11 21 531 Replace all crankshaft main bearing shells (Crankshaft removed)

Overview of Activities

Additional Information

Preliminary Work

1	Remove the front axle completely with the engine and transmission	
2	Removing the engine from the front axle	
3	Install the engine on the assembly stand	
4	Removing the oil filler cap	
5	Releasing the oil drain plug	
6	Tightening the oil drain plug	
7	Removing clean air pipe cylinders 4-6	
8	Removing the heat shield from the exhaust turbocharger for cylinders 1 to 3	
9	Removing the drive belt for alternator	
10	Removing the alternator	
11	Removing the air conditioning compressor	
12	Removing the deflecting element	
13	Remove all ignition coils.	
14	Removing all spark plugs	 
15	Removing the holder of the positive battery cable	
16	Removing the fuel delivery line	 
17	Installing the high pressure line between the high pressure pump and the rail for cylinders 1 to 6	
18	Removing both high pressure pumps	
19	Removing rail with injectors of cylinders 1 to 3	
20	Removing rail with injectors of cylinders 4 to 6	
21	Removing the connecting branch on the exhaust turbocharger for cylinders 4 to 6	
22	Removing oil return line for the cylinders 1 to 3	
23	Removing the oil return line for the cylinders 4 to 6	

24 Removing oil feed line for the cylinders 1 to 3

25 Removing the oil feed line for cylinders 4 to 6

26 Partially detach the auxiliary coolant pump for the exhaust turbocharger

27 Removing coolant feed line part 2 between auxiliary coolant pump and exhaust turbocharger

28 Removing coolant return line between exhaust turbocharger and thermostat

29 Removing both actuators

30 Removing the cylinder head cover

31 Removing the intake plenum

32 Blocking engine in the TDC firing position

33 Removing chain tensioner

34 Releasing the VANOS central valve of the intake adjuster

35 Releasing VANOS central valve of the exhaust camshaft adjuster

36 Removing the VANOS central valve of the intake adjuster

37 Remove the VANOS central valve of the exhaust camshaft adjuster

38 Remove exhaust camshaft adjuster

39 Removing intake adjuster

40 Remove the test gauges to fix the camshafts

41 Removing the oil return line in the cylinder head

42 Remove cylinder head. 

43 Removing the cylinder head gasket

44 Removing the component carrier

45 Removing the vibration damper

46 Removing flywheel 

47 Remove oil sump

48 Remove rear timing case cover

49 Removing timing chain

50 Removing the drive chain for the oil vacuum pump

51 Remove oil pump 

52 Removing the oil deflector

53 Removing all pistons with connecting rod

54 Remove crankshaft 

Main Work

55 Determining the classification of the crankshaft main bearing shell

56 Replacing the main bearing shells and the guide bearing shells

Postprocesses

57 Installing the crankshaft 

58 Check the coefficient of friction for the crankshaft

59 Checking the crankshaft side clearance

60 Measuring all pistons

61 Measuring a cylinder

62 Installing all pistons with connecting rod

63 Installing the oil deflector

64 Installing the drive chain for the oil vacuum pump

65 Installing the oil pump 

66 Installing timing chain

67 Install the rear timing case cover

68 Refitting sump

69 Installing the flywheel

70 Replacing front crankshaft seal

71 Installing the vibration damper

72 Installing the component carrier

73 Blocking the crankshaft in the TDC firing position of cylinder 1

74 Sealing the oil duct

75 Clean sealing surfaces 

76 Installing the cylinder head gasket

77 Installing the cylinder head 

78 Installing the oil return line in the cylinder head

79 Adjust the camshafts with the special tool

80 Installing the intake adjuster

81 Install exhaust camshaft adjuster

82 Install the VANOS central valve of the intake adjuster

83 Installing the VANOS central valve of the exhaust camshaft adjuster

84 Pretension the timing chain with the special tool

85 Tightening the VANOS central valve of the exhaust camshaft adjuster

86 Tightening the VANOS central valve of the intake adjuster

87 Remove all special tools

88 Install chain tensioner 

89 Checking camshaft timing

90 Installing the intake plenum

91 Installing cylinder head cover

92 Installing both actuators

93 Installing both the high pressure pumps

94 Prepare the injectors for installation

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

96 Installing rail with injectors of cylinders 1 to 3

97 Removing the high pressure line between the high pressure pump and the rail for cylinders 1 to 6  

98 Installing fuel delivery line

99 Installing all spark plugs

100 Installing all ignition coils

101 Installing the holder of the positive battery cable 

102 Installing the coolant return line between the exhaust turbocharger and thermostat

103 Installing the coolant feed line part 2 between the auxiliary coolant pump and exhaust turbocharger

104 Installing the oil feed line for the cylinders 1 to 3

105 Fastening the auxiliary coolant pump for the exhaust turbocharger

106 Installing exhaust turbocharger heat shield for cylinders 1 to 3

107 Installing connecting branch on exhaust turbocharger for cylinders 4 to 6

108 Installing the oil return line for the cylinders 1 to 3

109 Installing the oil return line for the cylinders 4 to 6

110 Installing the oil feed line for cylinders 4 to 6

111 Installing the clean air pipe of cylinders 4-6

112 Installing the deflecting element

113 Installing air conditioning compressor

114 Installing the alternator

115 Installing the drive belt for alternator

116 Topping up the engine oil

117 Installing the oil filler cap

118 Removing the engine from assembly stand 

119 Installing the engine on the front axle

120 Installing the complete front axle including engine and transmission

General information

⚠ CAUTION

Component with heavy weight.

Danger of injury!

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

⚠ CAUTION

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

Danger of injury!

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

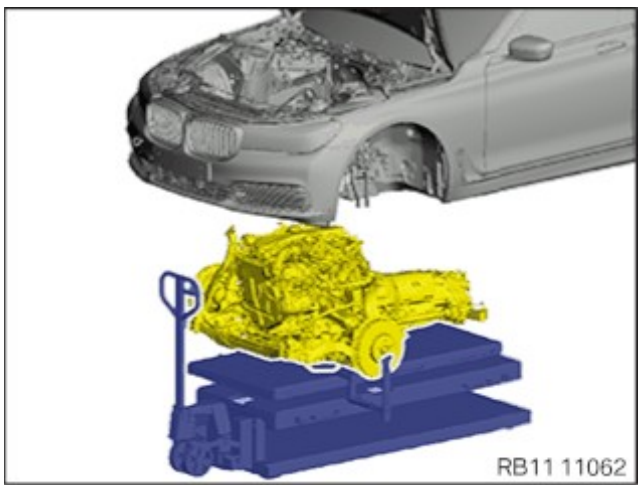
i TECHNICAL INFORMATION

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

PRELIMINARY WORK

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

Additional information is available.

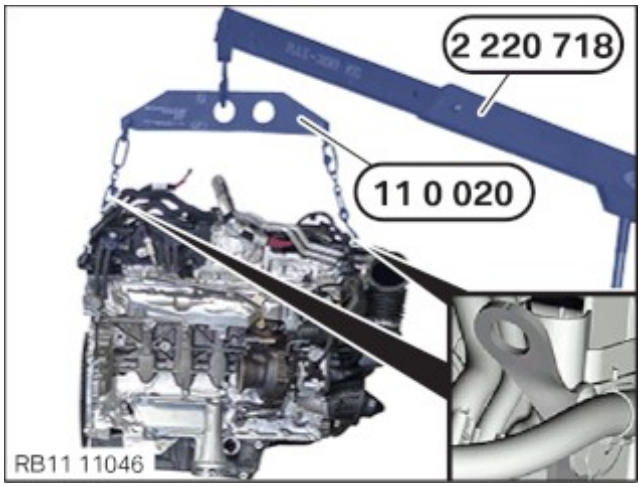


- See additional information.

2–Removing the engine from the front axle

Additional information is available.

- See additional information.



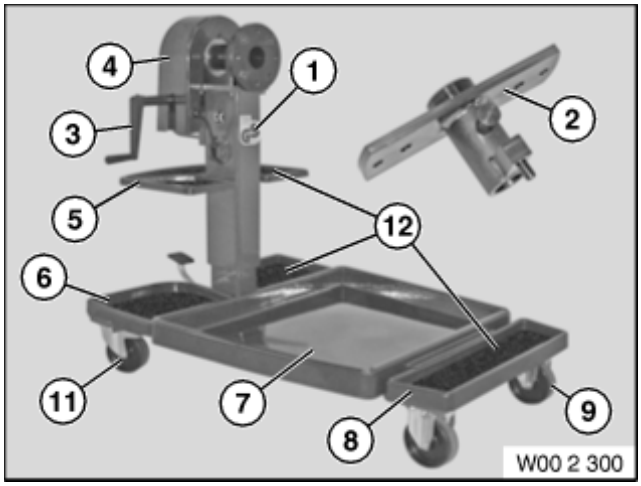
3–Install the engine on the assembly stand

⚠ CAUTION

Heavy component.

Heavy components can lead to injury or damage.

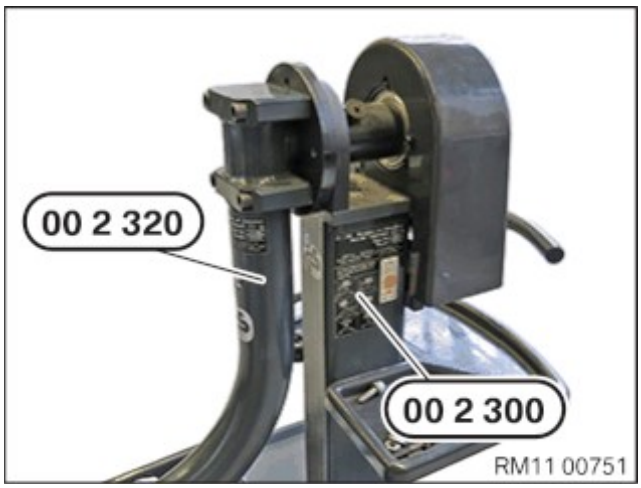
- Remove and install heavy components with the aid of another person/other persons.



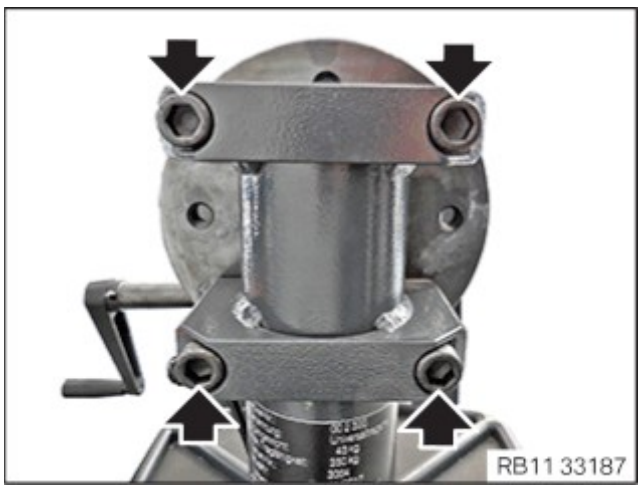
- Have the set of special tools **0 495 187 (00 2 300)** ready.

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

- Have the special tool **2 411 718** ready.



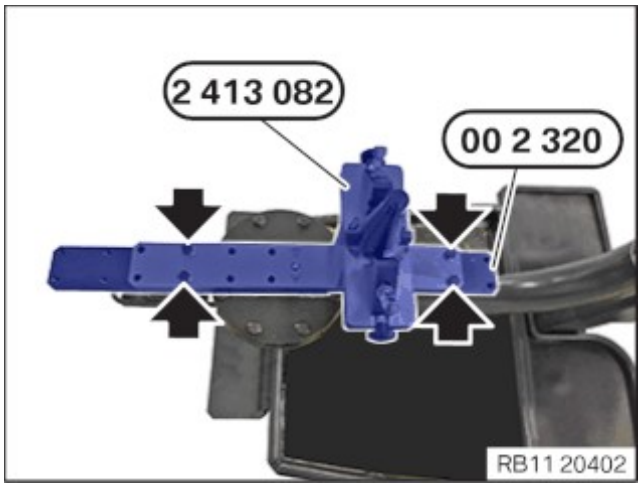
- Prepare the assembly stand **0 495 187 (00 2 300)** with the special tool **0 495 196 (00 2 320)**.



- Tighten screws (arrows).

Special tool 00 2 320 to special tool 00 2 300

M14X95		Tightening torque	130 Nm

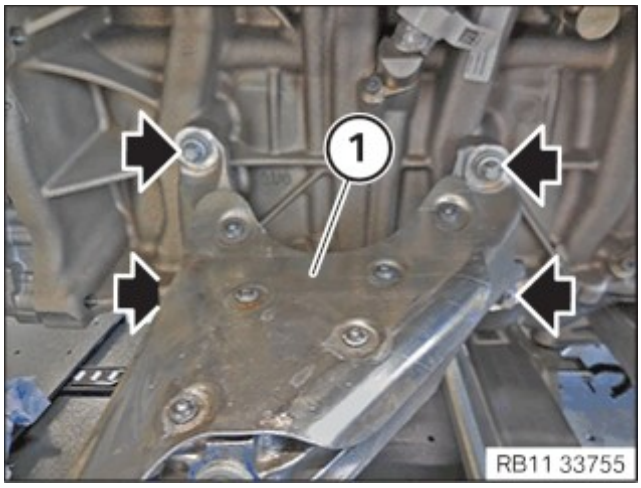


- Screw the special tool **2 413 082** together with special tool **0 495 196 (00 2 320)**.
- Tighten screws (arrows).

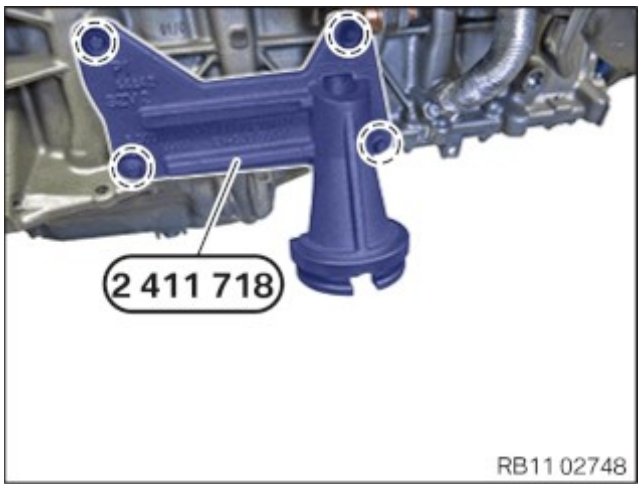
Special tool 2 413 082 to special tool 00 2 320

M12x65		Tightening torque	100 Nm

- Remove screws (arrows).



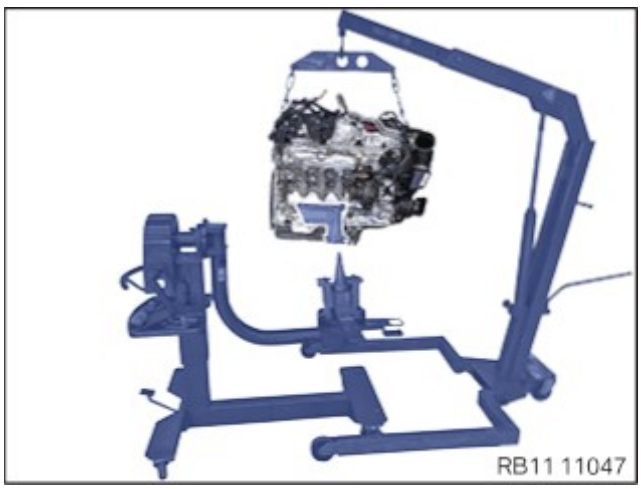
- Feed out the right engine mounting bracket (1) and remove it.



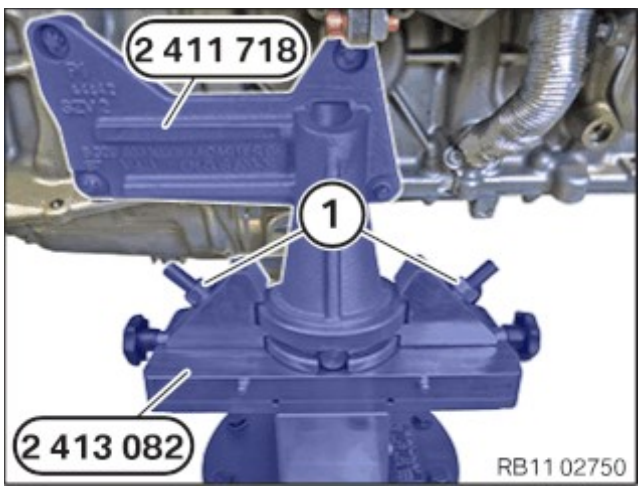
- Position and mount the special tool **2 411 718** on the engine.
- Tighten the bolts (marks).

Special tool 2 411 718 to crankcase

M10x30		Tightening torque	38 Nm

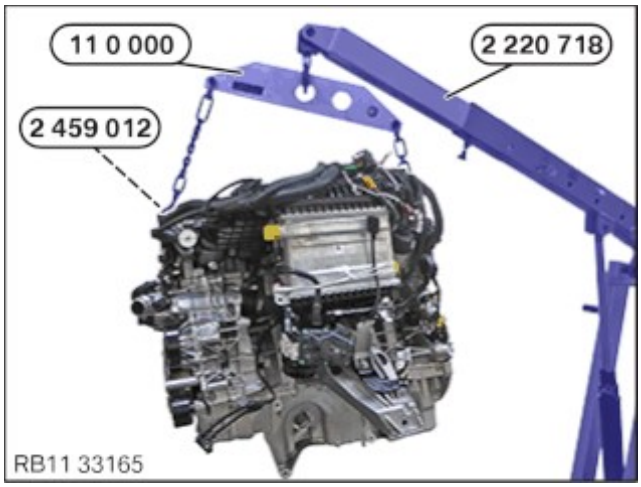


- Lower engine slowly.



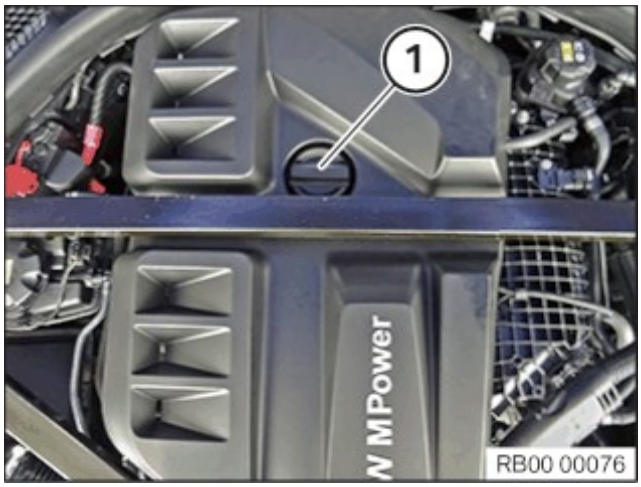
- Make sure special tool **2 411 718** engages with special tool **2 413 082**.
- Tighten nuts (1) by hand.

  The clamping jaws must fit completely.



- Release both hooks of the special tool **0 490 561 (11 0 000)** at the front of the special tool **2 459 012** and rear on the engine from the mounting brackets.
- Remove the special tool **2 220 718**.

4–Removing the oil filler cap



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.

- Open oil filler cap (1).

5–Releasing the oil drain plug

WARNING

Hot fluids.

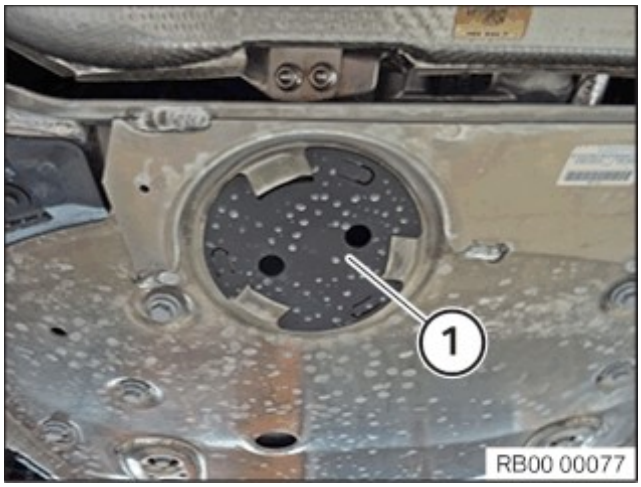
Risk of scalding!

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

TECHNICAL INFORMATION

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

- Pull the service cap (1) downwards and turn counter-clockwise.



- Release the oil drain plug (1) .
- Allow the engine oil to drain out fully.

6–Tightening the oil drain plug

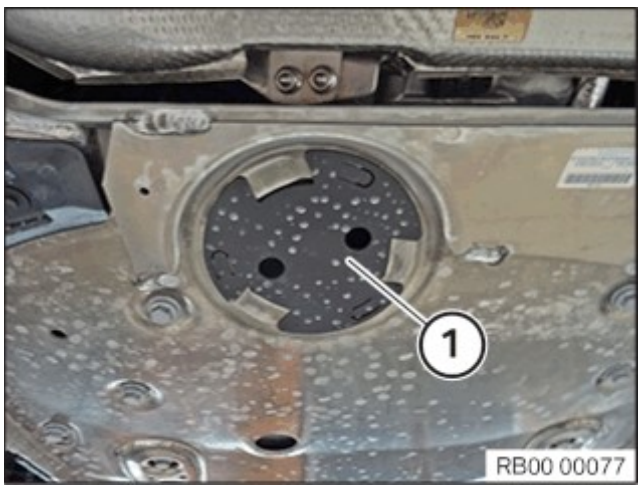
- Renew sealing ring (2).

  Parts: Sealing ring

- Position oil drain plug (1) on the oil sump and tighten.

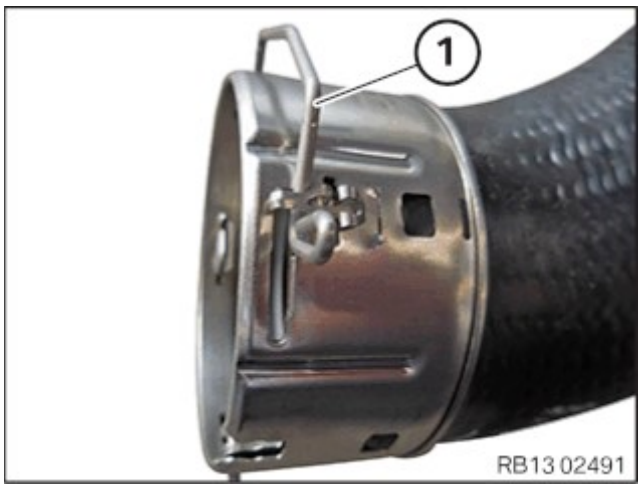
Oil drain plug

M12x16	Renew the sealing ring.	Tightening torque	25 Nm

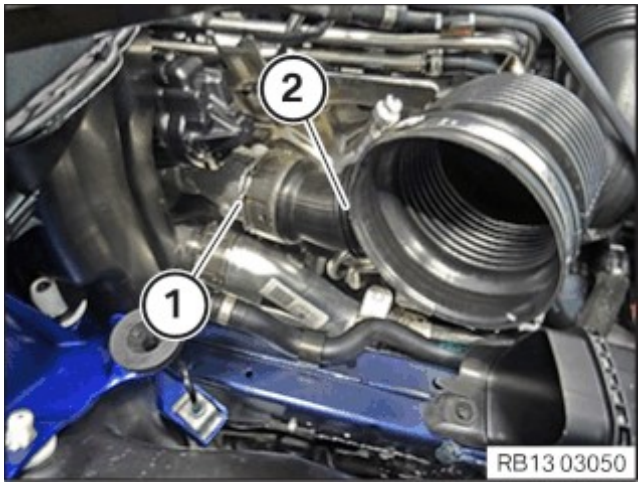


- Position the service cap (1) and turn it clockwise and lock it.

7–Removing clean air pipe cylinders 4-6

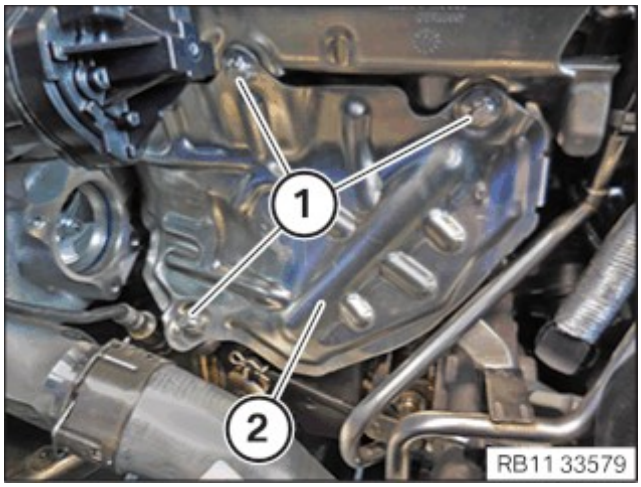


- Unlock clamp (1) and engage in this position.



- Unlock the clamp (1).
- Pull off, feed out and remove the clean air pipe (2) for the cylinders 4 to 6.

8–Removing the heat shield from the exhaust turbocharger for cylinders 1 to 3



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

9–Removing the drive belt for alternator

⚠ CAUTION

Spring preload.

Danger of injury!

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

⚠ CAUTION

Component with preload.

Danger of injury!

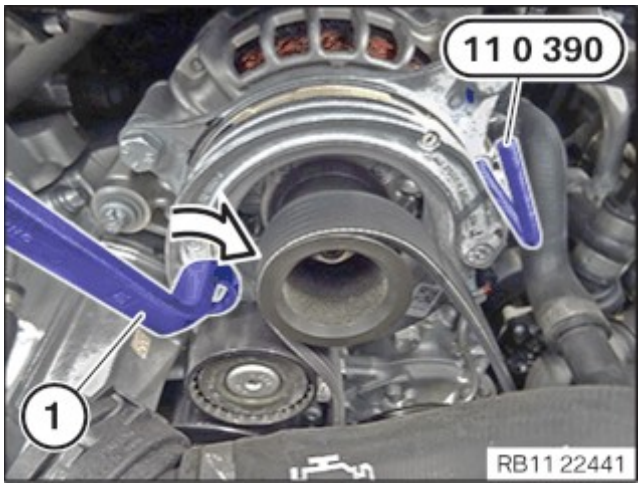
- Reduce preload as far as possible before disassembly. Relieve component.

i TECHNICAL INFORMATION

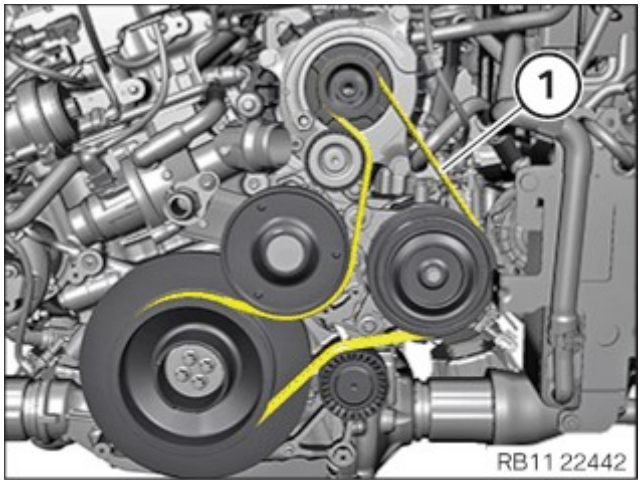
If the drive belt is reused: Mark direction of travel and reinstall drive belt in same direction of travel.

i TECHNICAL INFORMATION

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



- Increase the preload on the belt tensioner in **the direction of the arrow** using standard tools (1).
- Secure the belt tensioner with the special tool **0 496 268 (11 0 390)**.



- Pull the drive belt for alternator (1) out and remove it.

10–Removing the alternator

Additional information is available.

⚠ 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

Hot surfaces.

Risk of burning!

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

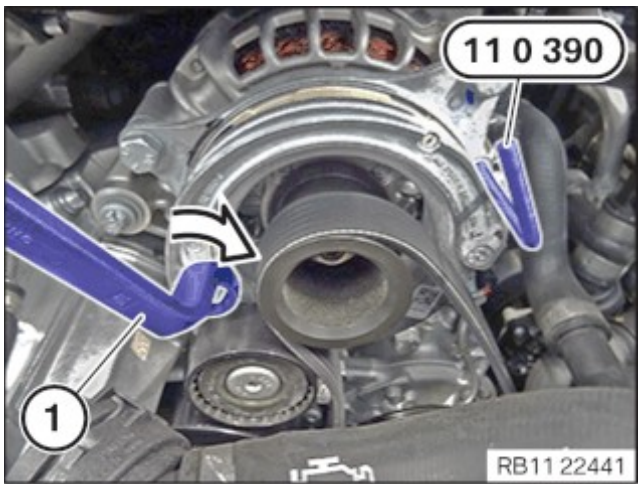
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

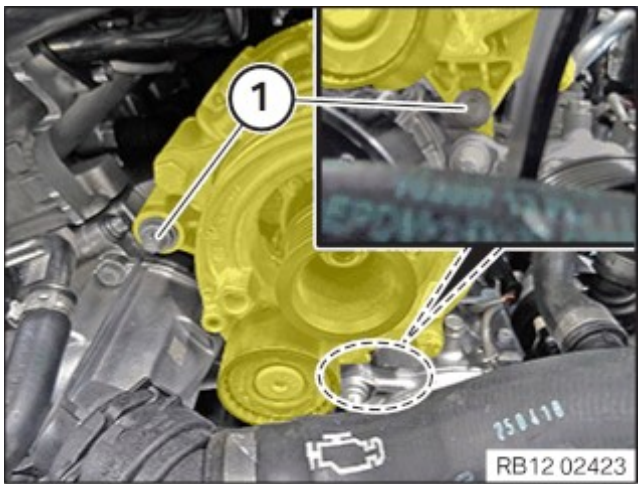
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the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

61 35 ... Notes on ESD protection (Electro Static Discharge)

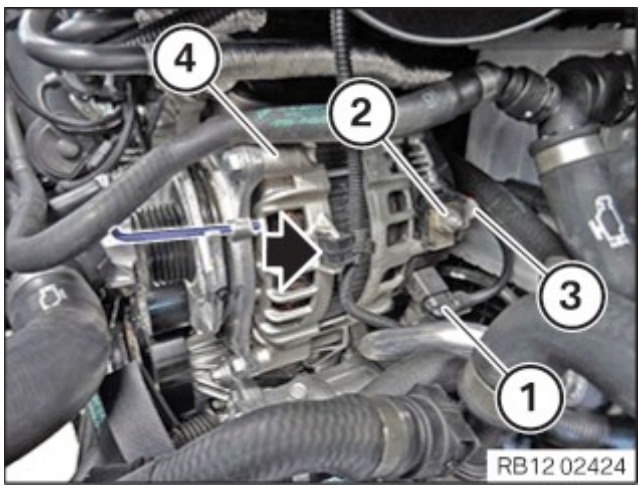


- Increase the preload on the belt tensioner in **the direction of the arrow** using standard tools (1).
- Secure the belt tensioner with the special tool **0 496 268 (11 0 390)**.

- Remove the drive belt (1) from the belt wheel (2) of the generator and set it aside.



- Loosen screws (1).



- Unlock plug connection (1) and disconnect.
- Unfasten nut (2).
- Feed out positive battery cable (3) and put to one side.
- Pull out the generator (4) and remove it.

11–Removing the air conditioning compressor

⚠ CAUTION

Residual pressure in the air conditioning.

Danger of injury!

- Wear safety goggles and protective gloves when disconnecting the refrigerant line.
- Seal refrigerant lines with seal plugs.

RISK OF DAMAGE

External damage to air conditioning compressor.

Excessive force applied during removal will result in damage to the air conditioning compressor.

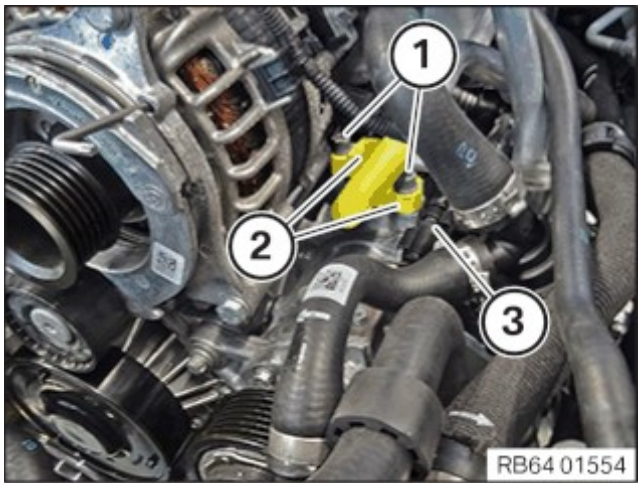
- Remove the air conditioning compressor without damaging it and without applying external force.
- Avoid impacts/knocks to plastic belt pulley (caused by tools, contact with base).
- Return faulty air conditioning compressors in their original packaging only.

RISK OF DAMAGE

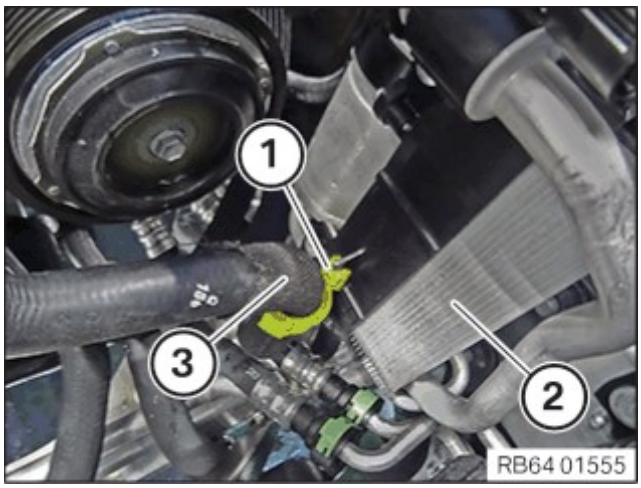
Contaminant or foreign body.

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.

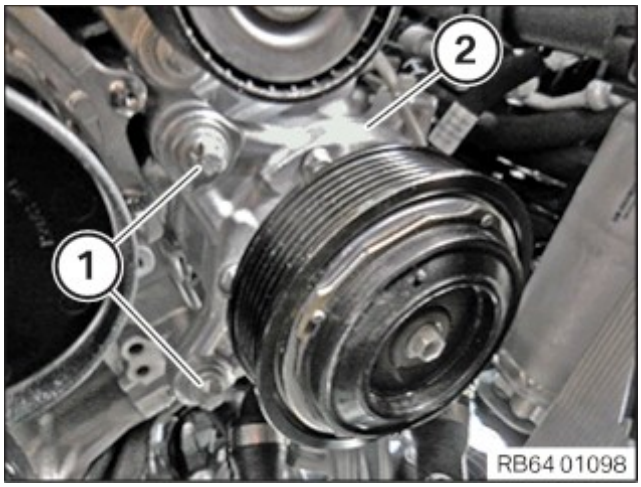


- Loosen screws (1).
- Remove the refrigerant lines (2) and set them aside.
- Unlock and disconnect connector (3).



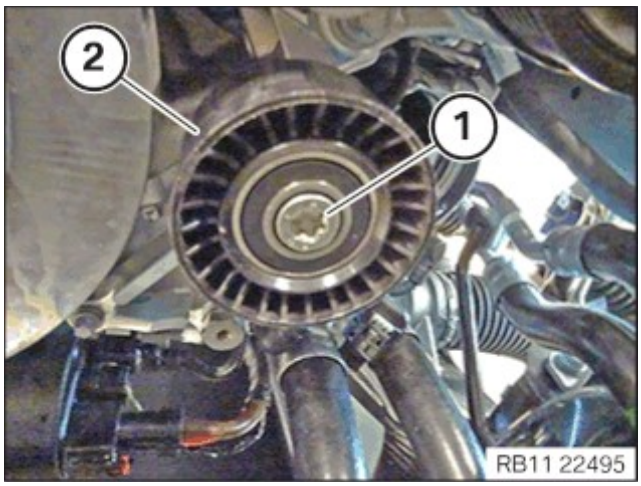
- Release hose support (1) from air conditioning condenser (2).
- Place coolant hose (3) aside.

- Loosen screws (1).
- Feed out and remove the air conditioning compressor (2).



12–Removing the deflecting element

- Pull out and remove the protective cap (1).



- Loosen screw (1).
- Pull out and remove the deflecting element (2).

13–Remove all ignition coils.

Additional information is available.

⚠ 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.).

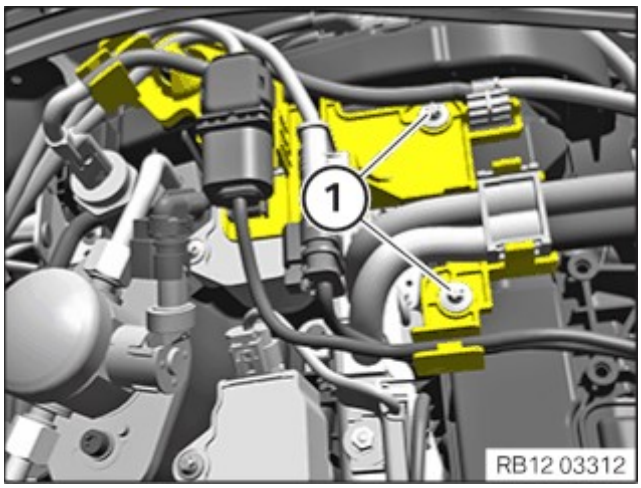
RISK OF DAMAGE

Electrostatic discharge.

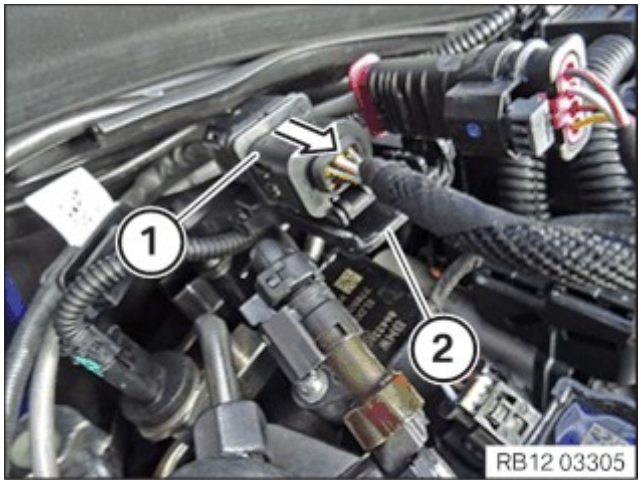
Damage to or destruction of electrical components.

- 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)

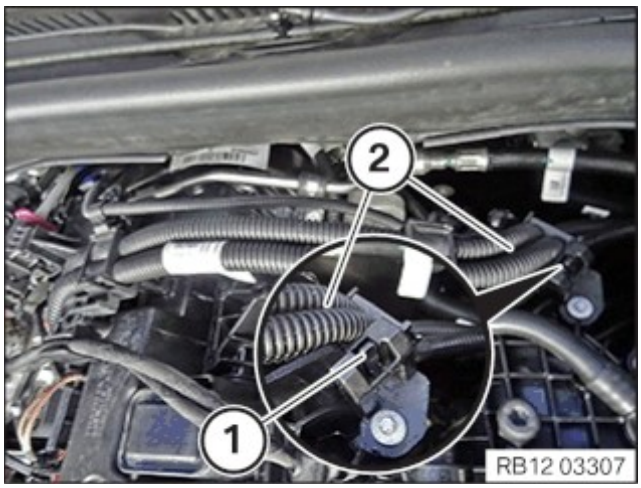
61 35 ... Notes on ESD protection (Electro Static Discharge)



- Loosen screws (1).

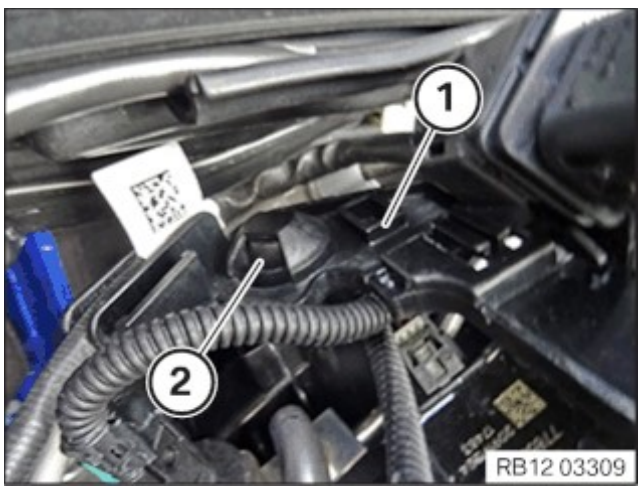


- Guide out the plug connection (1) from the holder (2) in direction of arrow and set it aside.
- Unlock plug connection (1) and disconnect.



- Unlock the lock (1).
- Remove the wiring harness section (2) and put to one side.

- Unlock the locks (arrows).
- Remove the wiring harness section (1) and put to one side.



- Pull off the bracket (1) from the ball stud (2).
- Place bracket (1) to one side.

NOTICE

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

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

14–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.

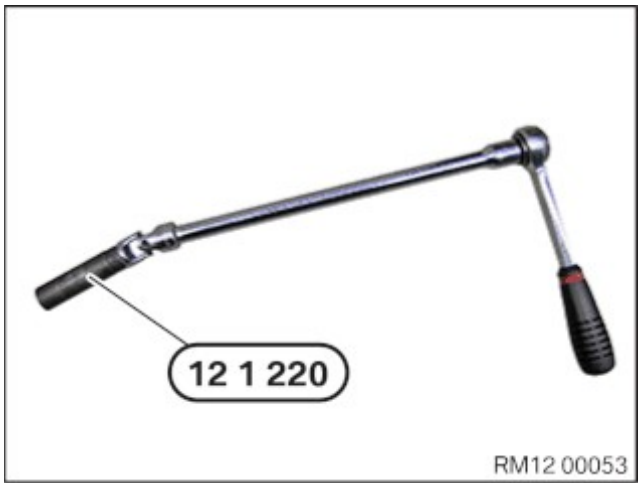
The spark plug shaft must be cleaned using compressed air after the ignition coils have been removed but before the spark plugs have been removed. After the spark plugs have been removed, once again check the sealing surface for contamination and if necessary, clean using a moist cloth or clean once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

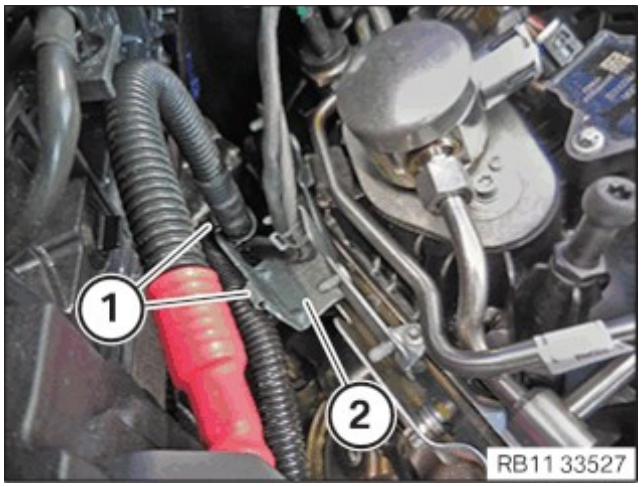
Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

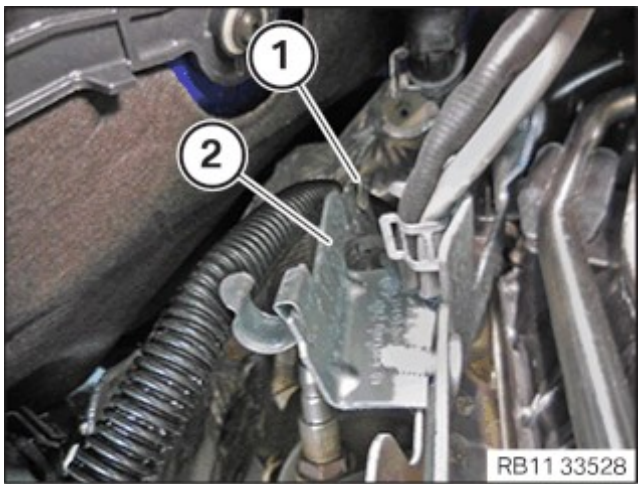
- Mount the special tool **0 495 560 (12 1 220)** on a pivoting extension.

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

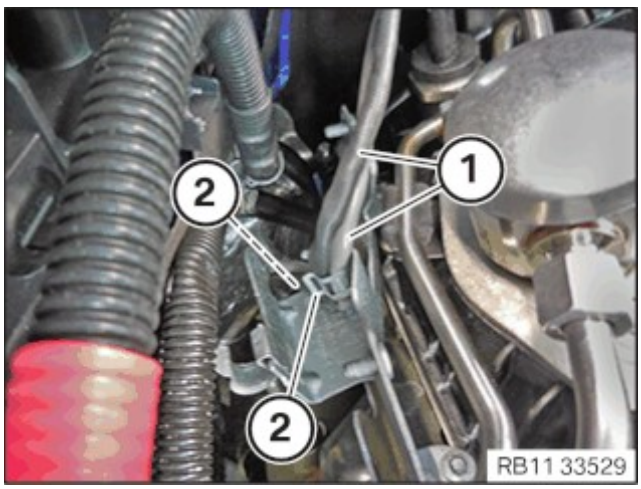
15–Removing the holder of the positive battery cable

- Release the clamps (1) from holder (2).

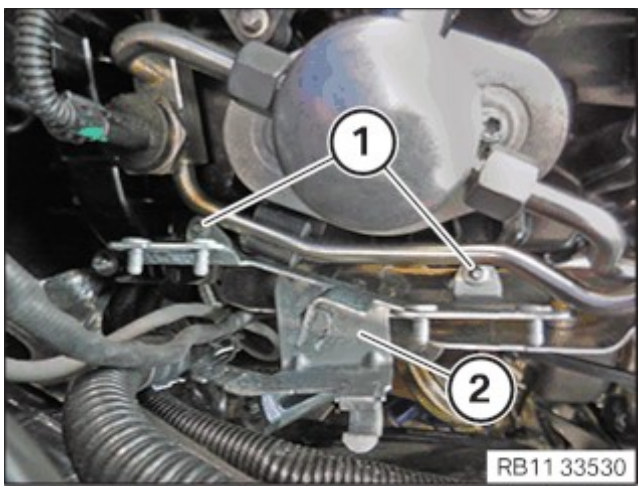




- Release the clamp (1) from holder (2).



