11 12 161 replace cylinder head

WARNING

Hot surfaces.

Risk of burning!

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

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

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

CAUTION

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

Danger of injury!

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

RISK OF DAMAGE

Engine damage due to lack of engine oil.

Lack of engine oil after the cylinder head or the engine has been renewed may cause damage to the valve gear.

- Do not start the engine after renewing the cylinder head or the engine without following the repair notes.
- The repair notes on renewing the cylinder head or the engine must be followed.
- For additional information, see: Repair notes on renewing the cylinder head or the engine

TECHNICAL INFORMATION

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

PRELIMINARY WORK

1 – Disconnecting all battery earth leads

- See additional information.

2 – Bring front compartment lid in the service position

Prerequisite

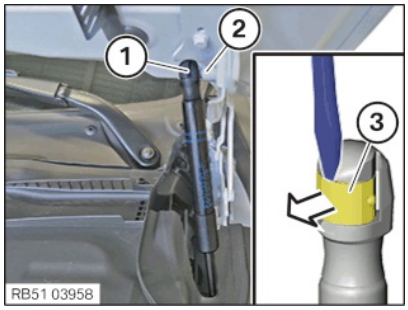
Engine compartment lid is open.

CAUTION

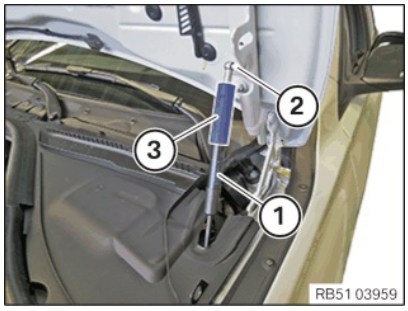
Shutting bonnet or tailgate.

Danger of injury!

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



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

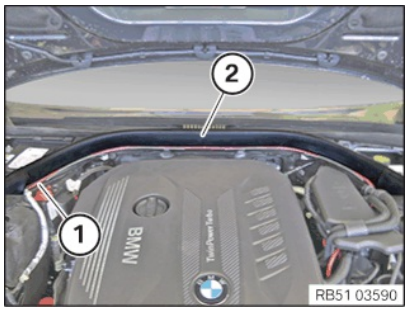


TECHNICAL INFORMATION

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

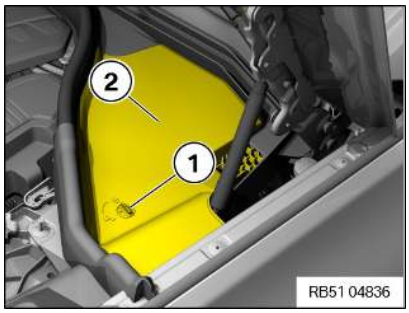
- Remove the bonnet support and open the bonnet further.
- Pull special tool or or 0 494 787 (51 0 040) (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

3 – Remove the seal for the rear bonnet



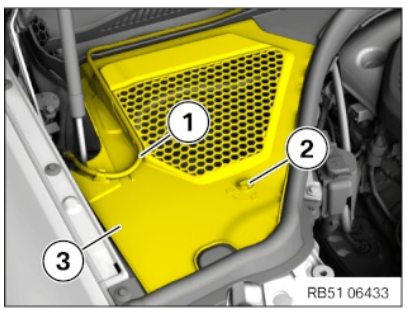
- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

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



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

5 – Remove the cover of the rear right engine compartment



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

6 – Removing the wiper arm on the left and right

NOTICE

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

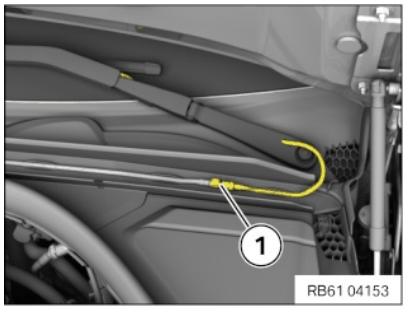
▸ **Remove the wiper arm**

RISK OF DAMAGE

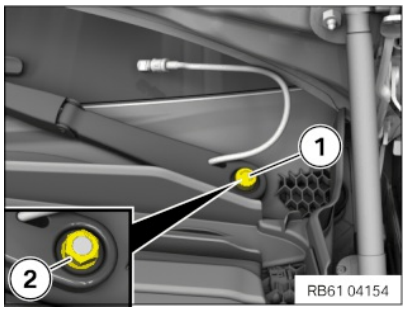
Damage to wiper console.

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

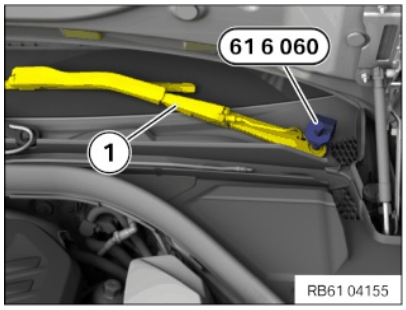
- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do **not** lever off the wiper arm because otherwise the wiper console may break at the predetermined breaking point for active pedestrian protection.



- Disconnect the washer fluid hose (1) at the separation point and feed out from the cowl panel guide.

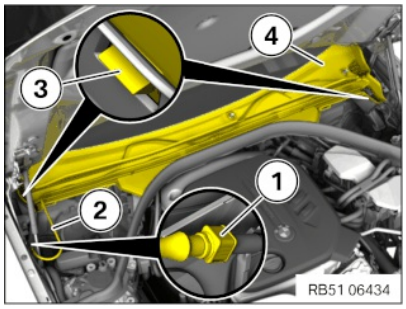


- Remove the protective cap (1).
- Loosen nut (2).

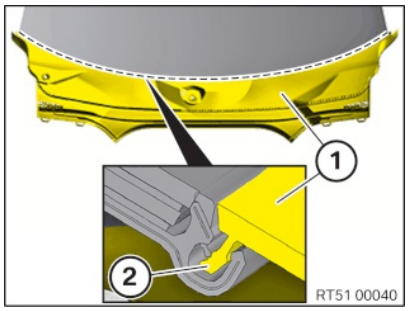


- Pull off the wiper arm (1) using special tool .

7 – Remove cowl panel cover



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

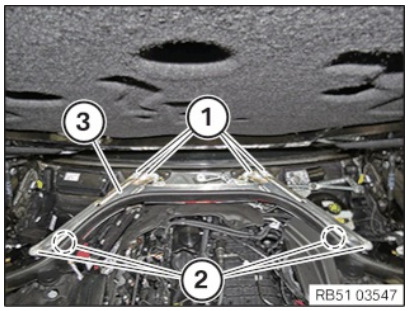


- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

8 – Removing the centre bulkhead upper part

TECHNICAL INFORMATION

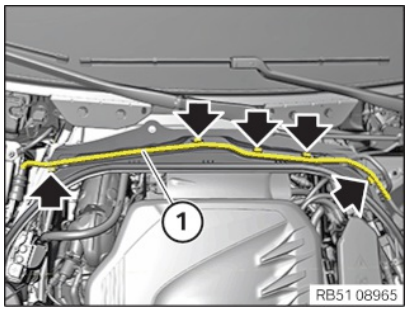
Driving without the strut brace/front-end strut or tension strut is not permitted.



NOTICE

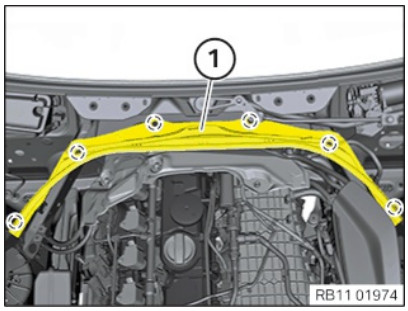
The following work step(s) is / are to be carried out if the specified component(s) is/are fitted.

- Loosen screws (1) and (2).
- Remove tension strut (3) in the spring strut dome upwards.



- **Version with mild hybrid technology:**

  Unclip the wire (1) at the holders (arrows).



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

9 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

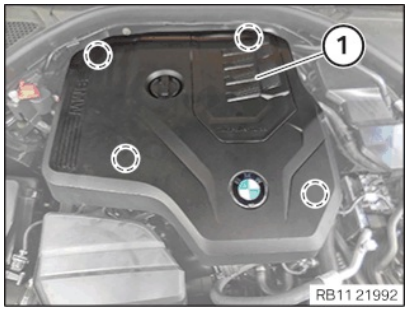
- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover/design cover.

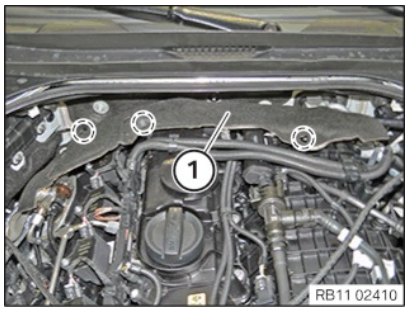
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover/design cover.

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



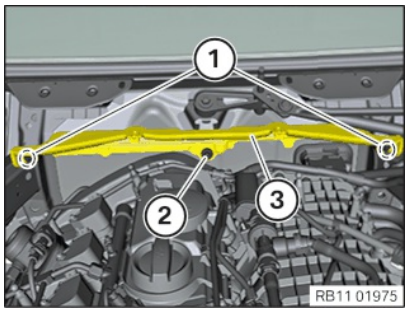
- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

10 – Removing acoustic cover at rear



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

11 – Removing the centre bulkhead lower section



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

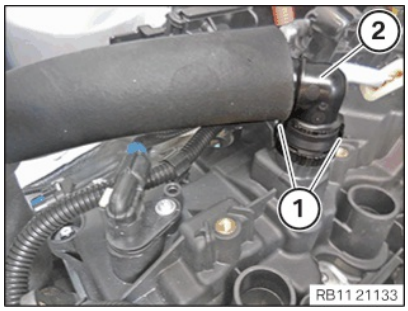
12 – Removing the clean air pipe with the resonator

WARNING

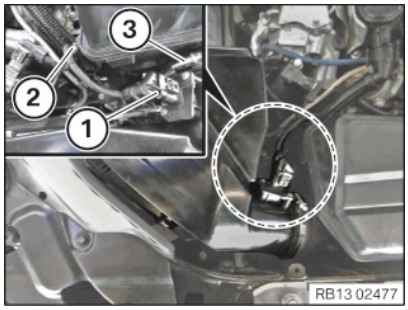
Hot surfaces.

Risk of burning!

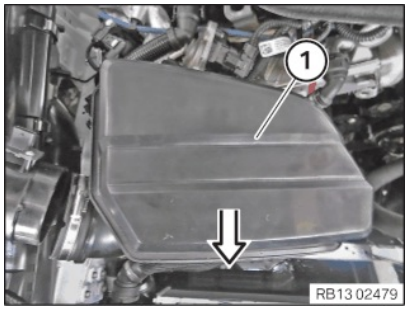
- Perform all work only on components that have cooled down.



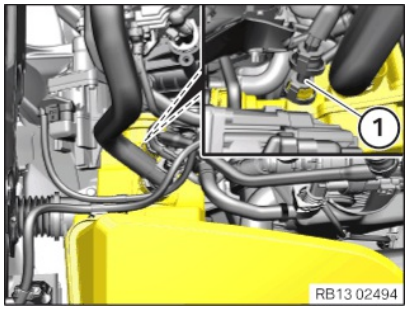
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



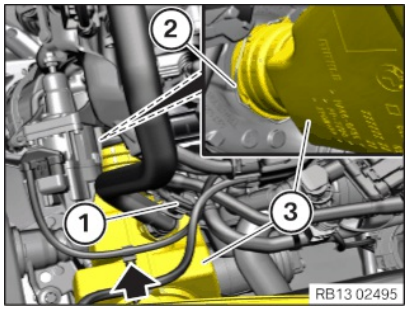
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



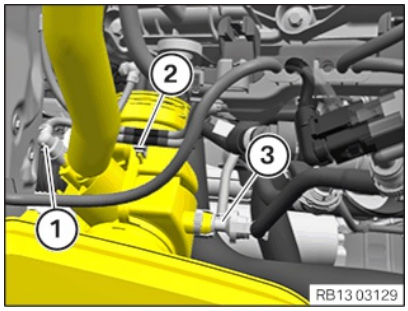
- Press and hold clean air pipe with the resonator (1) in the direction of the arrow.



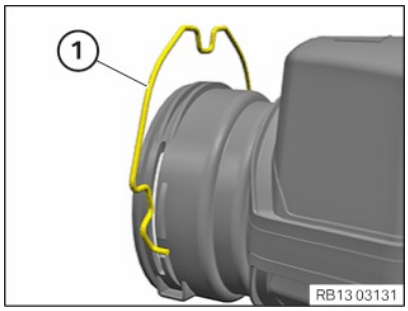
- **Version A:**
- Unlock and disconnect the tank ventilation line (1).



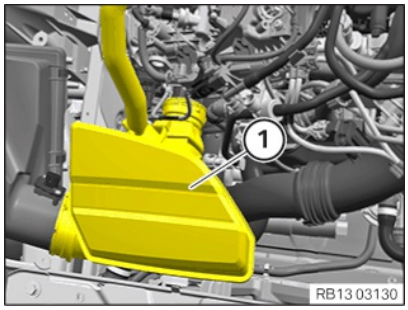
- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.



- **Version B:**
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unlock and pull off line (2).



- Unlock the clamp (1) and engage in this position.



- Unlock the clean air pipe with the resonator (1) and pull off.
- Feed out the clean air pipe with the resonator (1) and remove.

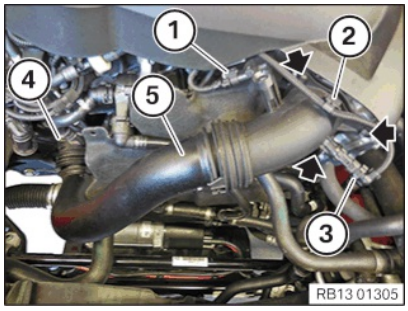
13 – Remove charge air line

WARNING

Hot surfaces.

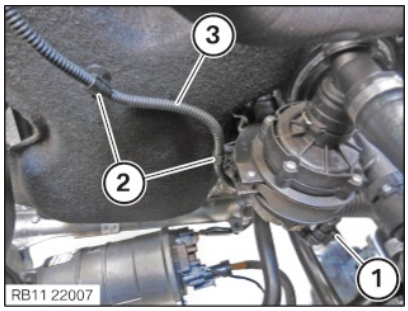
Risk of burning!

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

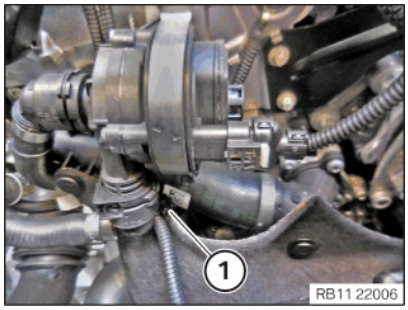


- Unlock plug connection (1) and disconnect.
- Unlock and loosen clamp (2).
- Unlock plug connection (3) and disconnect.
- Remove screws (arrows).
- Unlock and detach clamp (4) on exhaust turbocharger.
- Guide out and remove charge air line (5).

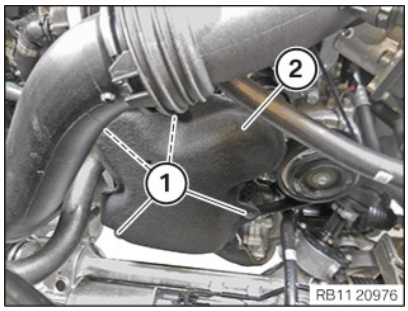
14 – Removing acoustic cover for engine at front



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



- Loosen clamp (1).



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

15 – Removing the DME control unit

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

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

TECHNICAL INFORMATION

Follow instructions for removing and installing control units.
For additional information see: 12 00 ... Notes on removal and installation of control units

TECHNICAL INFORMATION

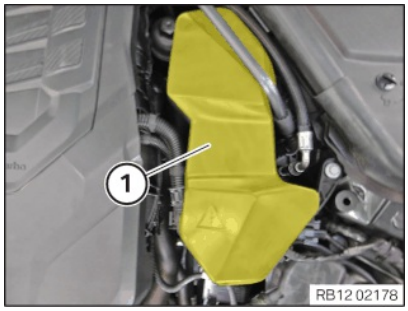
In a warranty case, you must always provide a fault memory printout with the defective part, even if the fault memory does not contain an entry.

TECHNICAL INFORMATION

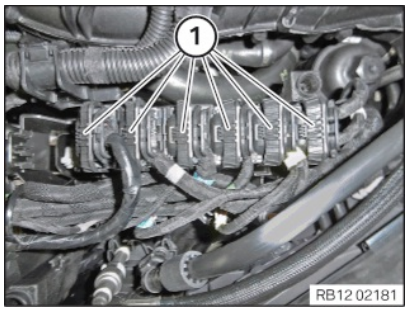
Control unit must be programmed after it is replaced.
For additional information see: 61 00 ... Programming/encoding control unit(s)

TECHNICAL INFORMATION

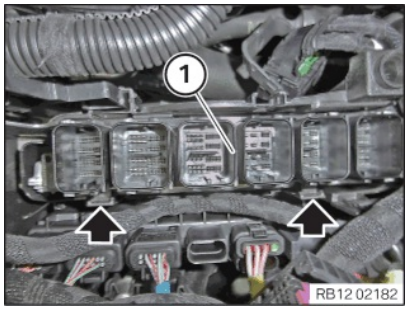
Disconnecting control units may cause fault code entries and functional limitations. Fault code entries must be read out and deleted if necessary.



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



- Unlock and disconnect the plug connection (1).



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

16 – Removing integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

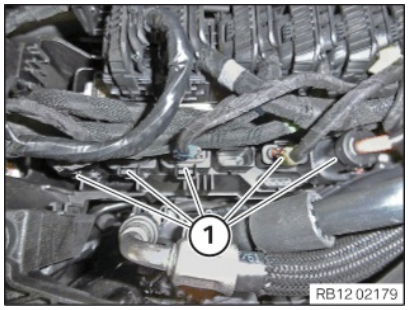
- Make sure that **no charger** is connected to the jump start support point in the engine compartment.
- Detach battery earth lead from battery.
- With auxiliary batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

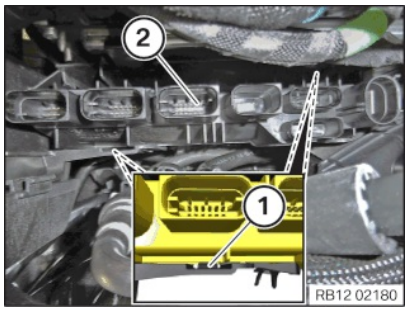
Electrostatic discharge.

Damage to or destruction of electrical components.

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

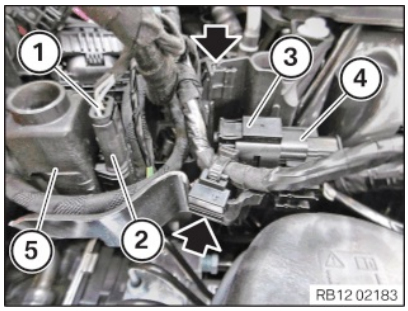


- Unlock and disconnect plug connections (1).

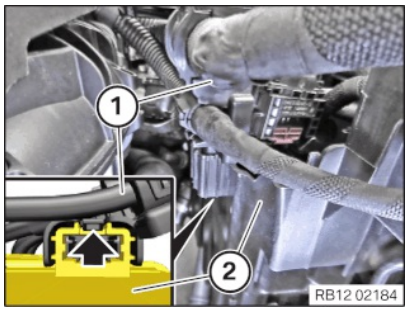


- Unlock the latch mechanisms (1).
- Guide out and remove integrated supply module (PDM) (2) upwards.

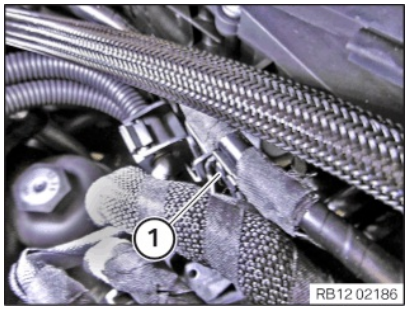
17 – Removing the control unit holder



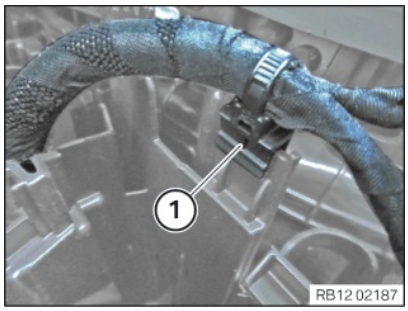
- Unlock plug connection (1) and disconnect.
- Unlock the connector (2) and disconnect from the starter (5).
- Unlock plug connection (3) and disconnect.
- Unlock the connector (4) and disconnect from the starter (5).
- Release the clamps (arrows).



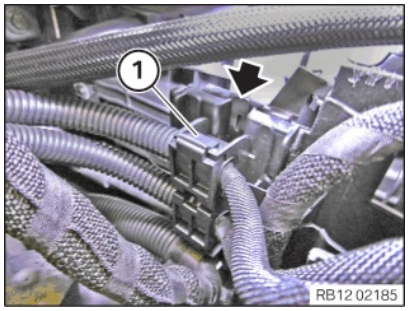
- Unlock the lock (arrow).
- Disconnect the cable plug (1) upwards from the control unit holder (2).



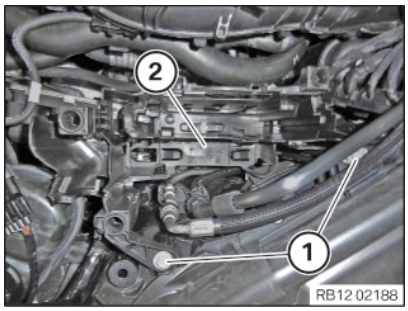
- Loosen clamp (1).



- Loosen clamp (1).

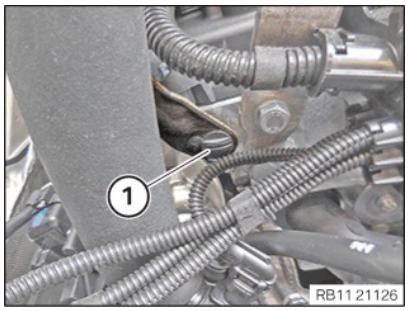


- Unlock the lock (arrow).
- Feed out the cable clip (1) upwards and set it aside.

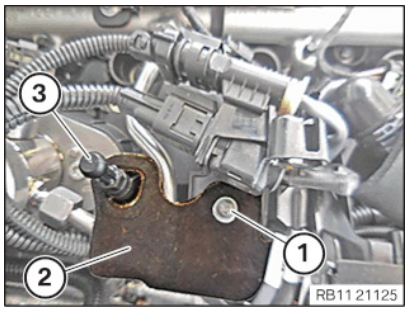


- Loosen screws (1).
- Guide out and remove the control unit holder (2).

18 – Removing the cylinder head cover acoustic cover



- Loosen clip (1).



- Loosen screw (1).
- Guide the acoustic cover (2) out of the ball pin (3) and remove.

19 – Remove all ignition coils.

NOTICE

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

▸ **Removing the ignition coil**

WARNING

Hot surfaces.

Risk of burning!

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

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.

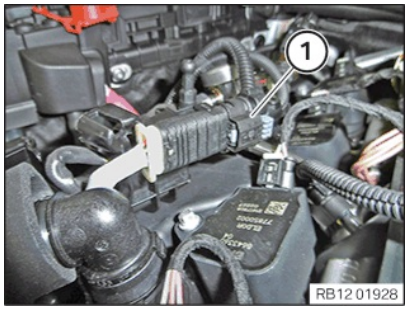
- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. Do not use **any** auxiliary materials or mounting agents (e.g. silicone spray, rubber care product, rust remover, etc.).

RISK OF DAMAGE

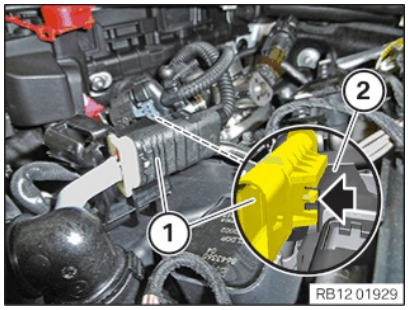
Electrostatic discharge.

Damage to or destruction of electrical components.

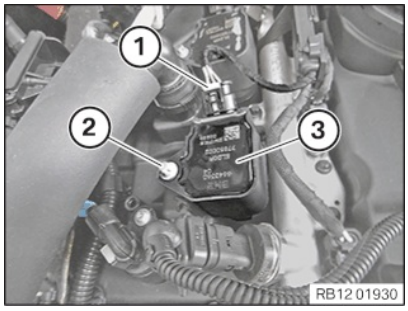
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the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



- Unlock plug connection (1) and disconnect.



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



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

20 – Removing all spark plugs

WARNING

Hot surfaces.

Risk of burning!

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

CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

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

- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

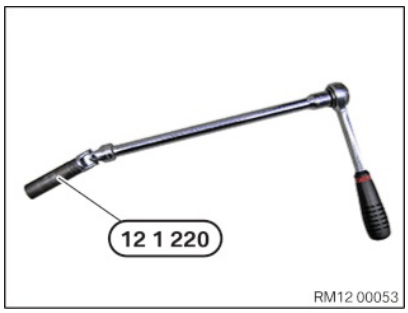
The spark plug shaft must be cleaned using compressed air after the ignition coils have been removed but before the spark plugs have been removed. After the spark plugs have been removed, once again check the sealing surface for contamination and if necessary, clean using a moist cloth or clean once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

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

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

NOTICE

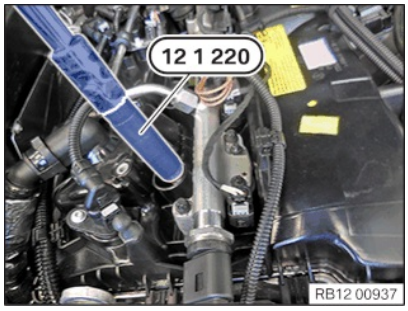
The description is for one component only. The procedure is identical for all further components.



TECHNICAL INFORMATION

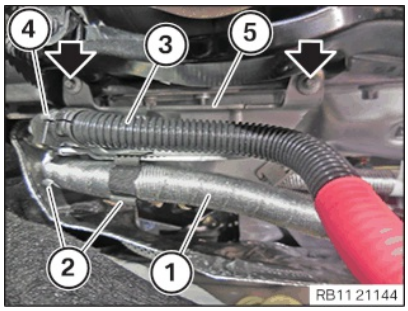
Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

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



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

21 – Remove the holder of the positive battery cable



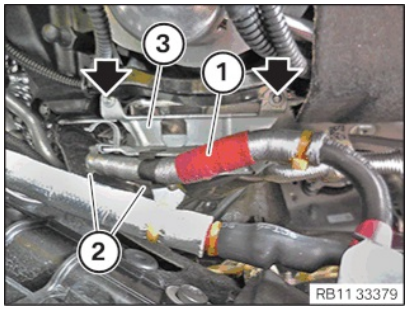
- **Version A (without mild hybrid technology)**

  Remove positive battery cable (1) from clamps (2).

  Detach the positive battery cable (3) from the bracket (4).

  Remove screws (arrows).

  Feed out the bracket (5) of the positive battery cable and set it aside.

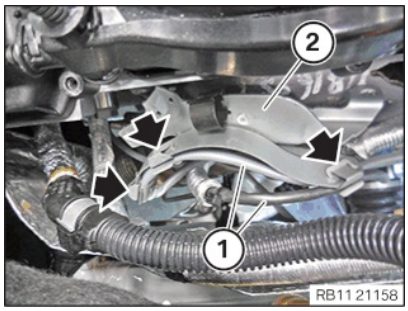


- **Version B (with mild hybrid technology)**

  Remove positive battery cable (1) from clamps (2).

  Remove screws (arrows).

  Feed out the holder (3) of the positive battery cable and set aside.



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

22 – Remove the heat shield at the cylinder head

WARNING

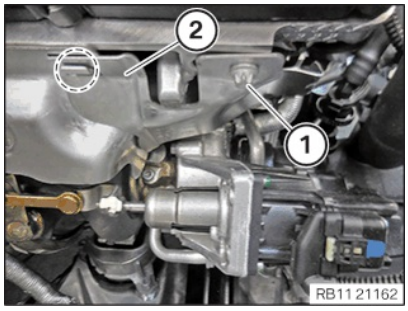
Hot surfaces.

Risk of burning!

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

- **Version without Real Driving Emissions 2 (-SA1DZ):**

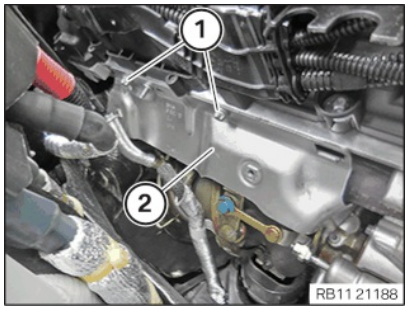
  Loosen screw (1).



- **Version without Real Driving Emissions 2 (-SA1DZ):**

  Loosen screw (1).

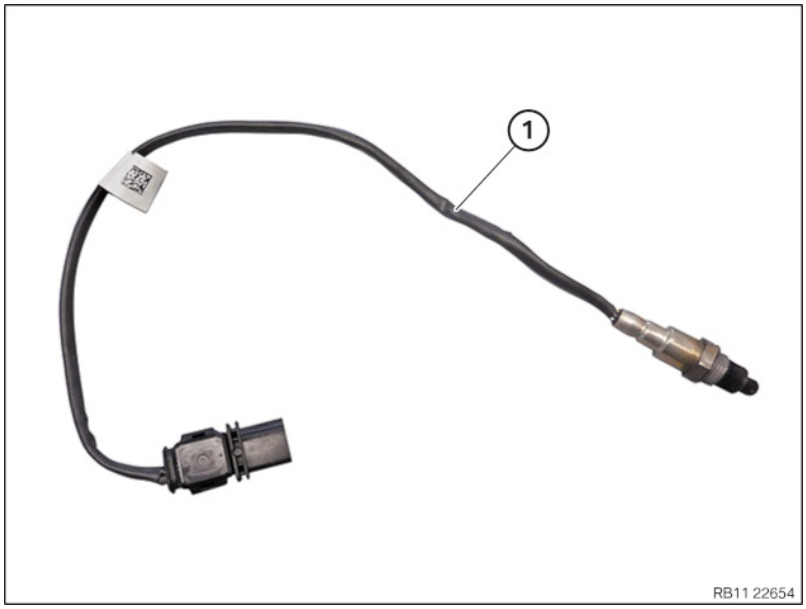
  Remove the heat shield (2) from the **marked** area and remove.



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

23 – Removing the front oxygen sensor

Lambda control probe



1 Lambda control probe

WARNING

Hot surfaces.

Risk of burning!

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

RISK OF DAMAGE

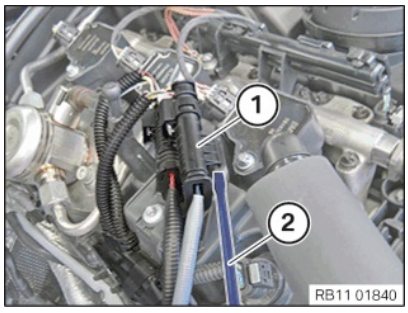
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

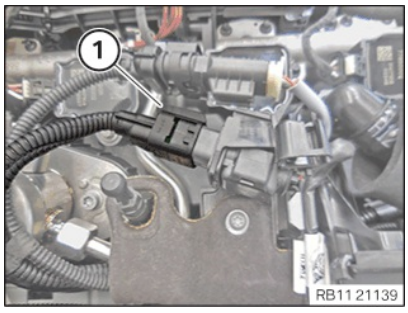
- Do not pull on the wires when disconnecting connectors and plug connections.

NOTICE

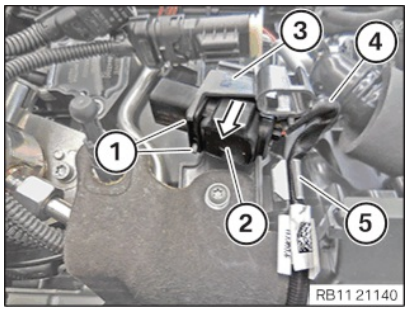
The oxygen control sensor cable of is black. The installation location of the front oxygen sensor is before the catalytic converter.



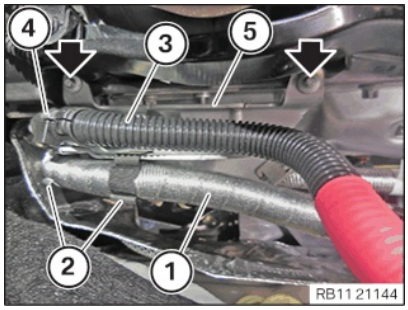
- Unlock the plug connection (1) with the screwdriver (2) and release it from the carrier plate.



- Unlock and release plug connection (1).



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



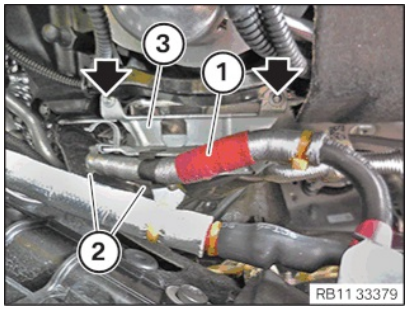
- **Version A (without mild hybrid technology)**

  Remove positive battery cable (1) from clamps (2).

  Detach the positive battery cable (3) from the bracket (4).

  Remove screws (arrows).

  Feed out the bracket (5) of the positive battery cable and set it aside.

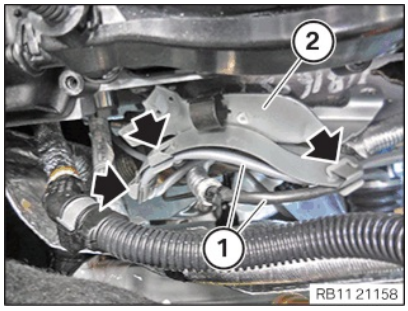


- **Version B (with mild hybrid technology)**

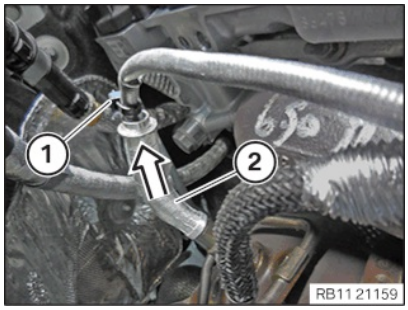
  Remove positive battery cable (1) from clamps (2).

  Remove screws (arrows).

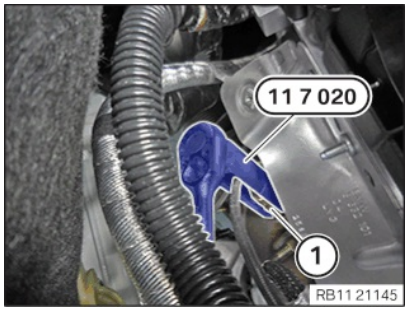
  Feed out the holder (3) of the positive battery cable and set aside.



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



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



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

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

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Make sure that **no charger** is connected to the jump start support point in the engine compartment.
- Detach battery earth lead from battery.
- With auxiliary batteries: Detach all battery earth leads from additional batteries.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

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

CAUTION

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

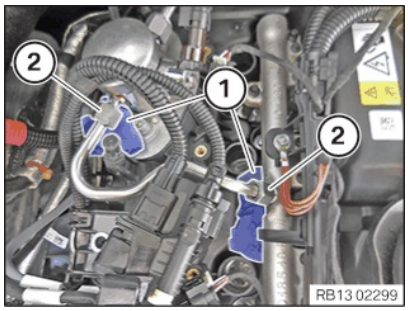
Danger of injury!

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

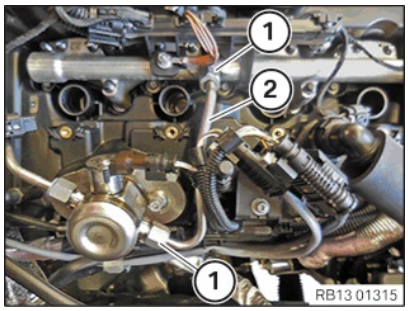
TECHNICAL INFORMATION

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

- Have the special tool ready.



- Position a lint-free cleaning cloth (1) on the union nuts (2).
- Release union nuts (2).
- Catch and dispose of escaping fuel.
- Feed out and dispose of the lint-free cleaning clothes (1).



- Release the union nuts (1) completely.
- Feed the high pressure line (2) out and remove.

- Seal all openings with the special tool .

25 – Remove fuel delivery line

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

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

CAUTION

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

Danger of injury!

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

RISK OF DAMAGE

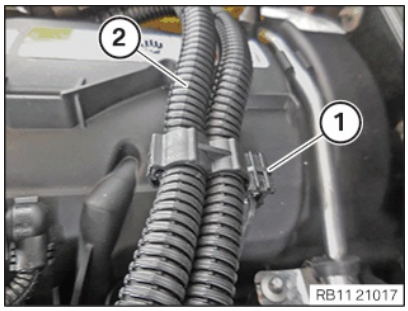
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

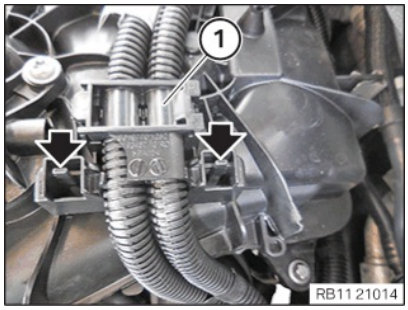
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

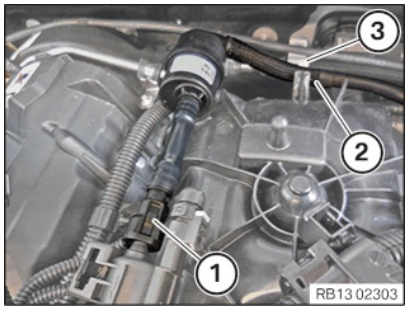
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



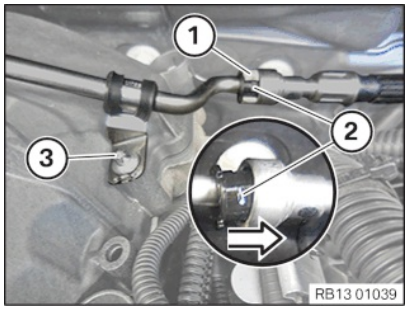
- Loosen clamp (1).
- Guide out wiring harness section (2) for the injectors and ignition coils and place it aside.



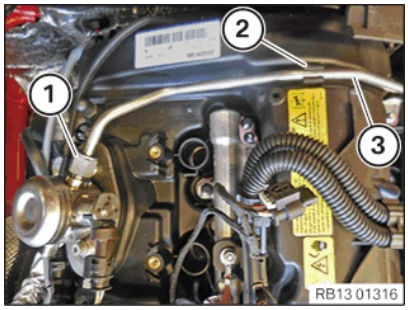
- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.



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



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



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

26 – Removing the rail with injectors

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 torsional movement of maximum 13 Nm.

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

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.

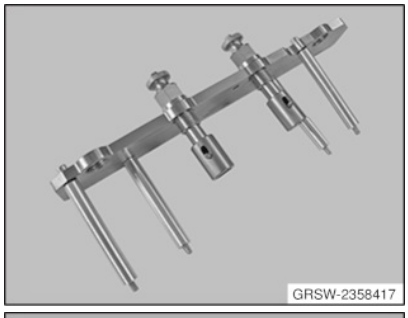
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

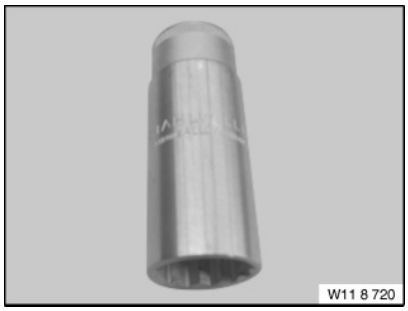
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the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

- Prepare special tool .

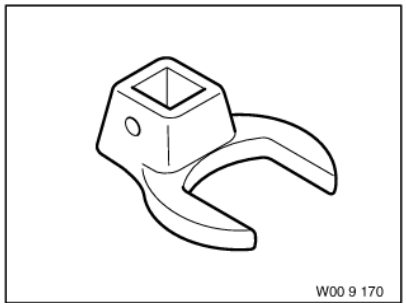


- Prepare special tool 2 358 417.

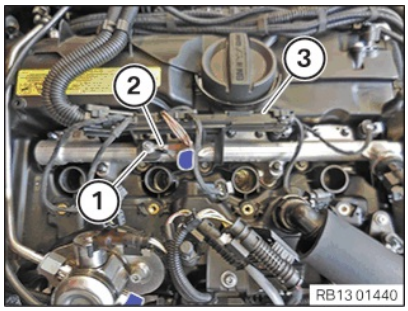
- Prepare special tool .



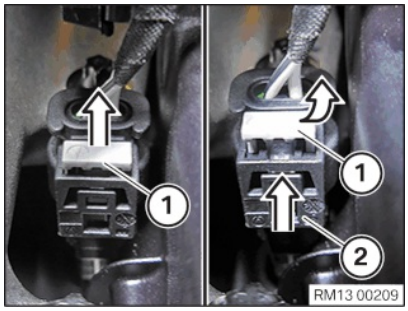
- Prepare special tool 0 496 106 (11 8 720).



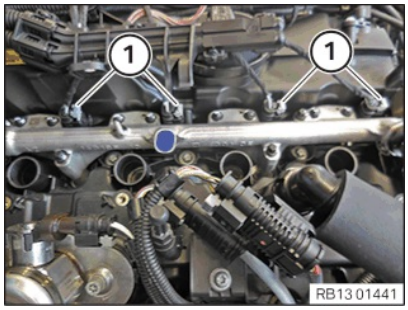
- Prepare special tool 0 490 507 (00 9 170).



- 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 off connector (2) from the injectors.



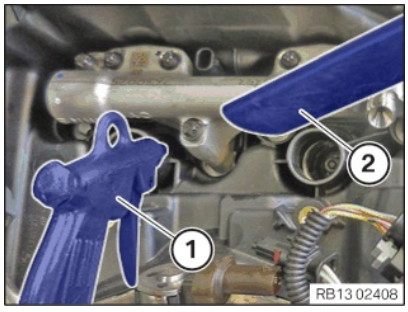
RISK OF DAMAGE

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 release all connectors (1) of the injectors.

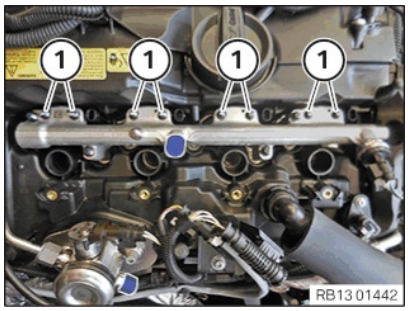


TECHNICAL INFORMATION

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

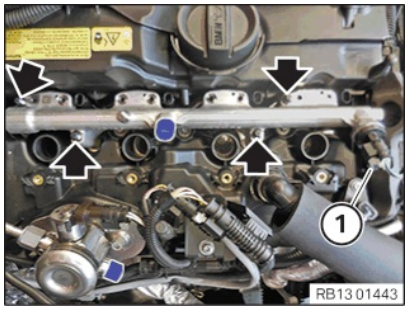
- Before releasing the high pressure lines: Blow out the injector shafts with air gun (1) with a little pressure.
- At the same time, use an **explosion-proof** vacuum cleaner (2) to draw off the dirt particles.



- Unscrew and remove the screws (M5x30) (1).

  Do **not** reuse screws (M5x30) (1).
- Renew the bolts (M5x30) (1).

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

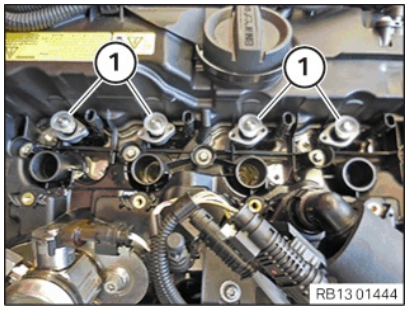


- Unscrew and remove screws (M6x70) (arrows).

  Do **not** reuse the screws (M6x70) (arrows).
- Renew the screws (M6x70) (arrows).

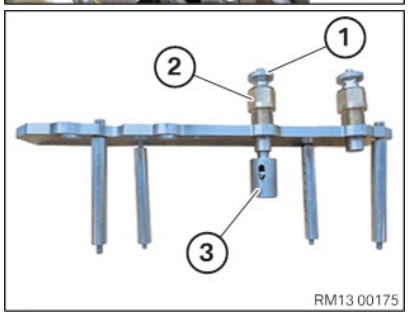
  Parts: Screws (M6x70)
- Unlock plug connection (1) and disconnect.
- Remove the rail in upward direction.

  The injectors remain in the cylinder head.



- Remove the gaskets (1).

  The seals (1) are only needed for the initial assembly at the plant and will **not** be reinstalled.



RISK OF DAMAGE

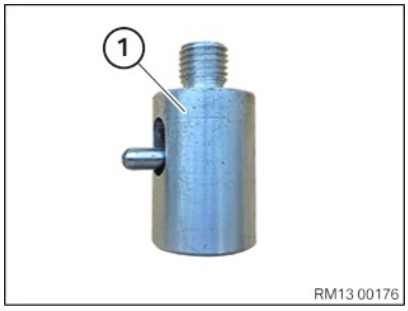
Damage to injectors.

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

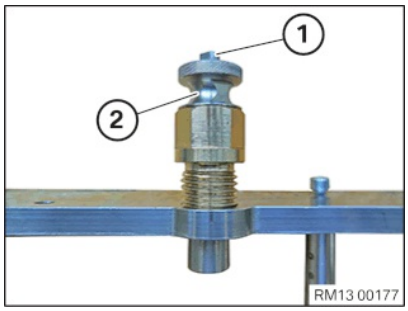
- Twist the injectors with a torsional movement of maximum 13 Nm.
- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use special tool 2 358 417 with special tool (spacer sleeves) to remove the injectors.

  Special tool 2 358 417 and spacer sleeves are used to ensure that the tensile force is not exceeded.

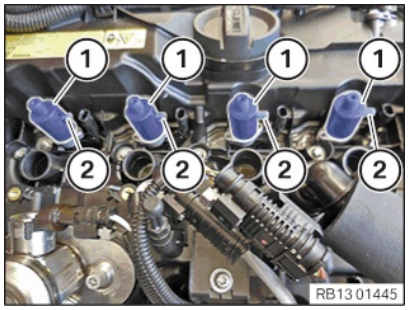
  The special tool 2 358 417 consists of:
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Fixture for the injector



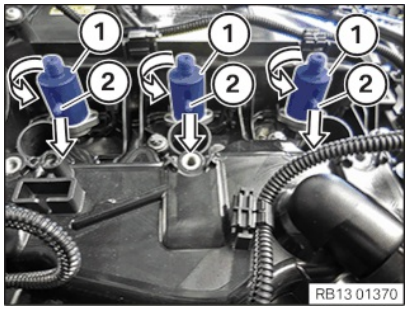
- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.



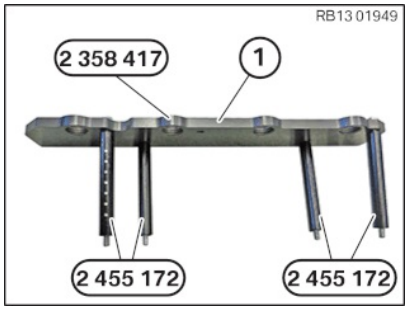
- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.



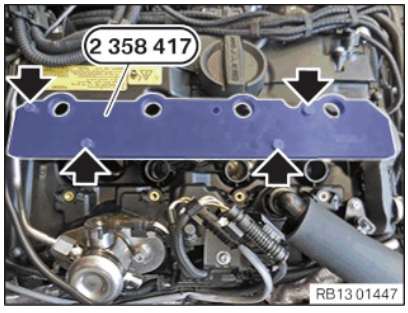
- Install all fixtures (1) for the injectors.
  The fixtures (1) are not locked when the levers (2) are up.



- Turn the fixtures (1) in the direction of the arrow by **90°** and lock the levers (2) downward.



- Prepare panel (1) from special tool 2 358 417 with spacer sleeves .

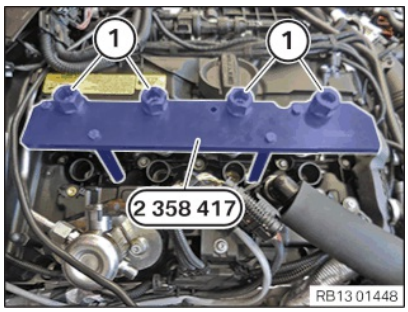


RISK OF DAMAGE

Damage to injectors.

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

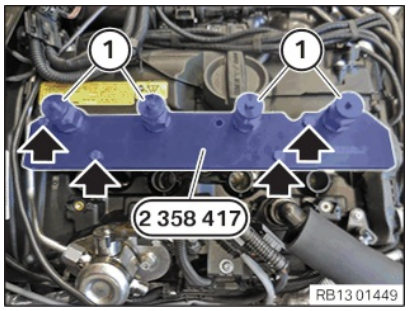
- Do not use the puller plate as a support.
- Attach special tool 2 358 417 with spacer sleeves on the cylinder head.
- Hand-tighten the bolts (arrows).



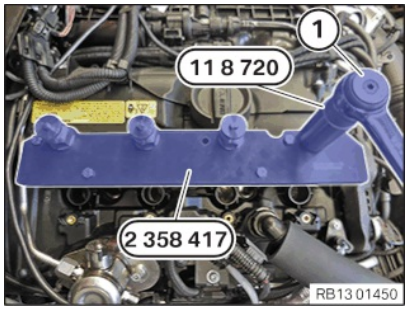
TECHNICAL INFORMATION

The extraction thread is a left-hand thread.

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



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



- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720) until the injectors of **cylinder 1,3,4** are pulled out.

TECHNICAL INFORMATION

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

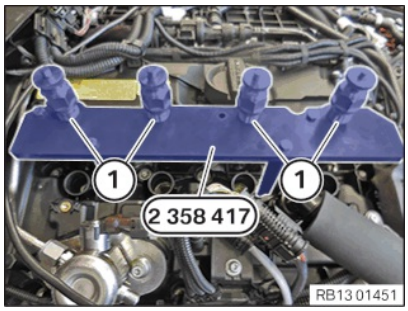
- Disassemble all injectors individually.

- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 490 507 (00 9 170)until the injector of **cylinder 2** is pulled out.

TECHNICAL INFORMATION

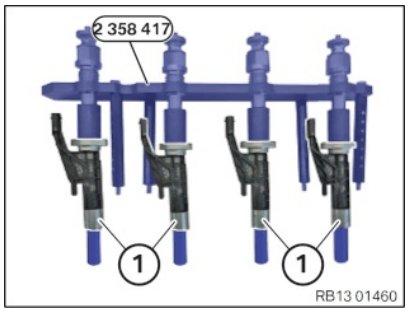
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

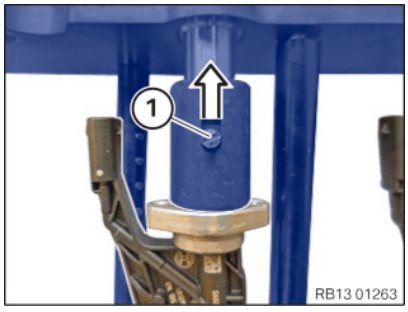


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  The threads of the pull-out thread must be completely visible.
- Loosen screws on special tool 2 358 417.



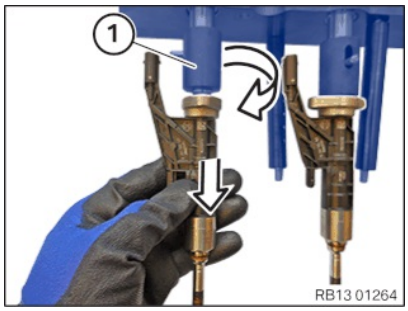
- Carefully remove special tool 2 358 417 with injectors (1) vertically upwards from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.



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.

27 – 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

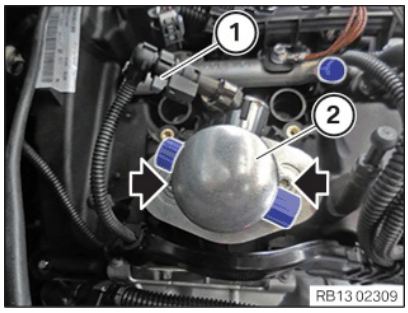
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

The high-pressure pump is preloaded by the piston spring and must be removed by alternately pulling out the screws without tilting.

Before installing the high pressure pump, turn the cam of the high-pressure pump drive to the bottom dead centre.

If necessary, turn the engine in the direction of engine rotation at the central bolt of the crankshaft, otherwise there is a risk of piston breakage of 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.

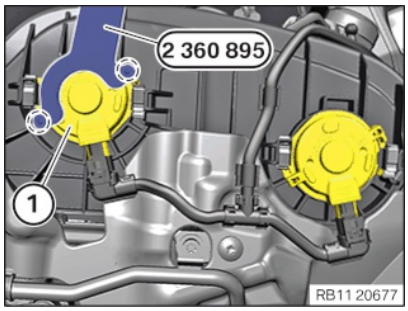
28 – Removing both actuators

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

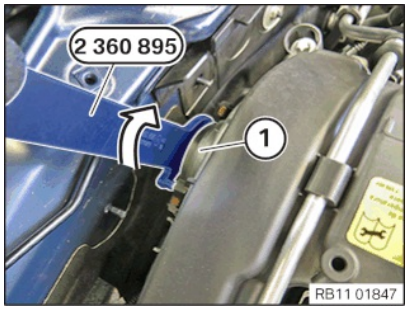
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the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



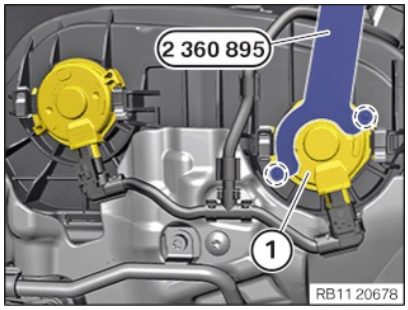
NOTICE

The figure shows the rear side of the engine.

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



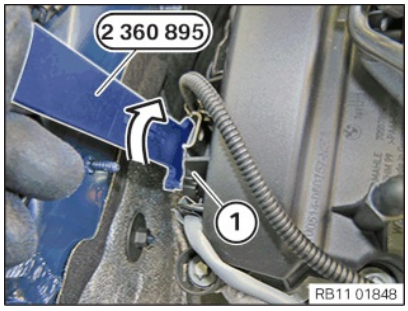
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



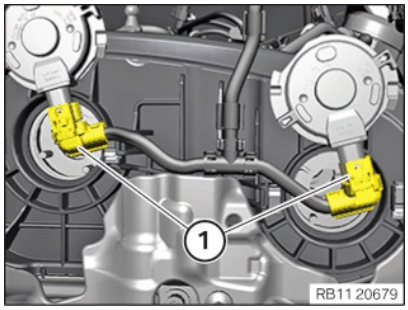
NOTICE

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.



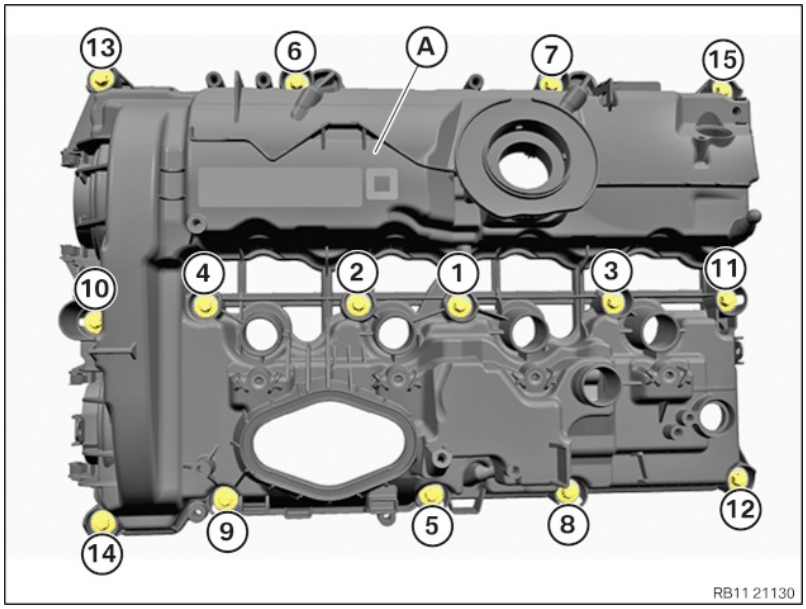
NOTICE

The figure shows the rear side of the engine.

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

29 – Removing the cylinder head cover

Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

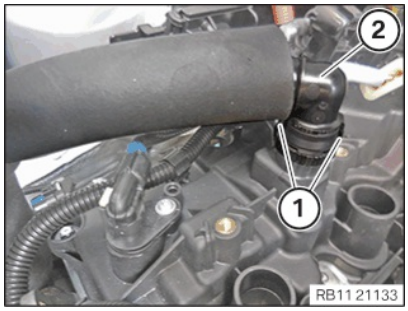
A Cylinder head cover

RISK OF DAMAGE

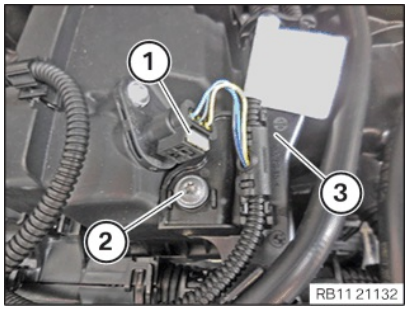
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

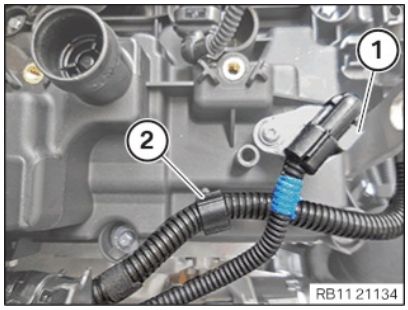
- Do not pull on the wires when disconnecting connectors and plug connections.



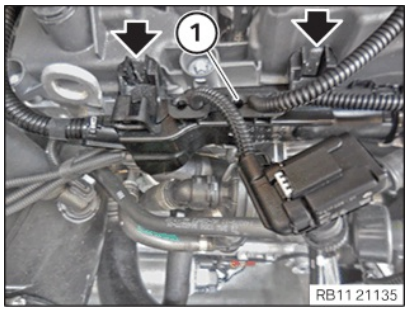
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



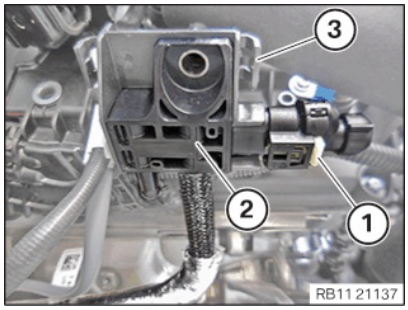
- Unlock and disconnect the plug connection (1) on the intake camshaft sensor.
- Loosen screw (2).
- Guide out the wiring harness section (3) for sensor system 1 and place to one side.



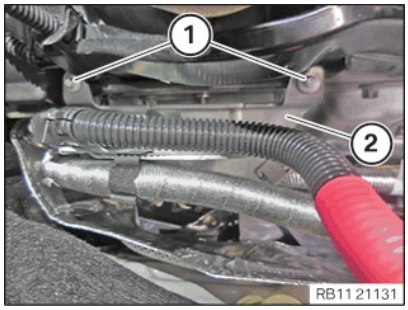
- Unlock and disconnect the plug connection (1) on the exhaust camshaft sensor.
- Unlock and loosen clamp (2).



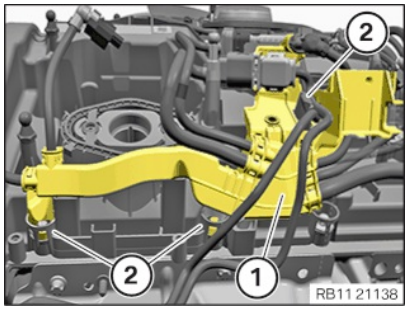
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for sensor system 2 and place to one side.



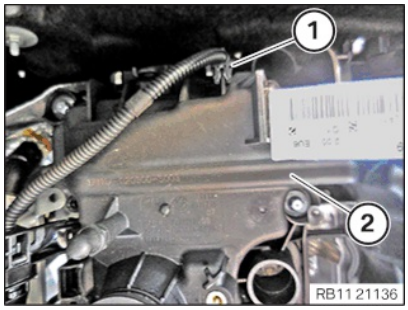
- Unlock plug connection (1) and disconnect.
- Feed out differential pressure sensor (2) from the holder (3) and place to one side.



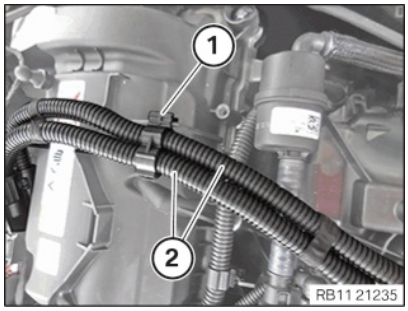
- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.



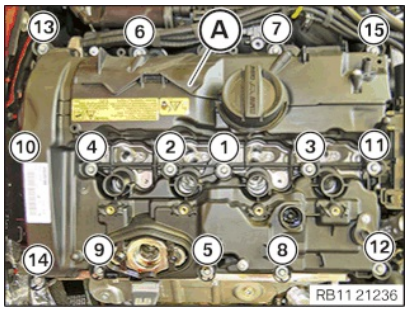
- Guide the wiring harness section (1) for the sensor system 2 out of the guides (2) and set it aside.



- Loosen clamp (1).

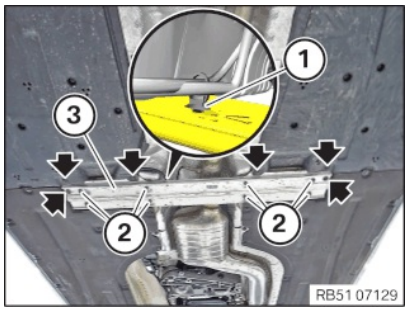


- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



- Loosen screws in the order (15) to (1).
- Guide the cylinder head cover (A) out and remove it.

30 – Remove the connecting support from the tunnel



- Remove screws (arrows).

NOTICE

The following work step(s) is / are to be carried out if the specified component(s) is/are fitted.

- Loosen clamp (1).
- Loosen screws (2).
- Guide out and remove connecting support (3) on the tunnel.

31 – Remove complete exhaust system

WARNING

Hot surfaces.

Risk of burning!

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

CAUTION

Component with heavy weight.

Danger of injury!

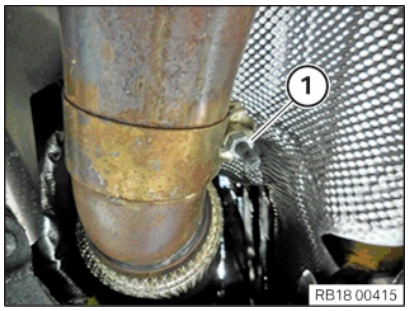
- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

CAUTION

Heavy component.

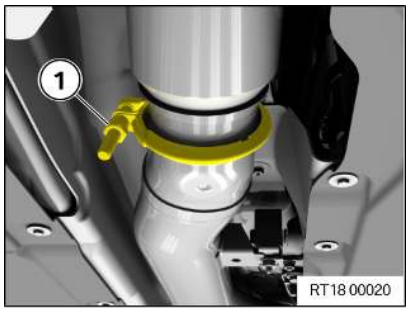
Heavy components can lead to injury or damage.

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



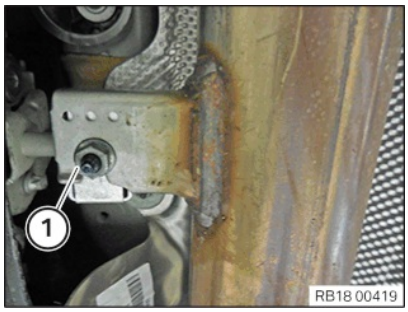
- **Version A:**

  Detach the ribbon clamp (1).

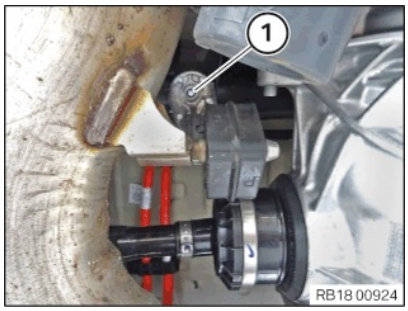


- **Version B:**

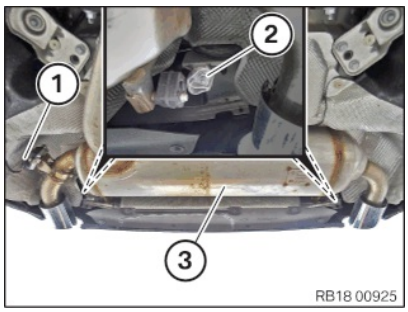
  Release the V-clip (1).



- Loosen nut (1).



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

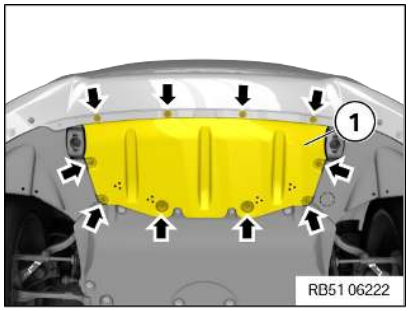


NOTICE

The following work step(s) is / are to be carried out if the specified component(s) is/are fitted.

- Unlock plug connection (1) and disconnect.
- Loosen nuts (2).
- Lower the exhaust system (3) with the help of an auxiliary person and remove it.

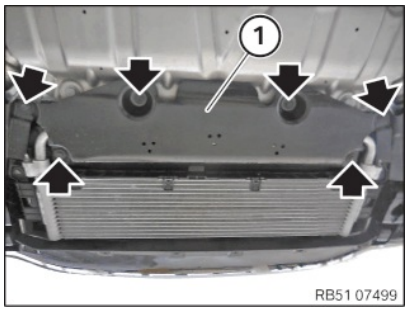
32 – Removing the front underbody protection



- **Version A:**

  Remove screws (arrows).

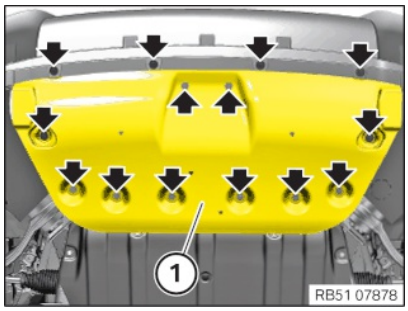
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version B:**

  Remove screws (arrows).

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

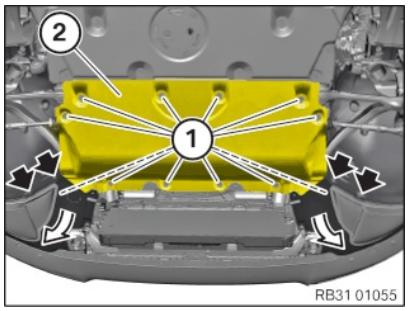


- **Version C:**

  Remove screws (arrows).

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

33 – Remove the underbody protection of the steering gear



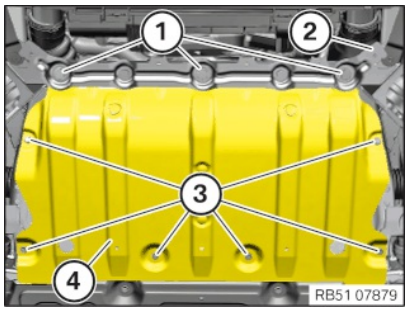
- **Version A:**

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

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove the underbody protection (2) of the steering gear.



- **Version B:**

  Loosen screws (1).

  Remove the holder (2) for the underride protection.

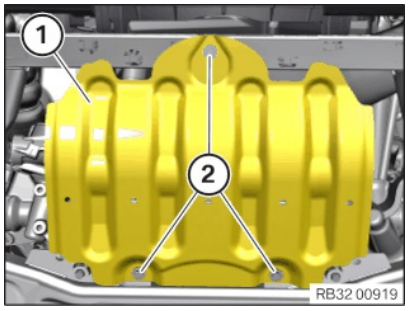
  Loosen screws (3).

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

34 – If installed: Removing the steering underbody protection

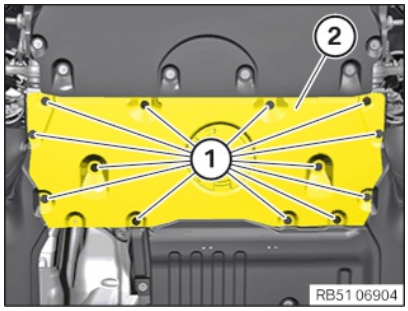
Prerequisite

Front underbody protection has been removed.



- Loosen screws (2).
- Remove underbody protection (1).

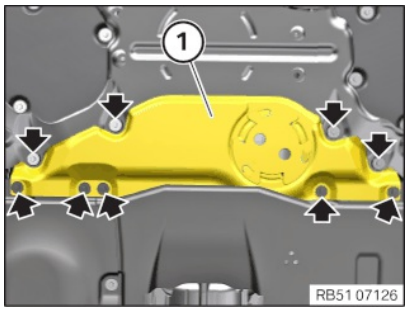
35 – Removing the centre underbody protection



- **Variant with rear wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .

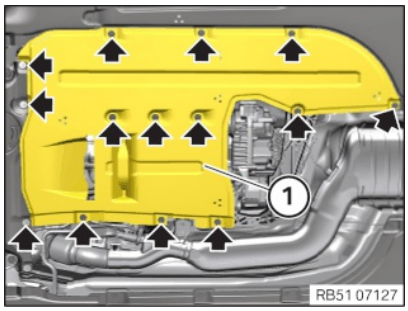


- **Version with all-wheel drive:**

  Remove screws (arrows).

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

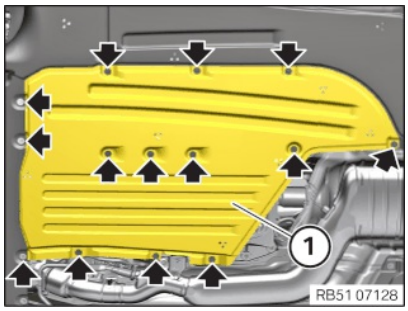
36 – Remove rear underbody protection



- **Version A:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).



- **Version B:**

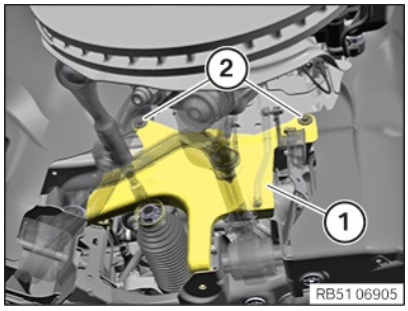
  Remove screws (arrows).

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

37 – Remove the cover of the steering assembly

Prerequisite

Underbody protection of the steering gear is removed.



- Loosen screws (2).
- Remove the cover (1).

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

WARNING

Hot surfaces.

Risk of burning!

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

TECHNICAL INFORMATION

Life-long fill of coolant!

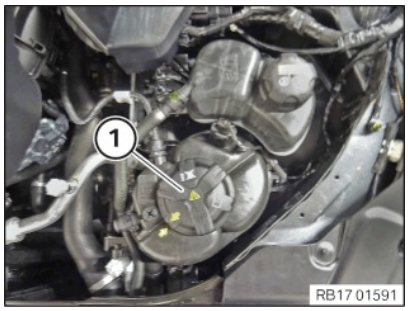
Do not reuse used coolant.

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

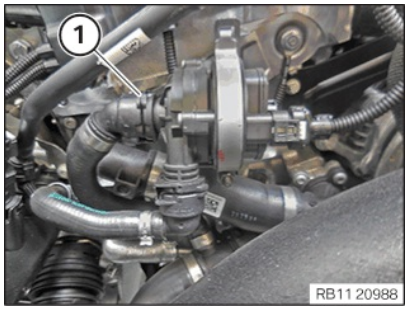
In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

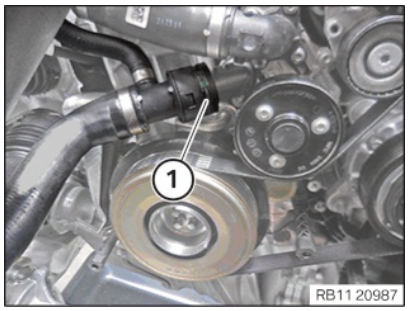
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen sealing cap (1).



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



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

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

WARNING

Hot surfaces.

Risk of burning!

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

TECHNICAL INFORMATION

Life-long fill of coolant!

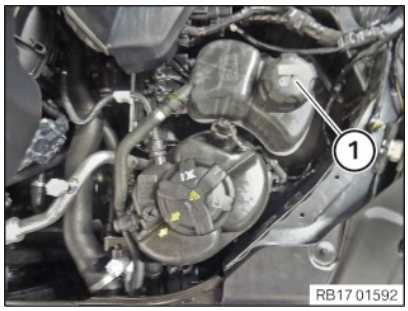
Do not reuse used coolant.

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

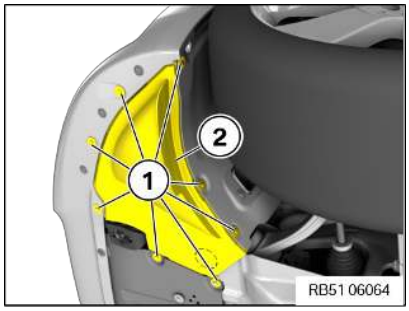
In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

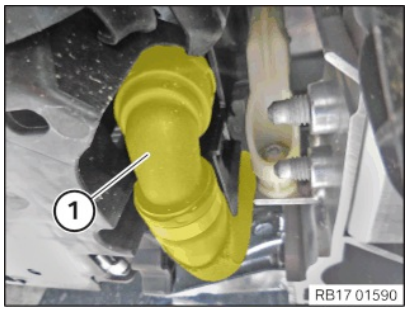
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen sealing cap (1).



- Loosen screws (1).
- Feed out the front left cover (2) downwards and remove it.

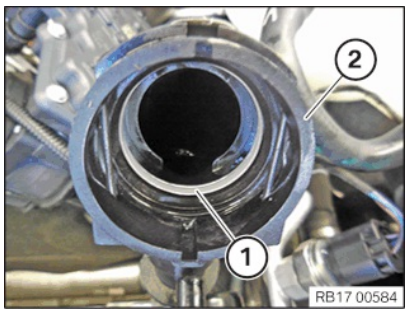


- Unlock and disconnect the coolant line (1).
- Catch and dispose of escaping coolant.

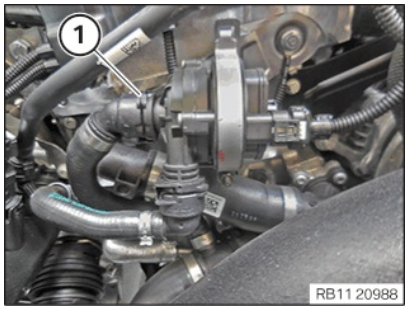
40 – Connecting the coolant lines for the high-temperature coolant circuit

TECHNICAL INFORMATION

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

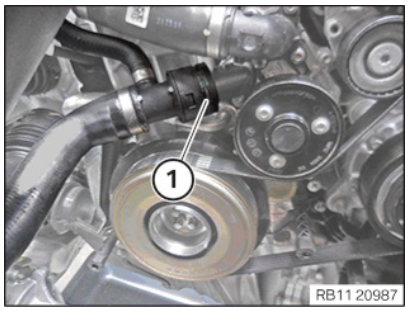


- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock coolant line (1).

  Coolant line (1) must audibly engage.



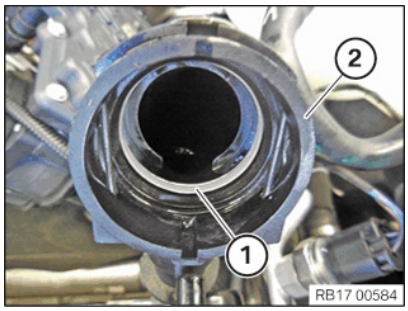
- Connect and lock coolant line (1).

  Coolant line (1) must audibly engage.

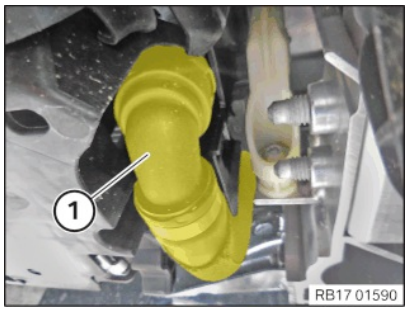
41 – Connecting the coolant lines for the low-temperature coolant circuit

TECHNICAL INFORMATION

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

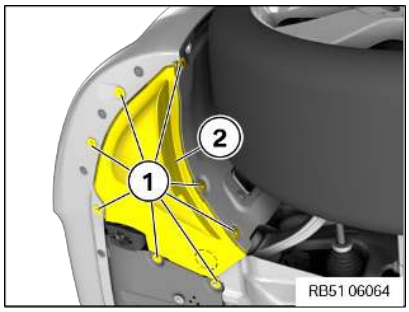


- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock the coolant line (1).

  The coolant line (1) must audibly engage.



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

Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

42 – 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.

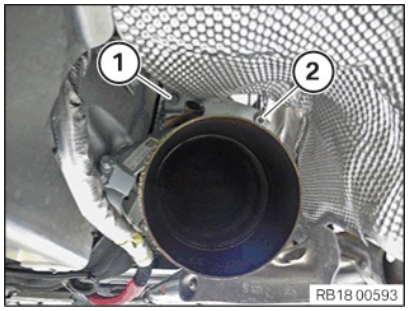
- Remove and install heavy components with the aid of another person/other persons.

CAUTION

Component with heavy weight.

Danger of injury!

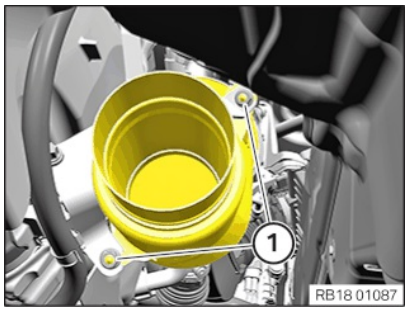
- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.



- **Version A:**

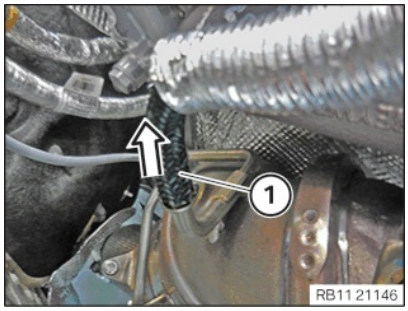
  Loosen screw (1).

  Loosen nut (2).

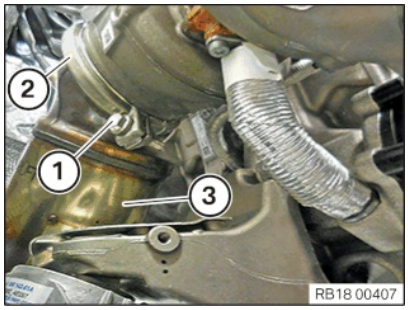


- **Version B:**

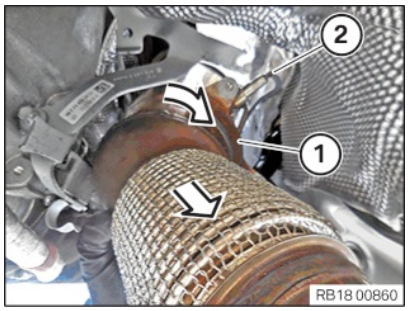
  Release nuts (1).



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



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

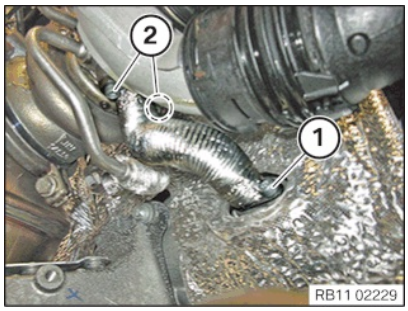


- Guide out catalytic converter (1) in direction of arrow and remove.
- Make sure that the monitoring oxygen sensor is (2) **not** damaged.

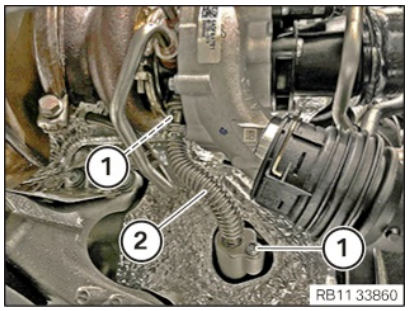
43 – Removing the oil return line for the exhaust turbocharger

TECHNICAL INFORMATION

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



- **Version A:**
- Have a rag ready and catch any engine oil that may emerge.
- Loosen the screws (1) and (2).
- Guide out and remove the oil return line .

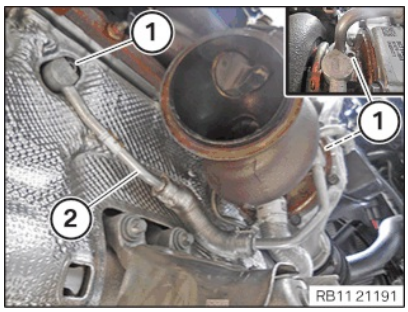


- **Version B:**
- Have a rag ready and catch any engine oil that may emerge.
- Loosen screws (1).
- Feed out and remove the oil return line (2).

44 – Remove the coolant feed line for the exhaust turbocharger

TECHNICAL INFORMATION

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



- Loosen screws (1).
- Guide out and remove the coolant feed line (2) from the crankcase.
- Guide out and remove the coolant feed line (2) from the exhaust turbocharger.

45 – Remove the coolant return line for the exhaust turbocharger

WARNING

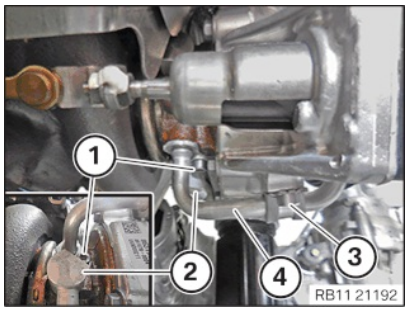
Hot fluids.

Risk of scalding!

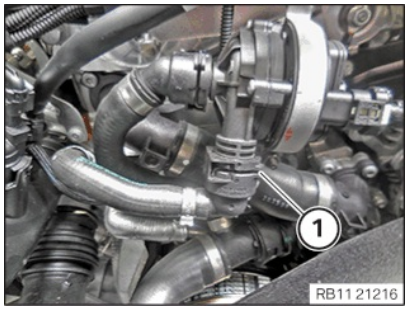
- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

TECHNICAL INFORMATION

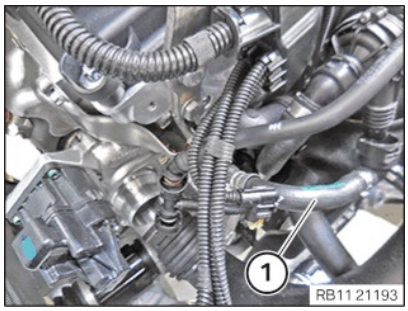
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screw (1).
- Guide out the coolant feed line (2) for the exhaust turbocharger and place it aside.
- Loosen screw (3).
- Guide out coolant return line (4) for the exhaust turbocharger and place it aside.



- Unlock and release the coolant return line for the exhaust turbocharger (1).



- Feed out and remove the coolant return line (1) for the exhaust turbocharger.

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

WARNING

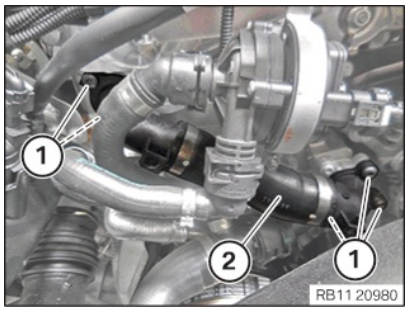
Hot surfaces.

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.

47 – Remove tank vent valve

WARNING

Hot surfaces.

Risk of burning!

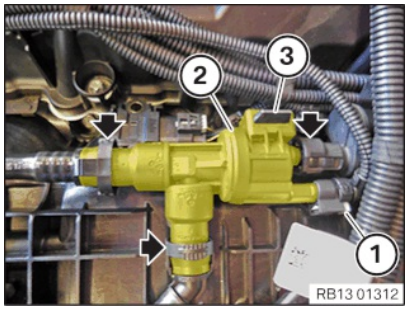
- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

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



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

48 – Removing the intake plenum

RISK OF DAMAGE

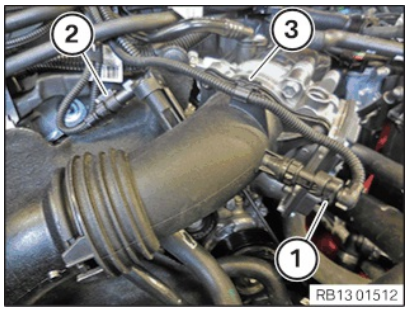
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

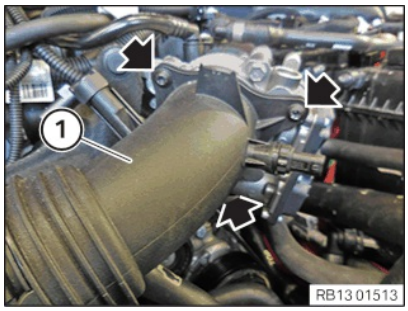
- Do not pull on the wires when disconnecting connectors and plug connections.

TECHNICAL INFORMATION

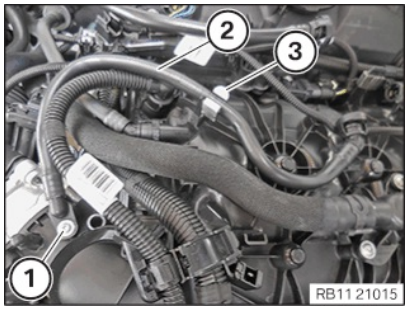
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



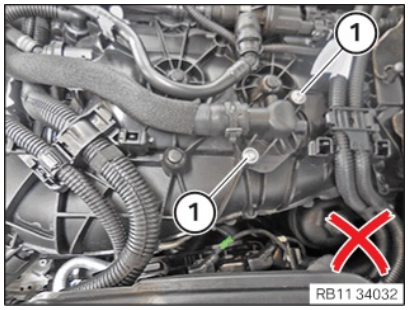
- Unlock plug connection (1) and disconnect.
- Unlock plug connection (2) and disconnect.
- Unlock and loosen clamp (3).



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



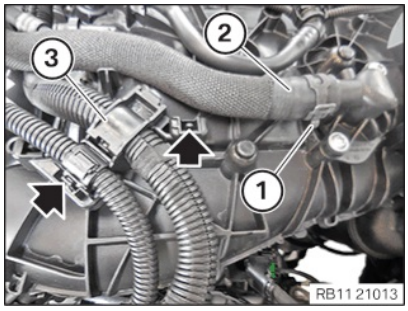
- Loosen screw (1).
- Guide tank ventilation line (2) out of clamp (3) and remove it.



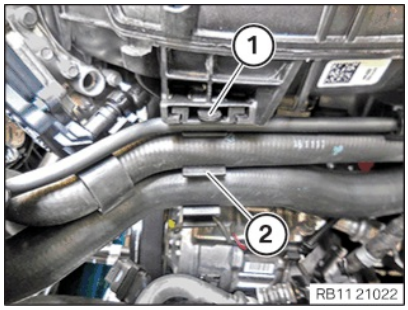
TECHNICAL INFORMATION

The tie-rods and mounting screws from the connection neck on the intake plenum are **not** allowed be opened.

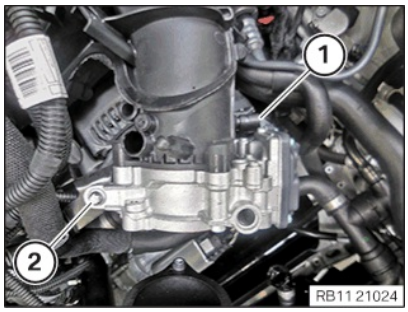
- Do **not** loosen screws (1).



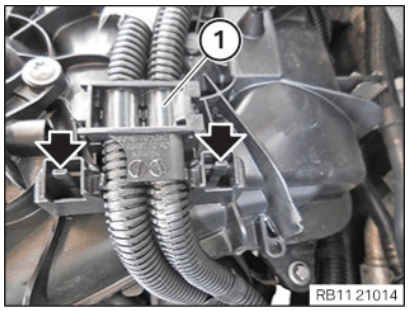
- Release the clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide the coolant hose (2) out and remove.
- Catch and dispose of escaping coolant.
- Unlock the locks (arrows).
- Guide out the wiring harness section (3) for sensor system 2 and place to one side.



