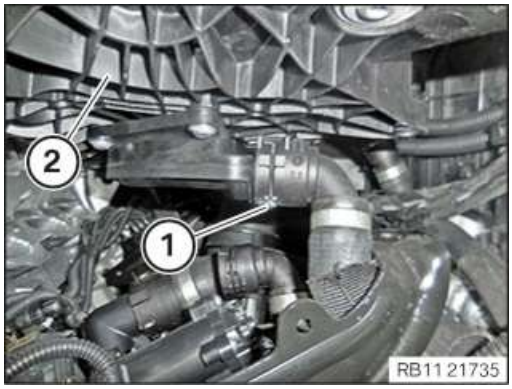
- Renew gaskets (1).

  Parts: Seals

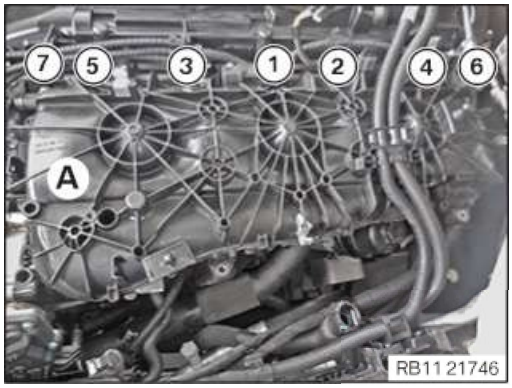


- Clean contact surface (1).

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- Feed in and position intake plenum (2).
- Connect and lock coolant line (1).
- Make sure that the cooling line (1) engages audibly.



TECHNICAL INFORMATION

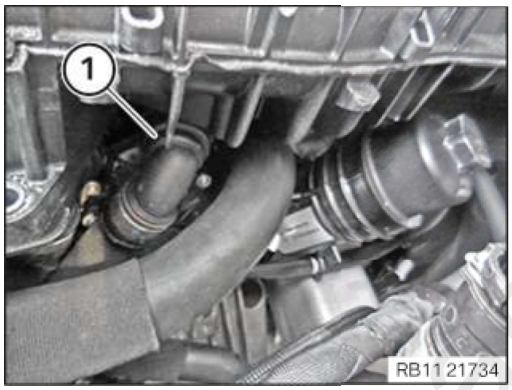
Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Position the intake plenum (A).
- Tighten screws in the order (1) to (7).

Note: Tighten the bolts in 360 degree steps.

Intake plenum to cylinder head

M6		Tightening torque	10 Nm



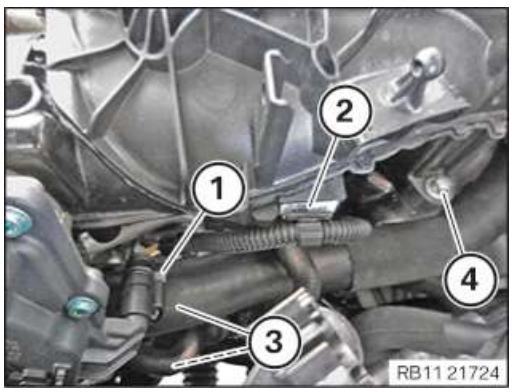
- Connect and lock coolant line (1).
- Make sure that the cooling line (1) engages audibly.



- Tighten down screw 1.

Intake plenum to support

M6X25		Tightening torque	8 Nm



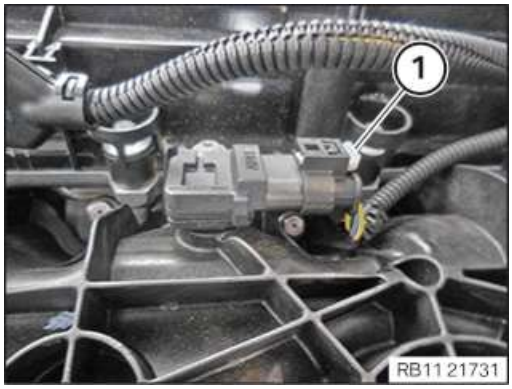
- Tighten down screw (4).

Intake plenum to support

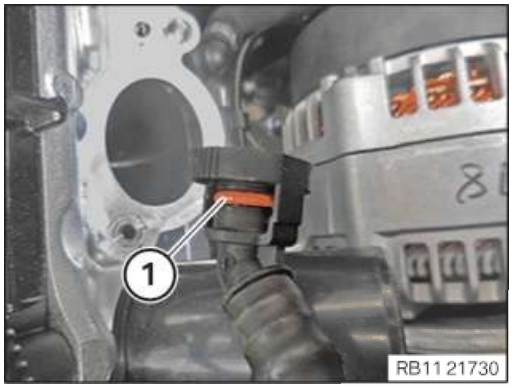
M6X25		Tightening torque	8 Nm

- Thread in and install coolant line (3).
- Secure clamps (2).
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.

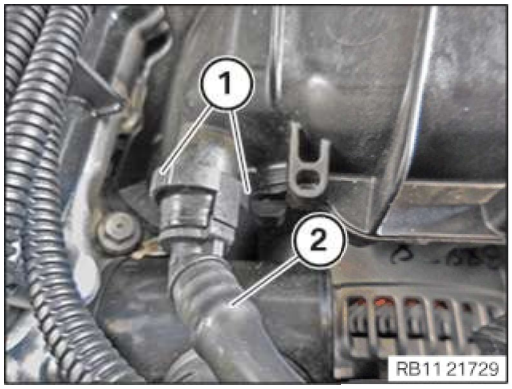
fordiagn.com



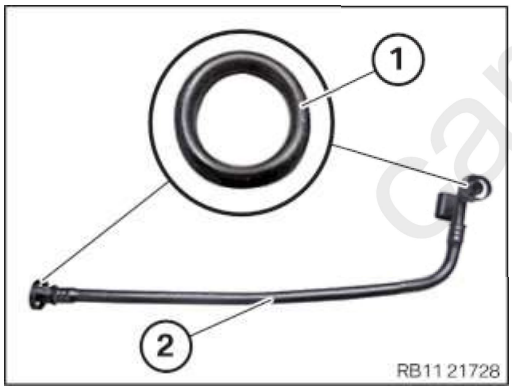
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.



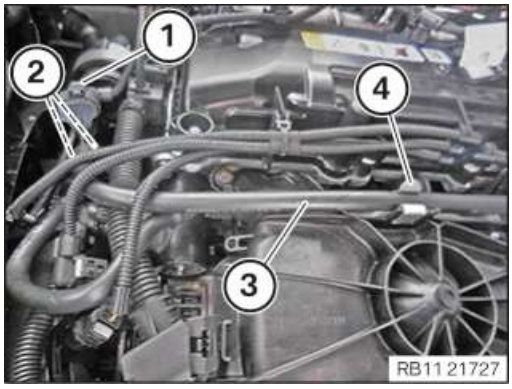
- Check sealing ring (1) for damage and renew tank ventilation line if necessary.



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

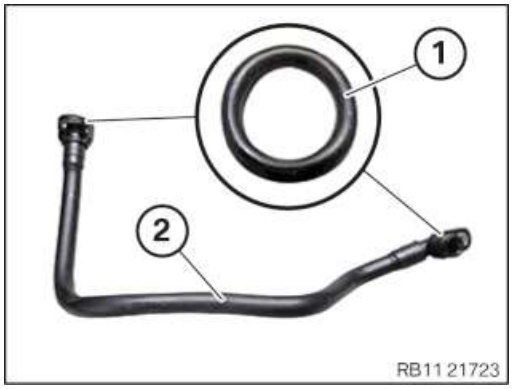


- Check sealing ring (1) for damage and renew tank ventilation line (2) if necessary.

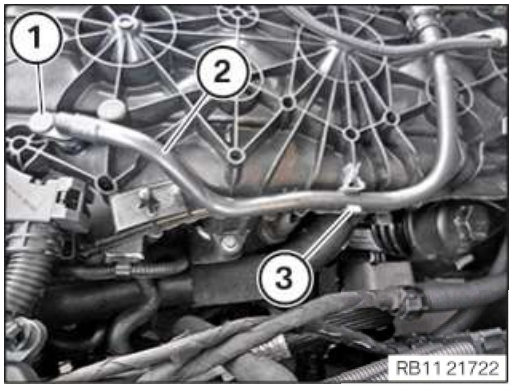


- Insert and install the tank ventilation line (3).
- Ensure that the locks (2) engage audibly.
- Secure the tank ventilation line (3) to the clamp (4).
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.

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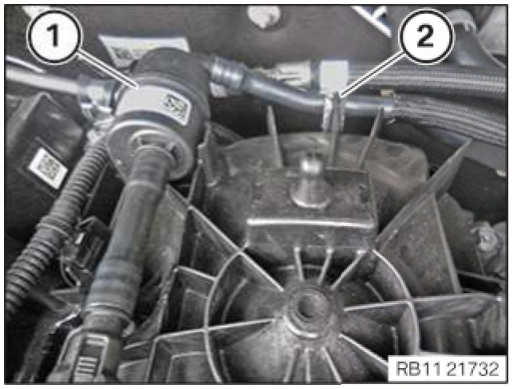
- Check sealing ring (1) for damage and renew tank ventilation line (2) if necessary.



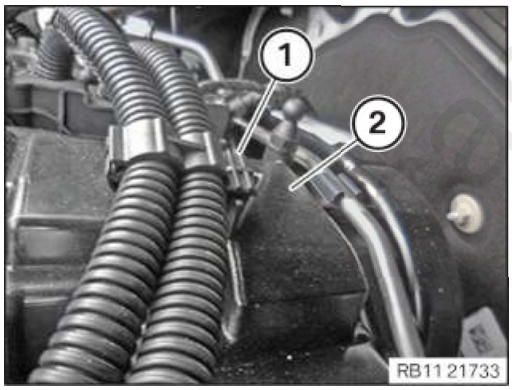
- Insert and install the tank ventilation line (2).
- Secure the tank ventilation line (2) to the clamp (3).
- Tighten down screw (1).

Tank ventilation line to intake plenum

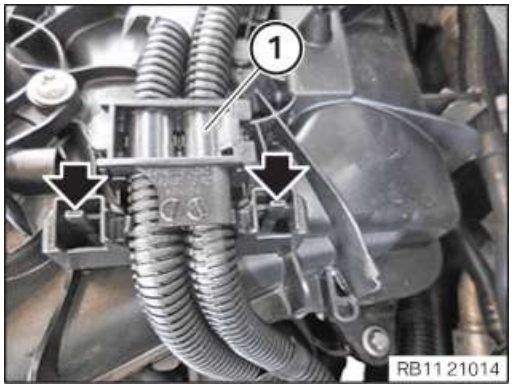
Oval-head screw		Tightening torque	3 Nm



- Insert and install the tank ventilation line (1).
- Secure the tank ventilation line (1) to the clamp (2).



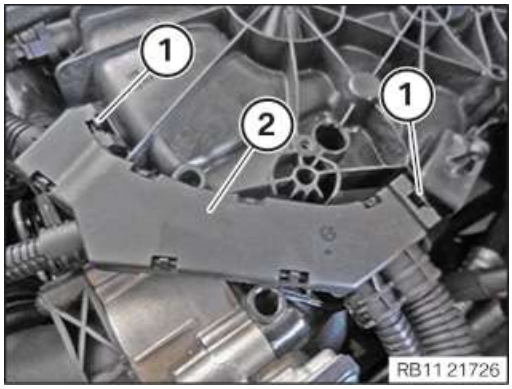
- Secure the wiring harness section(1) for the injectors and ignition coils on the cylinder head cover (2).



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

  The locks (arrows) must engage audibly.

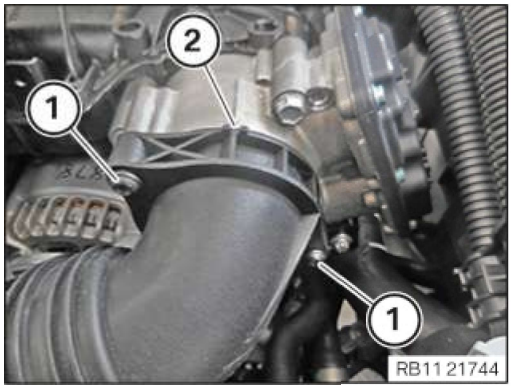
carfdiagn.com



- Feed in and install wiring harness section (2) for sensor system **2**.
- Ensure that the locks (1) engage audibly.



- Check the sealing ring (1) for damage and renew the sealing ring (1) as needed.

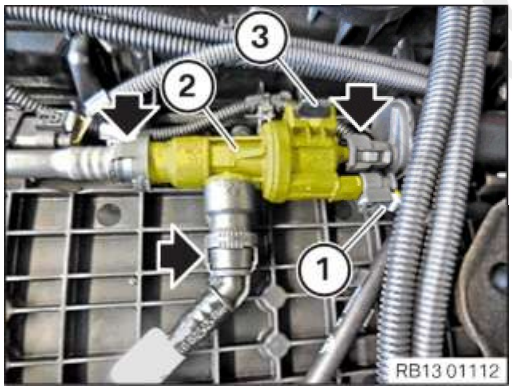


- Insert and install charge air line (2).
- Tighten the screws (1).

Charge air line to throttle valve

M6x30		Tightening torque	8 Nm

81 – Installing the tank vent valve



- Secure the tank vent valve (2) to the holder (3).
- Connect and lock the tank ventilation lines (arrows).

  The tank ventilation lines (arrows) must audibly engage.
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

82 – Install engine ventilation line

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

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

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

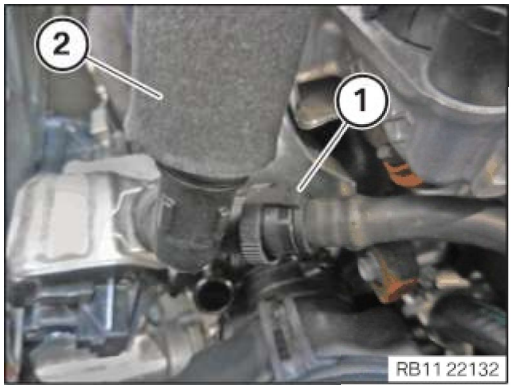
rdiagn.com

TECHNICAL INFORMATION

Check the retaining lug on the connector for damage and perform a tension check as needed.

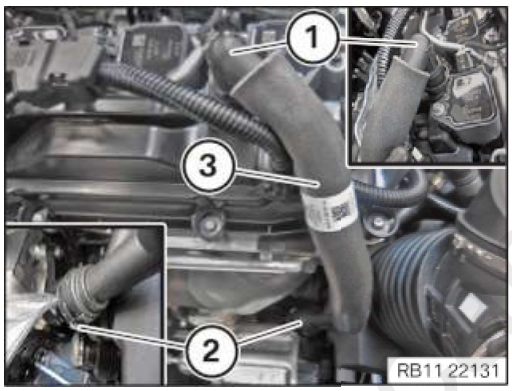


- Check sealing ring (1) for damage and renew tank ventilation line if necessary.

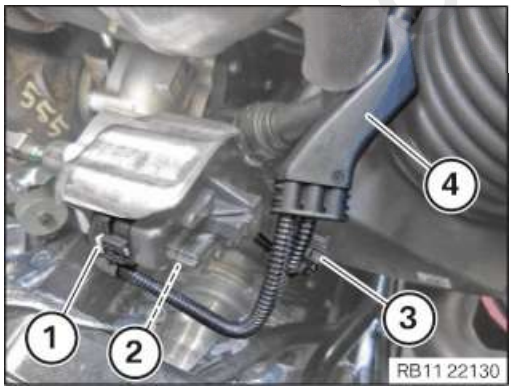


- Insert and position the engine ventilation line (2).
- Insert and install the tank ventilation line (1).

  Tank ventilation line (1) must engage audibly into place.



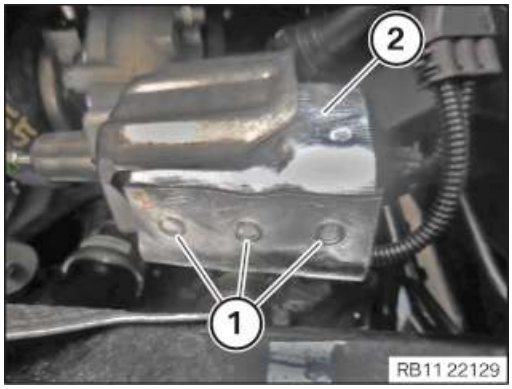
- Insert and install the engine ventilation line (3).
- Make sure you can hear the locks (1) and (2) engage.



- Feed in and position the wiring harness section of sensor system **2** (4).
- Connect connectors (2) and lock.
- Connect connectors (1) and lock.

  The connectors (1) and (2) must audibly engage.
- Secure clamps (3).

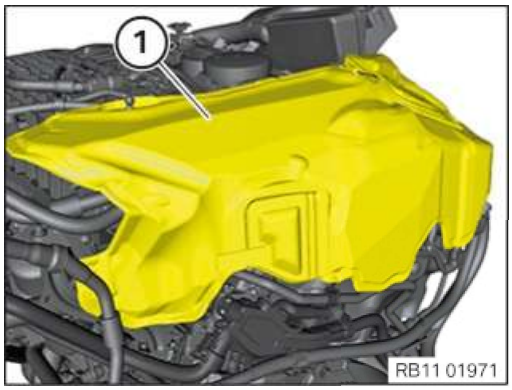
carmanualsdiag.com



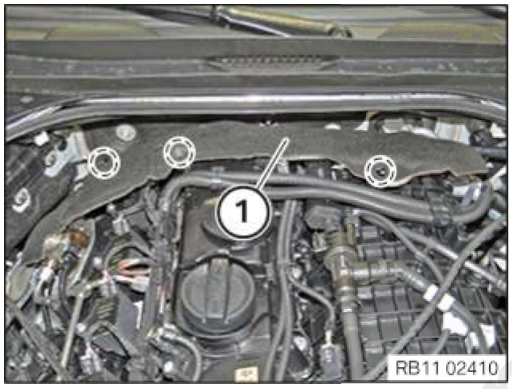
- Feed in and install heat shield (2).
- Lock the locks (1).

  Locks (1) must engage audibly.

83 – 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.

84 – Topping up the engine oil

RISK OF DAMAGE

Damage to the petrol particulate filter.

Vehicles equipped with a petrol particulate filter must be operated with low-ash engine oil only.

- Use BMW Longlife-04 , BMW Longlife-12 FE or BMW Longlife-17 FE+ engine oils or engine oils approved by BMW matching the same specifications only.
- For additional information see: Overview of approved engine oils for BMW Group engines.

RISK OF DAMAGE

Engine damage caused by excessively filling the engine with engine oil.

Filling an excessive quantity of engine oil may cause engine damage.

- Observe the exact engine oil filling capacity.
- Drain the engine oil.

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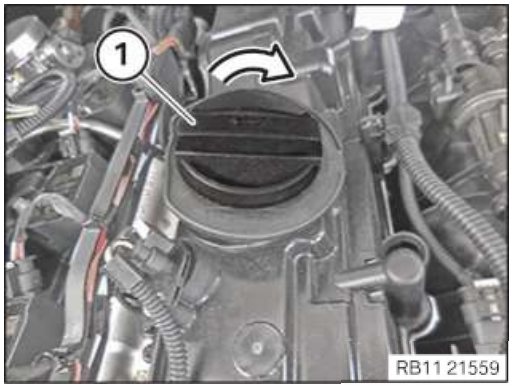
- Pour in engine oil.

Engine oil B58B30M1/B58B30O1

Filling capacity, engine oil change with oil filter element	6,50 l

Engine oil: Technically suitable engine oils for BMW Group engines

85 – Installing the oil filler cap



- Close oil filler cap (1) in direction of arrow.
- Make sure that the sealing cap (1) engages audibly.

86 – Remove engine from assembly stand

CAUTION

Heavy component.

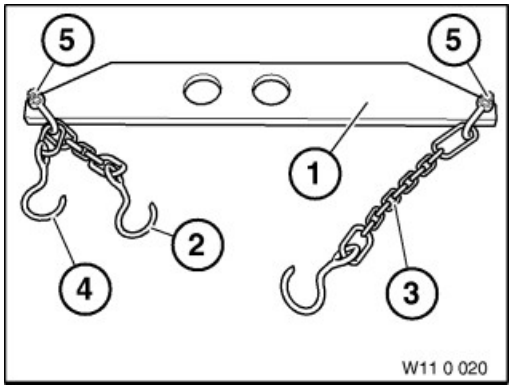
Heavy components can lead to injury or damage.

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

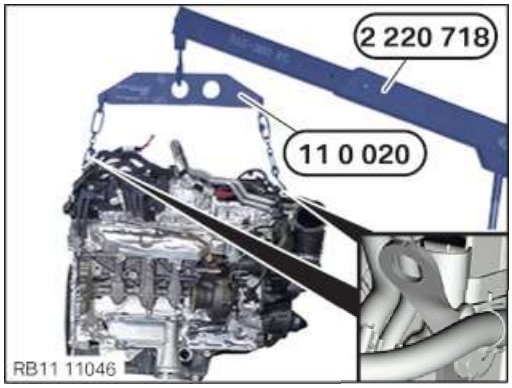


- Stage the workshop crane 2 220 718.

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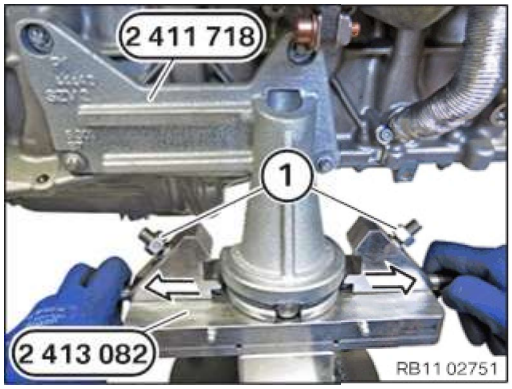
- Stage special tool (lifting gear) 0 490 567 (11 0 020).



TECHNICAL INFORMATION

The workshop crane, lifting gear and the mounting brackets on the engine must all be connected to each other so that the engine hangs straight upon lifting.

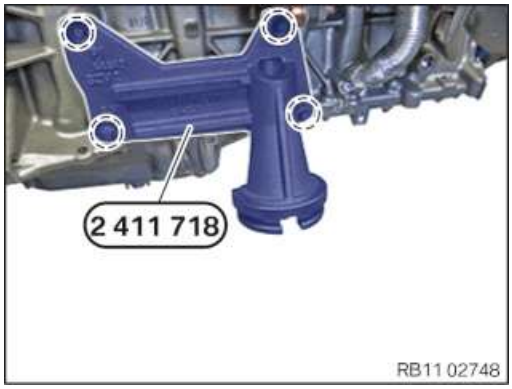
- Connect both hooks of the special tool 0 490 567 (11 0 020) to the front and back of the engine with the mounting brackets.
- Connect the workshop crane 2 220 718 to the special tool (lifting gear) 0 490 567 (11 0 020).



- Slacken nuts (1).
- Unclamp the clamping jaws of the special tool (engine fixture) 2 413 082 in the direction of arrow.



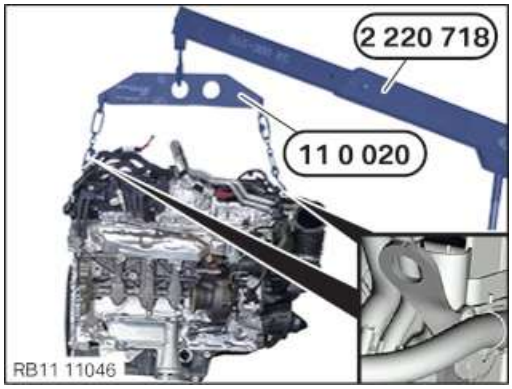
- Raise the engine slowly.



- Release the screws (marks) and remove the special tool (engine fixture) 2 411 718.

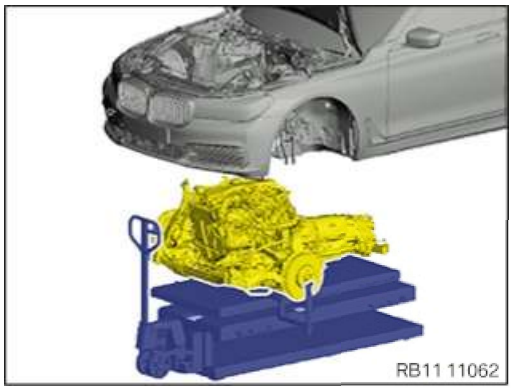
87 – Installing the engine on the front axle

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- See additional information.

88 – Installing the complete front axle including engine and transmission



- See additional information.

Additional Information

Overview of Tightening Torques

Flange to assembly stand			Used in step 3
M14X30		Tightening torque	135 Nm

Special tool 11 8 930 to special tool 00 2 320			Used in step 3
M14x35		Tightening torque	160 Nm

Special tool 2 411 718 to crankcase			Used in step 3
M10x30		Tightening torque	38 Nm

Oil drain plug			Used in step 6
M12x16	Replace sealing ring.	Tightening torque	25 Nm

Basic carrier to cylinder head			Used in step 245565
M6		Tightening torque	8 Nm

Test gauge to basic carrier			Used in step 245565
M6		Tightening torque	8 Nm

Special tool to cylinder head			Used in step 33
M8		Tightening torque	21,5 Nm

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Connecting rod bearing cap to connecting rod — Used in step 44

Renew screws.

Tighten screws crosswise.		Jointing torque	20 Nm
		1. Angle of rotation	70 °
		2. Angle of rotation	70 °

Oil deflector to crankcase — Used in step 45

M8 x 35	Replace screws.	Jointing torque	15 Nm
		Angle of rotation	45 °

Camshaft sprocket to oil vacuum pump — Used in step 46

M8	Important - left-hand thread Renew screw.	1. Jointing torque	5 Nm
		2. Angle of rotation	90 °

Oil vacuum pump to crankcase — Used in step 46

M8	Renew screw.	1. Tightening torque	15 Nm
		2. Angle of rotation	45 °

Oil sump to crankcase — Used in step 47

M8 x 30		Tightening torque	24 Nm

Oil sump to crankcase — Used in step 47

M8 x 110		Tightening torque	24 Nm

Transmission to oil sump (manual gearbox and automatic transmission) — Used in step 47

M8 x 50		Tightening torque	19 Nm

Bearing support to oil sump — Used in step 48

M8		Tightening torque	19 Nm

Front axle final drive to engine oil pan — Used in step 49

M12		Tightening torque	140 Nm

Cylinder head to crankcase — Used in step 54

M11	Observe tightening sequence. Fit new cylinder head bolts.	1. Jointing torque	30 Nm
		2. Angle of rotation	90 °
		3. Angle of rotation	180 °

Cylinder head bolt to timing case cover — Used in step 54

M8x40	Renew screws.	Tightening torque	19 Nm

Camshaft sensor wheel to intake camshaft — Used in step 54

M4 x35			4,5 Nm

Bearing journal to cylinder head — Used in step 54

Bearing journal	Renew the bearing journal!	Tightening torque	20 Nm

Sliding rail to cylinder head — Used in step 54

M6x16			8 Nm

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Cover on rear cylinder head — Used in step 54

M6		Tightening torque	8 Nm

Cable routing to cylinder head, rear — Used in step 54

M6 x 20		Tightening torque	8 Nm

Oil feed line for exhaust turbocharger to crankcase — Used in step 54

M6 x 12	Replace sealing ring.	Tightening torque	8 Nm

Coolant return line holder bracket to crankcase — Used in step 54

M6X12		Tightening torque	8 Nm

Heat shield to cylinder head — Used in step 54

M8X12	Renew screws.	Tightening torque	19 Nm

Heat shield to clamping strip — Used in step 54

M6X16	Renew screw.	Tightening torque	8 Nm

Coolant feed line to crankcase — Used in step 54

M6X12		Tightening torque	8 Nm

Exhaust turbocharger support to crankcase — Used in step 54

M8 x 20	Renew screws.		19 Nm

Exhaust turbocharger to support — Used in step 54

M8 x 25	Renew screw.		19 Nm

VANOS central valve to camshaft — Used in step 6162

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 64

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Coolant line to coolant pump/cylinder head — Used in step 66

M6x20		Tightening torque	8 Nm

Oil return line to turbocharger — Used in step 67

M6 x 12			8 Nm

Oil return line to crankcase — Used in step 67

M6 x 12			8 Nm

Cylinder head cover to cylinder head — Used in step 68

M6X30		Jointing torque	8 Nm

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Cylinder head cover to cylinder head			Used in step 68
M6X30		Tightening torque	11 Nm

Auxiliary coolant pump holder to cylinder head			Used in step 68
M6		Tightening torque	7 Nm

Standard screw connection M6			Used in step 68
M6			8 Nm

Differential pressure sensor to holder			Used in step 68
TS6X18		Tightening torque	3,5 Nm

Holder, positive battery cable to cylinder head cover			Used in step 68
6X18		Tightening torque	6 Nm

Ground cable to rail			Used in step 7172
M6			5 Nm

High pressure line between rail and high pressure pump			Used in step 73
M14x1,5		Tightening torque	33 Nm

High pressure pump to high pressure pump flange			Used in step 74
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

Spark plugs			Used in step 75
M12x1.25		Tightening torque	23 Nm

Ignition coil			Used in step 76
Screw		Tightening torque	8 Nm

Catalytic converter to turbocharger			Used in step 77
V-band clamp	Replace V-band clamp.	Tightening torque	19 Nm

Catalytic converter to holder			Used in step 77
M8 nut	Renew nut.	Tightening torque	28 Nm

Monitoring oxygen sensor to catalytic converter			Used in step 78
M18X1.5		Tightening torque	50 Nm

Front oxygen sensor to catalytic converter			Used in step 79
M18X1.5		Tightening torque	50 Nm

Intake plenum to cylinder head			Used in step 80
M6		Tightening torque	10 Nm

Intake plenum to support			Used in step 80
M6X25		Tightening torque	8 Nm

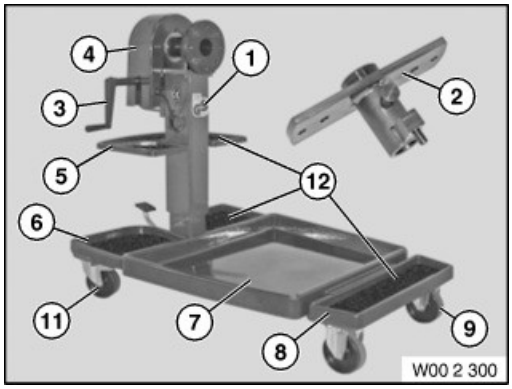
Tank ventilation line to intake plenum			Used in step 80
Oval-head screw		Tightening torque	3 Nm

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M6x30		Tightening torque	8 Nm

Overview of Special Tools

0 495 187 (00 2 300) Assembly stand



Common Used in step 3

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))	

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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.	

2 411 718 Engine support



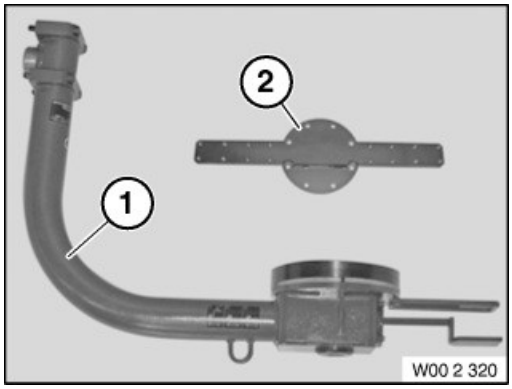
Common Used in step 386

Usage	For accommodating engine on assembly stand. Engine: B58; S58
Included in the tool or work	
Storage location	
Replaced by	
In connection with	2413082
SI-Number	01 23 15 (280)

0 495 196 (00 2 320) Support arm

Used in step 3

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Common

Usage	(Support arm with fixture) For mounting engines using the engine mounting bracket.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	002300 = 0495187
SI-Number	01 25 04 (155)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 197 (00 2 321)		**Support arm**	
2	0 495 198 (00 2 322)		**Panel** (take-up plate)	
3	0 495 380 (00 2 323)		**Panel** (fixture) Engine N73	
6	0 496 287 (00 2 326)		**Panel** (fixture) Engine: M73	
5	0 496 288 (00 2 327)	0 496 373	**Panel** (fixture) Engine: S62 Replaced by 11 5 420 (0 496 373)	
8	0 496 533 (00 2 328)		**Support** (Engine mount) Engine: N57, N57Top	
9	0 496 579 (00 2 329)	0 496 680	**Support** (Engine mount) Engine: N74 Replaced by 116160 (0 496 680)	
4	0 495 379 (00 2 324)		**Panel** (fixture) Engine M67TU	
5	0 495 381 (00 2 325)		**Panel** (fixture) Engine N62, N62TU	

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2 413 082 Support

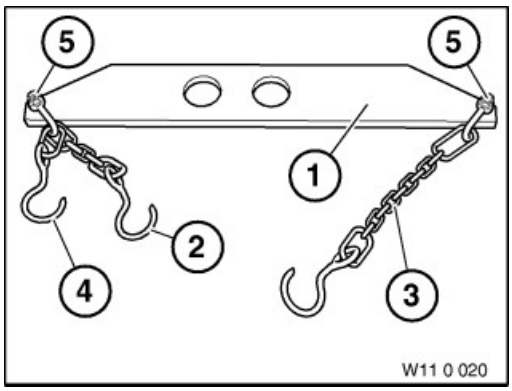


Common Used in step 386

Usage	For mounting the engines on the assembly stand.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	0495196
SI-Number	01 23 15 (280)

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0 490 567 (11 0 020) Lifting gear



Common Used in step 3335486

Usage	For removing and installing the engines. 08/2011 only available as a complete set. Delivered with TÜV inspection certificate and operating instructions. No delivery of separate parts.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 13 94 (888)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
5	0 490 572 (11 0 029)		**Shackle** (Shackle) 2 pieces As of 08/2011, only available as a complete set via 11 0 020 = 0490567. Delivered with TÜV inspection certificate and operating instructions.	
1	0 490 568 (11 0 021)		**Lifting gear** (Cross member) As of 08/2011, only available as a complete set via 11 0 020 = 0490567. Delivered with TÜV inspection certificate and operating instructions.	
2	0 490 569 (11 0 022)		**Chain** (Chain) As of 08/2011, only available as a complete set via 11 0 020 = 0490567. Delivered with TÜV inspection certificate and operating instructions.	
3	0 490 570 (11 0 023)		**Chain** (Chain) Version: long As of 08/2011, only available as a complete set via 11 0 020 = 0490567. Delivered with TÜV inspection certificate and operating instructions.	
4	0 490 571 (11 0 024)		**Chain** (Chain) Version: short As of 08/2011, only available as a complete set via 11 0 020 = 0490567. Delivered with TÜV inspection certificate and operating instructions.	

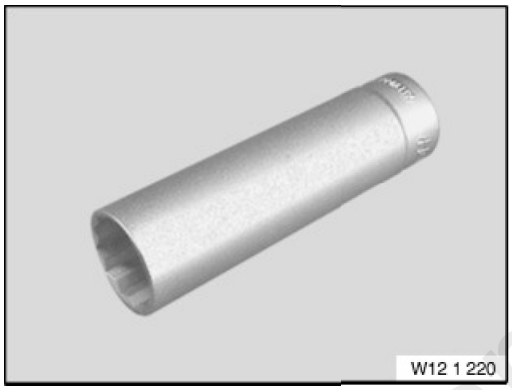
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2 220 718 Workshop crane



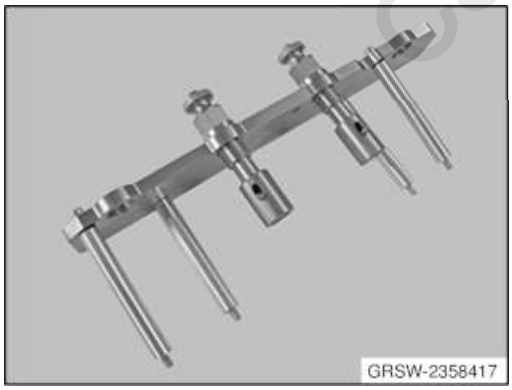
Common	Used in step	33386
Usage	WSK 1000	
Included in the tool or work		
Storage location	Individual	
Replaced by		
In connection with		
SI-Number	06 01 11 (701)	

0 495 560 (12 1 220) Socket



Common	Used in step	1575
Usage	For removing and installing the spark plugs (WAF 14 bihexal).	
Included in the tool or work		
Storage location	C18	
Replaced by		
In connection with		
SI-Number	01 20 06 (299)	

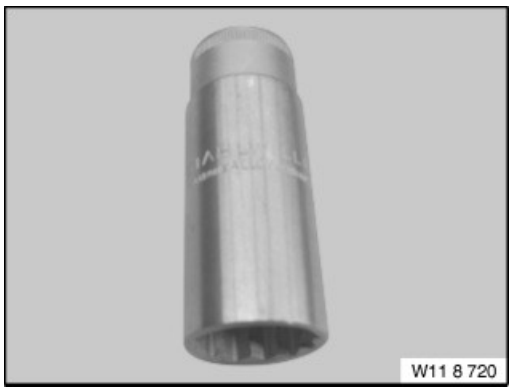
2 358 417 Device



Common	Used in step	1819
Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).	
Included in the tool or work		
Storage location	A57	
Replaced by		
In connection with		
SI-Number	01 13 14 (098)	

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0 496 106 (11 8 720) Socket WAF 46



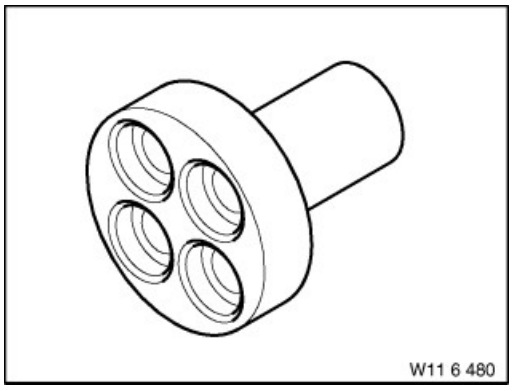
Common	Used in step 1819
Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

2 360 895 Pin wrench



Common	Used in step 2069
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 2453636574
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

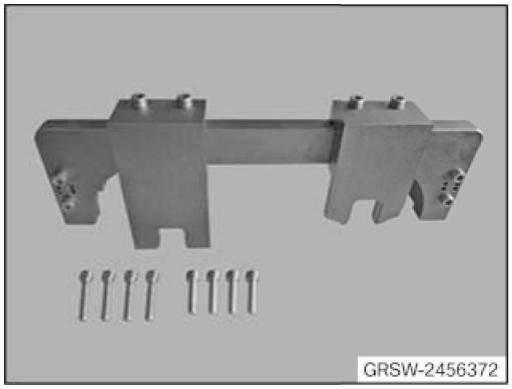
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2 288 380 Locating stud



Common	Used in step 24536365
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 2432556365
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 122 Gauge



Common	Used in step 243265
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 496 855 Ratchet handle



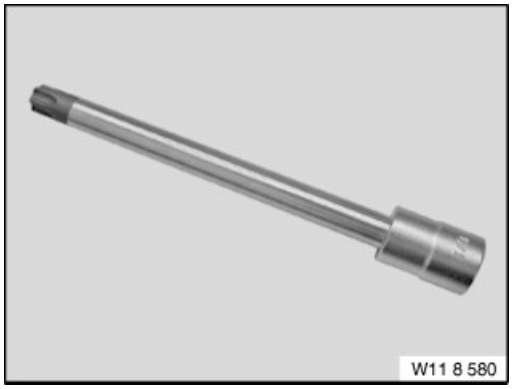
Common	Used in step 26276162
Usage	Insert reversible ratchet with nut for installation and disassembly of the VANOS- SW22. (only in longitudinal installation). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found 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 26276162
Usage	For removing and installing the VANOS adjuster. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	0496855
SI-Number	01 07 17 (487)

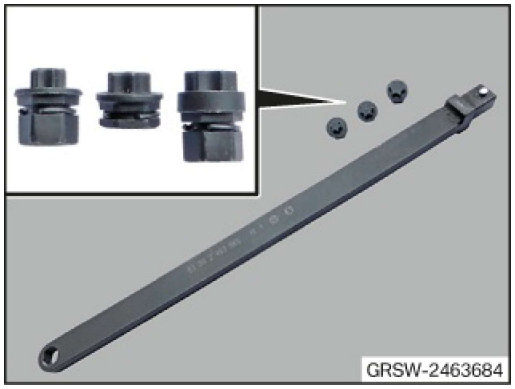
0 495 747 (11 8 580) Socket wrench



Common	Used in step 3354
Usage	(wrench socket Torx T60) For removing and installing cylinder head (outside diameter 13.5 mm).
Included in the tool or work	
Storage location	A19
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

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2 463 965 Socket wrench



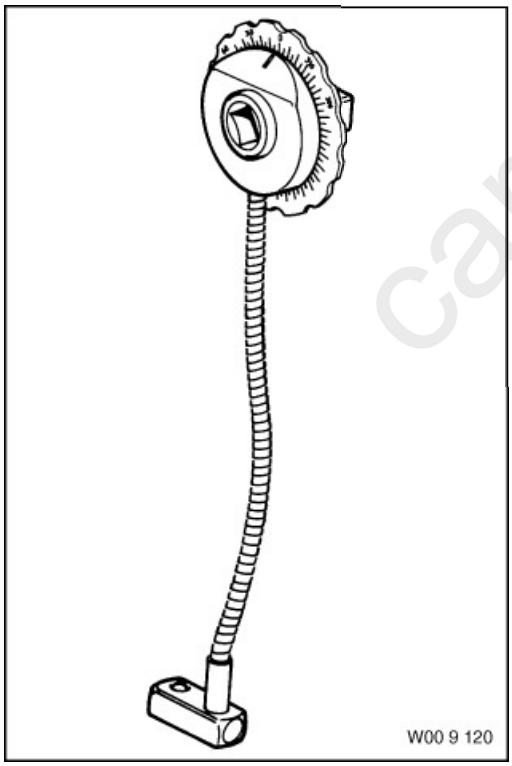
Common	Used in step 38
Usage	with T30, T40 and torx 45
Included in the tool or work	
Storage location	B6
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 463 755 Assembly tool



Common	Used in step 4044
Usage	For installation of pistons and connecting rods in the crankcase. Contour-graphic silhouette foil is included in the delivery specification.
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 18 (545)

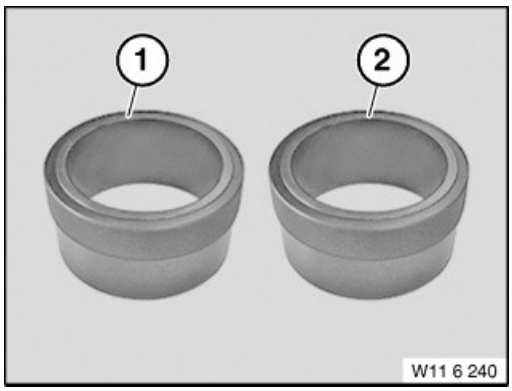
0 490 504 (00 9 120) Torque angle measuring dial



Common	Used in step 444554
Usage	For torsion angle adjustment of cylinder head bolts (all engines) And reinforcement plate front axle support E46
Included in the tool or work	
Storage location	A4
Replaced by	
In connection with	
SI-Number	

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0 495 373 (11 6 240) Bush



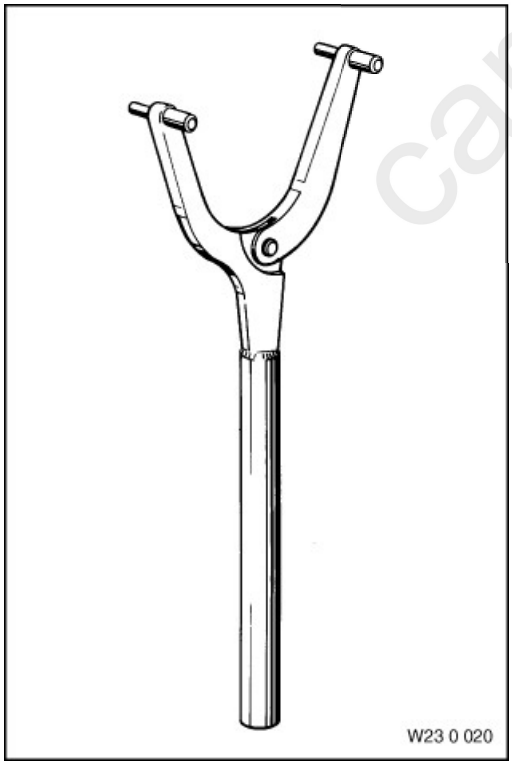
Common Used in step 44

Usage	(Assembly bush set) For fitting pistons (diameter 82 mm) with connecting rod into the crankcase. Engine: N52B25
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 02 06 (244)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
2	0 495 527 (11 6 242)		**Bush** (assembly bush 82.25 mm)	
1	0 495 526 (11 6 241)		**Bush** (assembly bush 82.00 mm)	

0 491 440 (23 0 020) Holder

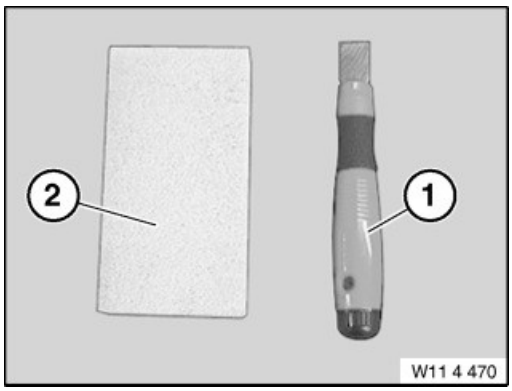


Common Used in step 46

Usage	(counter support) For all three- and four-hole flanges when releasing and tightening down
Included in the tool or work	
Storage location	B4
Replaced by	
In connection with	
SI-Number	

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0 495 102 (11 4 470) Tool



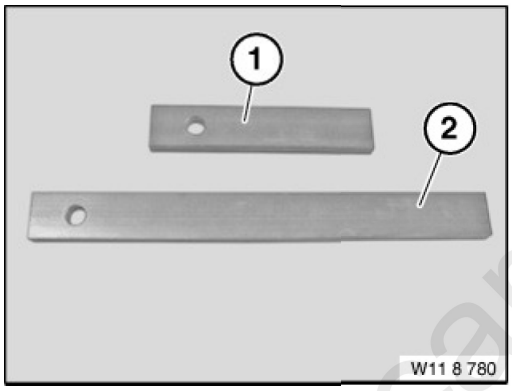
Common Used in step 47

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)	

0 496 120 (11 8 780) Plate



Common Used in step 47

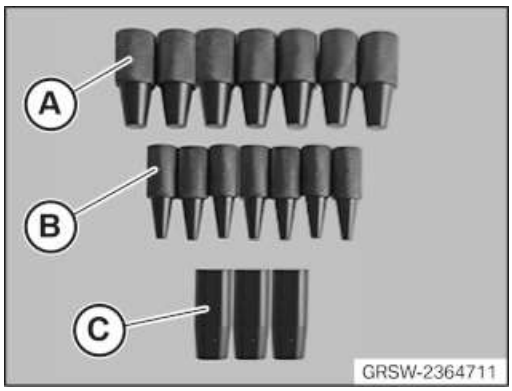
Usage	(Mounting plates) For securing transmission oil sump when gearbox is removed.
Included in the tool or work	
Storage location	B24
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 121 (11 8 781)		**Plate** (Mounting plate, short)Discontinued; only available via set 11 8 780 = 0496120.	
2	0 496 122 (11 8 782)		**Plate** (Mounting plate, long) Discontinued; only available via set 11 8 780 = 0496120.	

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2 364 711 Plug



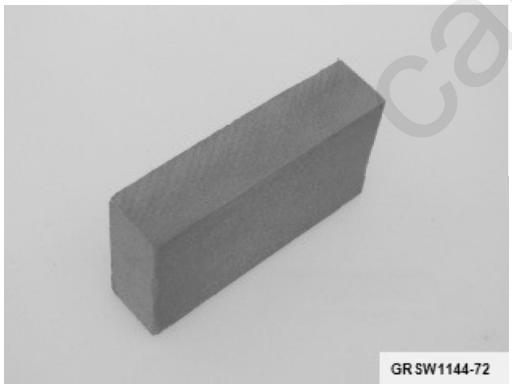
Common	Used in step 5051
Usage	For closing the pressure oil holes for cleaning the cylinder head sealing surfaces.
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 50 14 (203)

0 495 103 (11 4 471) Scraper



Common	Used in step 51
Usage	
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

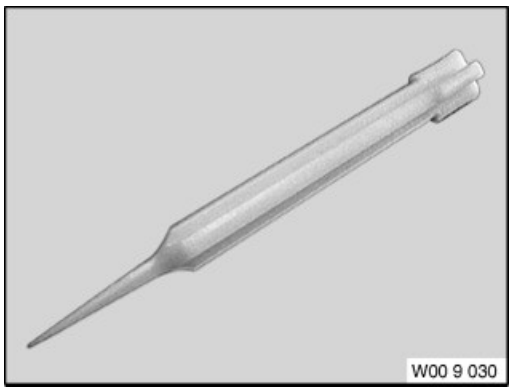
0 495 104 (11 4 472) Extractor



Common	Used in step 51
Usage	(grindstone)
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

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0 496 714 (00 9 030) Wedge



Common	Used in step 54
Usage	For dismantling O-rings, gaskets and trim panels. This special tool replaces special tool 00 9 316.
Included in the tool or work	
Storage location	A50
Replaced by	
In connection with	
SI-Number	01 20 09 (581)

2 455 654 Tensioning tool



Common	Used in step 6063
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 70
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 70
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

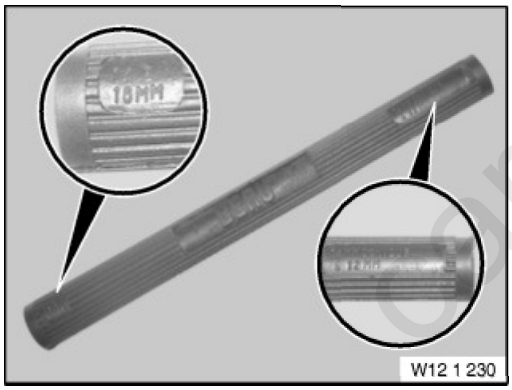
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2 358 022 Gauge



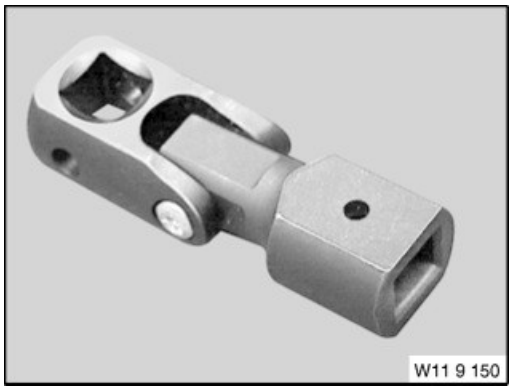
Common	Used in step 7172
Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 065 (12 1 230) Fitting aid



Common	Used in step 75
Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

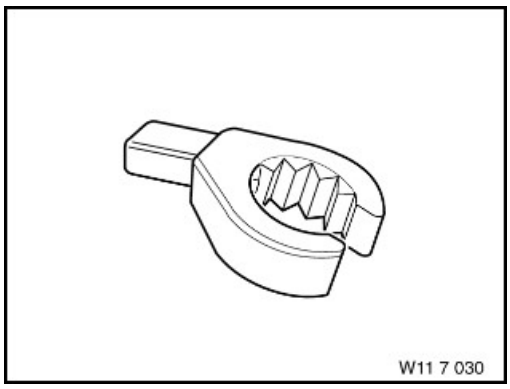
0 493 751 (11 9 150) Extension



Common	Used in step 78
Usage	(Socket wrench extension) For loosening and tightening the oxygen sensor
Included in the tool or work	
Storage location	C41
Replaced by	
In connection with	
SI-Number	01 15 00 (609)

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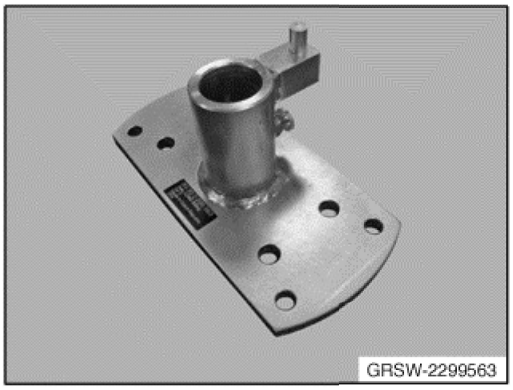
0 491 075 (11 7 030) Socket wrench insert



Common	Used in step 78
Usage	(Socket wrench insert 22 mm) For loosening and tightening the oxygen sensor
Included in the tool or work	
Storage location	A9
Replaced by	
In connection with	
SI-Number	01 06 95 (963)

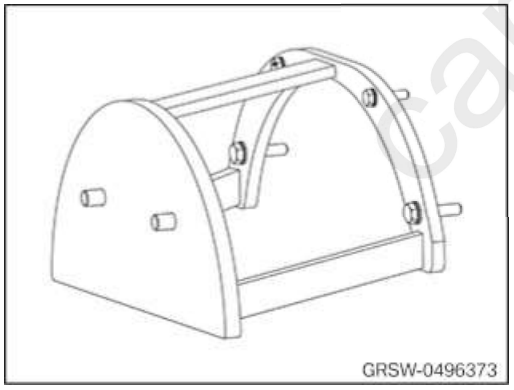
Replacement tools:

2 299 563 Adapter



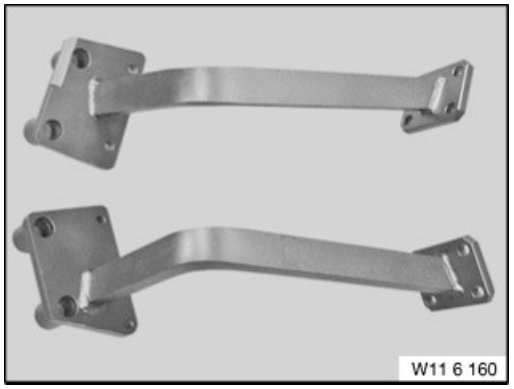
Common	Used in step 3
Usage	New adapter for the engine assembly stand. Replacement for 83 30 0 495 189 - 00 2 302.
Included in the tool or work	0 495 187
Storage location	
Replaced by	
In connection with	
SI-Number	

0 496 373 (11 5 420) Plate



Common	Used in step 3
Usage	(Fixture) Engine S62
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	

0 496 680 (11 6 160) Support



Common	Used in step 3
Usage	For mounting N74 engine on the assembly stand. In combination with 00 2 300, 00 2 320
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	00 2 300; 00 2 320 = 0495196
SI-Number	01 31 09 (604)

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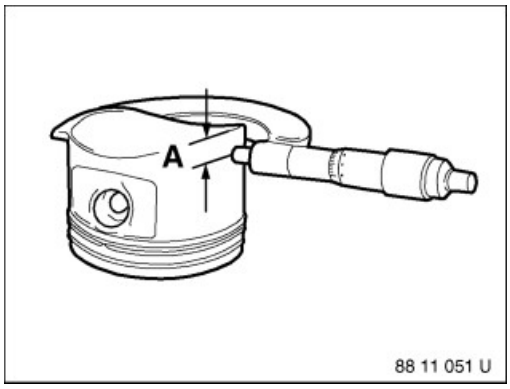
Overview Technical Data

Piston diameter

Used in step 42

Measure the piston diameter at distance (A) from the lower end of the piston skirt.

Distance (A) to the lower end of the piston skirt	10 mm
Nominal dimension of piston diameter	81,958 mm ... 81,996 mm



Cylinder bore B38/B46/B48/B58

Used in step 43

Diameter of cylinder bore	82,000 mm ... 82,014 mm
Permitted irregularity of the cylinder bore	0,01 mm
Permitted conicity of the cylinder bore	0,01 mm
Permissible total wear tolerance between piston and cylinder bore (engine operated)	0,15 mm

Height of the sealing bead

Used in step 47

	2,0 mm ... 2,5 mm

Engine oil B58B30M1/B58B30O1

Used in step 84

Filling capacity, engine oil change with oil filter element	6,50 l

Engine oil: Technically suitable engine oils for BMW Group engines

Links

General repair instructions	Used in step
11 00 ... Overview of consumables (Electronic Parts Catalogue)	477879

Repair instructions	Used in step
31 10 001 Completely removing and installing front axle with engine and transmission	188
31 10 001 Completely removing and installing front axle with engine and transmission	188
31 10 001 Completely removing and installing front axle with engine and transmission	188
31 10 001 Completely removing and installing front axle with engine and transmission	188
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31 10 001 Completely removing and installing front axle with engine and transmission	188
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31 10 001 Completely removing and installing front axle with engine and transmission	188
31 10 001 Completely remove and install front axle with engine and transmission (FRU specification without wheel alignment)	188
11 00 050 Remove and install engine	188

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11 00 050 Remove and install engine	188
31 10 001 Completely removing and installing front axle with engine and transmission	188
31 10 001 Completely removing and installing front axle with engine and transmission	188
31 10 001 Completely removing and installing front axle with engine and transmission	188
31 10 001 Completely removing and installing front axle with engine and transmission	188
31 10 001 Completely removing and installing front axle with engine and transmission	188
31 10 001 Completely removing and installing front axle with engine and transmission	188
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31 10 001 Completely removing and installing front axle with engine and transmission	188
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11 00 598 Removing and installing engine on front axle (for part no. 31 10 001/501)	287
11 00 598 Removing and installing engine on front axle (for part no. 31 10 001/501)	287
11 00 598 Removing and installing engine on front axle (for part no. 31 10 001/501)	287
11 00 598 Removing and installing engine on front axle (for part no. 31 10 001/501)	287
11 00 598 Removing and installing engine on front axle (for part no. 31 10 001/501)	287
11 00 598 Removing and installing engine on front axle (for part no. 31 10 001/501)	287
11 00 598 Removing and installing engine on front axle (for part no. 31 10 001/501)	287
61 35 ... Notes on ESD protection (Electro Static Discharge)	142022
13 53 ... Clean the cylinder heads in the area of injectors to prevent sand/dust contamination.	1819
61 35 ... Notes on ESD protection (Electro Static Discharge)	20
17 11 035 Removing and installing/replacing fan cowl with electric fan	74
31 10 001 Completely removing and installing front axle with engine and transmission	88
31 10 001 Completely removing and installing front axle with engine and transmission	88
31 10 001 Completely removing and installing front axle with engine and transmission	88
31 10 001 Completely removing and installing front axle with engine and transmission	88

Operating materials	**Used in step**
3.0 Technically appropriate engine oils for BMW Group engines	84

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This documentation refers to special tools that were not yet available when going to press.

11 25 000 Removing and installing/replacing all pistons

CAUTION

Component with heavy weight.

Danger of injury!

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

CAUTION

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

Danger of injury!

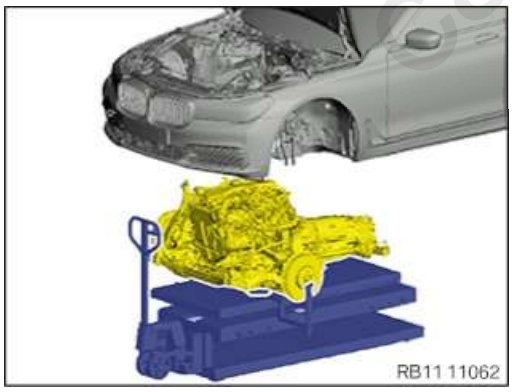
- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

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

PRELIMINARY WORK

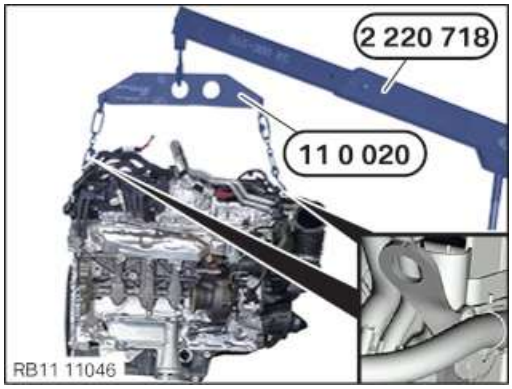
1 – Remove the front axle completely with the engine and transmission



- See additional information.

2 – Remove engine from front axle

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- See additional information.

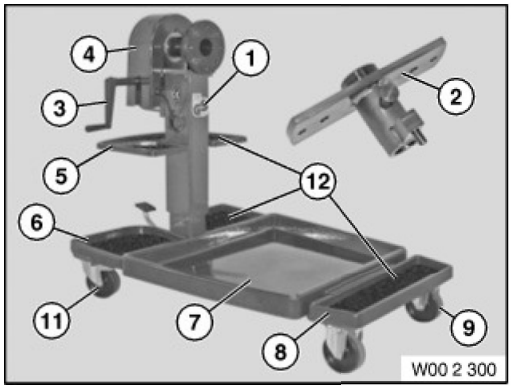
3 – Install the engine on the assembly stand

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

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



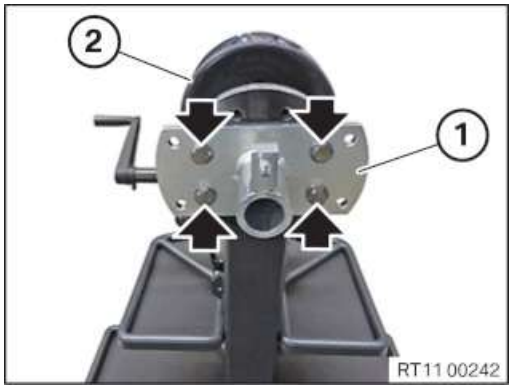
- Have the set of special tools 0 495 187 (00 2 300) ready.

Number	Description
1	Assembly stand
2	Flange
3	Crank
4	Cover
5	oddments tray
6	Shaped element rear
7	Collection pan
8	Shaped element front
9	Front wheel
10	Rear wheel with stop
11	Mat



- Have the special tool 2 411 718 ready.

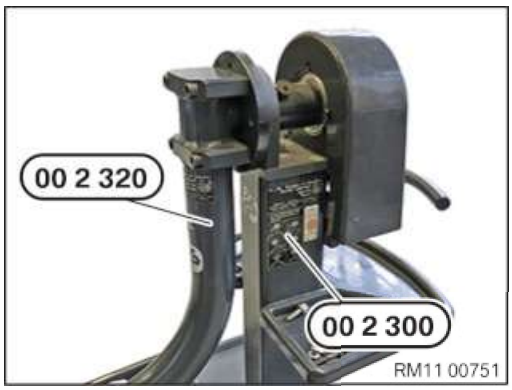
cardiagn.com



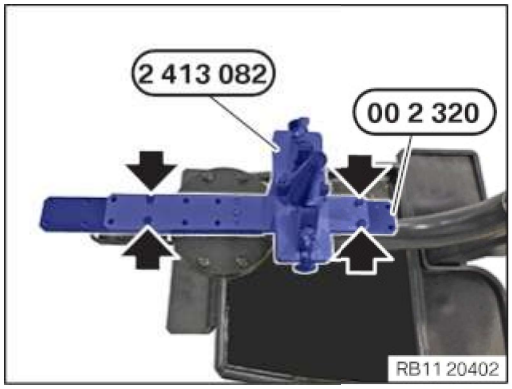
- Position flange (1) on assembly stand (2).
- Tighten screws (arrows).

Flange to assembly stand

M14X30		Tightening torque	135 Nm



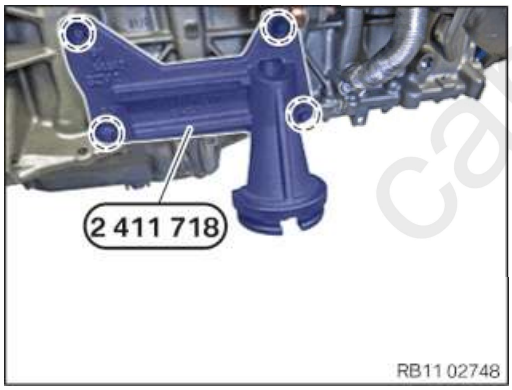
- Prepare the assembly stand 0 495 187 (00 2 300) with the special tool 0 495 196 (00 2 320).



- Screw the special tool 2 413 082 to the 0 495 196 (00 2 320) special tool.
- Tighten screws (arrows).

Special tool 11 8 930 to special tool 00 2 320

M14x35		Tightening torque	160 Nm



- Position and secure special tool (engine fixture) 2 411 718 on the engine.
- Tighten the bolts (marks).

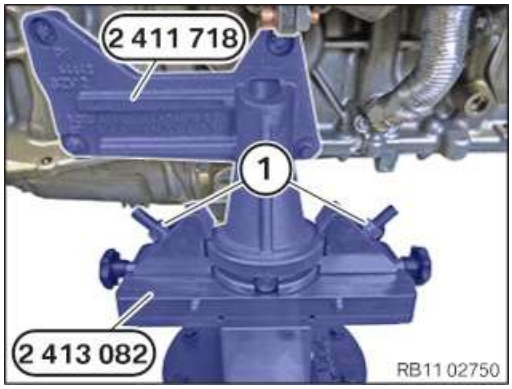
Special tool 2 411 718 to crankcase

M10x30		Tightening torque	38 Nm



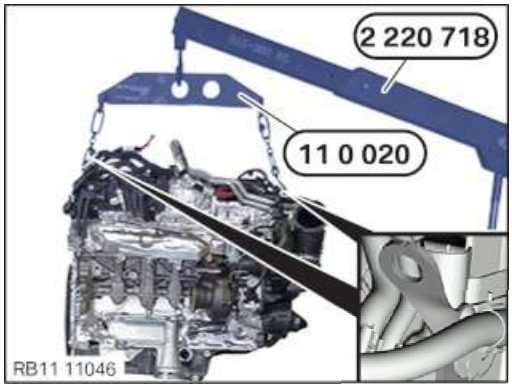
- Lower engine slowly.

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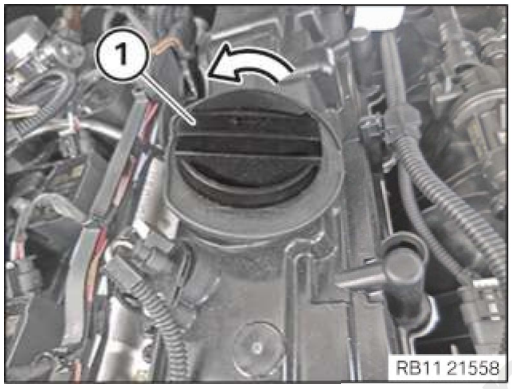
- Make sure special tool 2 411 718 engages with special tool 2 413 082.
- Tighten nuts (1) by hand.

  The clamping jaws must fit completely.



- Release both hooks of the special tool (lifting gear) 0 490 567 (11 0 020) at the front and back of the engine from the mounting brackets.
- Remove the workshop crane 2 220 718.

4 – Removing the oil filler cap



- Open the oil filler cap (1) in the direction of arrow.

5 – Releasing the oil drain plug

WARNING

Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

TECHNICAL INFORMATION

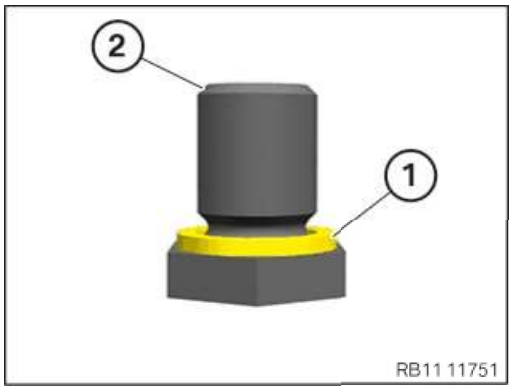
Catch and dispose of drained engine oil in a suitable collecting vessel. Observe country-specific waste disposal regulations.

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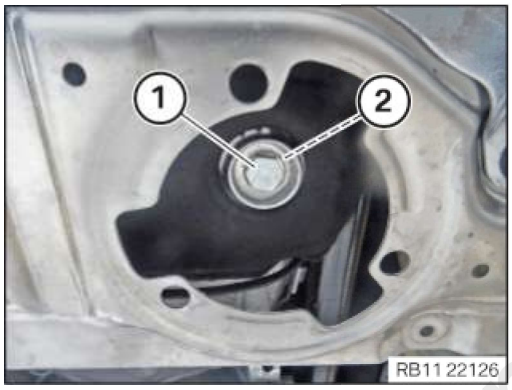
- Release oil drain plug (1).
- Feed out the oil drain plug (1) using sealing ring (2) and remove.
- Allow the engine oil to drain out fully.

6 – Tightening the oil drain plug



- Renew sealing ring (1) on the oil drain plug (2).

  Parts: Sealing ring
- Guide in the sealing ring (1) on the oil drain plug (2) and install.



- Feed in the oil drain plug (1) with the sealing ring (2) and install.
- Tighten oil drain plug (1).

Oil drain plug

M12x16	Replace sealing ring.	Tightening torque	25 Nm

7 – Removing engine ventilation line

WARNING

Hot surfaces.

Risk of burning!

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

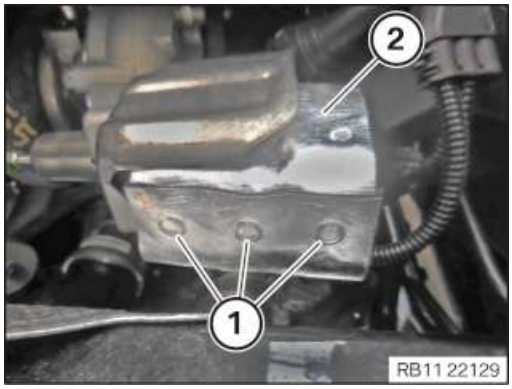
RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

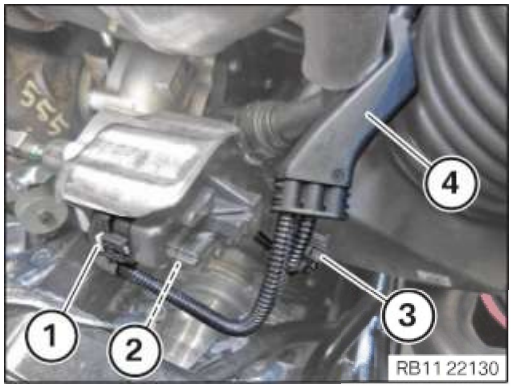
Sheared wires can cause a short circuit.

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

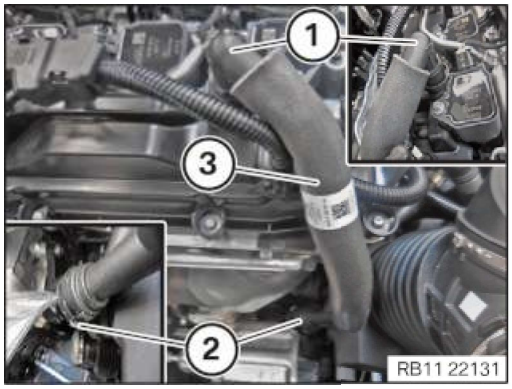
cardiagn.com



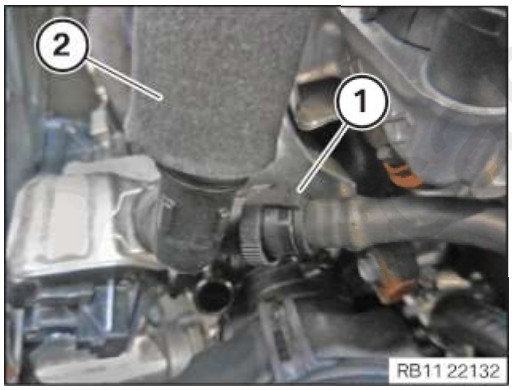
- Unlock the locks (1).
- Feed out and remove heat protection (2).



- Unlock and disconnect the plug connection (1).
- Unlock and disconnect the plug connection (2).
- Loosen clamp (3).
- Feed out wiring harness section for sensor system **2** (4) and set it aside.



- Unlock and loosen the locks (1).
- Unlock and loosen lock (2).
- Feed the engine ventilation line (3) out and set it aside.



- Unlock and release tank ventilation line (1).
- Feed out the engine ventilation line (2) and remove.

8 – Removing acoustic cover at rear



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

9 – Remove the front oxygen sensor

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WARNING

Hot surfaces.

Risk of burning!

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

RISK OF DAMAGE

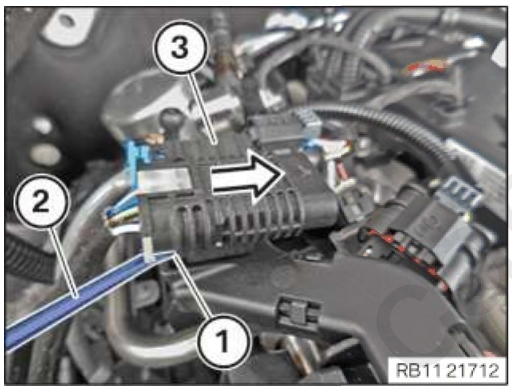
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

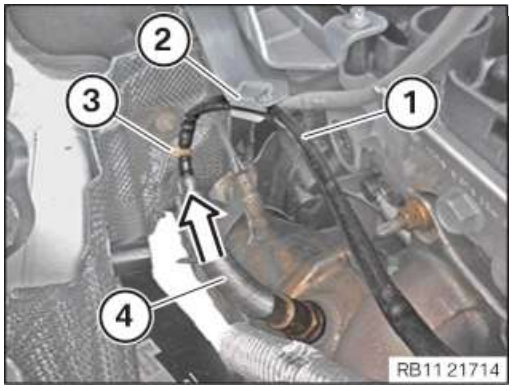
- Do not pull on the wires when disconnecting connectors and plug connections.



- Unlock and loosen connector (1).



- Unlock the locks (1) with a conventional screwdriver (2) and release.
- Feed out the connector (3) in **the direction of arrow** and set aside.



- Detach the line of the front oxygen sensor (1) from the holder (2).
- Unfasten cable strap (3).
- Feed out the heat shield (4) **in direction of arrow** and set it aside.

carsdiagn.com



- Release and remove the control sensor (1) with the special tool .

10 – Remove the monitoring oxygen sensor

WARNING

Hot surfaces.

Risk of burning!

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

RISK OF DAMAGE

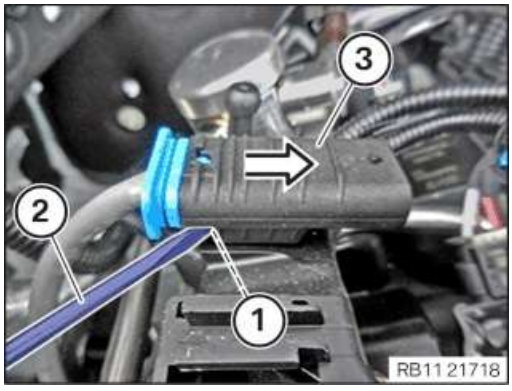
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

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

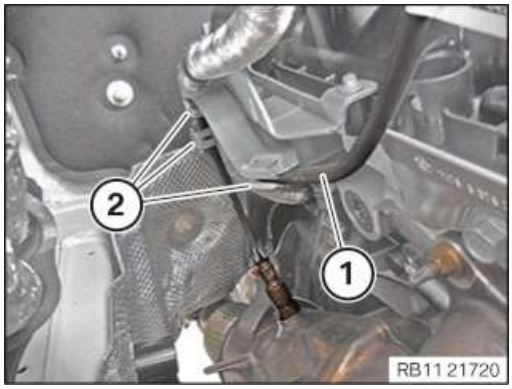


- Unlock and loosen connector (1).

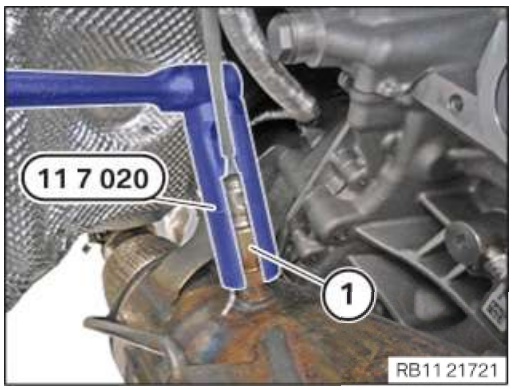


- Unlock the lock (1) with a suitable screwdriver (2).
- Feed out the connector (3) in the direction of the **arrow** and set it aside.

autodiagn.com



- Detach the line of the monitoring oxygen sensor (1) from the holder (2).



- Release the monitoring oxygen sensor (1) using special tool .
- Remove the monitoring sensor (1).

11 – Remove catalytic converter

WARNING

Hot surfaces.

Risk of burning!

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

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

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

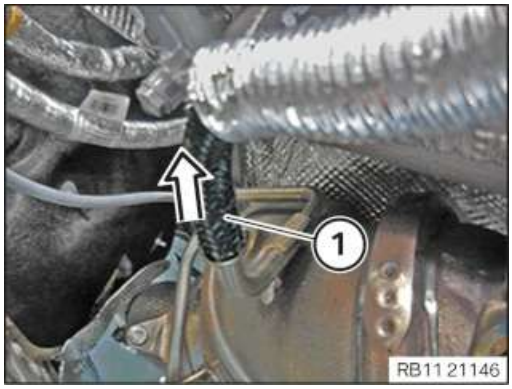
CAUTION

Component with heavy weight.

Danger of injury!

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

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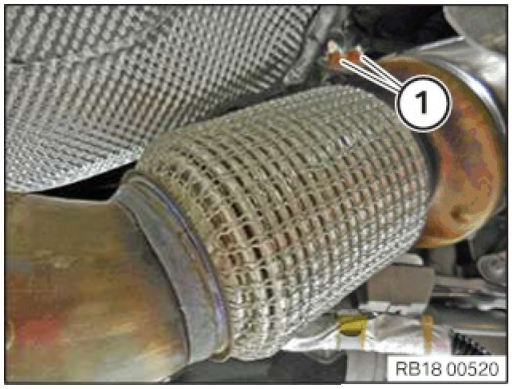


- **If installed: Disconnect pressure hose.**

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



- Loosen V-band clamp (1).



- Loosen nuts (1).



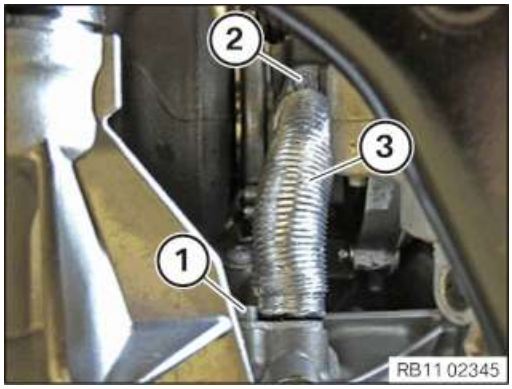
- Unlock and loosen clamp (1).
- Feed out catalytic converter and remove.

12 – Removing the oil return line for the exhaust turbocharger

TECHNICAL INFORMATION

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

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- Have cleaning rags ready for any escaping engine oil.
- Loosen screws (1) and (2).
- Guide out and remove the oil return line (3).

13 – Remove the coolant line between the cylinder head and the coolant pump

WARNING

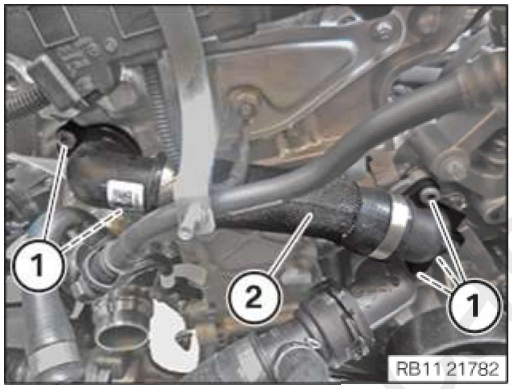
Hot surfaces.

Risk of burning!

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

TECHNICAL INFORMATION

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



- Loosen screws (1).
- Remove the coolant line (2).
- Catch and dispose of escaping coolant.

14 – Remove all ignition coils.

NOTICE

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

▸ **Removing the ignition coil**

WARNING

Hot surfaces.

Risk of burning!

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

carfdiag1.com

RISK OF DAMAGE

Damage to the ignition coil.

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

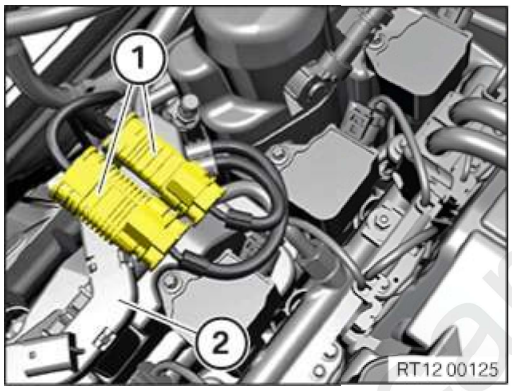
- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

RISK OF DAMAGE

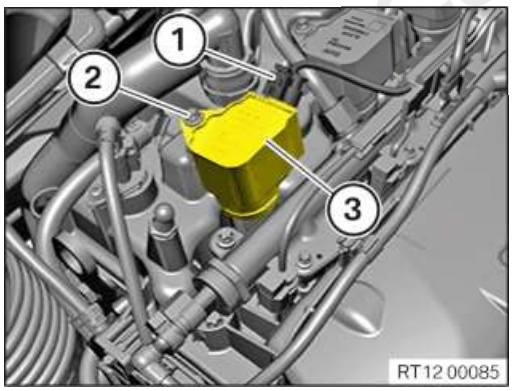
Electrostatic discharge.

Damage to or destruction of electrical components.

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



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



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

15 – Removing all spark plugs

WARNING

Hot surfaces.

Risk of burning!

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

CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

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



- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

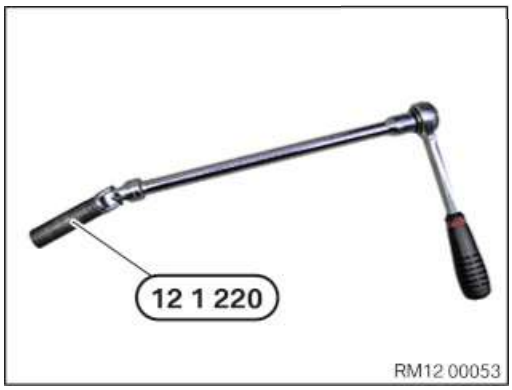
The spark plug shaft must be cleaned using compressed air after having removed the ignition coils and before removing the spark plugs. After having removed the spark plugs, once again check the sealing surface for contamination and (if necessary) clean using a moist cloth or clean using compressed air.

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

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

NOTICE

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



TECHNICAL INFORMATION

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

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

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

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

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

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

CAUTION

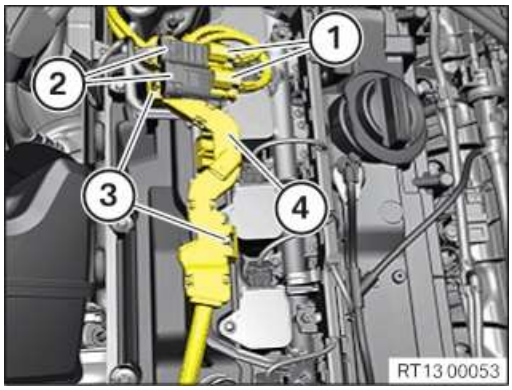
On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

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

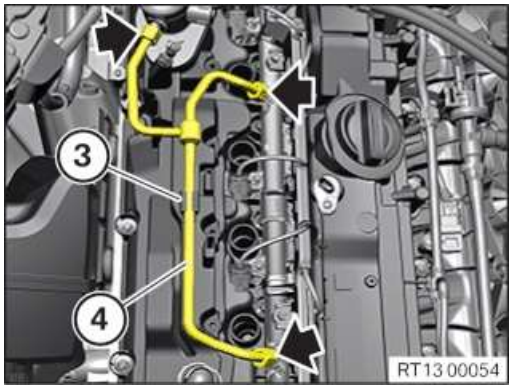
TECHNICAL INFORMATION

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



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

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

17 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

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

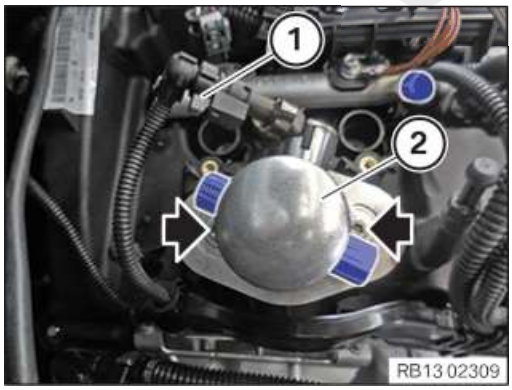
TECHNICAL INFORMATION

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

TECHNICAL INFORMATION

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

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



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

18 – Removing rail with injectors of cylinders 1 to 3

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

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

RISK OF DAMAGE

Damage to the ignition coil.

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

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

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

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

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

RISK OF DAMAGE

Damage to injectors.

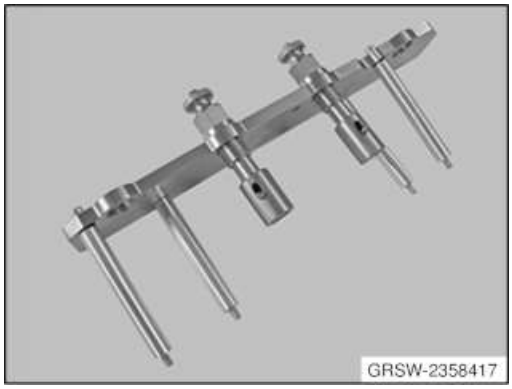
Excessive force may damage the injector and this means having to renew the injector.

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



- Prepare special tool .

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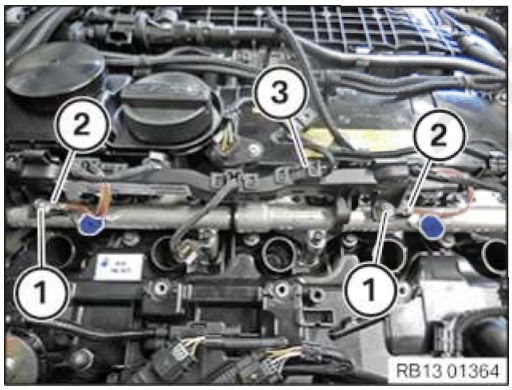
- Prepare special tool 2 358 417.



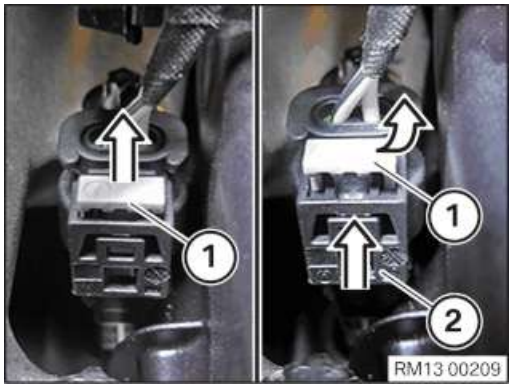
- Prepare special tool .



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

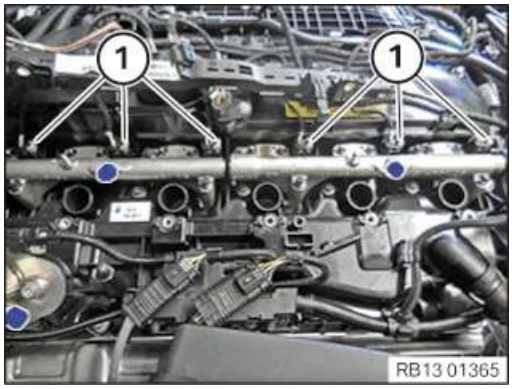


- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.

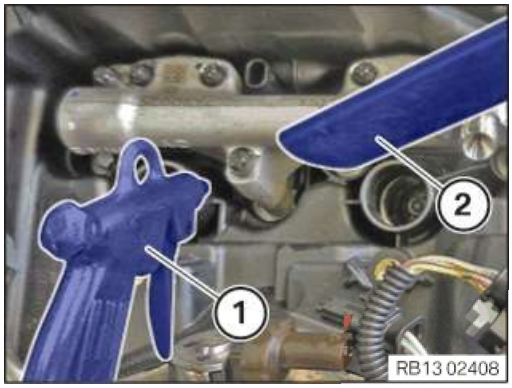


- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull out the connector (2) from the injectors.

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

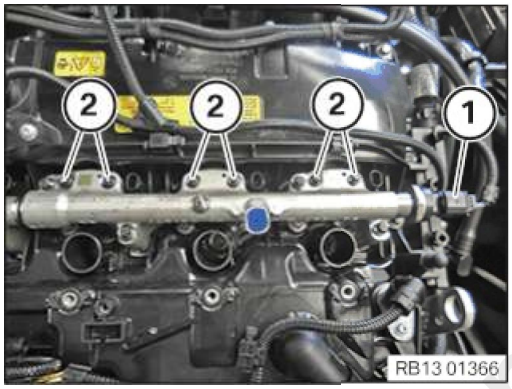


TECHNICAL INFORMATION

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

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

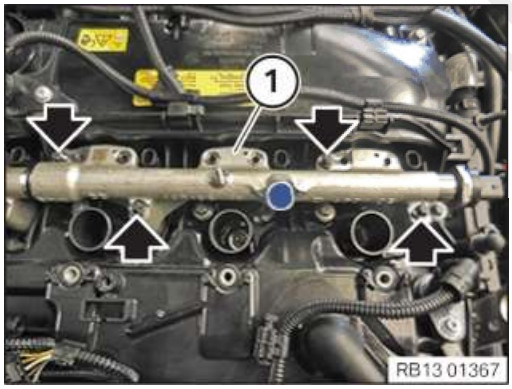
- Before releasing the high pressure lines: Blow out the injector shafts with an air gun(1) with less pressure.
- Simultaneously, draw off the dirt particles with an **explosion proof** vacuum cleaner (2).



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

  Do not reuse the bolts (2).

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

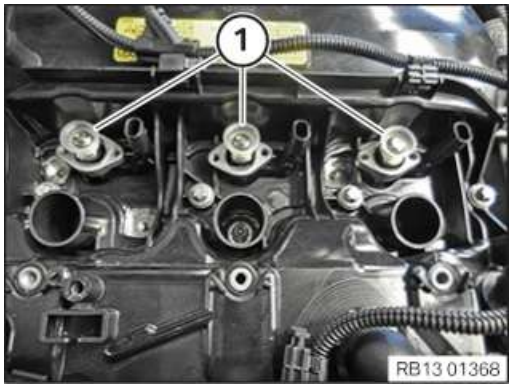


- Unscrew the screws (M6x30) (arrows).

  The screws may not be reused!
- Renew screws.

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

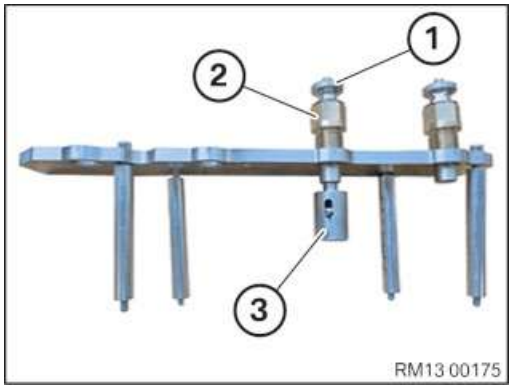
  The injectors remain in the cylinder head.



- Remove the gaskets (1).

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

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RISK OF DAMAGE

Damage to injectors.

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

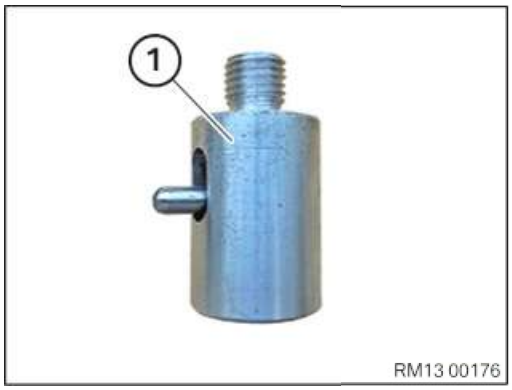
- Twist the injectors with a maximum torsional movement of 13 Nm.

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

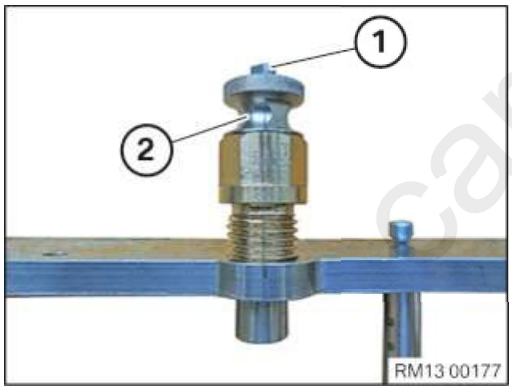
  The special tool 2 358 417 is used to ensure that the tensile force is not exceeded.

  Special tool 2 358 417 consists of:

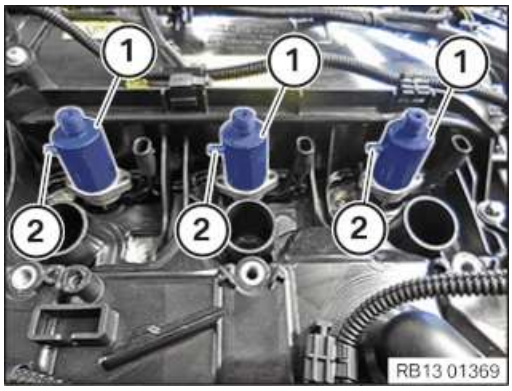
  - **(1)** Threaded sleeves
  - **(2)** Pull-out thread (left-hand thread)
  - **(3)** Mounting for the injectors



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



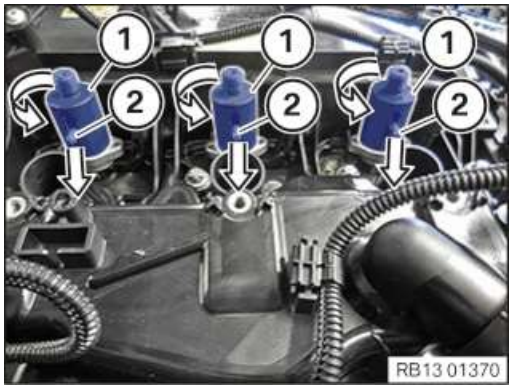
- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.



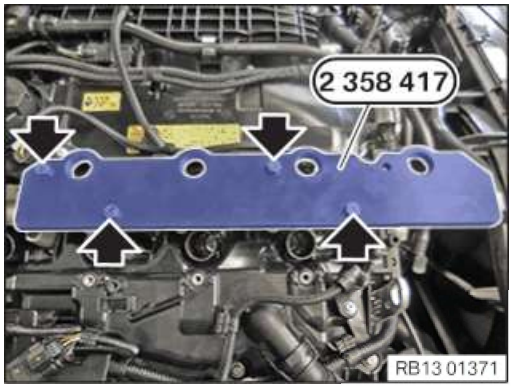
- Install all fixtures (1) for the injectors.

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

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



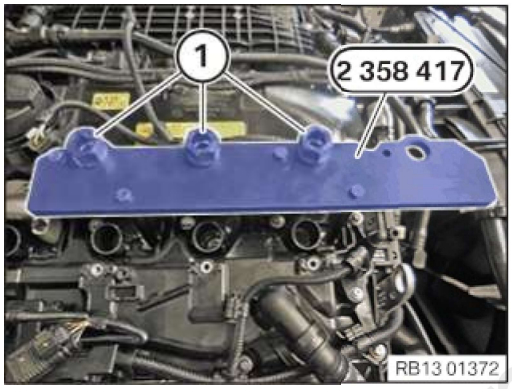
RISK OF DAMAGE

Damage to injectors.

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

- Do not use the puller plate as a support.

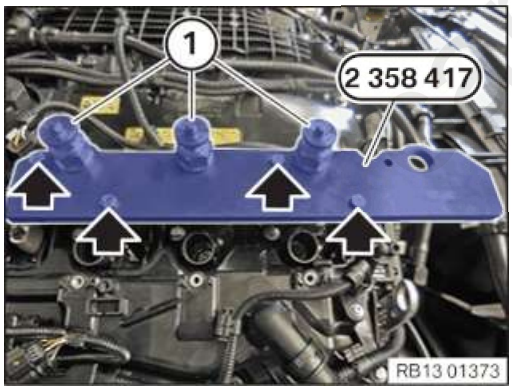
- Attach special tool 2 358 417 to cylinder head.
- Hand-tighten the bolts (arrows).



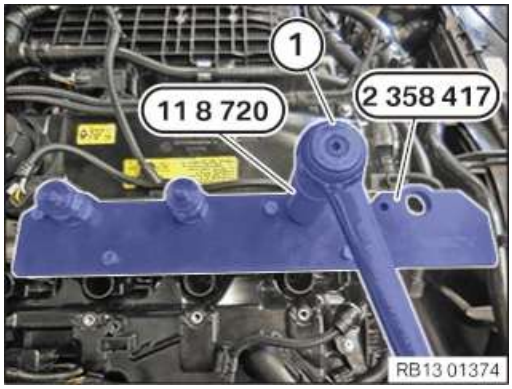
TECHNICAL INFORMATION

The extraction thread is a left-hand thread.

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



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



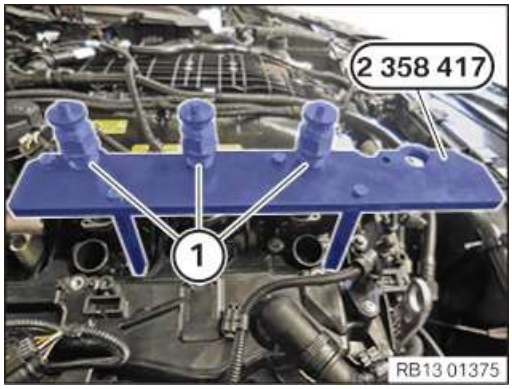
- Adjust torque wrench to 13 Nm **clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720)until the injector is pulled out.

TECHNICAL INFORMATION

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

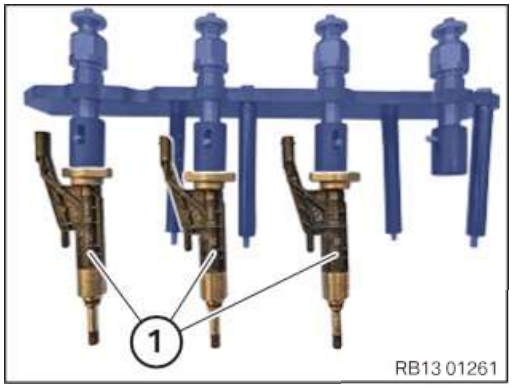
- Disassemble all injectors individually.