- Loosen the cables (1) from the clamps (2).



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

16–Removing the 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

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

Contaminant or foreign body.

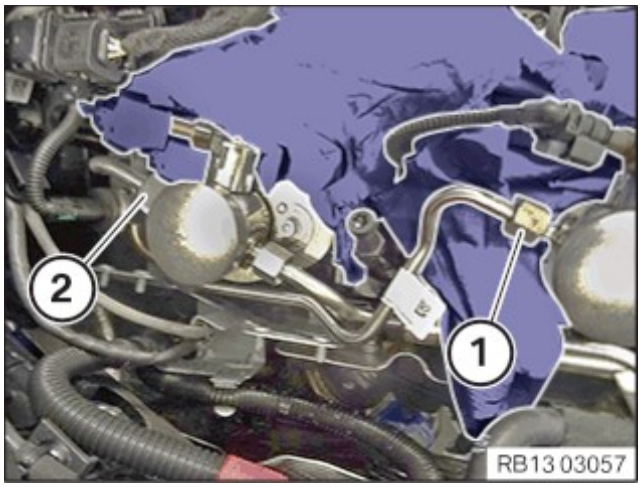
Contamination can result in malfunctions, operating failure or leaks.

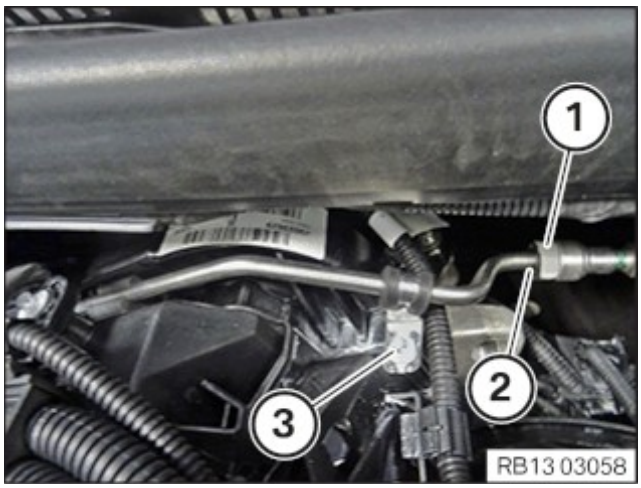
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

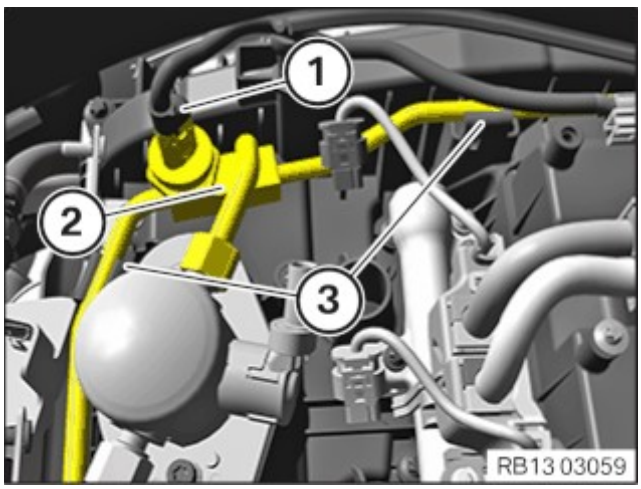
Reset special tool in early to avoid bending pressure lines.

- Release the union nut (1).
- Catch and dispose of escaping fuel.
- Release the union nut (2).
- Catch and dispose of escaping fuel.
- Seal all openings with the special tool **2 413 106**.





- Unlock and loosen clamp (1).
- Unlock and release the snap fastener (2).
- 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).



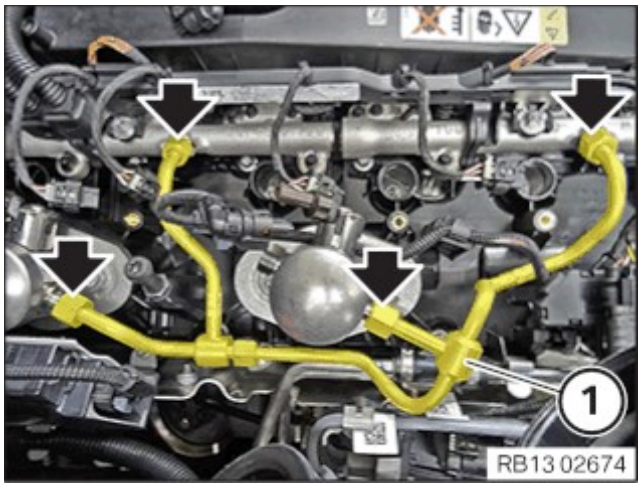
- Unlock plug connection (1) and disconnect.
- Feed out and remove the fuel feed line (2) from the clamps (3).

17–Installing the high pressure line between the high pressure pump and the rail for cylinders 1 to 6

- Insert and install the high pressure line (1).
- Tighten union nuts (arrows) with the special tool **0 495 280 (13 0 140)**.

High pressure line between rail and high pressure pump

M14x1,5		Tightening torque	33 Nm



18–Removing both high pressure pumps

▶ Removing the high pressure pump for cylinders 1 to 3

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

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

TECHNICAL INFORMATION

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

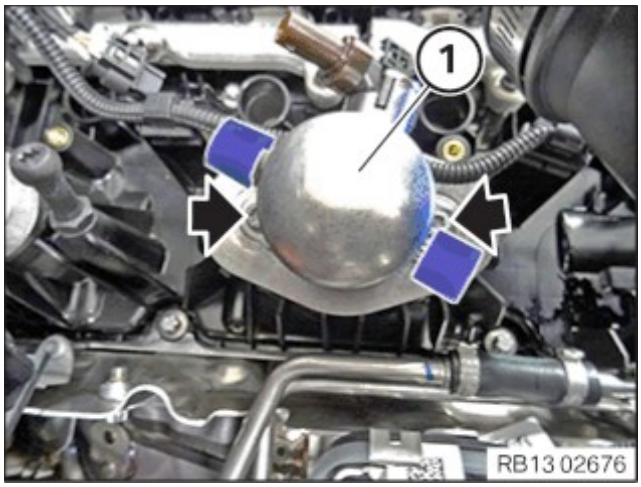
TECHNICAL INFORMATION

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.

- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Pull the high pressure pump (1) out and remove it.



◀

▶ Removing high pressure pump of cylinders 4 to 6

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

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

TECHNICAL INFORMATION

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

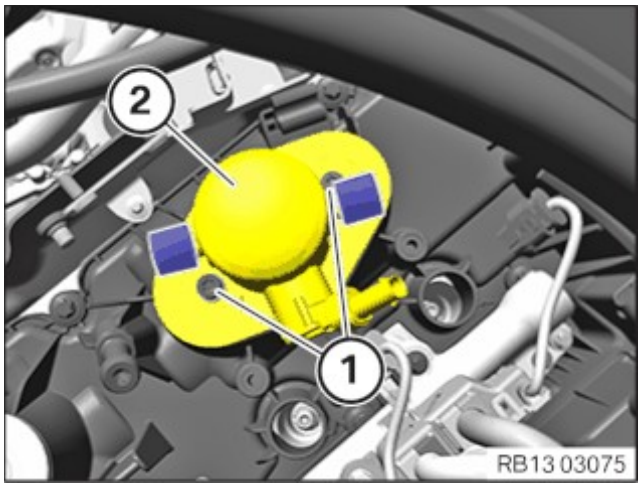
TECHNICAL INFORMATION

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.

- Release screws (1) **in an alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.



◀

19–Removing rail with injectors of cylinders 1 to 3

Additional information is available.

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

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

RISK OF DAMAGE

Damage to the ignition coil.

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

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

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

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

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

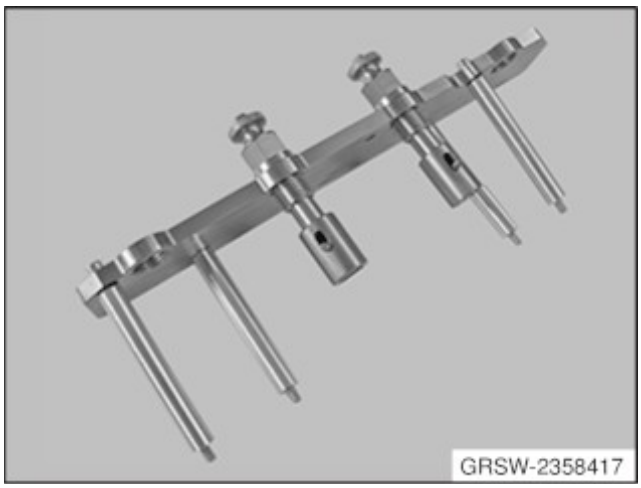
RISK OF DAMAGE

Damage to injectors.

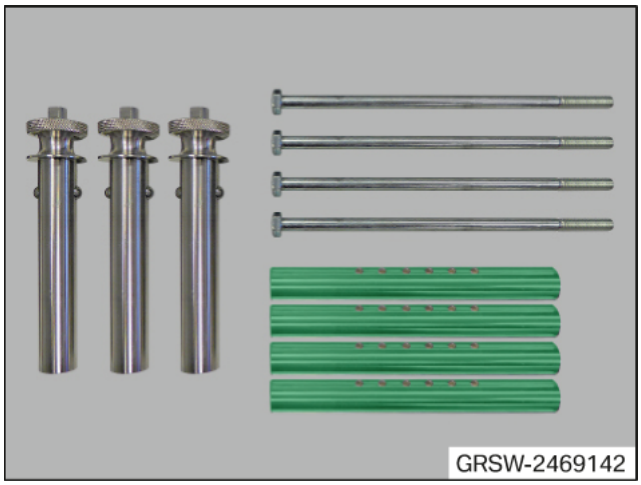
Excessive force may damage the injector and this means having to renew the injector.

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

- Prepare special tool **2 413 106**.

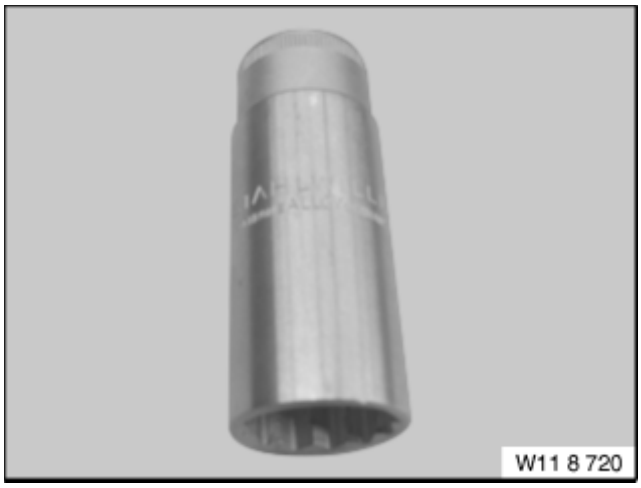


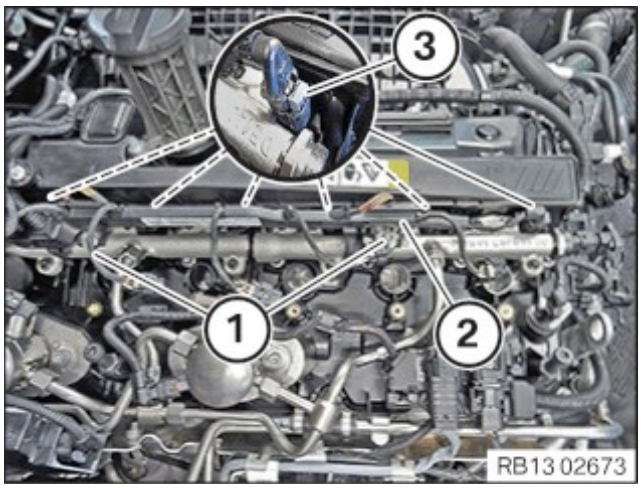
- Prepare special tool **2 358 417**.



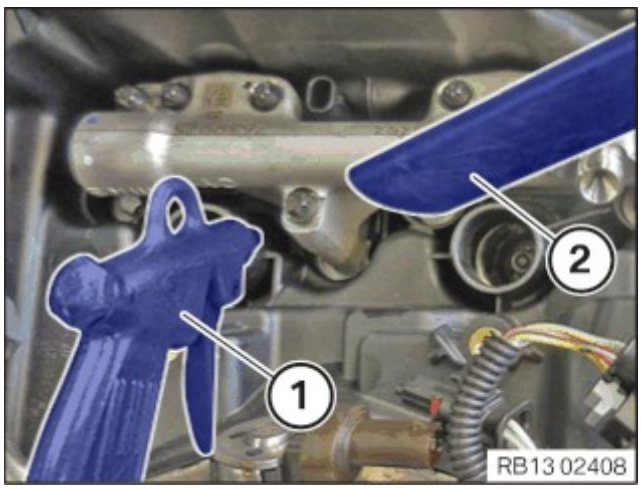
- Prepare special tool **2 469 142**.

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





- Loosen nuts (1).
- Pull out the cable channel (2) and set it aside.
- Unlock and disconnect the plug connections (3) of the injectors.

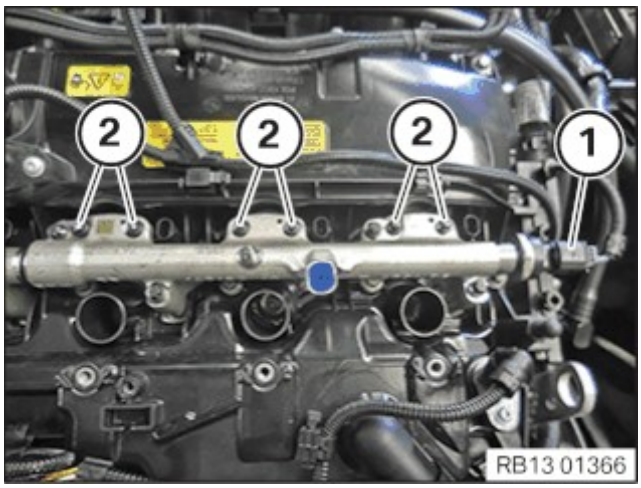


TECHNICAL INFORMATION

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

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

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

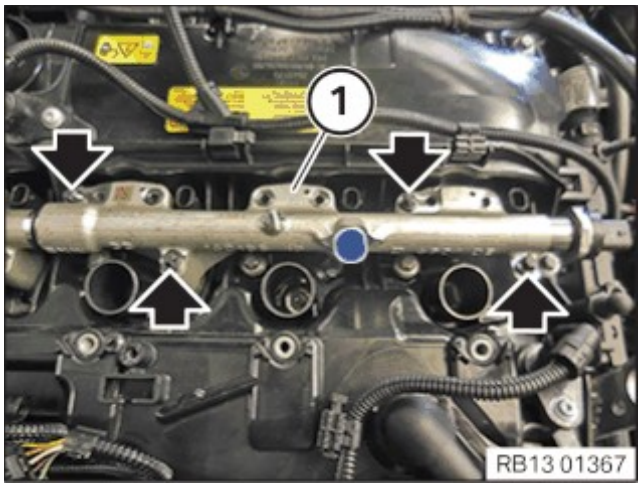


- Unlock plug connection (1) and disconnect.
- Release screws (M5x30) (2).
- Remove screws (2).

  Do not reuse the bolts (2).

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

- Unscrew the screws (M6x30) (arrows).



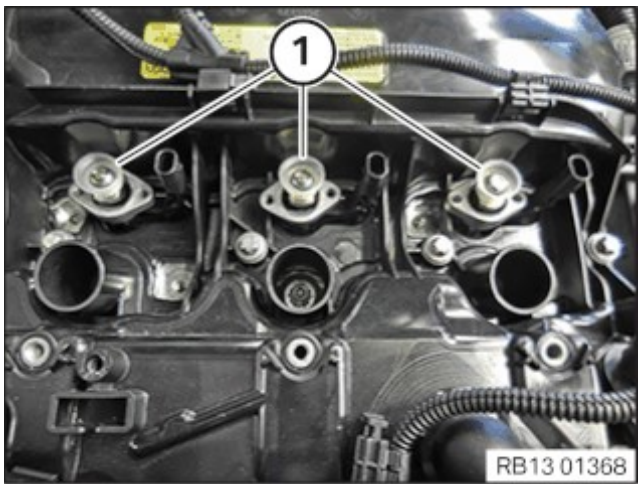
The screws may not be reused!

- Renew screws.

  Parts: Screws (M6x30)

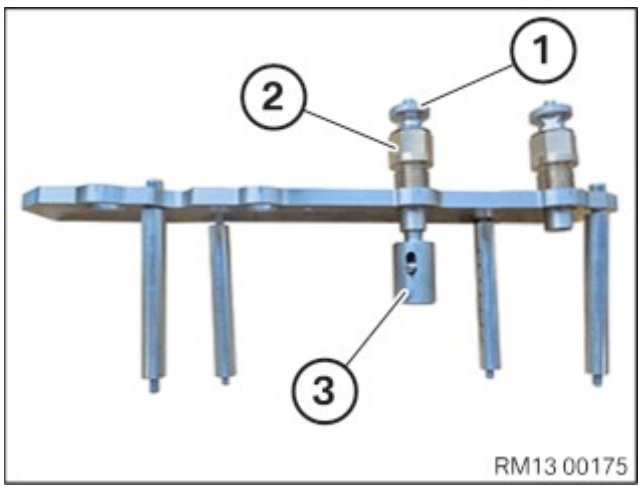
- Remove rail (1) in upward direction.

  The injectors remain in the cylinder head.



- Remove the gaskets (1).

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



RISK OF DAMAGE

Damage to injectors.

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

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

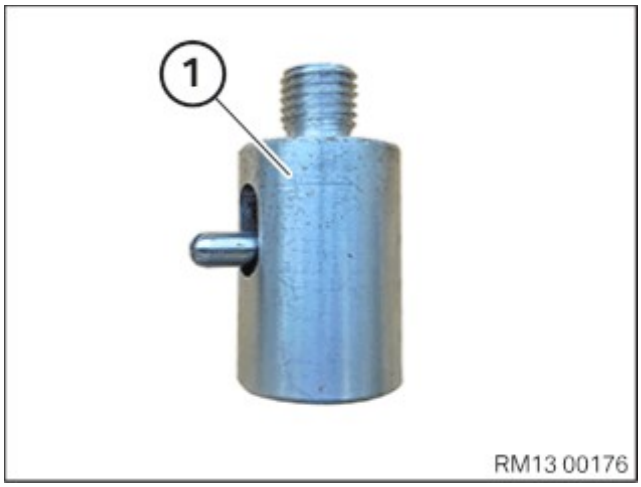
- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use the special tool **2 358 417**to remove the injectors.

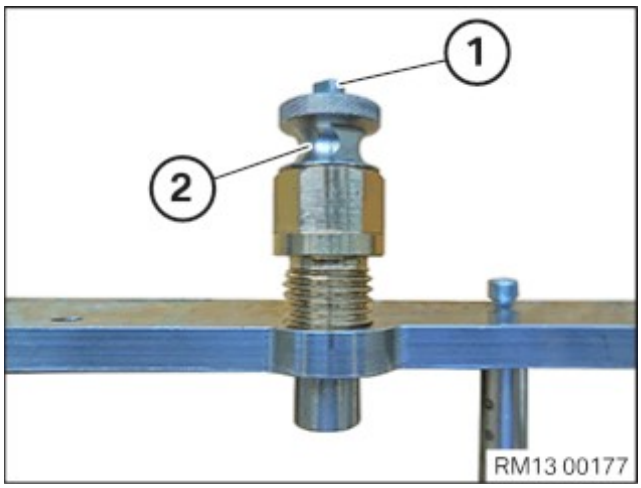
  The special tool **2 358 417** is used to ensure that the tensile force is not exceeded.

  Special tool **2 358 417** consists of:

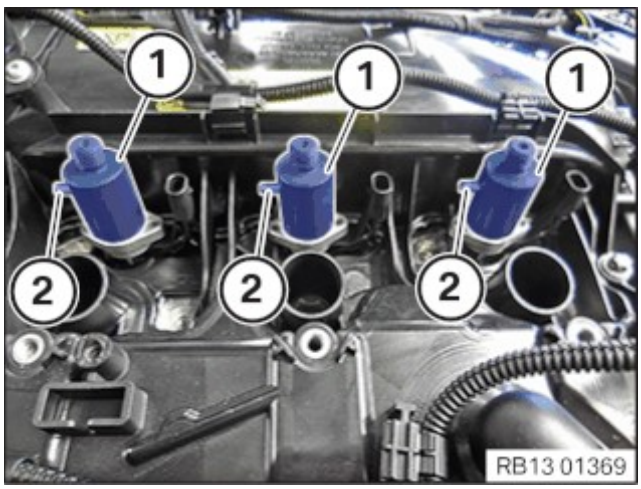
  - **(1)** Threaded sleeves
  - **(2)** Pull-out thread (left-hand thread)
  - **(3)** Mounting for the injectors

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



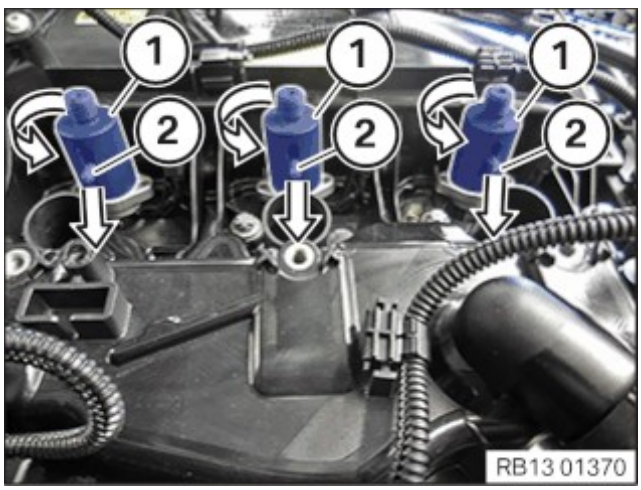


- Press the lock (1) in and remove threaded sleeve (2) from the special tool **2 358 417**.

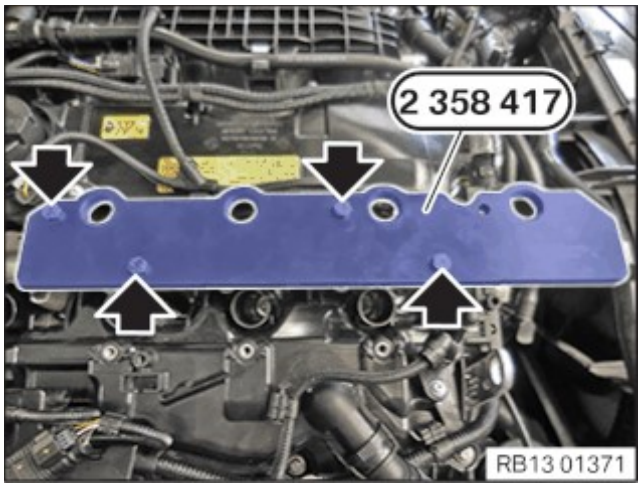


- Install all fixtures (1) for the injectors.

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



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



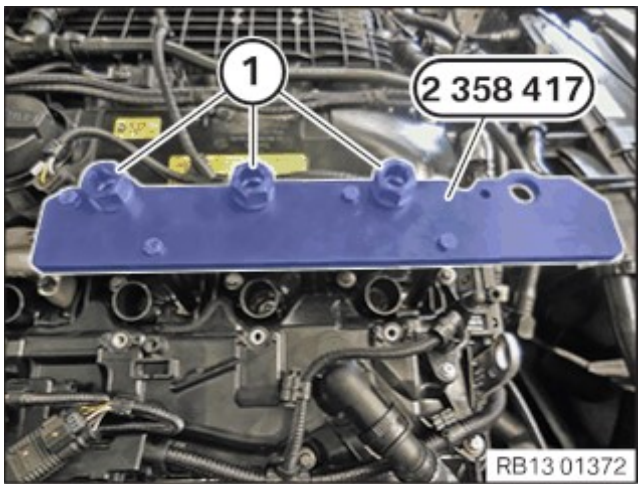
RISK OF DAMAGE

Damage to injectors.

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

- Do not use the puller plate as a support.

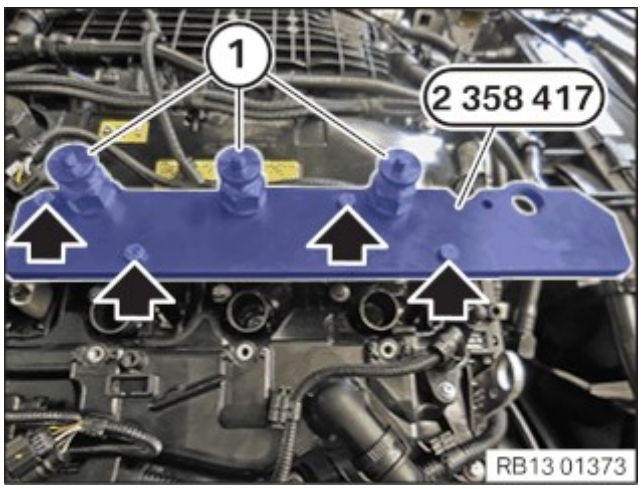
- Attach special tool **2 358 417** to cylinder head.
- Hand-tighten the bolts (arrows).



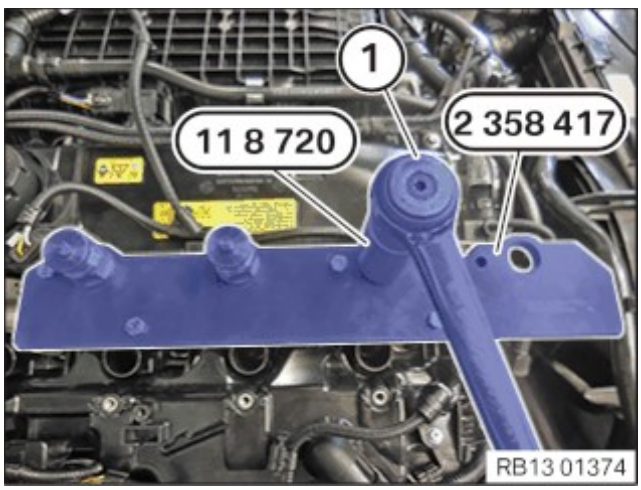
TECHNICAL INFORMATION

The extraction thread is a left-hand thread.

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



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

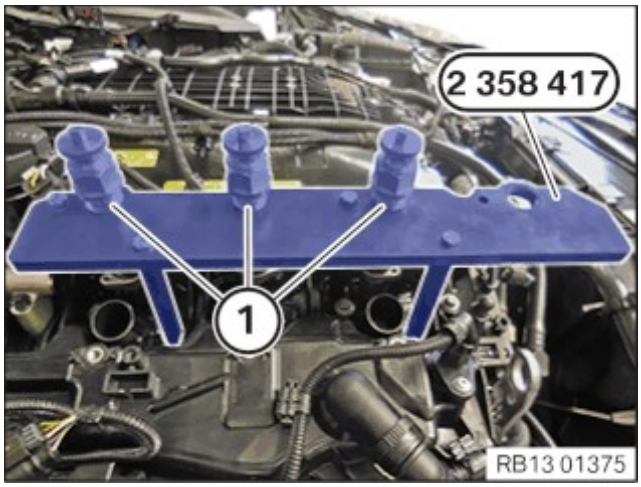


- Adjust torque wrench to 13 Nm **clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool **0 496 106 (11 8 720)**until the injector is pulled out.

TECHNICAL INFORMATION

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

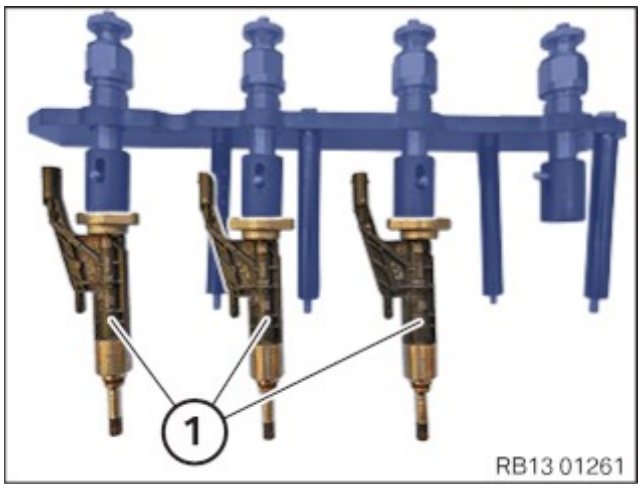
- Disassemble all injectors individually.



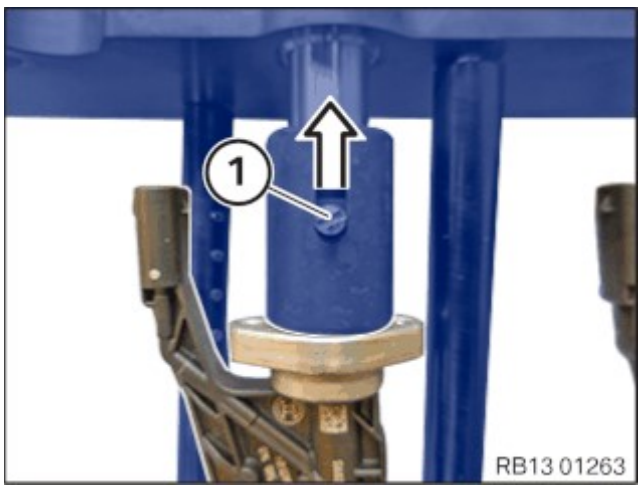
- Before removing the special tool **2 358 417** with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  This can be recognised on the completely visible threads of the sleeves (1).

- Loosen screws on special tool **2 358 417**.



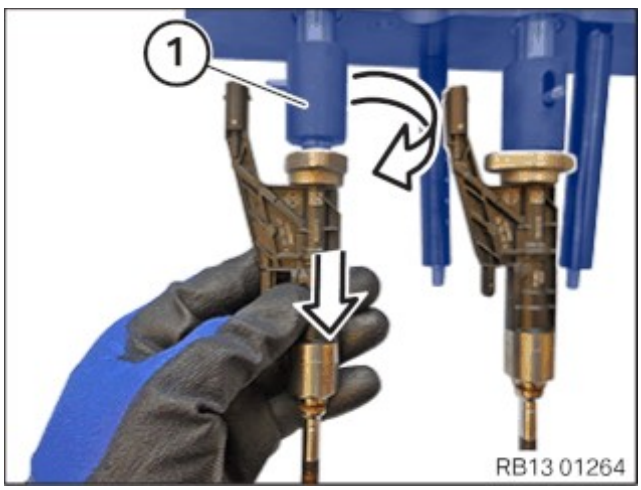
- Carefully remove the special tool **2 358 417**with injectors (1) from the cylinder head vertically upwards.
- Place the combination of the special tool **2 358 417** and the injectors (1) flat on a clean table.



NOTICE

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

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



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

20–Removing rail with injectors of cylinders 4 to 6

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

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

RISK OF DAMAGE

Damage to the ignition coil.

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

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

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

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

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

RISK OF DAMAGE

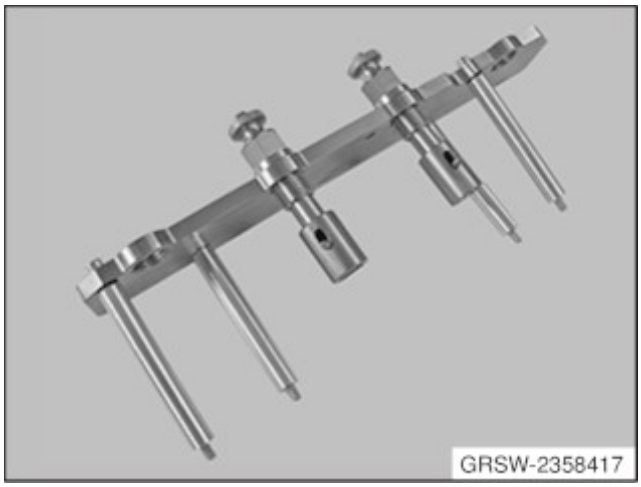
Damage to injectors.

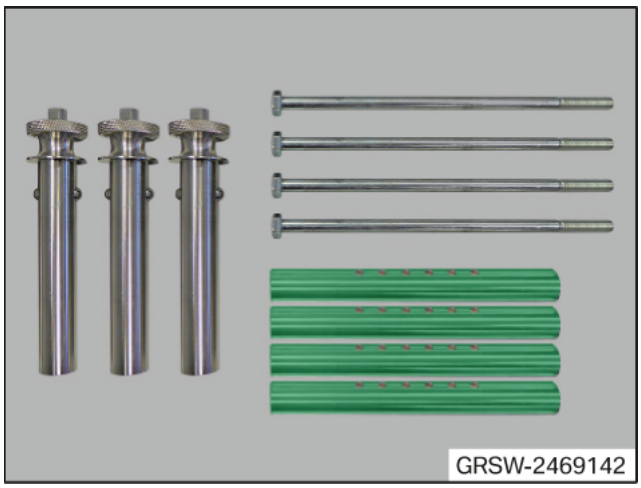
Excessive force may damage the injector and this means having to renew the injector.

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

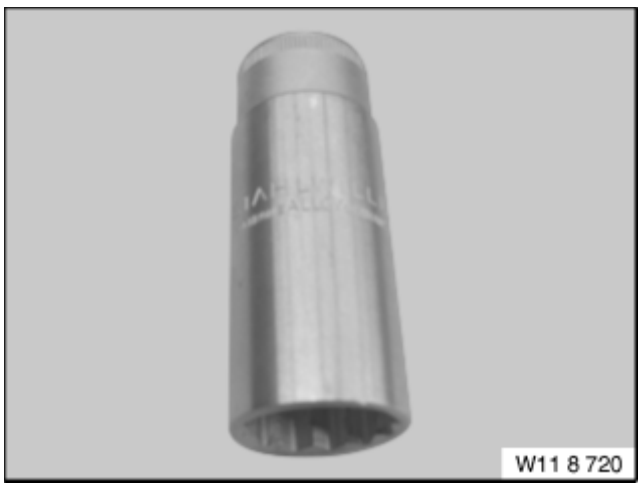
- Prepare special tool **2 413 106**.

- Prepare special tool **2 358 417**.

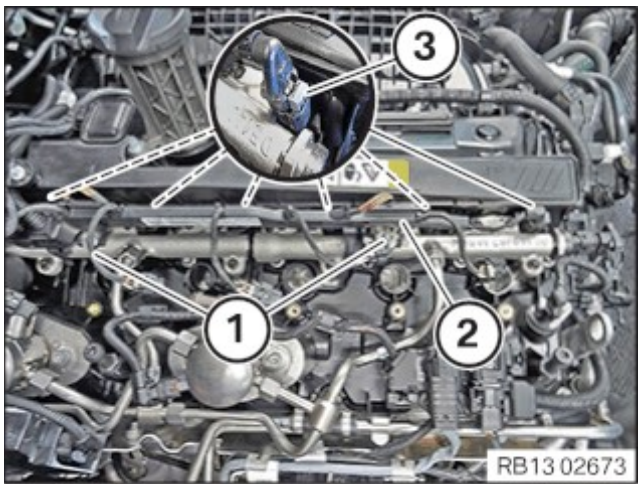




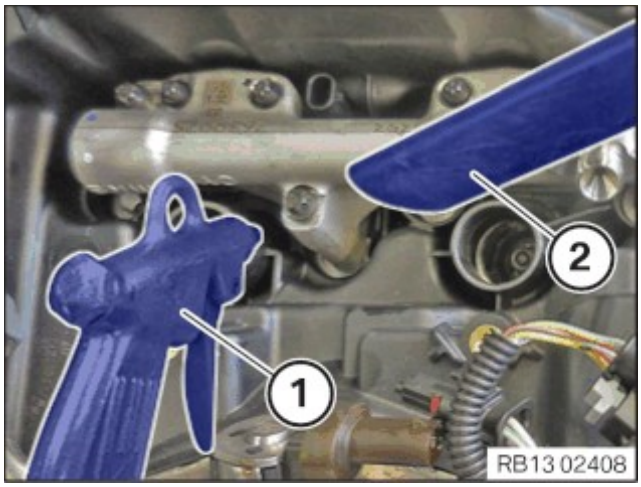
- Prepare special tool **2 469 142**.



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



- Loosen nuts (1).
- Feed out cable channel (2) and set aside.
- Unlock and disconnect plug connections (3) of the injectors.

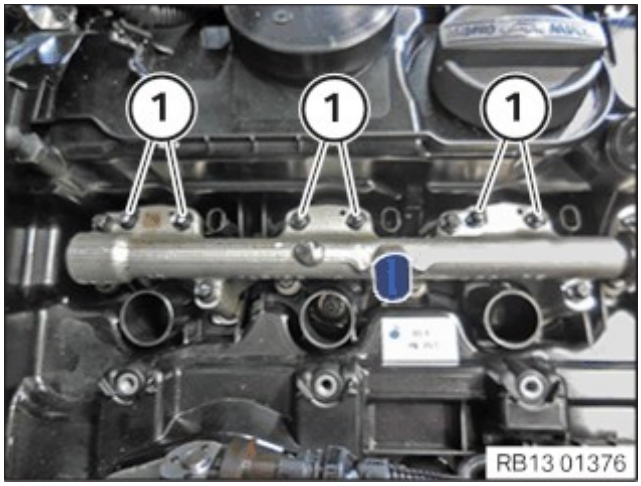


TECHNICAL INFORMATION

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

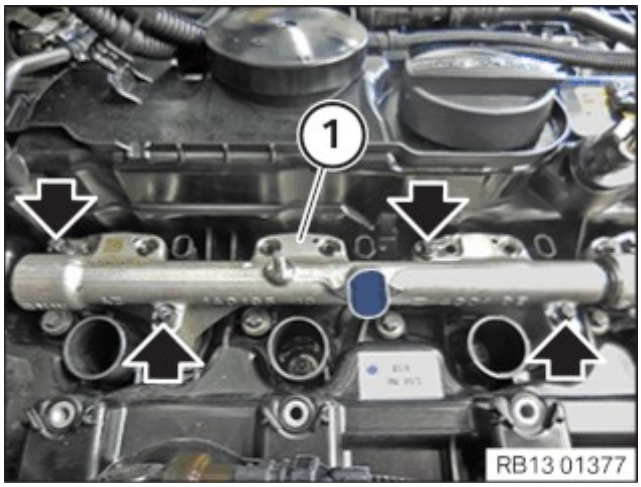
For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

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



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

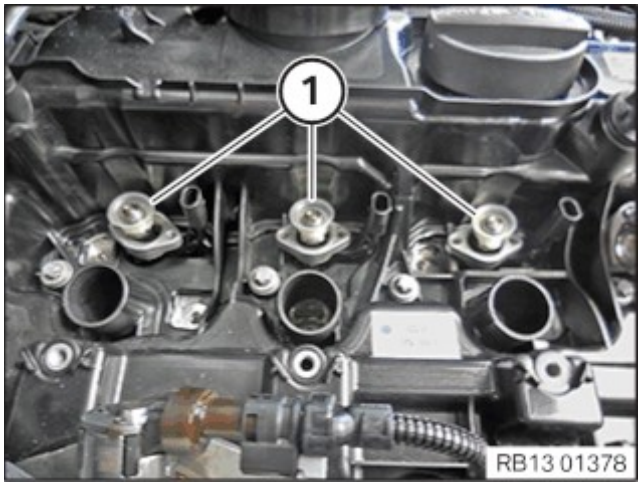
  Do **not** reuse screws (M5x30) (1).
- Catch and dispose of escaping fuel with suitable materials.



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

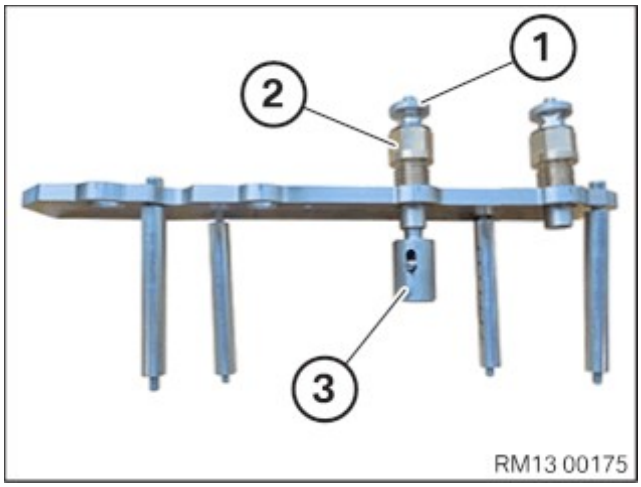
  Do **not** reuse the screws (M6x30).
- Remove rail (1) in upward direction.

  The injectors remain in the cylinder head.



- Remove seals (1) .

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



RISK OF DAMAGE

Damage to injectors.

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

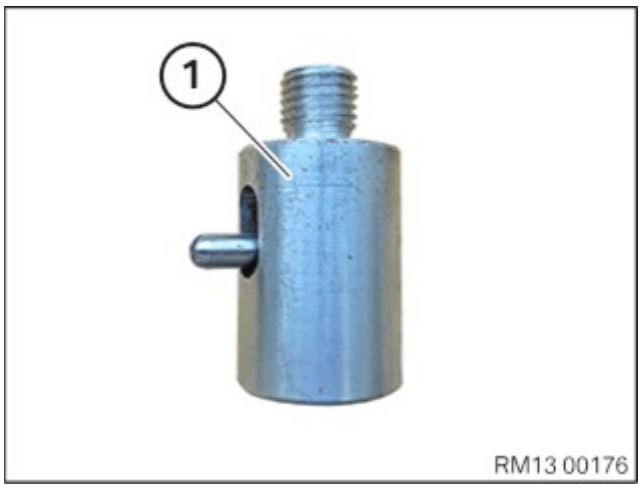
- Twist the injectors with a torsional movement of maximum 13 Nm.

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

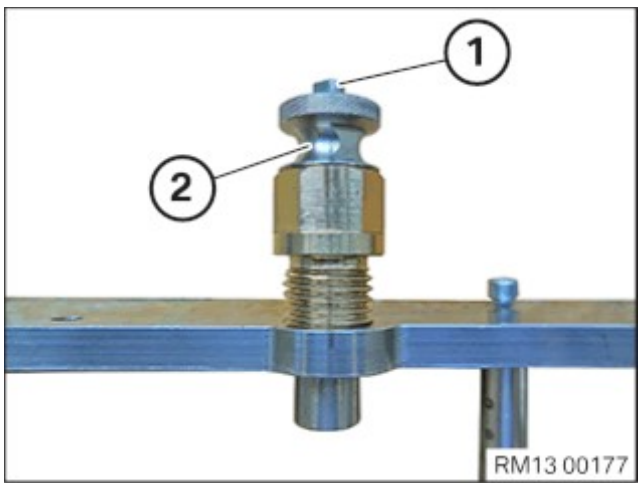
  The special tool **2 358 417** is used to ensure that the tensile force is not exceeded.

  The special tool **2 358 417** consists of:

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



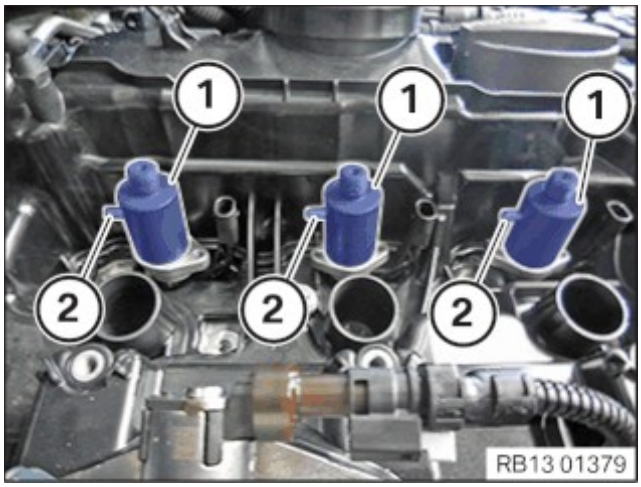
- Unscrew the fixture for injectors (1) from special tool **2 358 417**.

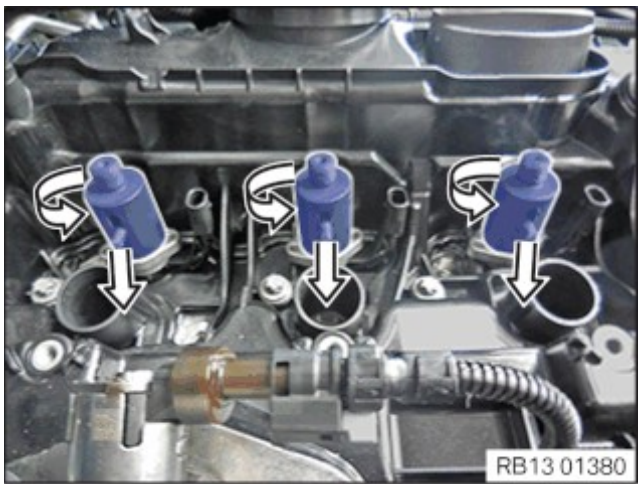


- Press lock (1) in and remove the threaded sleeve (2) from the special tool **2 358 417**.

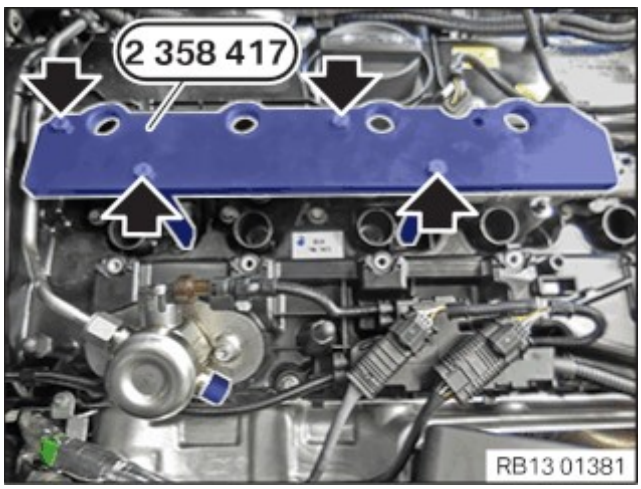
- Install all fixtures (1) for the injectors.