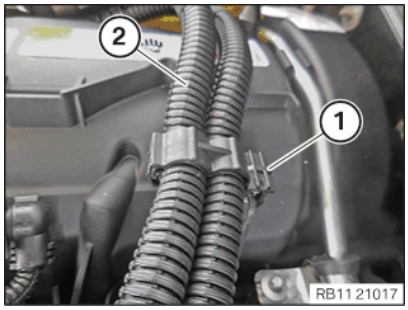
- Unlock lock (1).
- Thread out holder (2) and set aside.



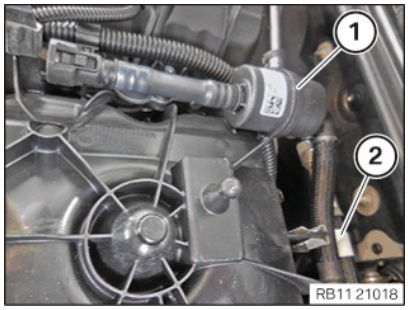
- Unlock plug connection (1) and disconnect.
- Loosen screw (2).



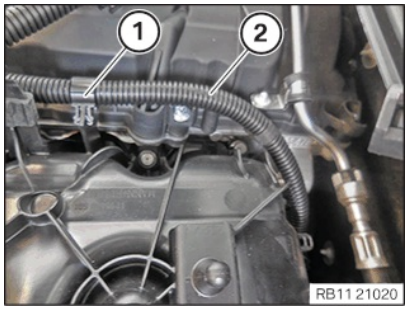
- Unlock the locks (arrows).
- Thread out the wiring harness section (1) for the injectors and ignition coils and set it aside.



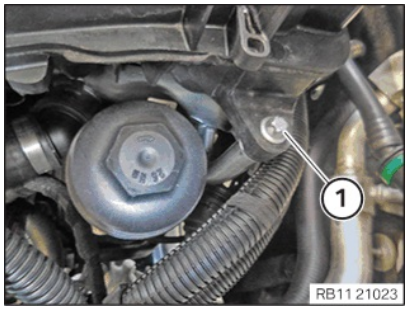
- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



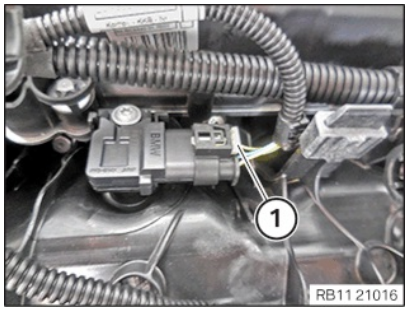
- Guide tank ventilation line (1) out of clamp (2) and place it aside.



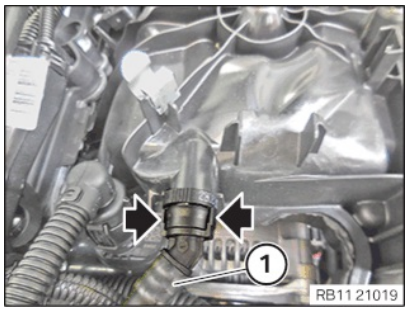
- Loosen clamp (1).
- Guide out the wiring harness section (2) for sensor system 1 and place to one side.



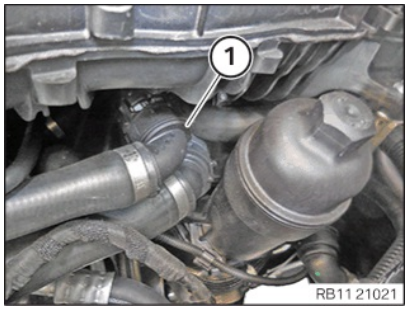
- Loosen screw (1).



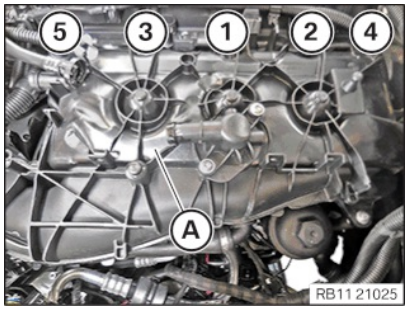
- Unlock plug connection (1) and disconnect.



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



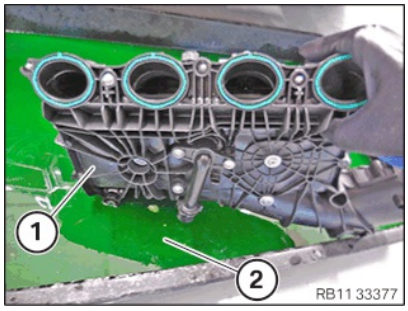
- Unlock and release coolant feed line (1).
- Catch and dispose of escaping coolant.



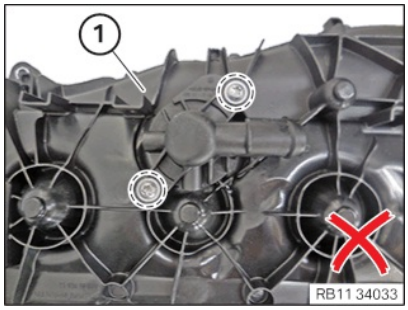
TECHNICAL INFORMATION

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

- Loosen screws in the order (5) to (1).
- Thread out intake plenum (A) and remove.



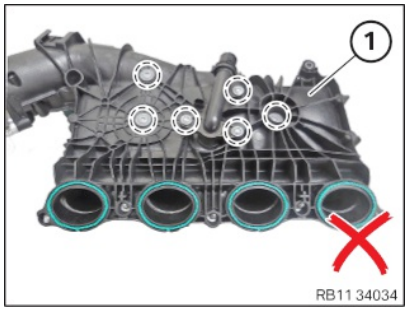
- Drain the remaining coolant (2) in the intake plenum (1).



TECHNICAL INFORMATION

The tie-rods and mounting screws from the connection neck on the intake plenum are **not** allowed be opened.

- Do **not** loosen the screws in the **marked area** on the intake plenum (1).

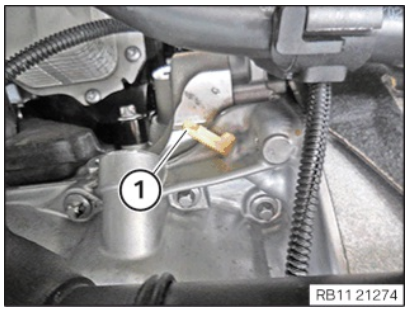


TECHNICAL INFORMATION

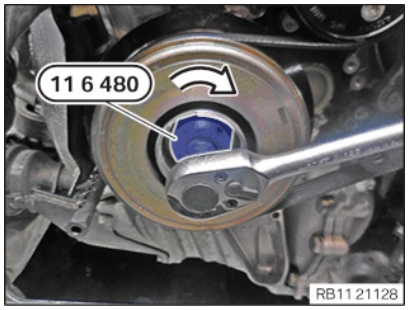
The tie-rods and mounting screws from the connection neck on the intake plenum are **not** allowed be opened.

- Do **not** loosen the screws in the **marked area** on the intake plenum (1).

49 – Blocking engine in the 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.

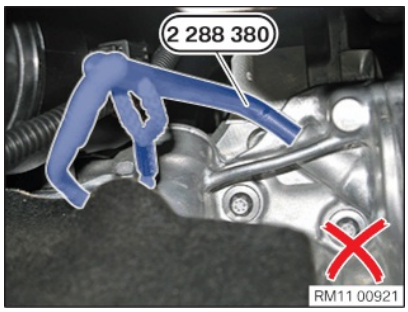
- Turn the combustion engine exclusively by hand in the correct direction of rotation: a) Clockwise, facing the vibration damper or b) Anticlockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- 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:**

  Dimensions (X) = 66 mm

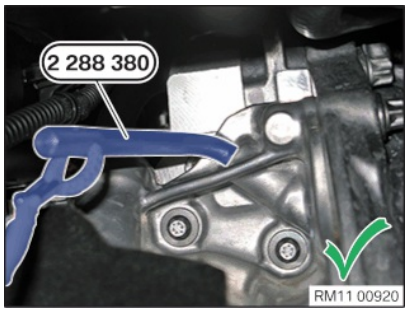
  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  The special tool 2 288 380 is **incorrectly** positioned.

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



- **Vehicles with automatic transmission:**

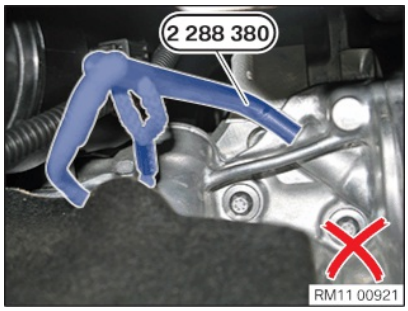
  The special tool 2 288 380 is **correctly** positioned.

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

- **Vehicles with manual gearbox:**

  Dimension (X) = 62 mm

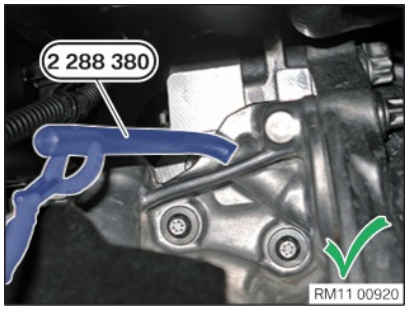
  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with manual gearbox:**

  The special tool 2 288 380 is **incorrectly** positioned.

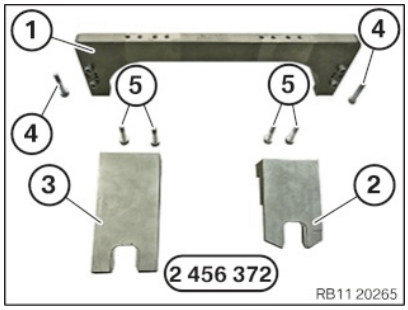
  The TDC firing position of cylinder 1 was **not** reached.



- **Vehicles with manual gearbox:**

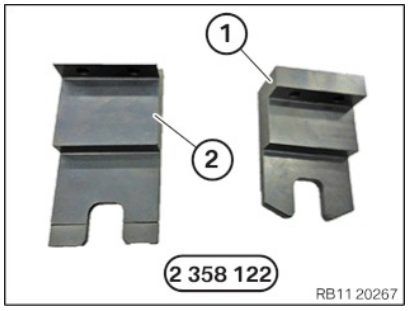
  The special tool 2 288 380 is **correctly** positioned.

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



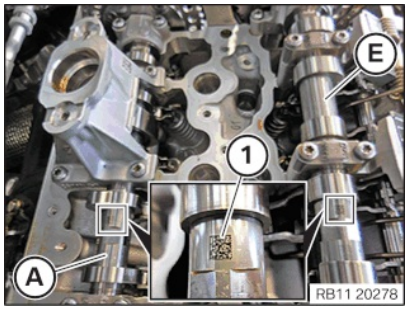
- Have the set of special tools 2 456 372 ready:

Number	Description
1	Basic carrier
2	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

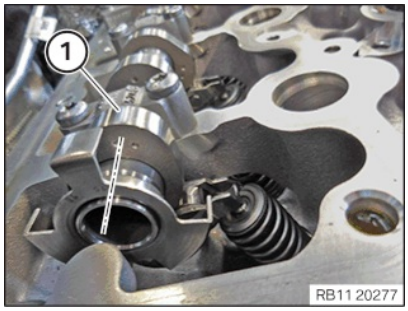


- Have the test gauges from the set of special tools 2 358 122 ready:

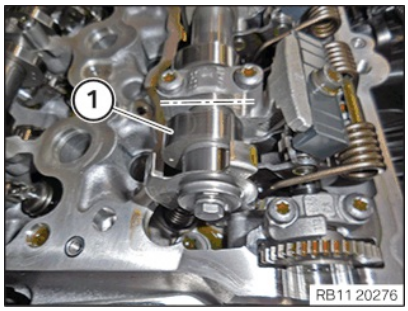
Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



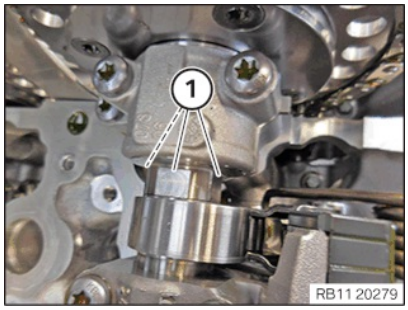
- Ensure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) can be read from above.



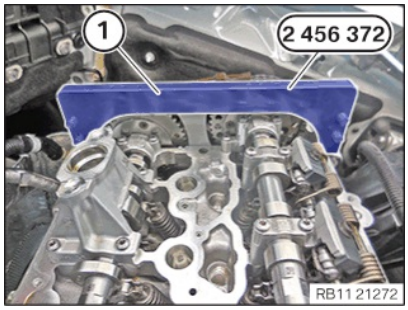
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



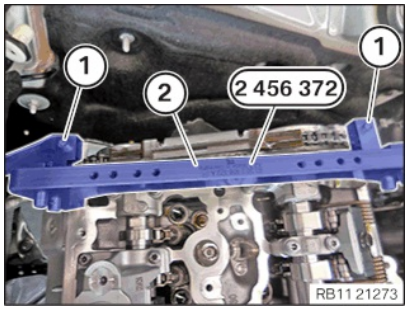
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



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



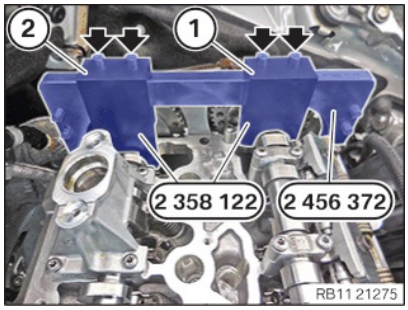
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- 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).

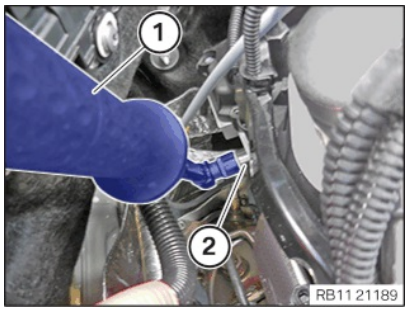
Test gauge to basic carrier

M6		Tightening torque	8 Nm

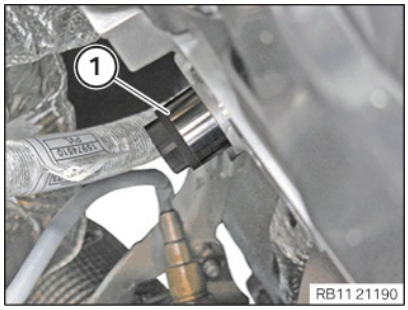
50 – Removing chain tensioner

TECHNICAL INFORMATION

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

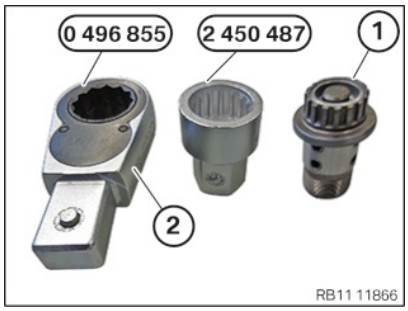


- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).

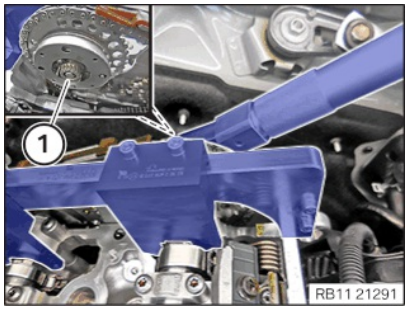


- Feed out and remove the chain tensioner (1).

51 – Releasing the VANOS central valve of the intake adjuster



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



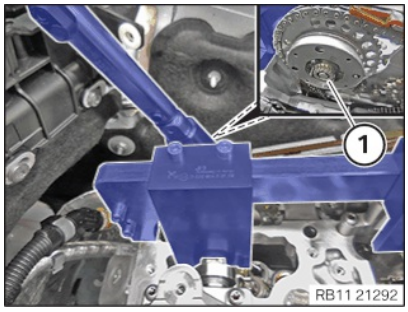
NOTICE

The figure shows the rear side of the engine.

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

52 – 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.

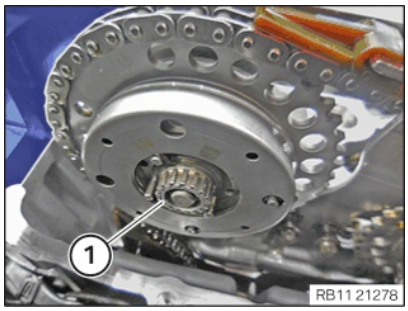


NOTICE

The figure shows the rear side of the engine.

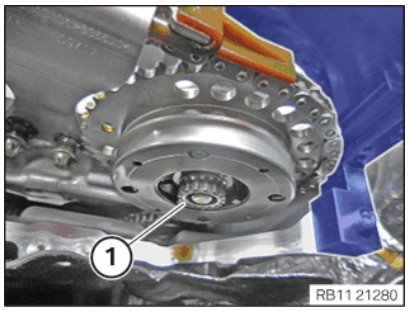
- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

53 – Removing the VANOS central valve of the intake adjuster



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

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

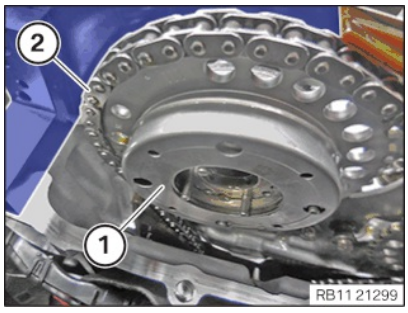


- Guide out and remove the VANOS central valve (1) of the exhaust camshaft adjuster.

55 – Removing intake adjuster

NOTICE

The figure shows the rear side of the engine.

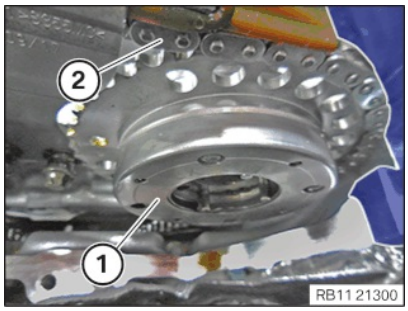


- Guide out the intake adjuster (1) from the timing chain (2) and remove.

56 – Remove exhaust camshaft adjuster

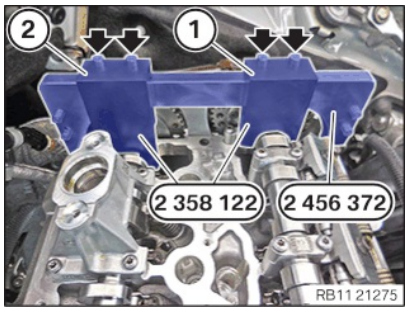
NOTICE

The figure shows the rear side of the engine.



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

57 – Remove the test gauges to fix the camshafts



- Remove screws (arrows).
- Guide out and remove test gauge (1) from the set of the 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.

58 – Removing cylinder head.

CAUTION

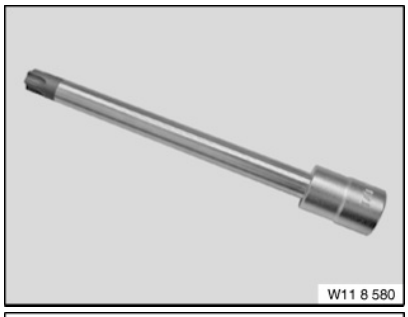
Heavy component.

Heavy components can lead to injury or damage.

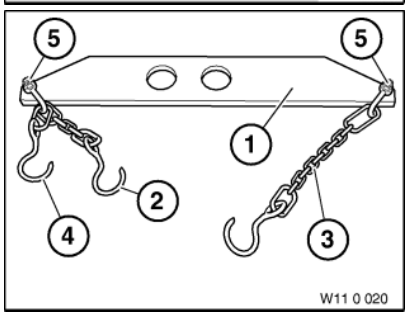
- Remove and install heavy components with the aid of another person/other persons.

TECHNICAL INFORMATION

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

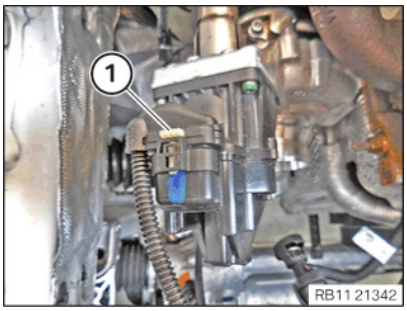


- Prepare special tool 0 495 747 (11 8 580).

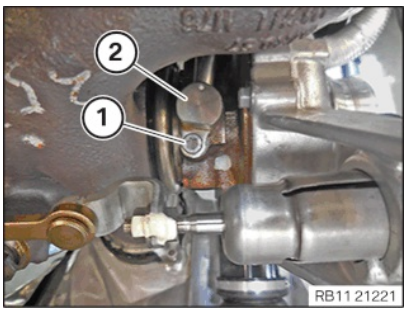


- Prepare special tool .

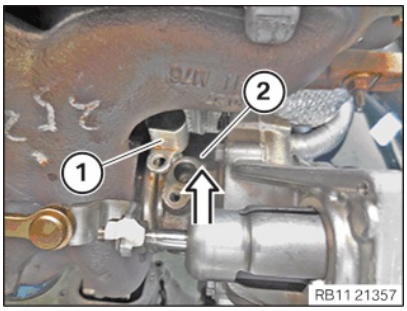
- Prepare the special tool 2 220 718.



- Unlock plug connection (1) and disconnect.

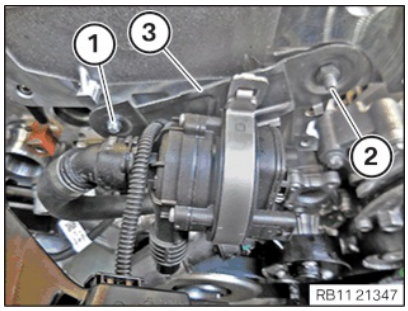


- Loosen screw (1).
- Release the oil feed line (2) on the exhaust turbocharger.

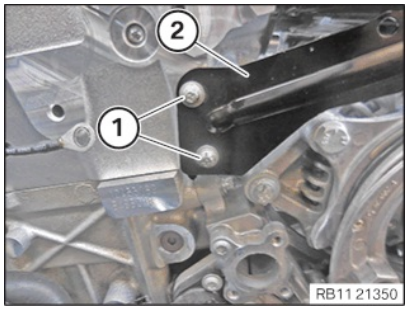


- Guide out the oil feed line (1) at the exhaust turbocharger (2) in the direction of the arrow and set aside.

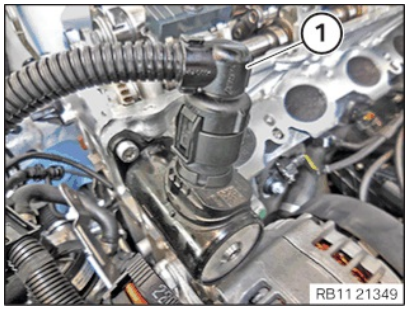
- Loosen nut (1).
- Feed out ground cable (2) and set it aside.



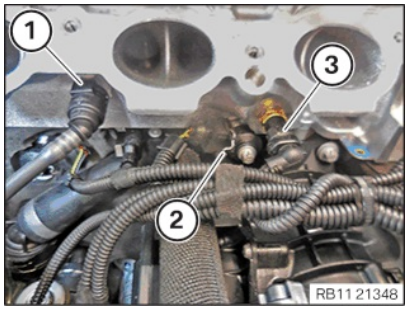
- Loosen screw (1).
- Loosen screw (2).
- Thread out holder (3) and set aside.



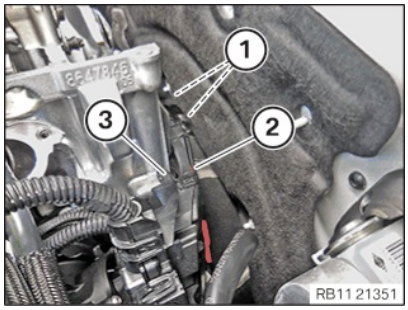
- Loosen screws (1).
- Thread out holder (2) and set aside.



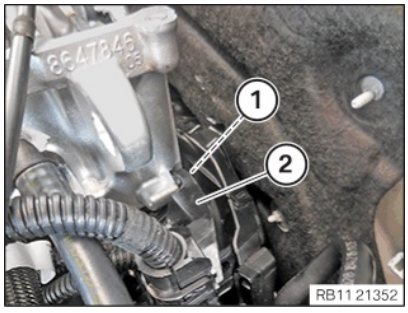
- Unlock plug connection (1) and disconnect.



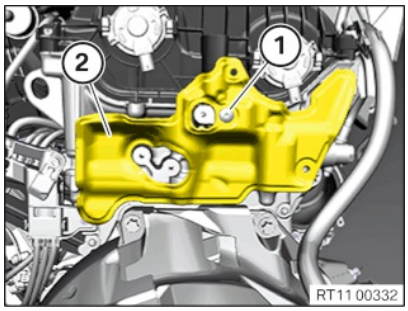
- Unlock and loosen coolant line (1).
- Unlock and disconnect plug connection (2) on the knock sensor.
- Unlock and disconnect plug connection (3) on coolant temperature sensor .



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



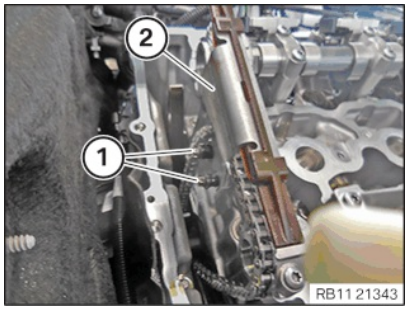
- Loosen screw (1).
- Guide out the wiring harness section (2) for sensor system 1 and place to one side.



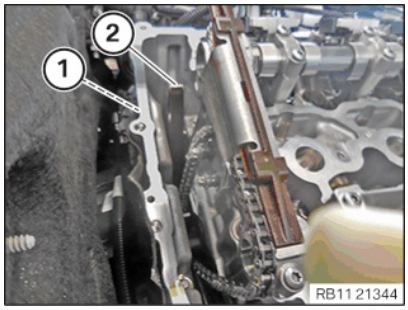
NOTICE

The figure shows the rear side of the engine.

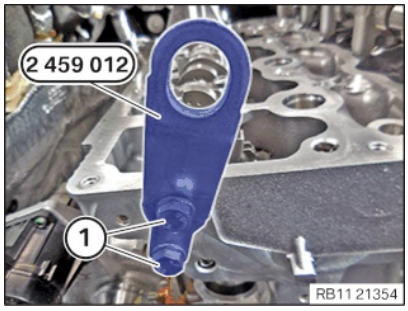
- Loosen screw (1).
- Guide out and remove the cover (2).



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



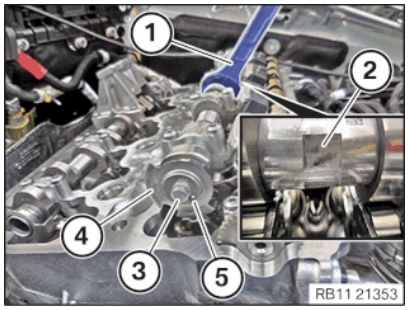
- Release the bearing journal (1) from the guide rail (2).



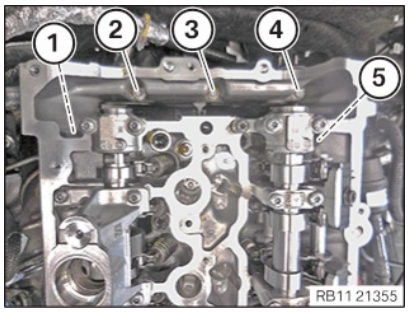
- Guide in and position special tool 2 459 012 on the cylinder head.
- Tighten the screws (1) of special tool 2 459 012.

Special tool to cylinder head

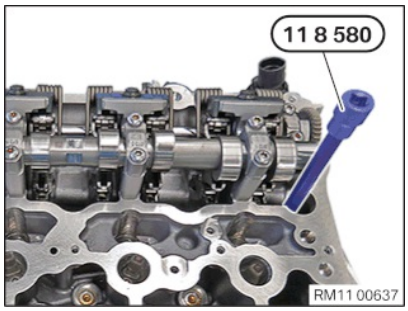
M8		Tightening torque	21,5 Nm



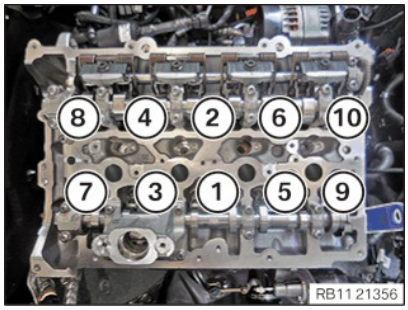
- Fix intake camshaft (2) with a commercially available open-end spanner (1).
- Loosen screw (3).
- Guide out camshaft sensor wheel (4) on guide pin (5) and remove it.



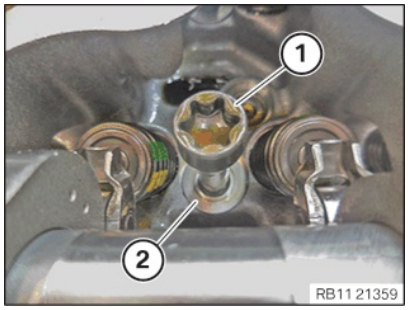
- Loosen the cylinder head bolts in the sequence from (5) to (1).



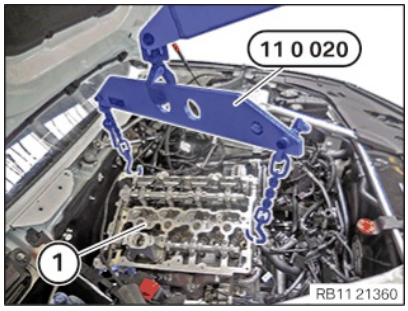
- Release cylinder head bolts with the special tool 0 495 747 (11 8 580).



- Release the cylinder head bolts with the special tool 0 495 747 (11 8 580) in the order of (10) to (1).



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



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.

- Hook special tool on special tool 2 220 718.
- Lift out cylinder head (1) and the exhaust turbocharger with the help of an **auxiliary person**, special tool 2 220 718 and special tool .
- Ensure that the **guide rails** of the timing chain are **not** damaged.

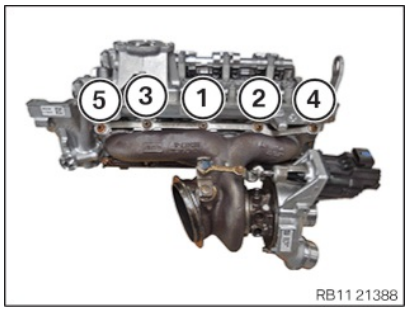
59 – Removing the exhaust turbocharger (cylinder head removed)

RISK OF DAMAGE

Damage to the electrical wastegate valve controller.

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

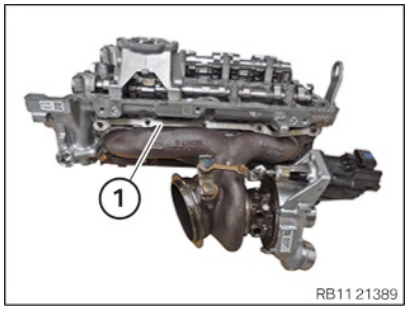
- Do not pull on the electrical wastegate valve controller.
- Apply force to the turbine housing and exhaust manifold only.
  - Do not pull on the compressor housing.



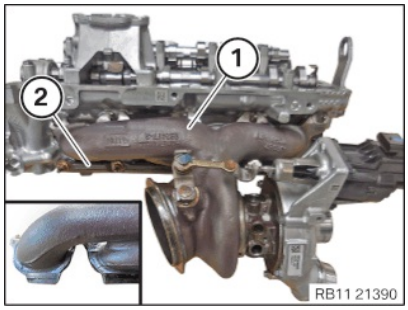
TECHNICAL INFORMATION

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

- Unscrew the nuts in sequence (5) to (1).



- Remove reinforcement plate (1).



CAUTION

Heavy component.

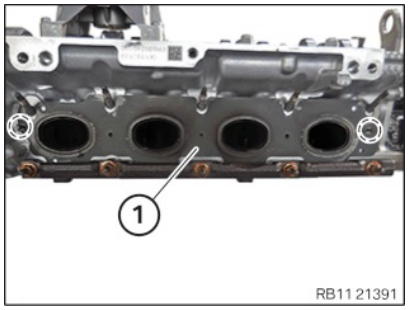
Heavy components can lead to injury or damage.

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

- Ensure that the clamping strip (2) remains screwed into place during the removal of the exhaust turbocharger (1).

  The exhaust turbocharger (1) is **not** screwed onto the bottom, but clamped in the clamping strip (2).

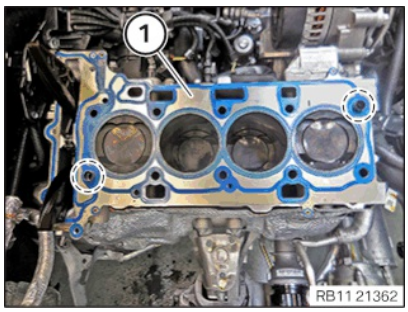
- Thread out and remove exhaust turbocharger (1).



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

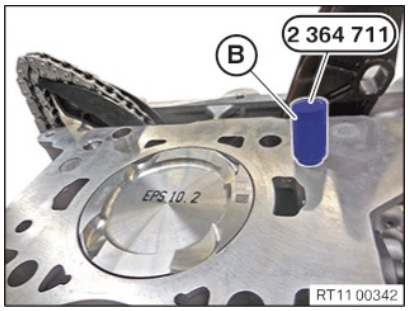
MAIN WORK

60 – Removing the cylinder head gasket



- Guide out and remove cylinder head gasket (1) in the **marked** area.

61 – Sealing the oil duct



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

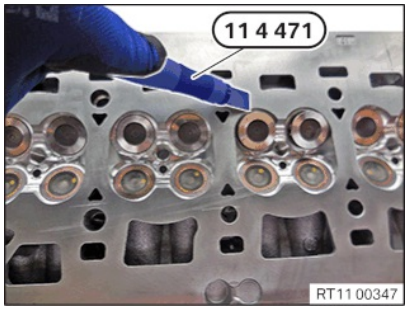
62 – Cleaning sealing surfaces

RISK OF DAMAGE

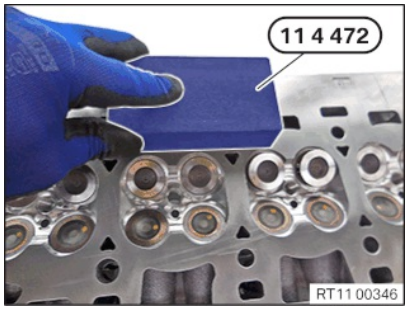
Damage to the surface.

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

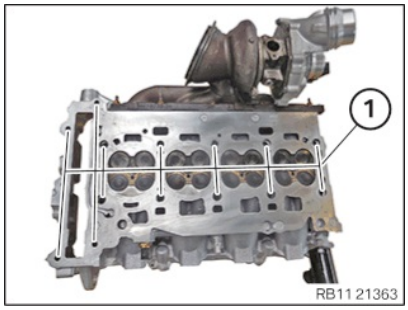
- Do not use any metal-cutting tools.



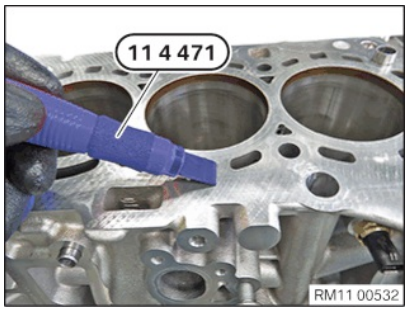
- Remove coarse backlogs from the sealing surfaces of the cylinder head using special tool 0 495 103 (11 4 471).



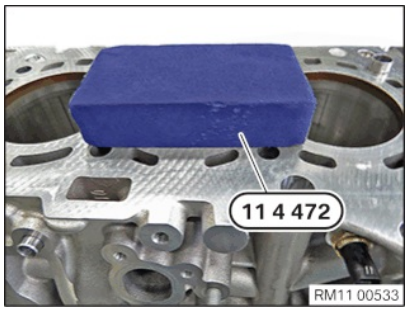
- Remove fine residues from the sealing surfaces of the cylinder head using special tool 0 495 104 (11 4 472).



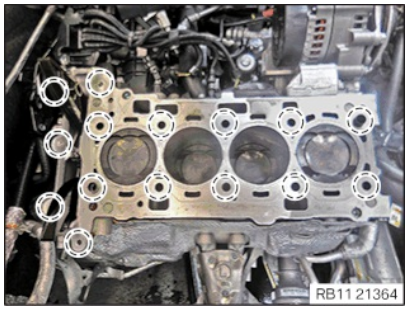
- Clean all blind holes (1) of the cylinder head.



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



- 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

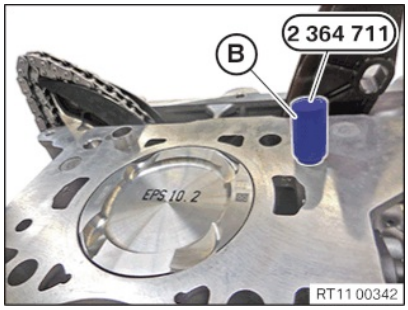
Swirling dirt particles caused by compressed air.

Danger of injury!

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

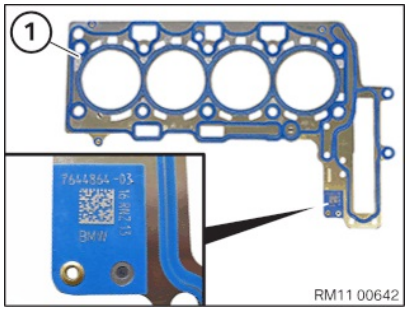
- Wear safety goggles.

- Clean all the threaded holes in the **marked** areas of the crankcase with compressed air.



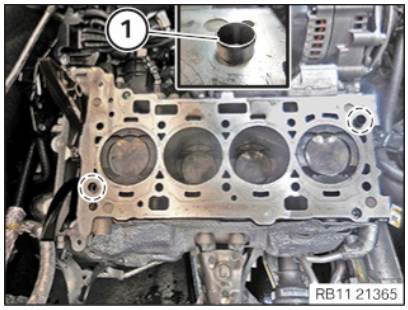
- Remove special tool (B) from the set of special tools 2 364 711.

63 – Replace cylinder head gasket

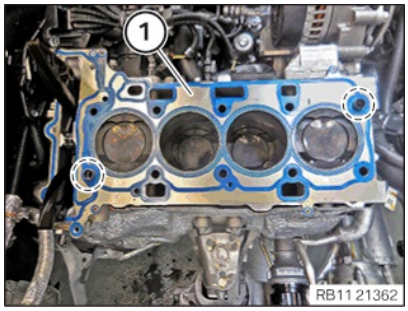


- Identify the cylinder head gasket (1) using the part number.

Note: If the cylinder head is reworked, an additional seal that is 0.3 mm thicker is available for the service.

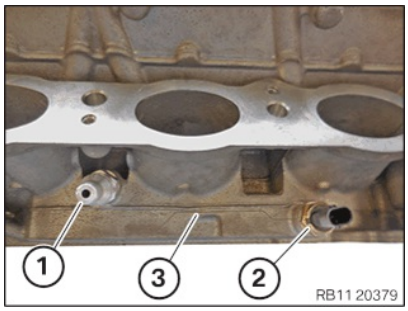


- Check the fitting sleeves (1) in the **marked** area for damage, renew if necessary.

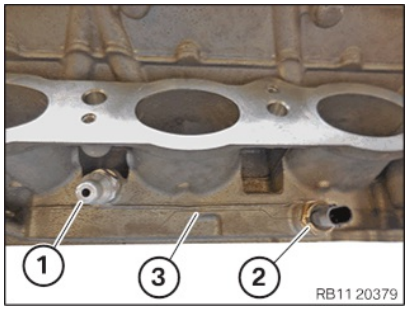


- Guide cylinder head gasket (1) into the **marked** area and install it.

64 – Replacing the cylinder head (remounting the components)



- Detach ventilation connection (1) on cylinder head (3).
- Detach coolant temperature sensor (2) on cylinder head (3).



- Renew cylinder head (3).

  Parts: Cylinder head
- Tighten ventilation connection (1) on cylinder head (3).

Ventilation connection/special tool to cylinder head

M10		18 Nm

- Tighten coolant temperature sensor (2) on cylinder head (3).

Coolant temperature sensor at cylinder head

Sensor		Tightening torque	18 Nm

POSTPROCESSES

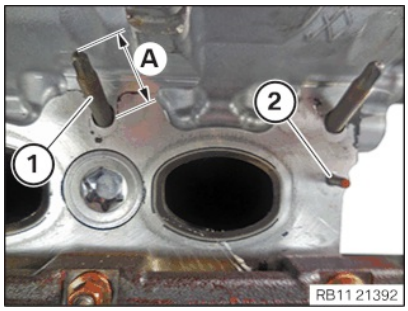
65 – Installing the exhaust turbocharger (cylinder head removed)

RISK OF DAMAGE

Damage to the electrical wastegate valve controller.

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

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



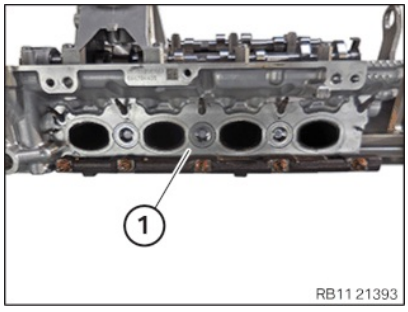
- Check the stud bolt (1) for damage, renew if necessary.

  Parts: Stud bolt
- Check the screw-in depth (A) of the stud bolt at the top (1), screw in again if necessary.

Screw-in depth of upper stud bolt on cylinder head

Dimension A	30 mm

- Check for correct fit of stud bolt (2).



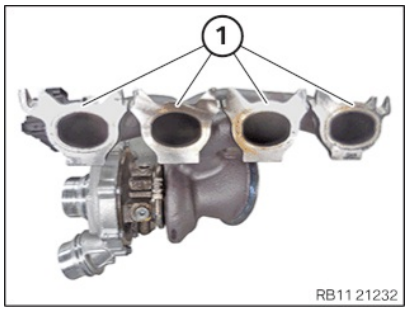
RISK OF DAMAGE

Damage to the surface.

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

- Do not use any metal-cutting tools.

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



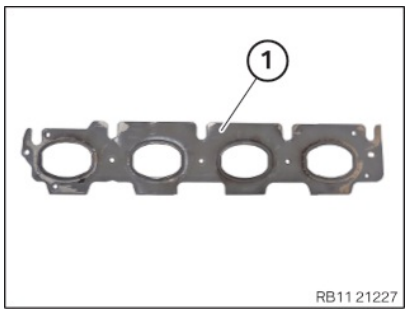
RISK OF DAMAGE

Damage to the surface.

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

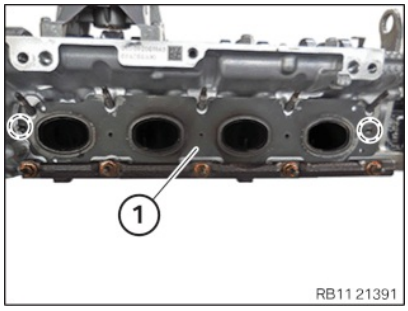
- Do not use any metal-cutting tools.

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

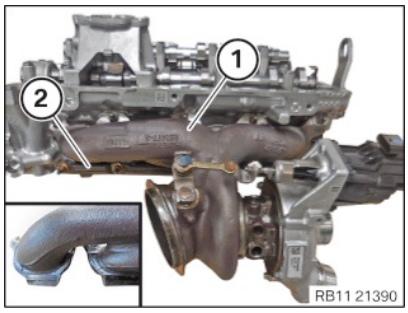


- Renew the seal (1).

  Parts: Gasket



- Insert and install the seal (1).
- Make sure the seal (1) has been **correctly** installed in the guide pins in the **marked** areas.



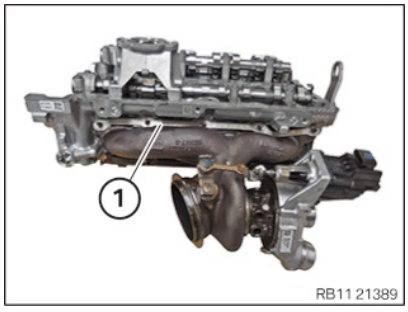
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

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

- Guide the exhaust turbocharger (1) toward the bottom into the clamping strip (2) and align it flush on the cylinder head.

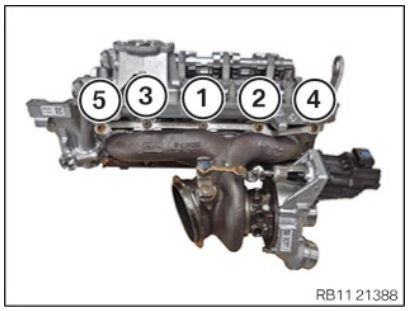


TECHNICAL INFORMATION

- Note the installation position of the component. The component may be installed in various installation positions.

- Mount sliding rail (1).

  The original BMW part number of the sliding rail (1) must be **legible** from the rear.



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.

- Renew nuts (1) to (5).

  Parts: Nuts
- Tighten the nuts in the sequence (1) to (5).

Exhaust turbocharger to cylinder head

M7	Observe tightening sequence. *Replace nuts.*	1. Jointing torque	10 Nm
		2. tightening torque	10 Nm
		3. Jointing torque	16 Nm
		4. tightening torque	16 Nm
		5. Tightening torque	16 Nm

66 – 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.

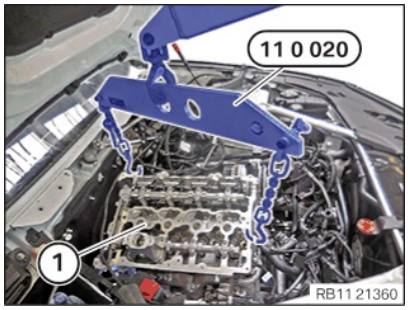
- Dry threaded holes (e.g. using compressed air).

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.



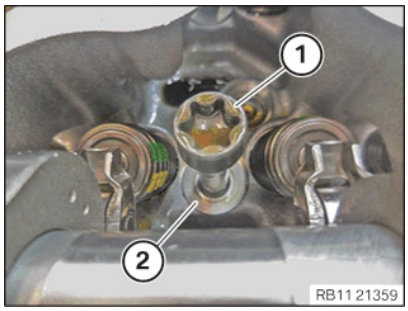
RISK OF DAMAGE

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.

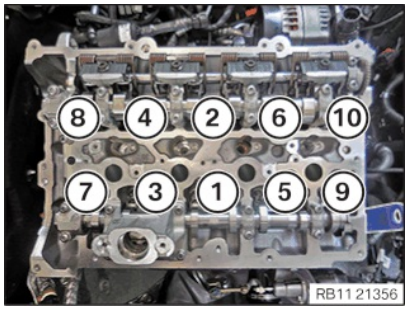
- Guide in, position and install cylinder head (1) and the exhaust turbocharger with the help of an auxiliary person, special tool 2 220 718 and special tool .
- Ensure that the **guide rails** of the timing chain are **not** damaged.



- Guide in and install all the washers (2).
- Renew all 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 engine block.
- Guide in and install all the cylinder head bolts (1).



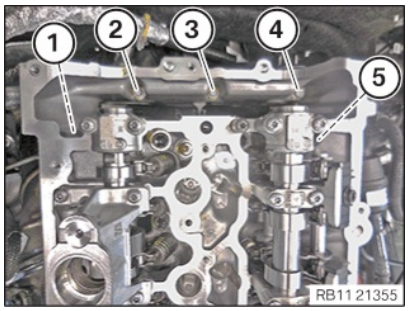
TECHNICAL INFORMATION

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

- Feed in cylinder head bolts (1) to (10) and install.
- Screw in the cylinder head bolts in the sequence (1) to (10).
- Tighten cylinder head bolts using special tools 0 495 747 (11 8 580) and 0 490 504 (00 9 120) in sequence (1) to (10).

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 °

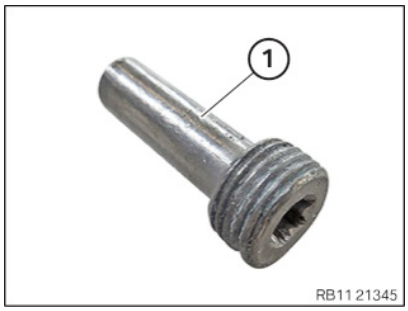


- Renew cylinder head bolts (1) to (5).

  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).

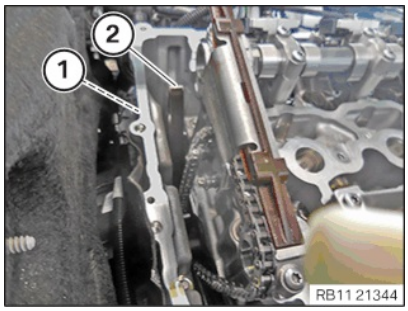
Cylinder head bolt to timing case cover

M8x40	Renew screws.	Tightening torque	19 Nm



- Renew bearing journal (1).

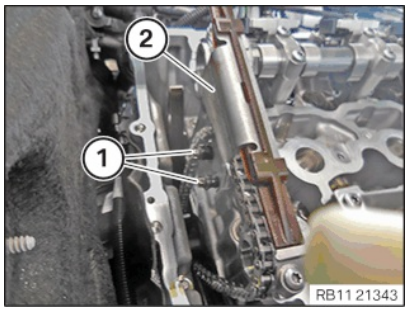
  Parts: Bearing journal



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

Bearing journal to cylinder head

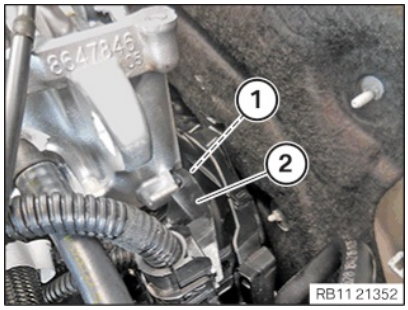
Bearing journal	Renew the bearing journal!	Tightening torque	22 Nm



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

Sliding rail to cylinder head

M6x16			8 Nm



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

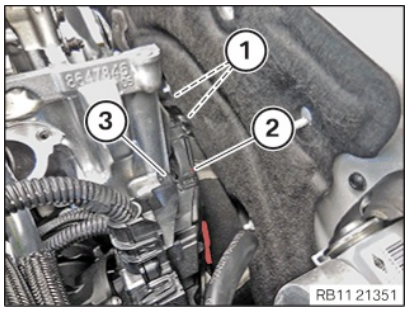
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- 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 clip on rear cylinder head/transmission

M6 x 20		Tightening torque	8 Nm



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

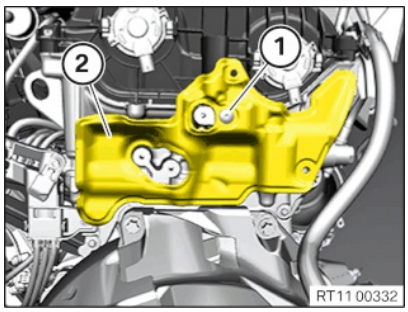
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- 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 clip on rear cylinder head/transmission

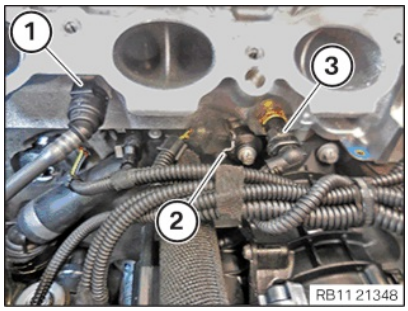
M6 x 20		Tightening torque	8 Nm



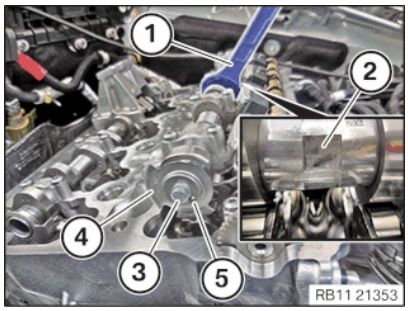
- Guide in and install cover (2).
- Tighten down screw (1).

Cover on rear cylinder head

M6		Tightening torque	8 Nm



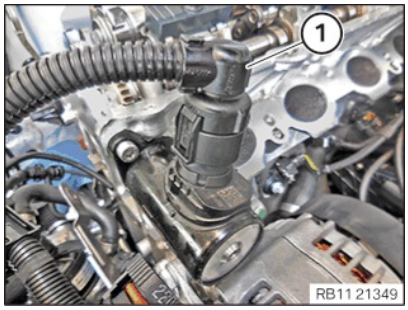
- Connect connector (3) on the coolant temperature sensor and lock it.
- Make sure that the connector (3) engages audibly on the coolant temperature sensor.
- Connect connector (2) on the knock sensor and lock it.
- Ensure that connector (2) engages audibly on the knock sensor.
- Connect and lock coolant line (1).
- Make sure that the cooling line (1) engages audibly.



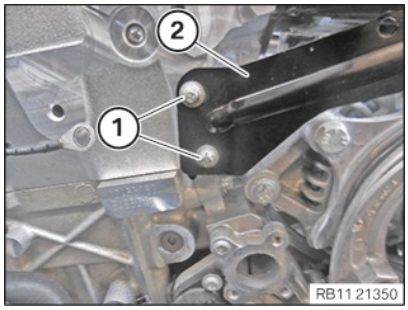
- Guide in and position camshaft sensor wheel (4) on guide pin (5).
- Fix intake camshaft (2) with a commercially available open-end spanner (1).
- Tighten down screw (3).

Camshaft sensor wheel to intake camshaft

M6x16	Renew screw.	1. Tightening torque	5 Nm
		2. Angle of rotation	90°



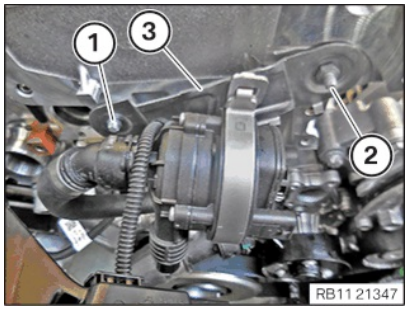
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



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

Manifold support for intake air to cylinder head

M6X16		Tightening torque	8 Nm



- Insert and position the holders (3).
- Tighten down screws (1) and (2).

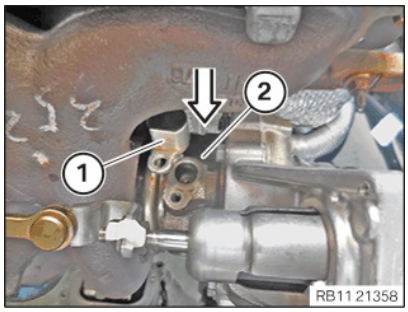
Holder for electrical auxiliary coolant pump on cylinder head

M6		Tightening torque	7 Nm

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

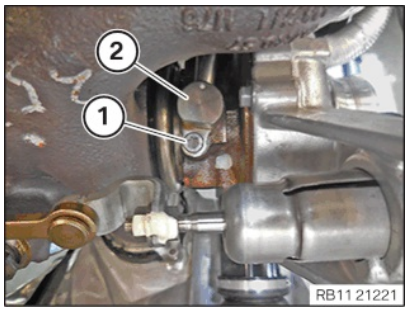
Standard screw connection M6

M6		Tightening torque	8 Nm



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

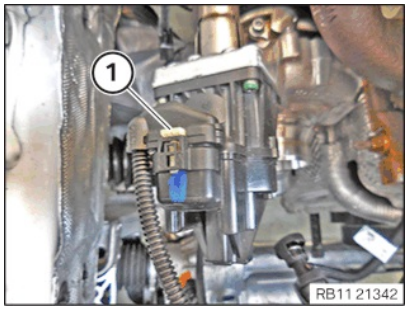
  Parts: Sealing ring
- Guide in and install oil feed line (1) in the direction of the arrow on exhaust turbocharger (2).



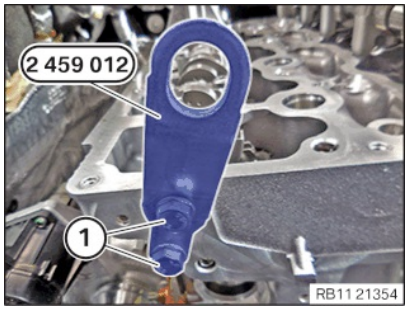
- Tighten screw (1) on the oil feed line (2).

Oil feed line to exhaust turbocharger/crankcase

M6x12		Tightening torque	8 Nm

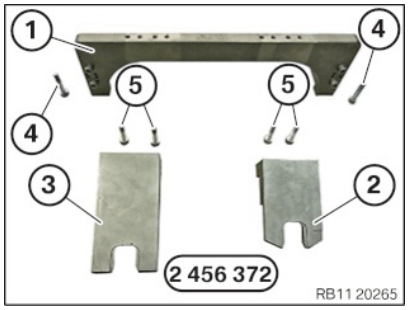


- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



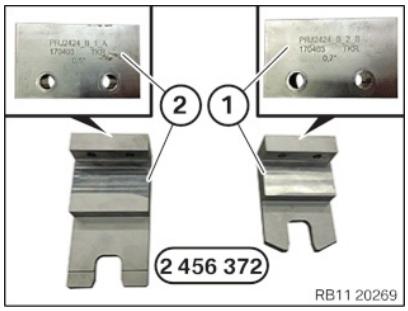
- Unscrew the bolts (1) of the special tool 2 459 012.
- Feed out the special tool 2 459 012 at the cylinder head and remove.

67 – Adjust the camshafts with the special tool

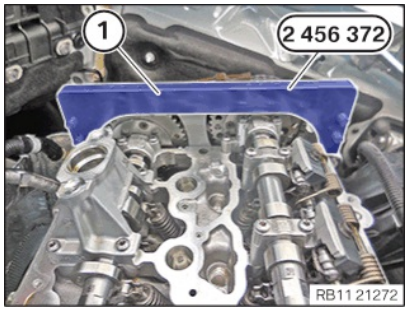


- Keep set of special tools 2 456 372 ready:

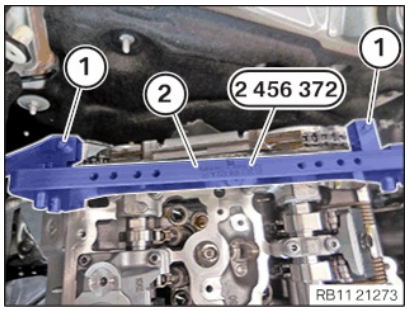
Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- 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.



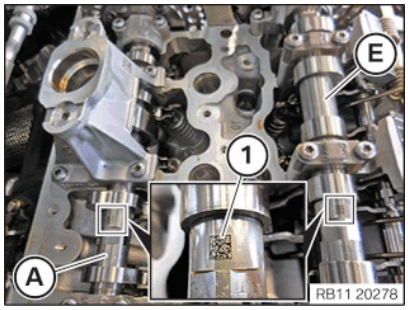
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



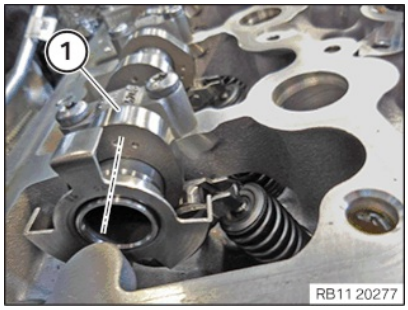
- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

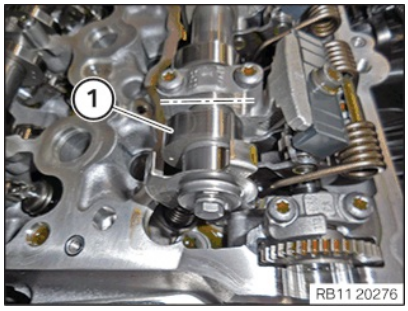
M6		Tightening torque	8 Nm



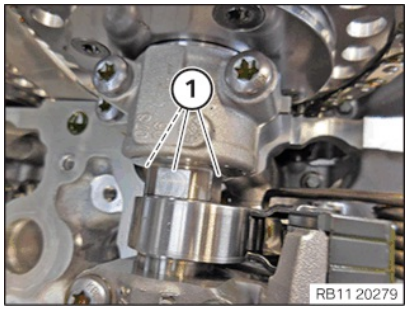
- Turn intake camshaft (E) and exhaust camshaft (A) to the correct position so that marks (1) can be read from above.



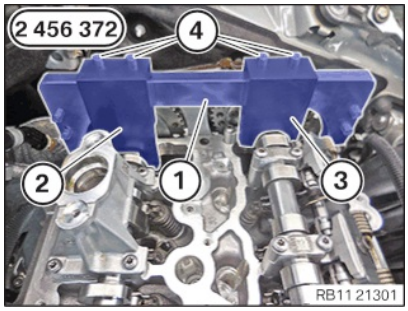
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the 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).

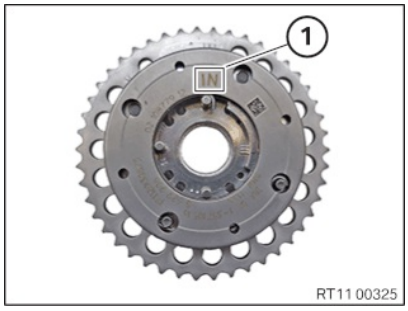
Test gauge to basic carrier

M6		Tightening torque	8 Nm

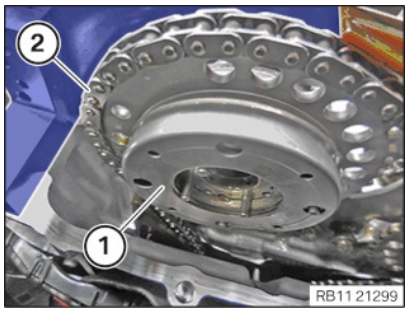
68 – Installing the intake adjuster

NOTICE

The figure shows the rear side of the engine.

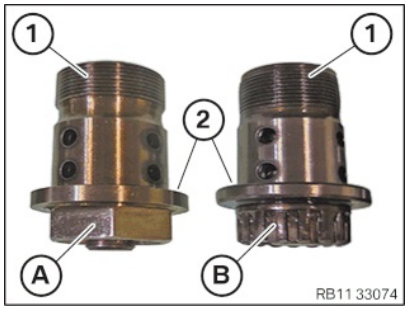


- Keep intake adjuster (1) marked IN ready.



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

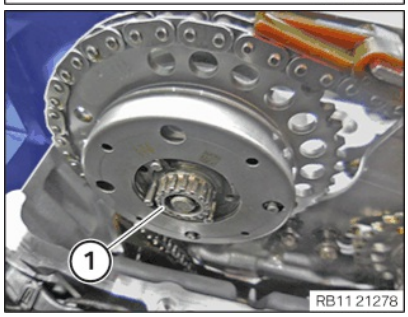
69 – Install the VANOS central valve of the intake adjuster



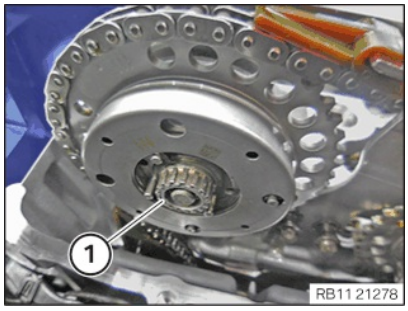
- **Equipment specification A with the thread M22:**

  Coat the VANOS central valve (A) on the thread (1) with **fresh** engine oil.
- Coat the VANOS central valve (A) on the contact surface (2) with **fresh** engine oil.
- **Equipment specification B with the thread M21:**

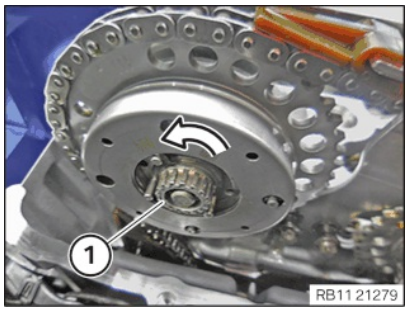
  Coat the VANOS central valve (B) on the thread (1) with **fresh** engine oil.
- Coat the VANOS central valve (B) on the contact surface (2) with **fresh** engine oil.



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



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

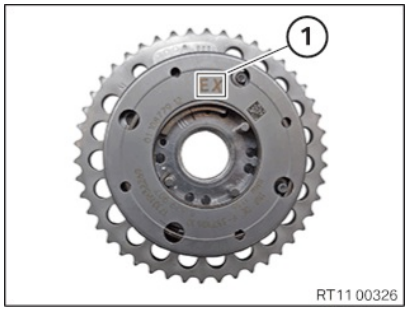


- Release the VANOS central valve (1) of the intake adjuster **in the direction of arrow** by 60°.

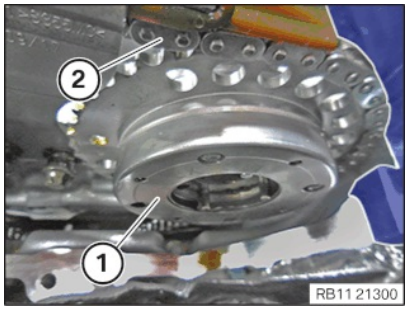
70 – Install exhaust camshaft adjuster

NOTICE

The figure shows the rear side of the engine.

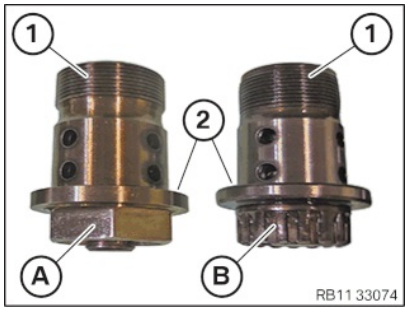


- Keep exhaust camshaft adjuster (1) marked EX ready.



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

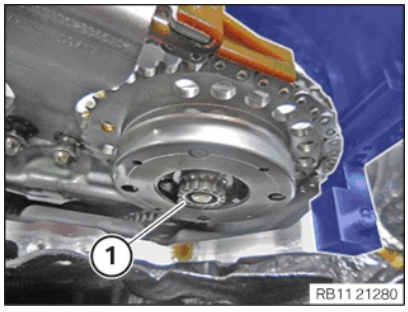
71 – Installing the VANOS central valve of the exhaust camshaft adjuster



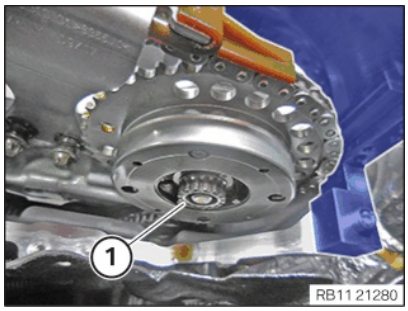
- **Version A with the thread M22:**

  Wet the VANOS central valve (A) at the thread (1) with **fresh** engine oil.
- Wet the VANOS central valve (A) on the contact surface (2) with **fresh** engine oil.
- **Version B with the thread M21:**

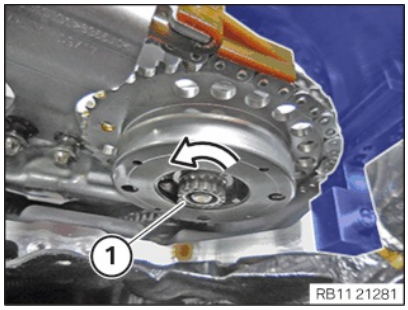
  Wet the VANOS central valve (B) at the thread (1) with **fresh** engine oil.
- Wet the VANOS central valve (B) on the contact surface (2) with **fresh** engine oil.



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

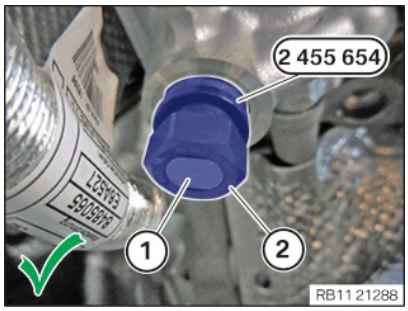


- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.



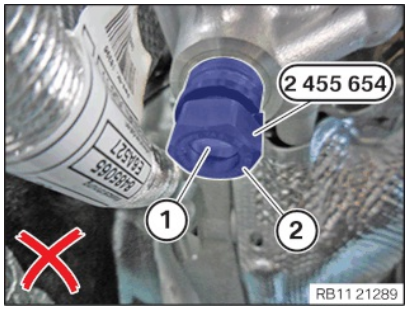
- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60°.

72 – 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.

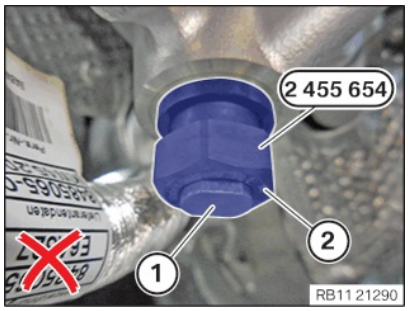
  The pin (1) must align **precisely** with housing (2).



- 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.



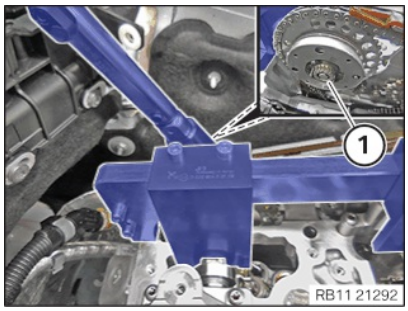
- Make sure that the preload of the timing chain is not **too high**.

  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.

73 – 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.

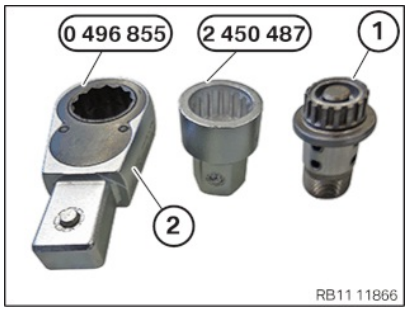


- Tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

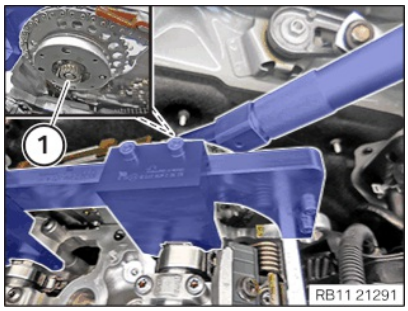
VANOS central valve to camshaft

M21	*VANOS central valve on the thread and on the contact surface must be coated with engine oil.*	1. Tightening torque	50 Nm
		2. Tightening torque	140 Nm
M22	*VANOS central valve on the thread and on the contact surface must be coated with engine oil.*	1. Tightening torque	50 Nm
		2. Tightening torque	140 Nm

74 – 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.

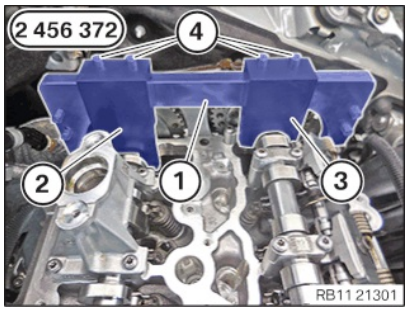


- Tighten the VANOS central valve (1) of the intake adjuster.

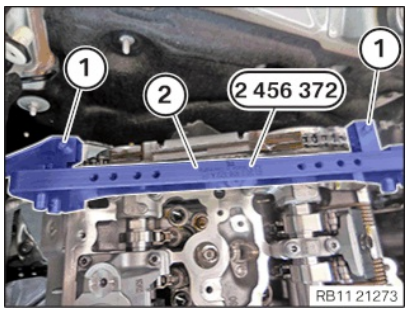
VANOS central valve to camshaft

M21	*VANOS central valve on the thread and on the contact surface must be coated with engine oil.*	1. Tightening torque	50 Nm
		2. Tightening torque	140 Nm
M22	*VANOS central valve on the thread and on the contact surface must be coated with engine oil.*	1. Tightening torque	50 Nm
		2. Tightening torque	140 Nm

75 – Disassembling all special tools

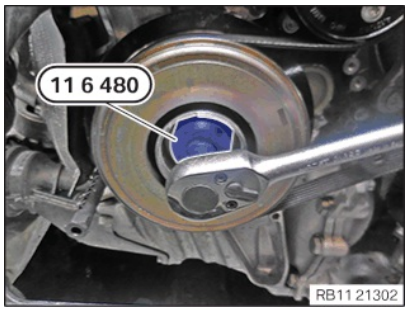


- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the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

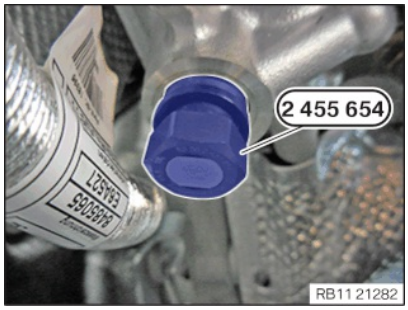


- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.

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



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



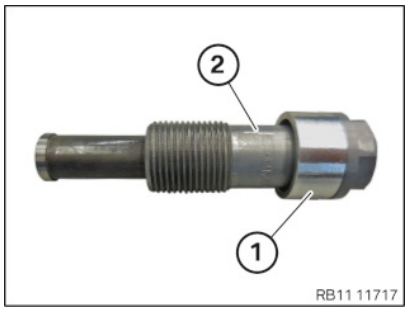
- Guide the special tool (1)2 455 654 out and remove.

76 – Install chain tensioner

TECHNICAL INFORMATION

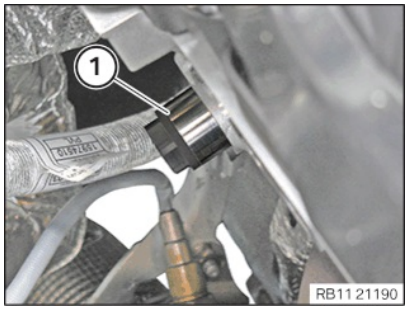
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

- 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.

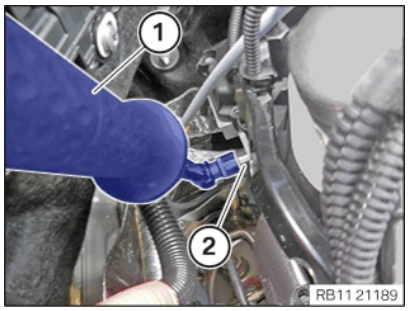


- Renew the sealing sleeve (1).

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



- Insert and install the chain tensioner (1).

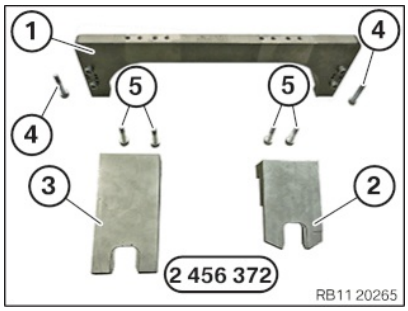


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

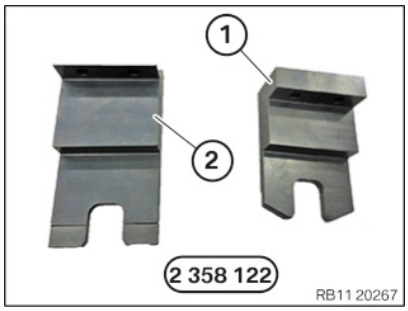
Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

77 – Checking camshaft timing



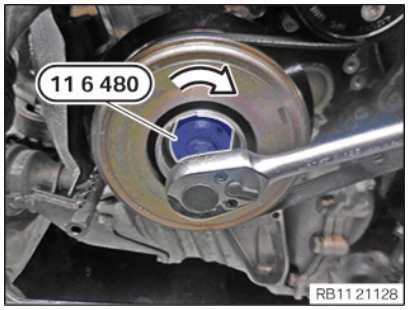
- Keep the set of special tools 2 456 372 at hand:

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



- Check the test gauges from the set of special tools 2 358 122 for completeness:

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



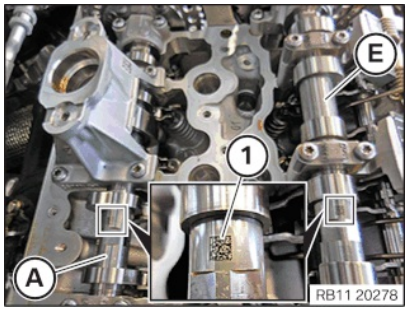
RISK OF DAMAGE

Damage to the engine.

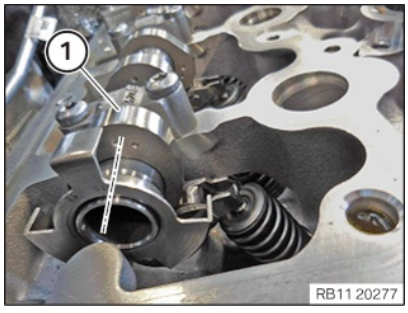
The engine may be damaged if it is manually rotated in the wrong direction.

- Turn the combustion engine exclusively by hand in the correct direction of rotation: a) Clockwise, facing the vibration damper or b) Anticlockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

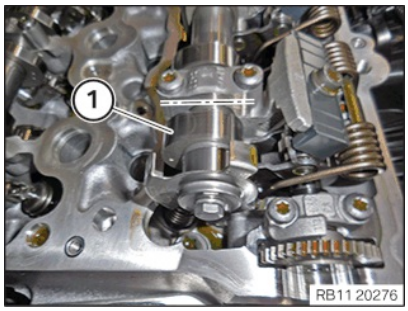
- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



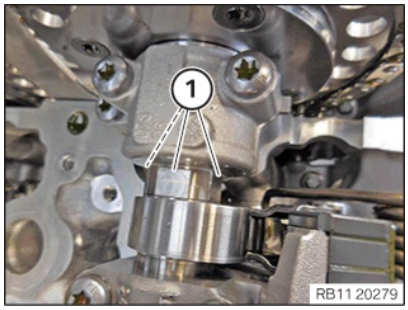
- Make sure the markings (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.



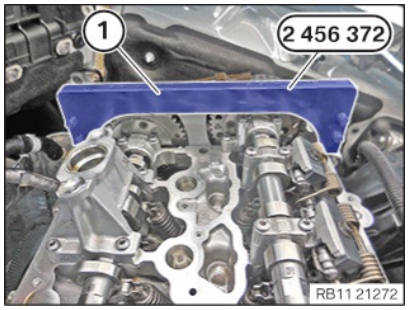
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



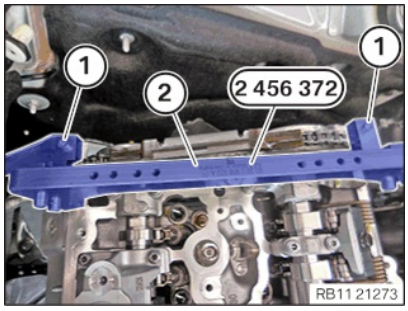
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Make sure that the flattened areas (1) on the intake and exhaust camshafts point upwards.



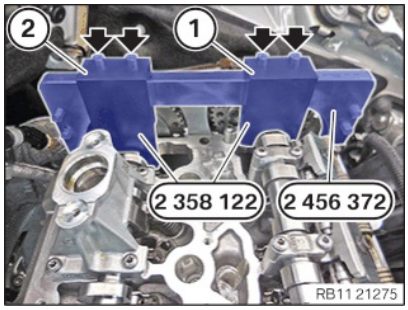
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



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

Basic carrier to cylinder head

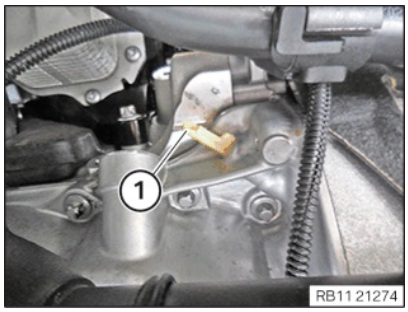
M6		Tightening torque	8 Nm



- 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

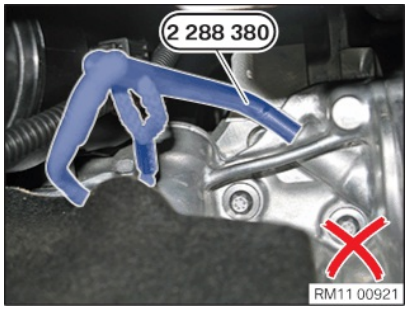


- Thread the sealing cap (1) out and remove.

- **Vehicles with automatic transmission:**

  Dimensions (X) = 66 mm

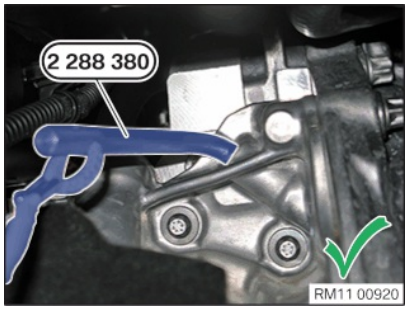
  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

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

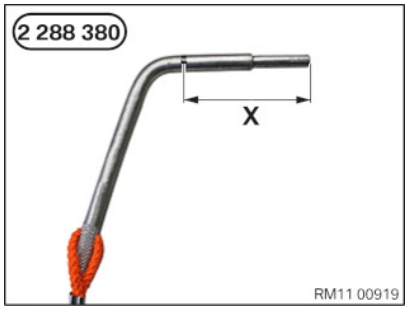
  The TDC firing position of cylinder 1 was **not** reached.



- **Vehicles with automatic transmission:**

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

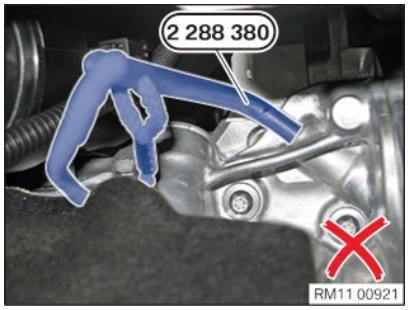
  The engine **is in the** TDC firing position of cylinder 1.



- **Vehicles with manual gearbox:**

  Dimension (X) = 62 mm

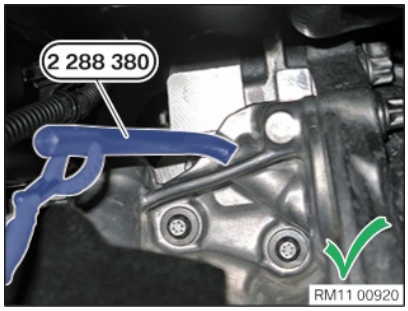
  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with manual gearbox:**

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

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

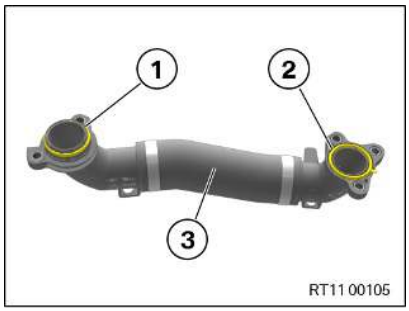


- **Vehicles with manual gearbox:**

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

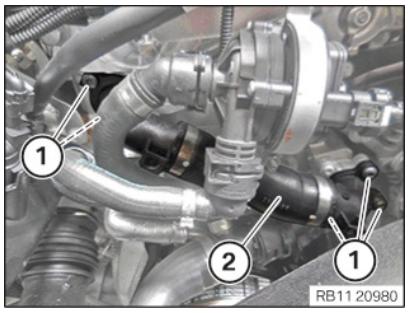
  The engine **is in the** TDC firing position of cylinder 1.

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



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

  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

79 – Installing the intake plenum

RISK OF DAMAGE

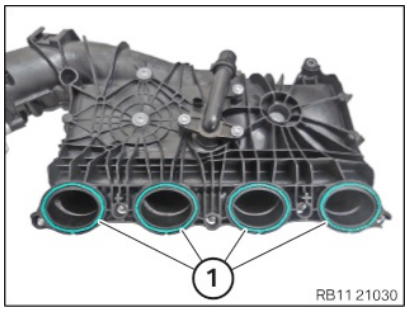
Improper routing of cables and wiring harnesses.

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

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

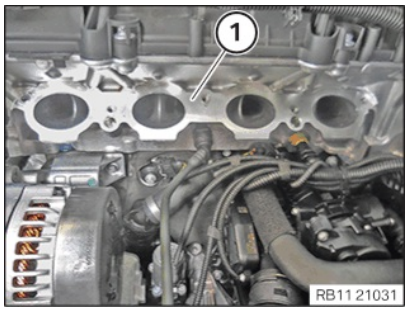
TECHNICAL INFORMATION

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

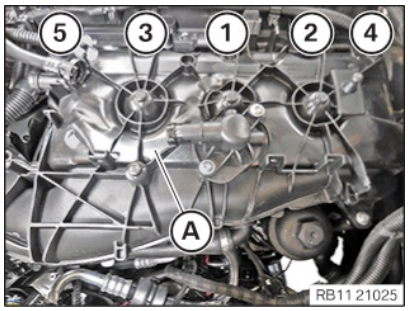


- Renew gaskets (1).

  Parts: Seals



- Clean contact surface (1).



TECHNICAL INFORMATION

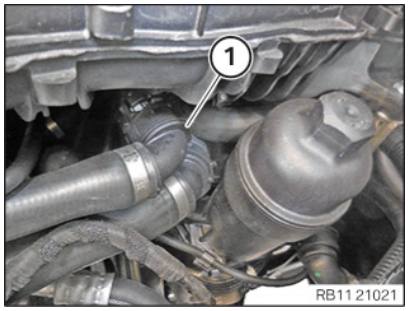
Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Guide in and position intake plenum (A) on the cylinder head.
- Tighten screws in the order (1) to (5).

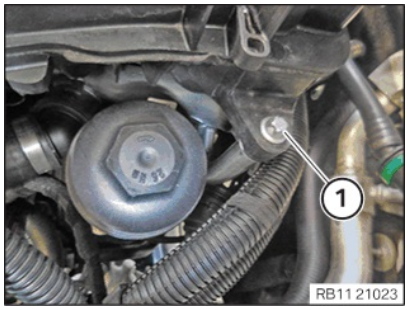
Note: Tighten the bolts in 360 degree steps.

Intake plenum to cylinder head

M6		Tightening torque	10 Nm



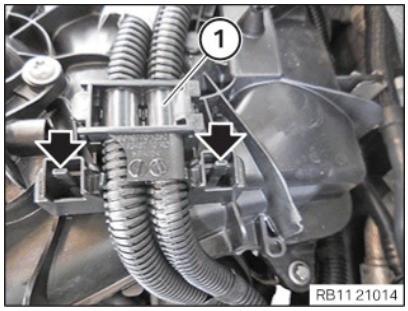
- Connect and lock coolant feed line (1).
- Make sure that coolant feed line (1) engages audibly.



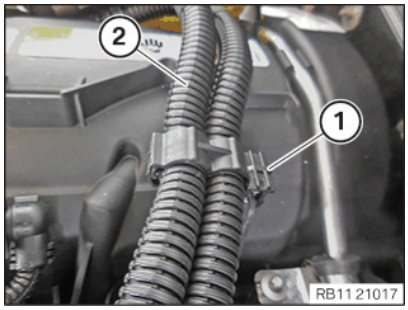
- Tighten down screw (1).

Intake plenum to support

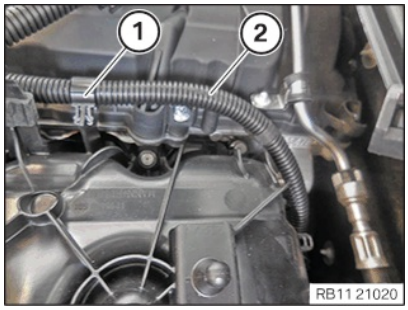
M6X25		Tightening torque	8 Nm



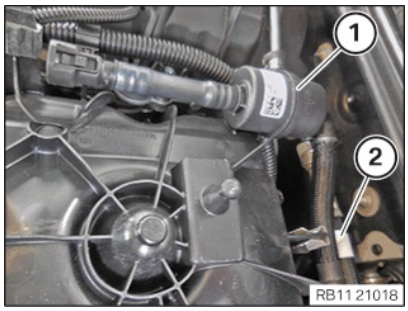
- Insert and install the wiring harness section (1) for the injectors and ignition coils.
  The locks (arrows) must engage audibly.



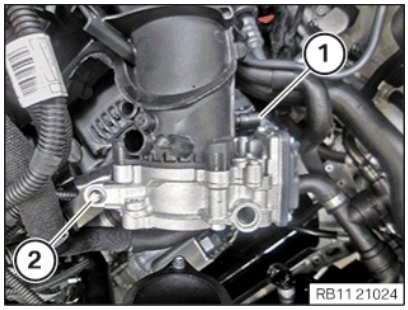
- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).



- Guide in and install wiring harness section (2) for sensor system 1.
- Secure clamps (1).