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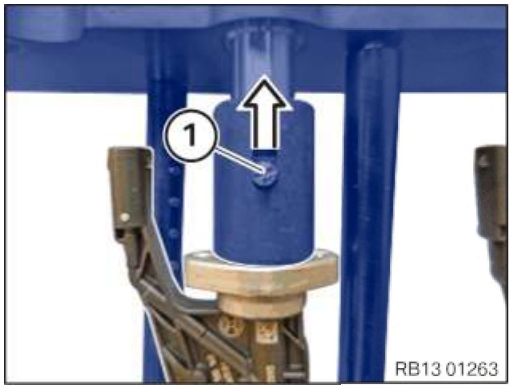


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

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



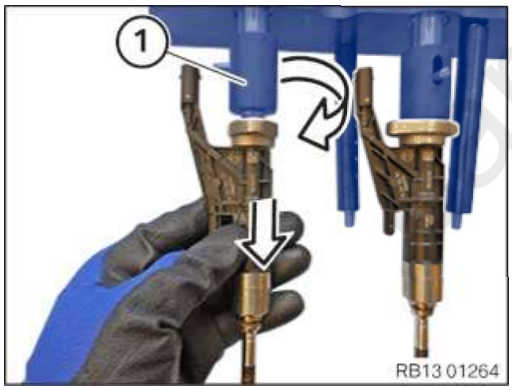
- Carefully remove the special tool 2 358 417with injectors (1) from the cylinder head vertically upwards.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat on a clean table.



NOTICE

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

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



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

19 – Removing rail with injectors of cylinders 4 to 6

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

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

RISK OF DAMAGE

Damage to the ignition coil.

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

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

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

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

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

RISK OF DAMAGE

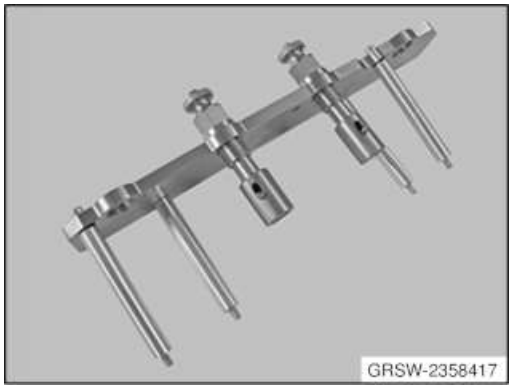
Damage to injectors.

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

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



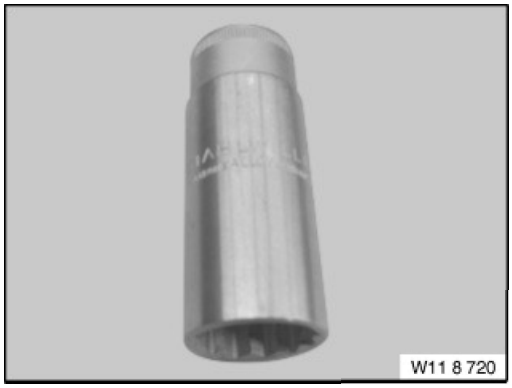
- Prepare special tool .



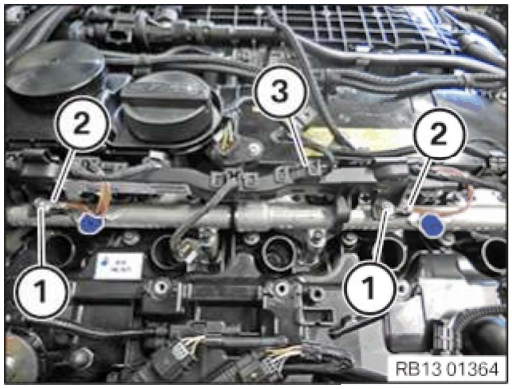
- Prepare special tool 2 358 417.



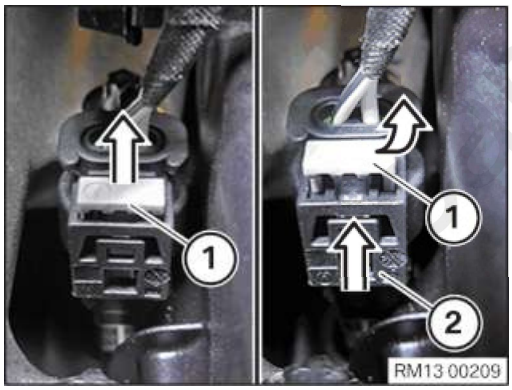
- Prepare special tool .



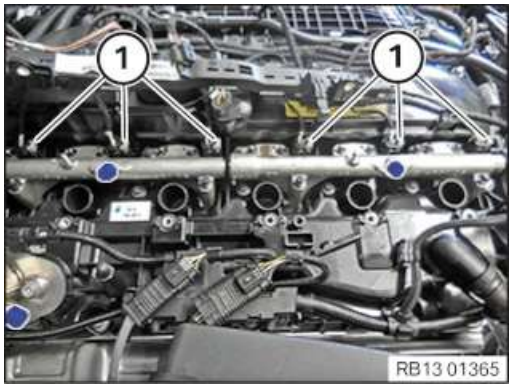
- Prepare special tool 0 496 106 (11 8 720).



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

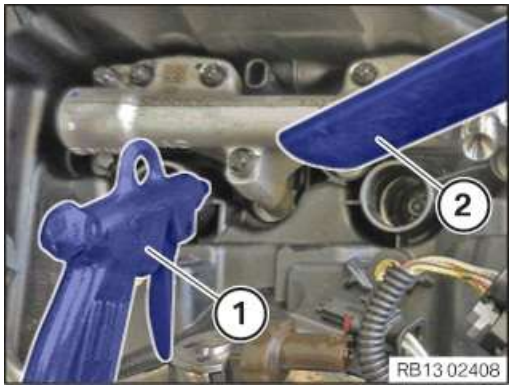


- Unlock lock (1) in direction of arrow upwards.
- Press lock (1) together and release.
- Disconnect the connector (2) from the injectors in the direction of the arrow.



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

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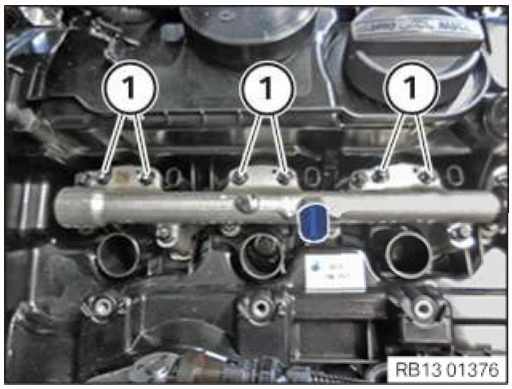


TECHNICAL INFORMATION

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

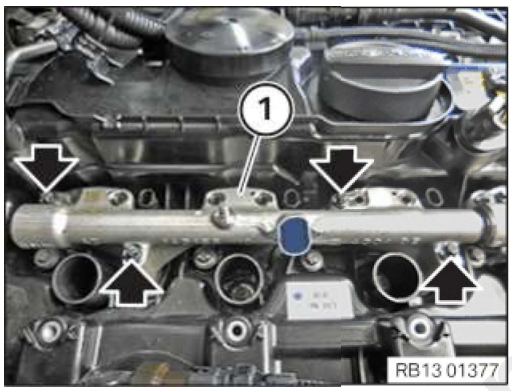
For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

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



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

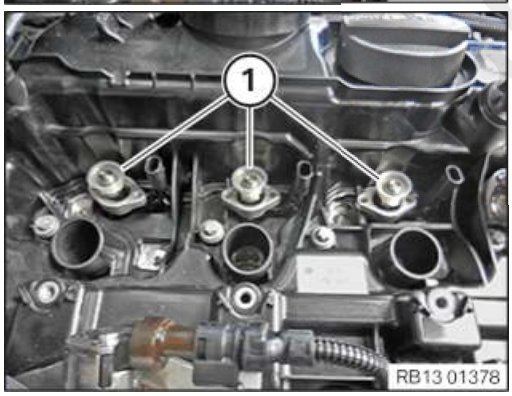
  Do **not** reuse screws (M5x30) (1).
- Catch and dispose of escaping fuel with suitable materials.



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

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

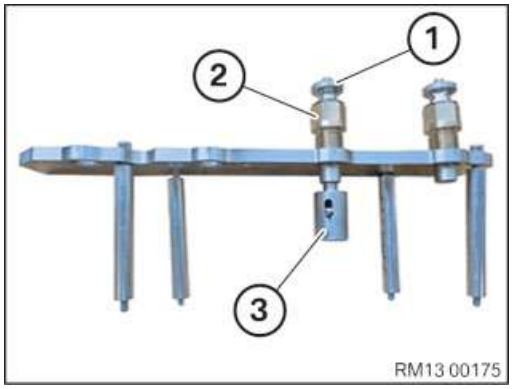
  The injectors remain in the cylinder head.



- Remove seals (1) .

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

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RISK OF DAMAGE

Damage to injectors.

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

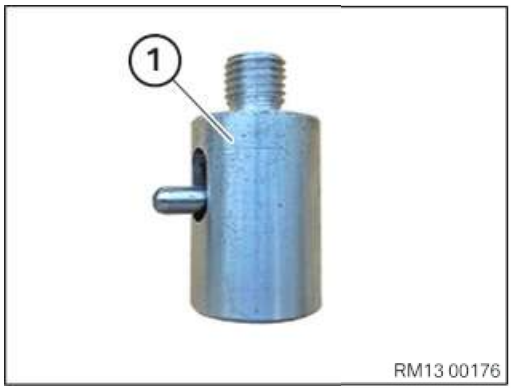
- Twist the injectors with a maximum torsional movement of 13 Nm.

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

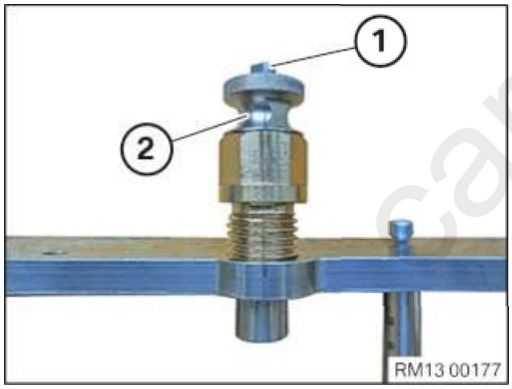
  The special tool 2 358 417 is used to ensure that the tensile force is not exceeded.

  The special tool 2 358 417 consists of:

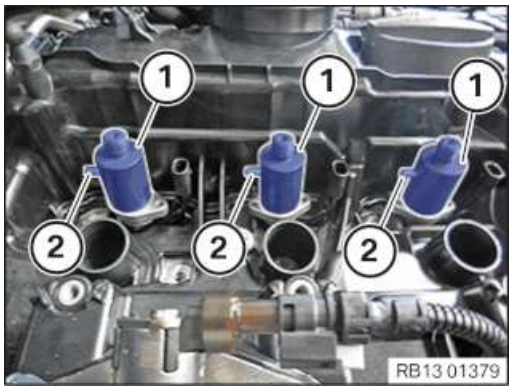
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Mounting for the injectors



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



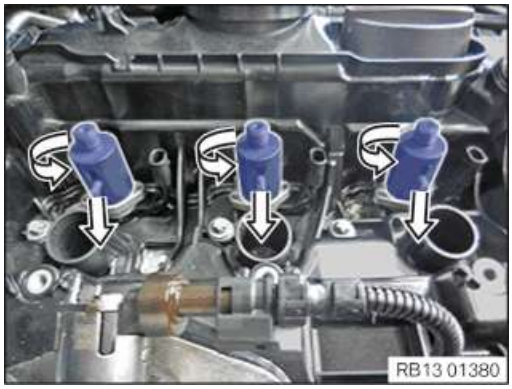
- Press lock (1) in and remove the threaded sleeve (2) from the special tool 2 358 417.



- Install all fixtures (1) for the injectors.

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

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



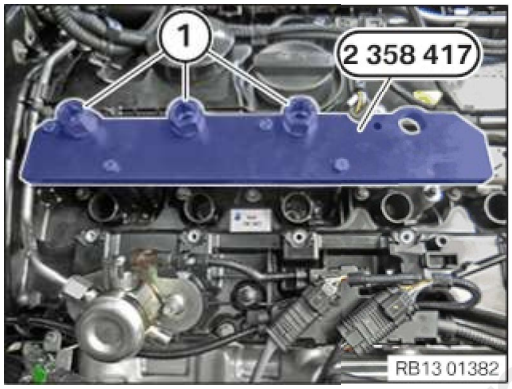
RISK OF DAMAGE

Damage to injectors.

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

- Do not use the puller plate as a support.

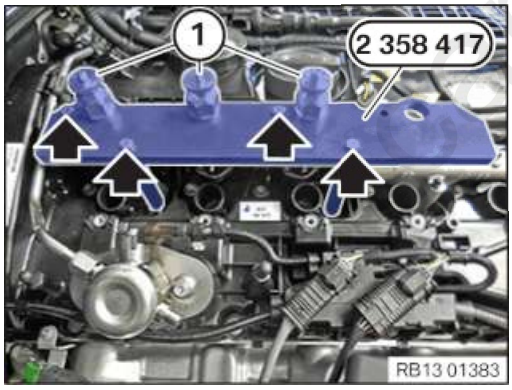
- Attach special tool 2 358 417 to cylinder head.
- Hand-tighten the bolts (arrows).



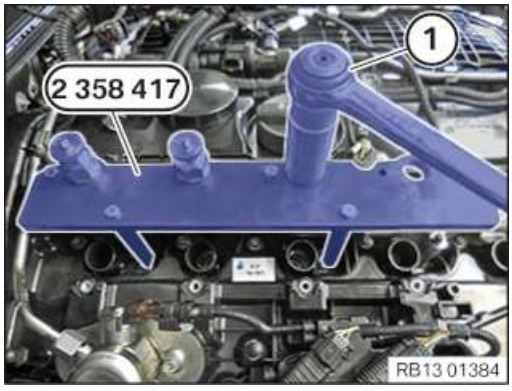
TECHNICAL INFORMATION

The extraction thread is a left-hand thread.

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



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



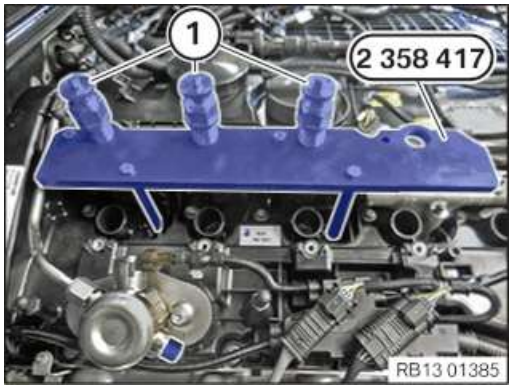
- Adjust torque wrench to 13 Nm **in clockwise** direction.
- Turn the torque wrench (1) with the special tool 0 496 106 (11 8 720) **clockwise**, until the injector is pulled out.

TECHNICAL INFORMATION

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

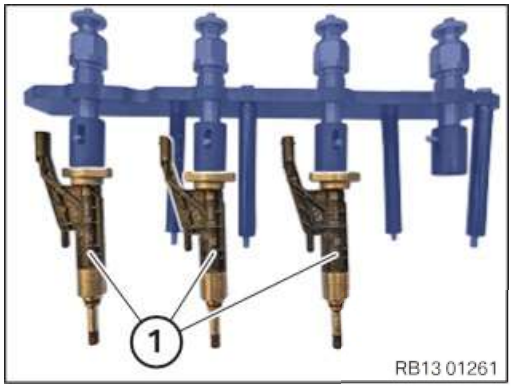
- Disassemble all injectors individually.

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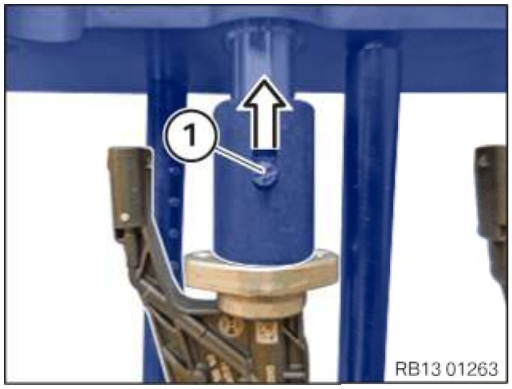


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

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



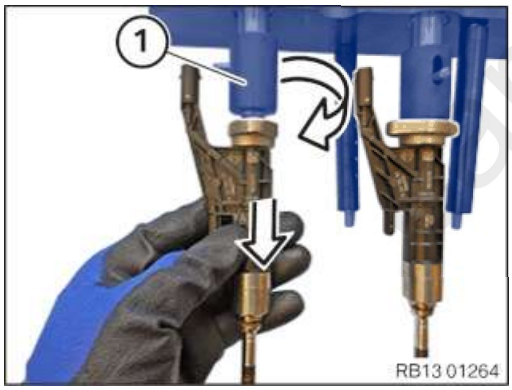
- Carefully remove the special tool 2 358 417 with the injectors (1) vertically straight up from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.



NOTICE

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

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



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

20 – Removing both actuators

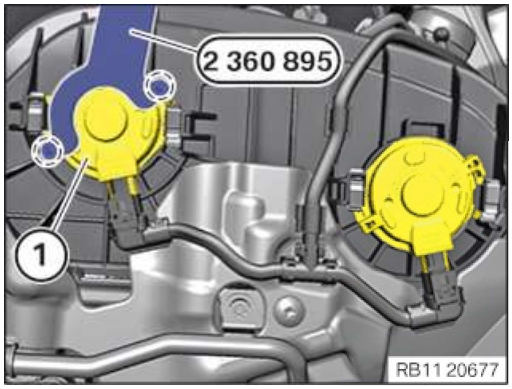
ardiagn.com

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

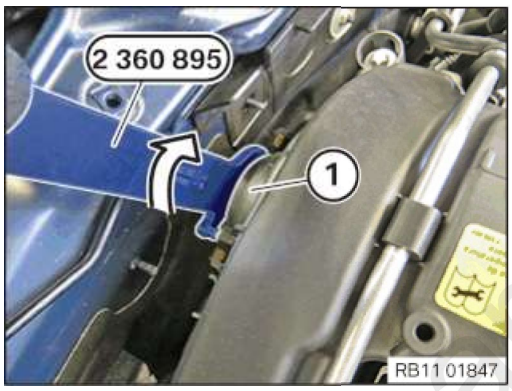
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the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



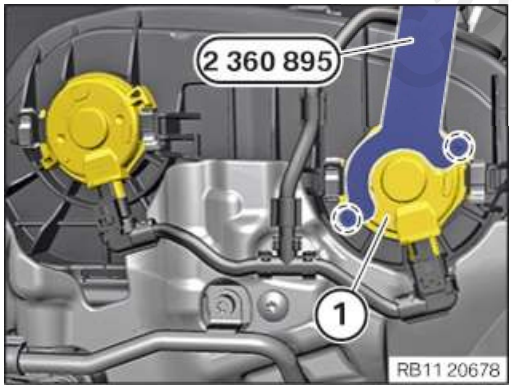
NOTICE

The figure shows the rear side of the engine.

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



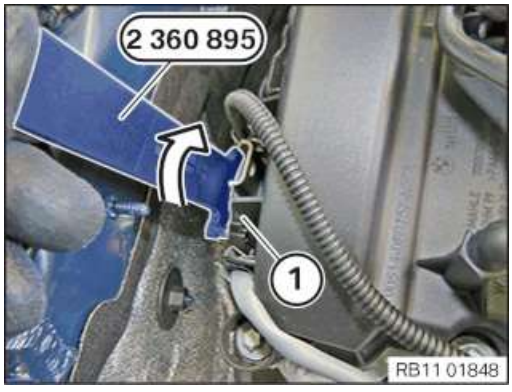
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



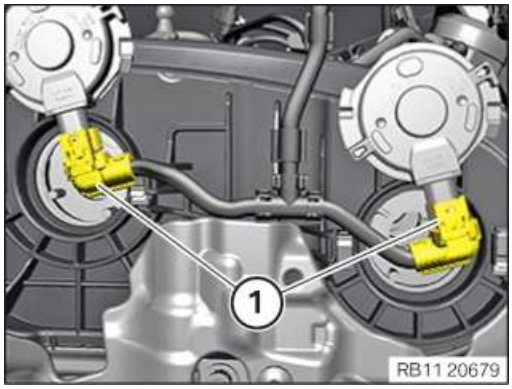
NOTICE

The figure shows the rear side of the engine.

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



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



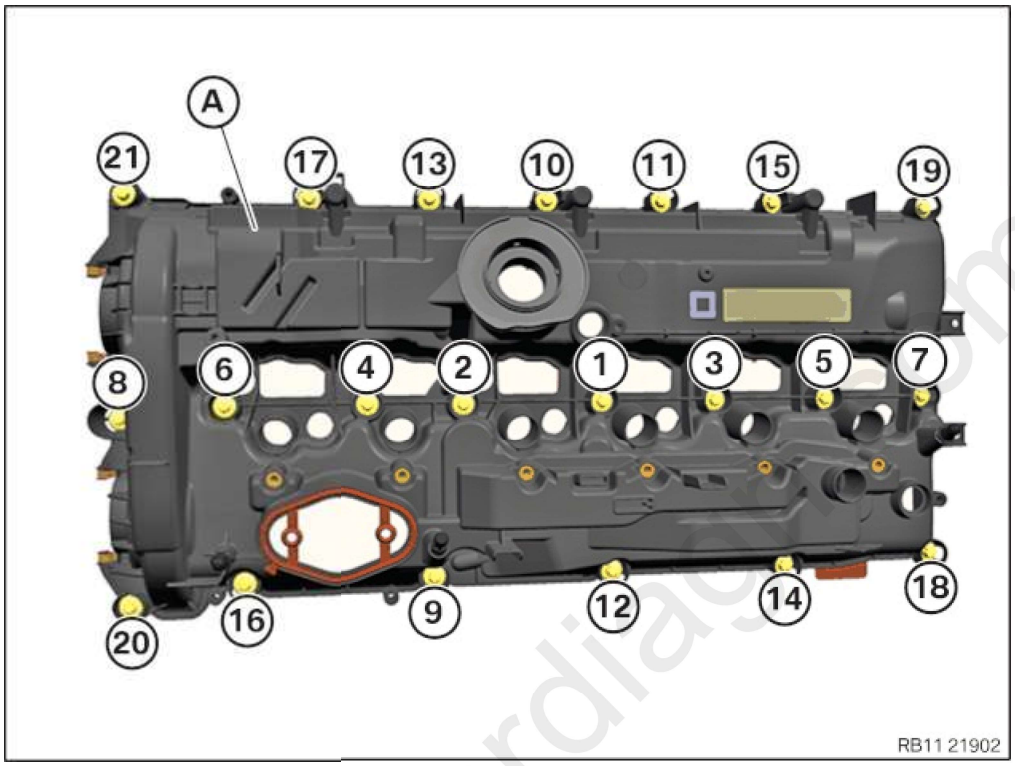
NOTICE

The figure shows the rear side of the engine.

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

21 – Removing the cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 21 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

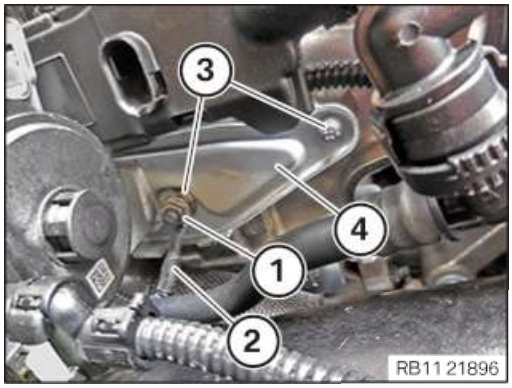
Sheared wires can cause a short circuit.

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

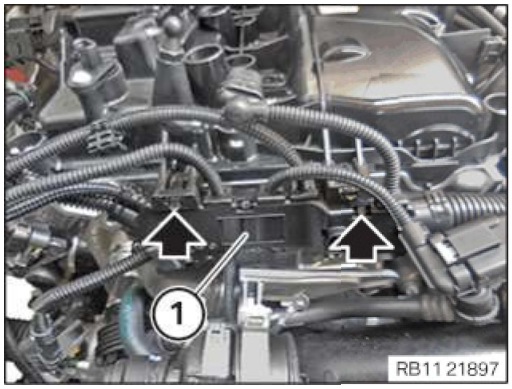
cardiagn.com



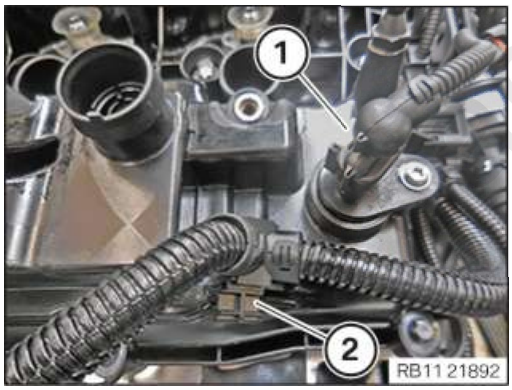
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



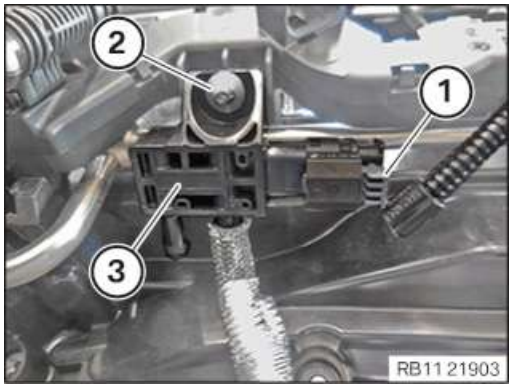
- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Loosen screws (3).
- Thread out holder (4) and set aside.



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

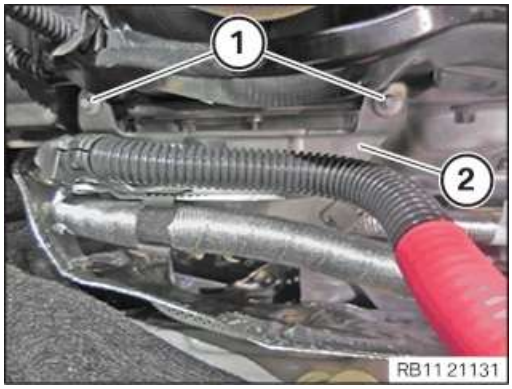


- Unlock and detach connector (1) on exhaust camshaft sensor .
- Loosen clamp (2).

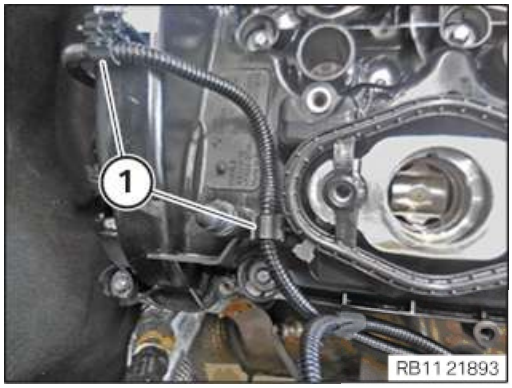


- **If installed:**
- Unlock and loosen connector (1).
- Loosen screw (2).
- Remove the differential pressure sensor (3) and put it to one side.

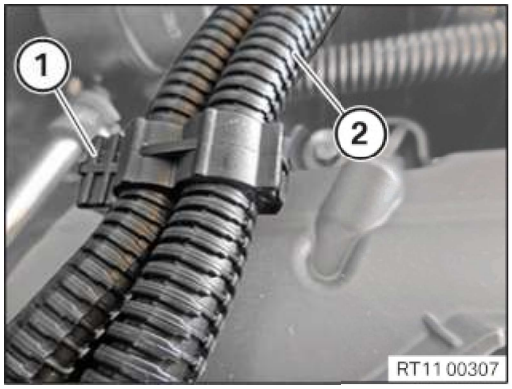
rdiagn.com



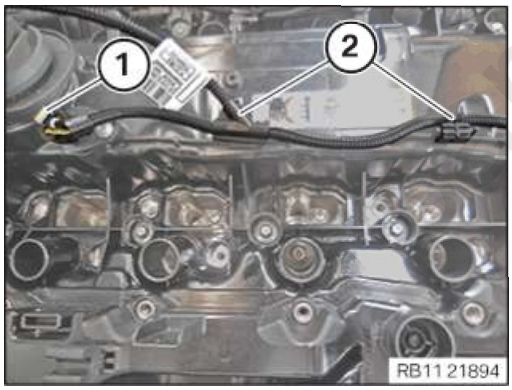
- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.



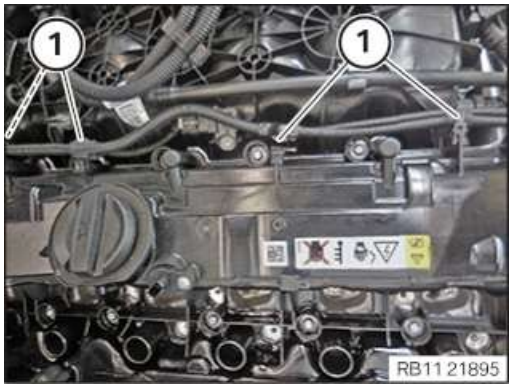
- Loosen clamps (1).



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

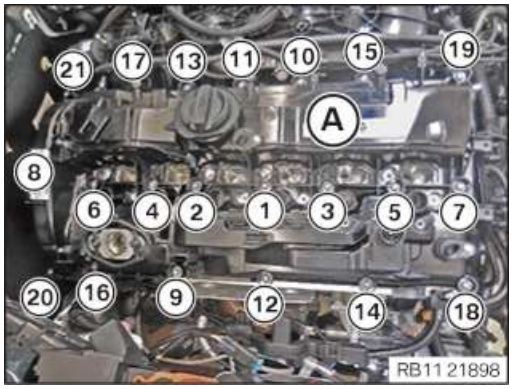


- Unlock and detach connector (1) on the intake camshaft sensor.
- Loosen clamps (2).

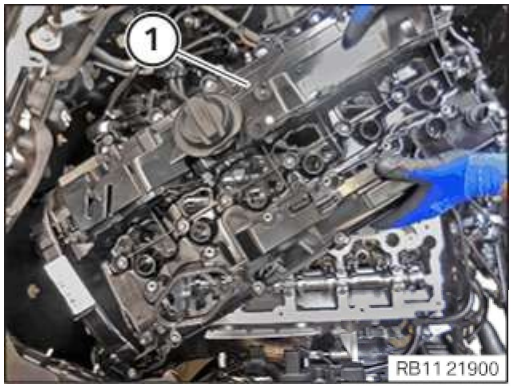


- Loosen clamps (1).

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



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

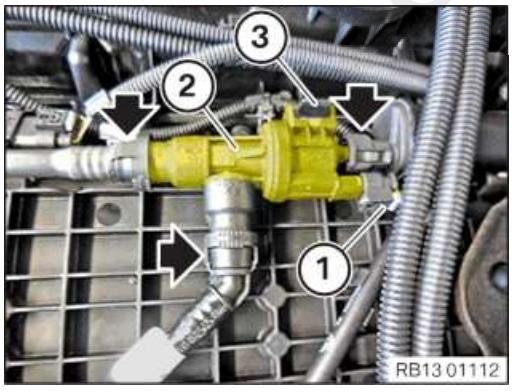
22 – Remove tank vent valve

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

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



- Unlock and disconnect connector (1).
- Unlock and disconnect the tank ventilation lines (arrows).
- Detach and remove the tank vent valve (2) from the holder (3).

23 – Removing the intake plenum

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RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

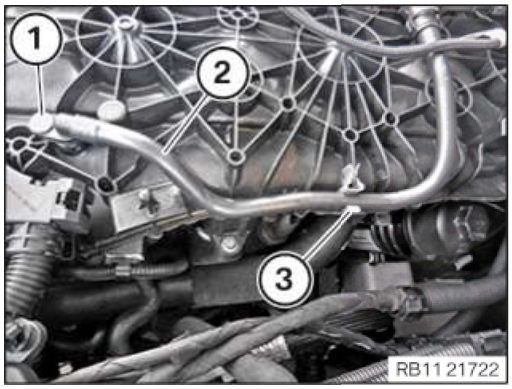
- Do not pull on the wires when disconnecting connectors and plug connections.

TECHNICAL INFORMATION

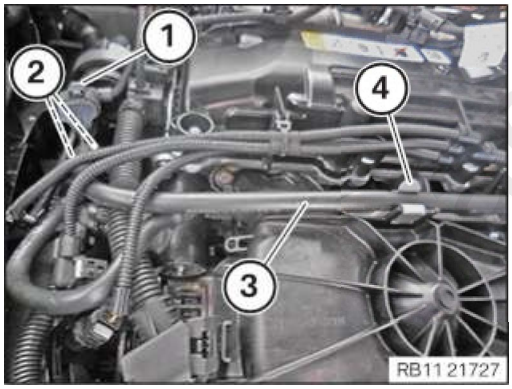
Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

TECHNICAL INFORMATION

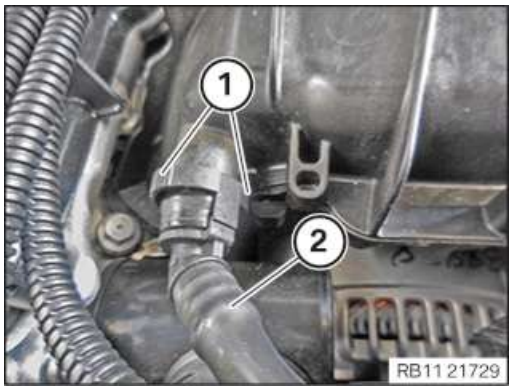
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screw (1).
- Guide tank ventilation line (2) out of clamp (3) and remove it.

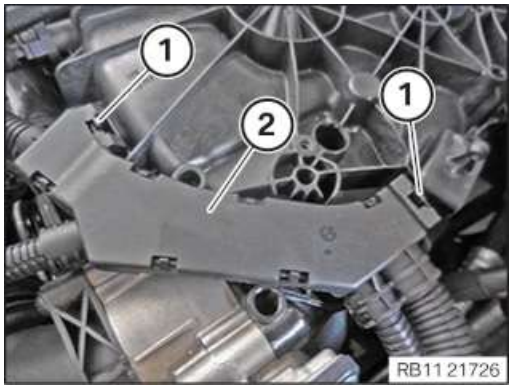


- Unlock and loosen connector (1).
- Unlock the locks (2).
- Guide tank ventilation line (3) out of clamp (4) and remove it.

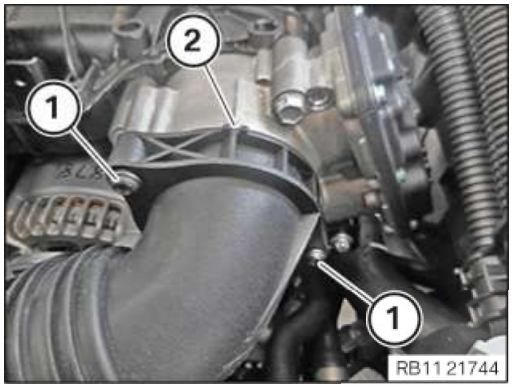


- Unlock the locks (1).
- Feed the tank ventilation line (2) out and set it aside.

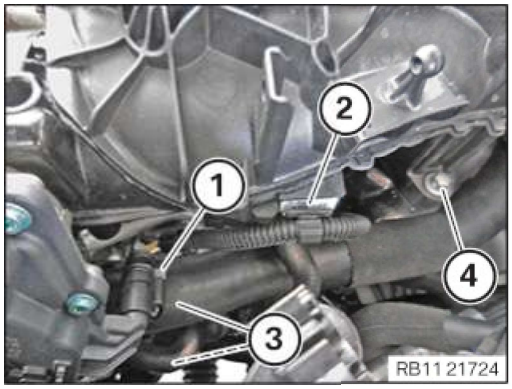
rdiagn.com



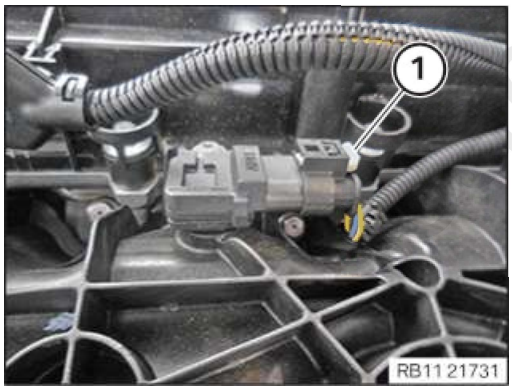
- Unlock the locks (1).
- Guide out the wiring harness section (2) for the sensor system **2** and place to one side.



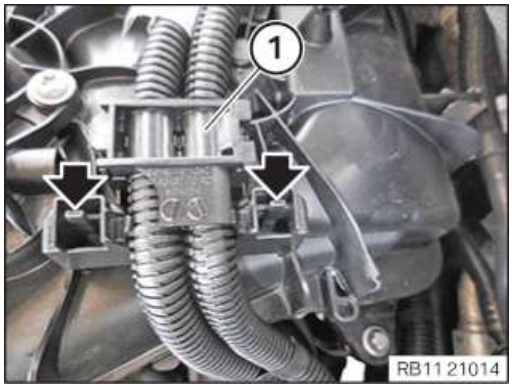
- Loosen screws (1).
- Feed out charge air line (2) and place to one side.



- Unlock and loosen connector (1).
- Loosen clamp (2).
- Thread off coolant line (3) and place to the side.
- Loosen screw (4).

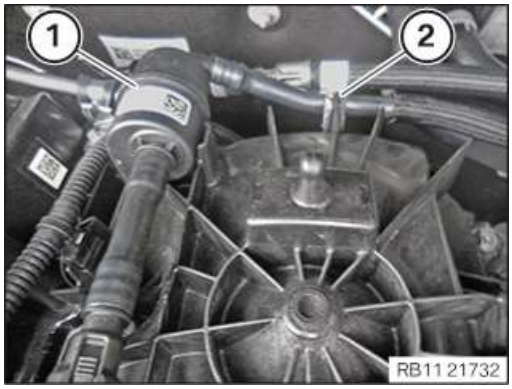


- Unlock and loosen connector (1).

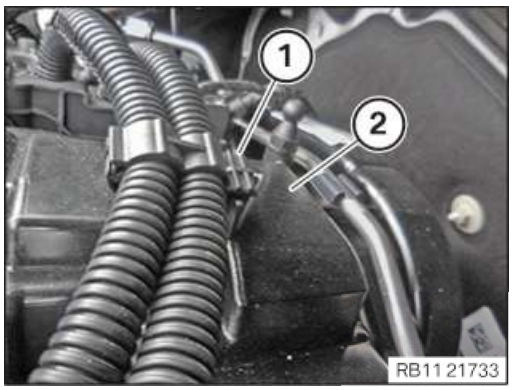


- Unlock the locks (arrows).
- Thread out the wiring harness section (1) for the injectors and ignition coils and set it aside.

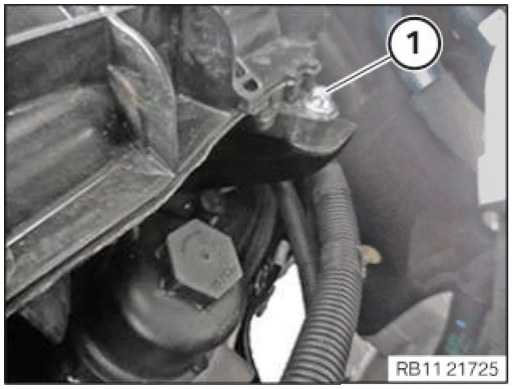
fdiagn.com



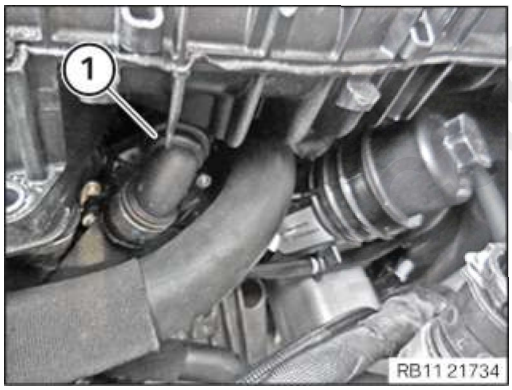
- Guide tank ventilation line (1) out of clamp (2) and place it aside.



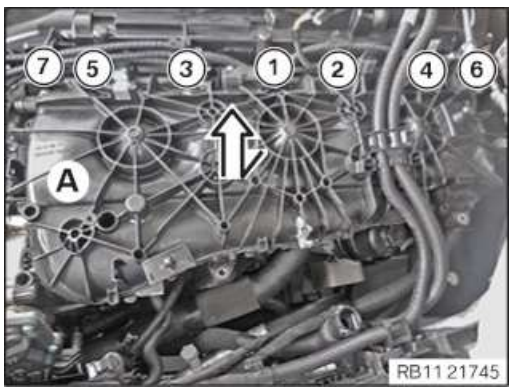
- Guide out the wiring harness section (1) for the injectors and ignition coils of the cylinder head cover (2) and set it aside.



- Loosen screw (1).

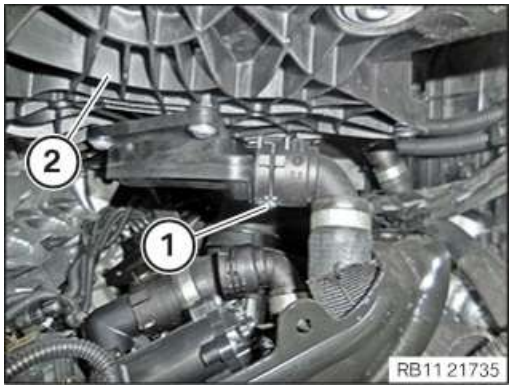


- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.



- Loosen screws in the order (7) to (1).
- Slightly raise intake plenum (A) in direction of arrow.

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TECHNICAL INFORMATION

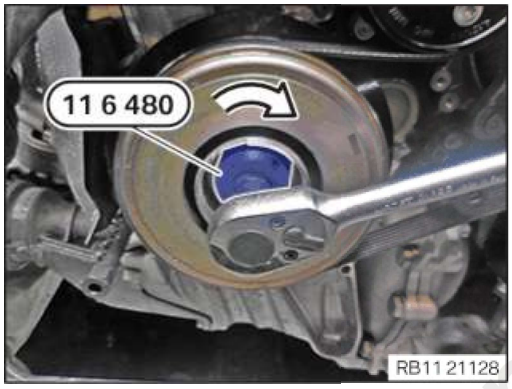
Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Unlock and release coolant line (1) below the intake plenum (2).
- Catch and dispose of escaping coolant.
- Thread out intake plenum (2) and remove.

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



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



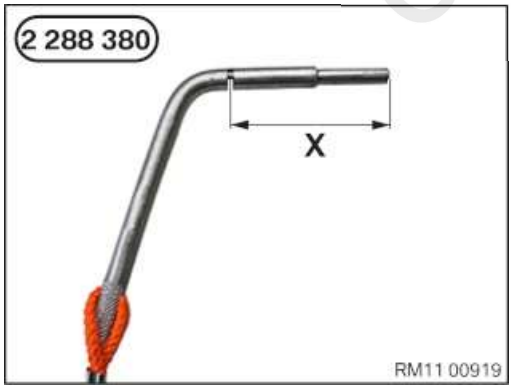
RISK OF DAMAGE

Damage to the engine.

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

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

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



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

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

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- **Vehicles with automatic transmission:**

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

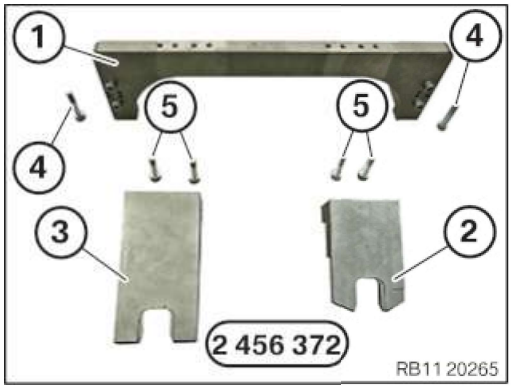
  The TDC firing position of cylinder 1 was **not** reached.



- **Vehicles with automatic transmission:**

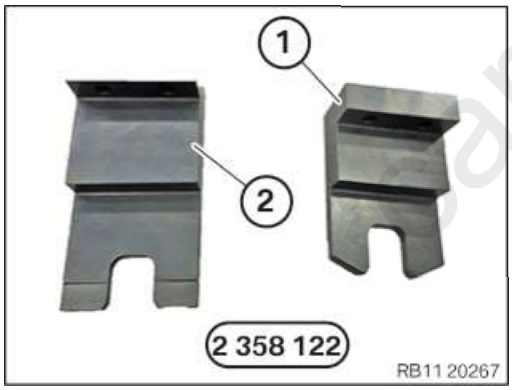
  Special tool 2 288 380 **correctly** positioned.

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



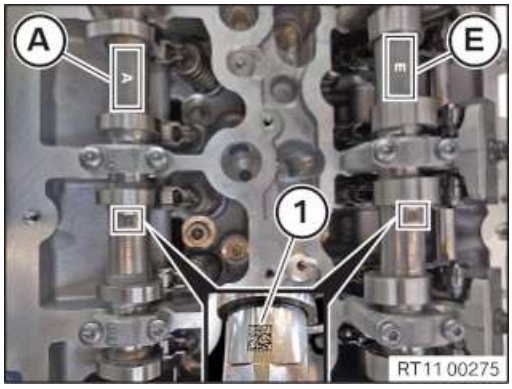
- Overview of the set of special tools 2 456 372:

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



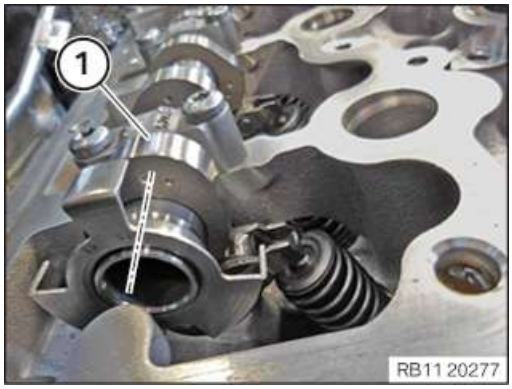
- Overview of the test gauges from the set of special tools 2 358 122:

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



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

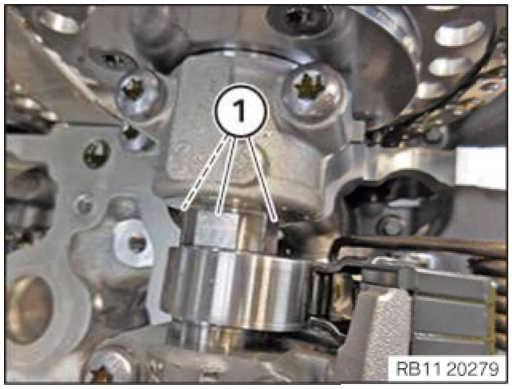
carldiag.com



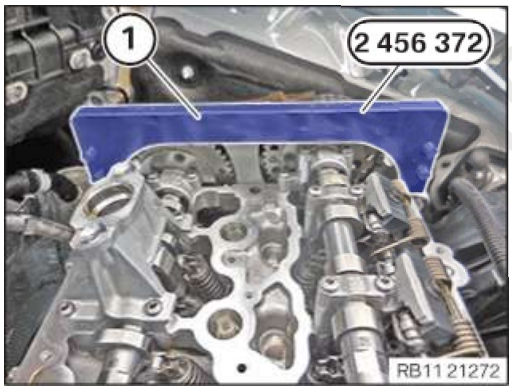
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



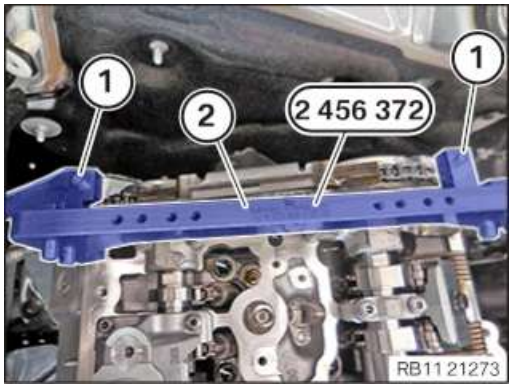
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.



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



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

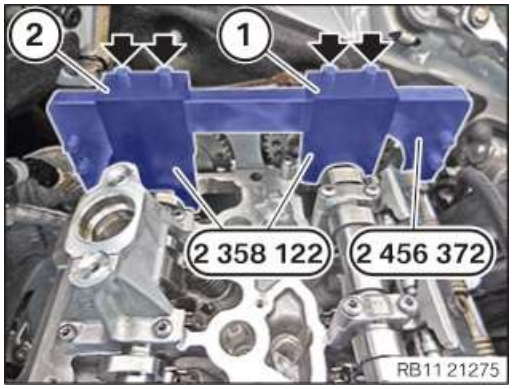


- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm

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

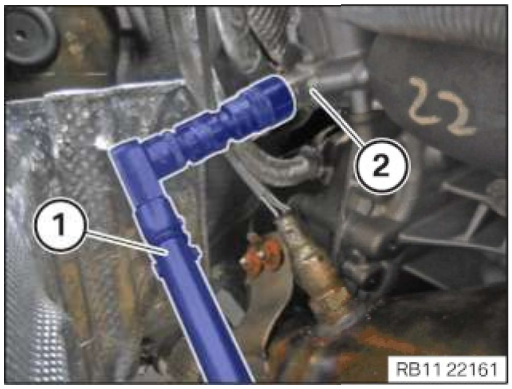
Test gauge to basic carrier

M6		Tightening torque	8 Nm

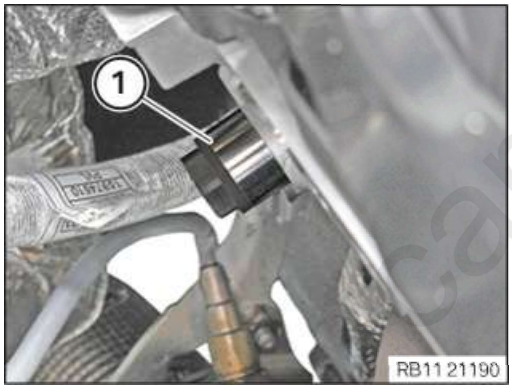
25 – Removing chain tensioner

TECHNICAL INFORMATION

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



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



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

26 – Releasing the VANOS central valve of the intake adjuster



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

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NOTICE

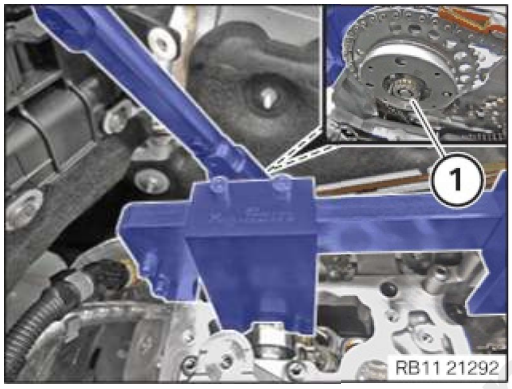
The figure shows the rear side of the engine.

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

27 – Releasing VANOS central valve of the exhaust camshaft adjuster



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

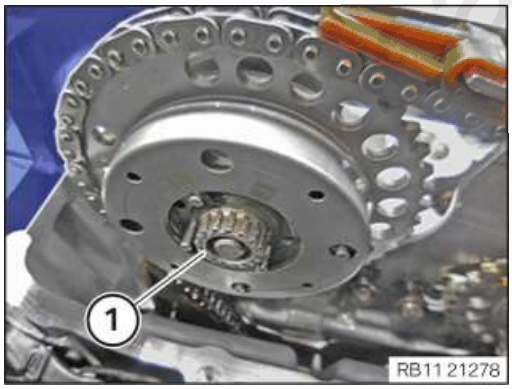


NOTICE

The figure shows the rear side of the engine.

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

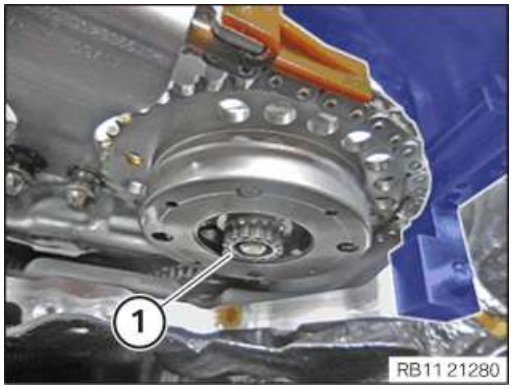
28 – Removing the VANOS central valve of the intake adjuster



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

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

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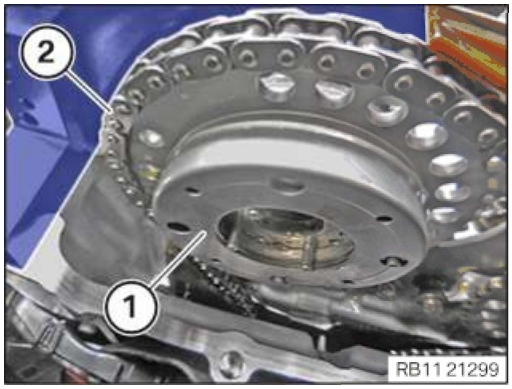


- Guide out and remove the VANOS central valve (1) of the exhaust camshaft adjuster.

30 – Removing intake adjuster

NOTICE

The figure shows the rear side of the engine.

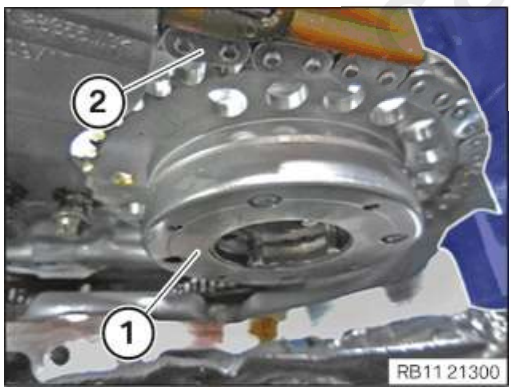


- Guide out the intake adjuster (1) from the timing chain (2) and remove.

31 – Remove exhaust camshaft adjuster

NOTICE

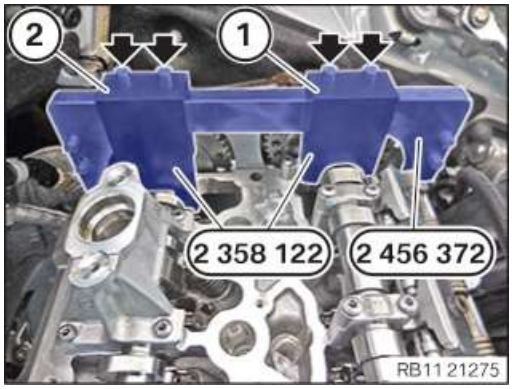
The figure shows the rear side of the engine.



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

32 – Remove the test gauges to fix the camshafts

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

33 – Remove cylinder head.

CAUTION

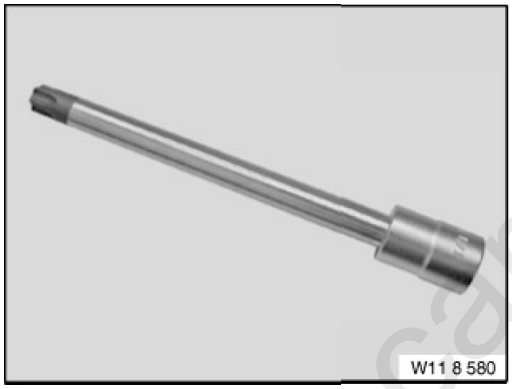
Heavy component.

Heavy components can lead to injury or damage.

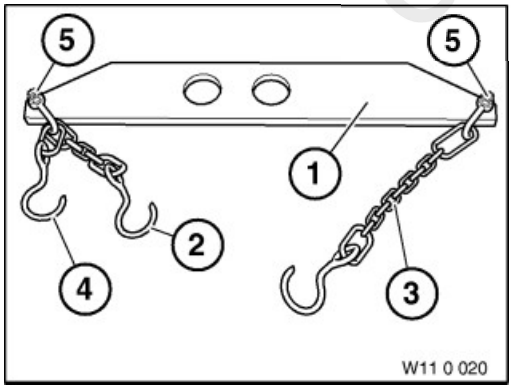
- Remove and install heavy components with the aid of another person/other persons.

TECHNICAL INFORMATION

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



- Prepare special tool 0 495 747 (11 8 580).

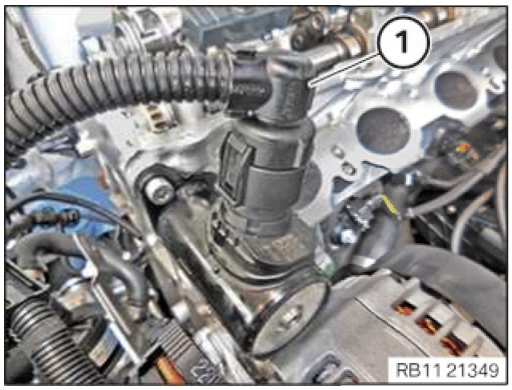


- Prepare special tool 0 490 567 (11 0 020).

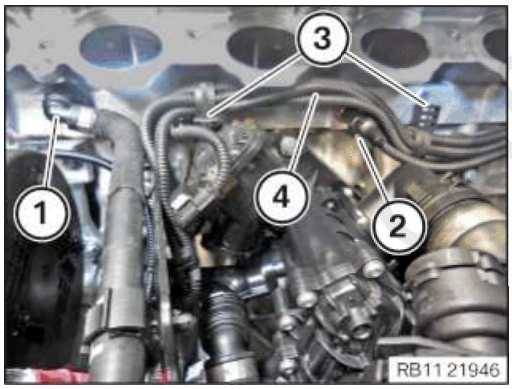
cardiagn.com



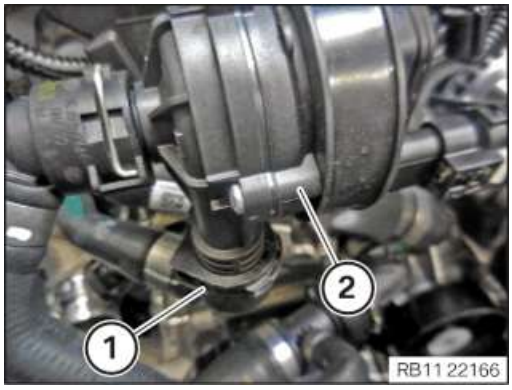
- Prepare the workshop crane 2 220 718.



- Unlock plug connection (1) and disconnect.

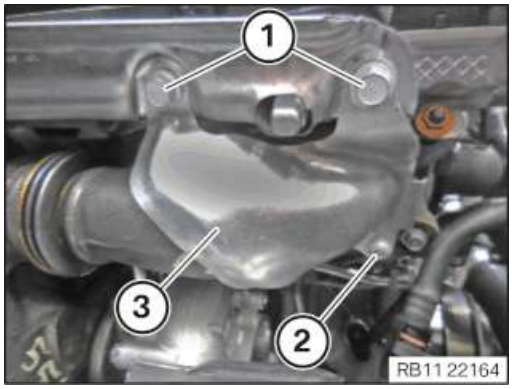


- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.
- Unlock plug connection (2) and disconnect.
- Loosen clamps (3).
- Feed out wiring harness section (4) for sensor system **1** and set it aside.



- Unlock and release coolant return line (1) on coolant pump (2) for the exhaust turbocharger.
- Catch and dispose of escaping coolant.

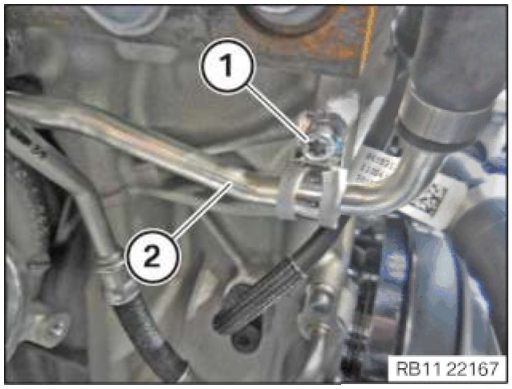
rdiagn.com



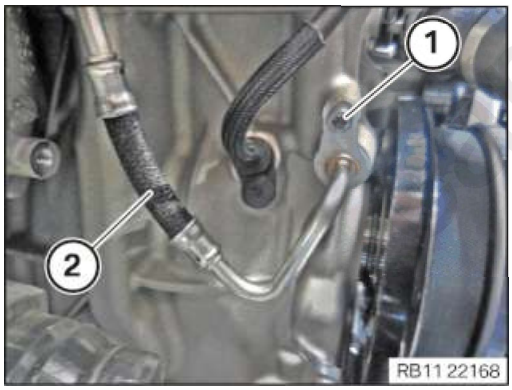
- Loosen screws (1).
- Loosen screw (2).
- Feed out and remove the heat shield (3).



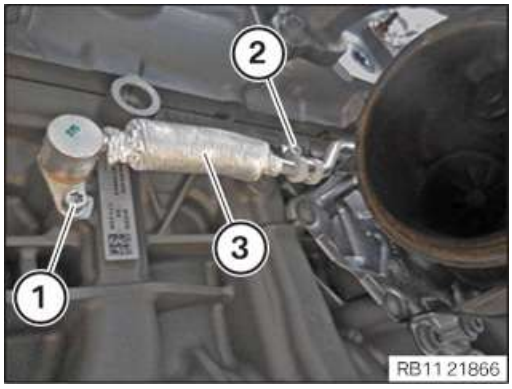
- Loosen screws (1).
- Feed out and remove the heat shield (2).



- Release screw (1) on coolant return line (2).

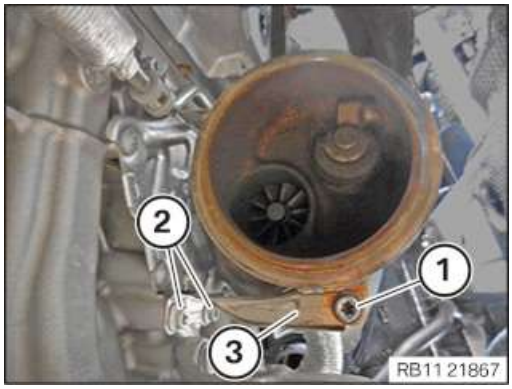


- Loosen screw (1).
- Guide out oil feed line (2) for the exhaust turbocharger and place it aside.
- Catch and dispose of emerging engine oil.

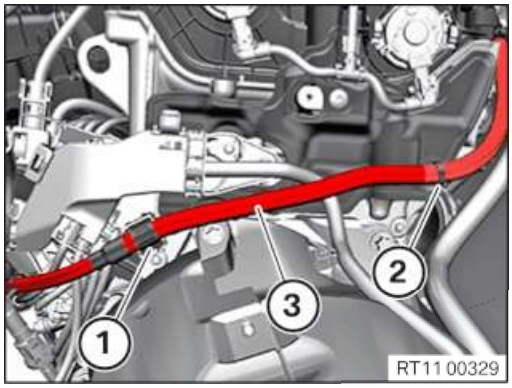


- Loosen screws (1) and (2).
- Guide the coolant feed line for exhaust turbocharger (3) from the crankcase and place it aside.
- Catch and dispose of escaping coolant.

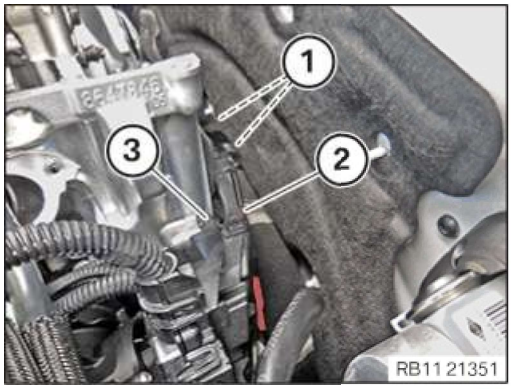
rdiagn.com



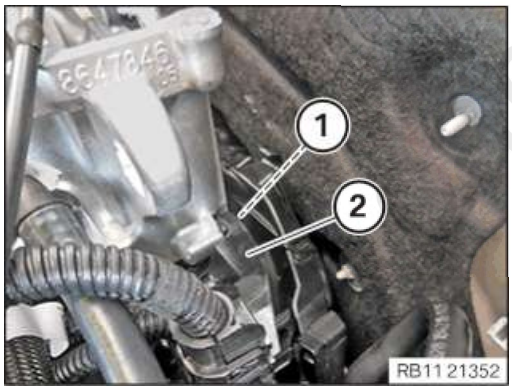
- Loosen screws (1) and (2).
- Feed the support (3) out and remove.



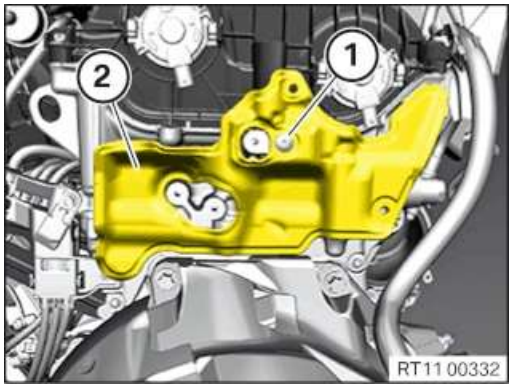
- Unlock and release clamps (1) and (2).
- Feed out positive battery cable (3) and put to one side.



- Loosen screws (1).
- Guide out transmission wiring harness (2) on wiring harness section (3) for sensor system 1 and set it aside.



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

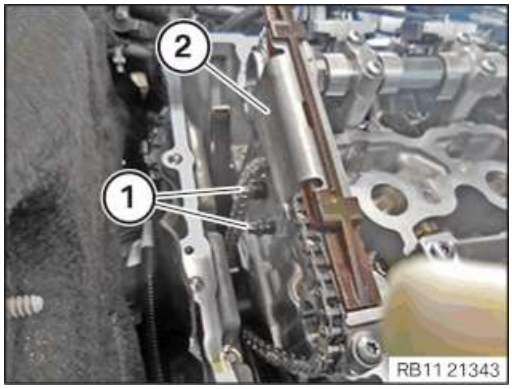


NOTICE

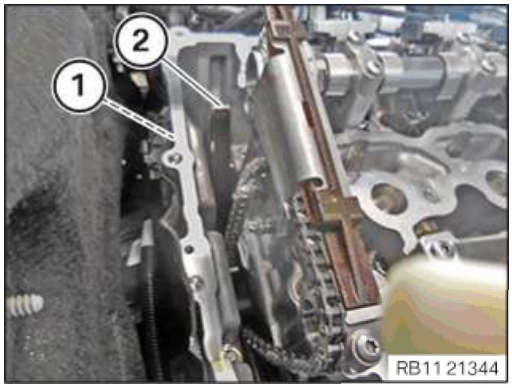
The figure shows the rear side of the engine.

- Loosen screw (1).
- Guide out and remove the cover (2).

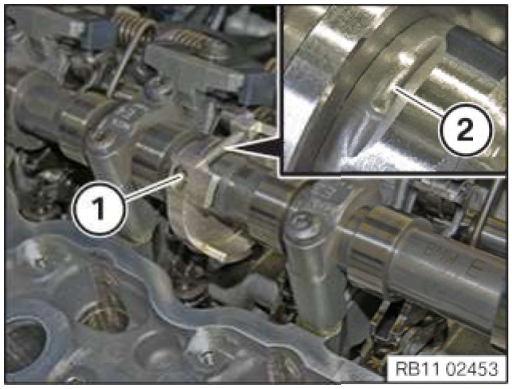
mdiagn.com



- Loosen screws (1).
- Guide out the slide rail (2) and remove.

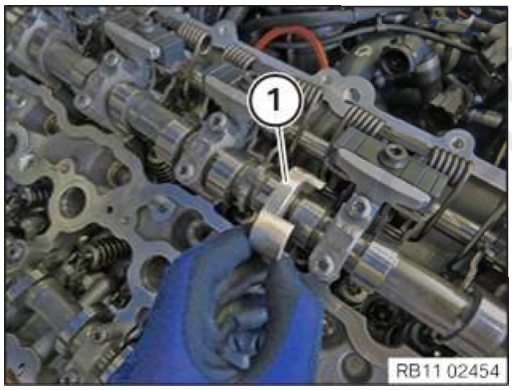


- Release the bearing journal (1) from the guide rail (2).



- Rotate intake camshaft, if necessary in the position shown.

  The recess (2) must point upwards.
- Loosen screw (1).



- Slide camshaft sensor wheel (1) in the direction of cylinder 1 and guide it out from the intake camshaft.

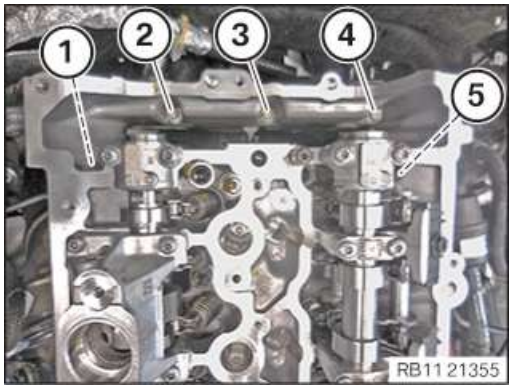


- Guide in and position special tool on the cylinder head.
- Tighten the screws (1) of special tool .

Special tool to cylinder head

M8		Tightening torque	21,5 Nm

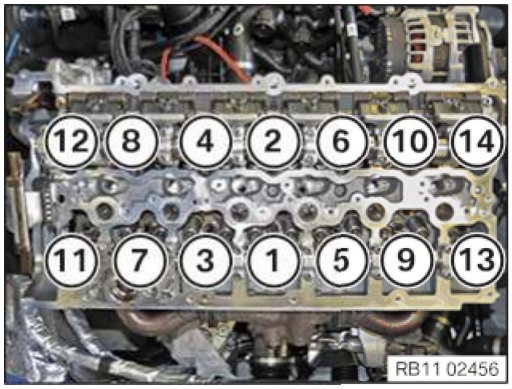
rdiagn.com



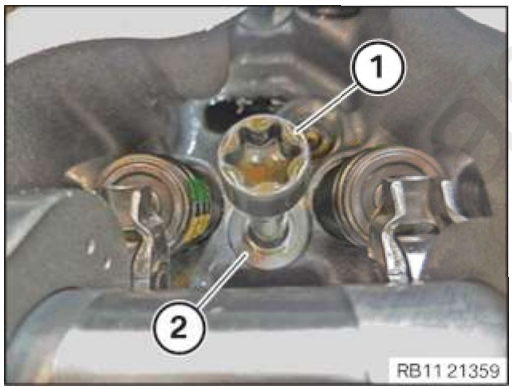
- Loosen the cylinder head bolts in the sequence from (5) to (1).



- Release cylinder head bolts with the special tool 0 495 747 (11 8 580).

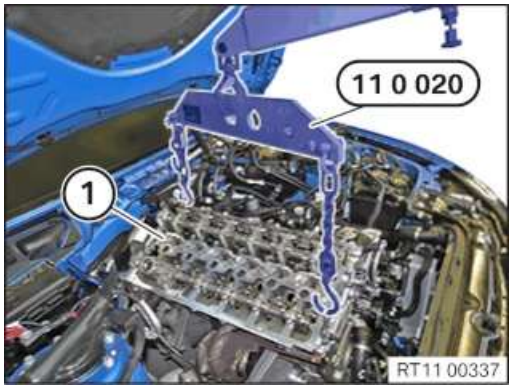


- Undo the screws using the special tool 0 495 747 (11 8 580) in the order (14) to (1) .



- Feed out and remove all the cylinder head bolts (1).
- Feed out and remove all the washers (2).

erdiagn.com



CAUTION

Heavy component.

Heavy components can lead to injury or damage.

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

RISK OF DAMAGE

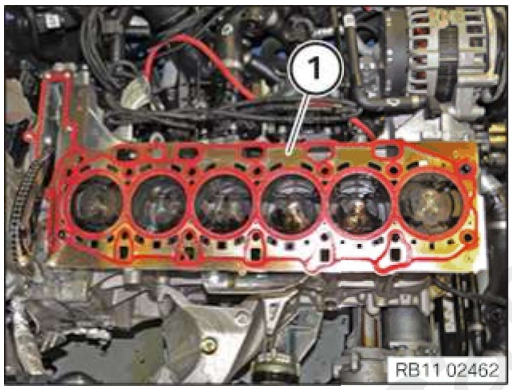
Damage to the guide rails.

Large amounts of force may damage the guide rails of the timing chain.

- Make sure not to damage the guide rail with the cylinder head when removing and installing the cylinder head.

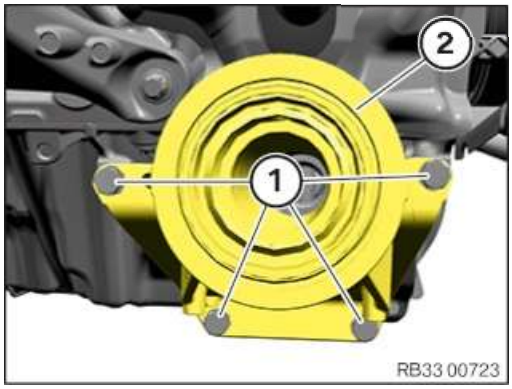
- Attach special tool 0 490 567 (11 0 020) to workshop crane.
- Lift out cylinder head (1) and the exhaust turbocharger with an auxiliary person, the workshop crane and special tool 0 490 567 (11 0 020).

34 – Removing the cylinder head gasket



- Thread out and remove cylinder head gasket (1).

35 – Remove bearing support



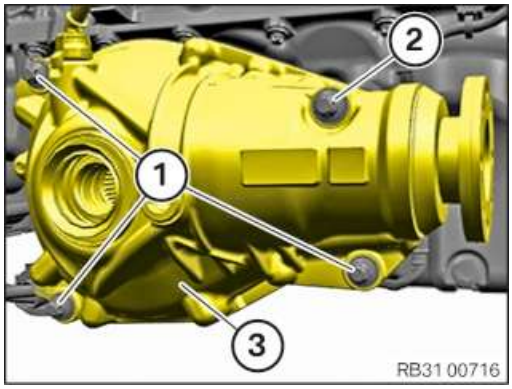
- Loosen screws (1).
- Remove the bearing support (2).

36 – Remove front axle differential

TECHNICAL INFORMATION

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

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- Mark installation location of the screws (1) and (2).
  - Screws (1) M12x55
  - Screw (2) M12x105
- Loosen screws (1) and (2).
- Remove front axle differential (3).

37 – Remove oil sump

RISK OF DAMAGE

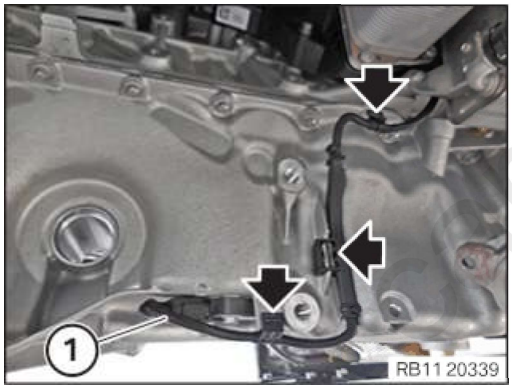
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

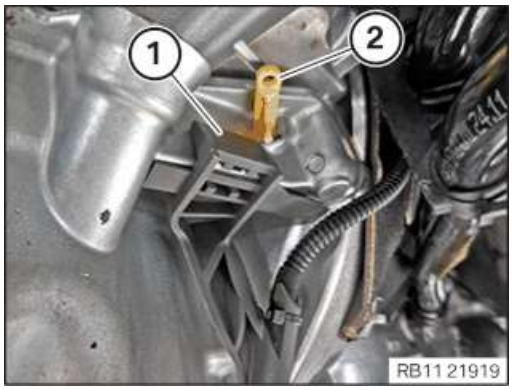
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

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



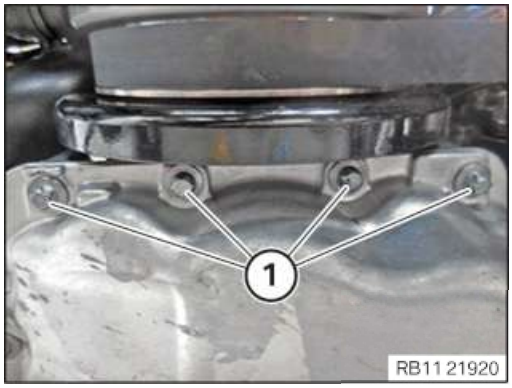
- Unlock clamps (arrows) and disconnect.
- Unlock and loosen connector (1).



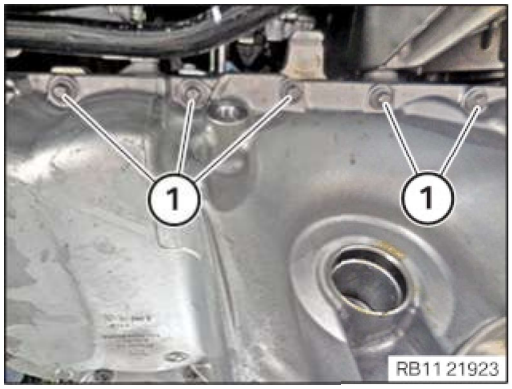
- Loosen clamp (1).
- Thread the sealing cap (2) out and remove.



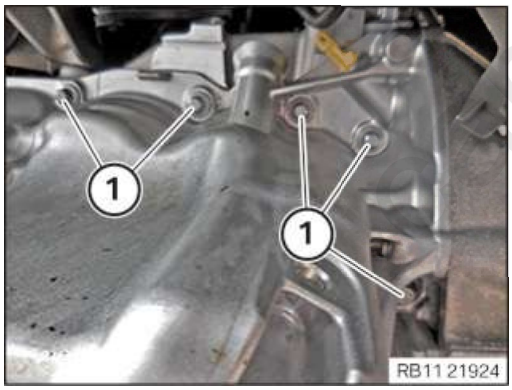
- Unscrew the transmission bolts (1).



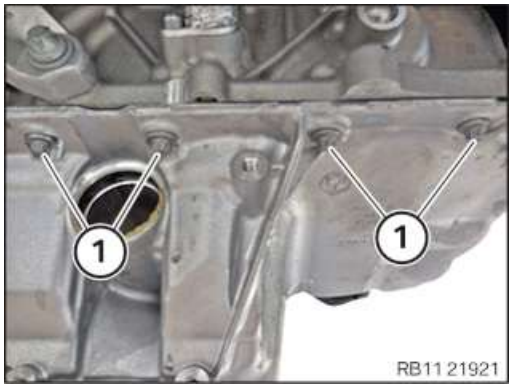
- Loosen screws (1).



- Loosen screws (1).

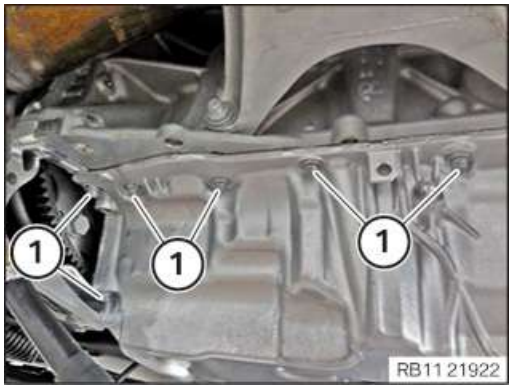


- Loosen screws (1).

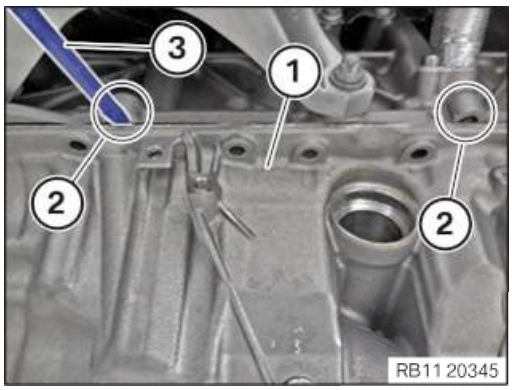


- Loosen screws (1).

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- Loosen screws (1).



TECHNICAL INFORMATION

Increased force may be necessary during disassembly because the component is bonded with liquid sealing compound.

- Release the oil sump (1) in the **marked** areas (2) using suitable tools (3).
- Guide out the oil sump (1) downwards to the rear and remove.

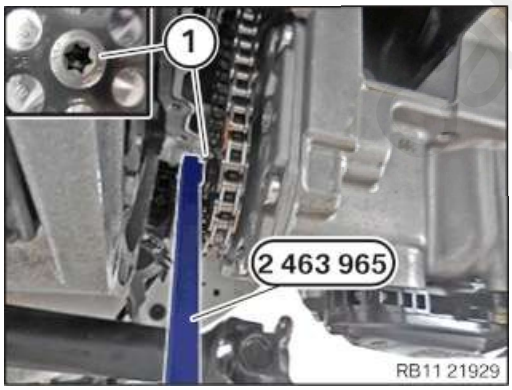
38 – Remove oil vacuum pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

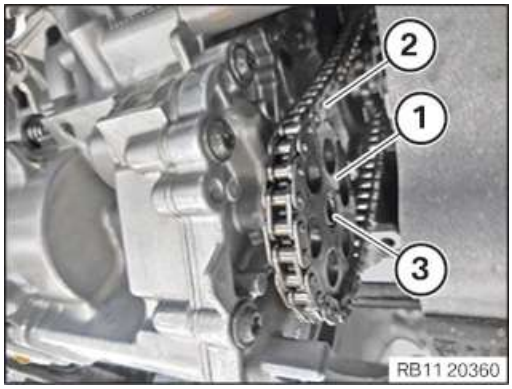
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.



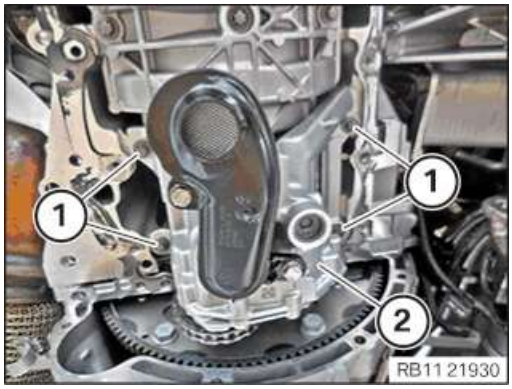
TECHNICAL INFORMATION

The thread is a left-hand thread.

- Release the screw (1) using the special tool 2 463 965.
- Thread out the bolt (1) and remove it.



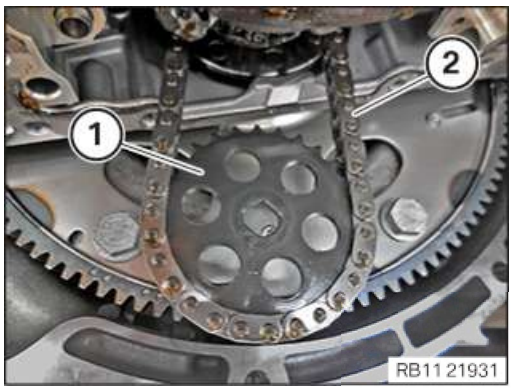
- Release the camshaft sprocket (1) from the oil vacuum pump (3).
- Feed the camshaft sprocket (1) out of the drive chain (2) and remove it.



TECHNICAL INFORMATION

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

- Release screws (1) on the oil vacuum pump (2).
- Feed out the oil vacuum pump (2) and remove it.



- Feed the camshaft sprocket (1) out of the drive chain (2) and remove it.

39 – Removing the oil deflector



- Release all the screws (marks).
- Guide out and remove the oil deflector (1).

MAIN WORK

40 – Removing all pistons with connecting rod

NOTICE

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

▸ **Removing the piston and connecting rod**

TECHNICAL INFORMATION

Piston, gudgeon pin, connecting rod and connecting rod bearing shells are matched to each other and balanced.
Always install the piston, gudgeon pin, connecting rod and connecting rod bearing shells in the cylinder from which they were removed.

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TECHNICAL INFORMATION

The connecting rods of the engine are balanced and are matched to each other.
A single connecting rod is not permitted to be replaced. Always replace all connecting rods.

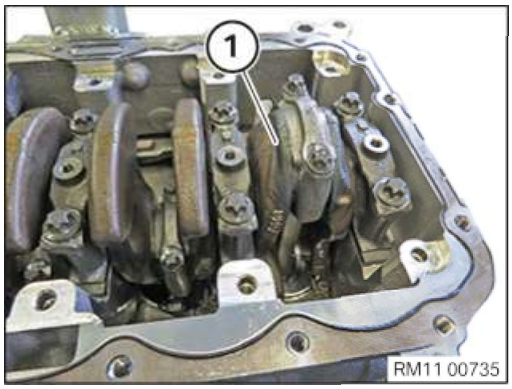
▷ **Detach the lower connecting rod bearing**

RISK OF DAMAGE

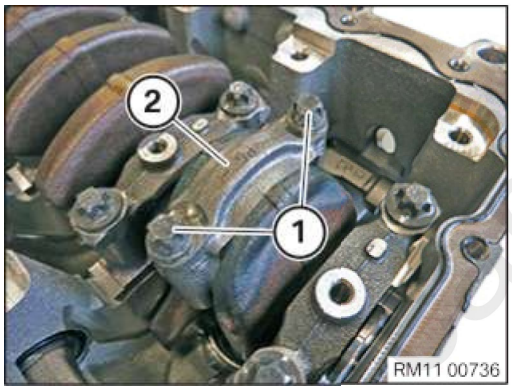
Damage on the cylinder wall and oil spray nozzles.

Major force can scratch the cylinder wall and bend the oil spray nozzles.

- Carefully move the piston and connecting rod in the engine block.



- Turn the crankshaft until the connecting rod bearing journal (1) reaches a vertical position.



RISK OF DAMAGE

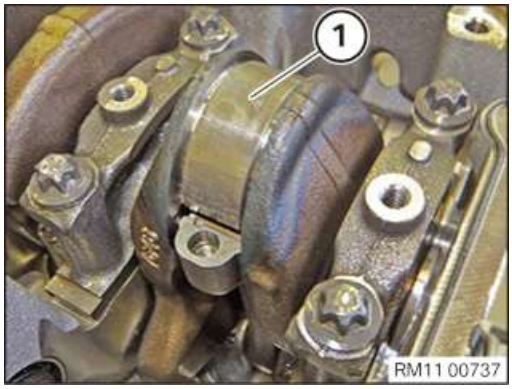
Engine damage caused by incorrectly installed bearing shells and bearing supports.

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.

- Unscrew the connecting rod bolts (1).
- Remove the connecting rod bearing cap (2) and put to one side in the correct order.

  Make sure that the connecting rod bearing cap (2) can be re-installed in the correct position.



RISK OF DAMAGE

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

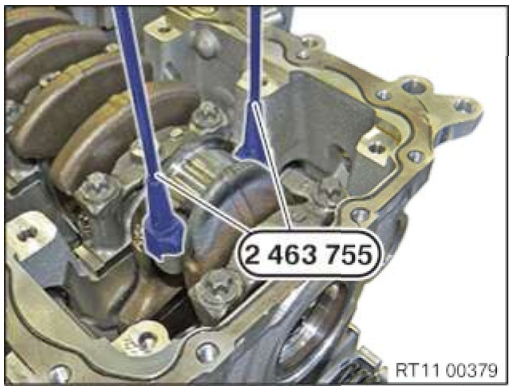
Engine damage may result from incorrectly installing bearing shells and bearing supports.

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

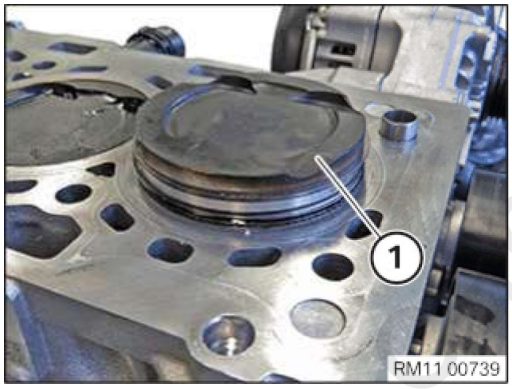
- Remove the connecting rod bearing (1).

  Make sure that the connecting rod bearing (1) can be re-installed in the correct position.

◁



- Screw special tool 2 463 755 in at large connecting rod eye.



- Push the piston (1) and the connecting rod upwards out of the crankcase.

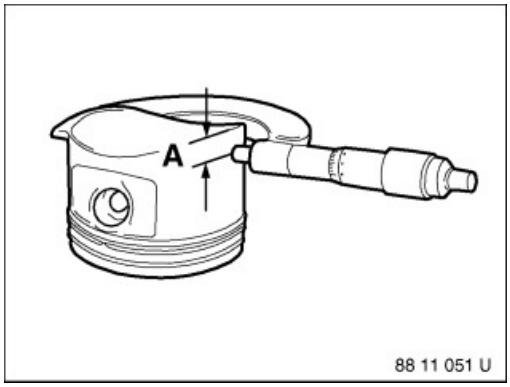
41 – Measuring piston

NOTICE

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

Check

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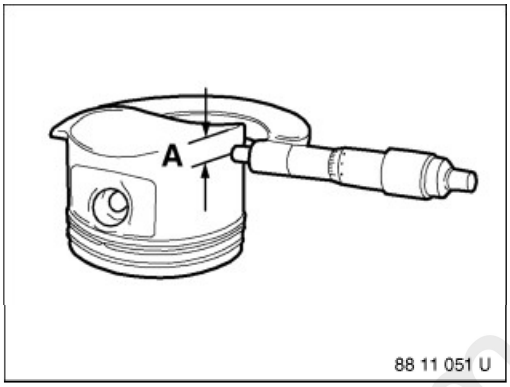


- Position measuring bolt in area (A) and measure piston installation clearance transversely to gudgeon pin.

Piston diameter

Measure the piston diameter at distance (A) from the lower end of the piston skirt.

Distance (A) to the lower end of the piston skirt	10 mm
Nominal dimension of piston diameter	81,958 mm ... 81,996 mm



Result

» Piston does not correspond to the specifications.

Measure

- Renew the piston.

42 – When replacing pistons: Remount all connecting rods

TECHNICAL INFORMATION

To determine the correct special tool for fitting the piston circlip, it is necessary to determine the inner diameter of the piston pin first.

TECHNICAL INFORMATION

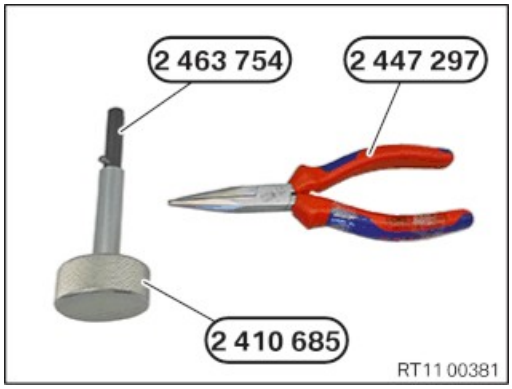


- Wear safety goggles.

NOTICE

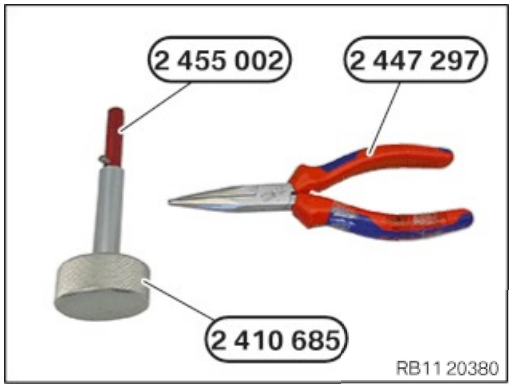
The description is for one component only. The procedure is identical for all further components.

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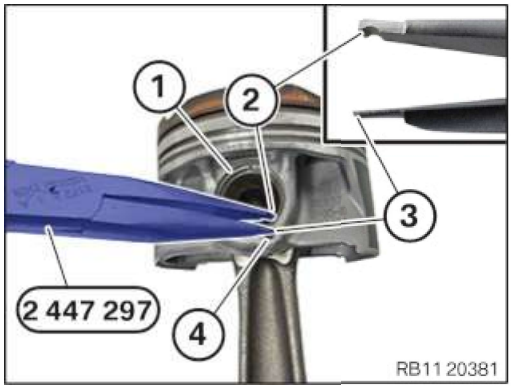
- Equipment specification with gudgeon pin with inner diameter of 12.0 mm:

  Use special tools 2 463 754, 2 410 685 and to remove the piston from the connecting rod.



- Equipment specification with gudgeon pin with inner diameter of 12.5 mm:

  Use special tools , 2 410 685 and to remove the piston from the connecting rod.



CAUTION

Gudgeon pin circlip with preload.

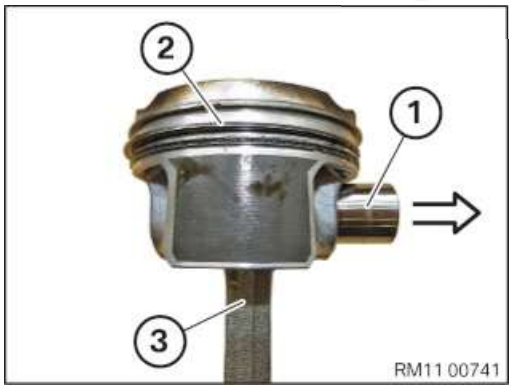
Danger of injury!

- The use of the specified special tool for the disassembly or installation is mandatory.

- Wear safety goggles.

- Use special tool to remove the gudgeon pin circlip.
- Insert the flat side (3) of the special tool into the groove (4).
- Grip the gudgeon pin circlip (1) by the domed side (2) and remove.

Check



TECHNICAL INFORMATION

Piston and gudgeon pin are matched to each other.

Always install piston and gudgeon pin together and do not switch by mistake.

- Check whether the gudgeon pin (1) demonstrates tangible play in the piston.
- Check whether the gudgeon pin (1) can be removed without excessive force.

Result

» The gudgeon pin (1) is difficult to remove.

» Gudgeon pin (1) has noticeable play.

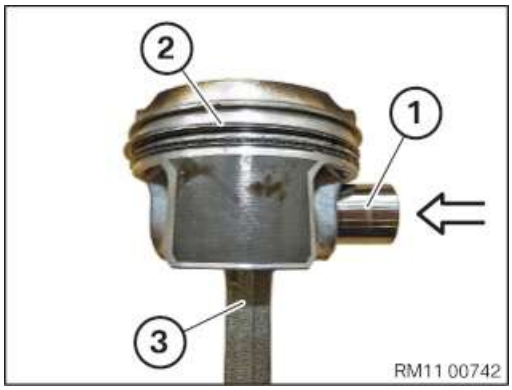
Measure

- Renew the piston (2) and the gudgeon pin (1).

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- Renew the piston.

  Parts: Pistons

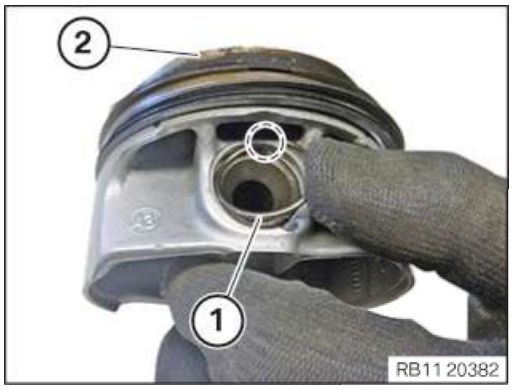


TECHNICAL INFORMATION

Piston and gudgeon pin are matched to each other.

Always install piston and gudgeon pin together and do not switch by mistake.

- Install gudgeon pin (1) in piston (2) and connecting rod (3).



CAUTION

Gudgeon pin circlip with preload.

Danger of injury!

- The use of the specified special tool for the disassembly or installation is mandatory.



- Wear safety goggles.

- Position the gudgeon pin circlip (1) such that the opening in the marked area of the gudgeon pin circlip points in the direction of the piston crown (2).



TECHNICAL INFORMATION

To determine the correct special tool for fitting the piston circlip, it is necessary to determine the inner diameter of the piston pin first.

- Equipment specification with gudgeon pin with inner diameter of 12.0 mm:

  Preload the gudgeon pin circlip (1) using your thumb.

  Simultaneously press the gudgeon pin circlip into the piston using special tools 2 410 685 and 2 463 754 .

  Twist and reposition special tool 2 410 685 and completely press the gudgeon pin circlip into the piston.



TECHNICAL INFORMATION

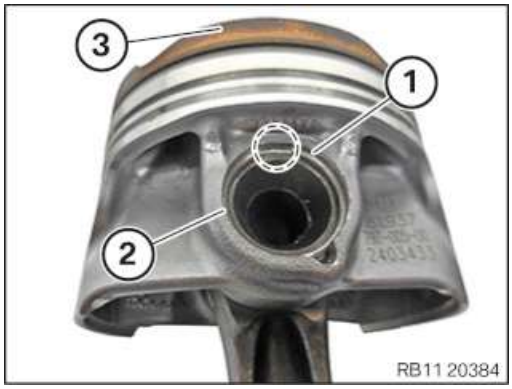
To determine the correct special tool for fitting the piston circlip, it is necessary to determine the inner diameter of the piston pin first.

- Equipment specification with gudgeon pin with inner diameter of 12.5 mm:

  Preload the gudgeon pin circlip (1) using your thumb.

  Simultaneously press the gudgeon pin circlip into the piston using special tools 2 410 685 and .

  Twist and reposition special tool 2 410 685 and completely press the gudgeon pin circlip into the piston.

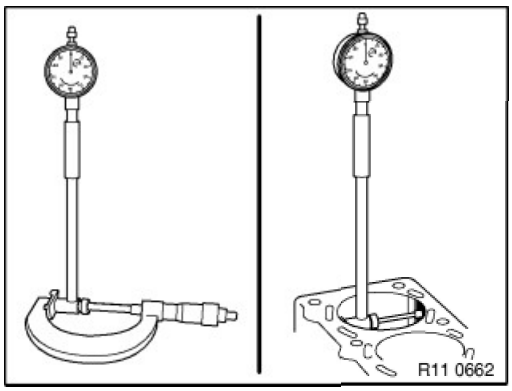


- Check whether the gudgeon pin circlip (1) has been correctly positioned in the groove (2).
- Check whether the opening in the marked area of the gudgeon pin circlip is pointing towards the piston crown (3).

43 – Measuring a cylinder

Prerequisite

Cylinder barrel is cleaned.



Check

- Carry out a measurement at all cylinders.
- Adjusting measuring screw to nominal dimension of cylinder bore.

Cylinder bore B38/B46/B48/B58

Diameter of cylinder bore	82,000 mm ... 82,014 mm
Permitted irregularity of the cylinder bore	0,01 mm
Permitted conicity of the cylinder bore	0,01 mm
Permissible total wear tolerance between piston and cylinder bore (engine operated)	0,15 mm

- Insert internal measuring device into measuring screw and set to zero.
- With the internal measuring device, measure the cylinder at the following points and check the deviations from the nominal dimension.
  - Lower third of the cylinder bore in direction of travel,
  - Lower third of the cylinder bore transversely to direction of travel,
  - Middle third of the cylinder bore in direction of travel,
  - Middle third of the cylinder bore transversely to direction of travel,
  - Upper third of the cylinder bore in direction of travel,
  - Upper third of the cylinder bore transversely to direction of travel.