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





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



RISK OF DAMAGE

Damage to injectors.

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

- Do not use the puller plate as a support.

NOTICE

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

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

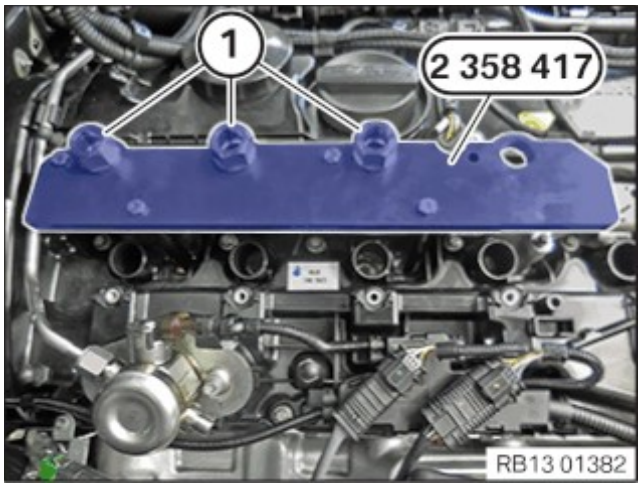
TECHNICAL INFORMATION

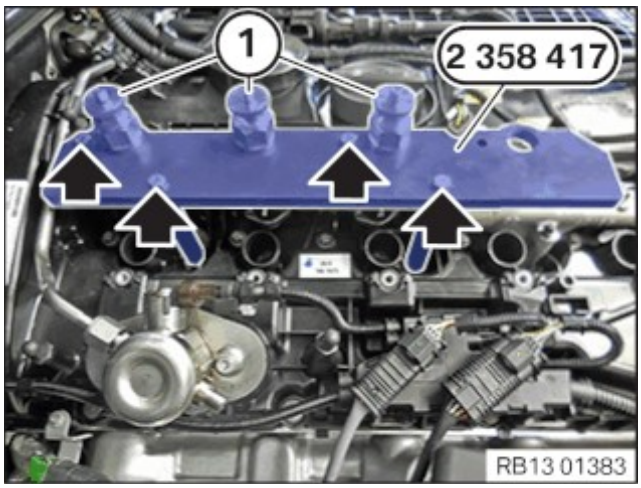
The extraction thread is a left-hand thread.

NOTICE

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

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

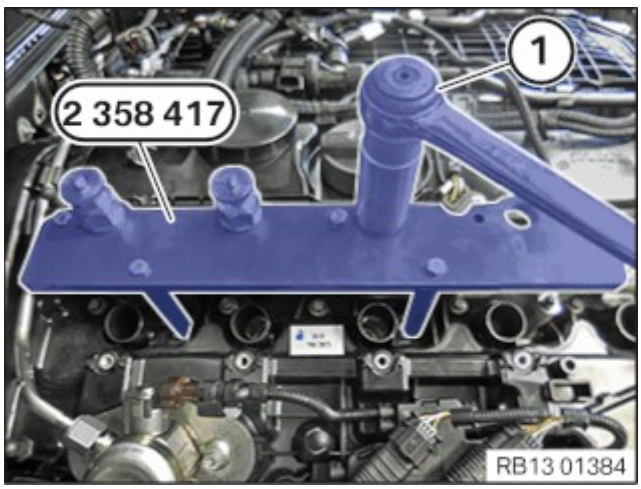




NOTICE

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

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



NOTICE

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

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

TECHNICAL INFORMATION

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

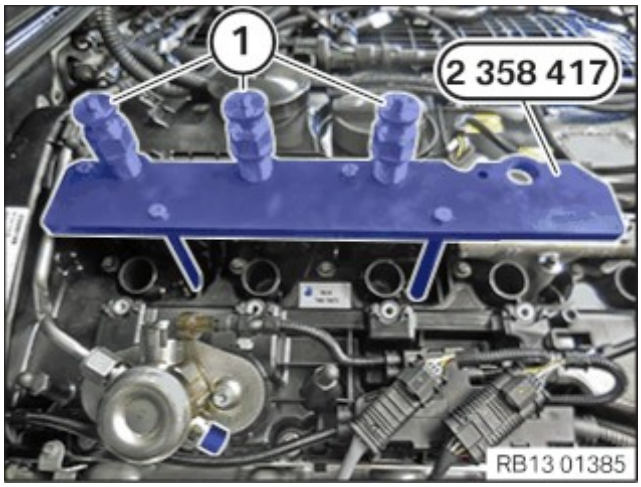
- Disassemble all injectors individually.

NOTICE

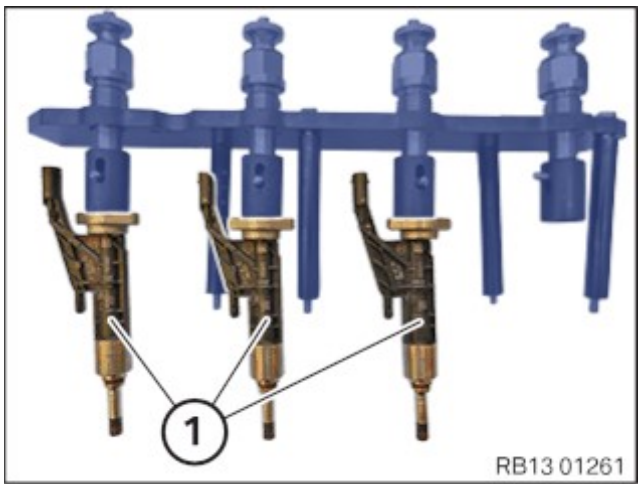
Schematic diagram is for example purposes. Some parts may differ in certain details.

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

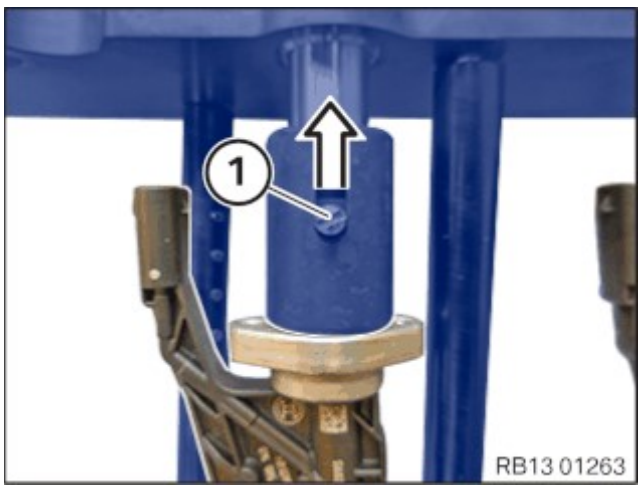
  This can be recognised on the completely visible thread starts of the threaded sleeves (1).



- Loosen screws on special tool **2 358 417**.



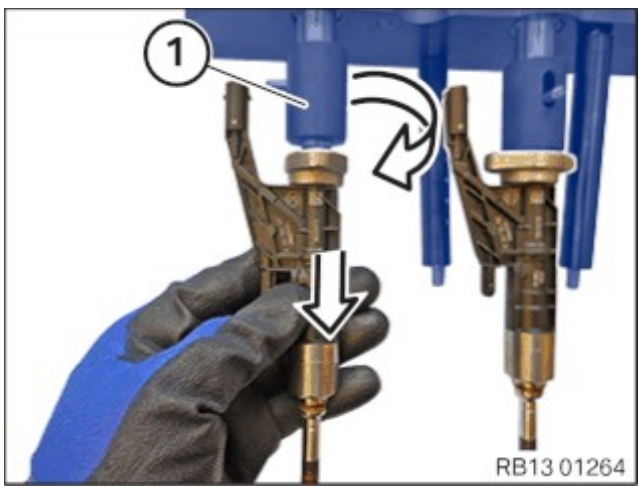
- Carefully remove the special tool **2 358 417** with the injectors (1) vertically straight up from the cylinder head.
- Place the combination of the special tool **2 358 417** and the injectors (1) flat onto a clean table.



NOTICE

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

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



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

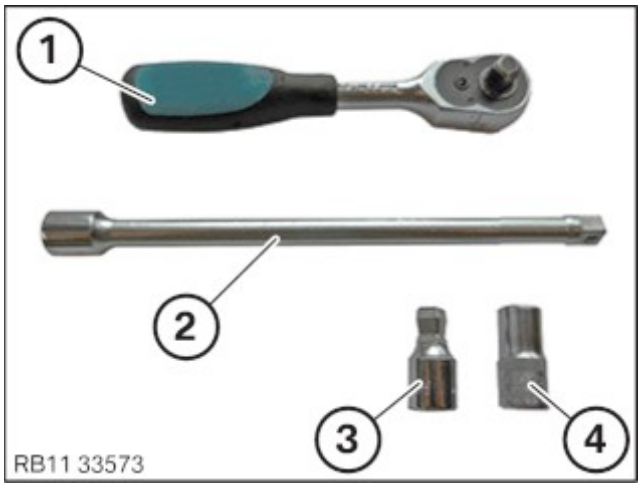
21–Removing the connecting branch on the exhaust turbocharger for cylinders 4 to 6

⚠ WARNING

Hot surfaces.

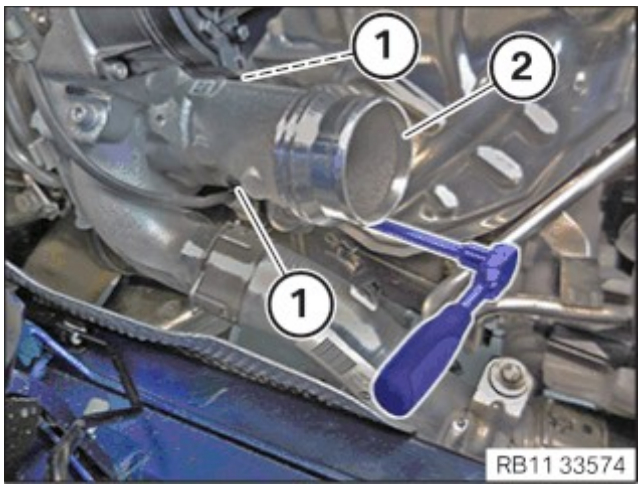
Risk of burning!

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



- Have all the standard tools ready:

Number	Description
1	Standard reversible ratchet (1/4)
2	Extension (1/4)
3	Pivoted extension (1/4)
4	External Torx E8



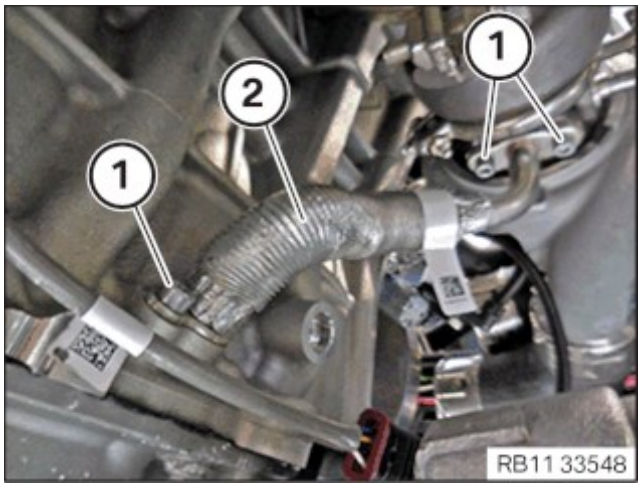
- Loosen screws (1).
- Guide out connecting branch (2) for cylinders 4 to 6 and remove it.

22–Removing oil return line for the cylinders 1 to 3

ℹ TECHNICAL INFORMATION

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

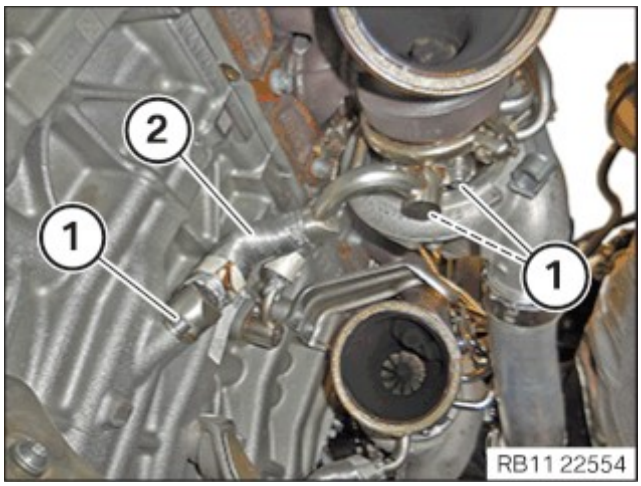
- Loosen screws (1).
- Feed out oil return line (2) for the cylinders **1** to **3** and remove.
- Catch and dispose of emerging engine oil.



23–Removing the oil return line for the cylinders 4 to 6

TECHNICAL INFORMATION

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

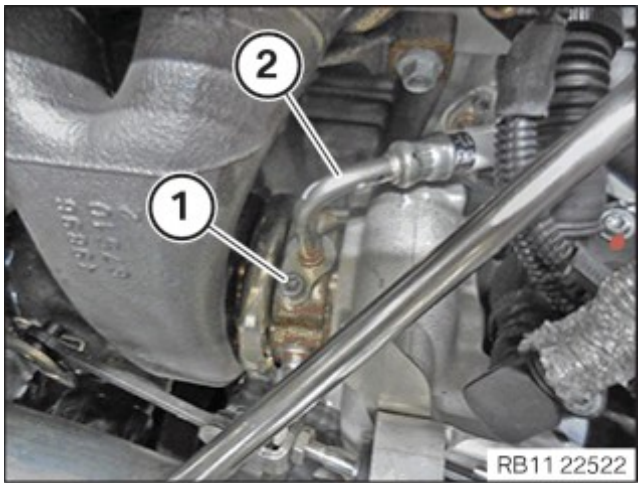


- Loosen screws (1).
- Pull out and remove the oil return line (2) for the cylinders 4 to 6.
- Catch and dispose of emerging engine oil.

24–Removing oil feed line for the cylinders 1 to 3

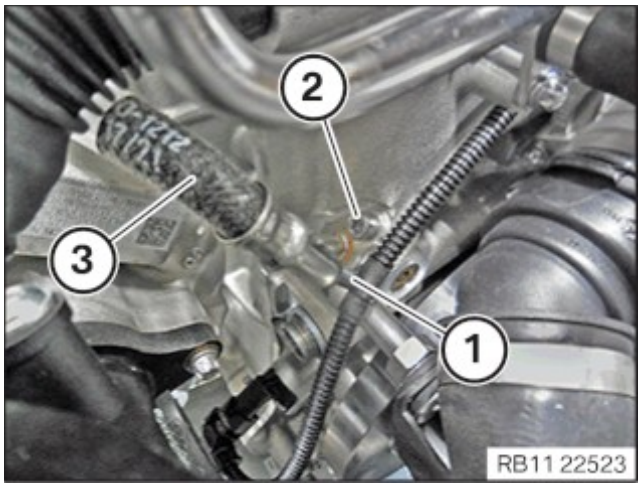
TECHNICAL INFORMATION

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



- Loosen screw (1).
- Feed out the oil feed line (2) for the cylinders 1 to 3 and set aside.
- Catch and dispose of emerging engine oil.

- Loosen clamp (1).

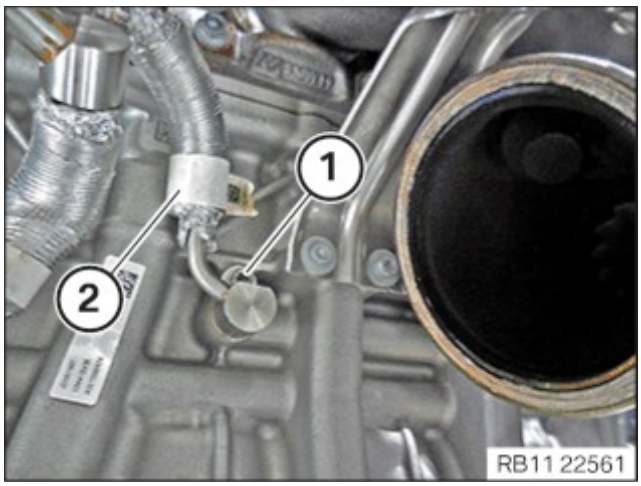


- Loosen screw (2).
- Feed out oil feed line (3) for cylinders 1 to 3 and remove.
- Catch and dispose of emerging engine oil.

25–Removing the oil feed line for cylinders 4 to 6

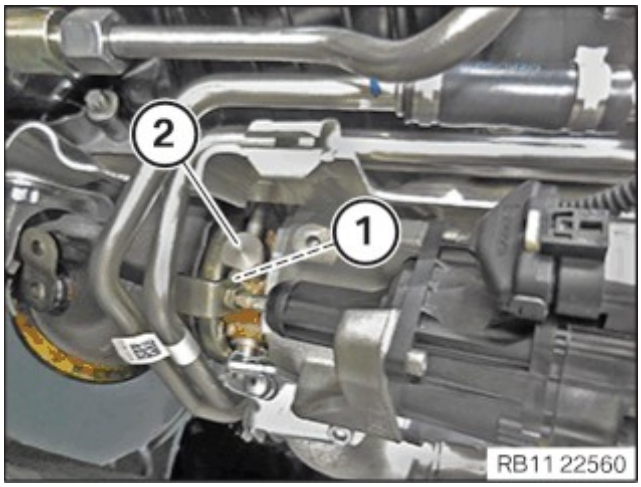
TECHNICAL INFORMATION

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



- Loosen screw (1).
- Feed out the oil feed line (2) for the cylinders 4 to 6 and set aside.

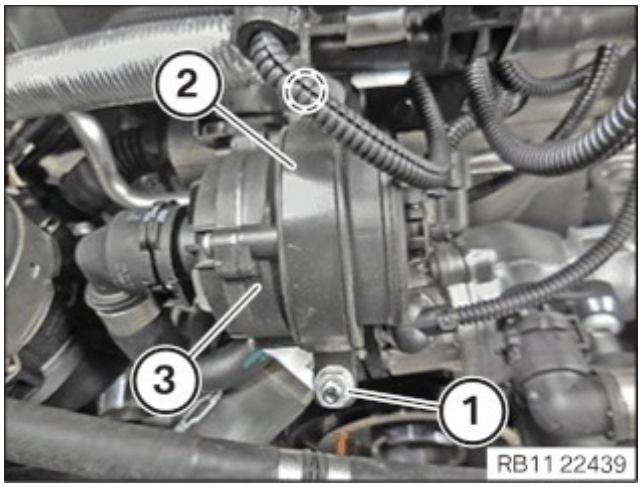
  Catch and dispose of emerging engine oil.



- Loosen screw (1).
- Feed out the oil feed line (2) for the cylinders 4 to 6 and remove downwards.

26–Partially detach the auxiliary coolant pump for the exhaust turbocharger

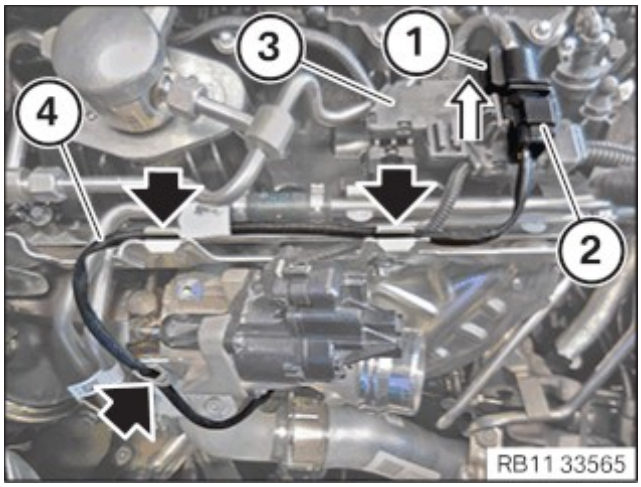
- Loosen nut (1).
- Guide out and remove retaining bracket (2) from the **marked** area.
- Guide out auxiliary coolant pump (3) and place it aside.



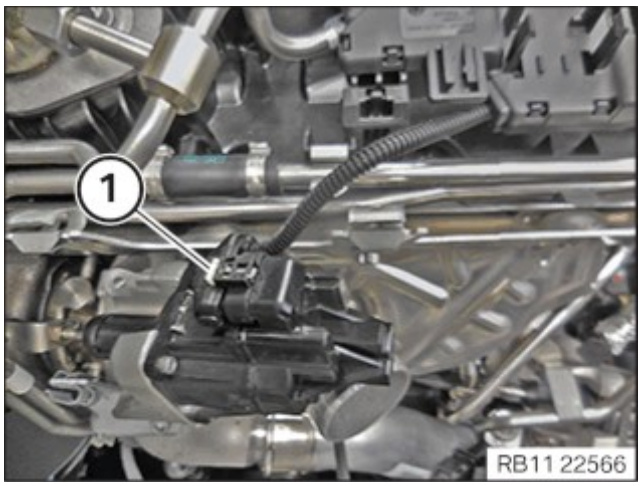
27–Removing coolant feed line part 2 between auxiliary coolant pump and exhaust turbocharger

TECHNICAL INFORMATION

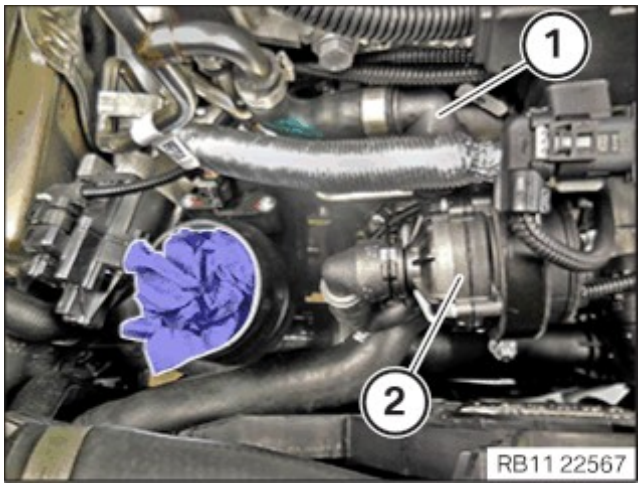
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

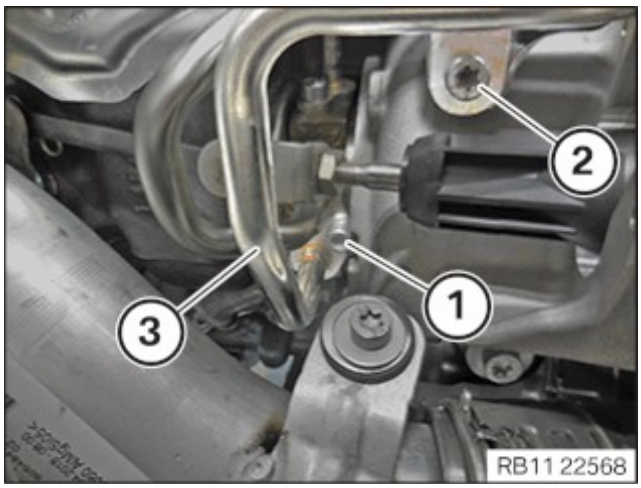


- Feed out the connector (1) and (2) in the direction of arrow from the carrier plate (3) and set aside.
- Unlock plug connection (1) and disconnect.
- Feed out cable (4) along the arrows and place to one side.

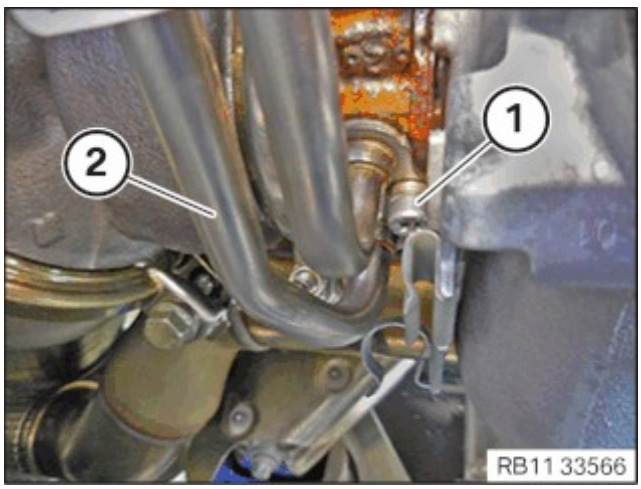


- Unlock plug connection (1) and disconnect.
- Unlock coolant feed line (1) part 2 at auxiliary coolant line (2) and release.
- Catch and dispose of escaping coolant.

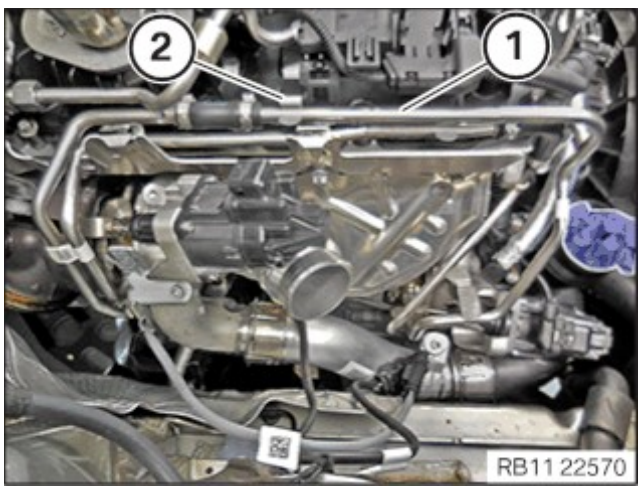




- Loosen the screws (1) and (2).
- Feed out coolant feed line (3) part 2 and place to one side.
- Catch and dispose of escaping coolant.



- Loosen screw (1).
- Feed out coolant feed line (2) part 2 and place to one side.

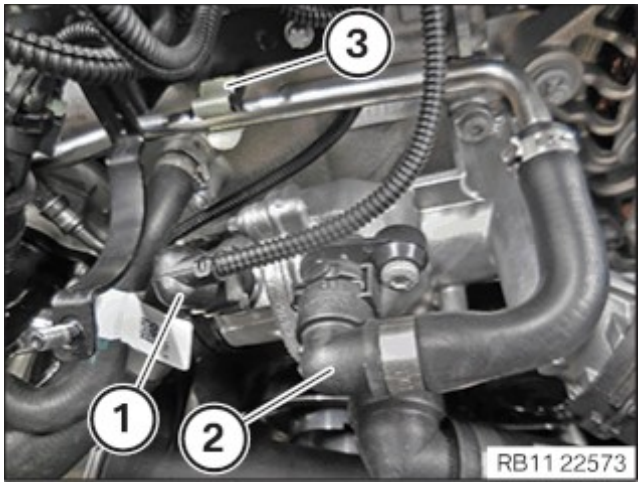


- Feed coolant feed line (1) part 2 out of clamp (2) and remove.

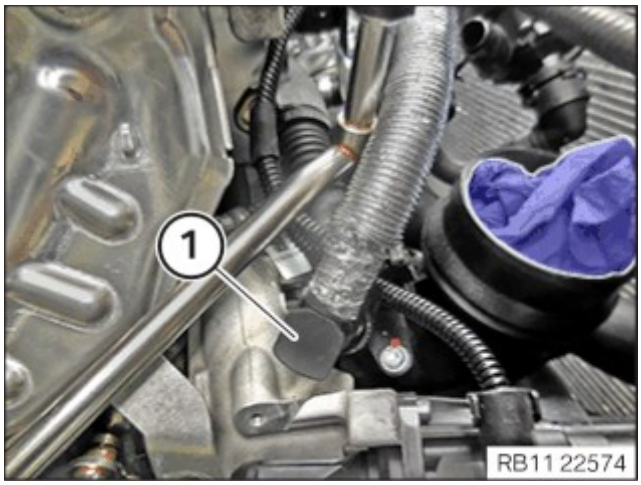
28–Removing coolant return line between exhaust turbocharger and thermostat

TECHNICAL INFORMATION

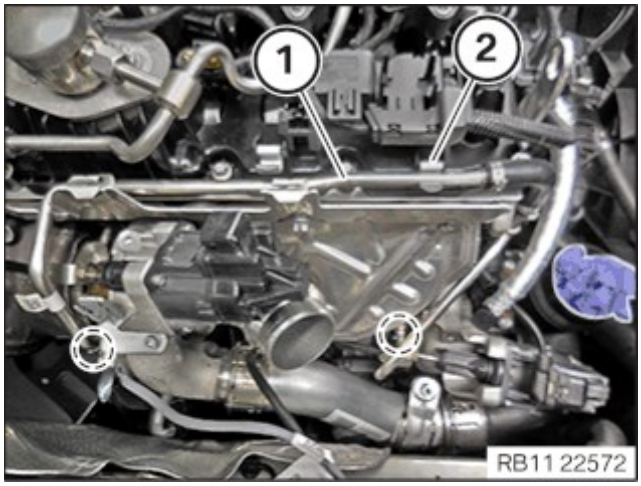
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Unlock plug connection (1) and disconnect.
- Unlock and release coolant return line (2).
- Feed coolant return line (2) out of clamp (3) and place to one side.



- Unlock and release tank ventilation line (1).



- Release coolant return line (1) from **marked** area.
- Release coolant return line (1) from clamp (2).
- Feed the coolant return line (1) out and remove it.

29–Removing both actuators

Additional information is available.

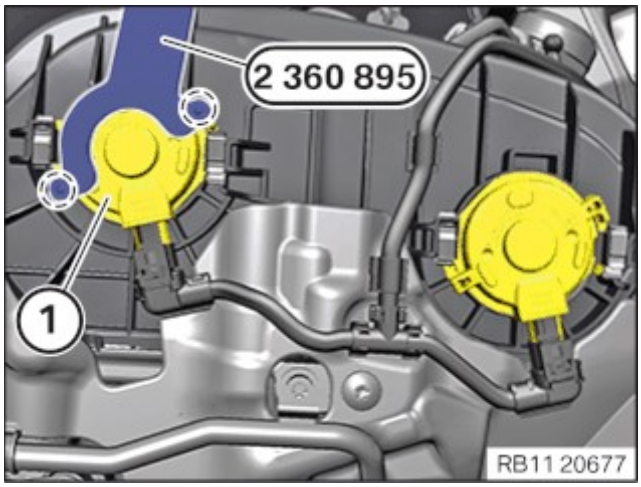
RISK OF DAMAGE

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)

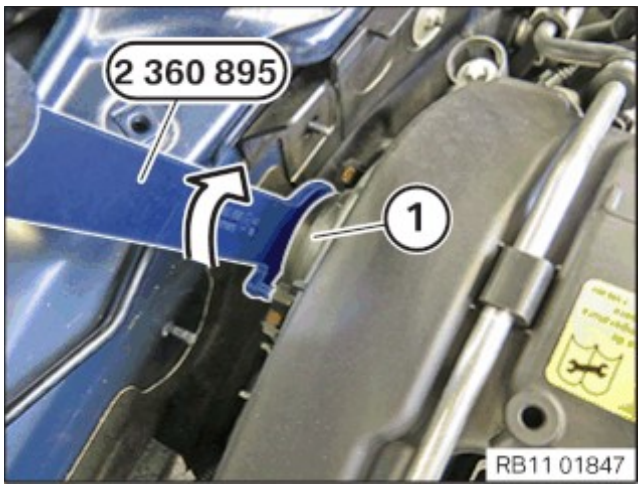
61 35 ... Notes on ESD protection (Electro Static Discharge)



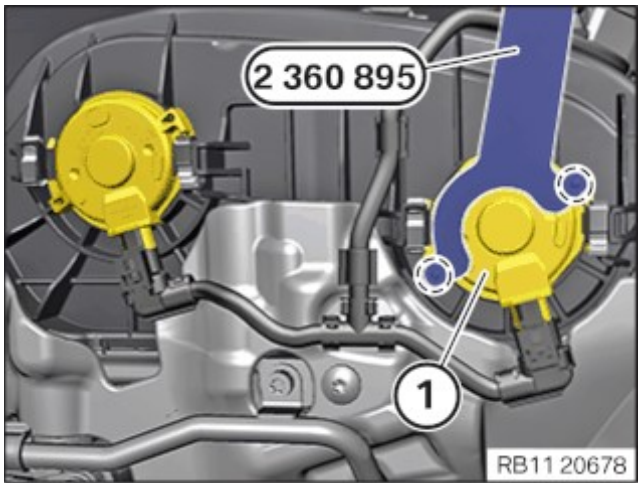
NOTICE

The figure shows the rear side of the engine.

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



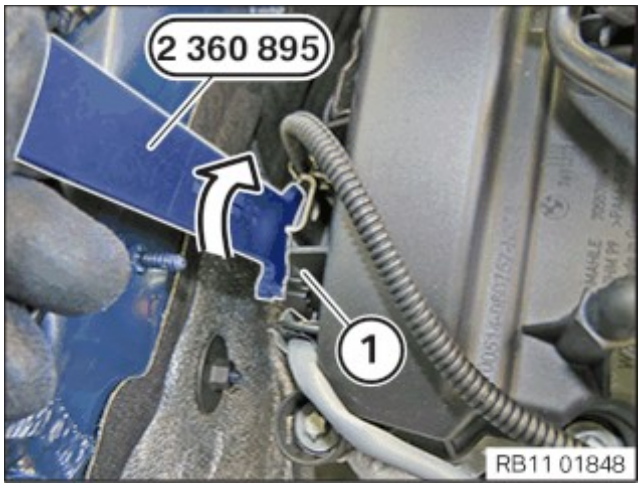
- Turn the actuator (1) on the intake side with the special tool **2 360 895** by about 50° in the direction of arrow and release it.



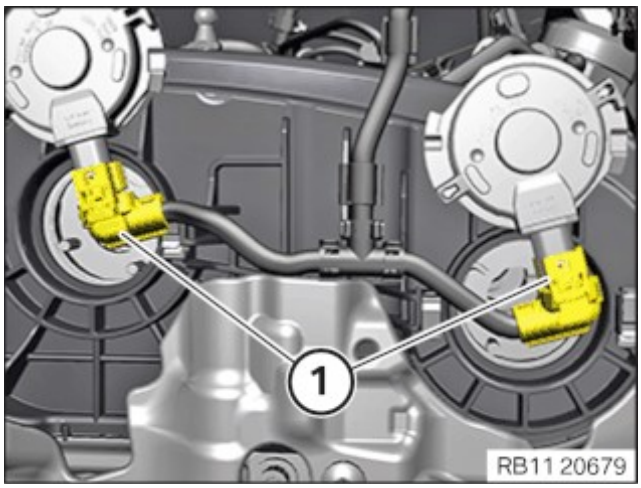
NOTICE

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.



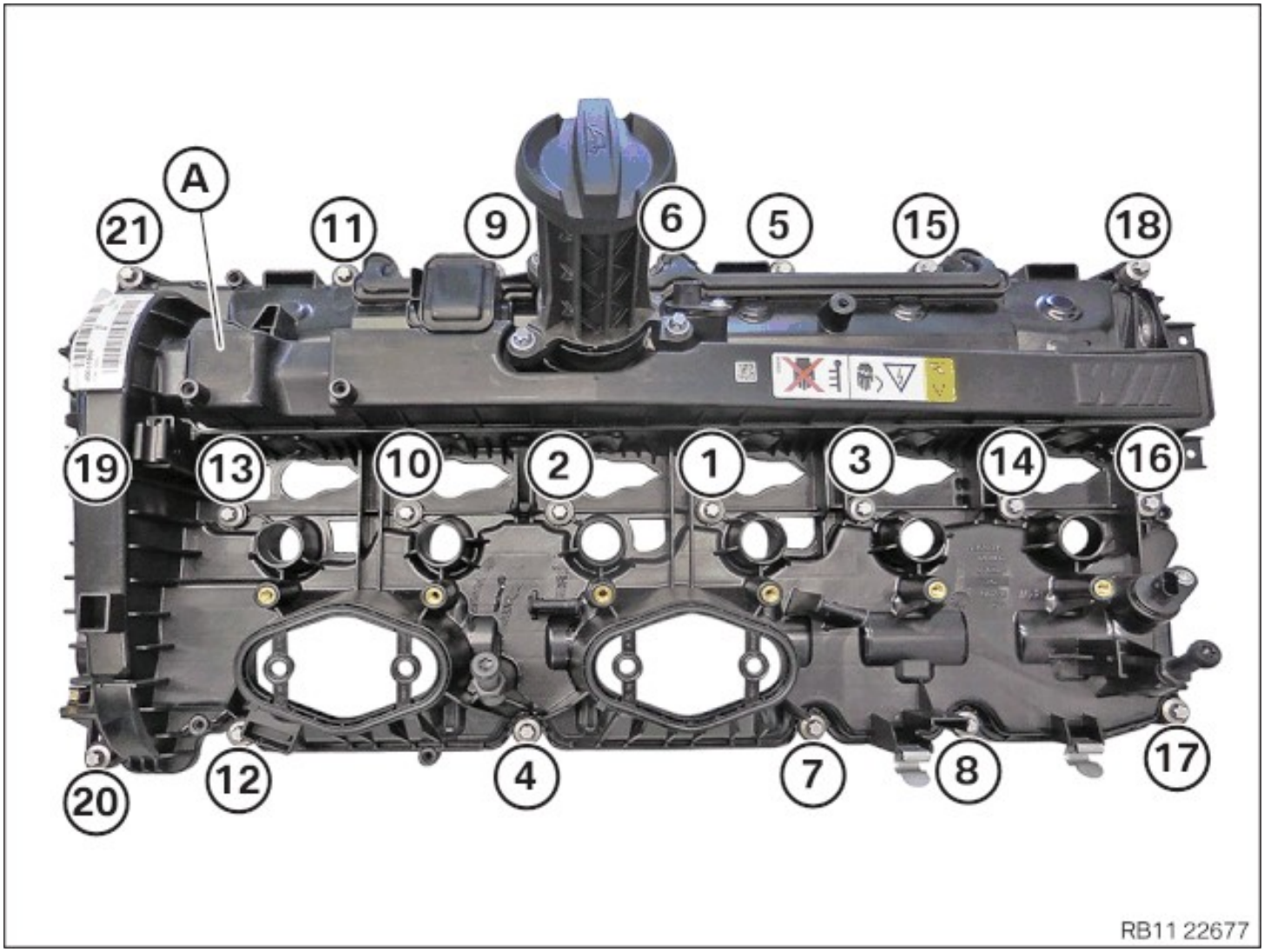
NOTICE

The figure shows the rear side of the engine.

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

30–Removing the cylinder head cover

Bolts of the cylinder head cover



1 - 21 Bolts of the cylinder head cover

A Cylinder head cover

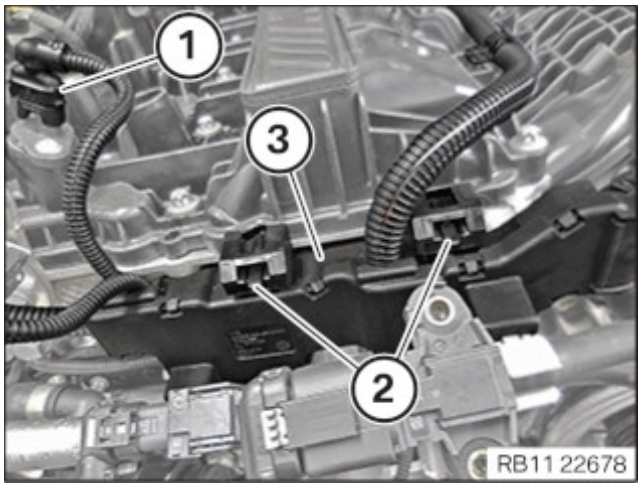
RISK OF DAMAGE

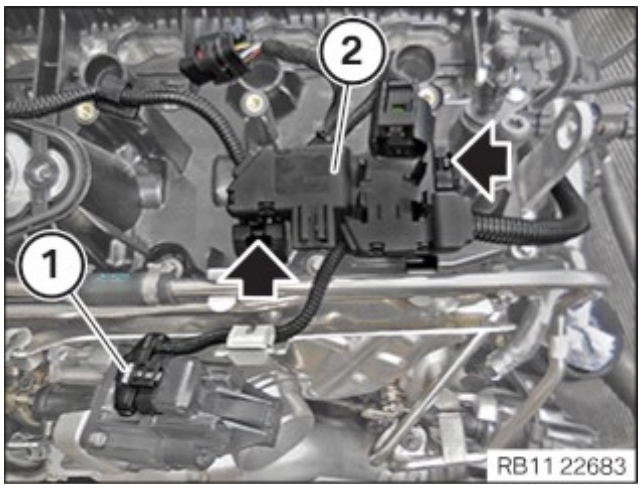
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

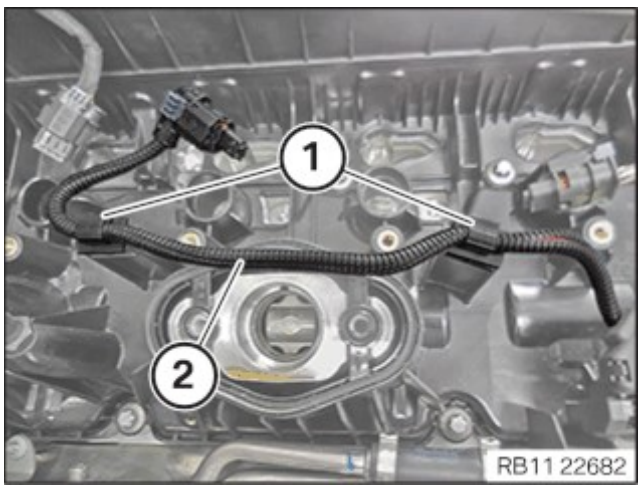
- Do not pull on the wires when disconnecting connectors and plug connections.

- Unlock plug connection (1) on the exhaust camshaft sensor and disconnect.
- Unlock and release locks (2).
- Guide out the wiring harness section (3) for the sensor system **2** and place to one side.

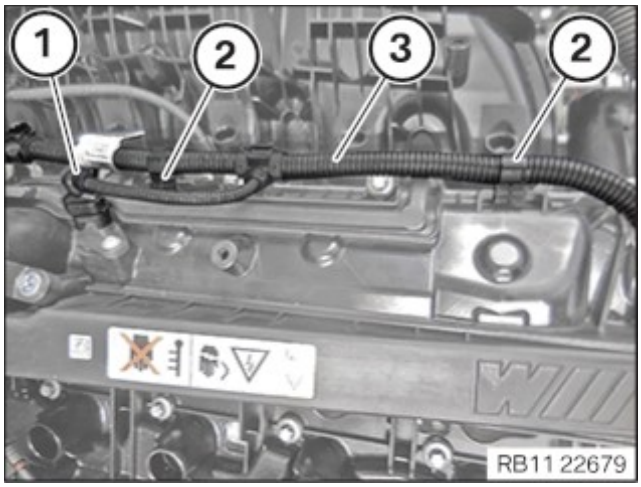




- Unlock plug connection (1) and disconnect.
- Unlock and release the lock (arrows).
- Guide out the wiring harness section (2) for the sensor system **2** and place to one side.

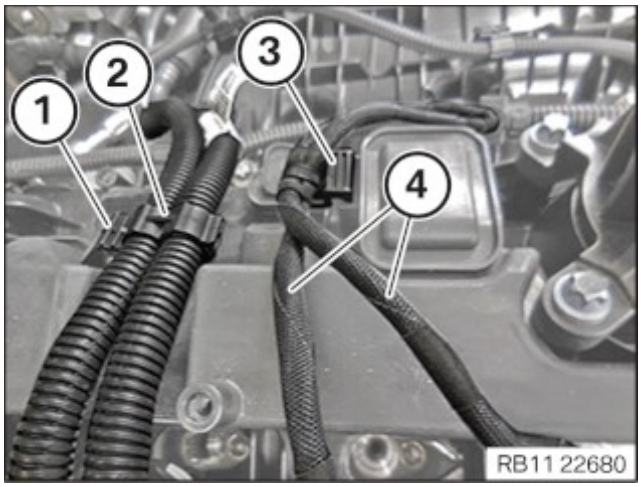


- Release clamps (1).
- Guide out the wiring harness section (2) for the sensor system **2** and place to one side.

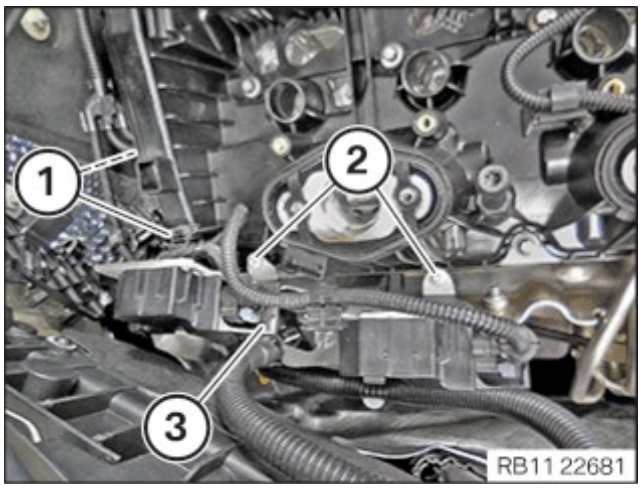


- Unlock the plug connection (1) on the intake camshaft sensor and disconnect.
- Loosen clamp (2).
- Guide out the wiring harness section (3) for the sensor system **2** and place to one side.

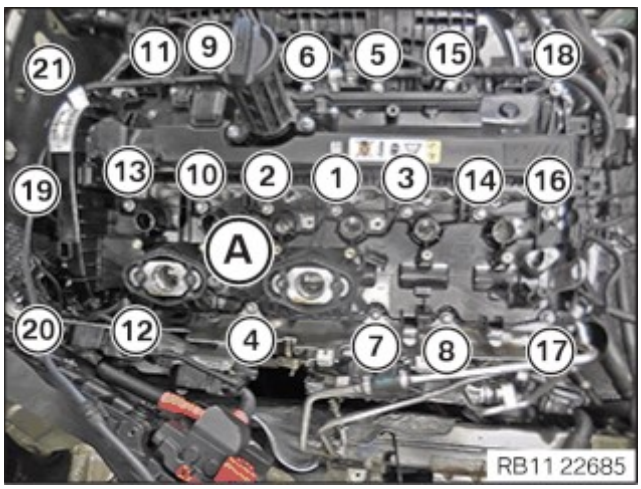
- Loosen clamp (1).



- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.
- Loosen clamp (3).
- Guide out the wiring harness section (4) for the sensor system **2** and place to one side.



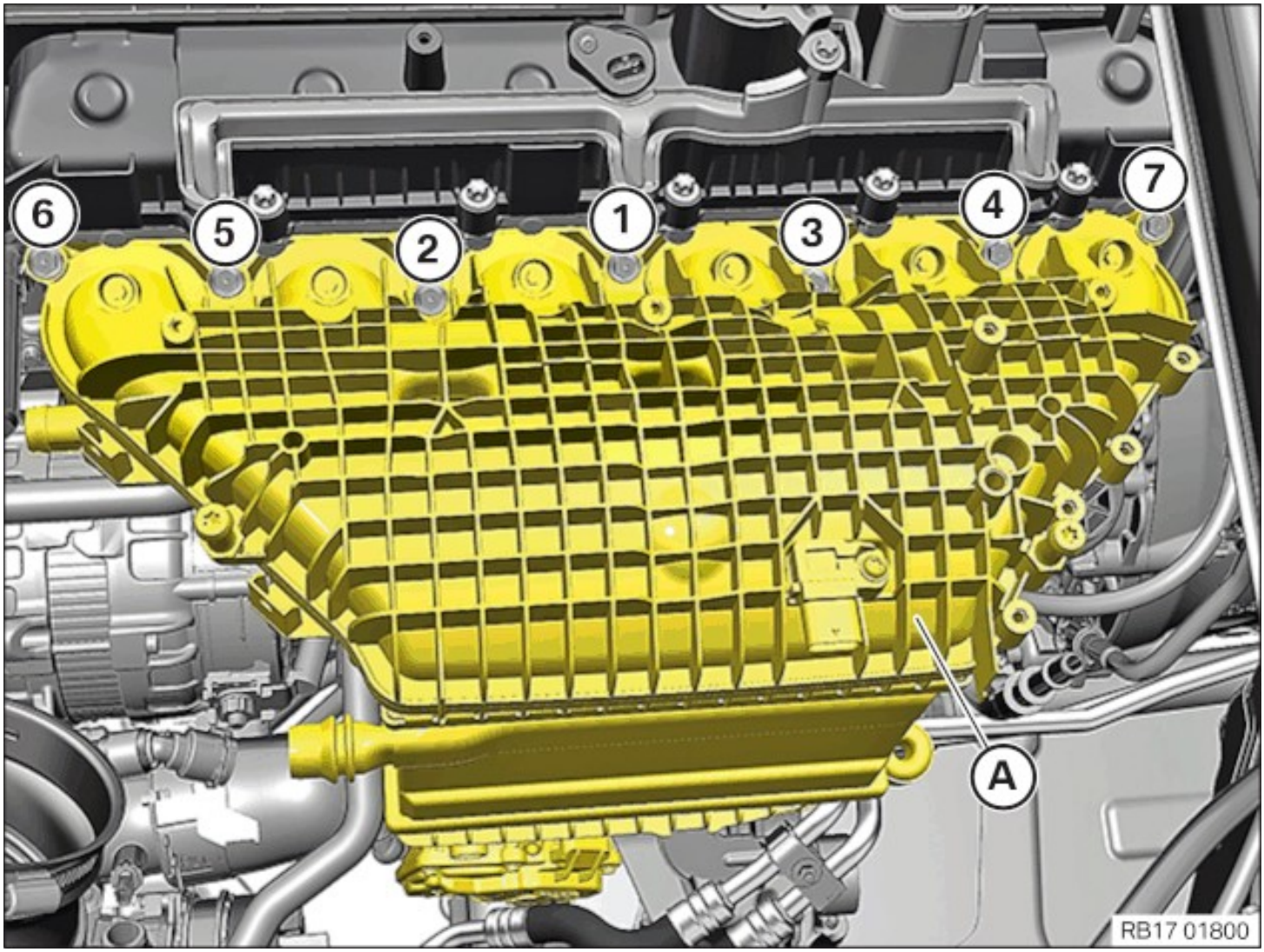
- Release clamps (1).
- Loosen screws (2).
- Guide out the holder (3) for the differential pressure sensor and place it aside.



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

31–Removing the intake plenum

Screws of the intake plenum



A Intake plenum

1-7 Screws

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.

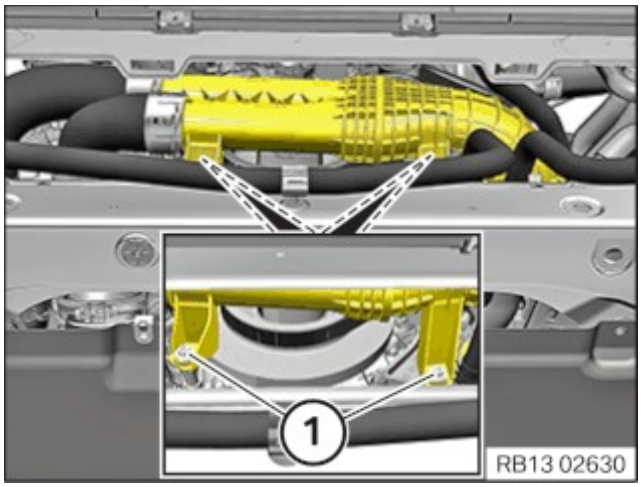
TECHNICAL INFORMATION

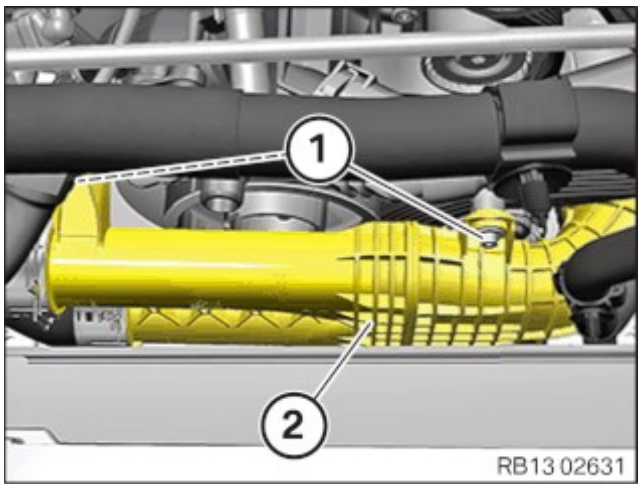
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

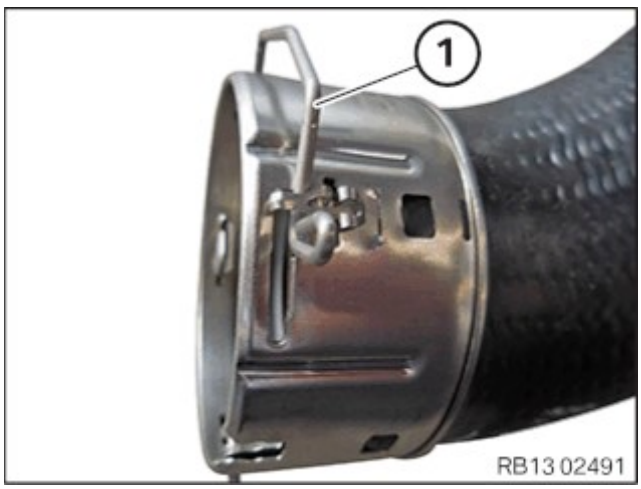
Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Loosen screws (1).

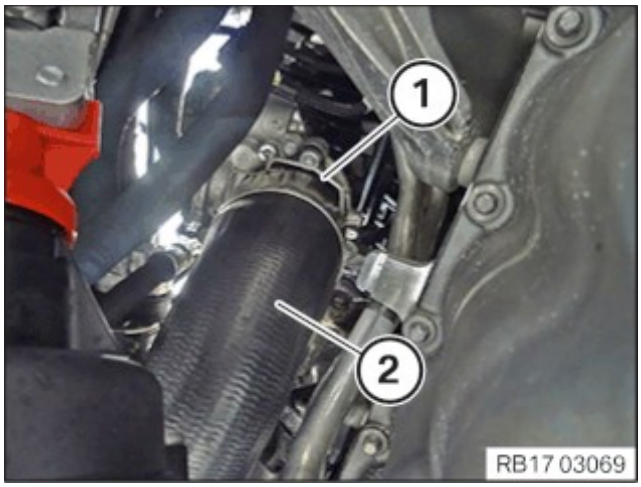




- Loosen screws (1).
- Pull out the charge air crossing (2) and set it aside.

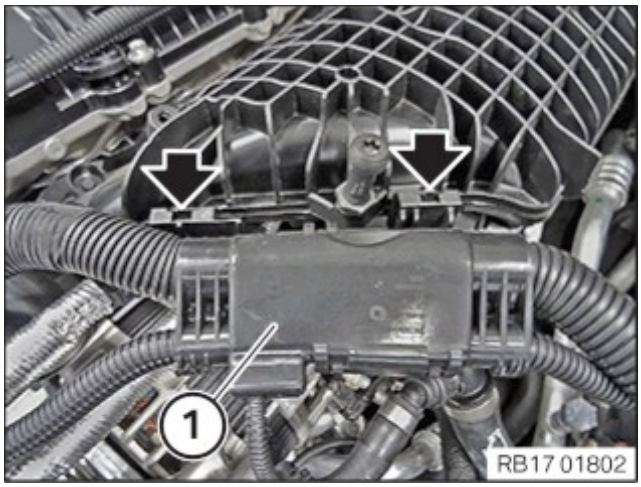


- Unlock clamp (1) and engage in this position.

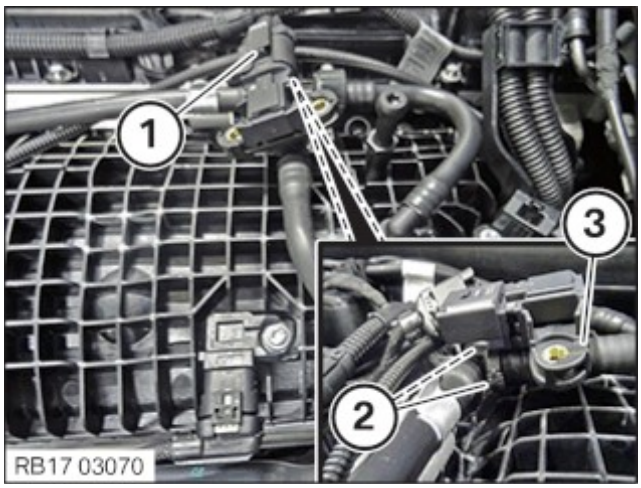


- Unlock the clamp (1).
- Pull off the charge air hose (2).

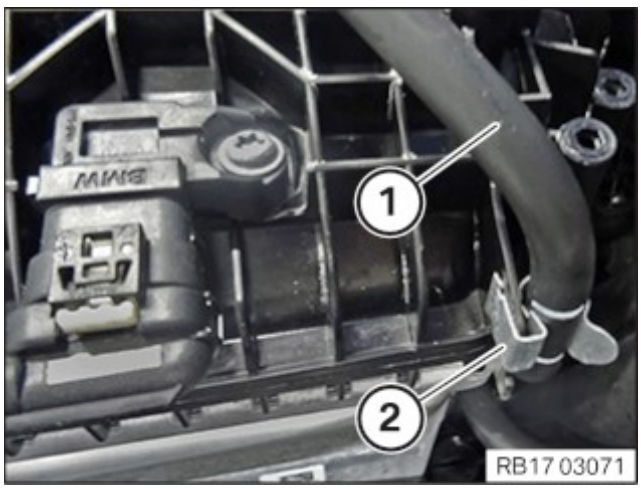
- Unlock the locks (arrows).



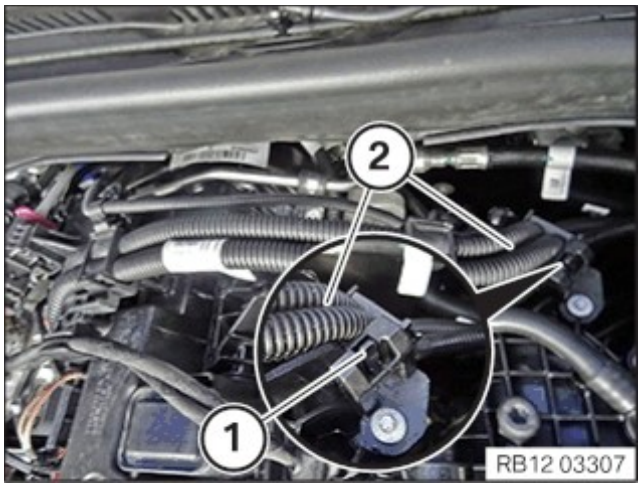
- Remove the wiring harness section (1) and put to one side.



- Unlock plug connection (1) and disconnect.
- Unlock the locks (2) .
- Pull off the tank ventilation line with the pressure sensor (3).

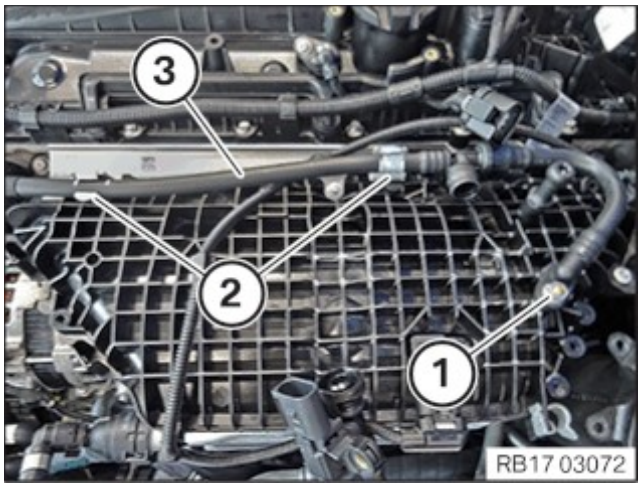


- Release the tank ventilation line (1) from the clamp (2).

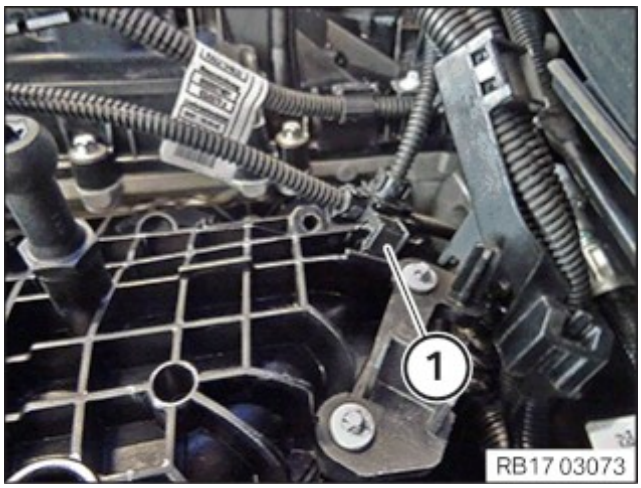


- Unlock the lock (1).
- Remove the wiring harness section (2) and put to one side.

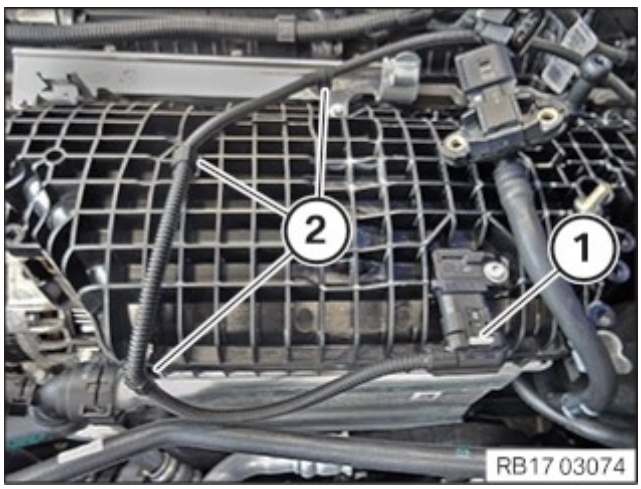
- Release nut (1).



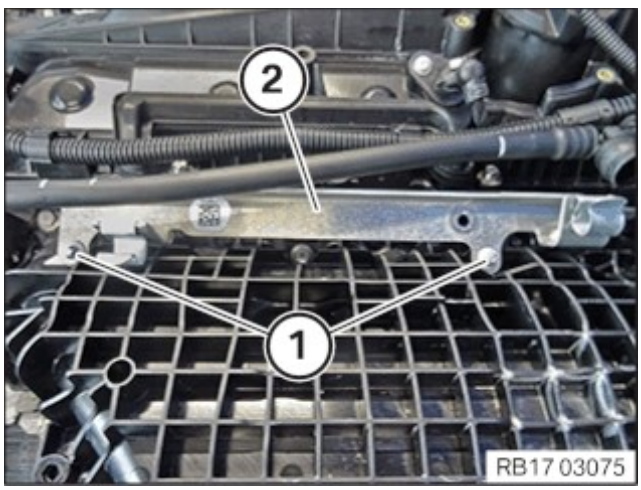
- Feed out the tank ventilation line (3) from the holders (2) and set it aside.



- Loosen clamp (1).

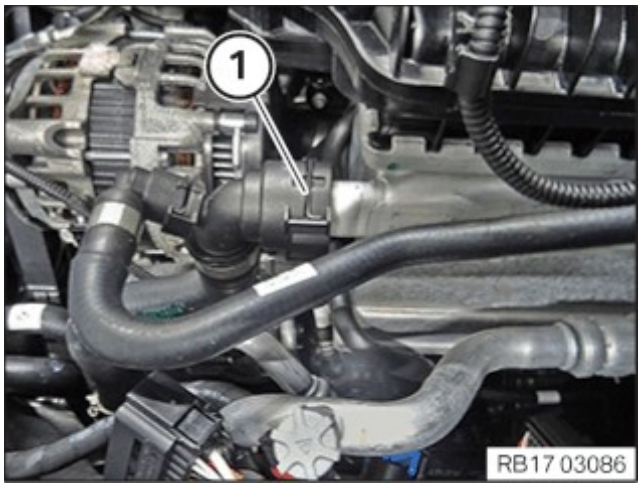


- Unlock plug connection (1) and disconnect.
- Release clamps (2).

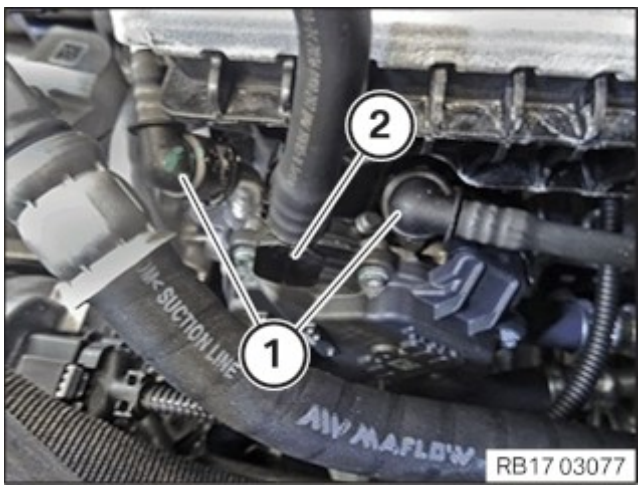


- Loosen screws (1).
- Guide out and remove holder (2).

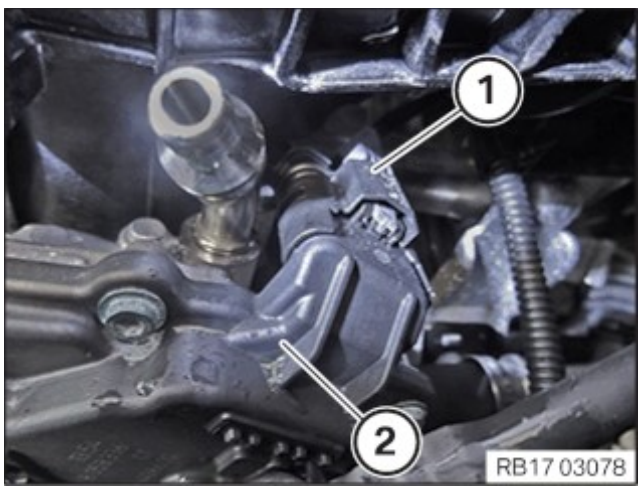
- Unlock and remove the coolant line (1).



- Unlock and remove the coolant line (1).

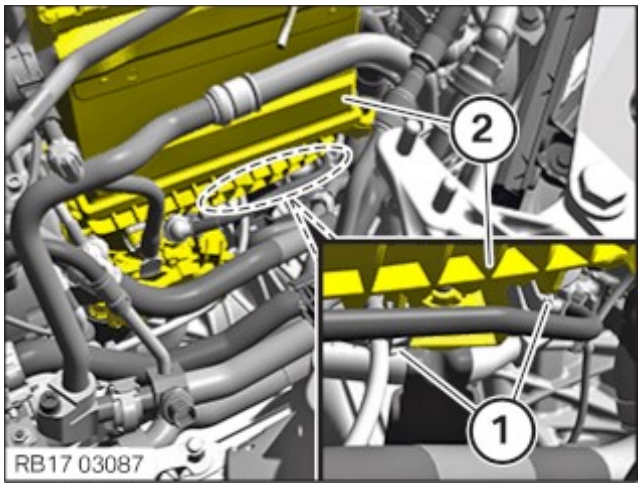


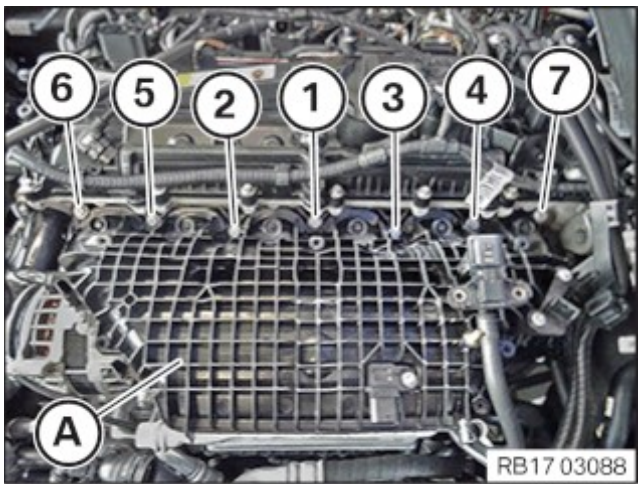
- Unlock coolant lines (1) and pull off.
- Unlock and pull off the tank ventilation line (2).



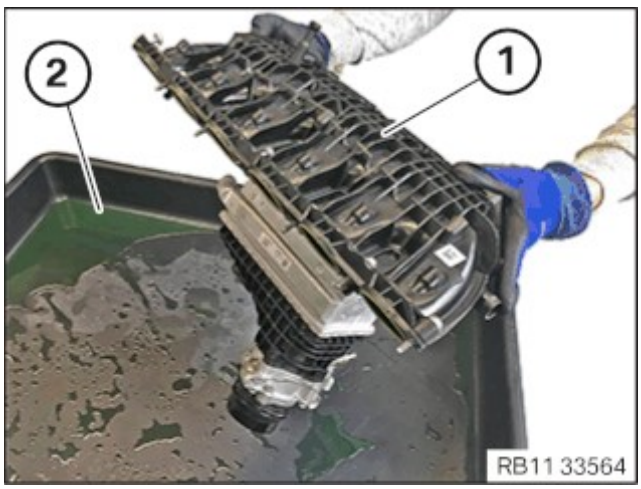
- Unlock the plug connection (1) and disconnect it from the throttle valve (2).

- Release the clamps (1) in the marked area from the charge air cooler (2).





- Loosen screws in the order (7) to (1).
- Feed out the charge air cooler (A) **carefully** and remove it.

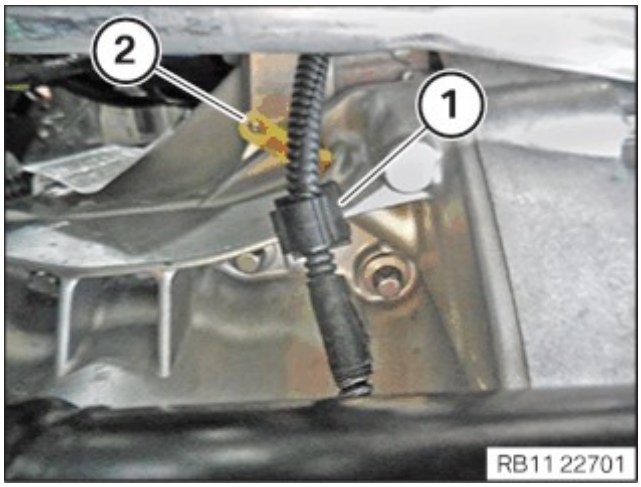


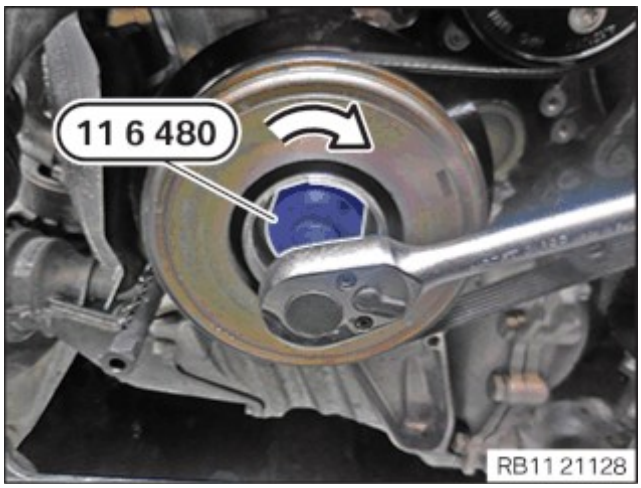
- Drain the remaining coolant (2) in the intake plenum (1).

32–Blocking engine in the TDC firing position

Additional information is available.

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





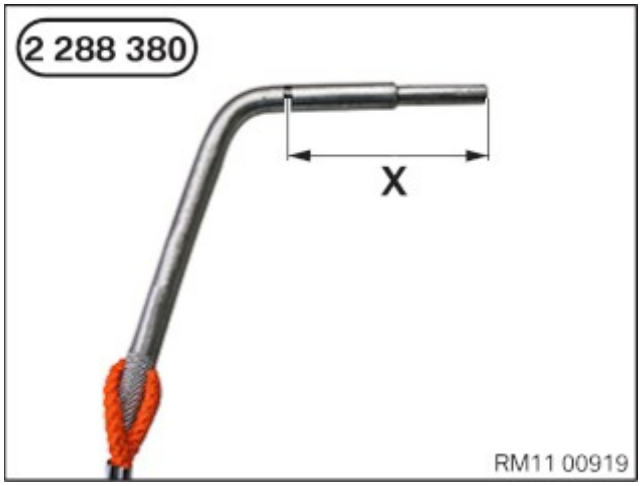
RISK OF DAMAGE

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.

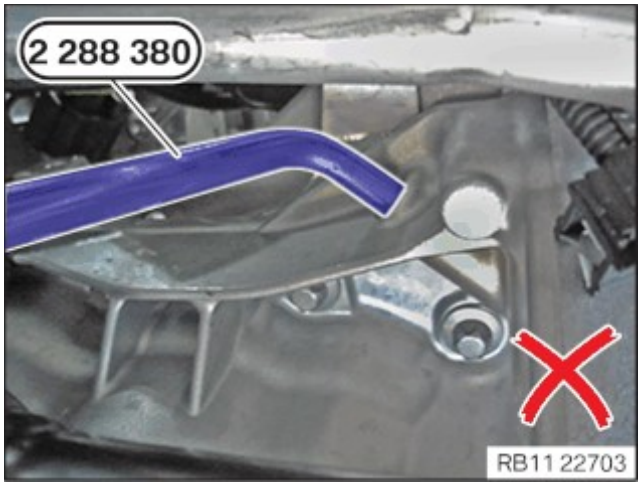
- Turn the engine in **direction of arrow** with the special tool **0 493 380 (11 6 480)** to the TDC firing position of **cylinder 1**.



- **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:**

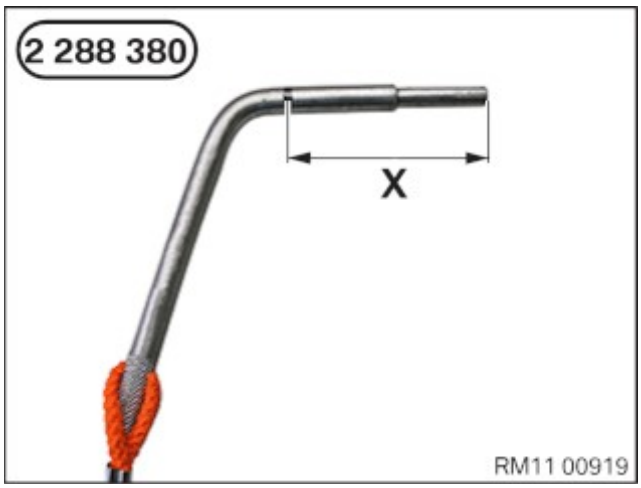
  The special tool **2 288 380** is **incorrectly** positioned.

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

- **Vehicles with automatic transmission:**

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

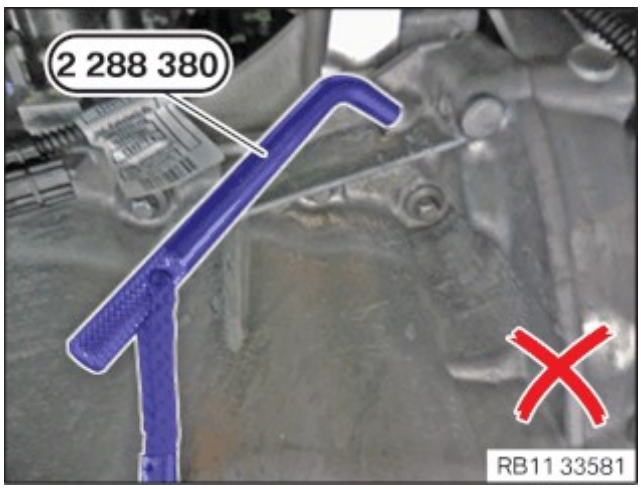
  The engine is in the TDC firing position of cylinder 1.



- **Vehicles with manual gearbox:**

  Dimension (X) = 61 mm

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



- **Vehicles with manual gearbox:**

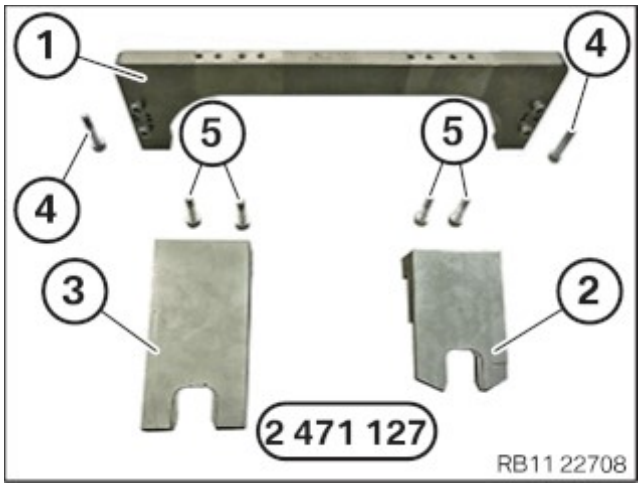
  Special tool **2 288 380** **incorrectly** positioned.

  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.



TECHNICAL INFORMATION

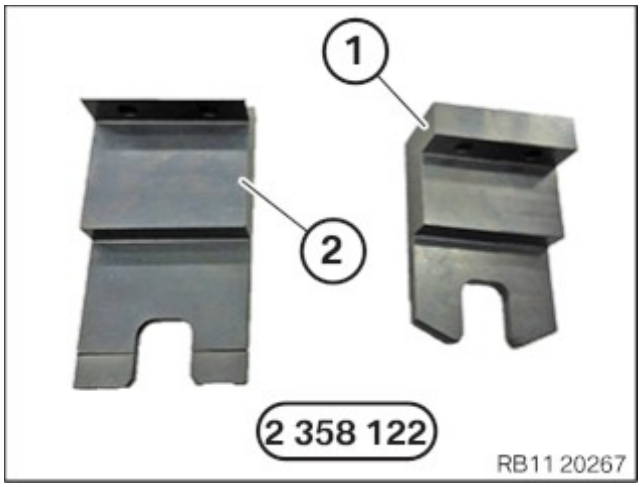
Alternative to the new special tool **SWZ: 2 471 127**, the already known special tool **SWZ: 2 456 372 can be used** in modified form.

Information on modification can be found in the further information.

The modified special tool is downwards compatible.

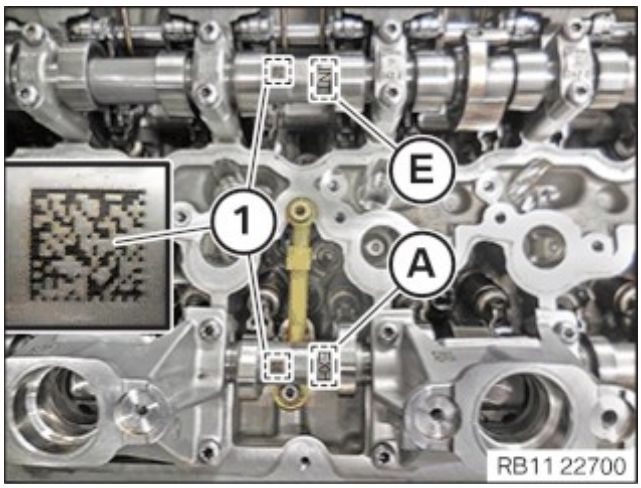
- Keep set of special tools **2 471 127** at hand:

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



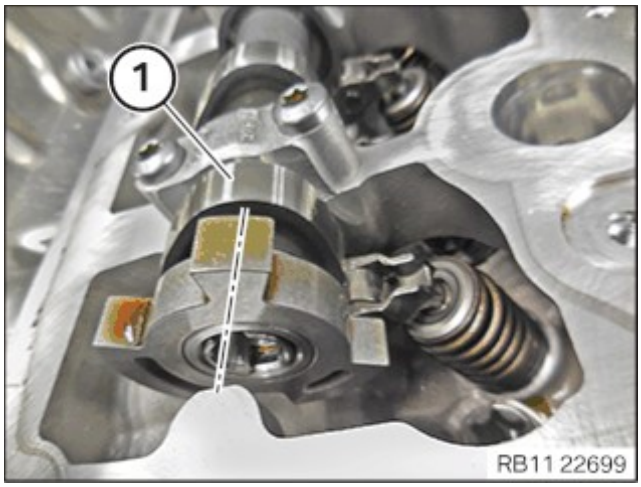
- Keep the test gauges from the set of special tools **2 358 122** ready:

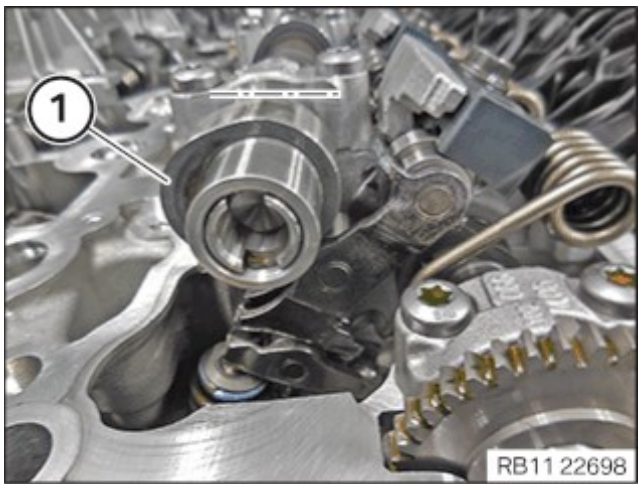
Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



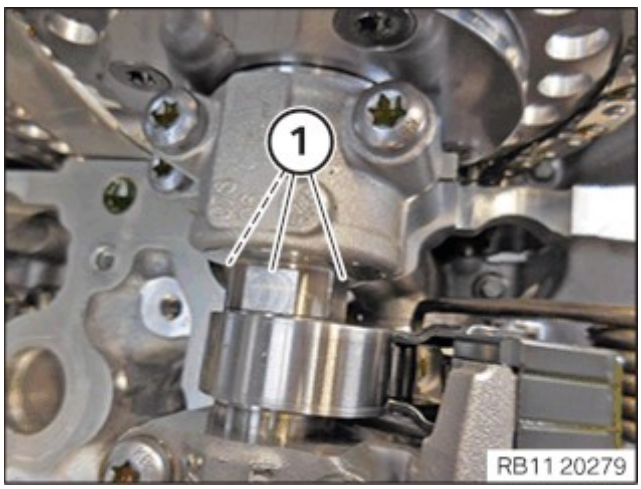
- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.

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

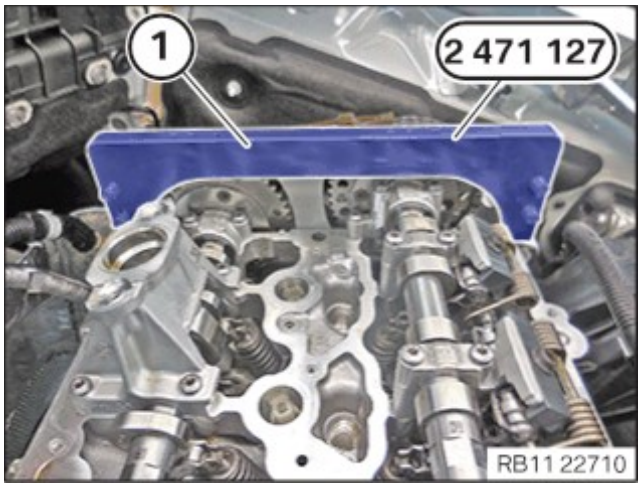




- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.

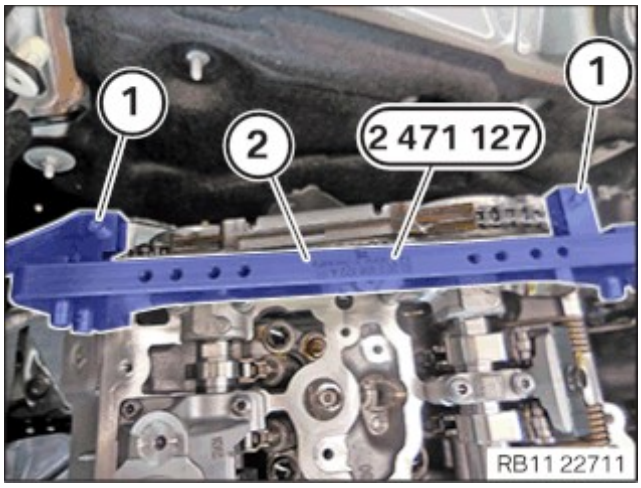


- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



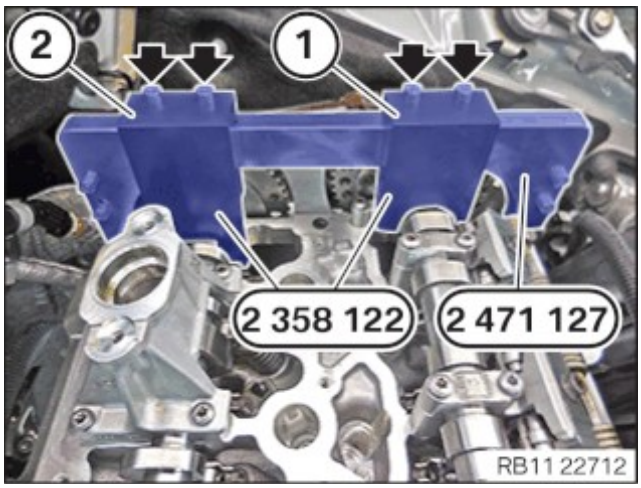
- Position the basic carrier (1) from the set of special tools **2 471 127** on the cylinder head.

- Tighten the screws (1) from the set of special tools **2 471 127** on the basic carrier (2).



Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position test gauge (1) from the special tool kit **2 358 122** between the intake camshaft and the basic carrier from the special tool kit **2 471 127**.
- Position test gauge (2) from the special tool kit **2 358 122** between the exhaust camshaft and the basic carrier from the special tool kit **2 471 127**.
- Tighten screws (arrows).

Test gauge to basic carrier

M6		Tightening torque	8 Nm

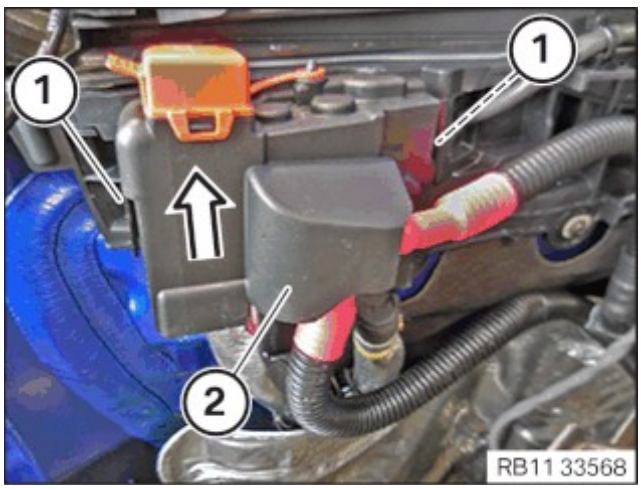
33–Removing chain tensioner

Prerequisite

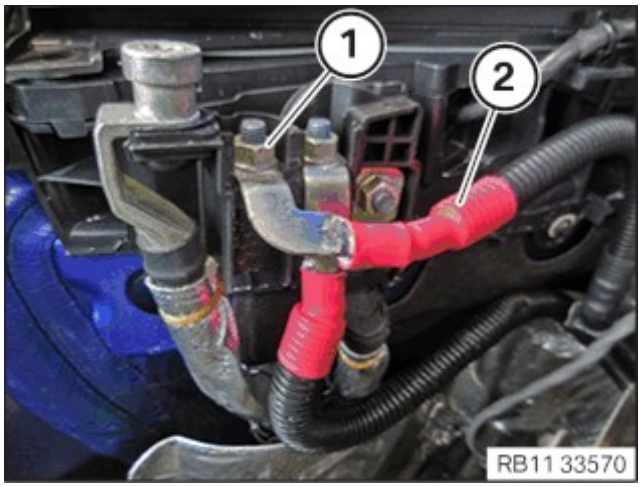
Battery earth lead disconnected.

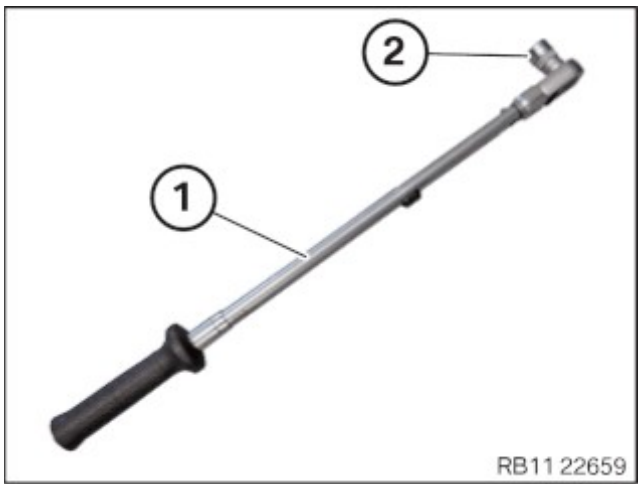
TECHNICAL INFORMATION

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



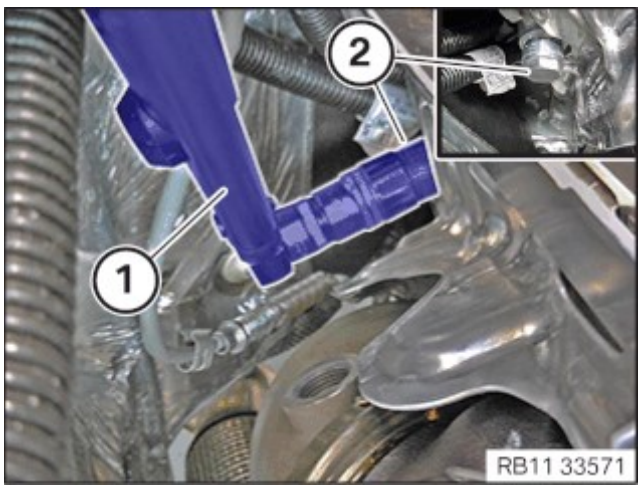
- Unlock the locks (1) .
- Guide and remove cover (2) in direction of arrow.
- Release nut (1).
- Pull the positive battery cable (2) out and set it aside.



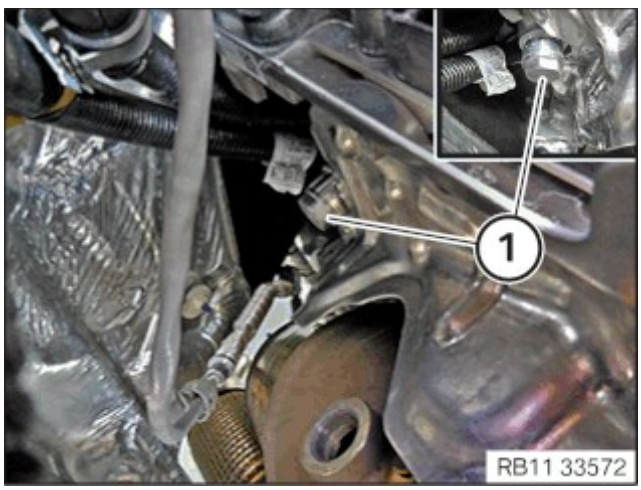


- Provide commercially available tool.