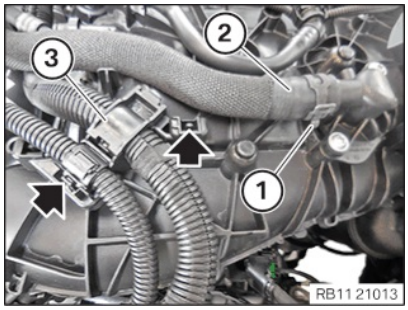
- Insert and install the tank ventilation line (1).
- Secure the tank ventilation line (1) to the clamp (2).



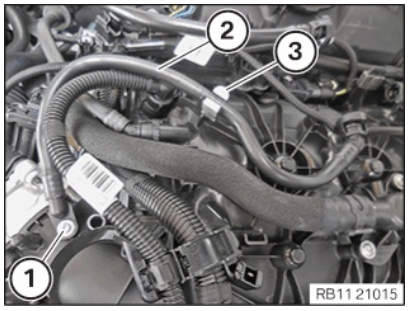
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.
- Tighten down screw (2).

Throttle body to holder

M6X25		Tightening torque	8 Nm



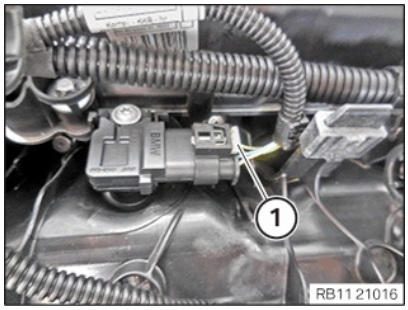
- Insert and install the coolant hose (2).
- Secure clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide in and install wiring harness section (3) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



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

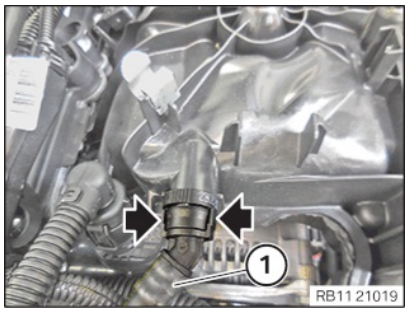
Tank ventilation line to intake plenum

Oval-head screw		Tightening torque	3 Nm



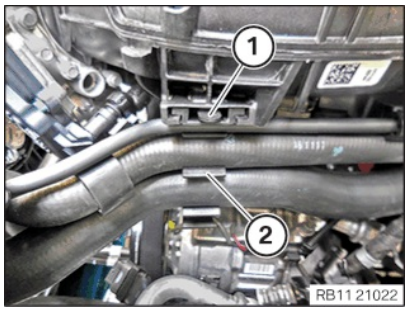
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

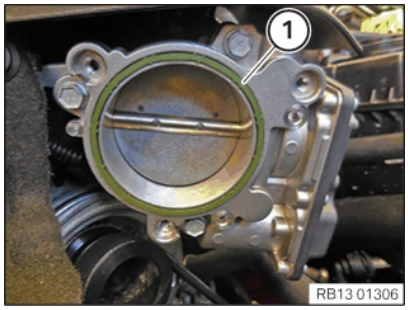


- Insert and install the tank ventilation line (1).

  The locks (arrows) must engage audibly.

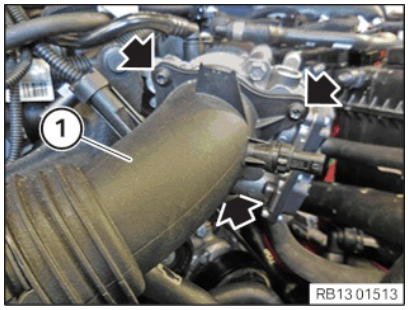


- Insert and install the holder (2).
- Ensure that the lock (1)engages audibly.



- Renew the gasket (1).

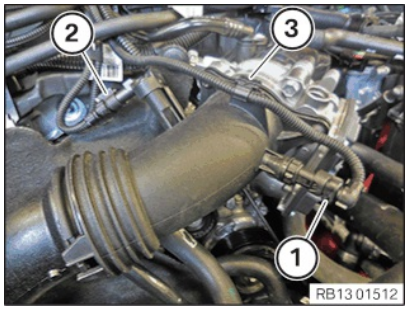
  Parts: Gasket



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

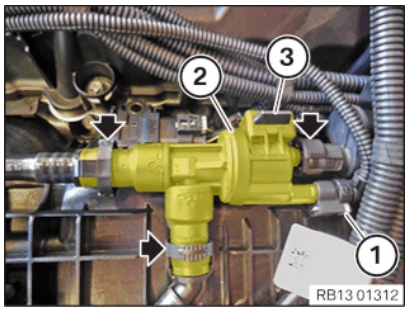
Charge air line to throttle body

M6		Tightening torque	8 Nm



- Connect connectors (1) and lock.
- Connect connectors (2) and lock.
- Make sure you can hear the connectors (1) and (2) engage.
- Secure clamps (3).

80 – Installing the tank vent valve

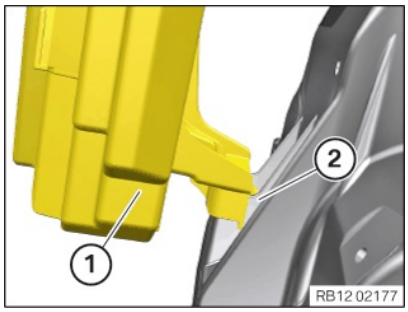


- Secure the tank vent valve (2) to the holder (3).
- Connect and lock the tank ventilation lines (arrows).

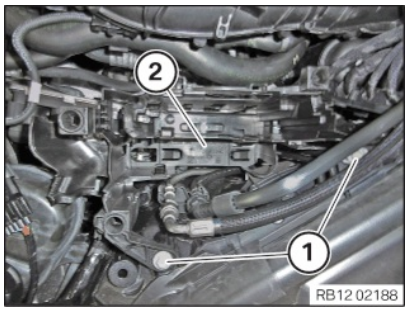
  The tank ventilation lines (arrows) must audibly engage.
- Connect and lock the connector (1).

  The connector (1) must engage audibly.

81 – Installing the control unit holder



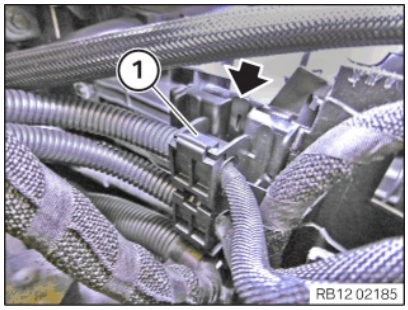
- Make sure the bottom control unit holder (1) is inserted correctly into the fixture (2).



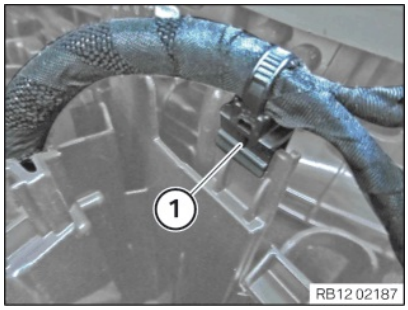
- Guide in and install control unit holder (2).
- Tighten the screws (1).

Control unit holder on spring strut dome

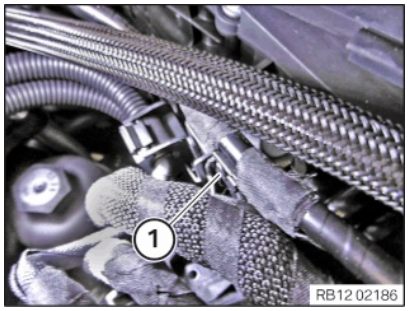
Hexagon screw		Tightening torque	8 Nm



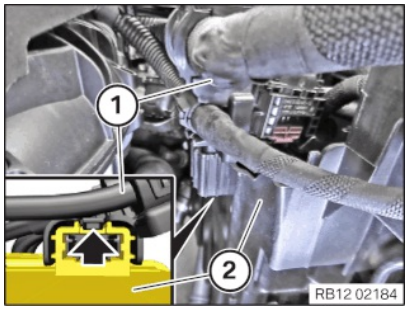
- Feed in and install the cable clip (1).
  Lock (arrow) must audibly engage.



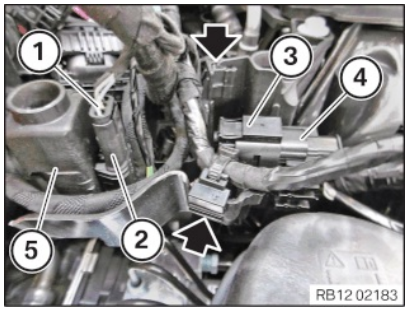
- Secure clamps (1).



- Secure clamps (1).



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



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

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

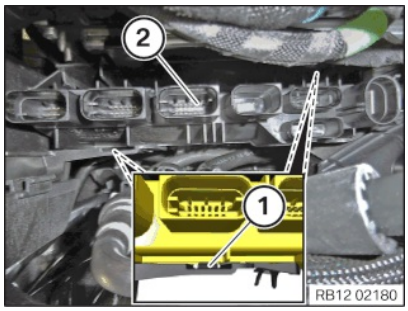
- Make sure that **no charger** is connected to the jump start support point in the engine compartment.
- Detach battery earth lead from battery.
- With auxiliary batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

Electrostatic discharge.

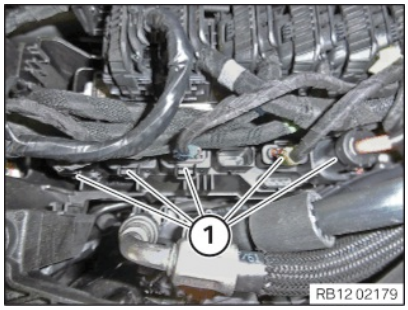
Damage to or destruction of electrical components.

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



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

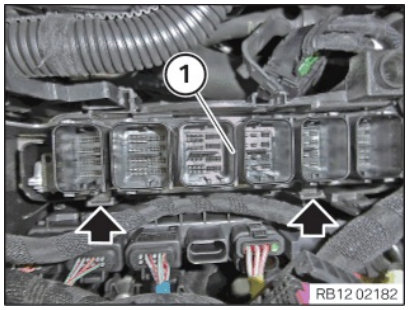
  The latch mechanisms (1) must engage audibly.
- Unlock the latch mechanisms (1).



- Connect connectors (1) and lock.

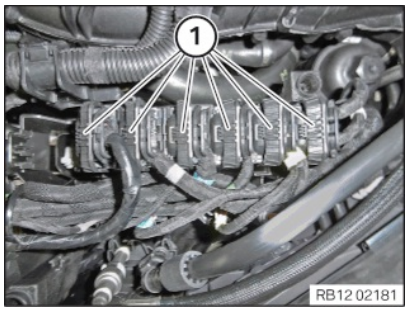
  The connectors (1) must engage audibly.

83 – Installing the DME control unit

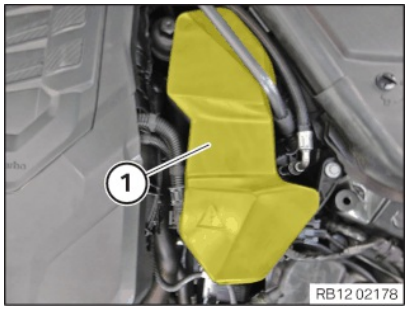


- Feed in and install DME control unit (1).

  The locks (arrows) must engage audibly.

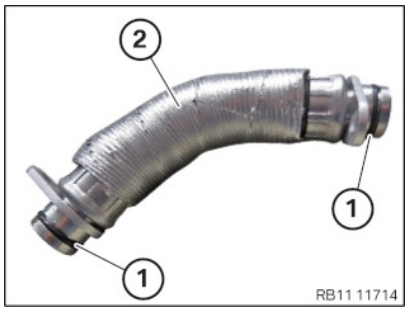


- Connect connectors (1) and lock.
  All connectors (1) must engage audibly.

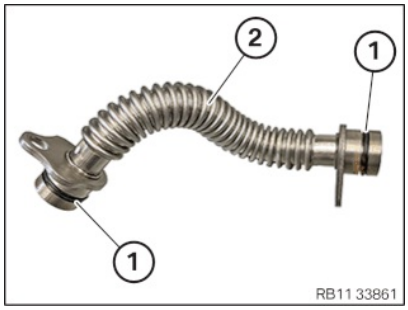


- Insert and install cover (1) into guides.

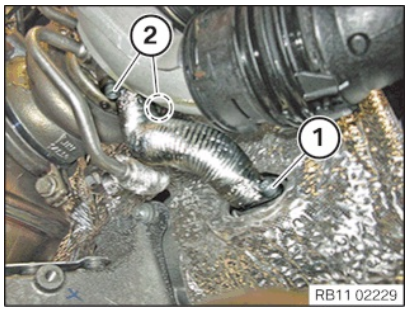
84 – Installing the oil return line for the exhaust turbocharger



- **Version A:**
- Renew the sealing rings (1) at the oil return line (2).
  Parts: Sealing ring



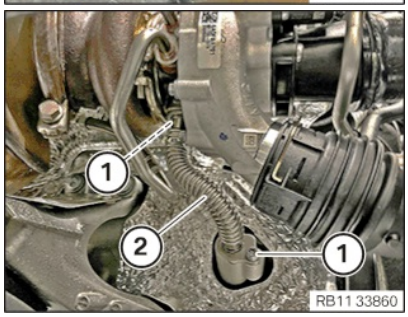
- **Version B:**
- Renew the sealing rings (1) at the oil return line (2).
  Parts: Sealing ring



- **Version A:**
- Feed in and install the oil return line .
- Tighten bolts (1) and (2).

Oil return line to exhaust turbocharger/crankcase

M6x14		Tightening torque	8 Nm



- **Version B**
- Feed in and install the oil return line (2).
- Tighten the screws (1).

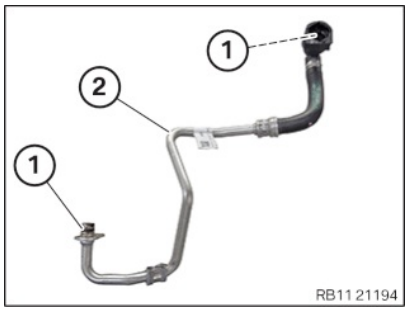
Oil return line to exhaust turbocharger/crankcase

M6x14		Tightening torque	8 Nm

85 – Install the coolant return line for the exhaust turbocharger

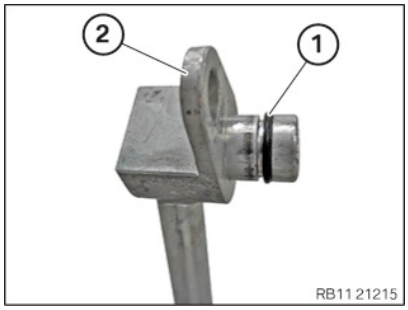
TECHNICAL INFORMATION

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



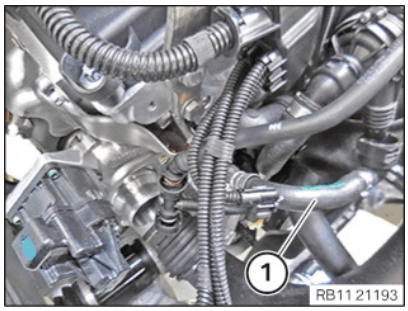
- Renew O-rings (1) on the coolant return line (2) with special tool 0 496 714 (00 9 030).

  Parts: O-rings

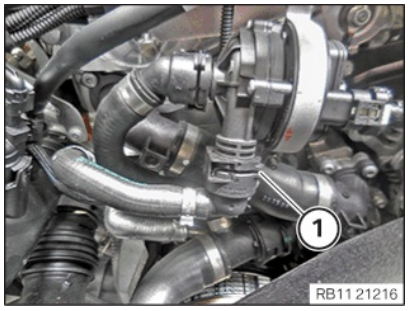


- Renew O-rings (1) on the coolant feed line (2) with special tool 0 496 714 (00 9 030).

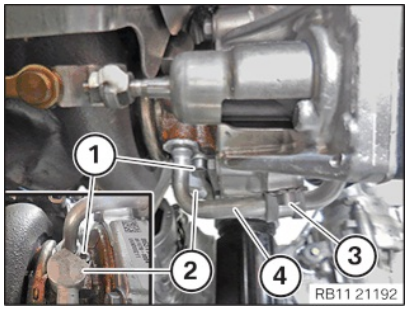
  Parts: O-ring



- Insert and position the coolant return line (1) for the exhaust turbocharger.



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



- Insert and install the coolant return line (4) for the exhaust turbocharger.
- Feed in and install coolant feed line (2) for the exhaust turbocharger.
- Tighten down screw (1).

Coolant feed line/coolant return line to exhaust turbocharger

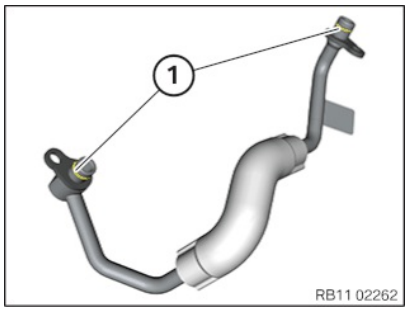
M6 x 12		Tightening torque	8 Nm

- Tighten down screw (3).

Coolant return line holder to exhaust turbocharger

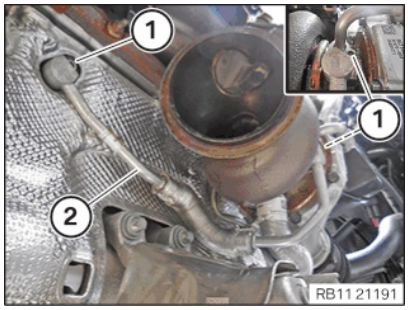
M6		Tightening torque	8 Nm

86 – Install the coolant feed line for the exhaust turbocharger



- Renew O-rings (1) on the coolant feed line with special tool 0 496 714 (00 9 030).

  Parts: O-rings



- Insert the coolant feed line (2) onto the crankcase and install.
- Tighten down screw (1).

Coolant feed line to crankcase

M6 x 12		Tightening torque	8 Nm

- Insert the coolant feed line (2) onto the exhaust turbocharger and install.
- Tighten down screw (1).

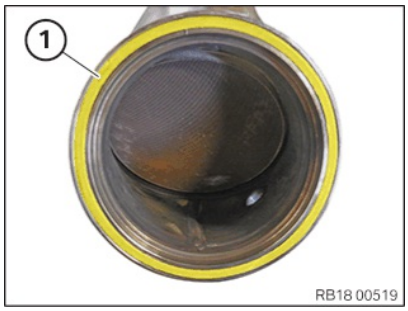
Coolant feed line/coolant return line to exhaust turbocharger

M6 x 12		Tightening torque	8 Nm

87 – Install catalytic converter

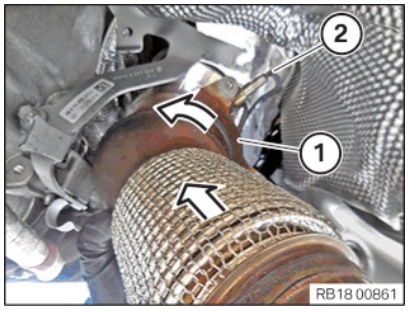
- Renew the V-clip (1).

  Parts: V-band clamp



- Renew the seal (1).

  Parts: Gasket



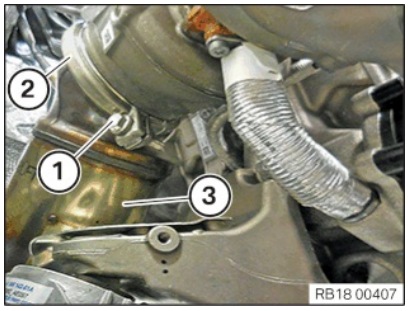
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

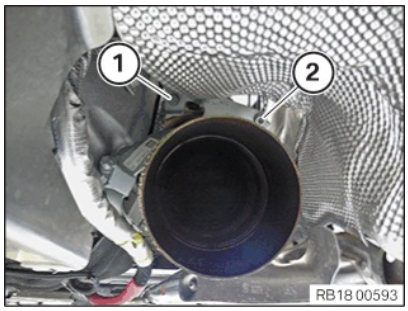
- Remove and install heavy components with the aid of another person/other persons.

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



- Renew the V-clip (2).

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



- **Version A:**

  Renew the screw (1).

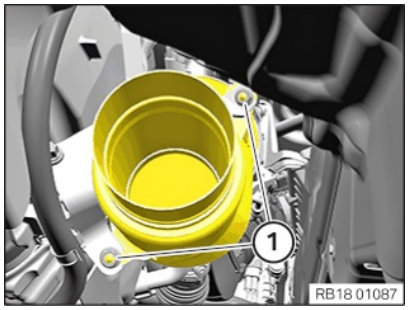
  Parts: Screw

  Position the bolt (1).

  Renew nut (2).

  Parts: Nut

  Position the nut (2).

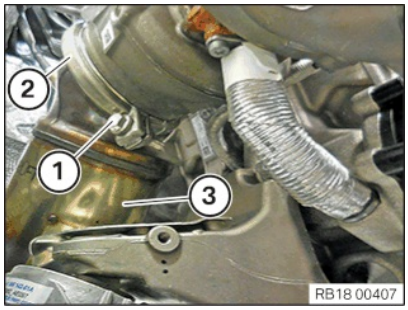


- **Version B:**

  Renew nuts (1).

  Parts: Nuts

  Position nuts (1).



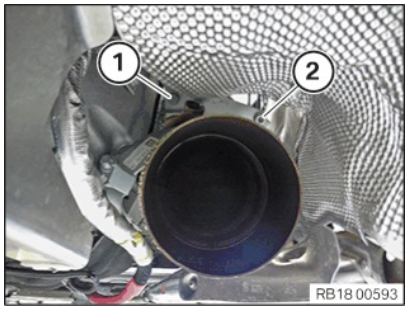
- Position the catalytic converter (3).
- Position V-clip (2).

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

- Tighten down screw (1).

Catalytic converter / petrol particulate filter to exhaust turbocharger

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



- **Version A:**

  Tighten down screw (1).

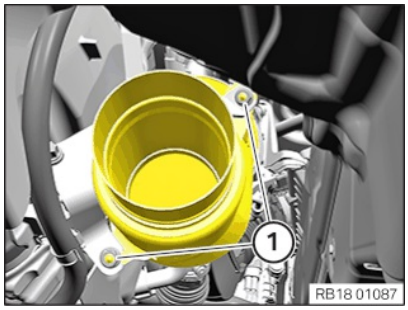
Catalytic converter to holder

M8	Renew screw.	Tightening torque	19 Nm

- Tighten nut (2).

Catalytic converter to holder

M8	Renew nut.	Tightening torque	19 Nm

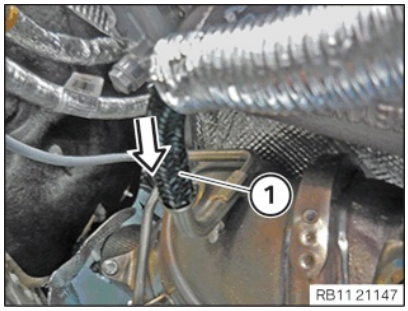


- **Version B:**

  Tighten nuts (1).

Catalytic converter to holder

M8	Renew nut.	Tightening torque	19 Nm



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

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

Heavy component.

Heavy components can lead to injury or damage.

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

CAUTION

Grinding dust when grinding components.

Hazardous to health!

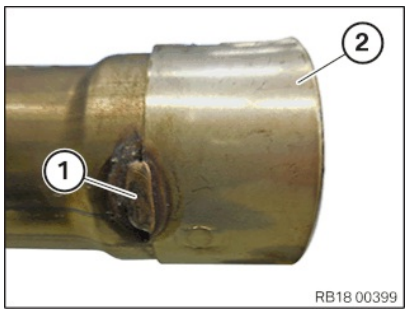
- Directly draw off the grinding dust.
- Ensure adequate ventilation.
- Conduct all work in appropriate personal protective equipment only.

TECHNICAL INFORMATION

Check the exhaust system for tightness after installation.

TECHNICAL INFORMATION

Mount the exhaust system in voltage-free state, maintaining the tightening sequence from the rear silencer towards the exhaust manifold.



CAUTION

Swarf resulting from sawing or grinding components.

Danger of injury!

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

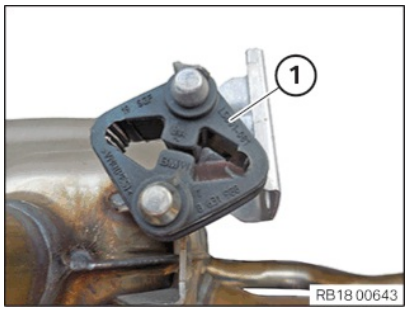
- **Version A:**

  Open the weld seam (1) with a conventional tool.

  Remove ribbon clamp (2).

  Renew the (2) ribbon clamp.

  Parts: Ribbon cable clamp

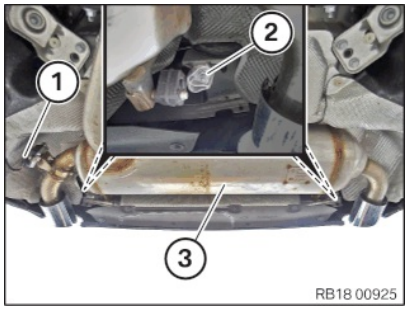


NOTICE

Schematic diagram is for example purposes. Some parts may differ in certain details.

- Check all the rubber mounts (1) of the exhaust system for damage.
- Replaced damaged rubber mounts.

  Parts: Rubber mount



- Insert and install the exhaust system (3) with the help of an auxiliary person.
- Renew nuts (2).

  Parts: Nuts
- Tighten nuts (2).

Rear silencer to body / bumper support

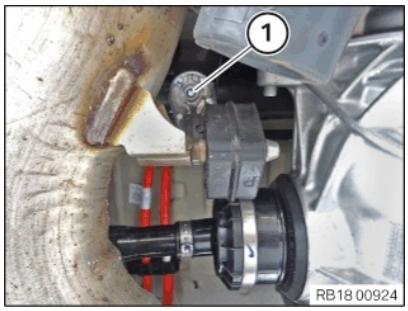
M8	Replace nuts.	Tightening torque	19 Nm

NOTICE

The following work step(s) is / are to be carried out if the specified component(s) is/are fitted.

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

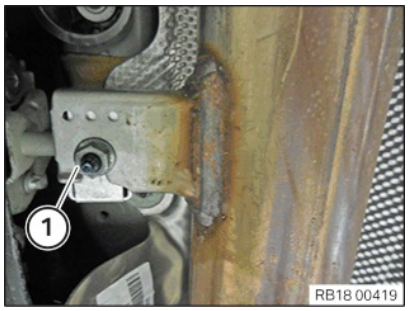


- Renew nut (1).

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

Rear silencer on support

Nut M8	Renew nut.	Tightening torque	19 Nm

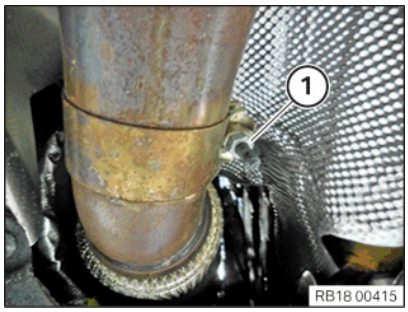


- Renew nut (1).

  Parts: Nut
- Tighten nut (1).

Front pipe/front silencer/petrol particulate filter to the transmission holder

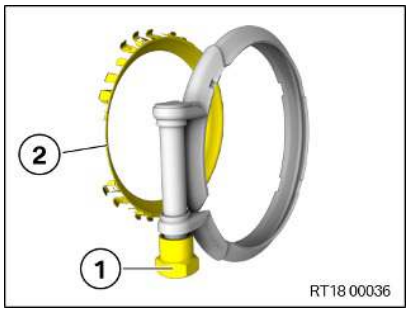
M8	Renew nut.	Tightening torque	19 Nm



- Tighten the ribbon clamp (1).

Exhaust system to catalytic converter

Ribbon clamp nut M8	Renew flat band clip.	Tightening torque	26 Nm
Ribbon clamp nut M10	Renew flat band clip.	Tightening torque	55 Nm

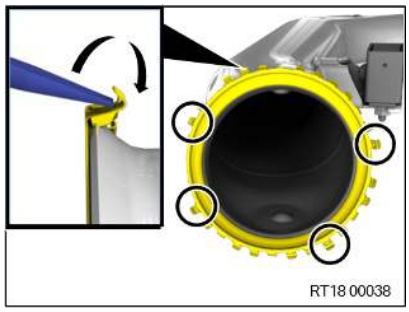


- **Version B:**

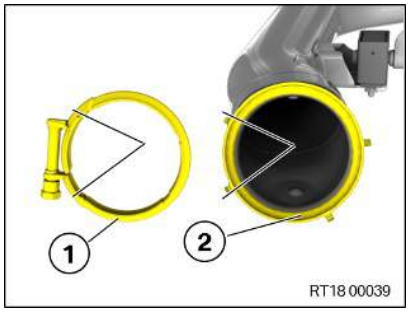
  Renew V-band clamp.

  Parts: V-band clamp

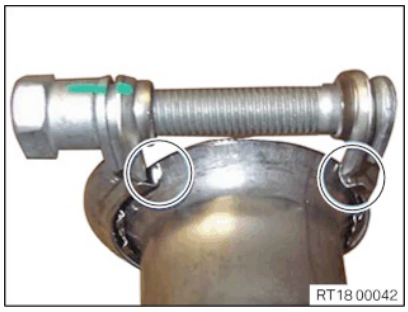
  Unscrew the nut (1) and remove the sealing ring (2).



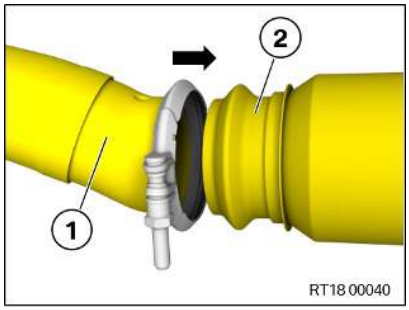
- Bend all sheet metal tabs over with a suitable tool, except those in the marked areas.



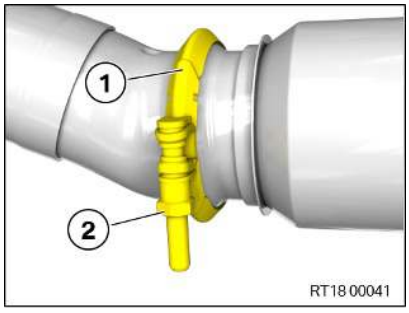
- Mount the V-clip (1) on the sealing ring (2).
- Make sure that the V-clip (1) is positioned correctly on the sealing ring (2).



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



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

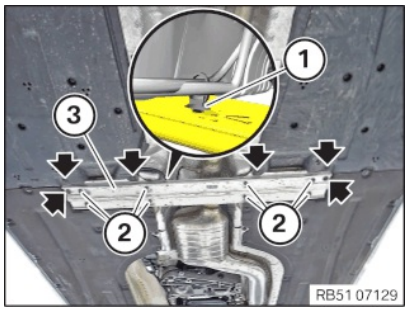


- Make sure that V-clip (1) is fitted correctly.
- Tighten down screw (2).

V-clip to catalytic converter

V-band clamp	Renew V-band clamp.	Tightening torque	25 Nm

89 – Install the connecting supports on the tunnel



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

Connecting support to tunnel

M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

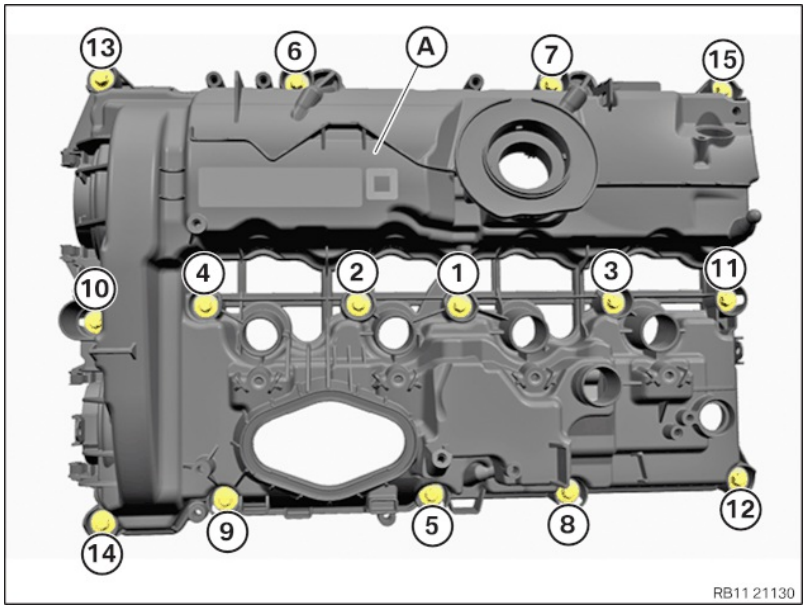
NOTICE

The following work step(s) is / are to be carried out if the specified component(s) is/are fitted.

- Secure the clamp (1).

90 – Installing cylinder head cover

Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

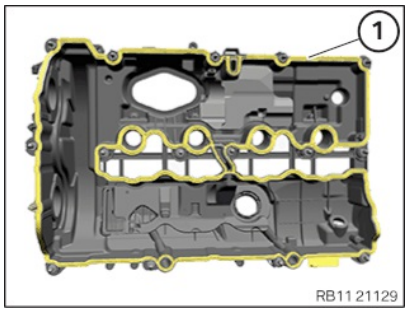
Improper routing of cables and wiring harnesses.

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

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

TECHNICAL INFORMATION

Depending on the build level, different cylinder head covers and therefore different profile seals can be fitted.
Identify suitable cylinder head cover in the Electronic Parts Catalogue and perform the corresponding variant of the work steps.

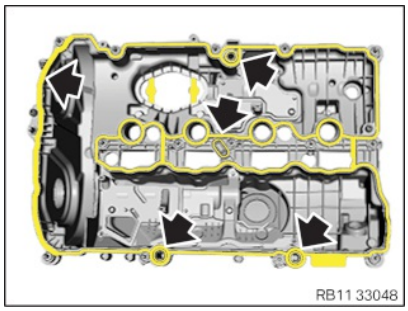


- **Variant with one profile seal:**

  Renew the profile seal (1).

  Parts: Profile seal

  Insert and install the profile seal (1).

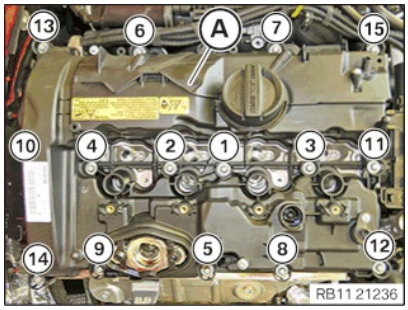


- **Variant with several profile seals:**

  Renew profile seals (arrows).

  Parts: Profile seals

  Insert and install the profile seal (1).



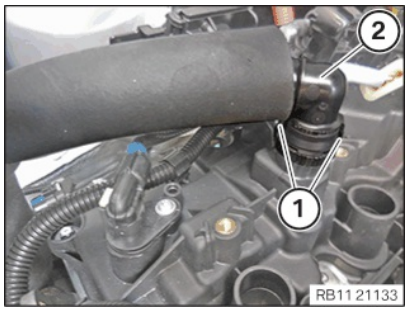
TECHNICAL INFORMATION

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

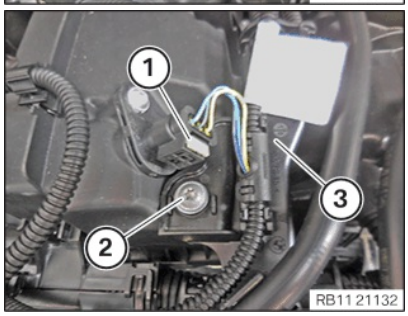
- Feed in and install cylinder head cover (A).
- Tighten screws in the order (1) to (15).

Cylinder head cover to cylinder head

M6x30		Tightening torque	8 Nm
		Tightening torque	10 Nm



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

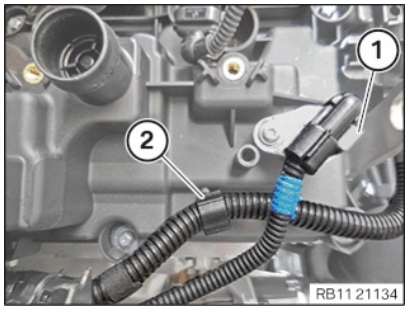


- Guide in and install wiring harness section (3) for sensor system 1.
- Tighten down screw (2).

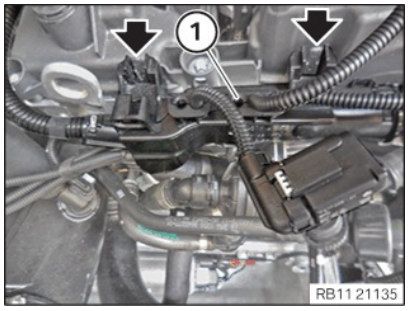
Wiring harness section of engine to cylinder head cover

M6		Tightening torque	8 Nm

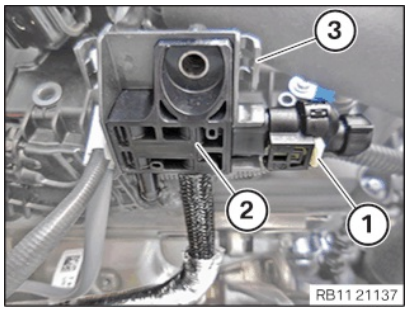
- Connect connector (1) on the intake camshaft sensor and lock it.
- Ensure that connector (1) on the intake camshaft sensor engages audibly.



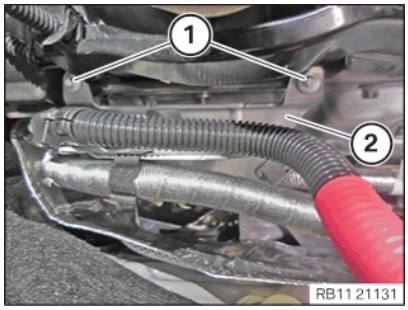
- Connect connector (1) on the exhaust camshaft sensor and lock it.
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).



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



- Thread in differential pressure sensor (2) on the holder (3) and install.
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



CAUTION

Improper routing of the positive battery cable.

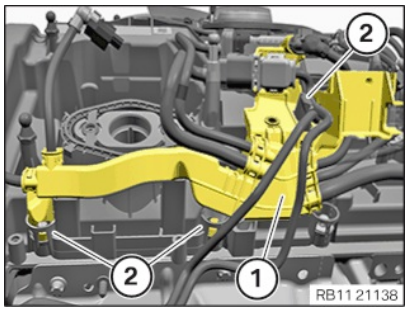
Risk of short circuits!

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

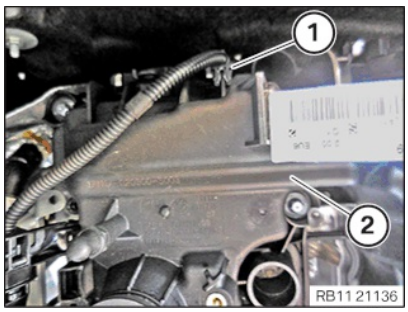
- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

Holder, positive battery cable to cylinder head cover

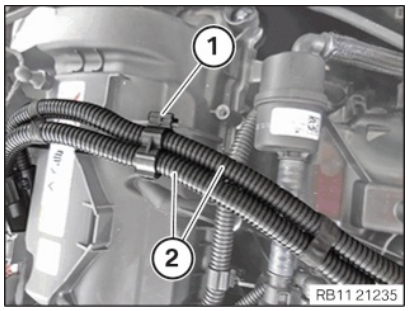
6X18		Tightening torque	6 Nm



- Guide in the wiring harness section (1) for sensor system 2 from guides (2) and install it.

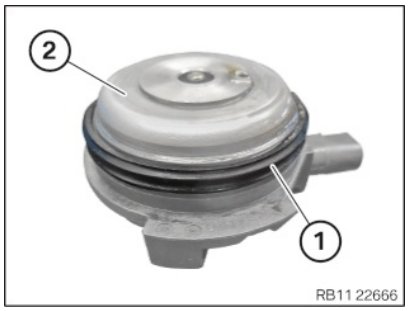


- Secure clamps (1).

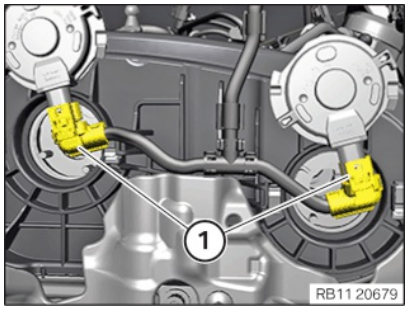


- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).

91 – Installing both actuators



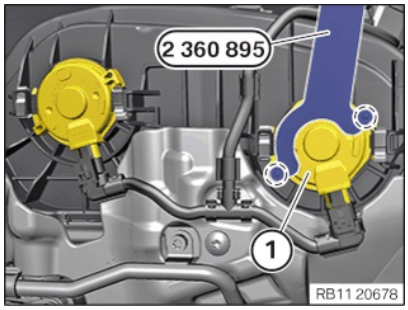
- Check seal (1) for damage and, if necessary, renew actuator (2).



NOTICE

The figure shows the rear side of the engine.

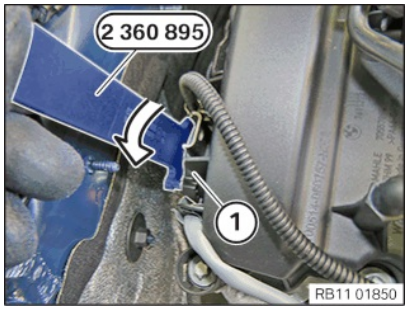
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



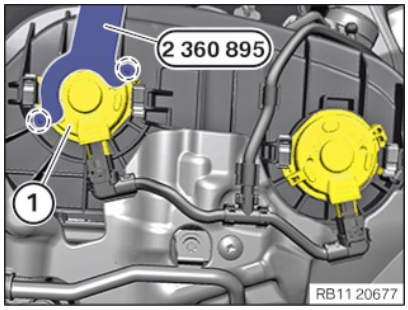
NOTICE

The figure shows the rear side of the engine.

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



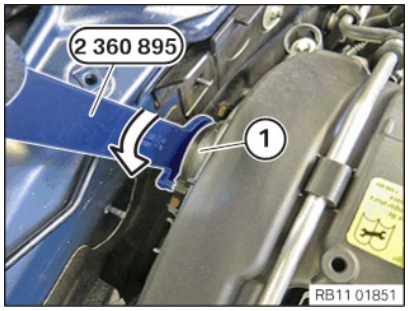
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.



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.

92 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

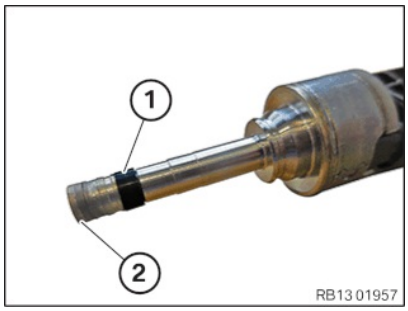
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- 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

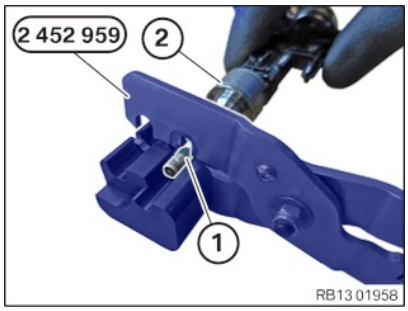
Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

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.

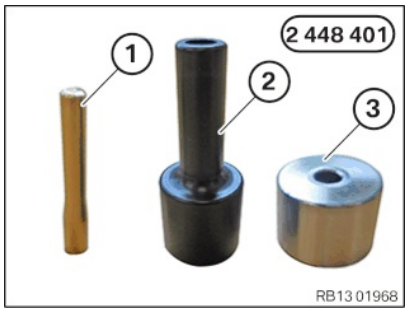


- Before installing the injectors: Renew the Teflon rings (1).

  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.

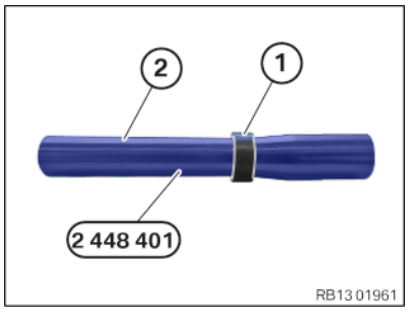


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

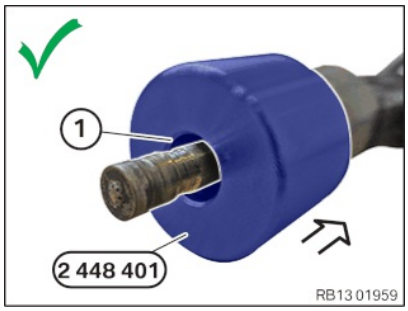
  (1) Installation cone

  (2) Sliding sleeve

  (3) Assembly sleeve

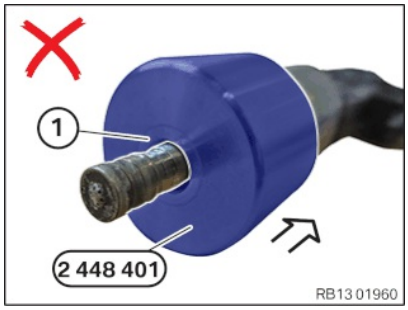


- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



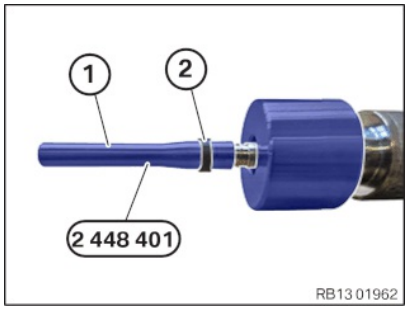
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

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

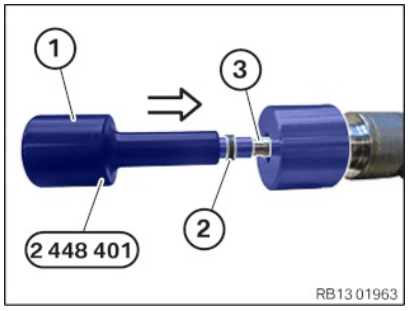


- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

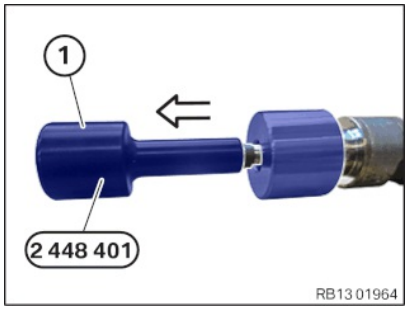
  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.



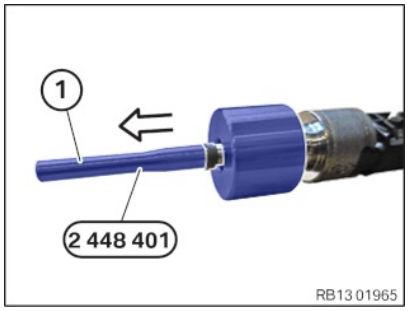
- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .



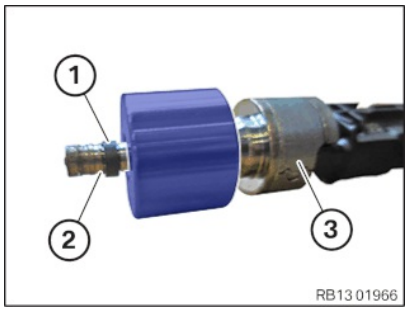
- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.



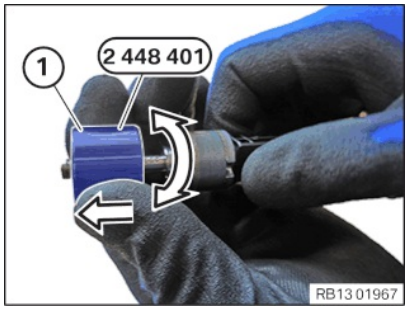
- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



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

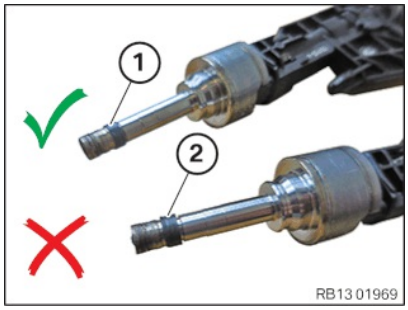


- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.



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

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

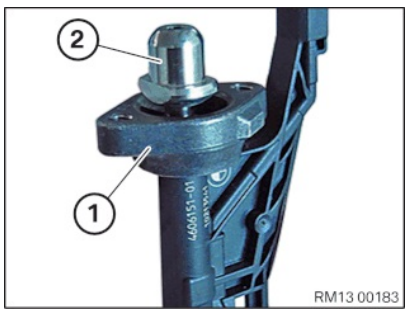


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

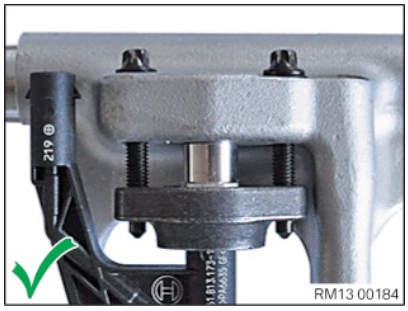
93 – Installing the rail with injectors

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.

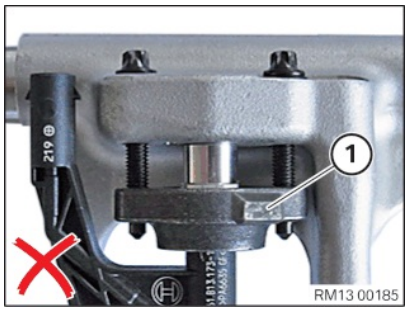


- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder** (1) **has a cast lug:** Make sure that the holder is installed in the correct position.



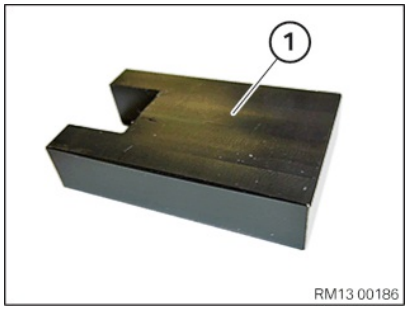
- If applicable, note the position of the cast lug:

  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.



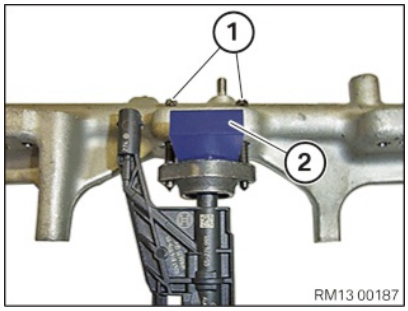
RISK OF DAMAGE

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.

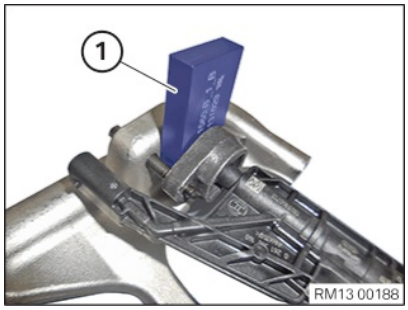
- Use the special tool (distance gauge) 2 358 022 (1).



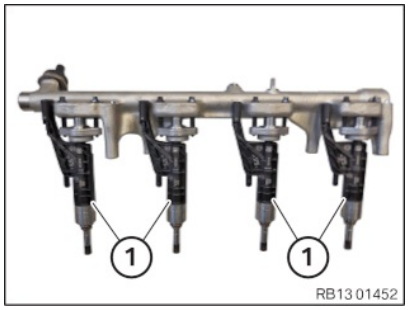
- Mount the injectors with holders and the **new** screws (M5x30) to the rail.

  Parts: Screws (M5x30)
- 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) uniformly until special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.

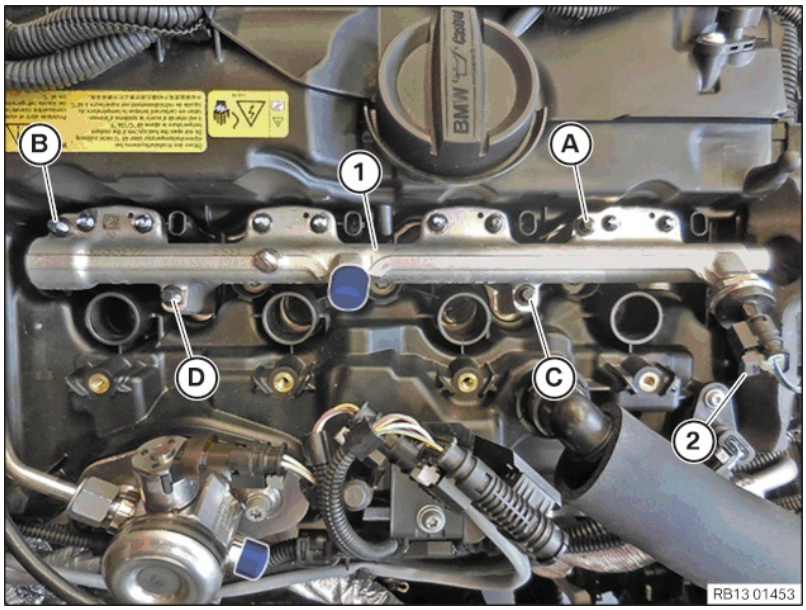


- Remove the special tool (distance gauge)2 358 022 (1) .
- Repeat this operation for all injectors.



- Check injectors (1) for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors (1) must move freely.



- 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 down until there is resistance, position screws (M6x70) (A), (B), (C) and (D), and turn them until hand-tight.
- Set torque wrench to 2 Nm.
- Tighten the screws (A,) (D), (B) and (C) at **90°** each in an alternating order using the torque wrench until the rail rests on the cylinder head.

  The figure shows the rail resting flat against the cylinder head.
- If the tightening torque (2 Nm) is reached before the rail rests on the cylinder head: Disassemble the rail and restart the installation procedure.

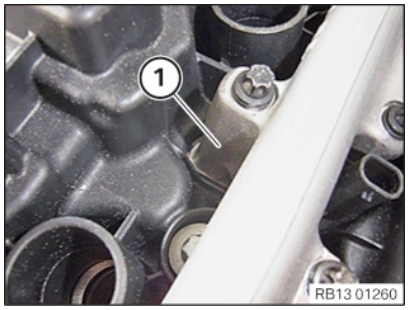
TECHNICAL INFORMATION

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

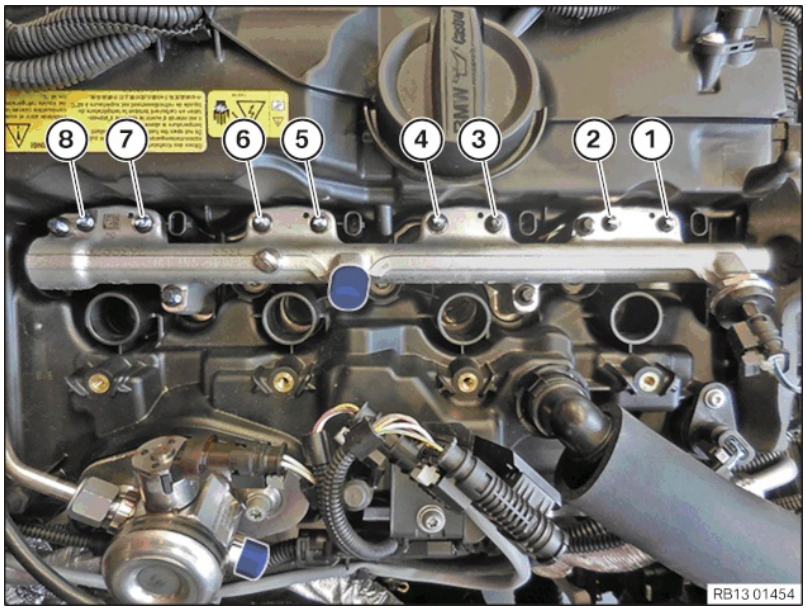
Non-observance of these requirements may result in leaks and damage.

- Tighten screw (A) by 5 Nm.
- Tighten screw (D) by 5 Nm.
- Tighten screw (B) by 5 Nm.
- Tighten screw (C) by 5 Nm.
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.



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



- Insert a wrench socket into an extension.

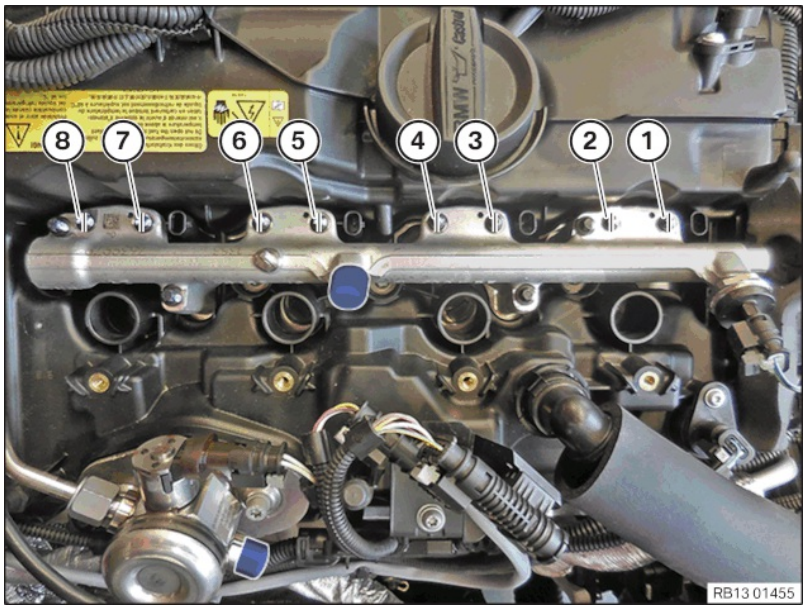
  Do not use a reversible ratchet or torque wrench.
- **Hand-tighten** the screws (M5x30) respectively in pairs (1) with (2), (3) with (4), (5) with (6), (7) with (8) alternatively with **90°**.
- Set torque wrench to 5 Nm.

TECHNICAL INFORMATION

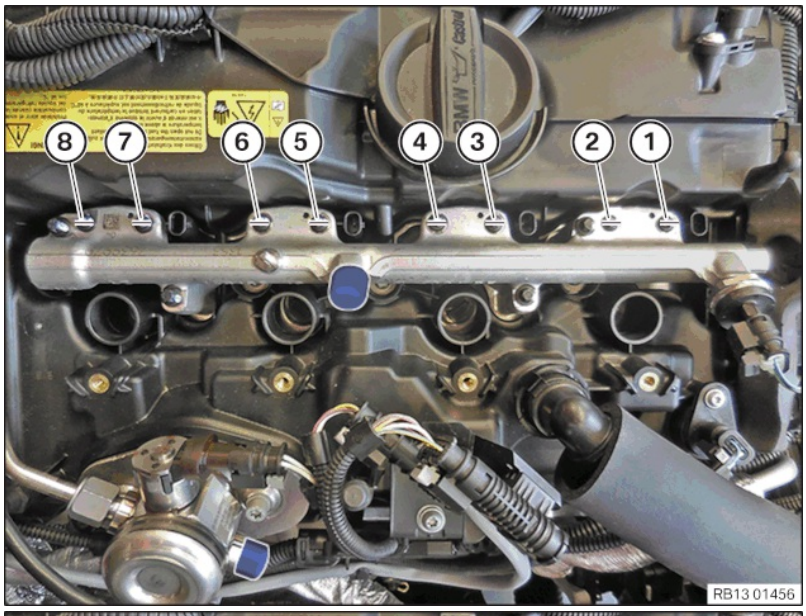
When assembling, it is essential to observe screwing sequences and tightening torques.

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

- **Screw the M5x30 screws according to the following plan:**
  - **Fuel injector 1:**
  - Tighten the bolt (1) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (2) at an angle of rotation of 90° 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 the bolt (3) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (4) at an angle of rotation of 90° 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 the bolt (5) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (6) at an angle of rotation of 90° with the torque wrench.
  - Repeat the steps for bolts (5) and (6), until both bolts reach a torque 5 Nm.
  - **Fuel injector 4:**
  - Tighten the bolt (7) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (8) at an angle of rotation of 90° with the torque wrench.
  - Repeat the steps for bolts (7) and (8) until both bolts reach a torque of 5 Nm .

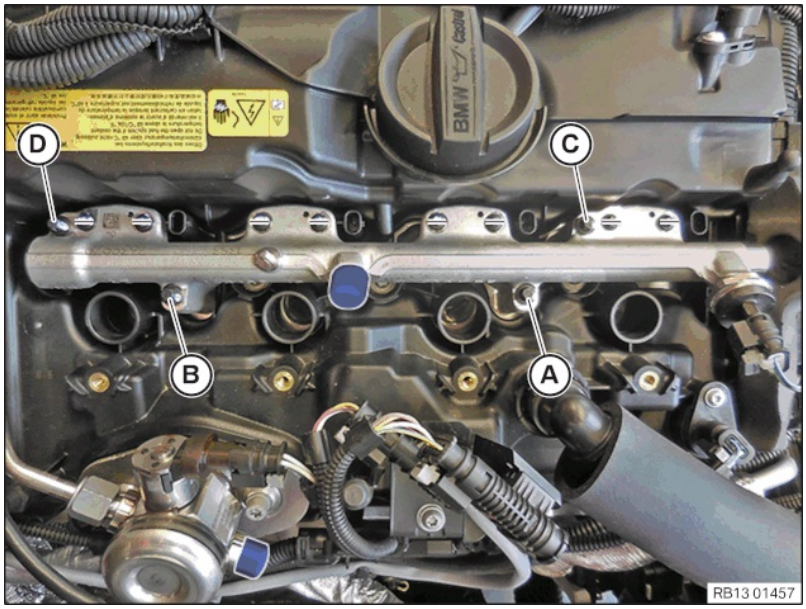


- Mark all bolts (1) to (8) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the bolt (1) with an angle of rotation of 90°.
  - Tighten the bolt (2) with an angle of rotation of 90°.
  - Tighten the bolt (3) with an angle of rotation of 90°.
  - Tighten the bolt (4) with an angle of rotation of 90°.
  - Tighten the bolt (5) with an angle of rotation of 90°.
  - Tighten the bolt (6) with an angle of rotation of 90°.
  - Tighten the bolt (7) with an angle of rotation of 90°.
  - Tighten the bolt (8) with an angle of rotation of 90°.



- Check if all bolts (1) to (8) were tightened with an angle of rotation of 90°.

  Marks (lines) must be horizontal (see figure).



- Release bolts (M6x70) (A) to (D).

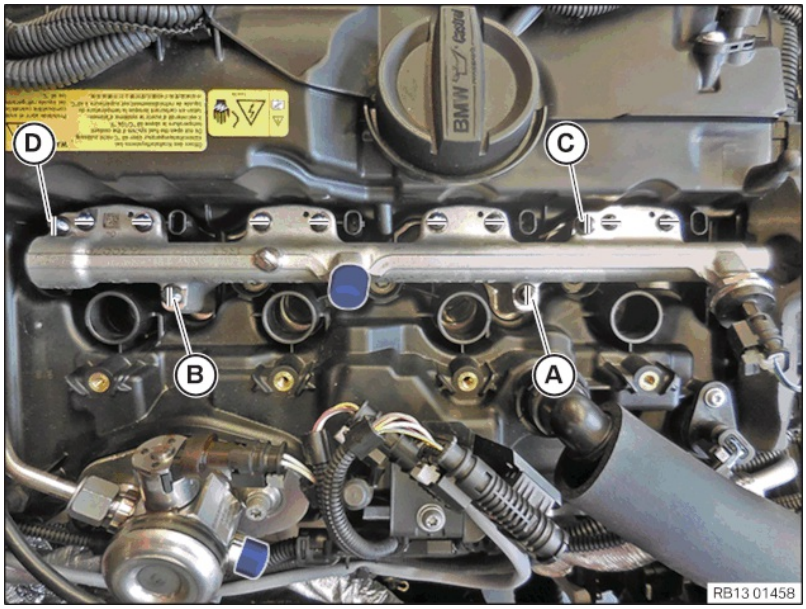
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

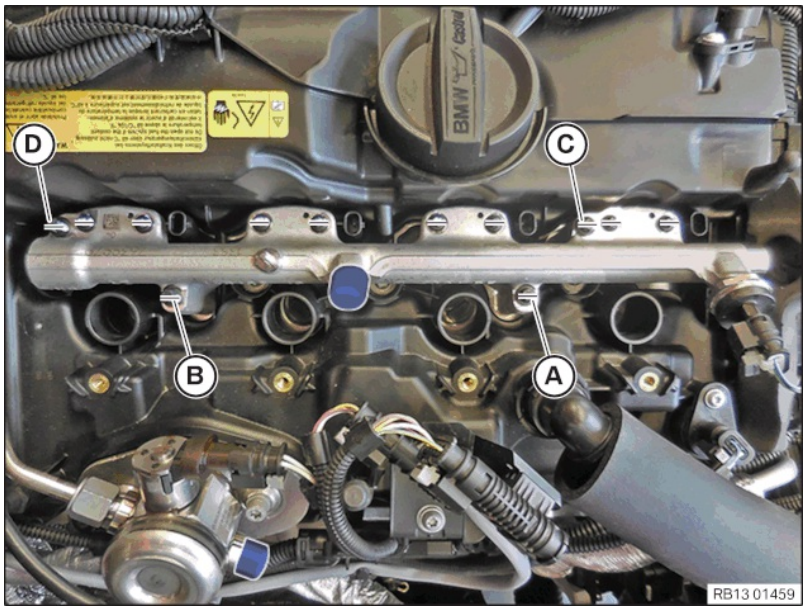
When assembling, it is essential to observe screwing sequences and tightening torques.

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

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

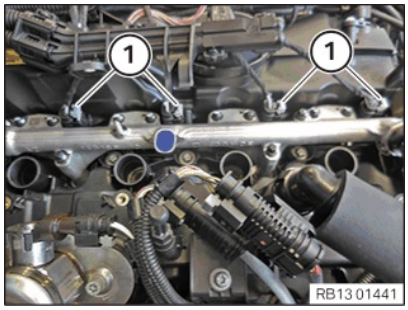


- Mark screws (A) to (D) with a vertical line (see figure).
- Tighten the screws (M6x70) (A) to (D) at an angle of rotation **of 90°**.



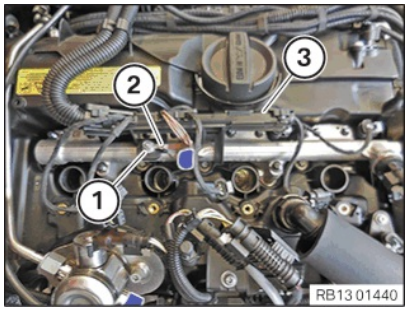
- Check if the screws (A) to (D) were tightened at an angle of rotation of **90°**.

  The 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 nut (1).

Ground cable to rail

M6		Tightening torque	5 Nm

94 – Installing the high pressure pump

RISK OF DAMAGE

Damage to the engine.

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

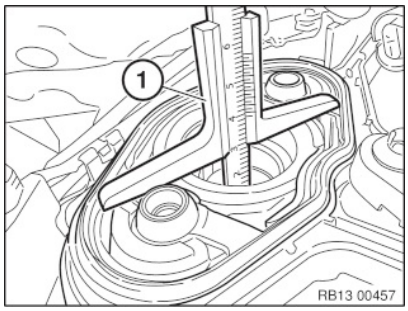
- Turn the combustion engine exclusively by hand in the correct direction of rotation: a) Clockwise, facing the vibration damper or b) Anticlockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

The high-pressure pump is preloaded by the piston spring and must be removed by alternately pulling out the screws without tilting.

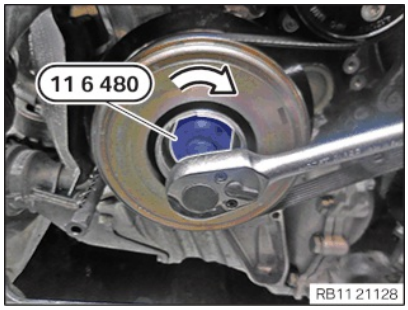
Before installing the high pressure pump, turn the cam of the high-pressure pump drive to the bottom dead centre.

If necessary, turn the engine in the direction of engine rotation at the central bolt of the crankshaft, otherwise there is a risk of piston breakage of the high-pressure pump.

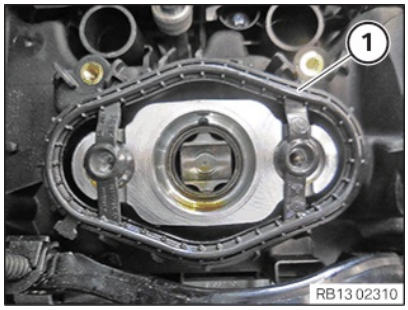


- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

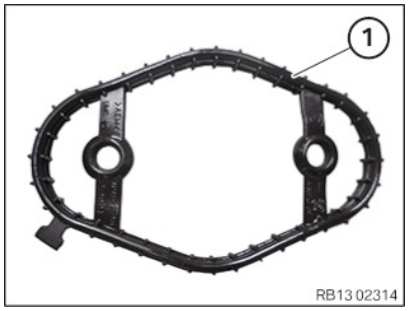
  The depth gauge (1) is in the deepest position.



- 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** .

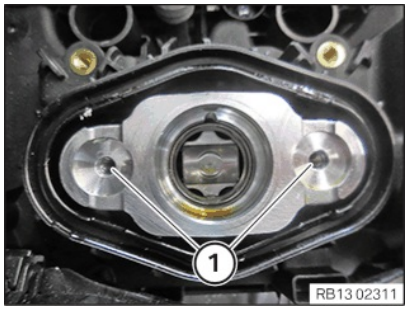


- Guide out and remove gasket (1).



- Renew the seal (1).

  Parts: Gasket



TECHNICAL INFORMATION

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

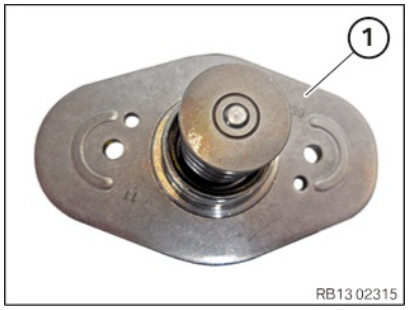
- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.

TECHNICAL INFORMATION

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

- Clean sealing surface (1).

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



RISK OF DAMAGE

Damage to the surface.

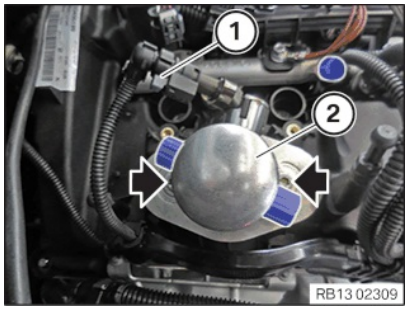
The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- 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: Screws
- 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

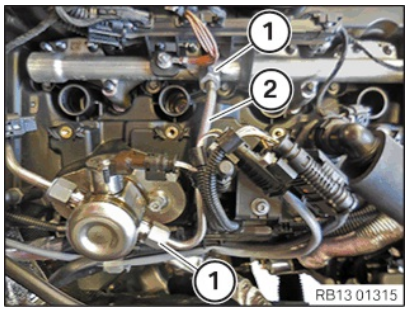
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

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

- Guide the special tool out and remove.



- Thread in and install the high pressure line (2).
- Tighten union nut (1) hand tight.
- Tighten union nut (1).

High pressure line between high pressure pump and high pressure rail

M14		Tightening torque	33 Nm

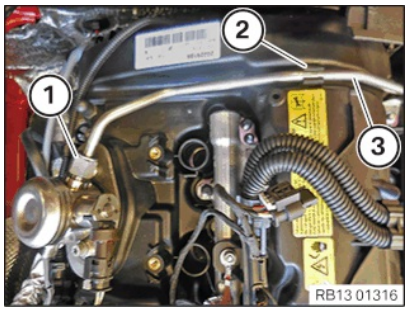
96 – Installing fuel delivery line

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

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

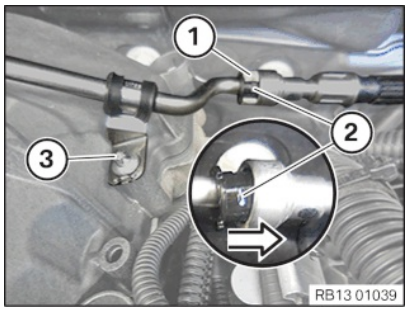
- Route all cables without abrasions, do not trap and crush.



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

Fuel delivery line to high pressure pump

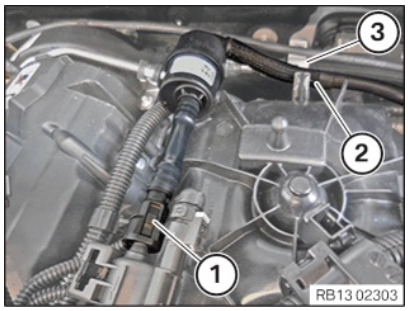
M14		Tightening torque	26 Nm



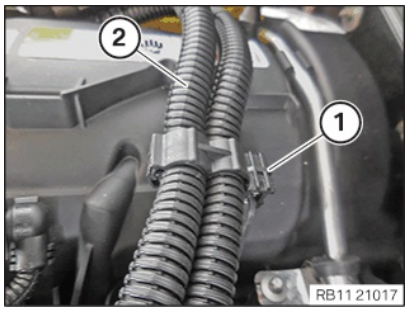
- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure the clamp (1).
- Tighten down screw (3).

Fuel delivery line to cylinder head cover

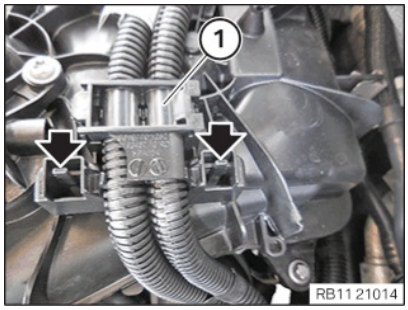
M6 screw		Tightening torque	7 Nm



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



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

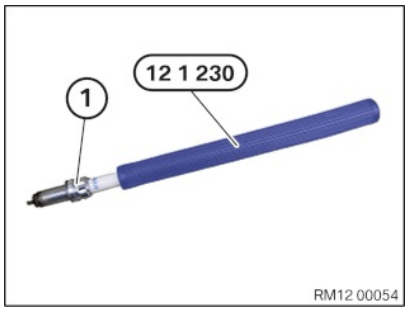


- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

97 – Installing all spark plugs

NOTICE

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

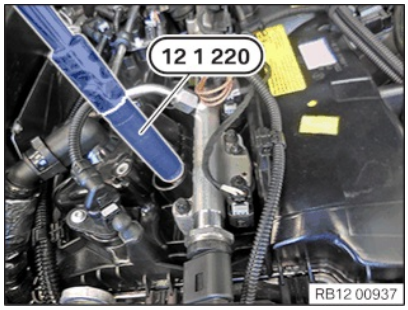


- Insert spark plug (1) into special tool 0 496 065 (12 1 230).

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

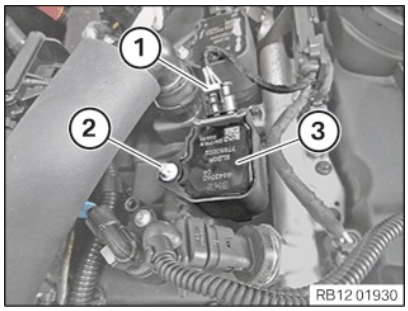
M12x1.25		Tightening torque	23 Nm

98 – Install all ignition coils

NOTICE

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

▸ **Install ignition coil.**



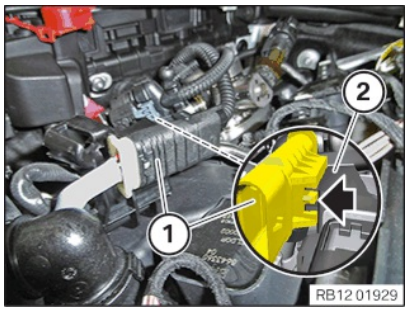
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

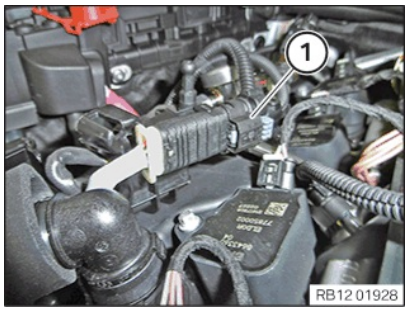
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



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

  The connector (1) must engage audibly.



- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

99 – Install front oxygen sensor

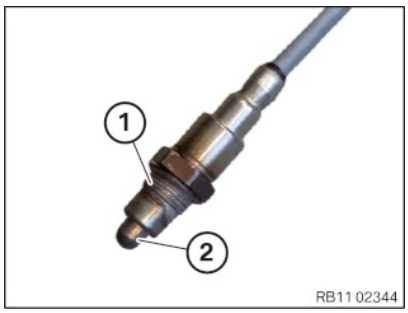
TECHNICAL INFORMATION

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



TECHNICAL INFORMATION

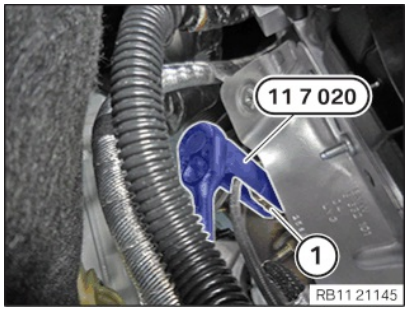
For additional information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

- Prepare the oxygen sensor.

  Do not damage the sensor ceramics.

  (1) = Thread

  (2) = Sensor ceramics



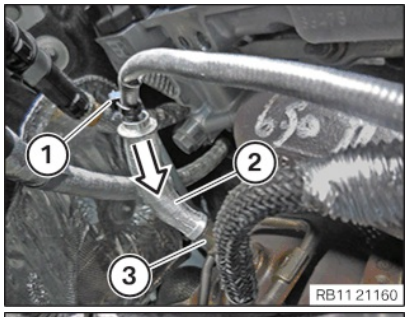
NOTICE

The oxygen control sensor cable of is black. The installation location of the front oxygen sensor is before the catalytic converter.

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

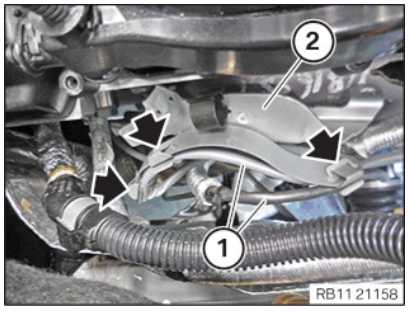
Lambda control probe

M18x1.5		Tightening torque	50 Nm

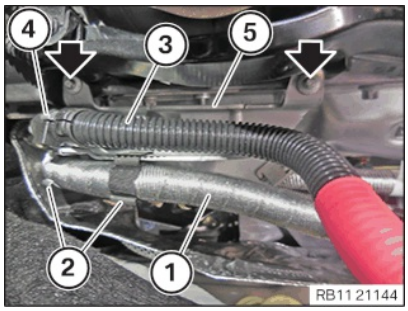


- Guide in the heat protection (2) in the direction of arrow and install.
- Ensure that the heat protection (2) is touching the limit position (3).
- Renew the cable straps (1).

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



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



- **Version A (without mild hybrid technology):**

CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

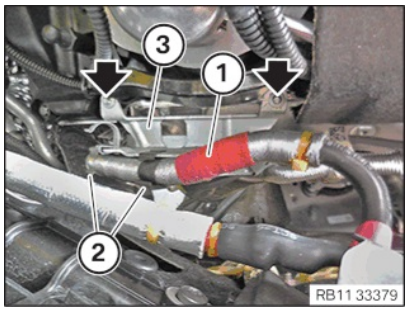
- Route the positive battery cable without abrasions and do not trap.

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

Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

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



- **Version B (with mild hybrid technology):**

CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

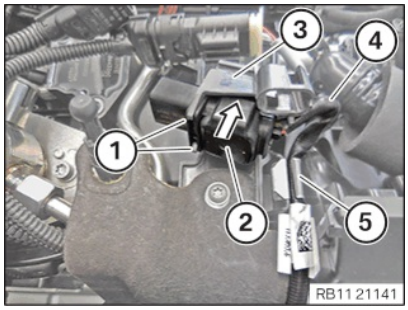
- Route the positive battery cable without abrasions and do not trap.

- Feed in and position the holder (3) of the positive battery cable.
- Tighten screws (arrows).

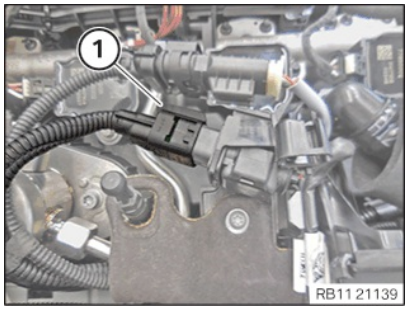
Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

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

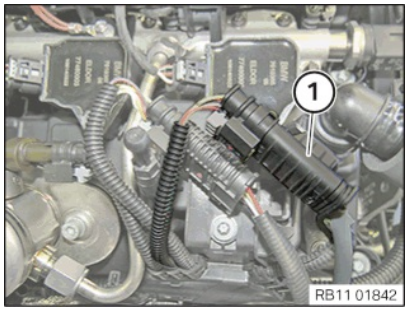


- Feed in the connector (2) in the direction of arrow on the carrier plate (3) and connect it.
- Locks (1) must engage audibly.
- Secure cable (4) to the clamp (5).



- Connect connectors (1) and lock.

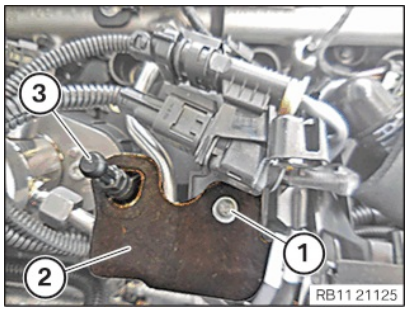
  The connector (1) must engage audibly.



- Connect the connector (1) and lock it.
- Feed the connector (1) into the carrier plate and connect it.

  The connector (1) must be engaged audibly.

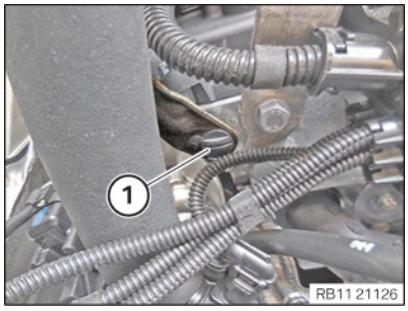
100 – Install the cylinder head cover acoustic cover



- Guide in and position the acoustic cover (2) on the ball pin (3).
- Tighten down screw (1).

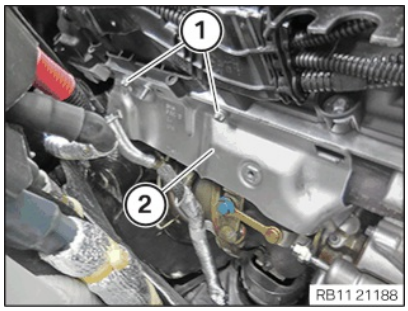
Acoustic cover (side) to cylinder head cover

TS6 x 20		6 Nm



- Secure the clip (1).

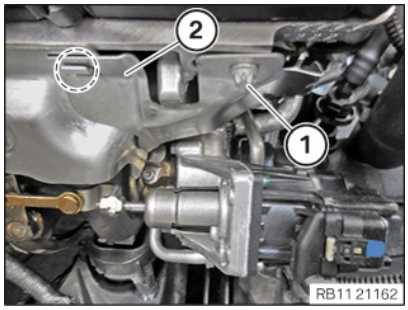
101 – Install the heat shield on the cylinder head



- Thread in and position the heat shield (2).
- Tighten the screws (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm



- **Version without Real Driving Emissions 2 (-SA1DZ):**

  Feed the heat shield (2) into the **marked** area and install it.

  Tighten down screw (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm

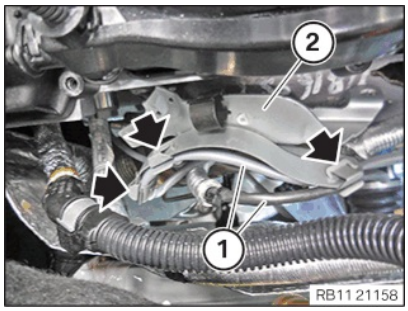
- **Version without Real Driving Emissions 2 (-SA1DZ):**

  Tighten down screw (1).

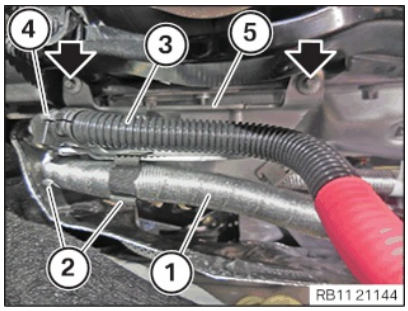
Heat shield to clamping strip

M6 x 12		Tightening torque	8 Nm

102 – Install the holder of the positive battery cable



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



- **Version A (without mild hybrid technology):**

CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

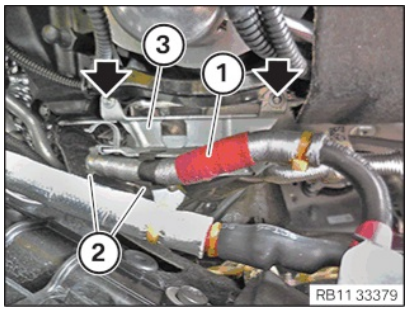
- Route the positive battery cable without abrasions and do not trap.

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

Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

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



- **Version B (with mild hybrid technology):**

CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

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

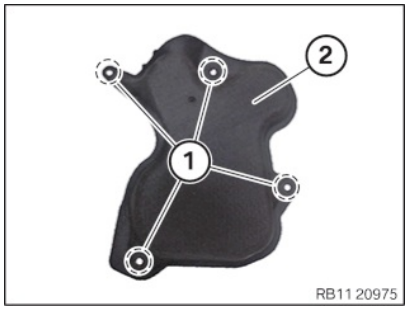
- Feed in and position the holder (3) of the positive battery cable.
- Tighten screws (arrows).

Holder, positive battery cable to cylinder head cover

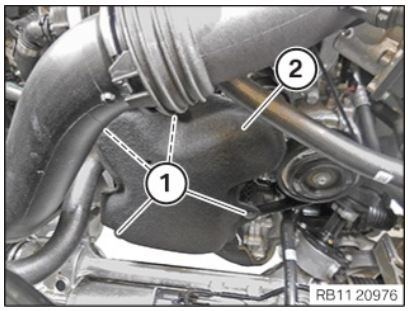
6X18		Tightening torque	6 Nm

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

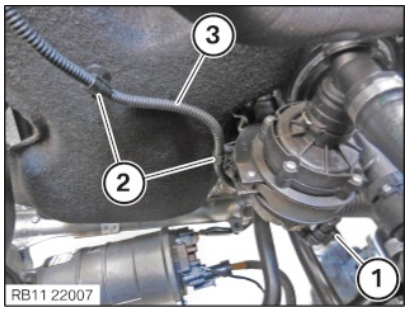
103 – Installing front acoustic cover for engine



- Check acoustic cover (2) in marked areas (1) for damage, renew if necessary.

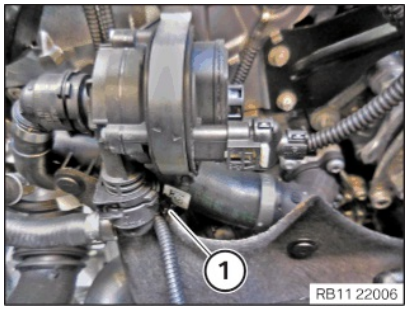


- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).



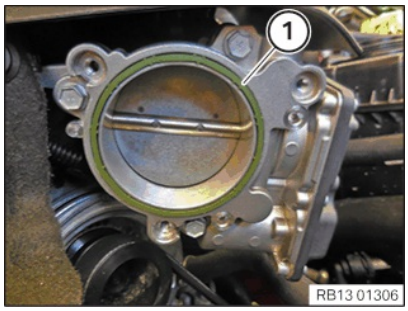
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



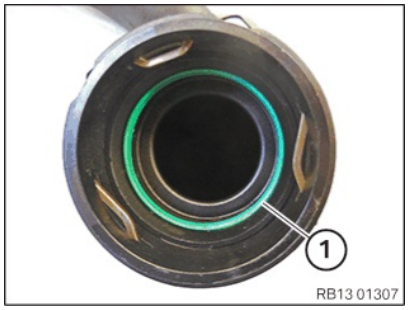
- Secure clamps (1).