Cylinder bore B38/B46/B48/B58

Diameter of cylinder bore	82,000 mm ... 82,014 mm
Permitted irregularity of the cylinder bore	0,01 mm
Permitted conicity of the cylinder bore	0,01 mm
Permissible total wear tolerance between piston and cylinder bore (engine operated)	0,15 mm

Result

» Cylinder does not correspond to the specifications.

Measure

- Renew the crankcase.

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44 – Installing all pistons with connecting rod

NOTICE

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

▶ **Installing piston with the connecting rod**

RISK OF DAMAGE

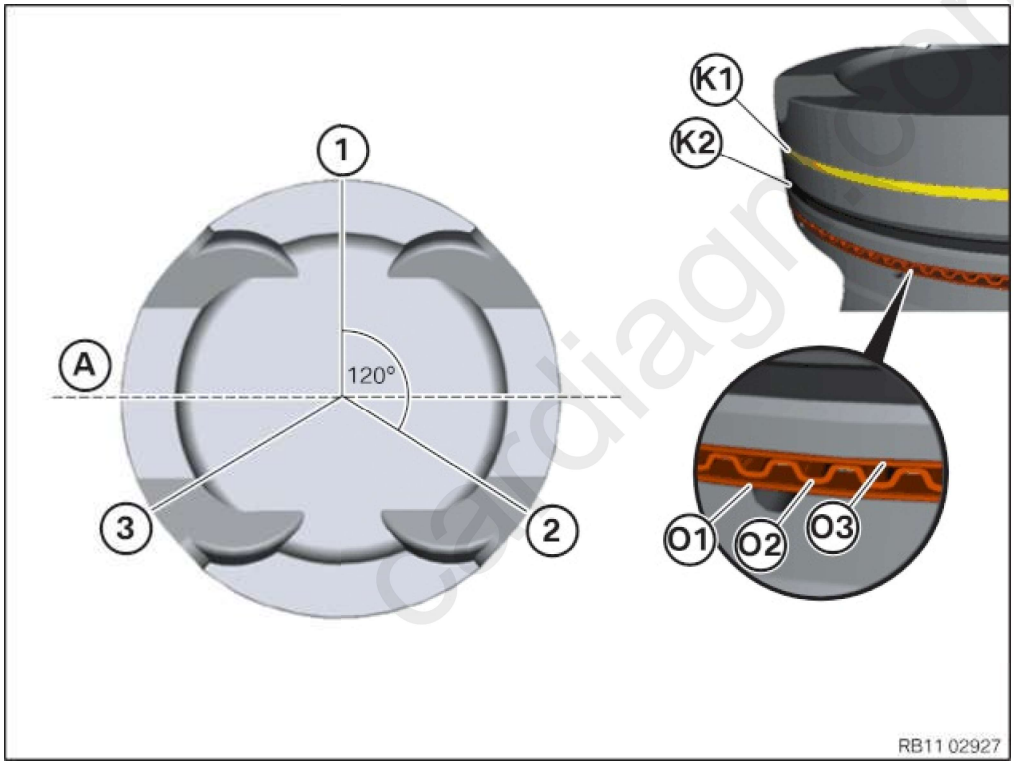
Damage on the cylinder wall and oil spray nozzles.

Major force can scratch the cylinder wall and bend the oil spray nozzles.

- Carefully move the piston and connecting rod in the engine block.

▷ **Aligning piston rings**

Aligning piston rings



1 12 o'clock position

2 4 o'clock position

3 8 o'clock position

A Axis of gudgeon pin

K1 Upper piston ring

K2 Middle piston ring

O1 Lower oil scraper ring

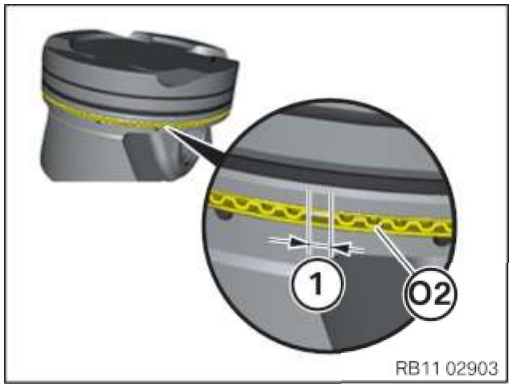
O2 Spring

O3 Upper oil scraper ring

- Align the contact points of all piston rings rotated by 120° each.

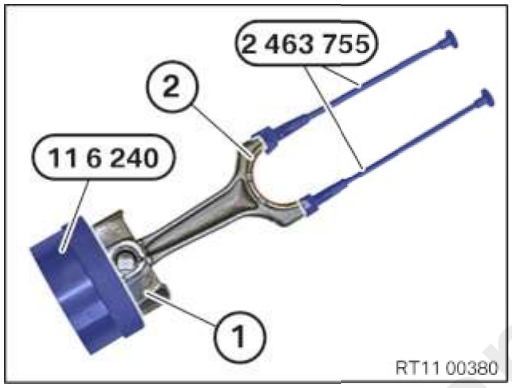
  Do not position contact points over axis of gudgeon pin (A).

Piston ring	Align at the following position
Lower oil scraper ring (O3)	Align at the 12 o'clock position (1)
Spring (O2)	Align at the 4 o'clock position (2)
Upper oil scraper ring (O1)	Align at the 8 o'clock position (3)
Middle piston ring (K2)	Align at the 12 o'clock position (1)
Upper piston ring (K1)	Align at the 4 o'clock position (2)



- Make sure that contact point (1) does not overlap spring (O2).

◁



- Coat the pistons (1) and piston rings lightly with oil.
- Insert the piston (1) with the piston rings into the special tool (bush) 0 495 373 (11 6 240).
- Screw special tool 2 463 755 on at large connecting rod eye (2).



- Align the piston so that the arrow (1) points to cylinder 1.
- Insert piston with the connecting rod into the special tool 0 495 373 (11 6 240) and guide it into the cylinder.

RISK OF DAMAGE

Damage on the cylinder wall and oil spray nozzles.

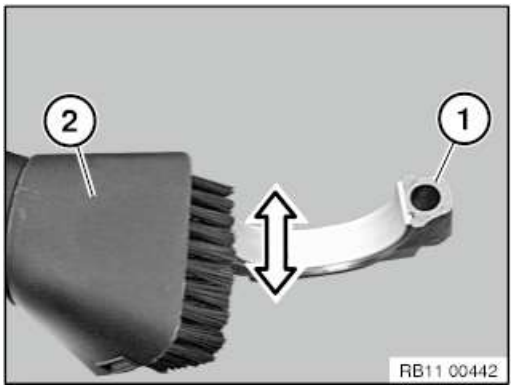
Major force can scratch the cylinder wall and bend the oil spray nozzles.

- Carefully move the piston and connecting rod in the engine block.

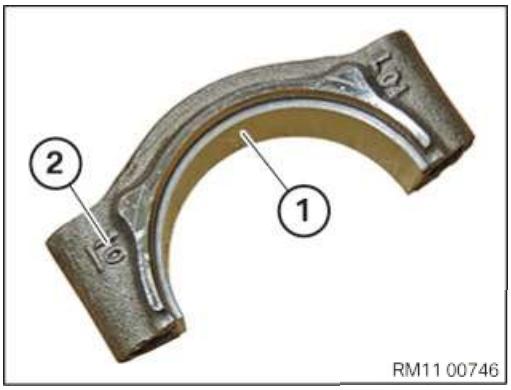
- Push in piston by hand with only little force. Do not use striking tools.

▷ **Install the lower connecting rod bearing**

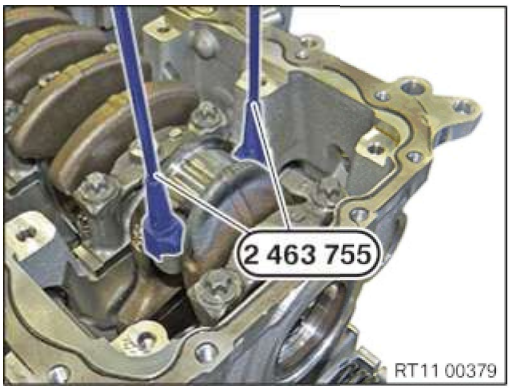
ardiagn.com



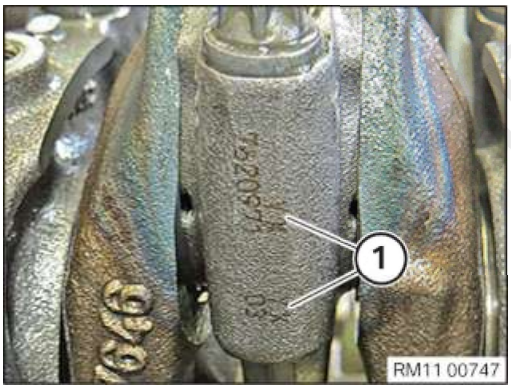
- Vacuum the connecting rod bearing shell and cracked surface (1) with a vacuum cleaner (2).



- Insert the connecting rod bearing shell (1) into the connecting rod bearing cap (2).
- Apply a light coat of oil to the connecting rod bearing shell (1).



- If necessary, screw the special tool (assembly tool) 2 463 755 into the large connecting rod eye.
- Pull the connecting rod up to the connecting rod bearing journal.



RISK OF DAMAGE

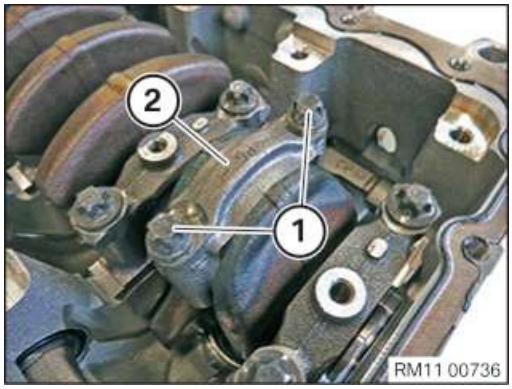
Engine damage caused by incorrectly installed bearing shells and bearing supports.

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.

- Attach the connecting rod bearing caps to the connecting rod until the designations (1) match.

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- Renew screws (1).

  Parts: Bolts

- Tighten the bolts with the special tool 0 490 504 (00 9 120).

Connecting rod bearing cap to connecting rod

Renew screws.

Tighten screws crosswise.	Jointing torque	20 Nm
	1. Angle of rotation	70 °
	2. Angle of rotation	70 °

◁

POSTPROCESSES

45 – Installing the oil deflector



- Renew bolts (markings).

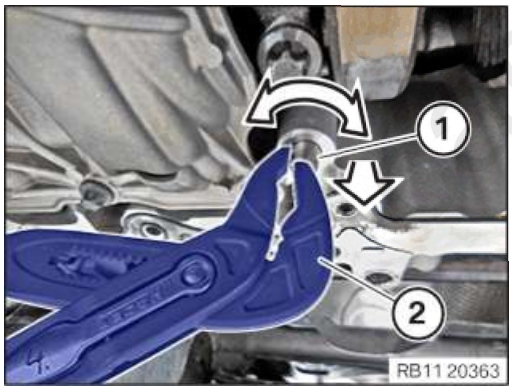
  Parts: Bolts

- Insert oil deflector (1) and position.
- Tighten bolts (markings) in a crosswise pattern using the special tool 0 490 504 (00 9 120).

Oil deflector to crankcase

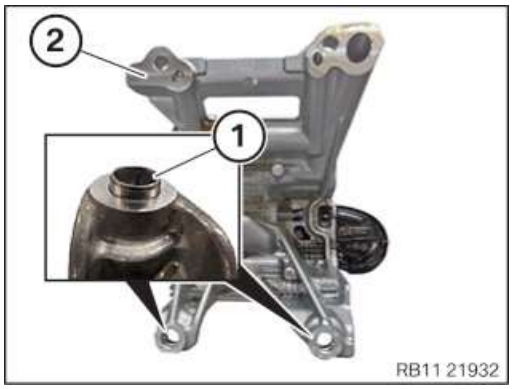
M8 x 35	Replace screws.	Jointing torque	15 Nm
		Angle of rotation	45 °

46 – Install the oil vacuum pump



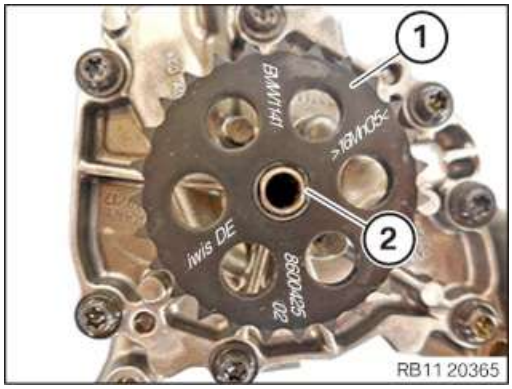
- Work centring sleeves (1) out of the crankcase in the direction of the arrow using conventional tools (2) and remove.
- Renew the centring sleeves (1).

  Parts: Centring sleeves



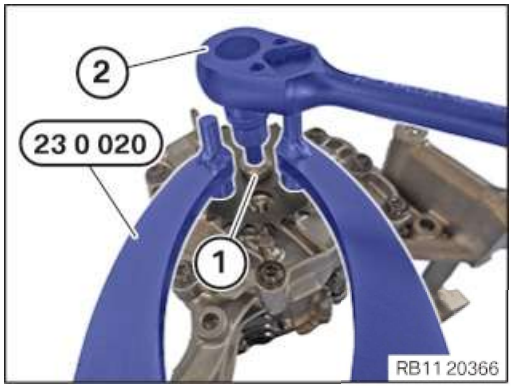
- Insert and install centring sleeves (1) at the oil vacuum pump (2).

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- Position the camshaft sprocket (1) at the oil vacuum pump (2).

  The labelling on the camshaft sprocket (1) must face away from the oil vacuum pump (2).



- Renew the screw (1).

  Parts: Screw

TECHNICAL INFORMATION

The thread is a left-hand thread.

- Insert bolt (1) and fit.

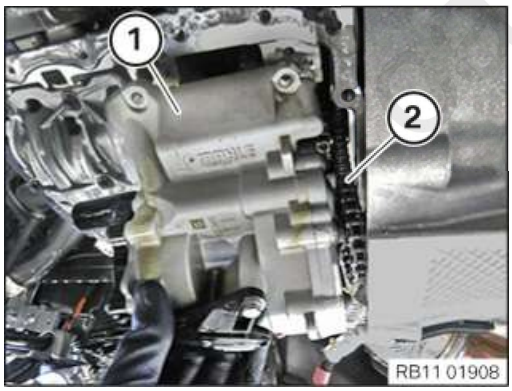
TECHNICAL INFORMATION

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

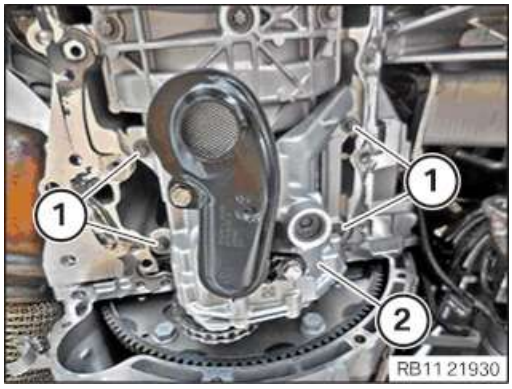
- Hold camshaft sprocket with special tool 0 491 440 (23 0 020) and tighten bolt (1) with conventional tools (2).

Camshaft sprocket to oil vacuum pump

M8	Important - left-hand thread Renew screw.	1. Jointing torque 2. Angle of rotation	5 Nm 90 °



- Insert and position the oil vacuum pump (1) in the drive chain (2).



- Renew screws (1).

  Parts: Bolts

- Tighten the screws (1).

Oil vacuum pump to crankcase

M8	Renew screw.	1. Tightening torque 2. Angle of rotation	15 Nm 45 °

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

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

RISK OF DAMAGE

Damage to the surface.

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

- Do not use any metal-cutting tools.



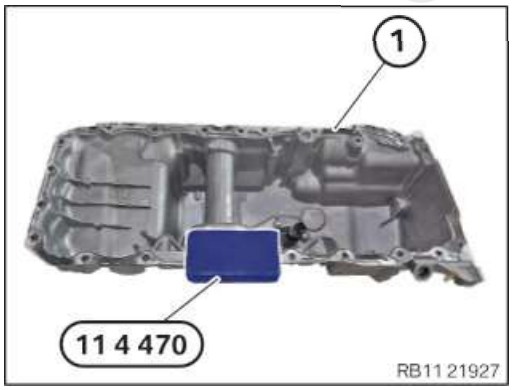
TECHNICAL INFORMATION

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

- Remove the coarse sealing residue on sealing surface (1) on the crankcase with special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215



TECHNICAL INFORMATION

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

- Remove the fine seal remains on the sealing surface (1) of the oil sump with the special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215

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- Have the special tool ready.

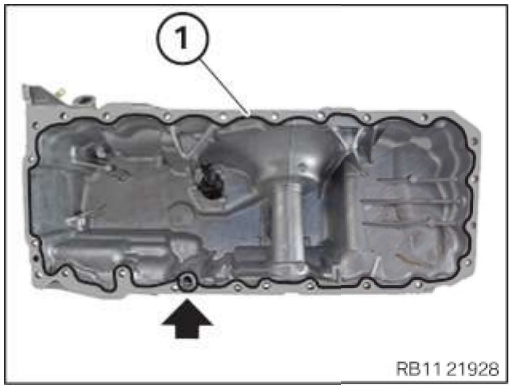


TECHNICAL INFORMATION

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

- Position the sealing compound (1) on special tool as shown.

  Parts: Sealing compound



TECHNICAL INFORMATION

The maximum application time of the liquid sealing compound is 12 minutes.

- Apply sealing bead (1) with the sealing compound in the **marked** area along the inner edge.

Sealing compound

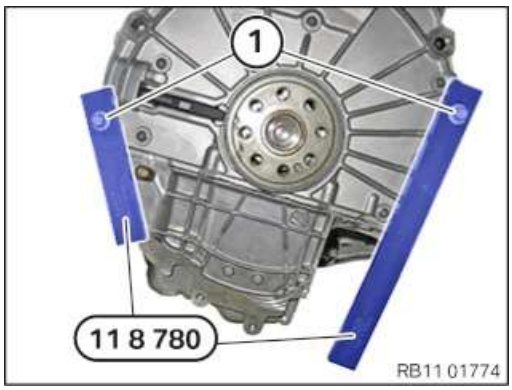
Loctite 5970 liquid sealing compound	50 ml, Cartridge	83190404517

Overview of consumables (Electronic Parts Catalogue)

Height of the sealing bead

	2,0 mm ... 2,5 mm

- Completely encircle the oil return orifice (arrow) with the sealing compound.



TECHNICAL INFORMATION

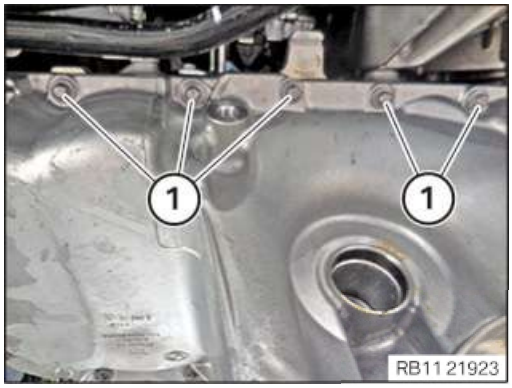
The special tool 11 8 780 is only required when the transmission is removed.

- Position the special tool 0 496 120 (11 8 780) with the transmission bolts (1) so that the oil sump is exactly flush with the timing case cover.
- Renew the centring sleeves where required.

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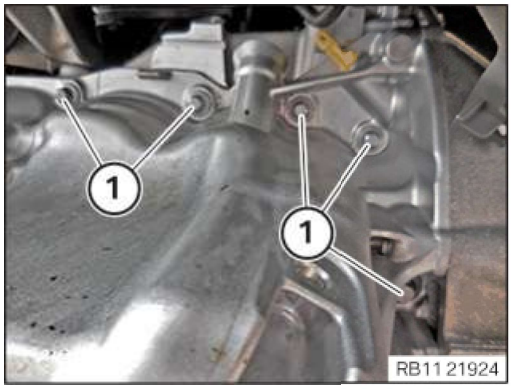
- Insert oil sump (1) upwards and forwards and position.



- Tighten the screws (1).

Oil sump to crankcase

M8 x 30		Tightening torque	24 Nm



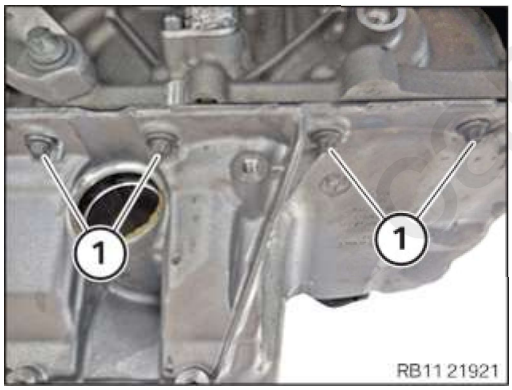
- Tighten the screws (1).

Oil sump to crankcase

M8 x 30		Tightening torque	24 Nm

Oil sump to crankcase

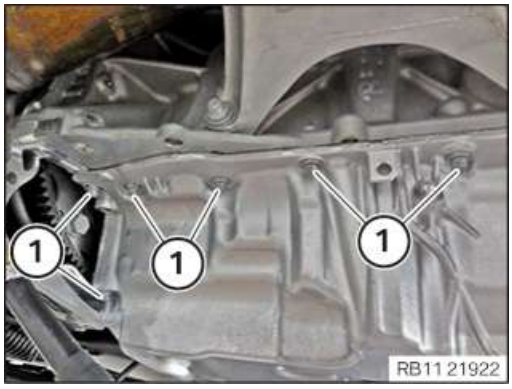
M8 x 110		Tightening torque	24 Nm



- Tighten the screws (1).

Oil sump to crankcase

M8 x 30		Tightening torque	24 Nm



- Tighten the screws (1).

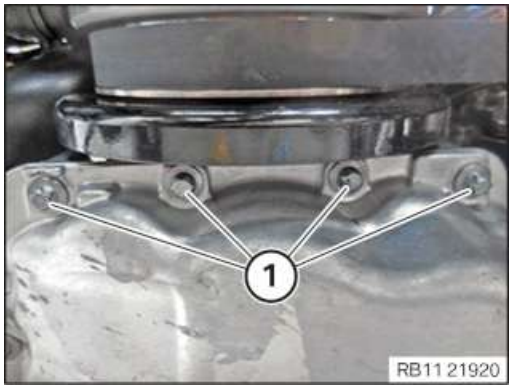
Oil sump to crankcase

M8 x 30		Tightening torque	24 Nm

Oil sump to crankcase

M8 x 110		Tightening torque	24 Nm

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- Tighten the screws (1).

Oil sump to crankcase

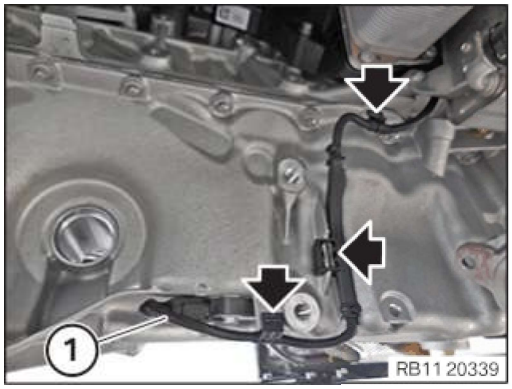
M8 x 30		Tightening torque	24 Nm



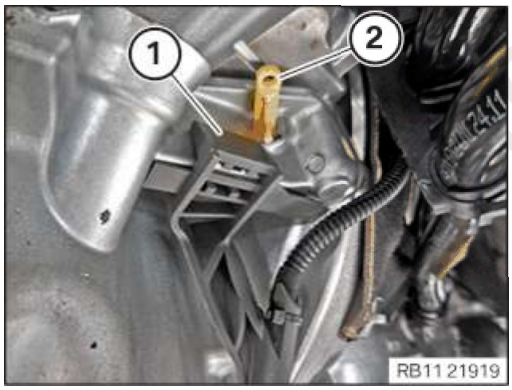
- Tighten transmission screws (1).

Transmission to oil sump (manual gearbox and automatic transmission)

M8 x 50		Tightening torque	19 Nm

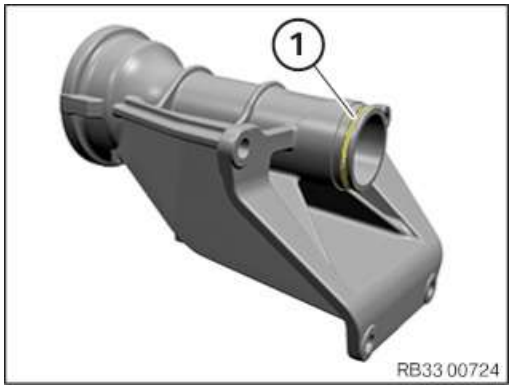


- Secure the clamps (arrows).
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.



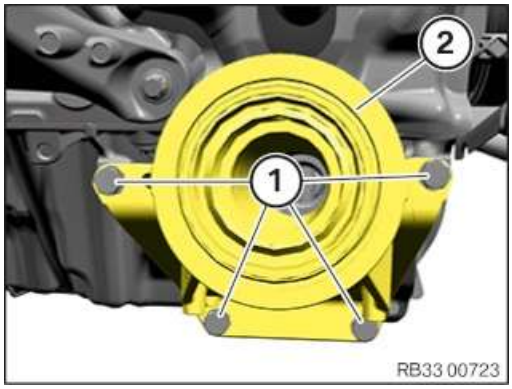
- Secure clamps (1).
- Guide in and install sealing cap (2).

48 – Install bearing support



- Coat the O-ring (1) with front axle transmission oil.

rdiagn.com

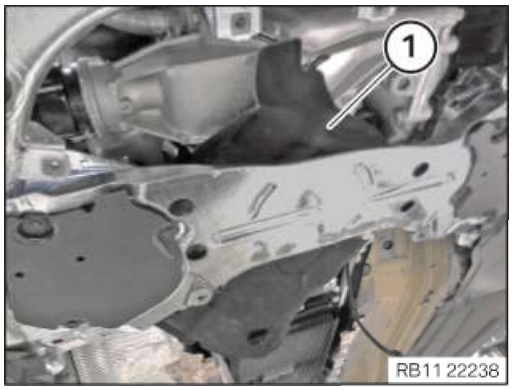


- Position the bearing support (2) at the engine oil sump.
- Tighten the screws (1).

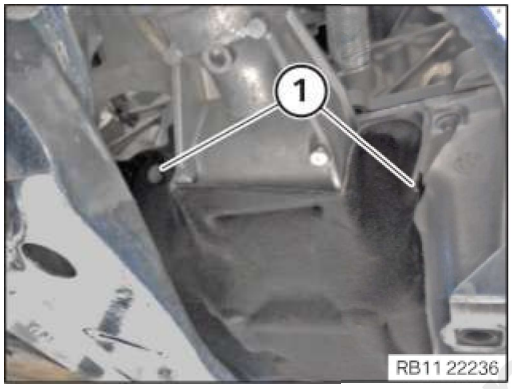
Bearing support to oil sump

M8		Tightening torque	19 Nm

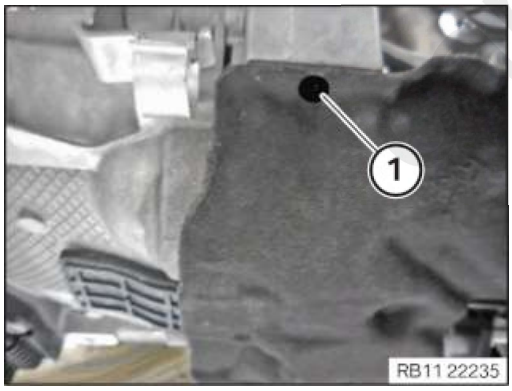
49 – Installing the acoustic cover for the oil sump



- Thread in and position the acoustic cover (1).

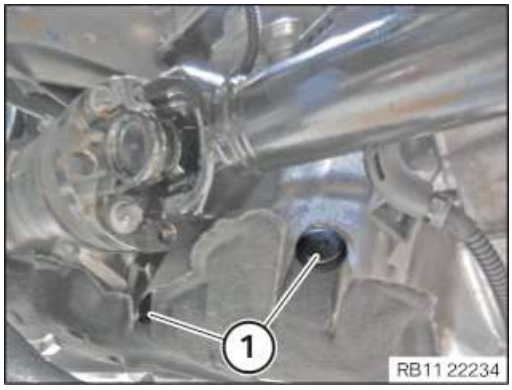


- Secure expanding rivet (1).



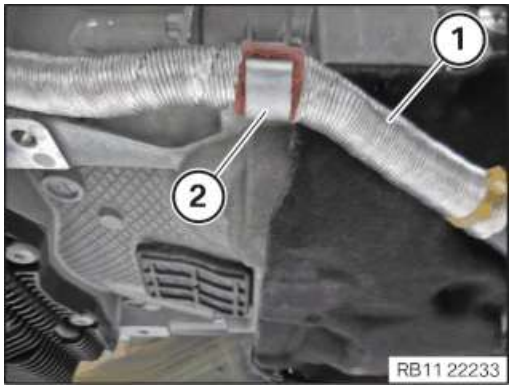
- Check the fir tree clip (1) for damage and renew if necessary.

  Parts: Fir tree clip

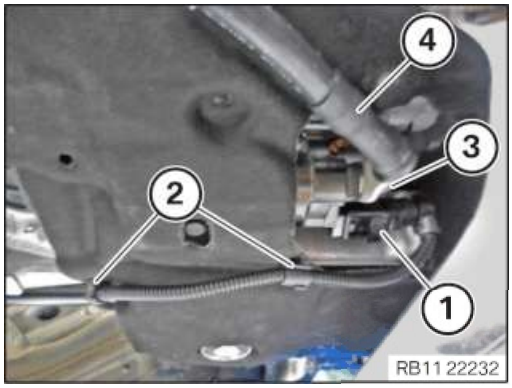


- Secure expanding rivet (1).

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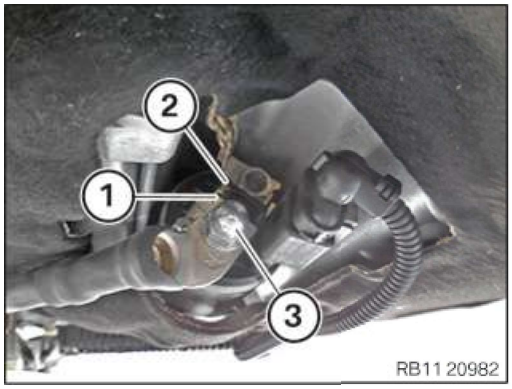


- Secure positive battery cable (1) at the clamp (2).



- Connect connectors (1) and lock.

  The connector (1) must engage audibly.
- Secure clamps (2).
- Insert and install the positive battery cable (4).
- Tighten the nut (3) hand-tight.



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

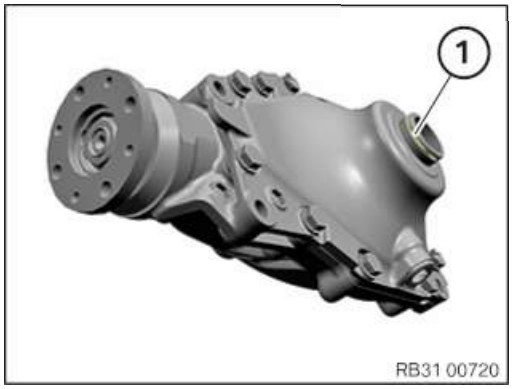
- Route the positive battery cable without abrasions and do not trap.

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

Battery positive lead to starter

M8		Tightening torque	13,5 Nm

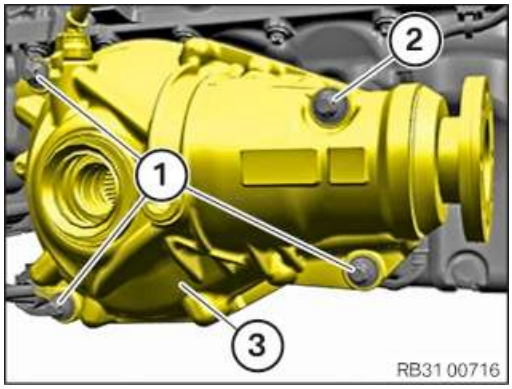
50 – Install front axle differential



- Renew O-ring (1).

  Parts: O-ring
- Coat the O-ring (1) with front axle transmission oil.

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- Position front axle differential (3).

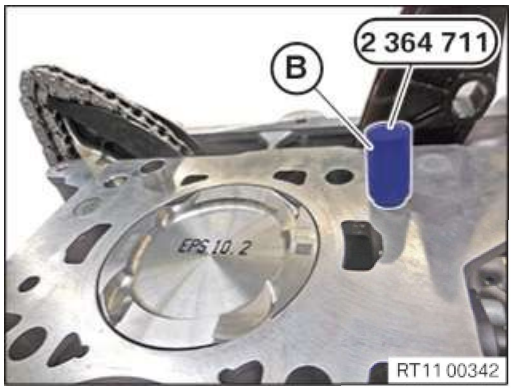
  Make sure marked screws are installed in correct installation locations:

  - Screws (1) M12x55
  - Screw (2) M12x105
- Tighten down screws (1) and (2).

Front axle final drive to engine oil pan

M12		Tightening torque	140 Nm

51 – Sealing the oil duct



- Seal the oil duct using special tool (B) from the set of special tools 2 364 711.

52 – Clean sealing surfaces

RISK OF DAMAGE

Damage to the surface.

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

- Do not use any metal-cutting tools.

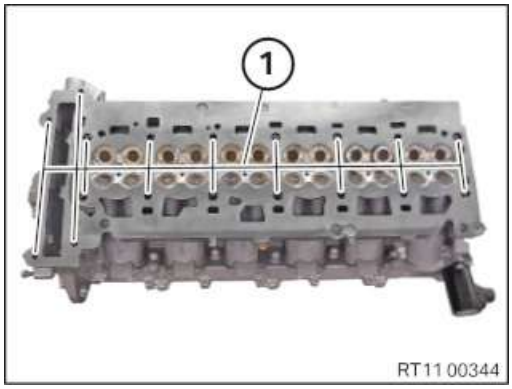


- Remove coarse backlogs from the sealing surfaces of the cylinder head using special tool 0 495 103 (11 4 471).



- Remove fine residues from the sealing surfaces of the cylinder head using special tool 0 495 104 (11 4 472).

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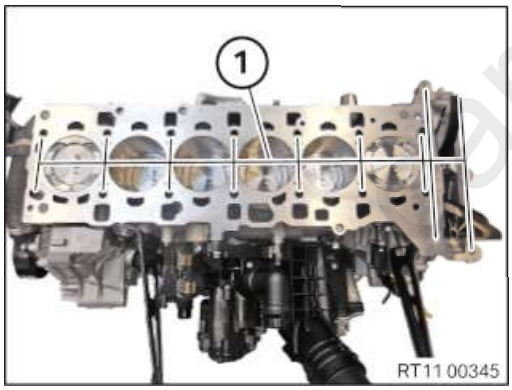
- Clean all blind holes (1) of the cylinder head.



- Remove coarse backlogs from the sealing surfaces of the crankcase using special tool 0 495 103 (11 4 471).



- Remove fine backlogs from the sealing surfaces of the crankcase using special tool 0 495 104 (11 4 472).
- Clean all blind holes of the crankcase.



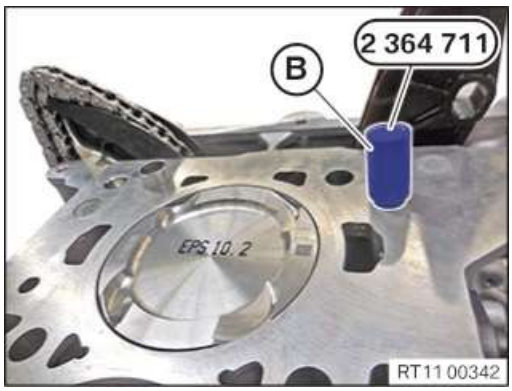
CAUTION

Swirling dirt particles caused by compressed air.

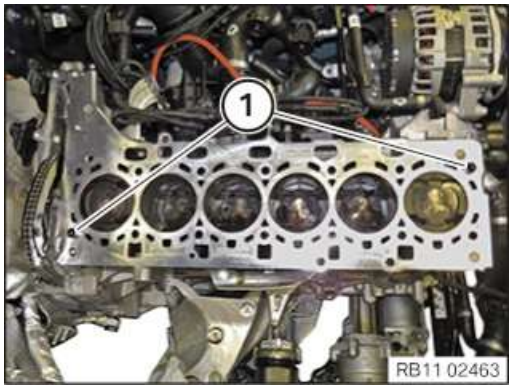
Danger of injury!

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

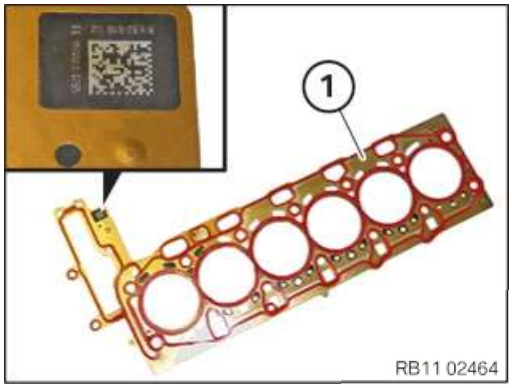
- Wear safety goggles.
- Clean all threaded holes (1) of the crankcase with compressed air.



- Remove special tool (B) contained in the set of special tools 2 364 711.

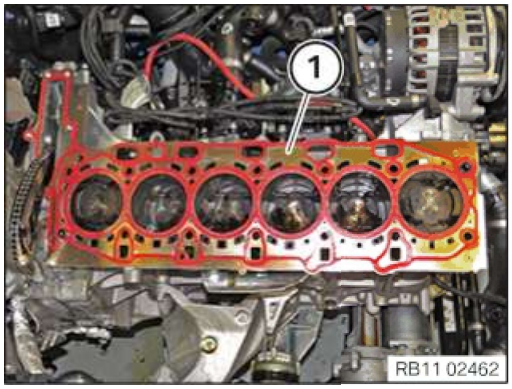


- Check the fitting sleeves (1) for damage and renew if necessary.



- Renew cylinder head gasket (1).

  Parts: Cylinder head gasket
- Install a thicker cylinder head gasket (1) with +0.3 mm in rebuilt cylinder heads.
- Check cylinder head gasket (1) using the part number.



- Install cylinder head gasket (1) and place it correctly on the fitting sleeves.

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



RISK OF DAMAGE

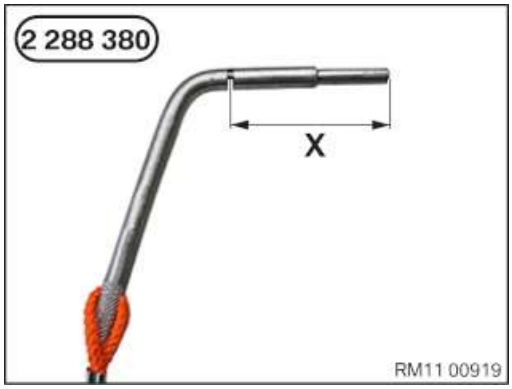
Damage to the engine.

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

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

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

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- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

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



- **Vehicles with automatic transmission:**

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

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



- **Vehicles with automatic transmission:**

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

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

55 – Installing the cylinder head

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

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

RISK OF DAMAGE

Damage to threads.

Fluid in the threaded hole may damage the thread when screws are tightened in the threads.

- Dry threaded holes (e.g. using compressed air).

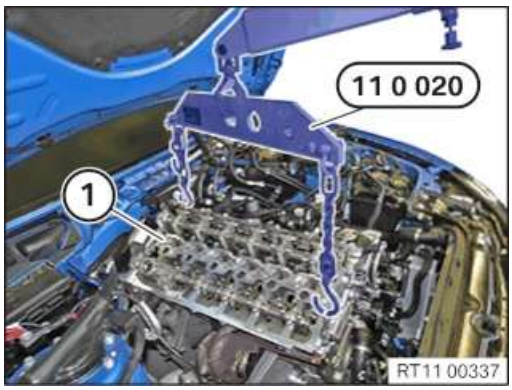
TECHNICAL INFORMATION

Do not remove bolt coating.

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TECHNICAL INFORMATION

When replacing the cylinder head: The complete valve control and the Valvetronic servomotor are already pre-assembled for new cylinder heads.



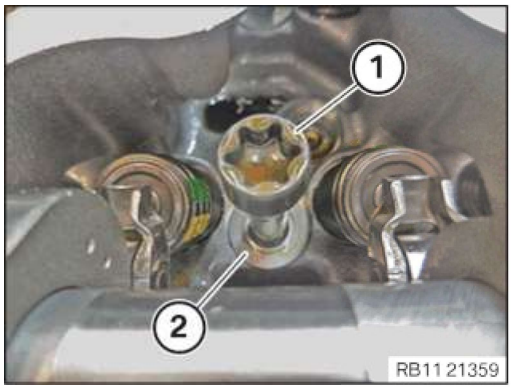
RISK OF DAMAGE

Damage to the guide rails.

Large amounts of force may damage the guide rails of the timing chain.

- Make sure not to damage the guide rail with the cylinder head when removing and installing the cylinder head.

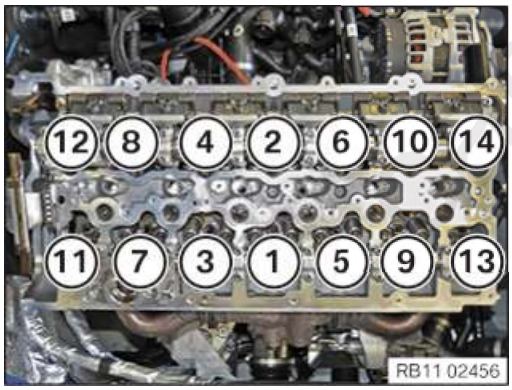
- Feed in, position and install cylinder head (1) and exhaust turbocharger with the help of an auxiliary person, the workshop crane and the special tool 0 490 567 (11 0 020).
- Ensure that the **guide rails** of the timing chain are **not** damaged.



- Insert and install washer (2).
- Renew the cylinder head bolts (1).

  Parts: Cylinder head bolts
- Do not wash off the coating (1) **of the cylinder head bolts** .
- **Lightly** oil contact surfaces of cylinder head bolt screw heads.

  No coolant, water or engine oil must be present in threaded holes of crankcase.
- Guide in and install cylinder head bolts (1).



TECHNICAL INFORMATION

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

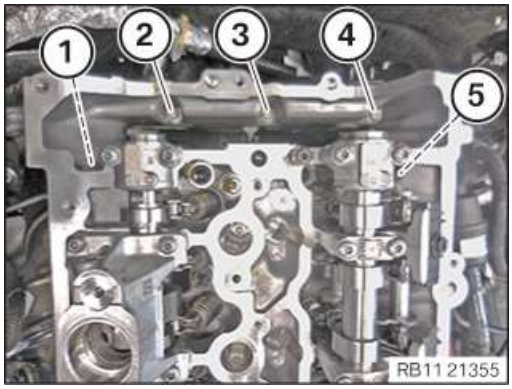
Non-observance of these requirements may result in leaks and damage.

- Screw in the cylinder head bolts in the sequence (1) to (14).
- Tighten the cylinder head bolts using the special tool 0 495 747 (11 8 580) and 0 490 504 (00 9 120) in the sequence (1) to (14).

Cylinder head to crankcase

M11	Observe tightening sequence. Fit new cylinder head bolts.	1. Jointing torque	30 Nm
		2. Angle of rotation	90 °
		3. Angle of rotation	180 °

manuals.com

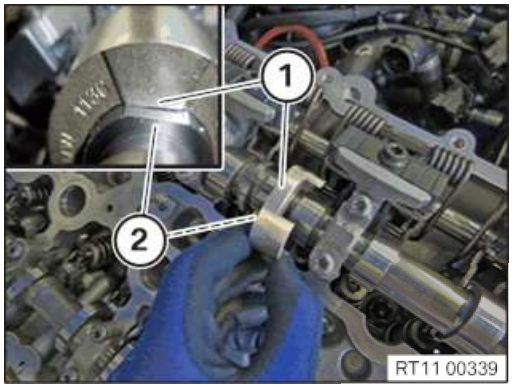


- Renew cylinder head bolts (1) to (5).

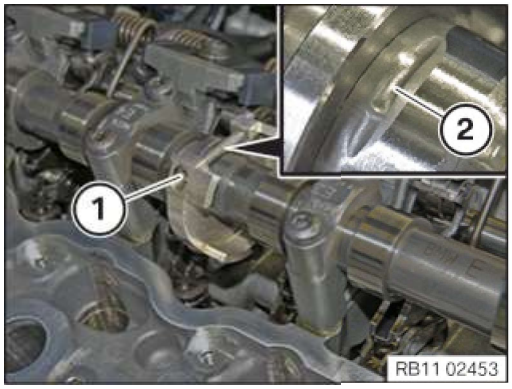
  Parts: Cylinder head bolts
- Make sure that there is **no** coolant, water or engine oil in the threaded holes of the timing case cover.
- Screw in cylinder head bolts (1) to (5).
- Tighten the cylinder head bolts in the order (1) to (5).

Cylinder head bolt to timing case cover

M8x40	Renew screws.	Tightening torque	19 Nm



- Feed in and position camshaft sensor wheel (1) on the intake camshaft (2).



- Rotate intake camshaft, if necessary in the position shown.

  The recess (2) must point upwards.
- Tighten down screw (1).

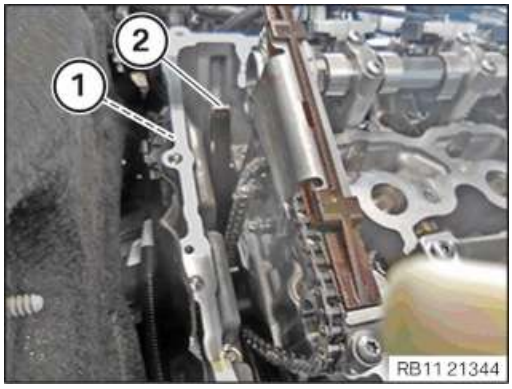
Camshaft sensor wheel to intake camshaft

M4 x35			4,5 Nm



- Renew bearing journal (1).

  Parts: Bearing journal

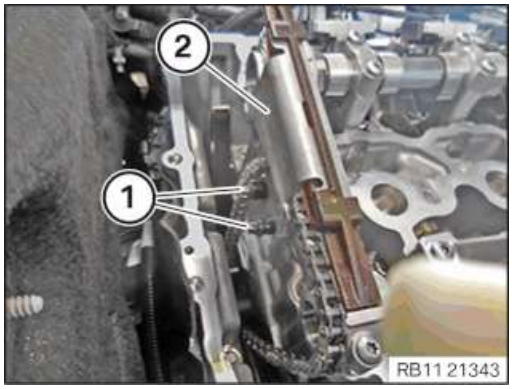


- Feed in and install bearing journal (1) on the guide rail (2).
- Tighten the bearing journals (1).

Bearing journal to cylinder head

Bearing journal	Renew the bearing journal!	Tightening torque	20 Nm

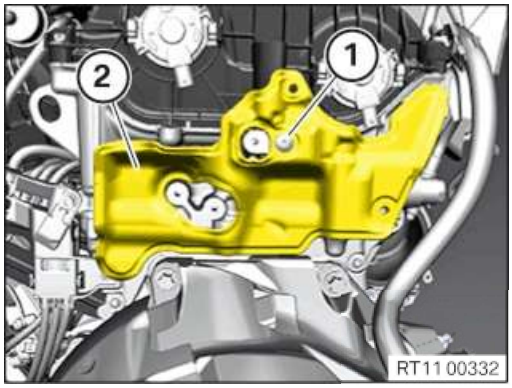
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- Insert slide rail (2) and install.
- Tighten the screws (1).

Sliding rail to cylinder head

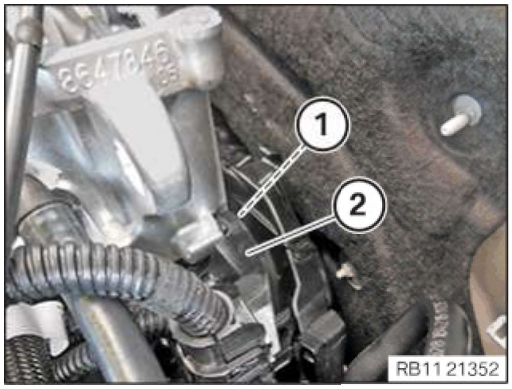
M6x16			8 Nm



- Guide in and install cover (2).
- Tighten down screw (1).

Cover on rear cylinder head

M6		Tightening torque	8 Nm



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

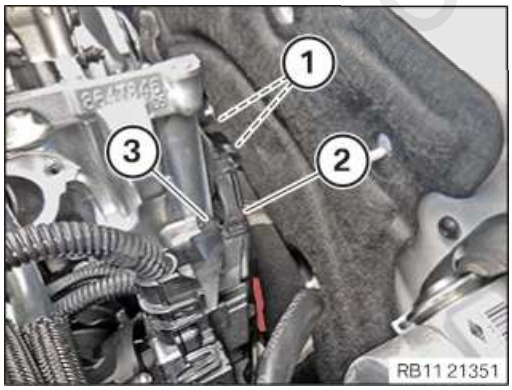
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

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

- Guide in and install wiring harness section (2) for sensor system 1.
- Tighten down screw (1).

Cable routing to cylinder head, rear

M6 x 20		Tightening torque	8 Nm



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

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

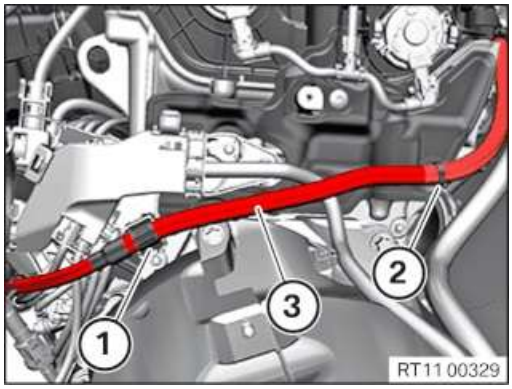
- Route all cables without abrasions, do not trap and crush.

- Guide in and install transmission wiring harness (2) on wiring harness section (3) for sensor system 1.
- Tighten the screws (1).

Cable routing to cylinder head, rear

M6 x 20		Tightening torque	8 Nm

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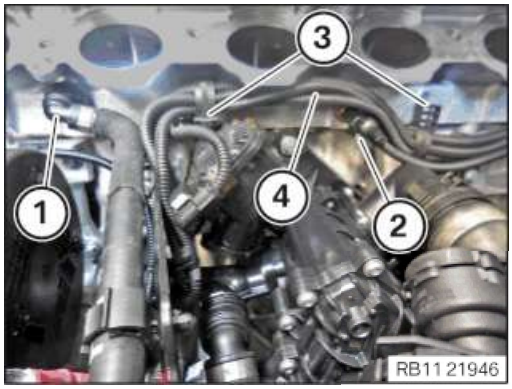
CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

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

- Insert and install the positive battery cable (3).
- Secure clamps (1) and (2).



RISK OF DAMAGE

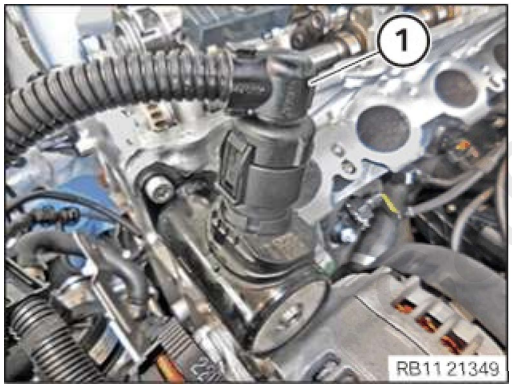
Improper routing of cables and wiring harnesses.

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

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

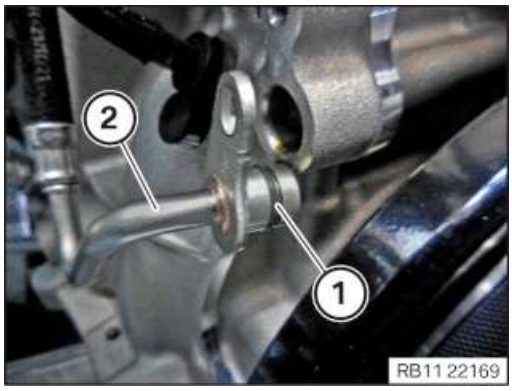
- Connect connectors (2) and lock.

  The connector must engage audibly.
- Guide in and position the wiring harness section (4) of sensor system **1**.
- Secure clamps (3).
- Connect and lock coolant line (1).
- Make sure that the cooling line (1) engages audibly.



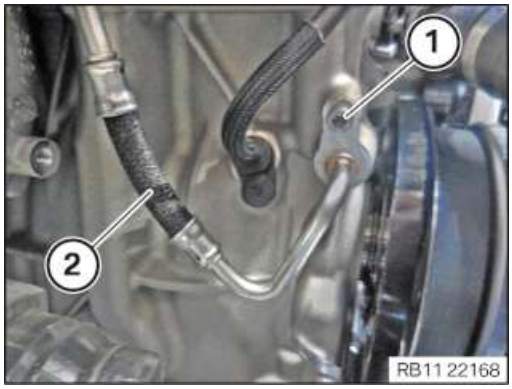
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Renew sealing ring (1) on the oil feed line (2) of the exhaust turbocharger with special tool 0 496 714 (00 9 030).

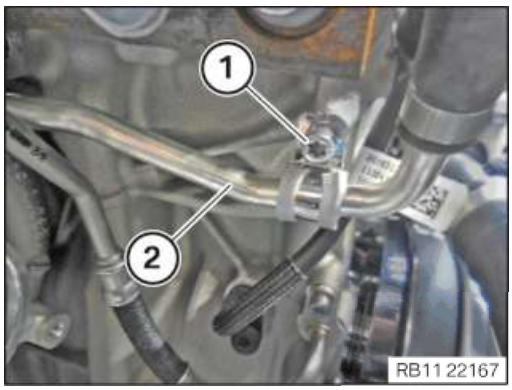
  Parts: Sealing ring



- Feed in and install the oil feed line (2) for the exhaust turbocharger.
- Tighten down screw (1).

Oil feed line for exhaust turbocharger to crankcase

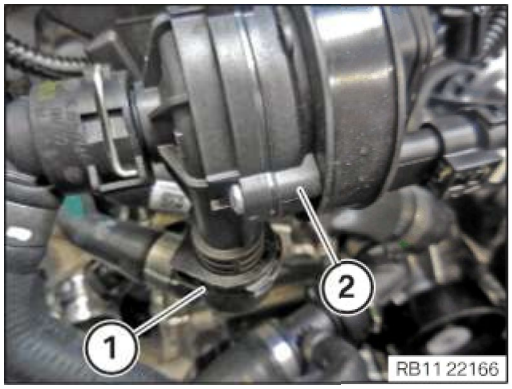
M6 x 12	Replace sealing ring.	Tightening torque	8 Nm



- Tighten screw (1) on the coolant return line (2).

Coolant return line holder bracket to crankcase

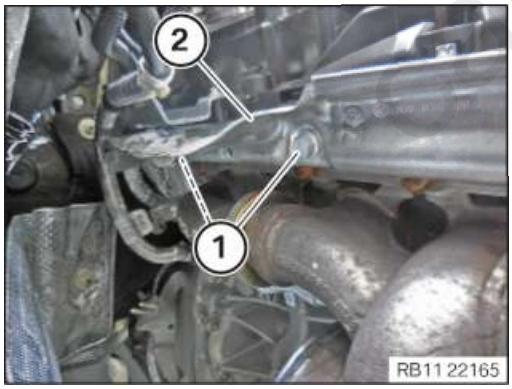
M6X12		Tightening torque	8 Nm



- Connect coolant return line (1) to the coolant pump (2) for the exhaust turbocharger and lock.

  The coolant return line (1) must engage audibly.

- Connect coolant return line (1) for the exhaust turbocharger and lock.
- Ensure the coolant return line (1) audibly engages.



- Feed in and install the heat shield (2).
- Renew screws (1).

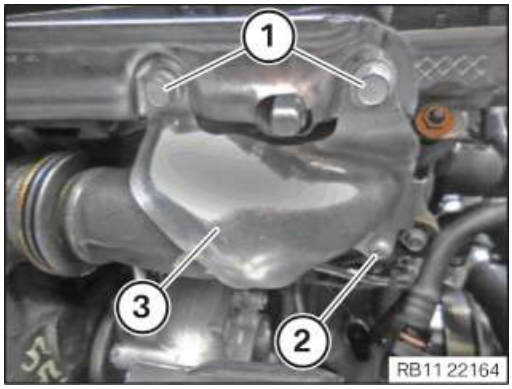
  Parts: Bolts

  Tighten the screws (1).

Heat shield to cylinder head

M8X12	Renew screws.	Tightening torque	19 Nm

ardiagn.com



- Feed in and install the heat shield (3).
- Renew screws (1).

  Parts: Bolts

  Tighten the screws (1).

Heat shield to cylinder head

M8X12	Renew screws.	Tightening torque	19 Nm

- Renew the screw (2).

  Parts: Screw

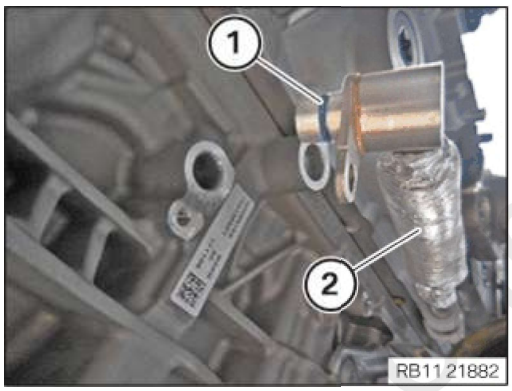
  Tighten down screw (2).

Heat shield to clamping strip

M6X16	Renew screw.	Tightening torque	8 Nm

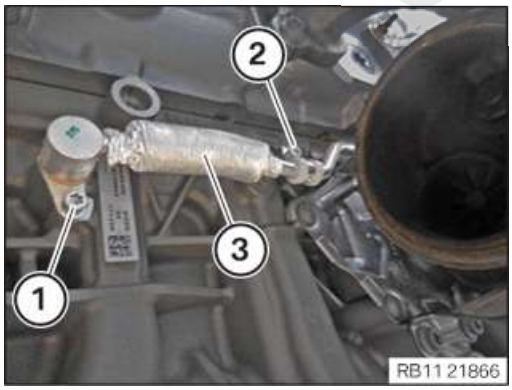


- Unscrew the bolts (1) of the special tool .
- Feed out the special tool at the cylinder head and remove.



- Renew sealing ring (1) on the coolant feed line (2) of the exhaust turbocharger with special tool 0 496 714 (00 9 030).

  Parts: Sealing ring



- Feed in and install coolant feed line for the exhaust turbocharger (3).
- Tighten down screw (1).

Coolant feed line to crankcase

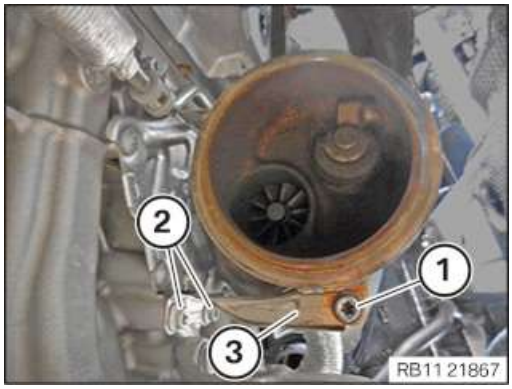
M6X12		Tightening torque	8 Nm

- Tighten down screw (2).

Coolant feed line to crankcase

M6X12		Tightening torque	8 Nm

mandiagn.com



- Renew screws (1) and (2).

  Parts: Bolts
- Feed in and install support (3).
- Tighten the screws (2).

Exhaust turbocharger support to crankcase

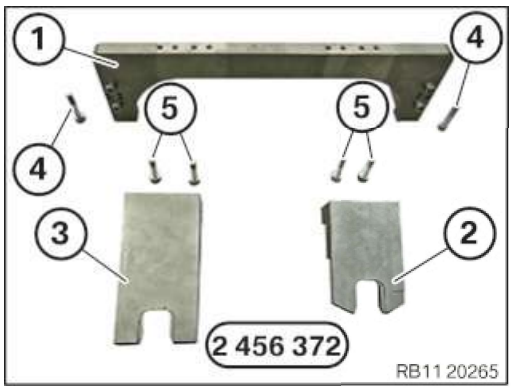
M8 x 20	Renew screws.	19 Nm

- Tighten the screws (1).

Exhaust turbocharger to support

M8 x 25	Renew screw.	19 Nm

56 – Adjust the camshafts with the special tool

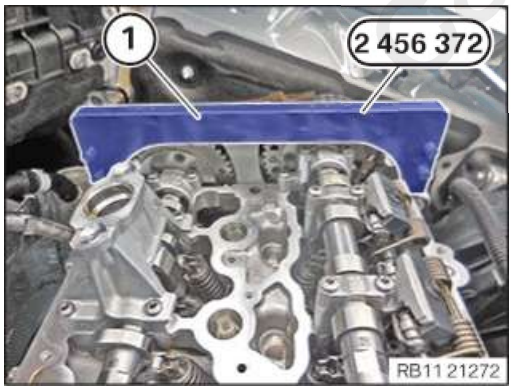


- Overview of the set of special tools 2 456 372:

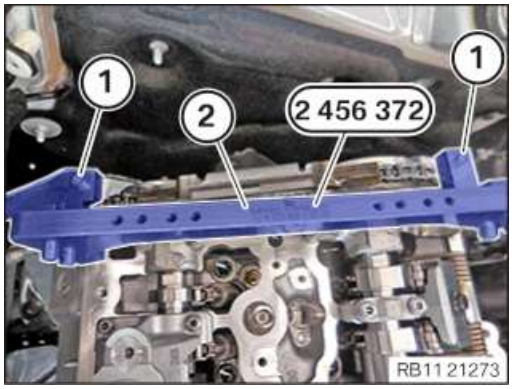
Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



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



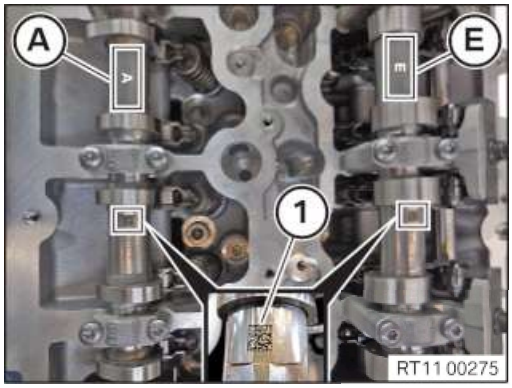
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



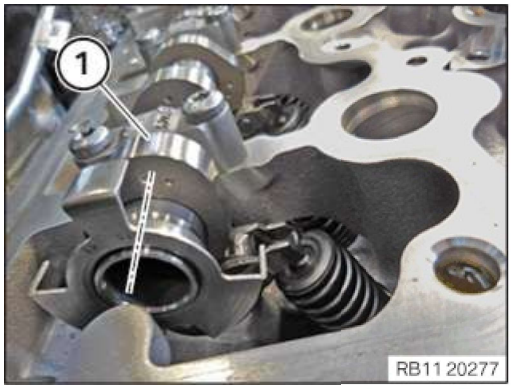
- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



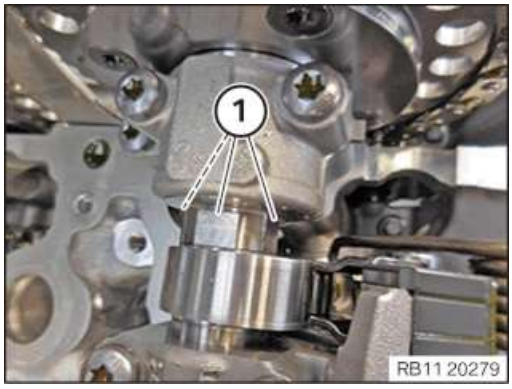
- Turn the intake camshaft (E) and the exhaust camshaft (A) such that the marks (1) can be read from the top.



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

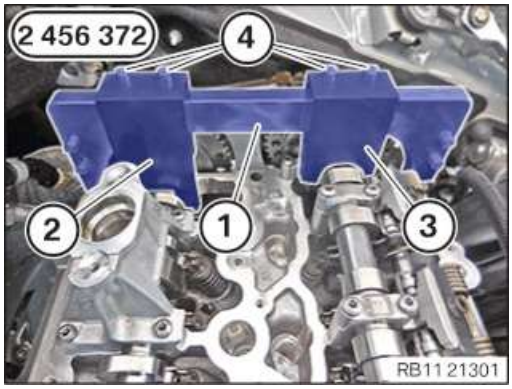


- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.



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

rdiagn.com



- 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

57 – Installing the intake adjuster

NOTICE

The figure shows the rear side of the engine.

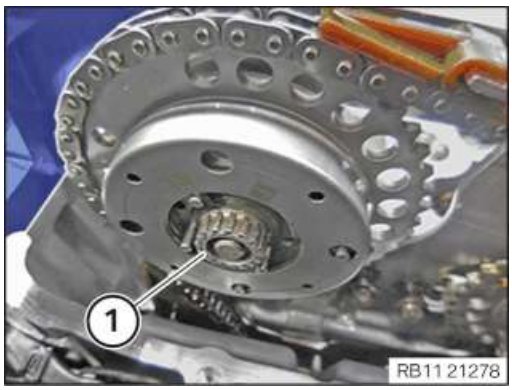


- Keep intake adjuster (1) marked IN ready.



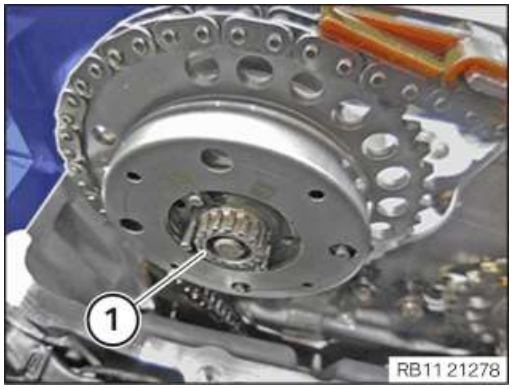
- Feed in intake adjuster (1) in the timing chain (2) and position on the intake camshaft .

58 – Install the VANOS central valve of the intake adjuster

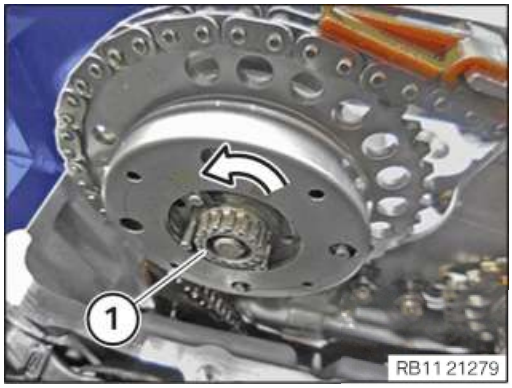


- Guide in the VANOS central valve (1) of the intake adjuster and install.

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- 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 °.

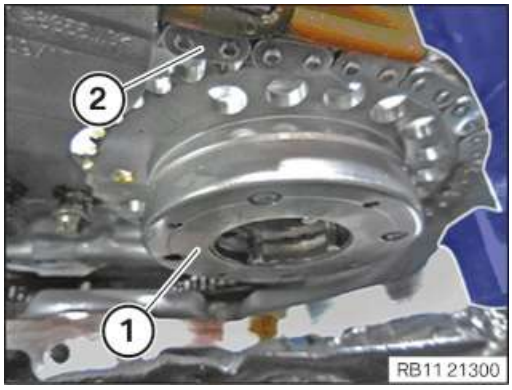
59 – Install exhaust camshaft adjuster

NOTICE

The figure shows the rear side of the engine.



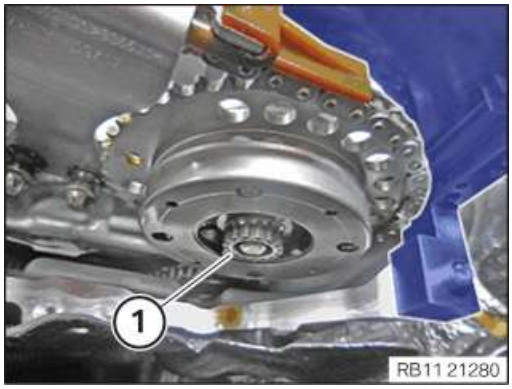
- Keep exhaust camshaft adjuster (1) marked EX ready.



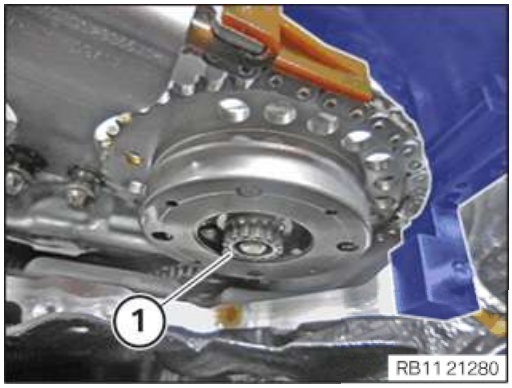
- Feed in exhaust camshaft adjuster (1) in the timing chain (2) and position on the exhaust camshaft .

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

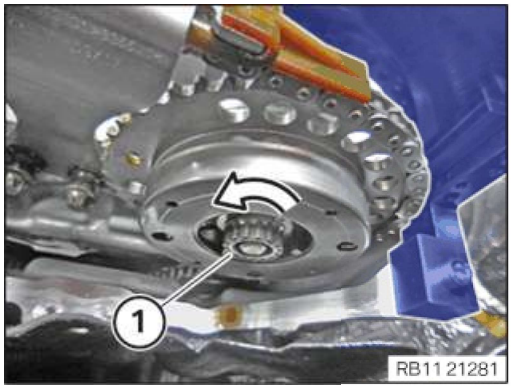
cardiagn.com



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

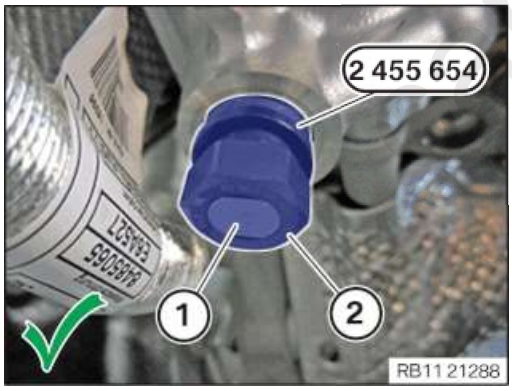


- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.



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

61 – Pretension the timing chain with the special tool



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

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

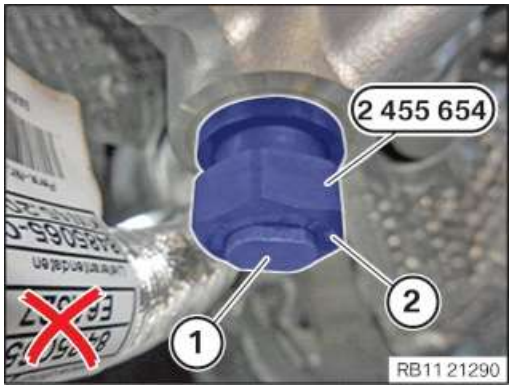


- Make sure that the preload of the timing chain is no **insufficient**.

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

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

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

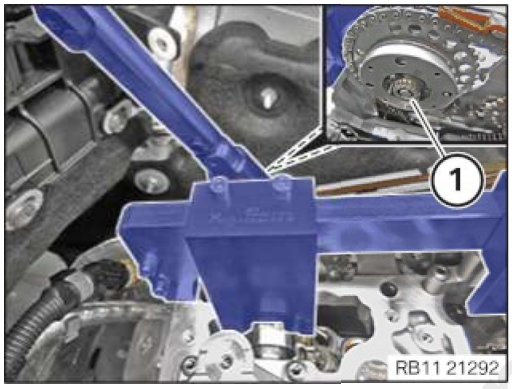
  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

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

62 – 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 °

63 – 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.

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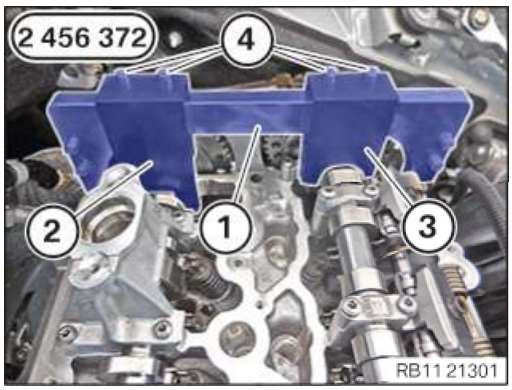


- Tighten the VANOS central valve (1) of the intake adjuster.

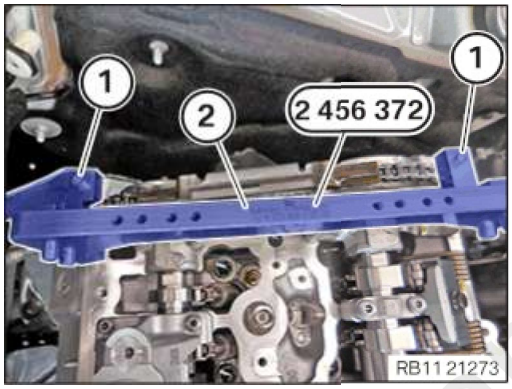
VANOS central valve to camshaft

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

64 – 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.

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

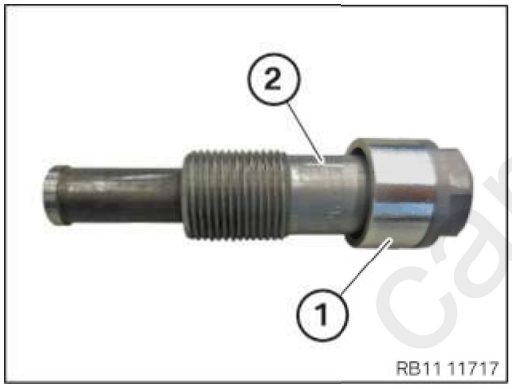
65 – Install chain tensioner

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.



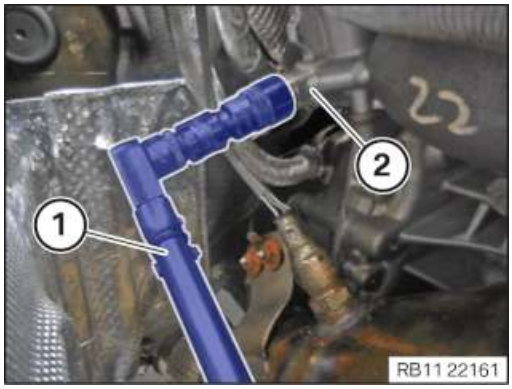
- Renew the sealing sleeve (1).

  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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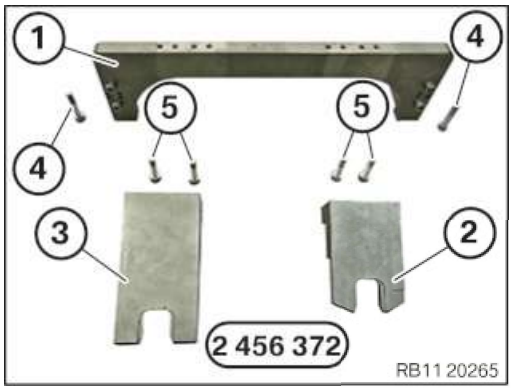


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

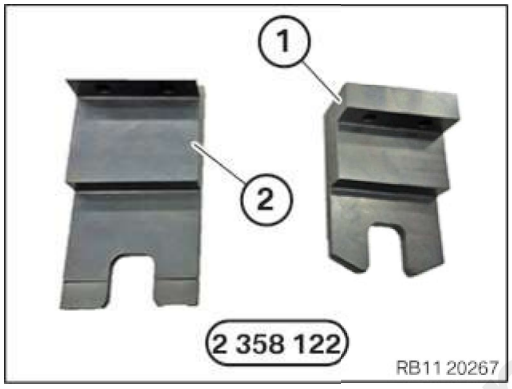
Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

66 – 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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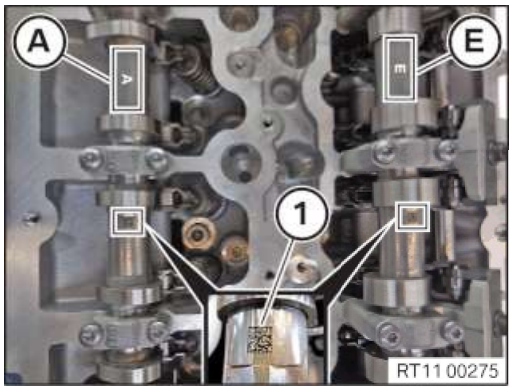
RISK OF DAMAGE

Damage to the engine.

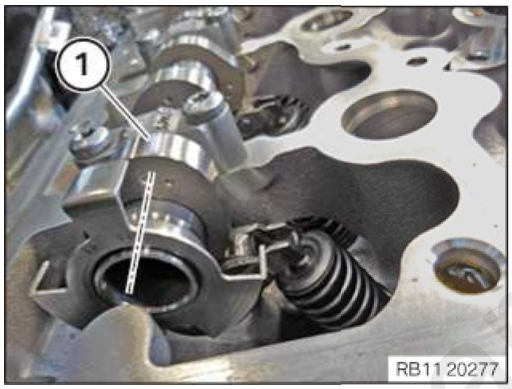
The engine may be damaged if it is manually rotated in the wrong direction.

- 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**.



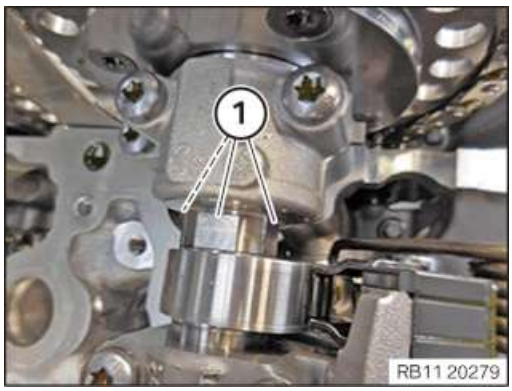
- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.



- 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.

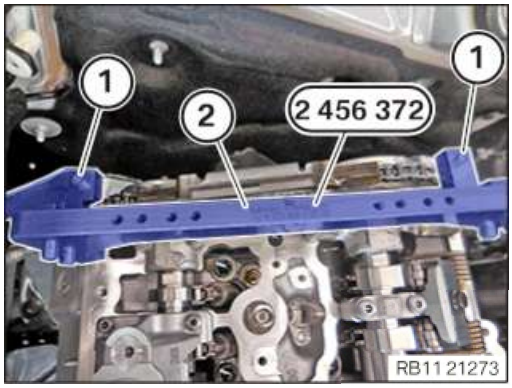


- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.

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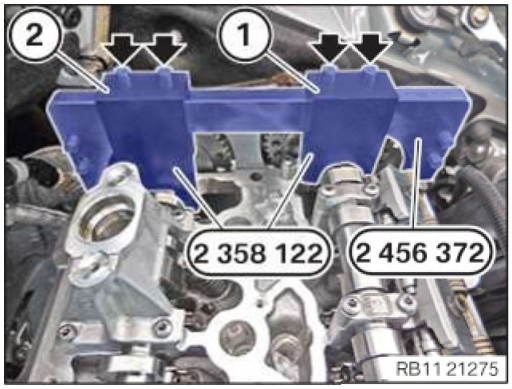
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- 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



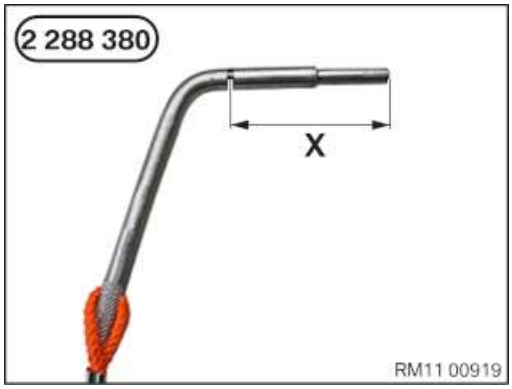
- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special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

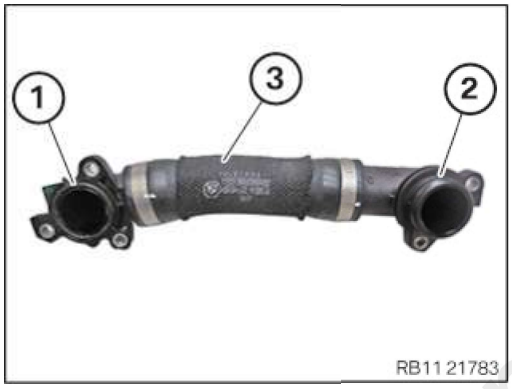


- **Vehicles with automatic transmission:**

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

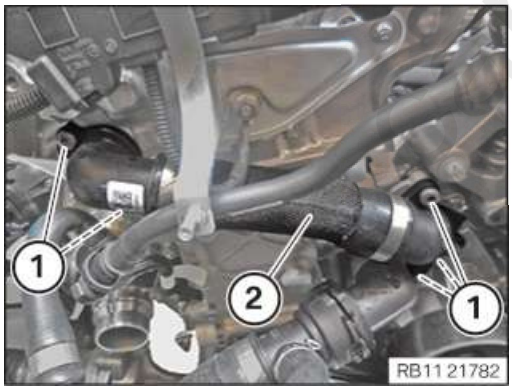
  The engine **is in the** TDC firing position of cylinder 1.

67 – Install the coolant line between the cylinder head and the coolant pump



- Check sealing rings (1) and (2) for damage; renew coolant line (3) if necessary.

  Parts: Sealing ring



TECHNICAL INFORMATION

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

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

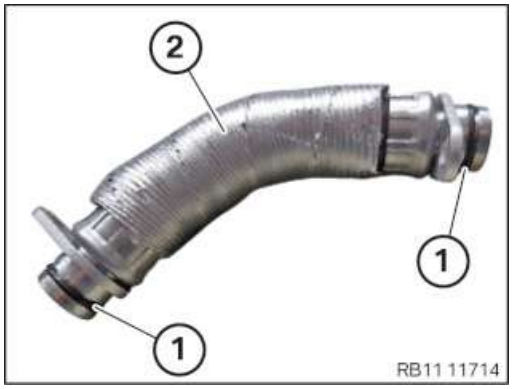
- Feed in and install coolant line (2).
- Hand-tighten the bolts (1).
- Tighten the screws (1).

Coolant line to coolant pump/cylinder head

M6x20		Tightening torque	8 Nm

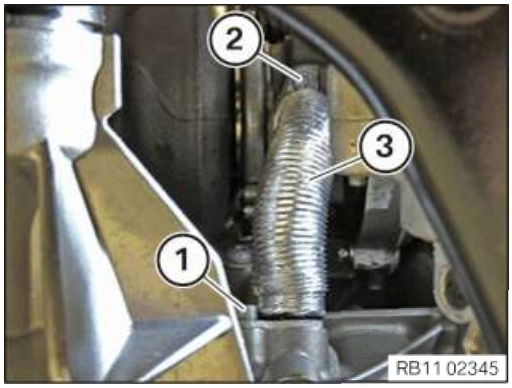
68 – Installing the oil return line for the exhaust turbocharger

.diagn.com



- Renew the sealing rings (1) on the oil return line (2).

  Parts: Sealing ring



- Feed in and install the oil return line (3).
- Tighten down screw (2).

Oil return line to turbocharger

M6 x 12		8 Nm

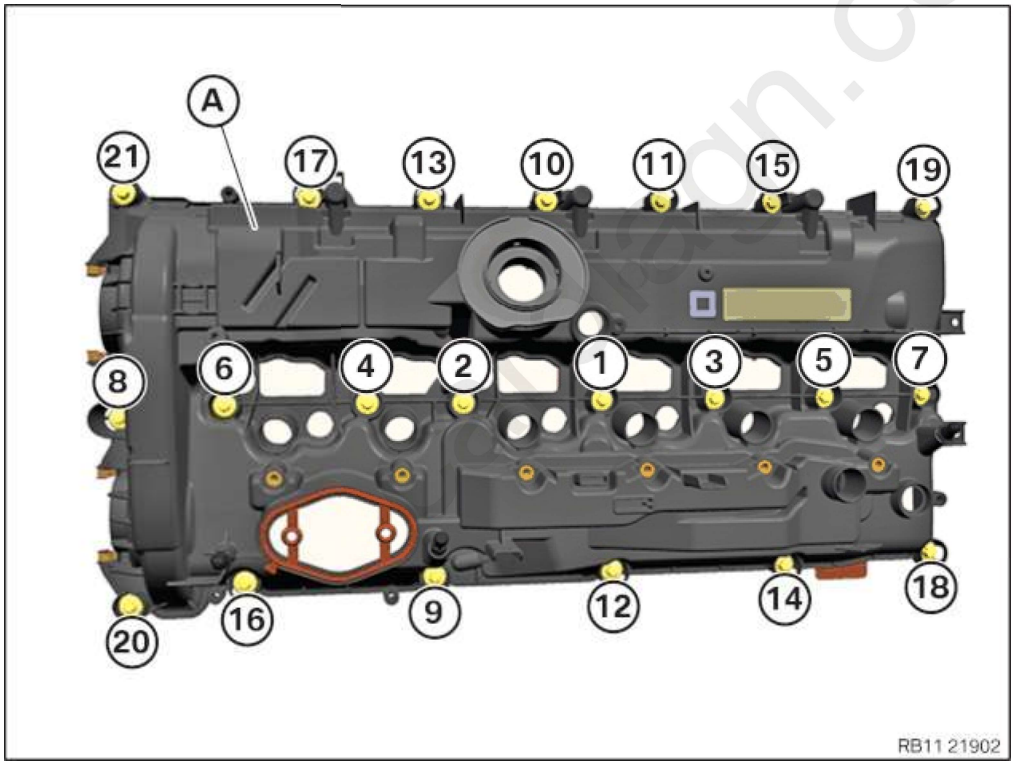
- Tighten down screw (1).

Oil return line to crankcase

M6 x 12		8 Nm

69 – Installing cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 21 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

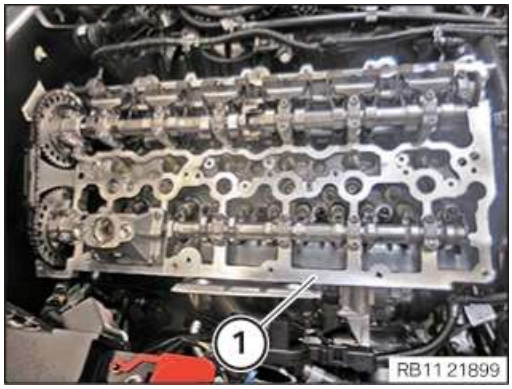
Improper routing of cables and wiring harnesses.

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

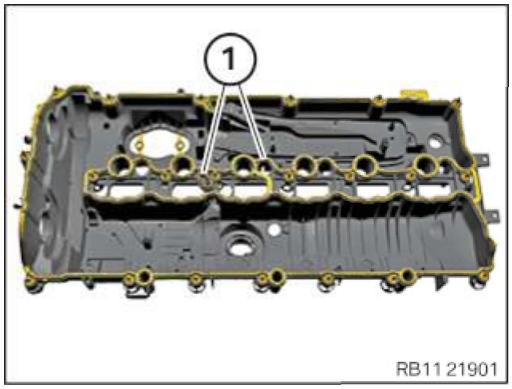
- Route all cables without abrasions, do not trap and crush.

TECHNICAL INFORMATION

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

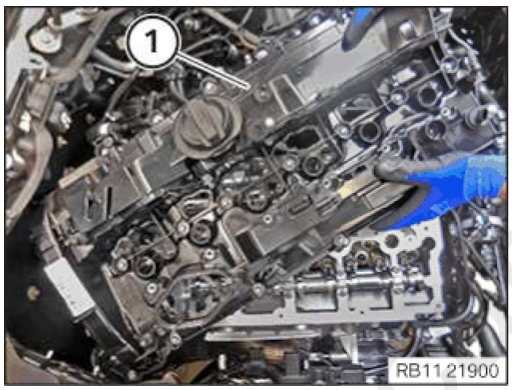


- Contact surface (1) must be free from oil and grease.



- Replace the seals (1).

  Parts: Seals



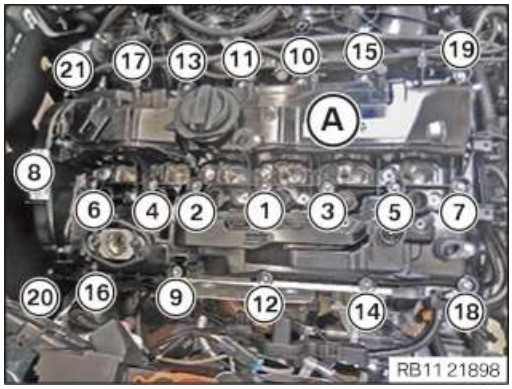
- Insert and install cylinder head cover (1).



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

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

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

Cylinder head cover to cylinder head

M6X30		Jointing torque	8 Nm

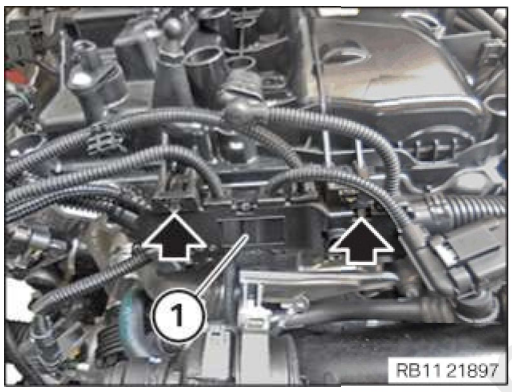
- Tighten all screws in a sequence from (1) to (21).

Cylinder head cover to cylinder head

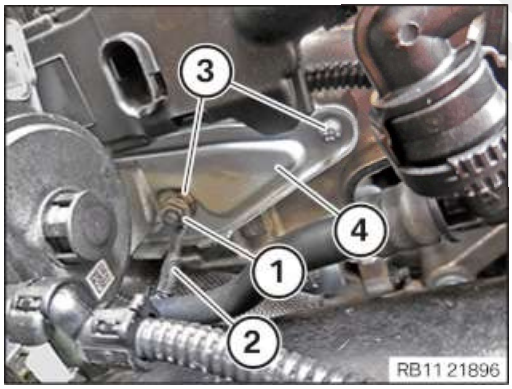
M6X30		Tightening torque	11 Nm



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



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



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

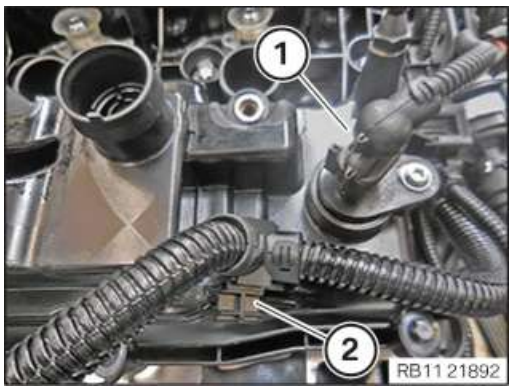
Auxiliary coolant pump holder to cylinder head

M6		Tightening torque	7 Nm

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

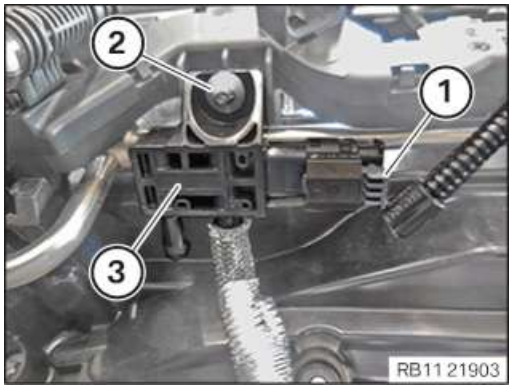
Standard screw connection M6

M6		8 Nm



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

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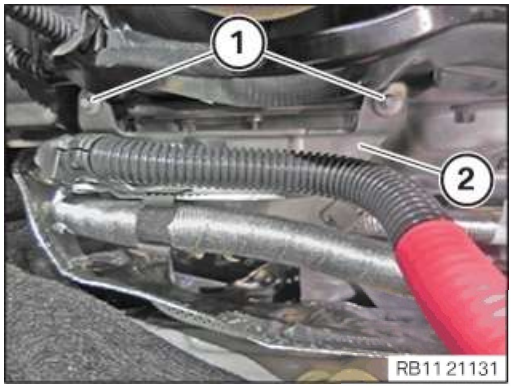


- **If installed:**
- Feed in and install the differential pressure sensor (3).
- Tighten down screw (2).

Differential pressure sensor to holder

TS6X18		Tightening torque	3,5 Nm

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



CAUTION

Improper routing of the positive battery cable.

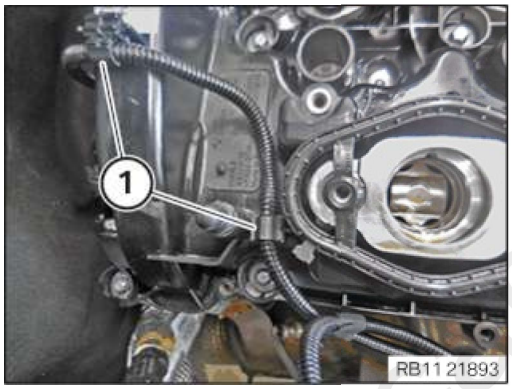
Risk of short circuits!

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

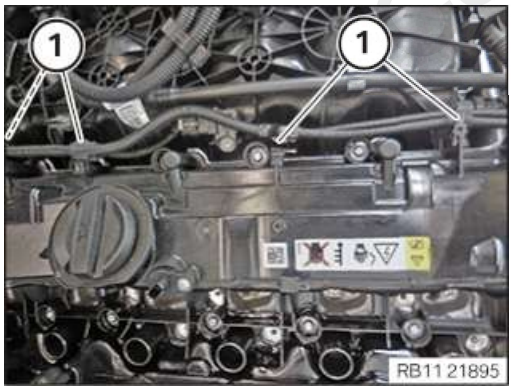
- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

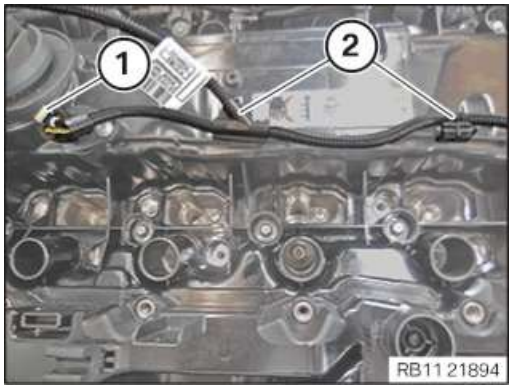


- Secure clamps (1).



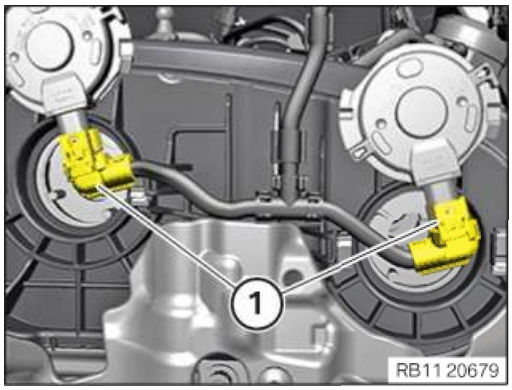
- Secure clamps (1).

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

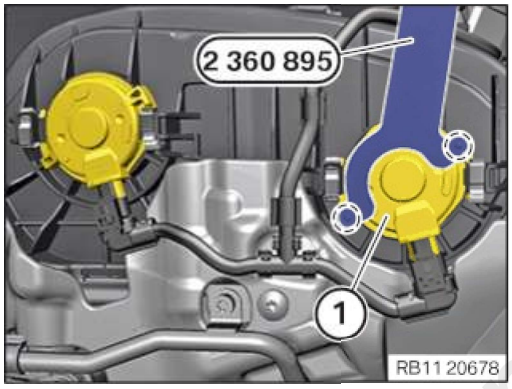
70 – Installing both actuators



NOTICE

The figure shows the rear side of the engine.

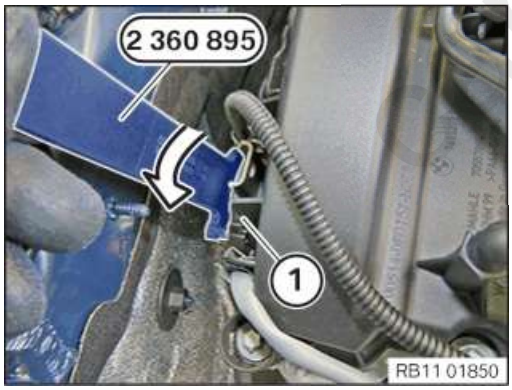
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



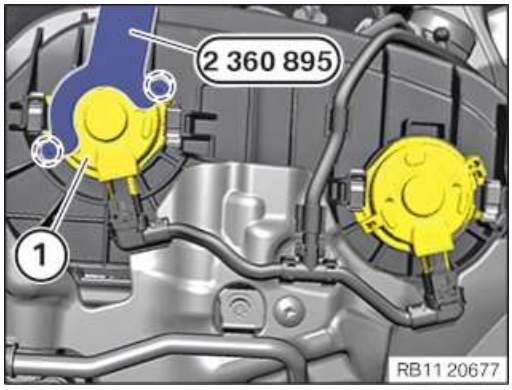
NOTICE

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.

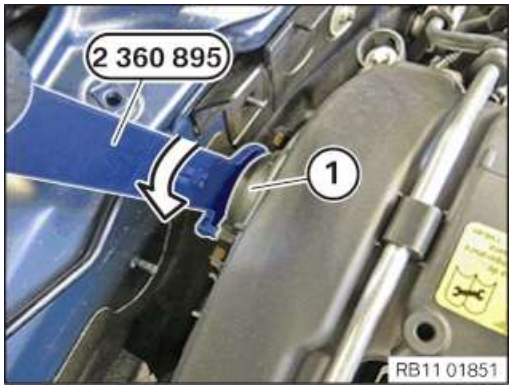


NOTICE

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.