Number	Description
1	Torque wrench 1/2 inch
2	Wrench socket SW19

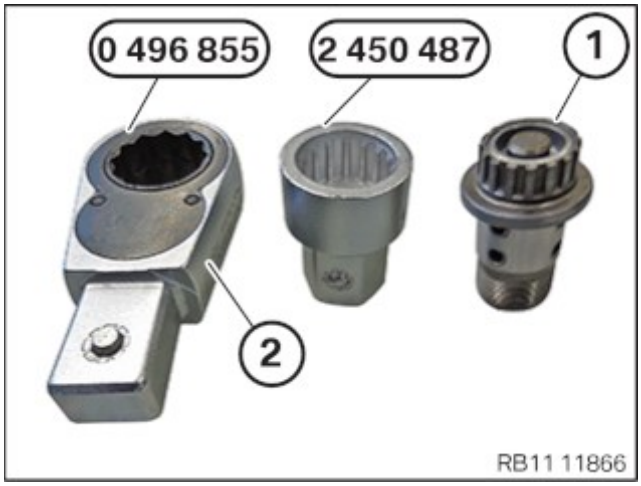


- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).

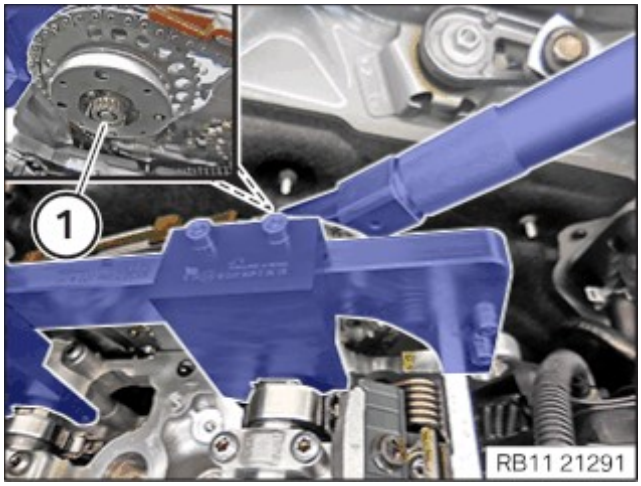


- Feed out and remove the chain tensioner (1).

34–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**.

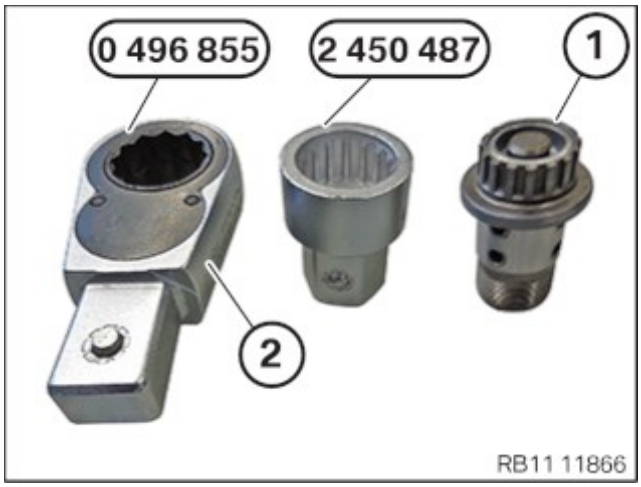


NOTICE

The figure shows the rear side of the engine.

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

35–Releasing VANOS central valve of the exhaust camshaft adjuster

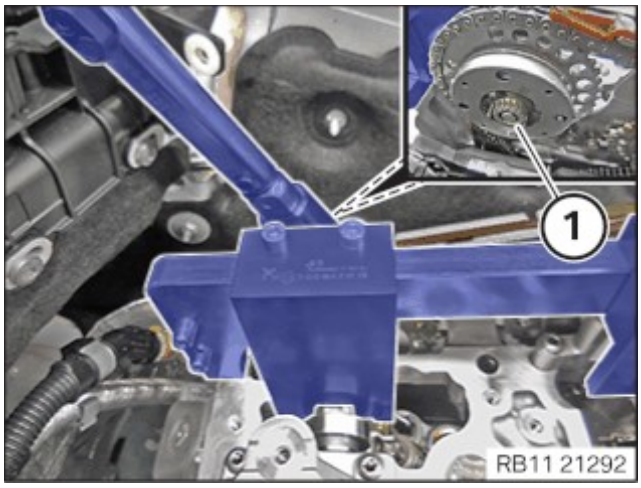


- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool **0 496 855** with the special tool **2 450 487**.

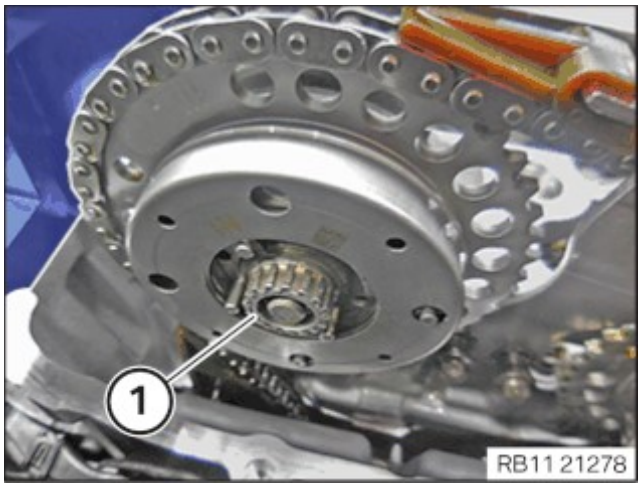
NOTICE

The figure shows the rear side of the engine.

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

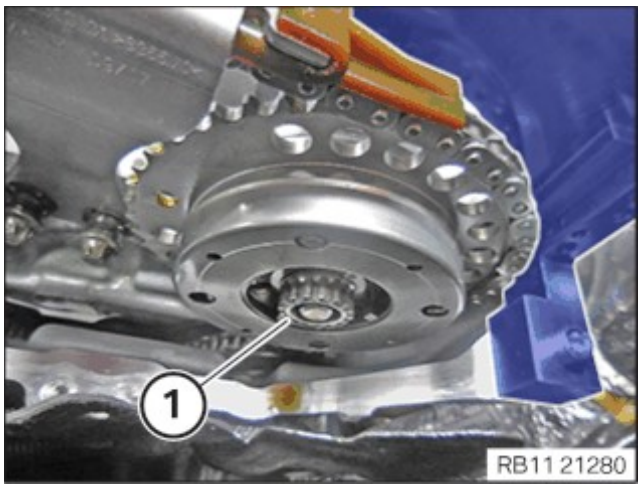


36–Removing the VANOS central valve of the intake adjuster



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

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



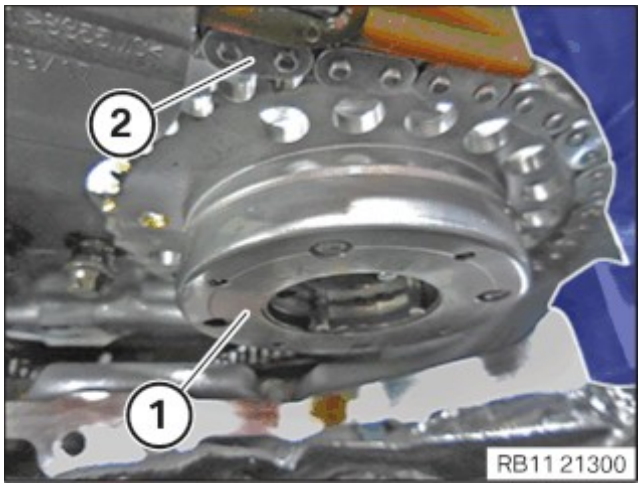
- Guide out and remove the VANOS central valve (1) of the exhaust camshaft adjuster.

38–Remove exhaust camshaft adjuster

NOTICE

The figure shows the rear side of the engine.

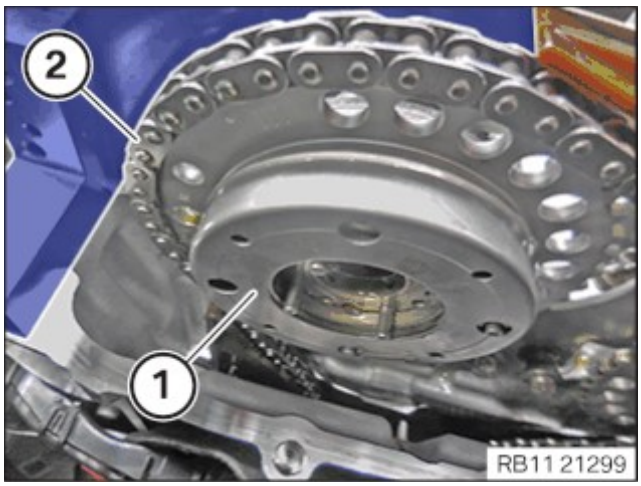
- Guide out the exhaust camshaft adjuster (1) from the timing chain (2) and remove.



39–Removing intake adjuster

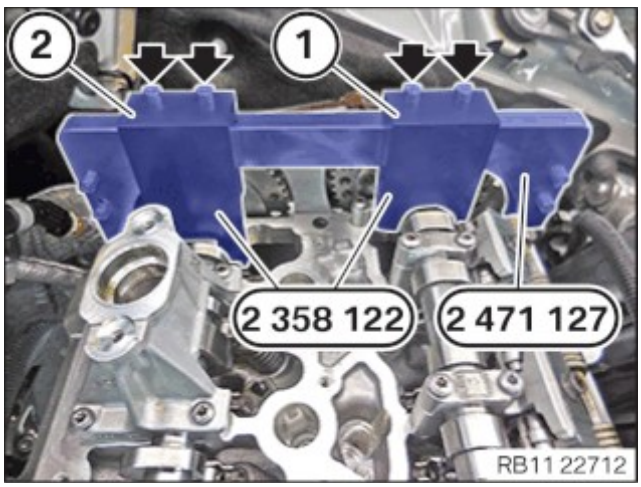
NOTICE

The figure shows the rear side of the engine.



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

40–Remove the test gauges to fix the camshafts



- Remove screws (arrows).
- Feed out and remove the test gauge (1) from the set of special tools **2 358 122** between the intake camshaft and the basic carrier of the set of special tools **2 471 127**.
- Feed out and remove the 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 **2 471 127**.

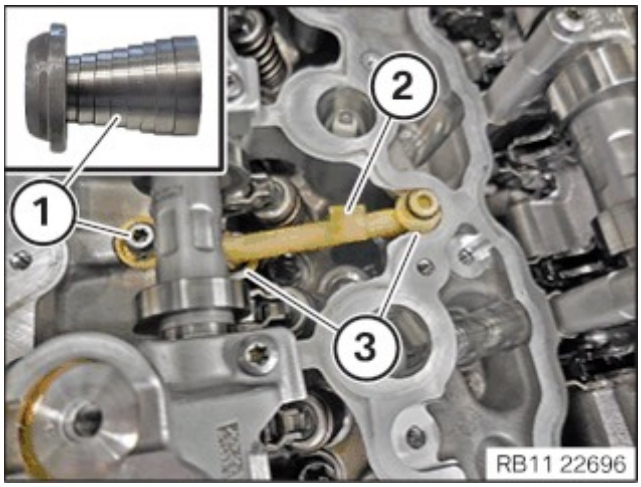
41–Removing the oil return line in the cylinder head

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

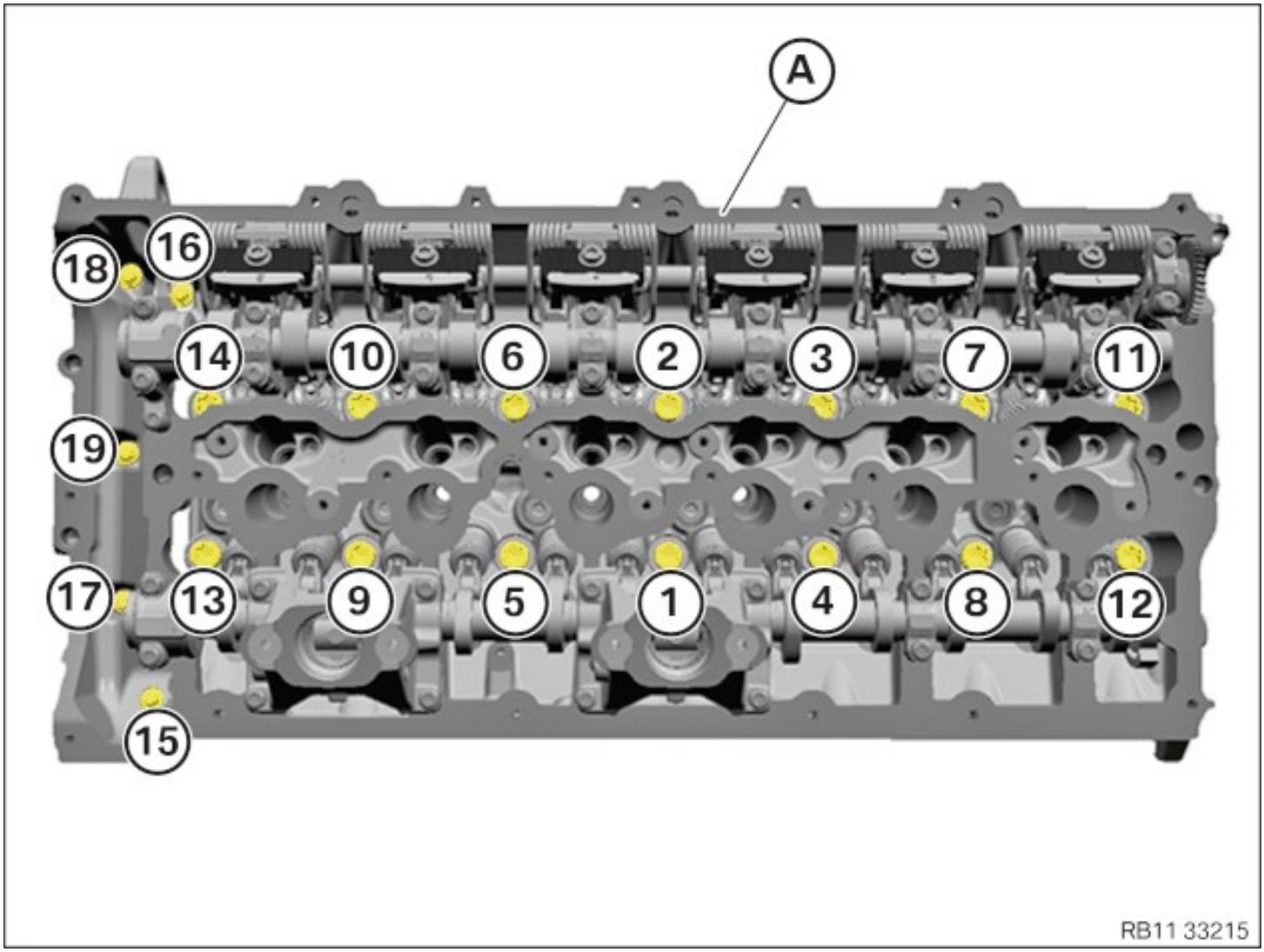
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.



- Loosen screw (1).
- Guide oil return line (2) from cylinder head (3) and remove it.

42–Remove cylinder head.

Bolts of the cylinder head



1 - 19 Bolts of the cylinder head

A Cylinder head

⚠ CAUTION

Heavy component.

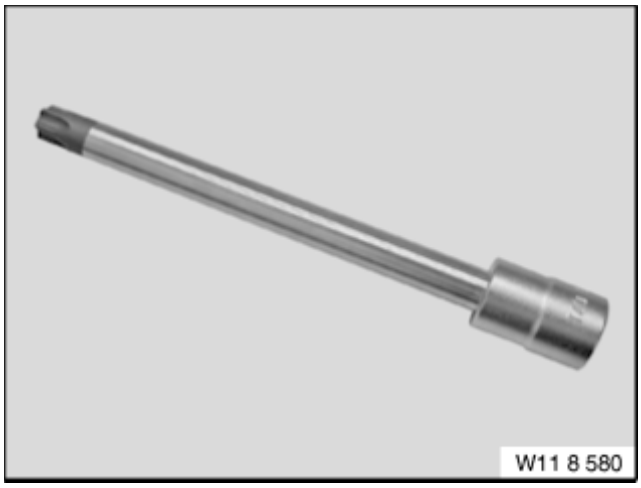
Heavy components can lead to injury or damage.

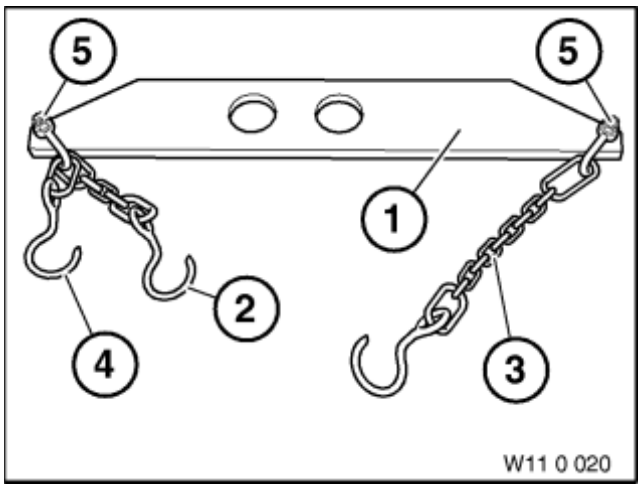
- Remove and install heavy components with the aid of another person/other persons.

i TECHNICAL INFORMATION

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

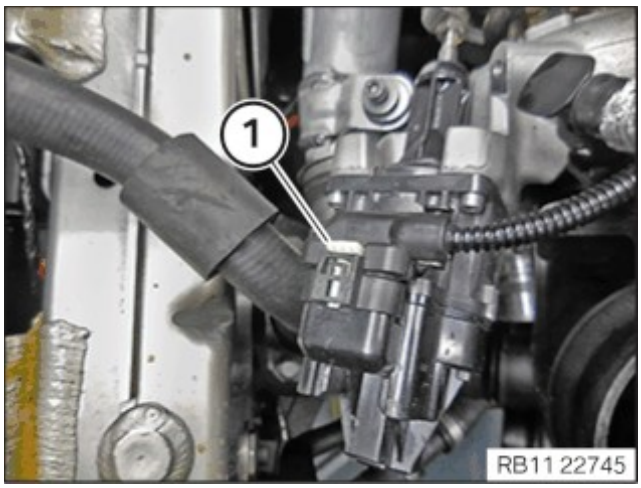
- Prepare special tool **0 495 747 (11 8 580)**.



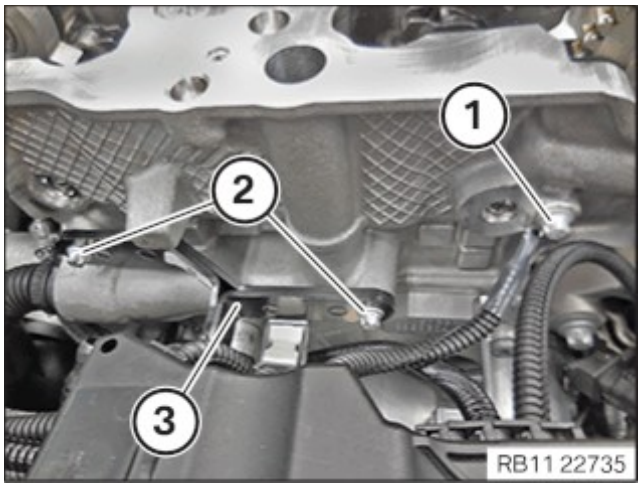


- Prepare special tool **0 490 567 (11 0 020)**.

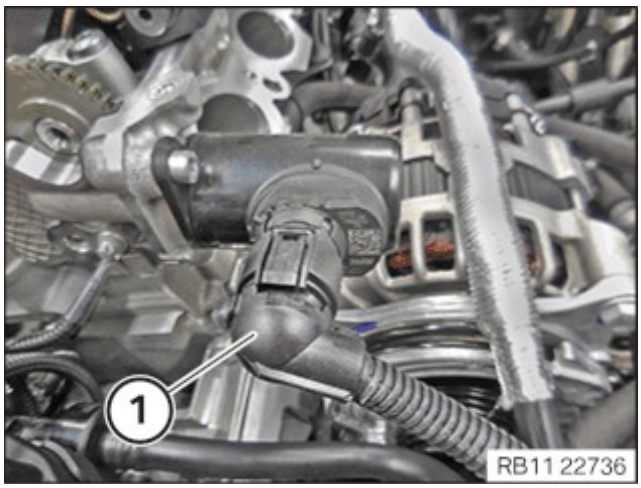
- Prepare the workshop crane **2 220 718**.



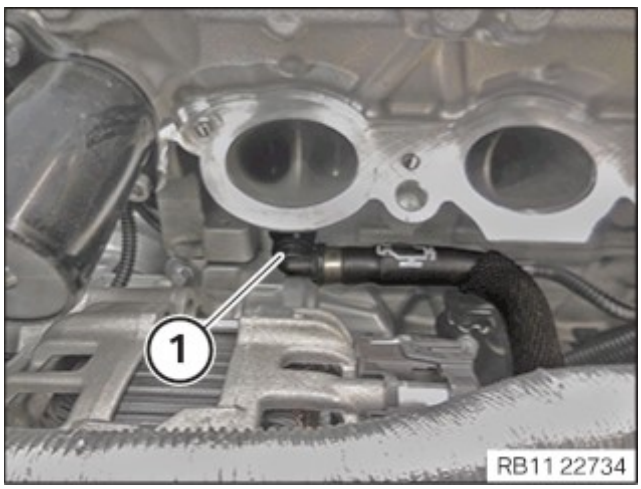
- Unlock plug connection (1) and disconnect.
- Release the screw (1).



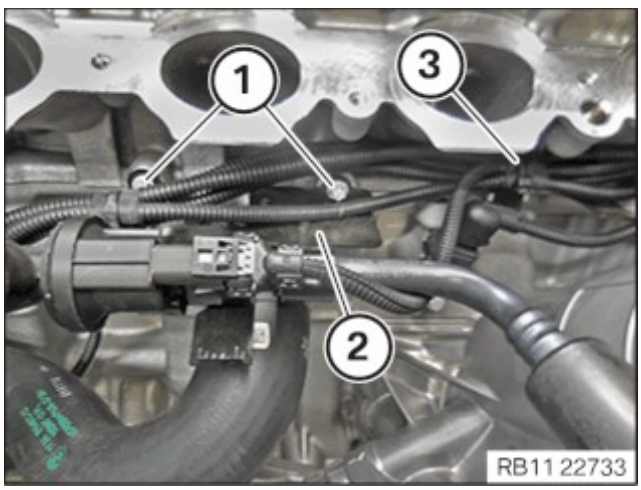
- Loosen screws (2).
- Guide out and remove holder (3).



- Unlock plug connection (1) and disconnect.

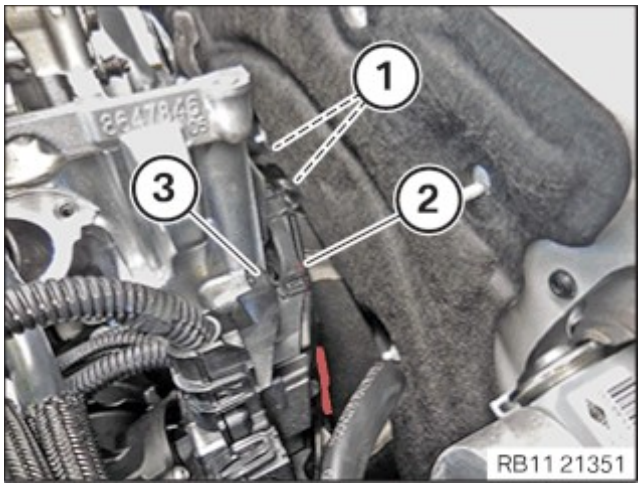


- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.

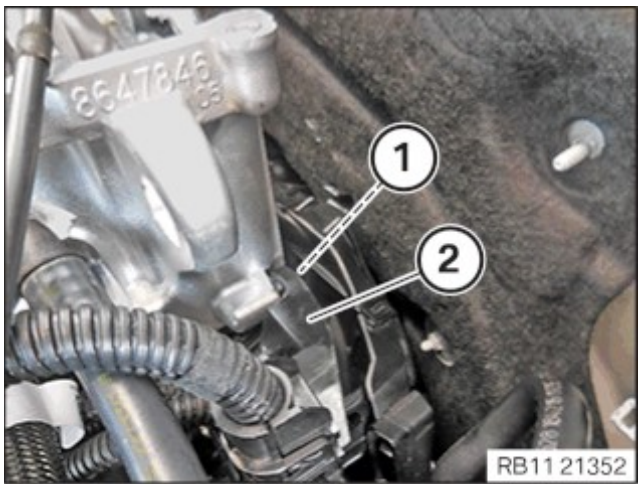


- Loosen screws (1).
- Guide out holder (2) and set it aside.
- Loosen clamp (3).

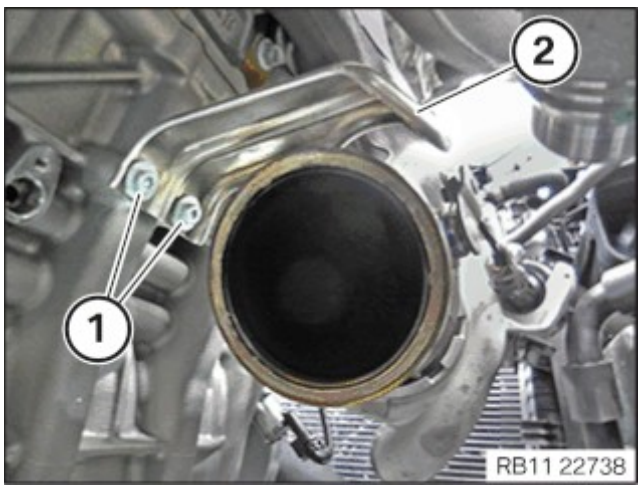
- Loosen screws (1).



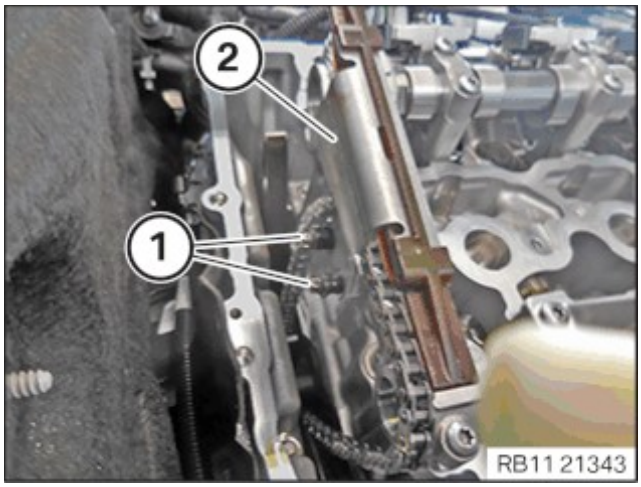
- Unlock the transmission wiring harness (2) on the wiring harness section (3) for the sensor system 1 and set it aside.



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

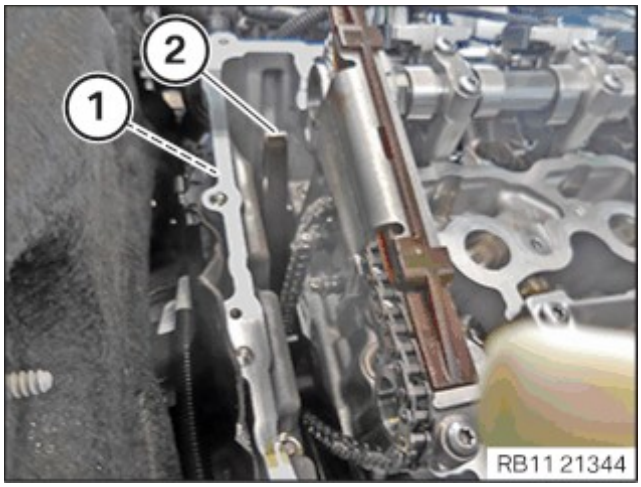


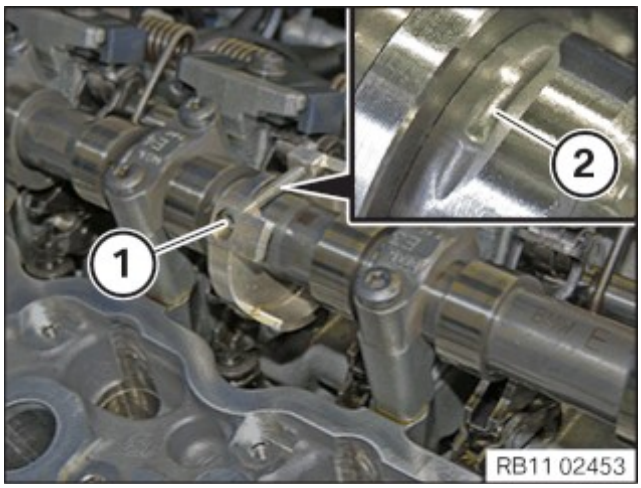
- Loosen screws (1).
- Guide out and remove holder (2).



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

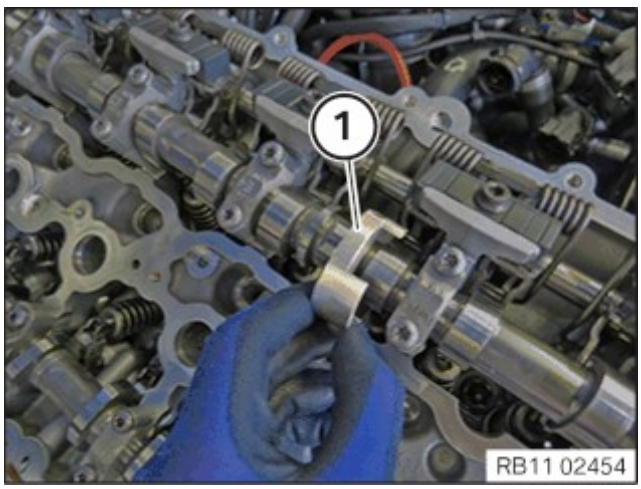
- Release the bearing journal (1) from the guide rail (2).



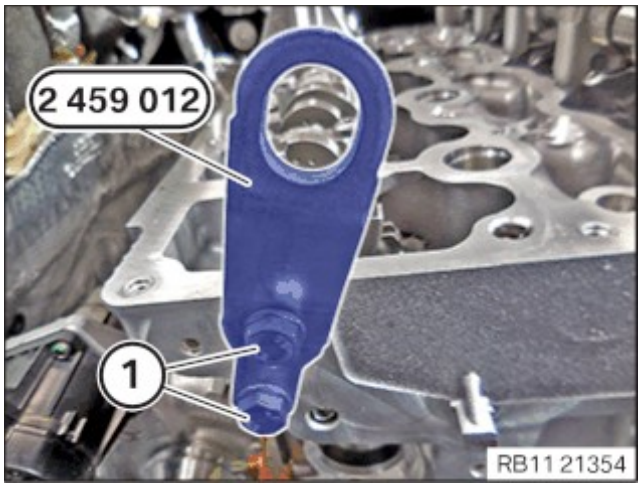


- Rotate intake camshaft, if necessary in the position shown.

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



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

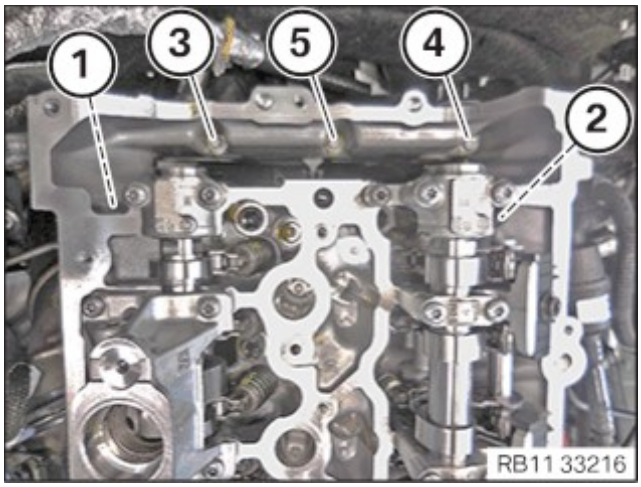


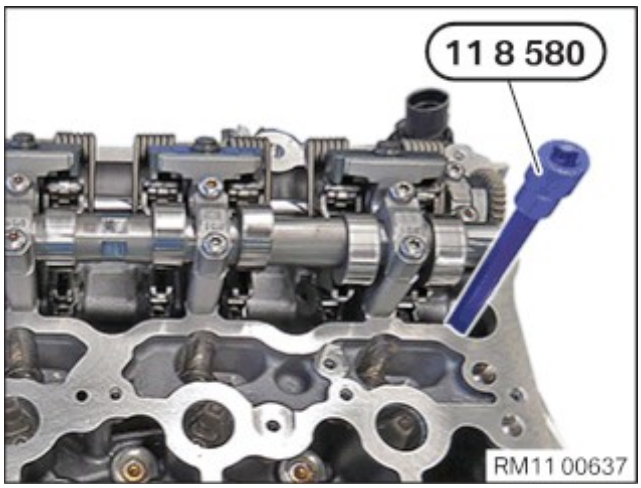
- Guide in and position special tool **2 459 012** on the cylinder head.
- Tighten the screws (1) of special tool **2 459 012**.

Special tool to cylinder head

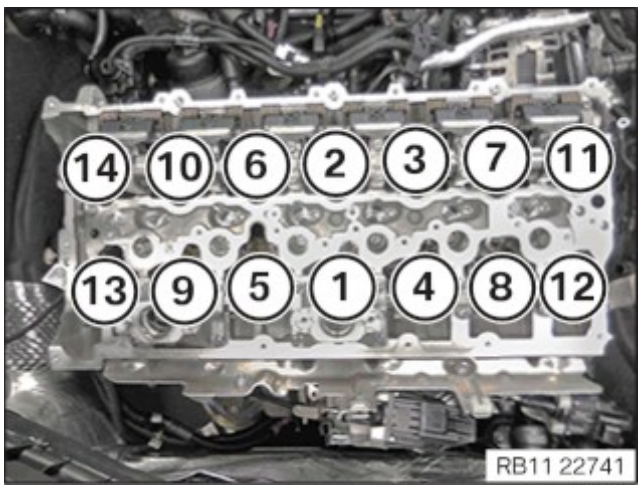
M8		Tightening torque	21,5 Nm

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

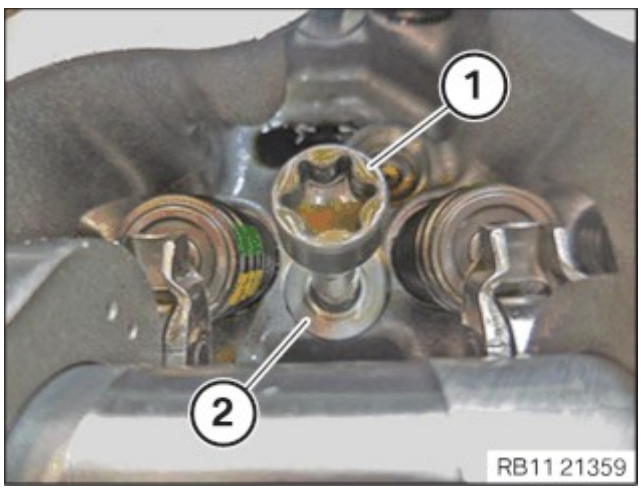




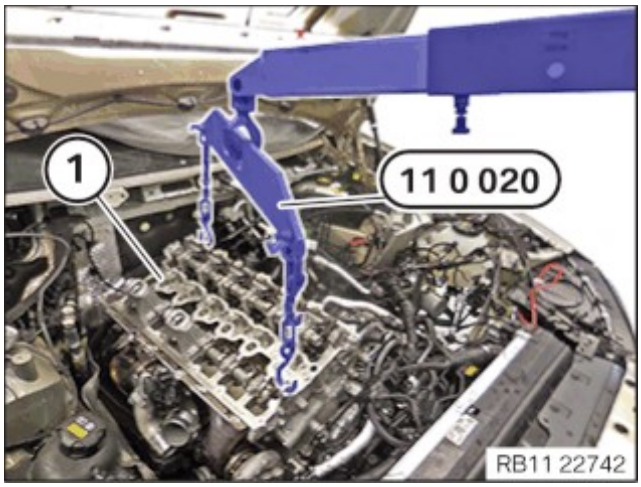
- Release cylinder head bolts with the special tool **0 495 747 (11 8 580)**.



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



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



⚠ CAUTION

Heavy component.

Heavy components can lead to injury or damage.

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

RISK OF DAMAGE

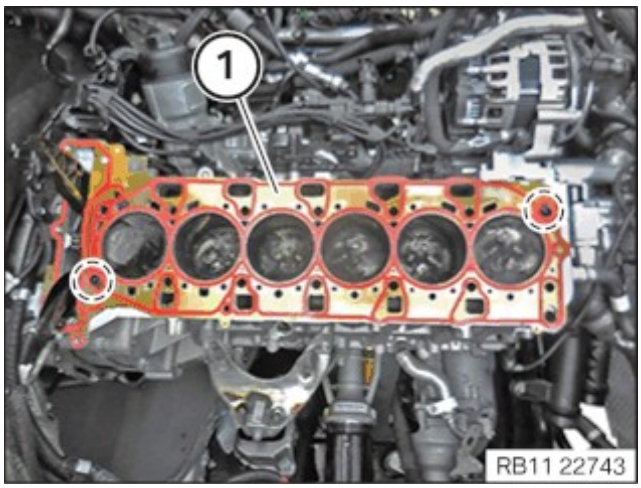
Damage to the guide rails.

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

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

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

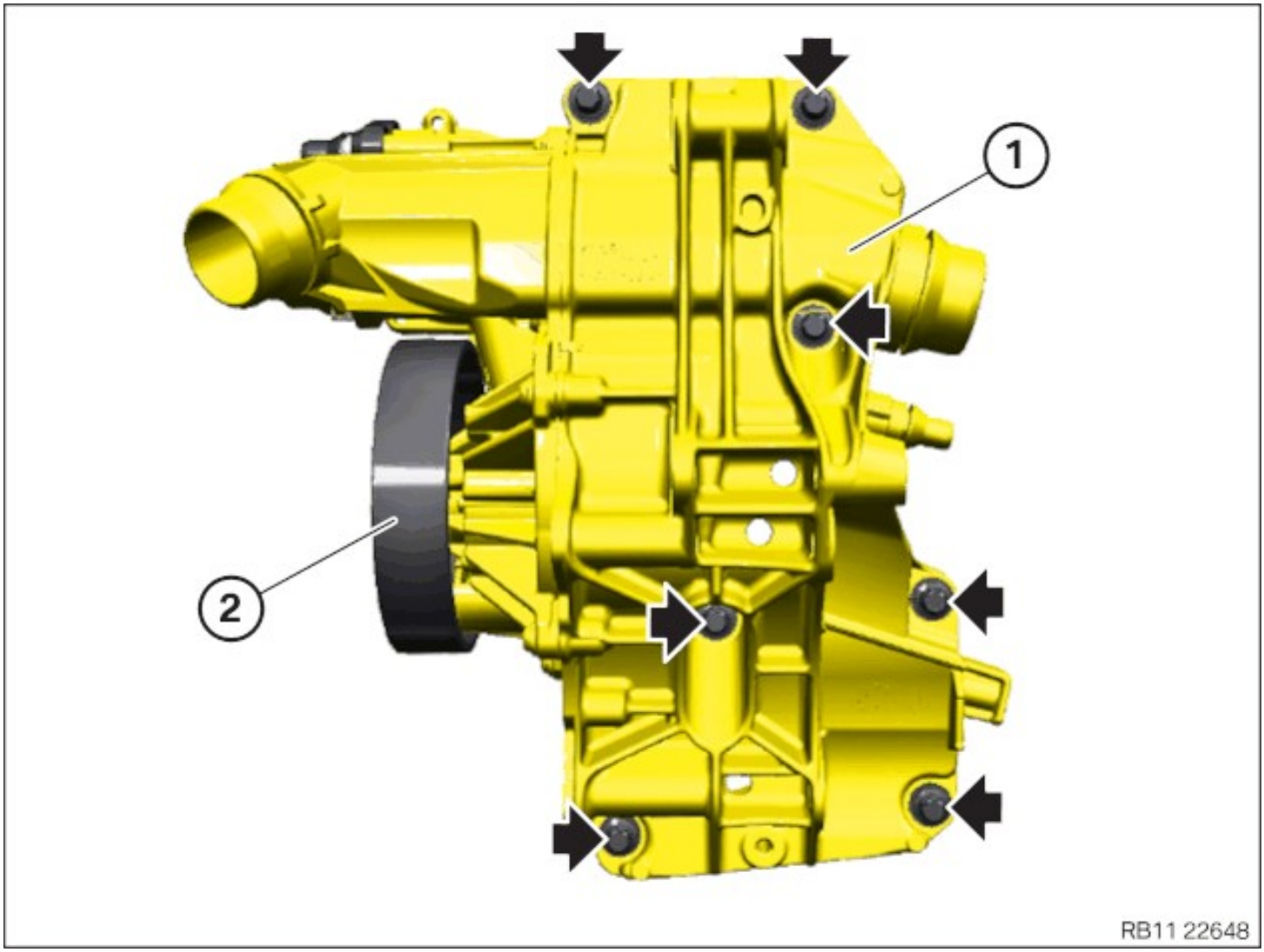
43–Removing the cylinder head gasket



- Feed cylinder head gasket (1) out of the **marked** area and remove it.

44–Removing the component carrier

Component carrier



1 Component carrier

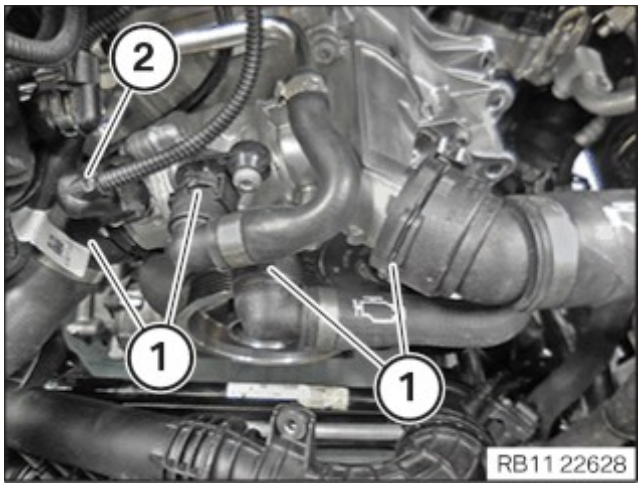
2 Coolant pump

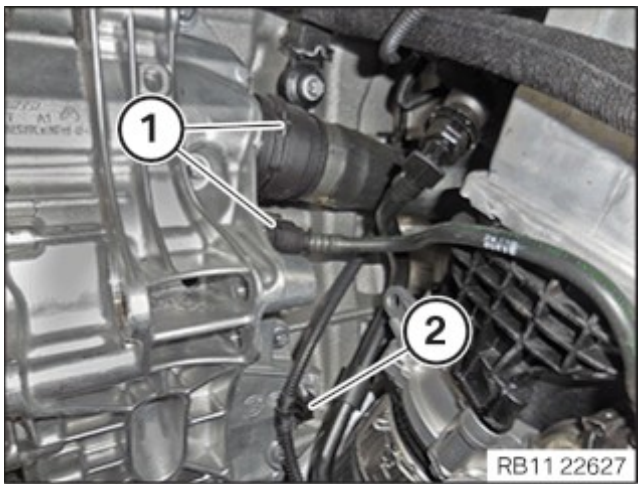
Arrows Screws

TECHNICAL INFORMATION

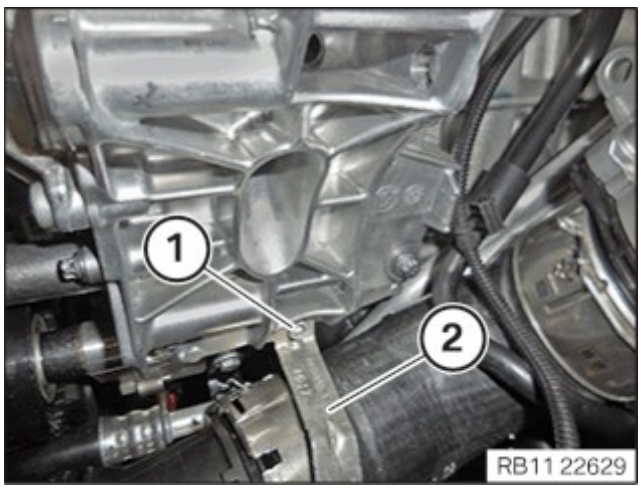
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

- Unlock and release the coolant lines (1).
- Catch and dispose of escaping coolant.
- Unlock plug connection (2) and disconnect.

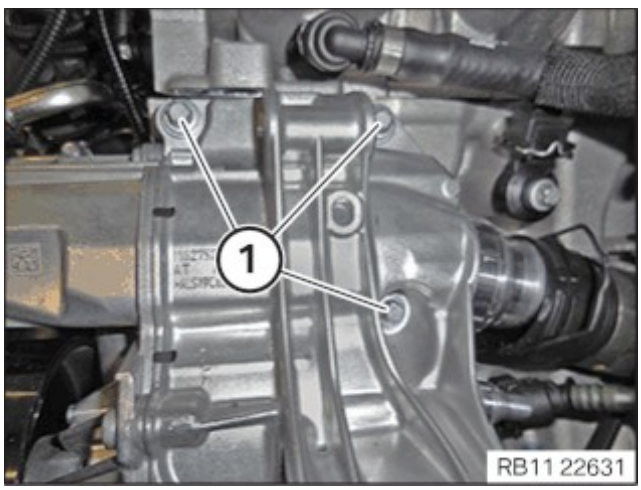




- Unlock and release the coolant lines (1).
- Catch and dispose of escaping coolant.
- Loosen clamp (2).