104 – Install charge air line



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

  Parts: Sealing ring

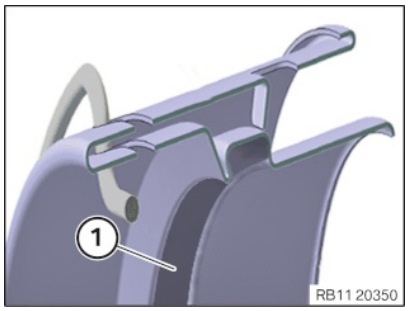


- Check the sealing ring (1) on the charge air line for damage and renew, if necessary.

▸ **Replacing damaged seal**

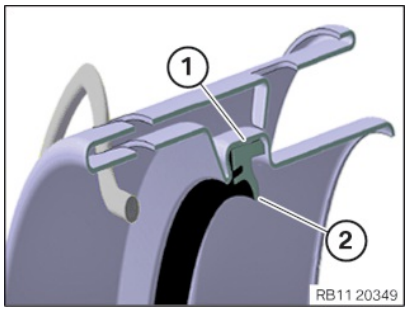
TECHNICAL INFORMATION

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



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

  The gasket groove (1) must be clean.



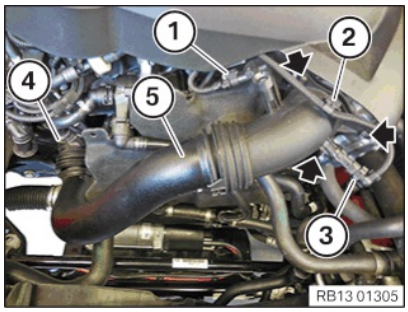
- Renew gasket.

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

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is directed inwards as shown.



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

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

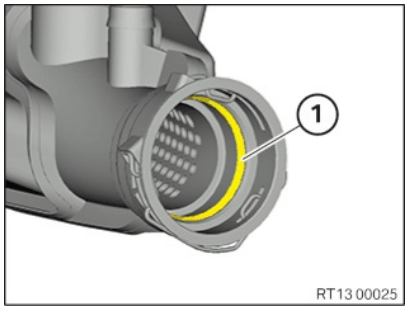
Charge air line to throttle body

M6		Tightening torque	8 Nm

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

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

105 – Installing clean air pipe with resonator

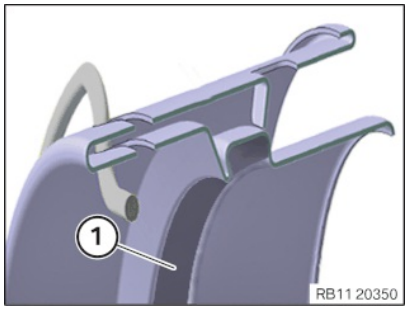


- Check the seal (1) for damage, and renew if necessary.

▸ **Replacing damaged seal**

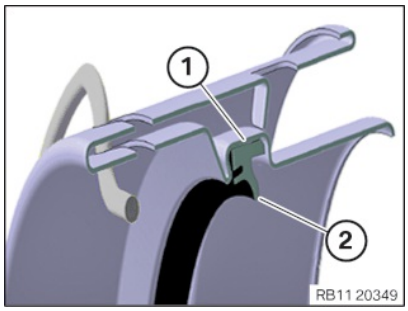
TECHNICAL INFORMATION

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



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

  The gasket groove (1) must be clean.



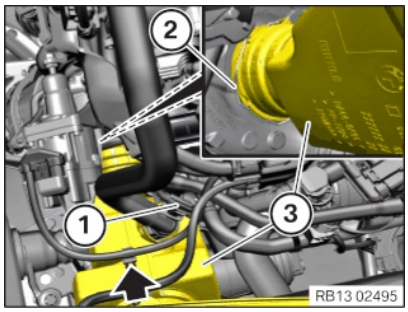
- Renew gasket.

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

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

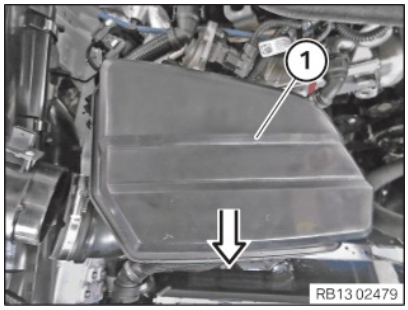
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is directed inwards as shown.



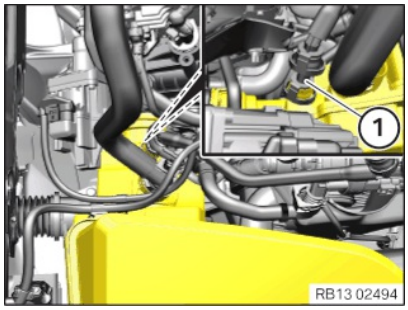
- **Version A:**
- Feed in and install the clean air pipe with resonator (3).
- Lock clamp (2).

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

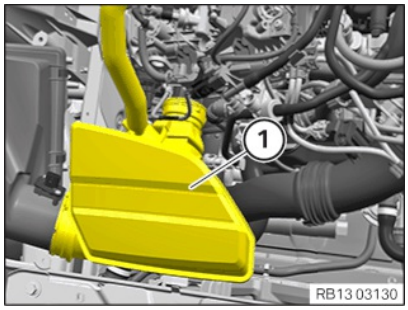
  The connector (1) must engage audibly.
- Secure clamp (arrow).



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

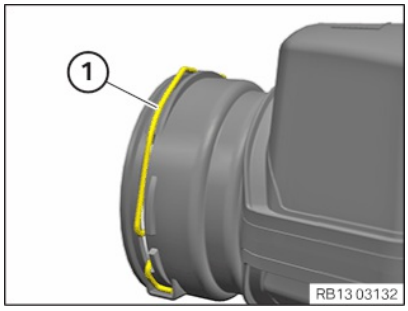


- Connect and lock the tank ventilation line (1).

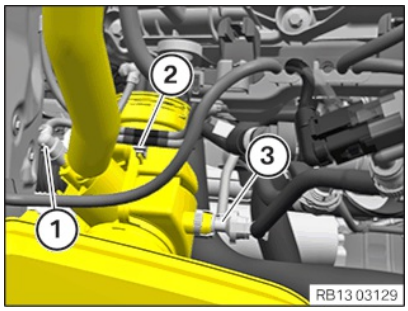


- **Version B:**
- Install clean air pipe with resonator (1) and connect.

  Clean air pipe with resonator (1) must engage audibly.



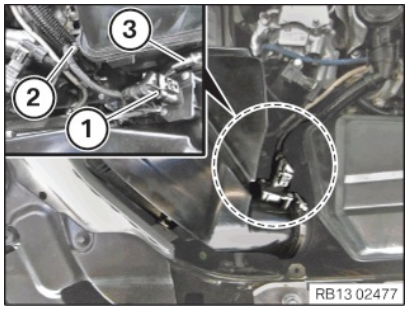
- Lock clamp (1).



- Connect the line (3).

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

  The connector (1) must engage audibly.



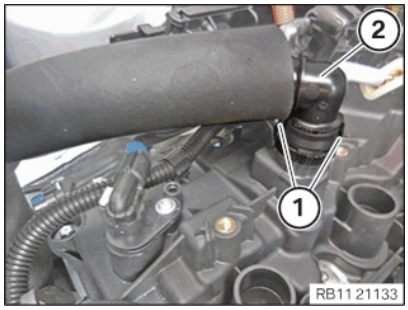
- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

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

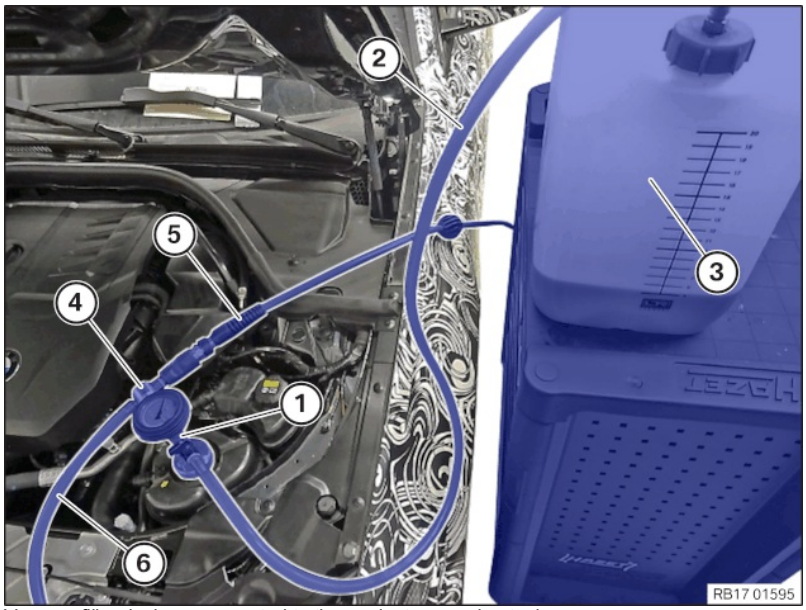
  The connector (1) must engage audibly.



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

106 – Filling the high-temperature cooling system with the vacuum filler device

Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum 6 bar)

6 Exhaust hose (Routing the exhaust hose to a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same

height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

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

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

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

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

TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

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

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

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

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

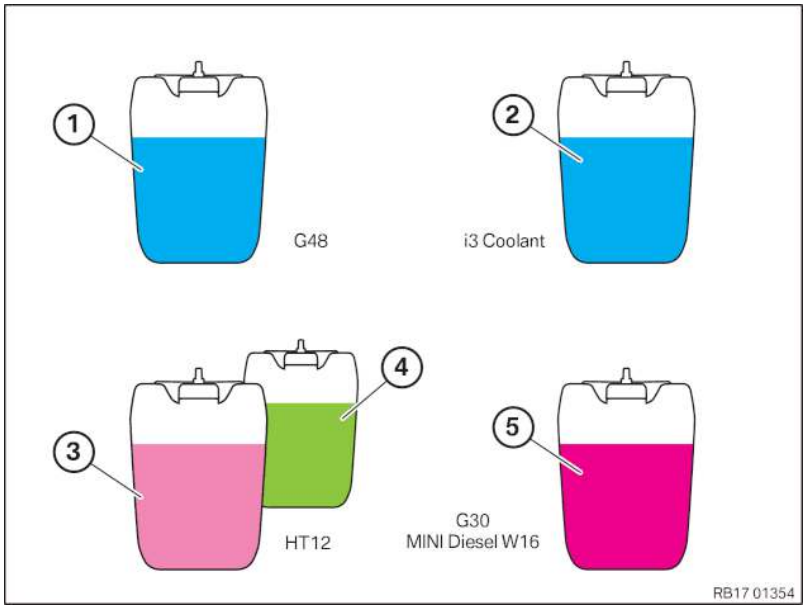
A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

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

▸ **Observe the coolant type**

Coolant in the collecting vessel of vacuum filler device



Choose the correct coolant for filling.

In general, a vehicle has to be filled with the coolant with which it is delivered from the factory.

1 G48 (Blue) (BMW LC-87) Must **not** be mixed with i3 Coolant or G30 MINI Diesel W16.

2 i3 Coolant (Blue) (BMW LC-13) Is used only for heater circuit i3. i3 Coolant must **not** be added to other coolant circuits or mixed with other coolants.

3 HT12 (Rose) (BMW LC-18) Must **not** be mixed with i3 Coolant or G30 MINI Diesel W16.

4 HT12 (Green) (BMW LC-18) Must **not** be mixed with i3 Coolant or G30 MINI Diesel W16.

5 G30 (Rose) (BMW LC-07) May be W16 used exclusively for the **MINI Diesel**. G30 must **not** be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine or components in high-voltage vehicles

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

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

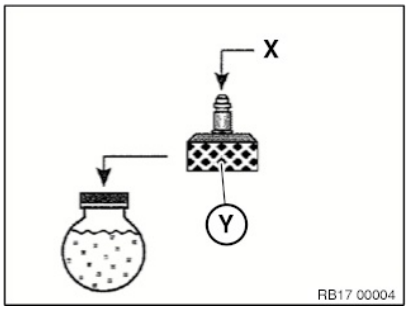
- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

Type	Engine	Adapter (Y) from 17 0 100
G20/G21/G22/G23/G26/G28/G29	B42/B46/B48/B58	**17 0 113**
G20/21/22/23/G26/G42	B57/B47 Mild hybrid technology	**17 0 113**

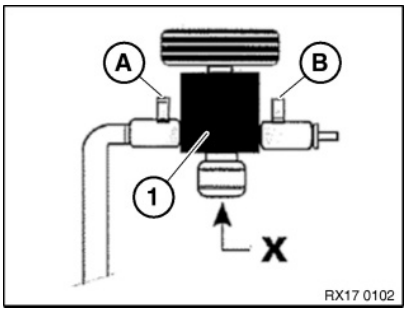
- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

Capacity of high-temperature coolant circuit G20 / G21 / G22 / G28

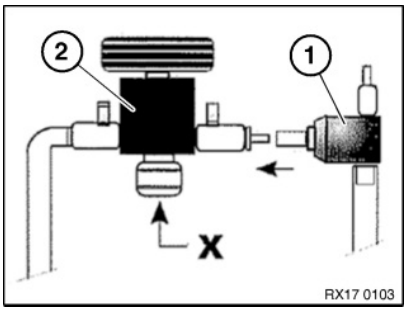
B42T20O1 / B48B20O1 / B46B20O1 / B48B20O1 (PHEV) / B48B20M1 (PHEV)	9.8 l
Expendable materials: Technically suitable antifreeze and corrosion inhibitor	



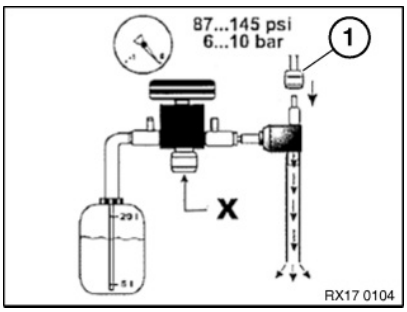
- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.



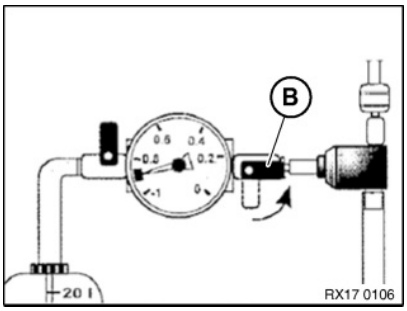
- Check whether shut-off valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



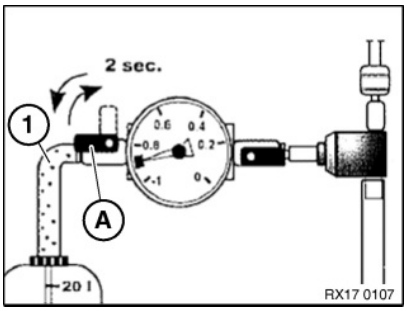
- Connect Venturi nozzle (1) to the vacuum filler device (2).
  (X)is the connection on the coolant expansion tank.



- Connect compressed air (1).
  (X)is the connection on the coolant expansion tank.

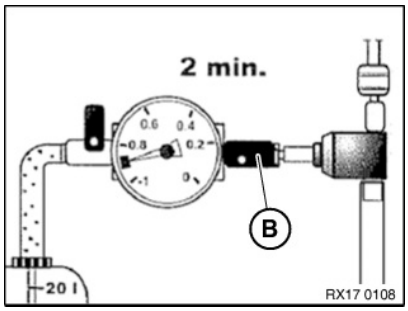


- Open shut-off valve (B).
  The Venturi nozzle produces a flow noise.



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

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

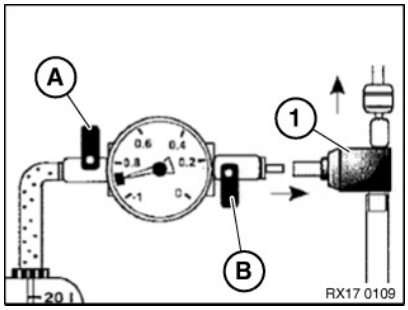


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

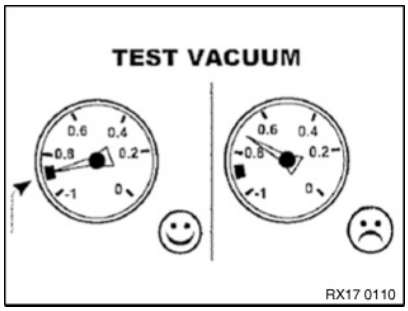
TECHNICAL INFORMATION

The coolant hoses contract during vacuum build-up.

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



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



Check

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

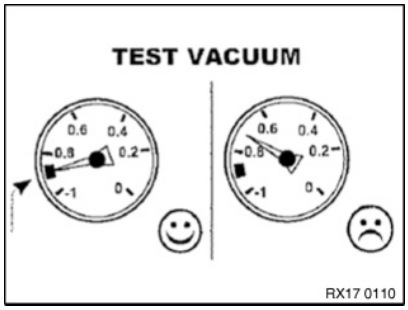
Result

» Vacuum drops.

Measure

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

Check



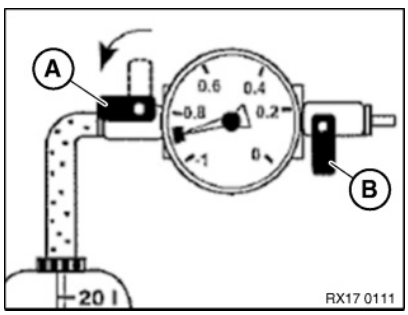
- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

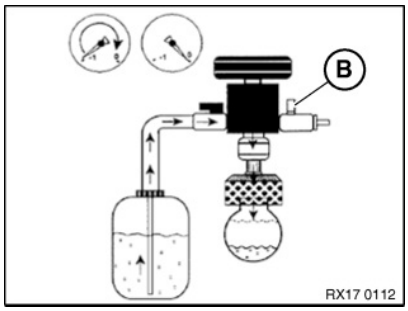
» Vacuum remains constant.

Measure

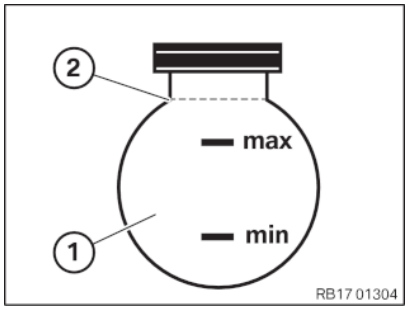
- Continue with filling.



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



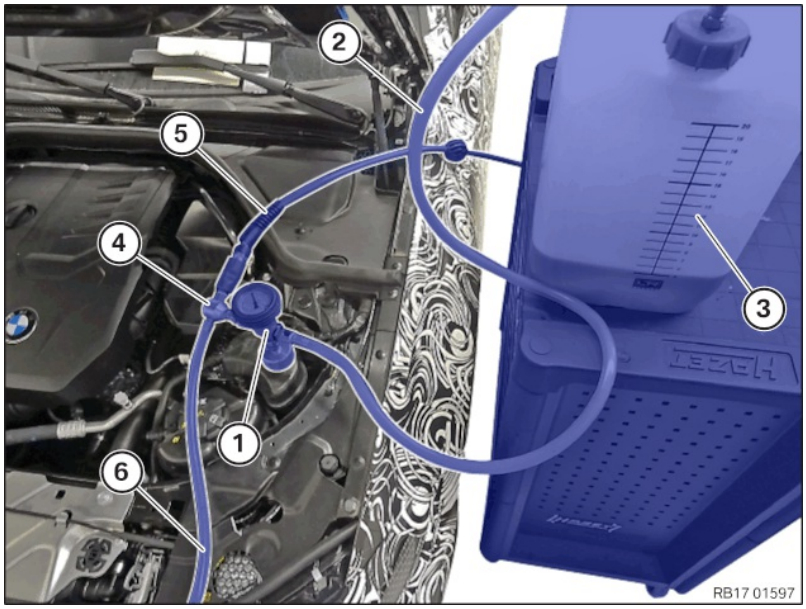
- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).



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

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

Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum 6 bar)

6 Exhaust hose (Routing the exhaust hose to a collecting vessel)

Prerequisite

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

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

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

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

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

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

TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

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

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

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

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

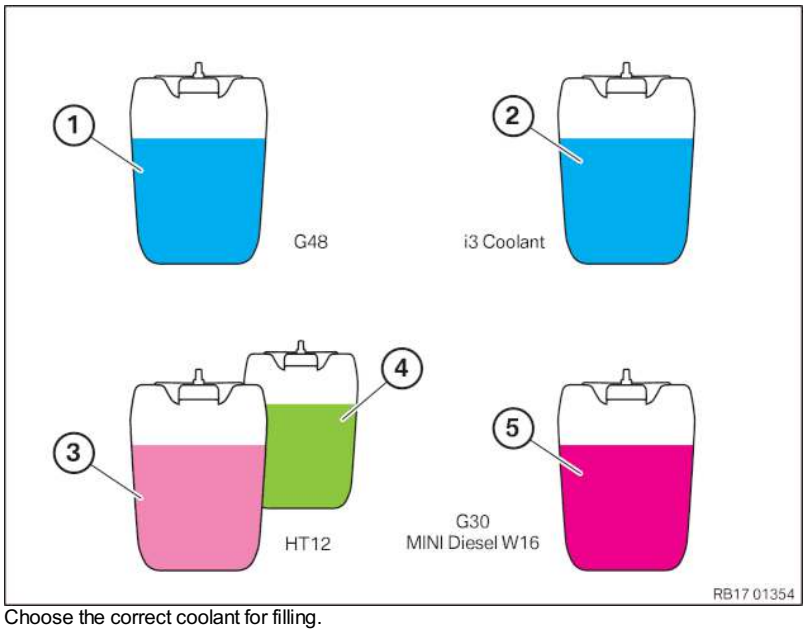
A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

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

▸ **Observe the coolant type**

Coolant in the collecting vessel of vacuum filler device



Choose the correct coolant for filling.

In general, a vehicle has to be filled with the coolant with which it is delivered from the factory.

1 G48 (Blue) (BMW LC-87) Must **not** be mixed with i3 Coolant or G30 MINI Diesel W16.

2 i3 Coolant (Blue) (BMW LC-13) Is used only for heater circuit i3. i3 Coolant must **not** be added to other coolant circuits or mixed with other coolants.

3 HT12 (Rose) (BMW LC-18) Must **not** be mixed with i3 Coolant or G30 MINI Diesel W16.

4 HT12 (Green) (BMW LC-18) Must **not** be mixed with i3 Coolant or G30 MINI Diesel W16.

5 G30 (Rose) (BMW LC-07) May be W16 used exclusively for the **MINI Diesel**. G30 must **not** be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine or components in high-voltage vehicles

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

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

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

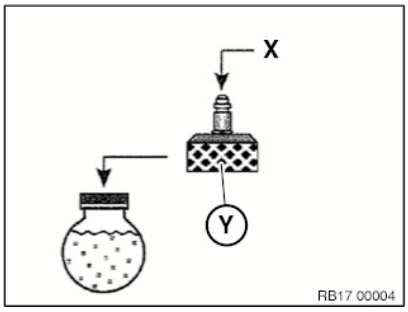
Type	Engine	Adapter (Y) from 17 0 100
G20/G21/G22/G23/G26/G28/G29	B42/B46/B48/B58	17 0 109
G20/21/22/23/G26/G42	B57/B47 Mild hybrid technology	17 0 109

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

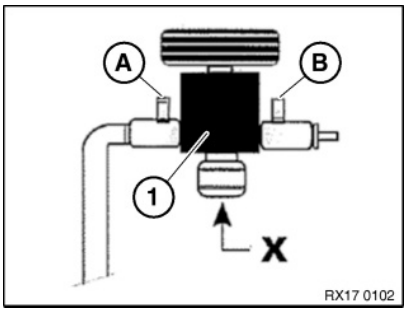
Capacity of low-temperature coolant circuit G20 / G21 / G22 / G28

B42T20O1 / B48B20O1 / B46B20O1 / B48B20O1 (PHEV) / B48B20M1 (PHEV)	4.2 l

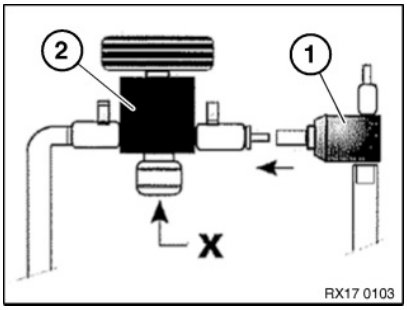
Expendable materials: Technically suitable antifreeze and corrosion inhibitor



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

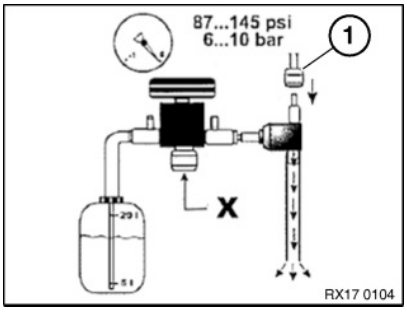


- Check that shutoff valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



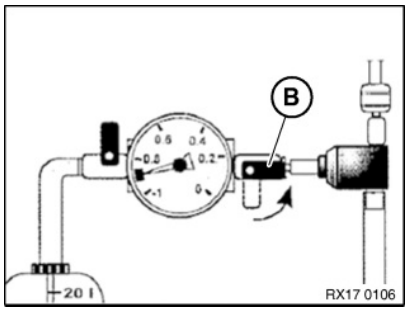
- Connect Venturi nozzle (1) to the vacuum filler device (2).

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



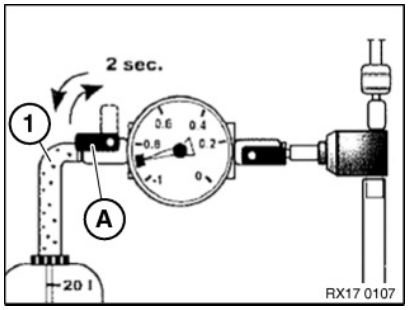
- Connect compressed air (1).

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



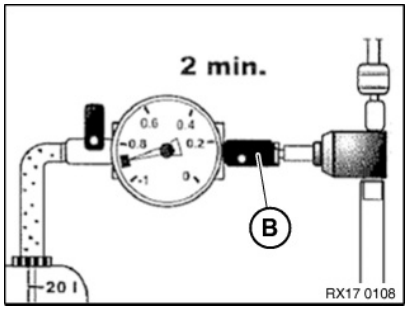
- Open shut-off valve (B).

  The Venturi nozzle produces a flow noise.



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

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

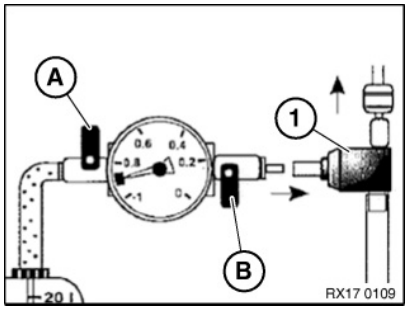


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

TECHNICAL INFORMATION

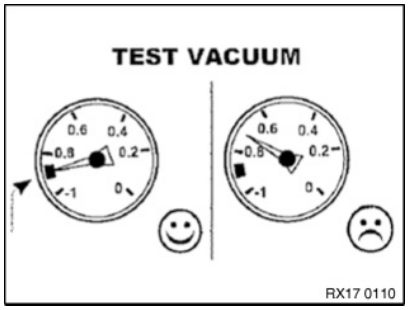
The coolant hoses contract during vacuum build-up.

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



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

Check



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

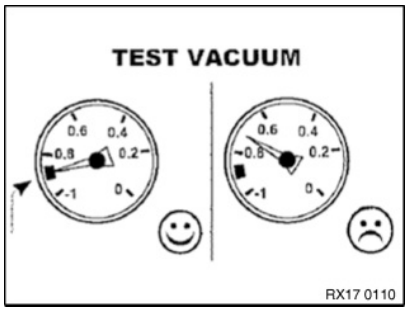
Result

» Vacuum drops.

Measure

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

Check



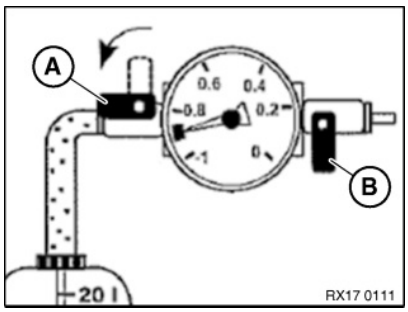
- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

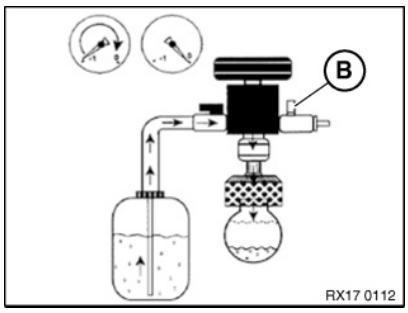
» Vacuum remains constant.

Measure

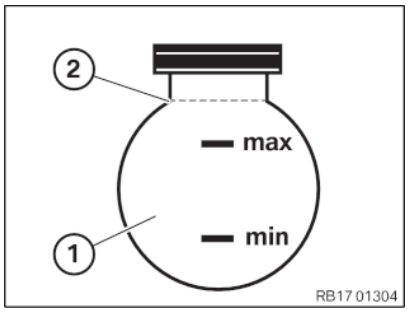
- Continue with filling.



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



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



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

108 – Connecting all battery earth leads

- See additional information.

109 – Bleed the high-temperature coolant circuit

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

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

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

TECHNICAL INFORMATION

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

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

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

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

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

TECHNICAL INFORMATION

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

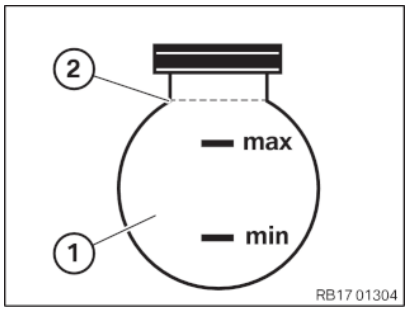
Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt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

TECHNICAL INFORMATION

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

TECHNICAL INFORMATION

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



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

  You can close the bleeder screw prior to expiry of the 10 s once coolant escapes.
- Adjust the coolant level in the high temperature coolant expansion tank (1) to the lower edge (2) of the coolant filler neck in the high temperature coolant expansion tank (1) .
- Close the sealing cap on the coolant expansion tank of the high--temperature cooling circuit.
- Make sure the bonnet is **closed**.
- Make sure that the wheels touch the ground.
- Engage the parking brake.
- Do not engage any gear in case of manual transmission, and engage into both P" or "N" automatic transmissions.
- Connect battery charger.
- **Activate** the testing-analysis-diagnosis (PAD) by quickly pressing the START-STOP button 3 times.
- Activate the low-beam headlight and the hazard warning lights **at the same time**.

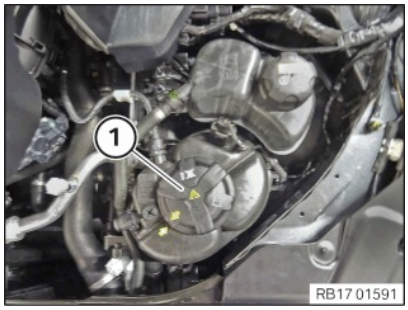
  If the low-beam headlight and the hazard-warning lights are **not** switched on, then the ignition (**terminal 15**) will automatically switch off after some time and interrupt the bleeding procedure.
- Check that the driving experience control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **not** press on the brake pedal.
- Start engine.
- The cooling system bleeding routine has been started, pay attention to the display on the instrument cluster (KOMBI). ("Service function started")

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

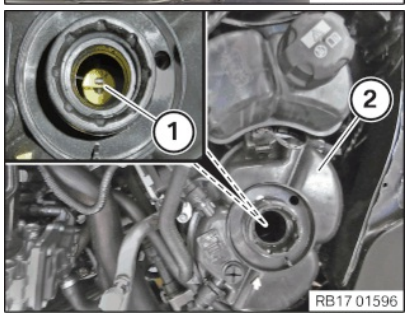
  The cooling system bleeding routine ends approx. 11 min **after** engine start.

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

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



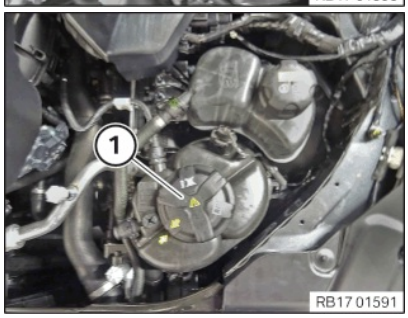
- Loosen sealing cap (1).



TECHNICAL INFORMATION

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

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



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

110 – Bleeding the low-temperature cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

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

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

TECHNICAL INFORMATION

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

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

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

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

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

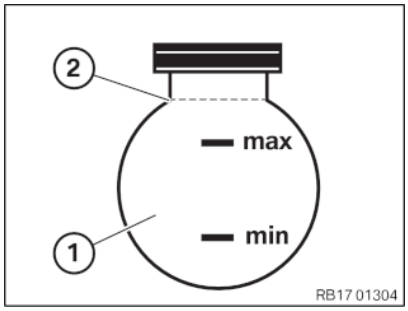
TECHNICAL INFORMATION

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

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

TECHNICAL INFORMATION

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



- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to lower edge (2) of the coolant filler neck of low-temperature coolant expansion tank (1).
- Close the sealing cap on the coolant expansion tank of the low-temperature coolant circuit.
- Ensure that the bonnet is **open**.
- Connect battery charger.
- **Activate** the testing-analysis-diagnosis (PAD) by quickly pressing the START-STOP button 3 times.
- Activate the low-beam headlight and the hazard warning lights **at the same time**.

  If the low-beam headlight and the hazard-warning lights are **not** switched on, then the ignition (**terminal 15**) will automatically switch off after some time and interrupt the bleeding procedure.
- Ensure that the Driving Experience Control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **not** press on the brake pedal.
- Do **not** start engine.

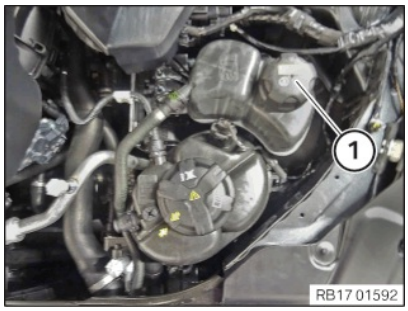
  The cooling system bleeding routine will start.

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

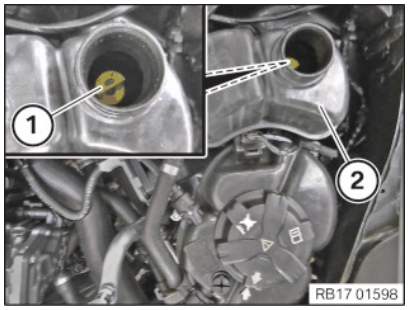
  The cooling system bleeding routine ends after 11 minutes.

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

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



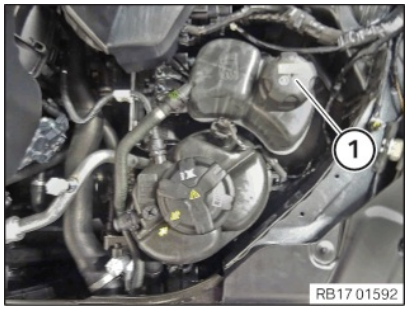
- Loosen sealing cap (1).



TECHNICAL INFORMATION

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

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



- Close sealing cap (1).

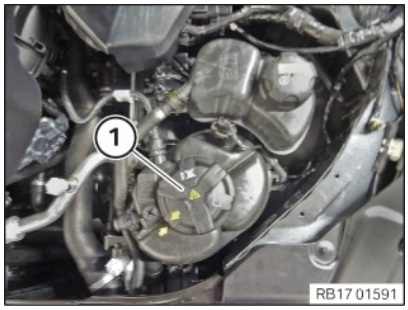
111 – Check the high-temperature cooling system for watertightness

WARNING

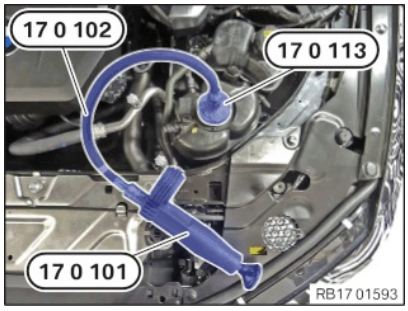
Hot surfaces.

Risk of burning!

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



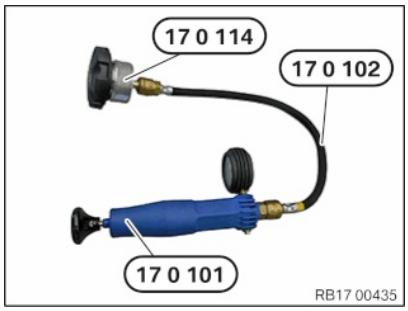
- Loosen sealing cap (1).



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

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

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



TECHNICAL INFORMATION

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

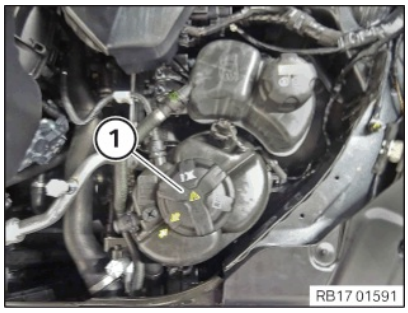
When driving at high ambient temperatures, the design may cause the pressure relief valve in the sealing cap to open slightly and air to escape together with dissolved coolant. This coolant vapour condenses on the surface of the coolant expansion tank and leaves traces of coolant when the vehicle has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

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

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

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

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



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

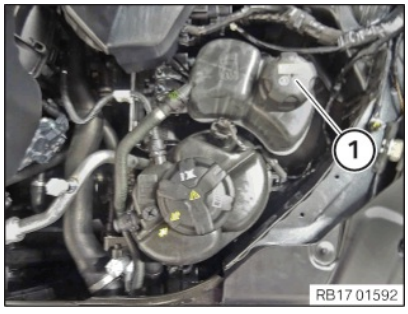
112 – Checking low-temperature cooling system for watertightness

WARNING

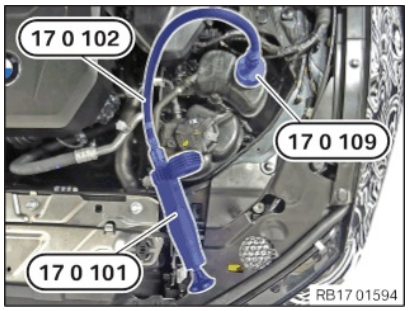
Hot surfaces.

Risk of burning!

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



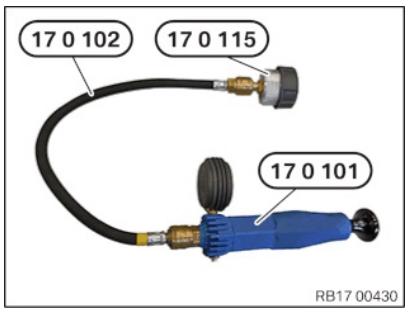
- Loosen sealing cap (1).



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

Opening pressure of sealing cap of low-temperature coolant circuit

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



TECHNICAL INFORMATION

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

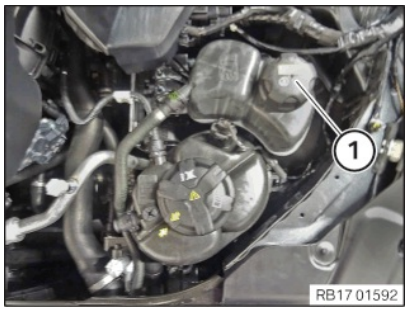
When driving at high ambient temperatures, the design may cause the pressure relief valve in the sealing cap to open slightly and air to escape together with dissolved coolant. This coolant vapour condenses on the surface of the coolant expansion tank and leaves traces of coolant when the vehicle has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

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

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

Opening pressure of sealing cap of low-temperature coolant circuit

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



- Close sealing cap (1).

113 – Check engine oil level

Prerequisite

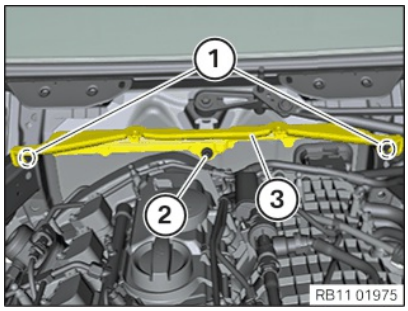
Vehicle is in a horizontal position.

TECHNICAL INFORMATION

Please comply with instructions in Owner's Handbook.

- Carry out an electronic oil measurement.
- Top up engine oil if necessary.

114 – Installing centre bulkhead lower section

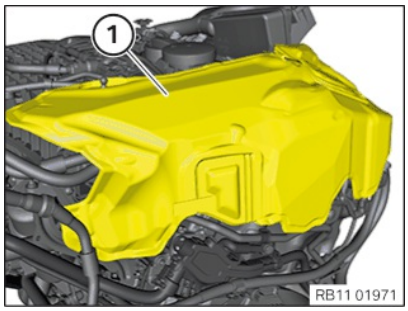


- Position the centre bulkhead lower part (3).
- Tighten nut (2) and screws (1).

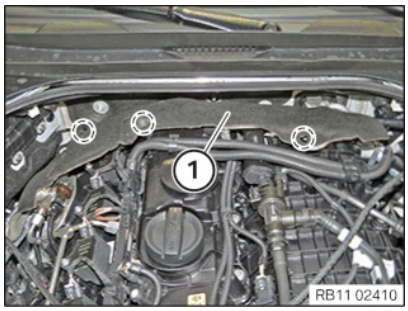
Bulkhead lower part to body

Screw		Tightening torque	2,6 Nm
Plastic nut		Tightening torque	2,6 Nm

115 – Installing acoustic cover at rear

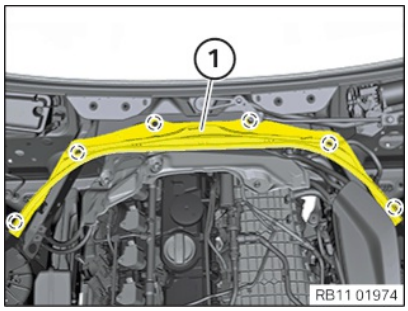


- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



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

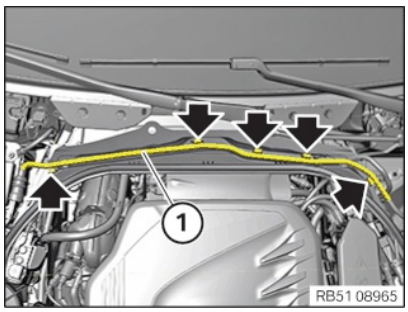
116 – Installing the centre bulkhead upper part



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

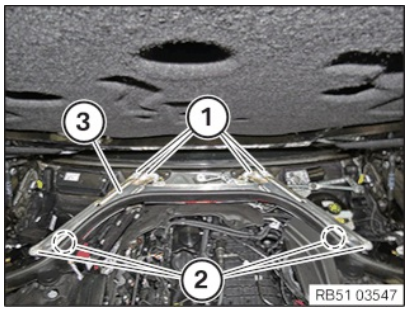
Bulkhead upper part to bottom bulkhead

		Tightening torque	3 Nm



- **Version with mild hybrid technology:**

  Clip in the wire (1) into the holders (arrows).



NOTICE

The following work step(s) is / are to be carried out if the specified component(s) is/are fitted.

- Install the tension strut (3) on the spring strut dome.
- Tighten the screws (1).

Tension strut on bulkhead

M10x25 screw		Tightening torque	56 Nm

- Renew screws (2).

  Parts: Screws
- Tighten the screws (2).

Tension strut to spring strut dome

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

117 – Installing cowl panel cover

RISK OF DAMAGE

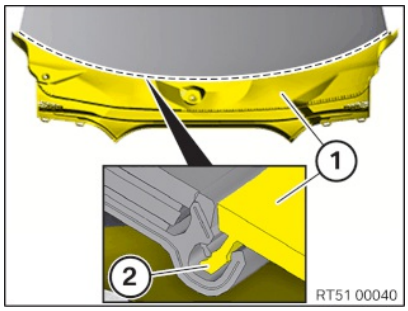
Damage caused by water ingress into the vehicle.

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

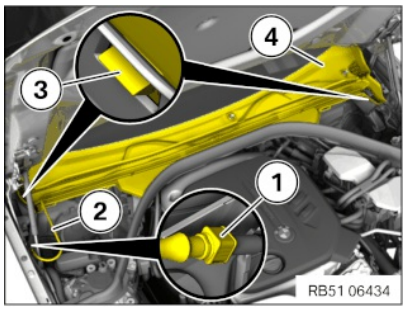
- Ensure correct installation of the components.
- Only use undamaged components.

TECHNICAL INFORMATION

Before installing the cowl panel cover it is **mandatory** to check that the 48 V line is routed correctly and fitted tightly.
An incorrectly laid or attached 48 V line can be damaged by the wiper kinematics.



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



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

118 – Install left and right wiper arm

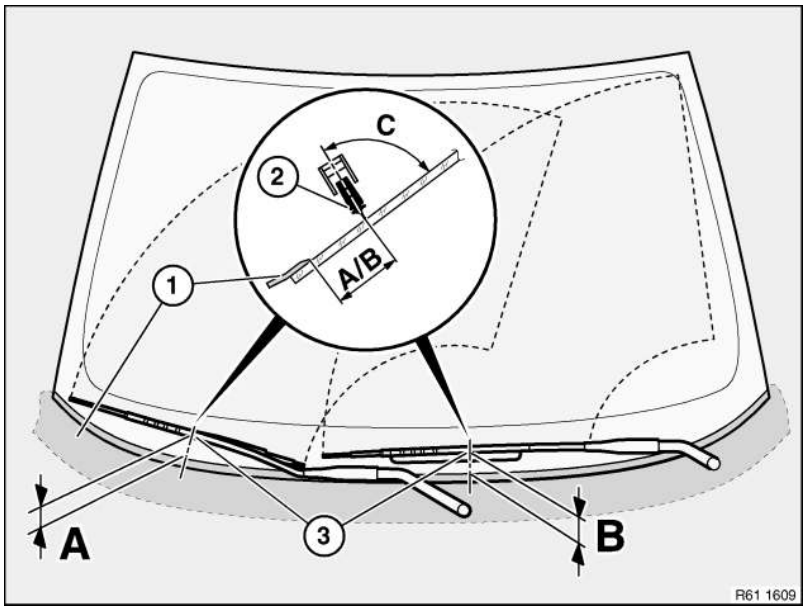
NOTICE

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

▸ **Installing left and right wiper arm**

TECHNICAL INFORMATION

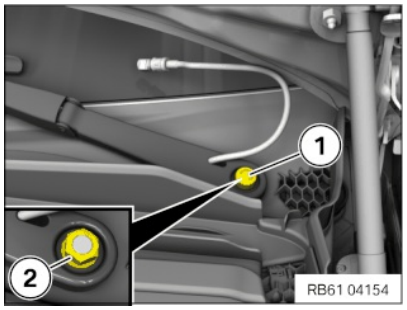
The wiper system must be in zero position.
After installing the cowl panel cover and before fitting the wiper arm:
Activate the wiper system once to ensure that it has the correct installation position.



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

Distance from window pane edge to wiper blade

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

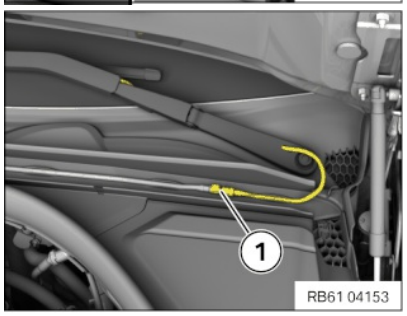


- Tighten nut (2).

Windscreen wiper arm

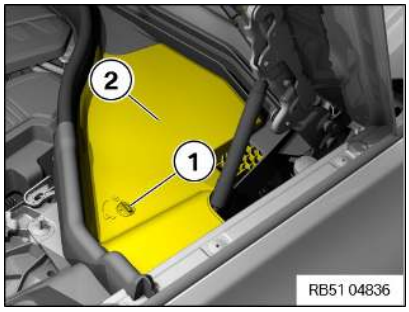
Combination hexagon nut		Tightening torque	35 Nm

- Connect the protective cap (1).



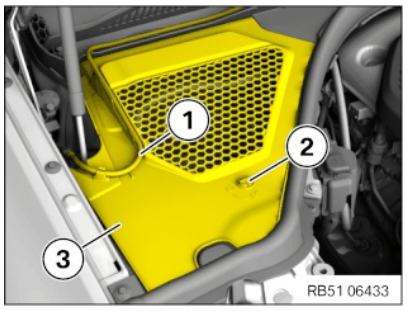
- Feed washer fluid hose (1) into the cowl panel guide and connect at the separation point.

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



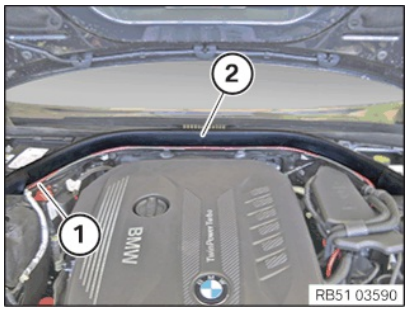
- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

120 – Install the rear right engine compartment cover



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

121 – Install the seal for the bonnet



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

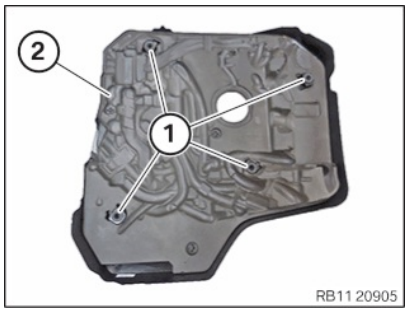
122 – Install acoustic cover

RISK OF DAMAGE

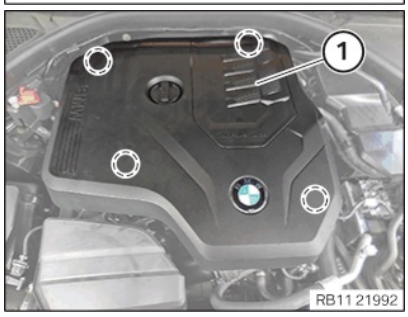
Damage to the acoustic cover/design cover.

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

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



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



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

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

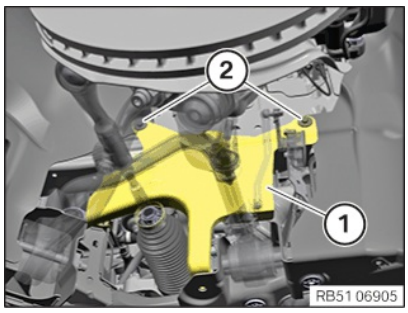
123 – Install the cover of the steering assembly

Prerequisite

Underbody protection of the steering gear is removed.

TECHNICAL INFORMATION

When tightening the screws, the cover can twist and cause chafe marks on the anti-roll bar (risk of corrosion).
Hold the cover while tightening the screws. Then check the position of the cover.



- Position the cover (1).
- Tighten the screws (2).

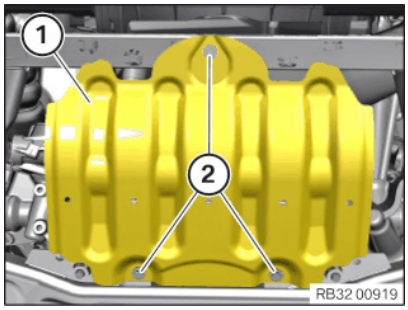
Cover, steering unit

Screw		Tightening torque	3 Nm

124 – If installed: Install underbody protection of the steering

Prerequisite

Front underbody protection has been removed.



- Position underbody protection (1).
- Tighten the screws (2).

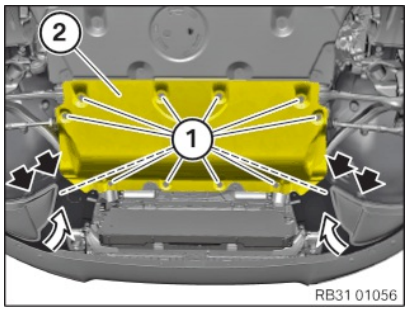
Underbody protection, steering, to front axle support

Multi-purpose boltM10		Tightening torque	56 Nm

Underbody protection, steering, to front axle support

Hexagon bolt M6		Tightening torque	8 Nm

125 – Install the underbody protection of the steering gear



- **Version A:**

  Position the underbody protection (2) of the steering gear.

  Tighten the screws (1).

Underbody protection of the steering gear

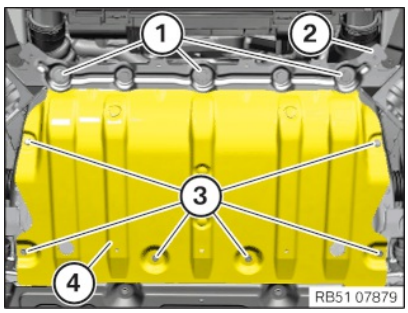
Hexagon screw for thermoplastic		Tightening torque	2.6 Nm
Hexagon bolt M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.

  Tighten the screws (arrows) of the lower wheel arch cover on the wheel arch cover.

Wheel arch trim panel, front

Thermoplastic hexagon screw		Tightening torque	2,6 Nm



- **Version B:**

  Feed in the underbody protection (4) of steering gear and install it.

  Tighten the screws (3).

Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	2.6 Nm
Hexagon bolt M6x20		Tightening torque	8 Nm

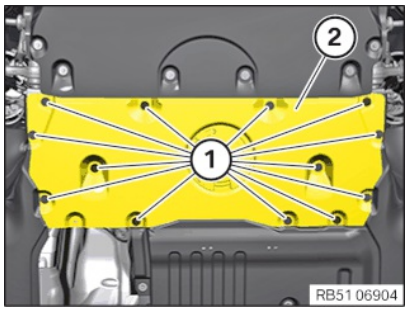
- Position the holder (2) for the underride protection.

  Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

126 – Installing the centre underbody protection



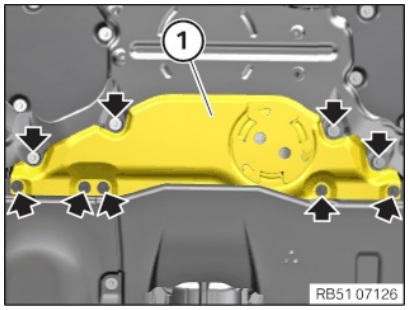
- **Variant with rear wheel drive:**

  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



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

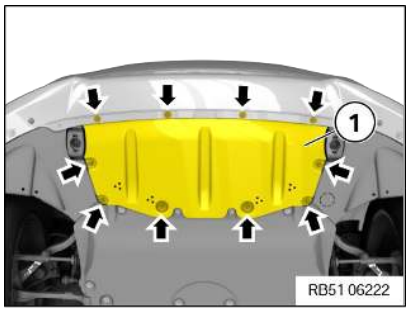
  Guide in centre underbody protection (1) and install.

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

127 – Installing the front underbody protection



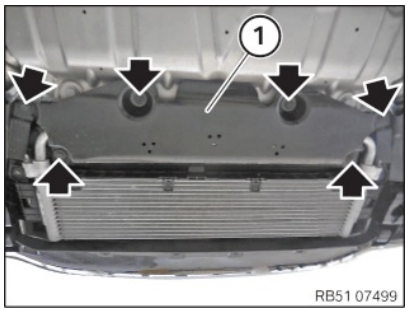
- **Version A:**

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

  Tighten screws (arrows).

Underbody protection front

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



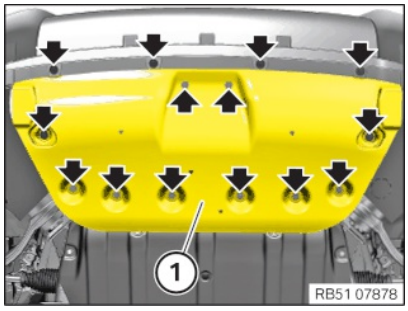
- **Version B:**

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

  Tighten screws (arrows).

Underbody protection front

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



- **Version C:**

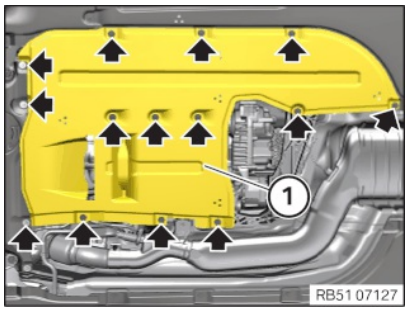
  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

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

128 – Installing underbody protection at rear



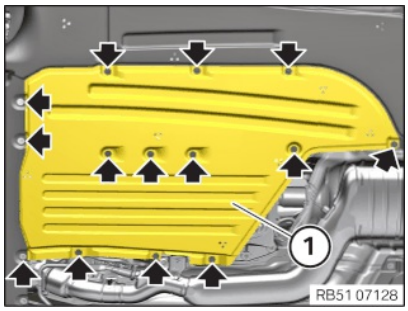
- **Version A:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version B:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

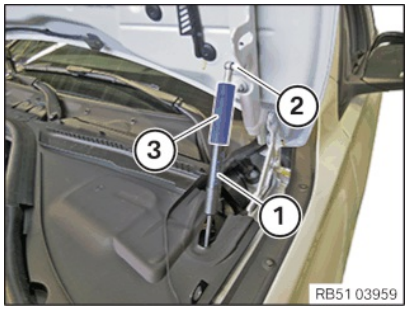
129 – Take bonnet out of the service position

CAUTION

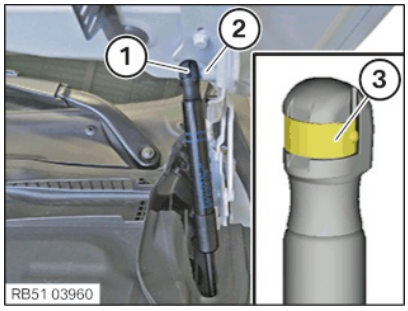
Shutting bonnet or tailgate.

Danger of injury!

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



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



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

Additional Information

Overview of Tightening Torques

Cover, front bottom on side — Used in step 41

Hexagon screw for thermoplastic		Tightening torque	3 Nm

Basic carrier to cylinder head — Used in step 496777

M6		Tightening torque	8 Nm

Test gauge to basic carrier — Used in step 496777

M6		Tightening torque	8 Nm

Special tool to cylinder head — Used in step 58

M8		Tightening torque	21,5 Nm

Ventilation connection/special tool to cylinder head — Used in step 64

M10			18 Nm

Coolant temperature sensor at cylinder head — Used in step 64

Sensor		Tightening torque	18 Nm

Exhaust turbocharger to cylinder head — Used in step 65

M7	Observe tightening sequence. *Replace nuts.*	1. Jointing torque	10 Nm
		2. tightening torque	10 Nm
		3. Jointing torque	16 Nm
		4. tightening torque	16 Nm
		5. Tightening torque	16 Nm

Cylinder head to crankcase — Used in step 66

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 66

M8x40	Renew screws.	Tightening torque	19 Nm

Bearing journal to cylinder head — Used in step 66

Bearing journal	Renew the bearing journal!	Tightening torque	22 Nm

Sliding rail to cylinder head — Used in step 66

M6x16			8 Nm

Cable clip on rear cylinder head/transmission — Used in step 66

M6 x 20		Tightening torque	8 Nm

Cover on rear cylinder head — Used in step 66

M6		Tightening torque	8 Nm

Camshaft sensor wheel to intake camshaft — Used in step 66

M6x16	Renew screw.	1. Tightening torque	5 Nm
		2. Angle of rotation	90°

Manifold support for intake air to cylinder head — Used in step 66

M6X16		Tightening torque	8 Nm

Holder for electrical auxiliary coolant pump on cylinder head — Used in step 66

M6		Tightening torque	7 Nm

Standard screw connection M6 — Used in step 66

M6		Tightening torque	8 Nm

Oil feed line to exhaust turbocharger/crankcase — Used in step 66

M6x12		Tightening torque	8 Nm

VANOS central valve to camshaft — Used in step 7374

M21	*VANOS central valve on the thread and on the contact surface must be coated with engine oil.*	1. Tightening torque	50 Nm
		2. Tightening torque	140 Nm
M22	*VANOS central valve on the thread and on the contact surface must be coated with engine oil.*	1. Tightening torque	50 Nm
		2. Tightening torque	140 Nm

Chain tensioner to cylinder head — Used in step 76

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Coolant line to coolant pump/cylinder head — Used in step 78

M6x20		Tightening torque	8 Nm

Intake plenum to cylinder head — Used in step 79

M6		Tightening torque	10 Nm

Intake plenum to support			Used in step 79
M6X25		Tightening torque	8 Nm

Throttle body to holder			Used in step 79
M6X25		Tightening torque	8 Nm

Tank ventilation line to intake plenum			Used in step 79
Oval-head screw		Tightening torque	3 Nm

Charge air line to throttle body			Used in step 79104
M6		Tightening torque	8 Nm

Control unit holder on spring strut dome			Used in step 81
Hexagon screw		Tightening torque	8 Nm

Oil return line to exhaust turbocharger/crankcase			Used in step 84
M6x14		Tightening torque	8 Nm

Coolant feed line/coolant return line to exhaust turbocharger			Used in step 8586
M6 x 12		Tightening torque	8 Nm

Coolant return line holder to exhaust turbocharger			Used in step 85
M6		Tightening torque	8 Nm

Coolant feed line to crankcase			Used in step 86
M6 x 12		Tightening torque	8 Nm

Catalytic converter / petrol particulate filter to exhaust turbocharger			Used in step 87
V-band clamp	Renew V-band clamp.	Tightening torque	13 Nm

Catalytic converter to holder			Used in step 87
M8	Renew screw.	Tightening torque	19 Nm

Catalytic converter to holder			Used in step 87
M8	Renew nut.	Tightening torque	19 Nm

Rear silencer to body / bumper support			Used in step 88
M8	Replace nuts.	Tightening torque	19 Nm

Rear silencer on support			Used in step 88
Nut M8	Renew nut.	Tightening torque	19 Nm

Front pipe/front silencer/petrol particulate filter to the transmission holder			Used in step 88
M8	Renew nut.	Tightening torque	19 Nm

Exhaust system to catalytic converter			Used in step 88
Ribbon clamp nut M8	Renew flat band clip.	Tightening torque	26 Nm
Ribbon clamp nut M10	Renew flat band clip.	Tightening torque	55 Nm

V-clip to catalytic converter			Used in step 88
V-band clamp	Renew V-band clamp.	Tightening torque	25 Nm

Connecting support to tunnel			Used in step 89
M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

Cylinder head cover to cylinder head			Used in step 90
M6x30		Tightening torque	8 Nm
		Tightening torque	10 Nm

Wiring harness section of engine to cylinder head cover — Used in step 90

M6		Tightening torque	8 Nm

Holder, positive battery cable to cylinder head cover — Used in step 9099102

6X18		Tightening torque	6 Nm

Ground cable to rail — Used in step 93

M6		Tightening torque	5 Nm

High pressure pump to high pressure pump flange — Used in step 94

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

High pressure line between high pressure pump and high pressure rail — Used in step 95

M14		Tightening torque	33 Nm

Fuel delivery line to high pressure pump — Used in step 96

M14		Tightening torque	26 Nm

Fuel delivery line to cylinder head cover — Used in step 96

M6 screw		Tightening torque	7 Nm

Spark plugs — Used in step 97

M12x1.25		Tightening torque	23 Nm

Ignition coil — Used in step 98

Screw		Tightening torque	8 Nm

Lambda control probe — Used in step 99

M18x1.5		Tightening torque	50 Nm

Acoustic cover (side) to cylinder head cover — Used in step 100

TS6 x 20			6 Nm

Heat shield to cylinder head — Used in step 101

M8 x 12		Tightening torque	19 Nm

Heat shield to clamping strip — Used in step 101

M6 x 12		Tightening torque	8 Nm

Clean air pipe to upper section of intake filter housing — Used in step 105

Clamp		Tightening torque	3 Nm

Bulkhead lower part to body — Used in step 114

Screw		Tightening torque	2,6 Nm
Plastic nut		Tightening torque	2,6 Nm

Bulkhead upper part to bottom bulkhead — Used in step 116

		Tightening torque	3 Nm

Tension strut on bulkhead — Used in step 116

M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome — Used in step 116

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

Windscreen wiper arm — Used in step 118

Combination hexagon nut		Tightening torque	35 Nm

Cover, steering unit — Used in step 123

Screw		Tightening torque	3 Nm

Underbody protection, steering, to front axle support			Used in step 124
Multi-purpose boltM10		Tightening torque	56 Nm

Underbody protection, steering, to front axle support			Used in step 124
Hexagon bolt M6		Tightening torque	8 Nm

Underbody protection of the steering gear			Used in step 125
Hexagon screw for thermoplastic		Tightening torque	2.6 Nm
Hexagon bolt M6x20		Tightening torque	8 Nm

Wheel arch trim panel, front			Used in step 125
Thermoplastic hexagon screw		Tightening torque	2,6 Nm

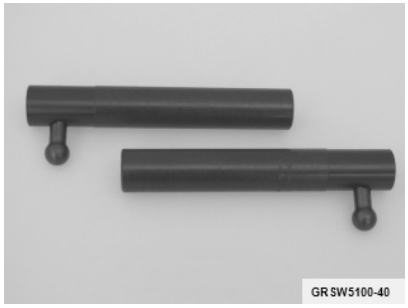
Holder underride guard to front axle support			Used in step 125
M10		Tightening torque	56 Nm

Underbody protection			Used in step 126128
Hexagon screw		Tightening torque	3 Nm

Underbody protection front			Used in step 127
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

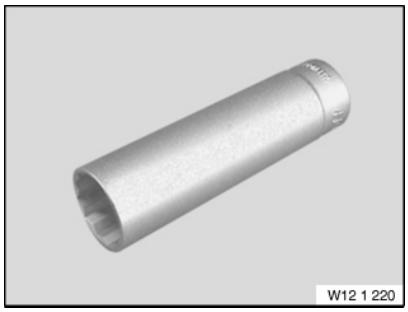
Overview of Special Tools

0 494 787 (51 0 040) Support



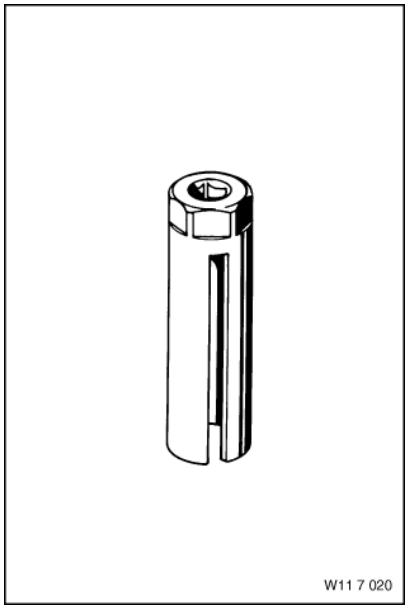
Common		Used in step 2
Usage	(Bonnet support (2 x)) For retaining engine compartment lid in working position	
Included in the tool or work		
Storage location	C46	
Replaced by		
In connection with		
SI-Number	01 24 03 (040)	

0 495 560 (12 1 220) Wrench socket



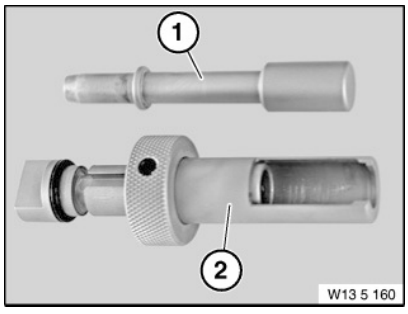
Common		Used in step 2097
Usage	For removing and installing the spark plugs (WAF 14 bihexal).	
Included in the tool or work		
Storage location	C18	
Replaced by		
In connection with		
SI-Number	01 20 06 (299)	

0 491 074 (11 7 020) Socket wrench insert



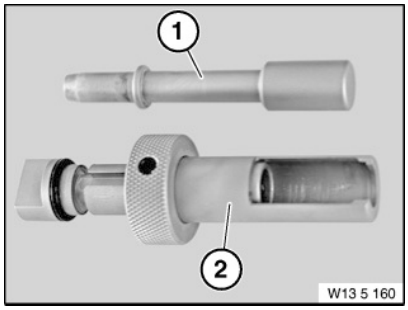
Common	Used in step 2399
Usage	(Socket wrench insert 22 mm) For loosening and tightening the oxygen sensor
Included in the tool or work	
Storage location	A9
Replaced by	
In connection with	
SI-Number	

0 496 567 (13 5 161) Fastener



Common	Used in step 25
Usage	(Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

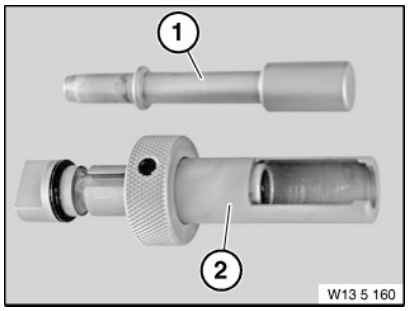
0 496 568 (13 5 162) Fastener



Common Used in step 25

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

0 496 565 (13 5 160) Fastener



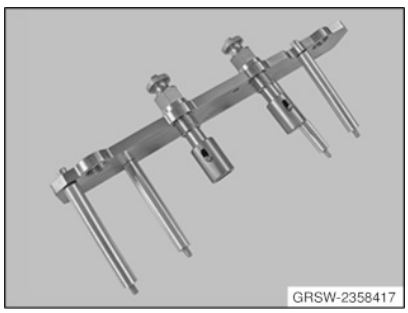
Common Used in step 25

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

Consisting of

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

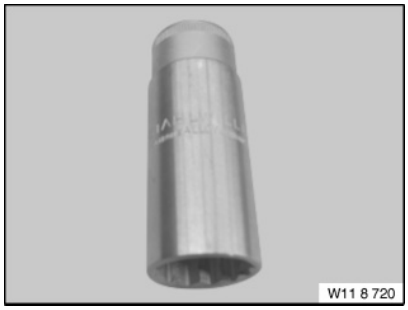
2 358 417 Device



Common Used in step 26

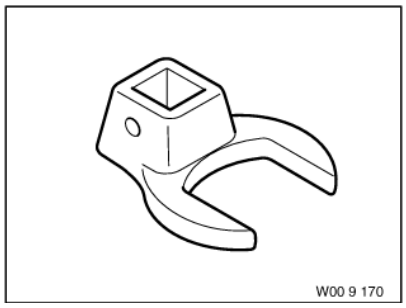
Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection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

0 496 106 (11 8 720) Socket WAF 46



Common	Used in step 26
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)

0 490 507 (00 9 170) Crow-foot wrench

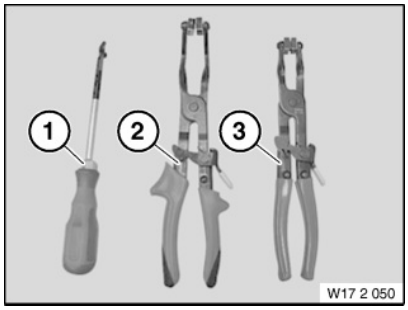


Common	Used in step 26
Usage	(Crow foot spanner WAF 24) For removing and installing the fuel cut-off
Included in the tool or work	
Storage location	A14
Replaced by	
In connection with	
SI-Number	01 09 94 (839)

2 360 895 Pin wrench

Common	Used in step 2891
Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 495 794 (17 2 050) Pliers



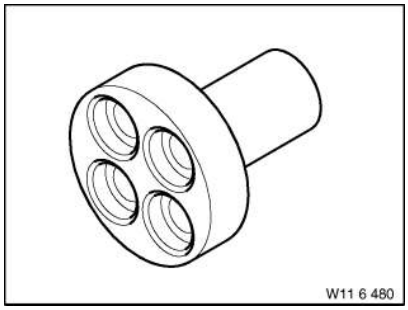
Common Used in step 4879

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

Consisting of

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

0 493 380 (11 6 480) Connector

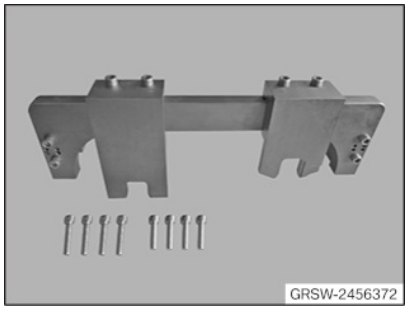


Common	Used in step 49757794
Usage	For turning over engine at crankshaft hub (vibration absorber).
Included in the tool or work	
Storage location	
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

2 288 380 Locating stud

Common	Used in step 497577
Usage	For disconnecting the crankshaft at the top dead centre. 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 4957677577
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	
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 122 Gauge

Common	Used in step 495777
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

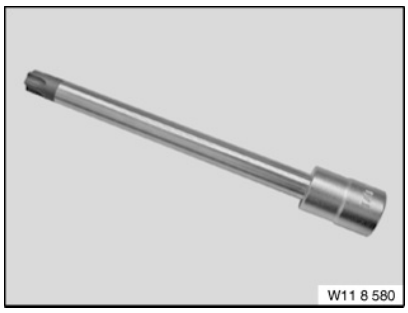
0 496 855 Ratchet handle

Common	Used in step 51527374
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 Wrench socket

Common	Used in step 51527374
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 5866
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)

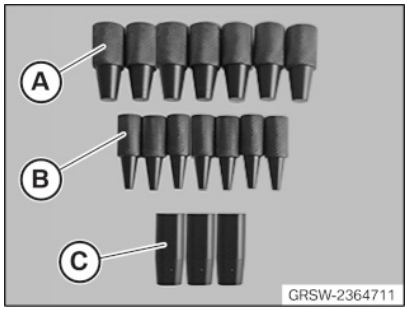
2 220 718 Workshop crane

Common	Used in step 5866
Usage	WSK 1000
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	06 01 11 (701)

2 459 012 Holder

Common	Used in step 5866
Usage	For removing and installing the cylinder head. Contour-graphic silhouette foil is included in the delivery specification.
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 364 711 Plug

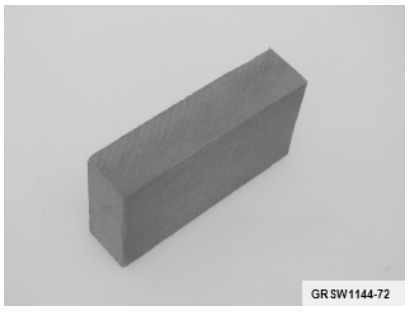


Common	Used in step 6162
Usage	For closing the pressure oil holes for cleaning the cylinder head sealing surfaces.
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	

0 495 103 (11 4 471) Scraper

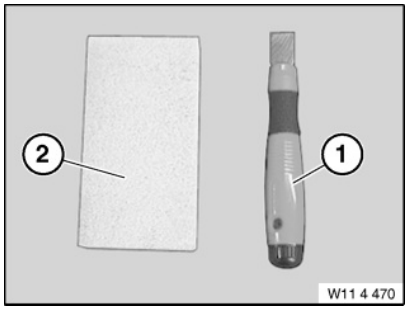
Common	Used in step 62
Usage	
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

0 495 104 (11 4 472) Extractor



Common	Used in step 62
Usage	(grindstone)
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

0 495 102 (11 4 470) Tool



Common Used in step 65

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

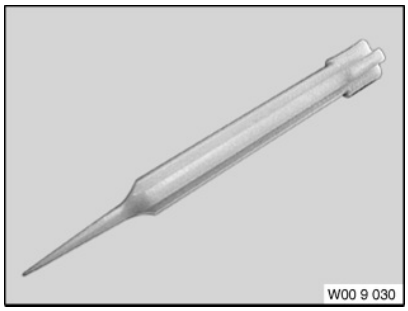
Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 103 (11 4 471)		**Scraper**	
2	0 495 104 (11 4 472)		**Extractor** (grindstone)	

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

Common Used in step 66

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	

0 496 714 (00 9 030) Wedge



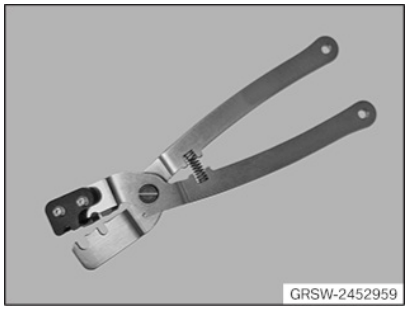
Common Used in step 668586

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 7275
Usage	To pretension the timing chain when adjusting the timings. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 452 959 Pliers



Common	Used in step 92
Usage	Replaced for the disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ No. 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)

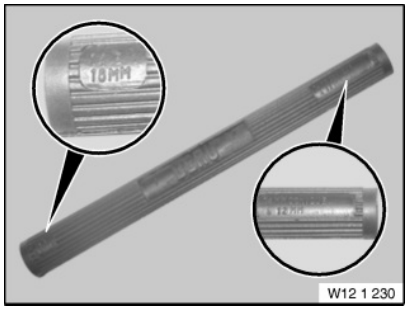
2 448 401 Fitting aid

Common	Used in step 92
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 93
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)

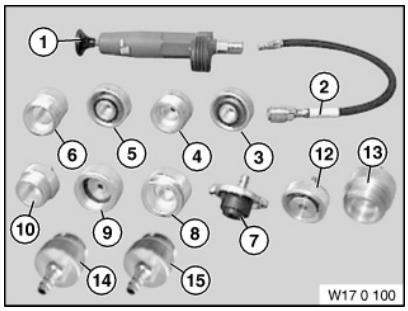
0 496 065 (12 1 230) Fitting aid



Common	Used in step 97
Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

0 494 417 (17 0 100) Tester

Used in step 106107111112



Common

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

Consisting of

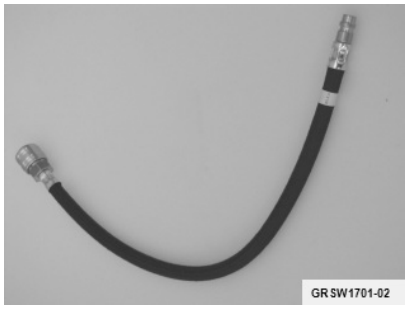
Pos	BMW Order number	Replaced by	Designation	In Connection with
5	0 494 422 (17 0 105)		**Adapter** For radiator cap (sawtooth thread)	
10	0 494 427 (17 0 111)		**Adapter** For radiator cap R53/W11, R50/W17 adapter replaced 17 0 052.	
1	0 494 418 (17 0 101)		**Pump** Replacement part for set 8330 0494417 (170100)	
2	0 494 419 (17 0 102)		**Hose** (hose with quick-release coupling)	
3	0 494 420 (17 0 103)		**Adapter** For radiator cap (normal thread)	
4	0 494 421 (17 0 104)		**Adapter** For radiator cap (normal thread)	
6	0 494 423 (17 0 106)		**Adapter** For radiator cap (sawtooth thread)	
7	0 494 424 (17 0 107)		**Adapter** For radiator cap R50 / W10	
8	0 494 425 (17 0 108)		**Adapter** For radiator cap R50 / W10	
9	0 494 426 (17 0 109)		**Adapter** For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051	
11	0 494 428 (17 0 112)		**Case**	
12	0 494 642 (17 0 113)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
13	0 494 643 (17 0 114)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
14	0 495 889 (17 0 115)		**Adapter** For radiator cap Model series: N12, N14	

0 494 418 (17 0 101) Pump

Common Used in step 111112

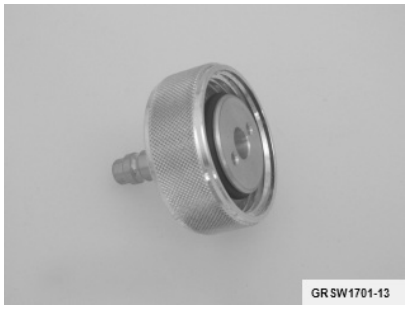
Usage	Replacement part for set 8330 0494417 (170100)
Included in the tool or work	0 494 417
Storage location	
Replaced by	
In connection with	
SI-Number	

0 494 419 (17 0 102) Hose



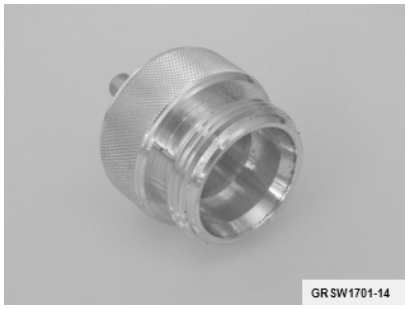
Common	Used in step 111112
Usage	(hose with quick-release coupling)
Included in the tool or work	0 494 417
Storage location	
Replaced by	
In connection with	
SI-Number	

0 494 642 (17 0 113) Adapter



Common	Used in step 111
Usage	For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)
Included in the tool or work	0 494 417
Storage location	
Replaced by	
In connection with	
SI-Number	

0 494 643 (17 0 114) Adapter

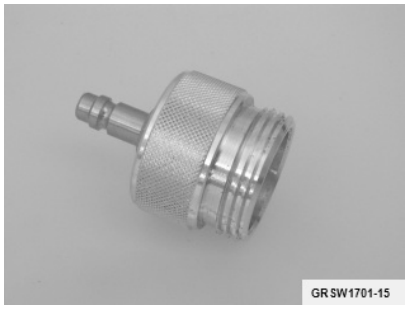


Common	Used in step 111
Usage	For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)
Included in the tool or work	0 494 417
Storage location	
Replaced by	
In connection with	
SI-Number	

0 494 426 (17 0 109) Adapter

Common	Used in step 112
Usage	For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051
Included in the tool or work	0 494 417
Storage location	
Replaced by	
In connection with	
SI-Number	

0 495 889 (17 0 115) Adapter



Common	Used in step 112
Usage	For radiator cap Model series: N12, N14
Included in the tool or work	0 494 417
Storage location	
Replaced by	
In connection with	
SI-Number	01 26 06 (321)

Overview Technical Data

Opening pressure of sealing cap / test pressure of high-temperature coolant circuit cooling system Used in step 111

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

Opening pressure of sealing cap of low-temperature coolant circuit	Used in step 112
Pressure relief valve opens when the pressure exceeds the ambient pressure.	min. 1,4 bar
Electric changeover valve must open at latest when the pressure is lower than the ambient pressure	max. 0,1 bar
Test pressure for cooling system (gauge pressure)	1,5 bar

Distance from window pane edge to wiper blade	Used in step 118
Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

Capacity of high-temperature coolant circuit G20 / G21 / G22 / G28	Used in step 106
B42T20O1 / B48B20O1 / B46B20O1 / B48B20O1 (PHEV) / B48B20M1 (PHEV)	9.8 l
Expendable materials: Technically suitable antifreeze and corrosion inhibitor	

Capacity of low-temperature coolant circuit G20 / G21 / G22 / G28	Used in step 107
B42T20O1 / B48B20O1 / B46B20O1 / B48B20O1 (PHEV) / B48B20M1 (PHEV)	4.2 l
Expendable materials: Technically suitable antifreeze and corrosion inhibitor	

Screw-in depth of upper stud bolt on cylinder head	Used in step 65
Dimension A	30 mm

Links

Repair instructions (PRE)	**Used in step**
Repair notes on renewing the cylinder head	

General repair instructions	**Used in step**
12 00 ... Instructions for removal and replacement of control units	1583
11 00 ... Overview of consumables (Electronic Parts Catalogue)	99

Repair instructions	**Used in step**
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1108
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1108
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108

61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1108
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1108
61 20 900 Disconnecting and connecting battery earth lead (Plug-in Hybrid Electric Vehicle)	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 35 ... Notes on ESD protection (Electro Static Discharge)	15161926284782
61 35 ... Notes on ESD protection (Electro Static Discharge)	15161926284782
13 53 ... Clean the cylinder head around the injectors due to grit / dust	26
61 13 ... Unlocking and disconnecting different plug connections	262990
61 00 730 Encode/program control unit(s) (after vehicle test)	83
17 00 ... Notes for working on cooling system	106107

Operating materials	**Used in step**
Main group 17	106107

11 12 161 replace cylinder head

WARNING

Hot surfaces.

Risk of burning!

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

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

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

CAUTION

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

Danger of injury!

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

RISK OF DAMAGE

Engine damage due to lack of engine oil.

Lack of engine oil after the cylinder head or the engine has been renewed may cause damage to the valve gear.

- Do not start the engine after renewing the cylinder head or the engine without following the repair notes.
- The repair notes on renewing the cylinder head or the engine must be followed.
- For additional information, see: Repair notes on renewing the cylinder head or the engine

TECHNICAL INFORMATION

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

PRELIMINARY WORK

1 – Disconnecting all battery earth leads

- See additional information.

2 – Bring front compartment lid in the service position

Prerequisite

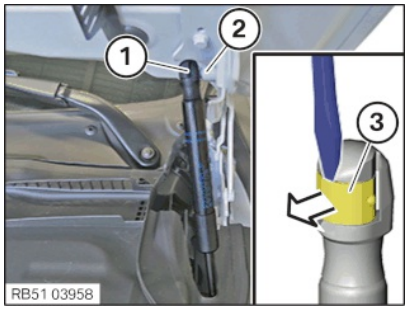
Engine compartment lid is open.

CAUTION

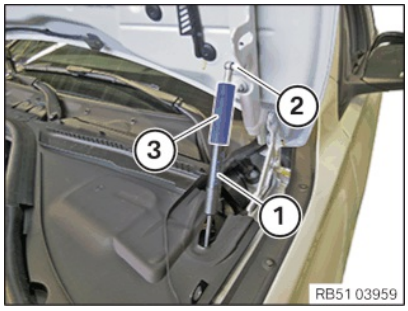
Shutting bonnet or tailgate.

Danger of injury!

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



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

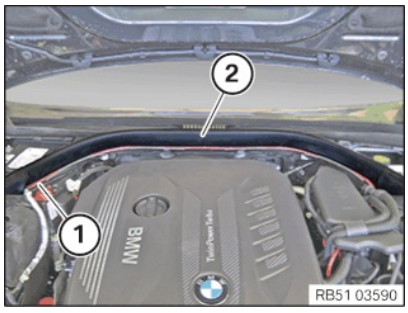


TECHNICAL INFORMATION

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

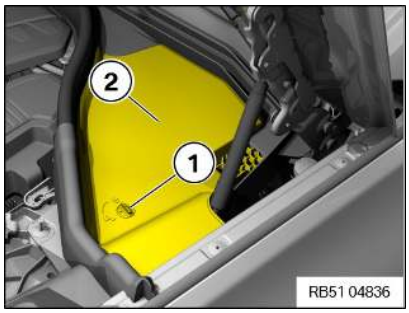
- Remove the bonnet support and open the bonnet further.
- Pull special tool or or 0 494 787 (51 0 040) (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

3 – Remove the seal for the rear bonnet



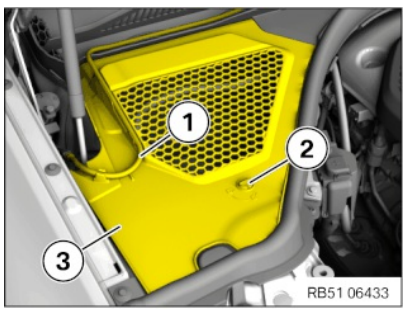
- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

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



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

5 – Remove the cover of the rear right engine compartment



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

6 – Removing the wiper arm on the left and right

NOTICE

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

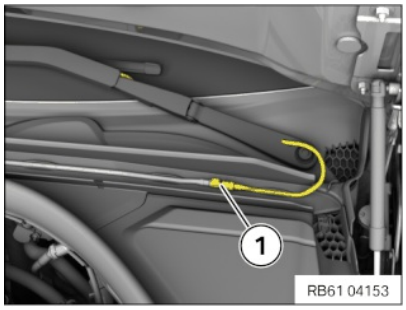
▸ **Remove the wiper arm**

RISK OF DAMAGE

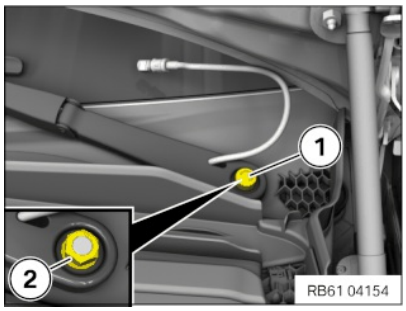
Damage to wiper console.

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

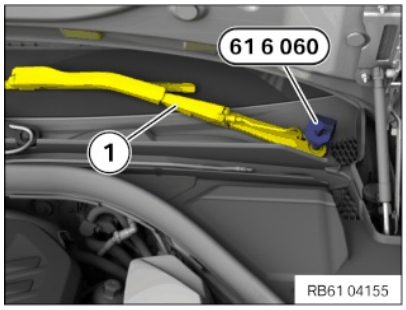
- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do **not** lever off the wiper arm because otherwise the wiper console may break at the predetermined breaking point for active pedestrian protection.



- Disconnect the washer fluid hose (1) at the separation point and feed out from the cowl panel guide.