71 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

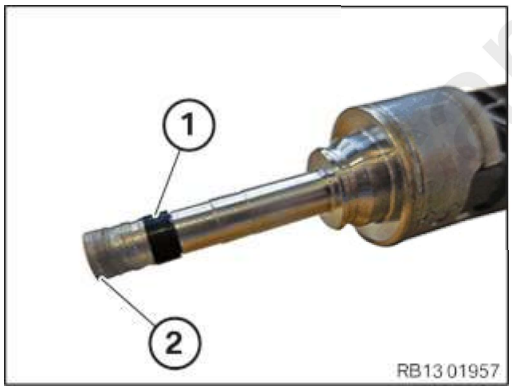
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

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

TECHNICAL INFORMATION

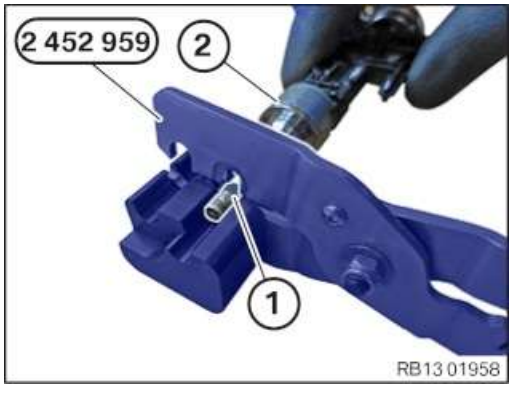
Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

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



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

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



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

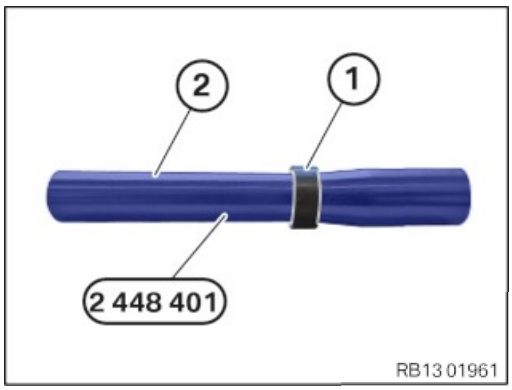


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

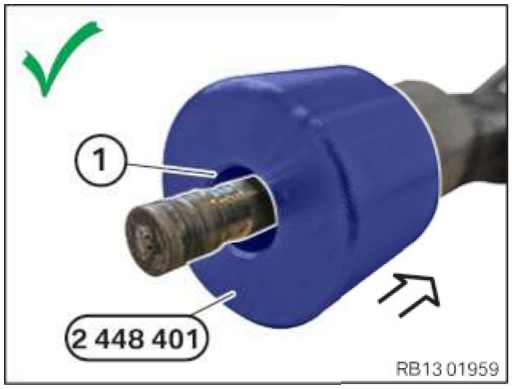
  (1) Installation cone

  (2) Sliding sleeve

  (3) Assembly sleeve

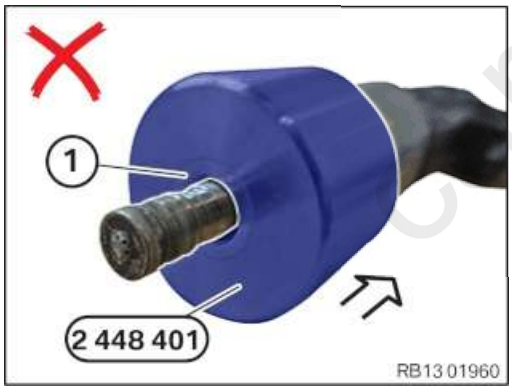


- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



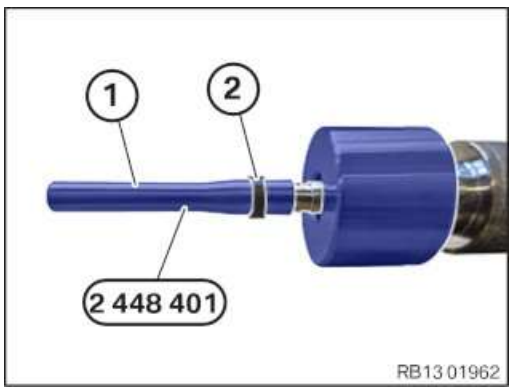
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

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



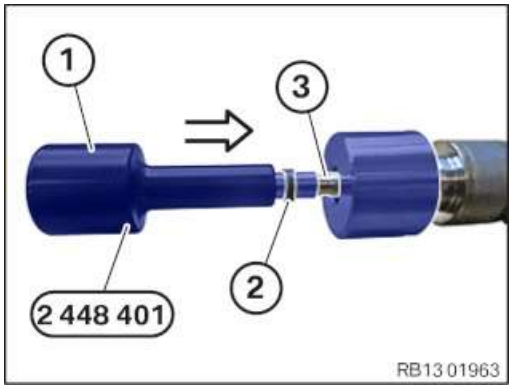
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

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

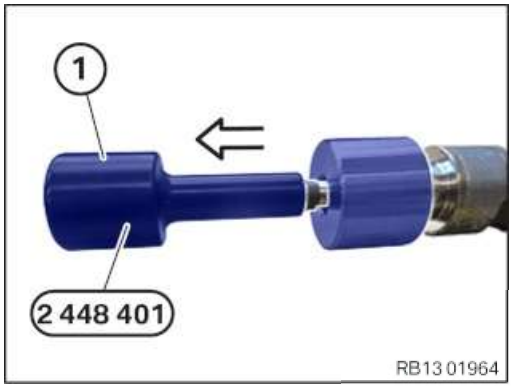


- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .

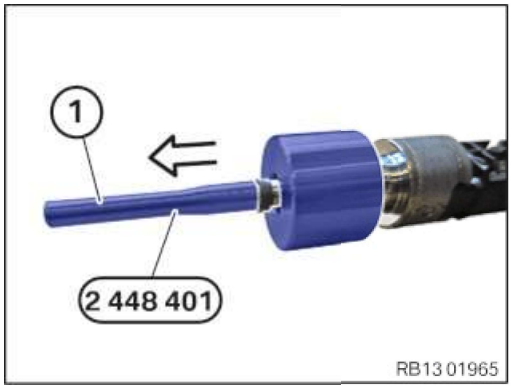
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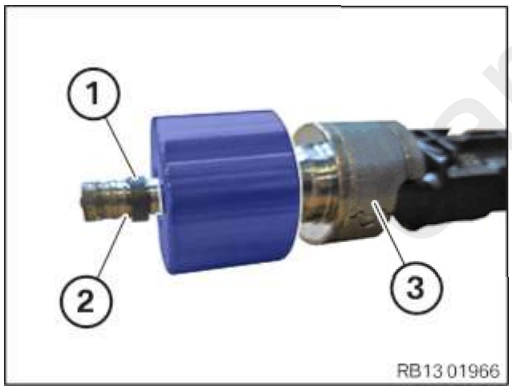
- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.



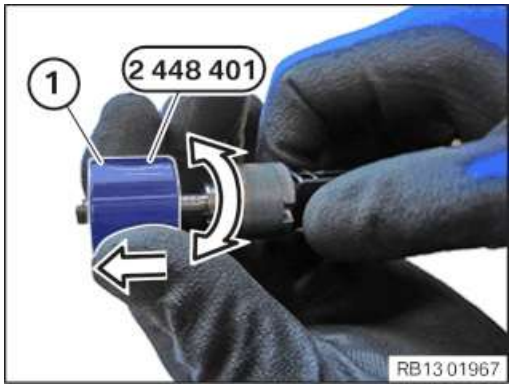
- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



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



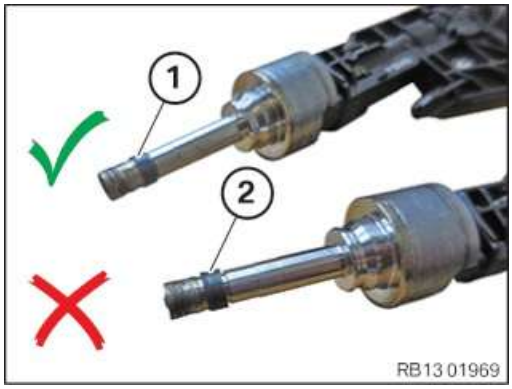
- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.



- 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).

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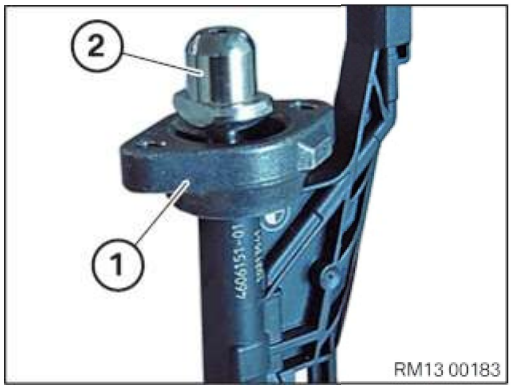


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

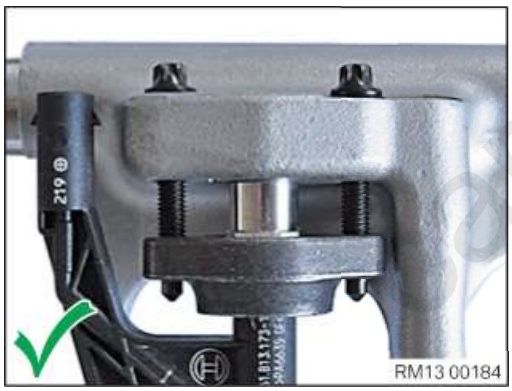
72 – Installing the high-pressure rail with injectors of the cylinders 4 to 6

TECHNICAL INFORMATION

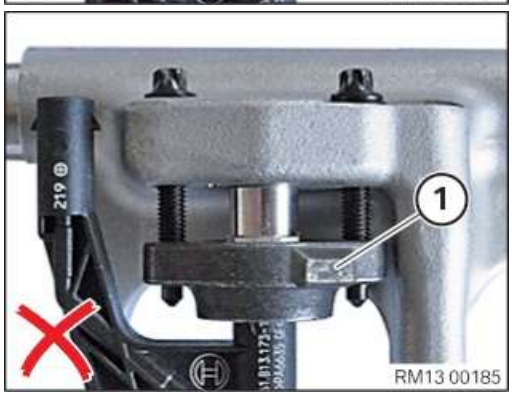
When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



- 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.

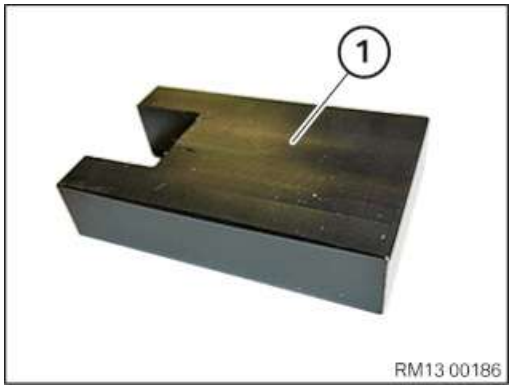


- If applicable, note the position of the cast lug:
  The holder is mounted **correctly** when the cast lug is located at the rear.



- If applicable, note the position of the cast lug:
  The holder is mounted **incorrectly** when the cast lug (1) is in front.

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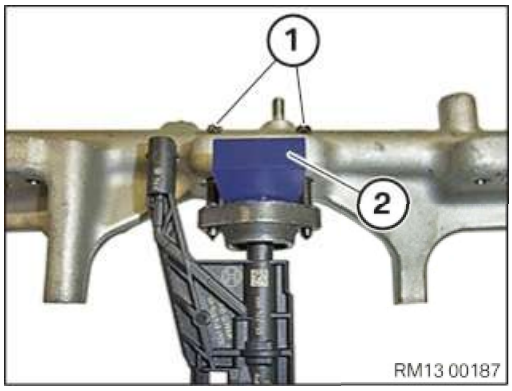
RISK OF DAMAGE

Damage to injectors.

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

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

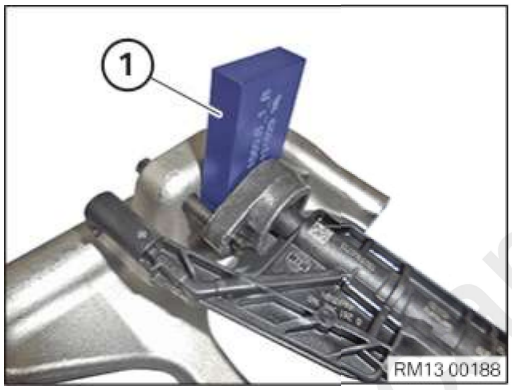
- Use the special tool (distance gauge) 2 358 022 (1).



- Replace (M5x30) screws.

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

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



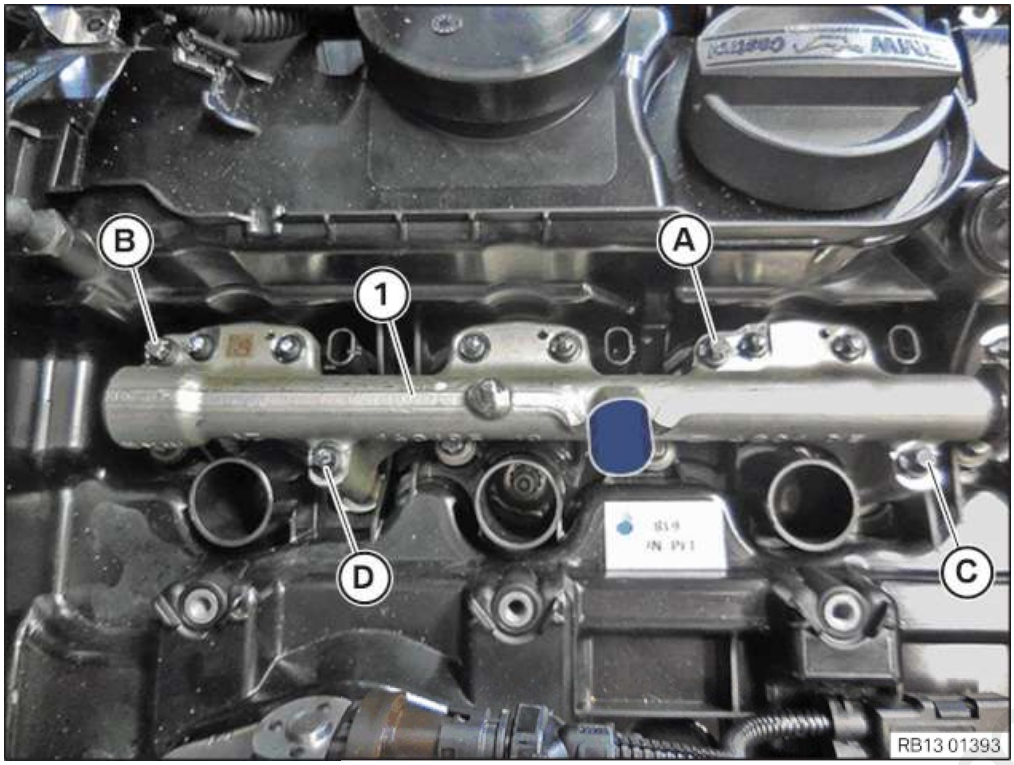
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.



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

  The injectors must move freely.

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- Renew screws (A) to (D).

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

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

TECHNICAL INFORMATION

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

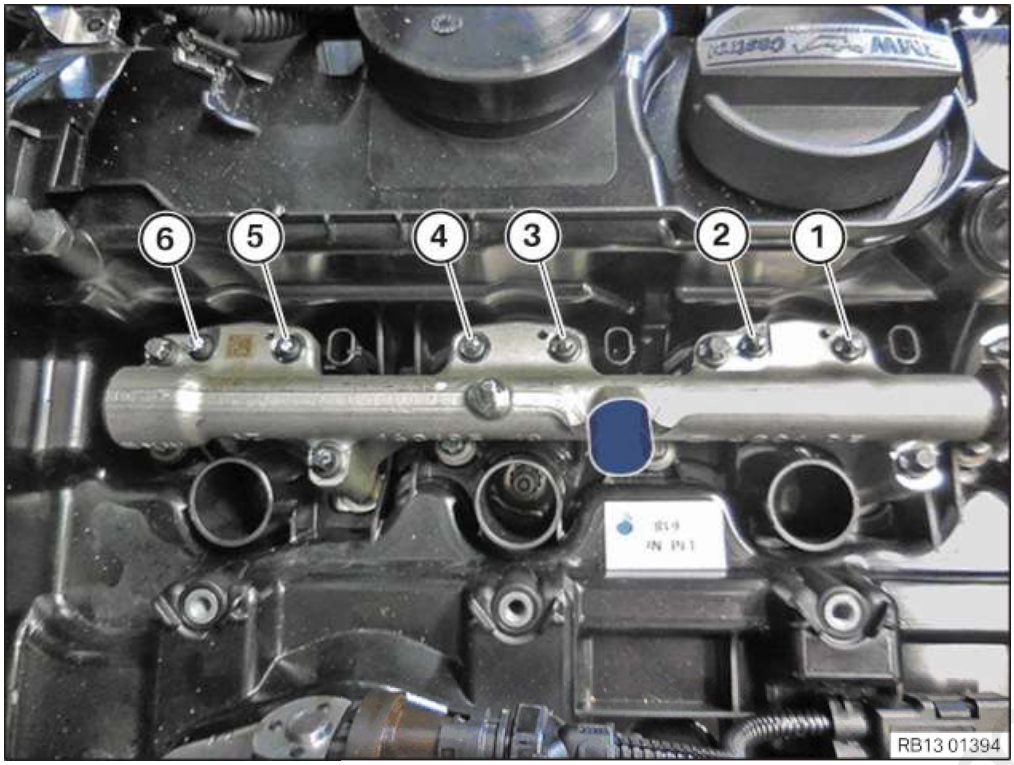
Non-observance of these requirements may result in leaks and damage.

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



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

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- Attach a socket to an extension.

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

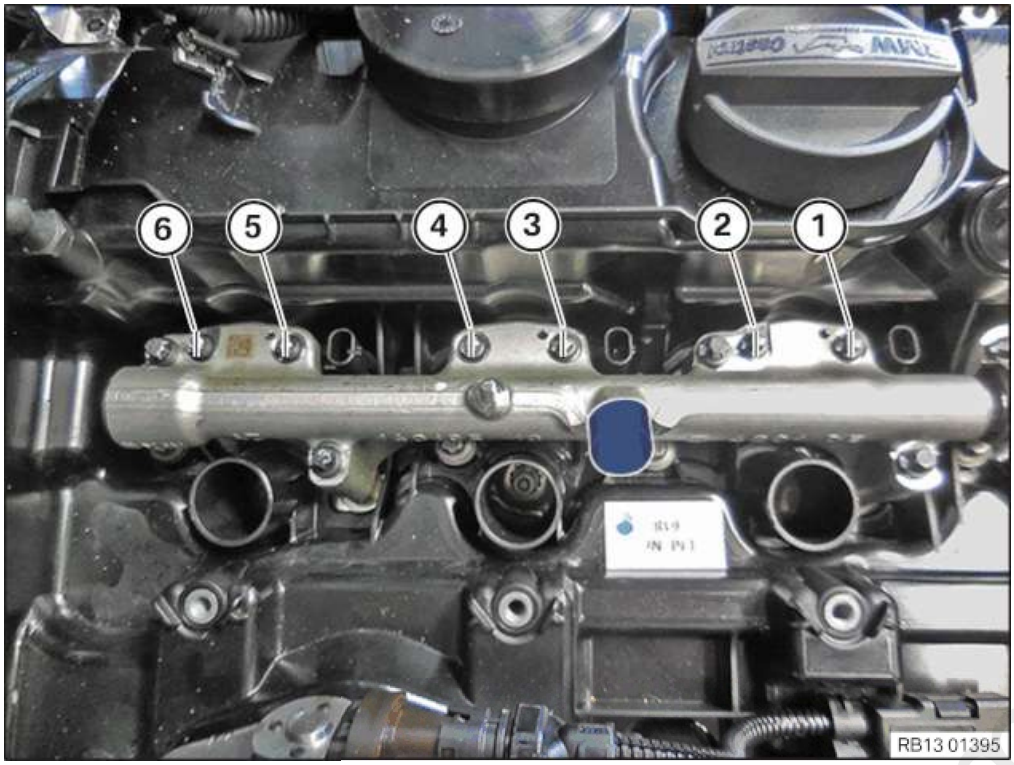
TECHNICAL INFORMATION

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

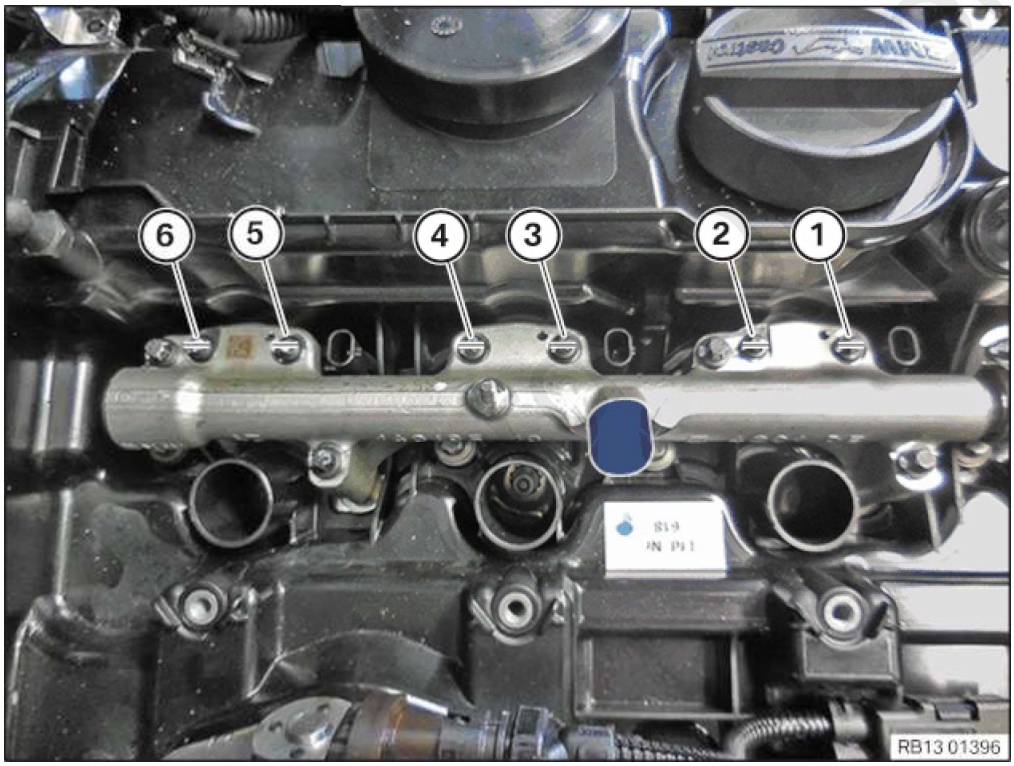
Non-observance of these requirements may result in leaks and damage.

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

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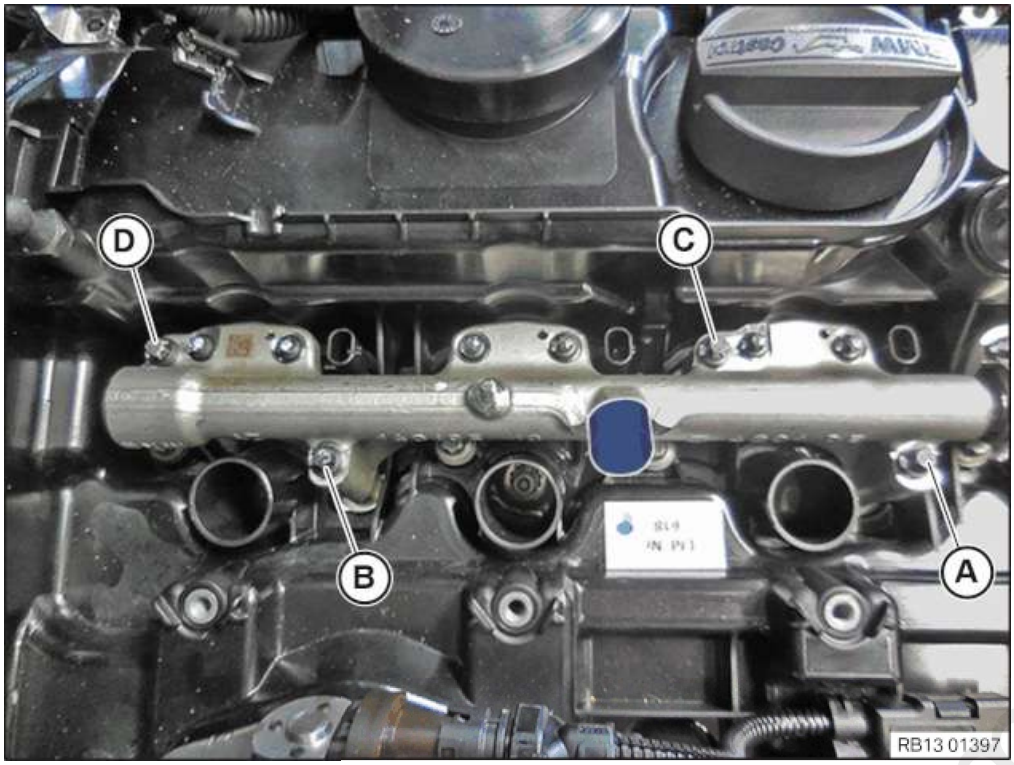


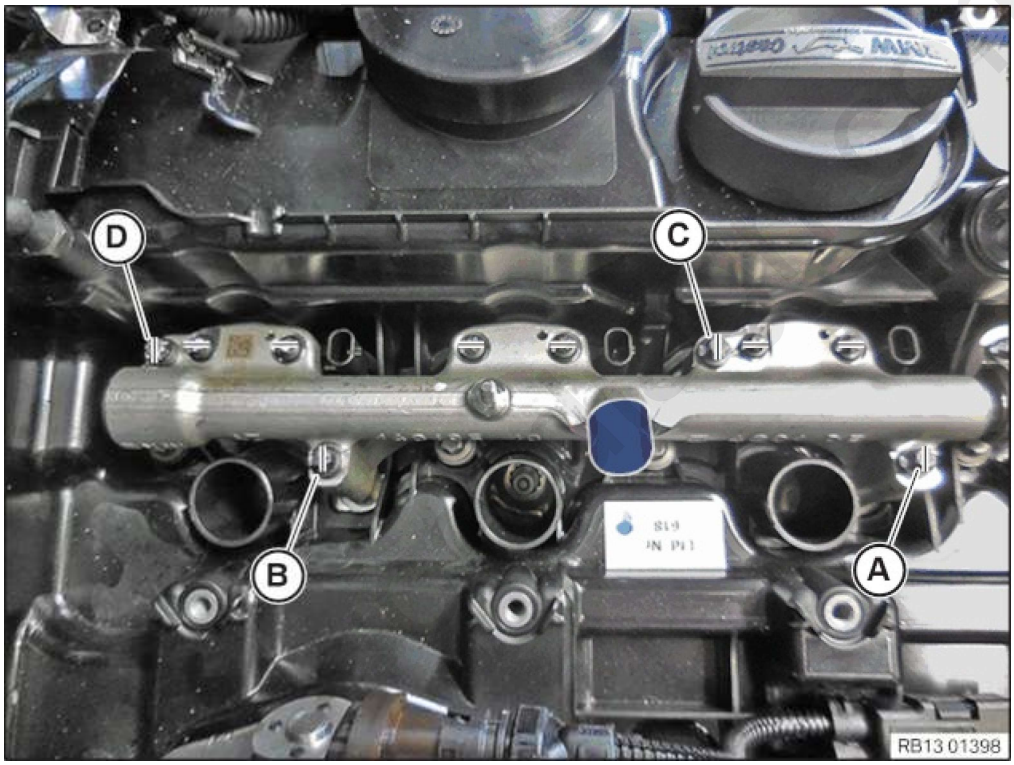
- Mark all bolts (1) to (6) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the screw (1) with an angle of rotation of 90° ±15°.
  - Tighten the screw (2) with an angle of rotation of 90° ±15°.
  - Tighten the screw (3) with an angle of rotation of 90°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



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

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





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

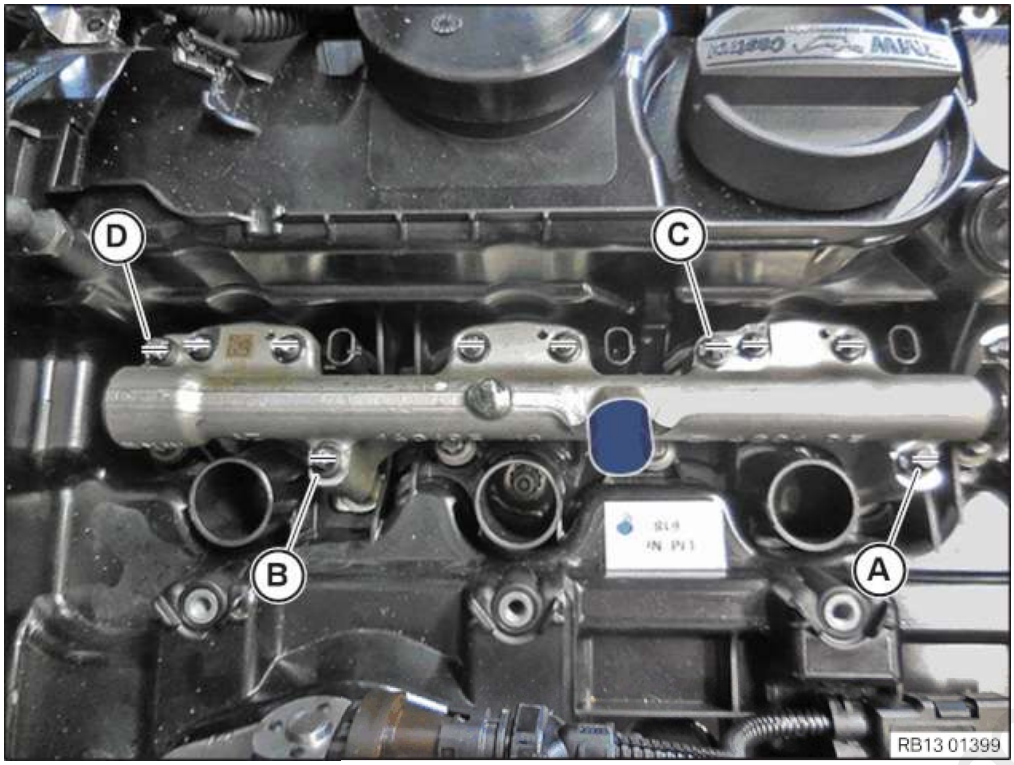
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

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

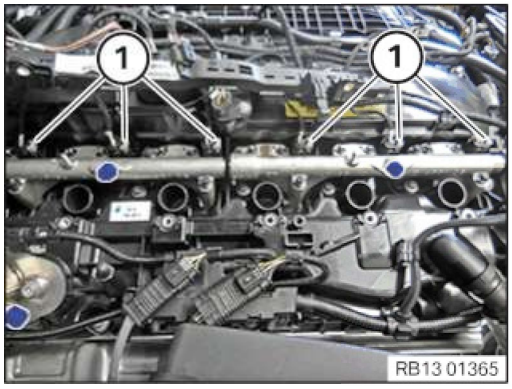
Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.
- Mark all bolts (A) to (D) with a vertical line (see figure).
- Tighten bolts (M6x70) (A) to (D) to a 90° angle of rotation.



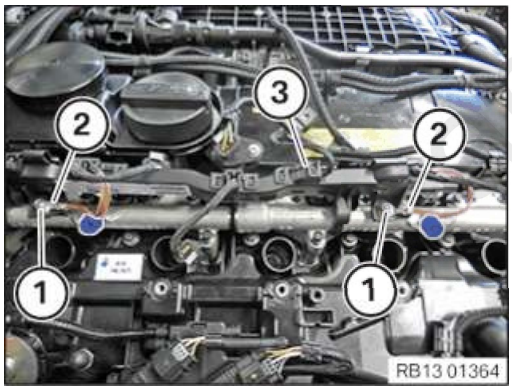
- Check if all bolts (A) to (D) have been tightened with a 90° angle of rotation.

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



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

  All connectors (1) must engage audibly.



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

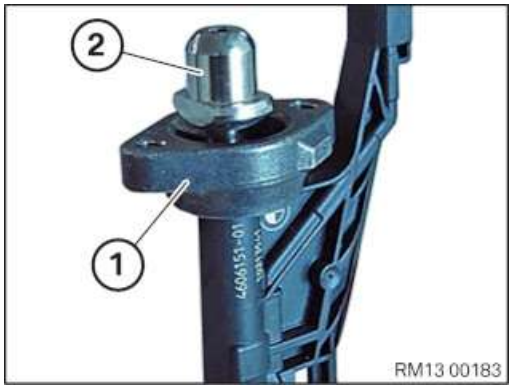
Ground cable to rail

M6			5 Nm

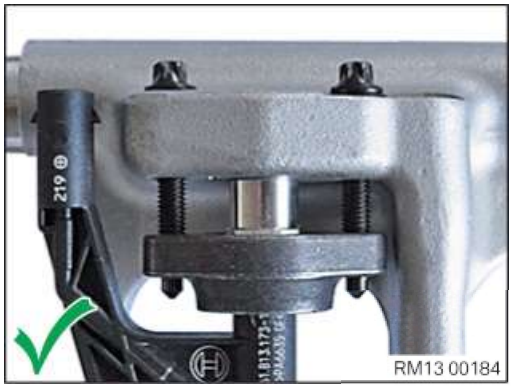
73 – Installing rail with injectors of cylinders 1 to 3

TECHNICAL INFORMATION

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

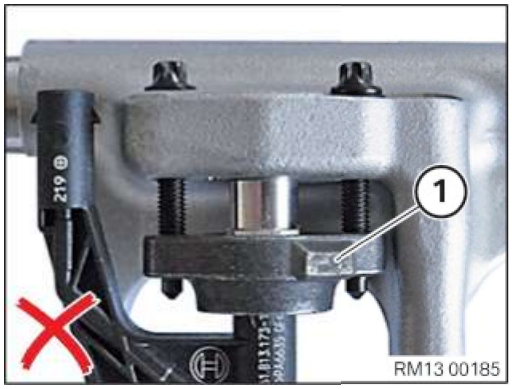


- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If there is a cast lug on the holder** (1) **:** Make sure that the holder is installed in the correct position.



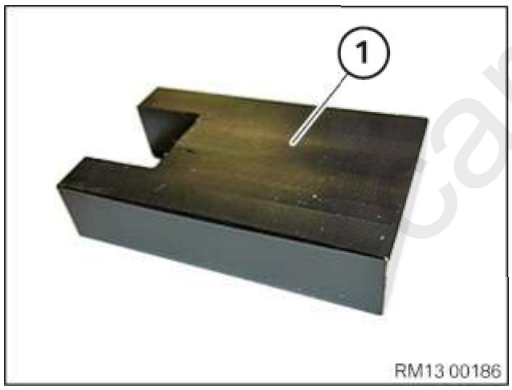
- Observe position of cast lug:

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



- Observe position of cast lug:

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



RISK OF DAMAGE

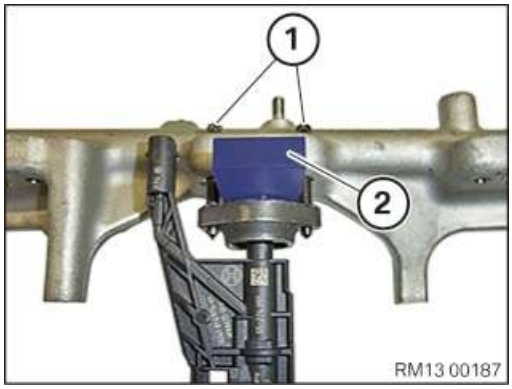
Damage to injectors.

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

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

- Use special tool 2 358 022(1) .

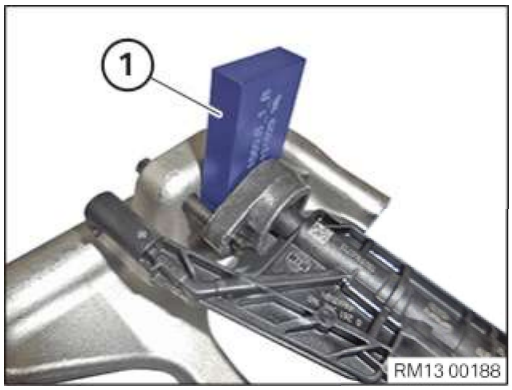
carliagn.com



- Replace (M5x30) screws.

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

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



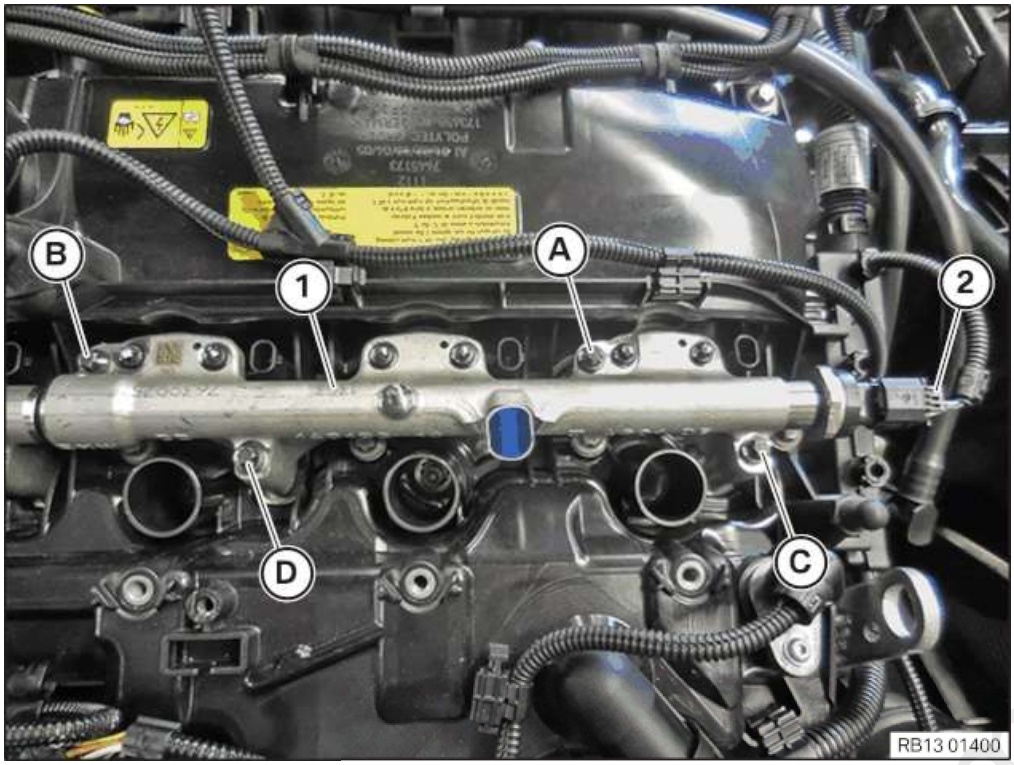
- Remove special tool 2 358 022(1) .
- Repeat this operation for all injectors.



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

  The injectors must move freely.

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- Renew screws (A) to (D).

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

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

TECHNICAL INFORMATION

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

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

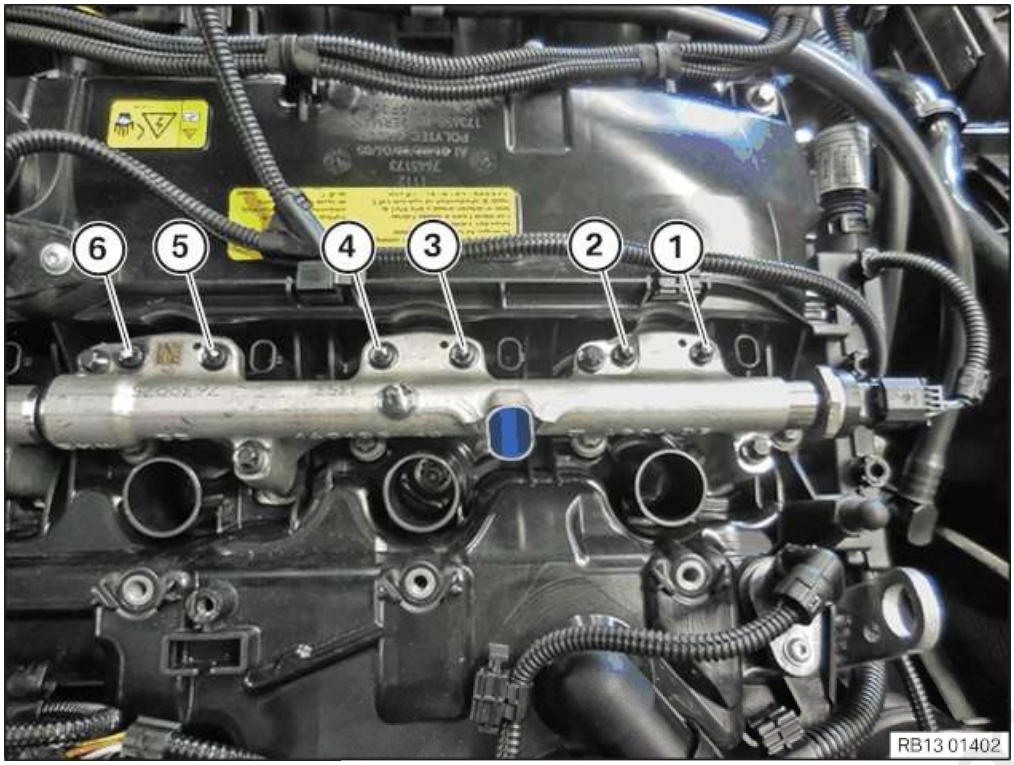
- Tighten screw (A) to 5 Nm.
- Tighten screw (D) to 5 Nm.
- Tighten screw (B) to 5 Nm.
- Tighten screw (C) to 5 Nm.
- Connect and lock the connector (2).

  The connector (2) must engage audibly.



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

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- Attach a socket to an extension.

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

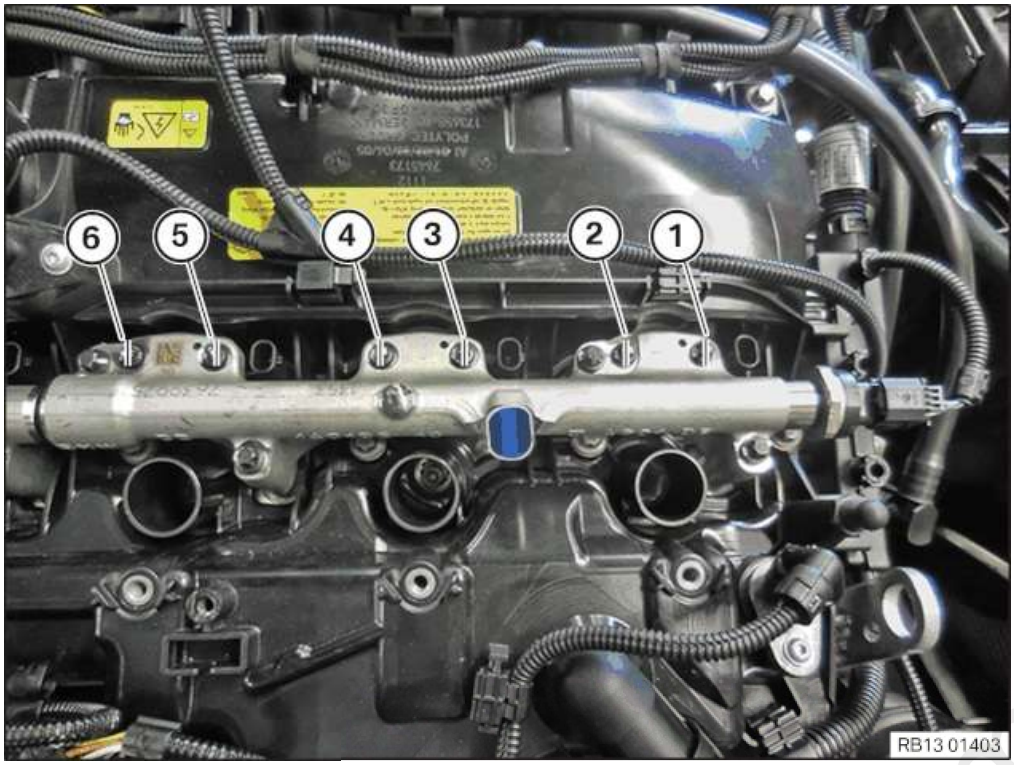
TECHNICAL INFORMATION

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

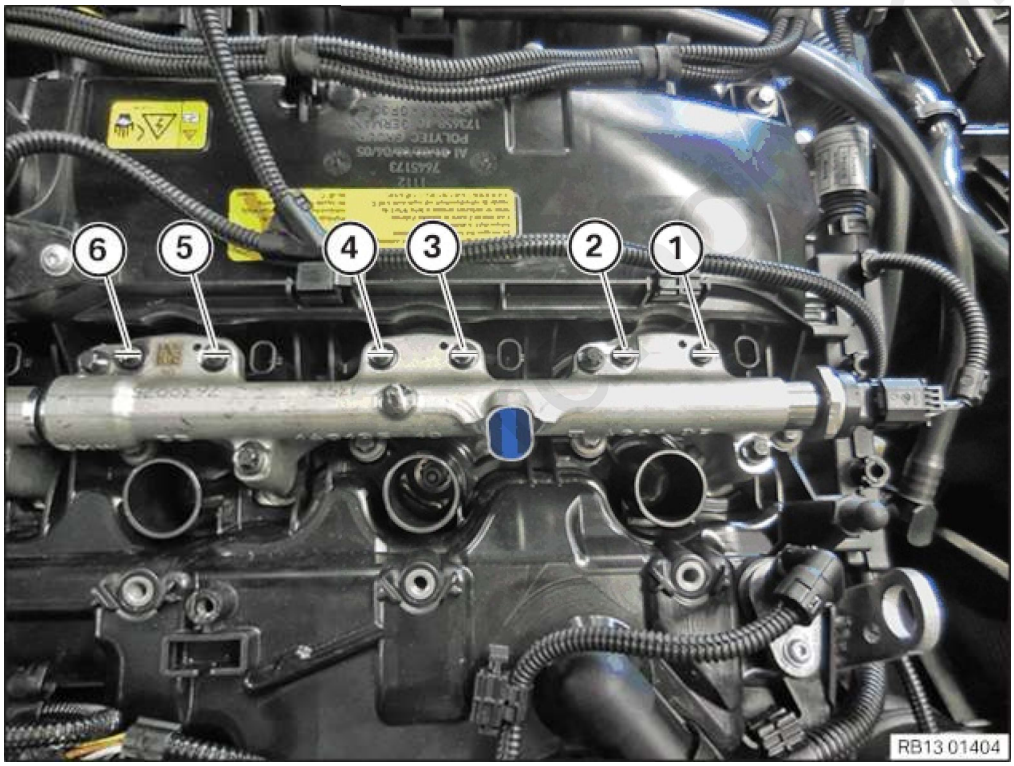
Non-observance of these requirements may result in leaks and damage.

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

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



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

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



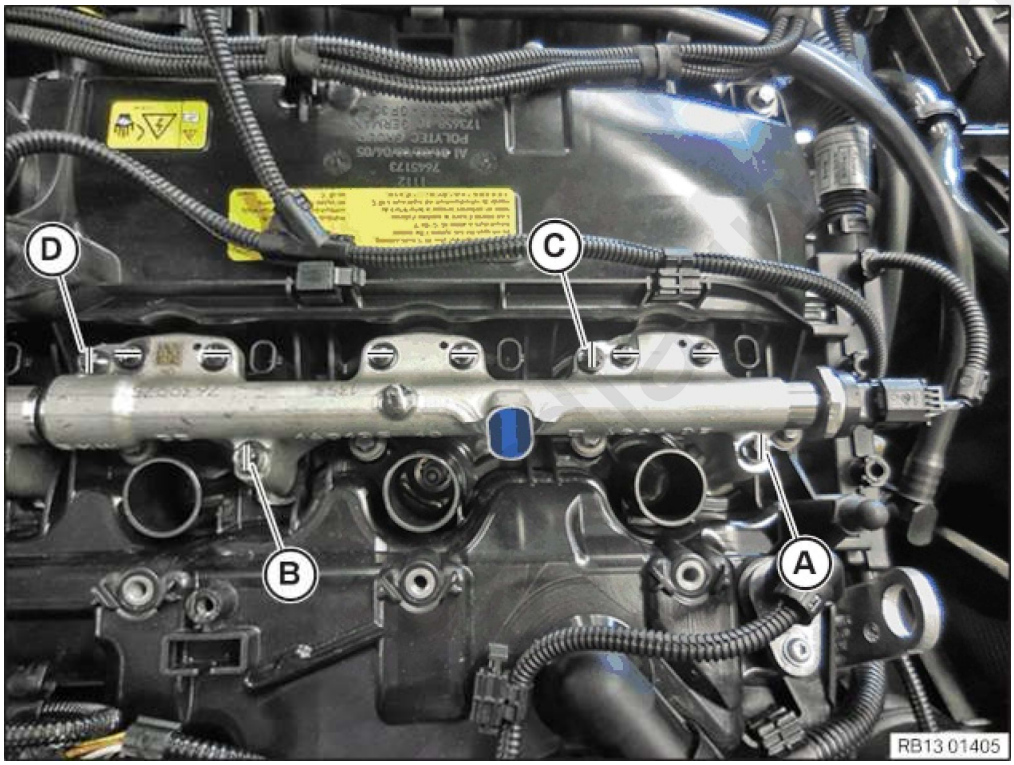
- Release screws (M6x70) (A) to (D) **without fail**.

TECHNICAL INFORMATION

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

Non-observance of these requirements may result in leaks and damage.

- Tighten screw (A) to 5 Nm.
- Tighten screw (D) to 5 Nm.
- Tighten screw (B) to 5 Nm.
- Tighten screw (C) to 5 Nm.

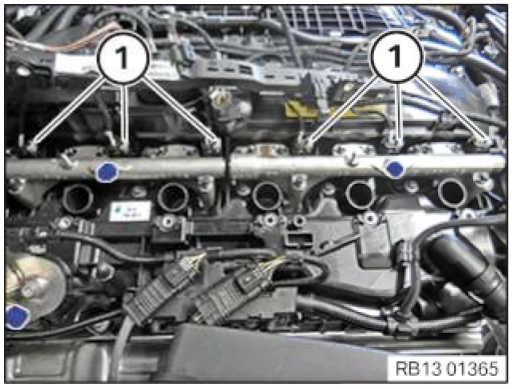


- Mark all the bolts (A) to (D) with a vertical line (see Figure).
- Tighten bolts (M6x70) (A) to (D) with an angle of rotation of 90°.



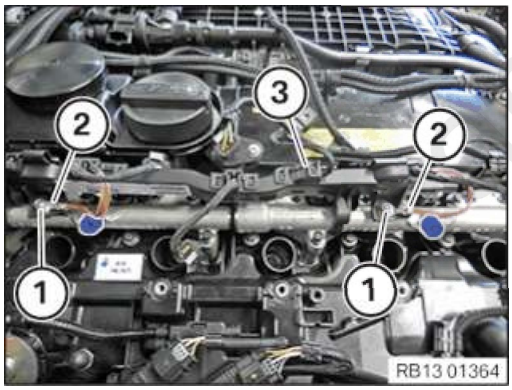
- Check whether all screws (A) to (D) have been tightened with an angle of rotation of 90°.

  All marks (lines) must be horizontal (see figure).



- Connect and lock all the connectors (1) to the injectors.

  All connectors (1) must engage audibly.

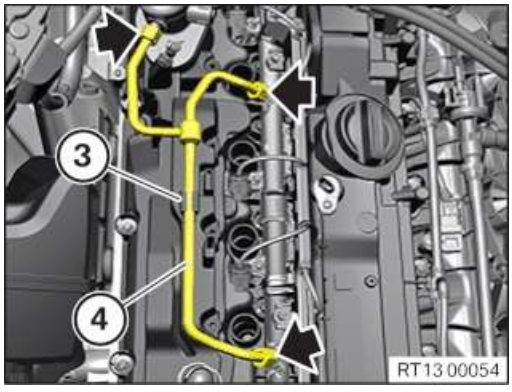


- Thread the cable channel (3) in and install.
- Thread in ground cable (2) and install.
- Tighten nuts (1).

Ground cable to rail

M6			5 Nm

74 – Installing high pressure line between rail and high pressure pump

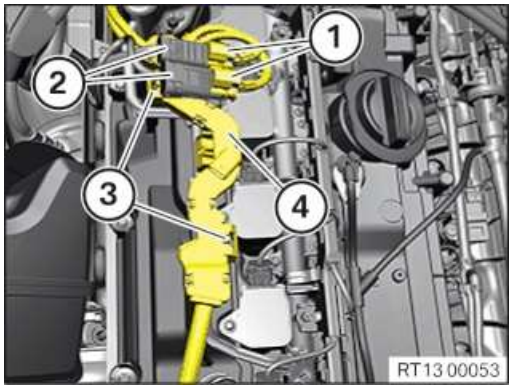


- Insert the high pressure line (4) into the holder (3) and install.
- Tighten union nuts (arrows) with the special tool .

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.

75 – Install high pressure pump

RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

Only G05 and G07

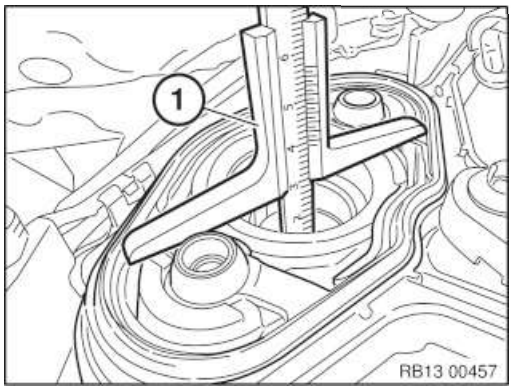
In vehicles with active anti-roll bar (ARS) the fan cowl must be removed in order to spin the engine.

For additional information see: 17 11 035 Removing and installing/replacing the fan cowl including electric fan

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

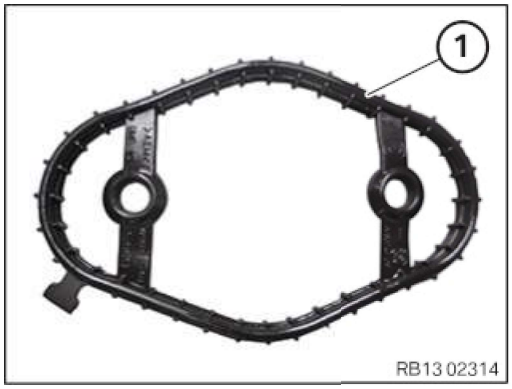
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.



TECHNICAL INFORMATION

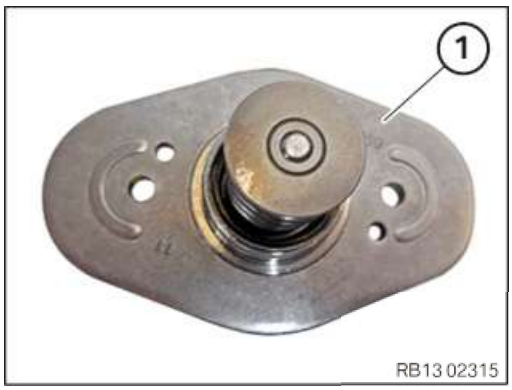
The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).

mdiagn.com



- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

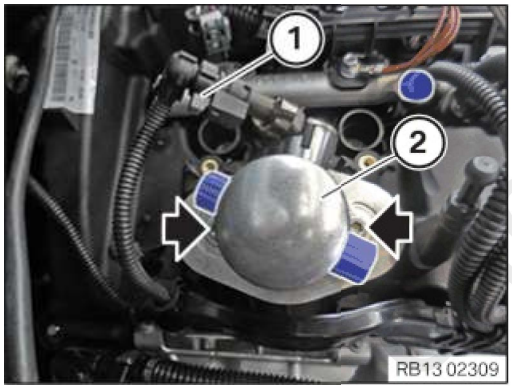
The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

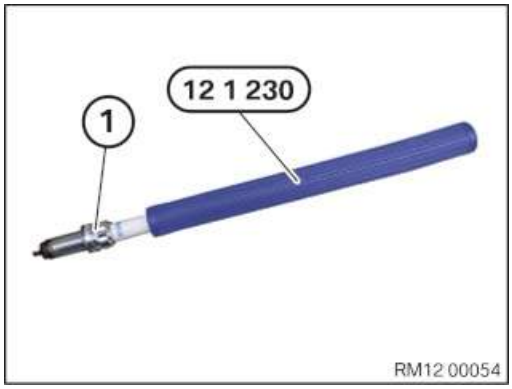
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

76 – 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.

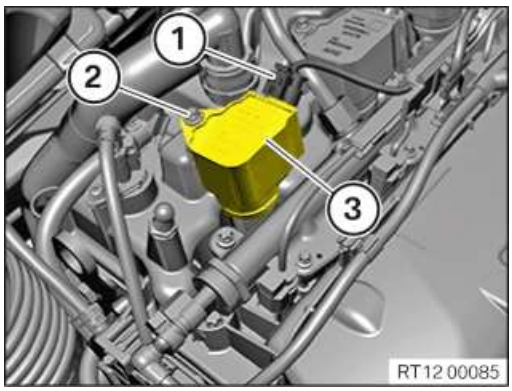
Spark plugs

M12x1.25		Tightening torque	23 Nm

77 – 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).

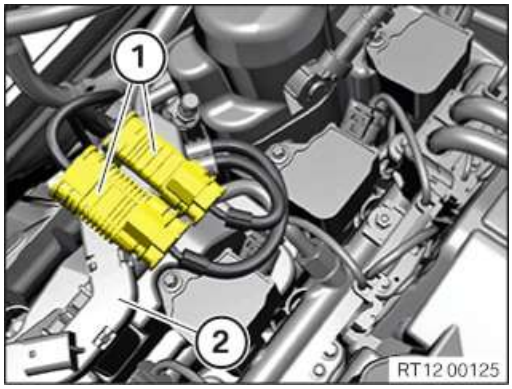
Ignition coil

Screw		Tightening torque	8 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

cardiagn.com



- Connect the connector (1) of the front oxygen sensor and the monitoring oxygen sensor on the cable shaft (2).

78 – Install catalytic converter



- Renew the V-clip (1).

  Parts: V-band clamp



- Renew the gasket (1).

  Parts: Gasket



- Feed in and install catalytic converter.
- Lock clamp (1).

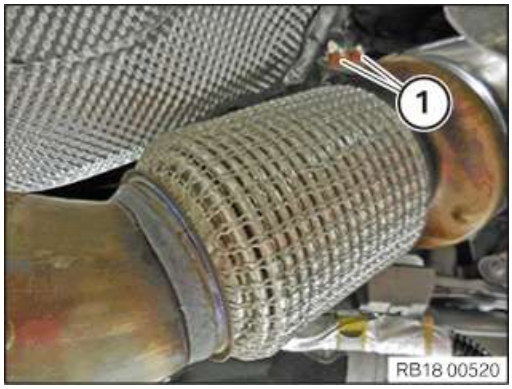
  The clamp (1) must engage audibly.



- Tighten V-band clamp (1).

Catalytic converter to turbocharger

V-band clamp	Replace V-band clamp.	Tightening torque	19 Nm



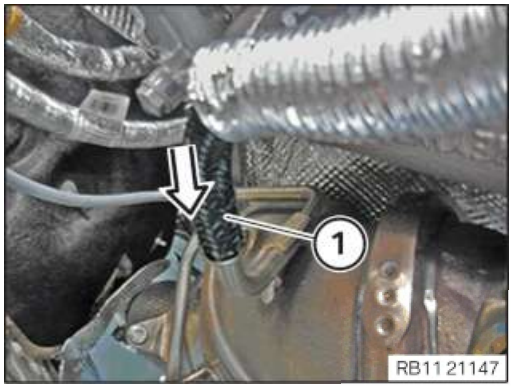
- Renew nuts (1).

  Parts: Nuts

- Tighten nuts (1).

Catalytic converter to holder

M8 nut	Renew nut.	Tightening torque	28 Nm



- **If installed: Connect pressure hose.**

  Renew pressure hose (1).

  Parts: Pressure hose

- Connect the pressure hose (1) in direction of arrow to the limit position.

79 – Install the monitoring oxygen sensor

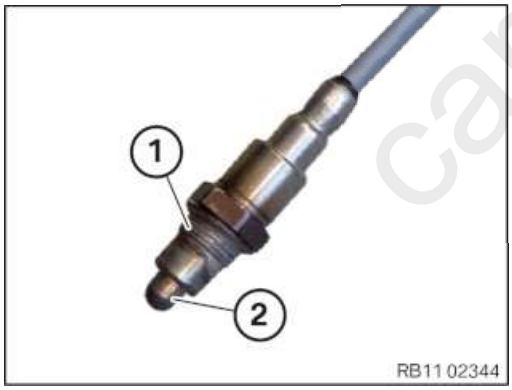
TECHNICAL INFORMATION

New oxygen sensors are to be greased lightly and evenly on the thread.

For oxygen sensors that are reused, the following should be observed:

Lightly and evenly grease the oxygen sensor only on the thread. Do not clean and grease that part of the oxygen sensor which protrudes in the exhaust branch (sensor ceramics).

For additional information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue



- Prepare the oxygen sensor.

  Do not damage the sensor ceramics.

  (1) = Thread

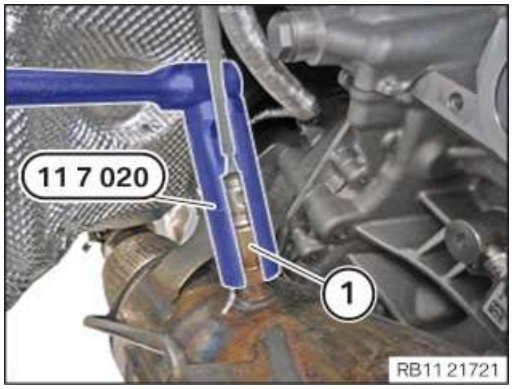
  (2) = Sensor ceramics

- Grease the thread (1) of the Lambda monitoring oxygen sensor thinly and evenly.

Expendable materials

Brake block paste * TU = Trade Unit. TU numbers cannot be ordered! For invoicing purposes only.	3 g, Bag	83192158851
	100 g, Tube	83192158852
	5 g, TU*	83230140233

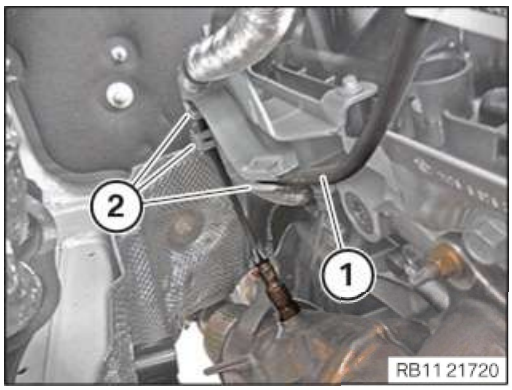
cardiagn.com



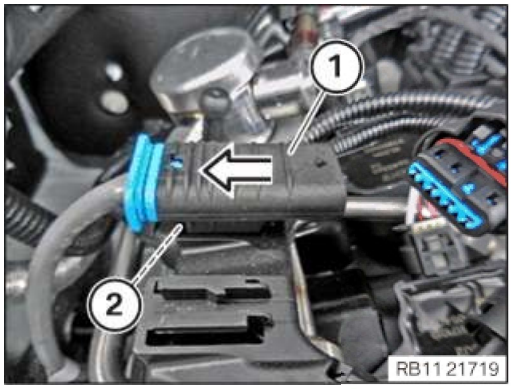
- Feed in the monitoring oxygen sensor (1) and install.
- Tighten monitoring oxygen sensor (1) using special tools 0 493 751 (11 9 150) and 0 491 075 (11 7 030) .

Monitoring oxygen sensor to catalytic converter

M18X1.5		Tightening torque	50 Nm



- Guide monitoring oxygen sensor line (1) into holder (2) and install it.



- Insert and install the connector (1) in the **direction of arrow**.
- Ensure that the lock (2)engages audibly.



- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.

80 – Install the front oxygen sensor

TECHNICAL INFORMATION

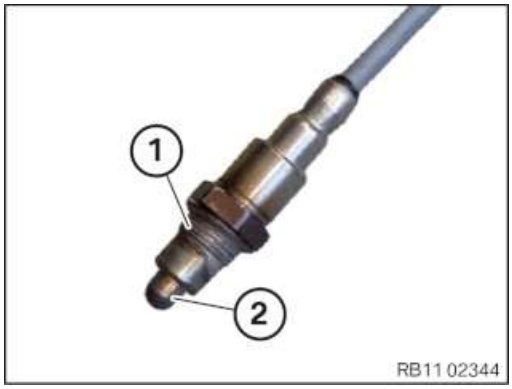
New oxygen sensors are to be greased lightly and evenly on the thread.

For oxygen sensors that are reused, the following should be observed:

Lightly and evenly grease the oxygen sensor only on the thread. Do not clean and grease that part of the oxygen sensor which protrudes in the exhaust branch (sensor ceramics).

For additional information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

fordiagn.com



- Prepare the oxygen sensor.

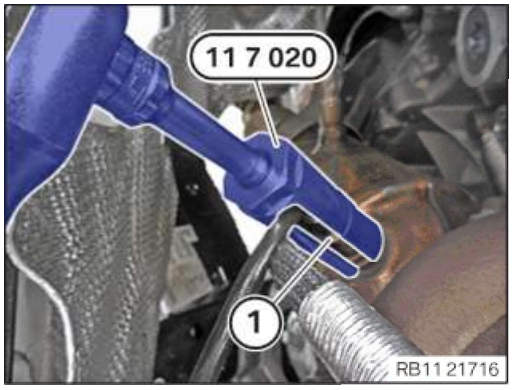
  Do not damage the sensor ceramics.

  (1) = Thread

  (2) = Sensor ceramics
- Apply a thin and even coat of grease to the thread (1) of the front oxygen sensor.

Expendable materials

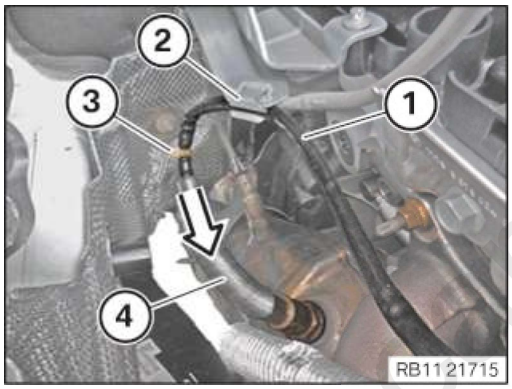
Brake block paste * TU = Trade Unit. TU numbers cannot be ordered! For invoicing purposes only.	3 g, Bag	83192158851
	100 g, Tube	83192158852
	5 g, TU*	83230140233



- Screw the control sensor (1) in and tighten it with the special tool .

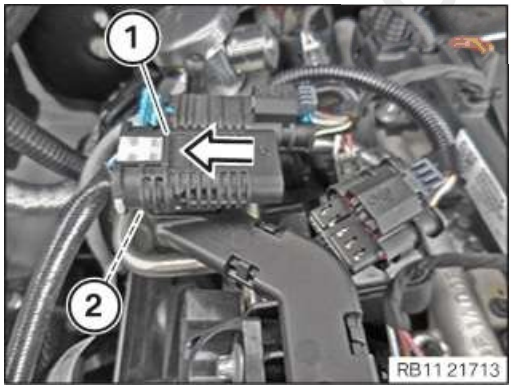
Front oxygen sensor to catalytic converter

M18X1.5		Tightening torque	50 Nm



- Guide in the heat protection (4) in the **direction of arrow** and install.
- Renew the cable straps (3).

  Parts: Cable strap
- Guide in and install the cable strap (3).
- Feed in and install the line of the front oxygen sensor (1) in the holder (2).



- Insert and install the connector (1) in the **direction of arrow**.
- Ensure that the lock (2)engages audibly.



- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.

81 – Installing the intake plenum

RISK OF DAMAGE

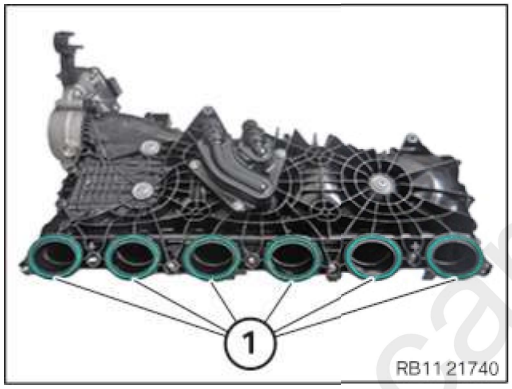
Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



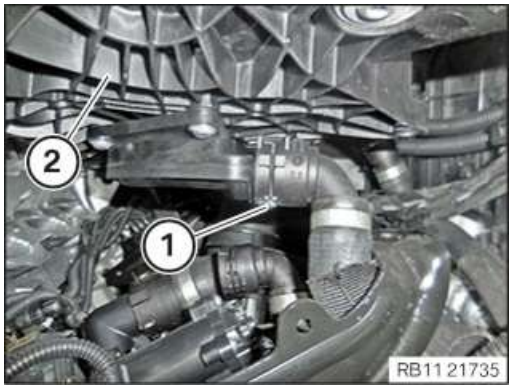
- Renew gaskets (1).

  Parts: Seals

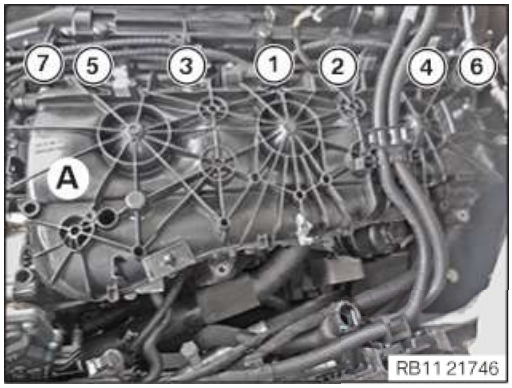


- Clean contact surface (1).

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- Feed in and position intake plenum (2).
- Connect and lock coolant line (1).
- Make sure that the cooling line (1) engages audibly.



TECHNICAL INFORMATION

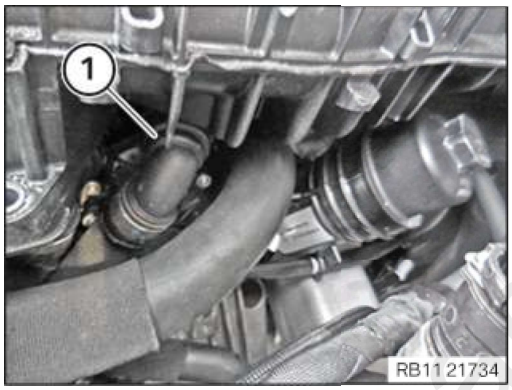
Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Position the intake plenum (A).
- Tighten screws in the order (1) to (7).

Note: Tighten the bolts in 360 degree steps.

Intake plenum to cylinder head

M6		Tightening torque	10 Nm



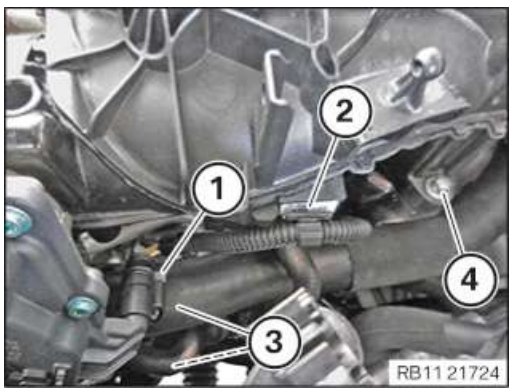
- Connect and lock coolant line (1).
- Make sure that the cooling line (1) engages audibly.



- Tighten down screw 1.

Intake plenum to support

M6X25		Tightening torque	8 Nm



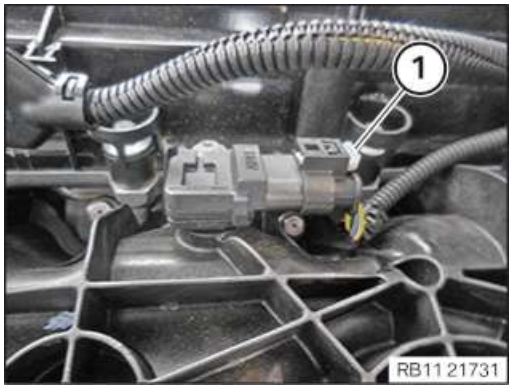
- Tighten down screw (4).

Intake plenum to support

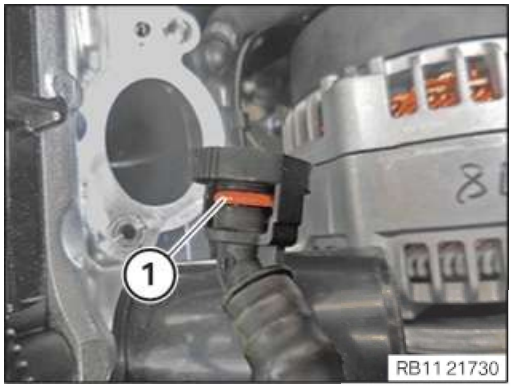
M6X25		Tightening torque	8 Nm

- Thread in and install coolant line (3).
- Secure clamps (2).
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.

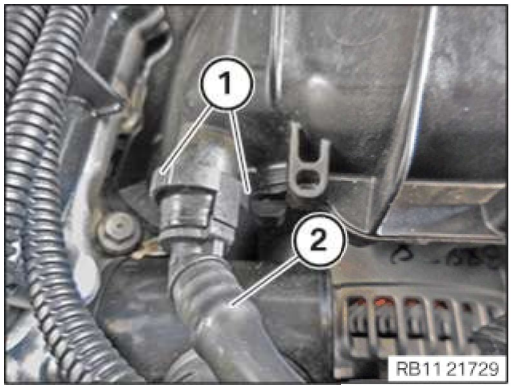
fdiagn.com



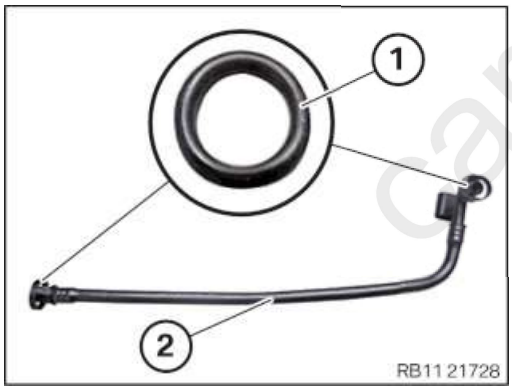
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.



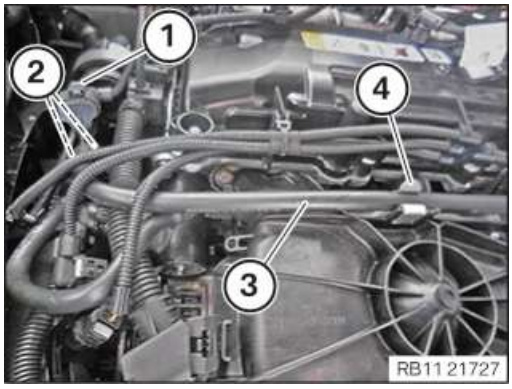
- Check sealing ring (1) for damage and renew tank ventilation line if necessary.



- Insert and install the tank ventilation line (2).
- Ensure that the locks (1) engage audibly.

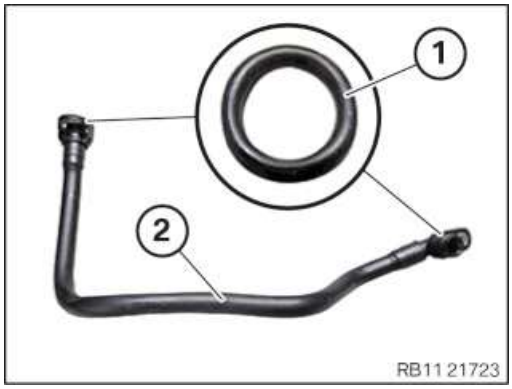


- Check sealing ring (1) for damage and renew tank ventilation line (2) if necessary.

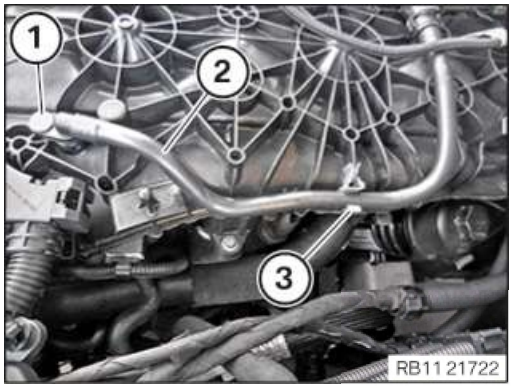


- Insert and install the tank ventilation line (3).
- Ensure that the locks (2) engage audibly.
- Secure the tank ventilation line (3) to the clamp (4).
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.

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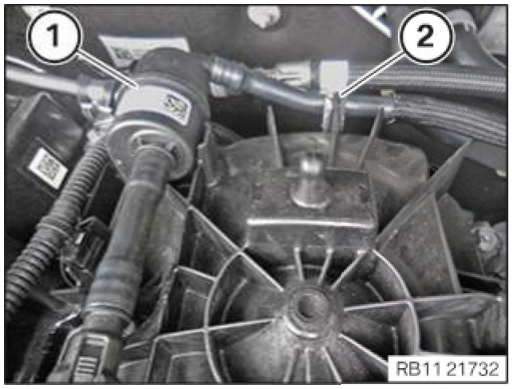
- Check sealing ring (1) for damage and renew tank ventilation line (2) if necessary.



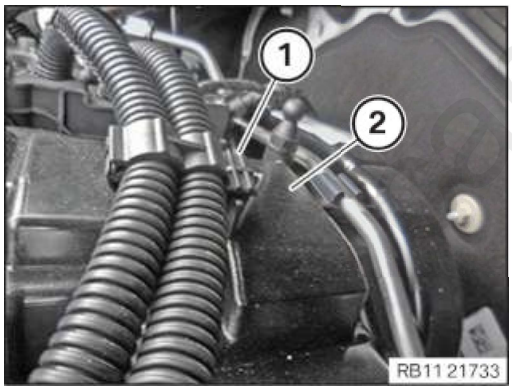
- Insert and install the tank ventilation line (2).
- Secure the tank ventilation line (2) to the clamp (3).
- Tighten down screw (1).

Tank ventilation line to intake plenum

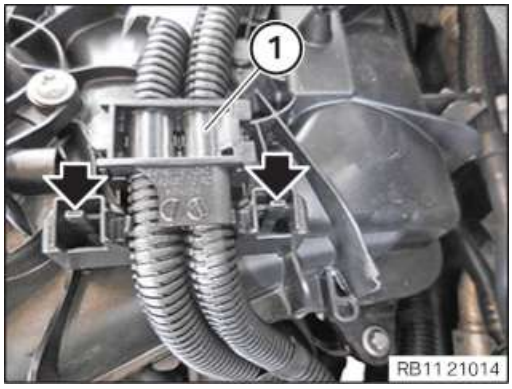
Oval-head screw		Tightening torque	3 Nm



- Insert and install the tank ventilation line (1).
- Secure the tank ventilation line (1) to the clamp (2).



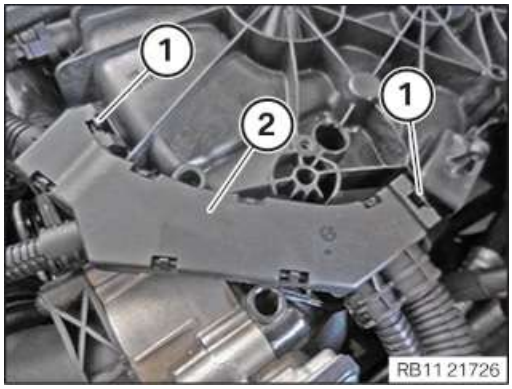
- Secure the wiring harness section(1) for the injectors and ignition coils on the cylinder head cover (2).



- Insert and install the wiring harness section (1) for the injectors and ignition coils.

  The locks (arrows) must engage audibly.

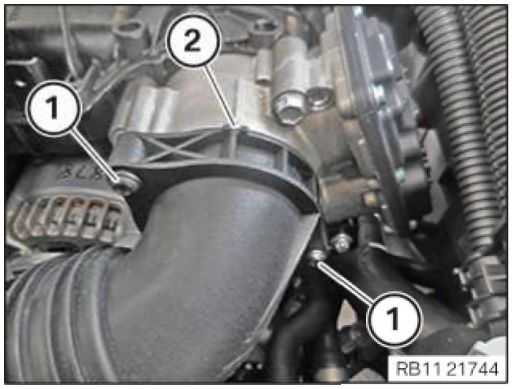
carfdiagn.com



- Feed in and install wiring harness section (2) for sensor system **2**.
- Ensure that the locks (1) engage audibly.



- Check the sealing ring (1) for damage and renew the sealing ring (1) as needed.

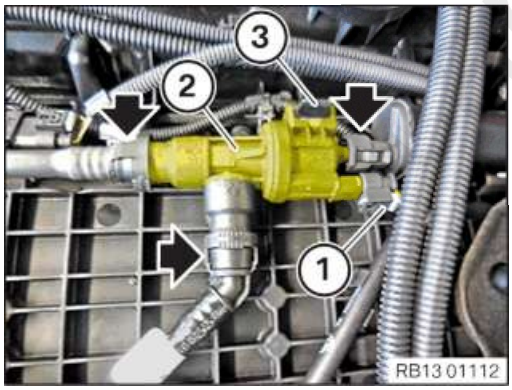


- Insert and install charge air line (2).
- Tighten the screws (1).

Charge air line to throttle valve

M6x30		Tightening torque	8 Nm

82 – Installing the tank vent valve



- Secure the tank vent valve (2) to the holder (3).
- Connect and lock the tank ventilation lines (arrows).

  The tank ventilation lines (arrows) must audibly engage.
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

83 – Install engine ventilation line

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

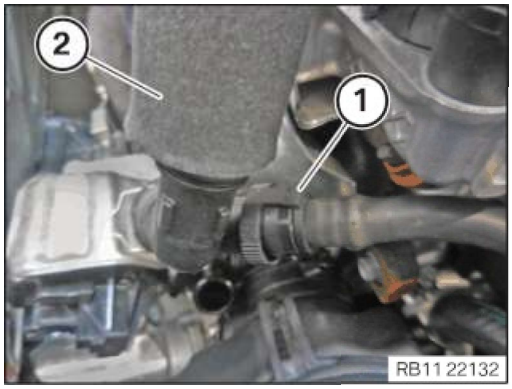
rdiagn.com

TECHNICAL INFORMATION

Check the retaining lug on the connector for damage and perform a tension check as needed.

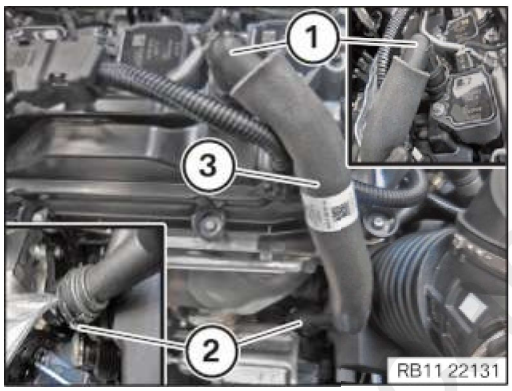


- Check sealing ring (1) for damage and renew tank ventilation line if necessary.

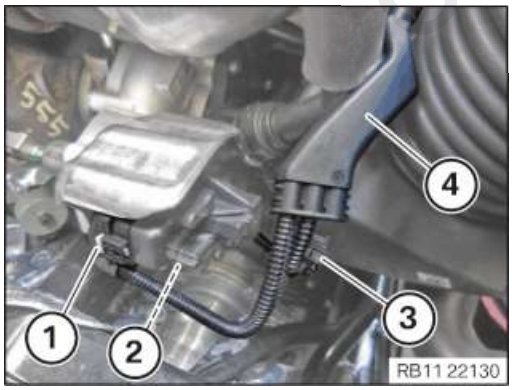


- Insert and position the engine ventilation line (2).
- Insert and install the tank ventilation line (1).

  Tank ventilation line (1) must engage audibly into place.



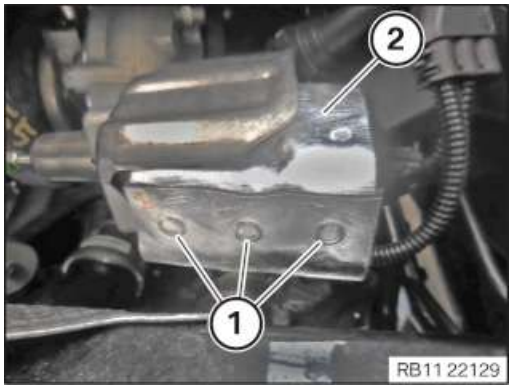
- Insert and install the engine ventilation line (3).
- Make sure you can hear the locks (1) and (2) engage.



- Feed in and position the wiring harness section of sensor system **2** (4).
- Connect connectors (2) and lock.
- Connect connectors (1) and lock.

  The connectors (1) and (2) must audibly engage.
- Secure clamps (3).

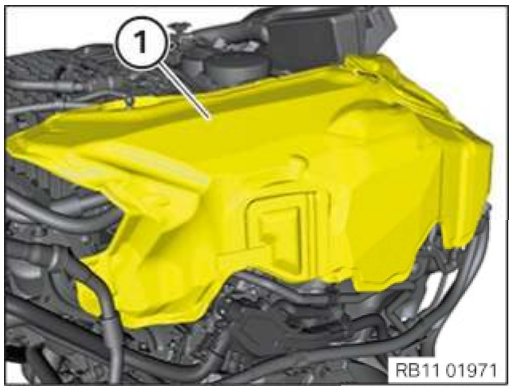
tdiag.com



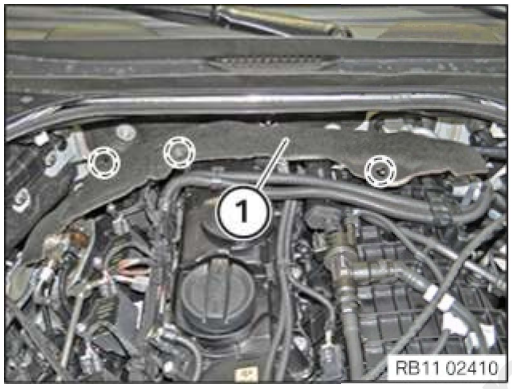
- Feed in and install heat shield (2).
- Lock the locks (1).

  Locks (1) must engage audibly.

84 – 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.

85 – Topping up the engine oil

RISK OF DAMAGE

Damage to the petrol particulate filter.

Vehicles equipped with a petrol particulate filter must be operated with low-ash engine oil only.

- Use BMW Longlife-04 , BMW Longlife-12 FE or BMW Longlife-17 FE+ engine oils or engine oils approved by BMW matching the same specifications only.
- For additional information see: Overview of approved engine oils for BMW Group engines.

RISK OF DAMAGE

Engine damage caused by excessively filling the engine with engine oil.

Filling an excessive quantity of engine oil may cause engine damage.

- Observe the exact engine oil filling capacity.
- Drain the engine oil.

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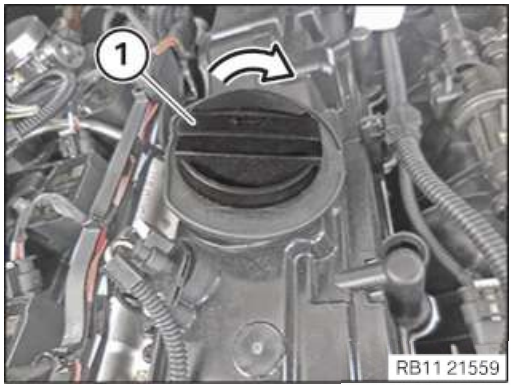
- Pour in engine oil.

Engine oil B58B30M1/B58B30O1

Filling capacity, engine oil change with oil filter element	6,50 l

Engine oil: Technically suitable engine oils for BMW Group engines

86 – Installing the oil filler cap



- Close oil filler cap (1) in direction of arrow.
- Make sure that the sealing cap (1) engages audibly.

87 – Remove engine from assembly stand

CAUTION

Heavy component.

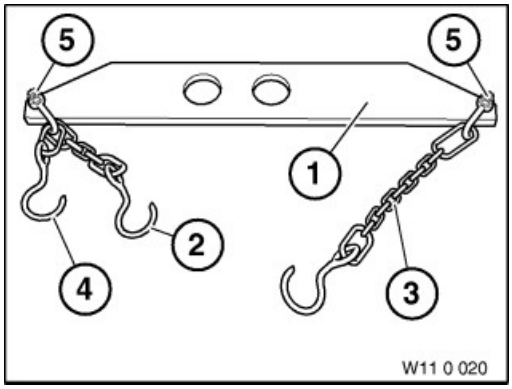
Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

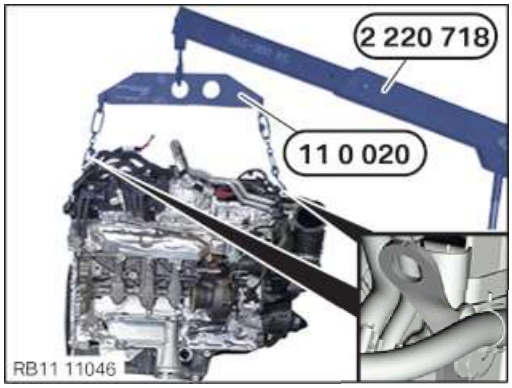


- Stage the workshop crane 2 220 718.

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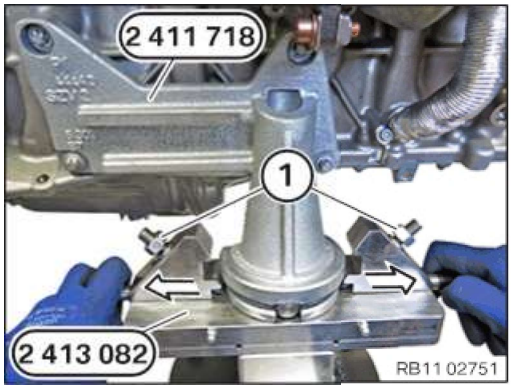
- Stage special tool (lifting gear) 0 490 567 (11 0 020).



TECHNICAL INFORMATION

The workshop crane, lifting gear and the mounting brackets on the engine must all be connected to each other so that the engine hangs straight upon lifting.

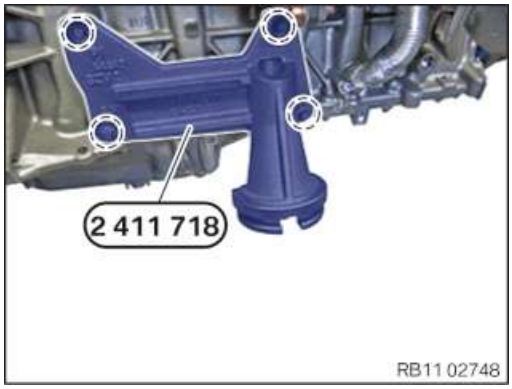
- Connect both hooks of the special tool 0 490 567 (11 0 020) to the front and back of the engine with the mounting brackets.
- Connect the workshop crane 2 220 718 to the special tool (lifting gear) 0 490 567 (11 0 020).



- Slacken nuts (1).
- Unclamp the clamping jaws of the special tool (engine fixture) 2 413 082 in the direction of arrow.

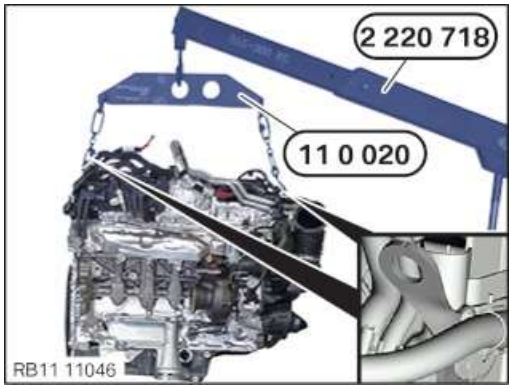


- Raise the engine slowly.



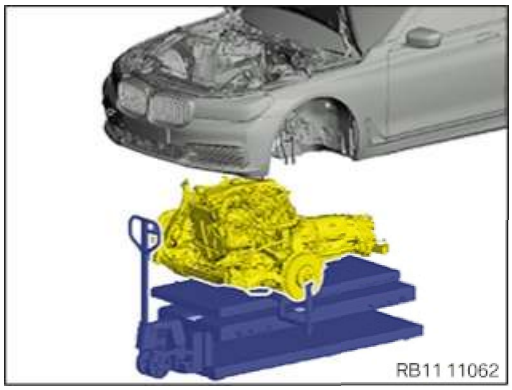
- Release the screws (marks) and remove the special tool (engine fixture) 2 411 718.

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- See additional information.

89 – Installing the complete front axle including engine and transmission



- See additional information.

Additional Information

Overview of Tightening Torques

Flange to assembly stand			Used in step 3
M14X30		Tightening torque	135 Nm

Special tool 11 8 930 to special tool 00 2 320			Used in step 3
M14x35		Tightening torque	160 Nm

Special tool 2 411 718 to crankcase			Used in step 3
M10x30		Tightening torque	38 Nm

Oil drain plug			Used in step 6
M12x16	Replace sealing ring.	Tightening torque	25 Nm

Basic carrier to cylinder head			Used in step 245666
M6		Tightening torque	8 Nm

Test gauge to basic carrier			Used in step 245666
M6		Tightening torque	8 Nm

Special tool to cylinder head			Used in step 33
M8		Tightening torque	21,5 Nm

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Connecting rod bearing cap to connecting rod — Used in step 44

Renew screws.

Tighten screws crosswise.	Jointing torque	20 Nm
	1. Angle of rotation	70 °
	2. Angle of rotation	70 °

Oil deflector to crankcase — Used in step 45

M8 x 35	Replace screws.	Jointing torque	15 Nm
		Angle of rotation	45 °

Camshaft sprocket to oil vacuum pump — Used in step 46

M8	Important - left-hand thread Renew screw.	1. Jointing torque	5 Nm
		2. Angle of rotation	90 °

Oil vacuum pump to crankcase — Used in step 46

M8	Renew screw.	1. Tightening torque	15 Nm
		2. Angle of rotation	45 °

Oil sump to crankcase — Used in step 47

M8 x 30		Tightening torque	24 Nm

Oil sump to crankcase — Used in step 47

M8 x 110		Tightening torque	24 Nm

Transmission to oil sump (manual gearbox and automatic transmission) — Used in step 47

M8 x 50		Tightening torque	19 Nm

Bearing support to oil sump — Used in step 48

M8		Tightening torque	19 Nm

Battery positive lead to starter — Used in step 49

M8		Tightening torque	13,5 Nm

Front axle final drive to engine oil pan — Used in step 50

M12		Tightening torque	140 Nm

Cylinder head to crankcase — Used in step 55

M11	Observe tightening sequence. Fit new cylinder head bolts.	1. Jointing torque	30 Nm
		2. Angle of rotation	90 °
		3. Angle of rotation	180 °

Cylinder head bolt to timing case cover — Used in step 55

M8x40	Renew screws.	Tightening torque	19 Nm

Camshaft sensor wheel to intake camshaft — Used in step 55

M4 x35			4,5 Nm

Bearing journal to cylinder head — Used in step 55

Bearing journal	Renew the bearing journal!	Tightening torque	20 Nm

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Sliding rail to cylinder head — Used in step 55

M6x16			8 Nm

Cover on rear cylinder head — Used in step 55

M6		Tightening torque	8 Nm

Cable routing to cylinder head, rear — Used in step 55

M6 x 20		Tightening torque	8 Nm

Oil feed line for exhaust turbocharger to crankcase — Used in step 55

M6 x 12	Replace sealing ring.	Tightening torque	8 Nm

Coolant return line holder bracket to crankcase — Used in step 55

M6X12		Tightening torque	8 Nm

Heat shield to cylinder head — Used in step 55

M8X12	Renew screws.	Tightening torque	19 Nm

Heat shield to clamping strip — Used in step 55

M6X16	Renew screw.	Tightening torque	8 Nm

Coolant feed line to crankcase — Used in step 55

M6X12		Tightening torque	8 Nm

Exhaust turbocharger support to crankcase — Used in step 55

M8 x 20	Renew screws.		19 Nm

Exhaust turbocharger to support — Used in step 55

M8 x 25	Renew screw.		19 Nm

VANOS central valve to camshaft — Used in step 6263

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 65

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Coolant line to coolant pump/cylinder head — Used in step 67

M6x20		Tightening torque	8 Nm

Oil return line to turbocharger — Used in step 68

M6 x 12			8 Nm

Oil return line to crankcase — Used in step 68

M6 x 12			8 Nm

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Cylinder head cover to cylinder head — Used in step 69

M6X30		Jointing torque	8 Nm

Cylinder head cover to cylinder head — Used in step 69

M6X30		Tightening torque	11 Nm

Auxiliary coolant pump holder to cylinder head — Used in step 69

M6		Tightening torque	7 Nm

Standard screw connection M6 — Used in step 69

M6			8 Nm

Differential pressure sensor to holder — Used in step 69

TS6X18		Tightening torque	3,5 Nm

Holder, positive battery cable to cylinder head cover — Used in step 69

6X18		Tightening torque	6 Nm

Ground cable to rail — Used in step 7273

M6			5 Nm

High pressure line between rail and high pressure pump — Used in step 74

M14x1,5		Tightening torque	33 Nm

High pressure pump to high pressure pump flange — Used in step 75

M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

Spark plugs — Used in step 76

M12x1.25		Tightening torque	23 Nm

Ignition coil — Used in step 77

Screw		Tightening torque	8 Nm

Catalytic converter to turbocharger — Used in step 78

V-band clamp	Replace V-band clamp.	Tightening torque	19 Nm

Catalytic converter to holder — Used in step 78

M8 nut	Renew nut.	Tightening torque	28 Nm

Monitoring oxygen sensor to catalytic converter — Used in step 79

M18X1.5		Tightening torque	50 Nm

Front oxygen sensor to catalytic converter — Used in step 80

M18X1.5		Tightening torque	50 Nm

Intake plenum to cylinder head — Used in step 81

M6		Tightening torque	10 Nm

Intake plenum to support — Used in step 81

M6X25		Tightening torque	8 Nm

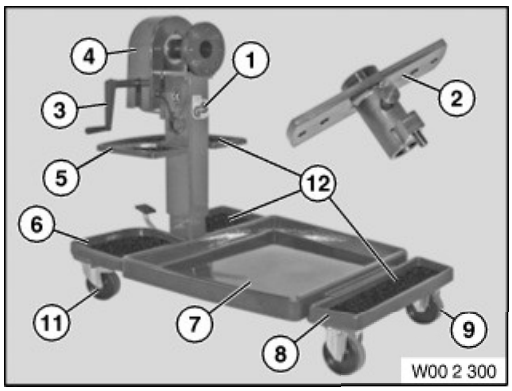
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Tank ventilation line to intake plenum			Used in step 81
Oval-head screw		Tightening torque	3 Nm

Charge air line to throttle valve			Used in step 81
M6x30		Tightening torque	8 Nm

Overview of Special Tools

0 495 187 (00 2 300) Assembly stand



Common		Used in step 3
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)	

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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.	