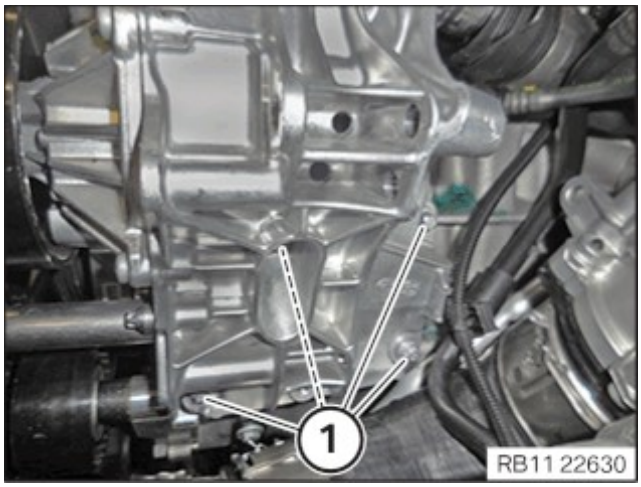


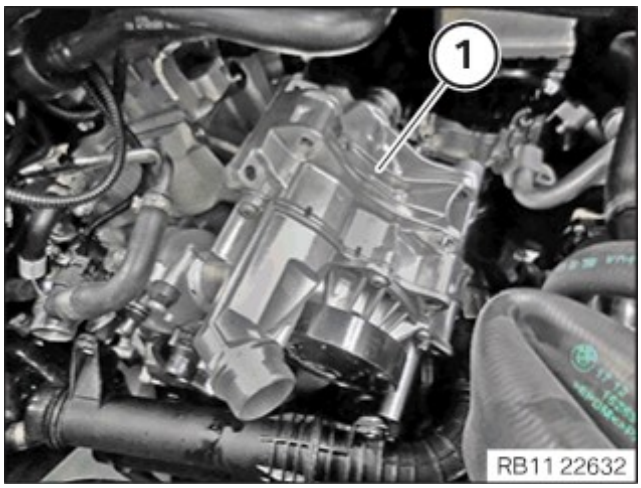
- Loosen screw (1).
- Thread out holder (2) and set aside.



- Loosen screws (1).

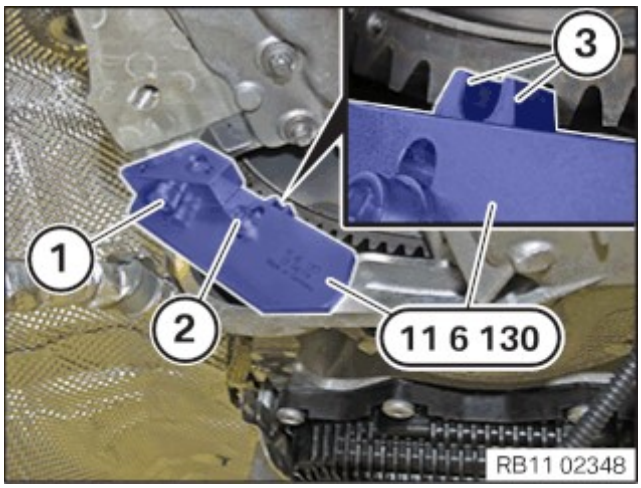
- Loosen screws (1).



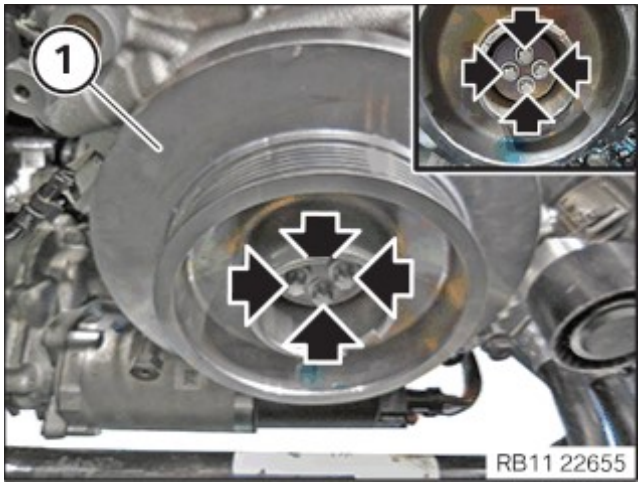


- Guide out the component carrier (1) and remove.
- Catch and dispose of escaping coolant.

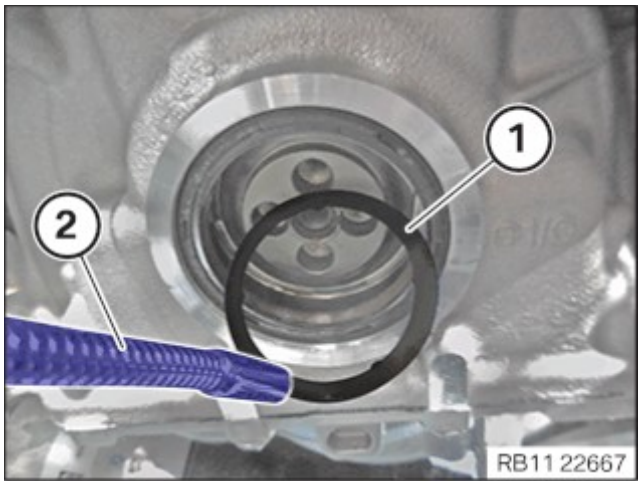
45–Removing the vibration damper



- Position special tool **0 496 595 (11 6 130)** and fasten with screw (1).
- Slide counter support on the bolt (2) in direction of flywheel and turn the engine on the vibration damper until the gearing (3) engages in the flywheel.
- Tighten the bolt (2).



- Remove screws (arrows).
- Pull vibration damper (1) out upwards and remove.



- Feed out and remove the friction disk (1) with a standard magnet (2).

46–Removing flywheel

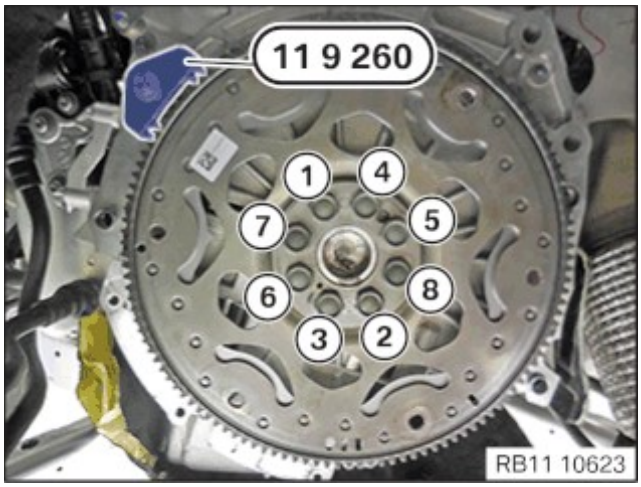
⚠ CAUTION

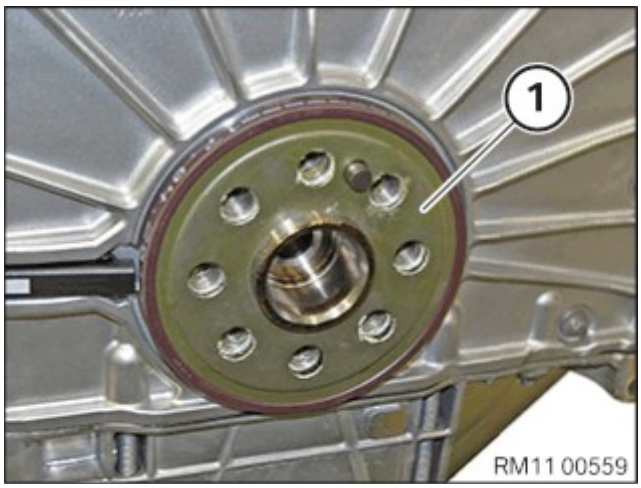
Heavy component.

Heavy components can lead to injury or damage.

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

- Fasten the flywheel with the special tool **0 493 938 (11 9 260)** and tighten with the special tool **0 494 130 (11 9 264)**.
- Release the screws (1) to (8).





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)

61 35 ... Notes on ESD protection (Electro Static Discharge)

- Feed out the magnet wheel (1) and remove.
- Protect the magnet wheel (1) in a plastic bag from swarf.
- The magnet wheel (1) is magnetic, place the magnet wheel (1) in correct position.

47–Remove oil sump

RISK OF DAMAGE

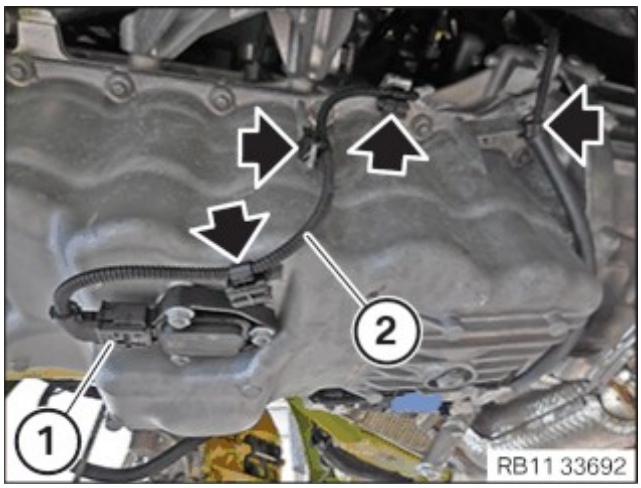
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

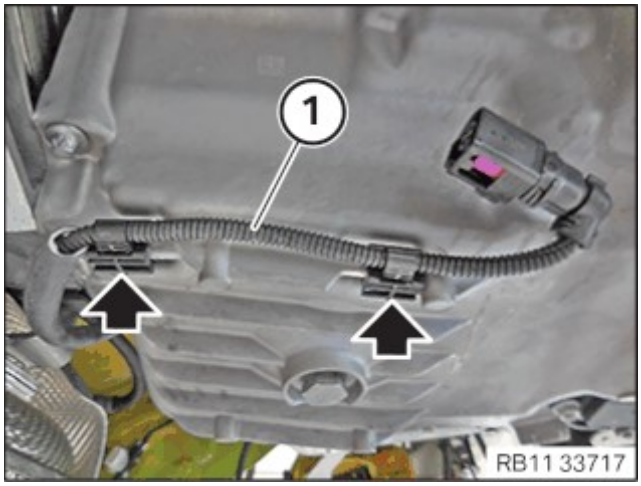
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

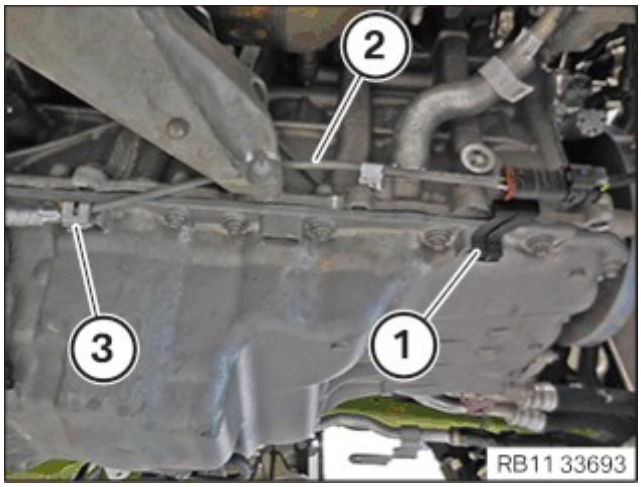
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Unlock plug connection (1) and disconnect.
- Unlock clamps (arrows) and disconnect.
- Feed out the wiring harness section (2) for **sensor system 1** and set to one side.

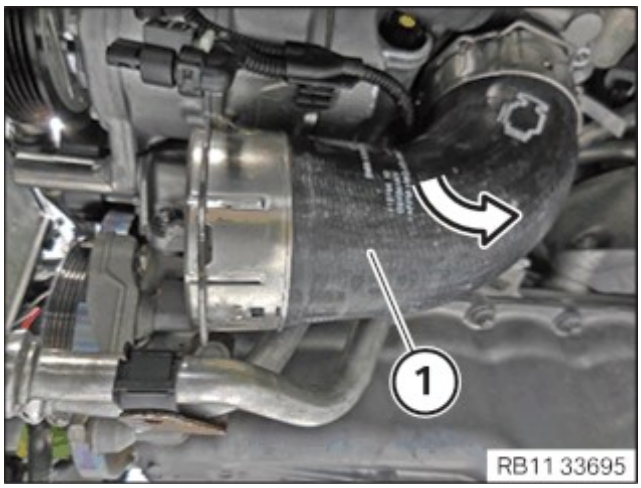


- Unlock clamps (arrows) and disconnect.
- Feed out the wiring harness section (1) for the **sensor system 1** and set aside.

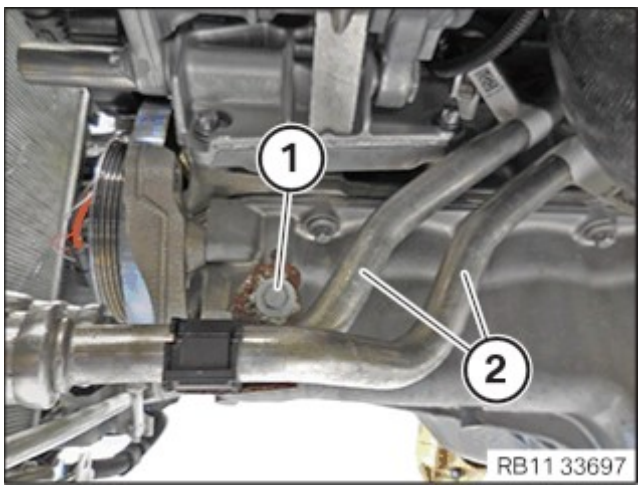


- Loosen clamp (1).
- Guide out the cable (2) from the clamp (3) and set aside.

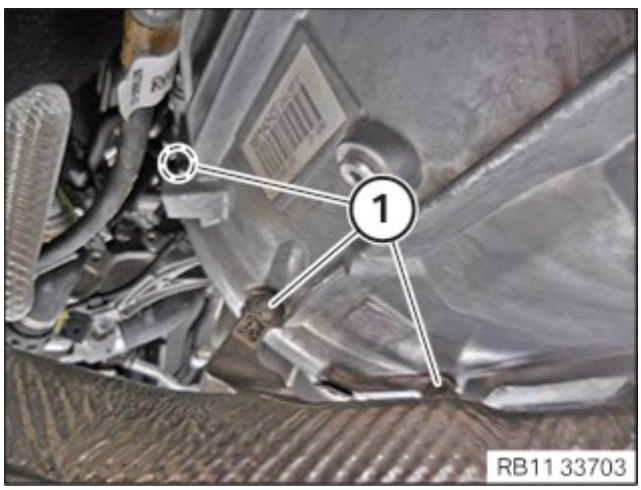
- Loosen screws (1).
- Release the spacer (2).
- Guide out and remove holder (3).



- Place the charge air duct (1) in **the direction of arrow**.



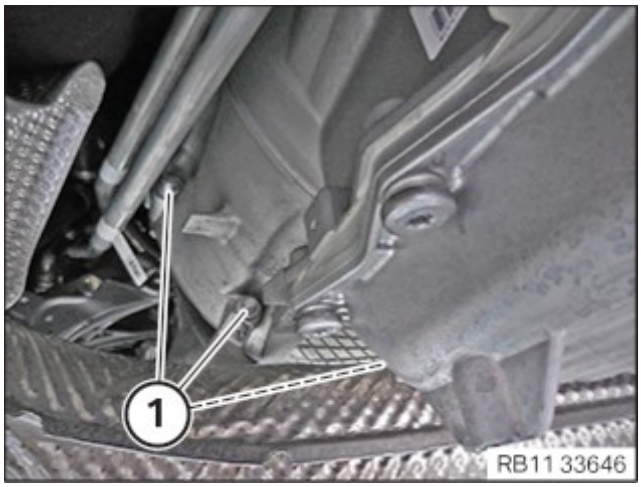
- Release the screw (1).
- Pull the engine oil pipes (2) out and set them aside.



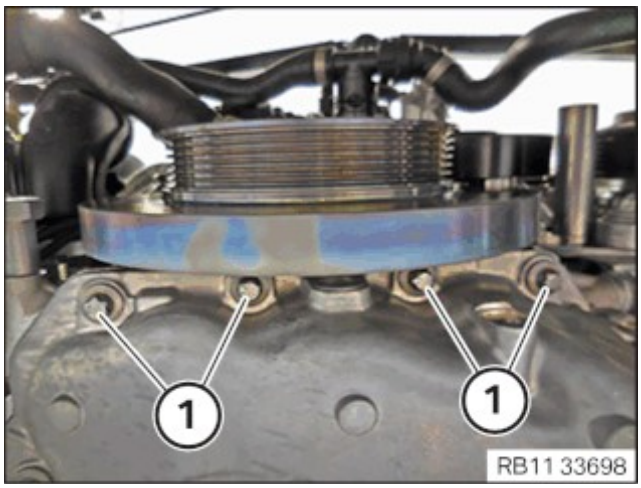
- **Version with manual transmission:**

  Unscrew the transmission bolts (1).

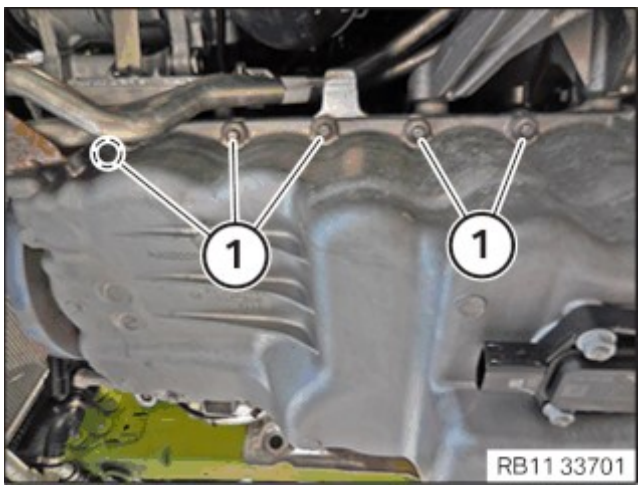
- **Version with automatic transmission:**



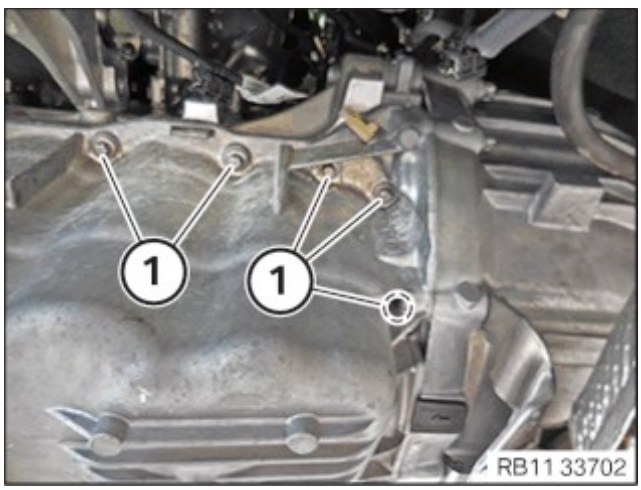
Unscrew the transmission bolts (1).



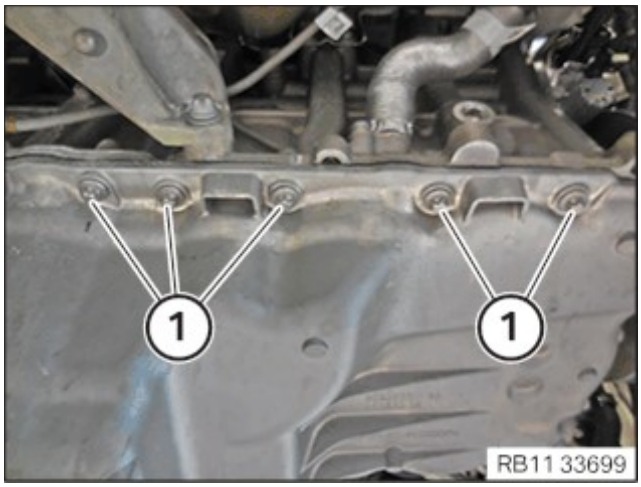
- Loosen screws (1).

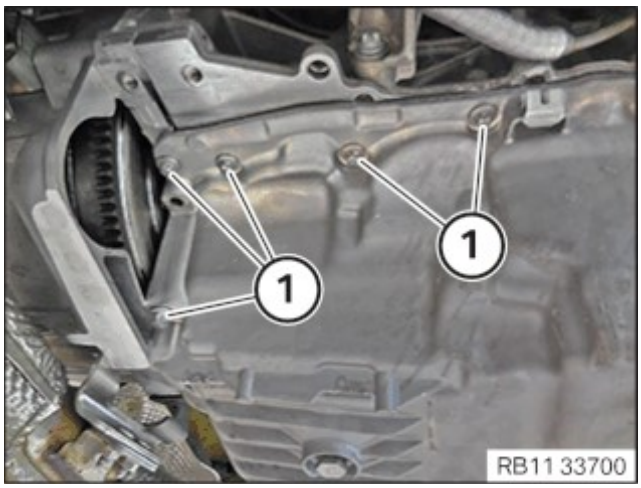


- Loosen screws (1).

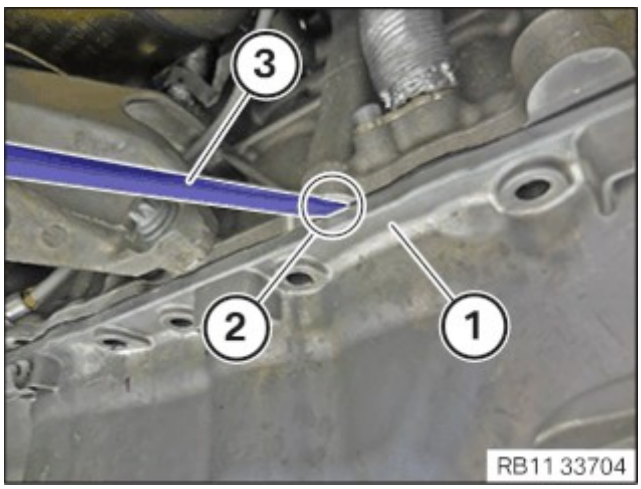


- Loosen screws (1).





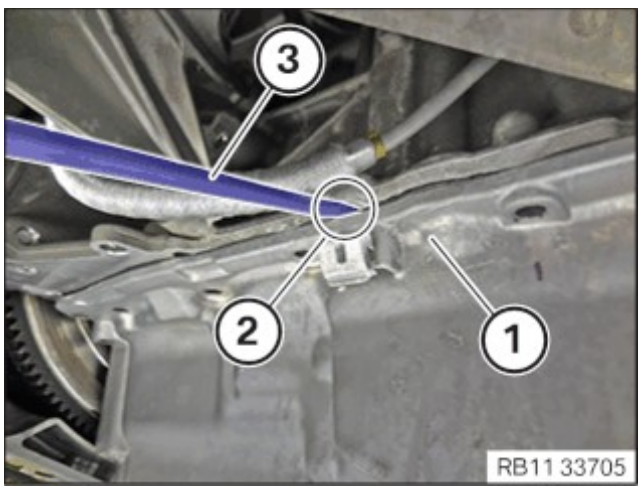
- Loosen screws (1).



TECHNICAL INFORMATION

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

- Release the oil sump (1) in the **marked** areas (2) with a suitable tool (3).



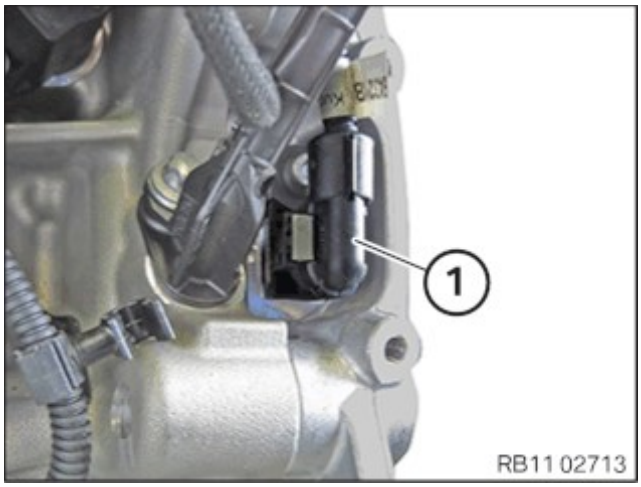
TECHNICAL INFORMATION

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

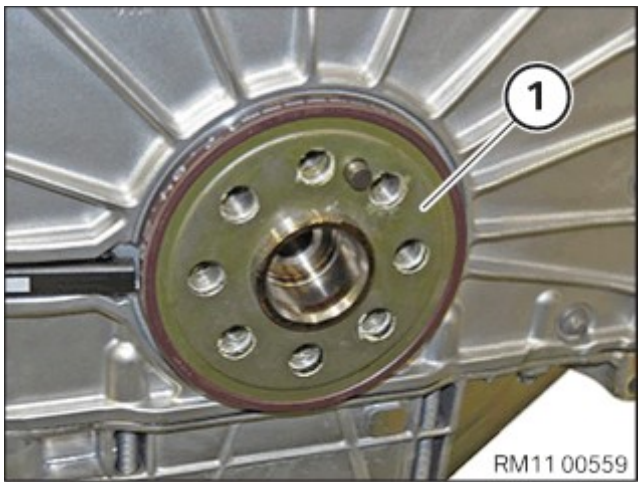
- Release the oil sump (1) in the **marked** areas (2) with a suitable tool (3).

- Feed out and remove the oil sump (1) downwards to the rear.

48–Remove rear timing case cover



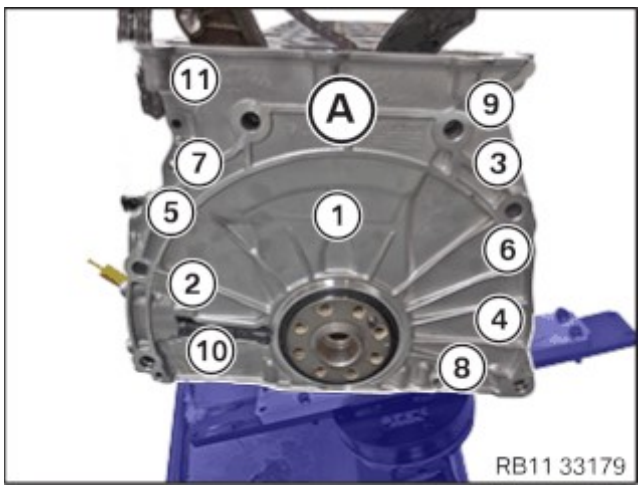
- Unlock plug connection (1) and disconnect.



TECHNICAL INFORMATION

Increment wheel is magnetic. Protect the increment wheel from contact with metallic swarf after disassembly.

- Remove the magnet wheel (1) from the crankshaft.



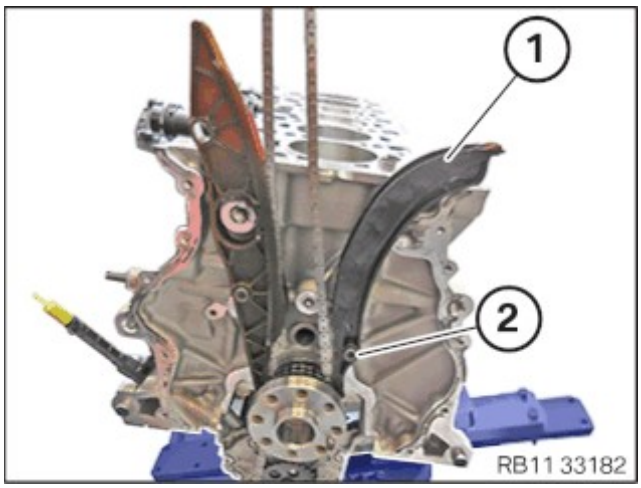
- Loosen screws in the order (11) to (1).

TECHNICAL INFORMATION

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

- Release and remove timing case cover (A) carefully.

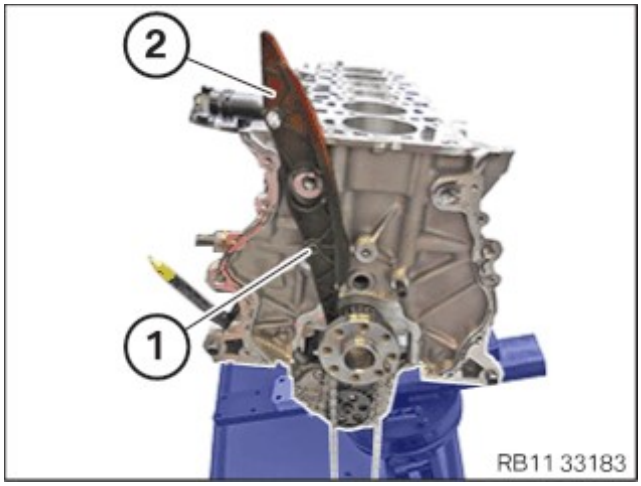
49–Removing timing chain



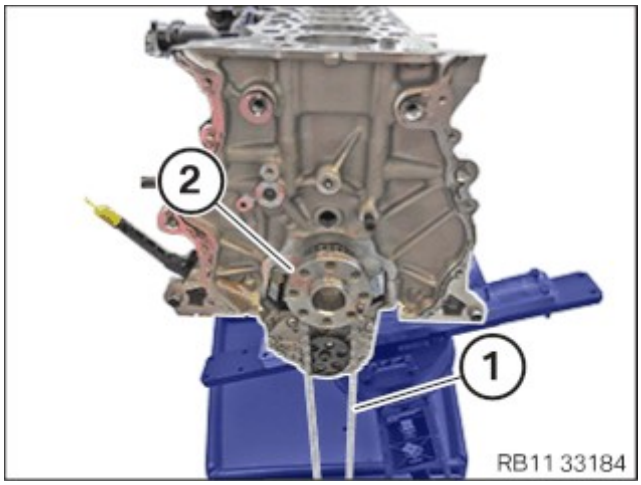
TECHNICAL INFORMATION

The bearing journal does not have to be removed.

- Thread the tensioning rail (1) out of the bearing journal (2) and remove.



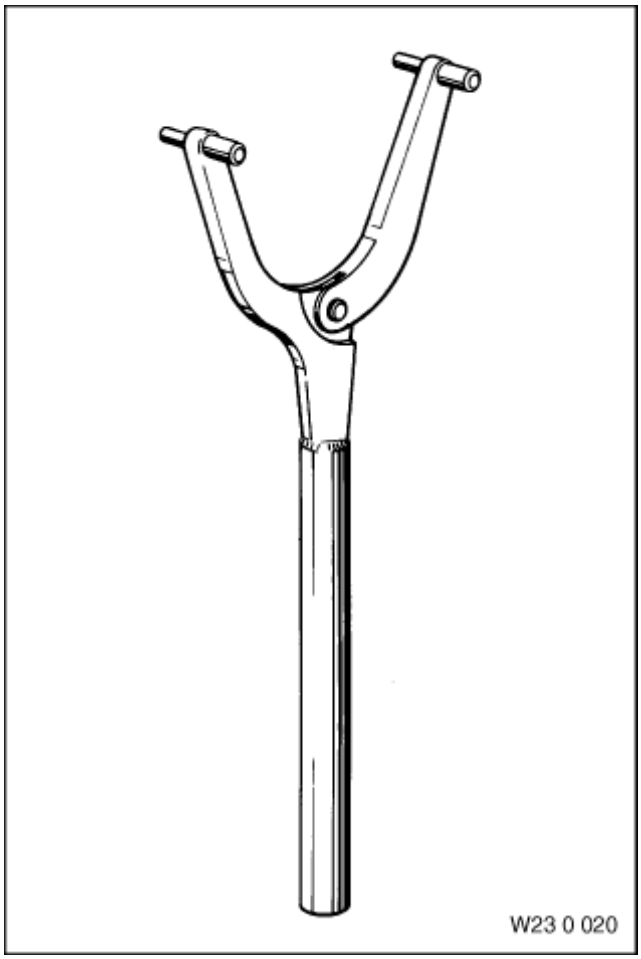
- Loosen the bearing journals (1).
- Guide out the guide rail (2) and remove.

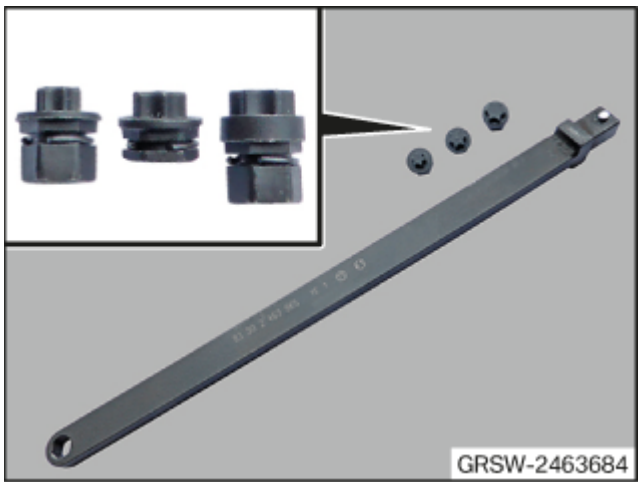


- Pull timing chain (1) out from the crankshaft (2) and remove.

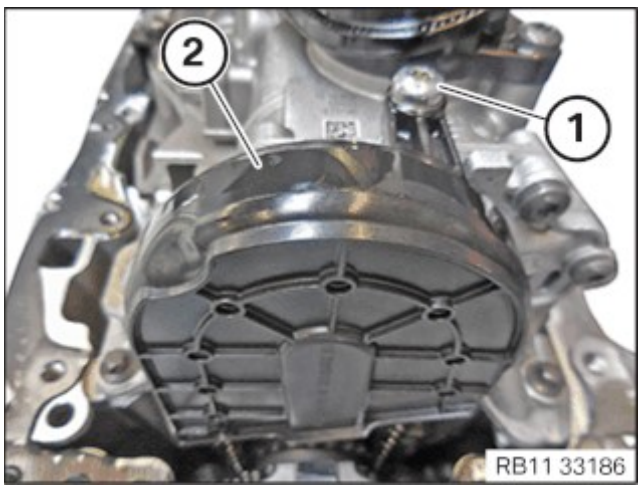
50–Removing the drive chain for the oil vacuum pump

- Have the special tool **0 491 440 (23 0 020)** ready.

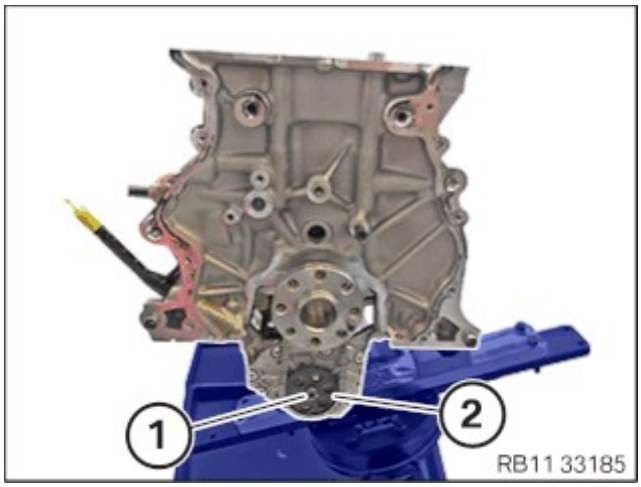




- Have the special tool **2 463 965** ready.



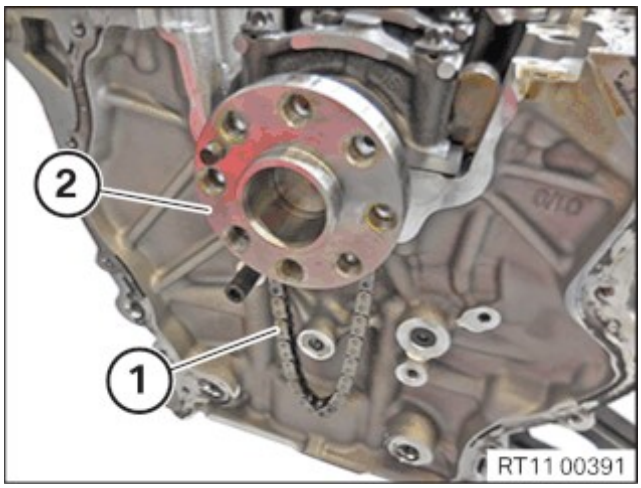
- Release the screw (1).
- Pull the cover (2) out and remove it.



TECHNICAL INFORMATION

The thread is a left-hand thread.

- Loosen screw (1).
- Use the special tool **0 491 440 (23 0 020)** to counter-hold the camshaft sprocket.
- Guide out and remove camshaft sprocket (2).



- Guide out and remove drive chain (1) from crankshaft (2).

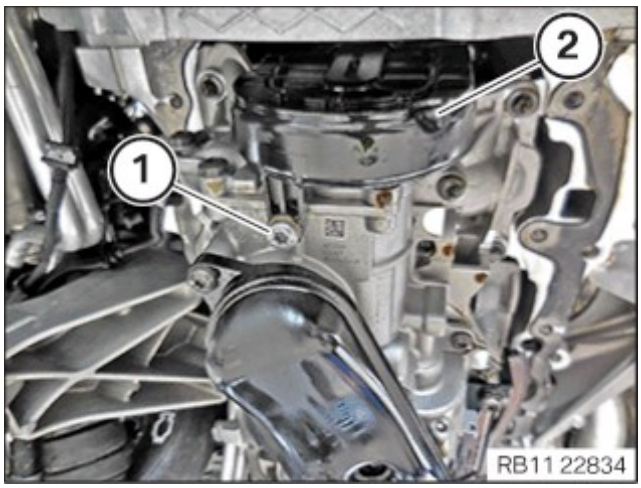
51–Remove oil pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

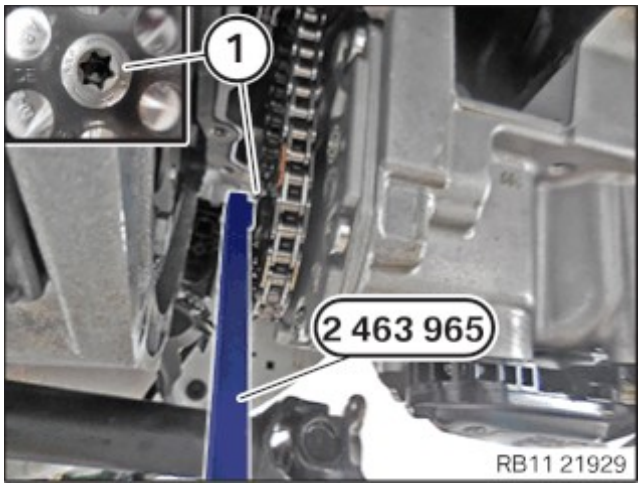
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.



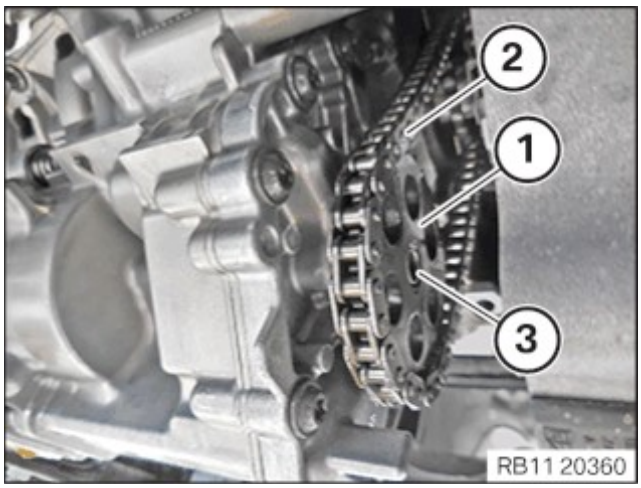
- Release the screw (1).
- Pull the cover (2) out and remove it.

TECHNICAL INFORMATION

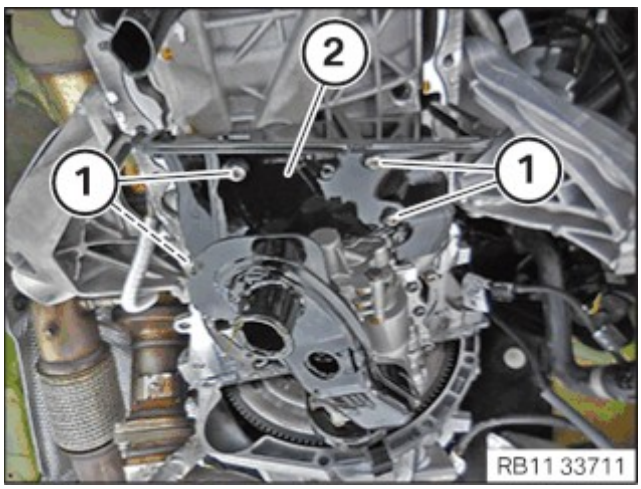
The thread is a left-hand thread.



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

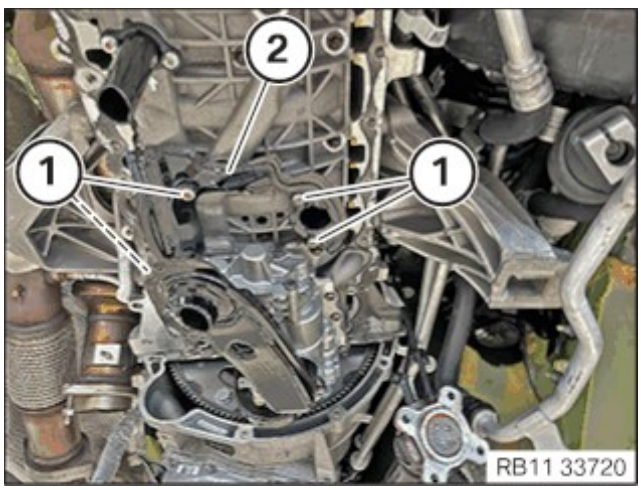


- Release the sprocket (1) with the drive chain (2) from the oil pump (3) .



- **Variant with rear wheel drive:**

  Loosen screws (1).
- Pull the cover (2) out and remove it.

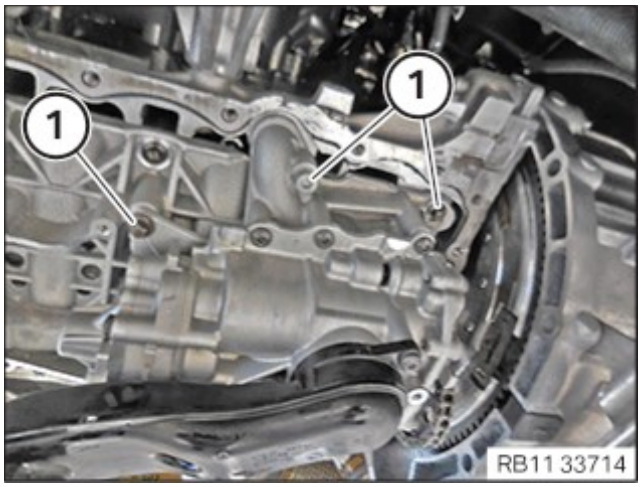


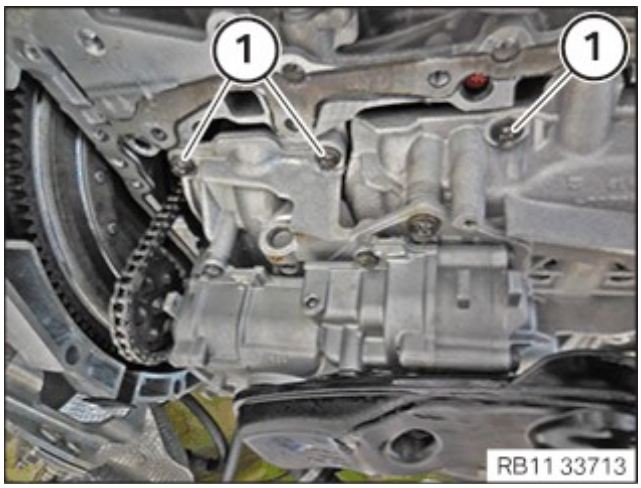
- **Version with all-wheel drive:**

  Loosen screws (1).

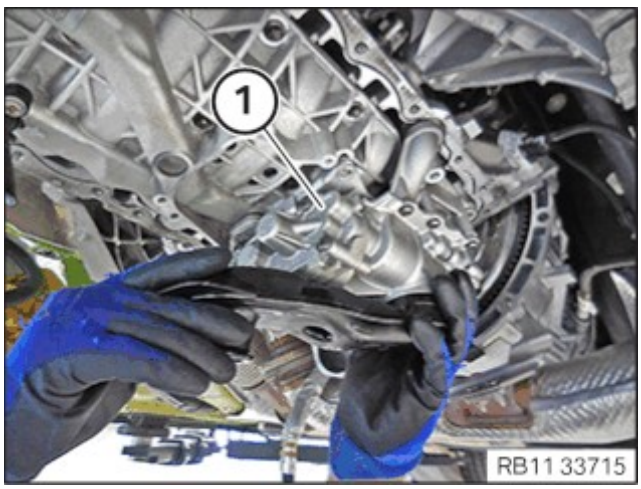
  Pull the cover (2) out and remove it.

- Release the screws (1).





- Loosen screws (1).



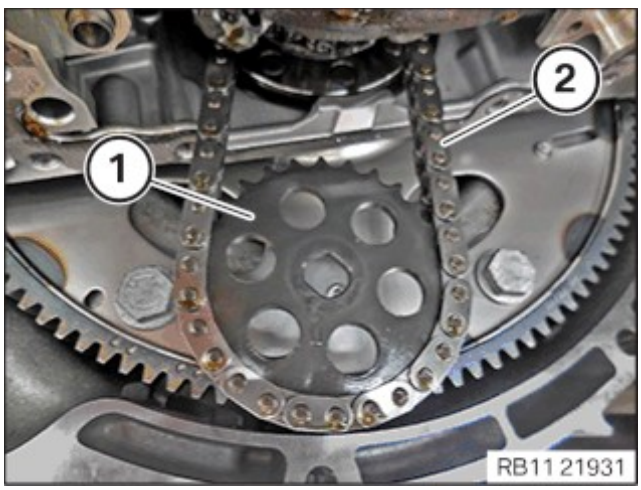
⚠ CAUTION

Heavy component.

Heavy components can lead to injury or damage.

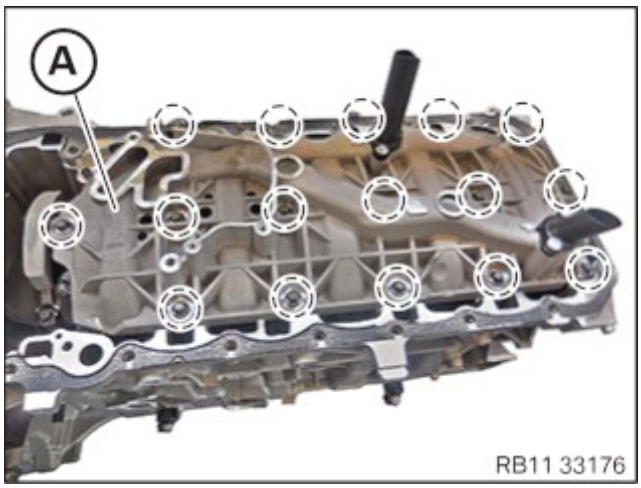
- Remove and install heavy components with the aid of another person/other persons.