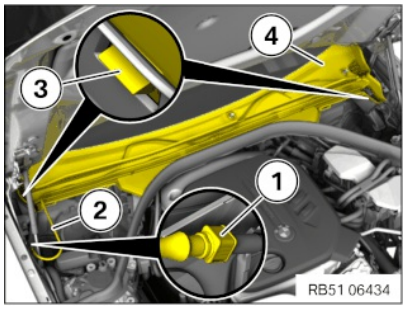


- Remove the protective cap (1).
- Loosen nut (2).

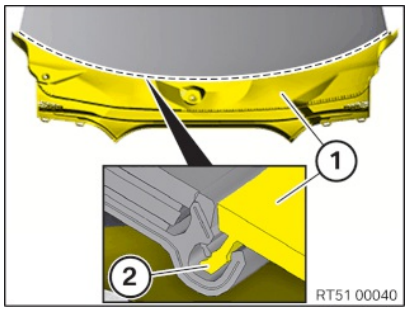


- Pull off the wiper arm (1) using special tool .

7 – Remove cowl panel cover



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

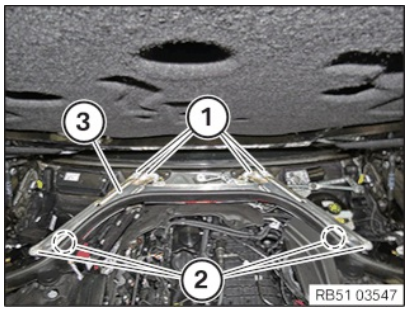


- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

8 – Removing the centre bulkhead upper part

TECHNICAL INFORMATION

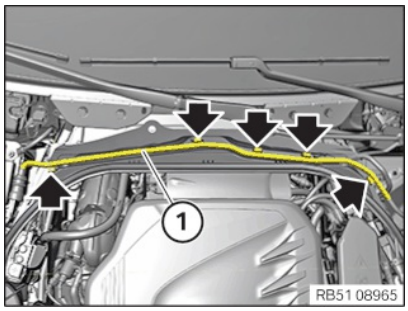
Driving without the strut brace/front-end strut or tension strut is not permitted.



NOTICE

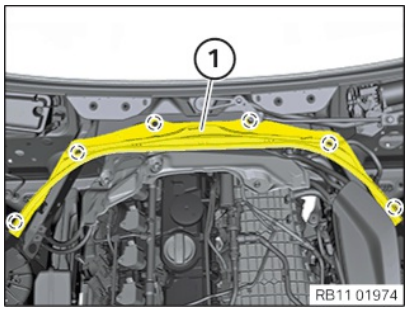
The following work step(s) is / are to be carried out if the specified component(s) is/are fitted.

- Loosen screws (1) and (2).
- Remove tension strut (3) in the spring strut dome upwards.



- **Version with mild hybrid technology:**

  Unclip the wire (1) at the holders (arrows).



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

9 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

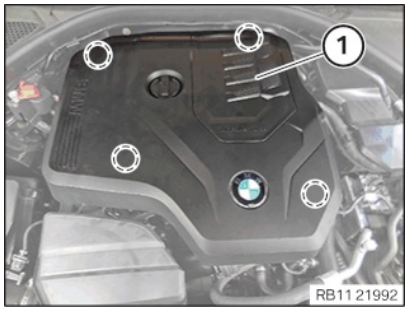
- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover/design cover.

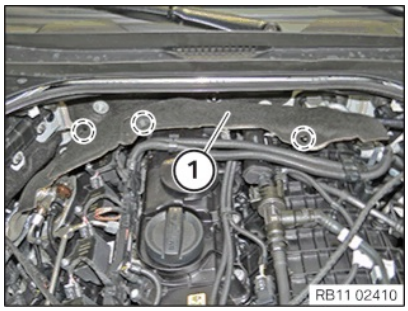
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover/design cover.

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



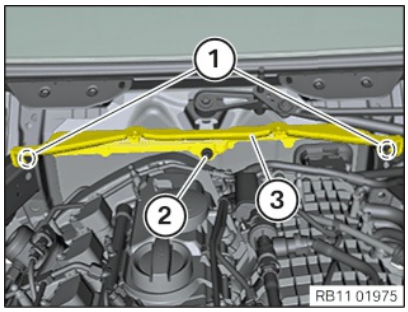
- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

10 – Removing acoustic cover at rear



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

11 – Removing the centre bulkhead lower section



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

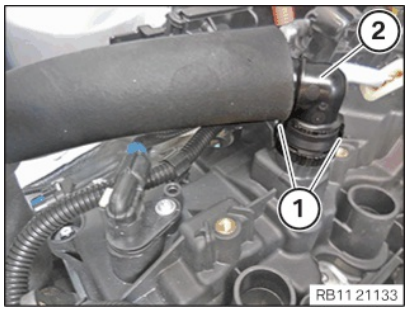
12 – Removing the clean air pipe with the resonator

WARNING

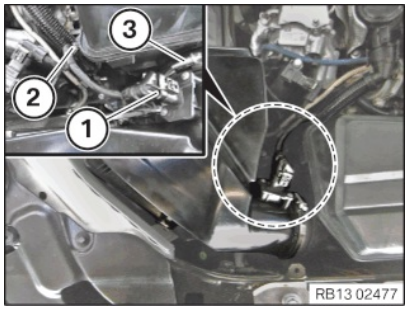
Hot surfaces.

Risk of burning!

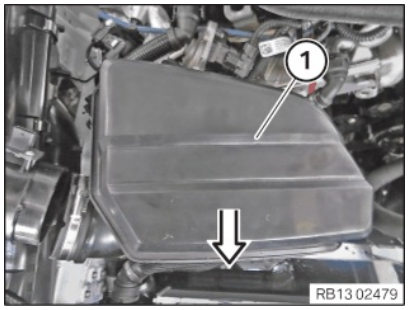
- Perform all work only on components that have cooled down.



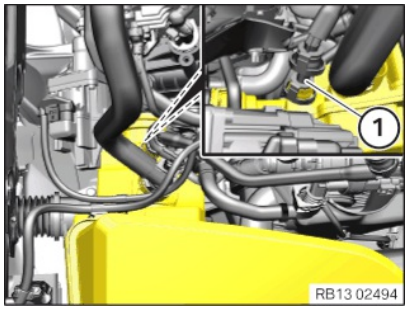
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



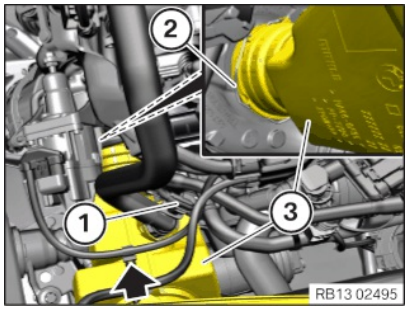
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



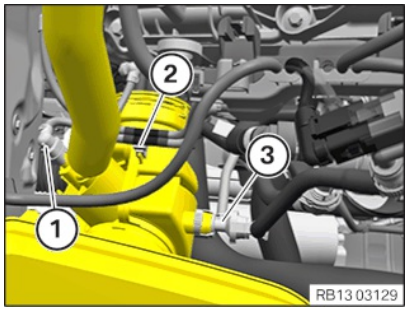
- Press and hold clean air pipe with the resonator (1) in the direction of the arrow.



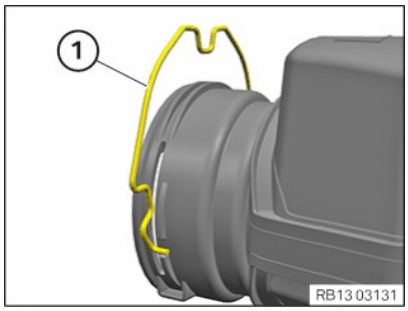
- **Version A:**
- Unlock and disconnect the tank ventilation line (1).



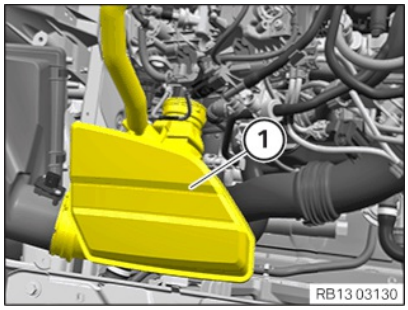
- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.



- **Version B:**
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unlock and pull off line (2).



- Unlock the clamp (1) and engage in this position.



- Unlock the clean air pipe with the resonator (1) and pull off.
- Feed out the clean air pipe with the resonator (1) and remove.

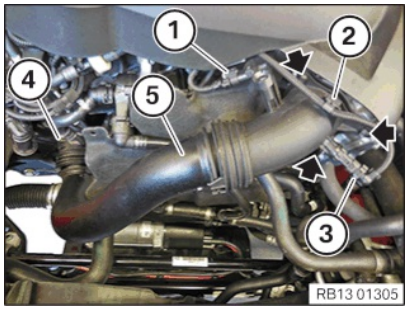
13 – Remove charge air line

WARNING

Hot surfaces.

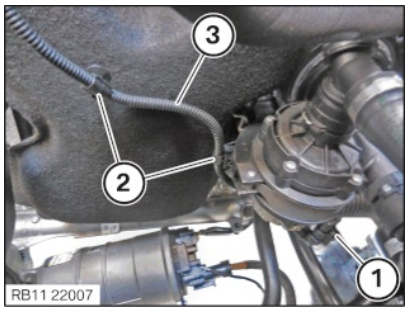
Risk of burning!

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

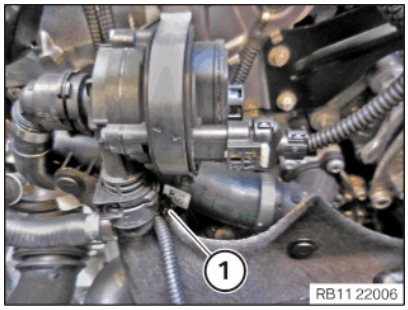


- Unlock plug connection (1) and disconnect.
- Unlock and loosen clamp (2).
- Unlock plug connection (3) and disconnect.
- Remove screws (arrows).
- Unlock and detach clamp (4) on exhaust turbocharger.
- Guide out and remove charge air line (5).

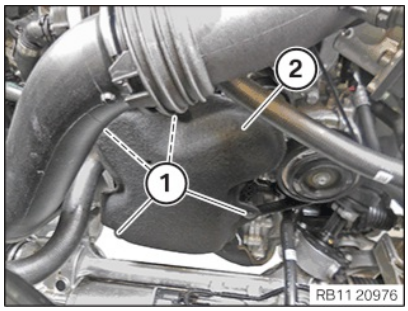
14 – Removing acoustic cover for engine at front



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



- Loosen clamp (1).



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

15 – Removing the DME control unit

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

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

TECHNICAL INFORMATION

Follow instructions for removing and installing control units.
For additional information see: 12 00 ... Notes on removal and installation of control units

TECHNICAL INFORMATION

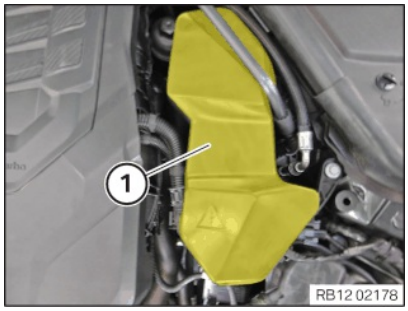
In a warranty case, you must always provide a fault memory printout with the defective part, even if the fault memory does not contain an entry.

TECHNICAL INFORMATION

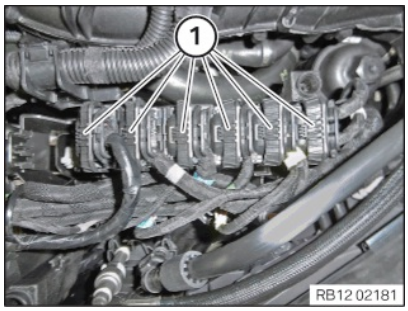
Control unit must be programmed after it is replaced.
For additional information see: 61 00 ... Programming/encoding control unit(s)

TECHNICAL INFORMATION

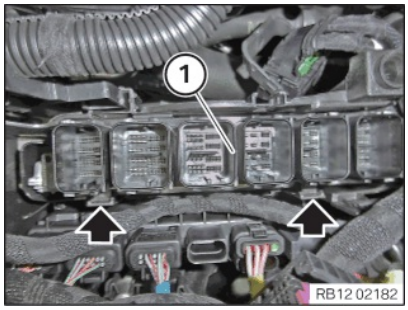
Disconnecting control units may cause fault code entries and functional limitations. Fault code entries must be read out and deleted if necessary.



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



- Unlock and disconnect the plug connection (1).



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

16 – Removing integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

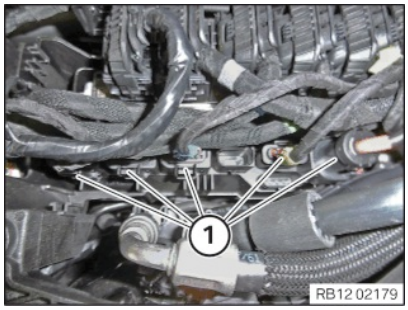
- Make sure that **no charger** is connected to the jump start support point in the engine compartment.
- Detach battery earth lead from battery.
- With auxiliary batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

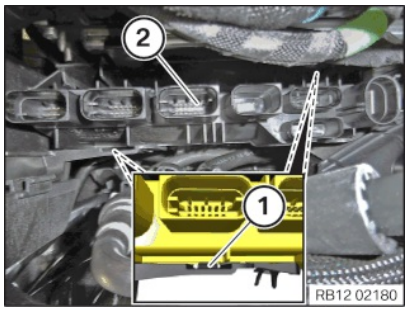
Electrostatic discharge.

Damage to or destruction of electrical components.

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

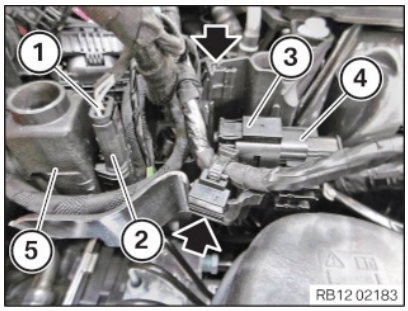


- Unlock and disconnect plug connections (1).

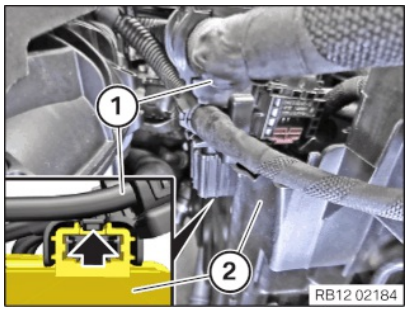


- Unlock the latch mechanisms (1).
- Guide out and remove integrated supply module (PDM) (2) upwards.

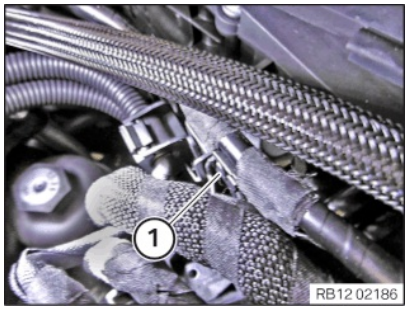
17 – Removing the control unit holder



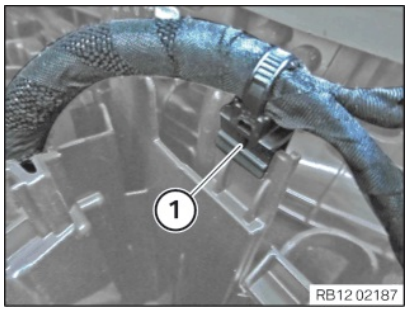
- Unlock plug connection (1) and disconnect.
- Unlock the connector (2) and disconnect from the starter (5).
- Unlock plug connection (3) and disconnect.
- Unlock the connector (4) and disconnect from the starter (5).
- Release the clamps (arrows).



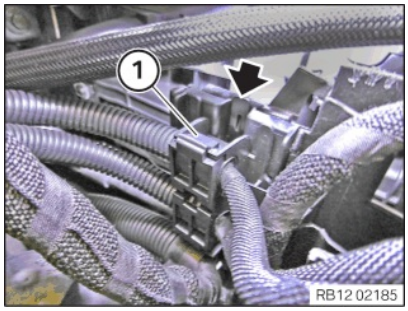
- Unlock the lock (arrow).
- Disconnect the cable plug (1) upwards from the control unit holder (2).



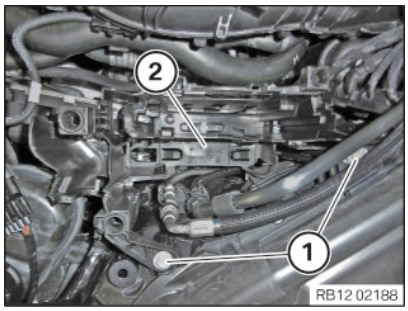
- Loosen clamp (1).



- Loosen clamp (1).

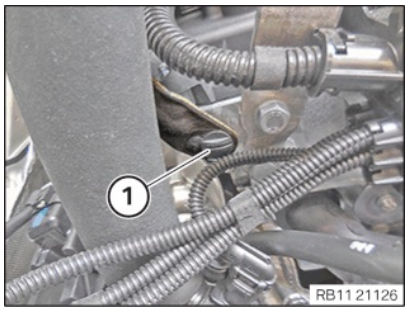


- Unlock the lock (arrow).
- Feed out the cable clip (1) upwards and set it aside.

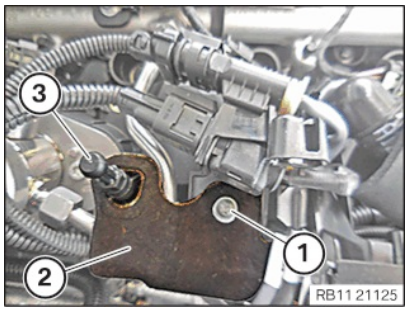


- Loosen screws (1).
- Guide out and remove the control unit holder (2).

18 – Removing the cylinder head cover acoustic cover



- Loosen clip (1).



- Loosen screw (1).
- Guide the acoustic cover (2) out of the ball pin (3) and remove.

19 – Remove all ignition coils.

NOTICE

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

▸ **Removing the ignition coil**

WARNING

Hot surfaces.

Risk of burning!

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

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.

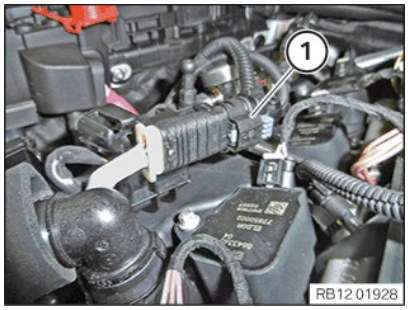
- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. Do not use **any** auxiliary materials or mounting agents (e.g. silicone spray, rubber care product, rust remover, etc.).

RISK OF DAMAGE

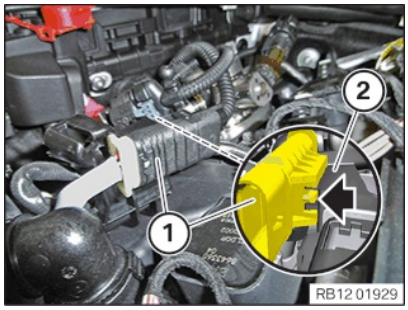
Electrostatic discharge.

Damage to or destruction of electrical components.

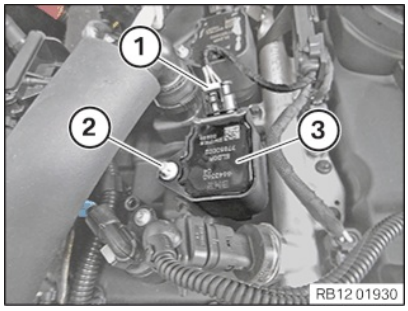
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the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



- Unlock plug connection (1) and disconnect.



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



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

20 – Removing all spark plugs

WARNING

Hot surfaces.

Risk of burning!

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

CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

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

- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

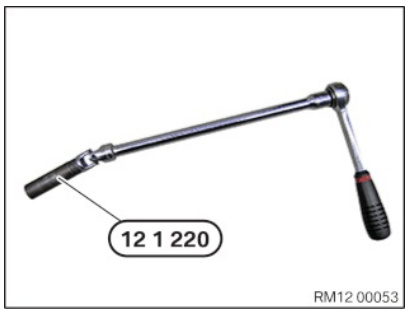
The spark plug shaft must be cleaned using compressed air after the ignition coils have been removed but before the spark plugs have been removed. After the spark plugs have been removed, once again check the sealing surface for contamination and if necessary, clean using a moist cloth or clean once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

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

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

NOTICE

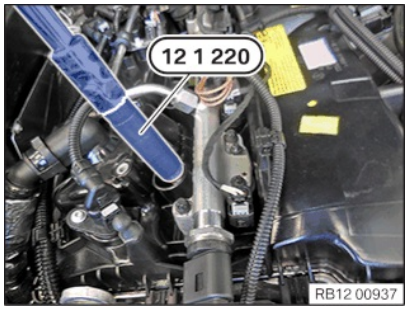
The description is for one component only. The procedure is identical for all further components.



TECHNICAL INFORMATION

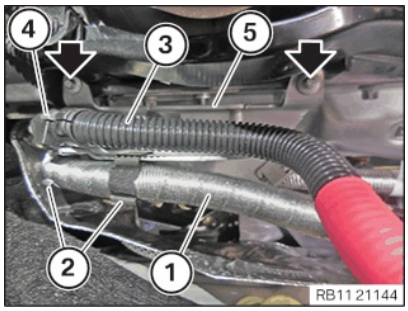
Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

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



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

21 – Remove the holder of the positive battery cable



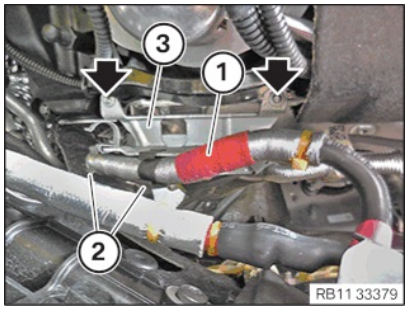
- **Version A (without mild hybrid technology)**

  Remove positive battery cable (1) from clamps (2).

  Detach the positive battery cable (3) from the bracket (4).

  Remove screws (arrows).

  Feed out the bracket (5) of the positive battery cable and set it aside.

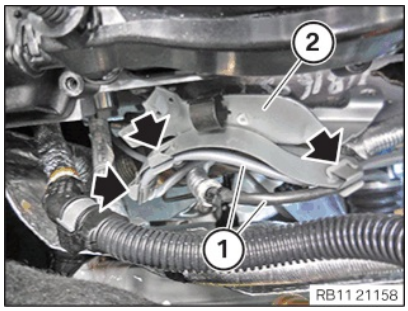


- **Version B (with mild hybrid technology)**

  Remove positive battery cable (1) from clamps (2).

  Remove screws (arrows).

  Feed out the holder (3) of the positive battery cable and set aside.



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

22 – Remove the heat shield at the cylinder head

WARNING

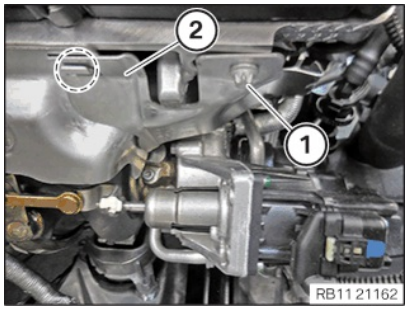
Hot surfaces.

Risk of burning!

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

- **Version without Real Driving Emissions 2 (-SA1DZ):**

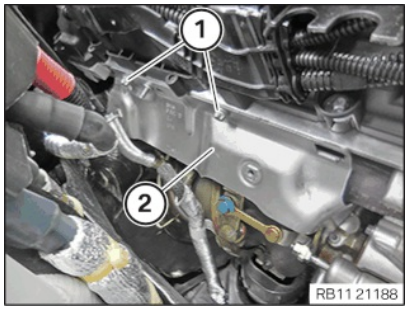
  Loosen screw (1).



- **Version without Real Driving Emissions 2 (-SA1DZ):**

  Loosen screw (1).

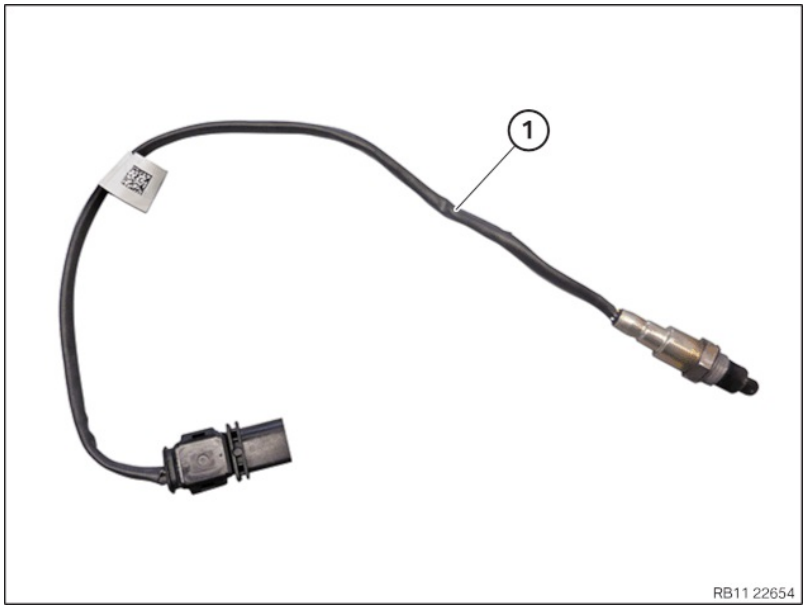
  Remove the heat shield (2) from the **marked** area and remove.



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

23 – Removing the front oxygen sensor

Lambda control probe



1 Lambda control probe

WARNING

Hot surfaces.

Risk of burning!

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

RISK OF DAMAGE

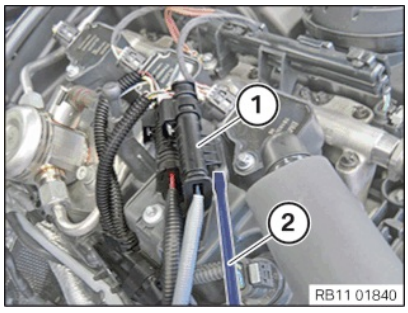
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

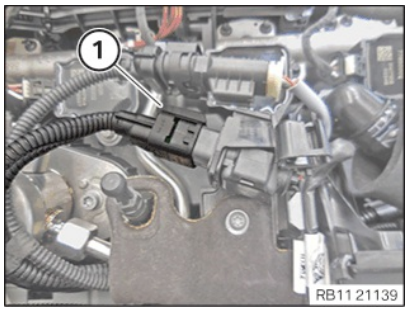
- Do not pull on the wires when disconnecting connectors and plug connections.

NOTICE

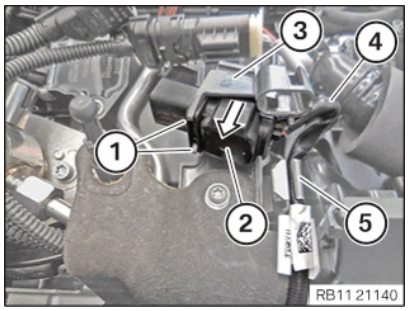
The oxygen control sensor cable of is black. The installation location of the front oxygen sensor is before the catalytic converter.



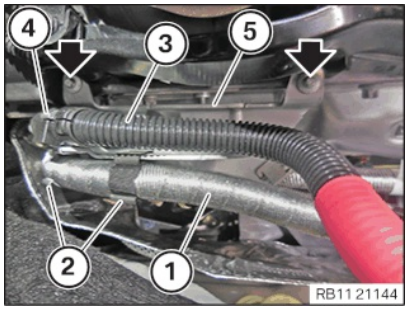
- Unlock the plug connection (1) with the screwdriver (2) and release it from the carrier plate.



- Unlock and release plug connection (1).



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



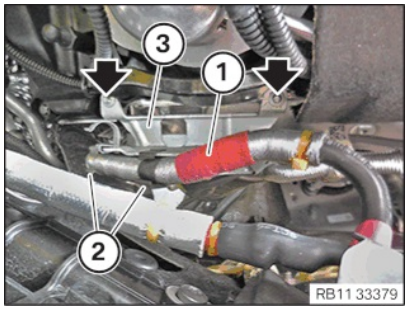
- **Version A (without mild hybrid technology)**

  Remove positive battery cable (1) from clamps (2).

  Detach the positive battery cable (3) from the bracket (4).

  Remove screws (arrows).

  Feed out the bracket (5) of the positive battery cable and set it aside.

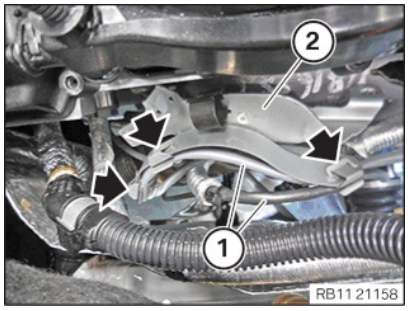


- **Version B (with mild hybrid technology)**

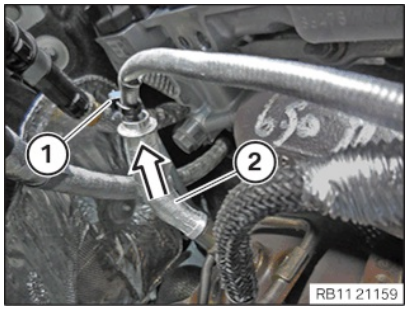
  Remove positive battery cable (1) from clamps (2).

  Remove screws (arrows).

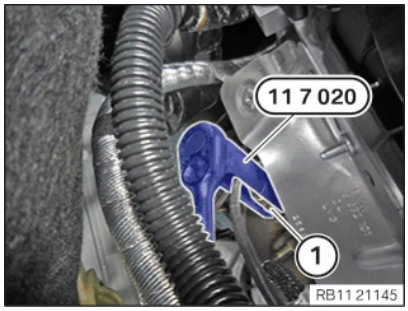
  Feed out the holder (3) of the positive battery cable and set aside.



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



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



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

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

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Make sure that **no charger** is connected to the jump start support point in the engine compartment.
- Detach battery earth lead from battery.
- With auxiliary batteries: Detach all battery earth leads from additional batteries.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

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

CAUTION

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

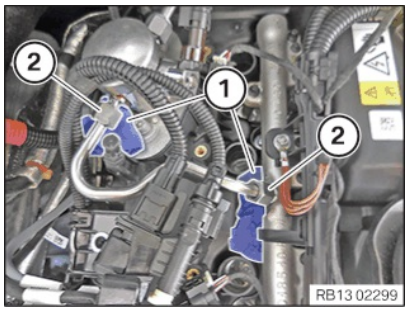
Danger of injury!

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

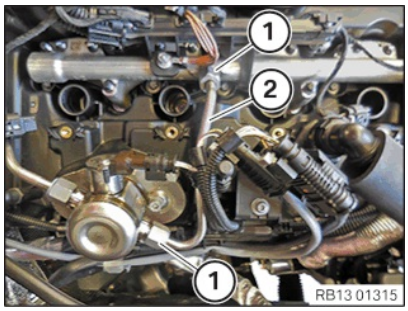
TECHNICAL INFORMATION

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

- Have the special tool ready.



- Position a lint-free cleaning cloth (1) on the union nuts (2).
- Release union nuts (2).
- Catch and dispose of escaping fuel.
- Feed out and dispose of the lint-free cleaning clothes (1).



- Release the union nuts (1) completely.
- Feed the high pressure line (2) out and remove.

- Seal all openings with the special tool .

25 – Remove fuel delivery line

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

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

CAUTION

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

Danger of injury!

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

RISK OF DAMAGE

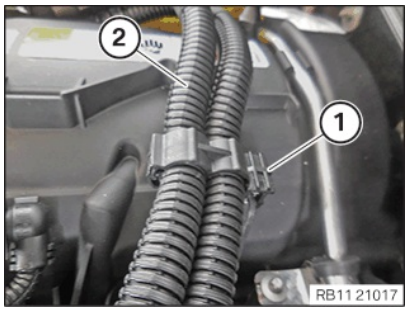
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

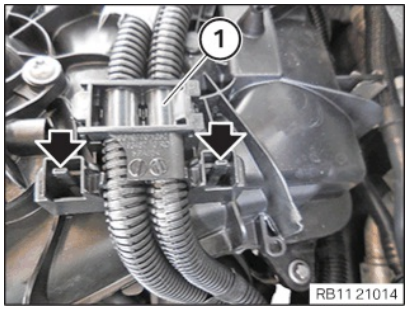
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

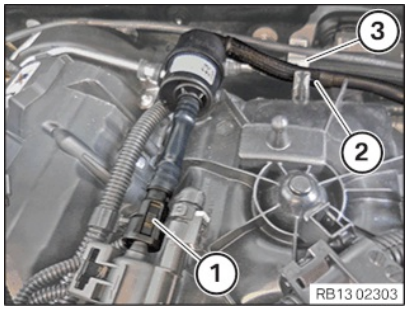
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



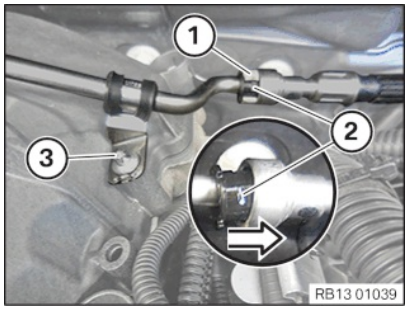
- Loosen clamp (1).
- Guide out wiring harness section (2) for the injectors and ignition coils and place it aside.



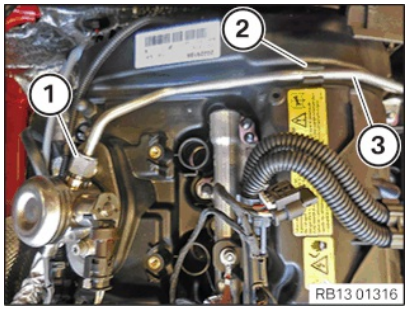
- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.



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



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



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

26 – Removing the rail with injectors

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 torsional movement of maximum 13 Nm.

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

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.

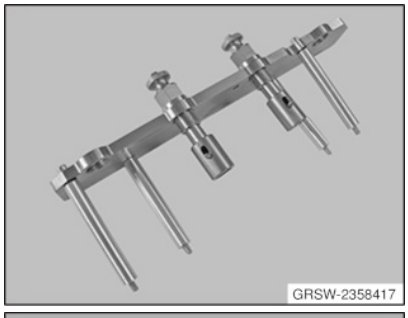
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

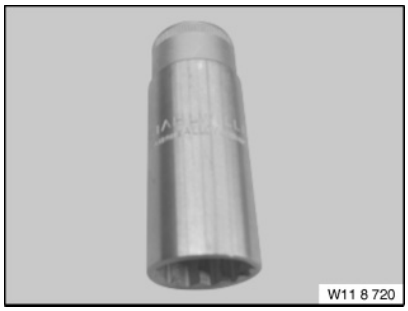
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the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

- Prepare special tool .

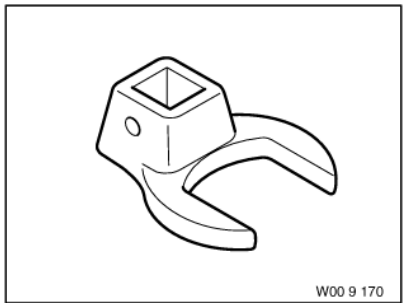


- Prepare special tool 2 358 417.

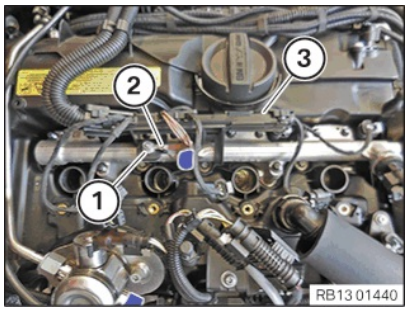
- Prepare special tool .



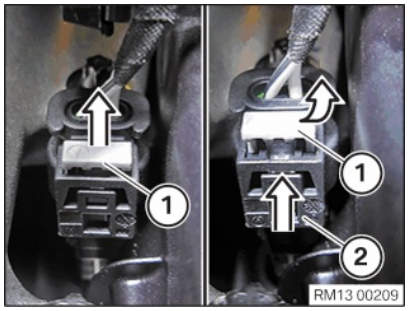
- Prepare special tool 0 496 106 (11 8 720).



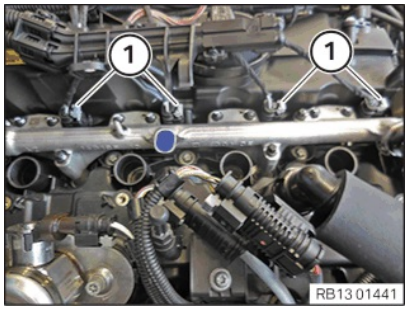
- Prepare special tool 0 490 507 (00 9 170).



- 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 off connector (2) from the injectors.



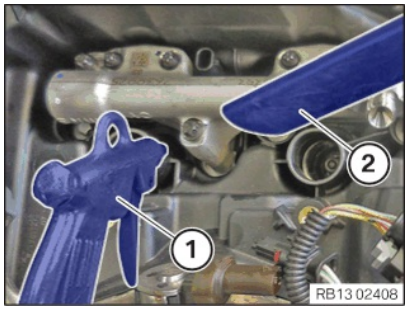
RISK OF DAMAGE

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 release all connectors (1) of the injectors.

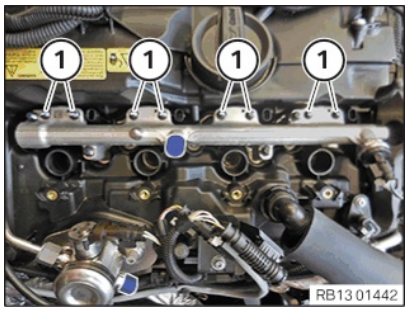


TECHNICAL INFORMATION

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

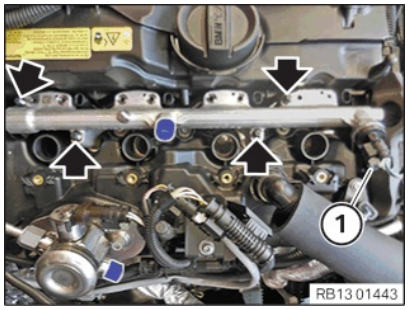
- Before releasing the high pressure lines: Blow out the injector shafts with air gun (1) with a little pressure.
- At the same time, use an **explosion-proof** vacuum cleaner (2) to draw off the dirt particles.



- Unscrew and remove the screws (M5x30) (1).

  Do **not** reuse screws (M5x30) (1).
- Renew the bolts (M5x30) (1).

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

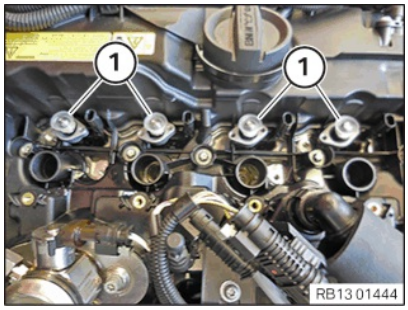


- Unscrew and remove screws (M6x70) (arrows).

  Do **not** reuse the screws (M6x70) (arrows).
- Renew the screws (M6x70) (arrows).

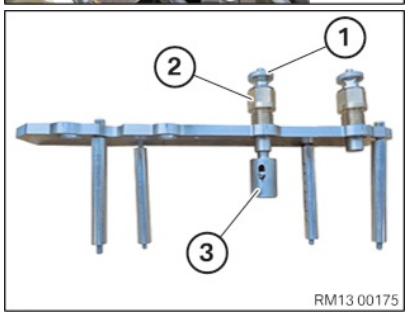
  Parts: Screws (M6x70)
- Unlock plug connection (1) and disconnect.
- Remove the rail in upward direction.

  The injectors remain in the cylinder head.



- Remove the gaskets (1).

  The seals (1) are only needed for the initial assembly at the plant and will **not** be reinstalled.



RISK OF DAMAGE

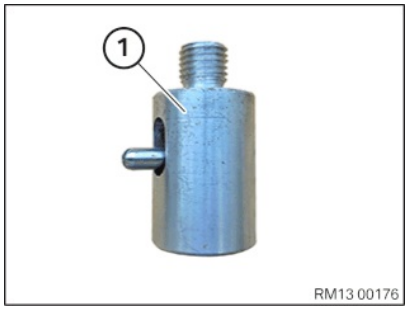
Damage to injectors.

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

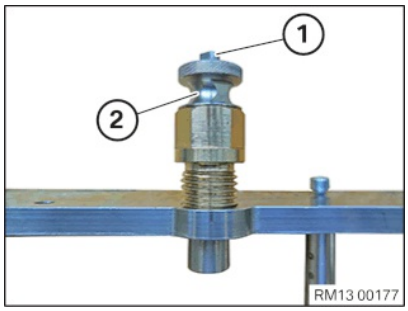
- Twist the injectors with a torsional movement of maximum 13 Nm.
- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use special tool 2 358 417 with special tool (spacer sleeves) to remove the injectors.

  Special tool 2 358 417 and spacer sleeves are used to ensure that the tensile force is not exceeded.

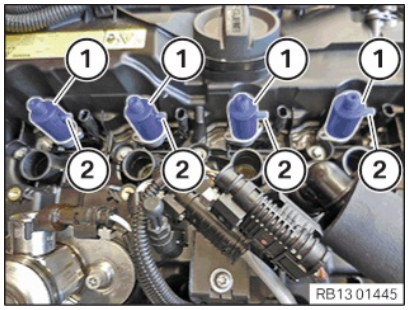
  The special tool 2 358 417 consists of:
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Fixture for the injector



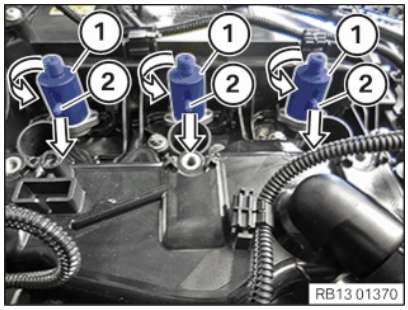
- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.



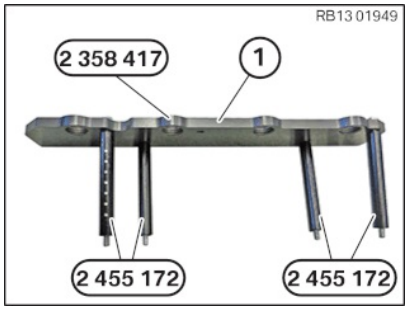
- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.



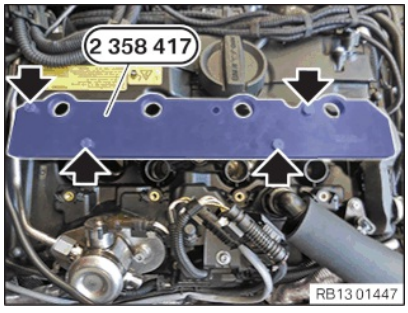
- Install all fixtures (1) for the injectors.
  The fixtures (1) are not locked when the levers (2) are up.



- Turn the fixtures (1) in the direction of the arrow by **90°** and lock the levers (2) downward.



- Prepare panel (1) from special tool 2 358 417 with spacer sleeves .

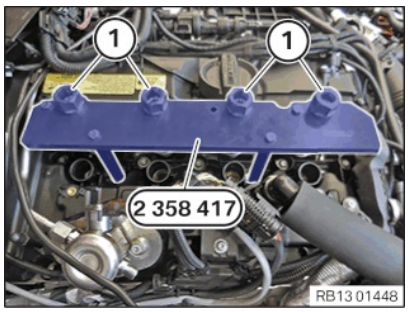


RISK OF DAMAGE

Damage to injectors.

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

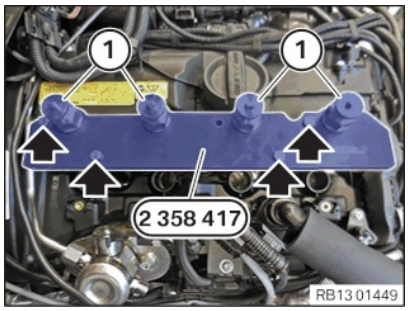
- Do not use the puller plate as a support.
- Attach special tool 2 358 417 with spacer sleeves on the cylinder head.
- Hand-tighten the bolts (arrows).



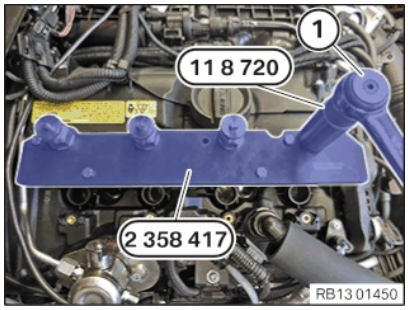
TECHNICAL INFORMATION

The extraction thread is a left-hand thread.

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



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



- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720) until the injectors of **cylinder 1,3,4** are pulled out.

TECHNICAL INFORMATION

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

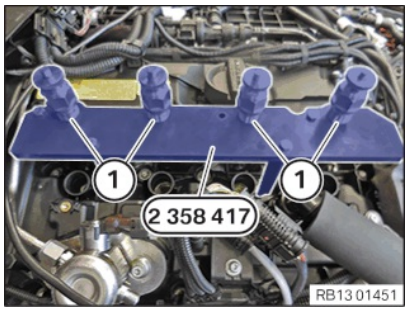
- Disassemble all injectors individually.

- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 490 507 (00 9 170)until the injector of **cylinder 2** is pulled out.

TECHNICAL INFORMATION

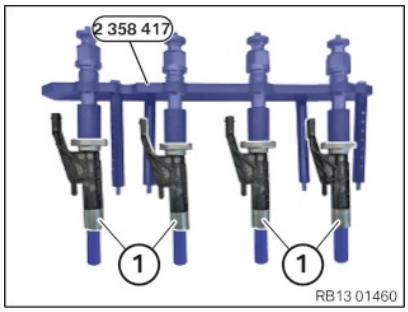
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

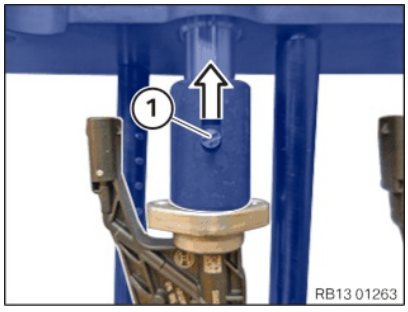


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  The threads of the pull-out thread must be completely visible.
- Loosen screws on special tool 2 358 417.



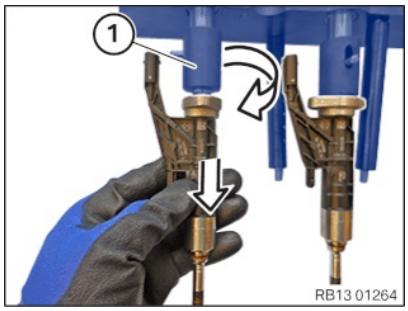
- Carefully remove special tool 2 358 417 with injectors (1) vertically upwards from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.



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.

27 – 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

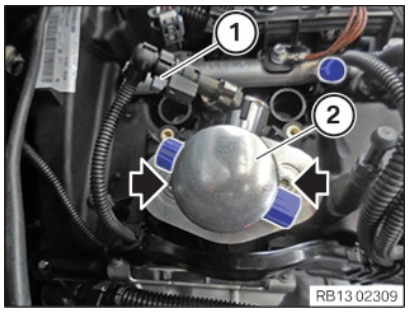
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

The high-pressure pump is preloaded by the piston spring and must be removed by alternately pulling out the screws without tilting.

Before installing the high pressure pump, turn the cam of the high-pressure pump drive to the bottom dead centre.

If necessary, turn the engine in the direction of engine rotation at the central bolt of the crankshaft, otherwise there is a risk of piston breakage of 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.

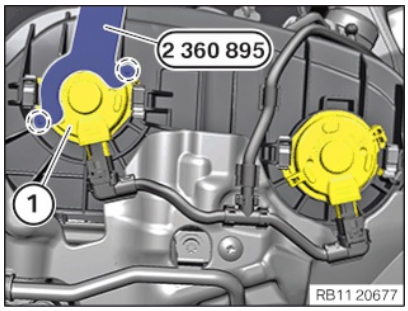
28 – Removing both actuators

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

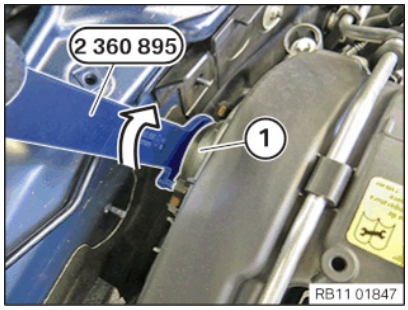
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the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



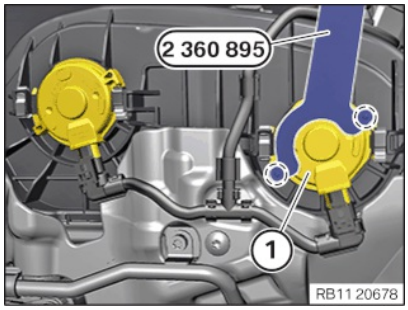
NOTICE

The figure shows the rear side of the engine.

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



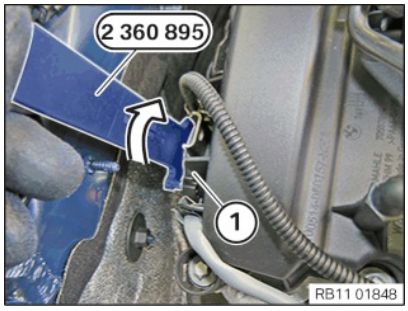
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



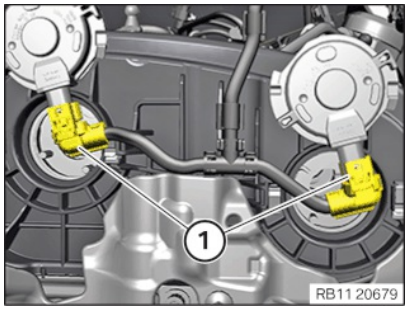
NOTICE

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.



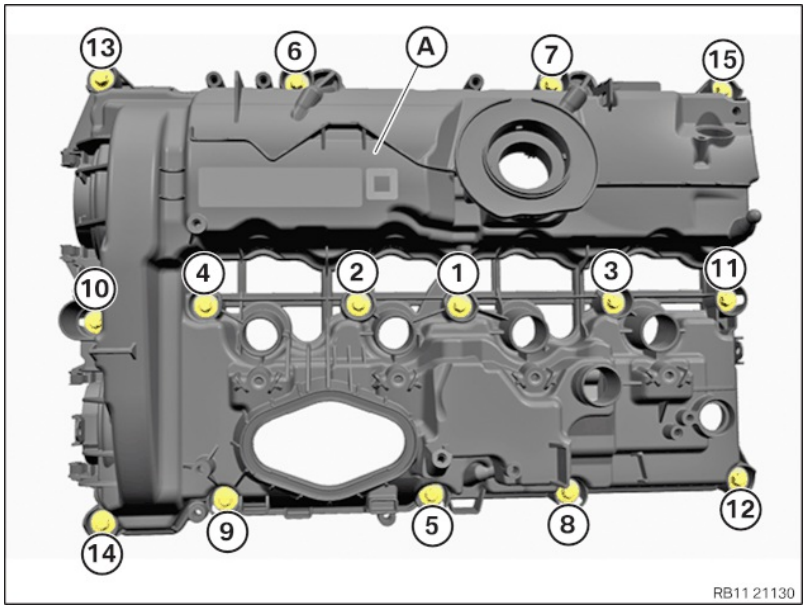
NOTICE

The figure shows the rear side of the engine.

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

29 – Removing the cylinder head cover

Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

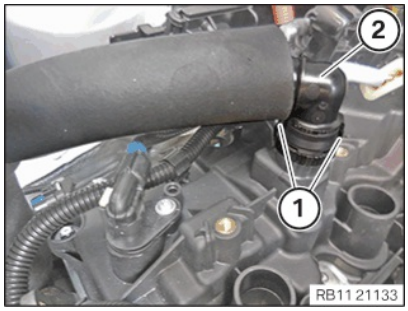
A Cylinder head cover

RISK OF DAMAGE

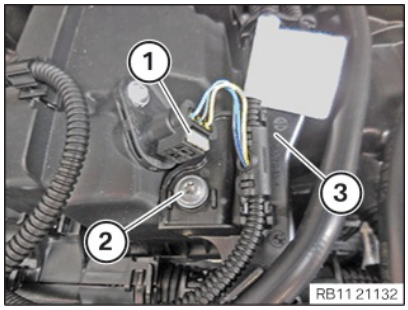
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

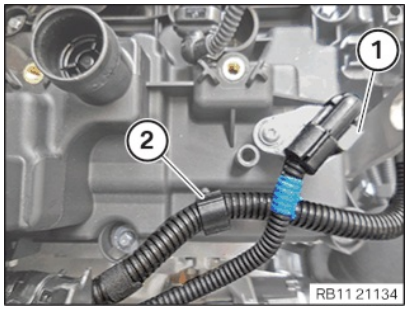
- Do not pull on the wires when disconnecting connectors and plug connections.



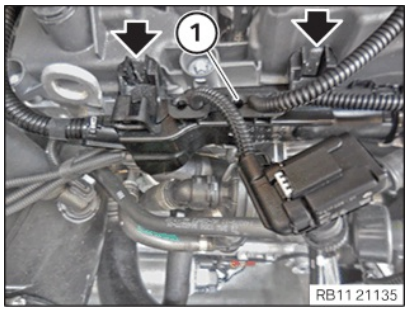
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



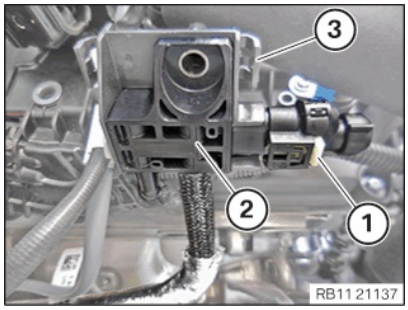
- Unlock and disconnect the plug connection (1) on the intake camshaft sensor.
- Loosen screw (2).
- Guide out the wiring harness section (3) for sensor system 1 and place to one side.



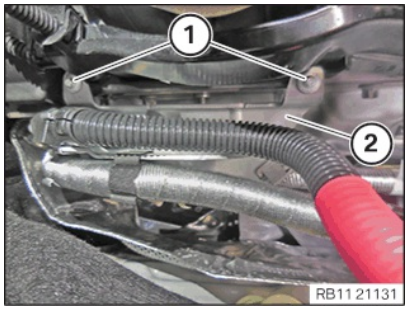
- Unlock and disconnect the plug connection (1) on the exhaust camshaft sensor.
- Unlock and loosen clamp (2).



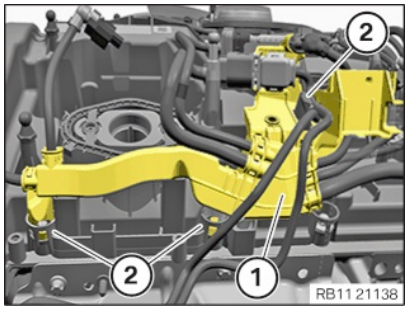
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for sensor system 2 and place to one side.



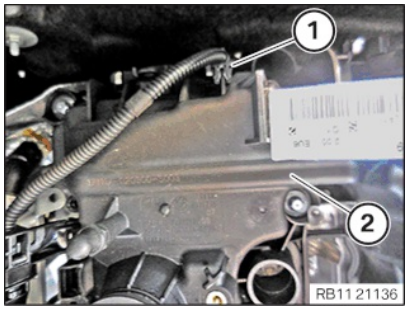
- Unlock plug connection (1) and disconnect.
- Feed out differential pressure sensor (2) from the holder (3) and place to one side.



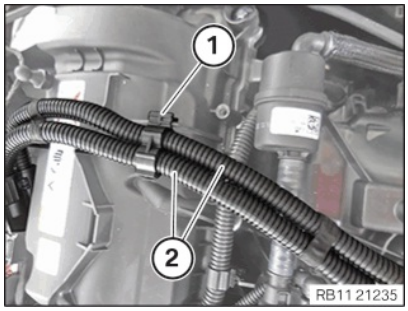
- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.



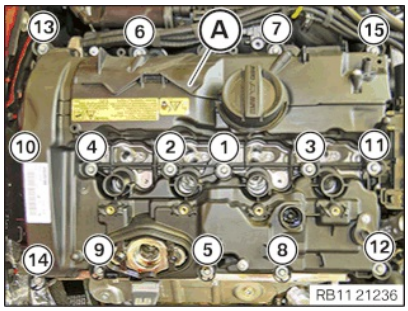
- Guide the wiring harness section (1) for the sensor system 2 out of the guides (2) and set it aside.



- Loosen clamp (1).

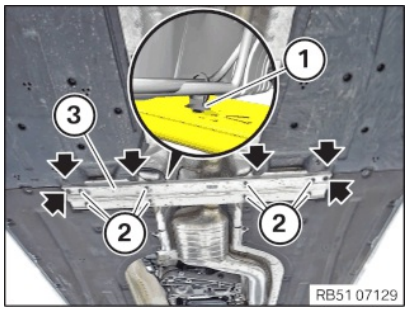


- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



- Loosen screws in the order (15) to (1).
- Guide the cylinder head cover (A) out and remove it.

30 – Remove the connecting support from the tunnel



- Remove screws (arrows).

NOTICE

The following work step(s) is / are to be carried out if the specified component(s) is/are fitted.

- Loosen clamp (1).
- Loosen screws (2).
- Guide out and remove connecting support (3) on the tunnel.

31 – Remove complete exhaust system

WARNING

Hot surfaces.

Risk of burning!

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

CAUTION

Component with heavy weight.

Danger of injury!

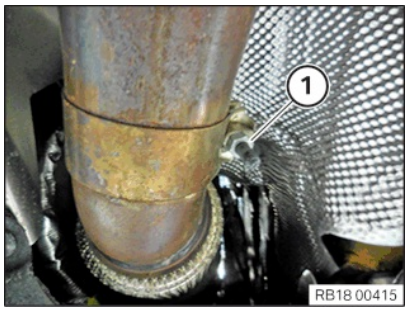
- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

CAUTION

Heavy component.

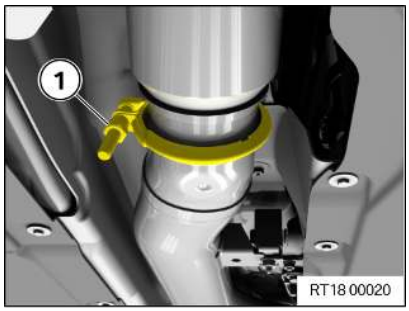
Heavy components can lead to injury or damage.

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



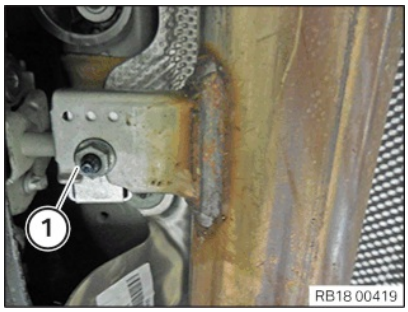
- **Version A:**

  Detach the ribbon clamp (1).

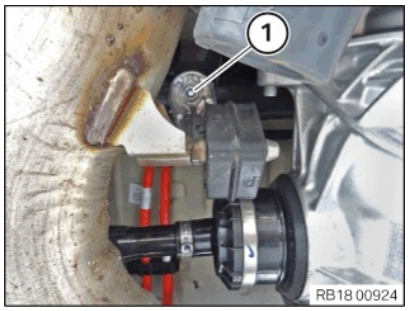


- **Version B:**

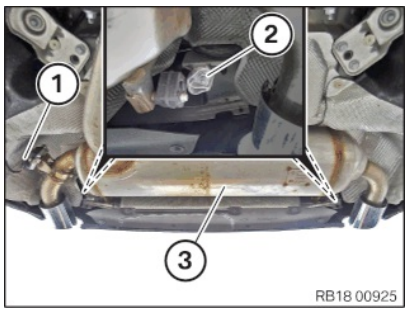
  Release the V-clip (1).



- Loosen nut (1).



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

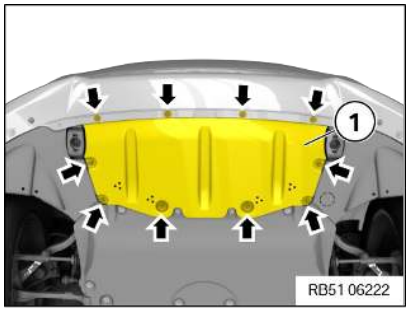


NOTICE

The following work step(s) is / are to be carried out if the specified component(s) is/are fitted.

- Unlock plug connection (1) and disconnect.
- Loosen nuts (2).
- Lower the exhaust system (3) with the help of an auxiliary person and remove it.

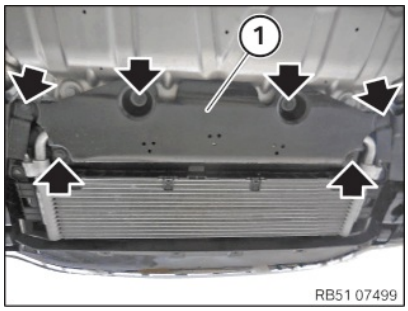
32 – Removing the front underbody protection



- **Version A:**

  Remove screws (arrows).

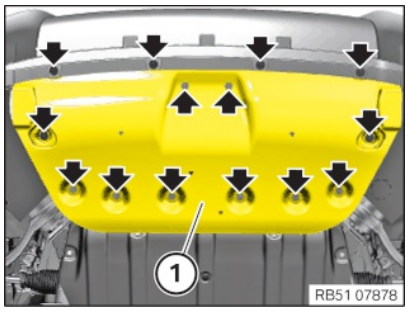
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version B:**

  Remove screws (arrows).

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

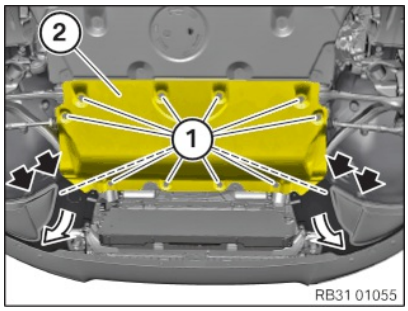


- **Version C:**

  Remove screws (arrows).

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

33 – Remove the underbody protection of the steering gear



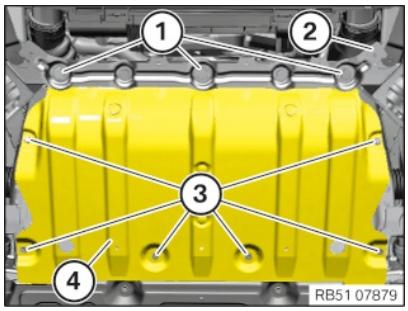
- **Version A:**

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

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove the underbody protection (2) of the steering gear.



- **Version B:**

  Loosen screws (1).

  Remove the holder (2) for the underride protection.

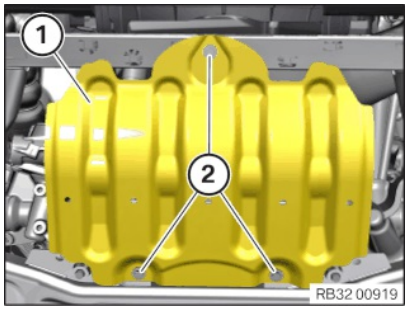
  Loosen screws (3).

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

34 – If installed: Removing the steering underbody protection

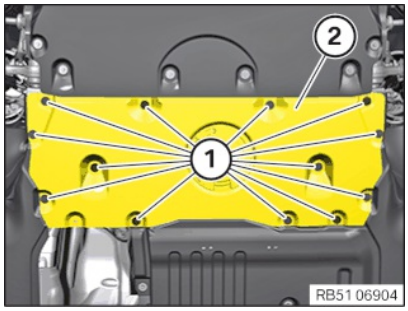
Prerequisite

Front underbody protection has been removed.



- Loosen screws (2).
- Remove underbody protection (1).

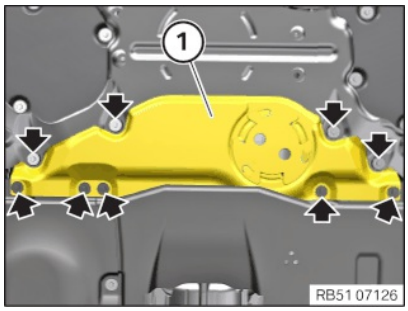
35 – Removing the centre underbody protection



- **Variant with rear wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .

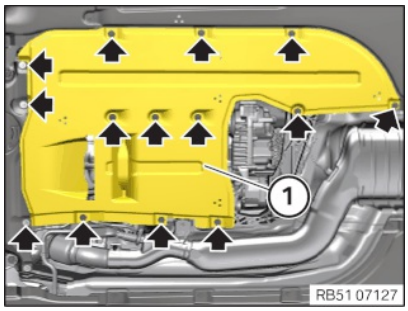


- **Version with all-wheel drive:**

  Remove screws (arrows).

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

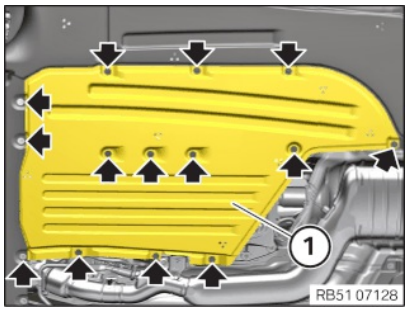
36 – Remove rear underbody protection



- **Version A:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).



- **Version B:**

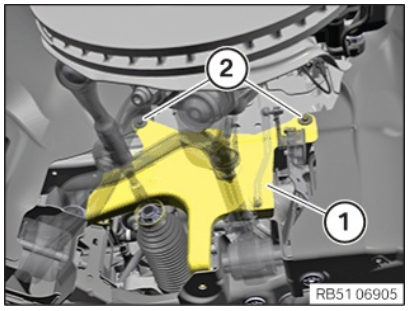
  Remove screws (arrows).

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

37 – Remove the cover of the steering assembly

Prerequisite

Underbody protection of the steering gear is removed.



- Loosen screws (2).
- Remove the cover (1).

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

WARNING

Hot surfaces.

Risk of burning!

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

TECHNICAL INFORMATION

Life-long fill of coolant!

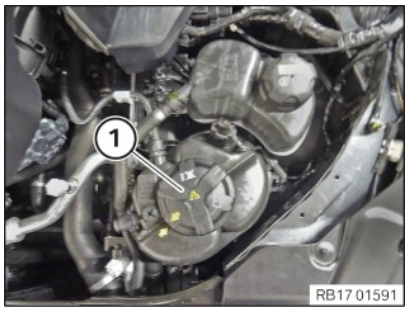
Do not reuse used coolant.

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

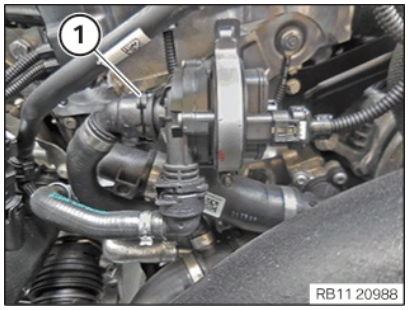
In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

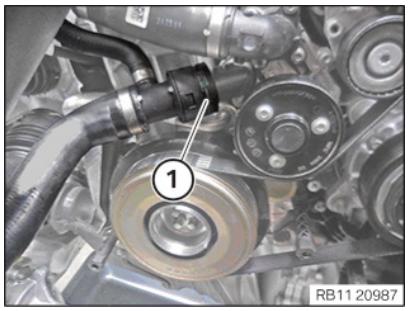
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen sealing cap (1).



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



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

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

WARNING

Hot surfaces.

Risk of burning!

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

TECHNICAL INFORMATION

Life-long fill of coolant!

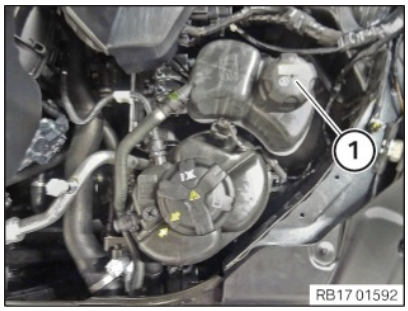
Do not reuse used coolant.

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

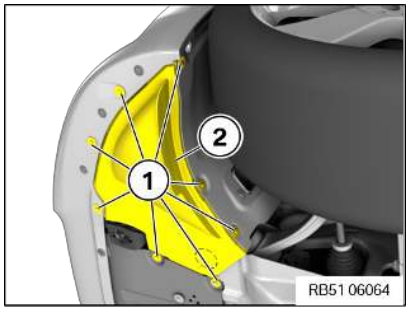
In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

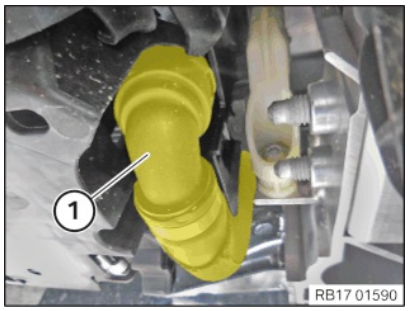
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen sealing cap (1).



- Loosen screws (1).
- Feed out the front left cover (2) downwards and remove it.

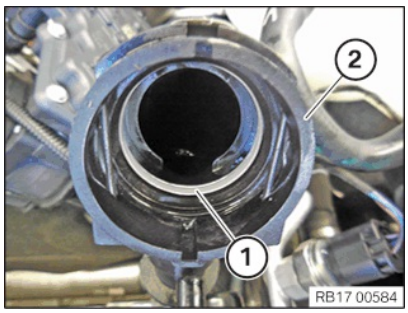


- Unlock and disconnect the coolant line (1).
- Catch and dispose of escaping coolant.

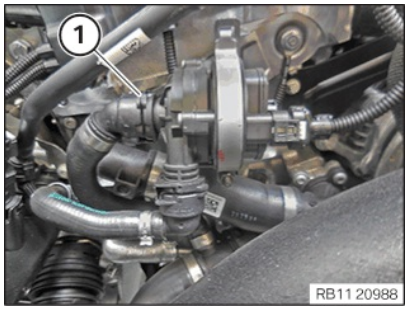
40 – Connecting the coolant lines for the high-temperature coolant circuit

TECHNICAL INFORMATION

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

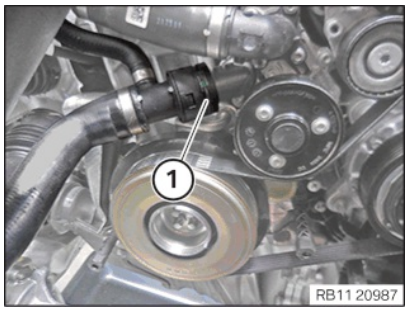


- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock coolant line (1).

  Coolant line (1) must audibly engage.



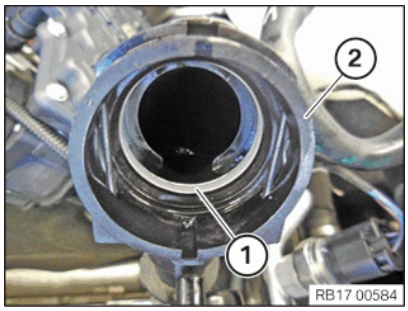
- Connect and lock coolant line (1).

  Coolant line (1) must audibly engage.

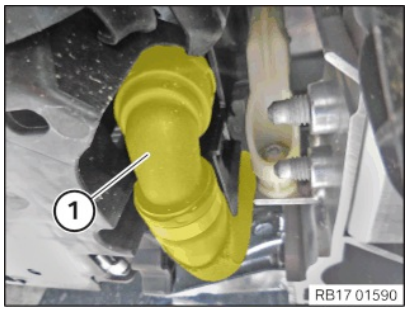
41 – Connecting the coolant lines for the low-temperature coolant circuit

TECHNICAL INFORMATION

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

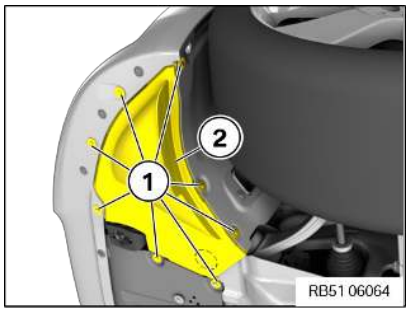


- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock the coolant line (1).

  The coolant line (1) must audibly engage.



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

Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

42 – 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.

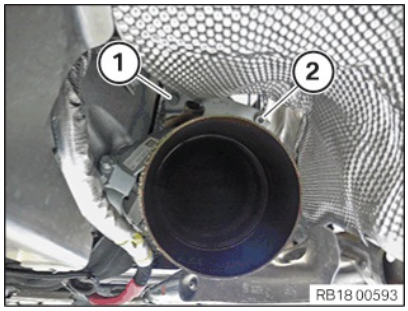
- Remove and install heavy components with the aid of another person/other persons.

CAUTION

Component with heavy weight.

Danger of injury!

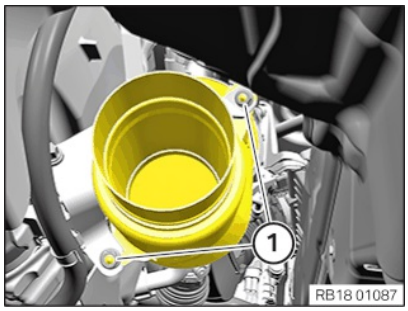
- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.



- **Version A:**

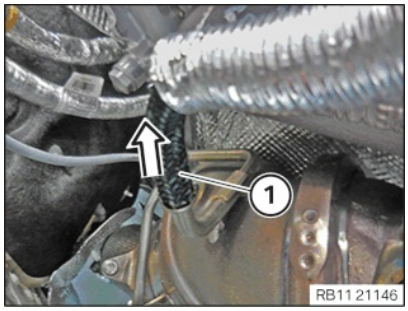
  Loosen screw (1).

  Loosen nut (2).

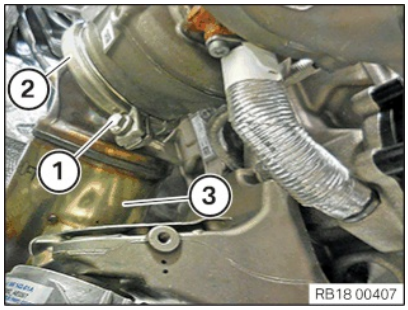


- **Version B:**

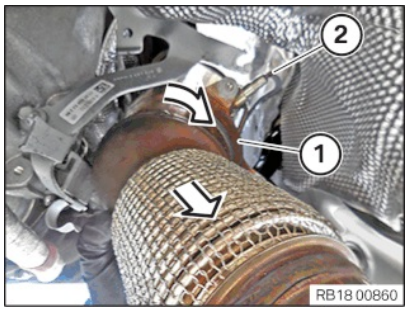
  Release nuts (1).



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



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

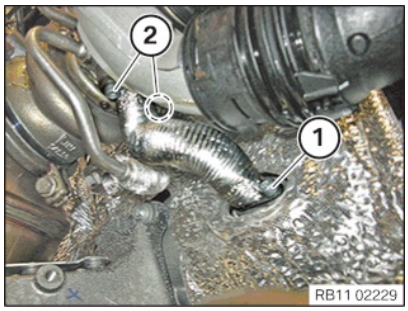


- Guide out catalytic converter (1) in direction of arrow and remove.
- Make sure that the monitoring oxygen sensor is (2) **not** damaged.

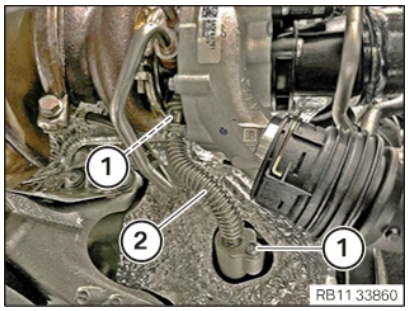
43 – Removing the oil return line for the exhaust turbocharger

TECHNICAL INFORMATION

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



- **Version A:**
- Have a rag ready and catch any engine oil that may emerge.
- Loosen the screws (1) and (2).
- Guide out and remove the oil return line .

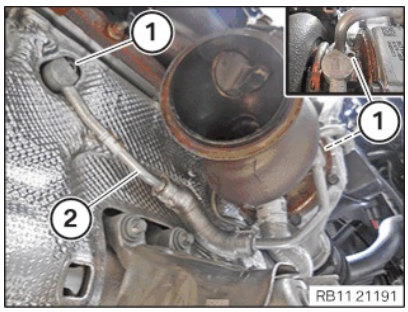


- **Version B:**
- Have a rag ready and catch any engine oil that may emerge.
- Loosen screws (1).
- Feed out and remove the oil return line (2).

44 – Remove the coolant feed line for the exhaust turbocharger

TECHNICAL INFORMATION

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



- Loosen screws (1).
- Guide out and remove the coolant feed line (2) from the crankcase.
- Guide out and remove the coolant feed line (2) from the exhaust turbocharger.

45 – Remove the coolant return line for the exhaust turbocharger

WARNING

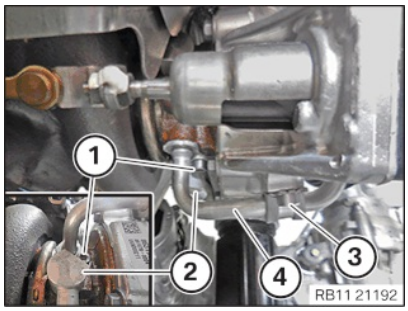
Hot fluids.

Risk of scalding!

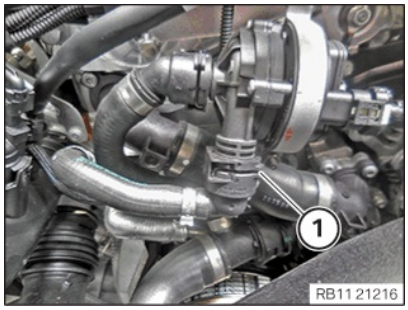
- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

TECHNICAL INFORMATION

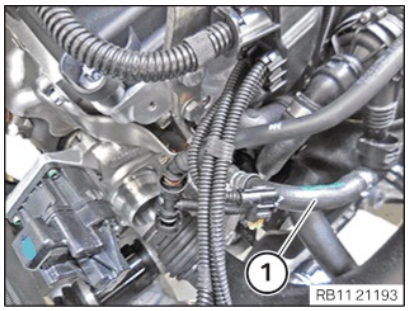
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screw (1).
- Guide out the coolant feed line (2) for the exhaust turbocharger and place it aside.
- Loosen screw (3).
- Guide out coolant return line (4) for the exhaust turbocharger and place it aside.



- Unlock and release the coolant return line for the exhaust turbocharger (1).



- Feed out and remove the coolant return line (1) for the exhaust turbocharger.

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

WARNING

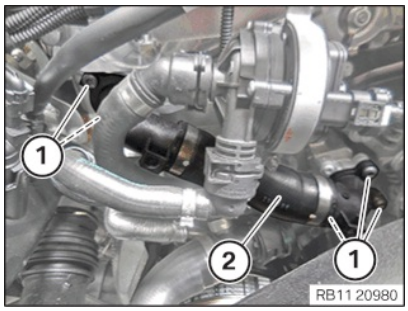
Hot surfaces.

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.

47 – Remove tank vent valve

WARNING

Hot surfaces.

Risk of burning!

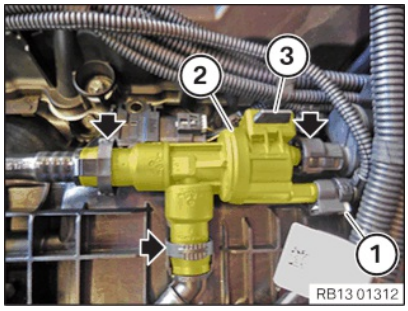
- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

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



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

48 – Removing the intake plenum

RISK OF DAMAGE

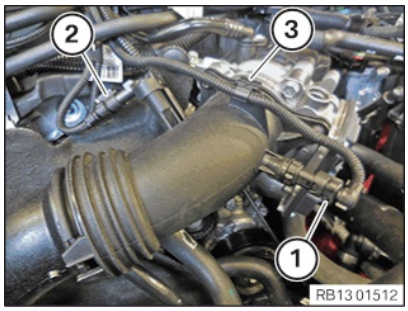
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

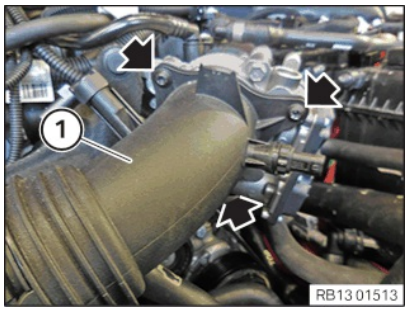
- Do not pull on the wires when disconnecting connectors and plug connections.

TECHNICAL INFORMATION

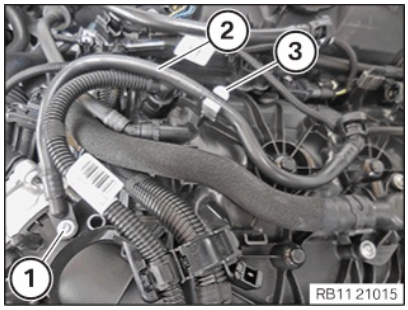
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



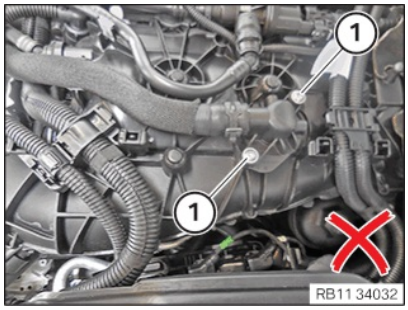
- Unlock plug connection (1) and disconnect.
- Unlock plug connection (2) and disconnect.
- Unlock and loosen clamp (3).



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



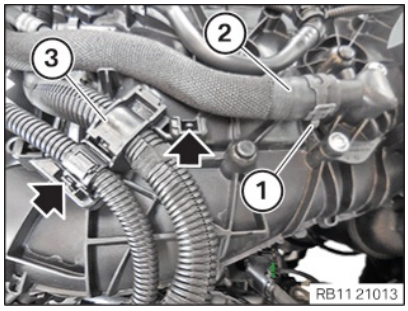
- Loosen screw (1).
- Guide tank ventilation line (2) out of clamp (3) and remove it.



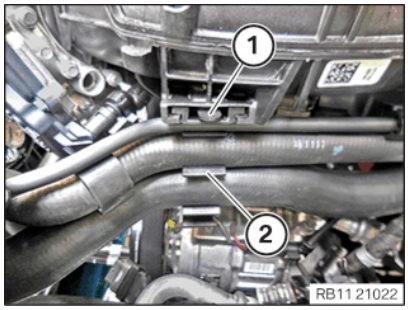
TECHNICAL INFORMATION

The tie-rods and mounting screws from the connection neck on the intake plenum are **not** allowed be opened.

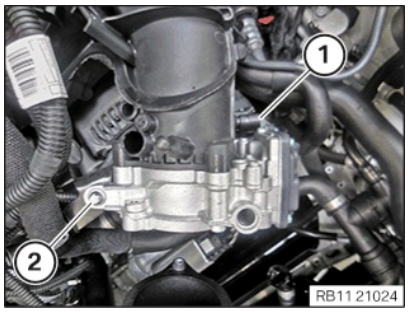
- Do **not** loosen screws (1).



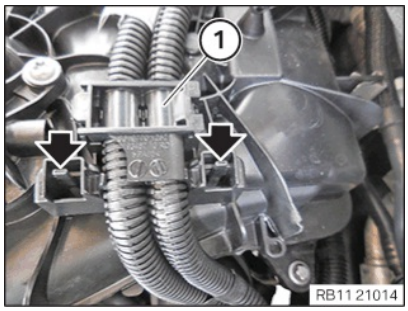
- Release the clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide the coolant hose (2) out and remove.
- Catch and dispose of escaping coolant.
- Unlock the locks (arrows).
- Guide out the wiring harness section (3) for sensor system 2 and place to one side.



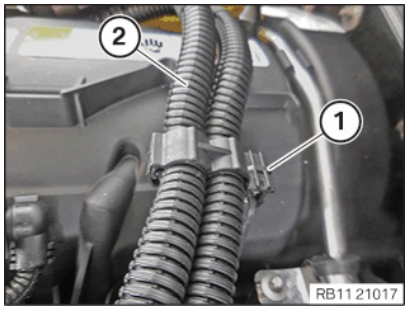
- Unlock lock (1).
- Thread out holder (2) and set aside.



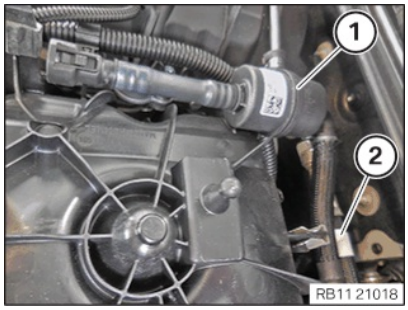
- Unlock plug connection (1) and disconnect.
- Loosen screw (2).



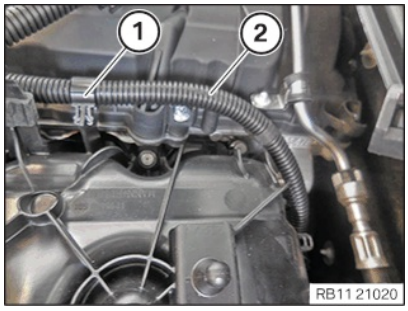
- Unlock the locks (arrows).
- Thread out the wiring harness section (1) for the injectors and ignition coils and set it aside.



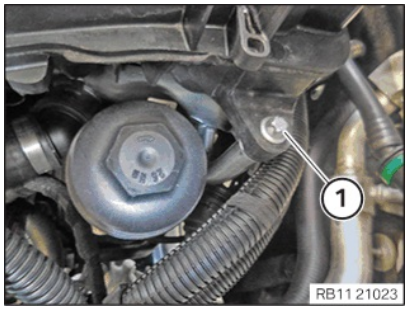
- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



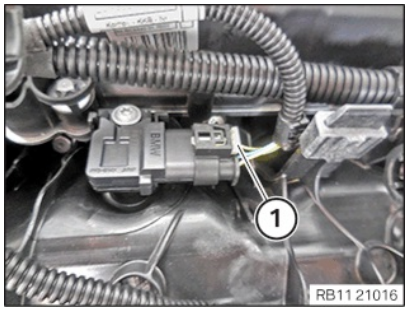
- Guide tank ventilation line (1) out of clamp (2) and place it aside.



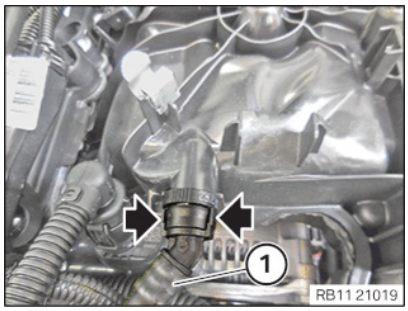
- Loosen clamp (1).
- Guide out the wiring harness section (2) for sensor system 1 and place to one side.



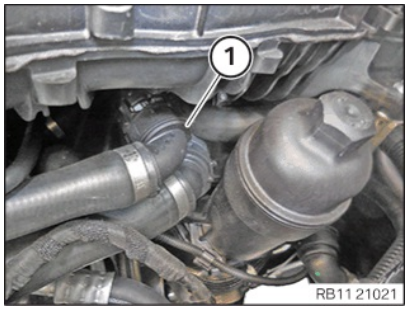
- Loosen screw (1).



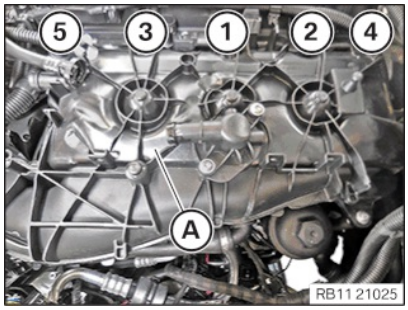
- Unlock plug connection (1) and disconnect.



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



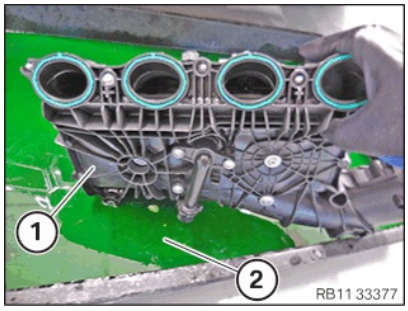
- Unlock and release coolant feed line (1).
- Catch and dispose of escaping coolant.



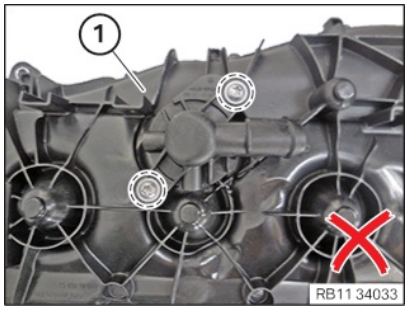
TECHNICAL INFORMATION

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

- Loosen screws in the order (5) to (1).
- Thread out intake plenum (A) and remove.