2 411 718 Engine support



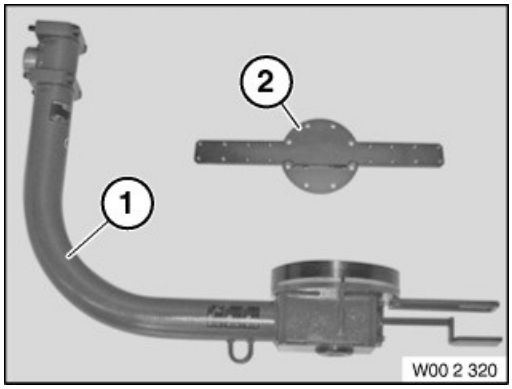
Common Used in step 387

Usage	For accommodating engine on assembly stand. Engine: B58; S58
Included in the tool or work	
Storage location	
Replaced by	
In connection with	2413082
SI-Number	01 23 15 (280)

0 495 196 (00 2 320) Support arm

Used in step 3

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Common

Usage	(Support arm with fixture) For mounting engines using the engine mounting bracket.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	002300 = 0495187
SI-Number	01 25 04 (155)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 197 (00 2 321)		**Support arm**	
2	0 495 198 (00 2 322)		**Panel** (take-up plate)	
3	0 495 380 (00 2 323)		**Panel** (fixture) Engine N73	
6	0 496 287 (00 2 326)		**Panel** (fixture) Engine: M73	
5	0 496 288 (00 2 327)	0 496 373	**Panel** (fixture) Engine: S62 Replaced by 11 5 420 (0 496 373)	
8	0 496 533 (00 2 328)		**Support** (Engine mount) Engine: N57, N57Top	
9	0 496 579 (00 2 329)	0 496 680	**Support** (Engine mount) Engine: N74 Replaced by 116160 (0 496 680)	
4	0 495 379 (00 2 324)		**Panel** (fixture) Engine M67TU	
5	0 495 381 (00 2 325)		**Panel** (fixture) Engine N62, N62TU	

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2 413 082 Support

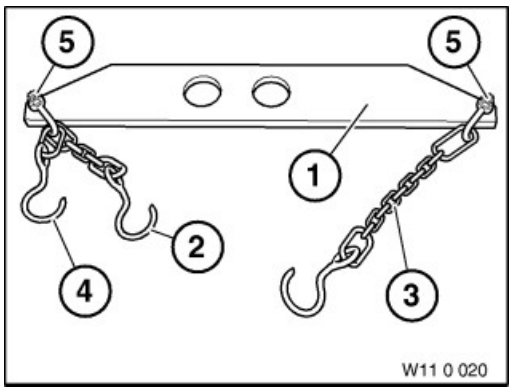


Common Used in step 387

Usage	For mounting the engines on the assembly stand.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	0495196
SI-Number	01 23 15 (280)

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0 490 567 (11 0 020) Lifting gear



Common Used in step 3335587

Usage	For removing and installing the engines. 08/2011 only available as a complete set. Delivered with TÜV inspection certificate and operating instructions. No delivery of separate parts.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 13 94 (888)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
5	0 490 572 (11 0 029)		**Shackle** (Shackle) 2 pieces As of 08/2011, only available as a complete set via 11 0 020 = 0490567. Delivered with TÜV inspection certificate and operating instructions.	
1	0 490 568 (11 0 021)		**Lifting gear** (Cross member) As of 08/2011, only available as a complete set via 11 0 020 = 0490567. Delivered with TÜV inspection certificate and operating instructions.	
2	0 490 569 (11 0 022)		**Chain** (Chain) As of 08/2011, only available as a complete set via 11 0 020 = 0490567. Delivered with TÜV inspection certificate and operating instructions.	
3	0 490 570 (11 0 023)		**Chain** (Chain) Version: long As of 08/2011, only available as a complete set via 11 0 020 = 0490567. Delivered with TÜV inspection certificate and operating instructions.	
4	0 490 571 (11 0 024)		**Chain** (Chain) Version: short As of 08/2011, only available as a complete set via 11 0 020 = 0490567. Delivered with TÜV inspection certificate and operating instructions.	

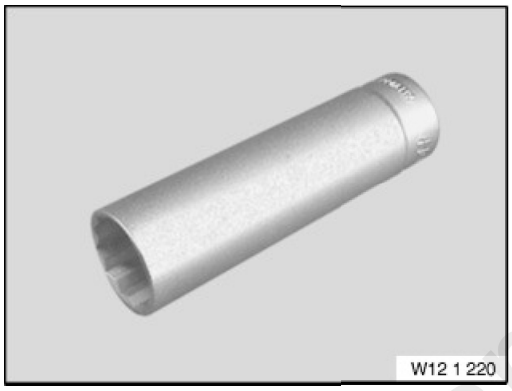
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2 220 718 Workshop crane



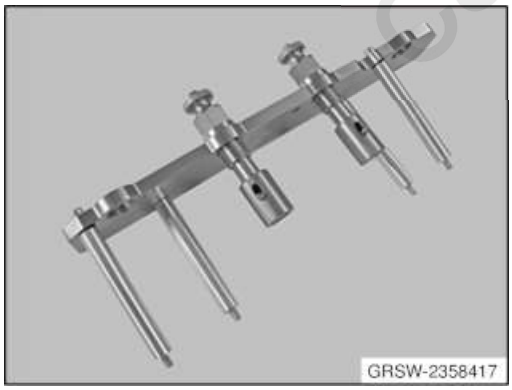
Common	Used in step	33387
Usage	WSK 1000	
Included in the tool or work		
Storage location	Individual	
Replaced by		
In connection with		
SI-Number	06 01 11 (701)	

0 495 560 (12 1 220) Socket



Common	Used in step	1576
Usage	For removing and installing the spark plugs (WAF 14 bihexal).	
Included in the tool or work		
Storage location	C18	
Replaced by		
In connection with		
SI-Number	01 20 06 (299)	

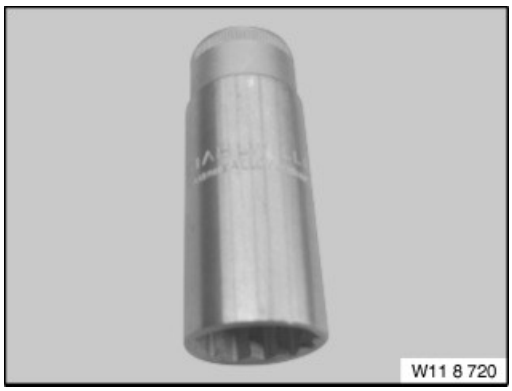
2 358 417 Device



Common	Used in step	1819
Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).	
Included in the tool or work		
Storage location	A57	
Replaced by		
In connection with		
SI-Number	01 13 14 (098)	

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0 496 106 (11 8 720) Socket WAF 46



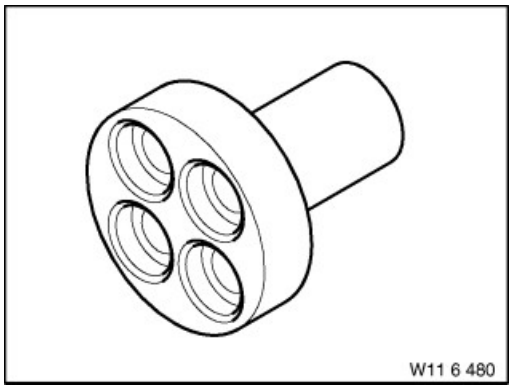
Common	Used in step 1819
Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

2 360 895 Pin wrench



Common	Used in step 2070
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 2454646675
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

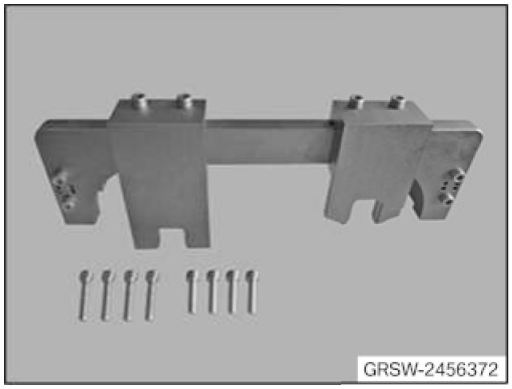
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2 288 380 Locating stud



Common	Used in step 24546466
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 2432566466
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 122 Gauge



Common	Used in step 243266
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 496 855 Ratchet handle



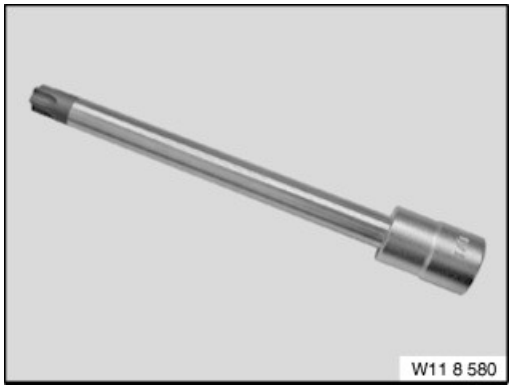
Common	Used in step 26276263
Usage	Insert reversible ratchet with nut for installation and disassembly of the VANOS- SW22. (only in longitudinal installation). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found 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 26276263
Usage	For removing and installing the VANOS adjuster. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	0496855
SI-Number	01 07 17 (487)

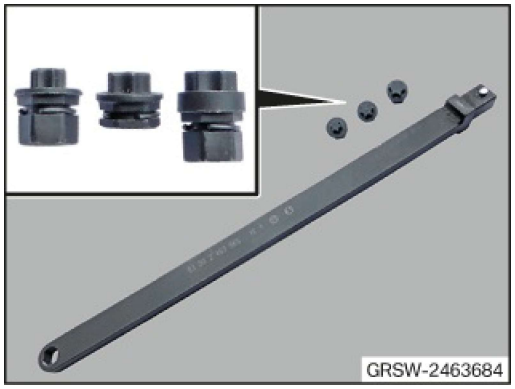
0 495 747 (11 8 580) Socket wrench



Common	Used in step 3355
Usage	(wrench socket Torx T60) For removing and installing cylinder head (outside diameter 13.5 mm).
Included in the tool or work	
Storage location	A19
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

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2 463 965 Socket wrench



Common	Used in step 38
Usage	with T30, T40 and torx 45
Included in the tool or work	
Storage location	B6
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 463 755 Assembly tool



Common	Used in step 4044
Usage	For installation of pistons and connecting rods in the crankcase. Contour-graphic silhouette foil is included in the delivery specification.
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 18 (545)

2 463 754 Adapter



Common	Used in step 42
Usage	For gudgeon pin circlip installation. Engine: B58O1, B58M1. Silhouette foil is included in the delivery specification.
Included in the tool or work	
Storage location	B56
Replaced by	
In connection with	
SI-Number	

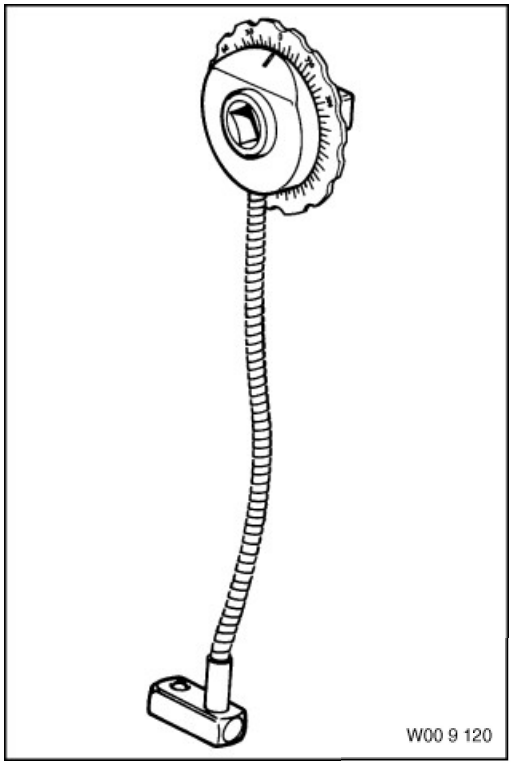
2 410 685 Installation drift



Common	Used in step 42
Usage	For gudgeon pin circlip installation. 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	B55
Replaced by	
In connection with	118560 = 0495743
SI-Number	01 23 15 (280)

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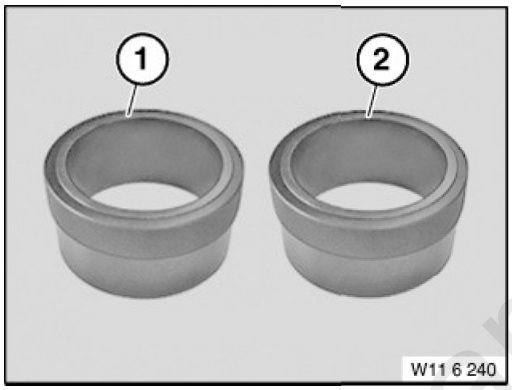
0 490 504 (00 9 120) Torque angle measuring dial



Common Used in step 444555

Usage	For torsion angle adjustment of cylinder head bolts (all engines) And reinforcement plate front axle support E46
Included in the tool or work	
Storage location	A4
Replaced by	
In connection with	
SI-Number	

0 495 373 (11 6 240) Bush



Common Used in step 44

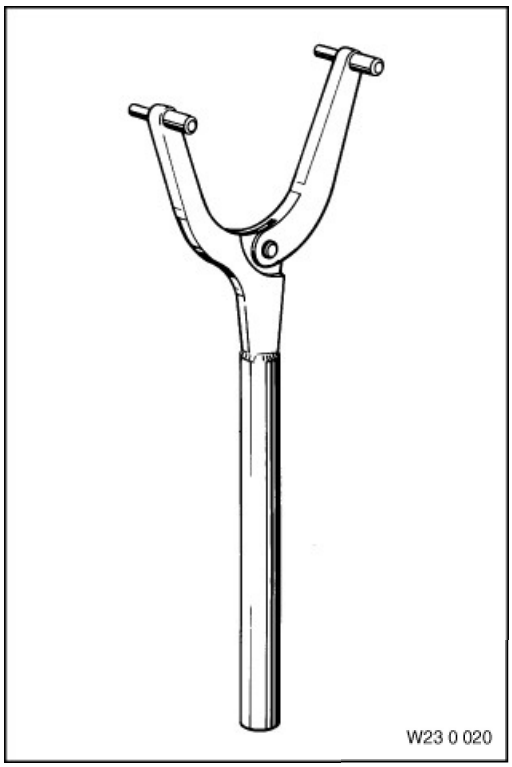
Usage	(Assembly bush set) For fitting pistons (diameter 82 mm) with connecting rod into the crankcase. Engine: N52B25
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 02 06 (244)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
2	0 495 527 (11 6 242)		**Bush** (assembly bush 82.25 mm)	
1	0 495 526 (11 6 241)		**Bush** (assembly bush 82.00 mm)	

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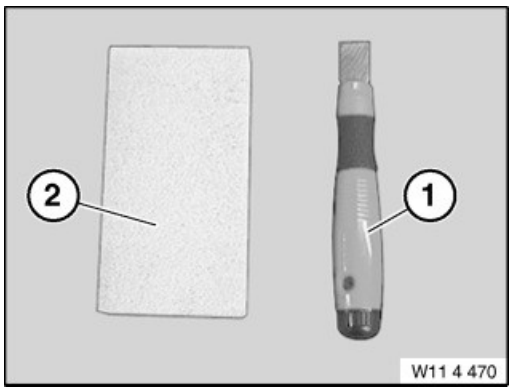
0 491 440 (23 0 020) Holder



Common	Used in step 46
Usage	(counter support) For all three- and four-hole flanges when releasing and tightening down
Included in the tool or work	
Storage location	B4
Replaced by	
In connection with	
SI-Number	

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0 495 102 (11 4 470) Tool



Common Used in step 47

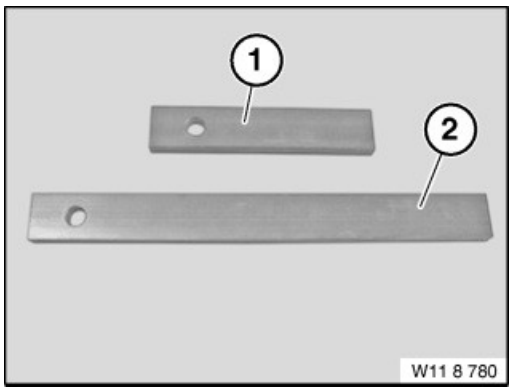
Usage	(cleaning kit) For cleaning sealing surfaces on magnesium crankcase/cylinder head.
Included in the tool or work	
Storage location	C52
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 103 (11 4 471)		**Scraper**	
2	0 495 104 (11 4 472)		**Extractor** (grindstone)	

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0 496 120 (11 8 780) Plate



Common

Used in step 47

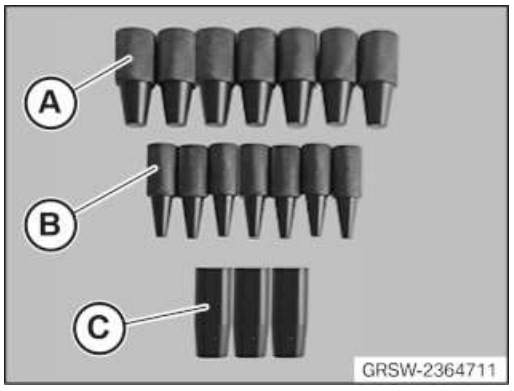
Usage	(Mounting plates) For securing transmission oil sump when gearbox is removed.
Included in the tool or work	
Storage location	B24
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 121 (11 8 781)		**Plate** (Mounting plate, short)Discontinued; only available via set 11 8 780 = 0496120.	
2	0 496 122 (11 8 782)		**Plate** (Mounting plate, long) Discontinued; only available via set 11 8 780 = 0496120.	

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2 364 711 Plug



Common

Used in step 5152

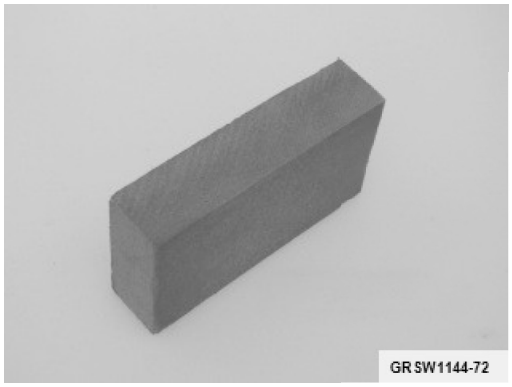
Usage	For closing the pressure oil holes for cleaning the cylinder head sealing surfaces.
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 50 14 (203)

0 495 103 (11 4 471) Scraper



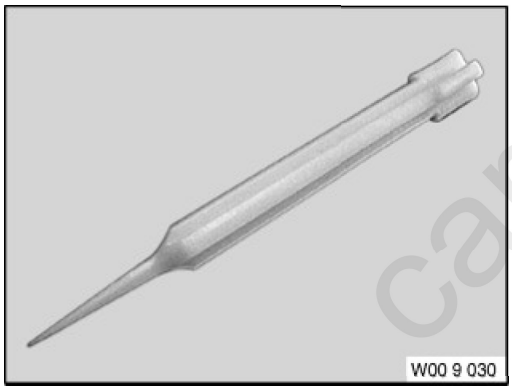
Common	Used in step 52
Usage	
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

0 495 104 (11 4 472) Extractor



Common	Used in step 52
Usage	(grindstone)
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

0 496 714 (00 9 030) Wedge



Common	Used in step 55
Usage	For dismantling O-rings, gaskets and trim panels. This special tool replaces special tool 00 9 316.
Included in the tool or work	
Storage location	A50
Replaced by	
In connection with	
SI-Number	01 20 09 (581)

2 455 654 Tensioning tool



Common	Used in step 6164
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 71

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 71

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

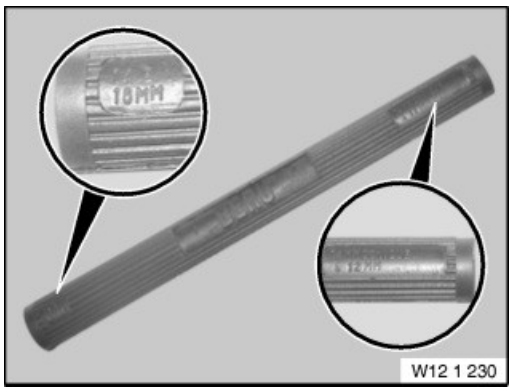


Common Used in step 7273

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)

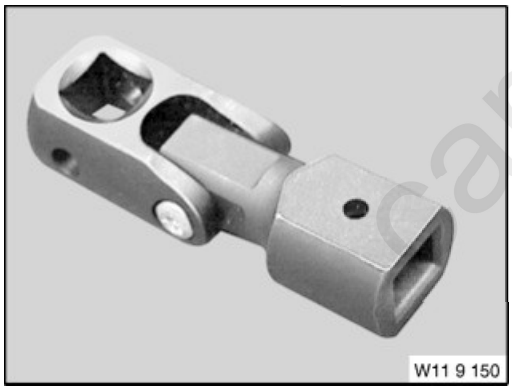
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0 496 065 (12 1 230) Fitting aid



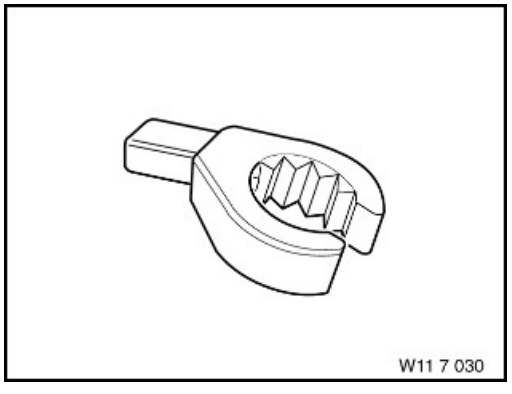
Common	Used in step 76
Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

0 493 751 (11 9 150) Extension



Common	Used in step 79
Usage	(Socket wrench extension) For loosening and tightening the oxygen sensor
Included in the tool or work	
Storage location	C41
Replaced by	
In connection with	
SI-Number	01 15 00 (609)

0 491 075 (11 7 030) Socket wrench insert



Common	Used in step 79
Usage	(Socket wrench insert 22 mm) For loosening and tightening the oxygen sensor
Included in the tool or work	
Storage location	A9
Replaced by	
In connection with	
SI-Number	01 06 95 (963)

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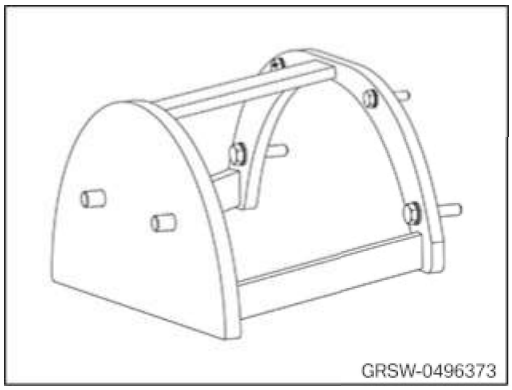
Replacement tools:

2 299 563 Adapter



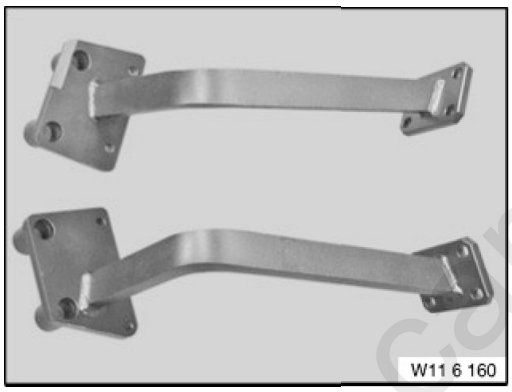
Common	Used in step 3
Usage	New adapter for the engine assembly stand. Replacement for 83 30 0 495 189 - 00 2 302.
Included in the tool or work	0 495 187
Storage location	
Replaced by	
In connection with	
SI-Number	

0 496 373 (11 5 420) Plate



Common	Used in step 3
Usage	(Fixture) Engine S62
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	

0 496 680 (11 6 160) Support



Common	Used in step 3
Usage	For mounting N74 engine on the assembly stand. In combination with 00 2 300, 00 2 320
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	00 2 300; 00 2 320 = 0495196
SI-Number	01 31 09 (604)

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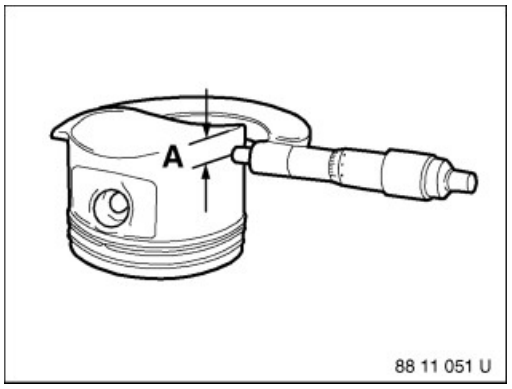
Overview Technical Data

Piston diameter

Used in step 41

Measure the piston diameter at distance (A) from the lower end of the piston skirt.

Distance (A) to the lower end of the piston skirt	10 mm
Nominal dimension of piston diameter	81,958 mm ... 81,996 mm



Cylinder bore B38/B46/B48/B58	Used in step 43
Diameter of cylinder bore	82,000 mm ... 82,014 mm
Permitted irregularity of the cylinder bore	0,01 mm
Permitted conicity of the cylinder bore	0,01 mm
Permissible total wear tolerance between piston and cylinder bore (engine operated)	0,15 mm

Height of the sealing bead	Used in step 47
	2,0 mm ... 2,5 mm

Engine oil B58B30M1/B58B30O1	Used in step 85
Filling capacity, engine oil change with oil filter element	6,50 l
Engine oil: Technically suitable engine oils for BMW Group engines	

Links

General repair instructions	**Used in step**
11 00 ... Overview of consumables (Electronic Parts Catalogue)	477980

Repair instructions	**Used in step**
31 10 001 Completely removing and installing front axle with engine and transmission	189
31 10 001 Completely removing and installing front axle with engine and transmission	189
31 10 001 Completely removing and installing front axle with engine and transmission	189
31 10 001 Completely removing and installing front axle with engine and transmission	189
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31 10 001 Completely removing and installing front axle with engine and transmission	189
31 10 001 Completely removing and installing front axle with engine and transmission	189
31 10 001 Completely remove and install front axle with engine and transmission (FRU specification without wheel alignment)	189
11 00 050 Remove and install engine	189
11 00 050 Remove and install engine	189
31 10 001 Completely removing and installing front axle with engine and transmission	189
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11 00 598 Removing and installing engine on front axle (for part no. 31 10 001/501)	288

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11 00 598 Removing and installing engine on front axle (for part no. 31 10 001/501)	288
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11 00 598 Removing and installing engine on front axle (for part no. 31 10 001/501)	288
11 00 598 Removing and installing engine on front axle (for part no. 31 10 001/501)	288
61 35 ... Notes on ESD protection (Electro Static Discharge)	142022
13 53 ... Clean the cylinder heads in the area of injectors to prevent sand/dust contamination.	1819
61 35 ... Notes on ESD protection (Electro Static Discharge)	20
17 11 035 Removing and installing/replacing fan cowl with electric fan	75
31 10 001 Completely removing and installing front axle with engine and transmission	89
31 10 001 Completely removing and installing front axle with engine and transmission	89
31 10 001 Completely removing and installing front axle with engine and transmission	89
31 10 001 Completely removing and installing front axle with engine and transmission	89

Operating materials	**Used in step**
3.0 Technically appropriate engine oils for BMW Group engines	85

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This documentation refers to special tools that were not yet available when going to press.

11 25 671 Replace the piston rings for all pistons

CAUTION

Component with heavy weight.

Danger of injury!

- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

The following engine requires a renewal of the piston rings in combination with new pistons only.

The following repair instructions explain the installation and removal including the renewal of the piston with the piston rings.

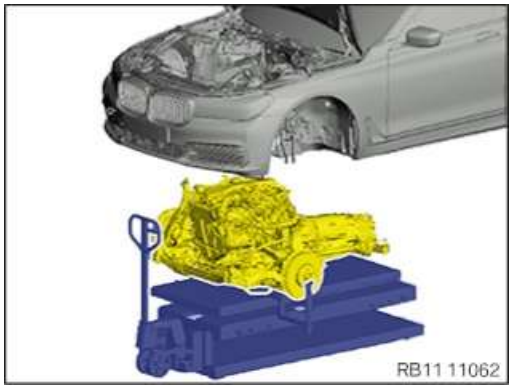
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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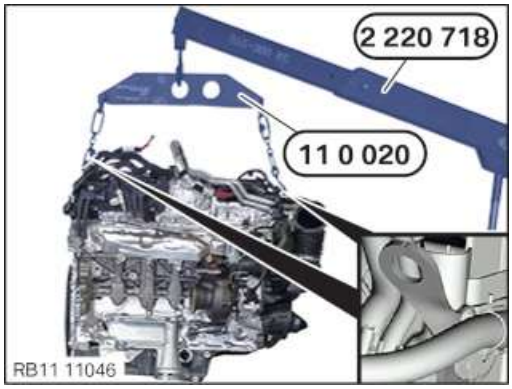
PRELIMINARY WORK

1 – Remove the front axle completely with the engine and transmission



- See additional information.

2 – Remove engine from front axle



- See additional information.

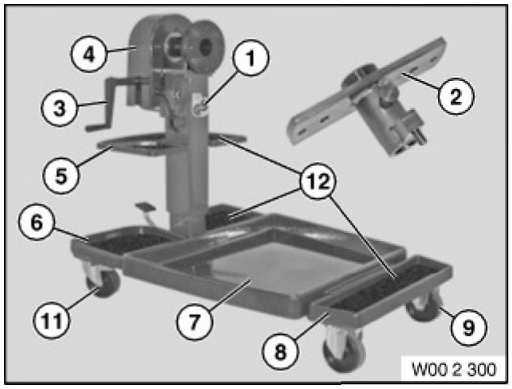
3 – Install the engine on the assembly stand

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.



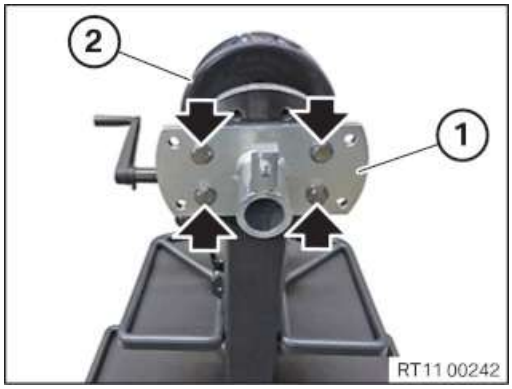
- Have the set of special tools 0 495 187 (00 2 300) ready.

Number	Description
1	Assembly stand
2	Flange
3	Crank
4	Cover
5	oddments tray
6	Shaped element rear
7	Collection pan
8	Shaped element front
9	Front wheel
10	Rear wheel with stop
11	Mat



- Have the special tool 2 411 718 ready.

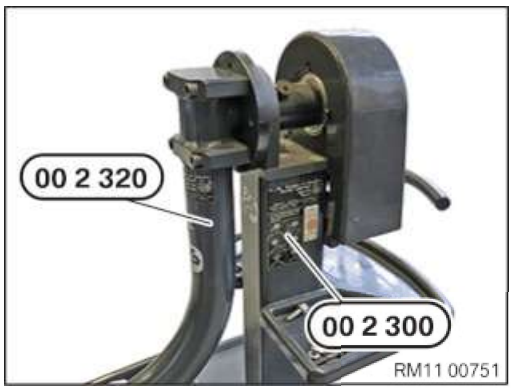
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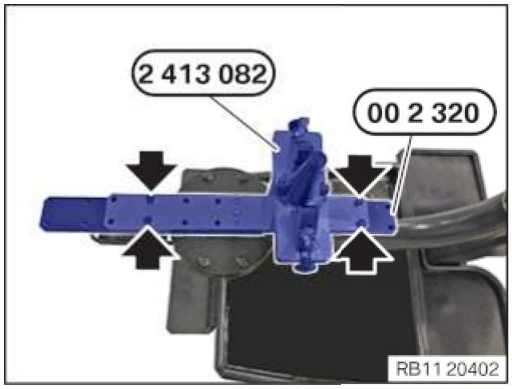
- Position flange (1) on assembly stand (2).
- Tighten screws (arrows).

Flange to assembly stand

M14X30		Tightening torque	135 Nm



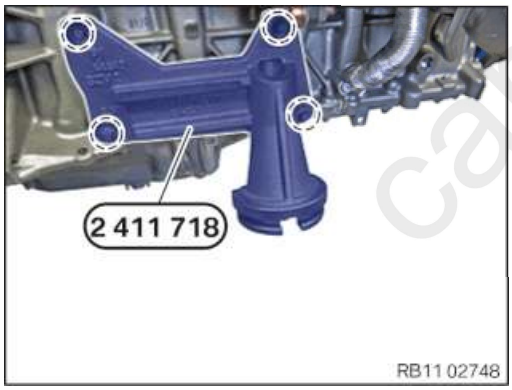
- Prepare the assembly stand 0 495 187 (00 2 300) with the special tool 0 495 196 (00 2 320).



- Screw the special tool 2 413 082 to the 0 495 196 (00 2 320) special tool.
- Tighten screws (arrows).

Special tool 11 8 930 to special tool 00 2 320

M14x35		Tightening torque	160 Nm



- Position and secure special tool (engine fixture) 2 411 718 on the engine.
- Tighten the bolts (marks).

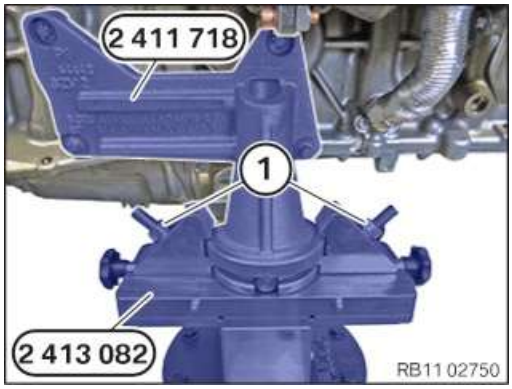
Special tool 2 411 718 to crankcase

M10x30		Tightening torque	38 Nm



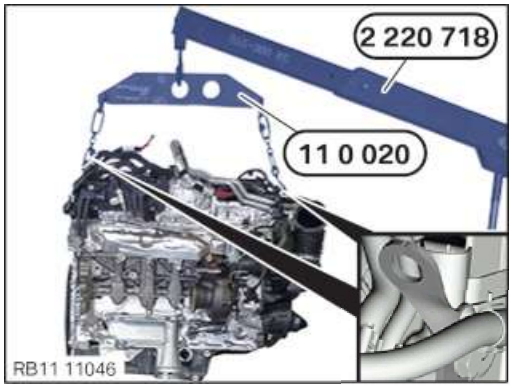
- Lower engine slowly.

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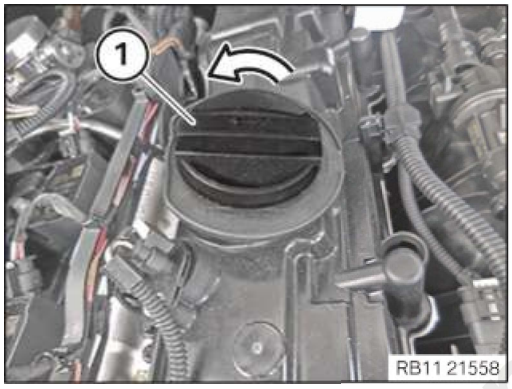
- Make sure special tool 2 411 718 engages with special tool 2 413 082.
- Tighten nuts (1) by hand.

  The clamping jaws must fit completely.



- Release both hooks of the special tool (lifting gear) 0 490 567 (11 0 020) at the front and back of the engine from the mounting brackets.
- Remove the workshop crane 2 220 718.

4 – Removing the oil filler cap



- Open the oil filler cap (1) in the direction of arrow.

5 – Releasing the oil drain plug

WARNING

Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

TECHNICAL INFORMATION

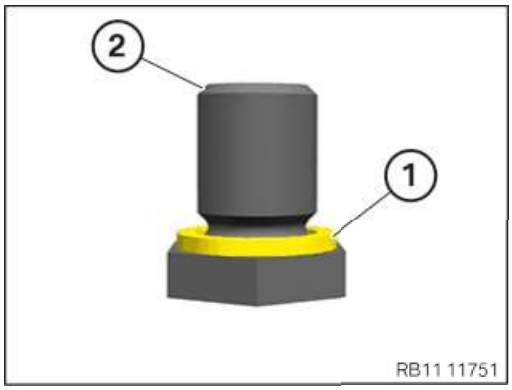
Catch and dispose of drained engine oil in a suitable collecting vessel. Observe country-specific waste disposal regulations.

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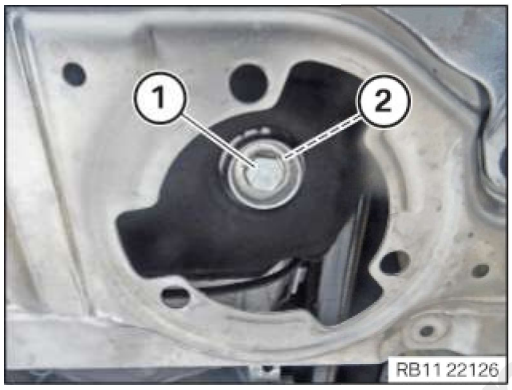
- Release oil drain plug (1).
- Feed out the oil drain plug (1) using sealing ring (2) and remove.
- Allow the engine oil to drain out fully.

6 – Tightening the oil drain plug



- Renew sealing ring (1) on the oil drain plug (2).

  Parts: Sealing ring
- Guide in the sealing ring (1) on the oil drain plug (2) and install.



- Feed in the oil drain plug (1) with the sealing ring (2) and install.
- Tighten oil drain plug (1).

Oil drain plug

M12x16	Replace sealing ring.	Tightening torque	25 Nm

7 – Removing engine ventilation line

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

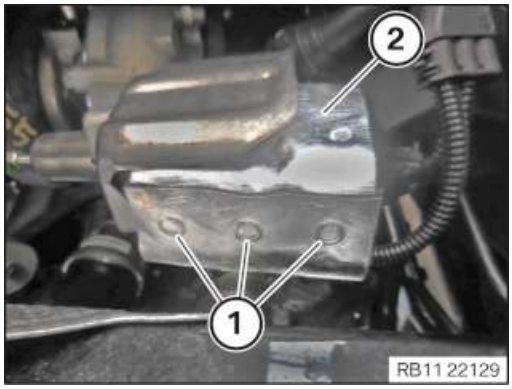
RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

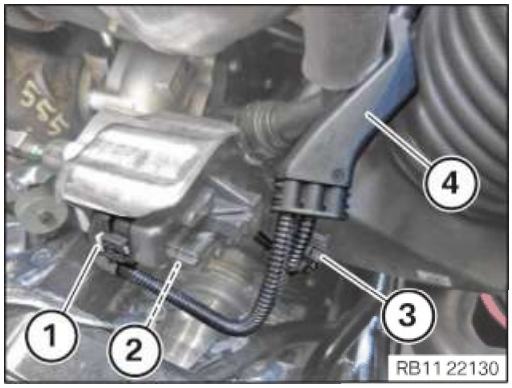
Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

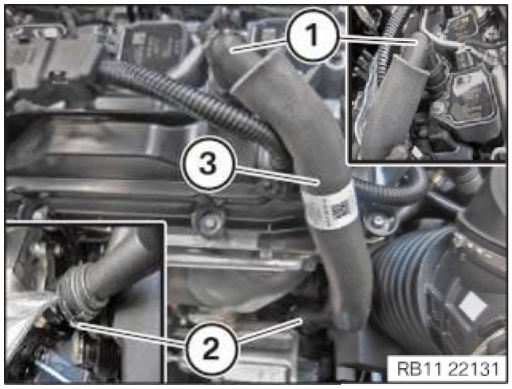
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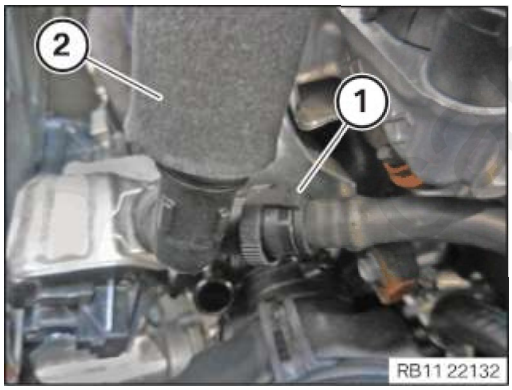
- Unlock the locks (1).
- Feed out and remove heat protection (2).



- Unlock and disconnect the plug connection (1).
- Unlock and disconnect the plug connection (2).
- Loosen clamp (3).
- Feed out wiring harness section for sensor system **2** (4) and set it aside.



- Unlock and loosen the locks (1).
- Unlock and loosen lock (2).
- Feed the engine ventilation line (3) out and set it aside.



- Unlock and release tank ventilation line (1).
- Feed out the engine ventilation line (2) and remove.

8 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

9 – Remove the front oxygen sensor

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WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

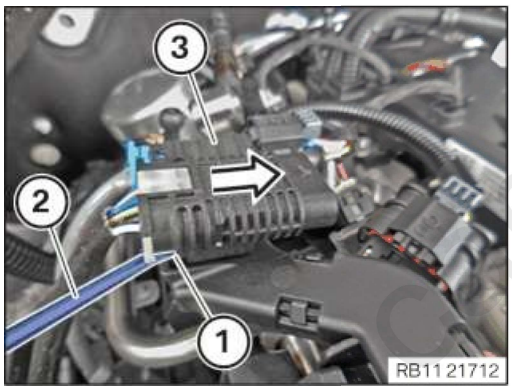
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

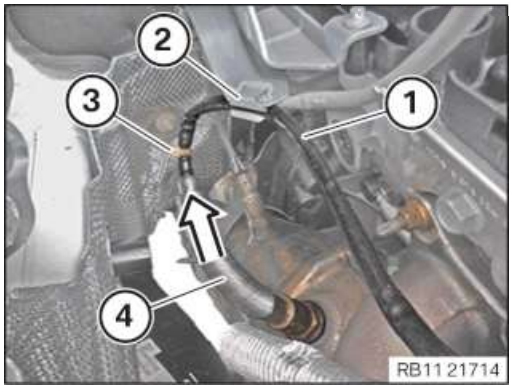
- Do not pull on the wires when disconnecting connectors and plug connections.



- Unlock and loosen connector (1).



- Unlock the locks (1) with a conventional screwdriver (2) and release.
- Feed out the connector (3) in **the direction of arrow** and set aside.



- Detach the line of the front oxygen sensor (1) from the holder (2).
- Unfasten cable strap (3).
- Feed out the heat shield (4) **in direction of arrow** and set it aside.

carsdiagn.com



- Release and remove the control sensor (1) with the special tool .

10 – Remove the monitoring oxygen sensor

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

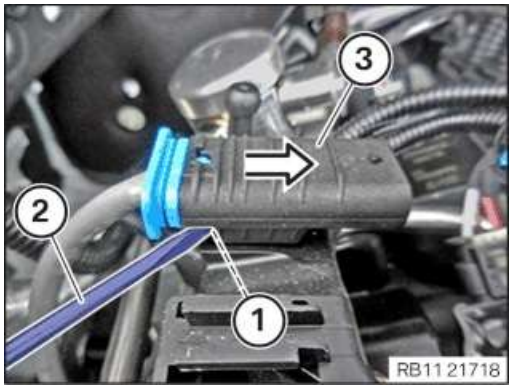
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

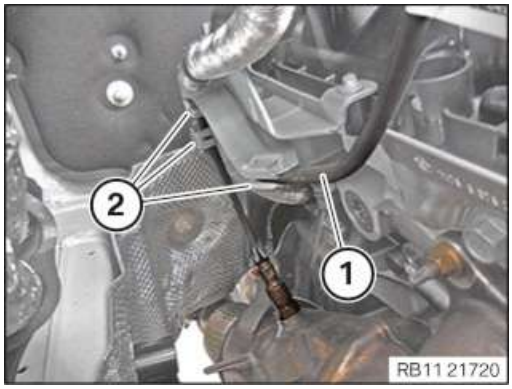


- Unlock and loosen connector (1).

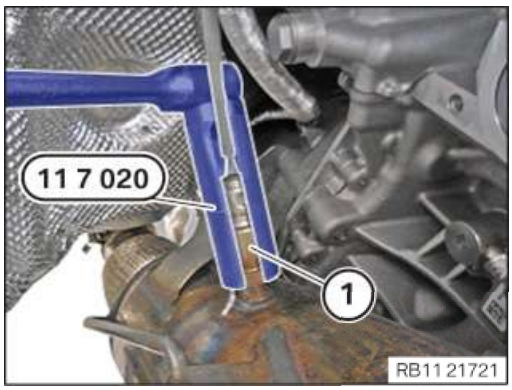


- Unlock the lock (1) with a suitable screwdriver (2).
- Feed out the connector (3) in the direction of the **arrow** and set it aside.

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- Detach the line of the monitoring oxygen sensor (1) from the holder (2).



- Release the monitoring oxygen sensor (1) using special tool .
- Remove the monitoring sensor (1).

11 – Remove catalytic converter

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

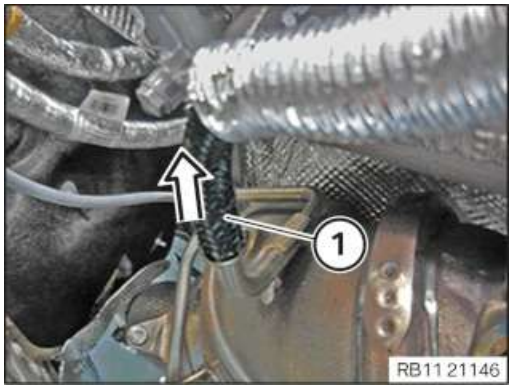
CAUTION

Component with heavy weight.

Danger of injury!

- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

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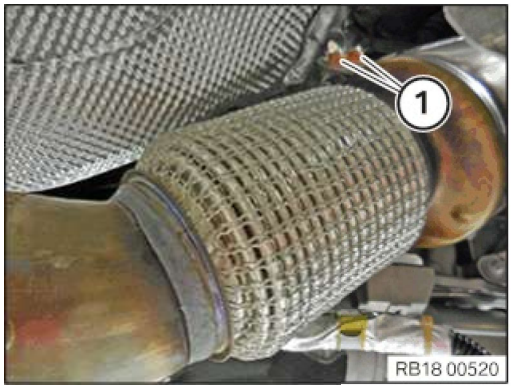


- **If installed: Disconnect pressure hose.**

  Pull off pressure hose (1) in direction of arrow and set it aside.



- Loosen V-band clamp (1).



- Loosen nuts (1).



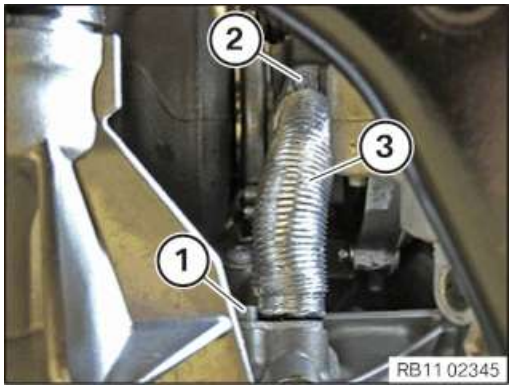
- Unlock and loosen clamp (1).
- Feed out catalytic converter and remove.

12 – Removing the oil return line for the exhaust turbocharger

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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- Have cleaning rags ready for any escaping engine oil.
- Loosen screws (1) and (2).
- Guide out and remove the oil return line (3).

13 – Remove the coolant line between the cylinder head and the coolant pump

WARNING

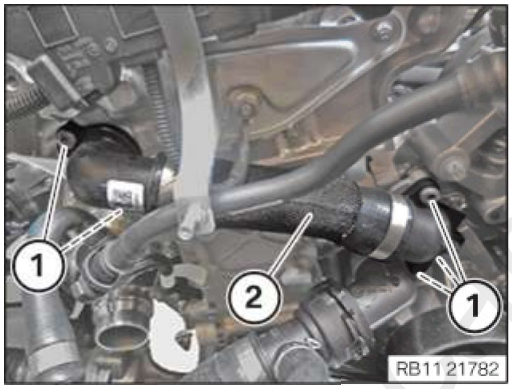
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screws (1).
- Remove the coolant line (2).
- Catch and dispose of escaping coolant.

14 – Remove all ignition coils.

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Removing the ignition coil**

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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RISK OF DAMAGE

Damage to the ignition coil.

The silicone hose of the ignition coil must not be contaminated by fuel as this can lead to failure of the ignition coil.

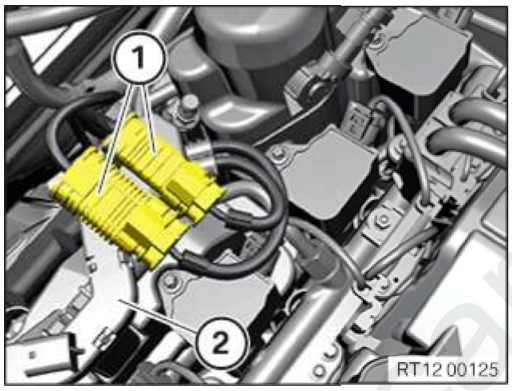
- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

RISK OF DAMAGE

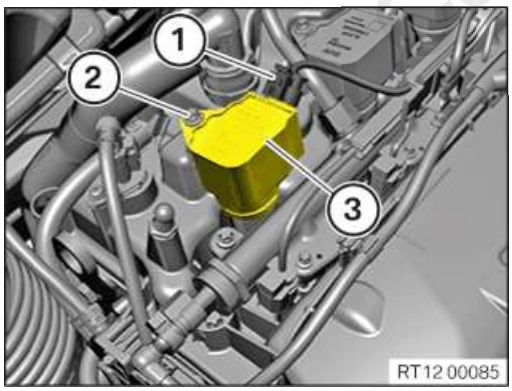
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Disconnect the connector (1) of the front oxygen sensor and the monitoring oxygen sensor from the cable channel (2) and set aside.



- Unlock plug connection (1) and disconnect.
- Loosen screw (2).
- Remove ignition coil (3).

15 – Removing all spark plugs

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.



- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

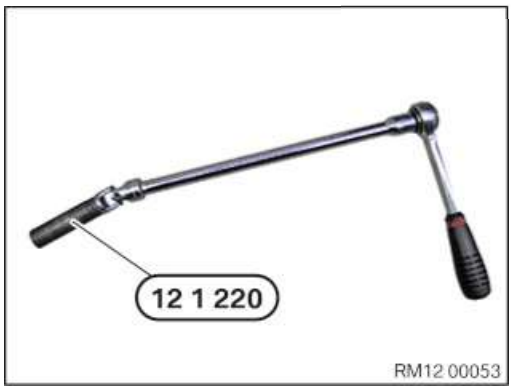
The spark plug shaft must be cleaned using compressed air after having removed the ignition coils and before removing the spark plugs. After having removed the spark plugs, once again check the sealing surface for contamination and (if necessary) clean using a moist cloth or clean using compressed air.

Deposits that are not removed according to instructions may enter the combustion chamber and lead to uncontrolled combustion. Remaining deposits on the spark plug sealing surfaces may lead to leaks and the spark plugs may come loose during engine operation.

Spark plug threads must not be greased or oiled. Insufficiently tightened spark plugs may cause leaks and the sparks plugs may come loose during engine operation.

NOTICE

The description is for one component only. The procedure is identical for all further components.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Mount the special tool 0 495 560 (12 1 220) on a pivoting extension.

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- Unscrew spark plugs with the special tool 0 495 560 (12 1 220) and a pivoting extension.

16 – Remove the high pressure line between the high pressure pump and the rail

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

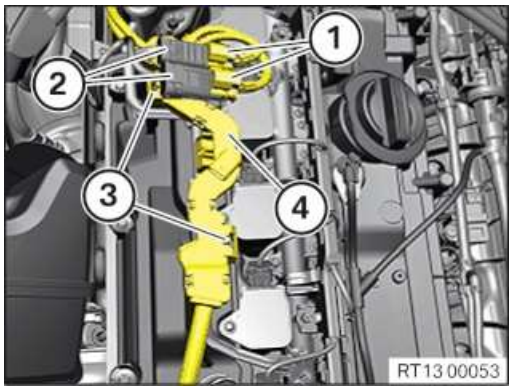
On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

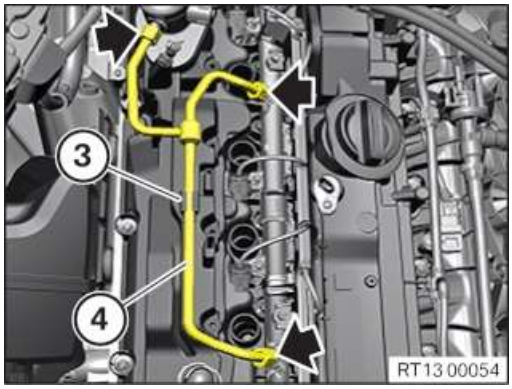
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Unlock and disconnect the plug connections (1) and (2).
- Unlock the locks (3).
- Guide out the wiring harness section of the engine wiring harness (4) and set it aside.

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- Position a lint-free rag under the union nuts.
- Unscrew union nuts (arrows) with the special tool .
- Catch and dispose of escaping fuel.
- Thread out the high pressure line (4) from the bracket (3) and remove it.
- Feed out and dispose of the lint-free cleaning clothes .

17 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

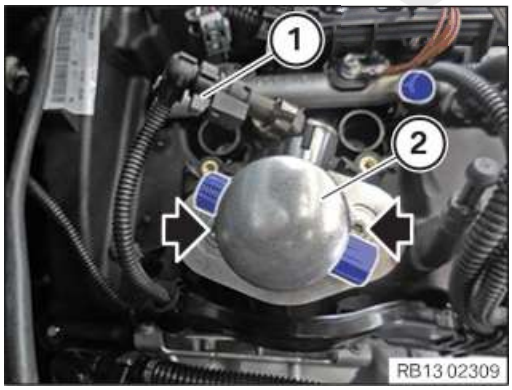
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

18 – Removing rail with injectors of cylinders 1 to 3

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

Damage to the ignition coil.

The silicone hose of the ignition coil must not be contaminated by fuel as this can lead to failure of the ignition coil.

- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

Damage to injectors.

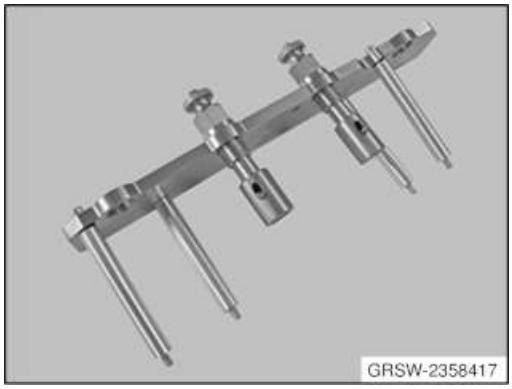
Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.



- Prepare special tool .

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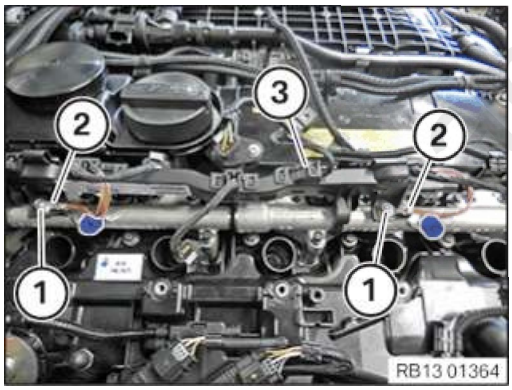
- Prepare special tool 2 358 417.



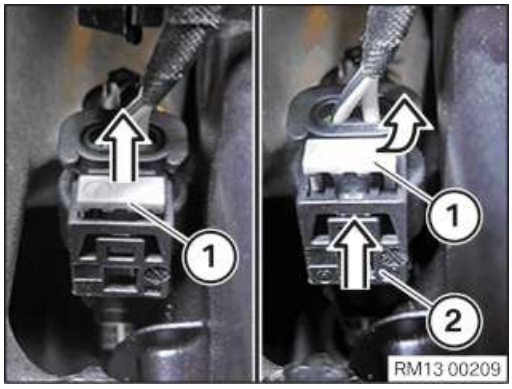
- Prepare special tool .



- Prepare special tool 0 496 106 (11 8 720).

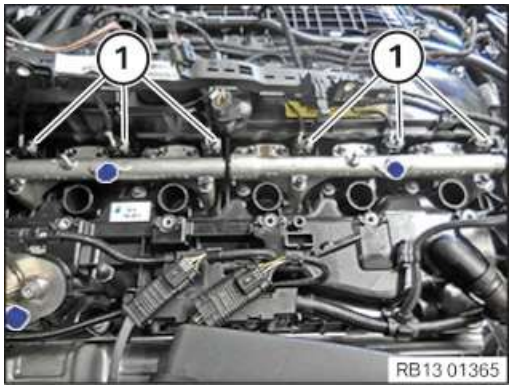


- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.

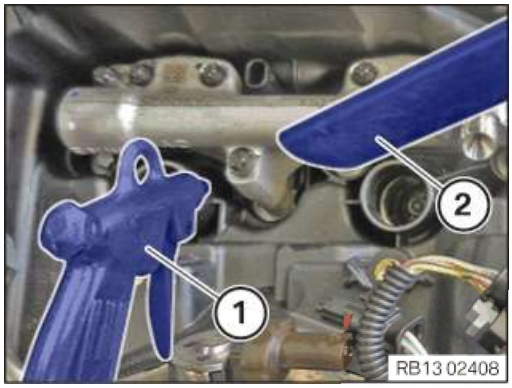


- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull out the connector (2) from the injectors.

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- Unlock and release all connectors (1) of the injectors.

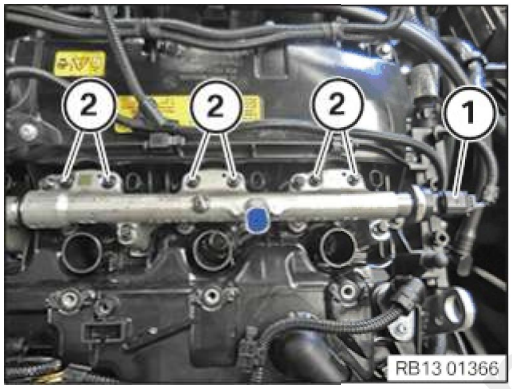


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

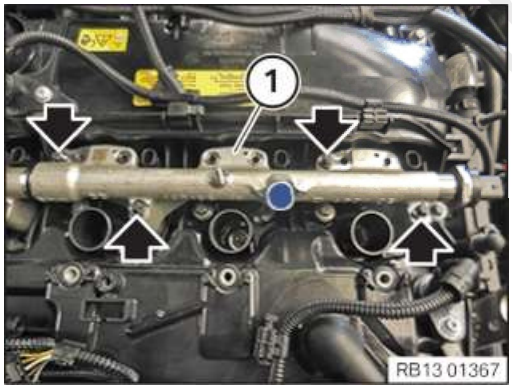
- Before releasing the high pressure lines: Blow out the injector shafts with an air gun(1) with less pressure.
- Simultaneously, draw off the dirt particles with an **explosion proof** vacuum cleaner (2).



- Unlock and loosen connector (1).
- Release screws (M5x30) (2).
- Remove screws (2).

  Do not reuse the bolts (2).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.

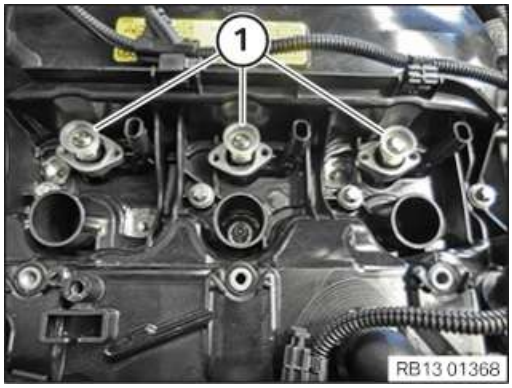


- Unscrew the screws (M6x30) (arrows).

  The screws may not be reused!
- Renew screws.

  Parts: Screws (M6x30)
- Remove rail (1) in upward direction.

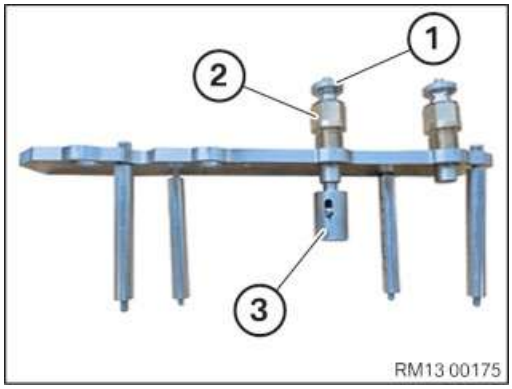
  The injectors remain in the cylinder head.



- Remove the gaskets (1).

  The seals (1) are only required during the initial assembly at the plant and will not be installed again.

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RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

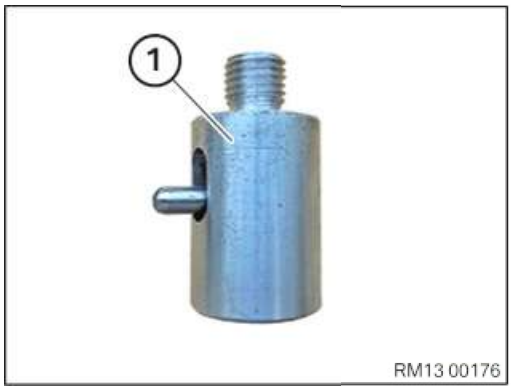
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use the special tool 2 358 417to remove the injectors.

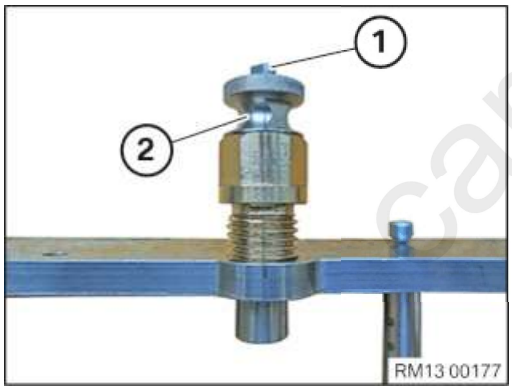
  The special tool 2 358 417 is used to ensure that the tensile force is not exceeded.

  Special tool 2 358 417 consists of:

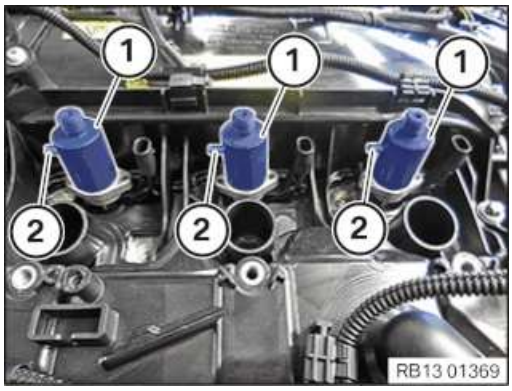
  - **(1)** Threaded sleeves
  - **(2)** Pull-out thread (left-hand thread)
  - **(3)** Mounting for the injectors



- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.



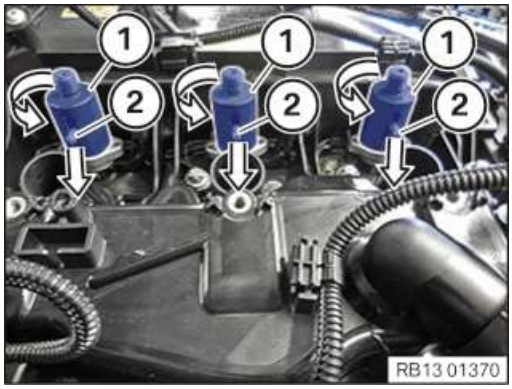
- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.



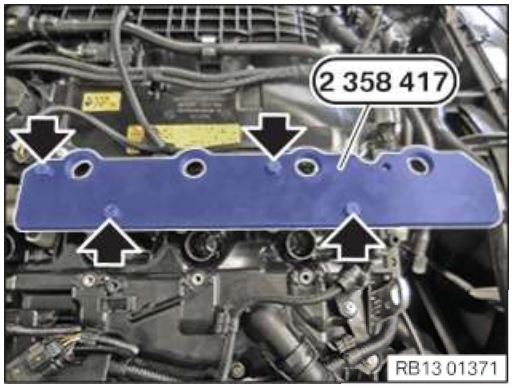
- Install all fixtures (1) for the injectors.

  The fixture (1) is not locked if the lever (2) is on the top.

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- Turn fixtures (1) by 90° and lock the lever (2) downwards.



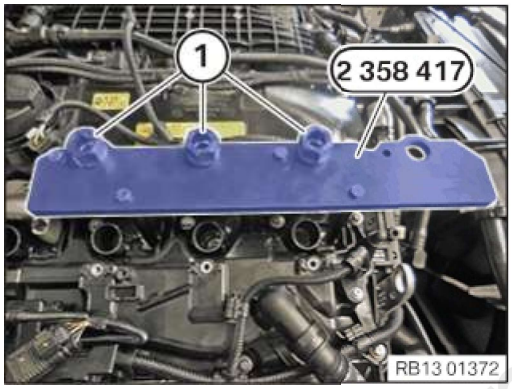
RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

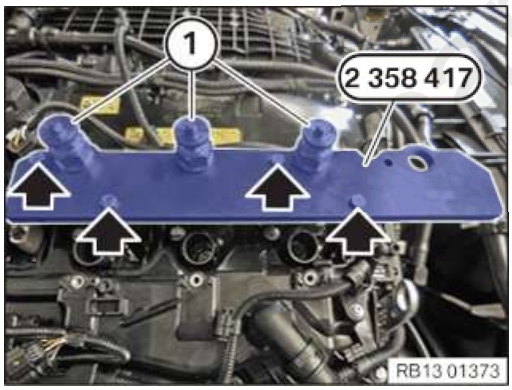
- Attach special tool 2 358 417 to cylinder head.
- Hand-tighten the bolts (arrows).



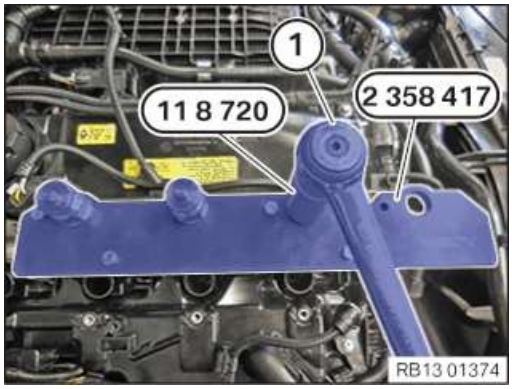
TECHNICAL INFORMATION

The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.



- Insert threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for injectors.
- Then tighten screws (arrows) on special tool 2 358 417 to 5 Nm.



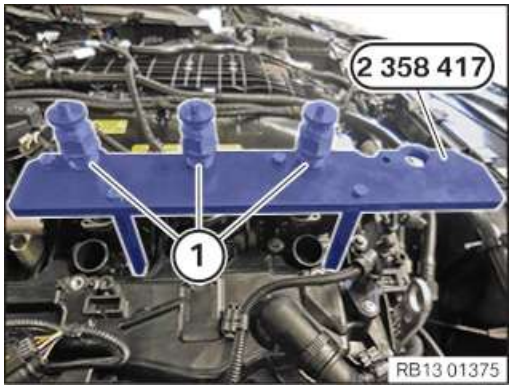
- Adjust torque wrench to 13 Nm **clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720)until the injector is pulled out.

TECHNICAL INFORMATION

If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

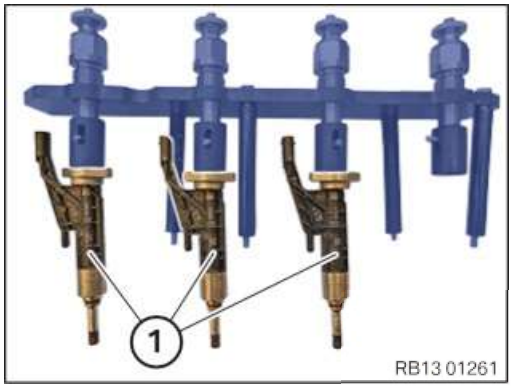
- Disassemble all injectors individually.

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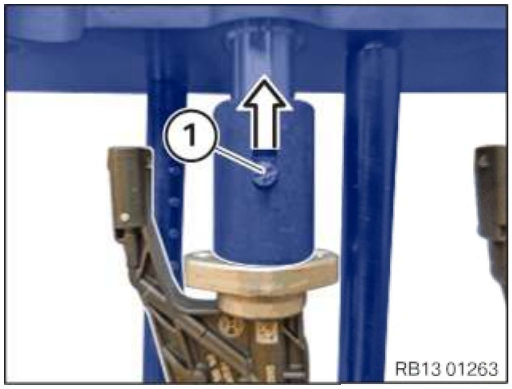


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  This can be recognised on the completely visible threads of the sleeves (1).
- Loosen screws on special tool 2 358 417.



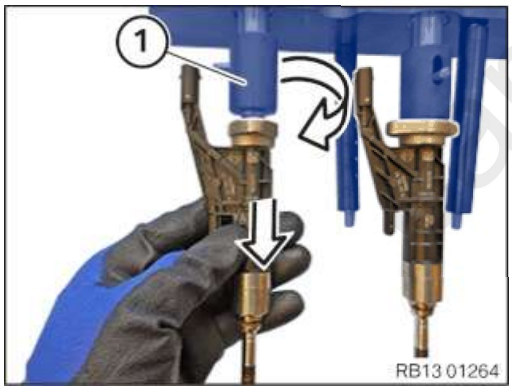
- Carefully remove the special tool 2 358 417with injectors (1) from the cylinder head vertically upwards.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat on a clean table.



NOTICE

The description is for one component only. The procedure is identical for all further components.

- Unlock the fixture lock (1) from the top.



- Turn the unlocked fixture (1) by 90°.
- Release and remove the injector downwards.

19 – Removing rail with injectors of cylinders 4 to 6

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

Damage to the ignition coil.

The silicone hose of the ignition coil must not be contaminated by fuel as this can lead to failure of the ignition coil.

- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

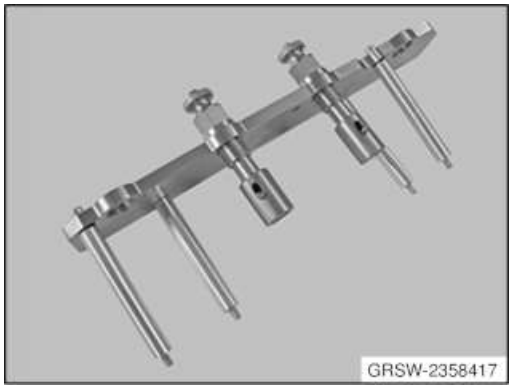
Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.



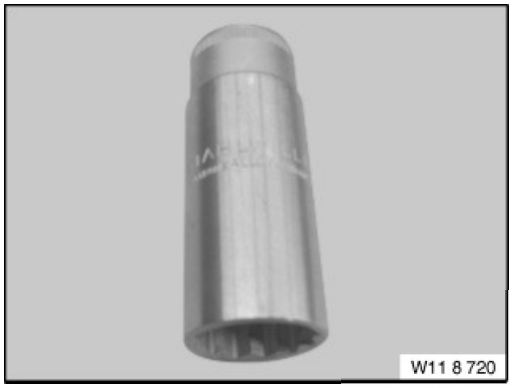
- Prepare special tool .



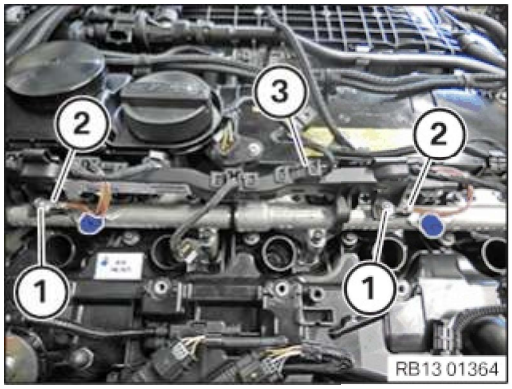
- Prepare special tool 2 358 417.



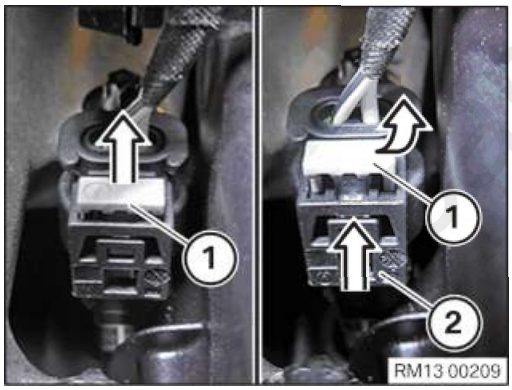
- Prepare special tool .



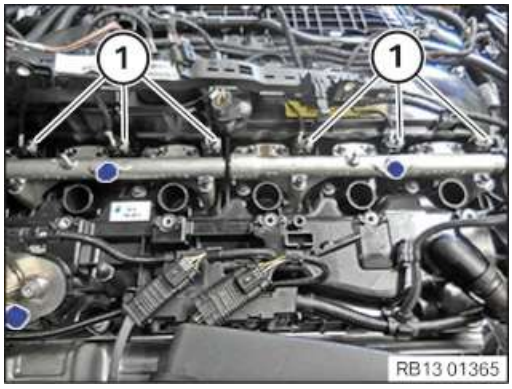
- Prepare special tool 0 496 106 (11 8 720).



- Release nuts (1) .
- Feed out ground cable (2) and set aside.
- Feed out cable channel (3) and set it aside.

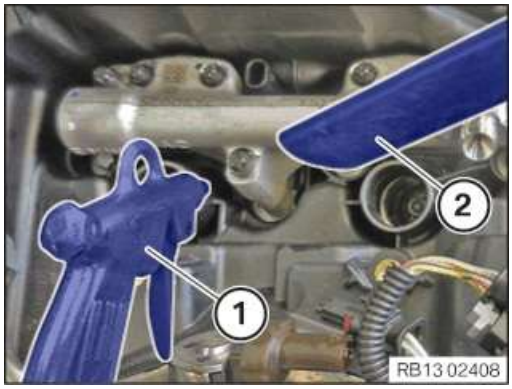


- Unlock lock (1) in direction of arrow upwards.
- Press lock (1) together and release.
- Disconnect the connector (2) from the injectors in the direction of the arrow.



- Unlock and release all connectors (1) of the injectors.

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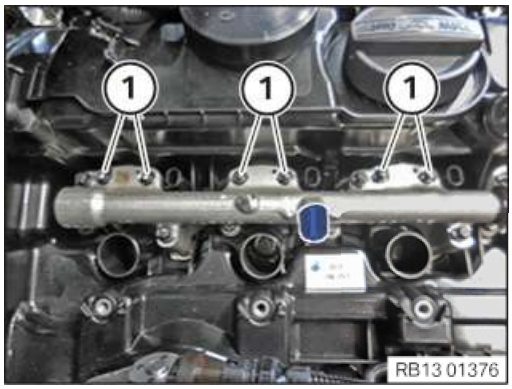


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

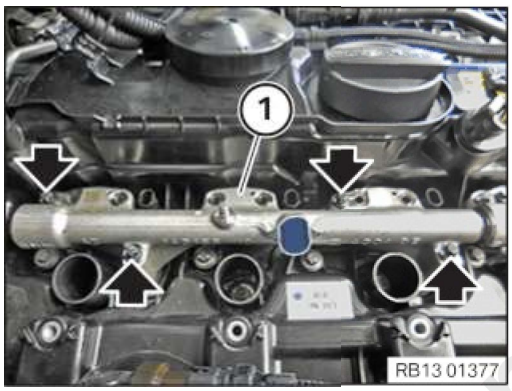
For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

- Before releasing the high pressure lines: Blow out the injector shaft with an air gun (1) with less pressure.
- Simultaneously, draw the dirt particles off **using an** explosion proof (2) vacuum cleaner.



- Release screws (M5x30) (1).
- Remove screws (M5x30) (1) .

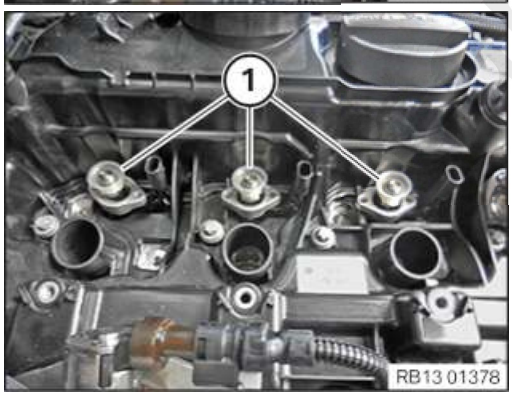
  Do **not** reuse screws (M5x30) (1).
- Catch and dispose of escaping fuel with suitable materials.



- Release screws (M6x30) (arrow).
- Remove screws (M6x30) (arrows).

  Do **not** reuse the screws (M6x30).
- Remove rail (1) upwards.

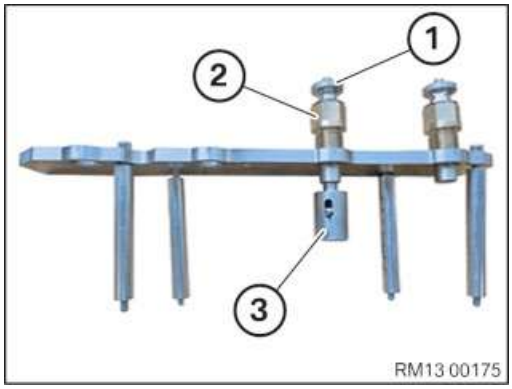
  The injectors remain in the cylinder head.



- Remove seals (1) .

  The seals (1) are required during first assembly within the plant only and will not be installed again.

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RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

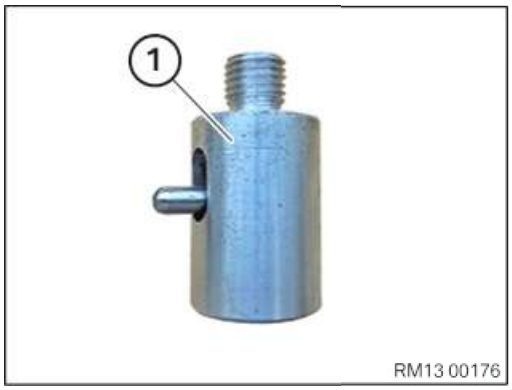
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use the special tool 2 358 417 to remove the injectors.

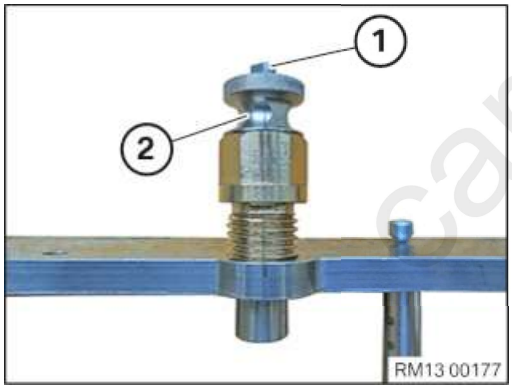
  The special tool 2 358 417 is used to ensure that the tensile force is not exceeded.

  The special tool 2 358 417 consists of:

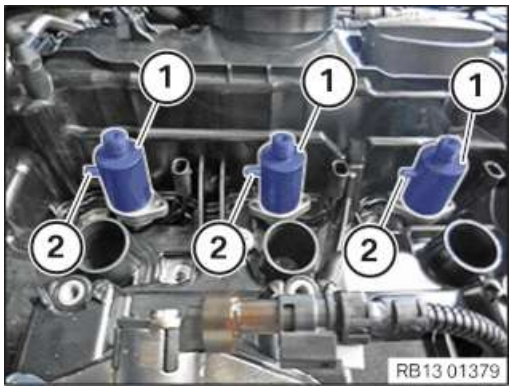
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Mounting for the injectors



- Unscrew the fixture for injectors (1) from special tool 2 358 417.



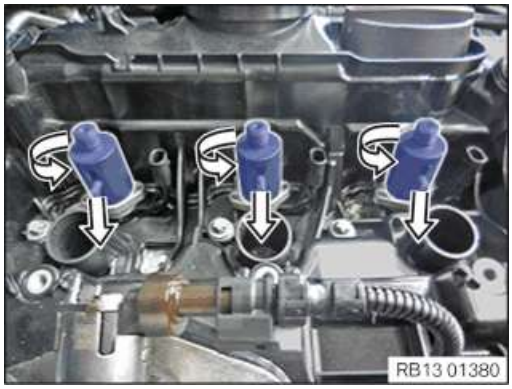
- Press lock (1) in and remove the threaded sleeve (2) from the special tool 2 358 417.



- Install all fixtures (1) for the injectors.

  The fixture (1) is not locked, if the lever is (2) on top.

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- Turn fixtures (1) by 90° and lock the lever (2) downwards.



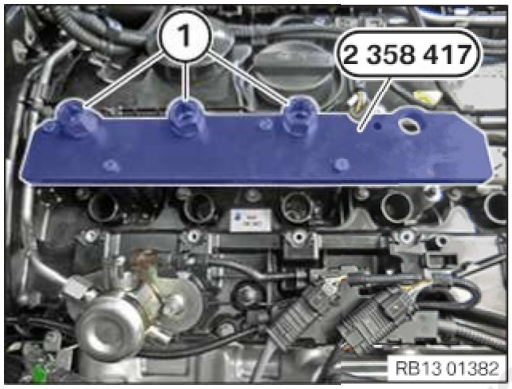
RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

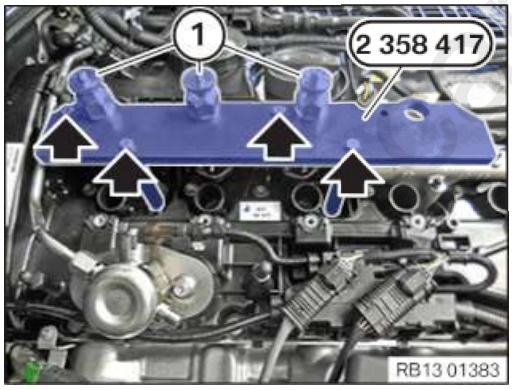
- Attach special tool 2 358 417 to cylinder head.
- Hand-tighten the bolts (arrows).



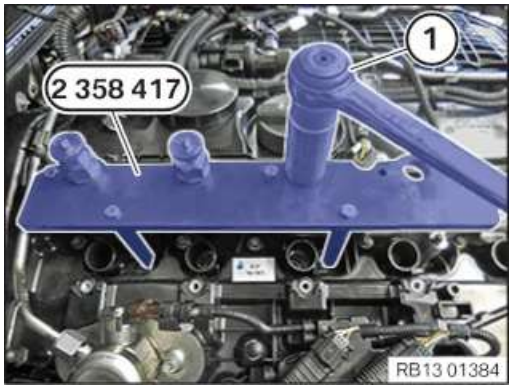
TECHNICAL INFORMATION

The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417 fully.



- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Then tighten screws (arrows) on special tool 2 358 417 to 5 Nm.



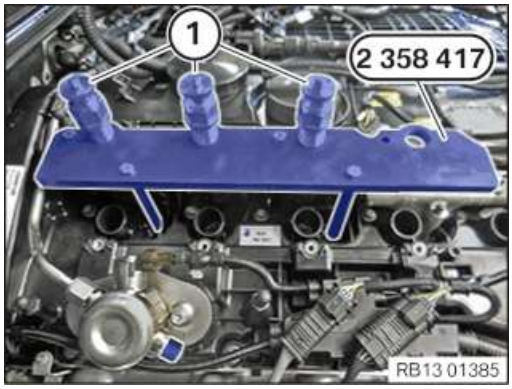
- Adjust torque wrench to 13 Nm **in clockwise** direction.
- Turn the torque wrench (1) with the special tool 0 496 106 (11 8 720) **clockwise**, until the injector is pulled out.

TECHNICAL INFORMATION

If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

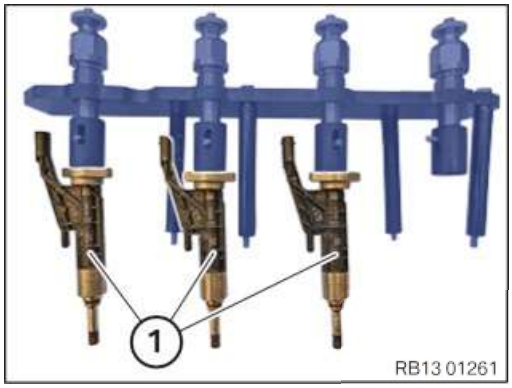
- Disassemble all injectors individually.

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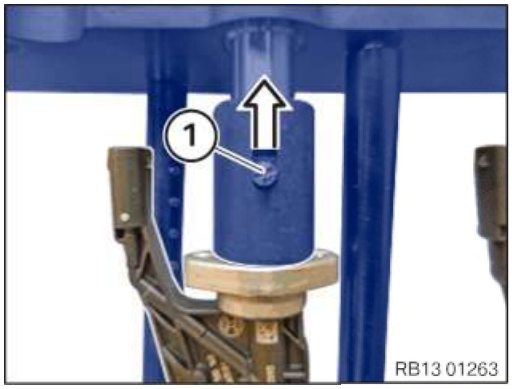


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  This can be recognised on the completely visible thread starts of the threaded sleeves (1).
- Loosen screws on special tool 2 358 417.



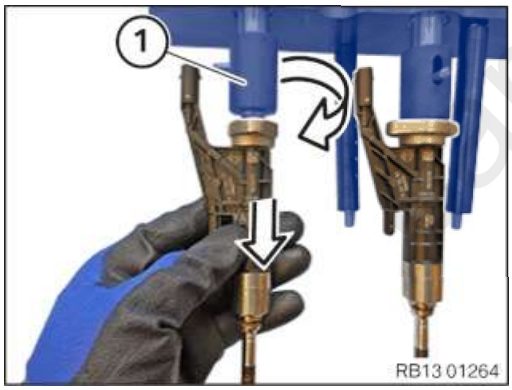
- Carefully remove the special tool 2 358 417 with the injectors (1) vertically straight up from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.



NOTICE

The description is for one component only. The procedure is identical for all further components.

- Unlock the fixture lock (1) from the top.



- Turn the unlocked fixture(1) by 90°.
- Release and remove the injector downwards.

20 – Removing both actuators

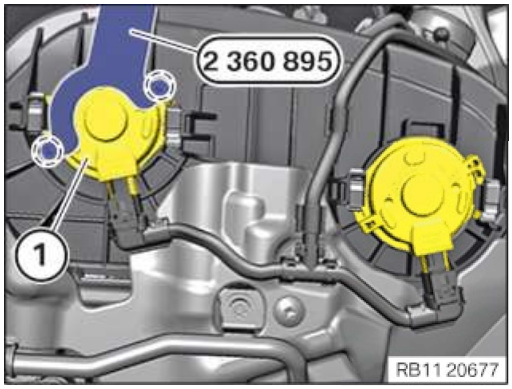
ardiagn.com

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

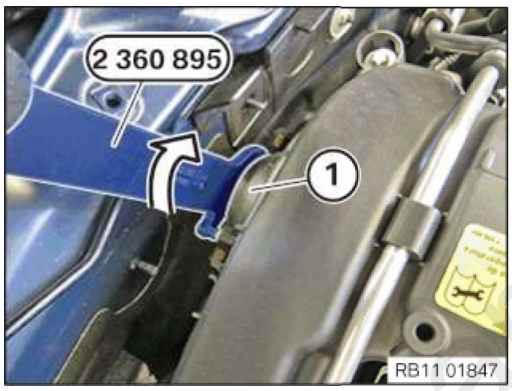
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



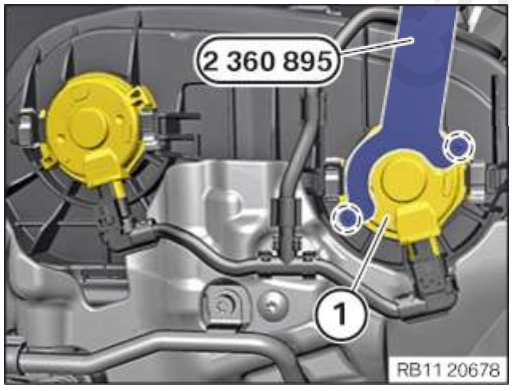
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



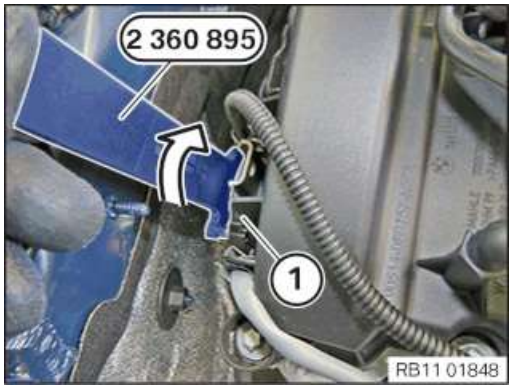
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



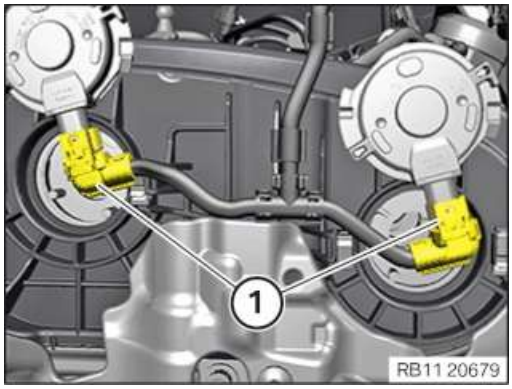
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



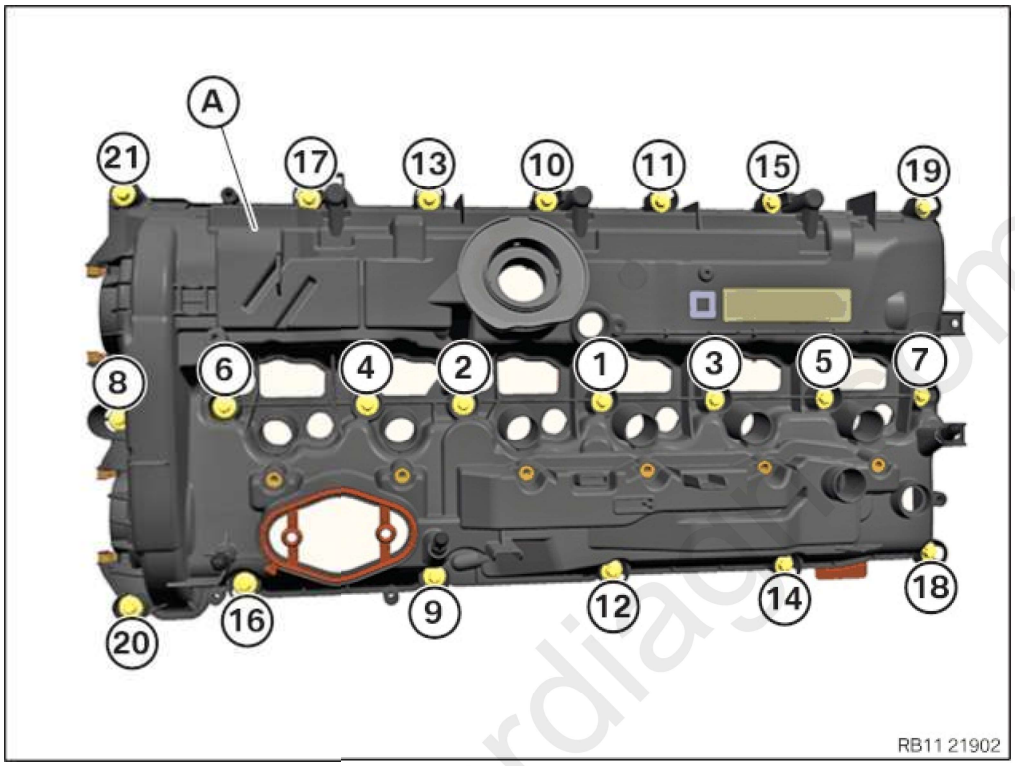
NOTICE

The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

21 – Removing the cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 21 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

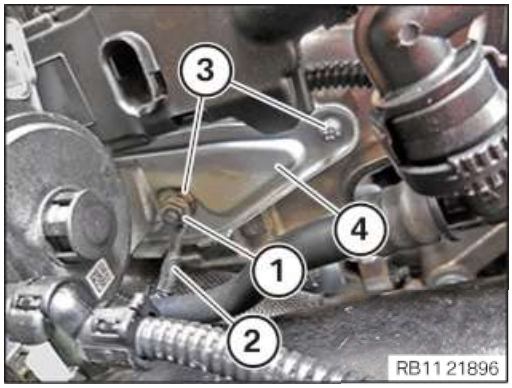
Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

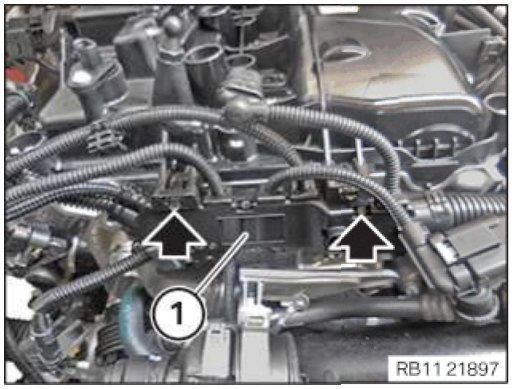
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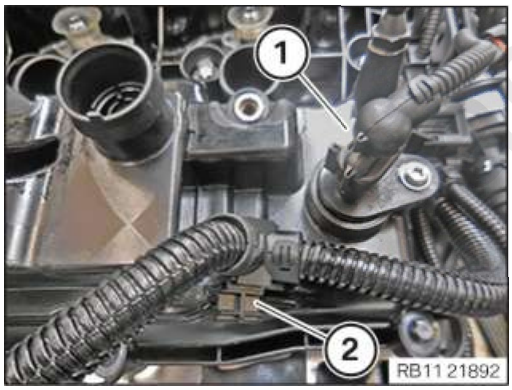
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



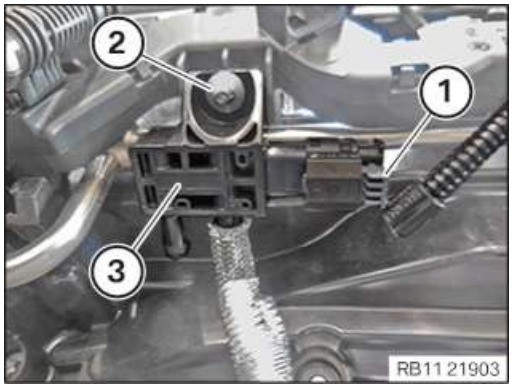
- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Loosen screws (3).
- Thread out holder (4) and set aside.



- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for the sensor system **2** and place to one side.

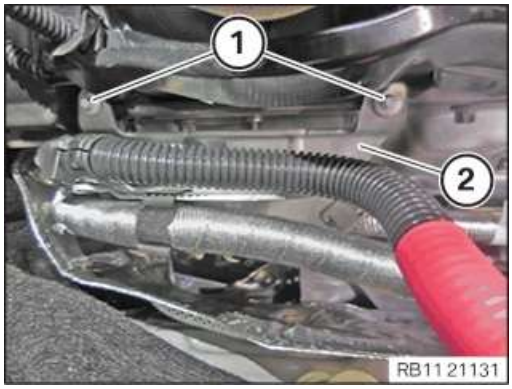


- Unlock and detach connector (1) on exhaust camshaft sensor .
- Loosen clamp (2).

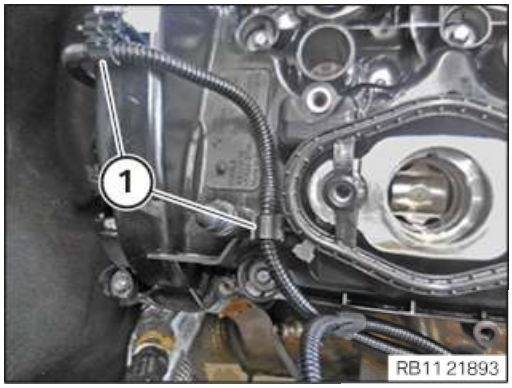


- **If installed:**
- Unlock and loosen connector (1).
- Loosen screw (2).
- Remove the differential pressure sensor (3) and put it to one side.

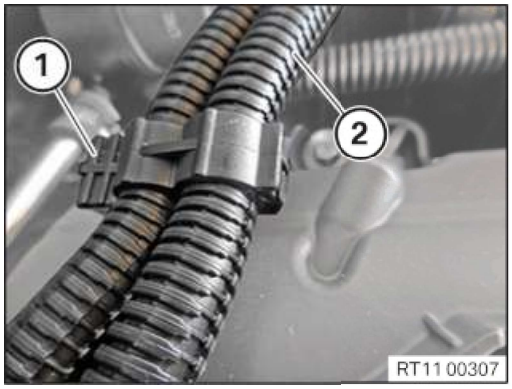
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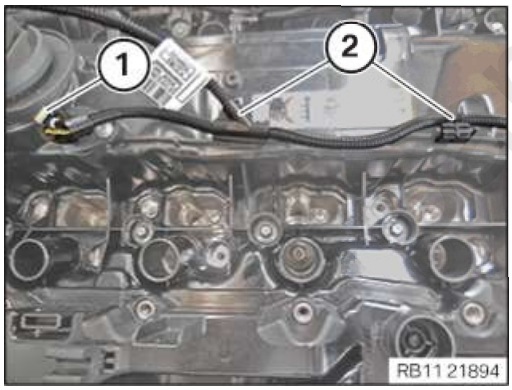
- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.



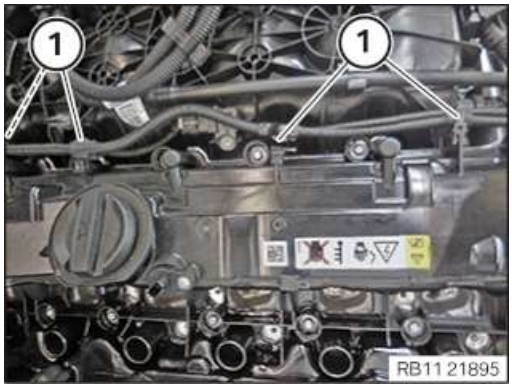
- Loosen clamps (1).



- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.

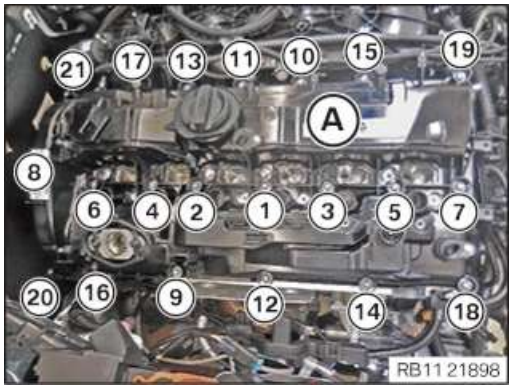


- Unlock and detach connector (1) on the intake camshaft sensor.
- Loosen clamps (2).

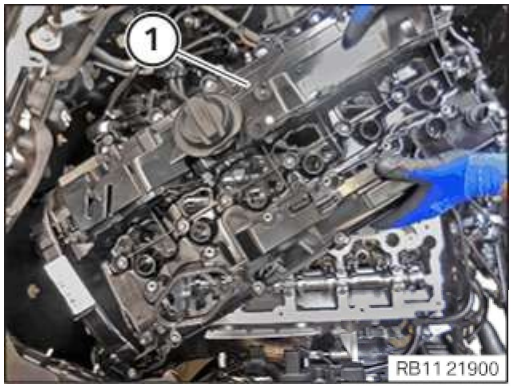


- Loosen clamps (1).

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- Release all screws on the cylinder head cover (A) in the sequence (21) to (1).



- Guide the cylinder head cover (1) out and remove it.

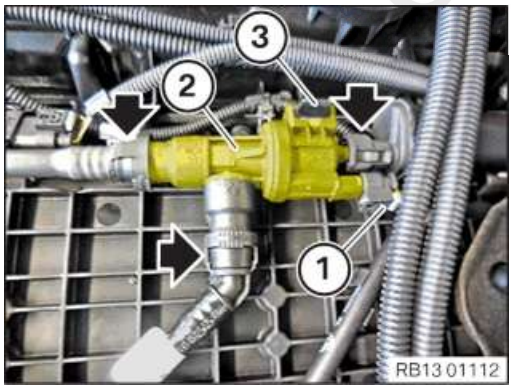
22 – Remove tank vent valve

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Unlock and disconnect connector (1).
- Unlock and disconnect the tank ventilation lines (arrows).
- Detach and remove the tank vent valve (2) from the holder (3).

23 – Removing the intake plenum

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RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

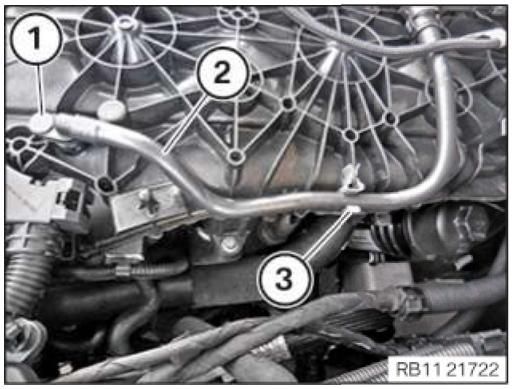
- Do not pull on the wires when disconnecting connectors and plug connections.

TECHNICAL INFORMATION

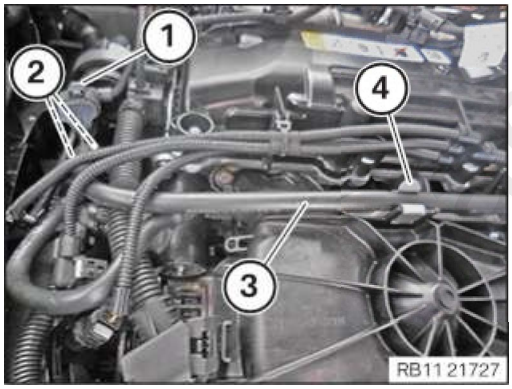
Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

TECHNICAL INFORMATION

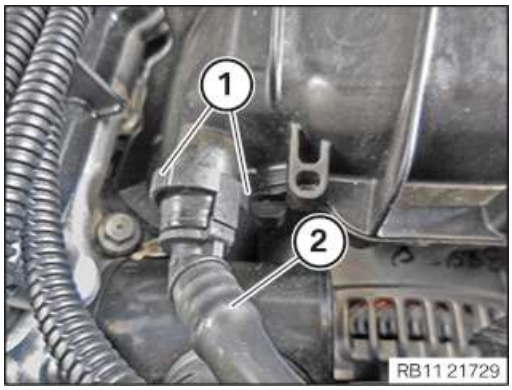
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screw (1).
- Guide tank ventilation line (2) out of clamp (3) and remove it.

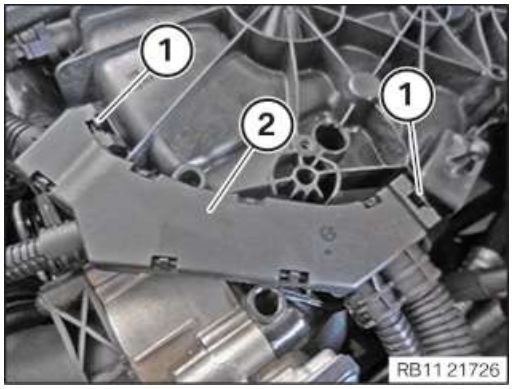


- Unlock and loosen connector (1).
- Unlock the locks (2).
- Guide tank ventilation line (3) out of clamp (4) and remove it.

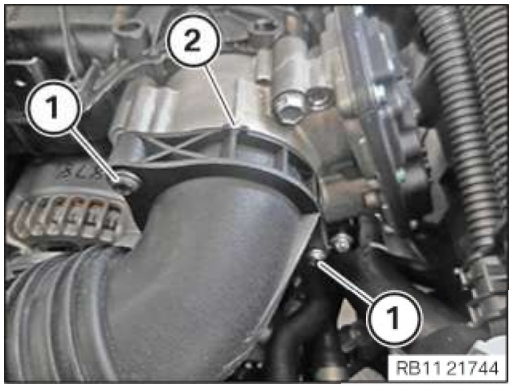


- Unlock the locks (1).
- Feed the tank ventilation line (2) out and set it aside.

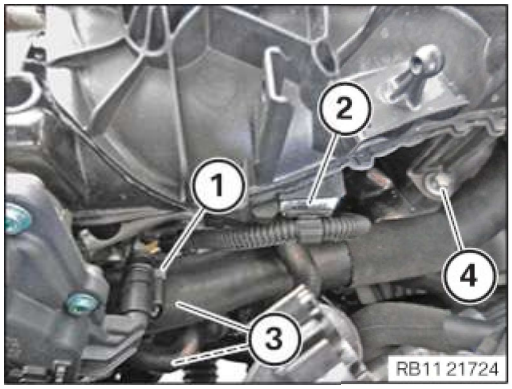
rdiagn.com



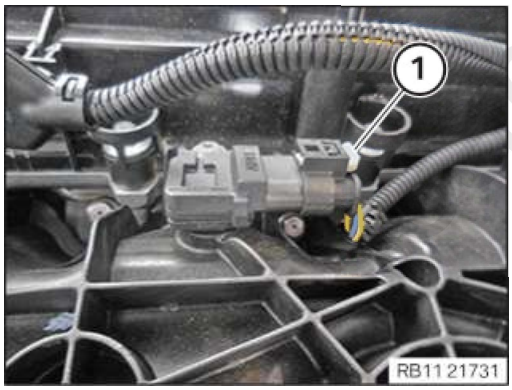
- Unlock the locks (1).
- Guide out the wiring harness section (2) for the sensor system **2** and place to one side.



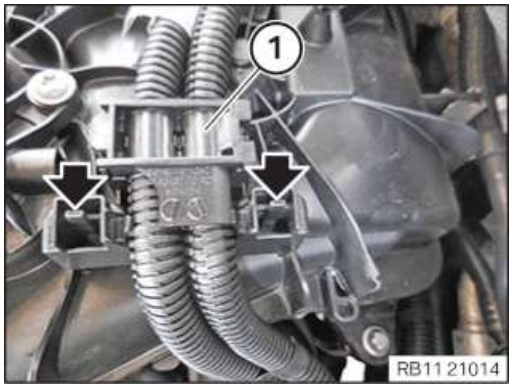
- Loosen screws (1).
- Feed out charge air line (2) and place to one side.



- Unlock and loosen connector (1).
- Loosen clamp (2).
- Thread off coolant line (3) and place to the side.
- Loosen screw (4).

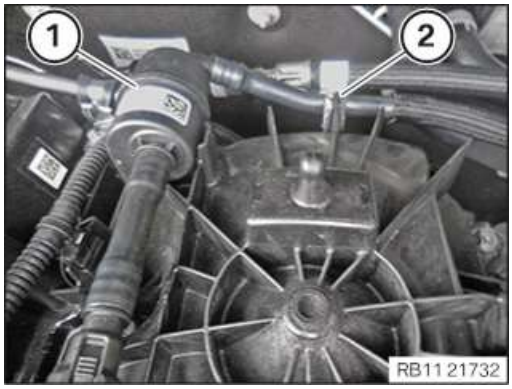


- Unlock and loosen connector (1).

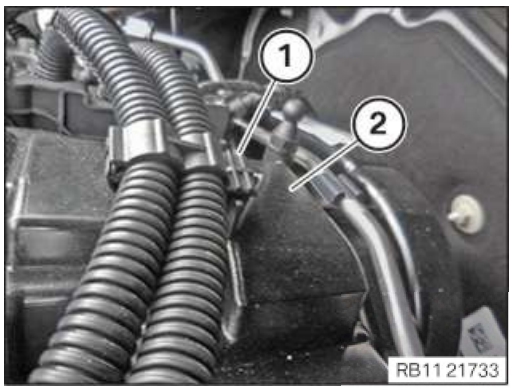


- Unlock the locks (arrows).
- Thread out the wiring harness section (1) for the injectors and ignition coils and set it aside.

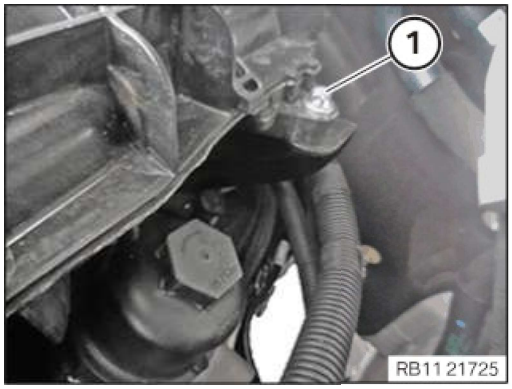
fdiagn.com



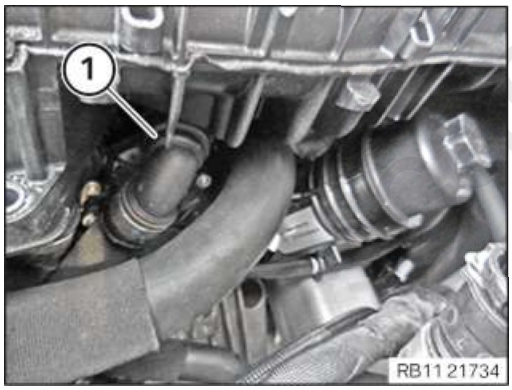
- Guide tank ventilation line (1) out of clamp (2) and place it aside.



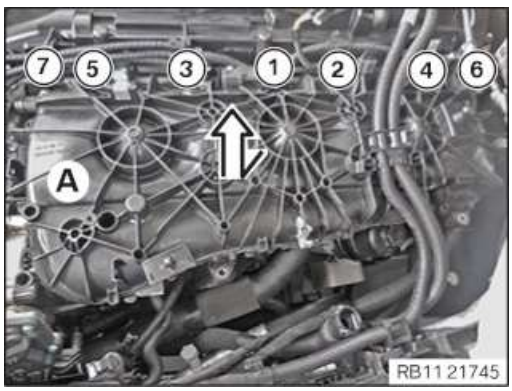
- Guide out the wiring harness section (1) for the injectors and ignition coils of the cylinder head cover (2) and set it aside.



- Loosen screw (1).

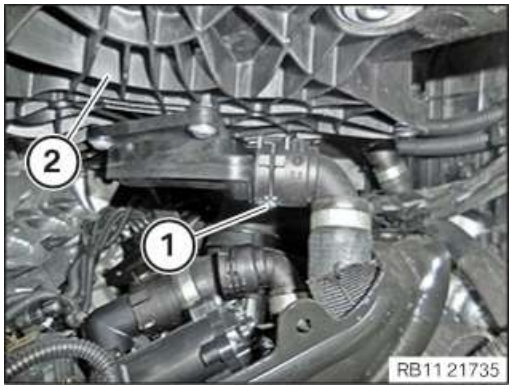


- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.



- Loosen screws in the order (7) to (1).
- Slightly raise intake plenum (A) in direction of arrow.

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TECHNICAL INFORMATION

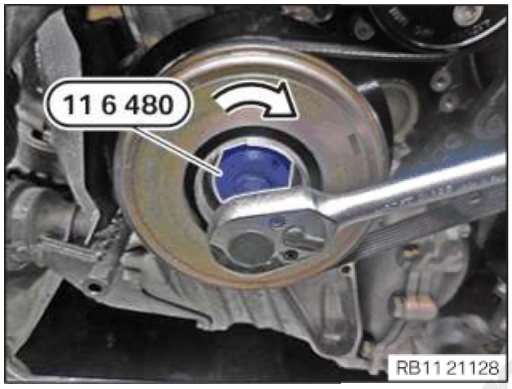
Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Unlock and release coolant line (1) below the intake plenum (2).
- Catch and dispose of escaping coolant.
- Thread out intake plenum (2) and remove.

24 – Block the engine with the special tool in TDC firing position



- Thread the sealing cap (1) out and remove.



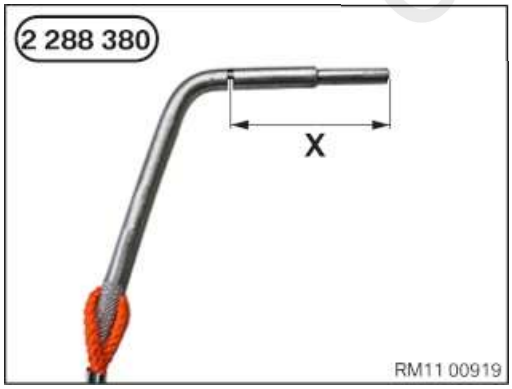
RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).

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- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

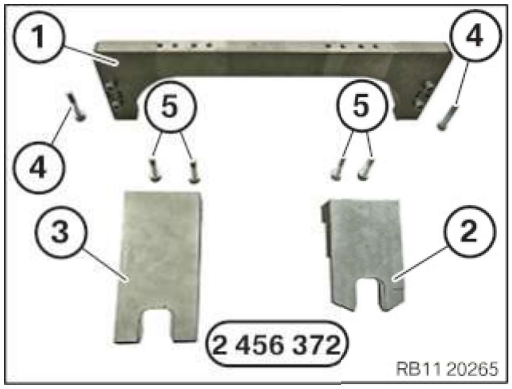
  The TDC firing position of cylinder 1 was **not** reached.



- **Vehicles with automatic transmission:**

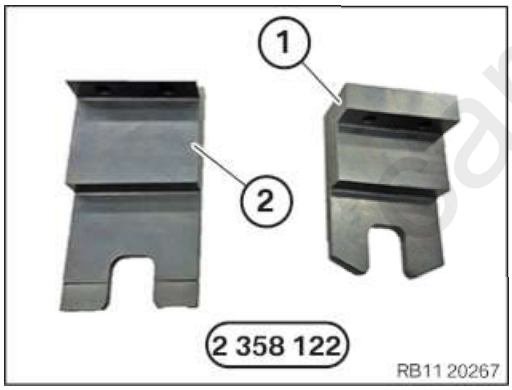
  Special tool 2 288 380 **correctly** positioned.

  The engine is in the TDC firing position of cylinder 1.



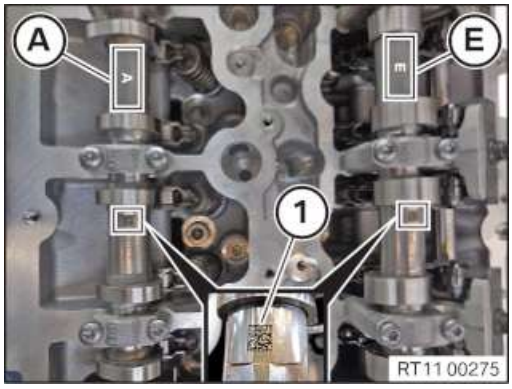
- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



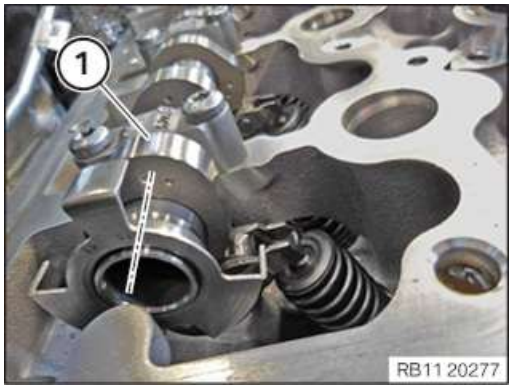
- Overview of the test gauges from the set of special tools 2 358 122:

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



- Turn intake camshaft (E) and exhaust camshaft (A) until marks (1) can be read from the top.

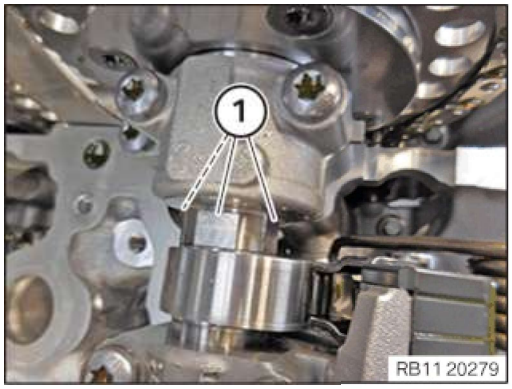
carldiag.com



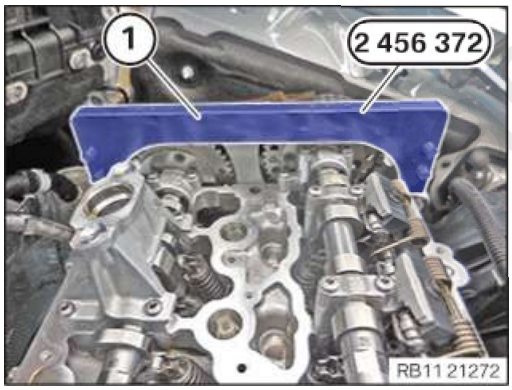
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



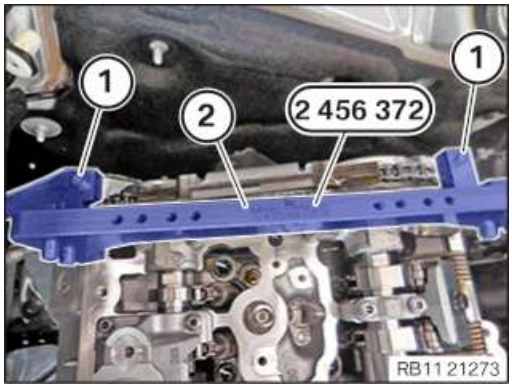
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



- Position basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.

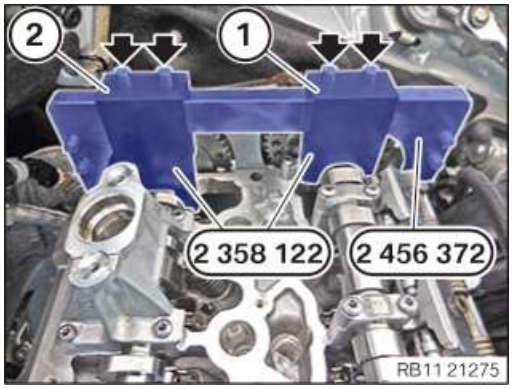


- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm

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- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

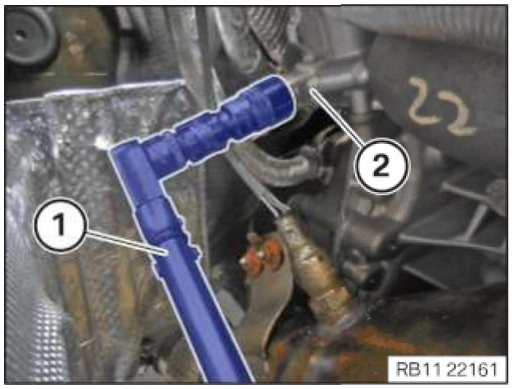
Test gauge to basic carrier

M6		Tightening torque	8 Nm

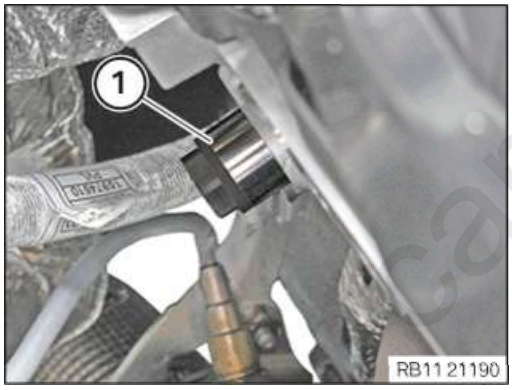
25 – Removing chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).



- Feed out and remove the chain tensioner (1).

26 – Releasing the VANOS central valve of the intake adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

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NOTICE

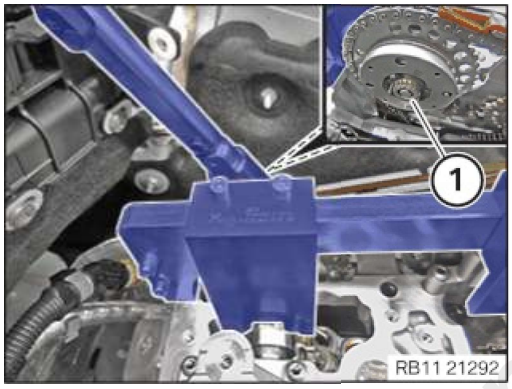
The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the intake adjuster.

27 – Releasing VANOS central valve of the exhaust camshaft adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

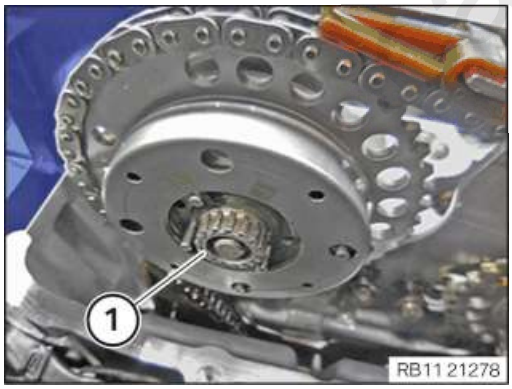


NOTICE

The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

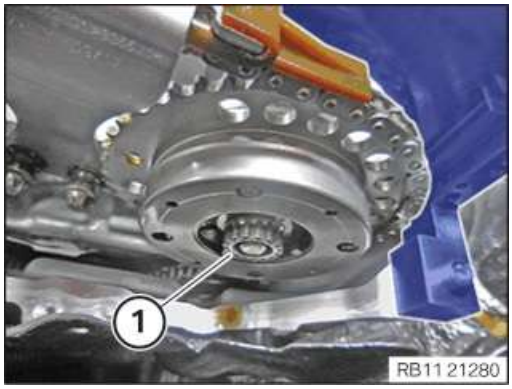
28 – Removing the VANOS central valve of the intake adjuster



- Guide out and remove the VANOS central valve (1) of the intake adjuster.

29 – Remove the VANOS central valve of the exhaust camshaft adjuster

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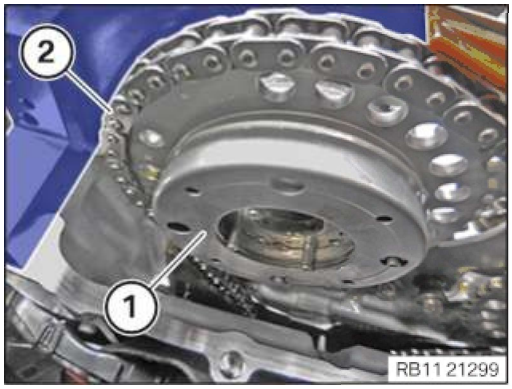


- Guide out and remove the VANOS central valve (1) of the exhaust camshaft adjuster.

30 – Removing intake adjuster

NOTICE

The figure shows the rear side of the engine.

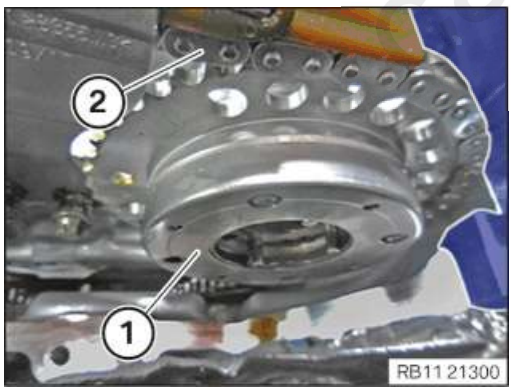


- Guide out the intake adjuster (1) from the timing chain (2) and remove.

31 – Remove exhaust camshaft adjuster

NOTICE

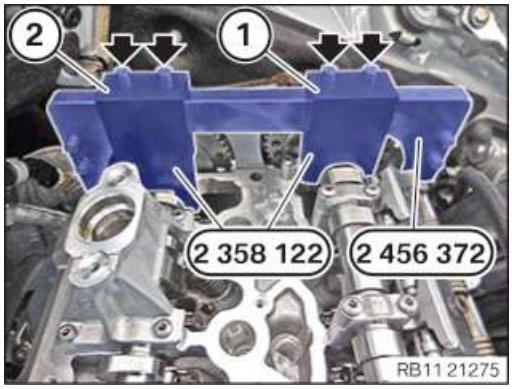
The figure shows the rear side of the engine.



- Guide out the exhaust camshaft adjuster (1) from the timing chain (2) and remove.

32 – Remove the test gauges to fix the camshafts

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- Remove screws (arrows).
- Guide out and remove test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier of the set of special tools 2 456 372.
- Guide out and remove test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier of the set of special tools 2 456 372.

33 – Remove cylinder head.

CAUTION

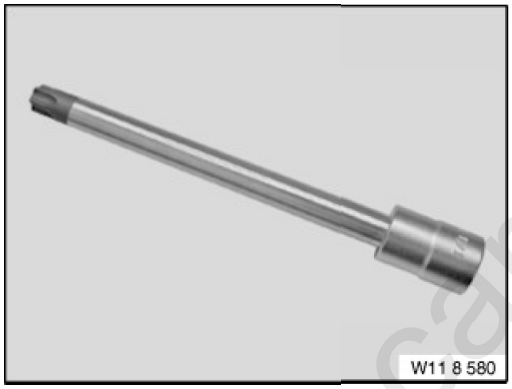
Heavy component.

Heavy components can lead to injury or damage.

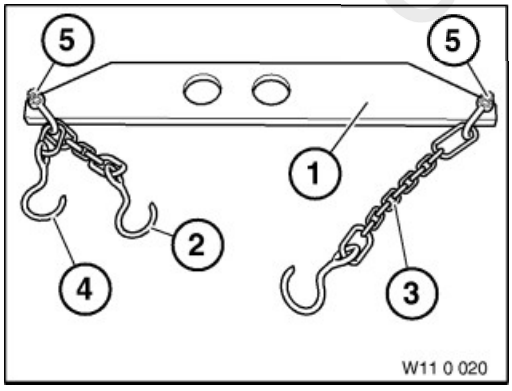
- Remove and install heavy components with the aid of another person/other persons.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Prepare special tool 0 495 747 (11 8 580).

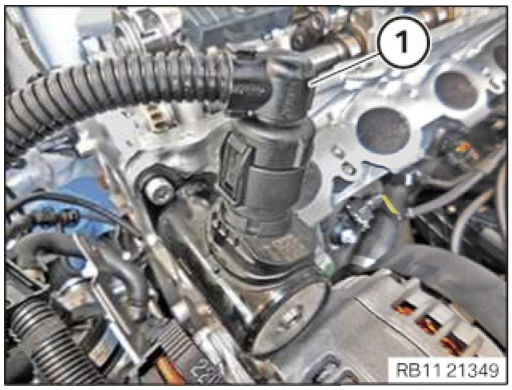


- Prepare special tool 0 490 567 (11 0 020).

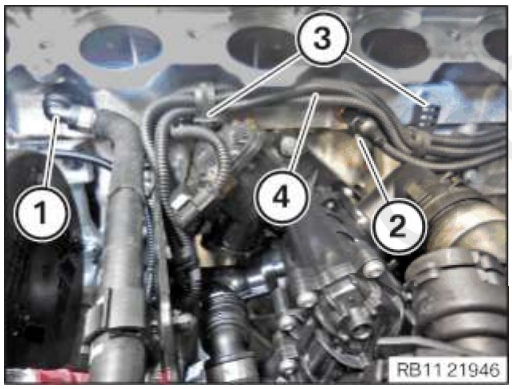
cardiagn.com



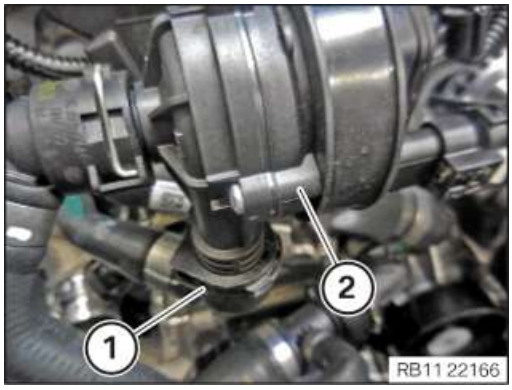
- Prepare the workshop crane 2 220 718.



- Unlock plug connection (1) and disconnect.

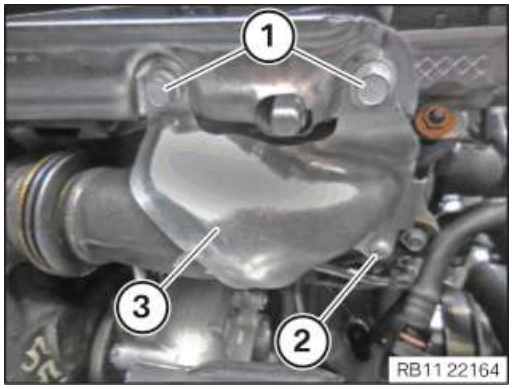


- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.
- Unlock plug connection (2) and disconnect.
- Loosen clamps (3).
- Feed out wiring harness section (4) for sensor system **1** and set it aside.



- Unlock and release coolant return line (1) on coolant pump (2) for the exhaust turbocharger.
- Catch and dispose of escaping coolant.

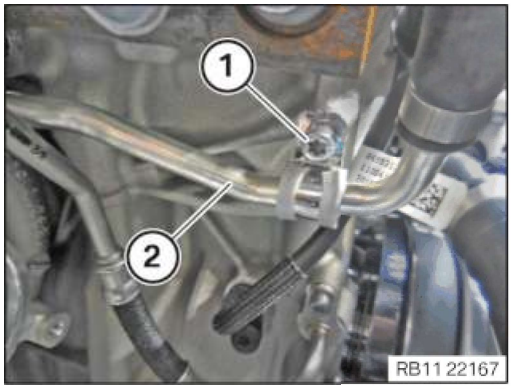
rdiagn.com



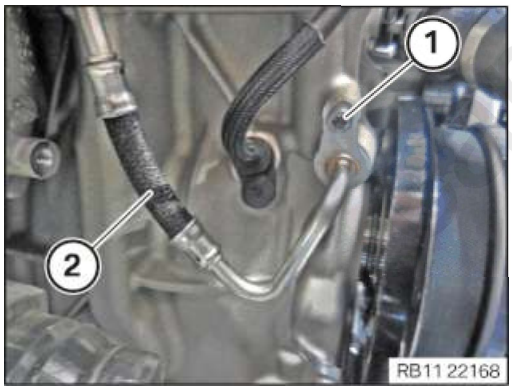
- Loosen screws (1).
- Loosen screw (2).
- Feed out and remove the heat shield (3).



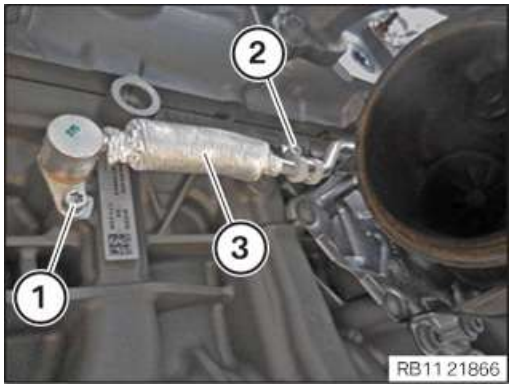
- Loosen screws (1).
- Feed out and remove the heat shield (2).



- Release screw (1) on coolant return line (2).

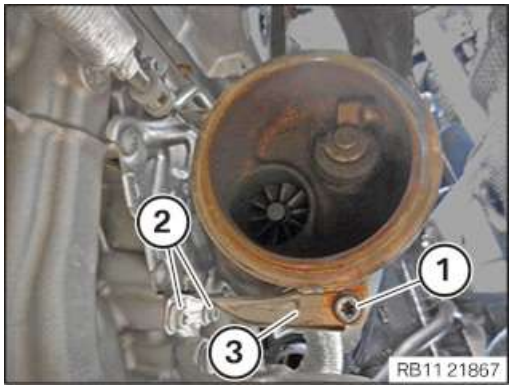


- Loosen screw (1).
- Guide out oil feed line (2) for the exhaust turbocharger and place it aside.
- Catch and dispose of emerging engine oil.

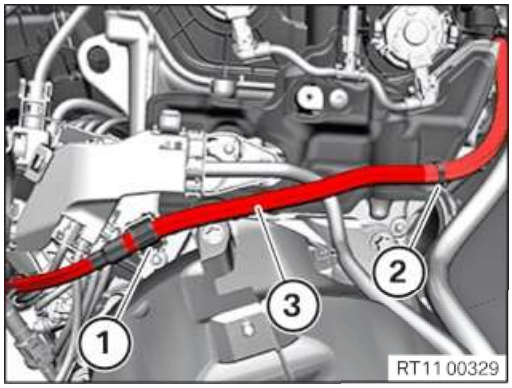


- Loosen screws (1) and (2).
- Guide the coolant feed line for exhaust turbocharger (3) from the crankcase and place it aside.
- Catch and dispose of escaping coolant.

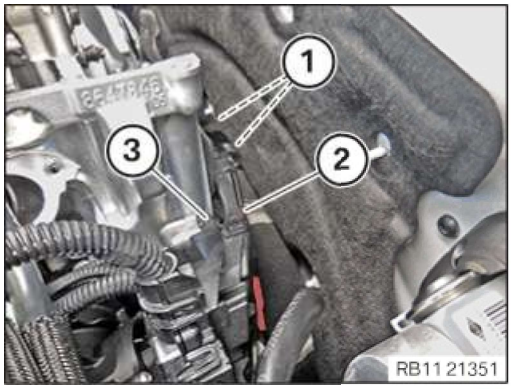
rdiagn.com



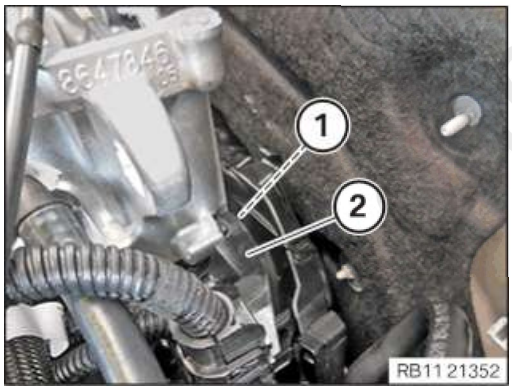
- Loosen screws (1) and (2).
- Feed the support (3) out and remove.



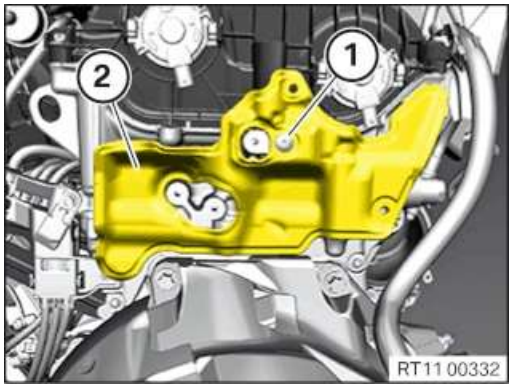
- Unlock and release clamps (1) and (2).
- Feed out positive battery cable (3) and put to one side.



- Loosen screws (1).
- Guide out transmission wiring harness (2) on wiring harness section (3) for sensor system 1 and set it aside.



- Loosen screw (1).
- Guide out the wiring harness section (2) for sensor system 1 and place to one side.

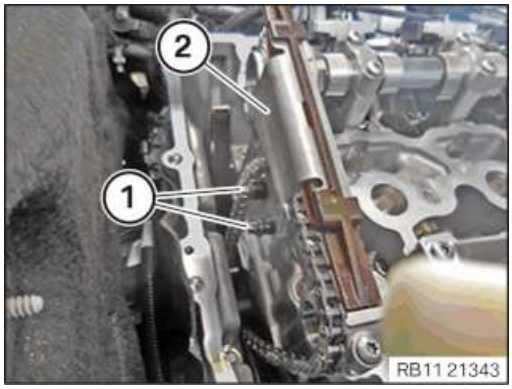


NOTICE

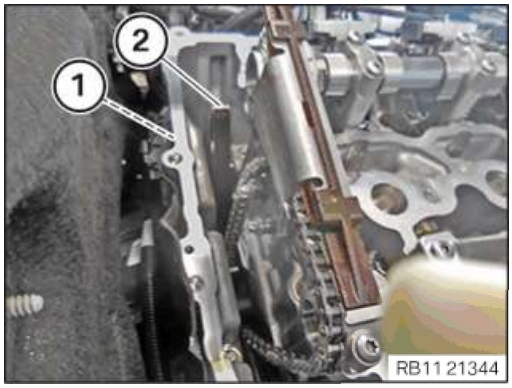
The figure shows the rear side of the engine.

- Loosen screw (1).
- Guide out and remove the cover (2).

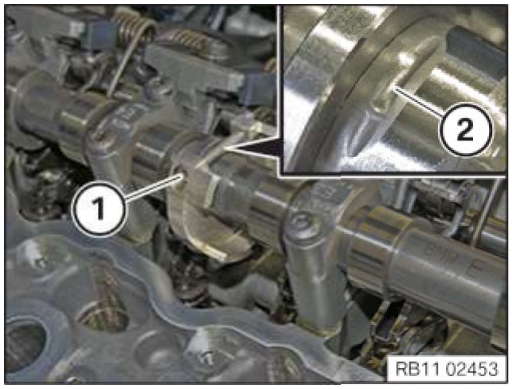
mdiagn.com



- Loosen screws (1).
- Guide out the slide rail (2) and remove.

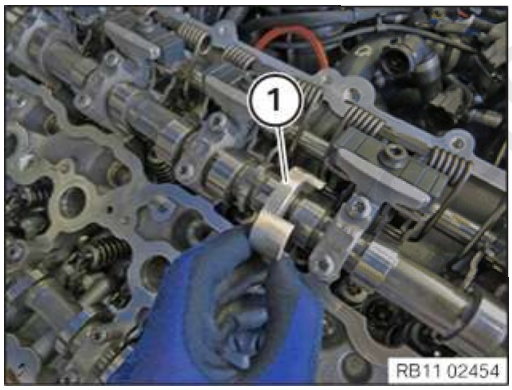


- Release the bearing journal (1) from the guide rail (2).



- Rotate intake camshaft, if necessary in the position shown.

  The recess (2) must point upwards.
- Loosen screw (1).



- Slide camshaft sensor wheel (1) in the direction of cylinder 1 and guide it out from the intake camshaft.

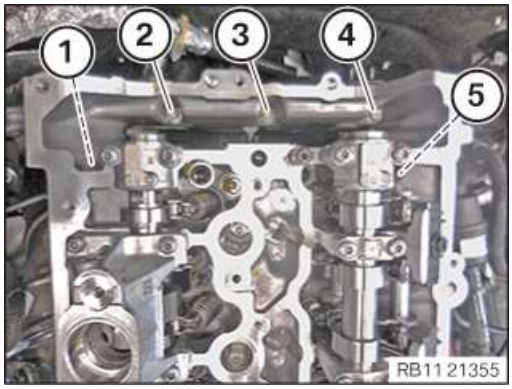


- Guide in and position special tool on the cylinder head.
- Tighten the screws (1) of special tool .

Special tool to cylinder head

M8		Tightening torque	21,5 Nm

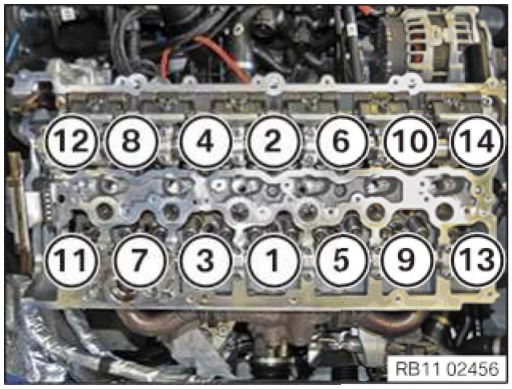
rdiagn.com



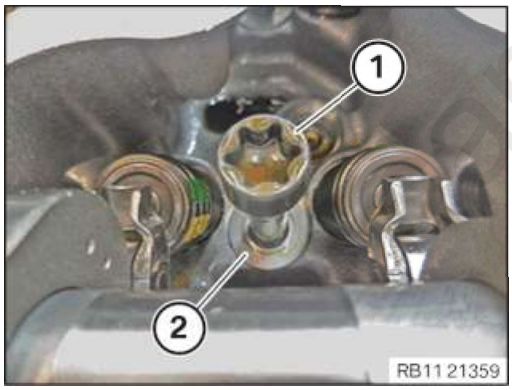
- Loosen the cylinder head bolts in the sequence from (5) to (1).



- Release cylinder head bolts with the special tool 0 495 747 (11 8 580).

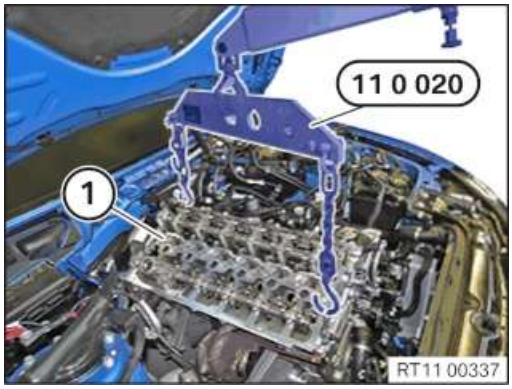


- Undo the screws using the special tool 0 495 747 (11 8 580) in the order (14) to (1) .



- Feed out and remove all the cylinder head bolts (1).
- Feed out and remove all the washers (2).

erdiagn.com



CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

RISK OF DAMAGE

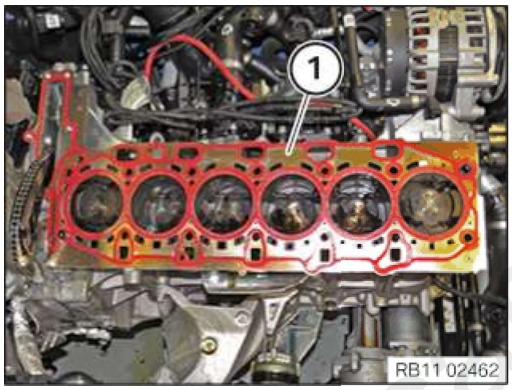
Damage to the guide rails.

Large amounts of force may damage the guide rails of the timing chain.

- Make sure not to damage the guide rail with the cylinder head when removing and installing the cylinder head.

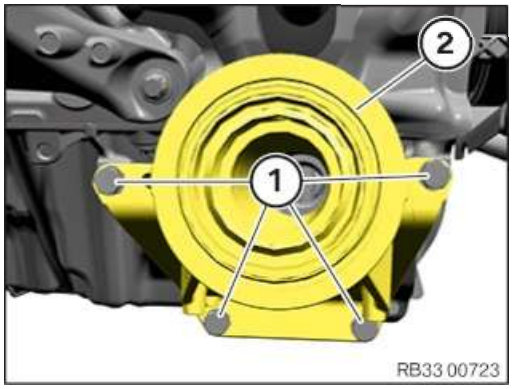
- Attach special tool 0 490 567 (11 0 020) to workshop crane.
- Lift out cylinder head (1) and the exhaust turbocharger with an auxiliary person, the workshop crane and special tool 0 490 567 (11 0 020).

34 – Removing the cylinder head gasket



- Thread out and remove cylinder head gasket (1).

35 – Remove bearing support



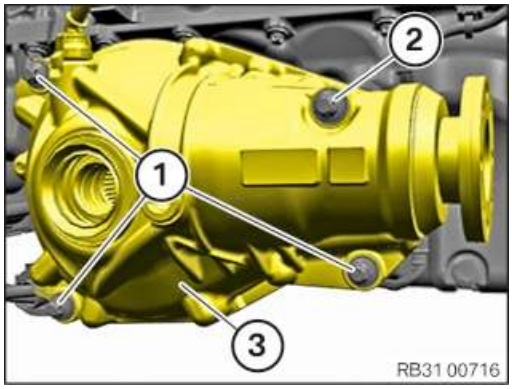
- Loosen screws (1).
- Remove the bearing support (2).

36 – Remove front axle differential

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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- Mark installation location of the screws (1) and (2).
  - Screws (1) M12x55
  - Screw (2) M12x105
- Loosen screws (1) and (2).
- Remove front axle differential (3).

37 – Remove oil sump

RISK OF DAMAGE

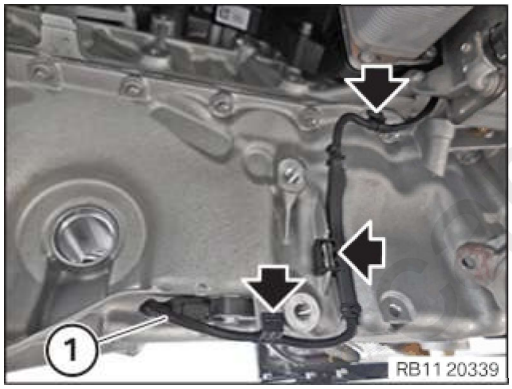
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

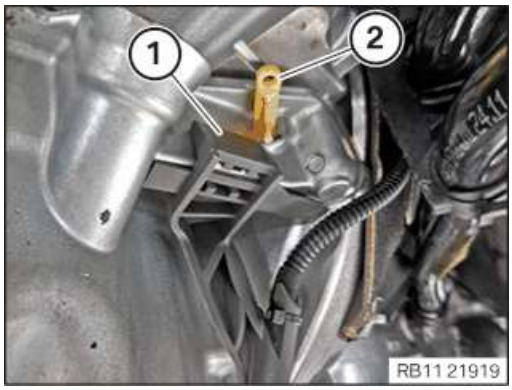
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



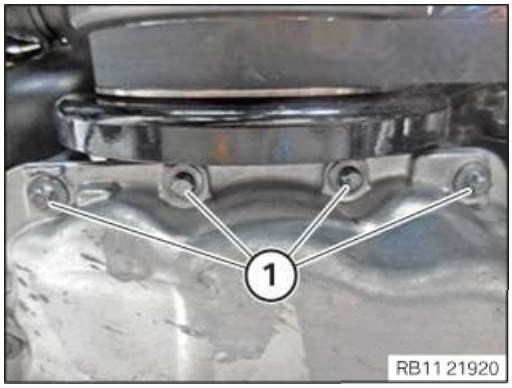
- Unlock clamps (arrows) and disconnect.
- Unlock and loosen connector (1).



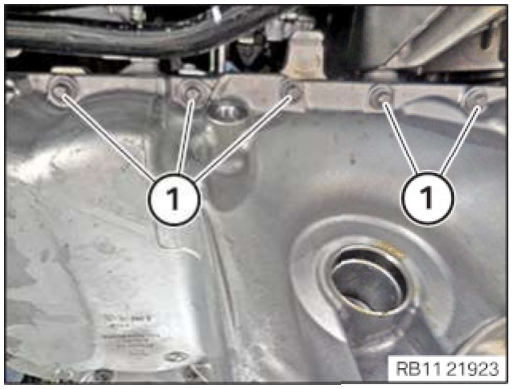
- Loosen clamp (1).
- Thread the sealing cap (2) out and remove.



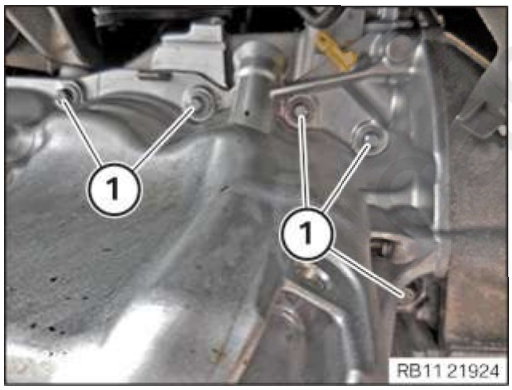
- Unscrew the transmission bolts (1).



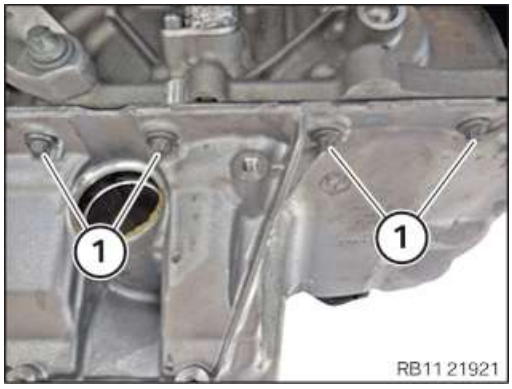
- Loosen screws (1).



- Loosen screws (1).

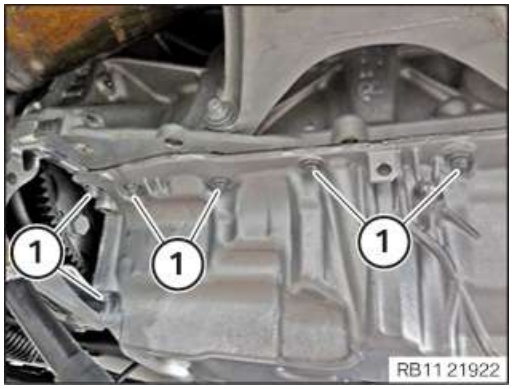


- Loosen screws (1).

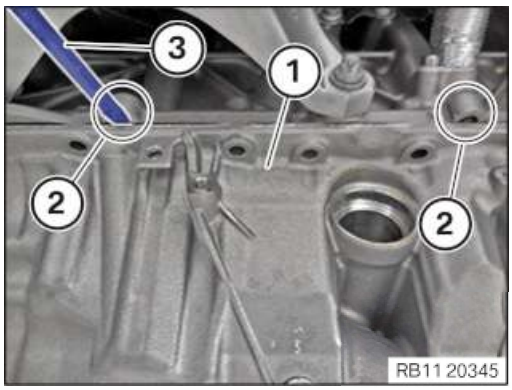


- Loosen screws (1).

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- Loosen screws (1).



TECHNICAL INFORMATION

Increased force may be necessary during disassembly because the component is bonded with liquid sealing compound.

- Release the oil sump (1) in the **marked** areas (2) using suitable tools (3).
- Guide out the oil sump (1) downwards to the rear and remove.

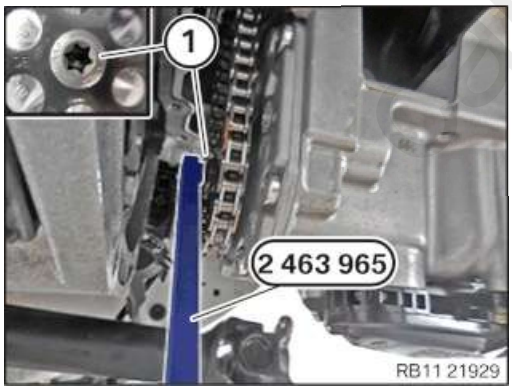
38 – Remove oil vacuum pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

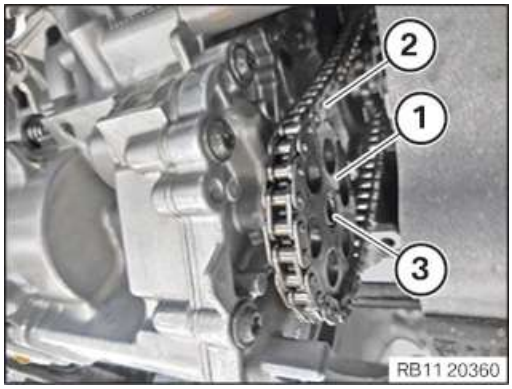
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.



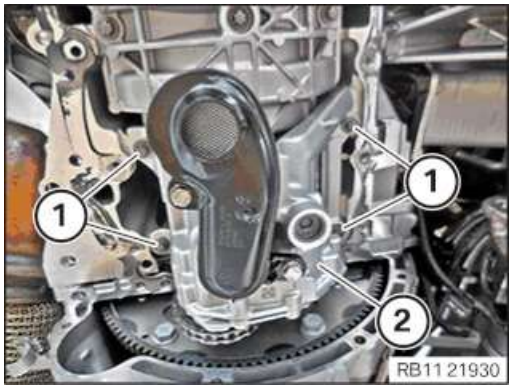
TECHNICAL INFORMATION

The thread is a left-hand thread.

- Release the screw (1) using the special tool 2 463 965.
- Thread out the bolt (1) and remove it.



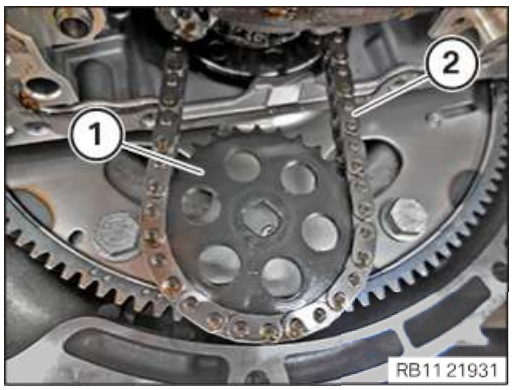
- Release the camshaft sprocket (1) from the oil vacuum pump (3).
- Feed the camshaft sprocket (1) out of the drive chain (2) and remove it.



TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

- Release screws (1) on the oil vacuum pump (2).
- Feed out the oil vacuum pump (2) and remove it.



- Feed the camshaft sprocket (1) out of the drive chain (2) and remove it.

39 – Removing the oil deflector



- Release all the screws (marks).
- Guide out and remove the oil deflector (1).

MAIN WORK

40 – Removing all pistons with connecting rod

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Removing the piston and connecting rod**

TECHNICAL INFORMATION

Piston, gudgeon pin, connecting rod and connecting rod bearing shells are matched to each other and balanced.
Always install the piston, gudgeon pin, connecting rod and connecting rod bearing shells in the cylinder from which they were removed.

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TECHNICAL INFORMATION

The connecting rods of the engine are balanced and are matched to each other.
A single connecting rod is not permitted to be replaced. Always replace all connecting rods.

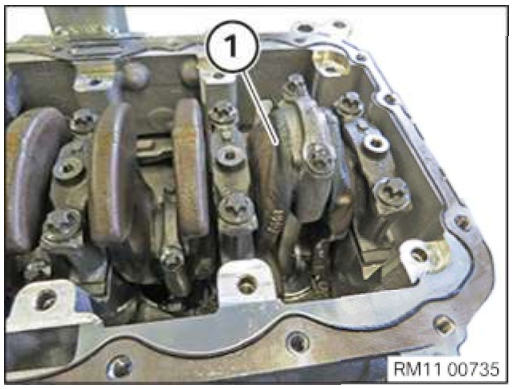
▷ **Detach the lower connecting rod bearing**

RISK OF DAMAGE

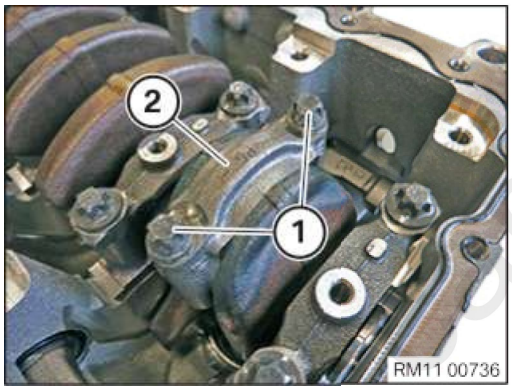
Damage on the cylinder wall and oil spray nozzles.

Major force can scratch the cylinder wall and bend the oil spray nozzles.

- Carefully move the piston and connecting rod in the engine block.



- Turn the crankshaft until the connecting rod bearing journal (1) reaches a vertical position.



RISK OF DAMAGE

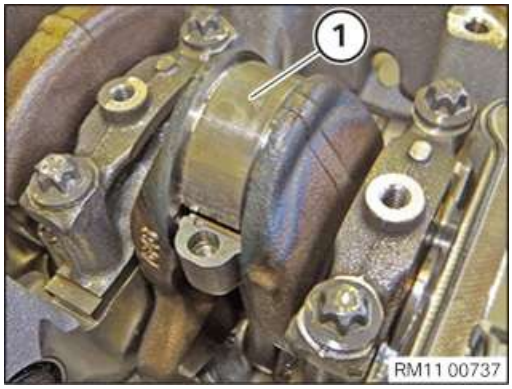
Engine damage caused by incorrectly installed bearing shells and bearing supports.

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.

- Unscrew the connecting rod bolts (1).
- Remove the connecting rod bearing cap (2) and put to one side in the correct order.

  Make sure that the connecting rod bearing cap (2) can be re-installed in the correct position.



RISK OF DAMAGE

Engine damage caused by incorrectly installed bearing shells and bearing supports.

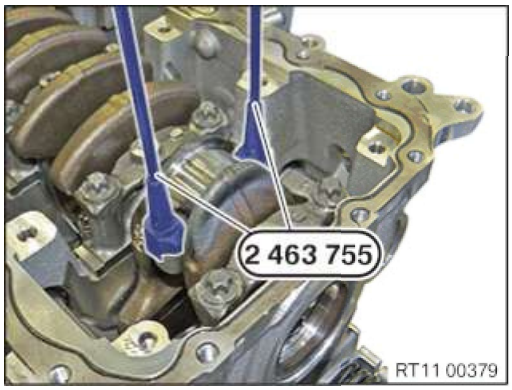
Engine damage may result from incorrectly installing bearing shells and bearing supports.

- Always install all bearing shells and bearing supports in the same position from which they were removed.

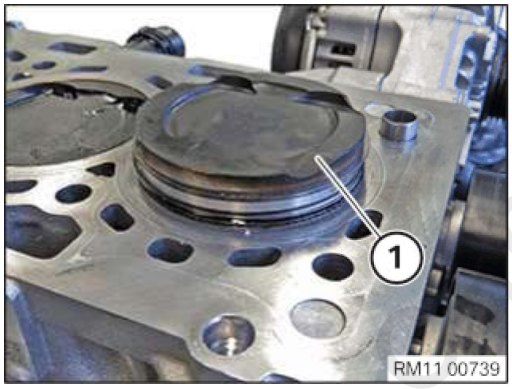
- Remove the connecting rod bearing (1).

  Make sure that the connecting rod bearing (1) can be re-installed in the correct position.

◁



- Screw special tool 2 463 755 in at large connecting rod eye.



- Push the piston (1) and the connecting rod upwards out of the crankcase.

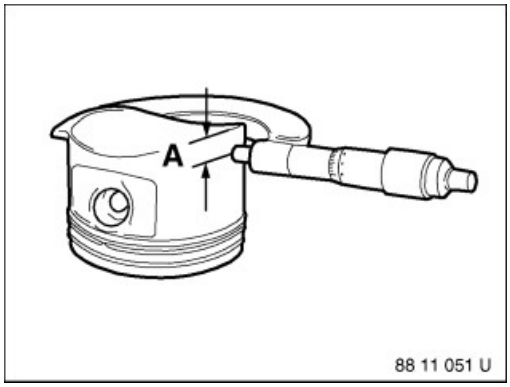
41 – Measuring piston

NOTICE

The description is for one component only. The procedure is identical for all further components.

Check

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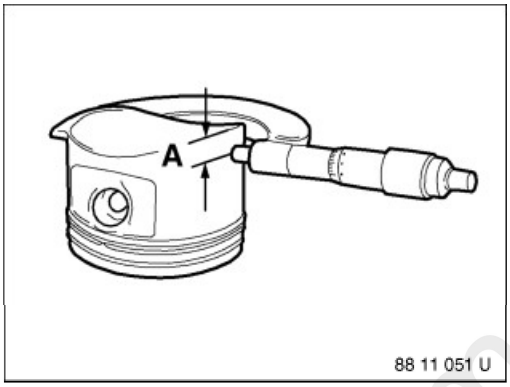


- Position measuring bolt in area (A) and measure piston installation clearance transversely to gudgeon pin.

Piston diameter

Measure the piston diameter at distance (A) from the lower end of the piston skirt.

Distance (A) to the lower end of the piston skirt	10 mm
Nominal dimension of piston diameter	81,958 mm ... 81,996 mm



Result

» Piston does not correspond to the specifications.

Measure

- Renew the piston.

42 – When replacing pistons: Remount all connecting rods

TECHNICAL INFORMATION

To determine the correct special tool for fitting the piston circlip, it is necessary to determine the inner diameter of the piston pin first.

TECHNICAL INFORMATION

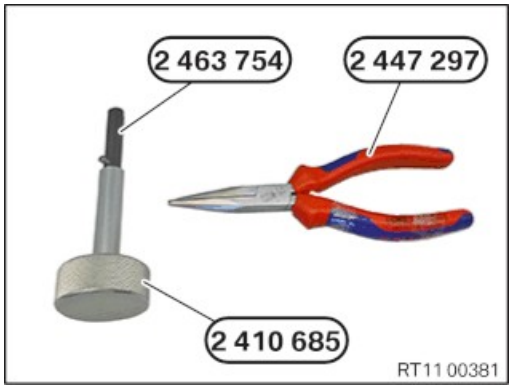


- Wear safety goggles.

NOTICE

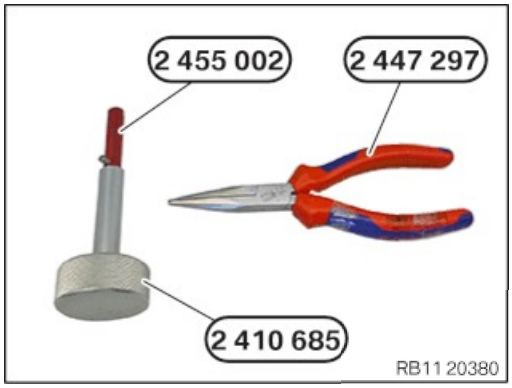
The description is for one component only. The procedure is identical for all further components.

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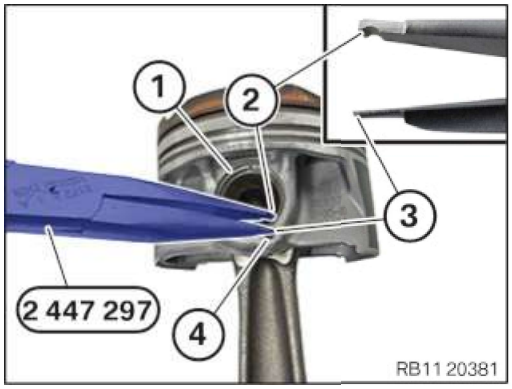
- Equipment specification with gudgeon pin with inner diameter of 12.0 mm:

  Use special tools 2 463 754, 2 410 685 and to remove the piston from the connecting rod.



- Equipment specification with gudgeon pin with inner diameter of 12.5 mm:

  Use special tools , 2 410 685 and to remove the piston from the connecting rod.



CAUTION

Gudgeon pin circlip with preload.

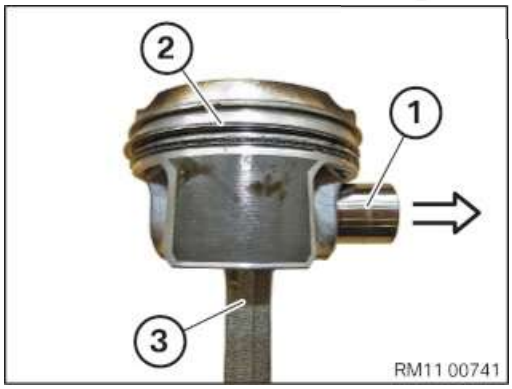
Danger of injury!

- The use of the specified special tool for the disassembly or installation is mandatory.

- Wear safety goggles.

- Use special tool to remove the gudgeon pin circlip.
- Insert the flat side (3) of the special tool into the groove (4).
- Grip the gudgeon pin circlip (1) by the domed side (2) and remove.

Check



TECHNICAL INFORMATION

Piston and gudgeon pin are matched to each other.

Always install piston and gudgeon pin together and do not switch by mistake.

- Check whether the gudgeon pin (1) demonstrates tangible play in the piston.
- Check whether the gudgeon pin (1) can be removed without excessive force.

Result

» The gudgeon pin (1) is difficult to remove.

» Gudgeon pin (1) has noticeable play.

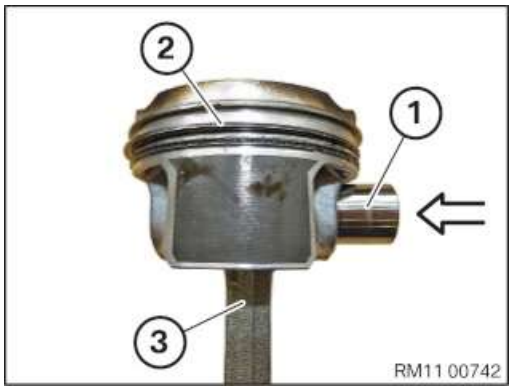
Measure

- Renew the piston (2) and the gudgeon pin (1).

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- Renew the piston.

  Parts: Pistons

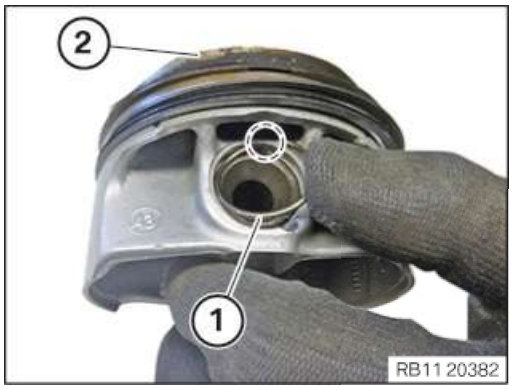


TECHNICAL INFORMATION

Piston and gudgeon pin are matched to each other.

Always install piston and gudgeon pin together and do not switch by mistake.

- Install gudgeon pin (1) in piston (2) and connecting rod (3).



CAUTION

Gudgeon pin circlip with preload.

Danger of injury!

- The use of the specified special tool for the disassembly or installation is mandatory.



- Wear safety goggles.

- Position the gudgeon pin circlip (1) such that the opening in the marked area of the gudgeon pin circlip points in the direction of the piston crown (2).



TECHNICAL INFORMATION

To determine the correct special tool for fitting the piston circlip, it is necessary to determine the inner diameter of the piston pin first.

- Equipment specification with gudgeon pin with inner diameter of 12.0 mm:

  Preload the gudgeon pin circlip (1) using your thumb.

  Simultaneously press the gudgeon pin circlip into the piston using special tools 2 410 685 and 2 463 754 .

  Twist and reposition special tool 2 410 685 and completely press the gudgeon pin circlip into the piston.



TECHNICAL INFORMATION

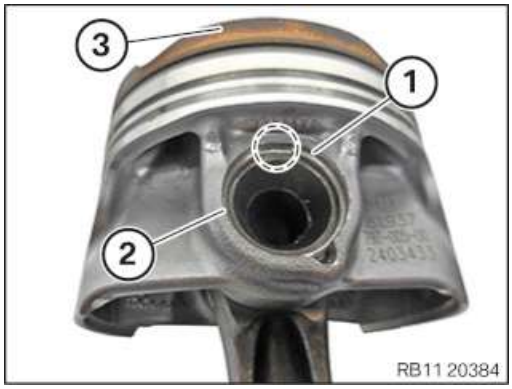
To determine the correct special tool for fitting the piston circlip, it is necessary to determine the inner diameter of the piston pin first.

- Equipment specification with gudgeon pin with inner diameter of 12.5 mm:

  Preload the gudgeon pin circlip (1) using your thumb.

  Simultaneously press the gudgeon pin circlip into the piston using special tools 2 410 685 and .

  Twist and reposition special tool 2 410 685 and completely press the gudgeon pin circlip into the piston.

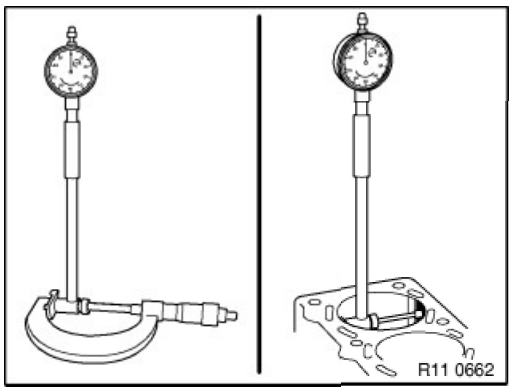


- Check whether the gudgeon pin circlip (1) has been correctly positioned in the groove (2).
- Check whether the opening in the marked area of the gudgeon pin circlip is pointing towards the piston crown (3).

43 – Measuring a cylinder

Prerequisite

Cylinder barrel is cleaned.



Check

- Carry out a measurement at all cylinders.
- Adjusting measuring screw to nominal dimension of cylinder bore.

Cylinder bore B38/B46/B48/B58

Diameter of cylinder bore	82,000 mm ... 82,014 mm
Permitted irregularity of the cylinder bore	0,01 mm
Permitted conicity of the cylinder bore	0,01 mm
Permissible total wear tolerance between piston and cylinder bore (engine operated)	0,15 mm

- Insert internal measuring device into measuring screw and set to zero.
- With the internal measuring device, measure the cylinder at the following points and check the deviations from the nominal dimension.
  - Lower third of the cylinder bore in direction of travel,
  - Lower third of the cylinder bore transversely to direction of travel,
  - Middle third of the cylinder bore in direction of travel,
  - Middle third of the cylinder bore transversely to direction of travel,
  - Upper third of the cylinder bore in direction of travel,
  - Upper third of the cylinder bore transversely to direction of travel.

Cylinder bore B38/B46/B48/B58

Diameter of cylinder bore	82,000 mm ... 82,014 mm
Permitted irregularity of the cylinder bore	0,01 mm
Permitted conicity of the cylinder bore	0,01 mm
Permissible total wear tolerance between piston and cylinder bore (engine operated)	0,15 mm

Result

» Cylinder does not correspond to the specifications.

Measure

- Renew the crankcase.

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44 – Installing all pistons with connecting rod

NOTICE

The description is for one component only. The procedure is identical for all further components.

▶ **Installing piston with the connecting rod**

RISK OF DAMAGE

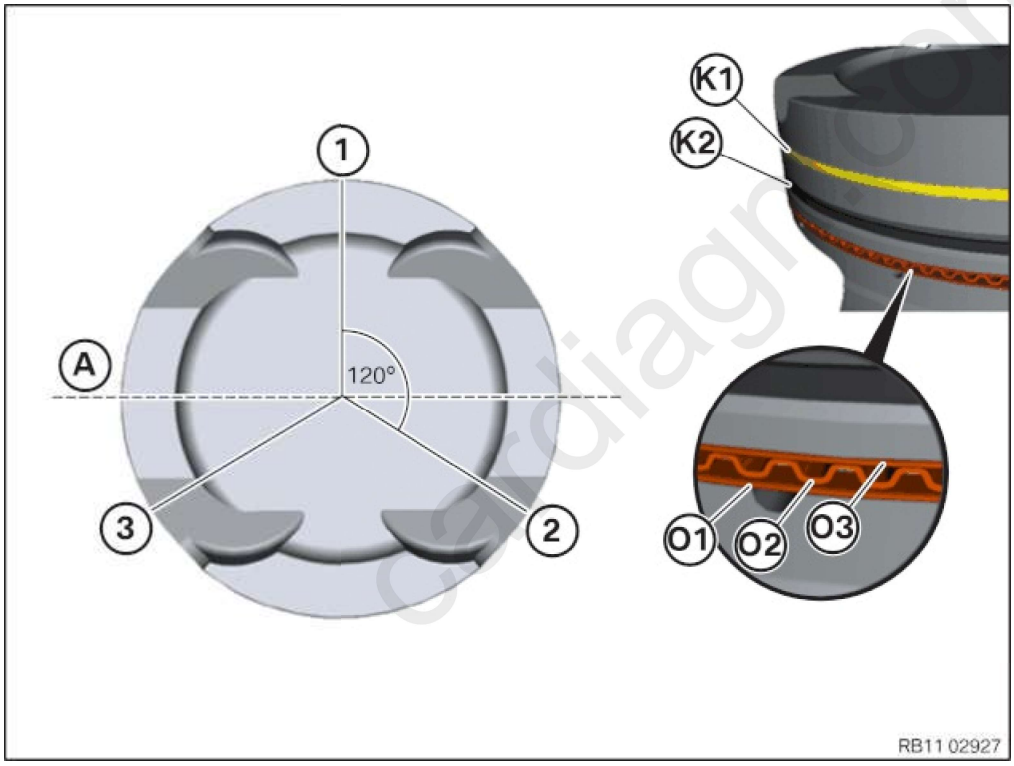
Damage on the cylinder wall and oil spray nozzles.

Major force can scratch the cylinder wall and bend the oil spray nozzles.

- Carefully move the piston and connecting rod in the engine block.

▷ **Aligning piston rings**

Aligning piston rings



1 12 o'clock position

2 4 o'clock position

3 8 o'clock position

A Axis of gudgeon pin

K1 Upper piston ring

K2 Middle piston ring

O1 Lower oil scraper ring

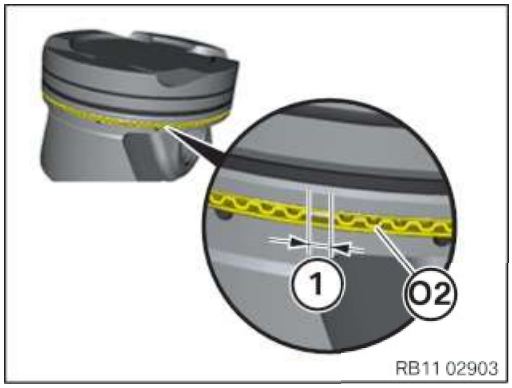
O2 Spring

O3 Upper oil scraper ring

- Align the contact points of all piston rings rotated by 120° each.

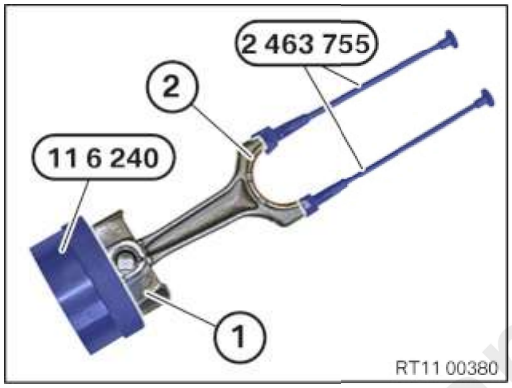
  Do not position contact points over axis of gudgeon pin (A).

Piston ring	Align at the following position
Lower oil scraper ring (O3)	Align at the 12 o'clock position (1)
Spring (O2)	Align at the 4 o'clock position (2)
Upper oil scraper ring (O1)	Align at the 8 o'clock position (3)
Middle piston ring (K2)	Align at the 12 o'clock position (1)
Upper piston ring (K1)	Align at the 4 o'clock position (2)



- Make sure that contact point (1) does not overlap spring (O2).

◁



- Coat the pistons (1) and piston rings lightly with oil.
- Insert the piston (1) with the piston rings into the special tool (bush) 0 495 373 (11 6 240).
- Screw special tool 2 463 755 on at large connecting rod eye (2).



- Align the piston so that the arrow (1) points to cylinder 1.
- Insert piston with the connecting rod into the special tool 0 495 373 (11 6 240) and guide it into the cylinder.

RISK OF DAMAGE

Damage on the cylinder wall and oil spray nozzles.

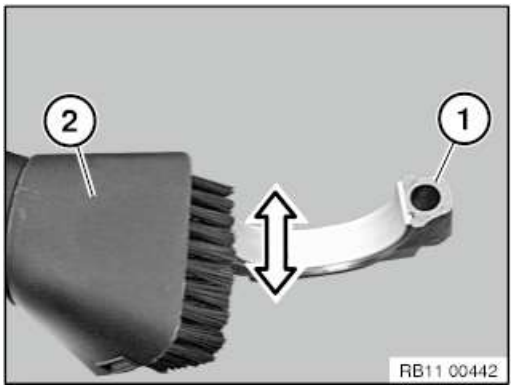
Major force can scratch the cylinder wall and bend the oil spray nozzles.

- Carefully move the piston and connecting rod in the engine block.

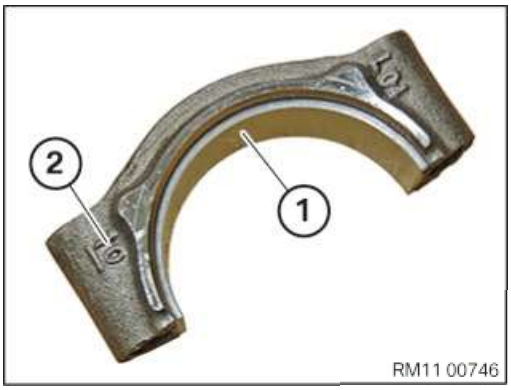
- Push in piston by hand with only little force. Do not use striking tools.

▷ **Install the lower connecting rod bearing**

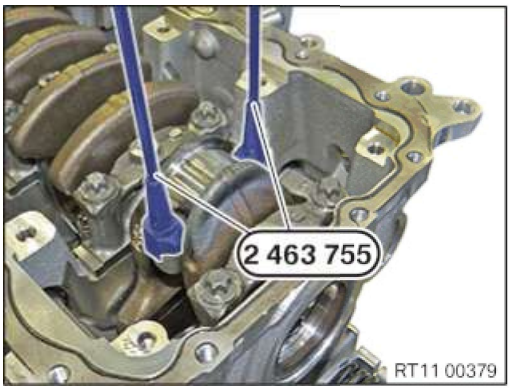
ardiagn.com



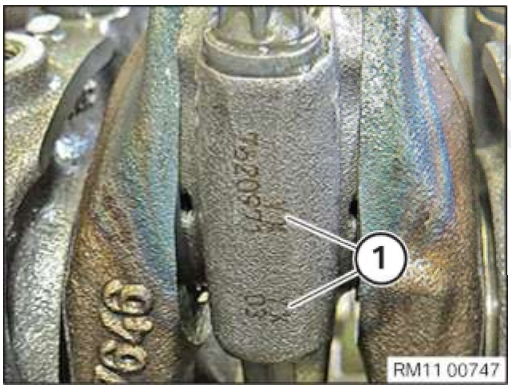
- Vacuum the connecting rod bearing shell and cracked surface (1) with a vacuum cleaner (2).



- Insert the connecting rod bearing shell (1) into the connecting rod bearing cap (2).
- Apply a light coat of oil to the connecting rod bearing shell (1).



- If necessary, screw the special tool (assembly tool) 2 463 755 into the large connecting rod eye.
- Pull the connecting rod up to the connecting rod bearing journal.



RISK OF DAMAGE

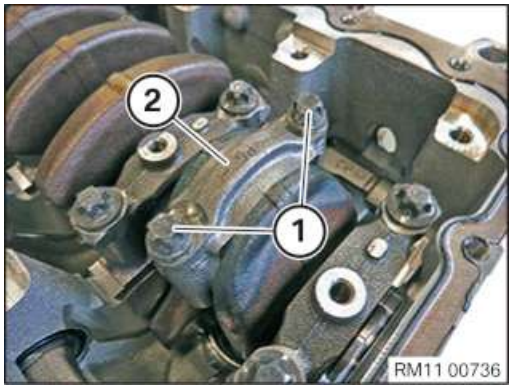
Engine damage caused by incorrectly installed bearing shells and bearing supports.

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.

- Attach the connecting rod bearing caps to the connecting rod until the designations (1) match.

mdiagn.com



- Renew screws (1).

  Parts: Bolts

- Tighten the bolts with the special tool 0 490 504 (00 9 120).

Connecting rod bearing cap to connecting rod

Renew screws.

Tighten screws crosswise.	Jointing torque	20 Nm
	1. Angle of rotation	70 °
	2. Angle of rotation	70 °

◁

POSTPROCESSES

45 – Installing the oil deflector



- Renew bolts (markings).

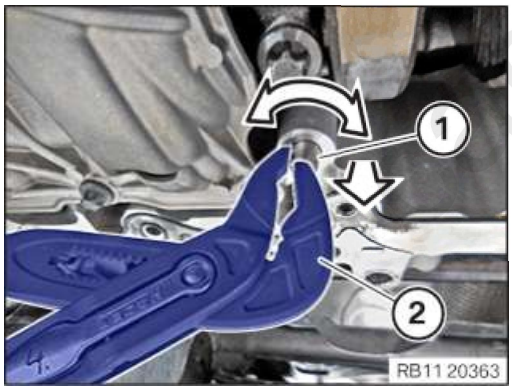
  Parts: Bolts

- Insert oil deflector (1) and position.
- Tighten bolts (markings) in a crosswise pattern using the special tool 0 490 504 (00 9 120).

Oil deflector to crankcase

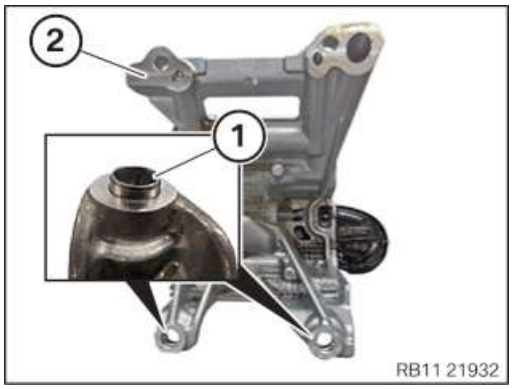
M8 x 35	Replace screws.	Jointing torque	15 Nm
		Angle of rotation	45 °

46 – Install the oil vacuum pump



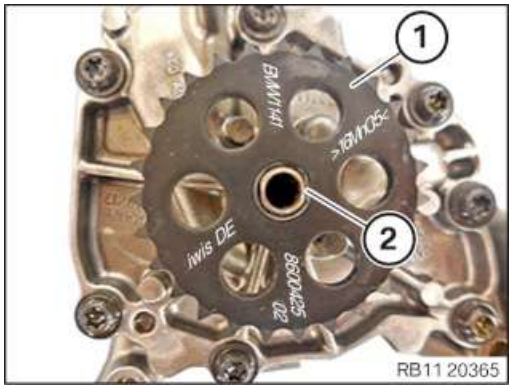
- Work centring sleeves (1) out of the crankcase in the direction of the arrow using conventional tools (2) and remove.
- Renew the centring sleeves (1).

  Parts: Centring sleeves



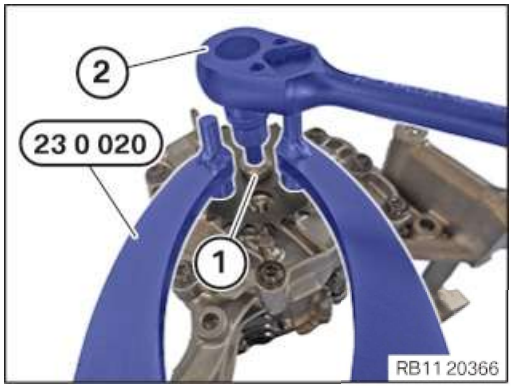
- Insert and install centring sleeves (1) at the oil vacuum pump (2).

rdiagr.com



- Position the camshaft sprocket (1) at the oil vacuum pump (2).

  The labelling on the camshaft sprocket (1) must face away from the oil vacuum pump (2).



- Renew the screw (1).

  Parts: Screw

TECHNICAL INFORMATION

The thread is a left-hand thread.

- Insert bolt (1) and fit.

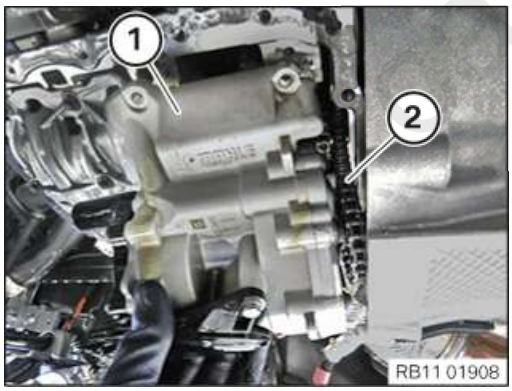
TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

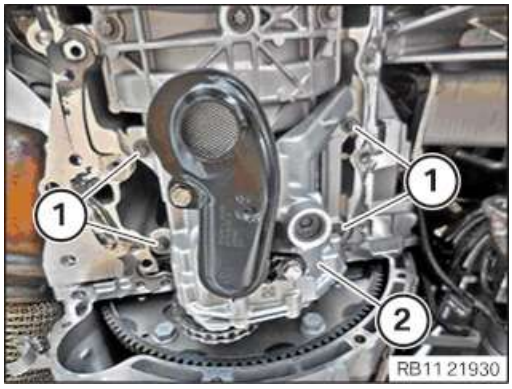
- Hold camshaft sprocket with special tool 0 491 440 (23 0 020) and tighten bolt (1) with conventional tools (2).

Camshaft sprocket to oil vacuum pump

M8	Important - left-hand thread Renew screw.	1. Jointing torque 2. Angle of rotation	5 Nm 90 °



- Insert and position the oil vacuum pump (1) in the drive chain (2).



- Renew screws (1).

  Parts: Bolts

- Tighten the screws (1).

Oil vacuum pump to crankcase

M8	Renew screw.	1. Tightening torque 2. Angle of rotation	15 Nm 45 °

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.



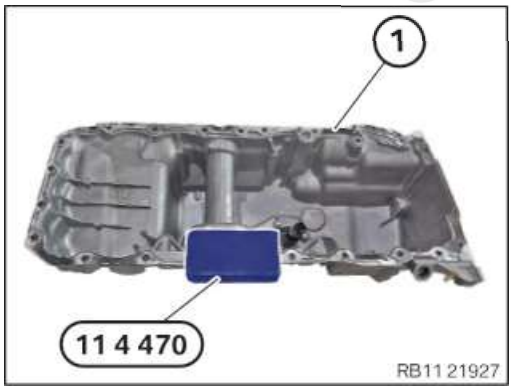
TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Remove the coarse sealing residue on sealing surface (1) on the crankcase with special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Remove the fine seal remains on the sealing surface (1) of the oil sump with the special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215

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- Have the special tool ready.

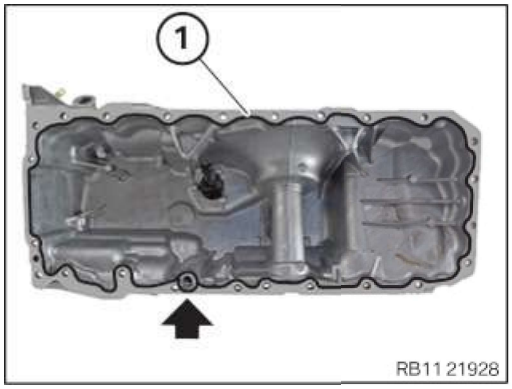


TECHNICAL INFORMATION

For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

- Position the sealing compound (1) on special tool as shown.

  Parts: Sealing compound



TECHNICAL INFORMATION

The maximum application time of the liquid sealing compound is 12 minutes.

- Apply sealing bead (1) with the sealing compound in the **marked** area along the inner edge.

Sealing compound

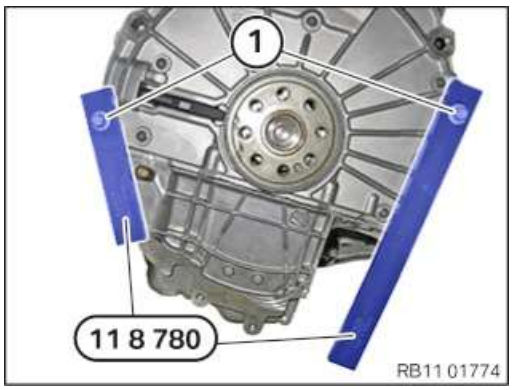
Loctite 5970 liquid sealing compound	50 ml, Cartridge	83190404517

Overview of consumables (Electronic Parts Catalogue)

Height of the sealing bead

	2,0 mm ... 2,5 mm

- Completely encircle the oil return orifice (arrow) with the sealing compound.



TECHNICAL INFORMATION

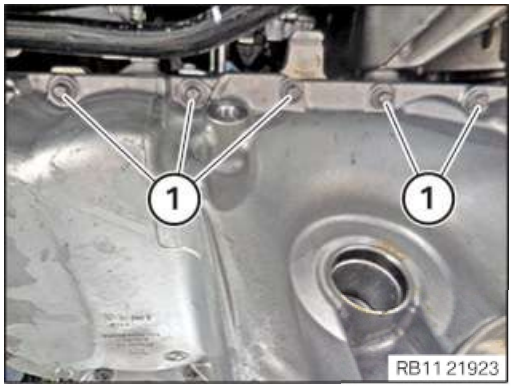
The special tool 11 8 780 is only required when the transmission is removed.

- Position the special tool 0 496 120 (11 8 780) with the transmission bolts (1) so that the oil sump is exactly flush with the timing case cover.
- Renew the centring sleeves where required.

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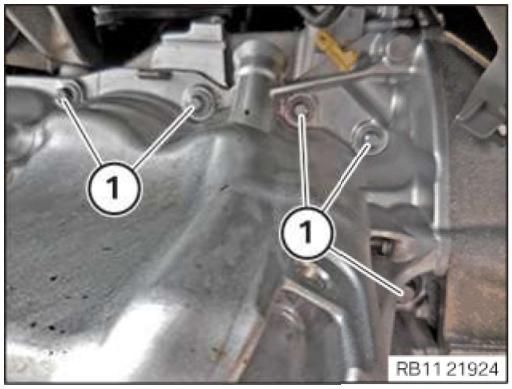
- Insert oil sump (1) upwards and forwards and position.



- Tighten the screws (1).

Oil sump to crankcase

M8 x 30		Tightening torque	24 Nm



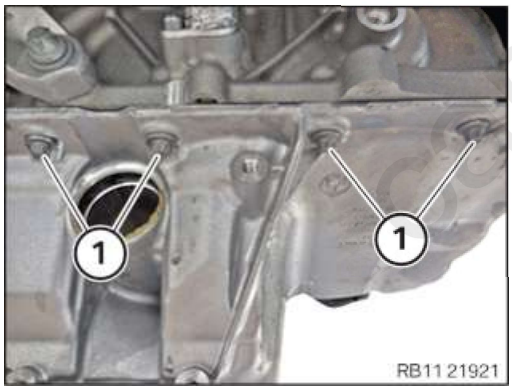
- Tighten the screws (1).

Oil sump to crankcase

M8 x 30		Tightening torque	24 Nm

Oil sump to crankcase

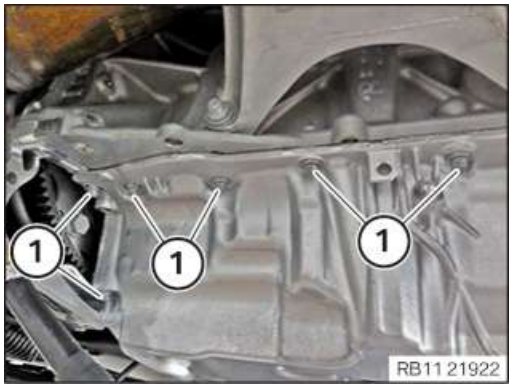
M8 x 110		Tightening torque	24 Nm



- Tighten the screws (1).

Oil sump to crankcase

M8 x 30		Tightening torque	24 Nm



- Tighten the screws (1).

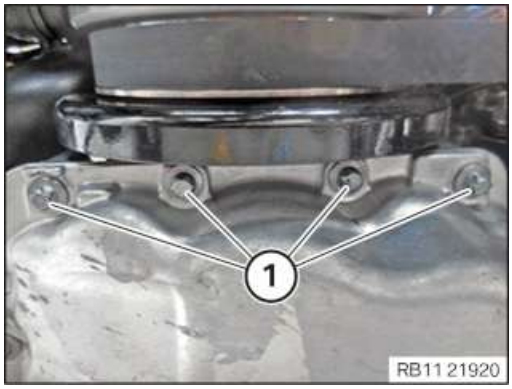
Oil sump to crankcase

M8 x 30		Tightening torque	24 Nm

Oil sump to crankcase

M8 x 110		Tightening torque	24 Nm

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- Tighten the screws (1).

Oil sump to crankcase

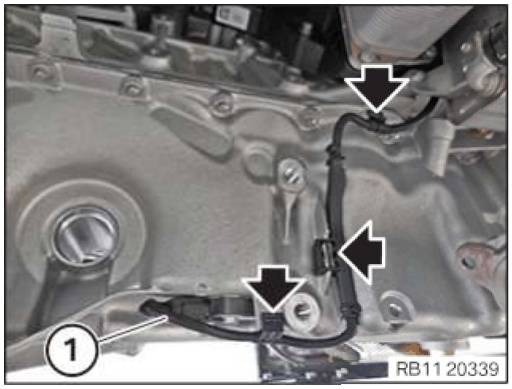
M8 x 30		Tightening torque	24 Nm



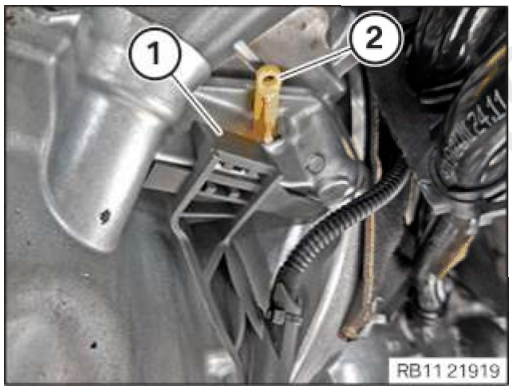
- Tighten transmission screws (1).

Transmission to oil sump (manual gearbox and automatic transmission)

M8 x 50		Tightening torque	19 Nm

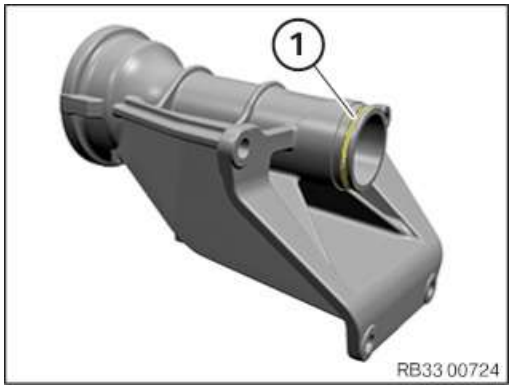


- Secure the clamps (arrows).
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.



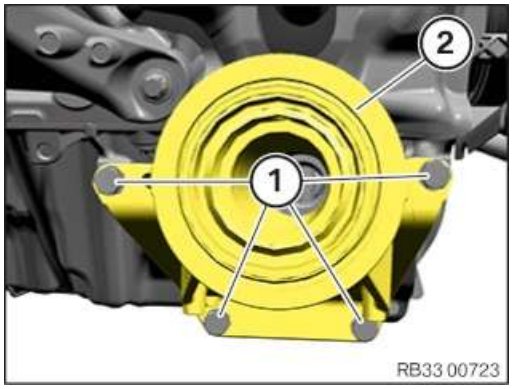
- Secure clamps (1).
- Guide in and install sealing cap (2).

48 – Install bearing support



- Coat the O-ring (1) with front axle transmission oil.

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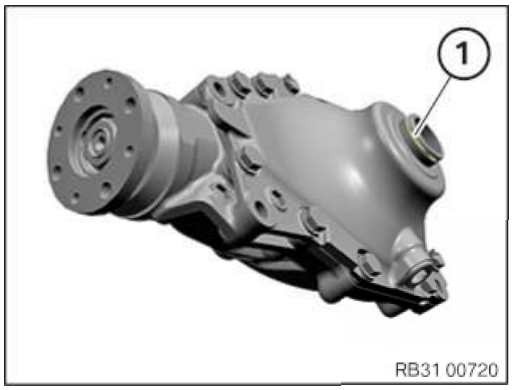


- Position the bearing support (2) at the engine oil sump.
- Tighten the screws (1).

Bearing support to oil sump

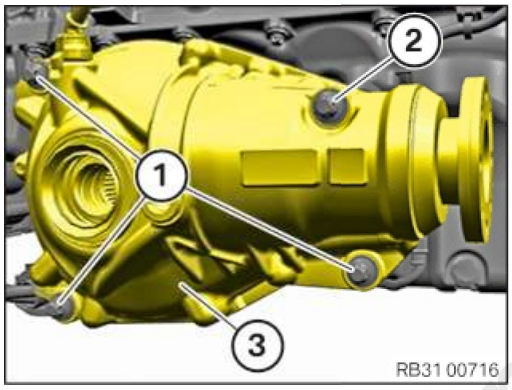
M8		Tightening torque	19 Nm

49 – Install front axle differential



- Renew O-ring (1).

  Parts: O-ring
- Coat the O-ring (1) with front axle transmission oil.



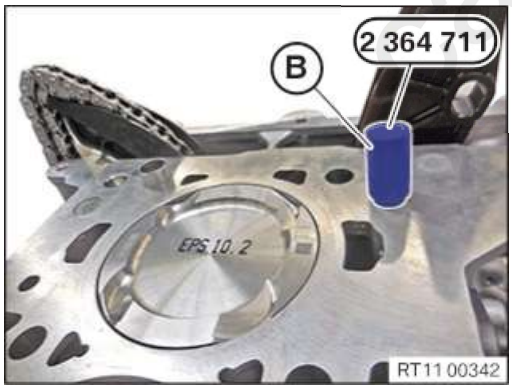
- Position front axle differential (3).

  Make sure marked screws are installed in correct installation locations:
  - Screws (1) M12x55
  - Screw (2) M12x105
- Tighten down screws (1) and (2).

Front axle final drive to engine oil pan

M12		Tightening torque	140 Nm

50 – Sealing the oil duct



- Seal the oil duct using special tool (B) from the set of special tools 2 364 711.