- Feed out the oil pump (1) and remove it.



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

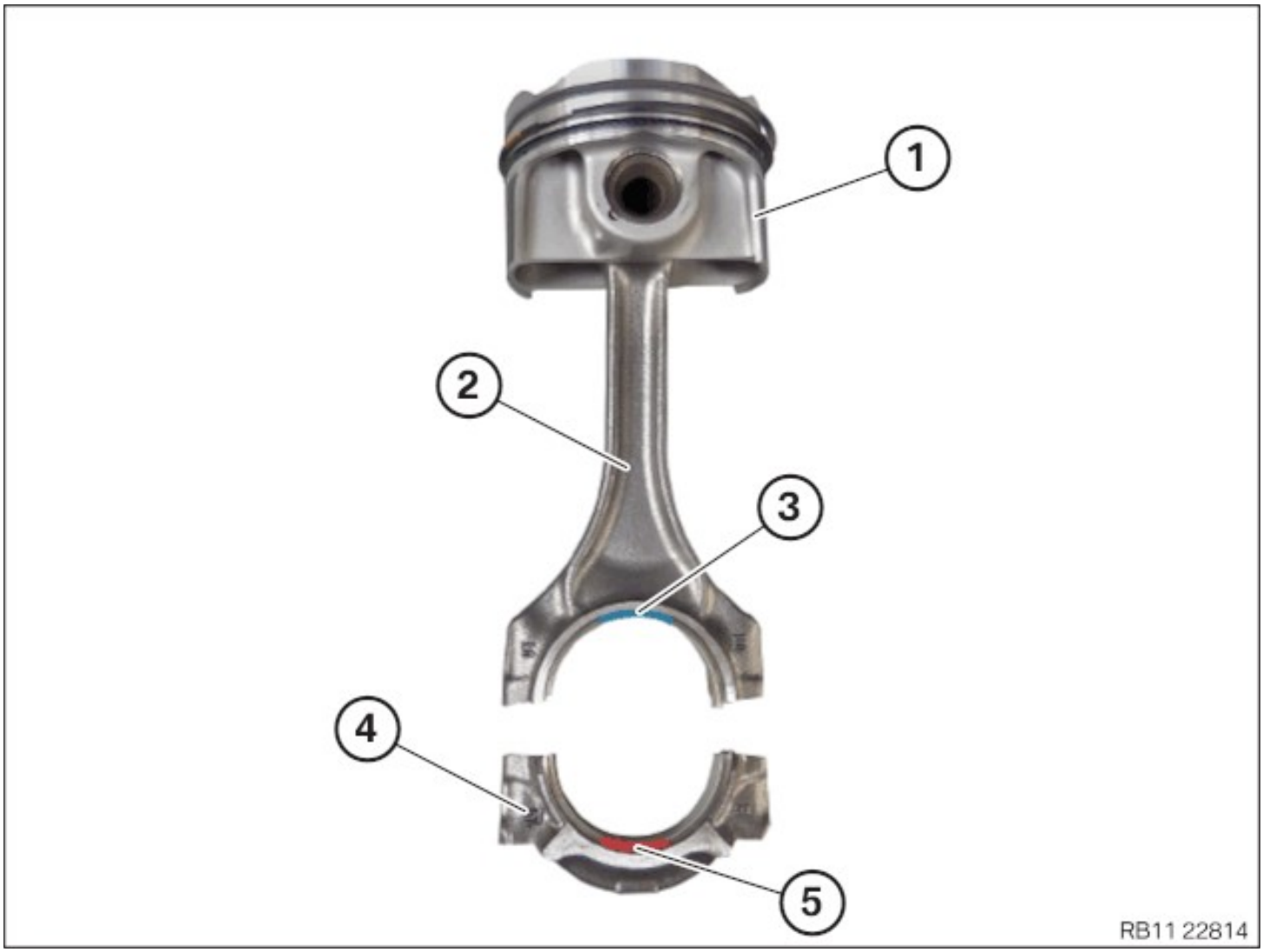
52–Removing the oil deflector



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

53–Removing all pistons with connecting rod

Pistons, connecting rods, connecting rod bearing shells, and connecting rod bearing caps



1 Pistons

2 Connecting rods

3 Connecting rod bearing shell at top (blue)

4 Connecting rod bearing shell at bottom (red)

5 Bottom connecting rod bearing cap

RISK OF DAMAGE

Damage on the cylinder wall and oil spray nozzles.

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

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

TECHNICAL INFORMATION

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

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

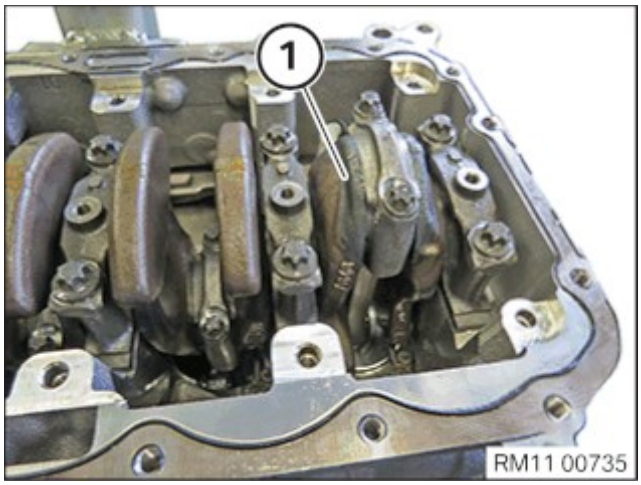
TECHNICAL INFORMATION

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

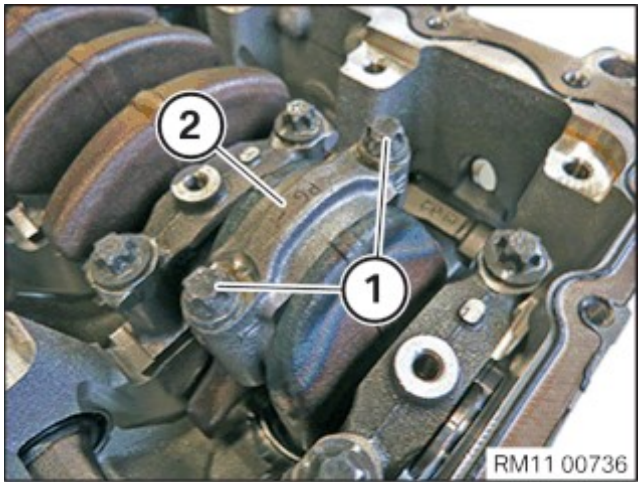
Always install the piston, gudgeon pin, connecting rod and connecting rod bearing shells in the cylinder from which they were removed.

NOTICE

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



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



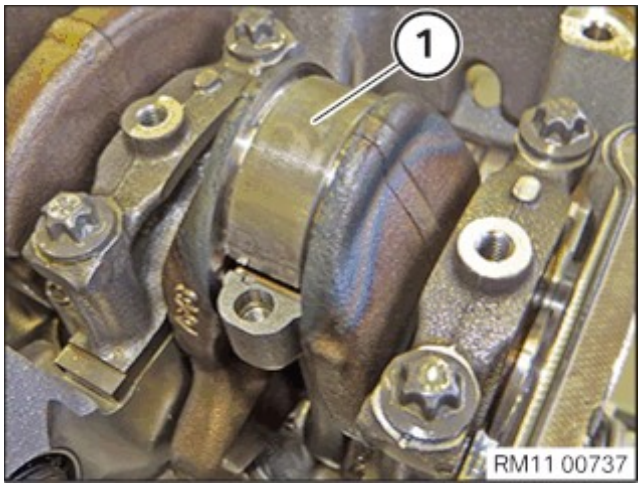
RISK OF DAMAGE

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

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

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

- Unscrew the connecting rod bolts (1).
- Remove the connecting rod bearing cap (2).
- Make sure that the connecting rod bearing cap (2) is reinstalled at the correct location. For this, put it in order.



RISK OF DAMAGE

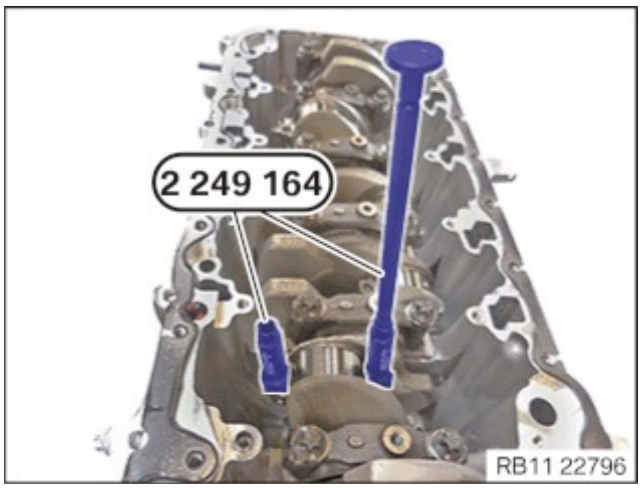
Engine damage caused by incorrectly installed bearing shells and bearing supports.

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

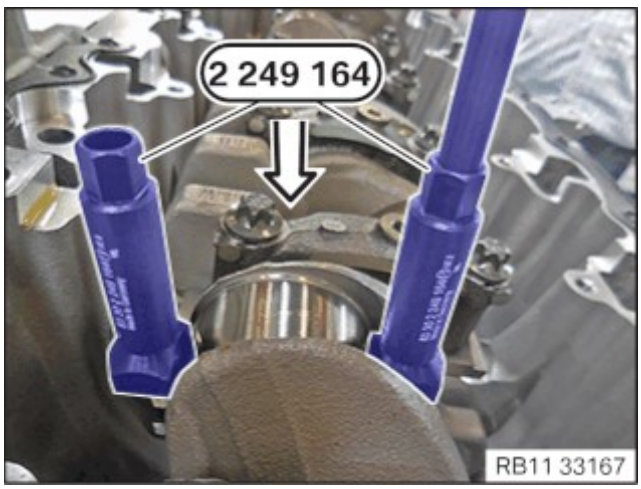
- Always install all bearing shells and bearing supports in the same position from which they were removed.

- Remove the connecting rod bearing (1).
- Ensure that the connecting rod bearing (1) is installed again at the correct location. For this, put it in order.

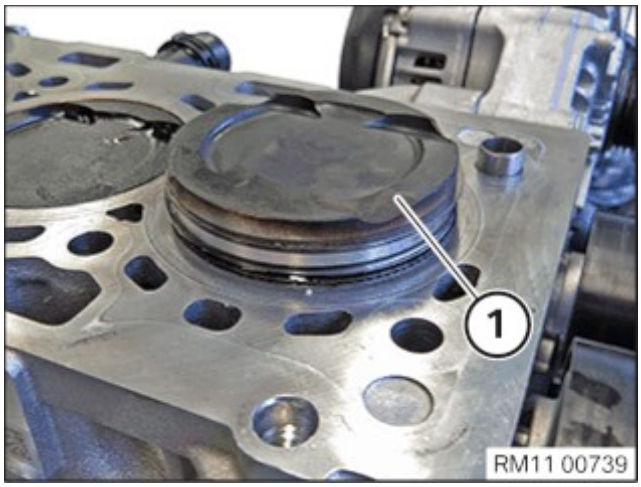
- Have the special tool **2 249 164** ready.



- Screw in the special tool **2 249 164** at the large connecting rod eye.



- Press the special tool **2 249 164** in **the direction of arrow**.



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

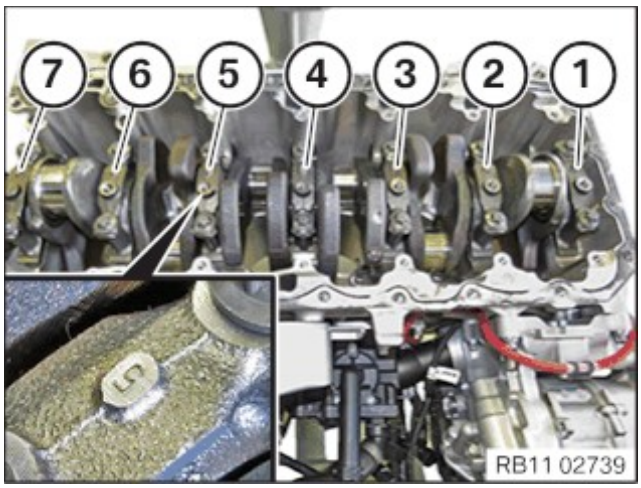
54–Remove crankshaft

RISK OF DAMAGE

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

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

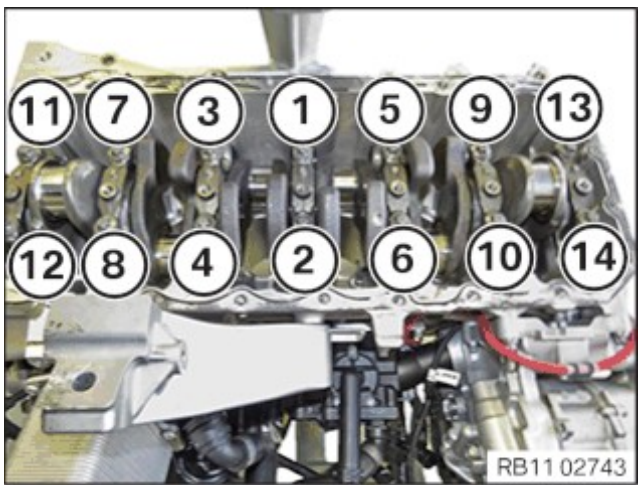
- Always install all bearing shells and bearing supports in the same position from which they were removed.



- Observe the assignment and numbering (1) to (7) of the main bearing caps.

  (1) = Engine, front (vibration damper)

  (7) = Clutch side



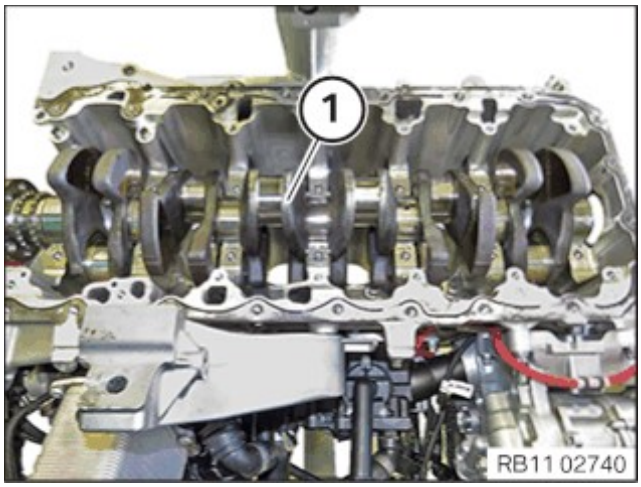
- Loosen screws in the order (14) to (1).

TECHNICAL INFORMATION

The crankshaft bearing cap, main bearing shell and guide bearing shell are aligned with each other.

Always install the crankshaft bearing cap, main bearing shells and guide bearing shells in the cylinder from which they were removed.

- Place the main bearing cap neatly into the special tool **0 495 105 (11 4 480)**.



⚠ CAUTION

Heavy component.

Heavy components can lead to injury or damage.

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

- Remove the crankshaft (1).

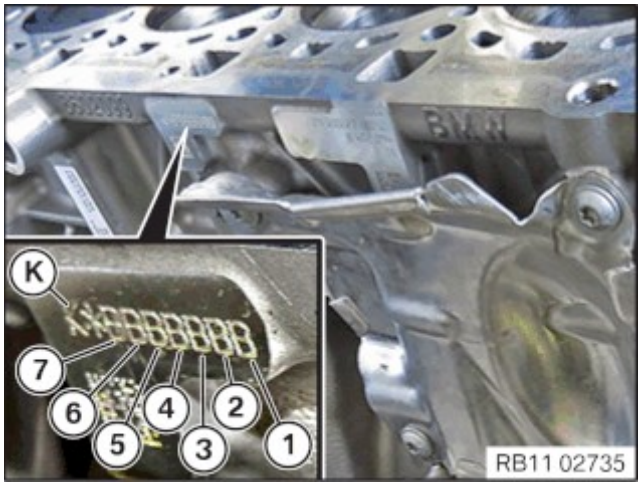
MAIN WORK

55–Determining the classification of the crankshaft main bearing shell

TECHNICAL INFORMATION

Main bearing shells and guide bearing shells are classified via colours or numbers.

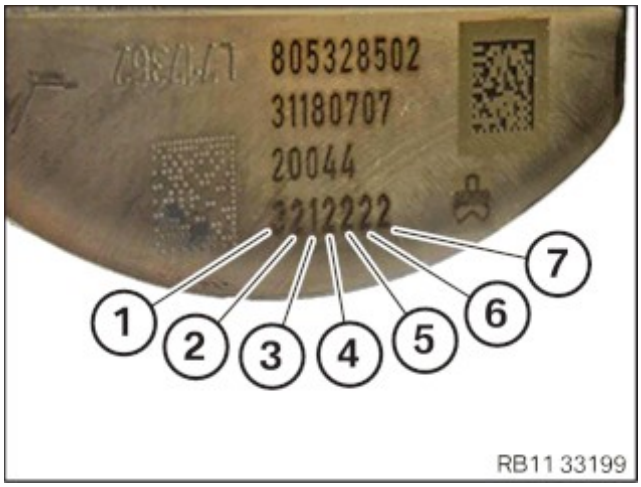
The classification of main bearing shells and guide bearing shells is changed to a classification, exclusively based on numbers. The classification based on colours is deleted.



- Read the code letter on the **crankcase** and enter it in the table.

  K = Clutch side

  Item numbers (7) to (1) describe the **bearing seats 7 to 1**. The **coefficient** is located on the **crankshaft bearing caps**.



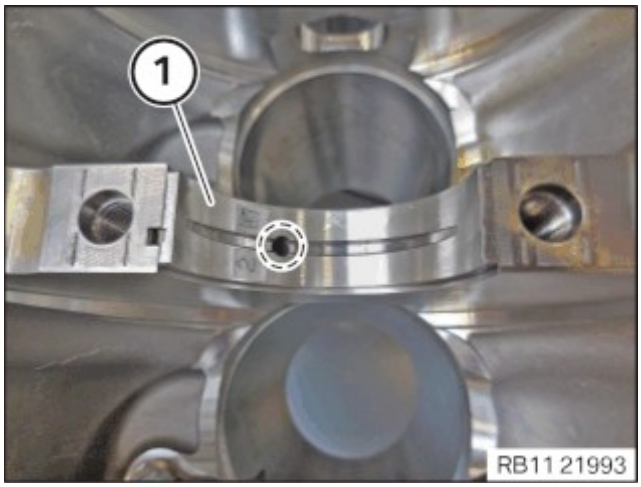
- Read the identification numbers on the **crankshaft** and enter in the table.

  Item numbers (1) to (7) describe the **bearing seats 1 to 7**. The **coefficient** is located on the **crankshaft bearing caps**.

- Enter the code letters of the **crankcase**.
- Enter the identification numbers of the **crankshaft**.

	Code letters on crankcase	**Code letters/identification numbers** on the crankshaft
Bearing seat 1		
Bearing seat 2		
Bearing seat 3		
Bearing seat 4		

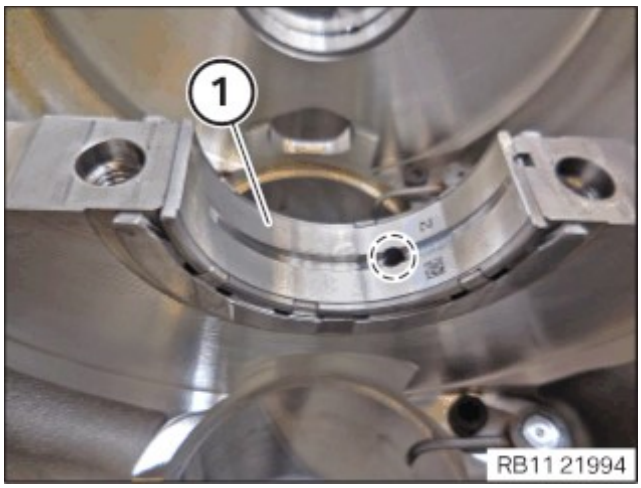
Bearing seat 5		
Bearing seat 6		
Bearing seat 7		



- Using the table, determine the respective correct main bearing shell with lubricating groove (1) for the crankcase.

  The main bearing shells are classified by **colours** or **numbers**.

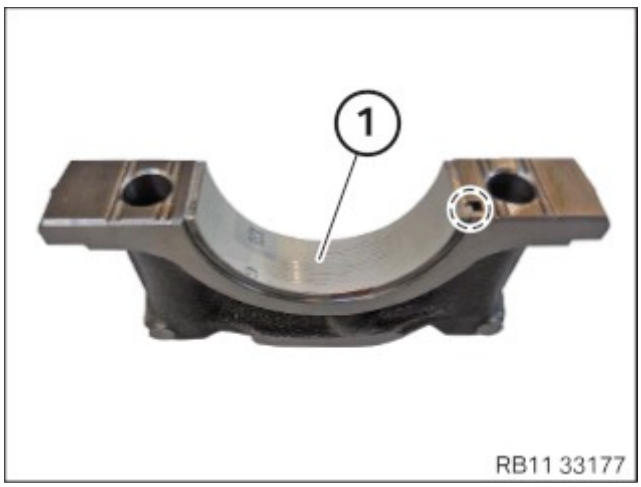
	A	B	C
1	Classification 1 (blue)	Classification 2 (green)	Classification 2 (green)
2	Classification 1 (blue)	Classification 2 (green)	Classification 3 (brown)
3	Classification 2 (green)	Classification 2 (green)	Classification 3 (brown)



- Using the table, determine the respective correct guide bearing shell with lubricating groove (1) for the crankcase.

  The guide bearing shells are classified by **colours** or **numbers**.

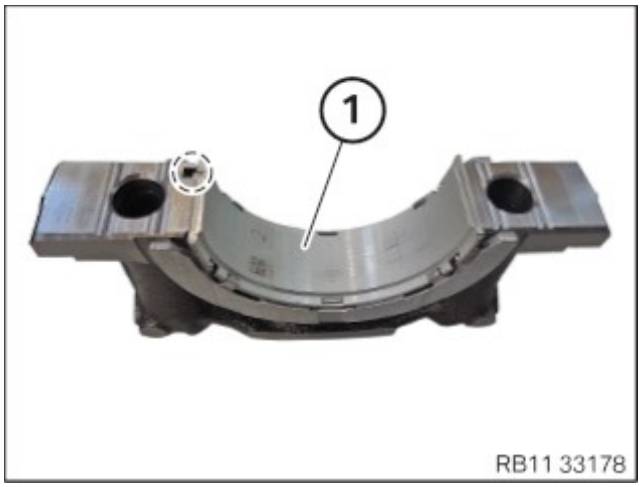
	A	B	C
1	Classification 1 (blue)	Classification 2 (green)	Classification 2 (green)
2	Classification 1 (blue)	Classification 2 (green)	Classification 3 (brown)
3	Classification 2 (green)	Classification 2 (green)	Classification 3 (brown)



- Using the table, determine the correct main bearing shell without lubricating groove (1) for the respective crankcase bearing cap.

  The main bearing shells are classified by using **colours** or **numbers**.

	A	B	C
1	Classification 1 (blue)	Classification 1 (blue)	Classification 2 (green)
2	Classification 2 (green)	Classification 2 (green)	Classification 2 (green)
3	Classification 2 (green)	Classification 3 (brown)	Classification 3 (brown)



- Using the table, determine the correct guide bearing shell without lubricating groove (1) for the respective crankcase bearing cap.

  The guide bearing shells are classified by **colours** or **numbers**.

	A	B	C
1	Classification 1 (blue)	Classification 1 (blue)	Classification 2 (green)
2	Classification 2 (green)	Classification 2 (green)	Classification 2 (green)
3	Classification 2 (green)	Classification 3 (brown)	Classification 3 (brown)

56–Replacing the main bearing shells and the guide bearing shells

RISK OF DAMAGE

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

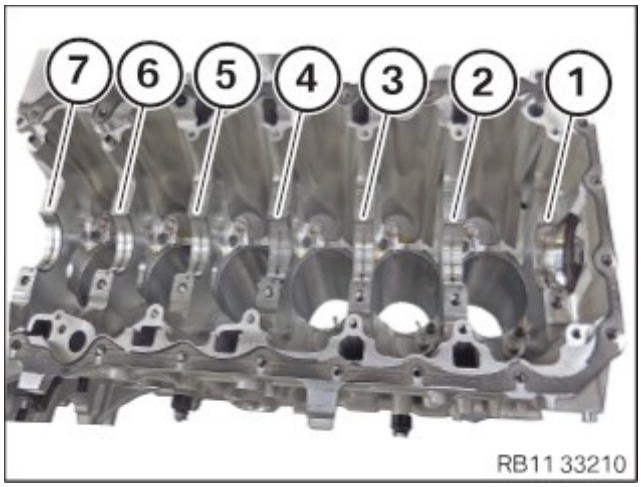
Engine damage may result from incorrectly installing bearing shells and bearing supports.

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

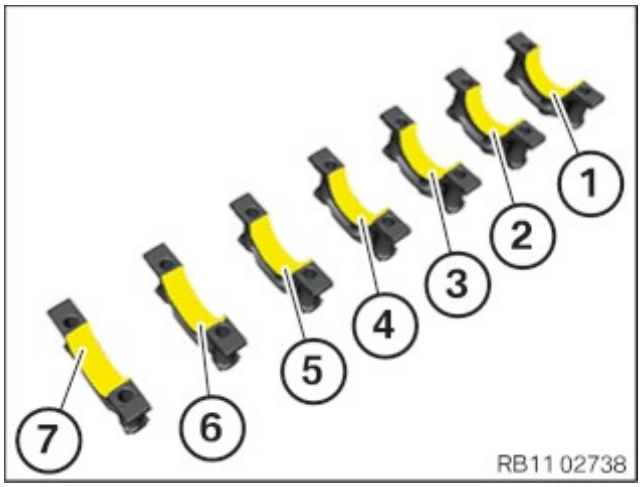
TECHNICAL INFORMATION

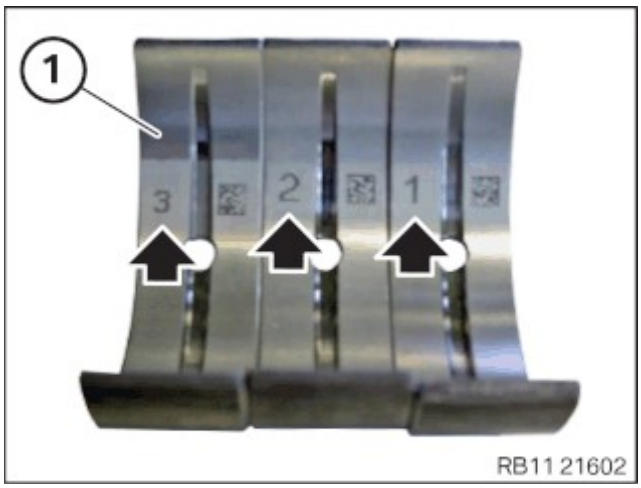
Main bearing shells and guide bearing shells are classified by means of numbers.

Observe the classification of the main bearing shells and guide bearing shells.



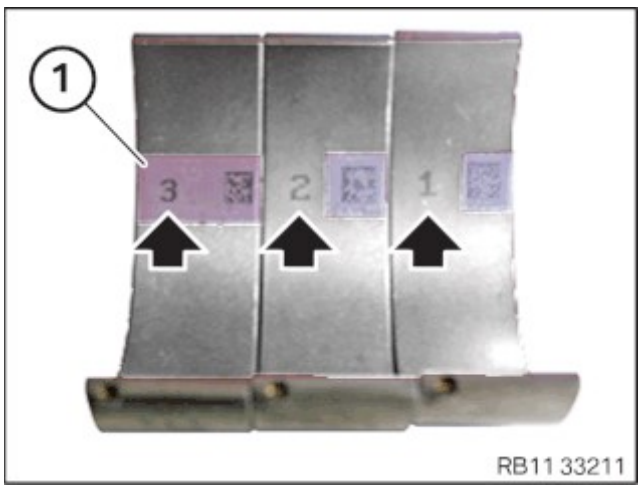
- Remove the main bearing shells with lubricating groove (1) to (3) and (5) to (7) from the crankcase.
- Remove the guide bearing shell with lubricating groove (4) from the crankcase.
- Remove the main bearing shells (1) to (3) and (5) to (7) from the crankshaft bearing cap.
- Remove the guide bearing shell (4) from the crankshaft bearing cap.





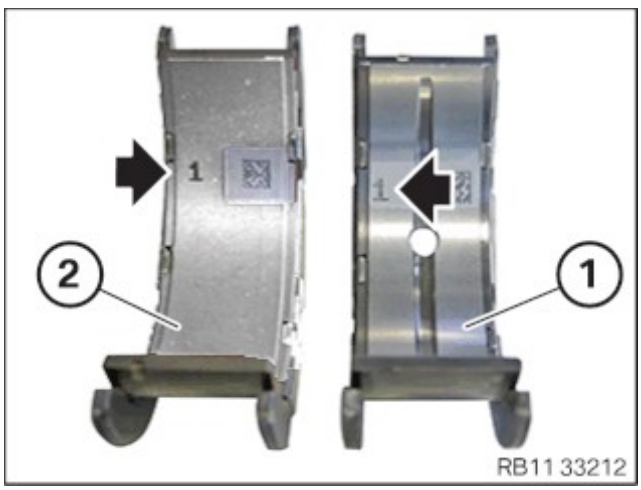
- Ensure that the **correct classification** (arrows) is installed.
- Replace main bearing shells (1) **with** lubricating groove.

  Parts: Main bearing shells with lubricating groove



- Ensure that the **correct classification** (arrows) is installed.
- Replace main bearing shells (1)**without** lubricating groove.

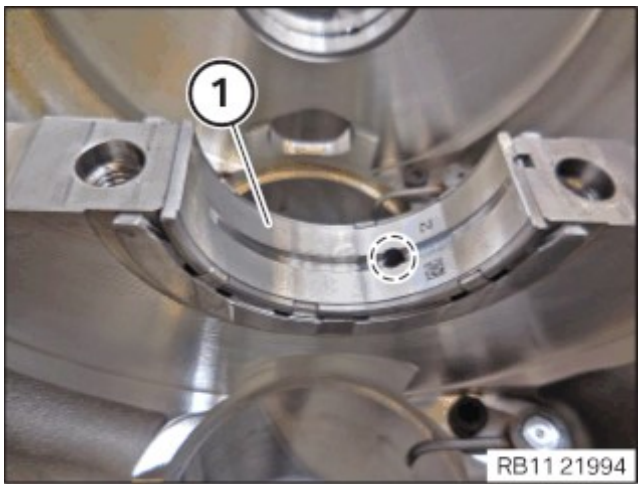
  Parts: Main bearing shells without lubricating groove



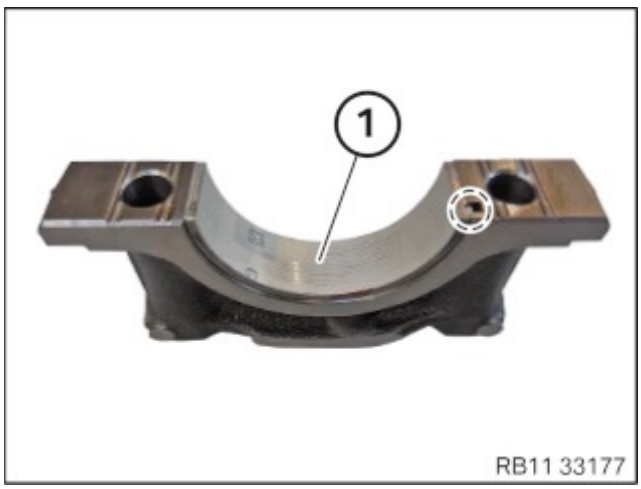
- Ensure that the **correct classification** (arrows) is installed.
- Replace guide bearing shell **with** lubricating groove (1) and the guide bearing shell (2) **without** lubricating groove.

  Parts: Guide bearing shells

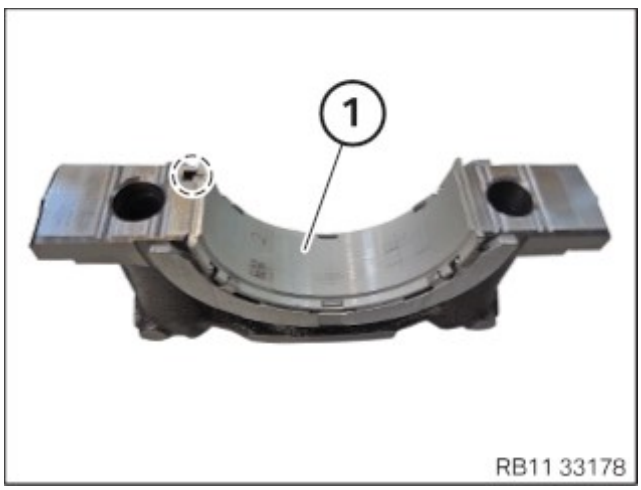
- Ensure the **correct** installation of crankshaft main bearing shell (1) with the guide lug in the **marked** area.



- Ensure the **correct** installation of crankshaft guide shell(1) with the guide lug in the **marked** area.

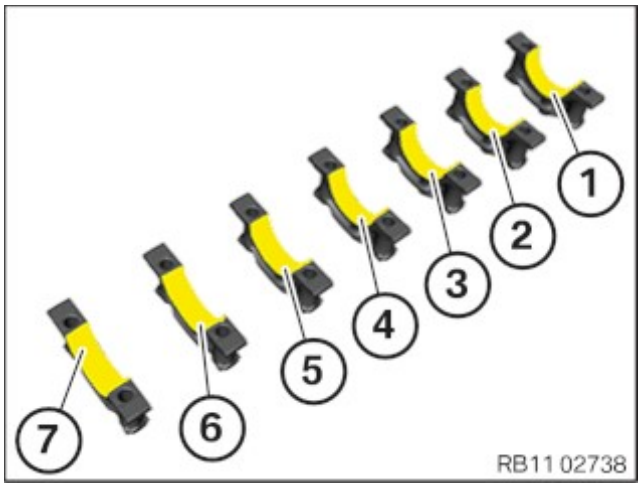


- Ensure the **correct** installation of crankshaft main bearing shell (1) with the guide lug in the **marked** area.

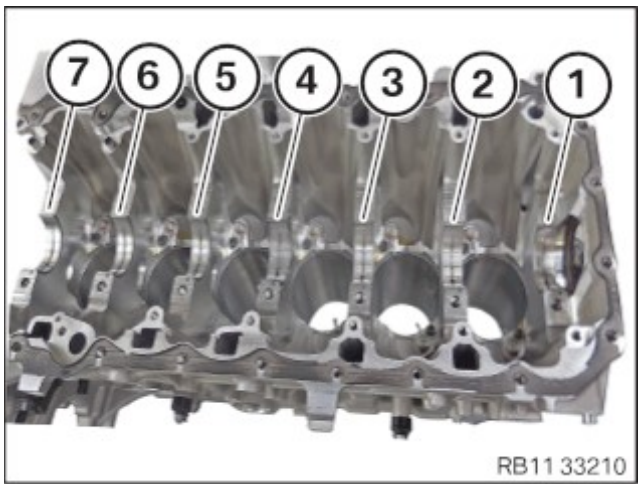


- Ensure the **correct** installation of crankshaft guide shell (1) with the guide lug in the **marked** area.

- Install main bearing shells (1) to (3) and (5) to (7) into the crankshaft bearing cap.



- Install the guide bearing shell (4) in the crankshaft bearing cap.
- Oil all main bearing shells and guide bearing shells (1) to (7).



- Install main bearing shells with lubricating groove (1) to (3) and (5) to (7) in the crankcase.
- Install the guide bearing shell with lubricating groove (4) in the crankcase.
- Oil all main bearing shells and guide bearing shells with lubricating groove (1) to (7).

POSTPROCESSES

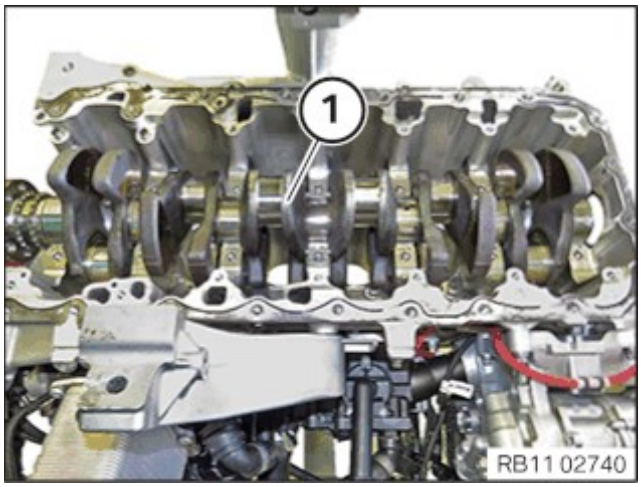
57–Installing the crankshaft

RISK OF DAMAGE

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

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

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



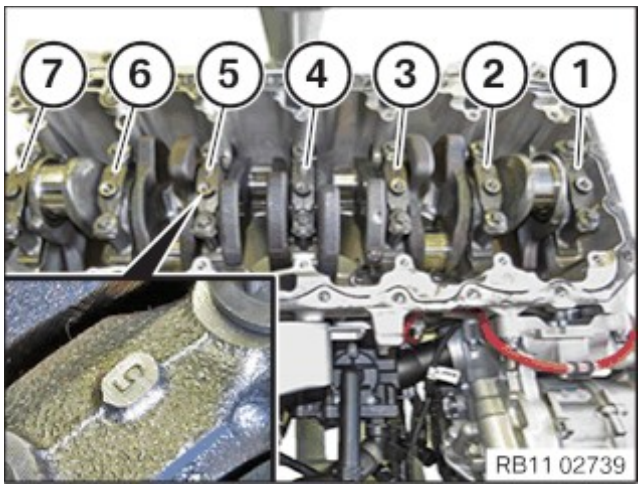
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

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

- Install the crankshaft (1).



TECHNICAL INFORMATION

The crankshaft bearing cap, main bearing shell and guide bearing shell are aligned with each other.

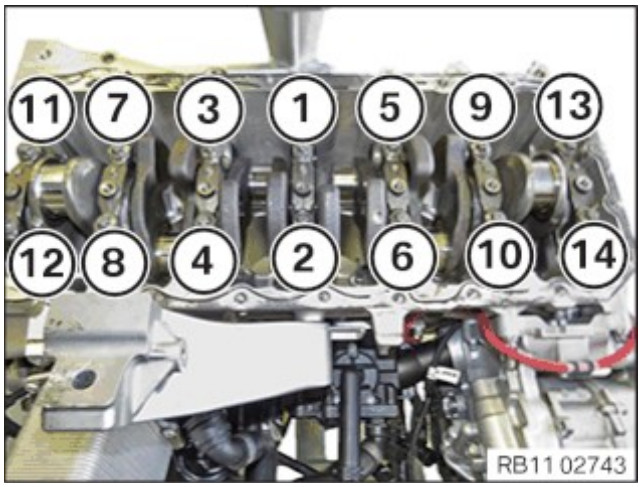
Always install the crankshaft bearing cap, main bearing shells and guide bearing shells in the cylinder from which they were removed.

- Observe the assignment and numbering (1) to (7) of the main bearing caps.

  (1) = Engine, front (vibration damper)

  (7) = Clutch side

- Position the main bearing caps (1) to (7).



- Renew screws (1) to (14).

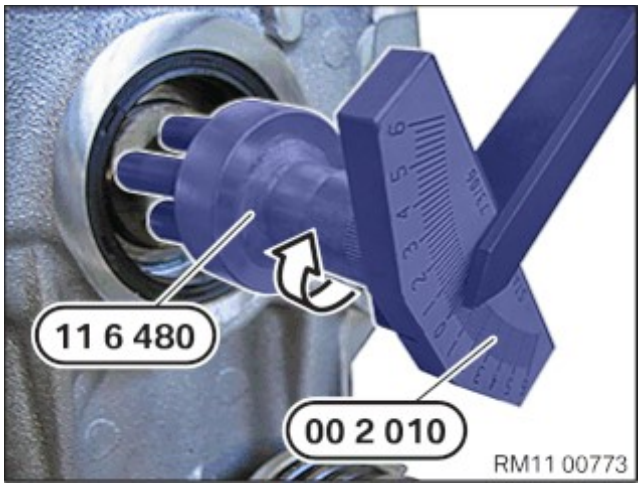
  Parts: Screws

- Tighten the bolts in sequence (1) to (14) with the special tool **0 490 504 (00 9 120)**.

Main bearing cap to crankcase

M10x85 11.9	Replace screws.	1. Tightening torque	25 Nm
		2. Angle of rotation	65 °
		3. Angle of rotation	65 °

58–Check the coefficient of friction for the crankshaft



Check

- Turn the crankshaft clockwise using special tool **0 490 130 (00 2 010)** and compare the wear on the scale to the **maximum permissible** torque.

Maximum permitted torque of the crankshaft

	max. 3 Nm

Result

» The maximum permitted torque is exceeded.

Measure

- Correct the radial clearance.

Check

- Check the classification of the main bearing shells and the guide bearing shells.

Result

» Classification of the main bearing shells and the guide bearing shells is not correct.

Measure

- Correct the classification of the main bearing shells and the guide bearing shells.

Check

- Check if the main bearing shells and the guide bearing shells are mounted correctly.

Result

» Main bearing shells and guide bearing shells are not mounted correctly.

Measure

- Correctly mount the main bearing shells and guide bearing shells.

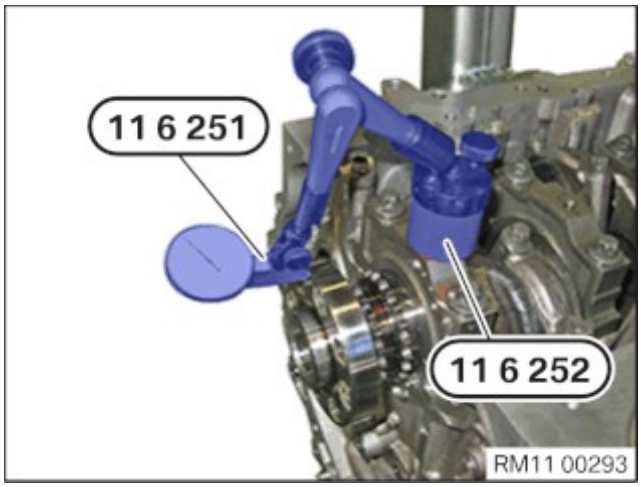
59–Checking the crankshaft side clearance

Check

- Attach the dial gauge **0 493 144 (11 6 251)** with the tripod **0 493 145 (11 6 252)** to the engine and measure the side clearance of the crankshaft.

Axial play of crankshaft

Axial play of crankshaft	0.120 mm ... 0.270 mm



Result

» The side clearance has been exceeded.

Measure

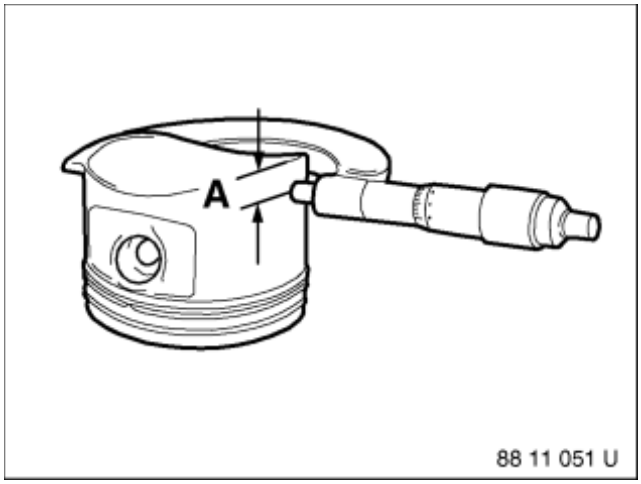
- Renew worn components.

60–Measuring all pistons

NOTICE

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

▶ Measuring piston



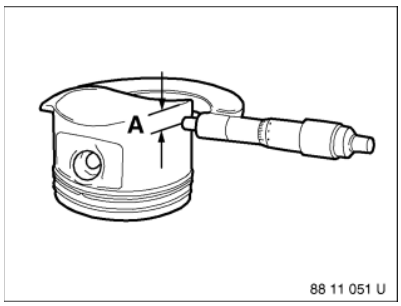
Check

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

Piston diameter

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

Distance (A) to the lower end of the piston skirt	10 mm
Nominal dimension of piston diameter	84.001 mm ... 83.963 mm
Distance (A) to the lower end of the piston skirt	24.5 mm
Nominal dimension of piston diameter	83.979 mm ... 83.941 mm
Distance (A) to the lower end of the piston skirt	49 mm
Nominal dimension of piston diameter	83.285 mm ... 83.247 mm



Result

» Piston does not correspond to the specifications.

Measure

- Renew the piston.

◀

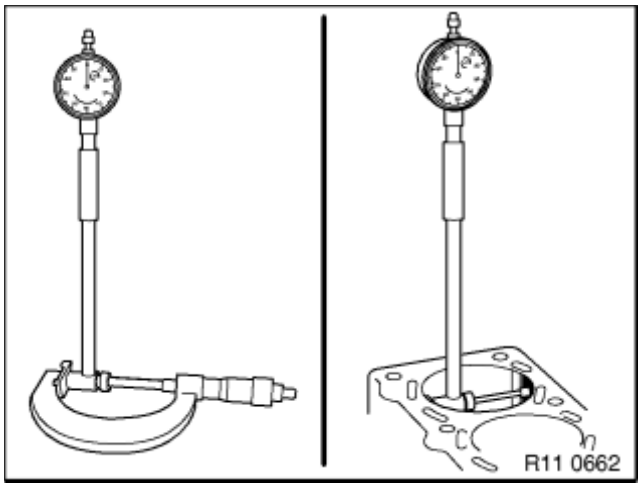
61–Measuring a cylinder

Prerequisite

Cylinder barrel is cleaned.