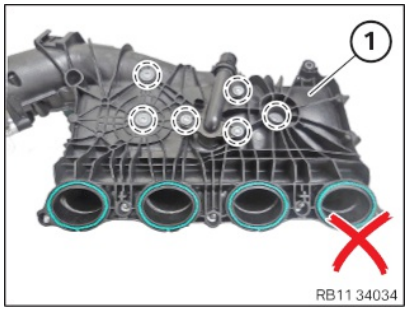
- Drain the remaining coolant (2) in the intake plenum (1).



TECHNICAL INFORMATION

The tie-rods and mounting screws from the connection neck on the intake plenum are **not** allowed be opened.

- Do **not** loosen the screws in the **marked area** on the intake plenum (1).

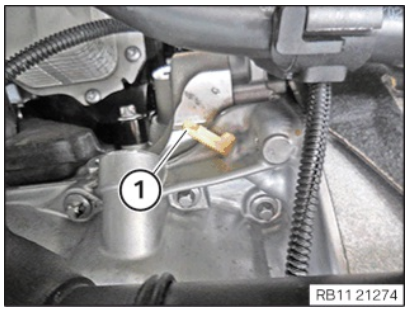


TECHNICAL INFORMATION

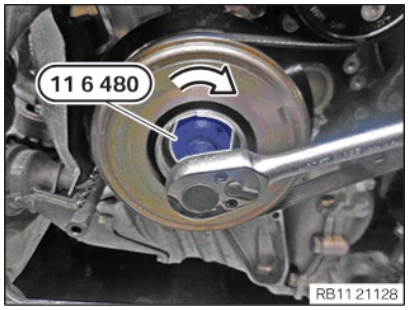
The tie-rods and mounting screws from the connection neck on the intake plenum are **not** allowed be opened.

- Do **not** loosen the screws in the **marked area** on the intake plenum (1).

49 – Blocking engine in the 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.

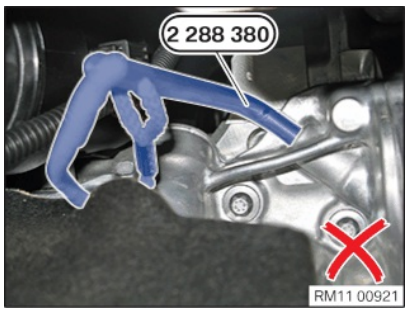
- Turn the combustion engine exclusively by hand in the correct direction of rotation: a) Clockwise, facing the vibration damper or b) Anticlockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- 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:**

  Dimensions (X) = 66 mm

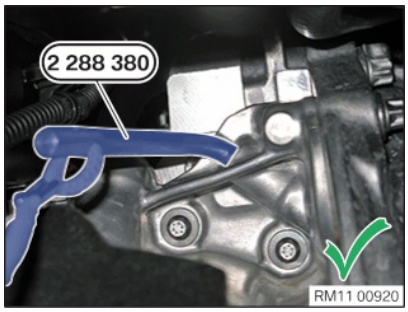
  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  The special tool 2 288 380 is **incorrectly** positioned.

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



- **Vehicles with automatic transmission:**

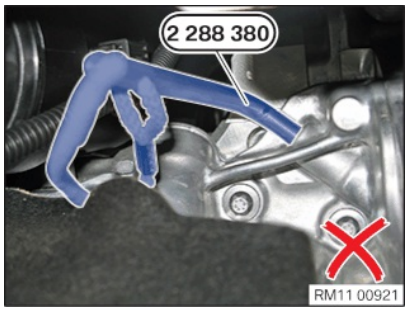
  The special tool 2 288 380 is **correctly** positioned.

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

- **Vehicles with manual gearbox:**

  Dimension (X) = 62 mm

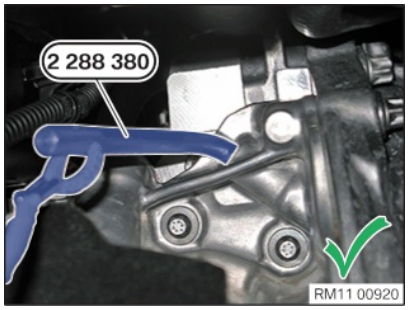
  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with manual gearbox:**

  The special tool 2 288 380 is **incorrectly** positioned.

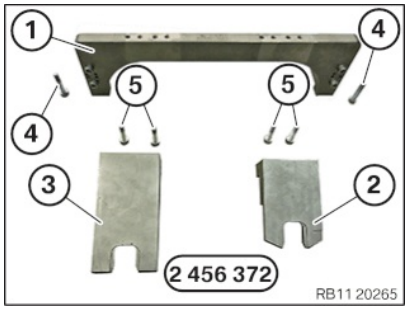
  The TDC firing position of cylinder 1 was **not** reached.



- **Vehicles with manual gearbox:**

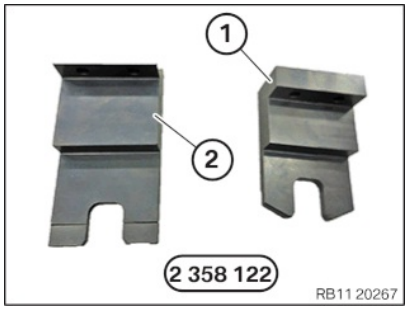
  The special tool 2 288 380 is **correctly** positioned.

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



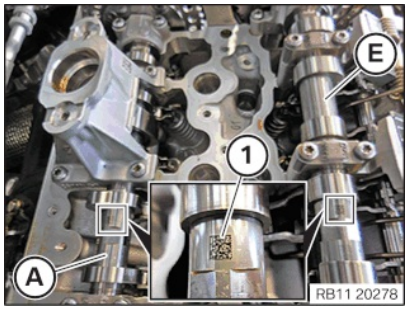
- Have the set of special tools 2 456 372 ready:

Number	Description
1	Basic carrier
2	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

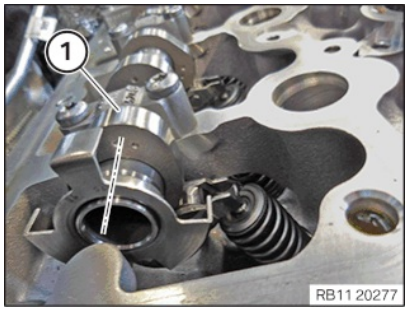


- Have the test gauges from the set of special tools 2 358 122 ready:

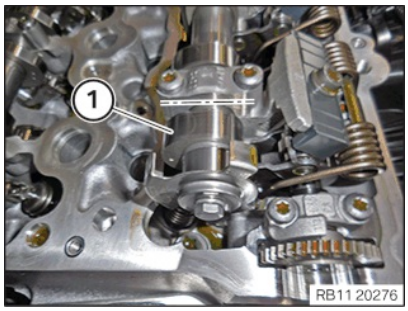
Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



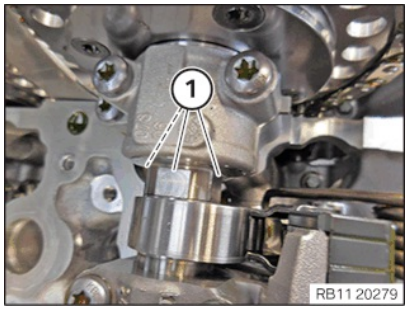
- Ensure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) can be read from above.



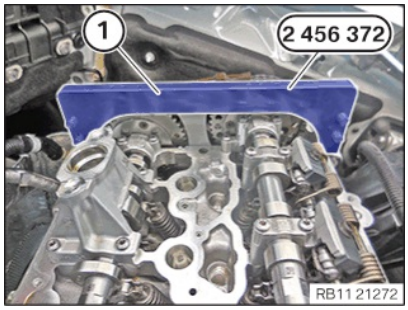
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



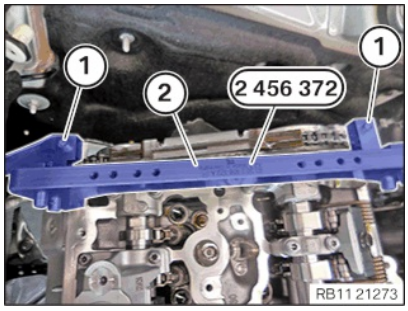
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



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



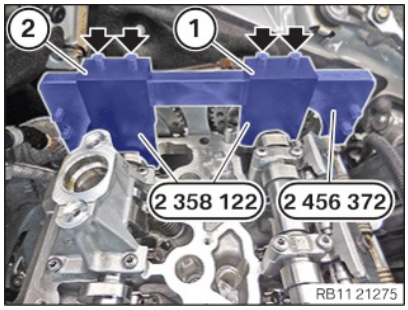
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- 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).

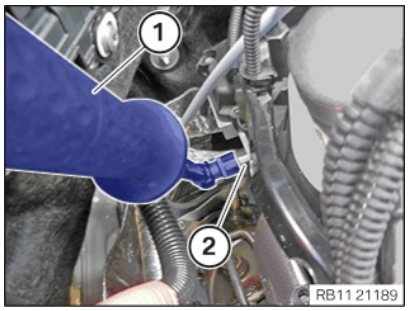
Test gauge to basic carrier

M6		Tightening torque	8 Nm

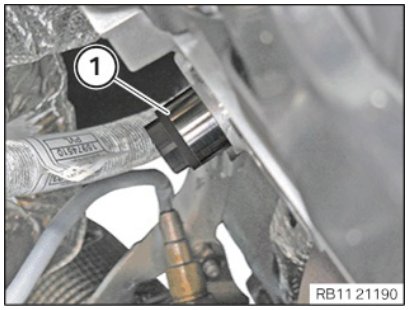
50 – Removing chain tensioner

TECHNICAL INFORMATION

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

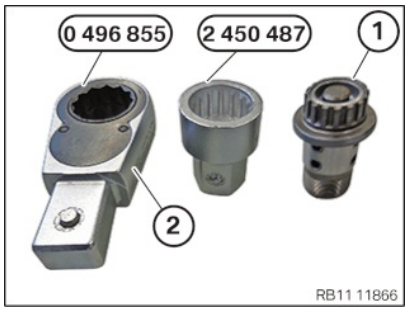


- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).

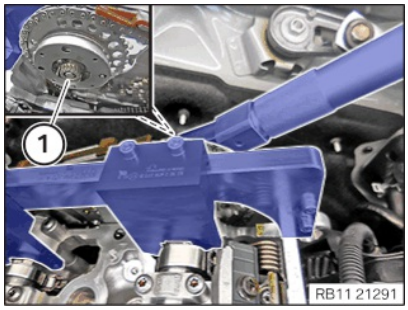


- Feed out and remove the chain tensioner (1).

51 – Releasing the VANOS central valve of the intake adjuster



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



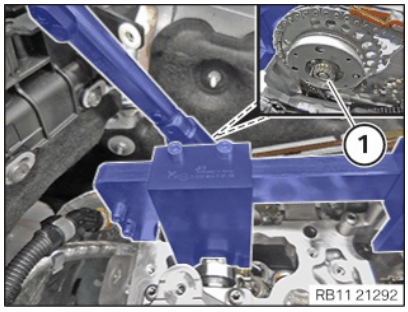
NOTICE

The figure shows the rear side of the engine.

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

52 – 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.

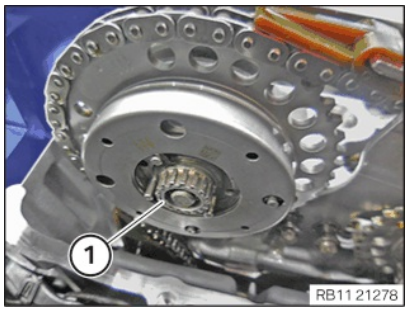


NOTICE

The figure shows the rear side of the engine.

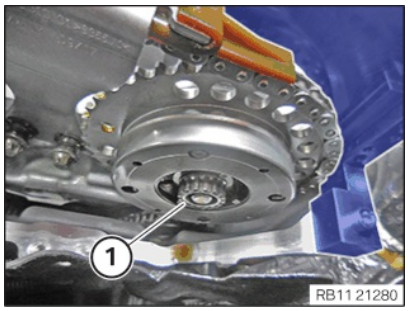
- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

53 – Removing the VANOS central valve of the intake adjuster



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

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

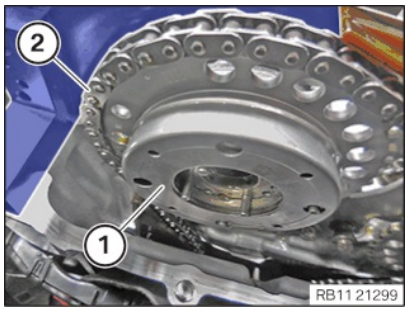


- Guide out and remove the VANOS central valve (1) of the exhaust camshaft adjuster.

55 – Removing intake adjuster

NOTICE

The figure shows the rear side of the engine.

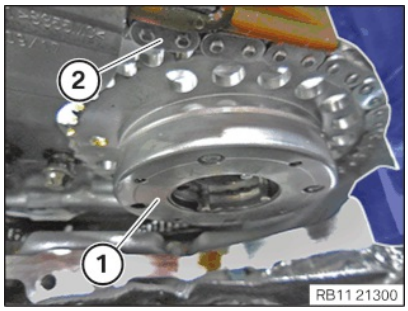


- Guide out the intake adjuster (1) from the timing chain (2) and remove.

56 – Remove exhaust camshaft adjuster

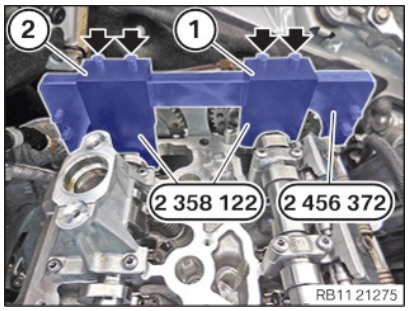
NOTICE

The figure shows the rear side of the engine.



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

57 – Remove the test gauges to fix the camshafts



- Remove screws (arrows).
- Guide out and remove test gauge (1) from the set of the 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.

58 – Removing cylinder head.

CAUTION

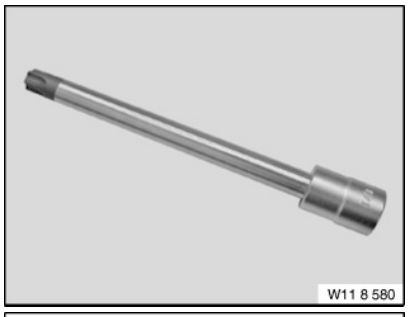
Heavy component.

Heavy components can lead to injury or damage.

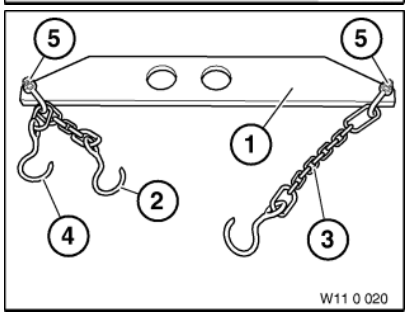
- Remove and install heavy components with the aid of another person/other persons.

TECHNICAL INFORMATION

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

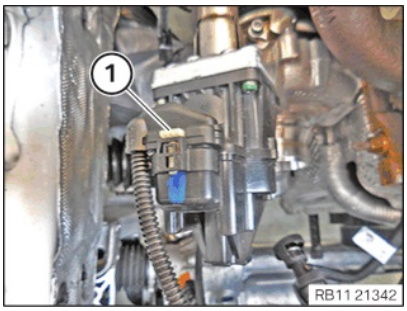


- Prepare special tool 0 495 747 (11 8 580).

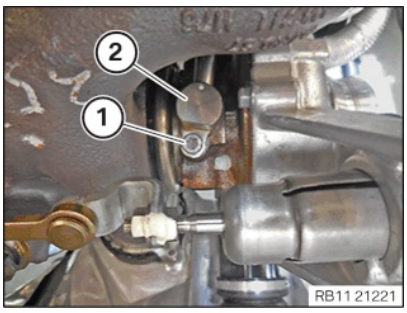


- Prepare special tool .

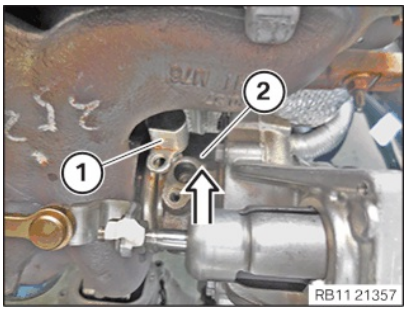
- Prepare the special tool 2 220 718.



- Unlock plug connection (1) and disconnect.

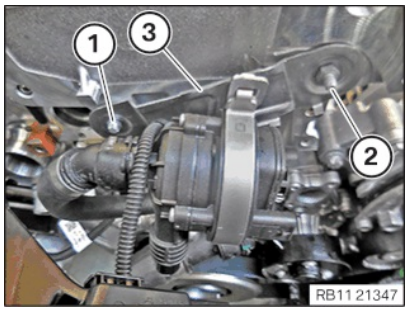


- Loosen screw (1).
- Release the oil feed line (2) on the exhaust turbocharger.

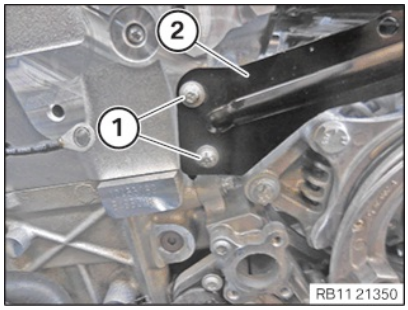


- Guide out the oil feed line (1) at the exhaust turbocharger (2) in the direction of the arrow and set aside.

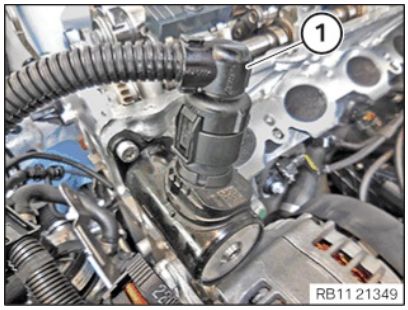
- Loosen nut (1).
- Feed out ground cable (2) and set it aside.



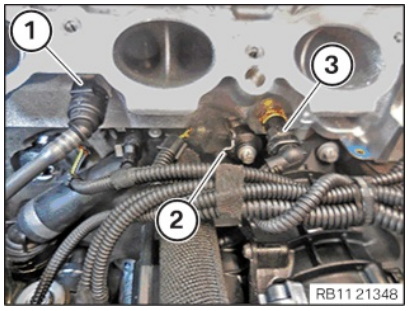
- Loosen screw (1).
- Loosen screw (2).
- Thread out holder (3) and set aside.



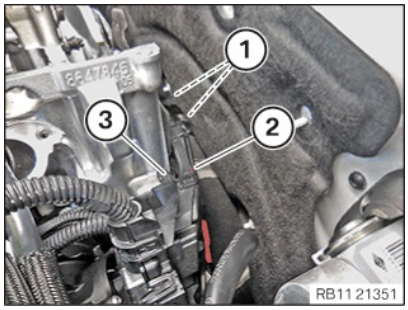
- Loosen screws (1).
- Thread out holder (2) and set aside.



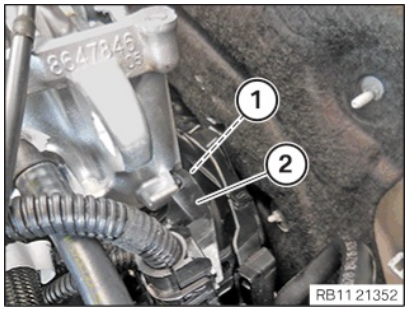
- Unlock plug connection (1) and disconnect.



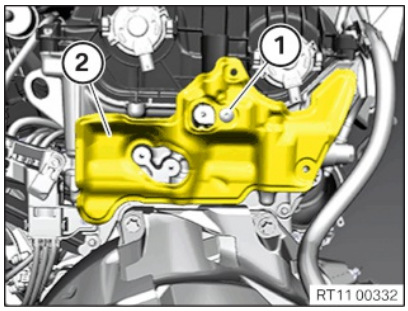
- Unlock and loosen coolant line (1).
- Unlock and disconnect plug connection (2) on the knock sensor.
- Unlock and disconnect plug connection (3) on coolant temperature sensor .



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



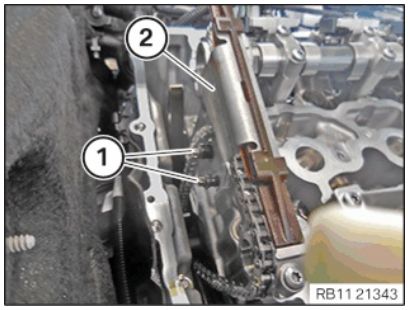
- Loosen screw (1).
- Guide out the wiring harness section (2) for sensor system 1 and place to one side.



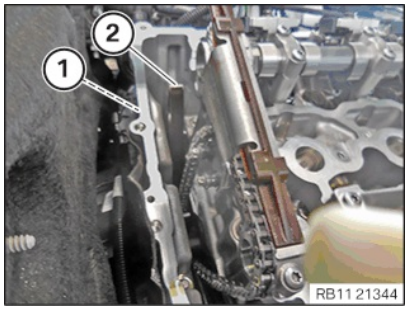
NOTICE

The figure shows the rear side of the engine.

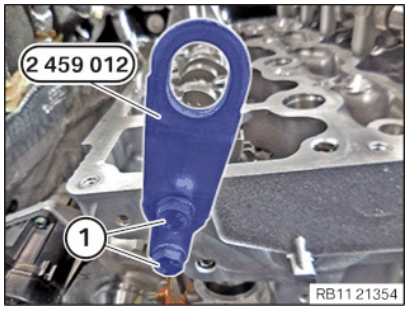
- Loosen screw (1).
- Guide out and remove the cover (2).



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



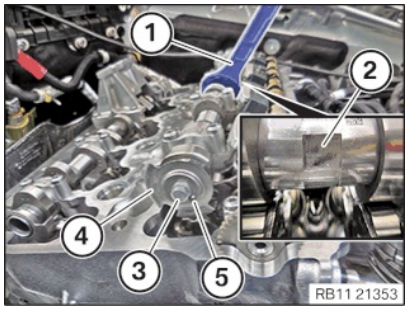
- Release the bearing journal (1) from the guide rail (2).



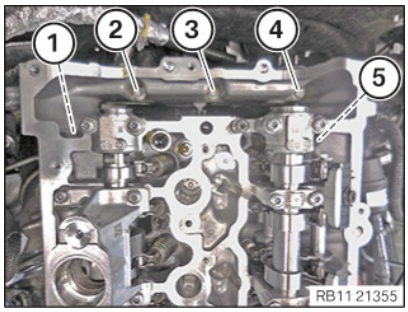
- Guide in and position special tool 2 459 012 on the cylinder head.
- Tighten the screws (1) of special tool 2 459 012.

Special tool to cylinder head

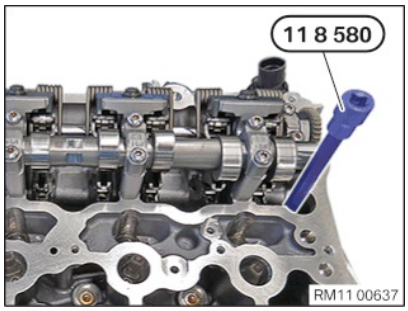
M8		Tightening torque	21,5 Nm



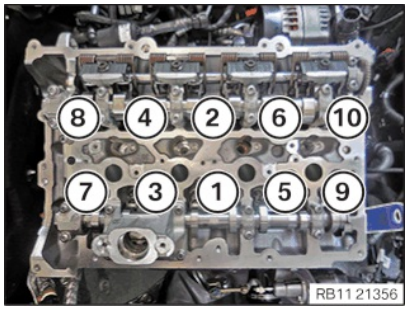
- Fix intake camshaft (2) with a commercially available open-end spanner (1).
- Loosen screw (3).
- Guide out camshaft sensor wheel (4) on guide pin (5) and remove it.



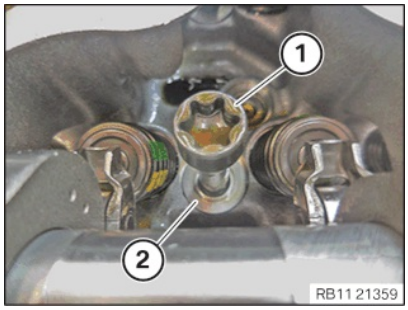
- Loosen the cylinder head bolts in the sequence from (5) to (1).



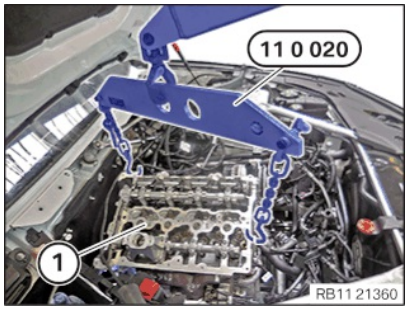
- Release cylinder head bolts with the special tool 0 495 747 (11 8 580).



- Release the cylinder head bolts with the special tool 0 495 747 (11 8 580) in the order of (10) to (1).



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



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.

- Hook special tool on special tool 2 220 718.
- Lift out cylinder head (1) and the exhaust turbocharger with the help of an **auxiliary person**, special tool 2 220 718 and special tool .
- Ensure that the **guide rails** of the timing chain are **not** damaged.

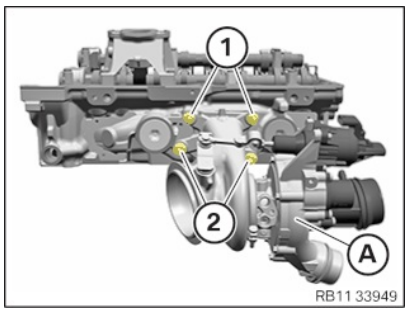
59 – Removing the exhaust turbocharger (cylinder head removed)

RISK OF DAMAGE

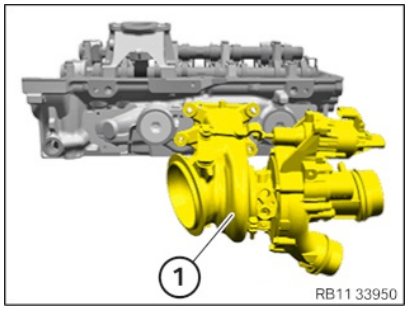
Damage to the electrical wastegate valve controller.

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

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



- Secure the exhaust turbocharger (A) from falling.
- Release nuts (1).
- Loosen screws (2).



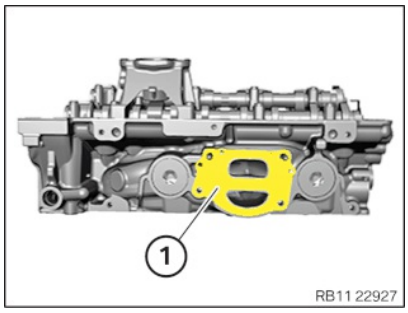
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

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

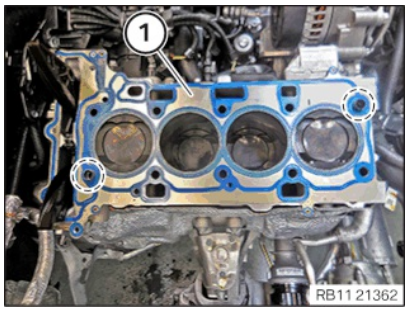
- Guide out exhaust turbocharger (1) and set it aside.



- Feed out and remove the seal (1).

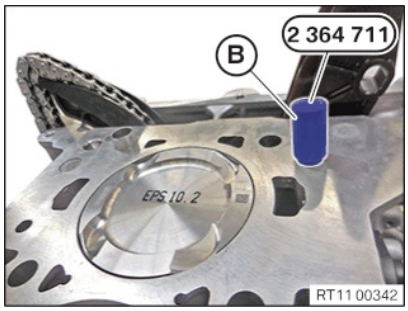
MAIN WORK

60 – Removing the cylinder head gasket



- Guide out and remove cylinder head gasket (1) in the **marked** area.

61 – Sealing the oil duct



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

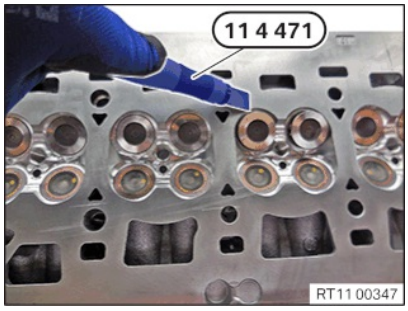
62 – Cleaning sealing surfaces

RISK OF DAMAGE

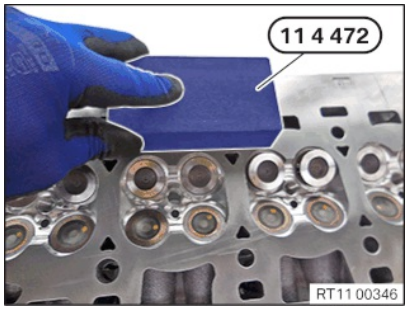
Damage to the surface.

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

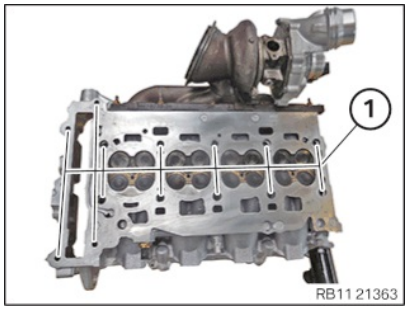
- Do not use any metal-cutting tools.



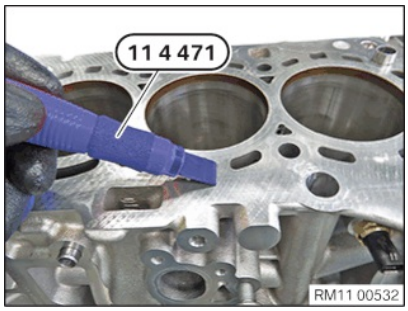
- Remove coarse backlogs from the sealing surfaces of the cylinder head using special tool 0 495 103 (11 4 471).



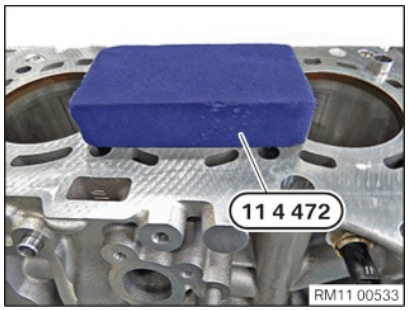
- Remove fine residues from the sealing surfaces of the cylinder head using special tool 0 495 104 (11 4 472).



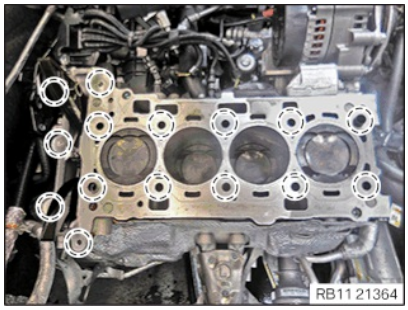
- Clean all blind holes (1) of the cylinder head.



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



- 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

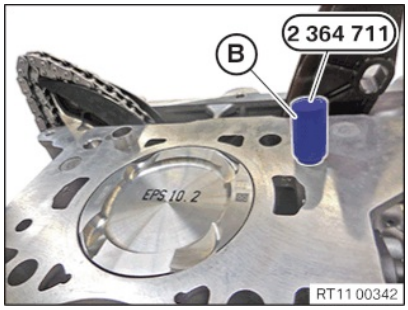
Swirling dirt particles caused by compressed air.

Danger of injury!

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

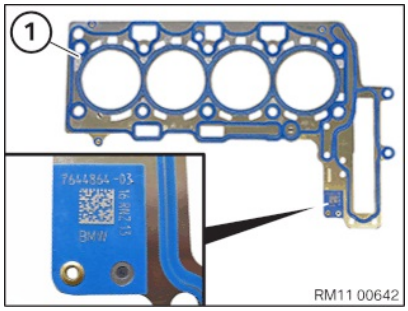
- Wear safety goggles.

- Clean all the threaded holes in the **marked** areas of the crankcase with compressed air.



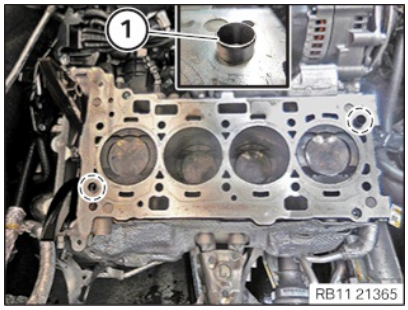
- Remove special tool (B) from the set of special tools 2 364 711.

63 – Replace cylinder head gasket

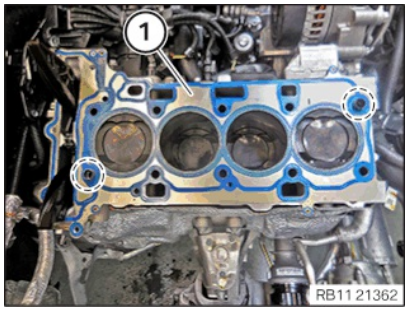


- Identify the cylinder head gasket (1) using the part number.

Note: If the cylinder head is reworked, an additional seal that is 0.3 mm thicker is available for the service.

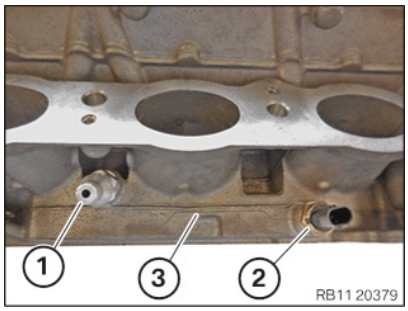


- Check the fitting sleeves (1) in the **marked** area for damage, renew if necessary.

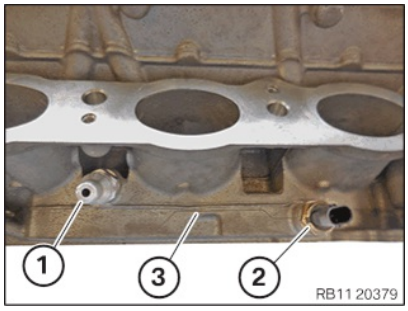


- Guide cylinder head gasket (1) into the **marked** area and install it.

64 – Replacing the cylinder head (remounting the components)



- Detach ventilation connection (1) on cylinder head (3).
- Detach coolant temperature sensor (2) on cylinder head (3).



- Renew cylinder head (3).

  Parts: Cylinder head
- Tighten ventilation connection (1) on cylinder head (3).

Ventilation connection/special tool to cylinder head

M10		18 Nm

- Tighten coolant temperature sensor (2) on cylinder head (3).

Coolant temperature sensor at cylinder head

Sensor		Tightening torque	18 Nm

POSTPROCESSES

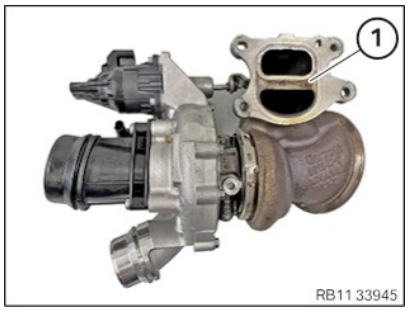
65 – Installing the exhaust turbocharger (cylinder head removed)

RISK OF DAMAGE

Damage to the electrical wastegate valve controller.

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

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



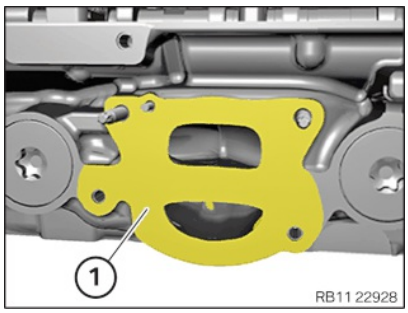
RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

- Clean the sealing surface (1) using special tool 0 495 102 (11 4 470).



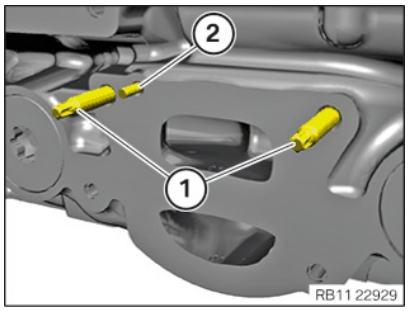
RISK OF DAMAGE

Damage to the surface.

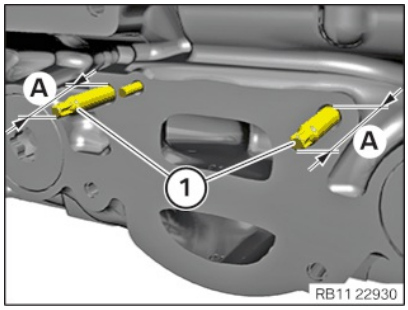
The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

- Clean the sealing surface (1) using special tool 0 495 102 (11 4 470).



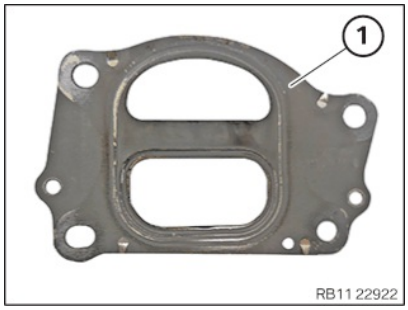
- Check stud bolts (1) and (2) for damage and renew as needed.
- Check for correct fit of stud bolt (2).



- Check insertion depth (A) of stud bolt (1).

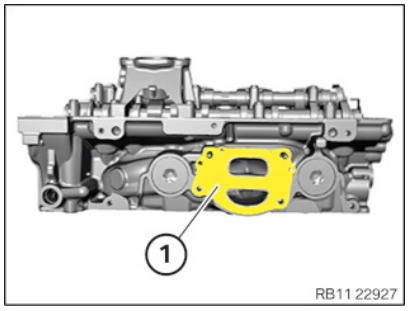
Screw-in depth of upper stud bolt on cylinder head

Screw-in depth	30 mm

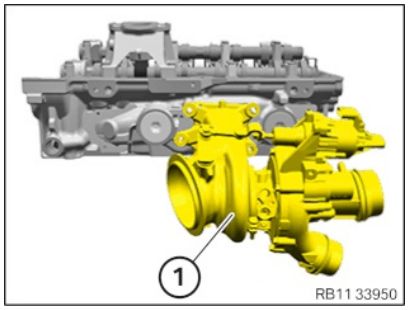


- Renew the seal (1).

  Parts: Gasket



- Insert and install the seal (1).



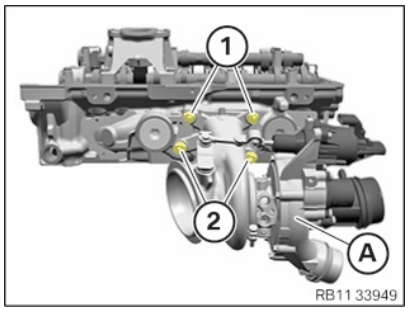
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

- Feed in and position the exhaust turbocharger (1).
- Secure the exhaust turbocharger (1) against falling down.



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.

- Renew the nuts (1) and bolts (2).

  Parts: Nuts, bolts
- Tighten nuts (1) by hand.
- Hand-tighten the bolts (2).
- Tighten the nut (1) and screws (2) on the exhaust turbocharger (A).

Exhaust turbocharger to cylinder head

M7	Renew screws. Replace nuts.	1. Jointing torque	5 Nm
		2. tightening torque	18 Nm
		3. tightening torque	18 Nm

66 – 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.

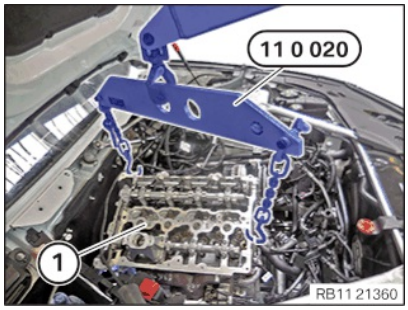
- Dry threaded holes (e.g. using compressed air).

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.



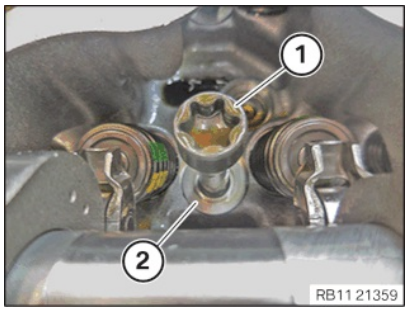
RISK OF DAMAGE

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.

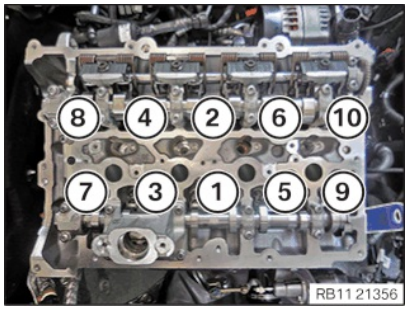
- Guide in, position and install cylinder head (1) and the exhaust turbocharger with the help of an auxiliary person, special tool 2 220 718 and special tool .
- Ensure that the **guide rails** of the timing chain are **not** damaged.



- Guide in and install all the washers (2).
- Renew all 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 engine block.
- Guide in and install all the cylinder head bolts (1).



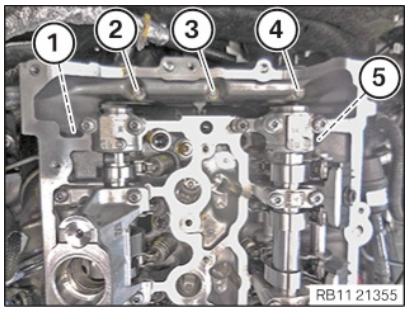
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.

- Feed in cylinder head bolts (1) to (10) and install.
- Screw in the cylinder head bolts in the sequence (1) to (10).
- Tighten cylinder head bolts using special tools 0 495 747 (11 8 580) and 0 490 504 (00 9 120) in sequence (1) to (10).

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 °

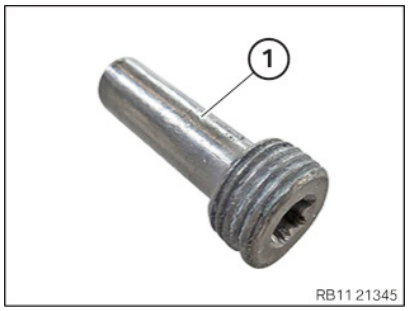


- Renew cylinder head bolts (1) to (5).

  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).

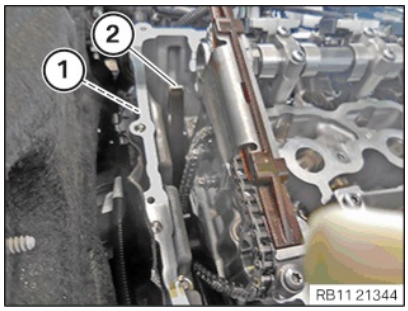
Cylinder head bolt to timing case cover

M8x40	Renew screws.	Tightening torque	19 Nm



- Renew bearing journal (1).

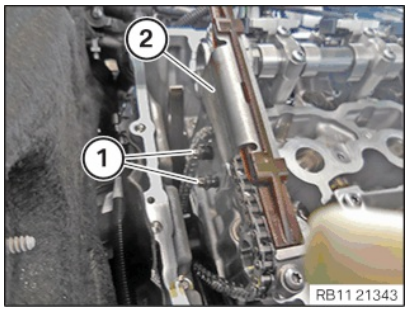
  Parts: Bearing journal



- Feed in and install bearing journal (1) on the guide rail (2).
- Tighten the bearing journals (1).

Bearing journal to cylinder head

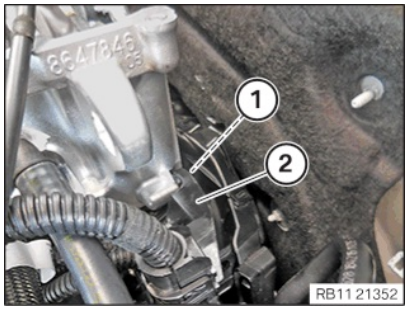
Bearing journal	Renew the bearing journal!	Tightening torque	22 Nm



- Insert slide rail (2) and install.
- Tighten the screws (1).

Sliding rail to cylinder head

M6x16			8 Nm



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

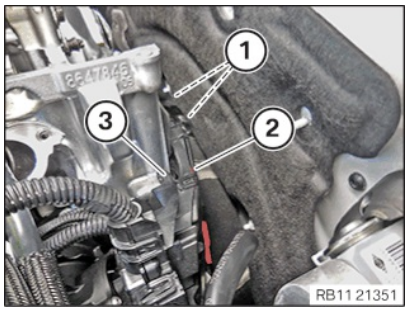
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- 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 clip on rear cylinder head/transmission

M6 x 20		Tightening torque	8 Nm



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

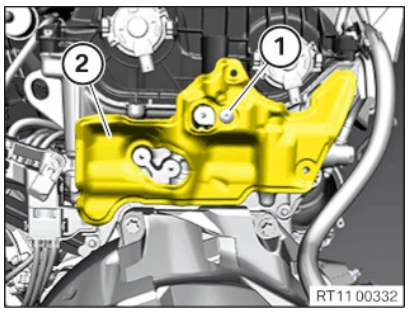
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- 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 clip on rear cylinder head/transmission

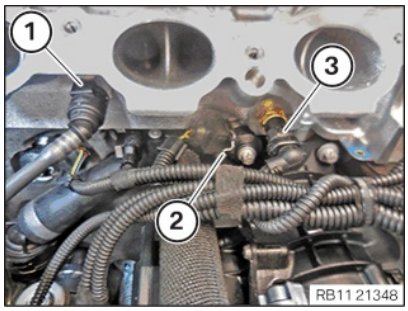
M6 x 20		Tightening torque	8 Nm



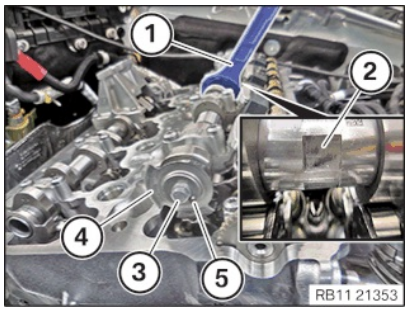
- Guide in and install cover (2).
- Tighten down screw (1).

Cover on rear cylinder head

M6		Tightening torque	8 Nm



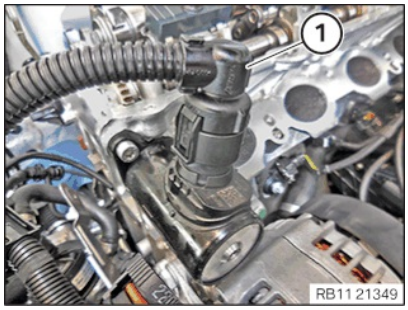
- Connect connector (3) on the coolant temperature sensor and lock it.
- Make sure that the connector (3) engages audibly on the coolant temperature sensor.
- Connect connector (2) on the knock sensor and lock it.
- Ensure that connector (2) engages audibly on the knock sensor.
- Connect and lock coolant line (1).
- Make sure that the cooling line (1) engages audibly.



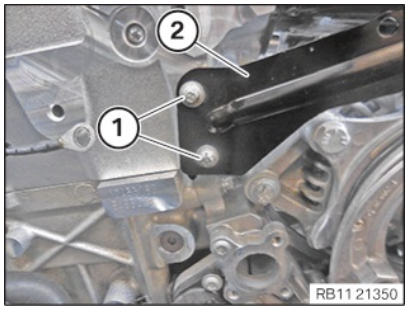
- Guide in and position camshaft sensor wheel (4) on guide pin (5).
- Fix intake camshaft (2) with a commercially available open-end spanner (1).
- Tighten down screw (3).

Camshaft sensor wheel to intake camshaft

M6x16	Renew screw.	1. Tightening torque	5 Nm
		2. Angle of rotation	90°



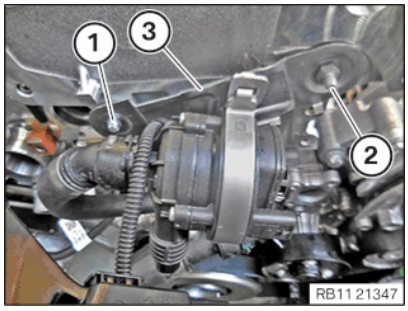
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



- Insert and install the holder (2).
- Tighten the screws (1).

Manifold support for intake air to cylinder head

M6X16		Tightening torque	8 Nm



- Insert and position the holders (3).
- Tighten down screws (1) and (2).

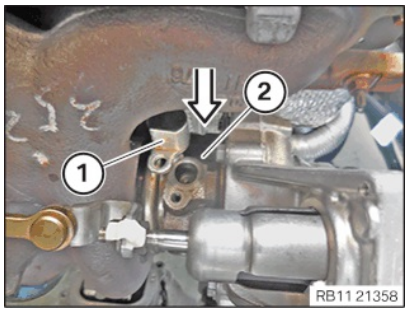
Holder for electrical auxiliary coolant pump on cylinder head

M6		Tightening torque	7 Nm

- Thread in ground cable (2) and install.
- Tighten nut (1).

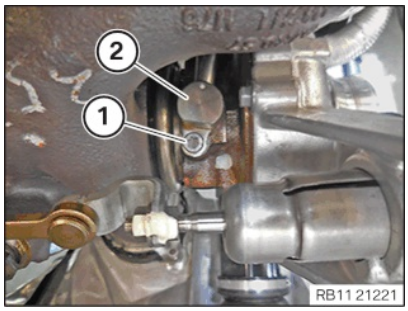
Standard screw connection M6

M6		Tightening torque	8 Nm



- Renew the sealing ring of oil feed line (1) with special tool 0 496 714 (00 9 030).

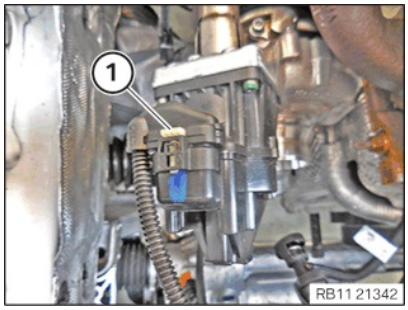
  Parts: Sealing ring
- Guide in and install oil feed line (1) in the direction of the arrow on exhaust turbocharger (2).



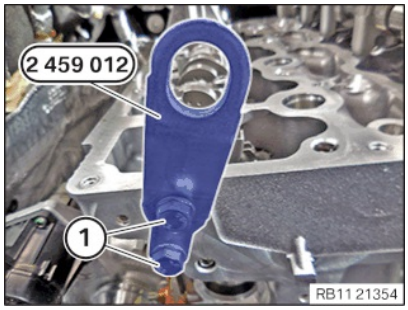
- Tighten screw (1) on the oil feed line (2).

Oil feed line to exhaust turbocharger/crankcase

M6x12		Tightening torque	8 Nm

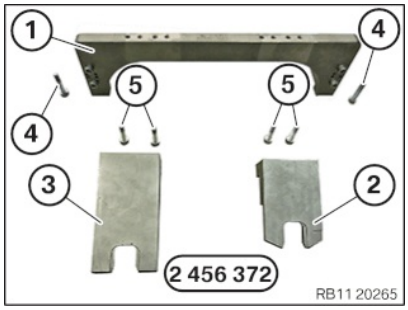


- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



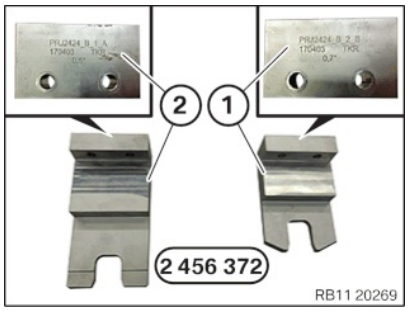
- Unscrew the bolts (1) of the special tool 2 459 012.
- Feed out the special tool 2 459 012 at the cylinder head and remove.

67 – Adjust the camshafts with the special tool

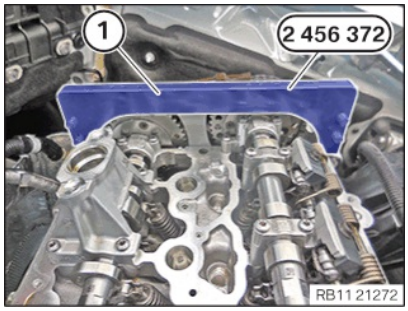


- Keep set of special tools 2 456 372 ready:

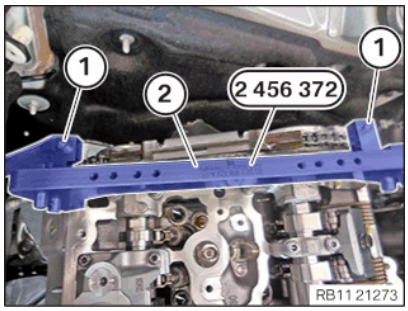
Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- 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.



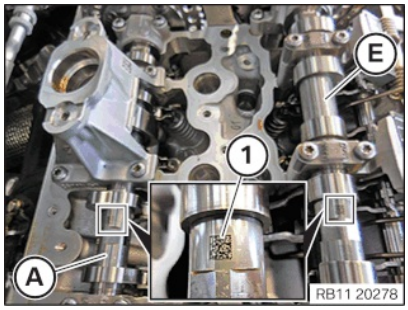
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



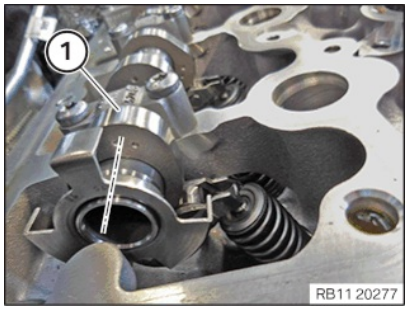
- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

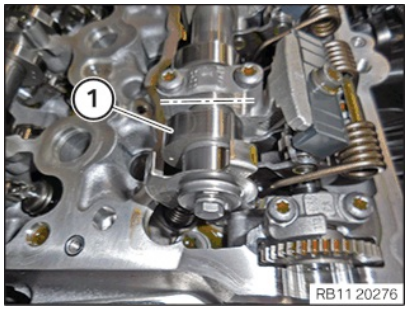
M6		Tightening torque	8 Nm



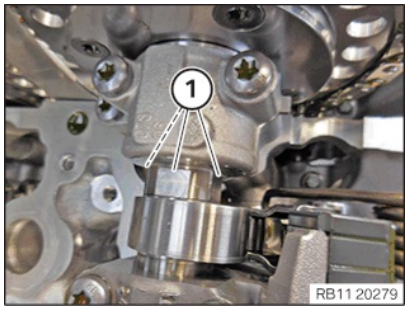
- Turn intake camshaft (E) and exhaust camshaft (A) to the correct position so that marks (1) can be read from above.



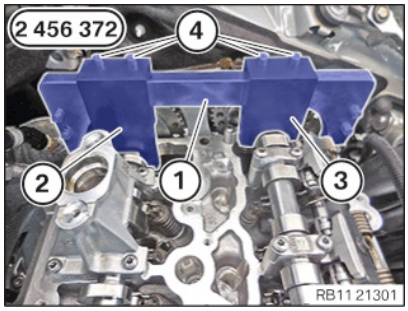
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the 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).

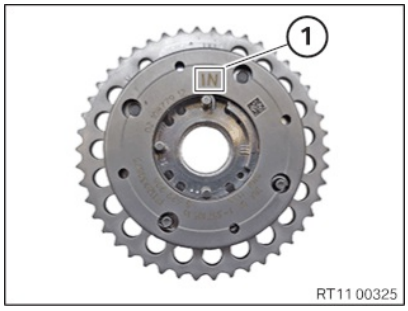
Test gauge to basic carrier

M6		Tightening torque	8 Nm

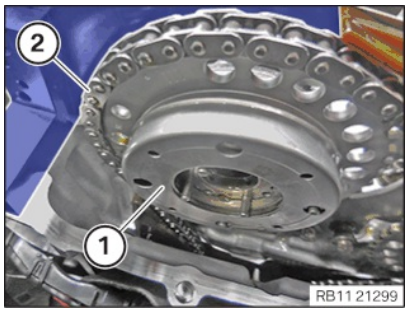
68 – Installing the intake adjuster

NOTICE

The figure shows the rear side of the engine.

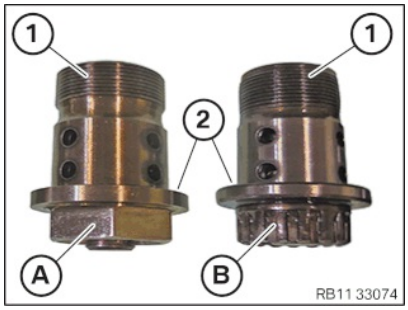


- Keep intake adjuster (1) marked IN ready.



- Feed in intake adjuster (1) in the timing chain (2) and position on the intake camshaft .

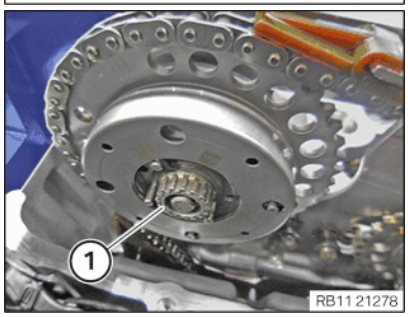
69 – Install the VANOS central valve of the intake adjuster



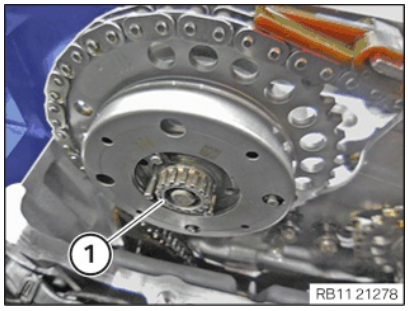
- **Equipment specification A with the thread M22:**

  Coat the VANOS central valve (A) on the thread (1) with **fresh** engine oil.
- Coat the VANOS central valve (A) on the contact surface (2) with **fresh** engine oil.
- **Equipment specification B with the thread M21:**

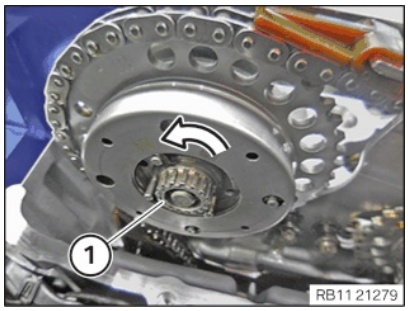
  Coat the VANOS central valve (B) on the thread (1) with **fresh** engine oil.
- Coat the VANOS central valve (B) on the contact surface (2) with **fresh** engine oil.



- Guide in the VANOS central valve (1) of the intake adjuster and install.



- Hand-tighten the VANOS central valve (1) of the intake adjuster.

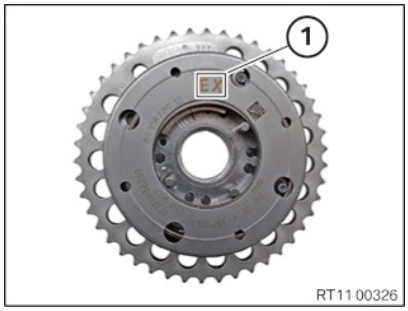


- Release the VANOS central valve (1) of the intake adjuster **in the direction of arrow** by 60°.

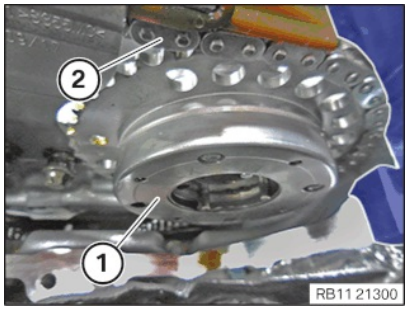
70 – Install exhaust camshaft adjuster

NOTICE

The figure shows the rear side of the engine.

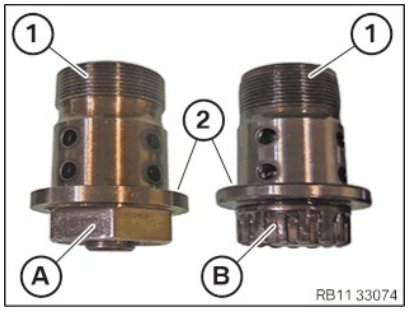


- Keep exhaust camshaft adjuster (1) marked EX ready.



- Feed in exhaust camshaft adjuster (1) in the timing chain (2) and position on the exhaust camshaft .

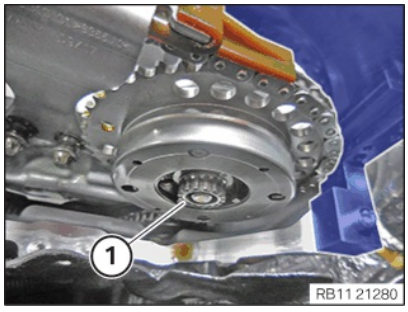
71 – Installing the VANOS central valve of the exhaust camshaft adjuster



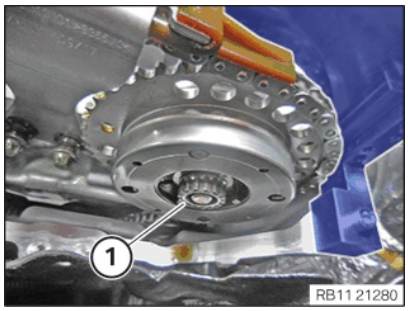
- **Version A with the thread M22:**

  Wet the VANOS central valve (A) at the thread (1) with **fresh** engine oil.
- Wet the VANOS central valve (A) on the contact surface (2) with **fresh** engine oil.
- **Version B with the thread M21:**

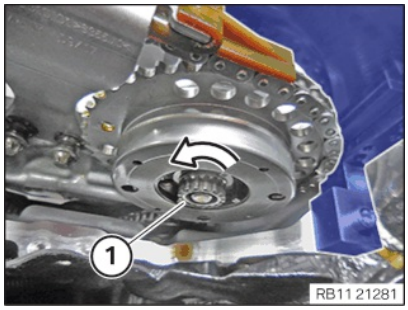
  Wet the VANOS central valve (B) at the thread (1) with **fresh** engine oil.
- Wet the VANOS central valve (B) on the contact surface (2) with **fresh** engine oil.



- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.

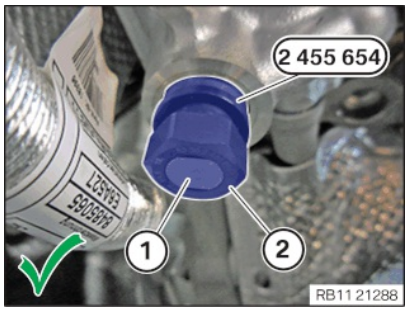


- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.



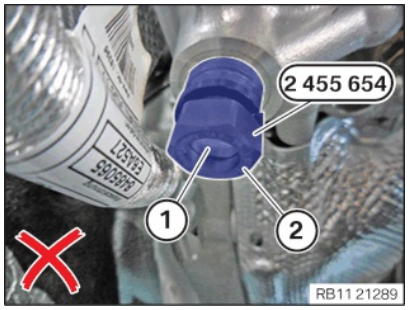
- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60°.

72 – 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.

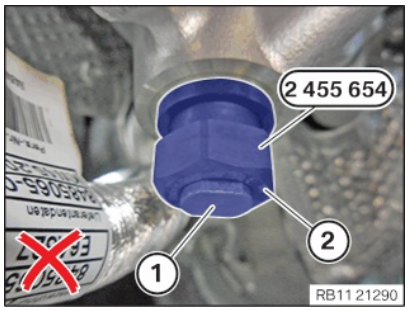
  The pin (1) must align **precisely** with housing (2).



- 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.



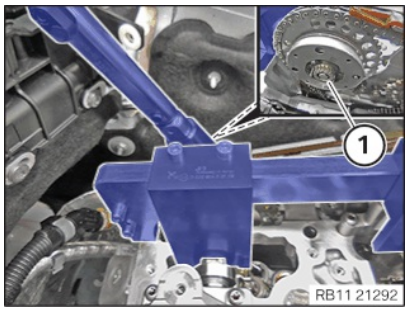
- Make sure that the preload of the timing chain is not **too high**.

  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.

73 – 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.

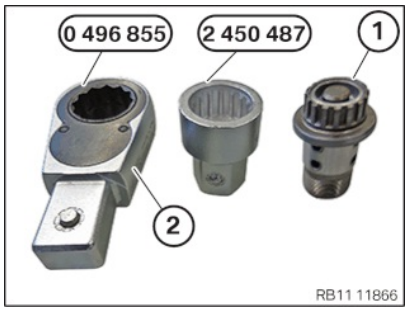


- Tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

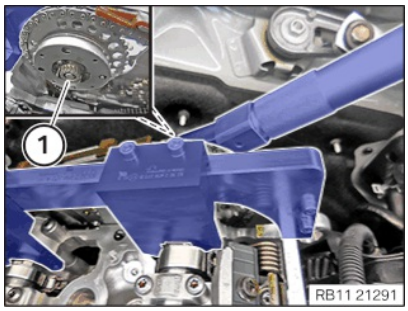
VANOS central valve to camshaft

M21	*VANOS central valve on the thread and on the contact surface must be coated with engine oil.*	1. Tightening torque	50 Nm
		2. Tightening torque	140 Nm
M22	*VANOS central valve on the thread and on the contact surface must be coated with engine oil.*	1. Tightening torque	50 Nm
		2. Tightening torque	140 Nm

74 – 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.

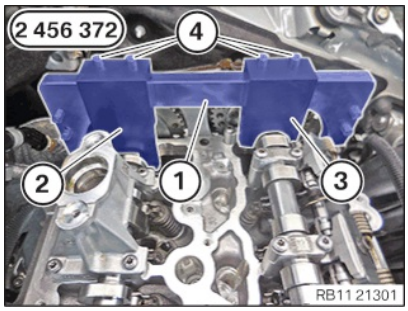


- Tighten the VANOS central valve (1) of the intake adjuster.

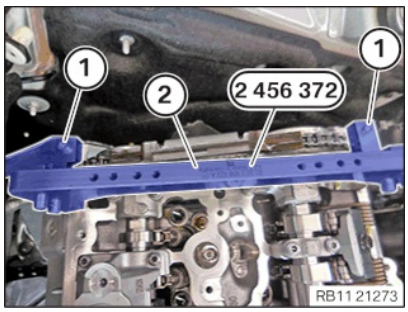
VANOS central valve to camshaft

M21	*VANOS central valve on the thread and on the contact surface must be coated with engine oil.*	1. Tightening torque	50 Nm
		2. Tightening torque	140 Nm
M22	*VANOS central valve on the thread and on the contact surface must be coated with engine oil.*	1. Tightening torque	50 Nm
		2. Tightening torque	140 Nm

75 – Disassembling all special tools

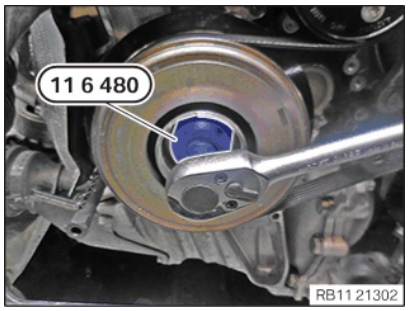


- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) and remove.

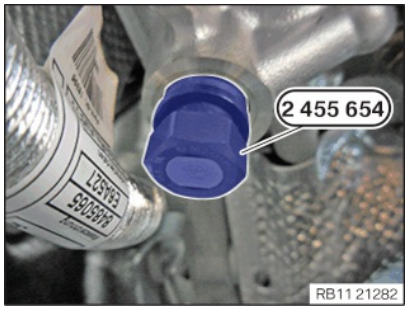


- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.

- Guide the special tool 2 288 380 out and remove.



- Guide the special tool 0 493 380 (11 6 480) out and remove.



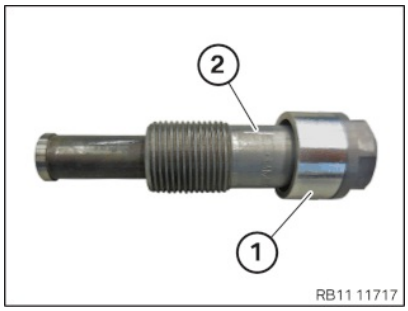
- Guide the special tool (1)2 455 654 out and remove.

76 – Install chain tensioner

TECHNICAL INFORMATION

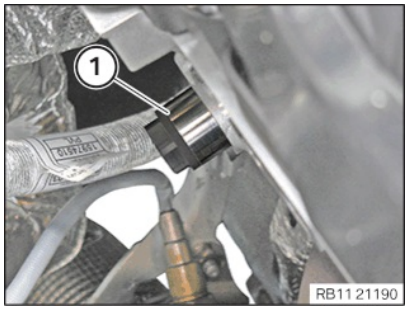
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

- 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.

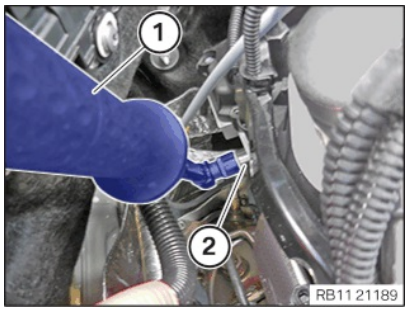


- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.



- Insert and install the chain tensioner (1).

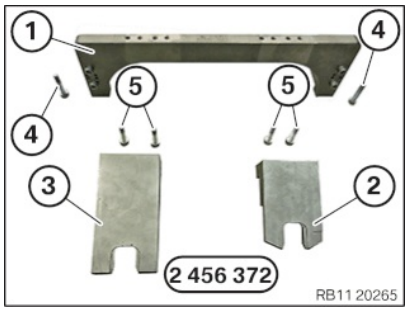


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

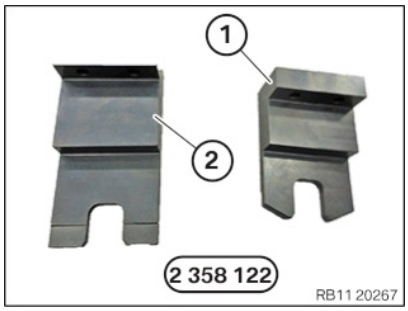
Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

77 – Checking camshaft timing



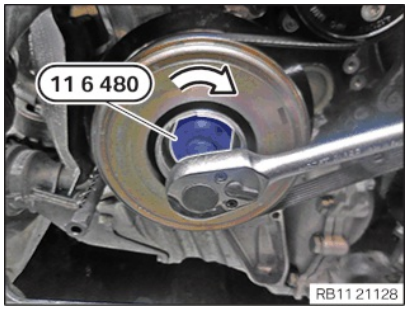
- Keep the set of special tools 2 456 372 at hand:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Screws of the basic carrier on the cylinder head
5	Screws of the gauge on the basic carrier



- Check the test gauges from the set of special tools 2 358 122 for completeness:

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



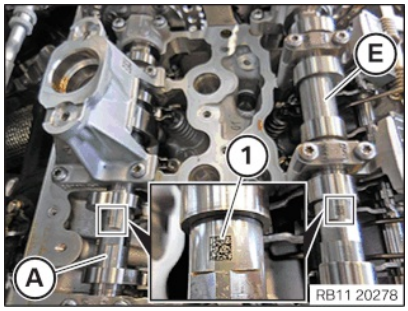
RISK OF DAMAGE

Damage to the engine.

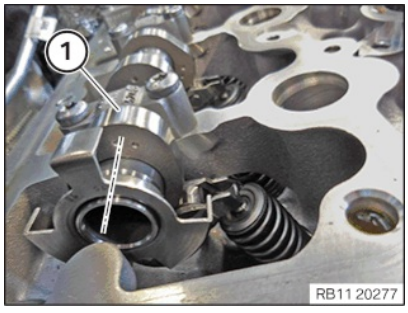
The engine may be damaged if it is manually rotated in the wrong direction.

- Turn the combustion engine exclusively by hand in the correct direction of rotation: a) Clockwise, facing the vibration damper or b) Anticlockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

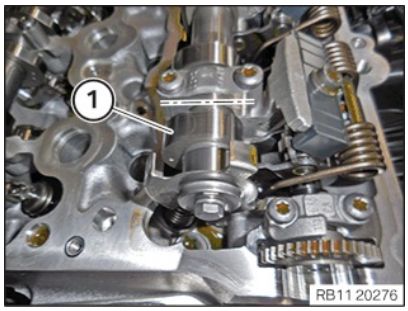
- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



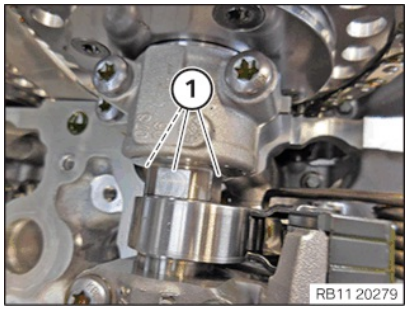
- Make sure the markings (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.



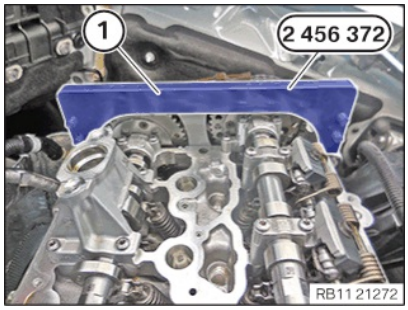
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



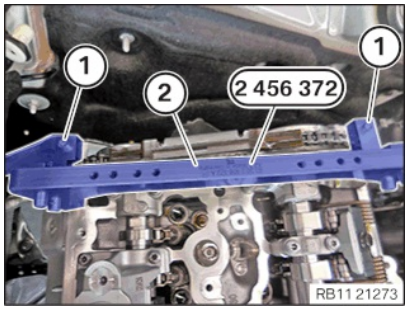
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Make sure that the flattened areas (1) on the intake and exhaust camshafts point upwards.



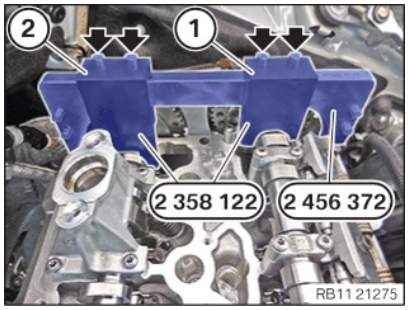
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

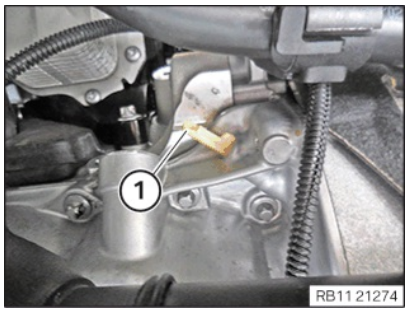
M6		Tightening torque	8 Nm



- 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

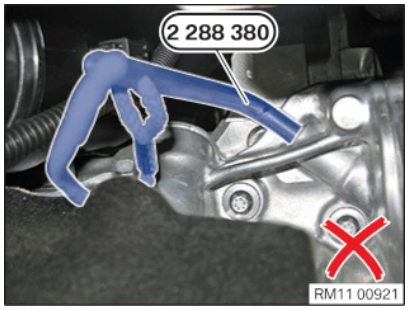


- Thread the sealing cap (1) out and remove.

- **Vehicles with automatic transmission:**

  Dimensions (X) = 66 mm

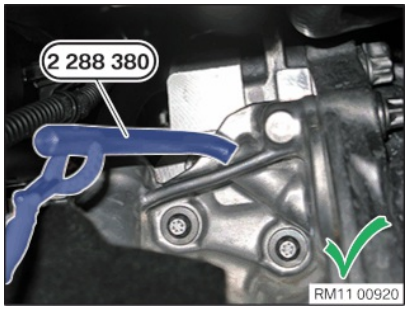
  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

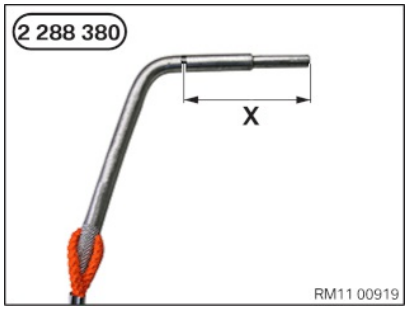
  The TDC firing position of cylinder 1 was **not** reached.



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

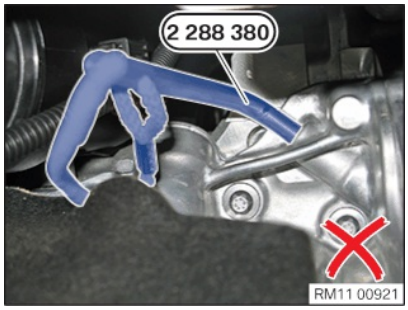
  The engine **is in the** TDC firing position of cylinder 1.



- **Vehicles with manual gearbox:**

  Dimension (X) = 62 mm

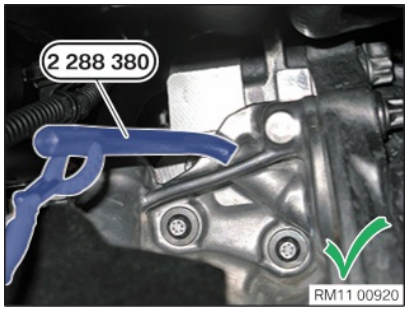
  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with manual gearbox:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

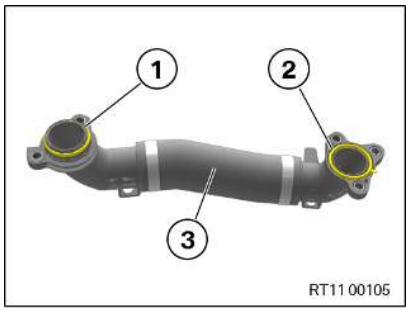


- **Vehicles with manual gearbox:**

  Special tool 2 288 380 has been **correctly** positioned.

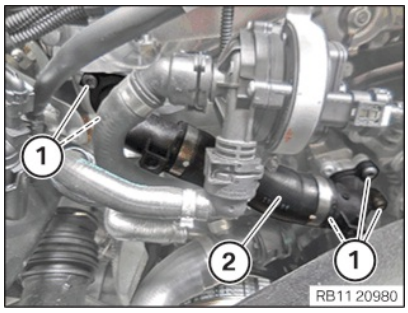
  The engine **is in the** TDC firing position of cylinder 1.

78 – Install the coolant line between the coolant pump and the cylinder head



- Check the sealing rings (1) and (2) for damage and if necessary, renew the coolant line (3).

  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

79 – Installing the intake plenum

RISK OF DAMAGE

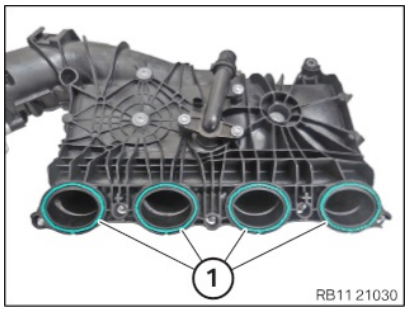
Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

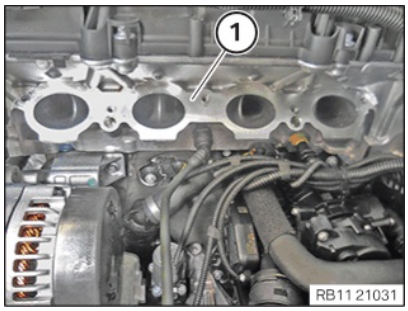
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

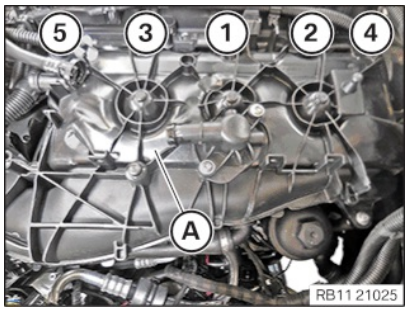


- Renew gaskets (1).

  Parts: Seals



- Clean contact surface (1).



TECHNICAL INFORMATION

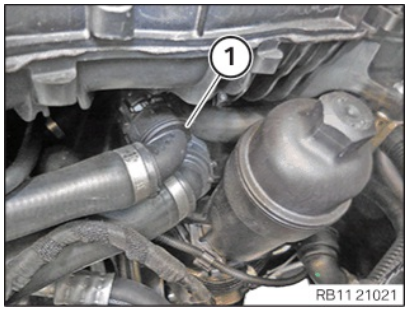
Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Guide in and position intake plenum (A) on the cylinder head.
- Tighten screws in the order (1) to (5).

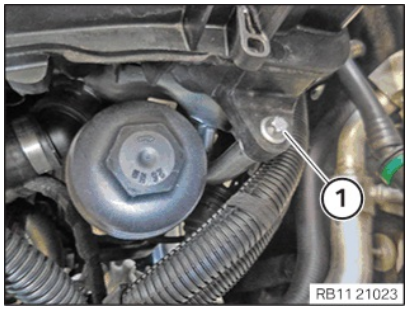
Note: Tighten the bolts in 360 degree steps.

Intake plenum to cylinder head

M6		Tightening torque	10 Nm



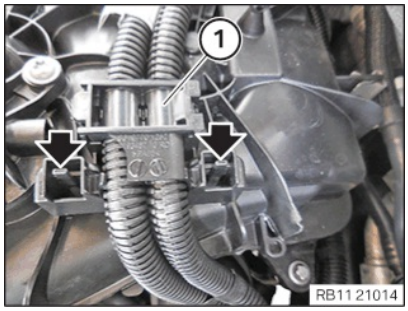
- Connect and lock coolant feed line (1).
- Make sure that coolant feed line (1) engages audibly.



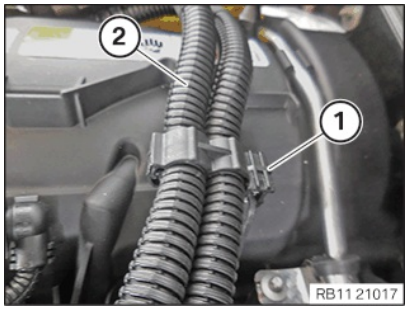
- Tighten down screw (1).

Intake plenum to support

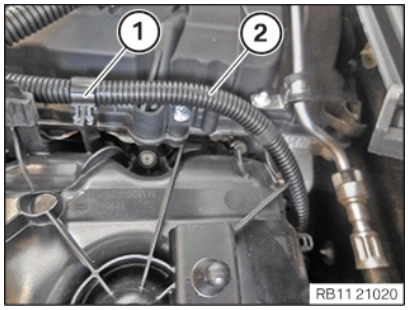
M6X25		Tightening torque	8 Nm



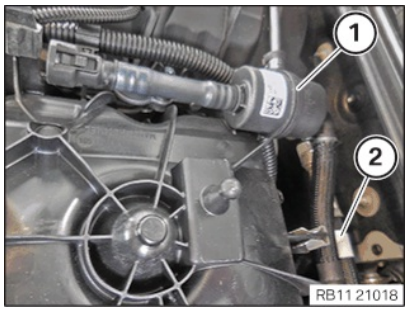
- Insert and install the wiring harness section (1) for the injectors and ignition coils.
  The locks (arrows) must engage audibly.



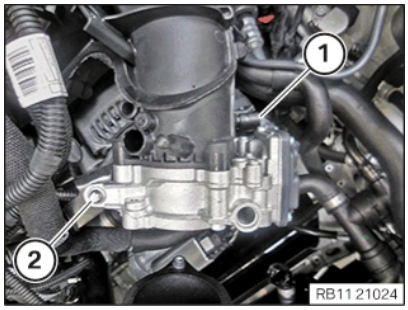
- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).



- Guide in and install wiring harness section (2) for sensor system 1.
- Secure clamps (1).



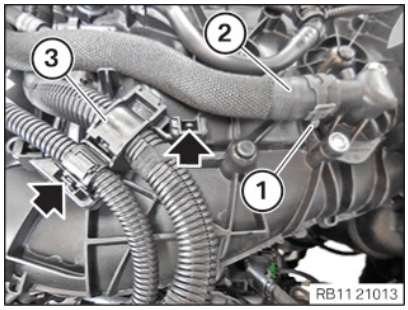
- Insert and install the tank ventilation line (1).
- Secure the tank ventilation line (1) to the clamp (2).



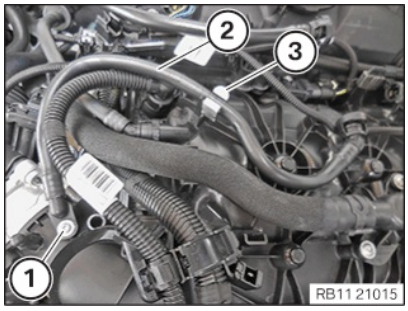
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.
- Tighten down screw (2).

Throttle body to holder

M6X25		Tightening torque	8 Nm



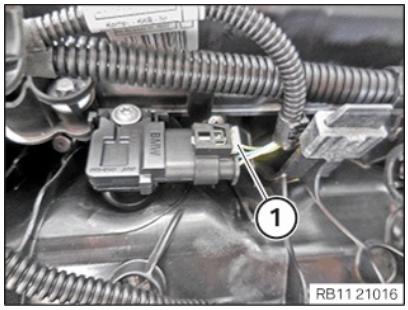
- Insert and install the coolant hose (2).
- Secure clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide in and install wiring harness section (3) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Insert and install the tank ventilation line (2).
- Secure the tank ventilation line (2) to the clamp (3).
- Tighten down screw (1).

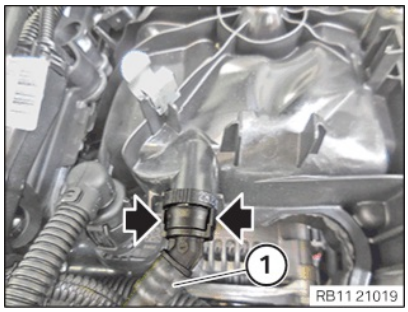
Tank ventilation line to intake plenum

Oval-head screw		Tightening torque	3 Nm



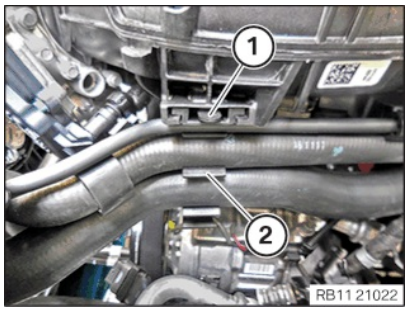
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

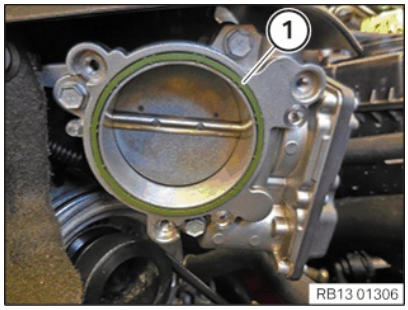


- Insert and install the tank ventilation line (1).

  The locks (arrows) must engage audibly.

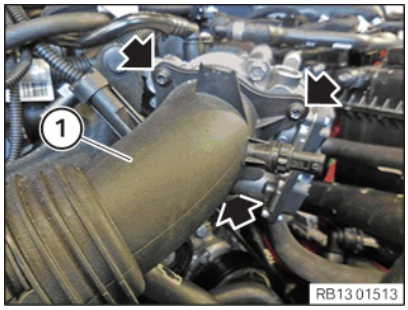


- Insert and install the holder (2).
- Ensure that the lock (1)engages audibly.



- Renew the gasket (1).

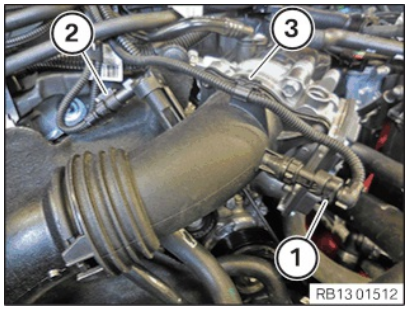
  Parts: Gasket



- Insert and install charge air line (1).
- Tighten screws (arrows).

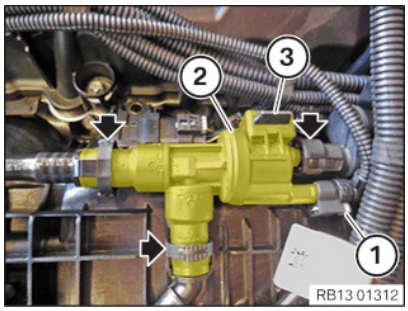
Charge air line to throttle body

M6		Tightening torque	8 Nm



- Connect connectors (1) and lock.
- Connect connectors (2) and lock.
- Make sure you can hear the connectors (1) and (2) engage.
- Secure clamps (3).

80 – Installing the tank vent valve

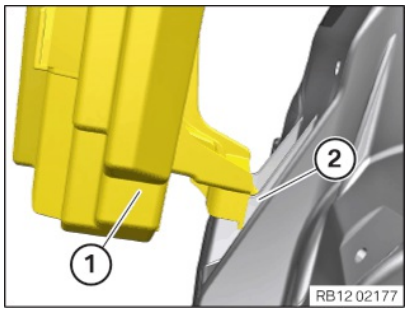


- Secure the tank vent valve (2) to the holder (3).
- Connect and lock the tank ventilation lines (arrows).