51 – Clean sealing surfaces

RISK OF DAMAGE

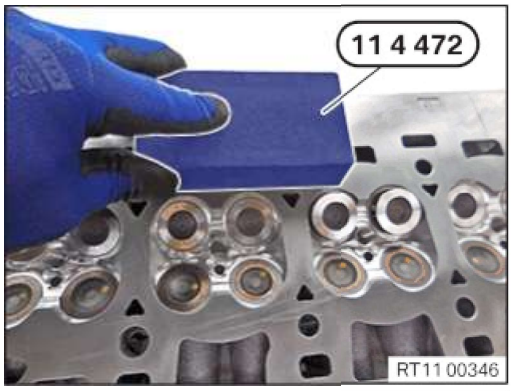
Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

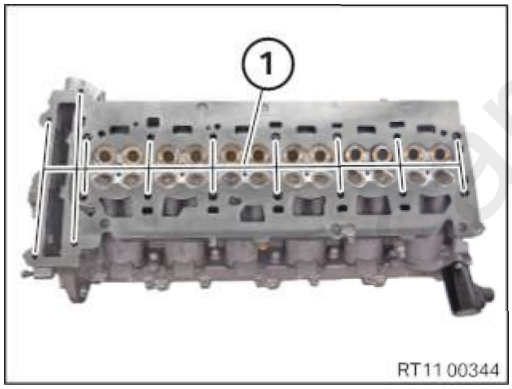
- Do not use any metal-cutting tools.



- Remove coarse backlogs from the sealing surfaces of the cylinder head using special tool 0 495 103 (11 4 471).



- Remove fine residues from the sealing surfaces of the cylinder head using special tool 0 495 104 (11 4 472).



- Clean all blind holes (1) of the cylinder head.

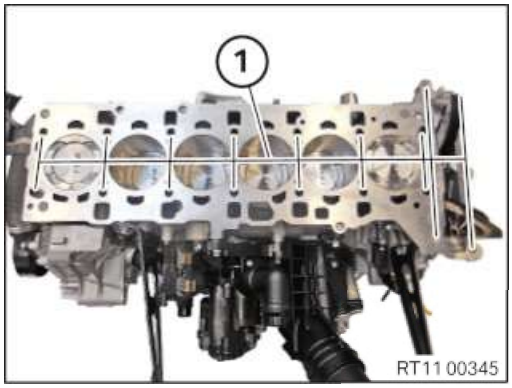


- Remove coarse backlogs from the sealing surfaces of the crankcase using special tool 0 495 103 (11 4 471).

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- Remove fine backlogs from the sealing surfaces of the crankcase using special tool 0 495 104 (11 4 472).
- Clean all blind holes of the crankcase.



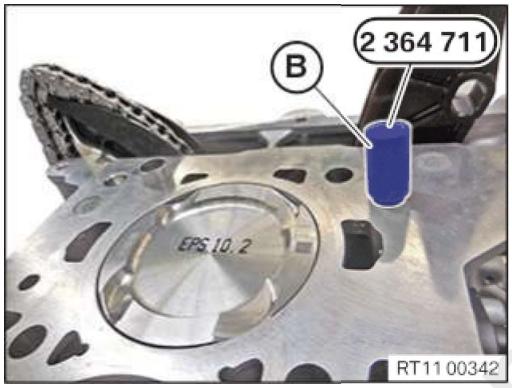
CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

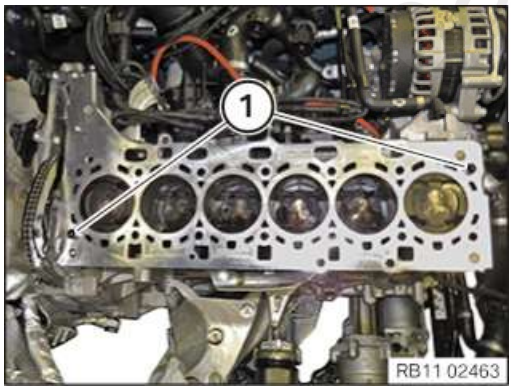
- Collect dirt particles, e.g. when blowing out, use cloth to do so.

- Wear safety goggles.
- Clean all threaded holes (1) of the crankcase with compressed air.

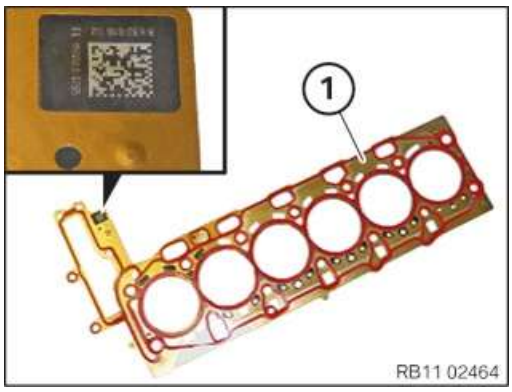


- Remove special tool (B) contained in the set of special tools 2 364 711.

52 – Installing the cylinder head gasket



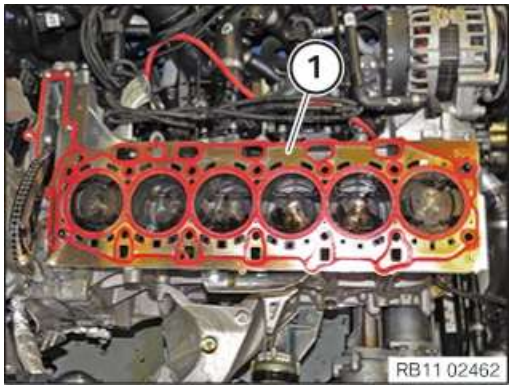
- Check the fitting sleeves (1) for damage and renew if necessary.



- Renew cylinder head gasket (1).

  Parts: Cylinder head gasket
- Install a thicker cylinder head gasket (1) with +0.3 mm in rebuilt cylinder heads.
- Check cylinder head gasket (1) using the part number.

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- Install cylinder head gasket (1) and place it correctly on the fitting sleeves.

53 – Block the crankshaft in he TDC firing position of cylinder 1



RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

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- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

  The engine is in the TDC firing position of cylinder 1.

54 – Installing the cylinder head

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

RISK OF DAMAGE

Damage to threads.

Fluid in the threaded hole may damage the thread when screws are tightened in the threads.

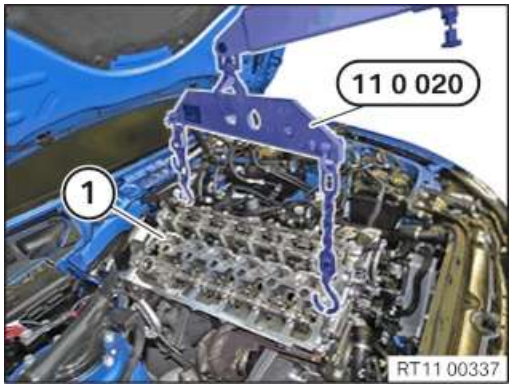
- Dry threaded holes (e.g. using compressed air).

TECHNICAL INFORMATION

Do not remove bolt coating.

TECHNICAL INFORMATION

When replacing the cylinder head: The complete valve control and the Valvetronic servomotor are already pre-assembled for new cylinder heads.



RISK OF DAMAGE

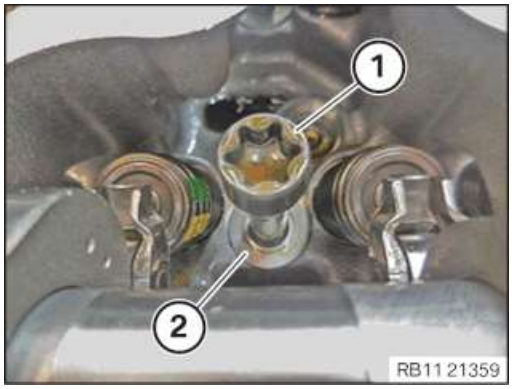
Damage to the guide rails.

Large amounts of force may damage the guide rails of the timing chain.

- Make sure not to damage the guide rail with the cylinder head when removing and installing the cylinder head.

- Feed in, position and install cylinder head (1) and exhaust turbocharger with the help of an auxiliary person, the workshop crane and the special tool 0 490 567 (11 0 020).
- Ensure that the **guide rails** of the timing chain are **not** damaged.

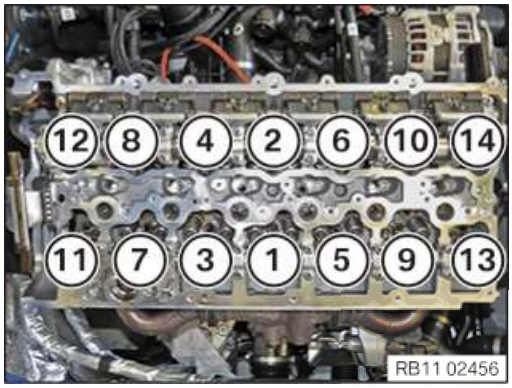
cardiagn.com



- Insert and install washer (2).
- Renew the cylinder head bolts (1).

  Parts: Cylinder head bolts
- Do not wash off the coating (1) **of the cylinder head bolts** .
- **Lightly** oil contact surfaces of cylinder head bolt screw heads.

  No coolant, water or engine oil must be present in threaded holes of crankcase.
- Guide in and install cylinder head bolts (1).



TECHNICAL INFORMATION

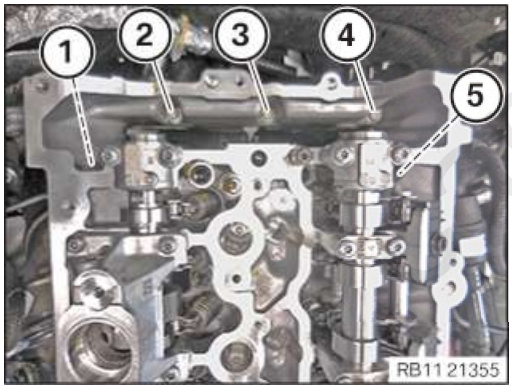
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Screw in the cylinder head bolts in the sequence (1) to (14).
- Tighten the cylinder head bolts using the special tool 0 495 747 (11 8 580) and 0 490 504 (00 9 120) in the sequence (1) to (14).

Cylinder head to crankcase

M11	Observe tightening sequence. Fit new cylinder head bolts.	1. Jointing torque 2. Angle of rotation 3. Angle of rotation	30 Nm 90 ° 180 °

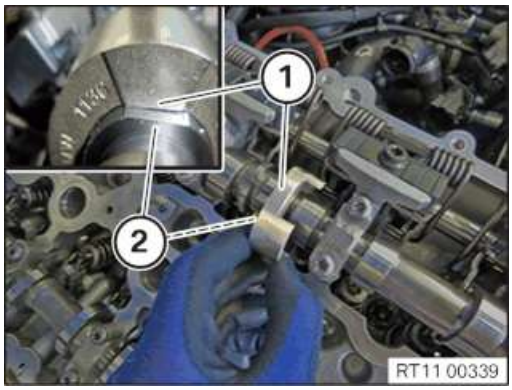


- Renew cylinder head bolts (1) to (5).

  Parts: Cylinder head bolts
- Make sure that there is **no** coolant, water or engine oil in the threaded holes of the timing case cover.
- Screw in cylinder head bolts (1) to (5).
- Tighten the cylinder head bolts in the order (1) to (5).

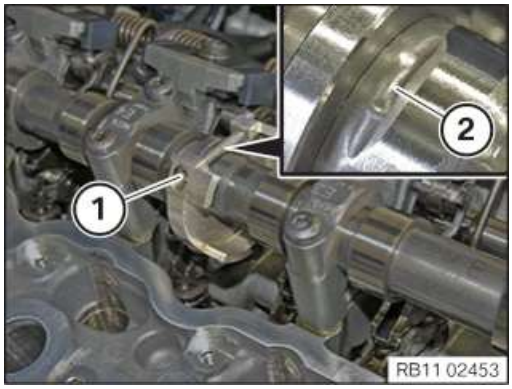
Cylinder head bolt to timing case cover

M8x40	Renew screws.	Tightening torque	19 Nm



- Feed in and position camshaft sensor wheel (1) on the intake camshaft (2).

tdiagn.com



- Rotate intake camshaft, if necessary in the position shown.

  The recess (2) must point upwards.
- Tighten down screw (1).

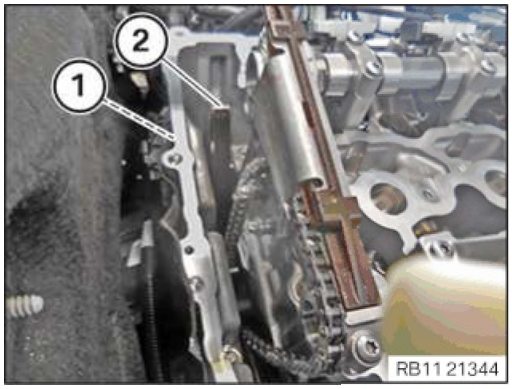
Camshaft sensor wheel to intake camshaft

M4 x35		4,5 Nm



- Renew bearing journal (1).

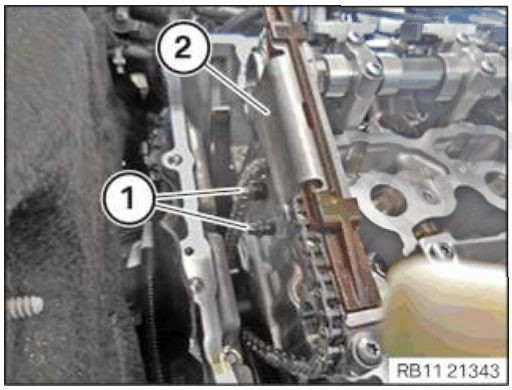
  Parts: Bearing journal



- Feed in and install bearing journal (1) on the guide rail (2).
- Tighten the bearing journals (1).

Bearing journal to cylinder head

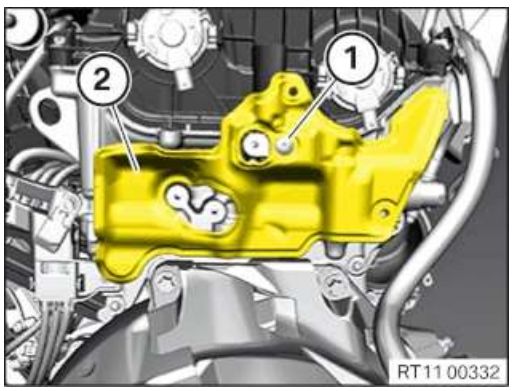
Bearing journal	Renew the bearing journal!	Tightening torque	20 Nm



- Insert slide rail (2) and install.
- Tighten the screws (1).

Sliding rail to cylinder head

M6x16			8 Nm

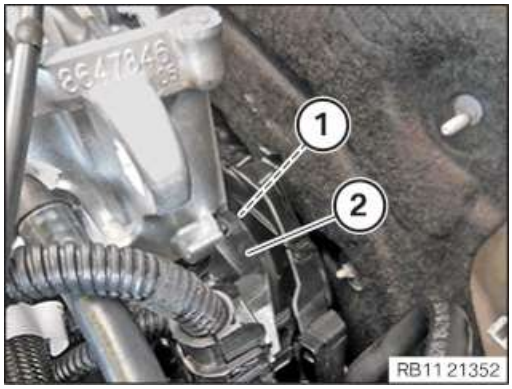


- Guide in and install cover (2).
- Tighten down screw (1).

Cover on rear cylinder head

M6		Tightening torque	8 Nm

ardiagn.com



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

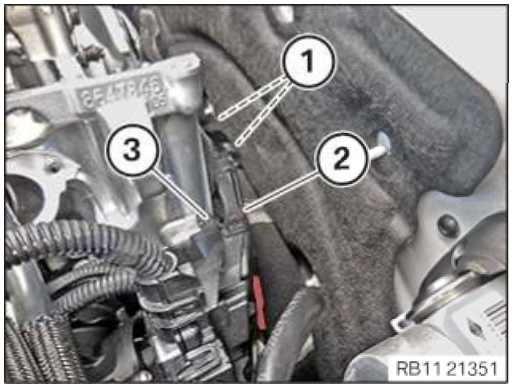
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

- Guide in and install wiring harness section (2) for sensor system 1.
- Tighten down screw (1).

Cable routing to cylinder head, rear

M6 x 20		Tightening torque	8 Nm



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

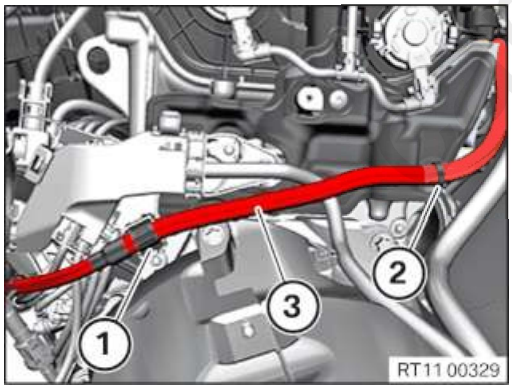
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

- Guide in and install transmission wiring harness (2) on wiring harness section (3) for sensor system 1.
- Tighten the screws (1).

Cable routing to cylinder head, rear

M6 x 20		Tightening torque	8 Nm



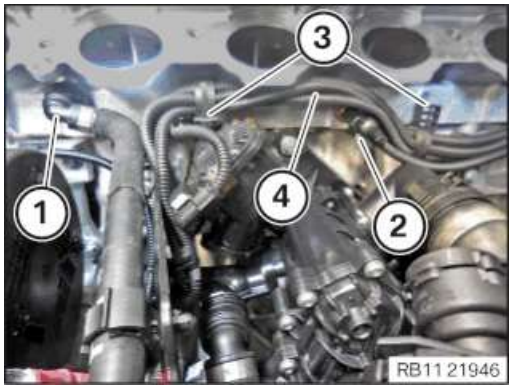
CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Insert and install the positive battery cable (3).
- Secure clamps (1) and (2).



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

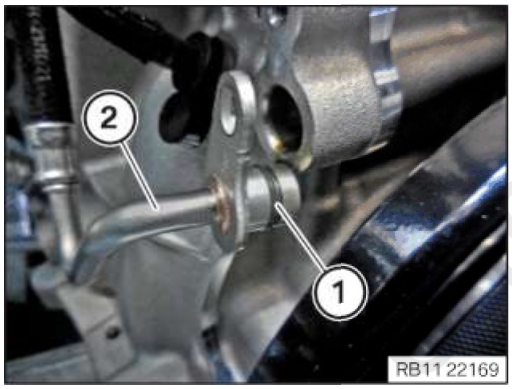
- Connect connectors (2) and lock.

  The connector must engage audibly.
- Guide in and position the wiring harness section (4) of sensor system **1**.
- Secure clamps (3).
- Connect and lock coolant line (1).
- Make sure that the cooling line (1) engages audibly.



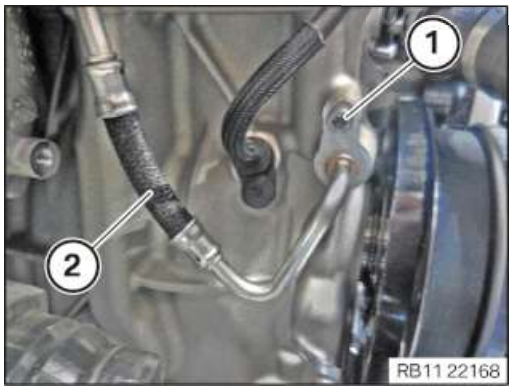
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Renew sealing ring (1) on the oil feed line (2) of the exhaust turbocharger with special tool 0 496 714 (00 9 030).

  Parts: Sealing ring

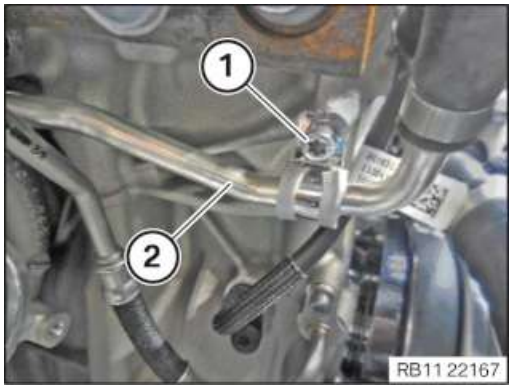


- Feed in and install the oil feed line (2) for the exhaust turbocharger.
- Tighten down screw (1).

Oil feed line for exhaust turbocharger to crankcase

M6 x 12	Replace sealing ring.	Tightening torque	8 Nm

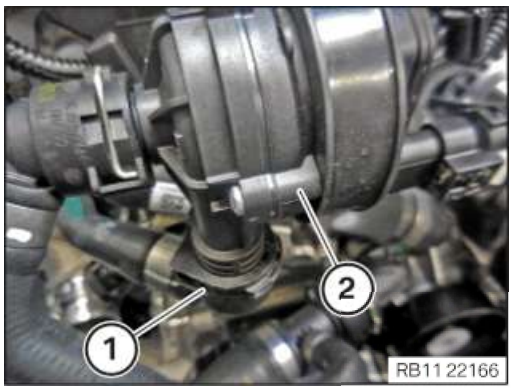
tdiagn.com



- Tighten screw (1) on the coolant return line (2).

Coolant return line holder bracket to crankcase

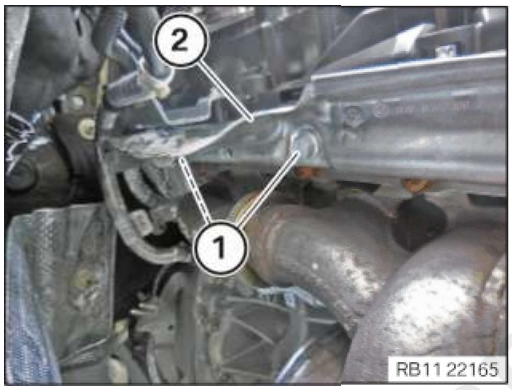
M6X12		Tightening torque	8 Nm



- Connect coolant return line (1) to the coolant pump (2) for the exhaust turbocharger and lock.

  The coolant return line (1) must engage audibly.

- Connect coolant return line (1) for the exhaust turbocharger and lock.
- Ensure the coolant return line (1) audibly engages.



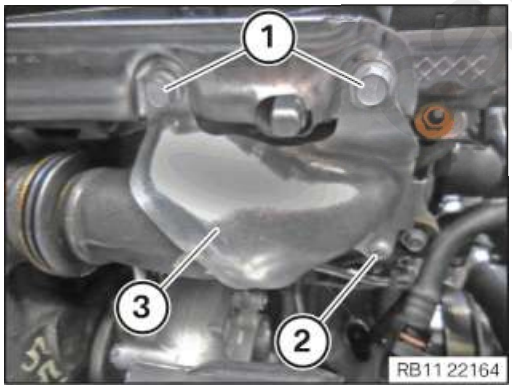
- Feed in and install the heat shield (2).
- Renew screws (1).

  Parts: Bolts

  Tighten the screws (1).

Heat shield to cylinder head

M8X12	Renew screws.	Tightening torque	19 Nm



- Feed in and install the heat shield (3).
- Renew screws (1).

  Parts: Bolts

  Tighten the screws (1).

Heat shield to cylinder head

M8X12	Renew screws.	Tightening torque	19 Nm

- Renew the screw (2).

  Parts: Screw

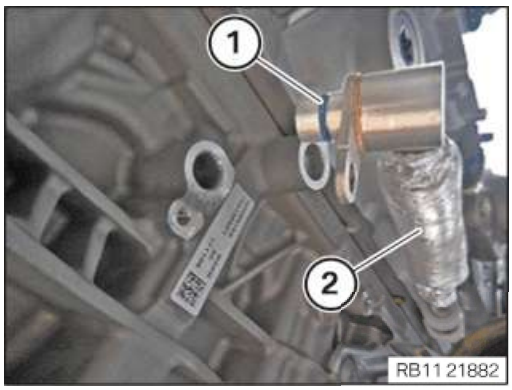
  Tighten down screw (2).

Heat shield to clamping strip

M6X16	Renew screw.	Tightening torque	8 Nm

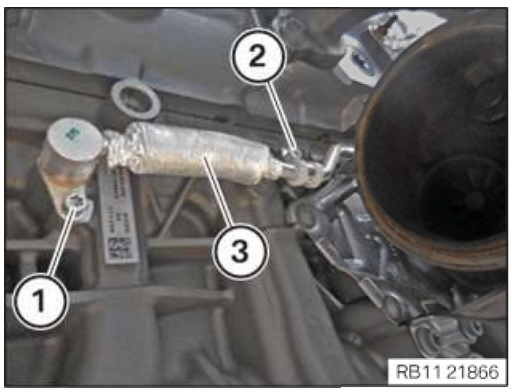


- Unscrew the bolts (1) of the special tool .
- Feed out the special tool at the cylinder head and remove.



- Renew sealing ring (1) on the coolant feed line (2) of the exhaust turbocharger with special tool 0 496 714 (00 9 030).

  Parts: Sealing ring



- Feed in and install coolant feed line for the exhaust turbocharger (3).
- Tighten down screw (1).

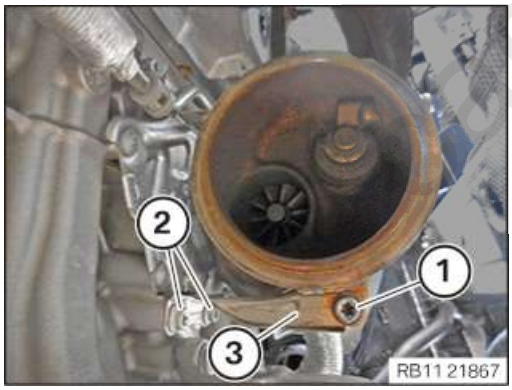
Coolant feed line to crankcase

M6X12		Tightening torque	8 Nm

- Tighten down screw (2).

Coolant feed line to crankcase

M6X12		Tightening torque	8 Nm



- Renew screws (1) and (2).

  Parts: Bolts
- Feed in and install support (3).
- Tighten the screws (2).

Exhaust turbocharger support to crankcase

M8 x 20	Renew screws.	19 Nm

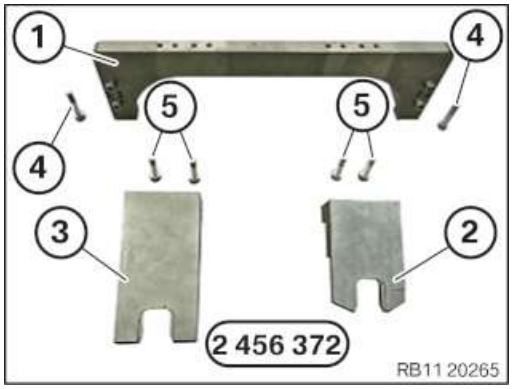
- Tighten the screws (1).

Exhaust turbocharger to support

M8 x 25	Renew screw.	19 Nm

55 – Adjust the camshafts with the special tool

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- Overview of the set of special tools 2 456 372:

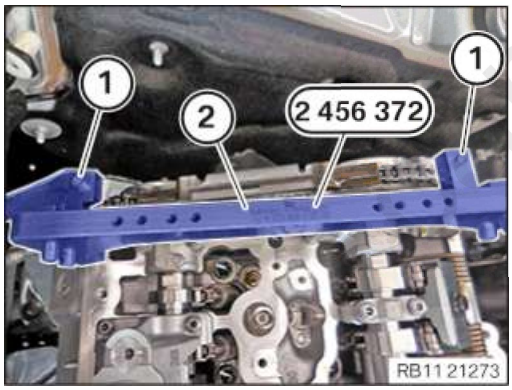
Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Use the setting gauge 0.7 ° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.



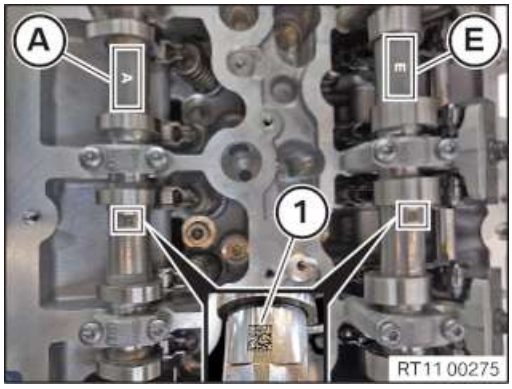
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

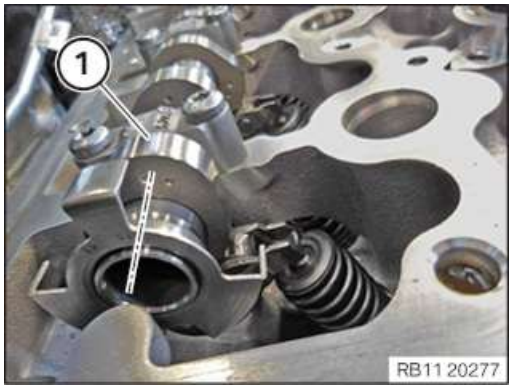
Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Turn the intake camshaft (E) and the exhaust camshaft (A) such that the marks (1) can be read from the top.

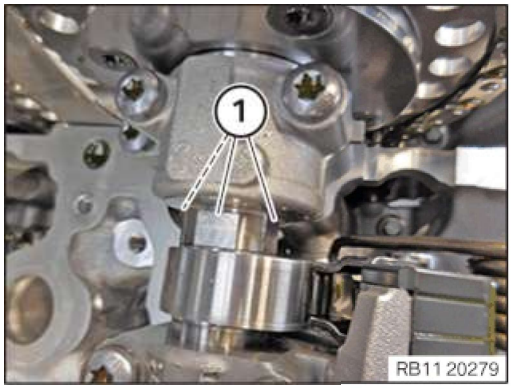
.diagn.com



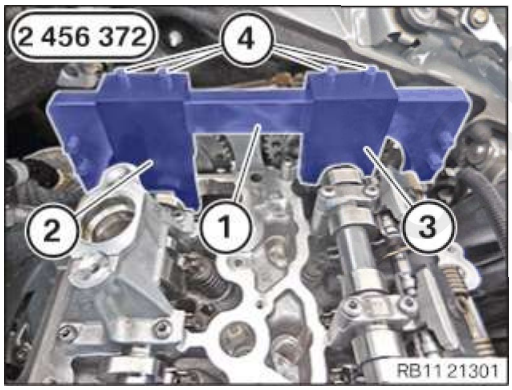
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



- Position the setting gauge 0.5° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten the screws (4).

Test gauge to basic carrier

M6		Tightening torque	8 Nm

56 – Installing the intake adjuster

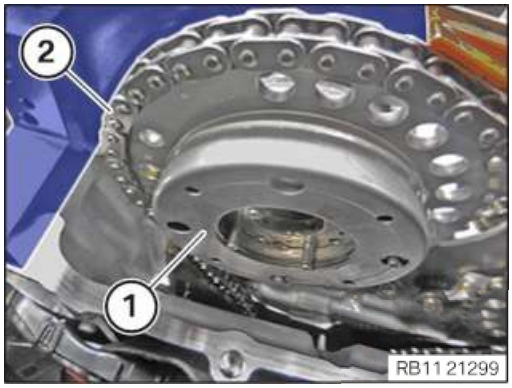
NOTICE

The figure shows the rear side of the engine.

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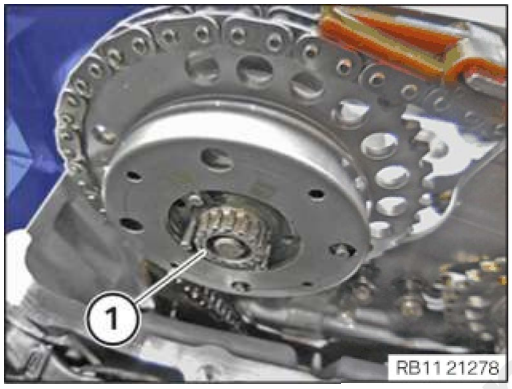


- Keep intake adjuster (1) marked IN ready.

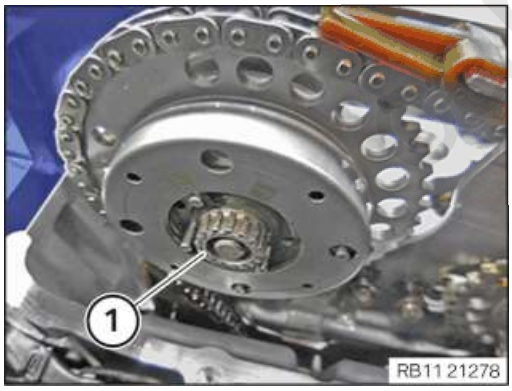


- Feed in intake adjuster (1) in the timing chain (2) and position on the intake camshaft .

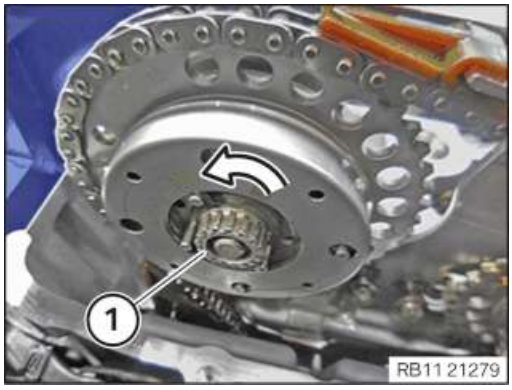
57 – Install the VANOS central valve of the intake adjuster



- 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 °.

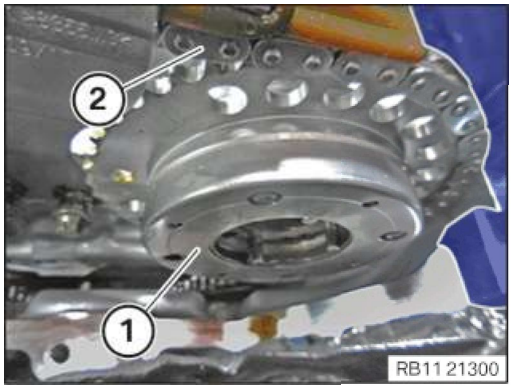
58 – Install exhaust camshaft adjuster

NOTICE

The figure shows the rear side of the engine.

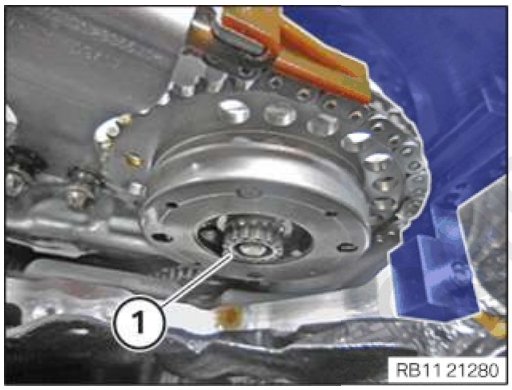


- Keep exhaust camshaft adjuster (1) marked EX ready.

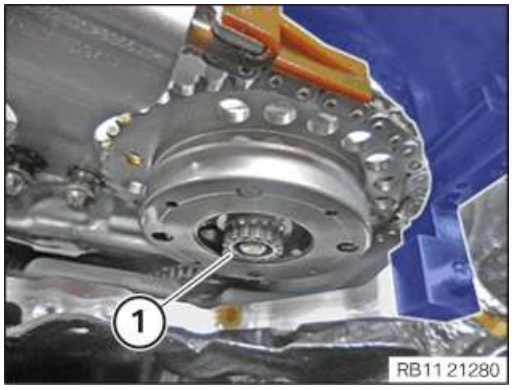


- Feed in exhaust camshaft adjuster (1) in the timing chain (2) and position on the exhaust camshaft .

59 – Installing the VANOS central valve of the exhaust camshaft adjuster

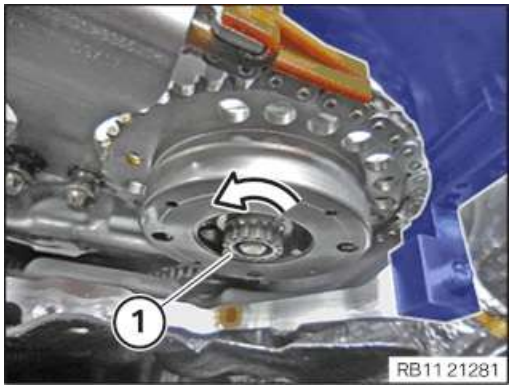


- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.



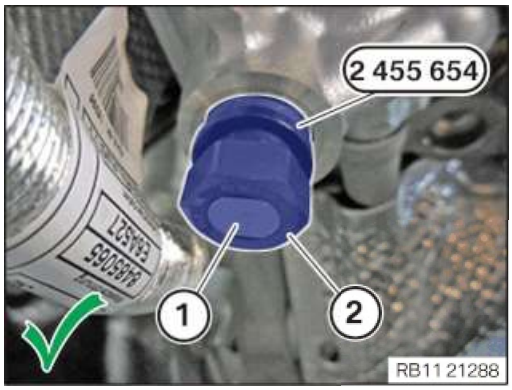
- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

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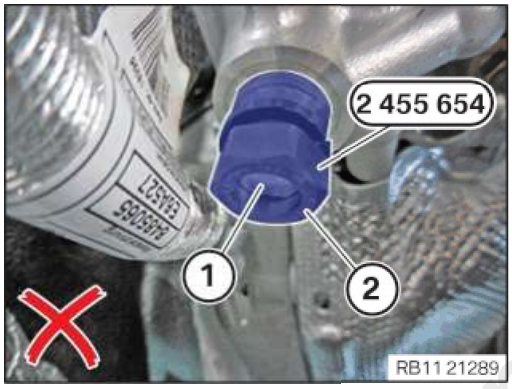
- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

60 – 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.

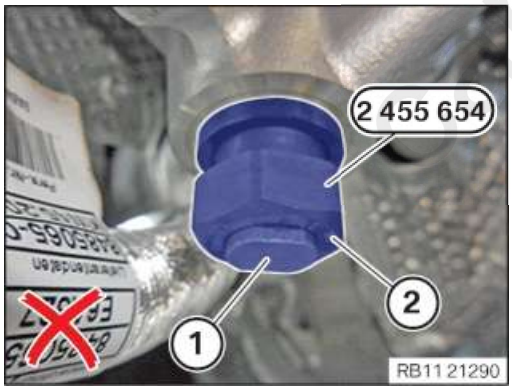
  The pin (1) must align **precisely** with housing (2).



- 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**.

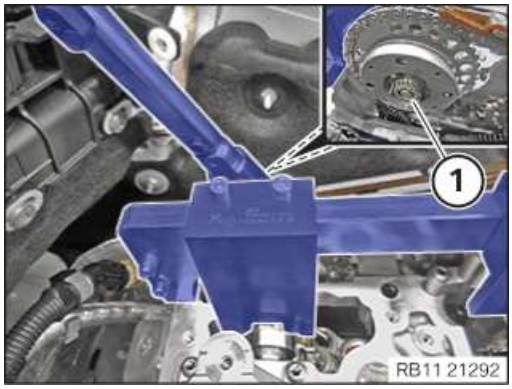
  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

61 – 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 °

62 – 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.

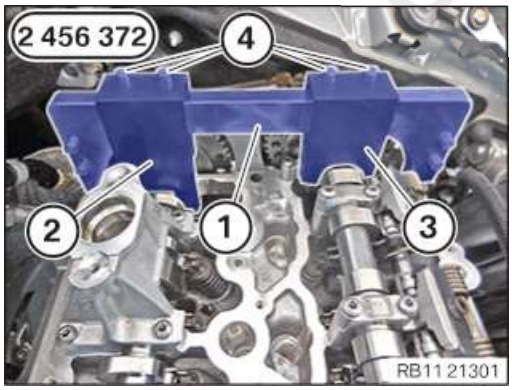


- Tighten the VANOS central valve (1) of the intake adjuster.

VANOS central valve to camshaft

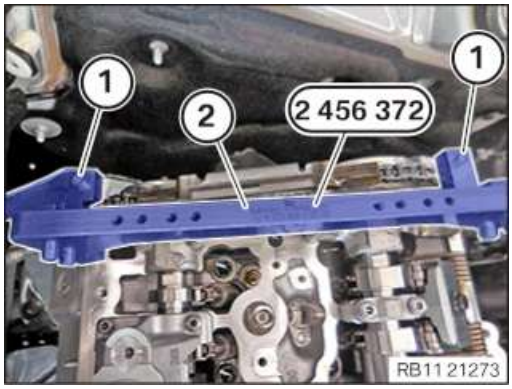
M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

63 – Disassembling all special tools

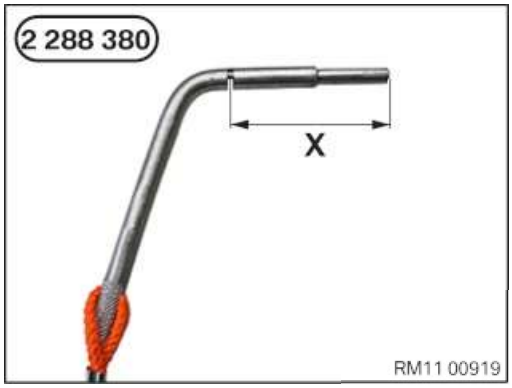


- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) and remove.

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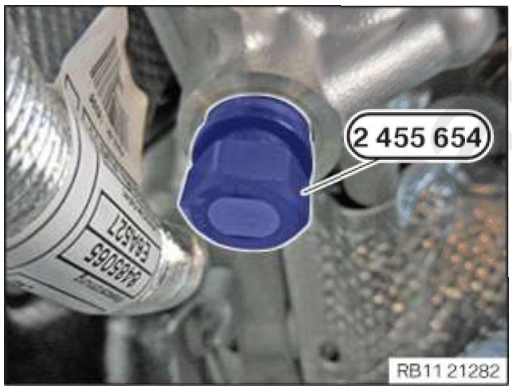
- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.



- Guide the special tool 2 288 380 out and remove.



- Guide the special tool 0 493 380 (11 6 480) out and remove.



- Guide the special tool (1)2 455 654 out and remove.

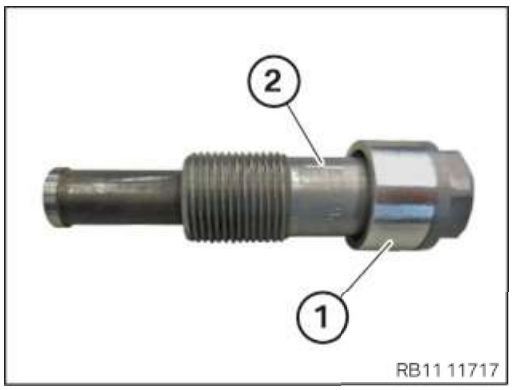
64 – Install chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

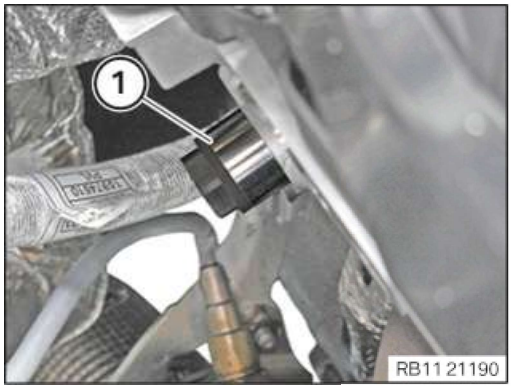


- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.

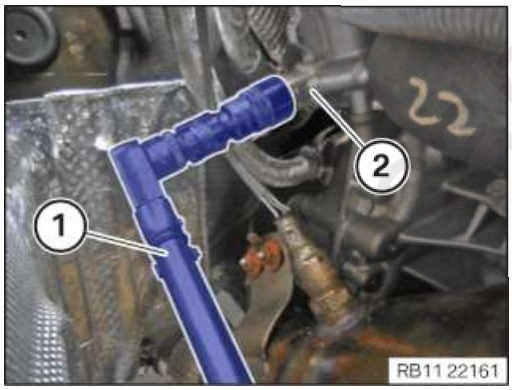


- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.



- Insert and install the chain tensioner (1).

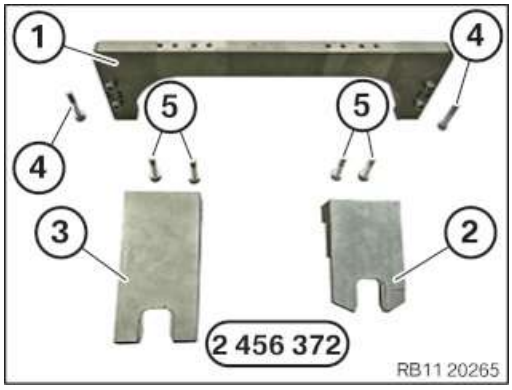


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

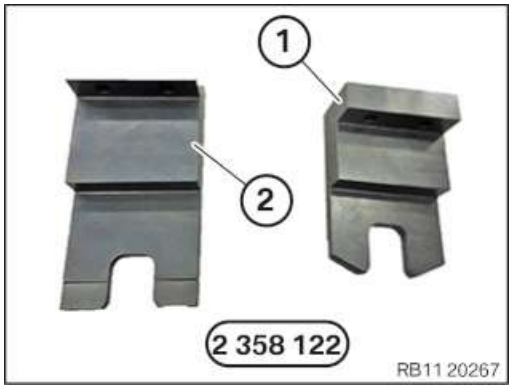
65 – Checking camshaft timing



- Have the set of special tools 2 456 372 ready.

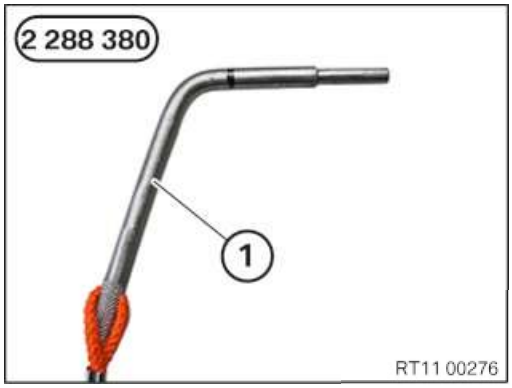
Number	Description
1	Basic carrier
2	0.7° setting gauge to adjust the intake camshaft
3	0.5° setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

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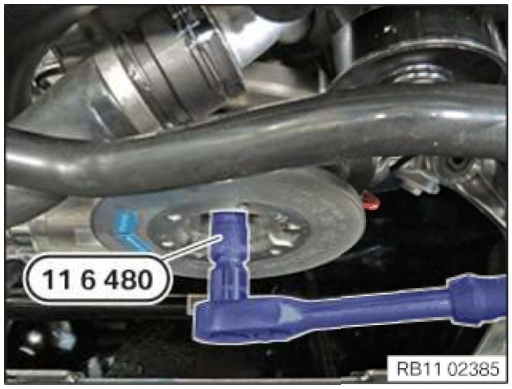
- Keep the test gauge from the set of special tools 2 358 122 ready.

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



- Have the special tool 2 288 380 ready.

Number	Description
1	Locating stud



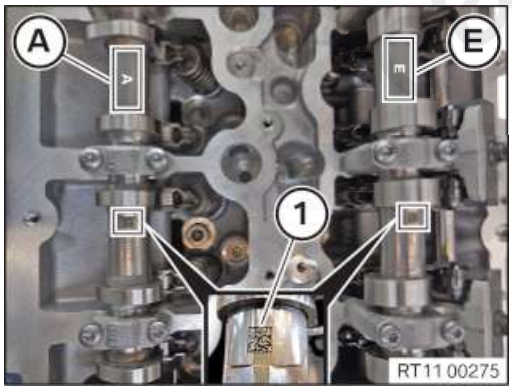
RISK OF DAMAGE

Damage to the engine.

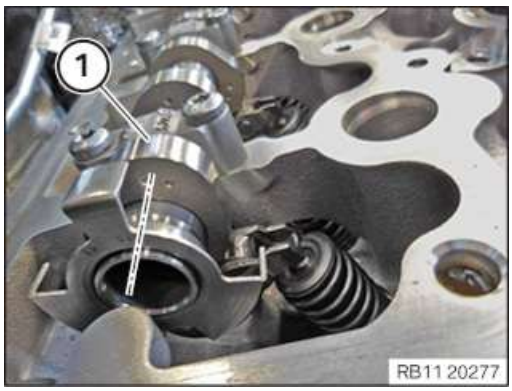
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



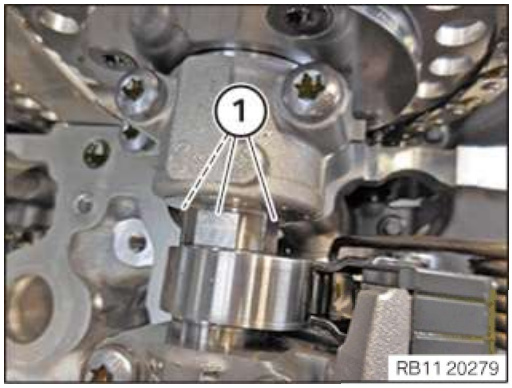
- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.



- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



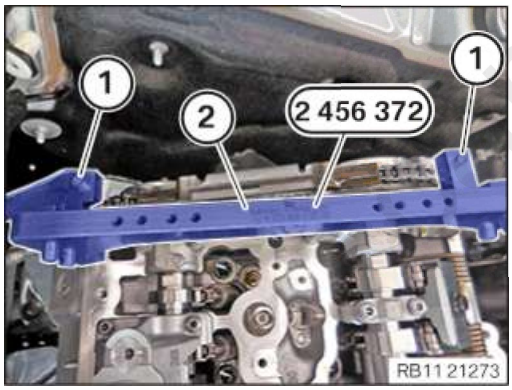
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



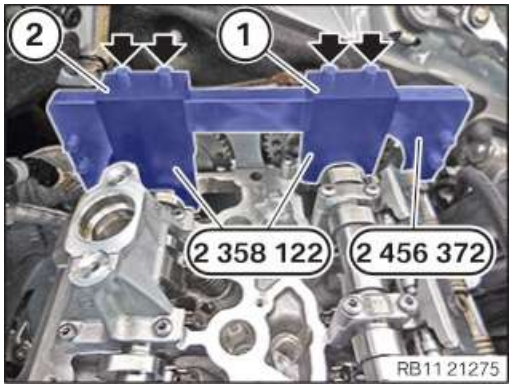
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

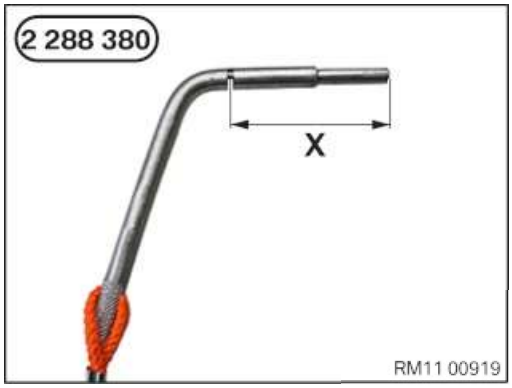
Test gauge to basic carrier

M6		Tightening torque	8 Nm

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- Thread the sealing cap (1) out and remove.



- **Vehicles with automatic transmission:**

  Dimensions (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

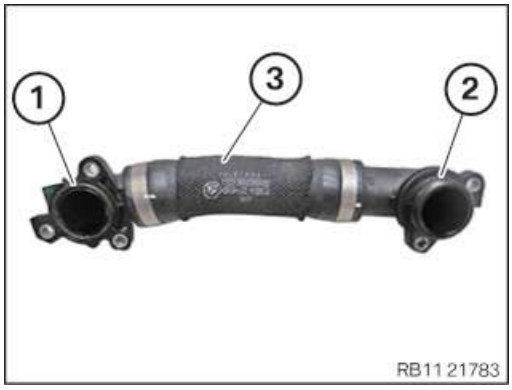


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

  The engine **is in the** TDC firing position of cylinder 1.

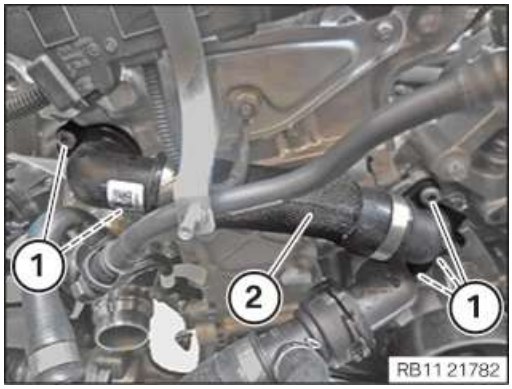
66 – Install the coolant line between the cylinder head and the coolant pump



- Check sealing rings (1) and (2) for damage; renew coolant line (3) if necessary.

  Parts: Sealing ring

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TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

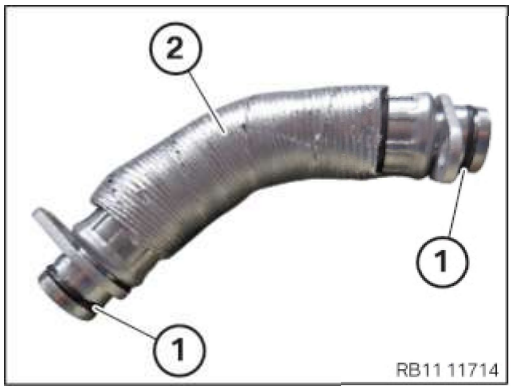
Non-observance of these requirements may result in leaks and damage.

- Feed in and install coolant line (2).
- Hand-tighten the bolts (1).
- Tighten the screws (1).

Coolant line to coolant pump/cylinder head

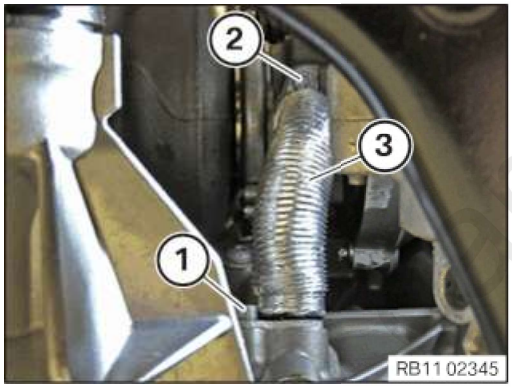
M6x20		Tightening torque	8 Nm

67 – Installing the oil return line for the exhaust turbocharger



- Renew the sealing rings (1) on the oil return line (2).

  Parts: Sealing ring



- Feed in and install the oil return line (3).
- Tighten down screw (2).

Oil return line to turbocharger

M6 x 12		8 Nm

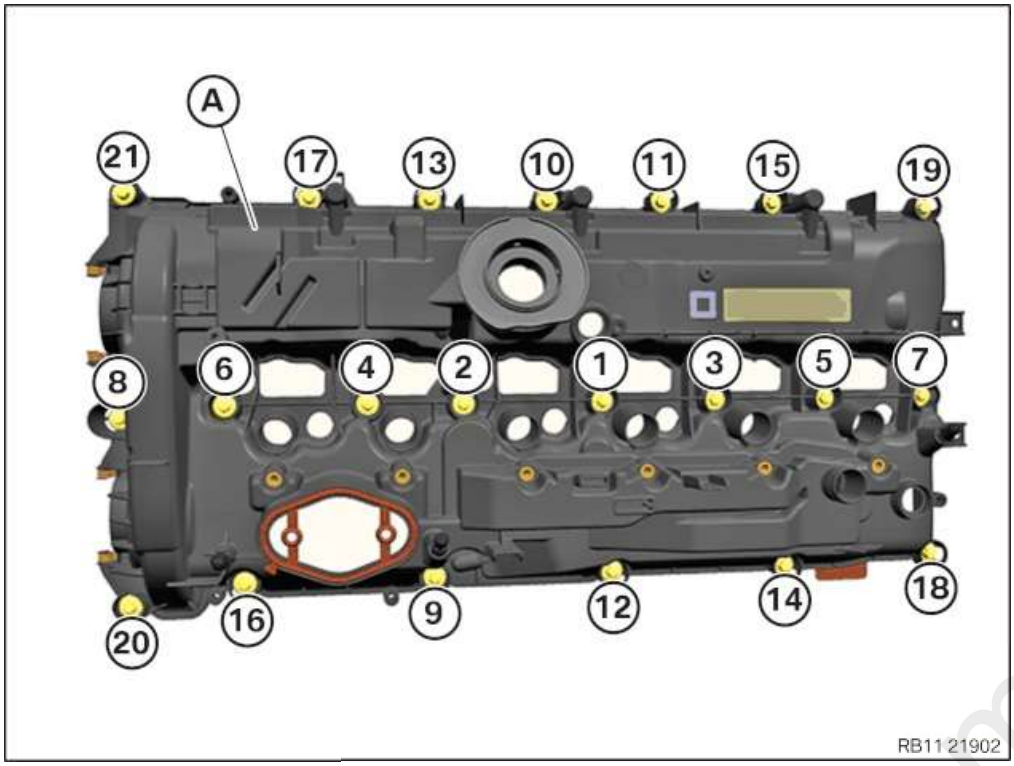
- Tighten down screw (1).

Oil return line to crankcase

M6 x 12		8 Nm

68 – Installing cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 21 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

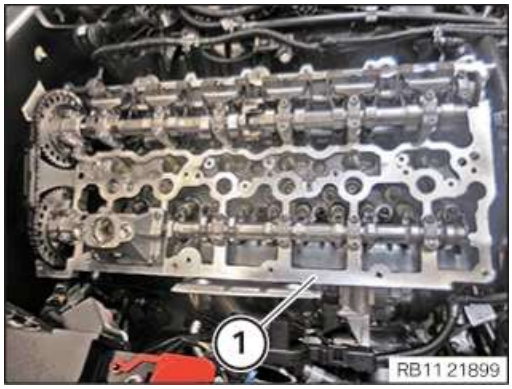
Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

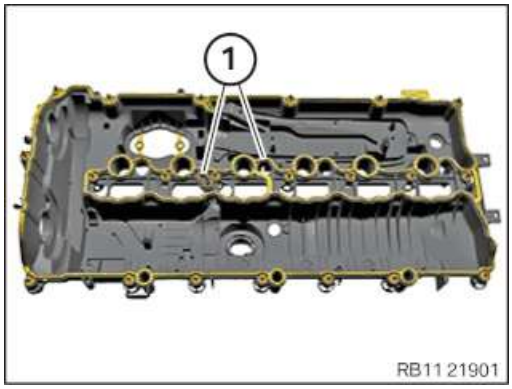
TECHNICAL INFORMATION

Latch mechanisms, guides and mounting elements must not be damaged or missing.



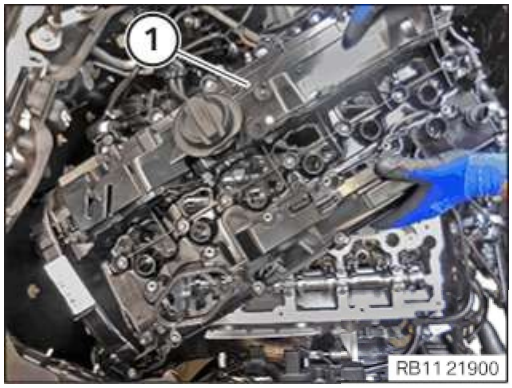
- Contact surface (1) must be free from oil and grease.

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- Replace the seals (1).

  Parts: Seals

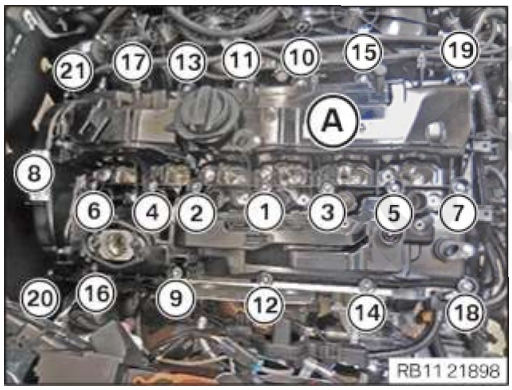


- Insert and install cylinder head cover (1).



- Ensure that the cylinder head cover (1) is installed in the **marked** area correctly on the high pressure pump bracket(2).

  The cylinder head cover (1) must not touch the high pressure pump bracket (2) in the **marked** area.



- Position the cylinder head cover (A).
- Make sure that the cylinder head cover (A) does not touch the high pressure pump bracket!
- Tighten all bolts in sequence (1) to (21).

Cylinder head cover to cylinder head

M6X30		Jointing torque	8 Nm

- Tighten all screws in a sequence from (1) to (21).

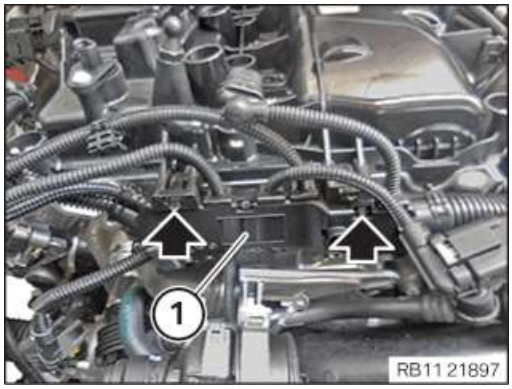
Cylinder head cover to cylinder head

M6X30		Tightening torque	11 Nm

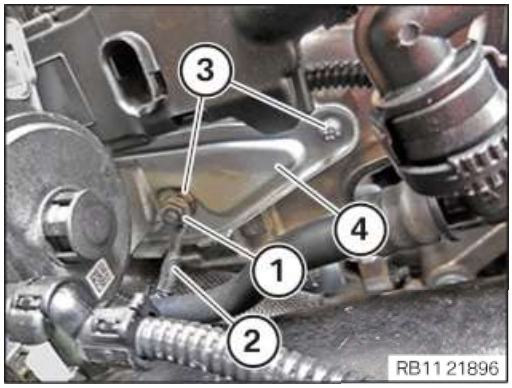


- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

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- Feed in and install wiring harness section (1) for sensor system **2**.
- Make sure that you can hear the locks (arrows) engage.



- Insert and position the holders (4).
- Tighten the screws (3).

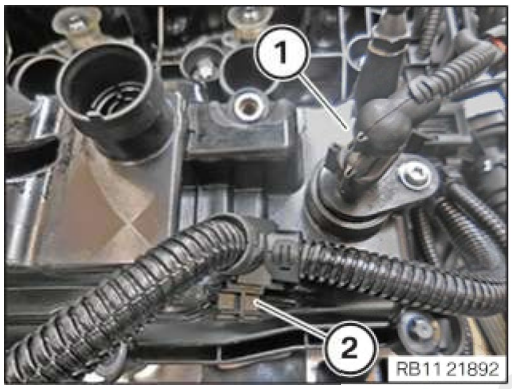
Auxiliary coolant pump holder to cylinder head

M6		Tightening torque	7 Nm

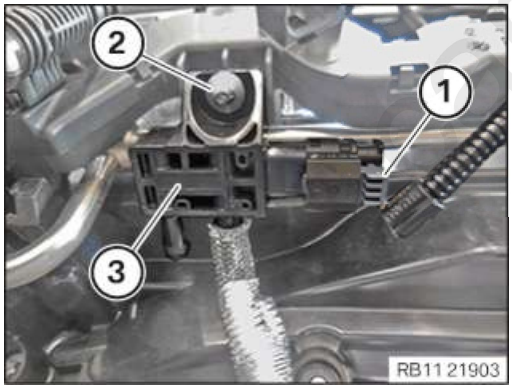
- Thread in ground cable (2) and install.
- Tighten nut (1).

Standard screw connection M6

M6			8 Nm



- Connect and lock the connector (1) on the exhaust camshaft sensor .
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).



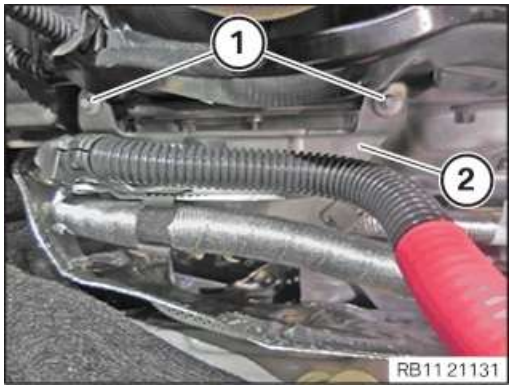
- **If installed:**
- Feed in and install the differential pressure sensor (3).
- Tighten down screw (2).

Differential pressure sensor to holder

TS6X18		Tightening torque	3,5 Nm

- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.

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CAUTION

Improper routing of the positive battery cable.

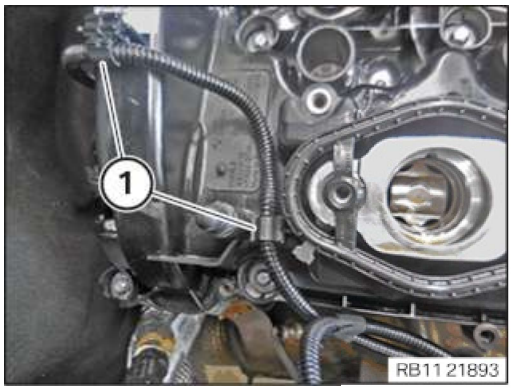
Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

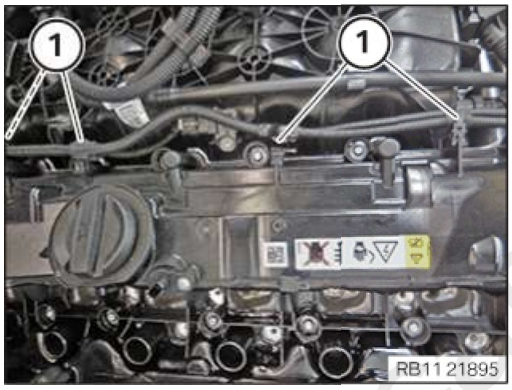
- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

Holder, positive battery cable to cylinder head cover

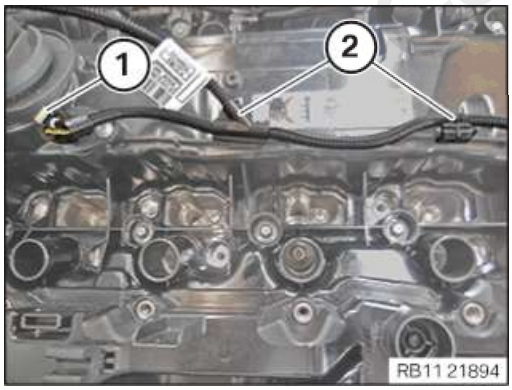
6X18		Tightening torque	6 Nm



- Secure clamps (1).



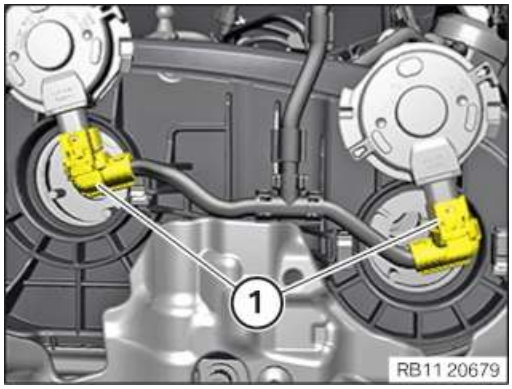
- Secure clamps (1).



- Connect connector (1) to the intake camshaft sensor and lock it.
- Make sure the connector (1) engages audibly.
- Secure clamps (2).

69 – Installing both actuators

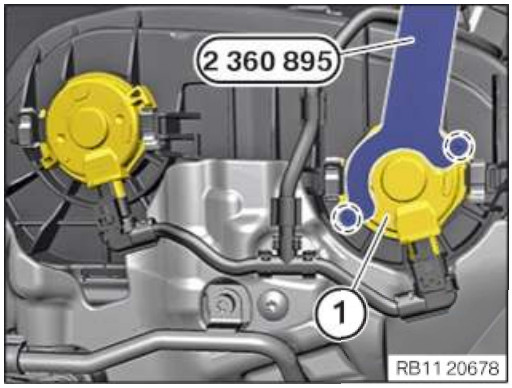
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NOTICE

The figure shows the rear side of the engine.

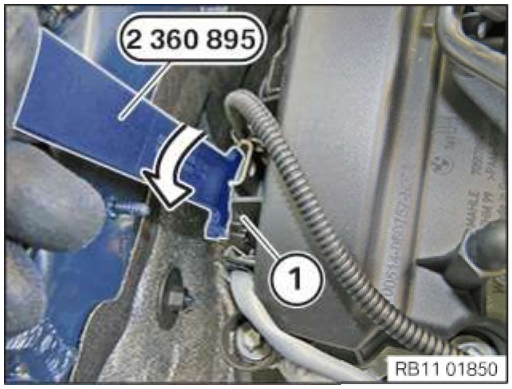
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



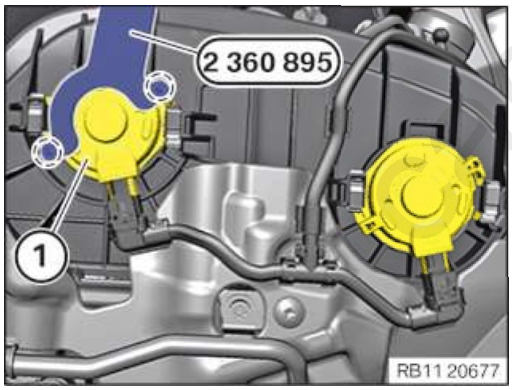
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



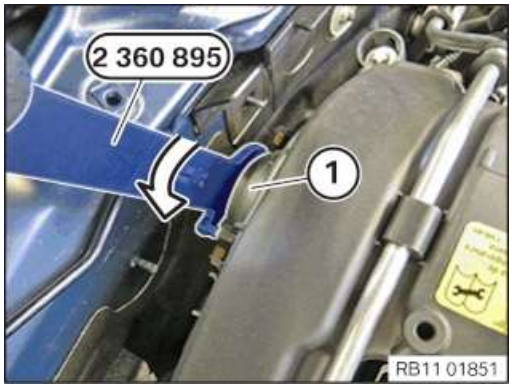
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.



NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

70 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

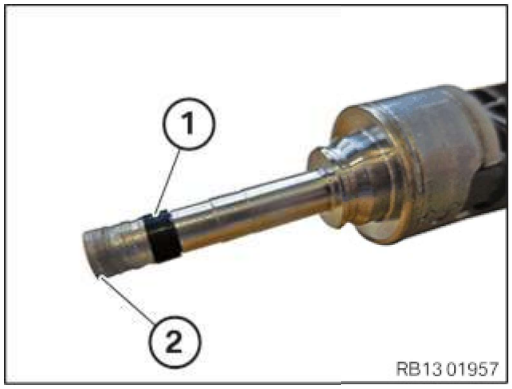
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

TECHNICAL INFORMATION

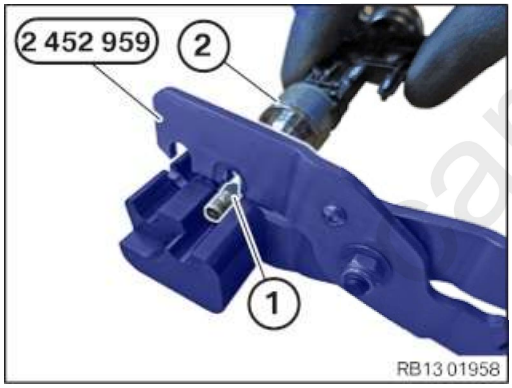
Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.



- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings
- Avoid mechanical contact with injector tip (2).



- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.



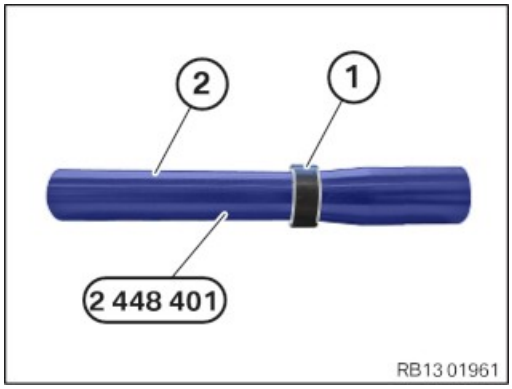
- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

  (1) Installation cone

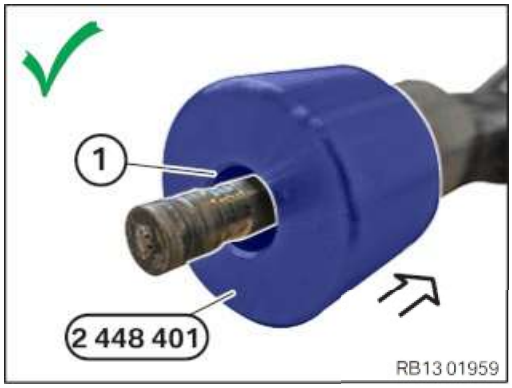
  (2) Sliding sleeve

  (3) Assembly sleeve

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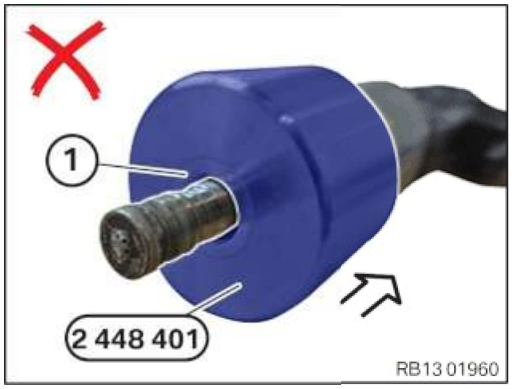


- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



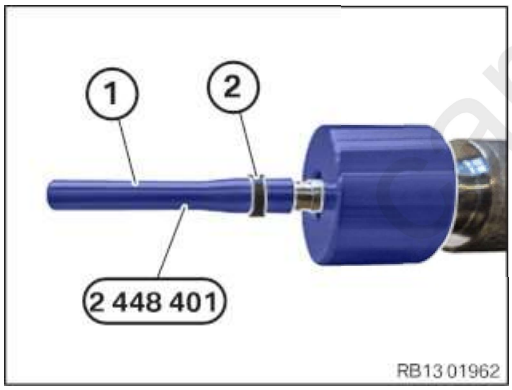
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The larger diameter of the assembly sleeve (1) must point to the injector tip.

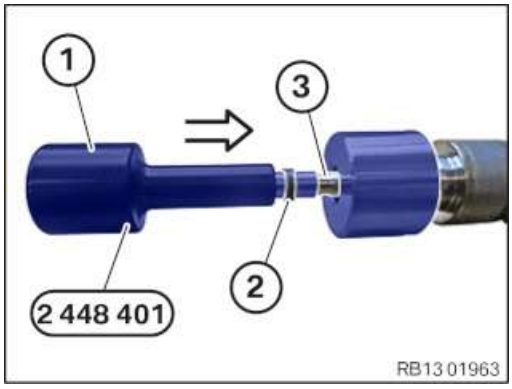


- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.

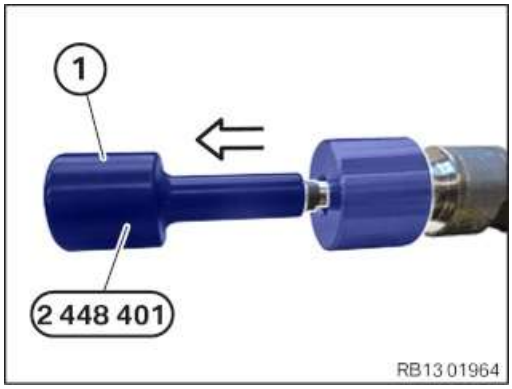


- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .

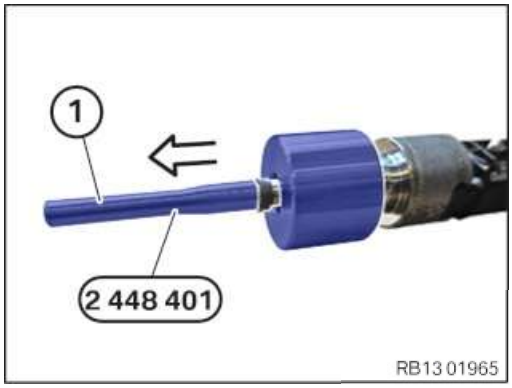


- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.

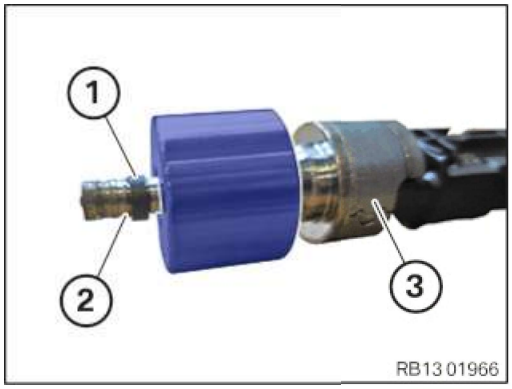
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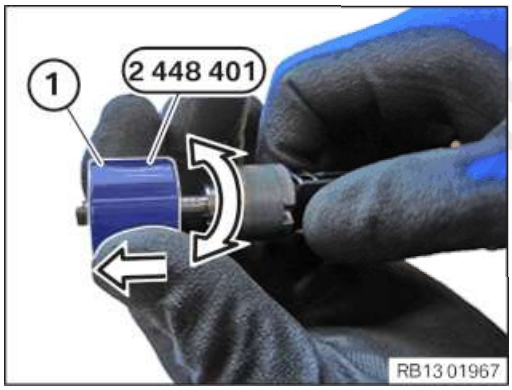
- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

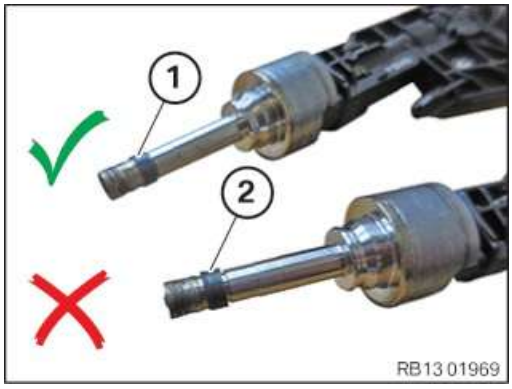


- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.



- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).

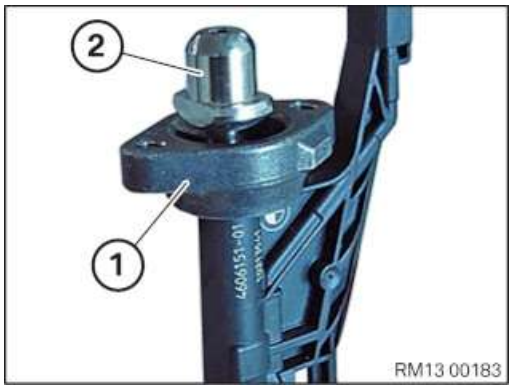


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

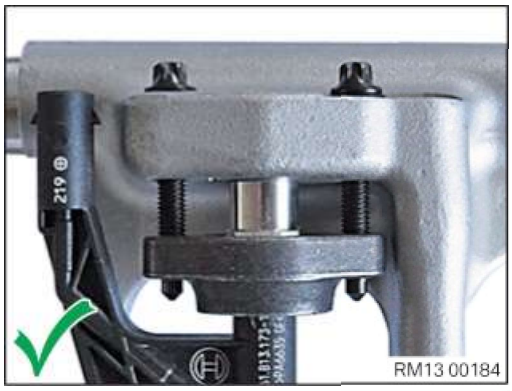
71 – Installing the high-pressure rail with injectors of the cylinders 4 to 6

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.

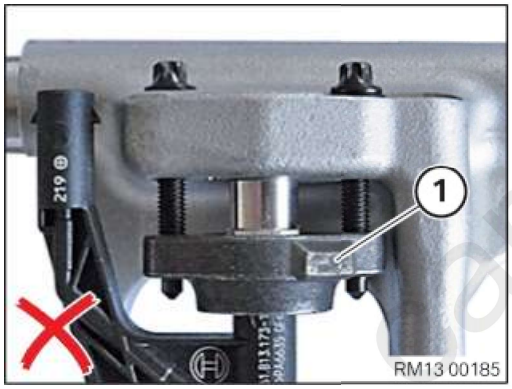


- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder**(1) **has a cast lug**: Make sure that the holder is installed in the correct position.



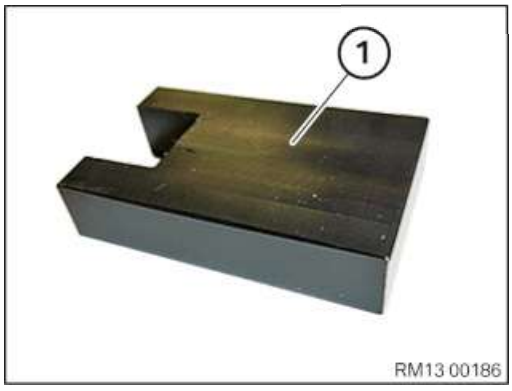
- If applicable, note the position of the cast lug:

  The holder is mounted **correctly** when the cast lug is located at the rear.



- If applicable, note the position of the cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.



RISK OF DAMAGE

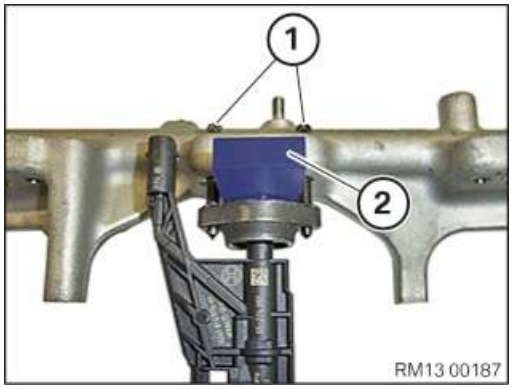
Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).

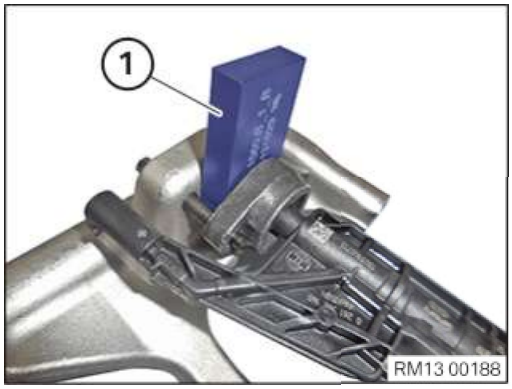
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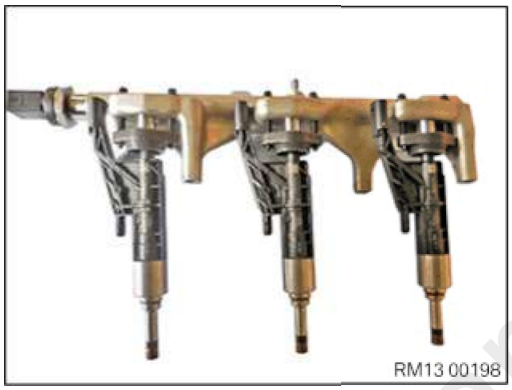
- Replace (M5x30) screws.

  Parts: Screws (M5x30)
- Mount the injectors with the holders and the bolts (M5x30) (1) on the rail.
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.
- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) evenly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.



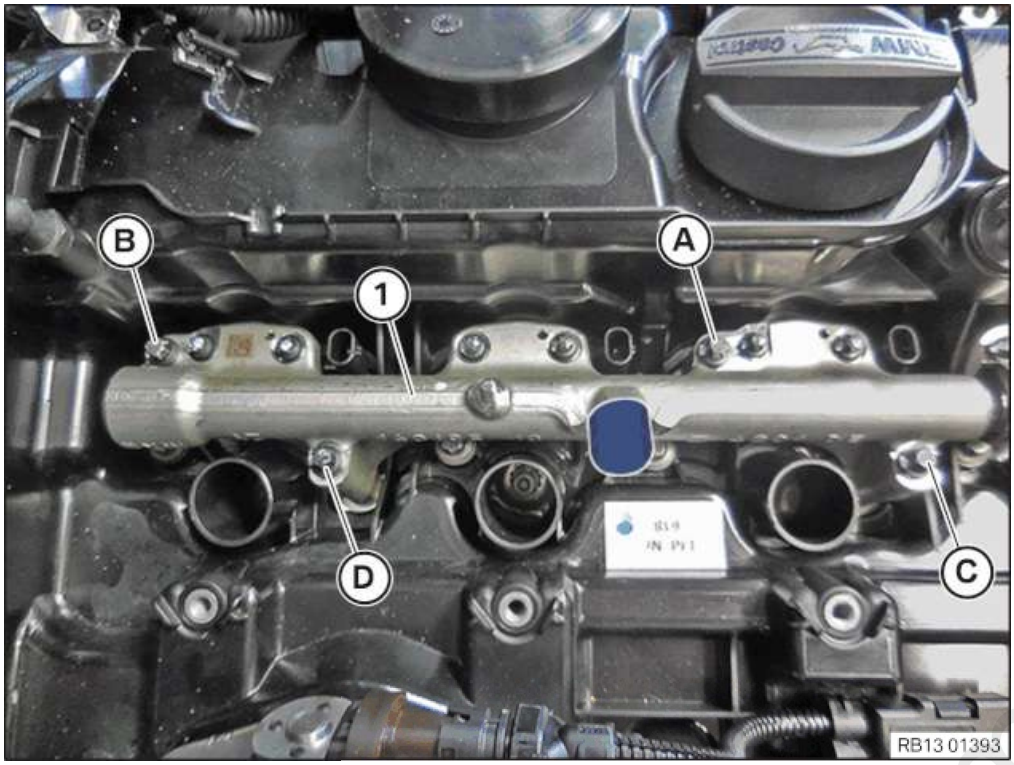
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.



- Check injectors for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors must move freely.

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- Renew screws (A) to (D).

  Parts: Bolts
- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- Press the rail (1) down until a resistance can be felt; join and hand-tighten the bolts (M6x30) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.

  The figure shows the rail resting flat against the cylinder head.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

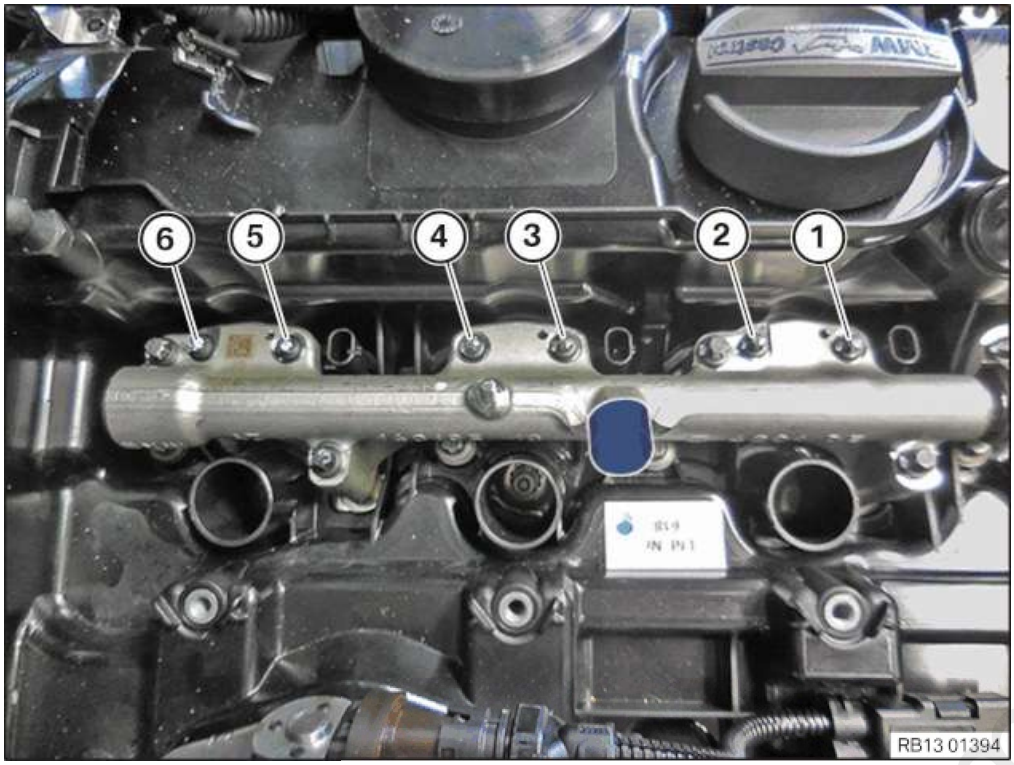
Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.



- Make sure that the rail (1) rests flat against the cylinder head.

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- Attach a socket to an extension.

  Do not use a reversible ratchet or torque wrench.
- Tighten the bolts (M5x30) in pairs ((1) with (2), (3) with (4), (5) with (6)) in alternating order **90° hand-tight**.
- Set the torque wrench to 5 Nm.

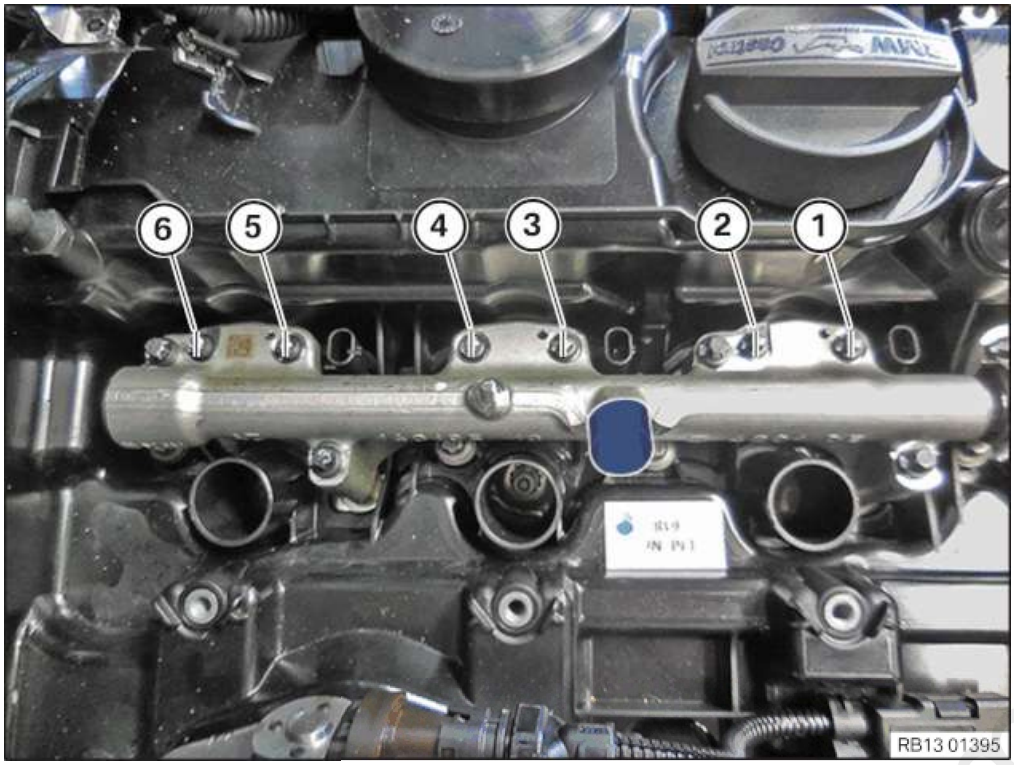
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

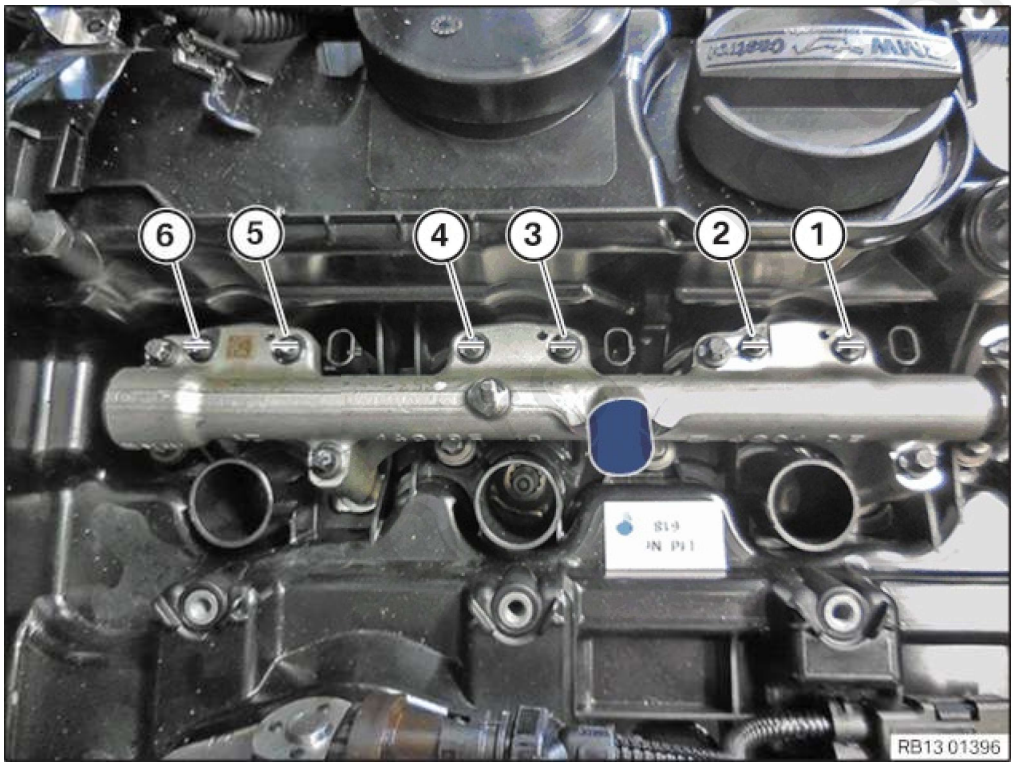
Non-observance of these requirements may result in leaks and damage.

- **Screw the (M5x30) bolts according to the following plan:**
  - **Fuel injector 4:**
  - Tighten screw (1) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (2) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 5:**
  - Tighten screw (3) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (4) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 6**:
  - Tighten screw (5) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (6) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts reach a torque of 5 Nm.

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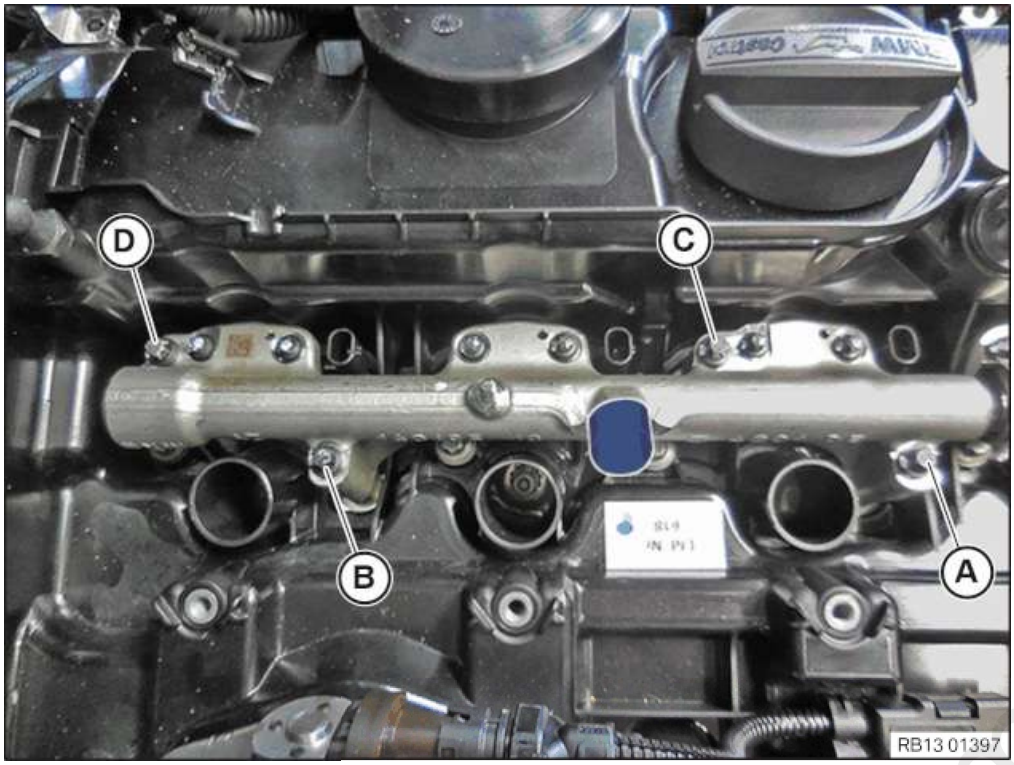


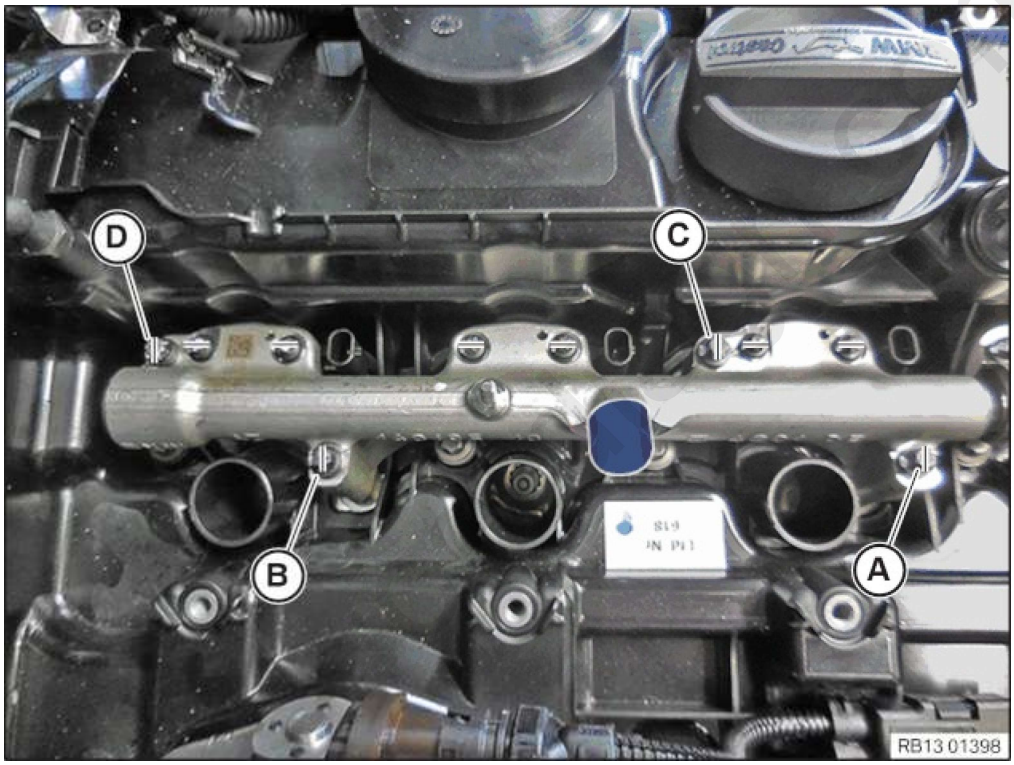
- Mark all bolts (1) to (6) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the screw (1) with an angle of rotation of 90° ±15°.
  - Tighten the screw (2) with an angle of rotation of 90° ±15°.
  - Tighten the screw (3) with an angle of rotation of 90° ±15°.
  - Tighten the screw (4) with an angle of rotation of 90° ±15°.
  - Tighten the screw (5) with an angle of rotation of 90° ±15°.
  - Tighten the screw (6) with an angle of rotation of 90° ±15°.