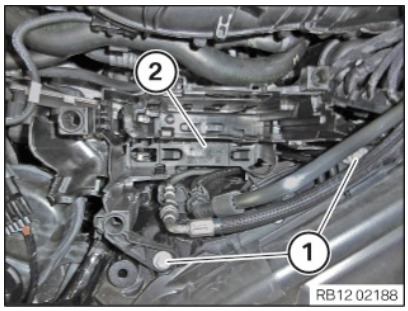
  The tank ventilation lines (arrows) must audibly engage.
- Connect and lock the connector (1).

  The connector (1) must engage audibly.

81 – Installing the control unit holder



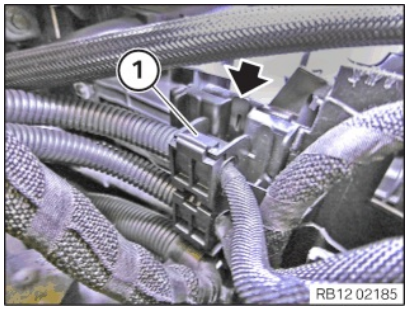
- Make sure the bottom control unit holder (1) is inserted correctly into the fixture (2).



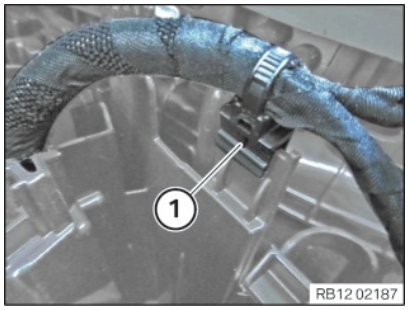
- Guide in and install control unit holder (2).
- Tighten the screws (1).

Control unit holder on spring strut dome

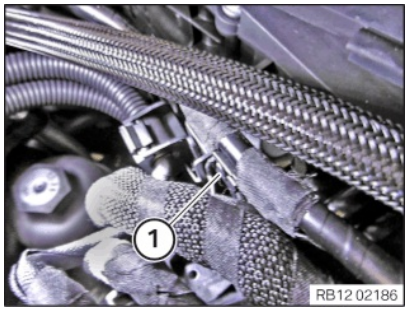
Hexagon screw		Tightening torque	8 Nm



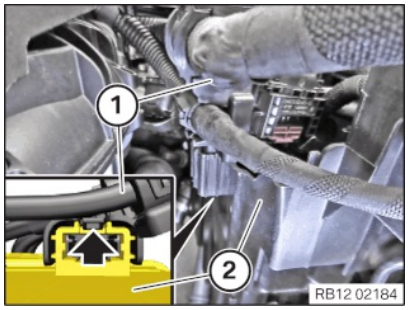
- Feed in and install the cable clip (1).
  Lock (arrow) must audibly engage.



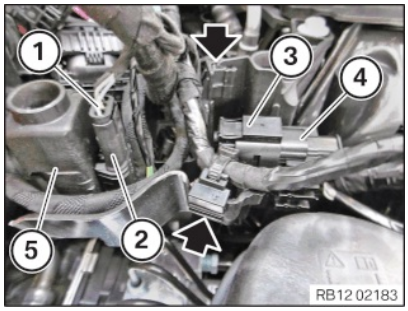
- Secure clamps (1).



- Secure clamps (1).



- Connect the cable clip (1) with the control unit holder (2) and lock.
  Lock (arrow) must audibly engage.



- Connect and lock the connector (4) with the control unit holder (5).
  The connector (4) must engage audibly.
- Connect connectors (3) and lock.
  The connector (3) must engage audibly.
- Connect and lock the connector (2) with the control unit holder (5).
  The connector (2) must engage audibly.
- Connect connectors (1) and lock.
  The connector (1) must engage audibly.
- Secure the clamps (arrows).

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

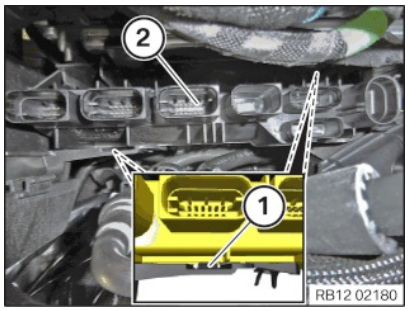
- Make sure that **no charger** is connected to the jump start support point in the engine compartment.
- Detach battery earth lead from battery.
- With auxiliary batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

Electrostatic discharge.

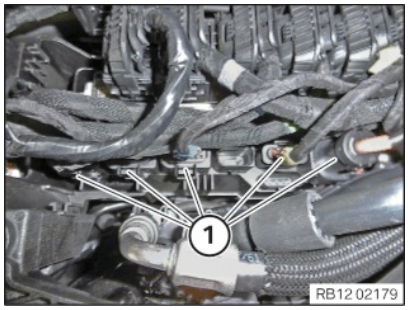
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 ... Notes for ESD protection (electrostatic discharge)



- Insert and install the integrated supply module (PDM) (2).

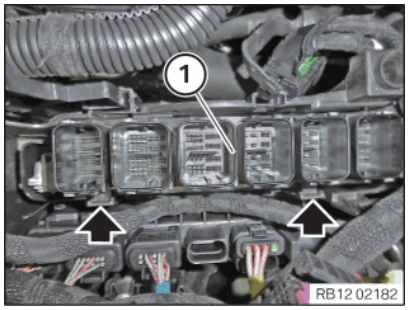
  The latch mechanisms (1) must engage audibly.
- Unlock the latch mechanisms (1).



- Connect connectors (1) and lock.

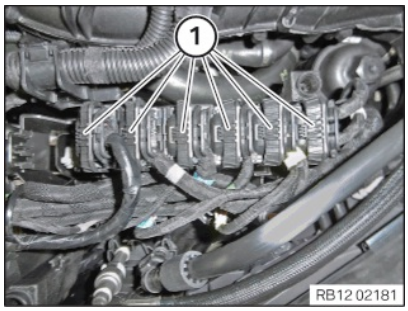
  The connectors (1) must engage audibly.

83 – Installing the DME control unit

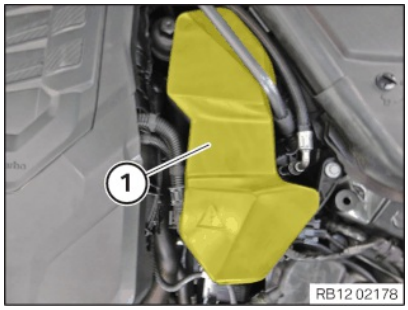


- Feed in and install DME control unit (1).

  The locks (arrows) must engage audibly.

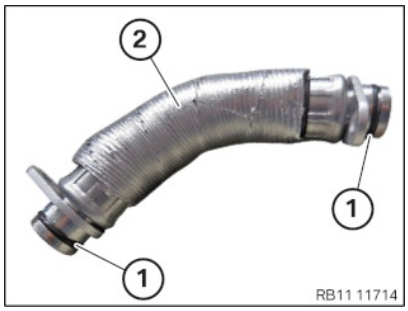


- Connect connectors (1) and lock.
  All connectors (1) must engage audibly.

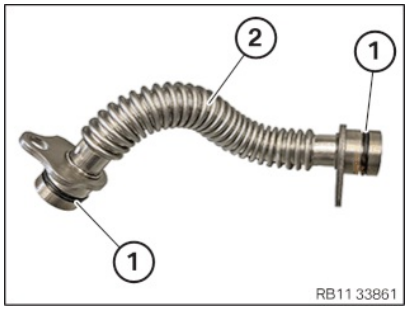


- Insert and install cover (1) into guides.

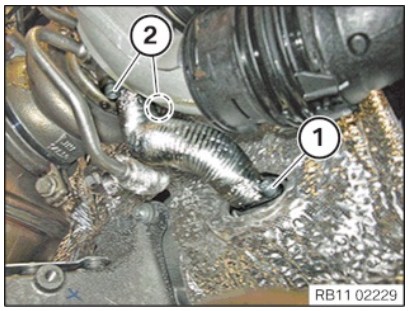
84 – Installing the oil return line for the exhaust turbocharger



- **Version A:**
- Renew the sealing rings (1) at the oil return line (2).
  Parts: Sealing ring



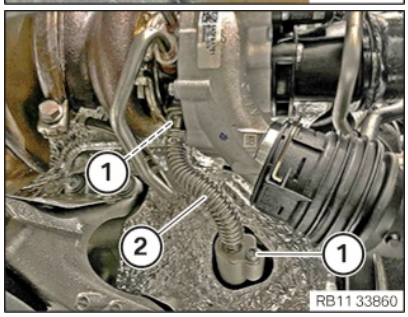
- **Version B:**
- Renew the sealing rings (1) at the oil return line (2).
  Parts: Sealing ring



- **Version A:**
- Feed in and install the oil return line .
- Tighten bolts (1) and (2).

Oil return line to exhaust turbocharger/crankcase

M6x14		Tightening torque	8 Nm



- **Version B**
- Feed in and install the oil return line (2).
- Tighten the screws (1).

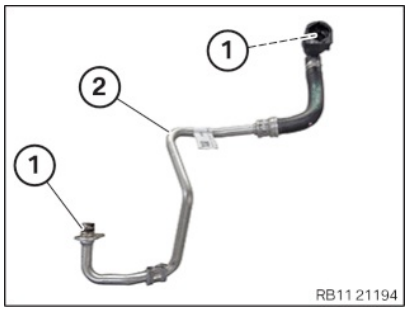
Oil return line to exhaust turbocharger/crankcase

M6x14		Tightening torque	8 Nm

85 – Install the coolant return line for the exhaust turbocharger

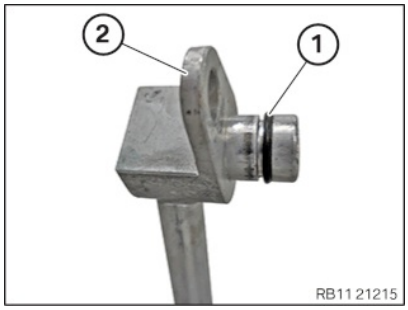
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



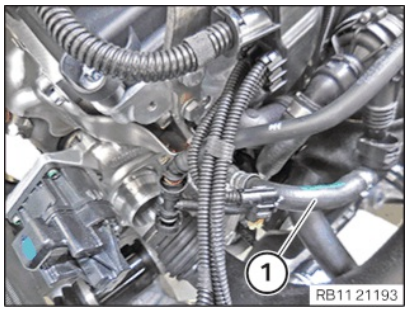
- Renew O-rings (1) on the coolant return line (2) with special tool 0 496 714 (00 9 030).

  Parts: O-rings

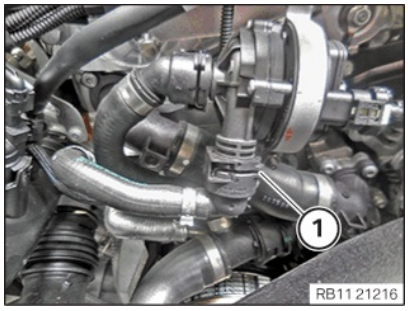


- Renew O-rings (1) on the coolant feed line (2) with special tool 0 496 714 (00 9 030).

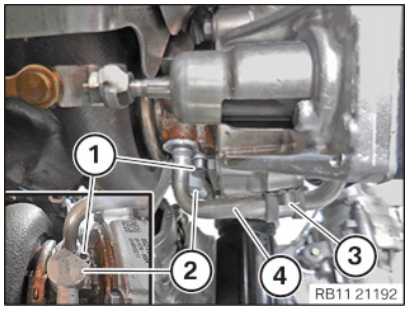
  Parts: O-ring



- Insert and position the coolant return line (1) for the exhaust turbocharger.



- Connect coolant return line (1) for the exhaust turbocharger and lock.
- Make sure that the coolant return line (1) for the exhaust turbocharger engages audibly.



- Insert and install the coolant return line (4) for the exhaust turbocharger.
- Feed in and install coolant feed line (2) for the exhaust turbocharger.
- Tighten down screw (1).

Coolant feed line/coolant return line to exhaust turbocharger

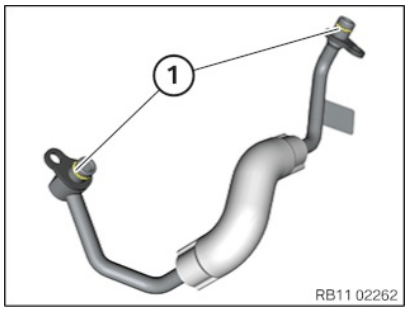
M6 x 12		Tightening torque	8 Nm

- Tighten down screw (3).

Coolant return line holder to exhaust turbocharger

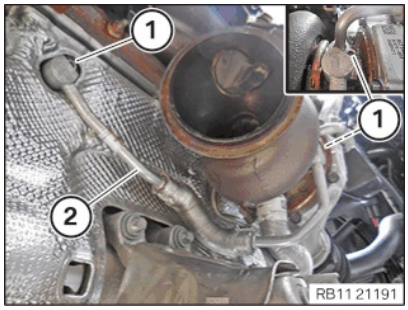
M6		Tightening torque	8 Nm

86 – Install the coolant feed line for the exhaust turbocharger



- Renew O-rings (1) on the coolant feed line with special tool 0 496 714 (00 9 030).

  Parts: O-rings



- Insert the coolant feed line (2) onto the crankcase and install.
- Tighten down screw (1).

Coolant feed line to crankcase

M6 x 12		Tightening torque	8 Nm

- Insert the coolant feed line (2) onto the exhaust turbocharger and install.
- Tighten down screw (1).

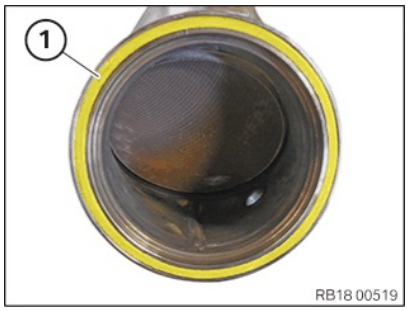
Coolant feed line/coolant return line to exhaust turbocharger

M6 x 12		Tightening torque	8 Nm

87 – Install catalytic converter

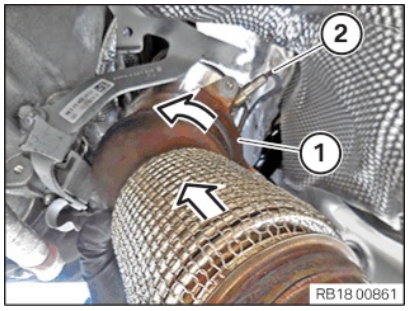
- Renew the V-clip (1).

  Parts: V-band clamp



- Renew the seal (1).

  Parts: Gasket



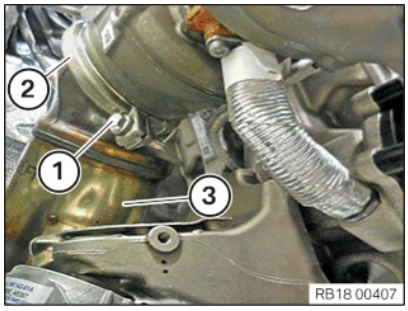
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

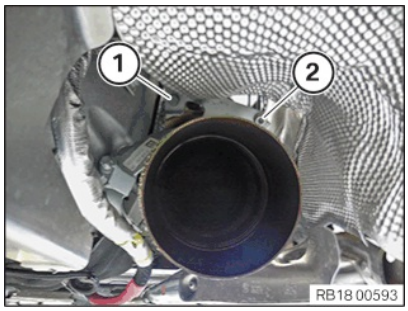
- Remove and install heavy components with the aid of another person/other persons.

- Guide in and install the catalytic converter (1) in the direction of arrow.
- Make sure that the monitoring oxygen sensor is (2) **not** damaged.



- Renew the V-clip (2).

  Parts: V-band clamp
- Feed in and install V-clip (2) on the catalytic converter (3).
- Position the bolt (1).



- **Version A:**

  Renew the screw (1).

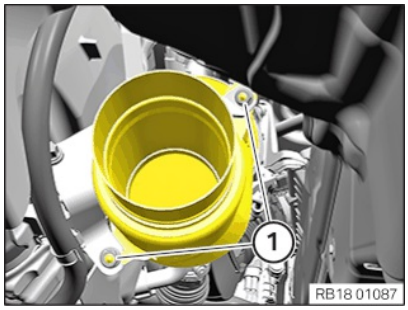
  Parts: Screw

  Position the bolt (1).

  Renew nut (2).

  Parts: Nut

  Position the nut (2).

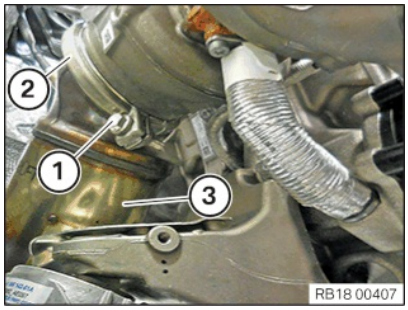


- **Version B:**

  Renew nuts (1).

  Parts: Nuts

  Position nuts (1).



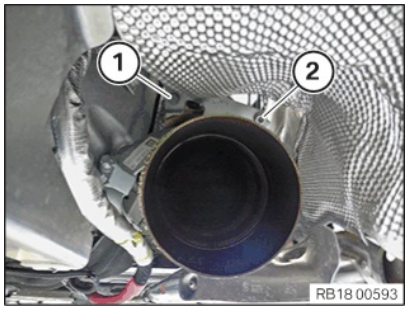
- Position the catalytic converter (3).
- Position V-clip (2).

Note: Ensure correct mounting orientation of the V-clip.

- Tighten down screw (1).

Catalytic converter / petrol particulate filter to exhaust turbocharger

V-band clamp	Renew V-band clamp.	Tightening torque	13 Nm



- **Version A:**

  Tighten down screw (1).

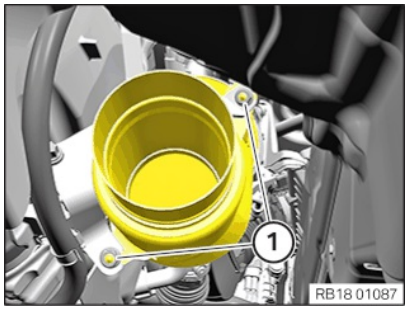
Catalytic converter to holder

M8	Renew screw.	Tightening torque	19 Nm

- Tighten nut (2).

Catalytic converter to holder

M8	Renew nut.	Tightening torque	19 Nm

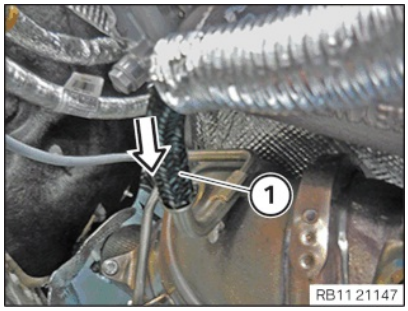


- **Version B:**

  Tighten nuts (1).

Catalytic converter to holder

M8	Renew nut.	Tightening torque	19 Nm



- Check the pressure hose (1) for damage and renew hardened pressure hose (1) if necessary.
- Connect the pressure hose (1) in direction of arrow to the limit position.

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

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

CAUTION

Grinding dust when grinding components.

Hazardous to health!

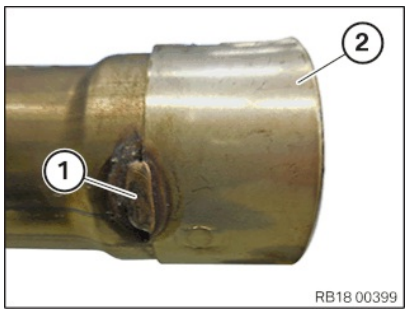
- Directly draw off the grinding dust.
- Ensure adequate ventilation.
- Conduct all work in appropriate personal protective equipment only.

TECHNICAL INFORMATION

Check the exhaust system for tightness after installation.

TECHNICAL INFORMATION

Mount the exhaust system in voltage-free state, maintaining the tightening sequence from the rear silencer towards the exhaust manifold.



CAUTION

Swarf resulting from sawing or grinding components.

Danger of injury!

- Conduct all work in appropriate personal protective equipment only.
- Wear safety goggles and protective gloves.

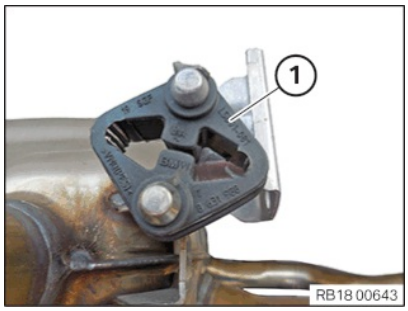
- **Version A:**

  Open the weld seam (1) with a conventional tool.

  Remove ribbon clamp (2).

  Renew the (2) ribbon clamp.

  Parts: Ribbon cable clamp

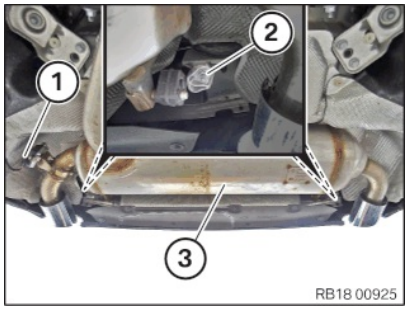


NOTICE

Schematic diagram is for example purposes. Some parts may differ in certain details.

- Check all the rubber mounts (1) of the exhaust system for damage.
- Replaced damaged rubber mounts.

  Parts: Rubber mount



- Insert and install the exhaust system (3) with the help of an auxiliary person.
- Renew nuts (2).

  Parts: Nuts
- Tighten nuts (2).

Rear silencer to body / bumper support

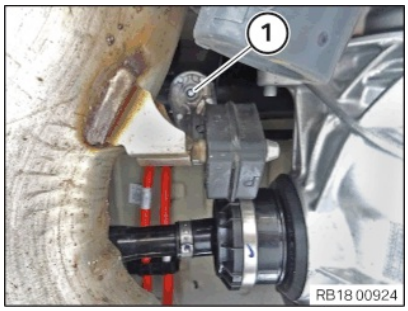
M8	Replace nuts.	Tightening torque	19 Nm

NOTICE

The following work step(s) is / are to be carried out if the specified component(s) is/are fitted.

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

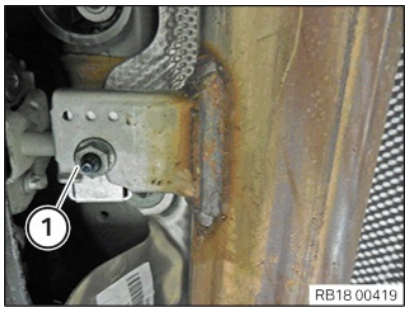


- Renew nut (1).

  Parts: Nut
- Tighten the bolt (1) on the rear axle support.

Rear silencer on support

Nut M8	Renew nut.	Tightening torque	19 Nm

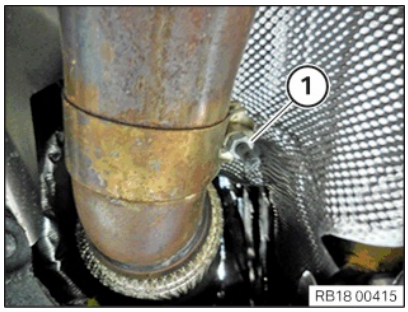


- Renew nut (1).

  Parts: Nut
- Tighten nut (1).

Front pipe/front silencer/petrol particulate filter to the transmission holder

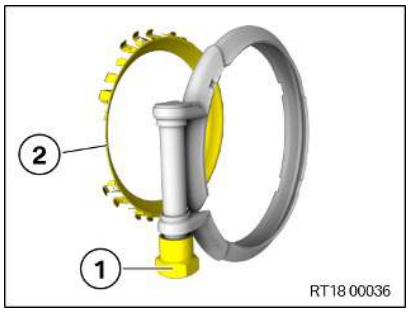
M8	Renew nut.	Tightening torque	19 Nm



- Tighten the ribbon clamp (1).

Exhaust system to catalytic converter

Ribbon clamp nut M8	Renew flat band clip.	Tightening torque	26 Nm
Ribbon clamp nut M10	Renew flat band clip.	Tightening torque	55 Nm

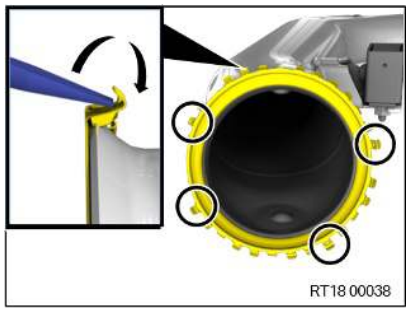


- **Version B:**

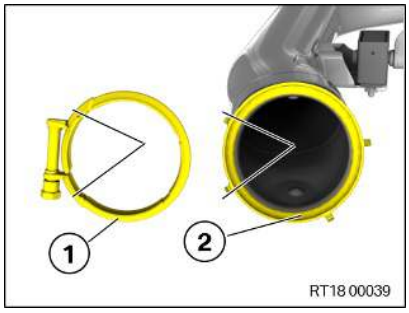
  Renew V-band clamp.

  Parts: V-band clamp

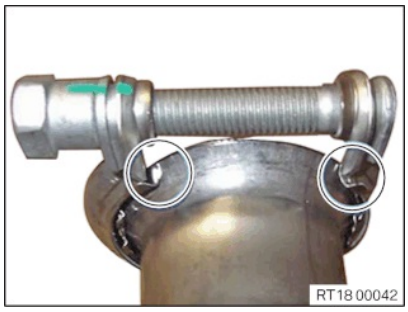
  Unscrew the nut (1) and remove the sealing ring (2).



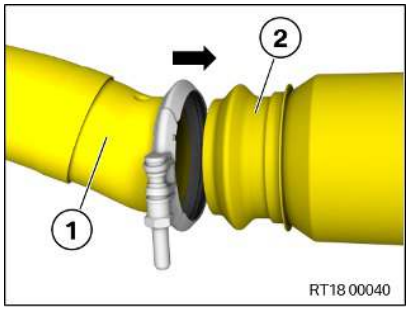
- Bend all sheet metal tabs over with a suitable tool, except those in the marked areas.



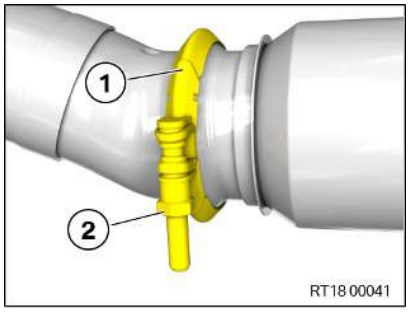
- Mount the V-clip (1) on the sealing ring (2).
- Make sure that the V-clip (1) is positioned correctly on the sealing ring (2).



- Ensure that the V-clip rests against the sheet metal tabs in the marked areas after mounting.



- Connect the exhaust system (1) with the catalytic converter (2) and position it correctly (arrow).

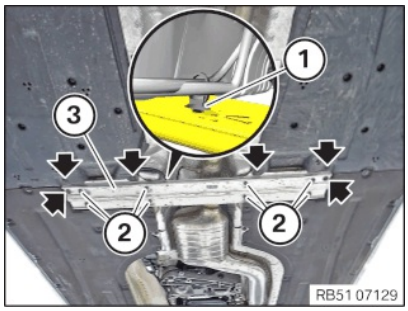


- Make sure that V-clip (1) is fitted correctly.
- Tighten down screw (2).

V-clip to catalytic converter

V-band clamp	Renew V-band clamp.	Tightening torque	25 Nm

89 – Install the connecting supports on the tunnel



- Guide in and install connecting support (3) on the tunnel.
- Tighten the screws (2).
- Tighten screws (arrows).

Connecting support to tunnel

M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

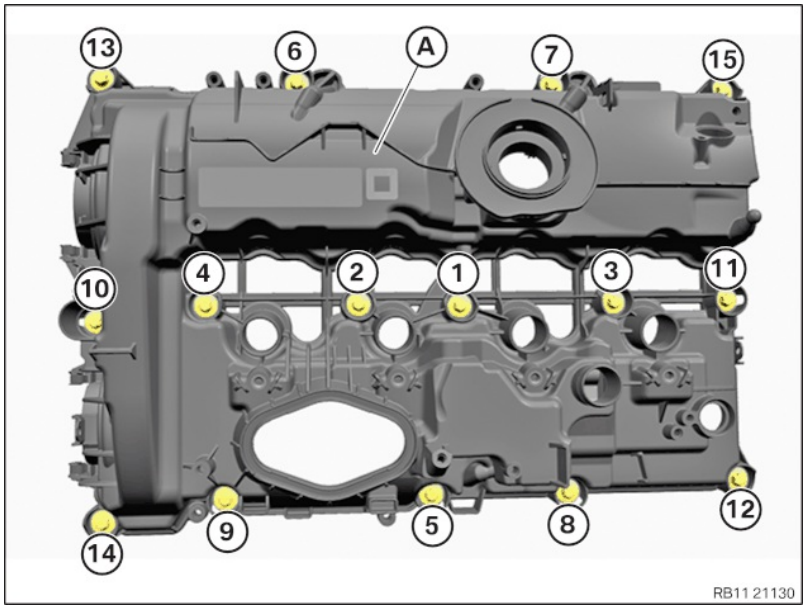
NOTICE

The following work step(s) is / are to be carried out if the specified component(s) is/are fitted.

- Secure the clamp (1).

90 – Installing cylinder head cover

Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

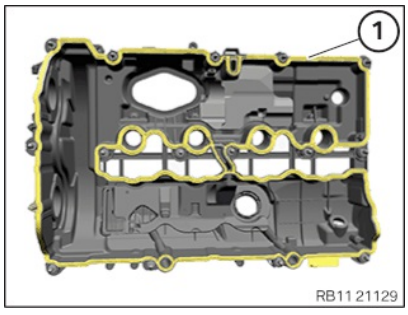
Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

TECHNICAL INFORMATION

Depending on the build level, different cylinder head covers and therefore different profile seals can be fitted.
Identify suitable cylinder head cover in the Electronic Parts Catalogue and perform the corresponding variant of the work steps.

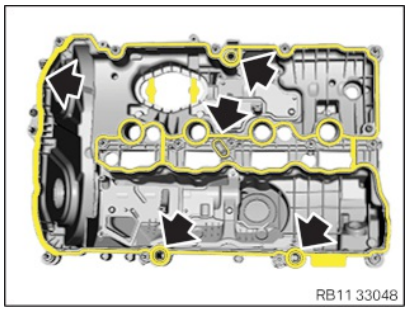


- **Variant with one profile seal:**

  Renew the profile seal (1).

  Parts: Profile seal

  Insert and install the profile seal (1).

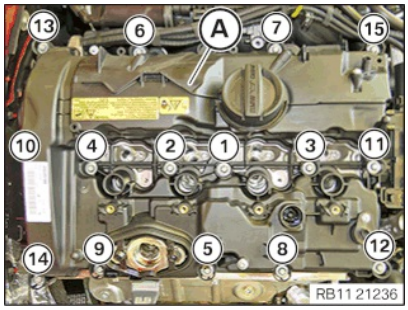


- **Variant with several profile seals:**

  Renew profile seals (arrows).

  Parts: Profile seals

  Insert and install the profile seal (1).



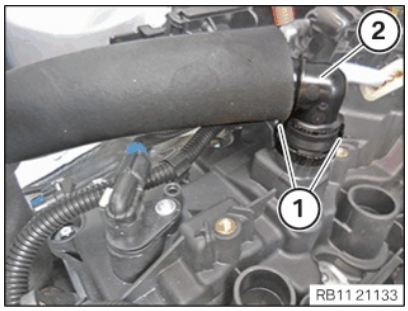
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.

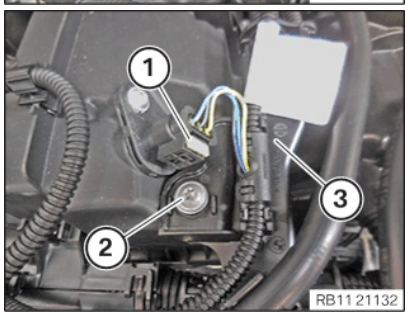
- Feed in and install cylinder head cover (A).
- Tighten screws in the order (1) to (15).

Cylinder head cover to cylinder head

M6x30		Tightening torque	8 Nm
		Tightening torque	10 Nm



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

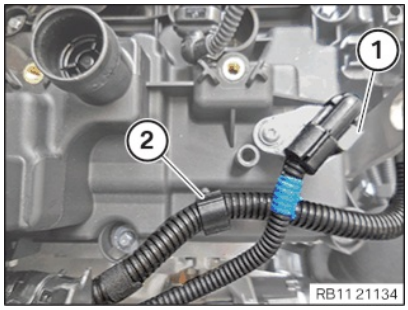


- Guide in and install wiring harness section (3) for sensor system 1.
- Tighten down screw (2).

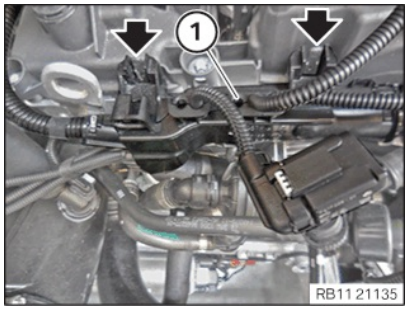
Wiring harness section of engine to cylinder head cover

M6		Tightening torque	8 Nm

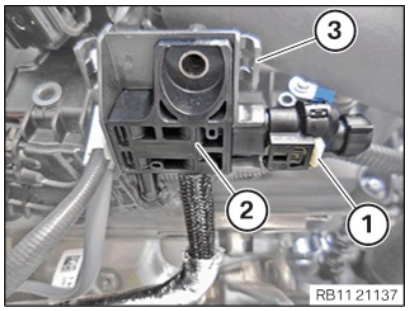
- Connect connector (1) on the intake camshaft sensor and lock it.
- Ensure that connector (1) on the intake camshaft sensor engages audibly.



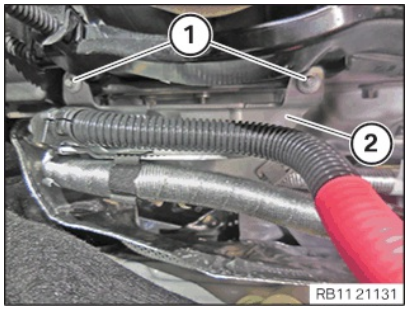
- Connect connector (1) on the exhaust camshaft sensor and lock it.
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).



- Guide in and install wiring harness section (1) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Thread in differential pressure sensor (2) on the holder (3) and install.
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



CAUTION

Improper routing of the positive battery cable.

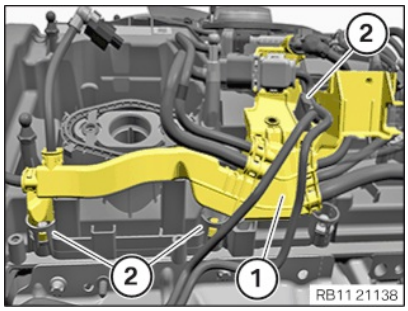
Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

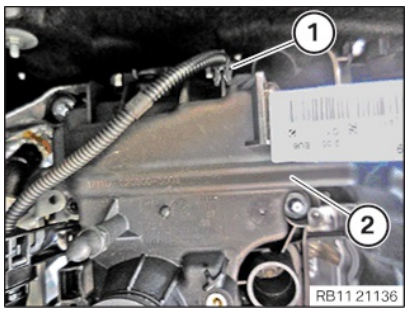
- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

Holder, positive battery cable to cylinder head cover

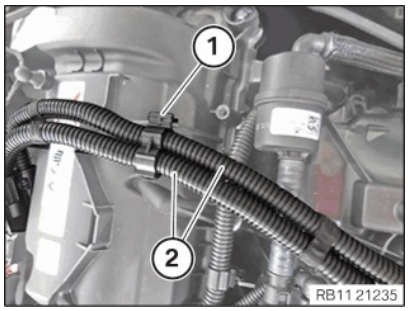
6X18		Tightening torque	6 Nm



- Guide in the wiring harness section (1) for sensor system 2 from guides (2) and install it.

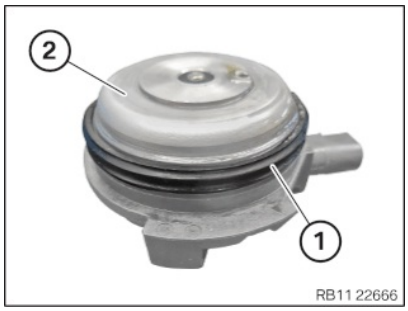


- Secure clamps (1).

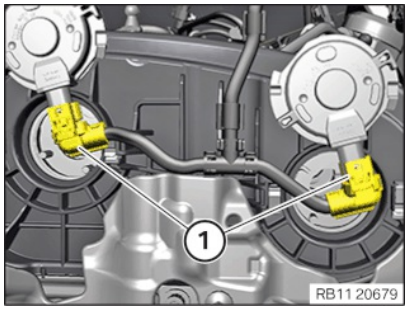


- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).

91 – Installing both actuators



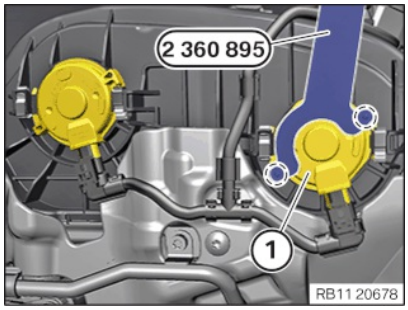
- Check seal (1) for damage and, if necessary, renew actuator (2).



NOTICE

The figure shows the rear side of the engine.

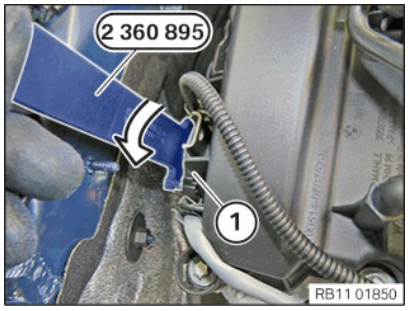
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



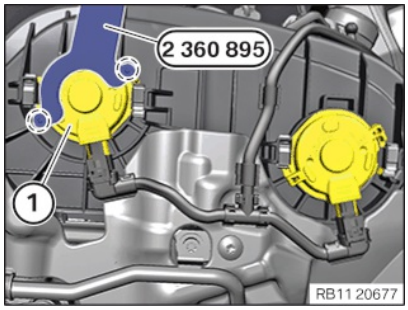
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



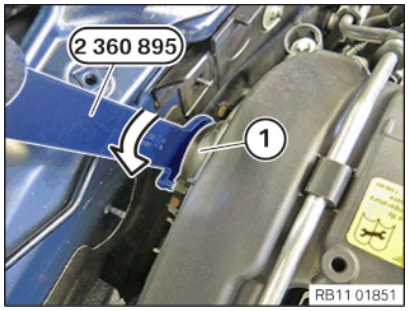
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.



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.

92 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

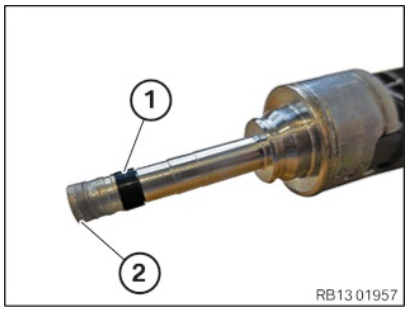
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- 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

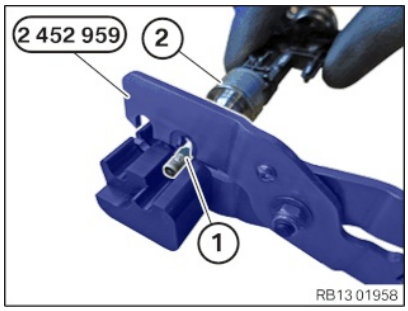
Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

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.

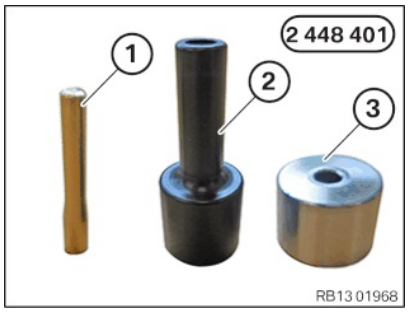


- Before installing the injectors: Renew the Teflon rings (1).

  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.

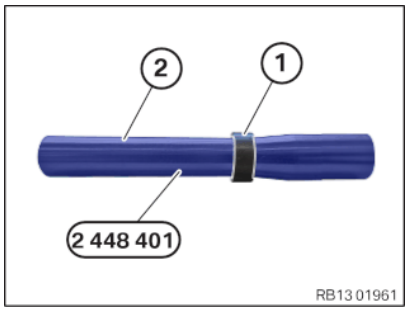


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

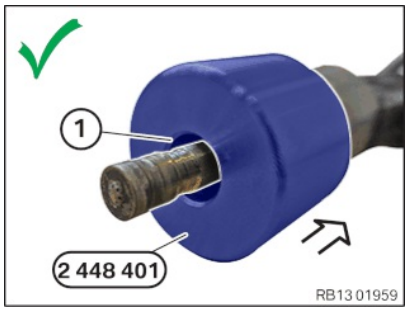
  (1) Installation cone

  (2) Sliding sleeve

  (3) Assembly sleeve

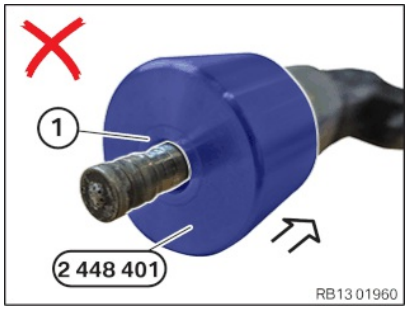


- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



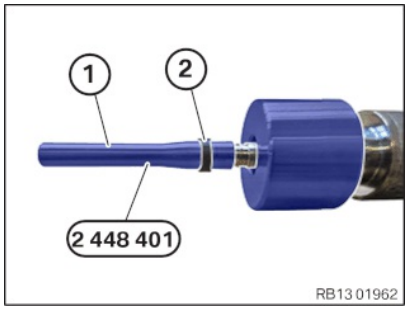
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The larger diameter of the assembly sleeve (1) must point to the injector tip.

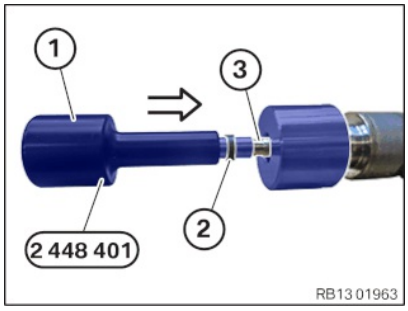


- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

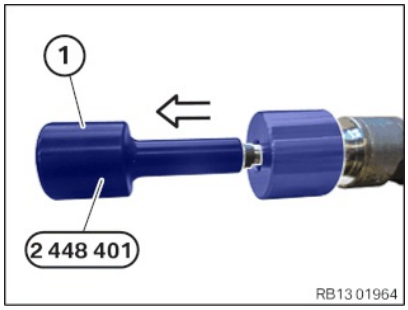
  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.



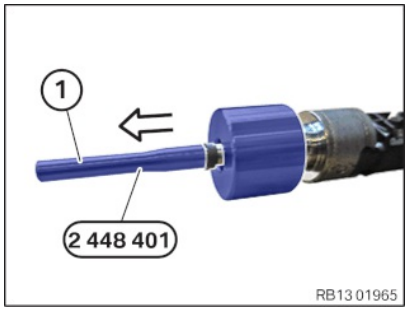
- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .



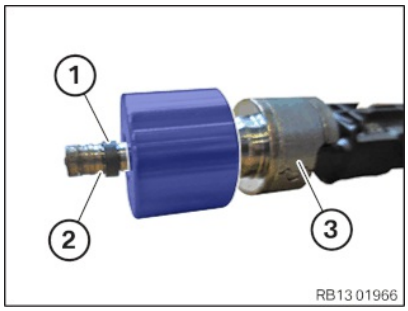
- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.



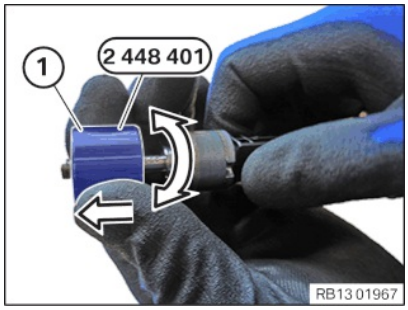
- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

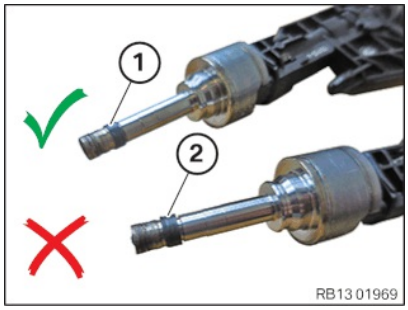


- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.



- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).

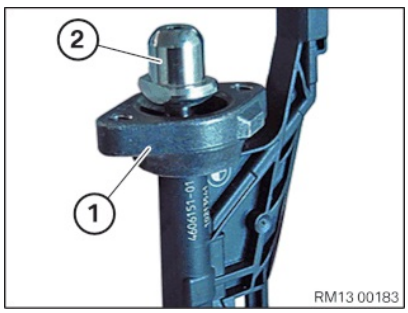


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

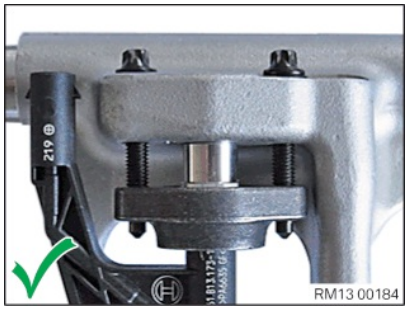
93 – Installing the rail with injectors

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.

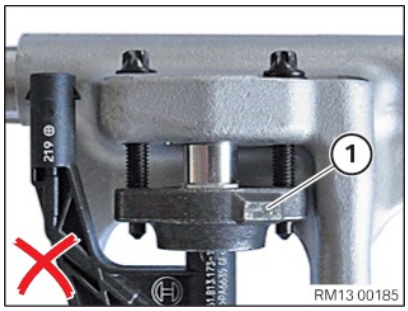


- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder** (1) **has a cast lug:** Make sure that the holder is installed in the correct position.



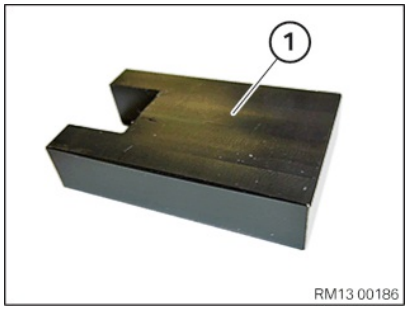
- If applicable, note the position of the cast lug:

  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.



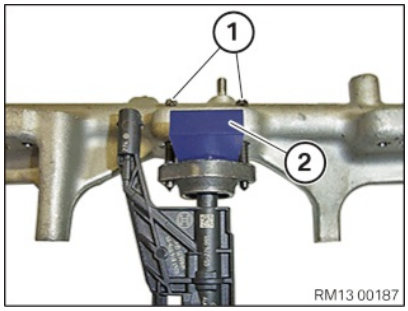
RISK OF DAMAGE

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.

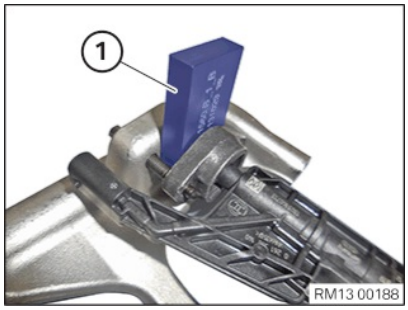
- Use the special tool (distance gauge) 2 358 022 (1).



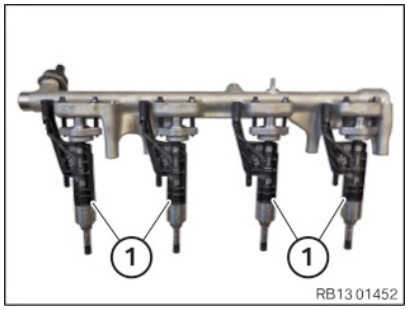
- Mount the injectors with holders and the **new** screws (M5x30) to the rail.

  Parts: Screws (M5x30)
- 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) uniformly until special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.

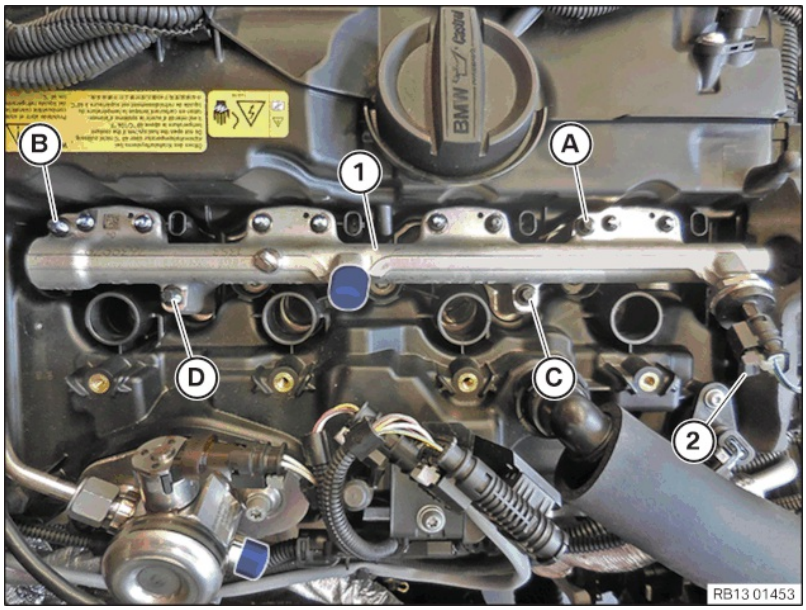


- Remove the special tool (distance gauge)2 358 022 (1) .
- Repeat this operation for all injectors.



- Check injectors (1) for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors (1) must move freely.



- 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 down until there is resistance, position screws (M6x70) (A), (B), (C) and (D), and turn them until hand-tight.
- Set torque wrench to 2 Nm.
- Tighten the screws (A,) (D), (B) and (C) at **90°** each in an alternating order using the torque wrench until the rail rests on the cylinder head.

  The figure shows the rail resting flat against the cylinder head.
- If the tightening torque (2 Nm) is reached before the rail rests on the cylinder head: Disassemble the rail and restart the installation procedure.

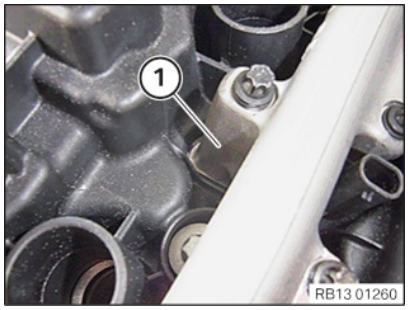
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

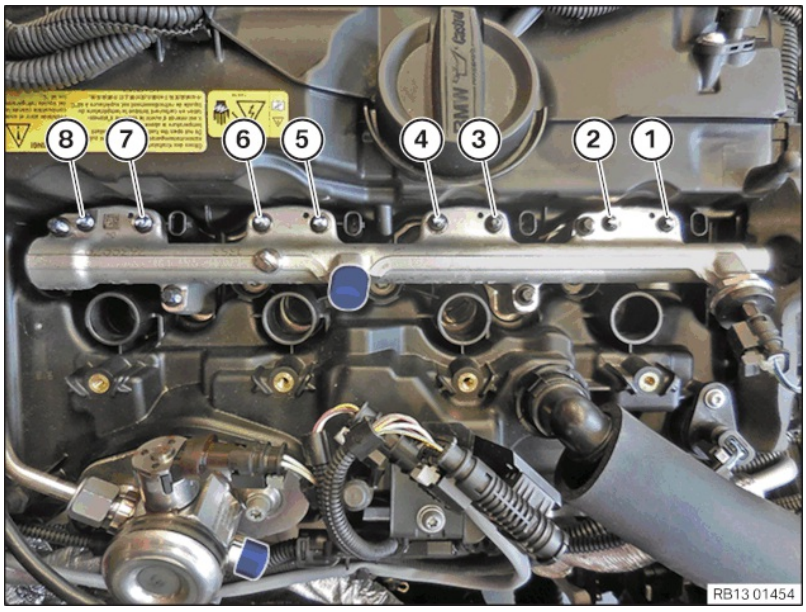
Non-observance of these requirements may result in leaks and damage.

- Tighten screw (A) by 5 Nm.
- Tighten screw (D) by 5 Nm.
- Tighten screw (B) by 5 Nm.
- Tighten screw (C) by 5 Nm.
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.



- Make sure that the rail (1) rests flat against the cylinder head.



- Insert a wrench socket into an extension.

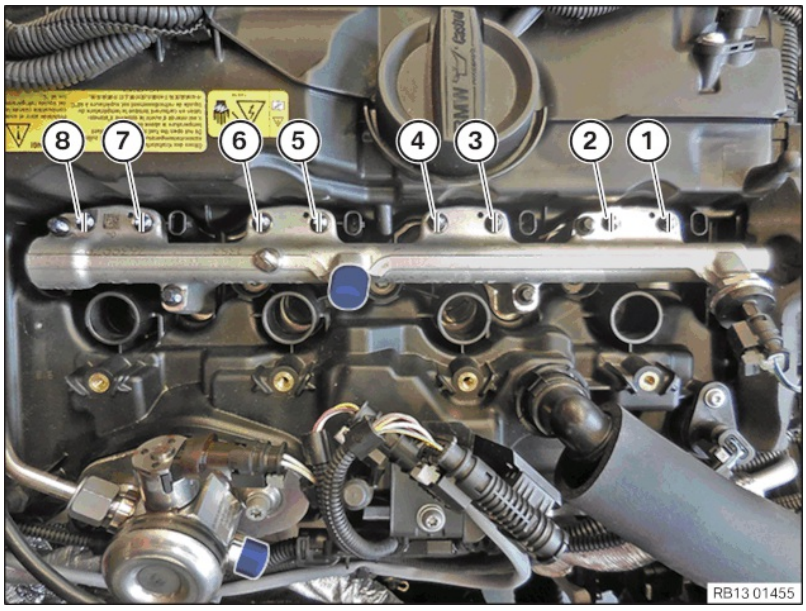
  Do not use a reversible ratchet or torque wrench.
- **Hand-tighten** the screws (M5x30) respectively in pairs (1) with (2), (3) with (4), (5) with (6), (7) with (8) alternatively with **90°**.
- Set torque wrench to 5 Nm.

TECHNICAL INFORMATION

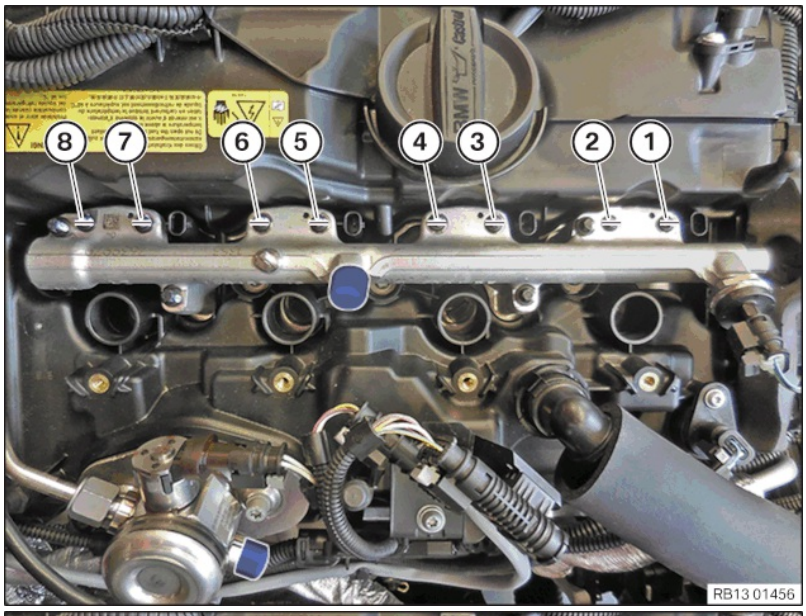
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- **Screw the M5x30 screws according to the following plan:**
  - **Fuel injector 1:**
  - Tighten the bolt (1) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (2) at an angle of rotation of 90° 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 the bolt (3) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (4) at an angle of rotation of 90° 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 the bolt (5) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (6) at an angle of rotation of 90° with the torque wrench.
  - Repeat the steps for bolts (5) and (6), until both bolts reach a torque 5 Nm.
  - **Fuel injector 4:**
  - Tighten the bolt (7) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (8) at an angle of rotation of 90° with the torque wrench.
  - Repeat the steps for bolts (7) and (8) until both bolts reach a torque of 5 Nm .

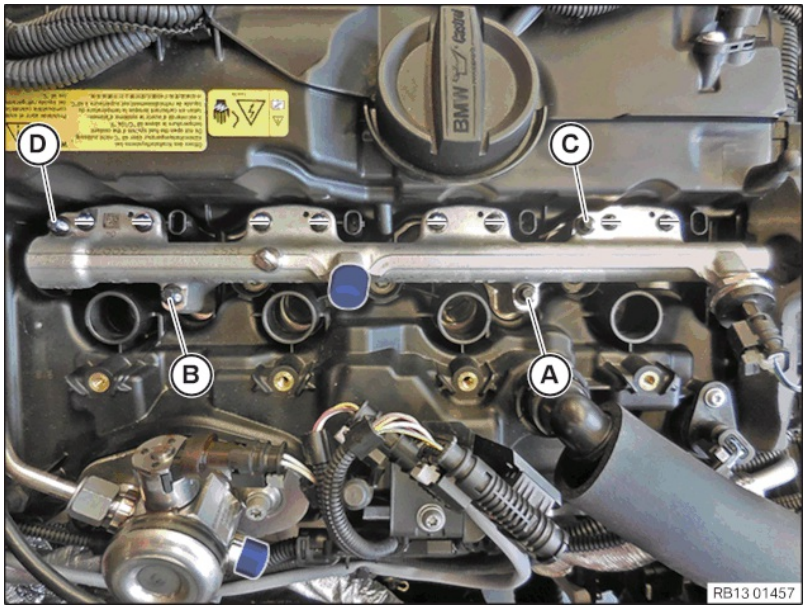


- Mark all bolts (1) to (8) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the bolt (1) with an angle of rotation of 90°.
  - Tighten the bolt (2) with an angle of rotation of 90°.
  - Tighten the bolt (3) with an angle of rotation of 90°.
  - Tighten the bolt (4) with an angle of rotation of 90°.
  - Tighten the bolt (5) with an angle of rotation of 90°.
  - Tighten the bolt (6) with an angle of rotation of 90°.
  - Tighten the bolt (7) with an angle of rotation of 90°.
  - Tighten the bolt (8) with an angle of rotation of 90°.



- Check if all bolts (1) to (8) were tightened with an angle of rotation of 90°.

  Marks (lines) must be horizontal (see figure).



- Release bolts (M6x70) (A) to (D).

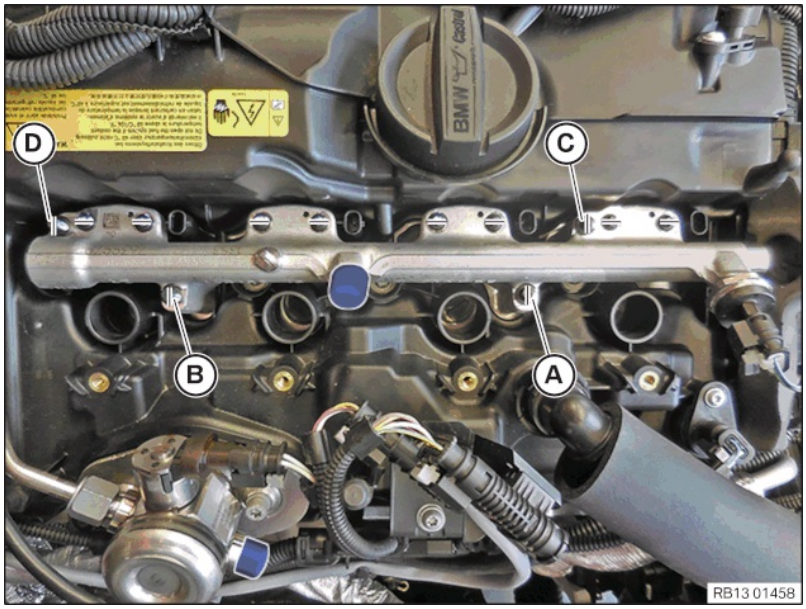
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

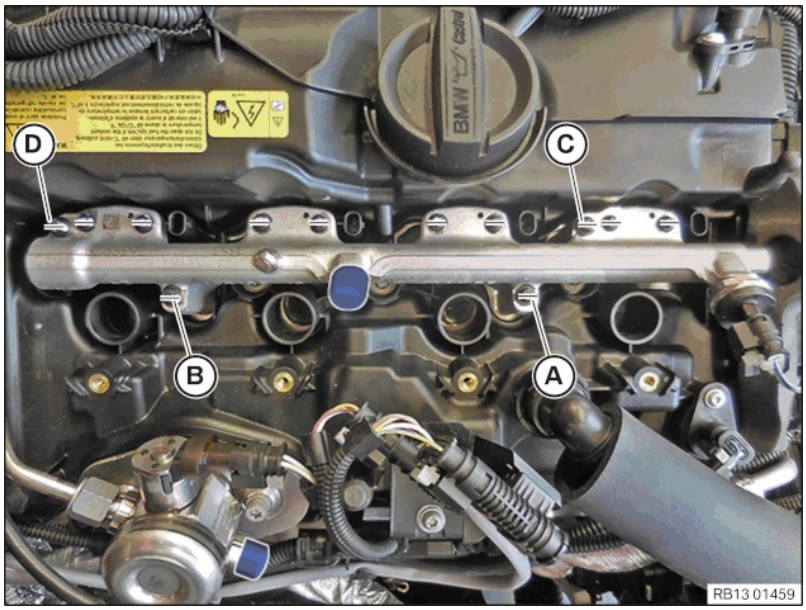
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten screw (A) at 5 Nm.
- Tighten screw (D) at 5 Nm.
- Tighten screw (B) at 5 Nm.
- Tighten screw (C) at 5 Nm.

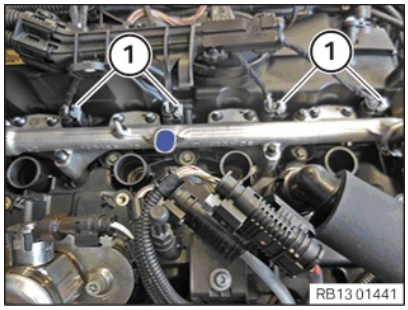


- Mark screws (A) to (D) with a vertical line (see figure).
- Tighten the screws (M6x70) (A) to (D) at an angle of rotation **of 90°**.



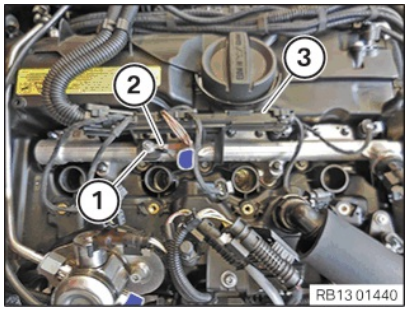
- Check if the screws (A) to (D) were tightened at an angle of rotation of **90°**.

  The 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 nut (1).

Ground cable to rail

M6		Tightening torque	5 Nm

94 – Installing the high pressure pump

RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

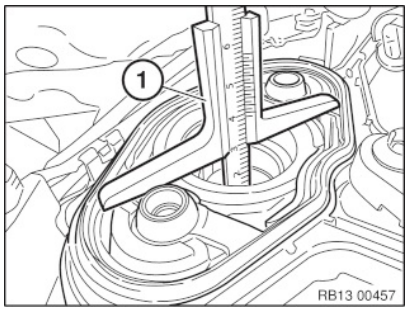
- Turn the combustion engine exclusively by hand in the correct direction of rotation: a) Clockwise, facing the vibration damper or b) Anticlockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

The high-pressure pump is preloaded by the piston spring and must be removed by alternately pulling out the screws without tilting.

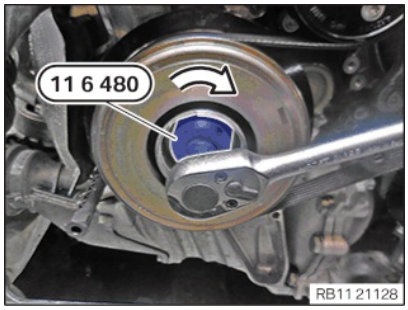
Before installing the high pressure pump, turn the cam of the high-pressure pump drive to the bottom dead centre.

If necessary, turn the engine in the direction of engine rotation at the central bolt of the crankshaft, otherwise there is a risk of piston breakage of the high-pressure pump.

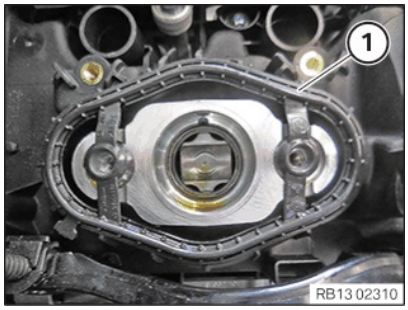


- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

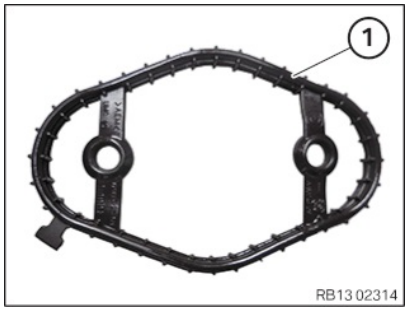
  The depth gauge (1) is in the deepest position.



- 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** .

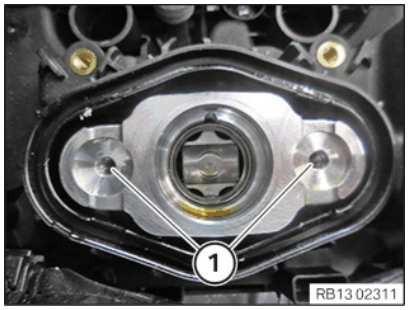


- Guide out and remove gasket (1).



- Renew the seal (1).

  Parts: Gasket



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

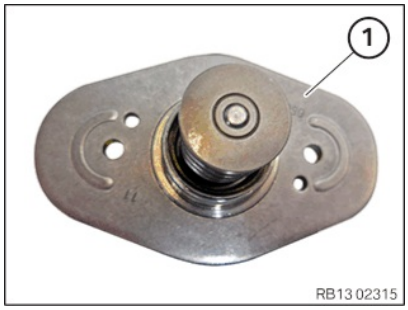
- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).

- Insert and install the seal (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

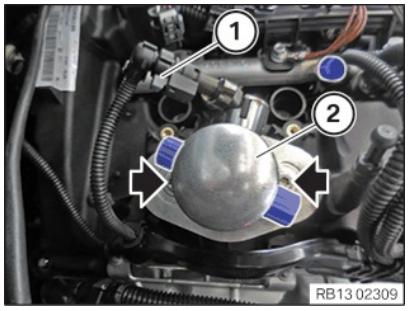
The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- 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: Screws
- 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

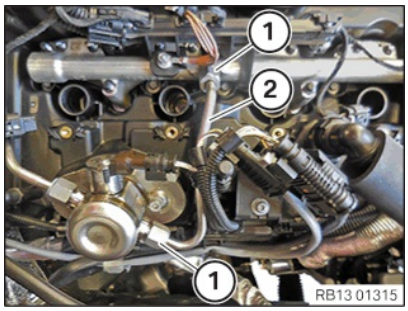
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

95 – Installing high pressure line between rail and high pressure pump

- Guide the special tool out and remove.



- Thread in and install the high pressure line (2).
- Tighten union nut (1) hand tight.
- Tighten union nut (1).

High pressure line between high pressure pump and high pressure rail

M14		Tightening torque	33 Nm

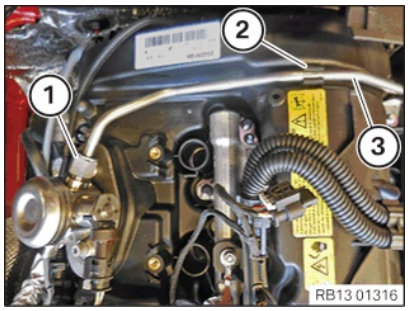
96 – Installing fuel delivery line

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

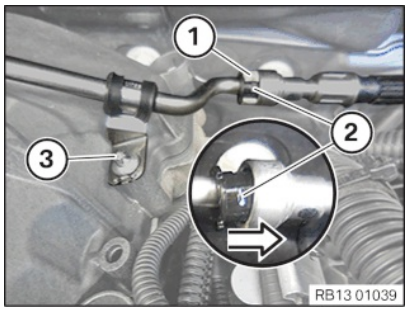
- Route all cables without abrasions, do not trap and crush.



- Guide the fuel delivery line (3) in and install.
- Install rubber damper (2).
- Check the rubber damper (2) for the correct fit.
- Tighten the union nut (1) hand-tight.
- Tighten union nut (1).

Fuel delivery line to high pressure pump

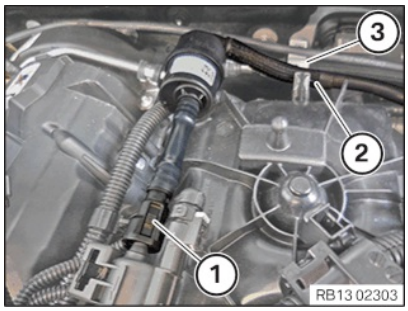
M14		Tightening torque	26 Nm



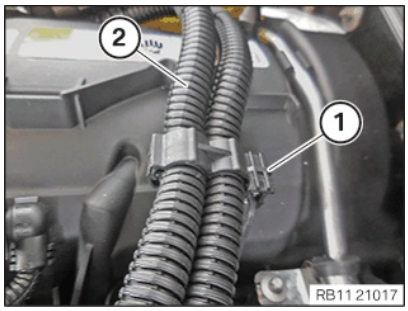
- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure the clamp (1).
- Tighten down screw (3).

Fuel delivery line to cylinder head cover

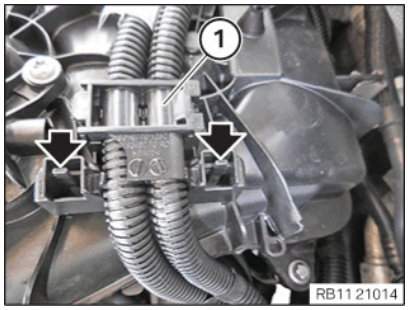
M6 screw		Tightening torque	7 Nm



- Insert and install the tank ventilation line (2).
- Lock (1) must engage audibly.
- Secure the tank ventilation line (2) to the clamp (3).



- Insert and install wiring harness section (2) for injectors and ignition coils.
- Secure the clamp (1).

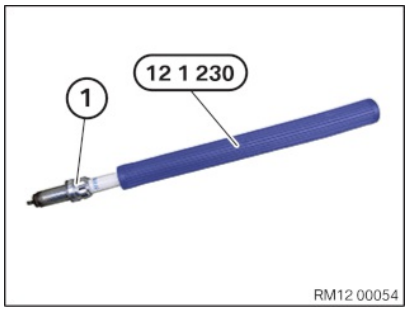


- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

97 – Installing all spark plugs

NOTICE

The description is for one component only. The procedure is identical for all further components.

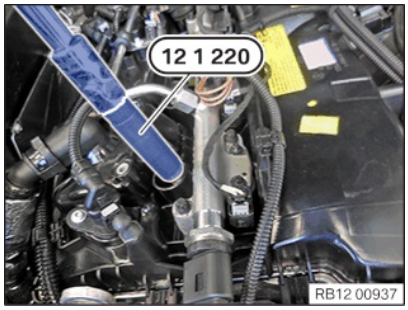


- Insert spark plug (1) into special tool 0 496 065 (12 1 230).

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

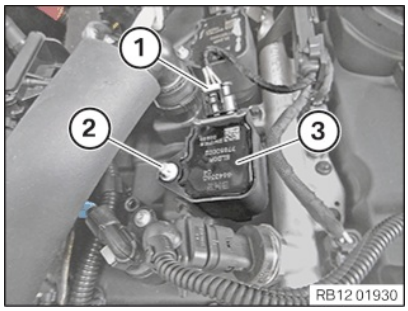
M12x1.25		Tightening torque	23 Nm

98 – Install all ignition coils

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Install ignition coil.**



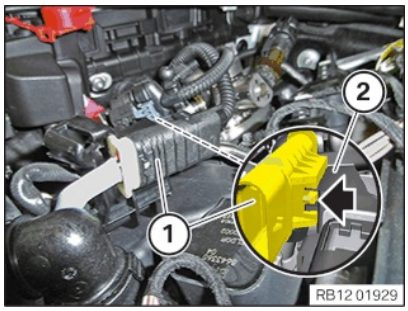
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

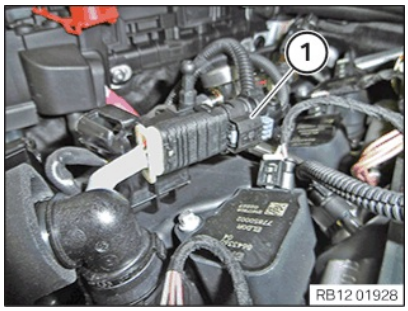
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Connect and lock connector (1) with holder (2) (arrow).

  The connector (1) must engage audibly.



- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

99 – Install front oxygen sensor

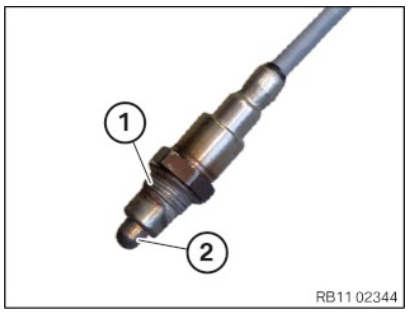
TECHNICAL INFORMATION

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



TECHNICAL INFORMATION

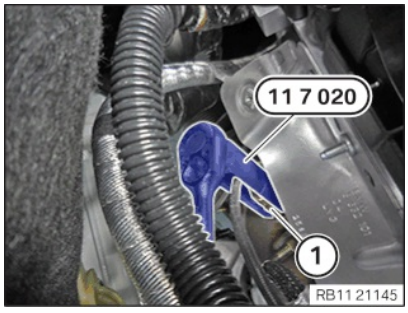
For additional information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

- Prepare the oxygen sensor.

  Do not damage the sensor ceramics.

  (1) = Thread

  (2) = Sensor ceramics



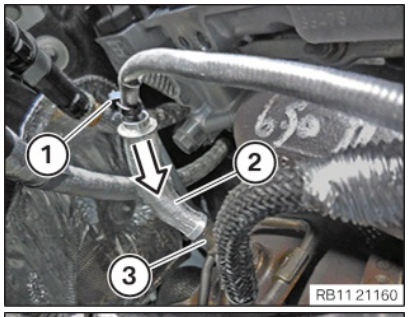
NOTICE

The oxygen control sensor cable of is black. The installation location of the front oxygen sensor is before the catalytic converter.

- Screw the front oxygen sensor (1) in and tighten with the special tool 0 491 074 (11 7 020).

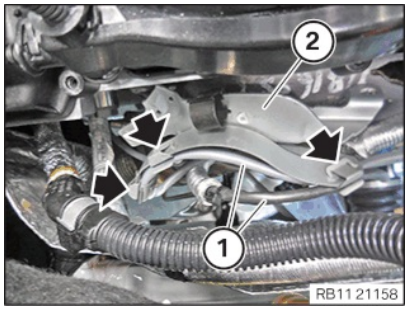
Lambda control probe

M18x1.5		Tightening torque	50 Nm

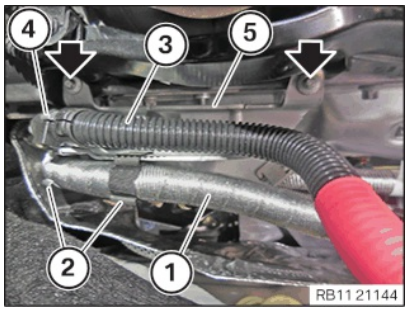


- Guide in the heat protection (2) in the direction of arrow and install.
- Ensure that the heat protection (2) is touching the limit position (3).
- Renew the cable straps (1).

  Parts: Cable strap
- Guide in and install the cable strap (1).



- Insert and position the bracket (2) of the positive battery cable.
- Secure the cable (1) in the clamps (arrows).



- **Version A (without mild hybrid technology):**

CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

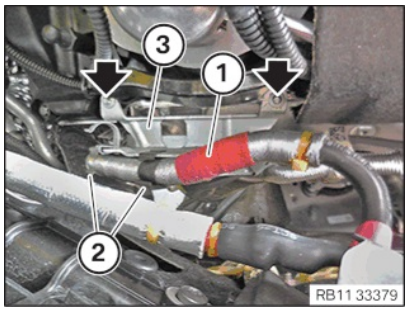
- Route the positive battery cable without abrasions and do not trap.

- Insert and position the bracket (5) of the positive battery cable.
- Tighten screws (arrows).

Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

- Secure the positive battery cable (1) at the clamps (2).
- Secure the positive battery cable (3) at the clamps (4).



- **Version B (with mild hybrid technology):**

CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

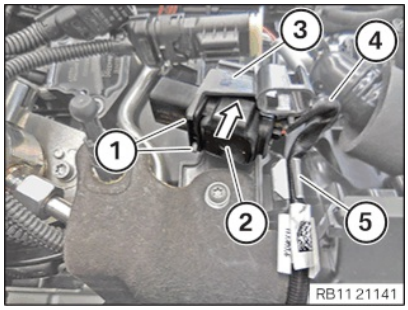
- Route the positive battery cable without abrasions and do not trap.

- Feed in and position the holder (3) of the positive battery cable.
- Tighten screws (arrows).

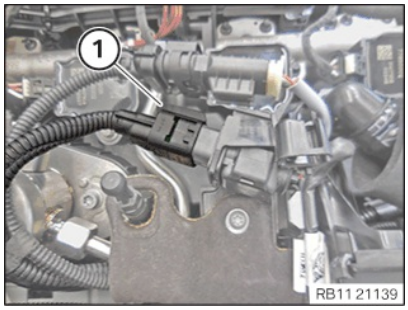
Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

- Secure the positive battery cable (1) at the clamps (2).

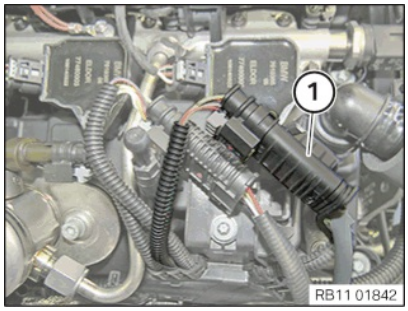


- Feed in the connector (2) in the direction of arrow on the carrier plate (3) and connect it.
- Locks (1) must engage audibly.
- Secure cable (4) to the clamp (5).



- Connect connectors (1) and lock.

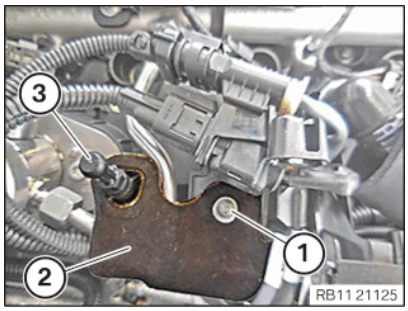
  The connector (1) must engage audibly.



- Connect the connector (1) and lock it.
- Feed the connector (1) into the carrier plate and connect it.

  The connector (1) must be engaged audibly.

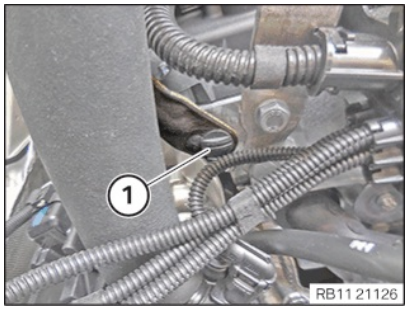
100 – Install the cylinder head cover acoustic cover



- Guide in and position the acoustic cover (2) on the ball pin (3).
- Tighten down screw (1).

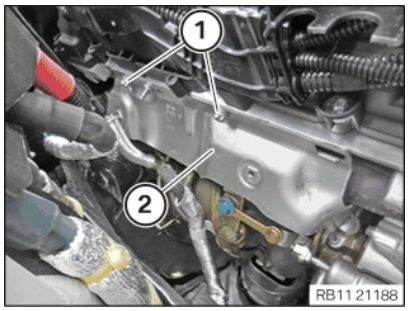
Acoustic cover (side) to cylinder head cover

TS6 x 20		6 Nm



- Secure the clip (1).

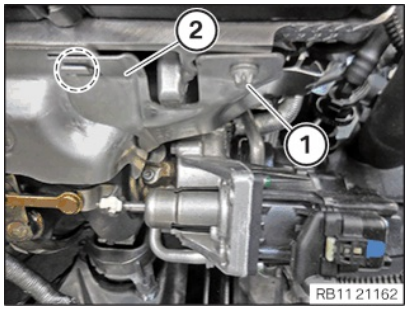
101 – Install the heat shield on the cylinder head



- Thread in and position the heat shield (2).
- Tighten the screws (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm



- **Version without Real Driving Emissions 2 (-SA1DZ):**

  Feed the heat shield (2) into the **marked** area and install it.

  Tighten down screw (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm

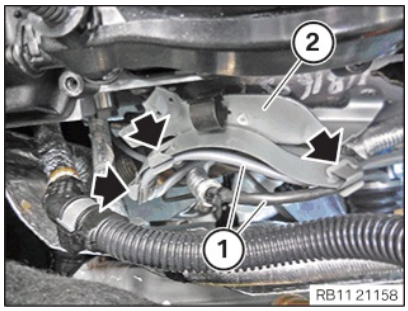
- **Version without Real Driving Emissions 2 (-SA1DZ):**

  Tighten down screw (1).

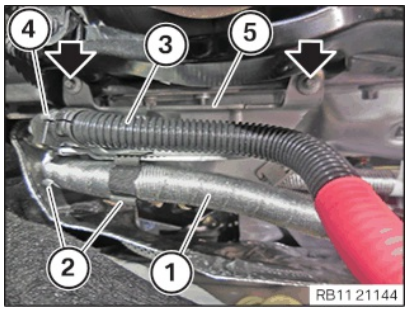
Heat shield to clamping strip

M6 x 12		Tightening torque	8 Nm

102 – Install the holder of the positive battery cable



- Insert and position the bracket (2) of the positive battery cable.
- Secure the cable (1) in the clamps (arrows).



- **Version A (without mild hybrid technology):**

CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

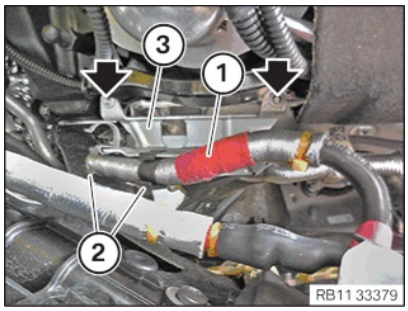
- Route the positive battery cable without abrasions and do not trap.

- Insert and position the bracket (5) of the positive battery cable.
- Tighten screws (arrows).

Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

- Secure the positive battery cable (1) at the clamps (2).
- Secure the positive battery cable (3) at the clamps (4).



- **Version B (with mild hybrid technology):**

CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

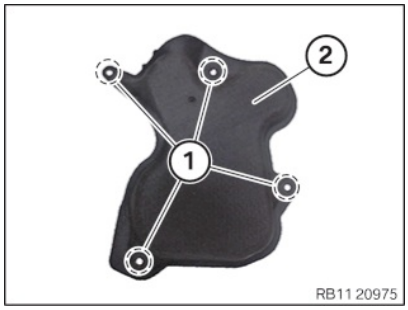
- Feed in and position the holder (3) of the positive battery cable.
- Tighten screws (arrows).

Holder, positive battery cable to cylinder head cover

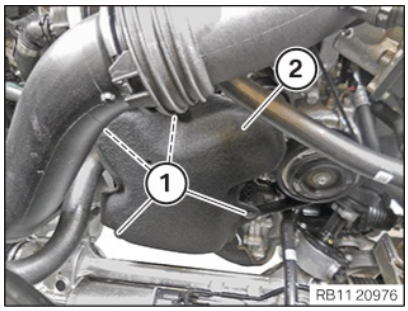
6X18		Tightening torque	6 Nm

- Secure the positive battery cable (1) at the clamps (2).

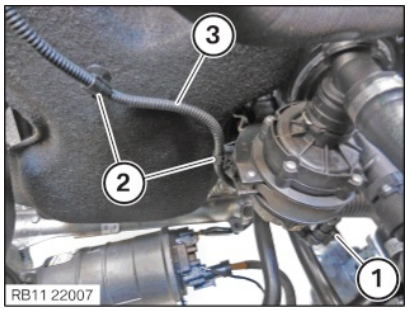
103 – Installing front acoustic cover for engine



- Check acoustic cover (2) in marked areas (1) for damage, renew if necessary.

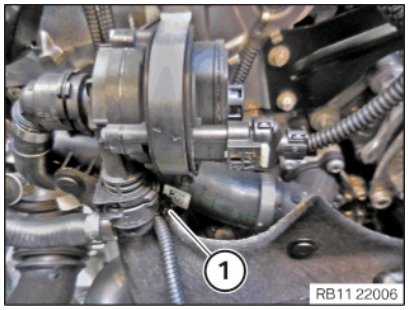


- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).



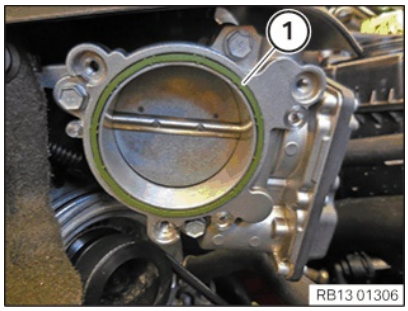
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



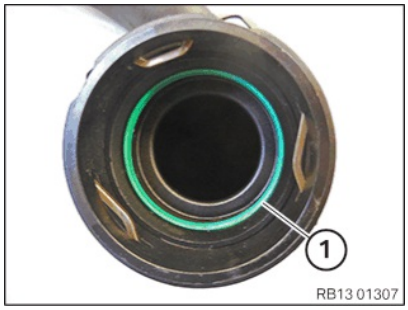
- Secure clamps (1).

104 – Install charge air line



- Renew the sealing ring (1) on the throttle valve.

  Parts: Sealing ring

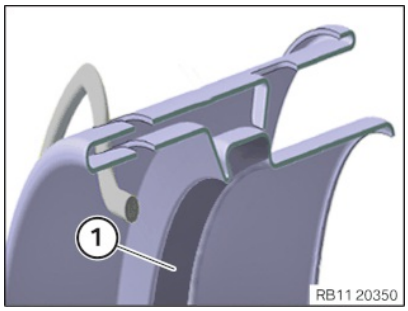


- Check the sealing ring (1) on the charge air line for damage and renew, if necessary.

▸ **Replacing damaged seal**

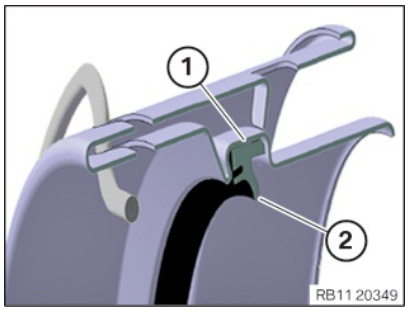
TECHNICAL INFORMATION

Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



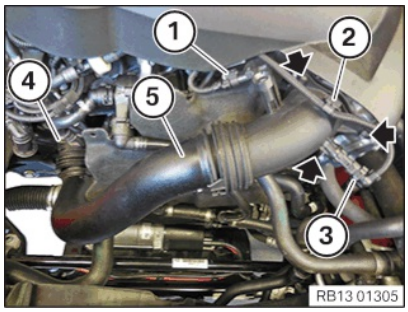
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is directed inwards as shown.



- Insert and install charge air line (5).
- Lock the clamp (4) on the exhaust turbocharger.

  The clamp (4) must engage audibly.
- Tighten screws (arrows).

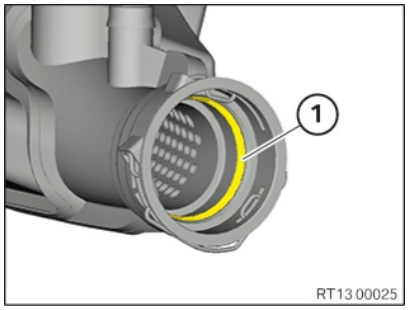
Charge air line to throttle body

M6		Tightening torque	8 Nm

- Connect and lock the connector (3) on the charge-air pressure sensor.
- Connect and lock the connector (1) on the charging pressure sensor.

  All connectors must audibly engage.
- Secure clamps (2).

105 – Installing clean air pipe with resonator

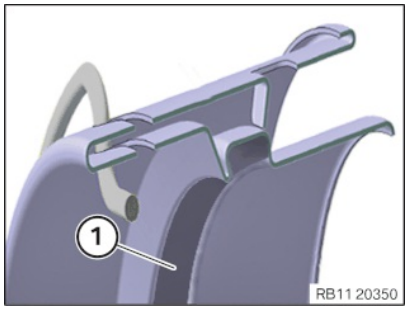


- Check the seal (1) for damage, and renew if necessary.

▸ **Replacing damaged seal**

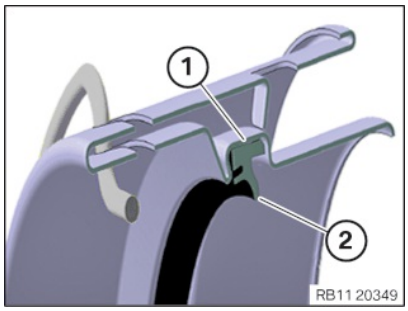
TECHNICAL INFORMATION

Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



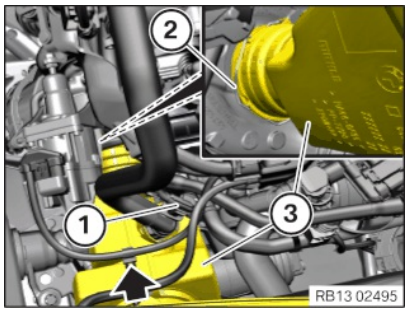
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

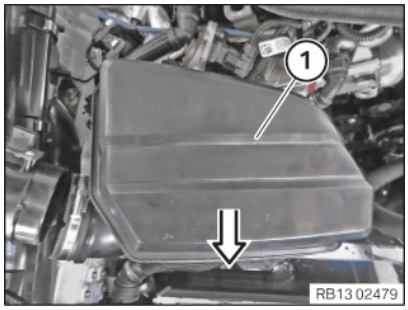
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is directed inwards as shown.



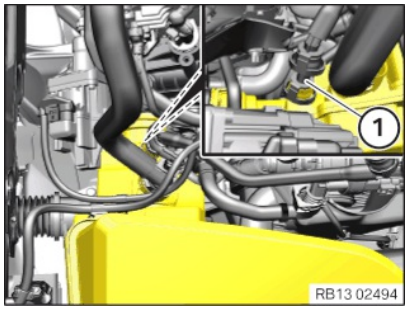
- **Version A:**
- Feed in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

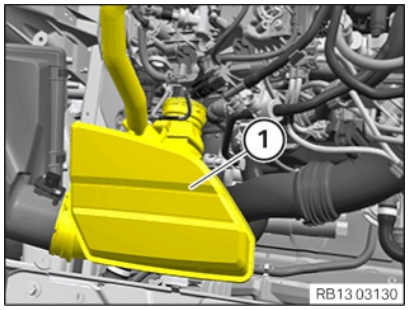
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold the clean air pipe with resonator (1) in the direction of arrow.

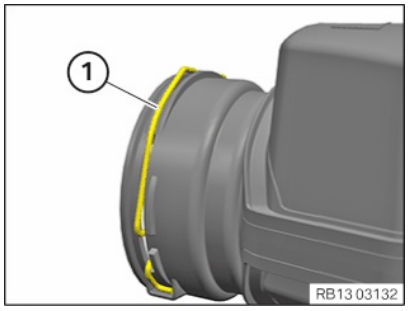


- Connect and lock the tank ventilation line (1).

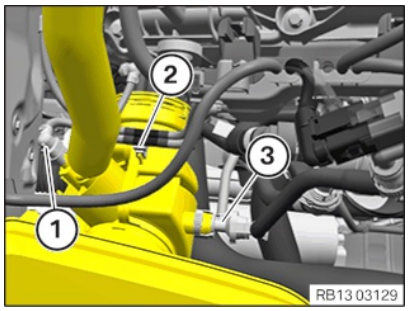


- **Version B:**
- Install clean air pipe with resonator (1) and connect.

  Clean air pipe with resonator (1) must engage audibly.



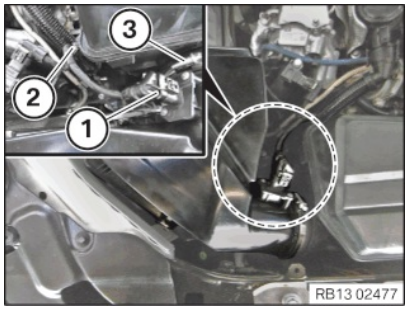
- Lock clamp (1).



- Connect the line (3).

  The line (3) must audibly engage.
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



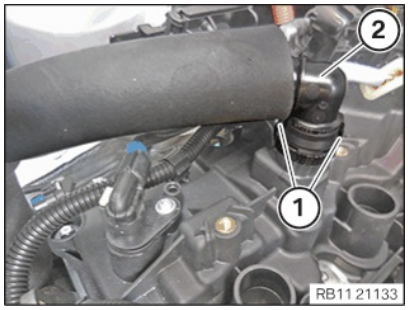
- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

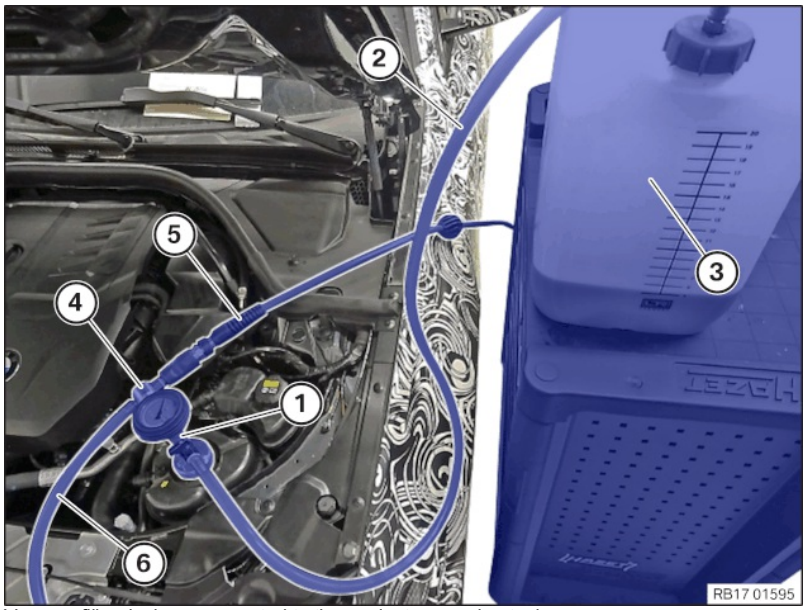
  The connector (1) must engage audibly.



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

106 – Filling the high-temperature cooling system with the vacuum filler device

Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum 6 bar)

6 Exhaust hose (Routing the exhaust hose to a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same

height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component and/or engine damage.

Filling specification **absolutely must** be adhered to.

Operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

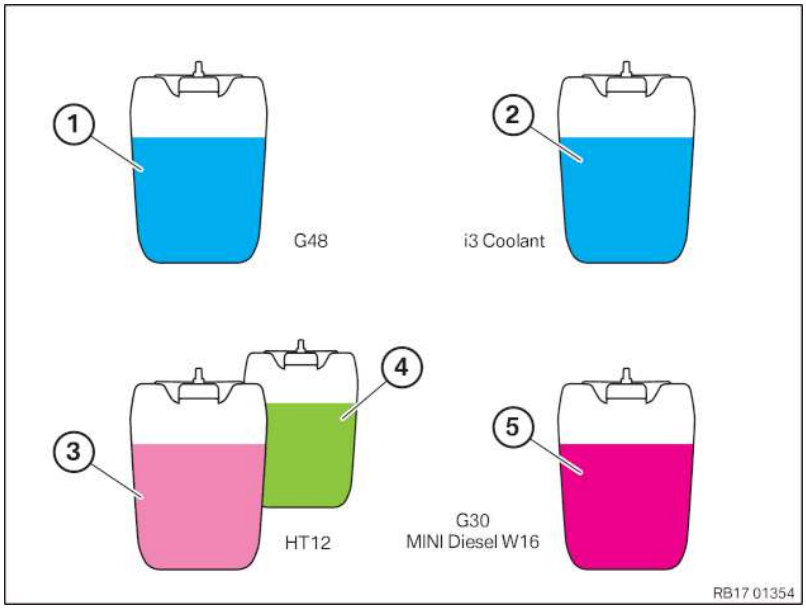
A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

Coolant in the collecting vessel of vacuum filler device



Choose the correct coolant for filling.

In general, a vehicle has to be filled with the coolant with which it is delivered from the factory.

1 G48 (Blue) (BMW LC-87) Must **not** be mixed with i3 Coolant or G30 MINI Diesel W16.

2 i3 Coolant (Blue) (BMW LC-13) Is used only for heater circuit i3. i3 Coolant must **not** be added to other coolant circuits or mixed with other coolants.

3 HT12 (Rose) (BMW LC-18) Must **not** be mixed with i3 Coolant or G30 MINI Diesel W16.

4 HT12 (Green) (BMW LC-18) Must **not** be mixed with i3 Coolant or G30 MINI Diesel W16.

5 G30 (Rose) (BMW LC-07) May be W16 used exclusively for the **MINI Diesel**. G30 must **not** be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine or components in high-voltage vehicles

The use of an incorrect coolant may lead to corrosion or gelling in the coolant circuit.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

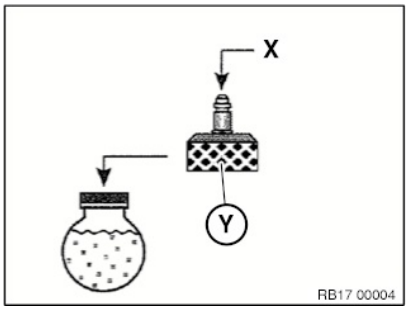
- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

Type	Engine	Adapter (Y) from 17 0 100
G20/G21/G22/G23/G26/G28/G29	B42/B46/B48/B58	**17 0 113**
G20/21/22/23/G26/G42	B57/B47 Mild hybrid technology	**17 0 113**

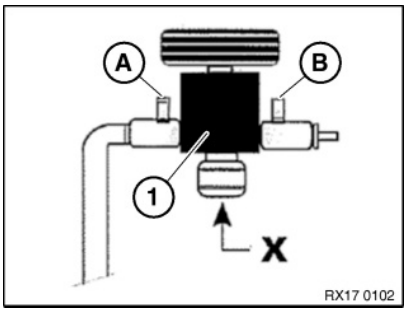
- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

Capacity of high-temperature coolant circuit G20 / G21 / G22 / G28

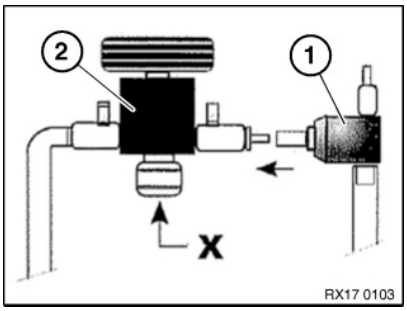
B42T20O1 / B48B20O1 / B46B20O1 / B48B20O1 (PHEV) / B48B20M1 (PHEV)	9.8 l
Expendable materials: Technically suitable antifreeze and corrosion inhibitor	



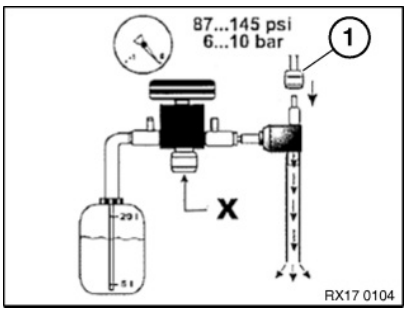
- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.



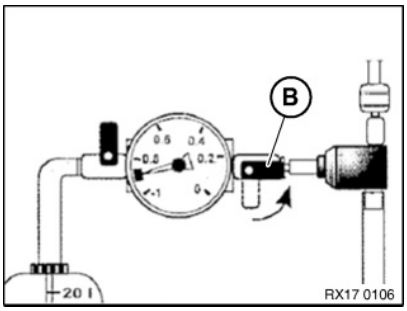
- Check whether shut-off valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



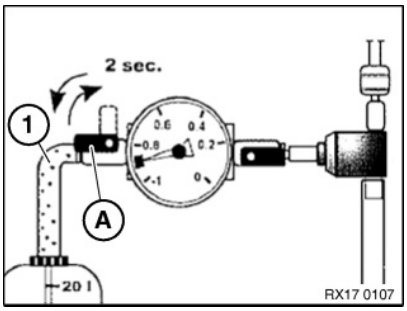
- Connect Venturi nozzle (1) to the vacuum filler device (2).
  (X)is the connection on the coolant expansion tank.



- Connect compressed air (1).
  (X)is the connection on the coolant expansion tank.

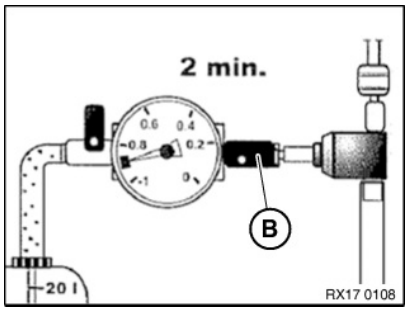


- Open shut-off valve (B).
  The Venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

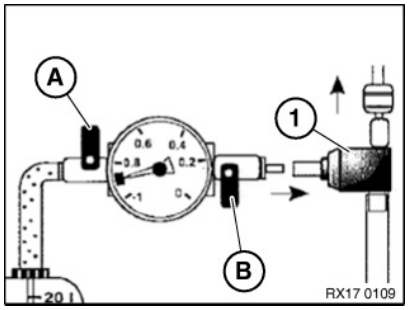


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

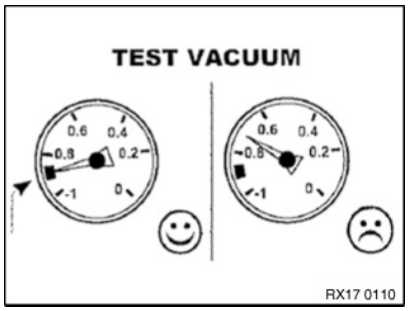
TECHNICAL INFORMATION

The coolant hoses contract during vacuum build-up.

- After having established a vacuum in the coolant circuit of between -0.7 to -0.95 bar (duration approximately 2 min), close the shut-off valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).



Check

- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

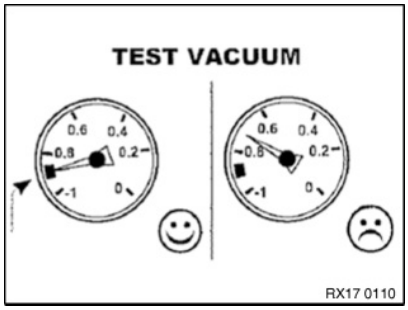
Result

» Vacuum drops.

Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check



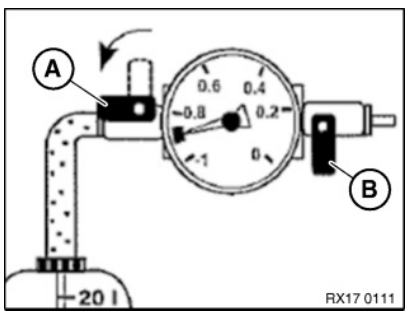
- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

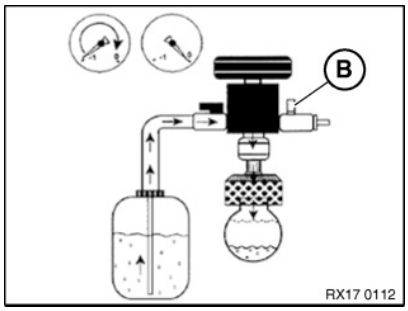
» Vacuum remains constant.

Measure

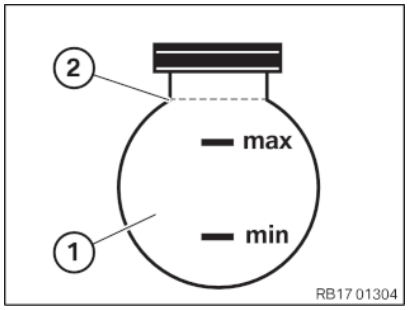
- Continue with filling.



- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.



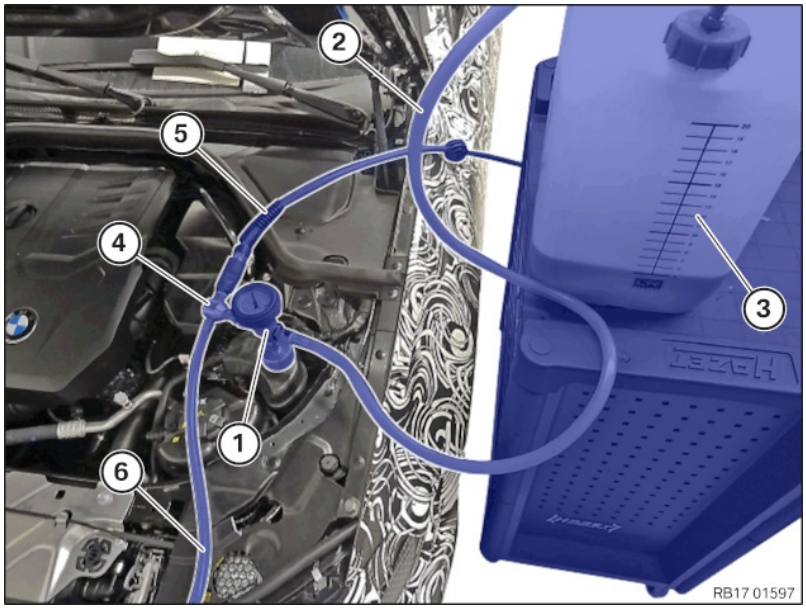
- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).



- Remove the vacuum filler device with the adapter from the high temperature coolant expansion tank (1).
- Top up the coolant level in the high temperature coolant expansion tank (1) to the lower edge of the coolant filler neck (2) in the high temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

107 – Filling the low-temperature cooling system with the vacuum filler device

Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum 6 bar)

6 Exhaust hose (Routing the exhaust hose to a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component and/or engine damage.

Filling specification **absolutely must** be adhered to.

Operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

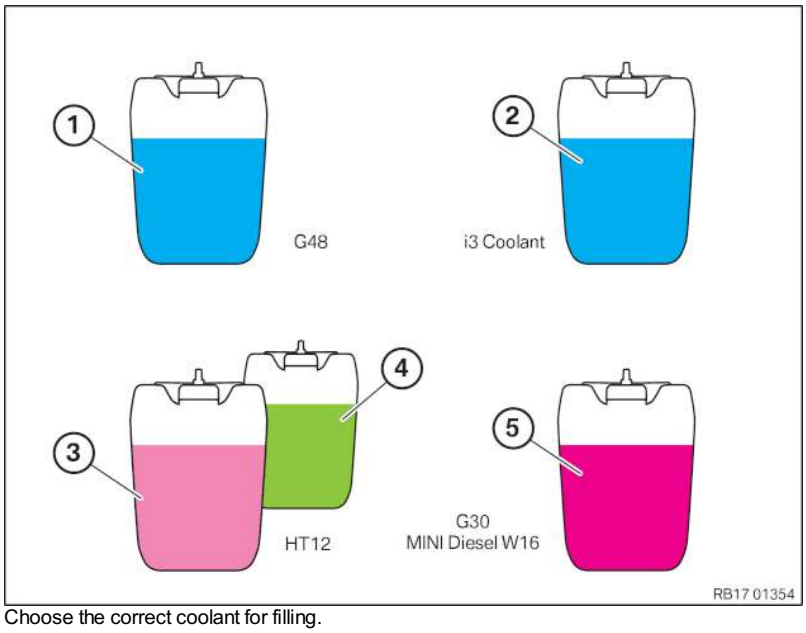
A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

Coolant in the collecting vessel of vacuum filler device



Choose the correct coolant for filling.

In general, a vehicle has to be filled with the coolant with which it is delivered from the factory.

1 G48 (Blue) (BMW LC-87) Must **not** be mixed with i3 Coolant or G30 MINI Diesel W16.

2 i3 Coolant (Blue) (BMW LC-13) Is used only for heater circuit i3. i3 Coolant must **not** be added to other coolant circuits or mixed with other coolants.

3 HT12 (Rose) (BMW LC-18) Must **not** be mixed with i3 Coolant or G30 MINI Diesel W16.

4 HT12 (Green) (BMW LC-18) Must **not** be mixed with i3 Coolant or G30 MINI Diesel W16.

5 G30 (Rose) (BMW LC-07) May be W16 used exclusively for the **MINI Diesel**. G30 must **not** be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine or components in high-voltage vehicles

The use of an incorrect coolant may lead to corrosion or gelling in the coolant circuit.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

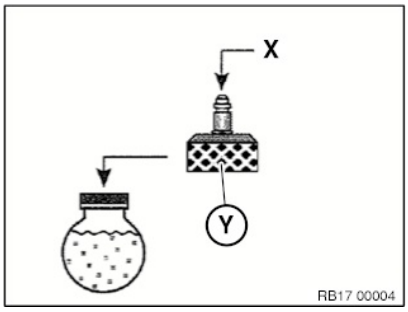
Type	Engine	Adapter (Y) from 17 0 100
G20/G21/G22/G23/G26/G28/G29	B42/B46/B48/B58	17 0 109
G20/21/22/23/G26/G42	B57/B47 Mild hybrid technology	17 0 109

- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

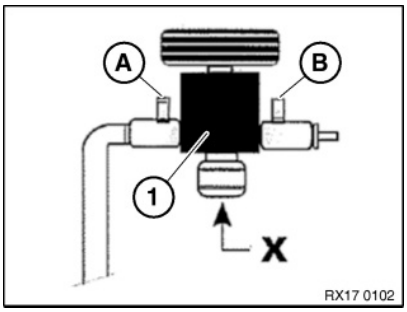
Capacity of low-temperature coolant circuit G20 / G21 / G22 / G28

B42T20O1 / B48B20O1 / B46B20O1 / B48B20O1 (PHEV) / B48B20M1 (PHEV)	4.2 l

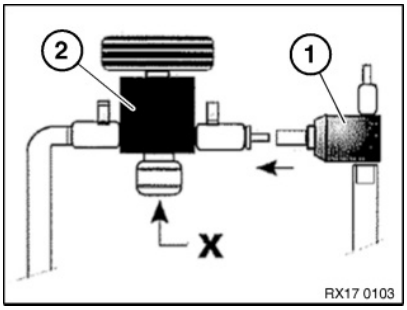
Expendable materials: Technically suitable antifreeze and corrosion inhibitor



- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.

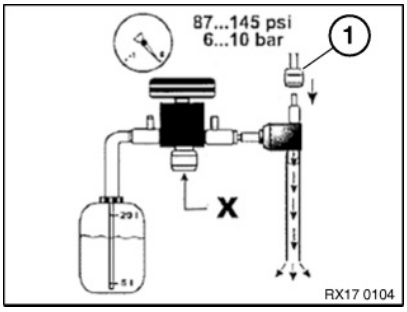


- Check that shutoff valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



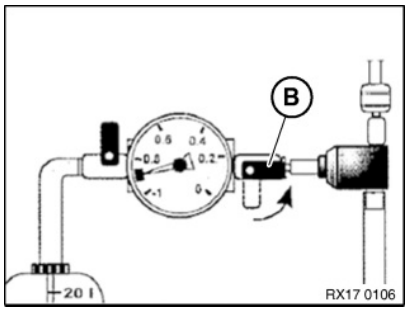
- Connect Venturi nozzle (1) to the vacuum filler device (2).

  (X)is the connection on the coolant expansion tank.



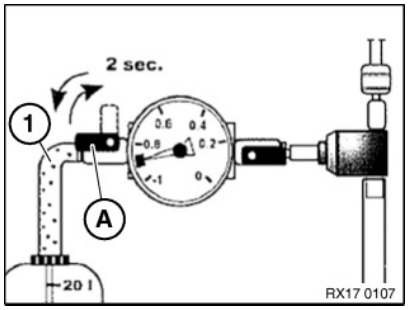
- Connect compressed air (1).

  (X)is the connection on the coolant expansion tank.



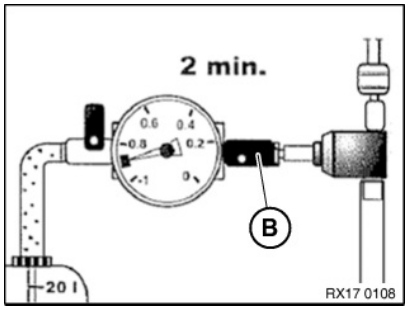
- Open shut-off valve (B).

  The Venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

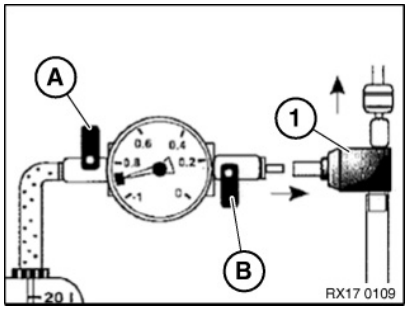


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

TECHNICAL INFORMATION

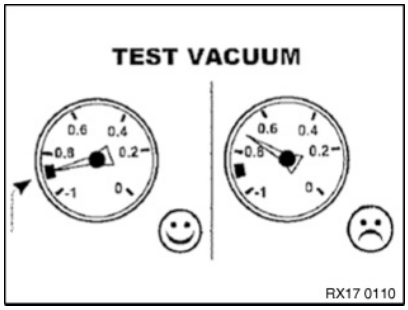
The coolant hoses contract during vacuum build-up.

- After a vacuum of -0.7 to -0.95 bar has been created in the coolant circuit (duration approx. 2 min), shut the shutoff valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).

Check



- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

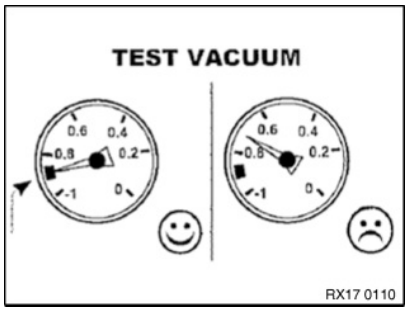
Result

» Vacuum drops.

Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check



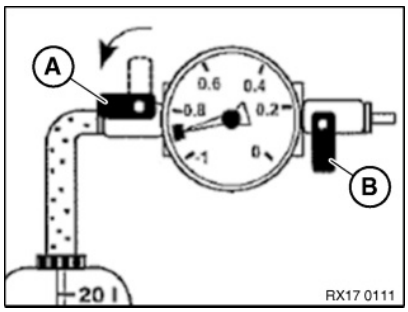
- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

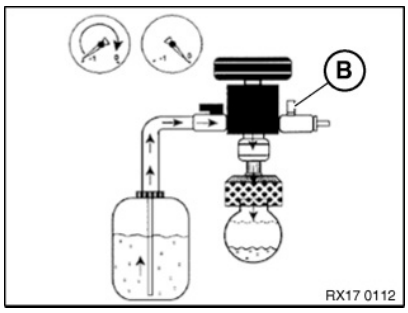
» Vacuum remains constant.

Measure

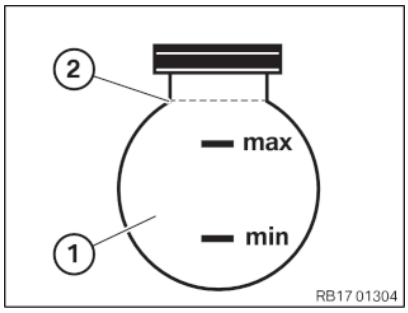
- Continue with filling.



- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.



- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).



- Remove the vacuum filler device with the adapter from the low-temperature coolant expansion tank (1).
- Adjust the coolant level in the low-temperature coolant expansion tank (1) to the lower edge of the coolant filler neck (2) of the low-temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

108 – Connecting all battery earth leads

- See additional information.

109 – Bleed the high-temperature coolant circuit

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component and/or engine damage.

Filling specification **absolutely must** be adhered to.

Operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

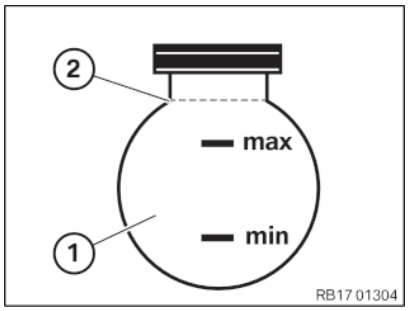
Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

TECHNICAL INFORMATION

The electrical fan is activated during the entire cooling system bleeding routine.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.



- Open the bleeder screw on the coolant expansion tank for the high-temperature coolant circuit and close it again after approx. **10 s**.

  You can close the bleeder screw prior to expiry of the 10 s once coolant escapes.
- Adjust the coolant level in the high temperature coolant expansion tank (1) to the lower edge (2) of the coolant filler neck in the high temperature coolant expansion tank (1) .
- Close the sealing cap on the coolant expansion tank of the high--temperature cooling circuit.
- Make sure the bonnet is **closed**.
- Make sure that the wheels touch the ground.
- Engage the parking brake.
- Do not engage any gear in case of manual transmission, and engage into both P" or "N" automatic transmissions.
- Connect battery charger.
- **Activate** the testing-analysis-diagnosis (PAD) by quickly pressing the START-STOP button 3 times.
- Activate the low-beam headlight and the hazard warning lights **at the same time**.

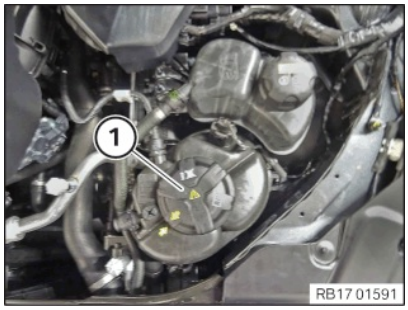
  If the low-beam headlight and the hazard-warning lights are **not** switched on, then the ignition (**terminal 15**) will automatically switch off after some time and interrupt the bleeding procedure.
- Check that the driving experience control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **not** press on the brake pedal.
- Start engine.
- The cooling system bleeding routine has been started, pay attention to the display on the instrument cluster (KOMBI). ("Service function started")

  The engine speed (up to 3500 rpm) and the actuators in the cooling system are activated **automatically** for 11 minutes according to a cooling system bleeding routine.

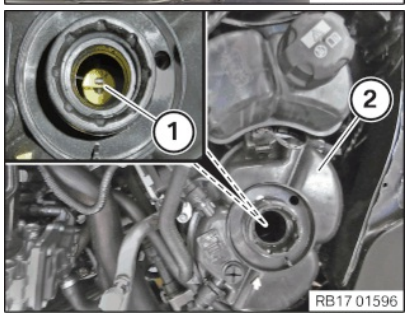
  The cooling system bleeding routine ends approx. 11 min **after** engine start.

  The engine speed **drops** to the idle speed.
- Observe the display in the instrument cluster (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Switch off engine.
- Allow the coolant temperature to cool down to **< 50°C**.



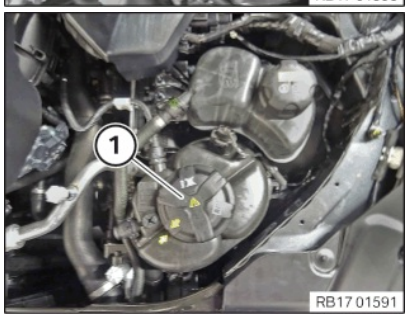
- Loosen sealing cap (1).



TECHNICAL INFORMATION

After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.
Overfilling the cooling system serves to balance the remaining air in the cooling system.
The normal filling level of the coolant is reached while driving.

- Adjust the filling level in the coolant expansion tank (2) of the high-temperature coolant circuit to **200 ml** over the **maximum mark**(1) .



- Close sealing cap (1).
- Close the sealing cap (1) until the **arrows** are flush.

110 – Bleeding the low-temperature cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component and/or engine damage.

Filling specification **absolutely must** be adhered to.

Operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

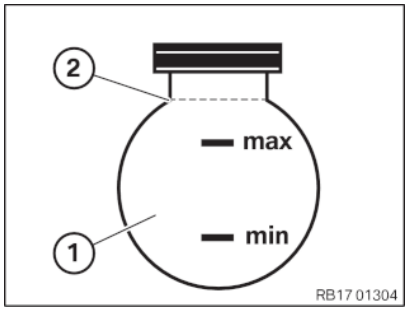
TECHNICAL INFORMATION

Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.



- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to lower edge (2) of the coolant filler neck of low-temperature coolant expansion tank (1).
- Close the sealing cap on the coolant expansion tank of the low-temperature coolant circuit.
- Ensure that the bonnet is **open**.
- Connect battery charger.
- **Activate** the testing-analysis-diagnosis (PAD) by quickly pressing the START-STOP button 3 times.
- Activate the low-beam headlight and the hazard warning lights **at the same time**.

  If the low-beam headlight and the hazard-warning lights are **not** switched on, then the ignition (**terminal 15**) will automatically switch off after some time and interrupt the bleeding procedure.
- Ensure that the Driving Experience Control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **not** press on the brake pedal.
- Do **not** start engine.

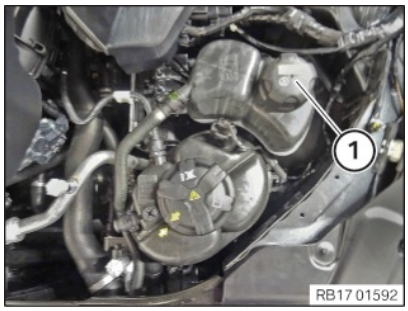
  The cooling system bleeding routine will start.

  The electric coolant pump in the low-temperature coolant circuit is activated for 11 minutes according to a cooling system bleeding routine.

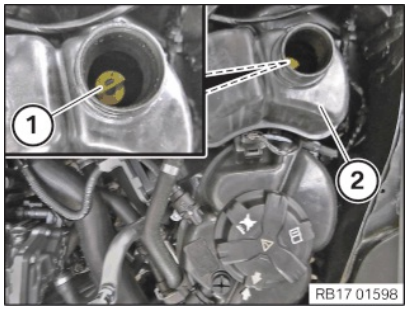
  The cooling system bleeding routine ends after 11 minutes.

  The electric coolant pump is **no** longer activated.
- Note the display in the instrument cluster (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Allow the coolant temperature to cool down to **< 50°C**.



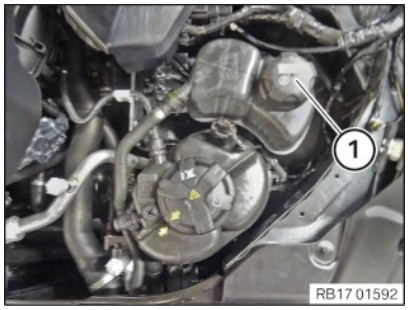
- Loosen sealing cap (1).



TECHNICAL INFORMATION

After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.
Overfilling the cooling system serves to balance the remaining air in the cooling system.
The normal filling level of the coolant is reached while driving.

- Adjust the filling level in coolant expansion tank (2) of the low-temperature coolant circuit to **100 ml** above the **maximum mark** (1) .



- Close sealing cap (1).

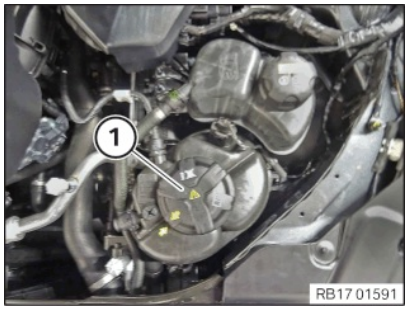
111 – Check the high-temperature cooling system for watertightness

WARNING

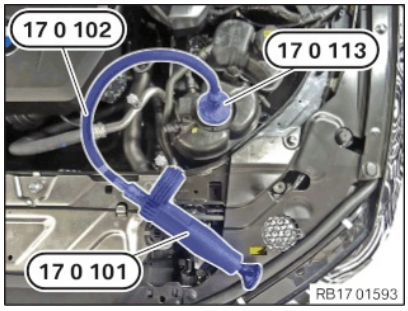
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.



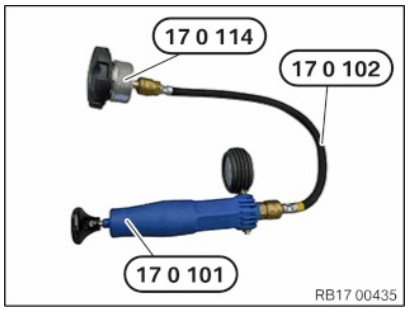
- Loosen sealing cap (1).



- Attach the special tool 0 494 418 (17 0 101) with special tools 0 494 419 (17 0 102) and 0 494 642 (17 0 113) from the set of special tools 0 494 417 (17 0 100).
- Build up excess pressure and wait for approximately 2 minutes.

Opening pressure of sealing cap / test pressure of high-temperature coolant circuit cooling system

Pressure relief valve opens when the pressure exceeds the ambient pressure.	min. 1,4 bar
Electric changeover valve must open at latest when the pressure is lower than the ambient pressure.	max. 0,1 bar
Test pressure for cooling system (gauge pressure)	1,5 bar



TECHNICAL INFORMATION

If the described test step is not completed successfully: repeat test step twice. Only replace the sealing cap after three tests with an incorrect opening pressure.

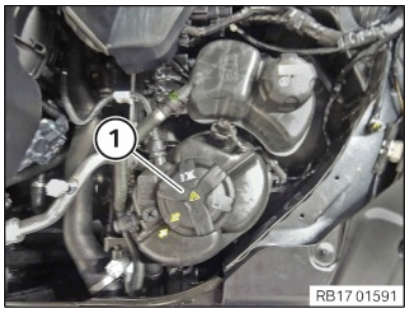
When driving at high ambient temperatures, the design may cause the pressure relief valve in the sealing cap to open slightly and air to escape together with dissolved coolant. This coolant vapour condenses on the surface of the coolant expansion tank and leaves traces of coolant when the vehicle has cooled down. These traces of coolant do not indicate whether the sealing cap is defective or not.

Escaping coolant vapours when the vehicle is at standstill may cause the pressure relief valve to stick to the sealing cap. This may cause an incorrect opening pressure.

- Screw on sealing cap (1) on special tool 0 494 643 (17 0 114) from the set of special tools 0 494 417 (17 0 100).
- Build up the pressure with special tools 0 494 418 (17 0 101) and 0 494 419 (17 0 102) from the set of special tools 0 494 417 (17 0 100).
- Observe on the pressure measuring device when the opening pressure has been reached.

Opening pressure of sealing cap / test pressure of high-temperature coolant circuit cooling system

Pressure relief valve opens when the pressure exceeds the ambient pressure.	min. 1,4 bar
Electric changeover valve must open at latest when the pressure is lower than the ambient pressure.	max. 0,1 bar
Test pressure for cooling system (gauge pressure)	1,5 bar



- Close sealing cap (1).
- Close the sealing cap (1) until the **arrows** are flush.

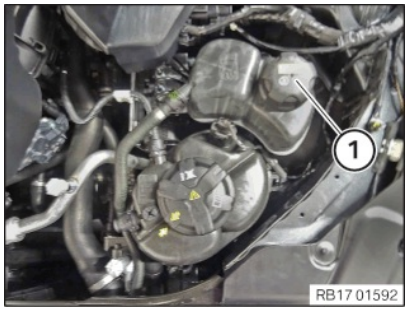
112 – Checking low-temperature cooling system for watertightness

WARNING

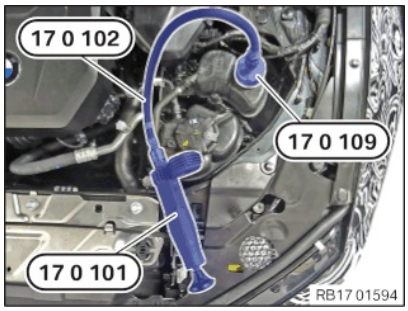
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.



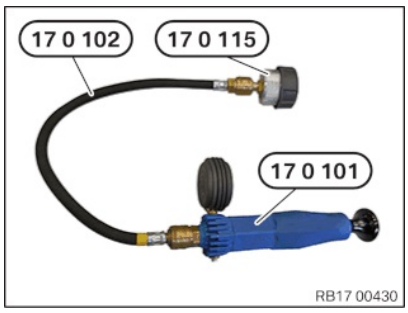
- Loosen sealing cap (1).



- Attach the special tool 0 494 418 (17 0 101) with special tools 0 494 419 (17 0 102) and 0 494 426 (17 0 109) from the set of special tools 0 494 417 (17 0 100).
- Build up excess pressure and wait for approximately 2 minutes.

Opening pressure of sealing cap of low-temperature coolant circuit

Pressure relief valve opens when the pressure exceeds the ambient pressure.	min. 1,4 bar
Electric changeover valve must open at latest when the pressure is lower than the ambient pressure	max. 0,1 bar
Test pressure for cooling system (gauge pressure)	1,5 bar



TECHNICAL INFORMATION

If the described test step is not completed successfully: repeat test step twice. Only replace the sealing cap after three tests with an incorrect opening pressure.

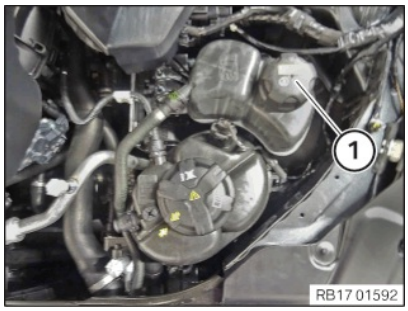
When driving at high ambient temperatures, the design may cause the pressure relief valve in the sealing cap to open slightly and air to escape together with dissolved coolant. This coolant vapour condenses on the surface of the coolant expansion tank and leaves traces of coolant when the vehicle has cooled down. These traces of coolant do not indicate whether the sealing cap is defective or not.

Escaping coolant vapours when the vehicle is at standstill may cause the pressure relief valve to stick to the sealing cap. This may cause an incorrect opening pressure.

- Screw on sealing cap (1) on special tool 0 495 889 (17 0 115) from the set of special tools 0 494 417 (17 0 100).
- Build up the pressure with special tools 0 494 418 (17 0 101) and 0 494 419 (17 0 102) from the set of special tools 0 494 417 (17 0 100).
- Observe on the pressure measuring device when the opening pressure has been reached.

Opening pressure of sealing cap of low-temperature coolant circuit

Pressure relief valve opens when the pressure exceeds the ambient pressure.	min. 1,4 bar
Electric changeover valve must open at latest when the pressure is lower than the ambient pressure	max. 0,1 bar
Test pressure for cooling system (gauge pressure)	1,5 bar



- Close sealing cap (1).

113 – Check engine oil level

Prerequisite

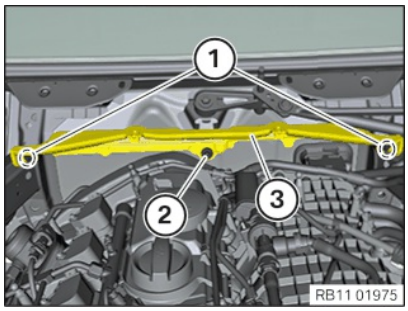
Vehicle is in a horizontal position.

TECHNICAL INFORMATION

Please comply with instructions in Owner's Handbook.

- Carry out an electronic oil measurement.
- Top up engine oil if necessary.

114 – Installing centre bulkhead lower section

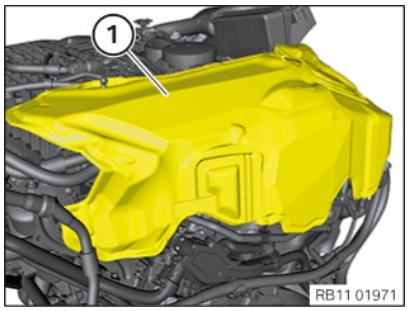


- Position the centre bulkhead lower part (3).
- Tighten nut (2) and screws (1).

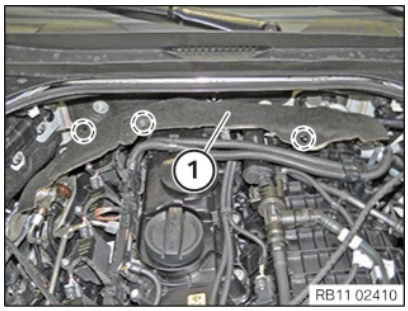
Bulkhead lower part to body

Screw		Tightening torque	2,6 Nm
Plastic nut		Tightening torque	2,6 Nm

115 – Installing acoustic cover at rear

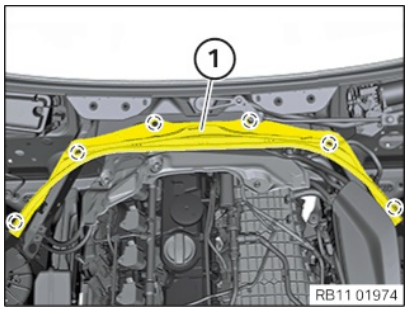


- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

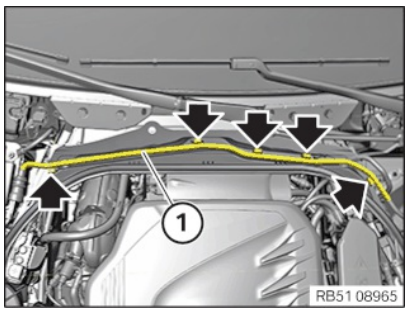
116 – Installing the centre bulkhead upper part



- Position the centre bulkhead upper part (1).
- Tighten the bolts in the marked areas.

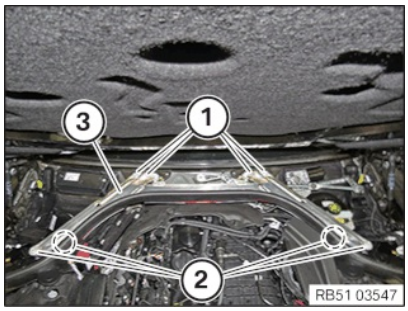
Bulkhead upper part to bottom bulkhead

		Tightening torque	3 Nm



- **Version with mild hybrid technology:**

  Clip in the wire (1) into the holders (arrows).



NOTICE

The following work step(s) is / are to be carried out if the specified component(s) is/are fitted.

- Install the tension strut (3) on the spring strut dome.
- Tighten the screws (1).

Tension strut on bulkhead

M10x25 screw		Tightening torque	56 Nm

- Renew screws (2).

  Parts: Screws
- Tighten the screws (2).

Tension strut to spring strut dome

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

117 – Installing cowl panel cover

RISK OF DAMAGE

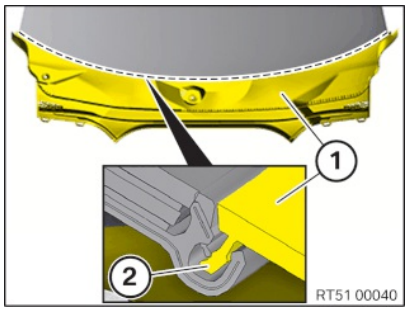
Damage caused by water ingress into the vehicle.

Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

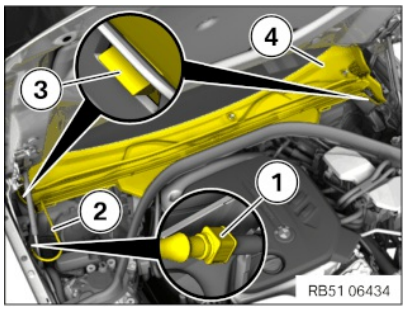
- Ensure correct installation of the components.
- Only use undamaged components.

TECHNICAL INFORMATION

Before installing the cowl panel cover it is **mandatory** to check that the 48 V line is routed correctly and fitted tightly.
An incorrectly laid or attached 48 V line can be damaged by the wiper kinematics.



- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

118 – Install left and right wiper arm

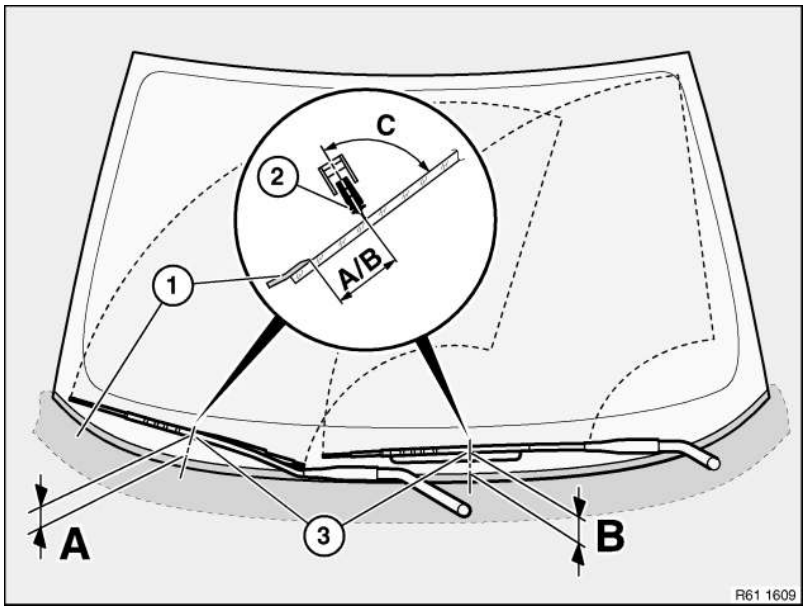
NOTICE

Description is for left component only. Procedure on the right side is identical.

▸ **Installing left and right wiper arm**

TECHNICAL INFORMATION

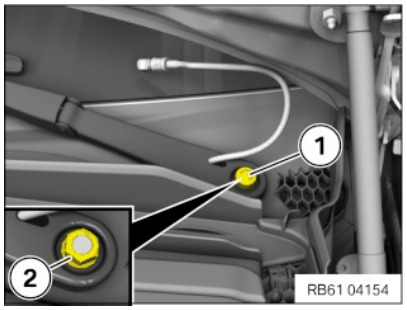
The wiper system must be in zero position.
After installing the cowl panel cover and before fitting the wiper arm:
Activate the wiper system once to ensure that it has the correct installation position.



- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

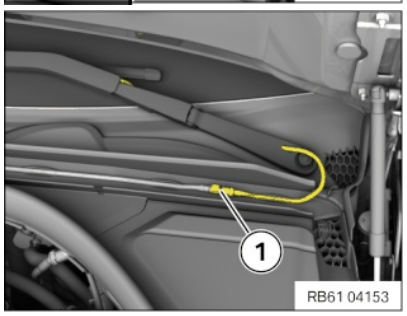


- Tighten nut (2).

Windscreen wiper arm

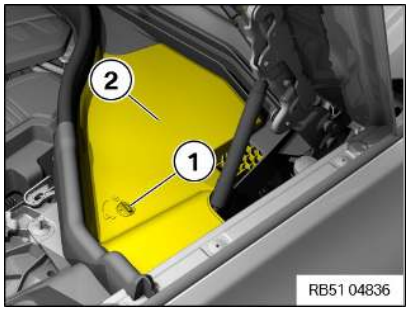
Combination hexagon nut		Tightening torque	35 Nm

- Connect the protective cap (1).



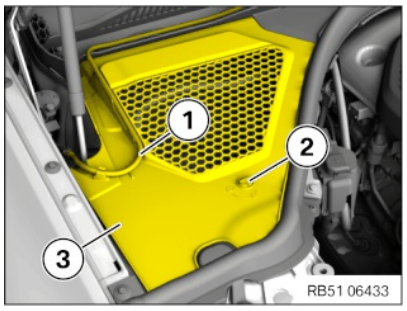
- Feed washer fluid hose (1) into the cowl panel guide and connect at the separation point.

119 – Install the cover of the engine compartment on the rear left



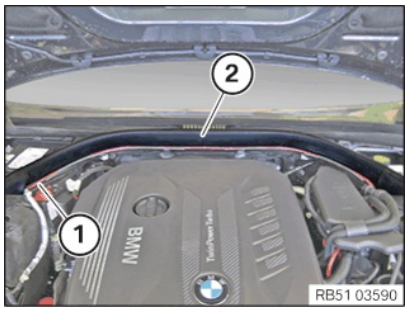
- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

120 – Install the rear right engine compartment cover



- Position the cover of the engine compartment on the rear right (3).
- Close lock (2).
- Insert washer fluid hose (1) into the guides.

121 – Install the seal for the bonnet



- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

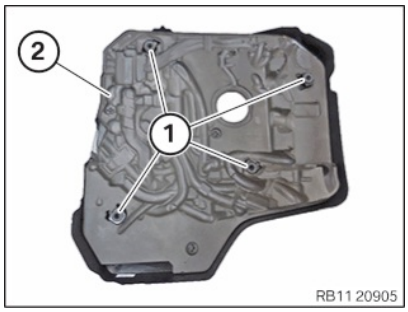
122 – Install acoustic cover

RISK OF DAMAGE

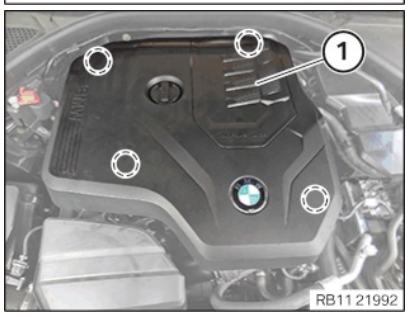
Damage to the acoustic cover/design cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover/design cover.

- Disassemble or mount the acoustic cover/design cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover/design cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.



- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

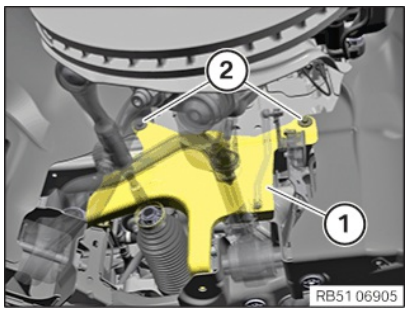
123 – Install the cover of the steering assembly

Prerequisite

Underbody protection of the steering gear is removed.

TECHNICAL INFORMATION

When tightening the screws, the cover can twist and cause chafe marks on the anti-roll bar (risk of corrosion).
Hold the cover while tightening the screws. Then check the position of the cover.



- Position the cover (1).
- Tighten the screws (2).

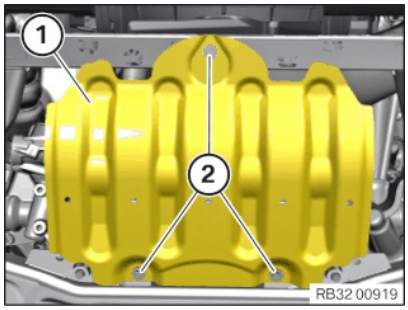
Cover, steering unit

Screw		Tightening torque	3 Nm

124 – If installed: Install underbody protection of the steering

Prerequisite

Front underbody protection has been removed.



- Position underbody protection (1).
- Tighten the screws (2).

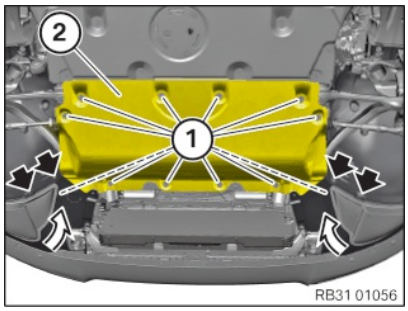
Underbody protection, steering, to front axle support

Multi-purpose boltM10		Tightening torque	56 Nm

Underbody protection, steering, to front axle support

Hexagon bolt M6		Tightening torque	8 Nm

125 – Install the underbody protection of the steering gear



- **Version A:**

  Position the underbody protection (2) of the steering gear.

  Tighten the screws (1).

Underbody protection of the steering gear

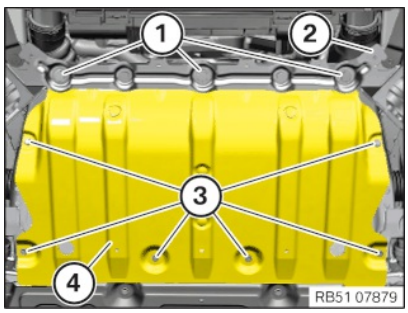
Hexagon screw for thermoplastic		Tightening torque	2.6 Nm
Hexagon bolt M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.

  Tighten the screws (arrows) of the lower wheel arch cover on the wheel arch cover.

Wheel arch trim panel, front

Thermoplastic hexagon screw		Tightening torque	2,6 Nm



- **Version B:**

  Feed in the underbody protection (4) of steering gear and install it.

  Tighten the screws (3).

Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	2.6 Nm
Hexagon bolt M6x20		Tightening torque	8 Nm

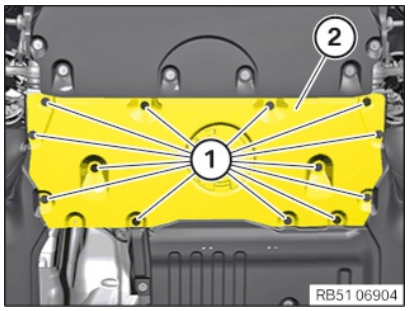
- Position the holder (2) for the underride protection.

  Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

126 – Installing the centre underbody protection



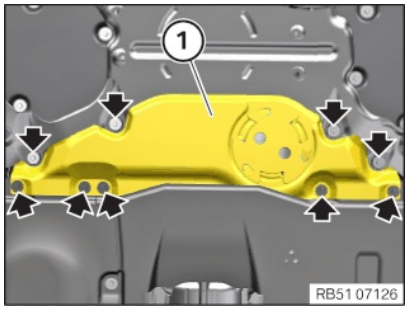
- **Variant with rear wheel drive:**

  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version with all-wheel drive:**

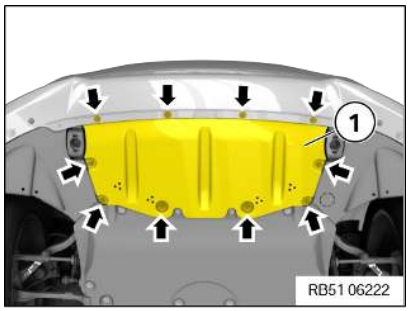
  Guide in centre underbody protection (1) and install.

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

127 – Installing the front underbody protection



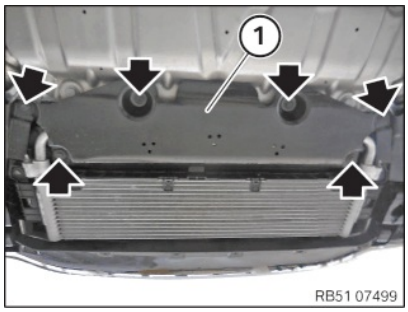
- **Version A:**

  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



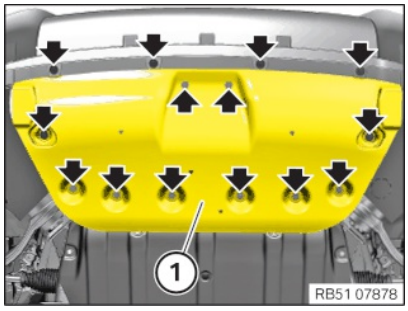
- **Version B:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version C:**

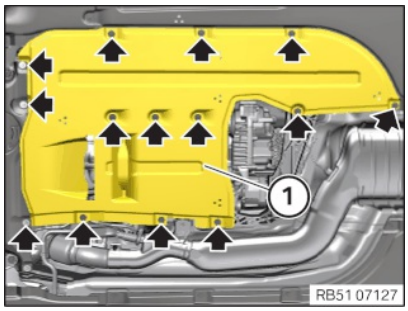
  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

128 – Installing underbody protection at rear



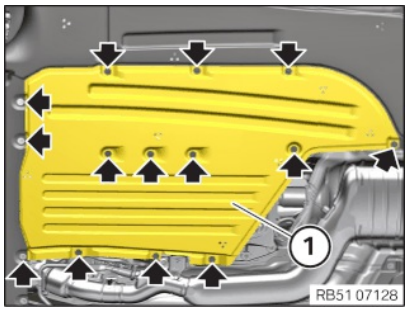
- **Version A:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version B:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

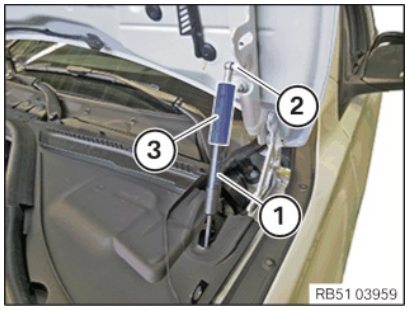
129 – Take bonnet out of the service position

CAUTION

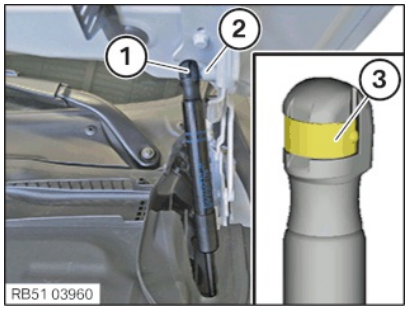
Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.



- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.



- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

Additional Information

Overview of Tightening Torques

Cover, front bottom on side — Used in step 41

Hexagon screw for thermoplastic		Tightening torque	3 Nm

Basic carrier to cylinder head — Used in step 496777

M6		Tightening torque	8 Nm

Test gauge to basic carrier — Used in step 496777

M6		Tightening torque	8 Nm

Special tool to cylinder head — Used in step 58

M8		Tightening torque	21,5 Nm

Ventilation connection/special tool to cylinder head — Used in step 64

M10			18 Nm

Coolant temperature sensor at cylinder head — Used in step 64

Sensor		Tightening torque	18 Nm

Exhaust turbocharger to cylinder head — Used in step 65

M7	Renew screws. Replace nuts.	1. Jointing torque 2. tightening torque 3. tightening torque	5 Nm 18 Nm 18 Nm

Cylinder head to crankcase — Used in step 66

M11	Observe tightening sequence. Fit new cylinder head bolts.	1. Jointing torque 2. Angle of rotation 3. Angle of rotation	30 Nm 90 ° 180 °

Cylinder head bolt to timing case cover — Used in step 66

M8x40	Renew screws.	Tightening torque	19 Nm

Bearing journal to cylinder head — Used in step 66

Bearing journal	Renew the bearing journal!	Tightening torque	22 Nm

Sliding rail to cylinder head — Used in step 66

M6x16			8 Nm

Cable clip on rear cylinder head/transmission — Used in step 66

M6 x 20		Tightening torque	8 Nm

Cover on rear cylinder head — Used in step 66

M6		Tightening torque	8 Nm

Camshaft sensor wheel to intake camshaft — Used in step 66

M6x16	Renew screw.	1. Tightening torque 2. Angle of rotation	5 Nm 90°

Manifold support for intake air to cylinder head — Used in step 66

M6X16		Tightening torque	8 Nm

Holder for electrical auxiliary coolant pump on cylinder head — Used in step 66

M6		Tightening torque	7 Nm

Standard screw connection M6 — Used in step 66

M6		Tightening torque	8 Nm

Oil feed line to exhaust turbocharger/crankcase — Used in step 66

M6x12		Tightening torque	8 Nm

VANOS central valve to camshaft — Used in step 7374

M21	*VANOS central valve on the thread and on the contact surface must be coated with engine oil.*	1. Tightening torque 2. Tightening torque	50 Nm 140 Nm
M22	*VANOS central valve on the thread and on the contact surface must be coated with engine oil.*	1. Tightening torque 2. Tightening torque	50 Nm 140 Nm

Chain tensioner to cylinder head — Used in step 76

Chain tensioner		Tightening torque Angle of rotation	20 Nm 40 °

Coolant line to coolant pump/cylinder head — Used in step 78

M6x20		Tightening torque	8 Nm

Intake plenum to cylinder head — Used in step 79

M6		Tightening torque	10 Nm

Intake plenum to support — Used in step 79

M6X25		Tightening torque	8 Nm

Throttle body to holder			Used in step 79
M6X25		Tightening torque	8 Nm

Tank ventilation line to intake plenum			Used in step 79
Oval-head screw		Tightening torque	3 Nm

Charge air line to throttle body			Used in step 79104
M6		Tightening torque	8 Nm

Control unit holder on spring strut dome			Used in step 81
Hexagon screw		Tightening torque	8 Nm

Oil return line to exhaust turbocharger/crankcase			Used in step 84
M6x14		Tightening torque	8 Nm

Coolant feed line/coolant return line to exhaust turbocharger			Used in step 8586
M6 x 12		Tightening torque	8 Nm

Coolant return line holder to exhaust turbocharger			Used in step 85
M6		Tightening torque	8 Nm

Coolant feed line to crankcase			Used in step 86
M6 x 12		Tightening torque	8 Nm

Catalytic converter / petrol particulate filter to exhaust turbocharger			Used in step 87
V-band clamp	Renew V-band clamp.	Tightening torque	13 Nm

Catalytic converter to holder			Used in step 87
M8	Renew screw.	Tightening torque	19 Nm

Catalytic converter to holder			Used in step 87
M8	Renew nut.	Tightening torque	19 Nm

Rear silencer to body / bumper support			Used in step 88
M8	Replace nuts.	Tightening torque	19 Nm

Rear silencer on support			Used in step 88
Nut M8	Renew nut.	Tightening torque	19 Nm

Front pipe/front silencer/petrol particulate filter to the transmission holder			Used in step 88
M8	Renew nut.	Tightening torque	19 Nm

Exhaust system to catalytic converter			Used in step 88
Ribbon clamp nut M8	Renew flat band clip.	Tightening torque	26 Nm
Ribbon clamp nut M10	Renew flat band clip.	Tightening torque	55 Nm

V-clip to catalytic converter			Used in step 88
V-band clamp	Renew V-band clamp.	Tightening torque	25 Nm

Connecting support to tunnel			Used in step 89
M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

Cylinder head cover to cylinder head			Used in step 90
M6x30		Tightening torque	8 Nm
		Tightening torque	10 Nm

Wiring harness section of engine to cylinder head cover			Used in step 90
M6		Tightening torque	8 Nm

Holder, positive battery cable to cylinder head cover — Used in step 9099102

6X18		Tightening torque	6 Nm

Ground cable to rail — Used in step 93

M6		Tightening torque	5 Nm

High pressure pump to high pressure pump flange — Used in step 94

M6x25	*Renewscrews.*	Jointing torque	12 Nm
		Tightening torque	90 °

High pressure line between high pressure pump and high pressure rail — Used in step 95

M14		Tightening torque	33 Nm

Fuel delivery line to high pressure pump — Used in step 96

M14		Tightening torque	26 Nm

Fuel delivery line to cylinder head cover — Used in step 96

M6 screw		Tightening torque	7 Nm

Spark plugs — Used in step 97

M12x1.25		Tightening torque	23 Nm

Ignition coil — Used in step 98

Screw		Tightening torque	8 Nm

Lambda control probe — Used in step 99

M18x1.5		Tightening torque	50 Nm

Acoustic cover (side) to cylinder head cover — Used in step 100

TS6 x 20			6 Nm

Heat shield to cylinder head — Used in step 101

M8 x 12		Tightening torque	19 Nm

Heat shield to clamping strip — Used in step 101

M6 x 12		Tightening torque	8 Nm

Clean air pipe to upper section of intake filter housing — Used in step 105

Clamp		Tightening torque	3 Nm

Bulkhead lower part to body — Used in step 114

Screw		Tightening torque	2,6 Nm
Plastic nut		Tightening torque	2,6 Nm

Bulkhead upper part to bottom bulkhead — Used in step 116

		Tightening torque	3 Nm

Tension strut on bulkhead — Used in step 116

M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome — Used in step 116

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

Windscreen wiper arm — Used in step 118

Combination hexagon nut		Tightening torque	35 Nm

Cover, steering unit — Used in step 123

Screw		Tightening torque	3 Nm

Underbody protection, steering, to front axle support — Used in step 124

Multi-purpose boltM10		Tightening torque	56 Nm

Underbody protection, steering, to front axle support — Used in step 124

Hexagon bolt M6		Tightening torque	8 Nm

Underbody protection of the steering gear — Used in step 125

Hexagon screw for thermoplastic		Tightening torque	2.6 Nm
Hexagon bolt M6x20		Tightening torque	8 Nm

Wheel arch trim panel, front — Used in step 125

Thermoplastic hexagon screw		Tightening torque	2,6 Nm

Holder underride guard to front axle support — Used in step 125

M10		Tightening torque	56 Nm

Underbody protection — Used in step 126128

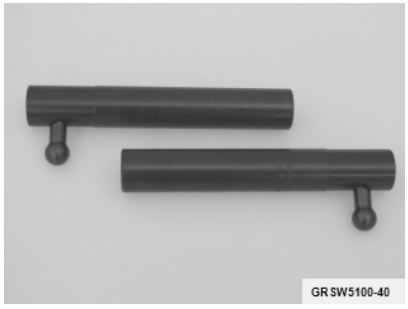
Hexagon screw		Tightening torque	3 Nm

Underbody protection front — Used in step 127

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

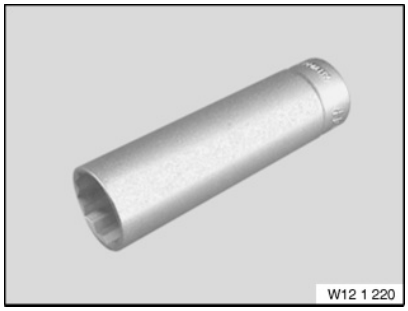
0 494 787 (51 0 040) Support



Common — Used in step 2

Usage	(Bonnet support (2 x)) For retaining engine compartment lid in working position
Included in the tool or work	
Storage location	C46
Replaced by	
In connection with	
SI-Number	01 24 03 (040)

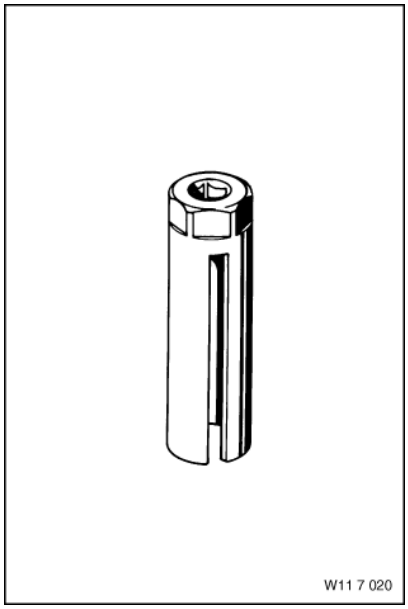
0 495 560 (12 1 220) Wrench socket



Common — Used in step 2097

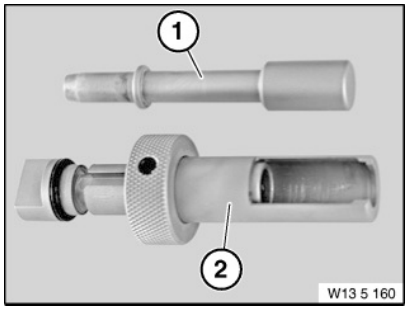
Usage	For removing and installing the spark plugs (WAF 14 bihexal).
Included in the tool or work	
Storage location	C18
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

0 491 074 (11 7 020) Socket wrench insert



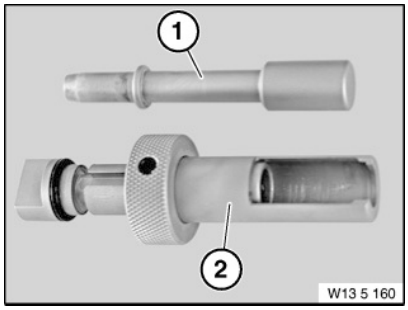
Common	Used in step 2399
Usage	(Socket wrench insert 22 mm) For loosening and tightening the oxygen sensor
Included in the tool or work	
Storage location	A9
Replaced by	
In connection with	
SI-Number	

0 496 567 (13 5 161) Fastener



Common	Used in step 25
Usage	(Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

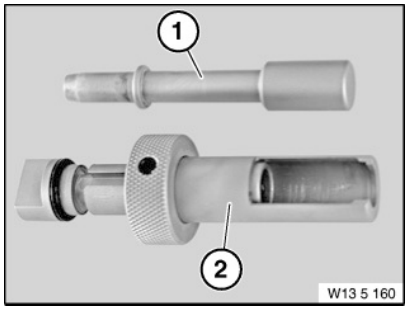
0 496 568 (13 5 162) Fastener



Common Used in step 25

Usage	(Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

0 496 565 (13 5 160) Fastener



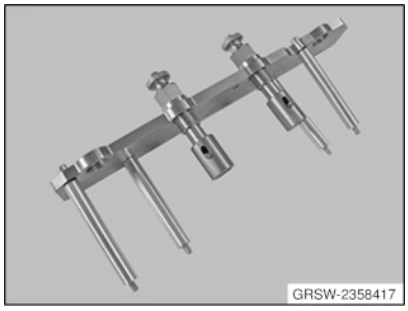
Common Used in step 25

Usage	(Caps (2x)) To close off the fuel lines when removing and installing the engine.
Included in the tool or work	
Storage location	B26
Replaced by	
In connection with	
SI-Number	01 22 08 (498)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 567 (13 5 161)		**Fastener** (Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set	
2	0 496 568 (13 5 162)		**Fastener** (Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool	

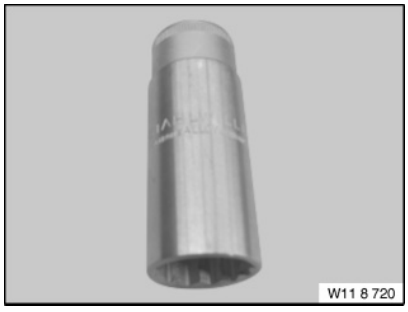
2 358 417 Device



Common Used in step 26

Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

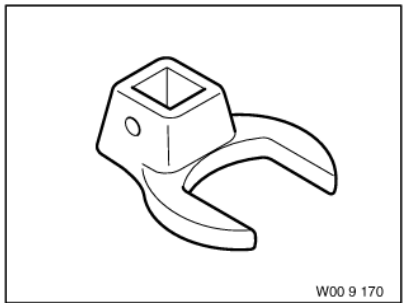
0 496 106 (11 8 720) Socket WAF 46



Common Used in step 26

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)

0 490 507 (00 9 170) Crow-foot wrench

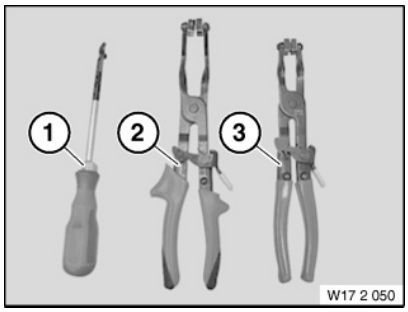


Common	Used in step 26
Usage	(Crow foot spanner WAF 24) For removing and installing the fuel cut-off
Included in the tool or work	
Storage location	A14
Replaced by	
In connection with	
SI-Number	01 09 94 (839)

2 360 895 Pin wrench

Common	Used in step 2891
Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 495 794 (17 2 050) Pliers

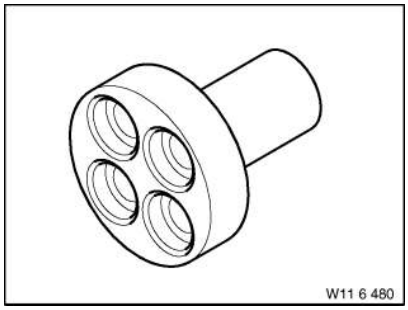


Common	Used in step 4879
Usage	(Set of pliers) For assembling and disassembling the spring band clamps (Coolant hoses)
Included in the tool or work	
Storage location	B85
Replaced by	
In connection with	
SI-Number	01 26 06 (321)

Consisting of

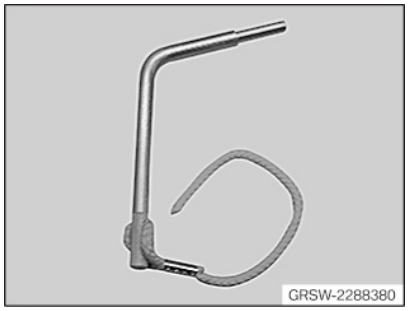
Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 795 (17 2 051)		**Release tool** Remaining inventories will be sold off and then no longer available individually, but as part of complete tool set 17 2 050 = 0495794 only.	
2	0 495 796 (17 2 052)		**Pliers** (Pliers (curved version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	
3	0 495 797 (17 2 053)		**Pliers** (Pliers (straight version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	

0 493 380 (11 6 480) Connector



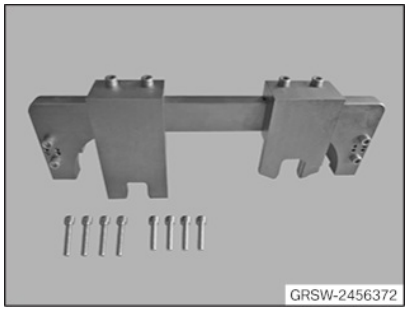
Common	Used in step 49757794
Usage	For turning over engine at crankshaft hub (vibration absorber).
Included in the tool or work	
Storage location	
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

2 288 380 Locating stud



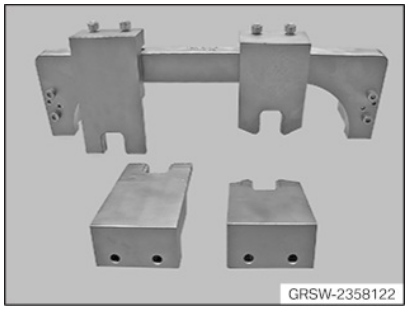
Common	Used in step 497577
Usage	For disconnecting the crankshaft at the top dead centre. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 04 14 (071)

2 456 372 Gauge



Common	Used in step 4957677577
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	
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 122 Gauge



Common	Used in step 495777
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

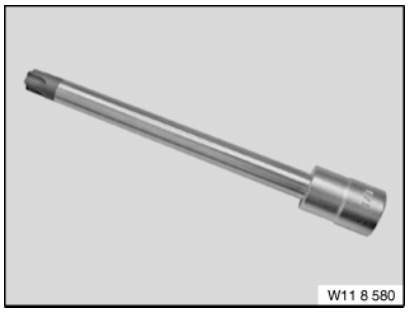
0 496 855 Ratchet handle

Common	Used in step 51527374
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 Wrench socket

Common	Used in step 51527374
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 5866
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)

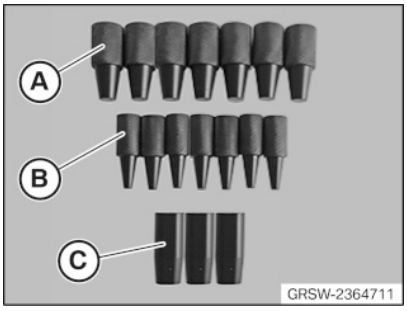
2 220 718 Workshop crane

Common	Used in step 5866
Usage	WSK 1000
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	06 01 11 (701)

2 459 012 Holder

Common	Used in step 5866
Usage	For removing and installing the cylinder head. Contour-graphic silhouette foil is included in the delivery specification.
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 364 711 Plug

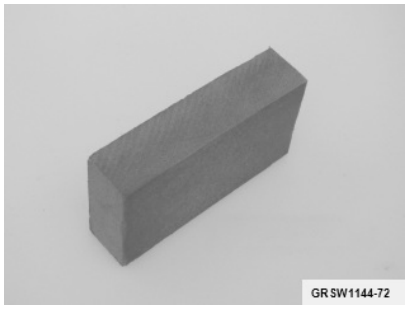


Common	Used in step 6162
Usage	For closing the pressure oil holes for cleaning the cylinder head sealing surfaces.
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	

0 495 103 (11 4 471) Scraper

Common	Used in step 62
Usage	
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

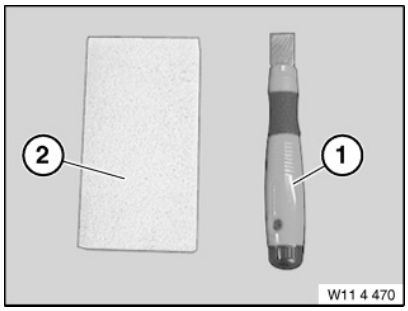
0 495 104 (11 4 472) Extractor



Common Used in step 62

Usage	(grindstone)
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

0 495 102 (11 4 470) Tool



Common Used in step 65

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

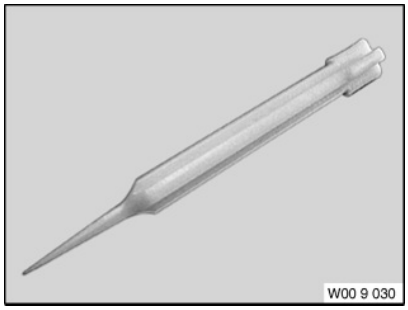
Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 103 (11 4 471)		**Scraper**	
2	0 495 104 (11 4 472)		**Extractor** (grindstone)	

0 490 504 (00 9 120) Torque angle measuring dial

Common Used in step 66

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	

0 496 714 (00 9 030) Wedge



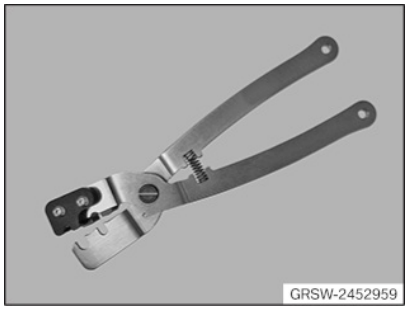
Common Used in step 668586

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 7275
Usage	To pretension the timing chain when adjusting the timings. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 452 959 Pliers



Common	Used in step 92
Usage	Replaced for the disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ No. 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)

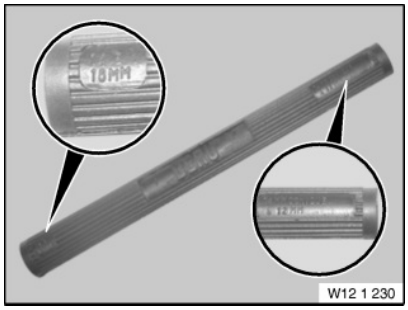
2 448 401 Fitting aid

Common	Used in step 92
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 93
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)

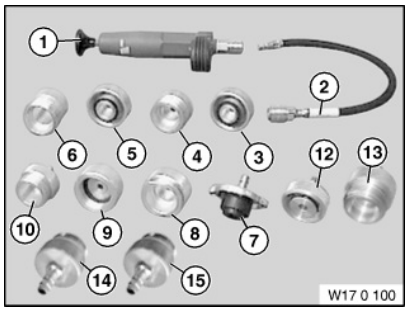
0 496 065 (12 1 230) Fitting aid



Common Used in step 97

Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

0 494 417 (17 0 100) Tester



Common Used in step 106107111112

Usage	For checking engine cooling system on watertightness. For checking radiator cap.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 02 (884)

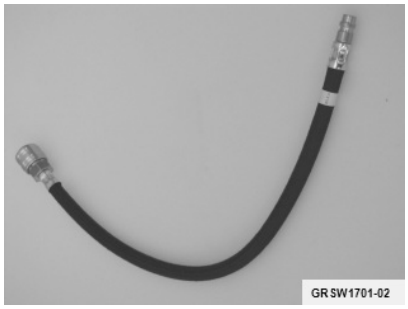
Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
5	0 494 422 (17 0 105)		**Adapter** For radiator cap (sawtooth thread)	
10	0 494 427 (17 0 111)		**Adapter** For radiator cap R53/W11, R50/W17 adapter replaced 17 0 052.	
1	0 494 418 (17 0 101)		**Pump** Replacement part for set 8330 0494417 (170100)	
2	0 494 419 (17 0 102)		**Hose** (hose with quick-release coupling)	
3	0 494 420 (17 0 103)		**Adapter** For radiator cap (normal thread)	
4	0 494 421 (17 0 104)		**Adapter** For radiator cap (normal thread)	
6	0 494 423 (17 0 106)		**Adapter** For radiator cap (sawtooth thread)	
7	0 494 424 (17 0 107)		**Adapter** For radiator cap R50 / W10	
8	0 494 425 (17 0 108)		**Adapter** For radiator cap R50 / W10	
9	0 494 426 (17 0 109)		**Adapter** For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051	
11	0 494 428 (17 0 112)		**Case**	
12	0 494 642 (17 0 113)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
13	0 494 643 (17 0 114)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
14	0 495 889 (17 0 115)		**Adapter** For radiator cap Model series: N12, N14	

0 494 418 (17 0 101) Pump

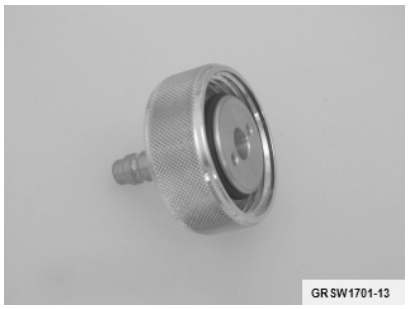
Common	Used in step 111112
Usage	Replacement part for set 8330 0494417 (170100)
Included in the tool or work	0 494 417
Storage location	
Replaced by	
In connection with	
SI-Number	

0 494 419 (17 0 102) Hose



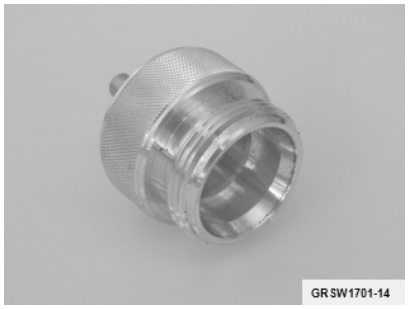
Common	Used in step 111112
Usage	(hose with quick-release coupling)
Included in the tool or work	0 494 417
Storage location	
Replaced by	
In connection with	
SI-Number	

0 494 642 (17 0 113) Adapter



Common	Used in step 111
Usage	For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)
Included in the tool or work	0 494 417
Storage location	
Replaced by	
In connection with	
SI-Number	

0 494 643 (17 0 114) Adapter

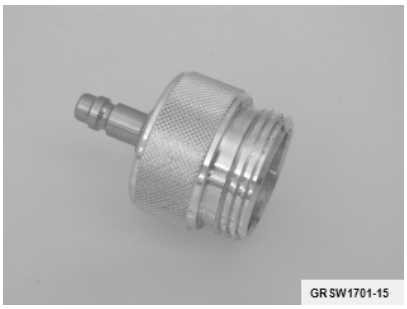


Common	Used in step 111
Usage	For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)
Included in the tool or work	0 494 417
Storage location	
Replaced by	
In connection with	
SI-Number	

0 494 426 (17 0 109) Adapter

Common	Used in step 112
Usage	For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051
Included in the tool or work	0 494 417
Storage location	
Replaced by	
In connection with	
SI-Number	

0 495 889 (17 0 115) Adapter



Common	Used in step 112
Usage	For radiator cap Model series: N12, N14
Included in the tool or work	0 494 417
Storage location	
Replaced by	
In connection with	
SI-Number	01 26 06 (321)

Overview Technical Data

Opening pressure of sealing cap / test pressure of high-temperature coolant circuit cooling system	Used in step 111
Pressure relief valve opens when the pressure exceeds the ambient pressure.	min. 1,4 bar
Electric changeover valve must open at latest when the pressure is lower than the ambient pressure.	max. 0,1 bar
Test pressure for cooling system (gauge pressure)	1,5 bar

Opening pressure of sealing cap of low-temperature coolant circuit	Used in step 112
Pressure relief valve opens when the pressure exceeds the ambient pressure.	min. 1,4 bar
Electric changeover valve must open at latest when the pressure is lower than the ambient pressure	max. 0,1 bar
Test pressure for cooling system (gauge pressure)	1,5 bar

Distance from window pane edge to wiper blade	Used in step 118
Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

Capacity of high-temperature coolant circuit G20 / G21 / G22 / G28	Used in step 106
B42T20O1 / B48B20O1 / B46B20O1 / B48B20O1 (PHEV) / B48B20M1 (PHEV)	9.8 l
Expendable materials: Technically suitable antifreeze and corrosion inhibitor	

Capacity of low-temperature coolant circuit G20 / G21 / G22 / G28	Used in step 107
B42T20O1 / B48B20O1 / B46B20O1 / B48B20O1 (PHEV) / B48B20M1 (PHEV)	4.2 l
Expendable materials: Technically suitable antifreeze and corrosion inhibitor	

Screw-in depth of upper stud bolt on cylinder head	Used in step 65
Screw-in depth	30 mm

Links

Repair instructions (PRE)	Used in step
Repair notes on renewing the cylinder head	

General repair instructions	Used in step
12 00 ... Instructions for removal and replacement of control units	1583
11 00 ... Overview of consumables (Electronic Parts Catalogue)	6599

Repair instructions	Used in step
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1108
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1108
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1108
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1108
61 20 900 Disconnecting and connecting battery earth lead (Plug-in Hybrid Electric Vehicle)	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108
61 20 900 Disconnecting and connecting battery earth lead	1108

61 35 ... Notes on ESD protection (Electro Static Discharge)	15161926284782
61 35 ... Notes on ESD protection (Electro Static Discharge)	15161926284782
13 53 ... Clean the cylinder head around the injectors due to grit / dust	26
61 13 ... Unlocking and disconnecting different plug connections	262990
61 00 730 Encode/program control unit(s) (after vehicle test)	83
17 00 ... Notes for working on cooling system	106107

Operating materials	**Used in step**
Main group 17	106107