- Check if all bolts (1) to (6) have been tightened with a 90° ±15° angle of rotation.

  All marks (lines) must be horizontal (see figure).





- Unscrew the bolts (M6x70) (A) to (D).

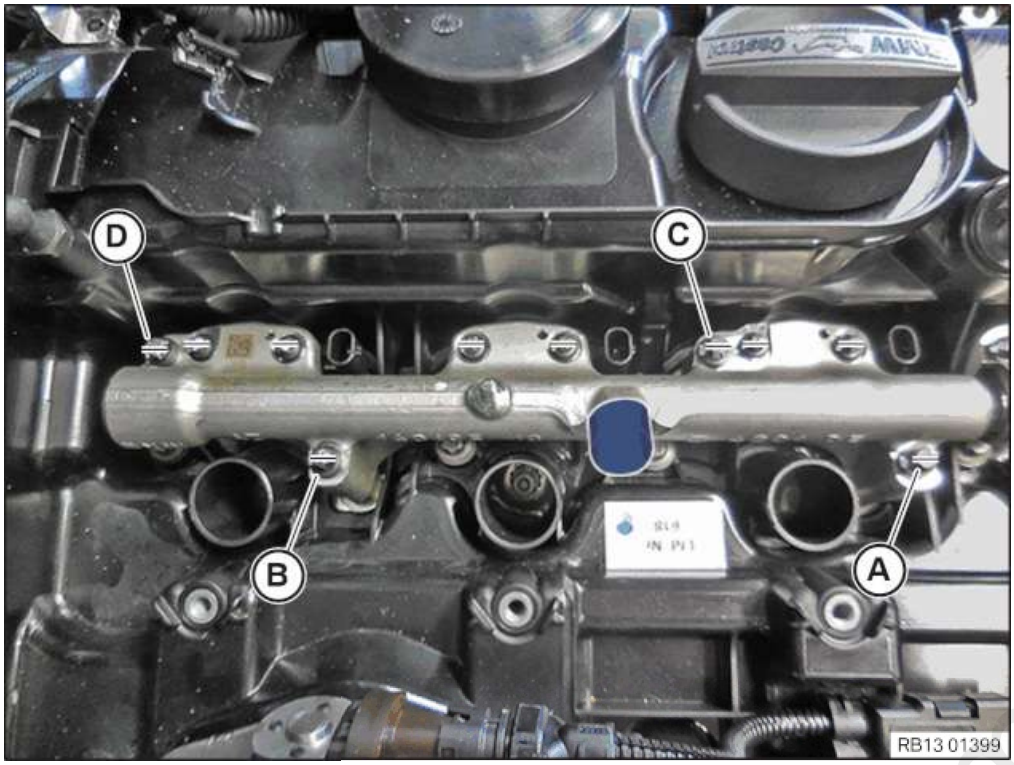
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

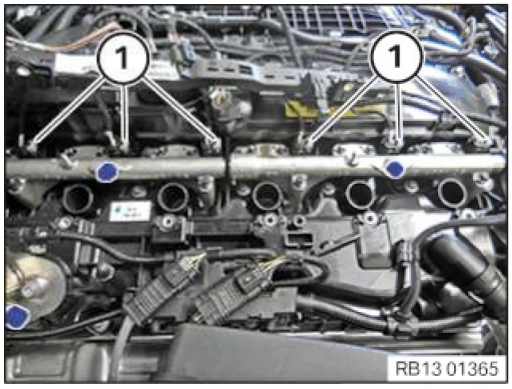
Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.
- Mark all bolts (A) to (D) with a vertical line (see figure).
- Tighten bolts (M6x70) (A) to (D) to a 90° angle of rotation.



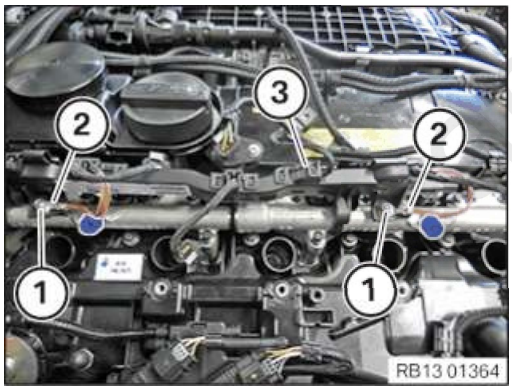
- Check if all bolts (A) to (D) have been tightened with a 90° angle of rotation.

  All marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nuts (1).

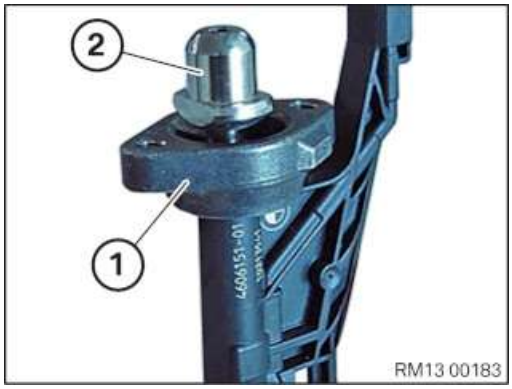
Ground cable to rail

M6			5 Nm

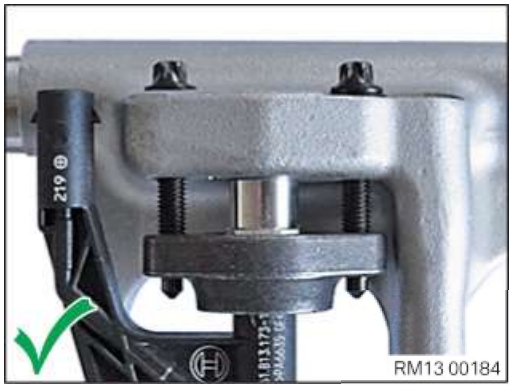
72 – Installing rail with injectors of cylinders 1 to 3

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.

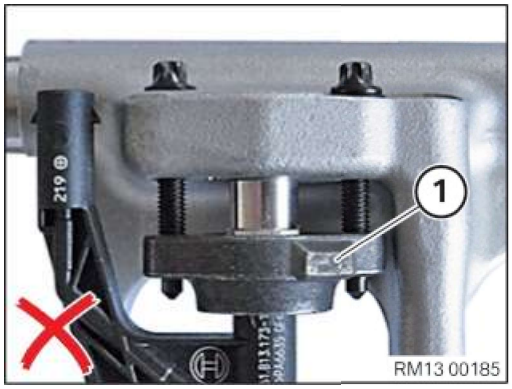


- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If there is a cast lug on the holder** (1) **:** Make sure that the holder is installed in the correct position.



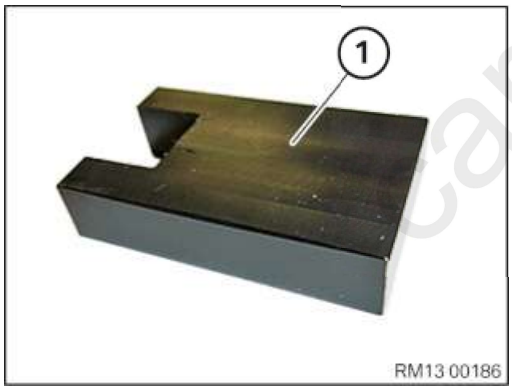
- Observe position of cast lug:

  The holder is mounted **correctly** when the cast lug is located at the rear.



- Observe position of cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.



RISK OF DAMAGE

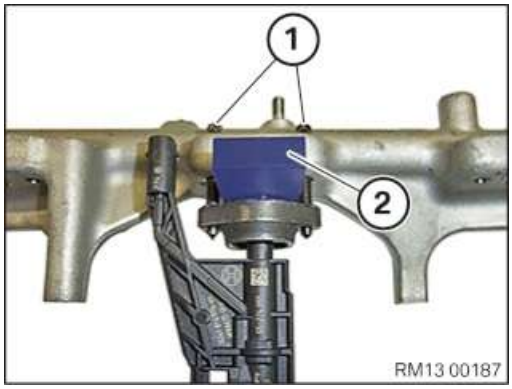
Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use special tool 2 358 022(1) .

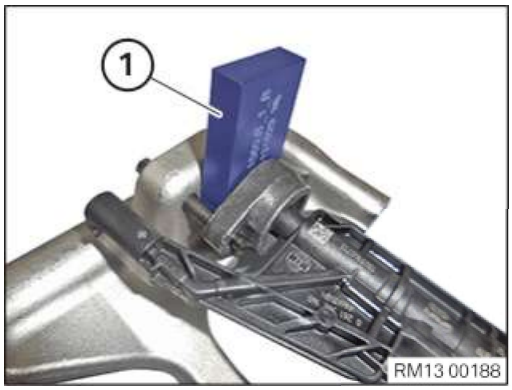
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- Replace (M5x30) screws.

  Parts: Screws (M5x30)
- Mount the injectors with the holders and the bolts (M5x30) (1) on the rail.
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.
- Slide special tool 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure the special tool 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) uniformly until the special tool 2 358 022 (2) rests flat against the rail and the holder.



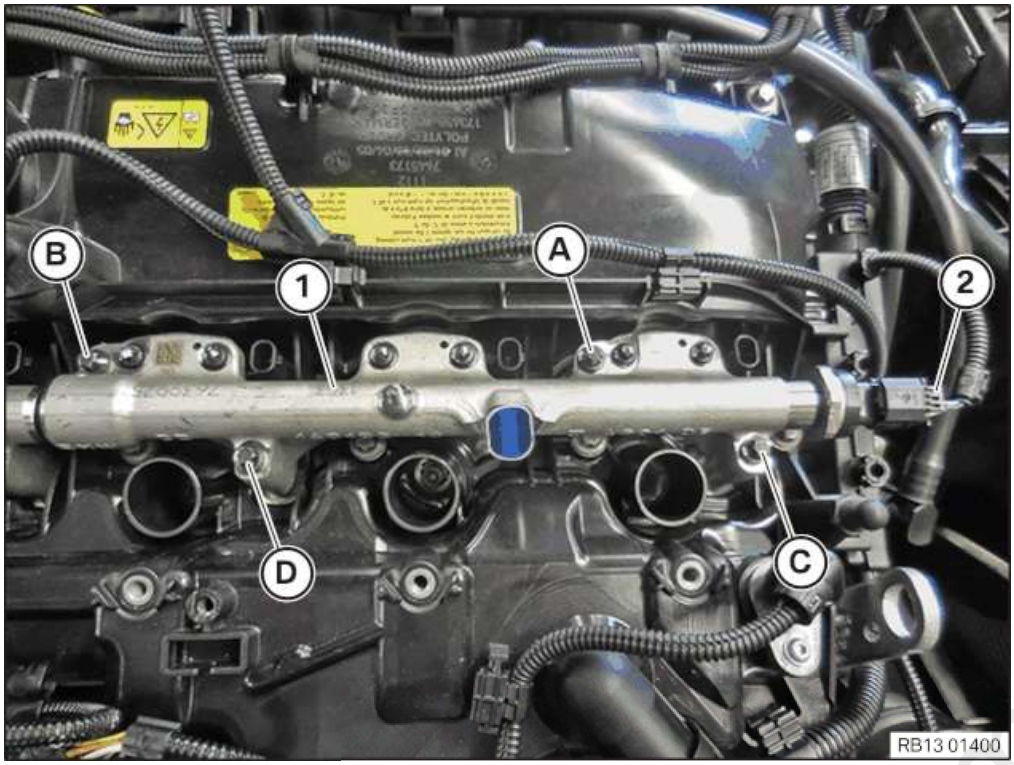
- Remove special tool 2 358 022(1) .
- Repeat this operation for all injectors.



- Check injectors for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors must move freely.

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- Renew screws (A) to (D).

  Parts: Bolts
- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- Press rail (1) down until a resistance can be felt; join and hand-tighten screws (M6x30) (A) and (B).
- Tighten screws (A) and (B) alternately by **180°** each with the torque wrench until the rail is positioned on the cylinder head.

  The figure shows the rail resting flat against the cylinder head.
- Insert screws (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

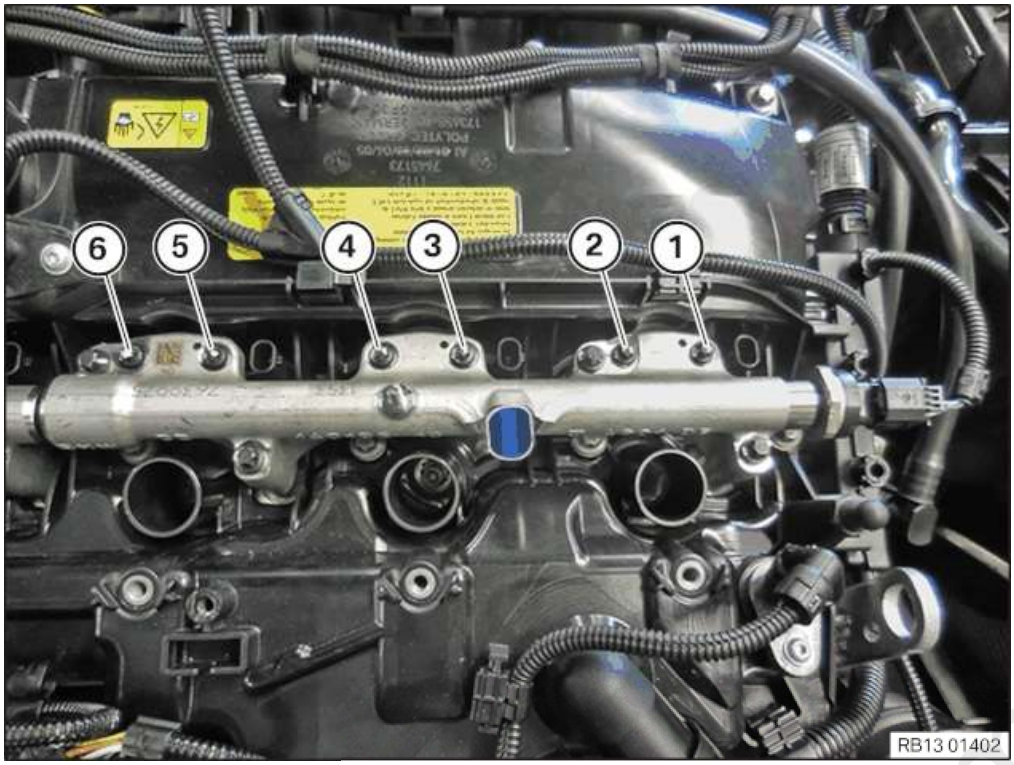
- Tighten screw (A) to 5 Nm.
- Tighten screw (D) to 5 Nm.
- Tighten screw (B) to 5 Nm.
- Tighten screw (C) to 5 Nm.
- Connect and lock the connector (2).

  The connector (2) must engage audibly.



- Make sure that the rail (1) rests flat against the cylinder head.

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- Attach a socket to an extension.

  Do not use a reversible ratchet or torque wrench.
- Hand-tighten screws (M5x30) in pairs ((1) with (2), (3) with (4), (5) with (6)) alternately by **90°**.
- Set torque wrench to 5 Nm.

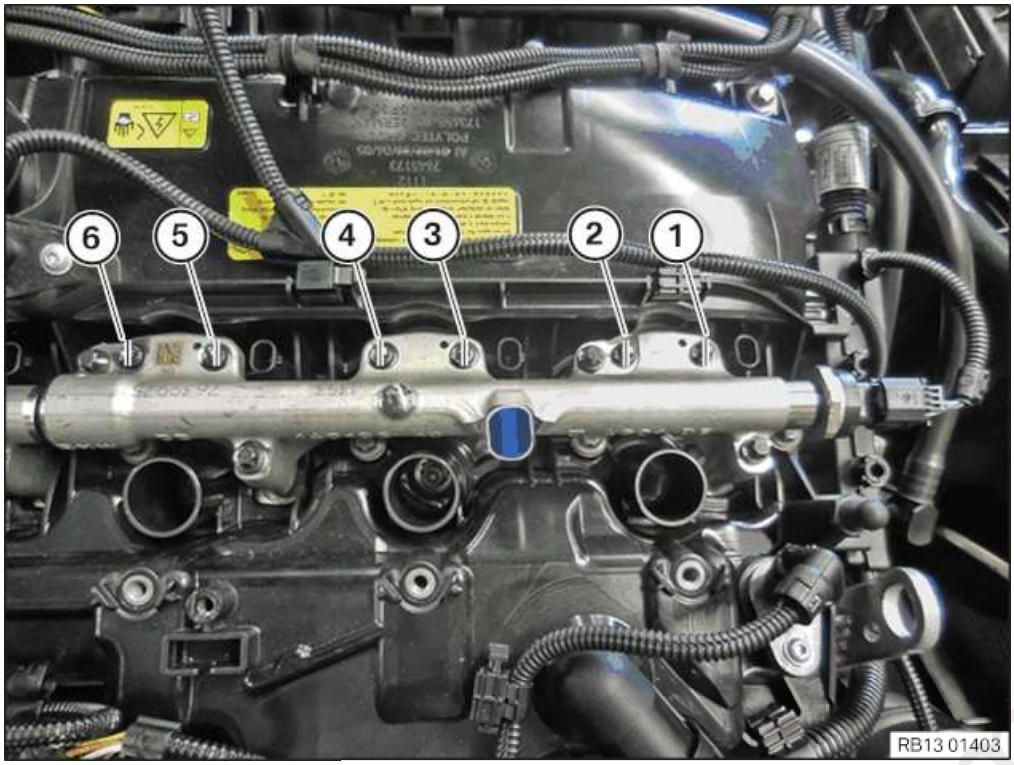
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

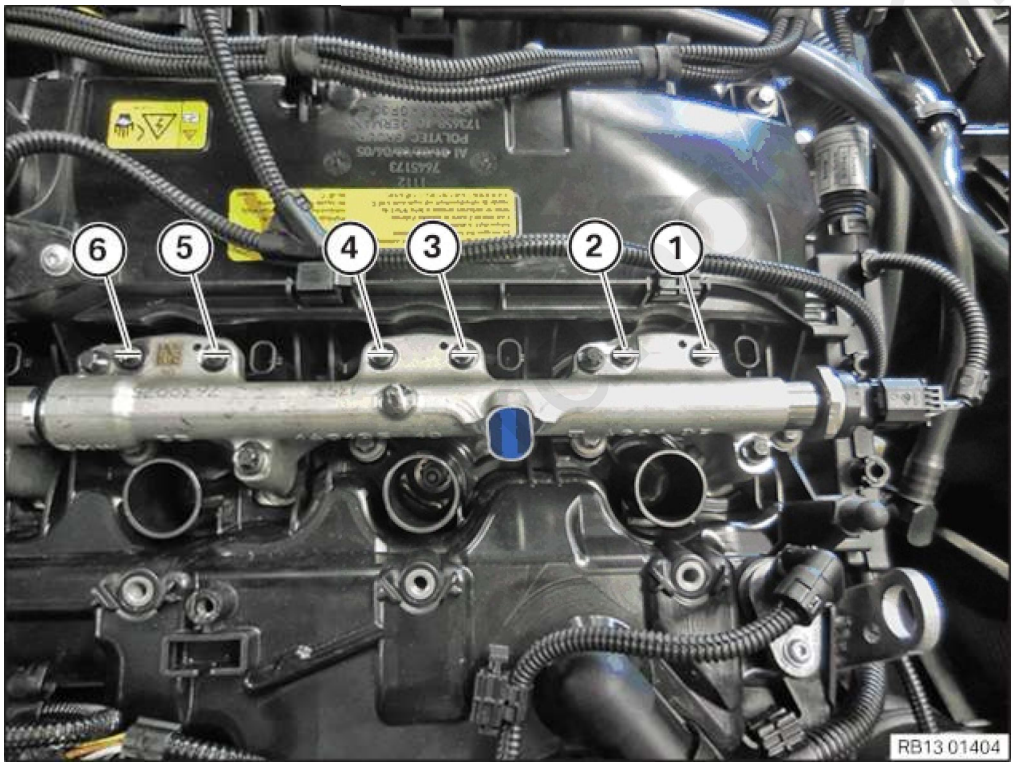
Non-observance of these requirements may result in leaks and damage.

- **Screw the (M5x30) bolts according to the following plan:**
  - **Fuel injector 1:**
  - Tighten screw (1) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (2) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten screw (3) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (4) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 3**:
  - Tighten screw (5) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (6) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts reach a torque of 5 Nm.

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- Mark all bolts (1) to (6) with a line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the screw (1) with an angle of rotation of 90° ±15°.
  - Tighten the screw (2) with an angle of rotation of 90° ±15°.
  - Tighten the screw (3) with an angle of rotation of 90° ±15°.
  - Tighten the screw (4) with an angle of rotation of 90° ±15°.
  - Tighten the screw (5) with an angle of rotation of 90° ±15°.
  - Tighten the screw (6) with an angle of rotation of 90° ±15°.



- Check if all bolts (1) to (6) have been tightened with a 90° ±15° angle of rotation.

  All markings (lines) must be horizontal (see Figure).



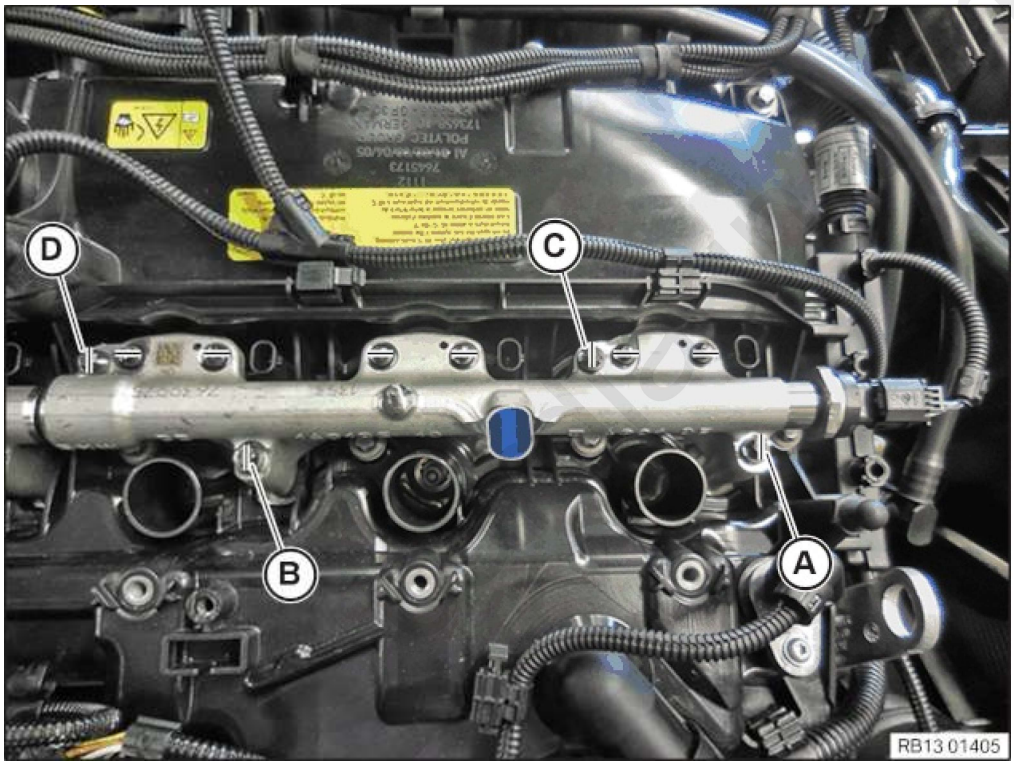
- Release screws (M6x70) (A) to (D) **without fail**.

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten screw (A) to 5 Nm.
- Tighten screw (D) to 5 Nm.
- Tighten screw (B) to 5 Nm.
- Tighten screw (C) to 5 Nm.

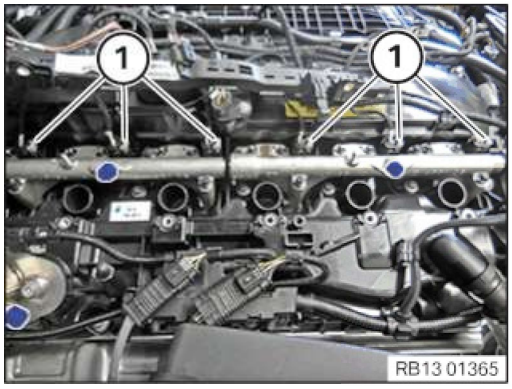


- Mark all the bolts (A) to (D) with a vertical line (see Figure).
- Tighten bolts (M6x70) (A) to (D) with an angle of rotation of 90°.



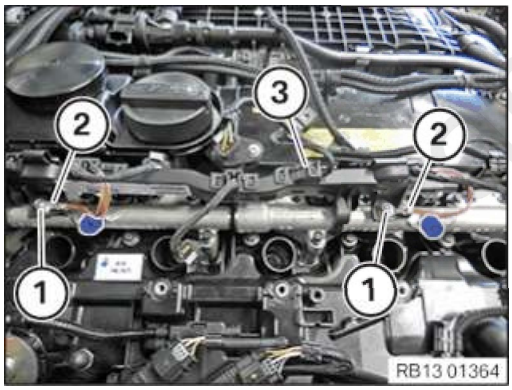
- Check whether all screws (A) to (D) have been tightened with an angle of rotation of 90°.

  All marks (lines) must be horizontal (see figure).



- Connect and lock all the connectors (1) to the injectors.

  All connectors (1) must engage audibly.

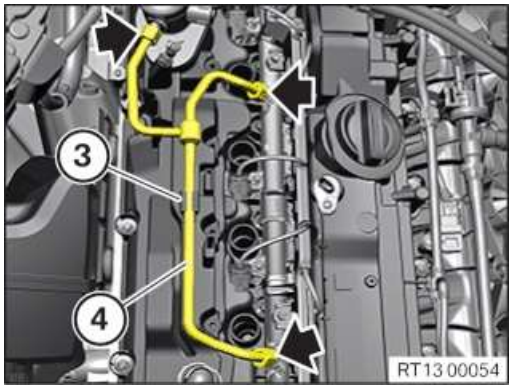


- Thread the cable channel (3) in and install.
- Thread in ground cable (2) and install.
- Tighten nuts (1).

Ground cable to rail

M6			5 Nm

73 – Installing high pressure line between rail and high pressure pump

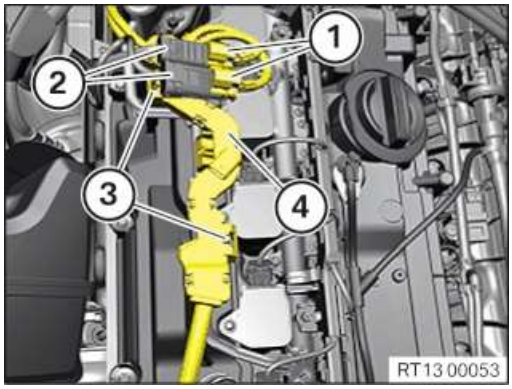


- Insert the high pressure line (4) into the holder (3) and install.
- Tighten union nuts (arrows) with the special tool .

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.

74 – Install high pressure pump

RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

Only G05 and G07

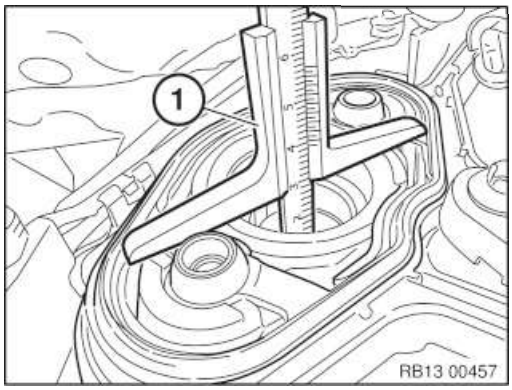
In vehicles with active anti-roll bar (ARS) the fan cowl must be removed in order to spin the engine.

For additional information see: 17 11 035 Removing and installing/replacing the fan cowl including electric fan

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

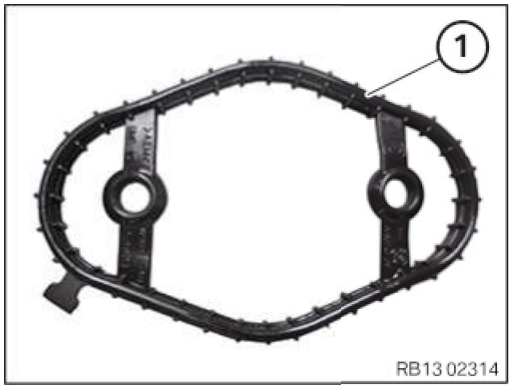
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.



TECHNICAL INFORMATION

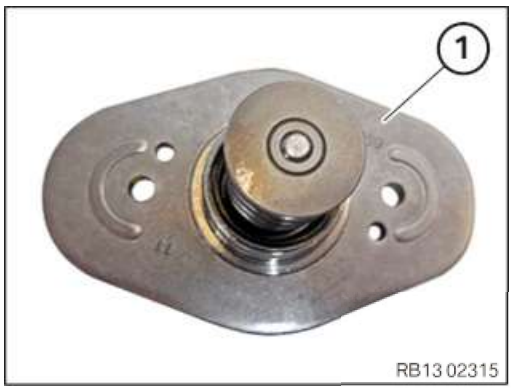
The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).

.com



- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

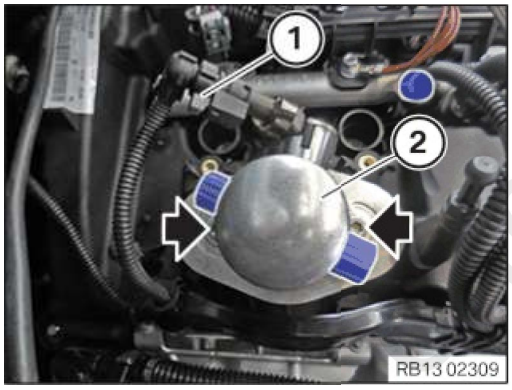
The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

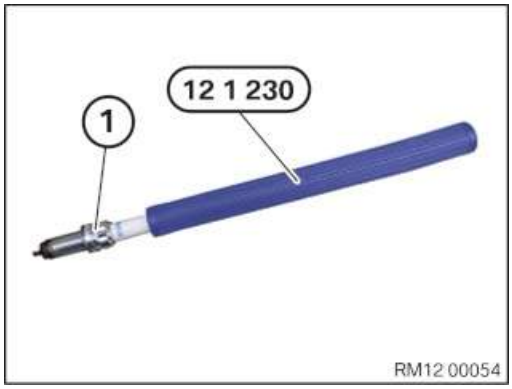
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

75 – 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

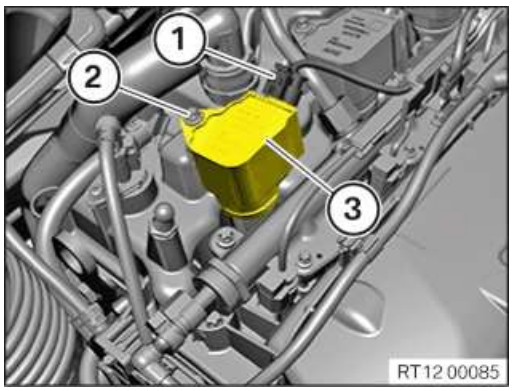
M12x1.25		Tightening torque	23 Nm

76 – Install all ignition coils

NOTICE

The description is for one component only. The procedure is identical for all further components.

▶ **Install ignition coil.**



- Install ignition coil (3).
- Tighten down screw (2).

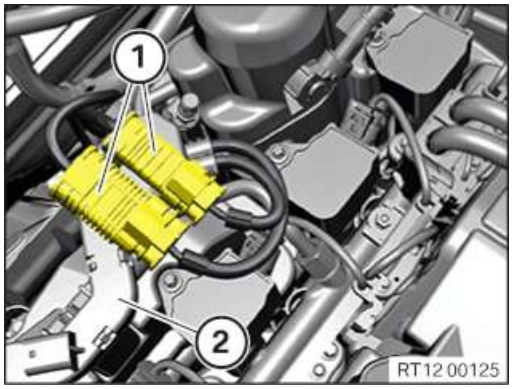
Ignition coil

Screw		Tightening torque	8 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

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- Connect the connector (1) of the front oxygen sensor and the monitoring oxygen sensor on the cable shaft (2).

77 – Install catalytic converter



- Renew the V-clip (1).

  Parts: V-band clamp



- Renew the gasket (1).

  Parts: Gasket



- Feed in and install catalytic converter.
- Lock clamp (1).

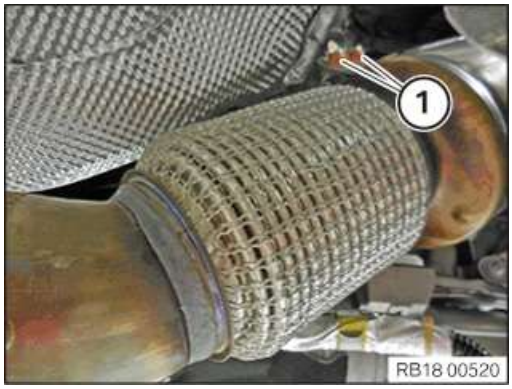
  The clamp (1) must engage audibly.



- Tighten V-band clamp (1).

Catalytic converter to turbocharger

V-band clamp	Replace V-band clamp.	Tightening torque	19 Nm



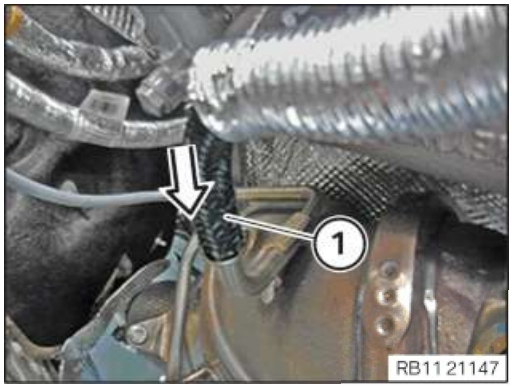
- Renew nuts (1).

  Parts: Nuts

- Tighten nuts (1).

Catalytic converter to holder

M8 nut	Renew nut.	Tightening torque	28 Nm



- **If installed: Connect pressure hose.**

  Renew pressure hose (1).

  Parts: Pressure hose

- Connect the pressure hose (1) in direction of arrow to the limit position.

78 – Install the monitoring oxygen sensor

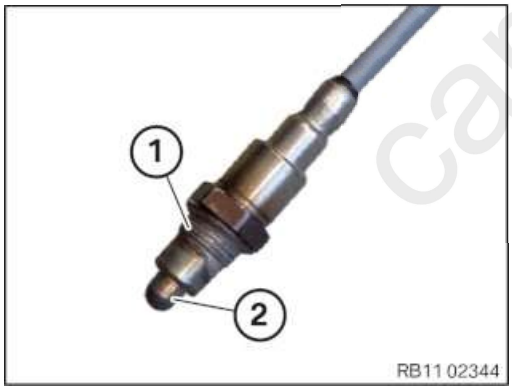
TECHNICAL INFORMATION

New oxygen sensors are to be greased lightly and evenly on the thread.

For oxygen sensors that are reused, the following should be observed:

Lightly and evenly grease the oxygen sensor only on the thread. Do not clean and grease that part of the oxygen sensor which protrudes in the exhaust branch (sensor ceramics).

For additional information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue



- Prepare the oxygen sensor.

  Do not damage the sensor ceramics.

  (1) = Thread

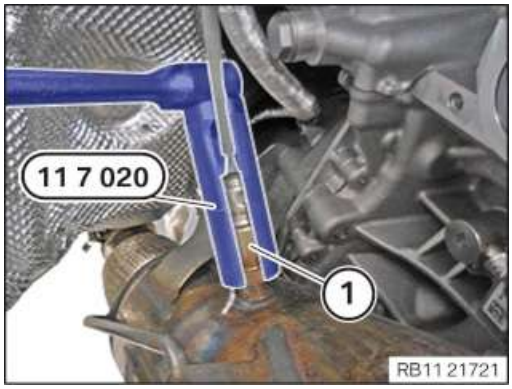
  (2) = Sensor ceramics

- Grease the thread (1) of the Lambda monitoring oxygen sensor thinly and evenly.

Expendable materials

Brake block paste * TU = Trade Unit. TU numbers cannot be ordered! For invoicing purposes only.	3 g, Bag	83192158851
	100 g, Tube	83192158852
	5 g, TU*	83230140233

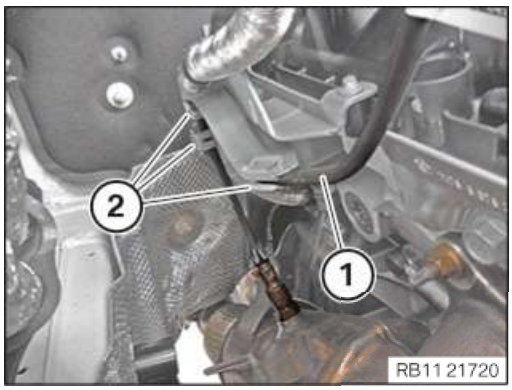
cardiagn.com



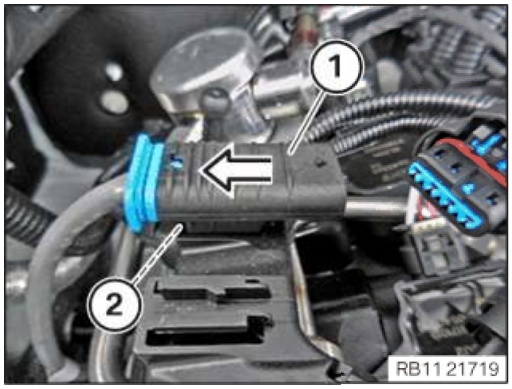
- Feed in the monitoring oxygen sensor (1) and install.
- Tighten monitoring oxygen sensor (1) using special tools 0 493 751 (11 9 150) and 0 491 075 (11 7 030) .

Monitoring oxygen sensor to catalytic converter

M18X1.5		Tightening torque	50 Nm



- Guide monitoring oxygen sensor line (1) into holder (2) and install it.



- Insert and install the connector (1) in the **direction of arrow**.
- Ensure that the lock (2)engages audibly.



- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.

79 – Install the front oxygen sensor

TECHNICAL INFORMATION

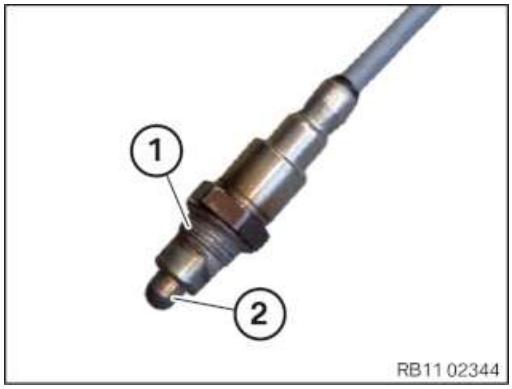
New oxygen sensors are to be greased lightly and evenly on the thread.

For oxygen sensors that are reused, the following should be observed:

Lightly and evenly grease the oxygen sensor only on the thread. Do not clean and grease that part of the oxygen sensor which protrudes in the exhaust branch (sensor ceramics).

For additional information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

fordiagn.com



- Prepare the oxygen sensor.

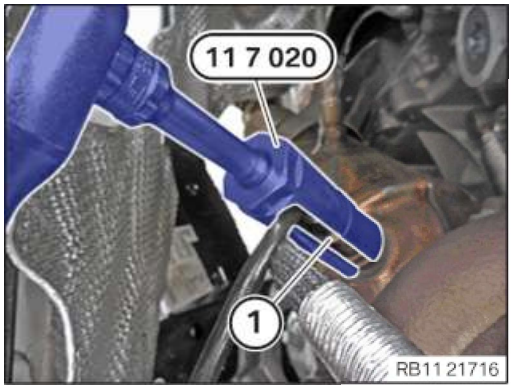
  Do not damage the sensor ceramics.

  (1) = Thread

  (2) = Sensor ceramics
- Apply a thin and even coat of grease to the thread (1) of the front oxygen sensor.

Expendable materials

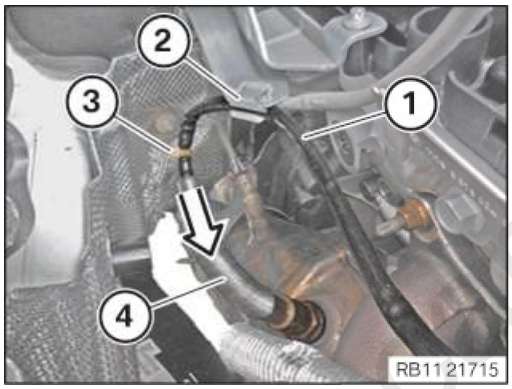
Brake block paste * TU = Trade Unit. TU numbers cannot be ordered! For invoicing purposes only.	3 g, Bag	83192158851
	100 g, Tube	83192158852
	5 g, TU*	83230140233



- Screw the control sensor (1) in and tighten it with the special tool .

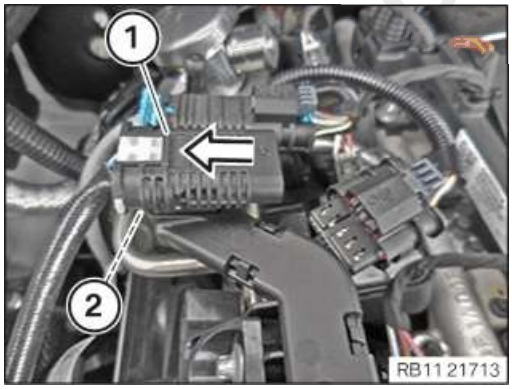
Front oxygen sensor to catalytic converter

M18X1.5		Tightening torque	50 Nm



- Guide in the heat protection (4) in the **direction of arrow** and install.
- Renew the cable straps (3).

  Parts: Cable strap
- Guide in and install the cable strap (3).
- Feed in and install the line of the front oxygen sensor (1) in the holder (2).



- Insert and install the connector (1) in the **direction of arrow**.
- Ensure that the lock (2)engages audibly.



- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.

80 – Installing the intake plenum

RISK OF DAMAGE

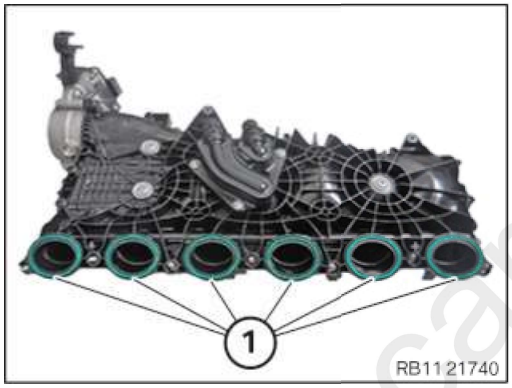
Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



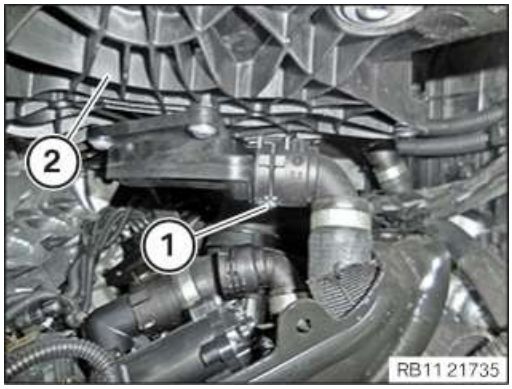
- Renew gaskets (1).

  Parts: Seals

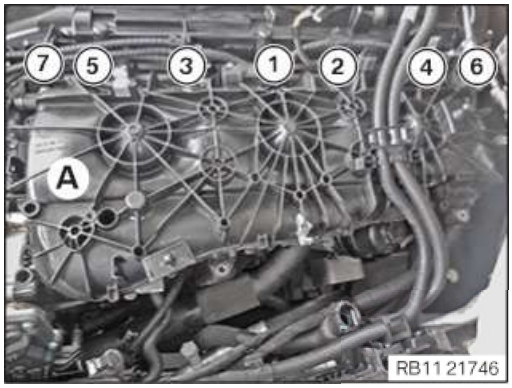


- Clean contact surface (1).

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- Feed in and position intake plenum (2).
- Connect and lock coolant line (1).
- Make sure that the cooling line (1) engages audibly.



TECHNICAL INFORMATION

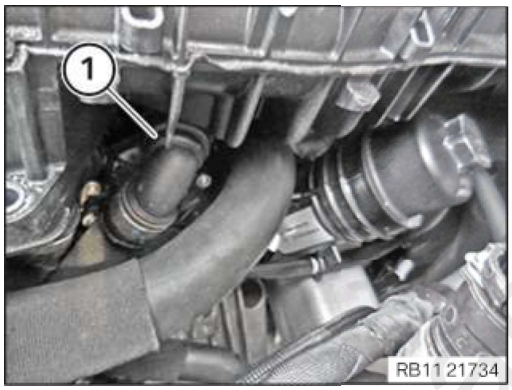
Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Position the intake plenum (A).
- Tighten screws in the order (1) to (7).

Note: Tighten the bolts in 360 degree steps.

Intake plenum to cylinder head

M6		Tightening torque	10 Nm



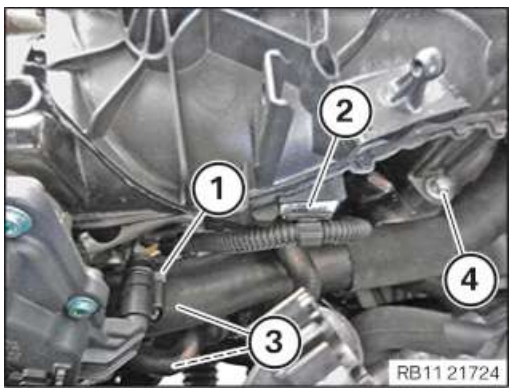
- Connect and lock coolant line (1).
- Make sure that the cooling line (1) engages audibly.



- Tighten down screw 1.

Intake plenum to support

M6X25		Tightening torque	8 Nm



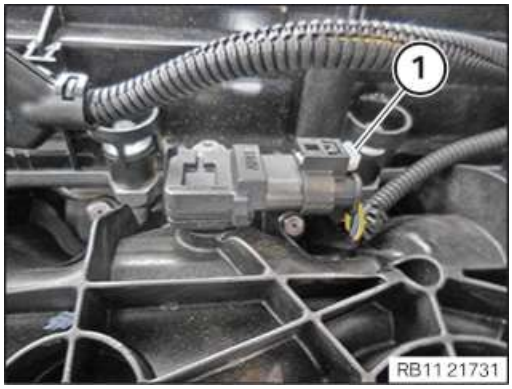
- Tighten down screw (4).

Intake plenum to support

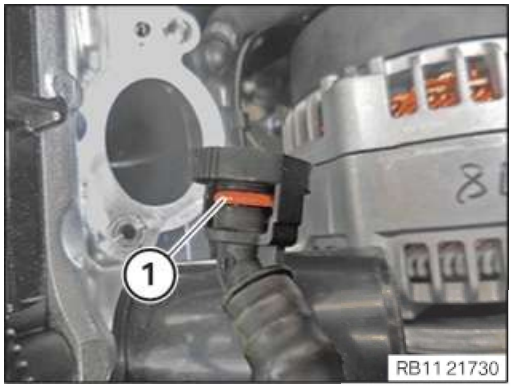
M6X25		Tightening torque	8 Nm

- Thread in and install coolant line (3).
- Secure clamps (2).
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.

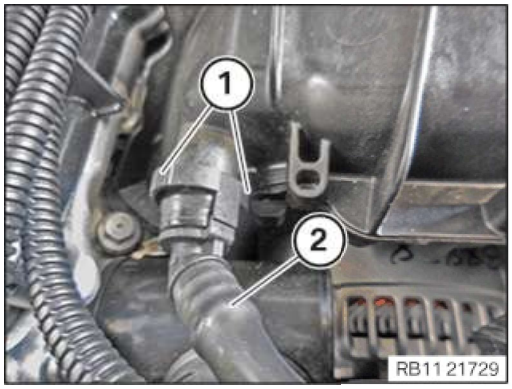
fdiagn.com



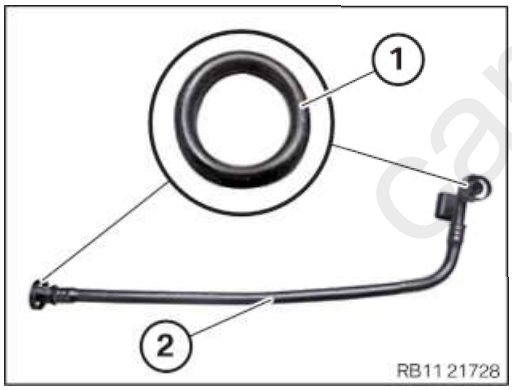
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.



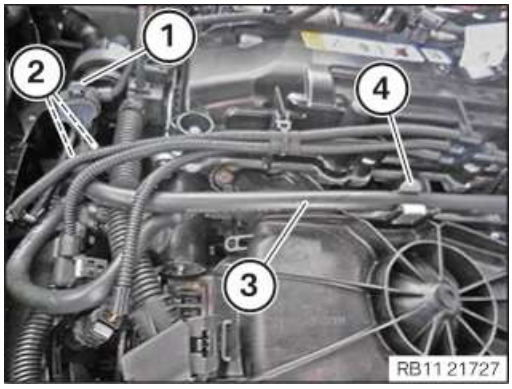
- Check sealing ring (1) for damage and renew tank ventilation line if necessary.



- Insert and install the tank ventilation line (2).
- Ensure that the locks (1) engage audibly.

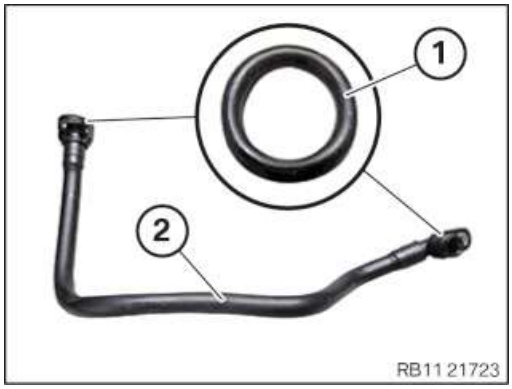


- Check sealing ring (1) for damage and renew tank ventilation line (2) if necessary.

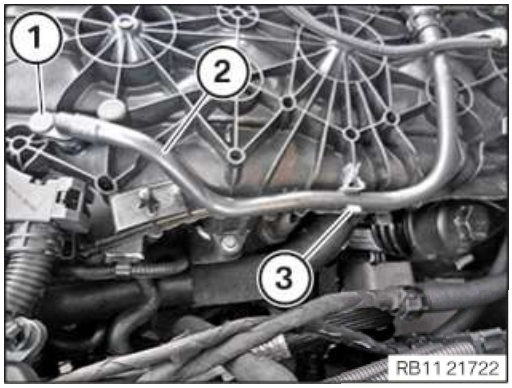


- Insert and install the tank ventilation line (3).
- Ensure that the locks (2) engage audibly.
- Secure the tank ventilation line (3) to the clamp (4).
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.

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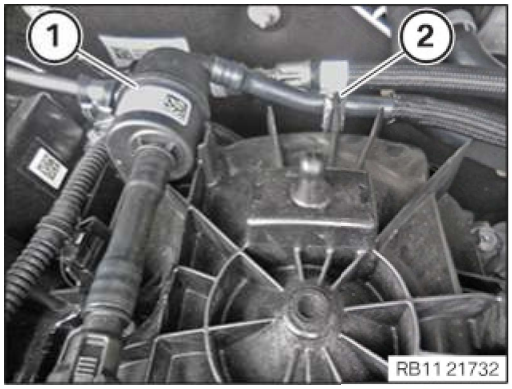
- Check sealing ring (1) for damage and renew tank ventilation line (2) if necessary.



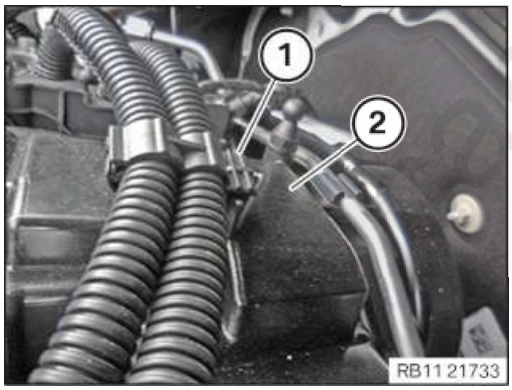
- Insert and install the tank ventilation line (2).
- Secure the tank ventilation line (2) to the clamp (3).
- Tighten down screw (1).

Tank ventilation line to intake plenum

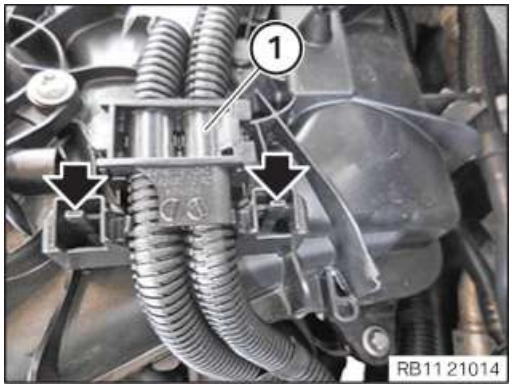
Oval-head screw		Tightening torque	3 Nm



- Insert and install the tank ventilation line (1).
- Secure the tank ventilation line (1) to the clamp (2).



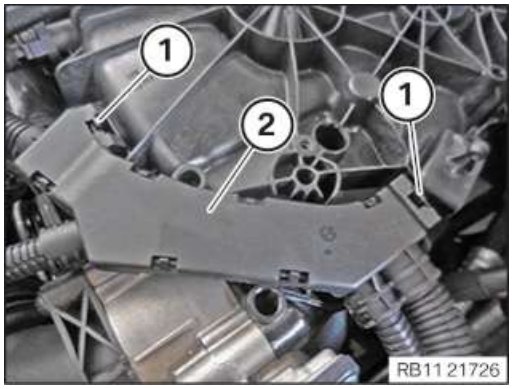
- Secure the wiring harness section(1) for the injectors and ignition coils on the cylinder head cover (2).



- Insert and install the wiring harness section (1) for the injectors and ignition coils.

  The locks (arrows) must engage audibly.

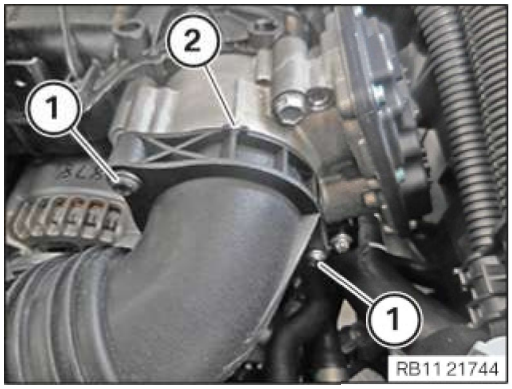
carfdiagn.com



- Feed in and install wiring harness section (2) for sensor system **2**.
- Ensure that the locks (1) engage audibly.



- Check the sealing ring (1) for damage and renew the sealing ring (1) as needed.

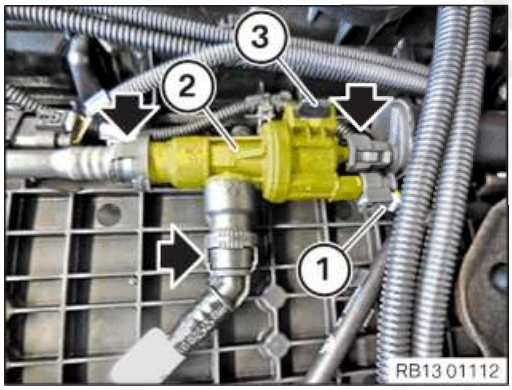


- Insert and install charge air line (2).
- Tighten the screws (1).

Charge air line to throttle valve

M6x30		Tightening torque	8 Nm

81 – Installing the tank vent valve



- Secure the tank vent valve (2) to the holder (3).
- Connect and lock the tank ventilation lines (arrows).

  The tank ventilation lines (arrows) must audibly engage.
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

82 – Install engine ventilation line

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

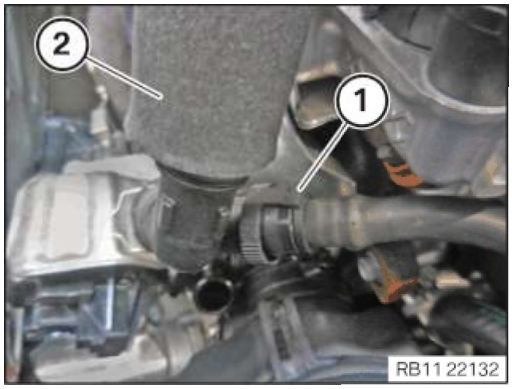
rdiagn.com

TECHNICAL INFORMATION

Check the retaining lug on the connector for damage and perform a tension check as needed.

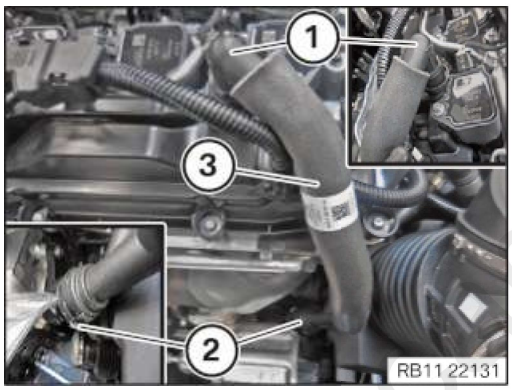


- Check sealing ring (1) for damage and renew tank ventilation line if necessary.

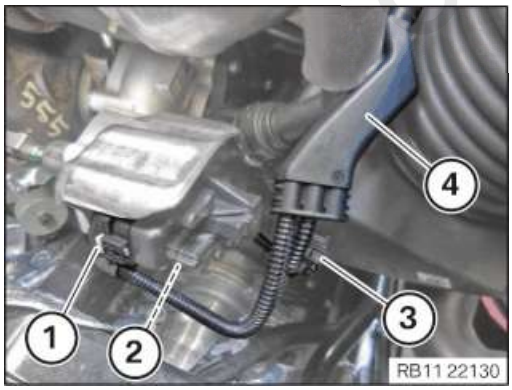


- Insert and position the engine ventilation line (2).
- Insert and install the tank ventilation line (1).

  Tank ventilation line (1) must engage audibly into place.



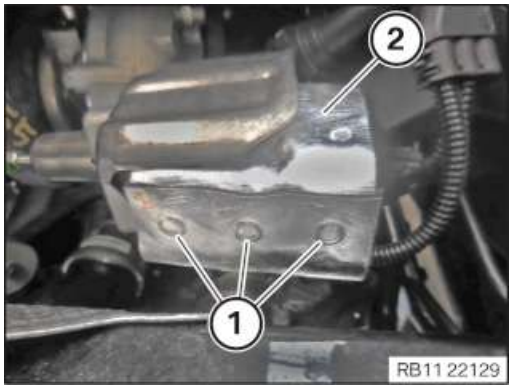
- Insert and install the engine ventilation line (3).
- Make sure you can hear the locks (1) and (2) engage.



- Feed in and position the wiring harness section of sensor system **2** (4).
- Connect connectors (2) and lock.
- Connect connectors (1) and lock.

  The connectors (1) and (2) must audibly engage.
- Secure clamps (3).

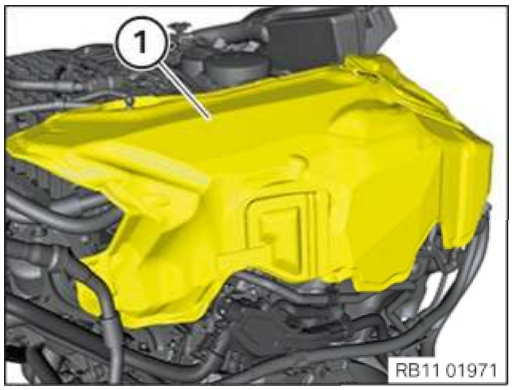
tdiag.com



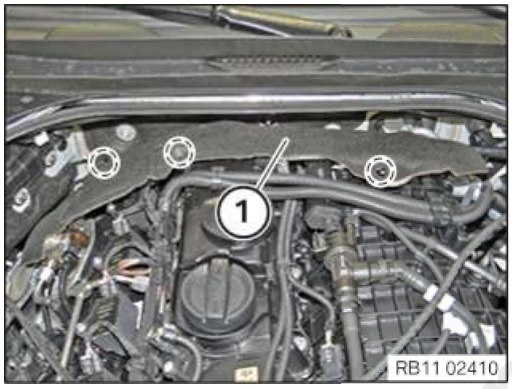
- Feed in and install heat shield (2).
- Lock the locks (1).

  Locks (1) must engage audibly.

83 – 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.

84 – Topping up the engine oil

RISK OF DAMAGE

Damage to the petrol particulate filter.

Vehicles equipped with a petrol particulate filter must be operated with low-ash engine oil only.

- Use BMW Longlife-04 , BMW Longlife-12 FE or BMW Longlife-17 FE+ engine oils or engine oils approved by BMW matching the same specifications only.
- For additional information see: Overview of approved engine oils for BMW Group engines.

RISK OF DAMAGE

Engine damage caused by excessively filling the engine with engine oil.

Filling an excessive quantity of engine oil may cause engine damage.

- Observe the exact engine oil filling capacity.
- Drain the engine oil.

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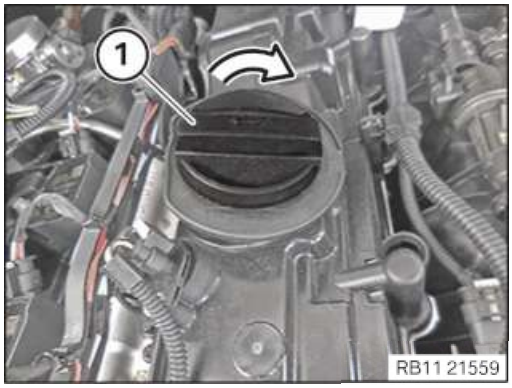
- Pour in engine oil.

Engine oil B58B30M1/B58B30O1

Filling capacity, engine oil change with oil filter element	6,50 l

Engine oil: Technically suitable engine oils for BMW Group engines

85 – Installing the oil filler cap



- Close oil filler cap (1) in direction of arrow.
- Make sure that the sealing cap (1) engages audibly.

86 – Remove engine from assembly stand

CAUTION

Heavy component.

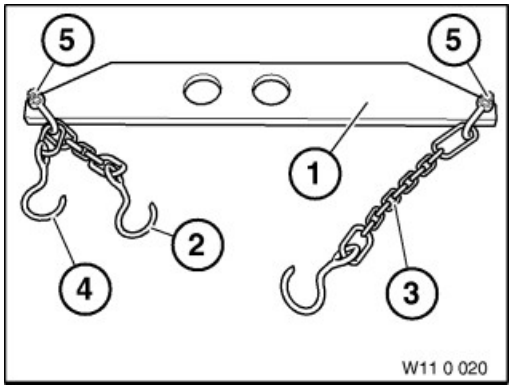
Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

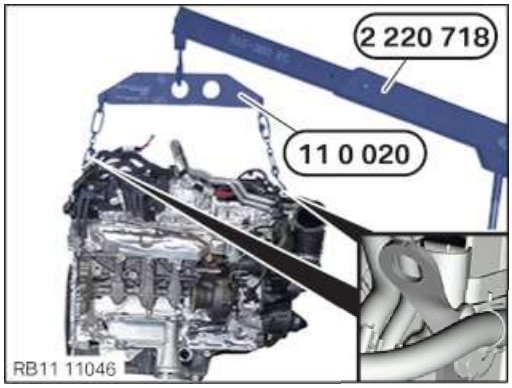


- Stage the workshop crane 2 220 718.

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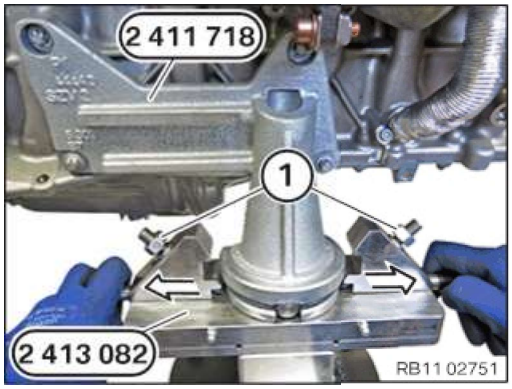
- Stage special tool (lifting gear) 0 490 567 (11 0 020).



TECHNICAL INFORMATION

The workshop crane, lifting gear and the mounting brackets on the engine must all be connected to each other so that the engine hangs straight upon lifting.

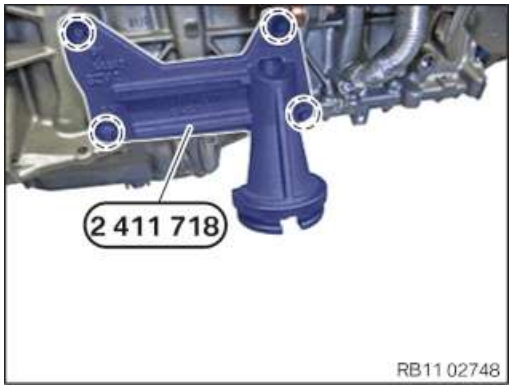
- Connect both hooks of the special tool 0 490 567 (11 0 020) to the front and back of the engine with the mounting brackets.
- Connect the workshop crane 2 220 718 to the special tool (lifting gear) 0 490 567 (11 0 020).



- Slacken nuts (1).
- Unclamp the clamping jaws of the special tool (engine fixture) 2 413 082 in the direction of arrow.



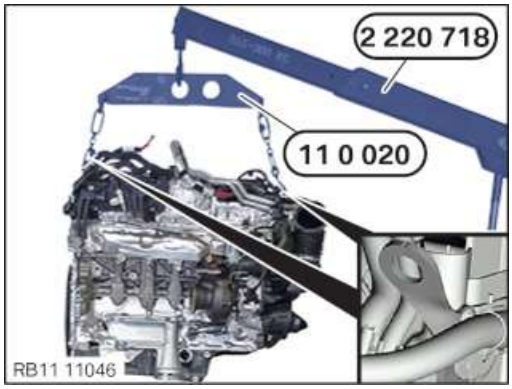
- Raise the engine slowly.



- Release the screws (marks) and remove the special tool (engine fixture) 2 411 718.

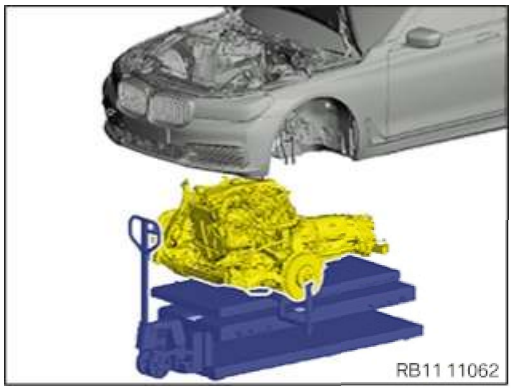
87 – Installing the engine on the front axle

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- See additional information.

88 – Installing the complete front axle including engine and transmission



- See additional information.

Additional Information

Overview of Tightening Torques

Flange to assembly stand			Used in step 3
M14X30		Tightening torque	135 Nm

Special tool 11 8 930 to special tool 00 2 320			Used in step 3
M14x35		Tightening torque	160 Nm

Special tool 2 411 718 to crankcase			Used in step 3
M10x30		Tightening torque	38 Nm

Oil drain plug			Used in step 6
M12x16	Replace sealing ring.	Tightening torque	25 Nm

Basic carrier to cylinder head			Used in step 245565
M6		Tightening torque	8 Nm

Test gauge to basic carrier			Used in step 245565
M6		Tightening torque	8 Nm

Special tool to cylinder head			Used in step 33
M8		Tightening torque	21,5 Nm

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Connecting rod bearing cap to connecting rod — Used in step 44

Renew screws.

Tighten screws crosswise.		Jointing torque	20 Nm
		1. Angle of rotation	70 °
		2. Angle of rotation	70 °

Oil deflector to crankcase — Used in step 45

M8 x 35	Replace screws.	Jointing torque	15 Nm
		Angle of rotation	45 °

Camshaft sprocket to oil vacuum pump — Used in step 46

M8	Important - left-hand thread Renew screw.	1. Jointing torque	5 Nm
		2. Angle of rotation	90 °

Oil vacuum pump to crankcase — Used in step 46

M8	Renew screw.	1. Tightening torque	15 Nm
		2. Angle of rotation	45 °

Oil sump to crankcase — Used in step 47

M8 x 30		Tightening torque	24 Nm

Oil sump to crankcase — Used in step 47

M8 x 110		Tightening torque	24 Nm

Transmission to oil sump (manual gearbox and automatic transmission) — Used in step 47

M8 x 50		Tightening torque	19 Nm

Bearing support to oil sump — Used in step 48

M8		Tightening torque	19 Nm

Front axle final drive to engine oil pan — Used in step 49

M12		Tightening torque	140 Nm

Cylinder head to crankcase — Used in step 54

M11	Observe tightening sequence. Fit new cylinder head bolts.	1. Jointing torque	30 Nm
		2. Angle of rotation	90 °
		3. Angle of rotation	180 °

Cylinder head bolt to timing case cover — Used in step 54

M8x40	Renew screws.	Tightening torque	19 Nm

Camshaft sensor wheel to intake camshaft — Used in step 54

M4 x35			4,5 Nm

Bearing journal to cylinder head — Used in step 54

Bearing journal	Renew the bearing journal!	Tightening torque	20 Nm

Sliding rail to cylinder head — Used in step 54

M6x16			8 Nm

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Cover on rear cylinder head — Used in step 54

M6		Tightening torque	8 Nm

Cable routing to cylinder head, rear — Used in step 54

M6 x 20		Tightening torque	8 Nm

Oil feed line for exhaust turbocharger to crankcase — Used in step 54

M6 x 12	Replace sealing ring.	Tightening torque	8 Nm

Coolant return line holder bracket to crankcase — Used in step 54

M6X12		Tightening torque	8 Nm

Heat shield to cylinder head — Used in step 54

M8X12	Renew screws.	Tightening torque	19 Nm

Heat shield to clamping strip — Used in step 54

M6X16	Renew screw.	Tightening torque	8 Nm

Coolant feed line to crankcase — Used in step 54

M6X12		Tightening torque	8 Nm

Exhaust turbocharger support to crankcase — Used in step 54

M8 x 20	Renew screws.		19 Nm

Exhaust turbocharger to support — Used in step 54

M8 x 25	Renew screw.		19 Nm

VANOS central valve to camshaft — Used in step 6162

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 64

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Coolant line to coolant pump/cylinder head — Used in step 66

M6x20		Tightening torque	8 Nm

Oil return line to turbocharger — Used in step 67

M6 x 12			8 Nm

Oil return line to crankcase — Used in step 67

M6 x 12			8 Nm

Cylinder head cover to cylinder head — Used in step 68

M6X30		Jointing torque	8 Nm

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Cylinder head cover to cylinder head			Used in step 68
M6X30		Tightening torque	11 Nm

Auxiliary coolant pump holder to cylinder head			Used in step 68
M6		Tightening torque	7 Nm

Standard screw connection M6			Used in step 68
M6			8 Nm

Differential pressure sensor to holder			Used in step 68
TS6X18		Tightening torque	3,5 Nm

Holder, positive battery cable to cylinder head cover			Used in step 68
6X18		Tightening torque	6 Nm

Ground cable to rail			Used in step 7172
M6			5 Nm

High pressure line between rail and high pressure pump			Used in step 73
M14x1,5		Tightening torque	33 Nm

High pressure pump to high pressure pump flange			Used in step 74
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

Spark plugs			Used in step 75
M12x1.25		Tightening torque	23 Nm

Ignition coil			Used in step 76
Screw		Tightening torque	8 Nm

Catalytic converter to turbocharger			Used in step 77
V-band clamp	Replace V-band clamp.	Tightening torque	19 Nm

Catalytic converter to holder			Used in step 77
M8 nut	Renew nut.	Tightening torque	28 Nm

Monitoring oxygen sensor to catalytic converter			Used in step 78
M18X1.5		Tightening torque	50 Nm

Front oxygen sensor to catalytic converter			Used in step 79
M18X1.5		Tightening torque	50 Nm

Intake plenum to cylinder head			Used in step 80
M6		Tightening torque	10 Nm

Intake plenum to support			Used in step 80
M6X25		Tightening torque	8 Nm

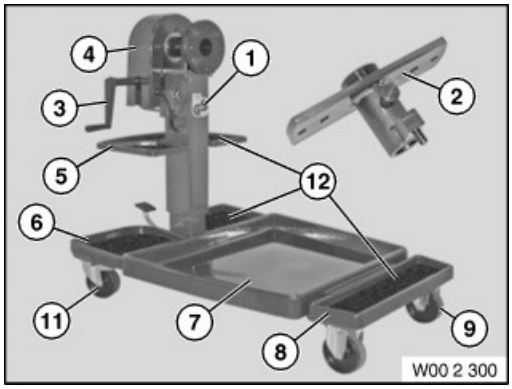
Tank ventilation line to intake plenum			Used in step 80
Oval-head screw		Tightening torque	3 Nm

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Charge air line to throttle valve			Used in step 80
M6x30		Tightening torque	8 Nm

Overview of Special Tools

0 495 187 (00 2 300) Assembly stand



Common Used in step 3

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))	

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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.	

2 411 718 Engine support



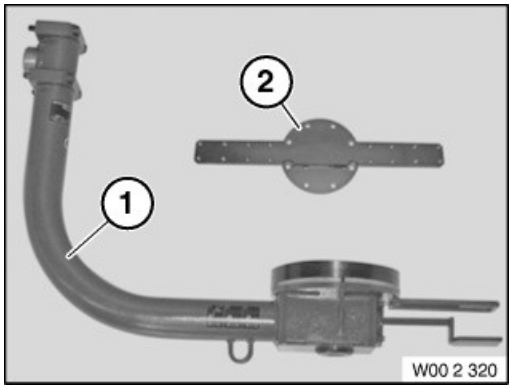
Common Used in step 386

Usage	For accommodating engine on assembly stand. Engine: B58; S58
Included in the tool or work	
Storage location	
Replaced by	
In connection with	2413082
SI-Number	01 23 15 (280)

0 495 196 (00 2 320) Support arm

Used in step 3

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Common

Usage	(Support arm with fixture) For mounting engines using the engine mounting bracket.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	002300 = 0495187
SI-Number	01 25 04 (155)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 197 (00 2 321)		**Support arm**	
2	0 495 198 (00 2 322)		**Panel** (take-up plate)	
3	0 495 380 (00 2 323)		**Panel** (fixture) Engine N73	
6	0 496 287 (00 2 326)		**Panel** (fixture) Engine: M73	
5	0 496 288 (00 2 327)	0 496 373	**Panel** (fixture) Engine: S62 Replaced by 11 5 420 (0 496 373)	
8	0 496 533 (00 2 328)		**Support** (Engine mount) Engine: N57, N57Top	
9	0 496 579 (00 2 329)	0 496 680	**Support** (Engine mount) Engine: N74 Replaced by 116160 (0 496 680)	
4	0 495 379 (00 2 324)		**Panel** (fixture) Engine M67TU	
5	0 495 381 (00 2 325)		**Panel** (fixture) Engine N62, N62TU	

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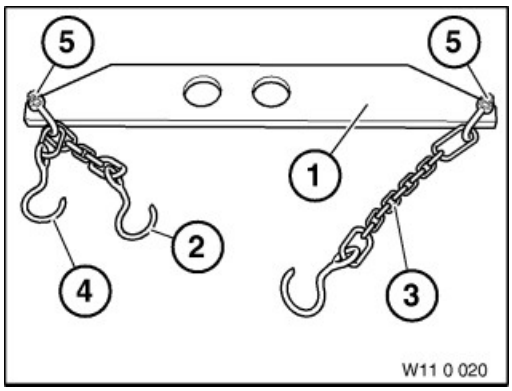
2 413 082 Support



Common	Used in step 386
Usage	For mounting the engines on the assembly stand.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	0495196
SI-Number	01 23 15 (280)

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0 490 567 (11 0 020) Lifting gear



Common Used in step 3335486

Usage	For removing and installing the engines. 08/2011 only available as a complete set. Delivered with TÜV inspection certificate and operating instructions. No delivery of separate parts.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 13 94 (888)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
5	0 490 572 (11 0 029)		**Shackle** (Shackle) 2 pieces As of 08/2011, only available as a complete set via 11 0 020 = 0490567. Delivered with TÜV inspection certificate and operating instructions.	
1	0 490 568 (11 0 021)		**Lifting gear** (Cross member) As of 08/2011, only available as a complete set via 11 0 020 = 0490567. Delivered with TÜV inspection certificate and operating instructions.	
2	0 490 569 (11 0 022)		**Chain** (Chain) As of 08/2011, only available as a complete set via 11 0 020 = 0490567. Delivered with TÜV inspection certificate and operating instructions.	
3	0 490 570 (11 0 023)		**Chain** (Chain) Version: long As of 08/2011, only available as a complete set via 11 0 020 = 0490567. Delivered with TÜV inspection certificate and operating instructions.	
4	0 490 571 (11 0 024)		**Chain** (Chain) Version: short As of 08/2011, only available as a complete set via 11 0 020 = 0490567. Delivered with TÜV inspection certificate and operating instructions.	

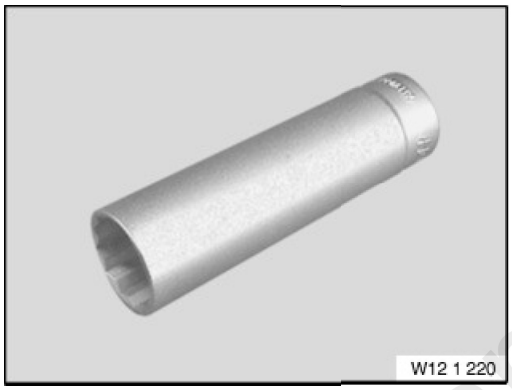
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2 220 718 Workshop crane



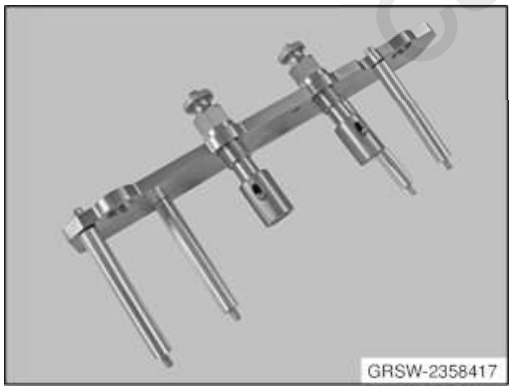
Common	Used in step	33386
Usage	WSK 1000	
Included in the tool or work		
Storage location	Individual	
Replaced by		
In connection with		
SI-Number	06 01 11 (701)	

0 495 560 (12 1 220) Socket



Common	Used in step	1575
Usage	For removing and installing the spark plugs (WAF 14 bihexal).	
Included in the tool or work		
Storage location	C18	
Replaced by		
In connection with		
SI-Number	01 20 06 (299)	

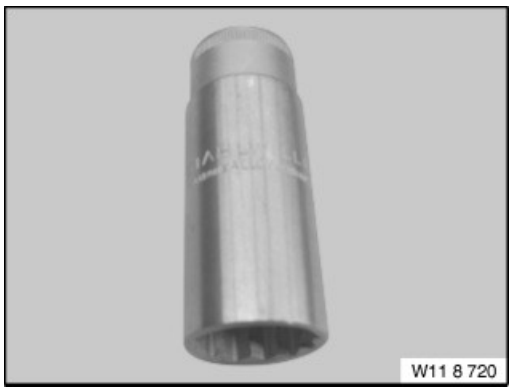
2 358 417 Device



Common	Used in step	1819
Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).	
Included in the tool or work		
Storage location	A57	
Replaced by		
In connection with		
SI-Number	01 13 14 (098)	

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0 496 106 (11 8 720) Socket WAF 46



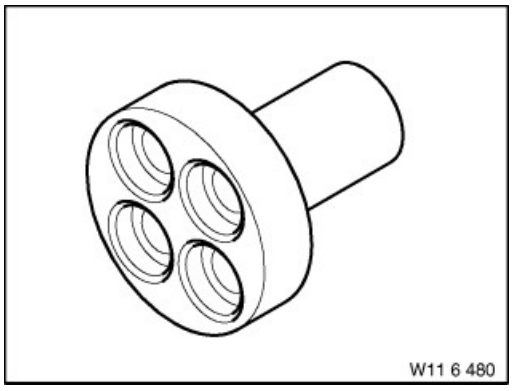
Common	Used in step 1819
Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

2 360 895 Pin wrench



Common	Used in step 2069
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 2453636574
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

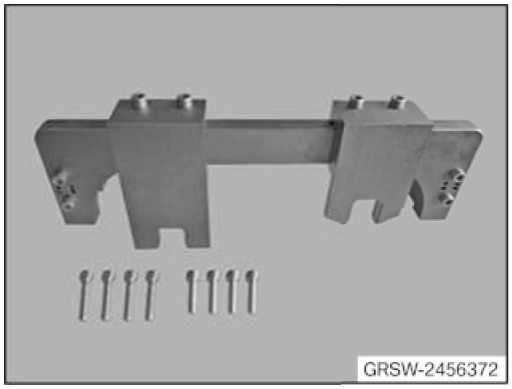
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2 288 380 Locating stud



Common	Used in step 24536365
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 2432556365
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 122 Gauge



Common	Used in step 243265
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 496 855 Ratchet handle



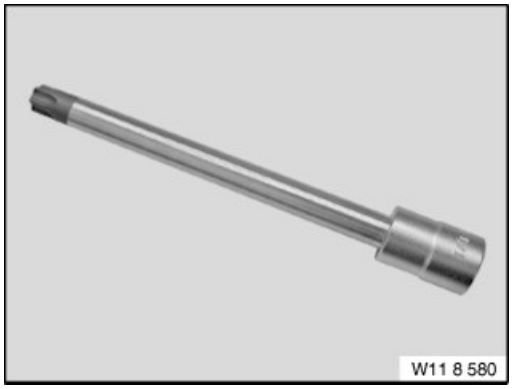
Common	Used in step 26276162
Usage	Insert reversible ratchet with nut for installation and disassembly of the VANOS- SW22. (only in longitudinal installation). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found 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 26276162
Usage	For removing and installing the VANOS adjuster. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	0496855
SI-Number	01 07 17 (487)

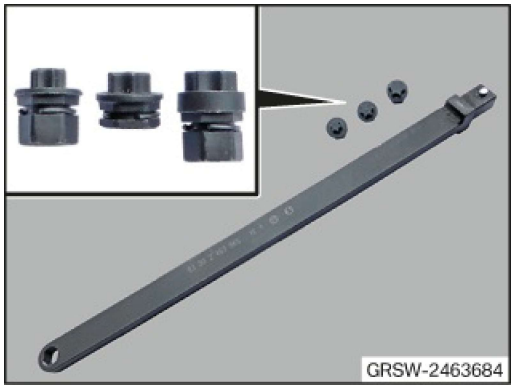
0 495 747 (11 8 580) Socket wrench



Common	Used in step 3354
Usage	(wrench socket Torx T60) For removing and installing cylinder head (outside diameter 13.5 mm).
Included in the tool or work	
Storage location	A19
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

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2 463 965 Socket wrench



Common	Used in step 38
Usage	with T30, T40 and torx 45
Included in the tool or work	
Storage location	B6
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 463 755 Assembly tool



Common	Used in step 4044
Usage	For installation of pistons and connecting rods in the crankcase. Contour-graphic silhouette foil is included in the delivery specification.
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 18 (545)

2 463 754 Adapter



Common	Used in step 42
Usage	For gudgeon pin circlip installation. Engine: B58O1, B58M1. Silhouette foil is included in the delivery specification.
Included in the tool or work	
Storage location	B56
Replaced by	
In connection with	
SI-Number	

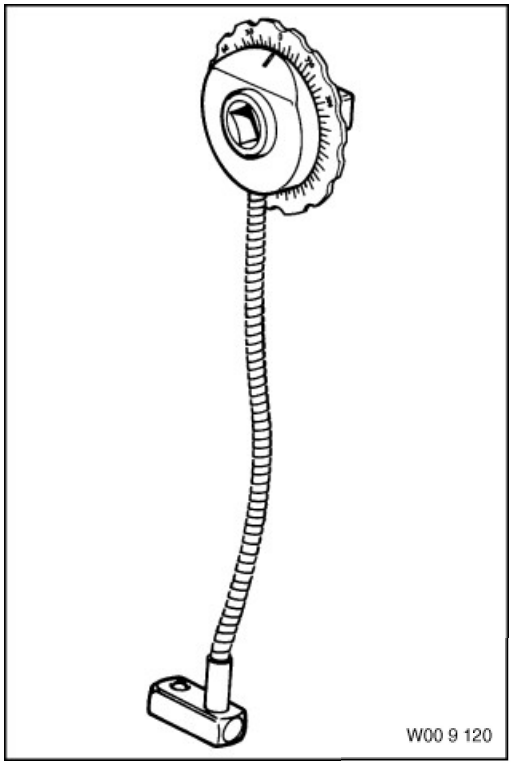
2 410 685 Installation drift



Common	Used in step 42
Usage	For gudgeon pin circlip installation. 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	B55
Replaced by	
In connection with	118560 = 0495743
SI-Number	01 23 15 (280)

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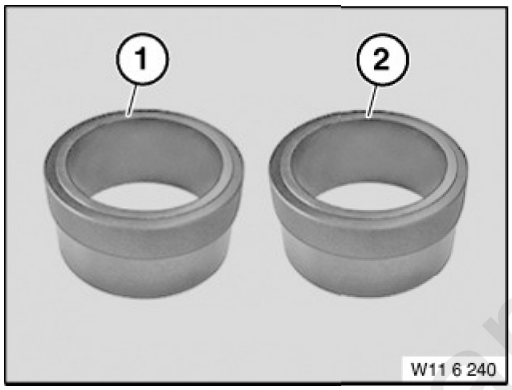
0 490 504 (00 9 120) Torque angle measuring dial



Common Used in step 444554

Usage	For torsion angle adjustment of cylinder head bolts (all engines) And reinforcement plate front axle support E46
Included in the tool or work	
Storage location	A4
Replaced by	
In connection with	
SI-Number	

0 495 373 (11 6 240) Bush



Common Used in step 44

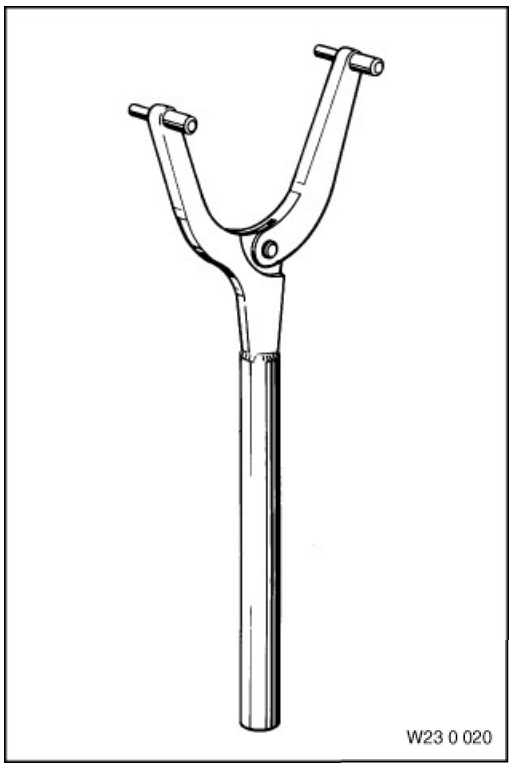
Usage	(Assembly bush set) For fitting pistons (diameter 82 mm) with connecting rod into the crankcase. Engine: N52B25
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 02 06 (244)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
2	0 495 527 (11 6 242)		**Bush** (assembly bush 82.25 mm)	
1	0 495 526 (11 6 241)		**Bush** (assembly bush 82.00 mm)	

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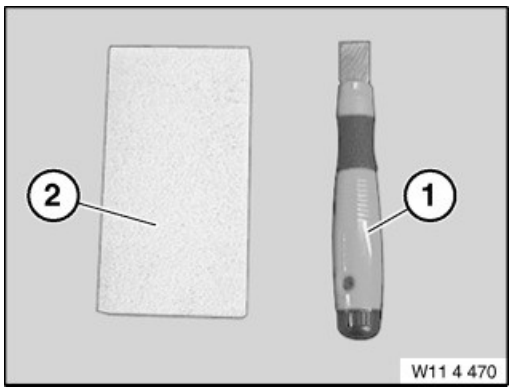
0 491 440 (23 0 020) Holder



Common	Used in step 46
Usage	(counter support) For all three- and four-hole flanges when releasing and tightening down
Included in the tool or work	
Storage location	B4
Replaced by	
In connection with	
SI-Number	

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0 495 102 (11 4 470) Tool



Common Used in step 47

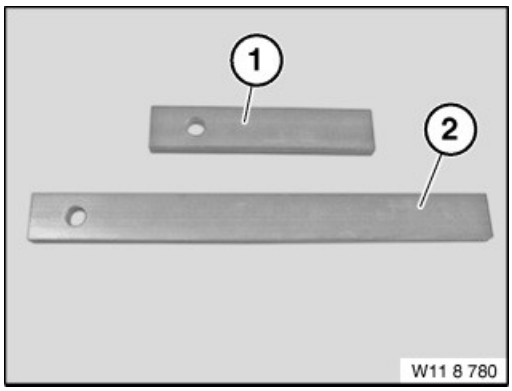
Usage	(cleaning kit) For cleaning sealing surfaces on magnesium crankcase/cylinder head.
Included in the tool or work	
Storage location	C52
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 103 (11 4 471)		**Scraper**	
2	0 495 104 (11 4 472)		**Extractor** (grindstone)	

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0 496 120 (11 8 780) Plate



Common Used in step 47

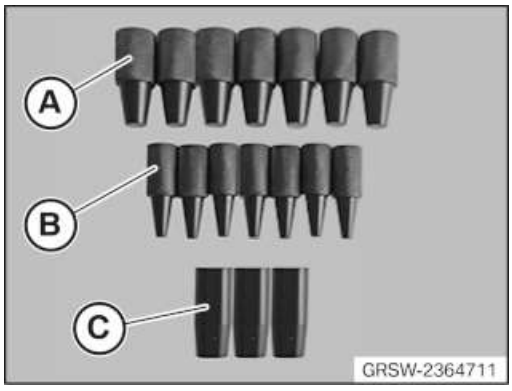
Usage	(Mounting plates) For securing transmission oil sump when gearbox is removed.
Included in the tool or work	
Storage location	B24
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 121 (11 8 781)		**Plate** (Mounting plate, short)Discontinued; only available via set 11 8 780 = 0496120.	
2	0 496 122 (11 8 782)		**Plate** (Mounting plate, long) Discontinued; only available via set 11 8 780 = 0496120.	

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2 364 711 Plug



Common Used in step 5051

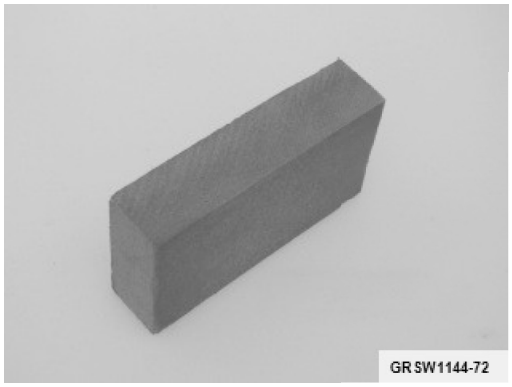
Usage	For closing the pressure oil holes for cleaning the cylinder head sealing surfaces.
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 50 14 (203)

0 495 103 (11 4 471) Scraper



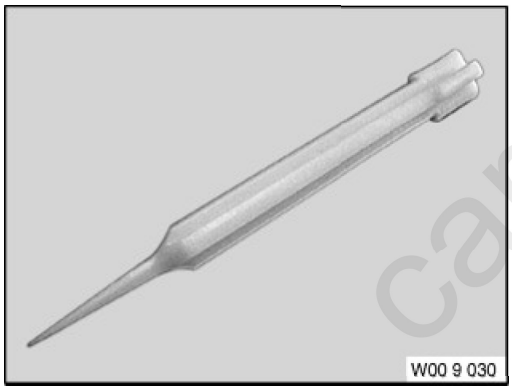
Common	Used in step 51
Usage	
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

0 495 104 (11 4 472) Extractor



Common	Used in step 51
Usage	(grindstone)
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

0 496 714 (00 9 030) Wedge



Common	Used in step 54
Usage	For dismantling O-rings, gaskets and trim panels. This special tool replaces special tool 00 9 316.
Included in the tool or work	
Storage location	A50
Replaced by	
In connection with	
SI-Number	01 20 09 (581)

2 455 654 Tensioning tool



Common	Used in step 6063
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 70
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 70
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)

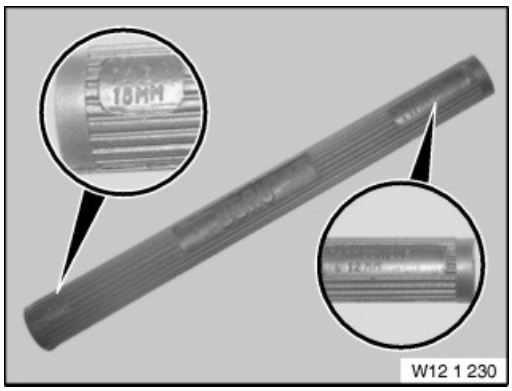
2 358 022 Gauge



Common	Used in step 7172
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)

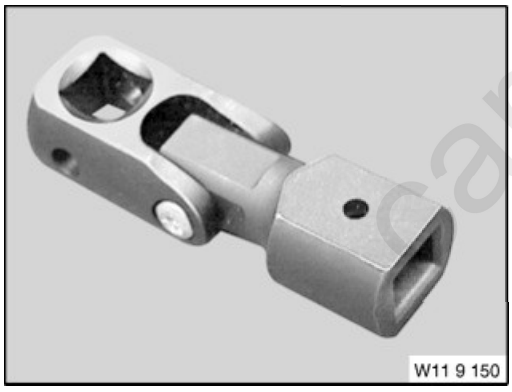
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0 496 065 (12 1 230) Fitting aid



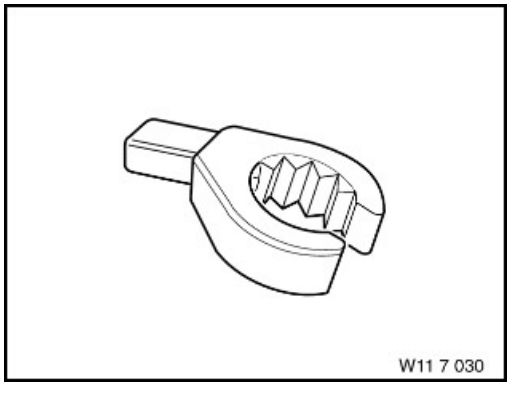
Common	Used in step 75
Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

0 493 751 (11 9 150) Extension



Common	Used in step 78
Usage	(Socket wrench extension) For loosening and tightening the oxygen sensor
Included in the tool or work	
Storage location	C41
Replaced by	
In connection with	
SI-Number	01 15 00 (609)

0 491 075 (11 7 030) Socket wrench insert



Common	Used in step 78
Usage	(Socket wrench insert 22 mm) For loosening and tightening the oxygen sensor
Included in the tool or work	
Storage location	A9
Replaced by	
In connection with	
SI-Number	01 06 95 (963)

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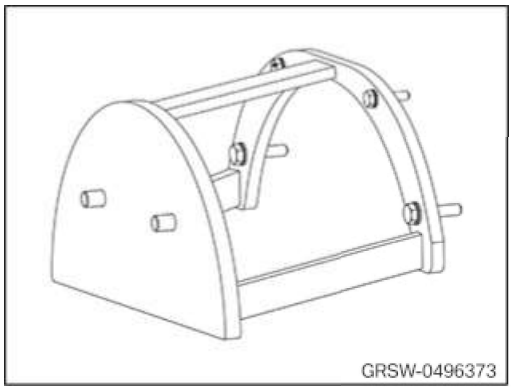
Replacement tools:

2 299 563 Adapter



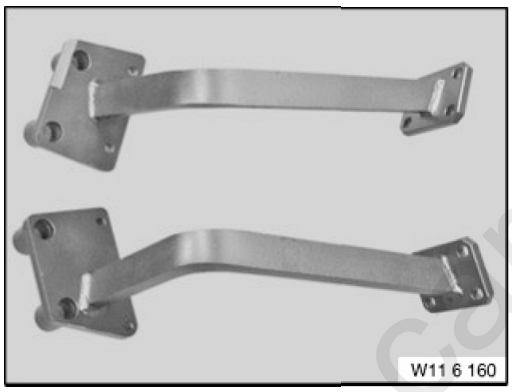
Common	Used in step 3
Usage	New adapter for the engine assembly stand. Replacement for 83 30 0 495 189 - 00 2 302.
Included in the tool or work	0 495 187
Storage location	
Replaced by	
In connection with	
SI-Number	

0 496 373 (11 5 420) Plate



Common	Used in step 3
Usage	(Fixture) Engine S62
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	

0 496 680 (11 6 160) Support



Common	Used in step 3
Usage	For mounting N74 engine on the assembly stand. In combination with 00 2 300, 00 2 320
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	00 2 300; 00 2 320 = 0495196
SI-Number	01 31 09 (604)

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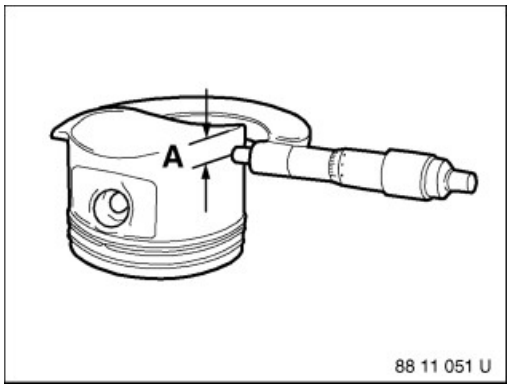
Overview Technical Data

Piston diameter

Used in step 41

Measure the piston diameter at distance (A) from the lower end of the piston skirt.

Distance (A) to the lower end of the piston skirt	10 mm
Nominal dimension of piston diameter	81,958 mm ... 81,996 mm



Cylinder bore B38/B46/B48/B58	Used in step 43
Diameter of cylinder bore	82,000 mm ... 82,014 mm
Permitted irregularity of the cylinder bore	0,01 mm
Permitted conicity of the cylinder bore	0,01 mm
Permissible total wear tolerance between piston and cylinder bore (engine operated)	0,15 mm

Height of the sealing bead	Used in step 47
	2,0 mm ... 2,5 mm

Engine oil B58B30M1/B58B30O1	Used in step 84
Filling capacity, engine oil change with oil filter element	6,50 l

Engine oil: Technically suitable engine oils for BMW Group engines

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