Check

- Adjusting measuring screw to nominal dimension of cylinder bore.



Cylinder bore

Distance from the upper edge of the cylinder barrel to the measuring point	0 mm ... 60 mm
Diameter of cylinder bore	83.993 mm ... 84.007 mm
Permitted irregularity of the cylinder bore	0.007 mm
Distance from the upper edge of the cylinder barrel to the measuring point	60 mm ... 80 mm
Diameter of cylinder bore	83.993 mm ... 84.007 mm
Permitted irregularity of the cylinder bore	0,007 mm
Distance from the upper edge of the cylinder barrel to the measuring point	80 mm ... 115 mm
Diameter of cylinder bore	83.993 mm ... 84.007 mm
Permitted irregularity of the cylinder bore	0,007 mm
Distance from the upper edge of the cylinder barrel to the measuring point	115 mm ... 135 mm
Diameter of cylinder bore	83.993 mm ... 84.007 mm
Permitted irregularity of the cylinder bore	0,007 mm

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

Cylinder bore	
Distance from the upper edge of the cylinder barrel to the measuring point	0 mm ... 60 mm
Diameter of cylinder bore	83.993 mm ... 84.007 mm
Permitted irregularity of the cylinder bore	0.007 mm
Distance from the upper edge of the cylinder barrel to the measuring point	60 mm ... 80 mm
Diameter of cylinder bore	83.993 mm ... 84.007 mm
Permitted irregularity of the cylinder bore	0,007 mm
Distance from the upper edge of the cylinder barrel to the measuring point	80 mm ... 115 mm
Diameter of cylinder bore	83.993 mm ... 84.007 mm
Permitted irregularity of the cylinder bore	0,007 mm
Distance from the upper edge of the cylinder barrel to the measuring point	115 mm ... 135 mm
Diameter of cylinder bore	83.993 mm ... 84.007 mm
Permitted irregularity of the cylinder bore	0,007 mm

Result

» Cylinder does not correspond to the specifications.

Measure

- Replace motor.

62–Installing all pistons with connecting rod

RISK OF DAMAGE

Damage on the cylinder wall and oil spray nozzles.

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

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

TECHNICAL INFORMATION

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

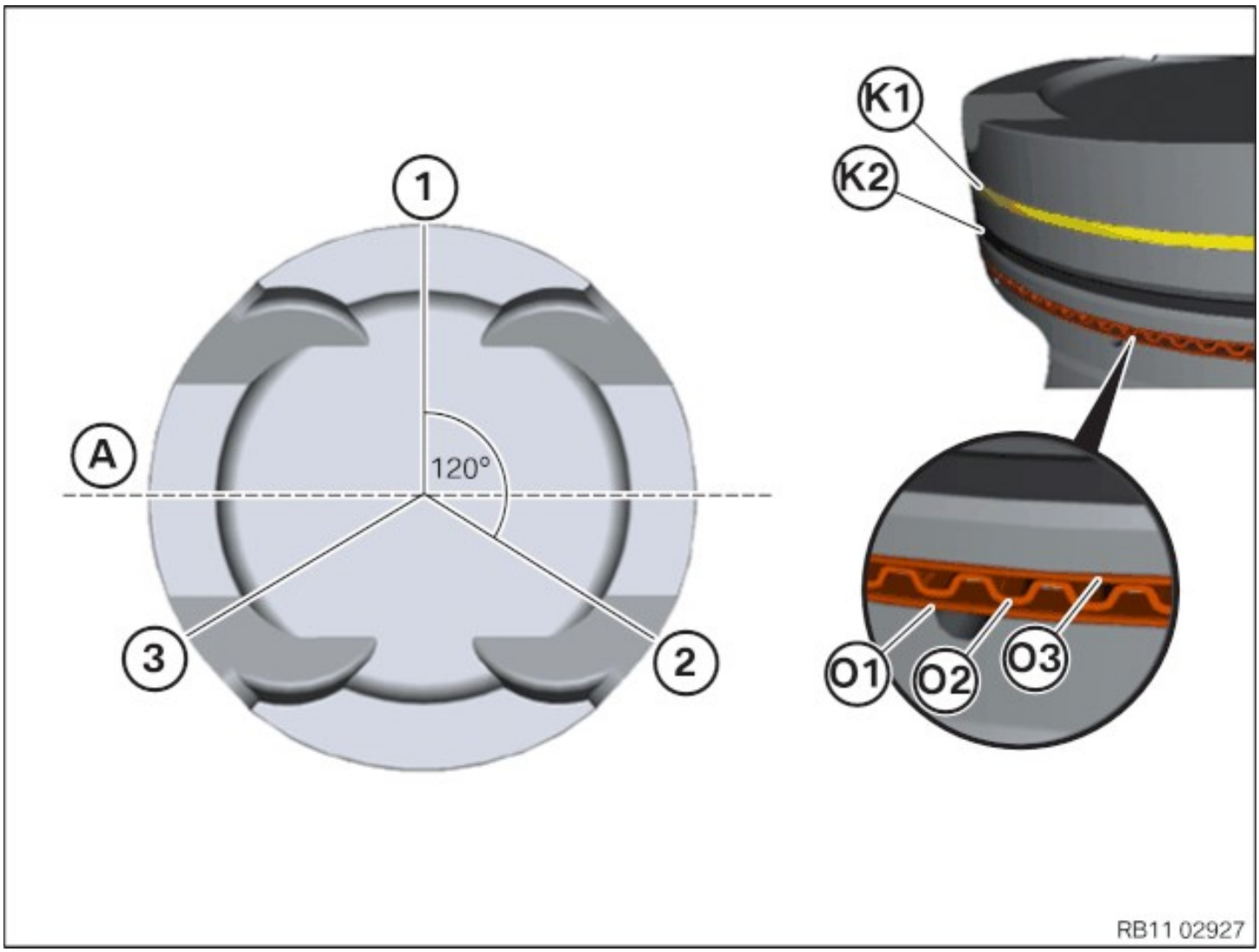
Always install the piston, gudgeon pin, connecting rod and connecting rod bearing shells in the cylinder from which they were removed.

NOTICE

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

▶ Aligning piston rings

Aligning piston rings



1 12 o'clock position

2 4 o'clock position

3 8 o'clock position

A Axis of gudgeon pin

K1 Upper piston ring

K2 Middle piston ring

O1 Lower oil scraper ring

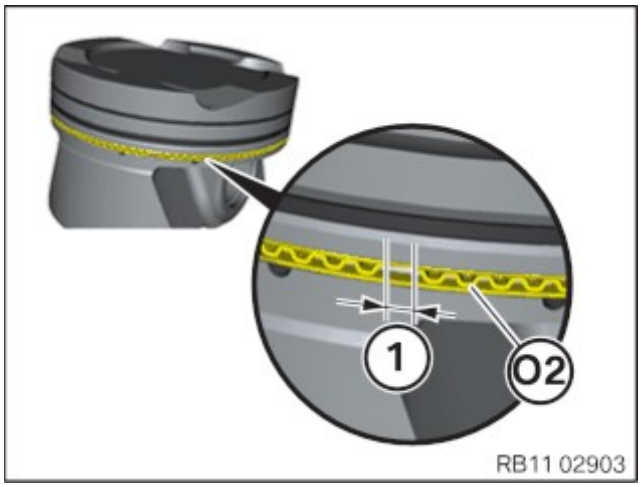
O2 Spring

O3 Upper oil scraper ring

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

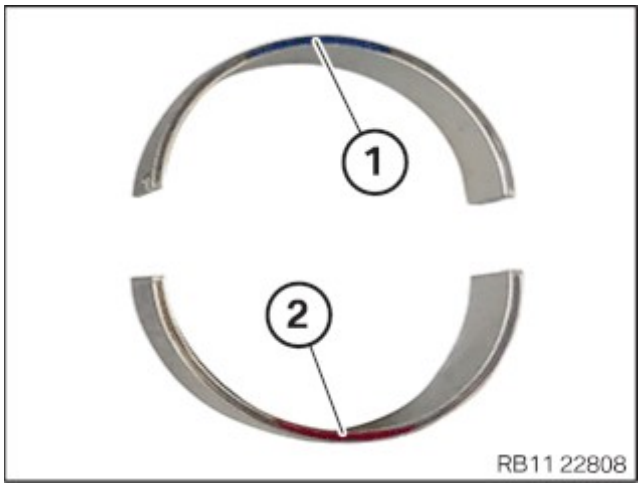
The piston ring gaps must not be positioned in line with the axis of the gudgeon pin (A).

Piston ring	Alignment
Lower oil scraper ring (O3)	12 o'clock position (1)
Spring (O2)	4 o'clock position (2)
Upper oil scraper ring (O1)	8 o'clock position (3)
Central piston ring (K2)	12 o'clock position (1)
Upper piston ring (K1)	4 o'clock position (2)



- Make sure that the spring (O2) does not overlap the piston ring gap (1).

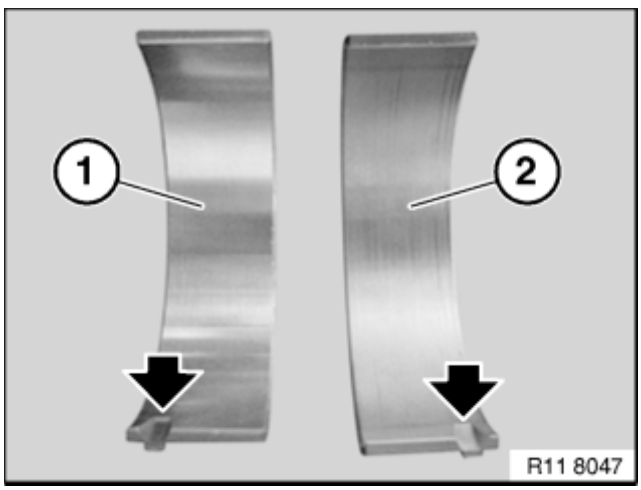
◀



i TECHNICAL INFORMATION

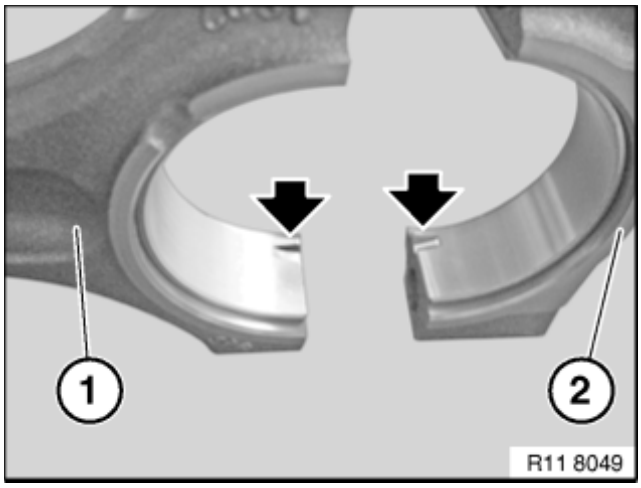
Note the different colours of the connecting rod bearing shells for top and bottom (see overview graphic and EPC).

- Install connecting rod bearing shell (1) with the **blue** colour coding at the **top** in the connecting rod.
- Install connecting rod bearing shell (2) with the **red** colour coding at the **bottom** in the connecting rod bearing cap.



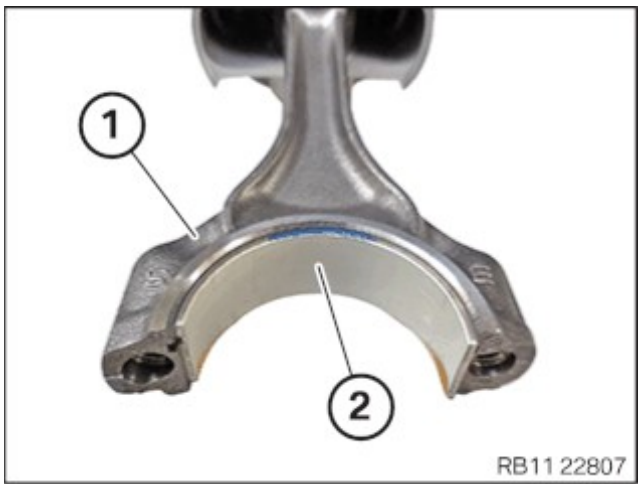
- To avoid incorrect assembly: Pay attention to marks (arrows).

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

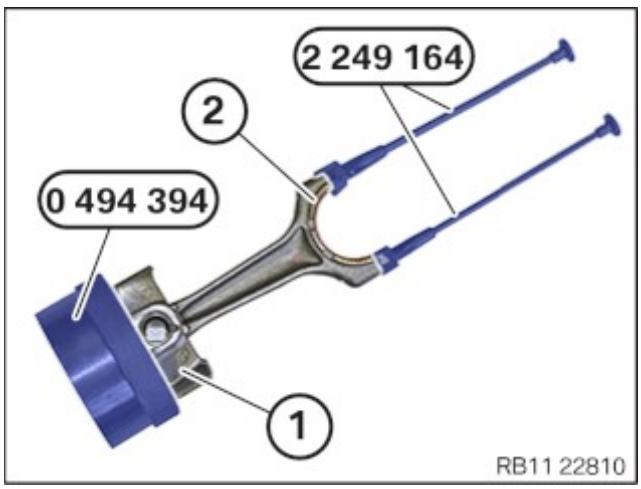


- To avoid incorrect assembly: Pay attention to marks (arrows).

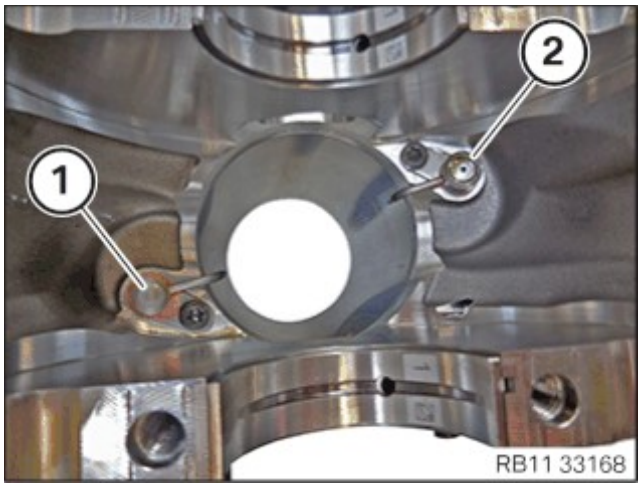
  The connecting rod bearing cap (2) and the connecting rod (1) are equipped with **a fuse each to act** against incorrect assembly.



- Insert the connecting rod bearing shell (2) with blue colour coding on the top in the connecting rod (1).
- Lightly oil the connecting rod bearing shell (2).

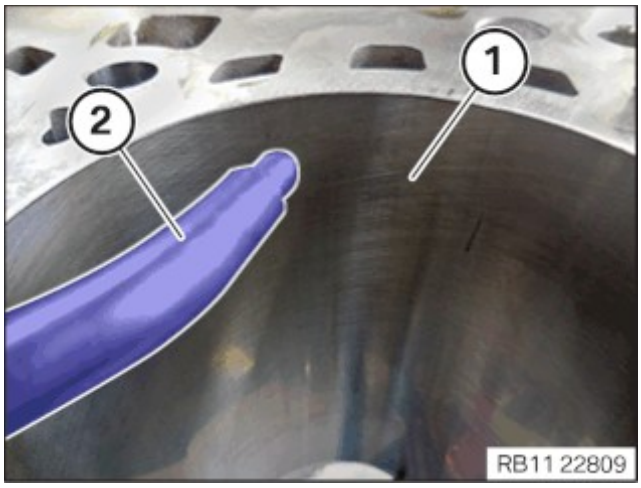


- Coat the pistons (1) and piston rings lightly with oil.
- Insert pistons (1) with the piston rings into special tool **0 494 394 (11 8 141)**.
- Screw special tool **2 249 164** onto the large connecting rod eye (2).

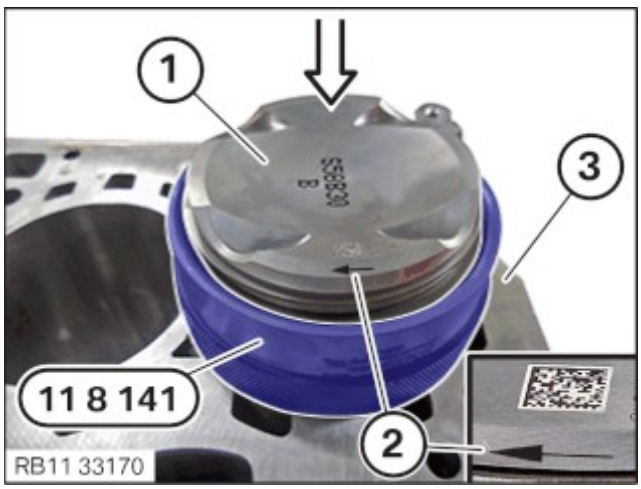


- Check oil spray nozzles (1) and (2) for damage; replace if necessary.

- Coat cylinder wall (1) with fresh engine oil (2).



- Position special tool **0 494 394 (11 8 141)** at the crankcase. (1)



RISK OF DAMAGE

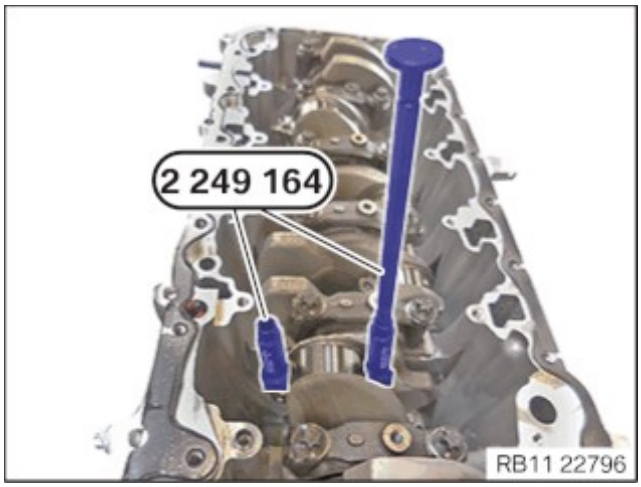
Damage on the cylinder wall and oil spray nozzles.

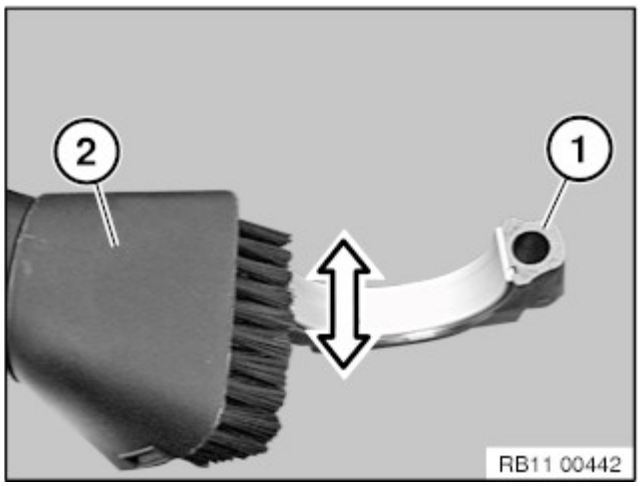
Major force can scratch the cylinder wall and bend the oil spray nozzles.

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

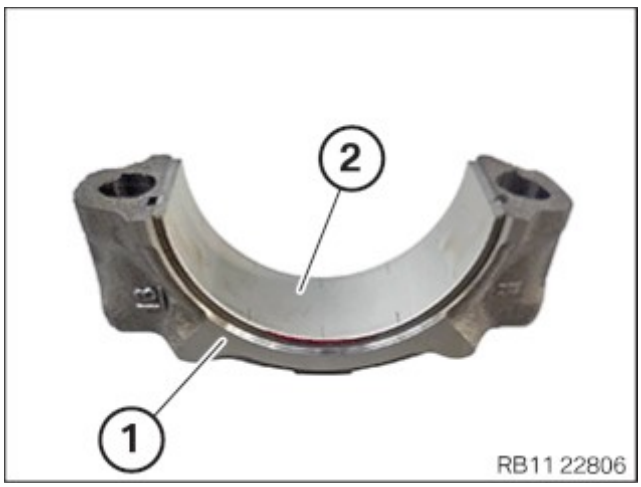
- Align pistons (1) so that the arrow (2) points to **cylinder 1** .
- Insert pistons (1) with connecting rod into the special tool **0 494 394 (11 8 141)** and guide into cylinder of the crankcase (3).
- Press in piston by hand (1) with little force in **the direction of the arrow**.

  Striking tools must not be used.
- Pull the connecting rod with the special tool **2 249 164** up to the connecting rod bearing journal.
- Unscrew special tool **2 249 164** and remove.

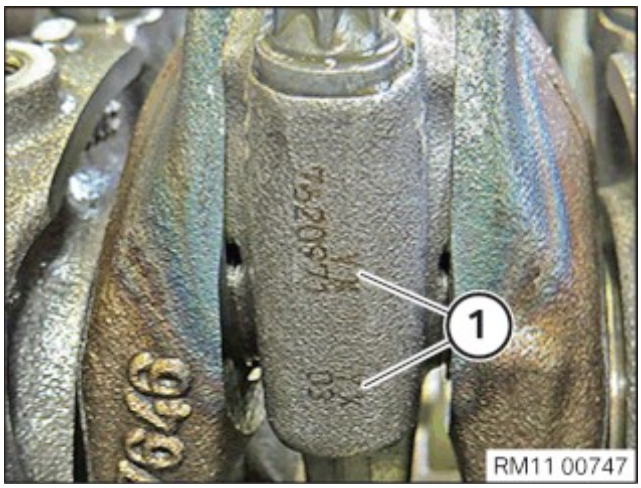




- Vacuum the connecting rod bearing shell and cracked surface (1) with a vacuum cleaner (2).



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



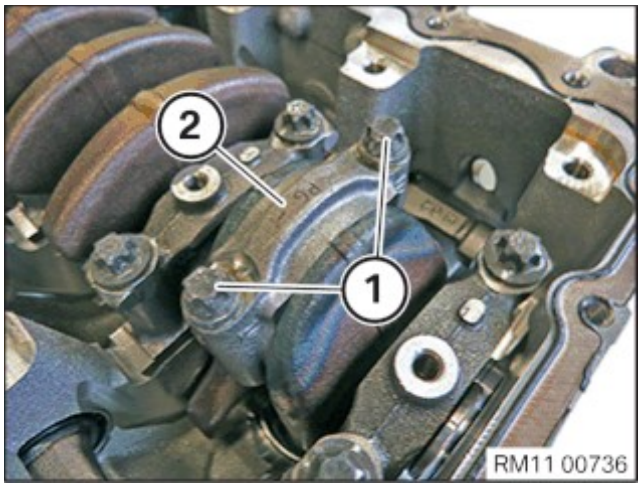
RISK OF DAMAGE

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

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

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

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

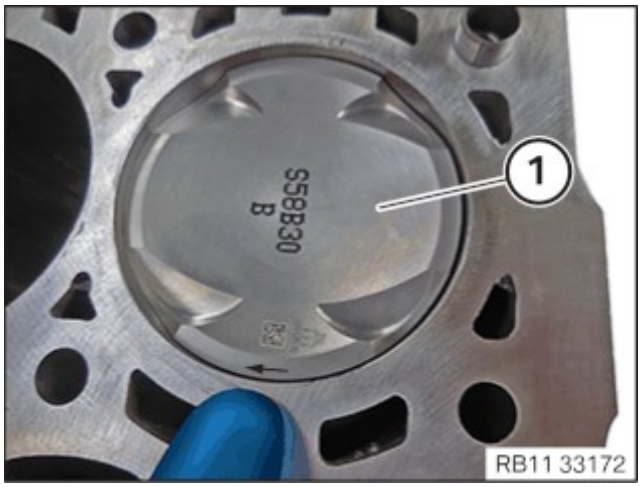


Parts: Screws

- Tighten down screws (1) with the special tool **0 490 504 (00 9 120)** on the connecting rod bearing cap (2).

Connecting rod bearing cap to connecting rod

M9x1.25	Renew screws. Suction off crack surfaces.	1. Tightening torque	6 Nm
		2. Tightening torque	20 Nm
		3. Angle of rotation	75 °
		4. Unscrew all bolts.	180 °
		5. Tightening torque	6 Nm
		6. Tightening torque	20 Nm
		7. Angle of rotation	75 °
		8. Unscrew all bolts.	180 °
		9. Tightening torque	6 Nm
		110 Jointing torque	20 Nm
		11. Angle of rotation	75 °



- Ensure correct installation position of the piston (1).

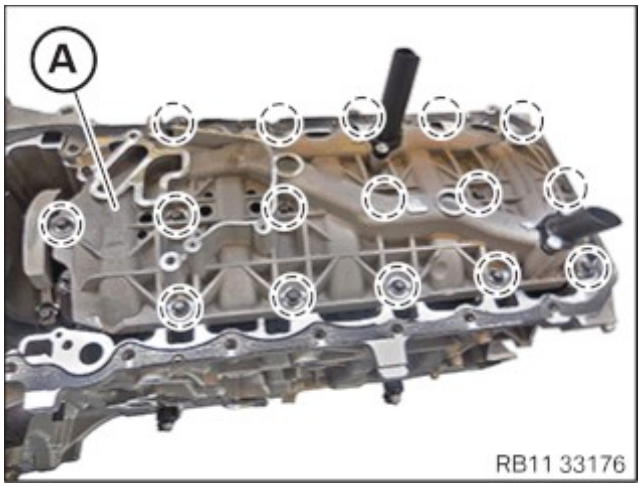
  The arrow must point to **cylinder 1**.

63–Installing the oil deflector

- Renew bolts (markings).

  Parts: Screws

- Insert and position the oil deflector (A).

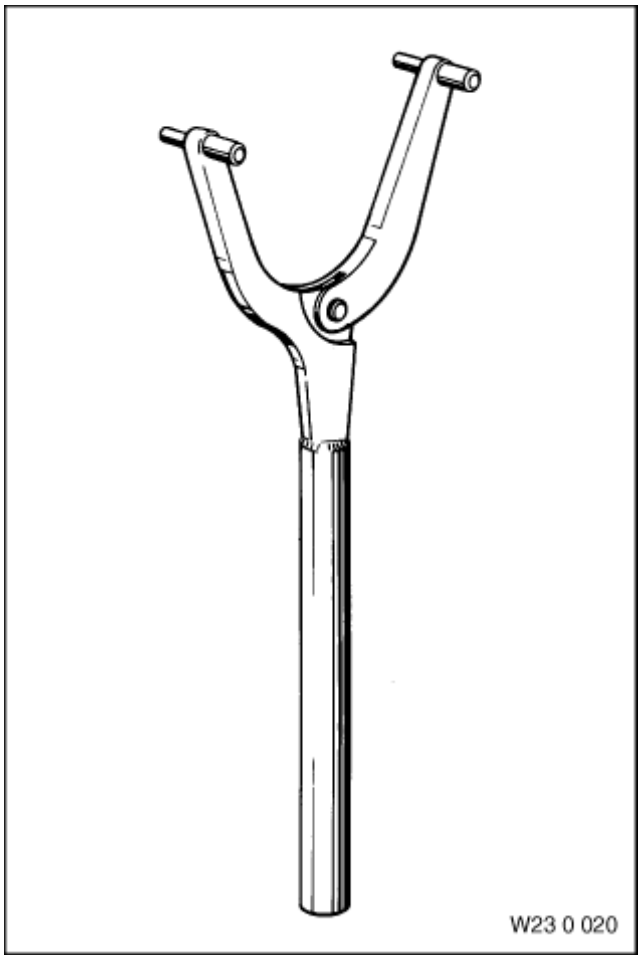


- Tighten bolts (markings) in a crosswise pattern using the special tool **0 490 504 (00 9 120)**.

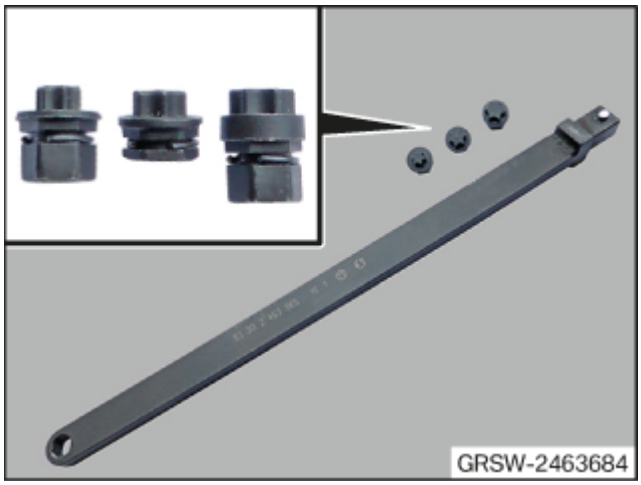
Oil deflector to crankcase

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

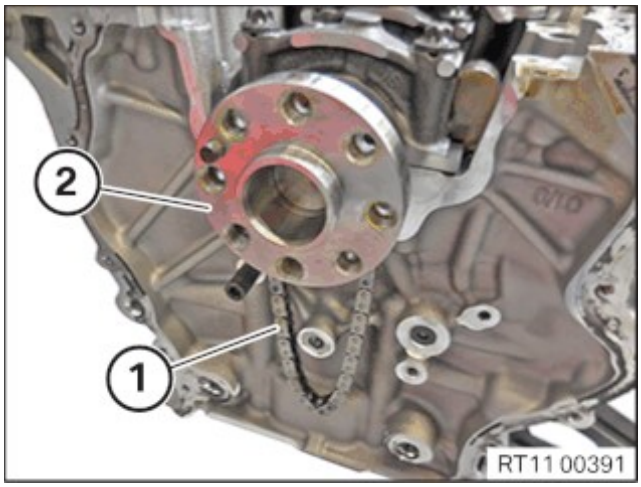
64–Installing the drive chain for the oil vacuum pump



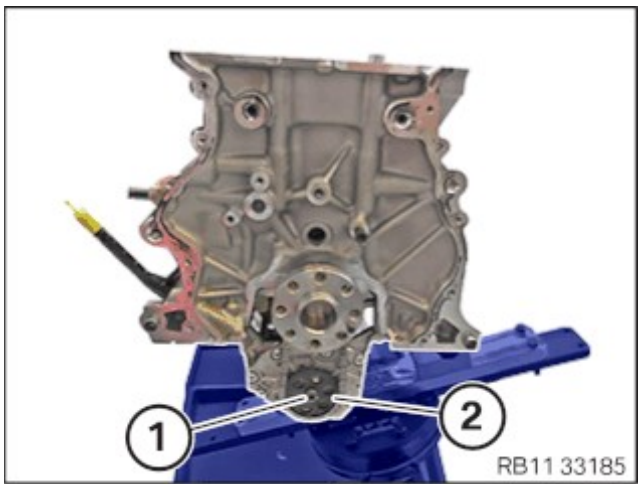
- Have the special tool **0 491 440 (23 0 020)** ready.



- Have the special tool **2 463 965** ready.



- Guide in and install drive chain (1) on crankshaft (2).



TECHNICAL INFORMATION

The thread is a left-hand thread.

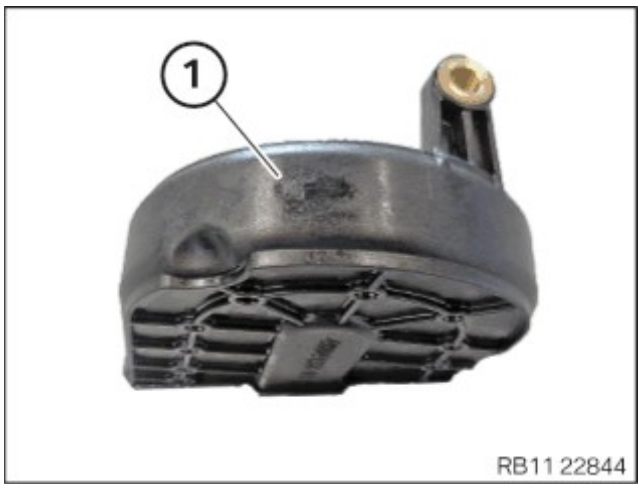
- Position camshaft sprocket (2) on the oil vacuum pump so that the labelling on the camshaft sprocket (2) is facing away from the oil vacuum pump.
- Insert the camshaft sprocket (2) in the drive chain.
- Renew the screw (1).

  Parts: Screw
- Hold the camshaft sprocket (2) with the special tool **0 491 440 (23 0 020)** and tighten the bolt (1).

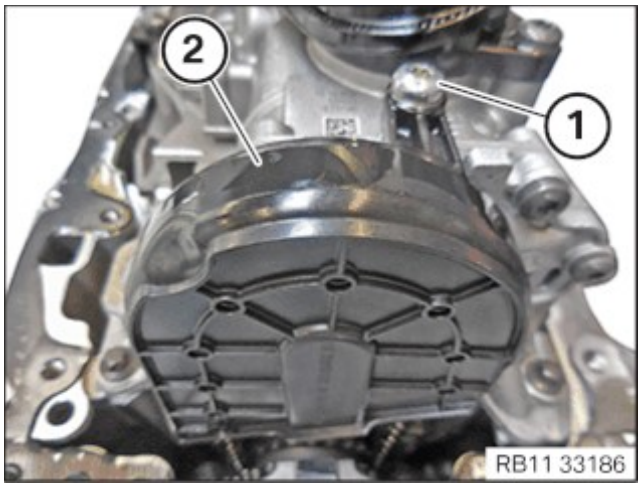
Camshaft sprocket to oil vacuum pump

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

-



- Check the cover (1) for damage, if necessary renew the cover (1).
- Insert and install the cover (2).
- Tighten down screw (1).



Sprocket cover on oil vacuum pump

M6X20		Tightening torque	8 Nm

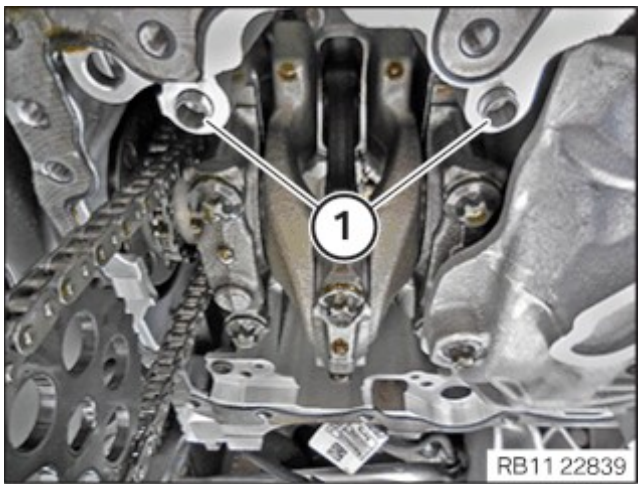
65–Installing the oil pump

RISK OF DAMAGE

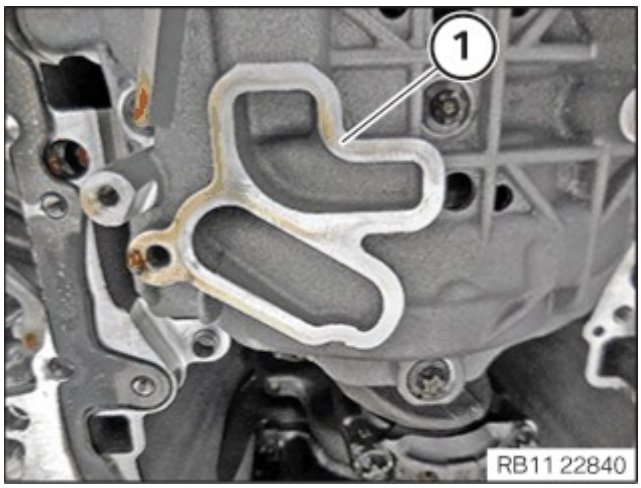
Damage to the surface.

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.



- Check centering sleeves (1) for damage and, if necessary, renew them.

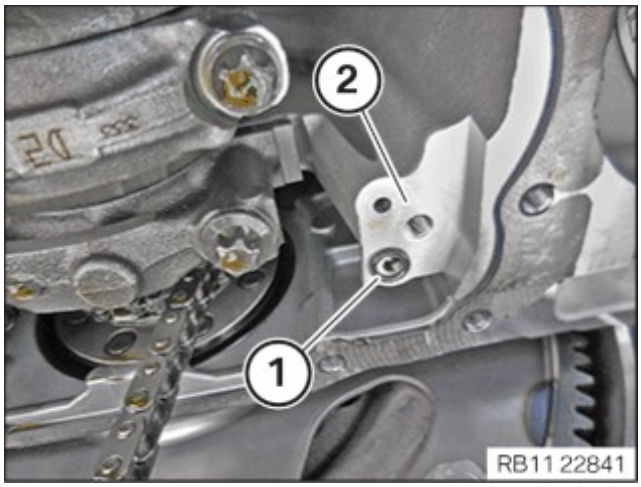


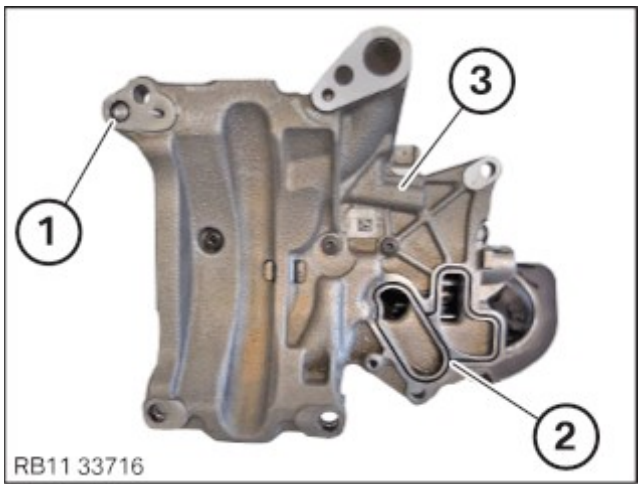
TECHNICAL INFORMATION

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

- Clean sealing surface (1).

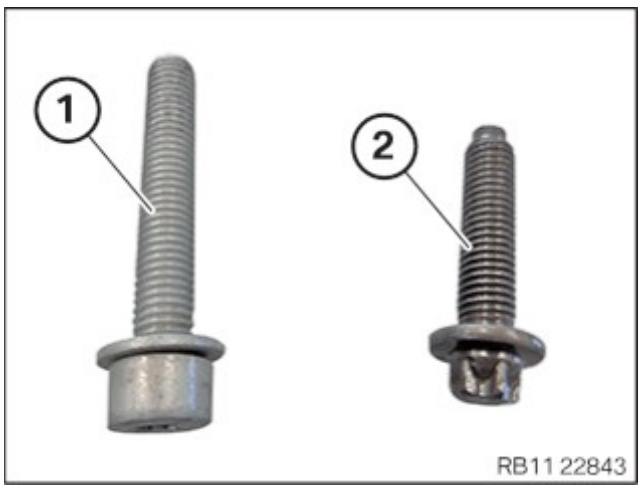
- Make sure that the sealing ring (1) is **not** installed on the crankcase (2).





- Renew sealing rings (1) and (2) on oil pump (3).

  Parts: Sealing ring



RISK OF DAMAGE

Component damage caused by incorrect screw length.

The use of screws with the incorrect screw length can damage the component.

- Check for correct screw length.
- Re-install screws that correspond to the original screw length.

- Ensure that screw (1) (M8x50) is installed again in the **same position**.
- Ensure that screws (2) (M8x35) are installed again in the **same position**.

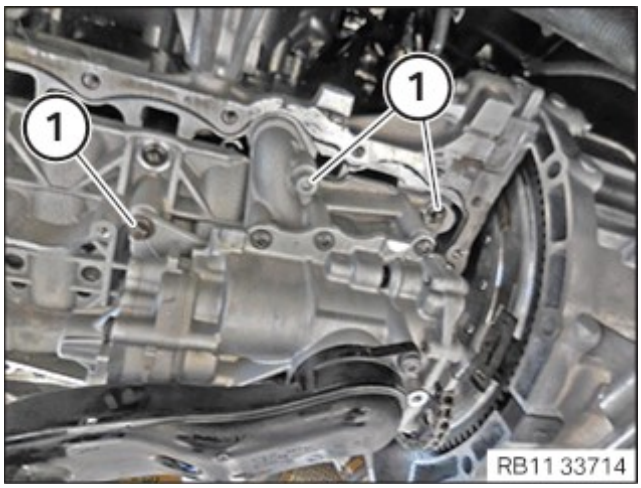
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

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

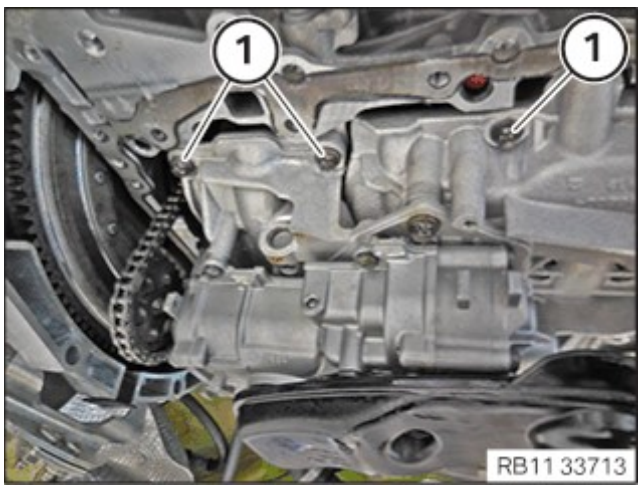
- Guide in and position oil pump (1).



- Renew screws (1).

  Parts: Screws

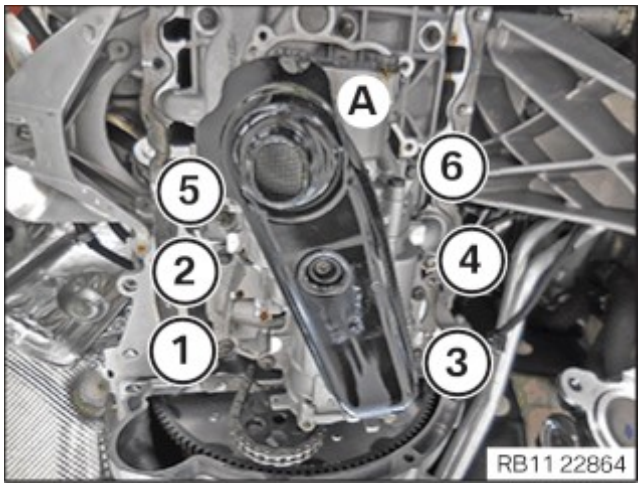
- Hand-tighten the screws (1).



- Renew screws (1).

  Parts: Screws

- Hand-tight the bolts (1).

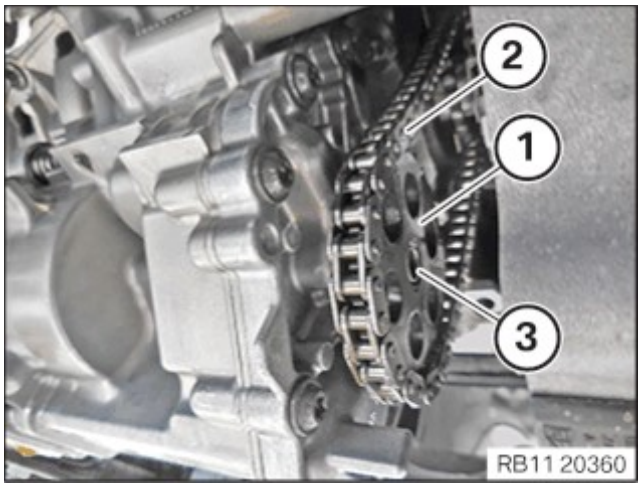


- Tighten the screws in order from (1) to (6) on oil pump (A).

Oil pump to crankcase

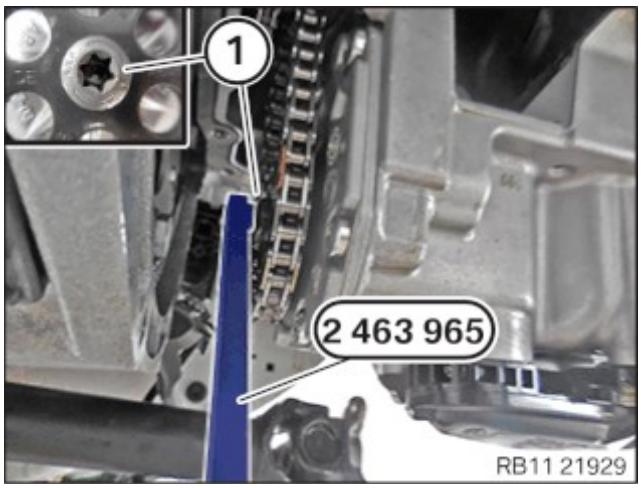
M8	Renew screw.	1. Tightening torque	15 Nm
		2. Angle of rotation	45 °

- Feed in and position the sprocket (1) on the drive chain (2).



- Position sprocket (1) on oil pump (3).

  The labelling on sprocket (1) must point away from oil pump (3).



TECHNICAL INFORMATION

The thread is a left-hand thread.

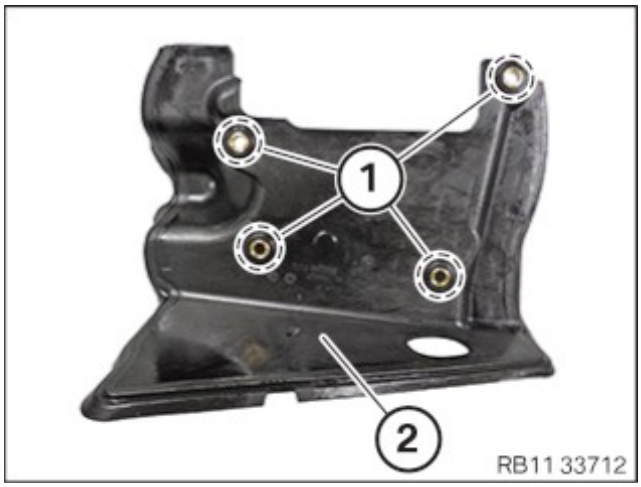
- Renew the screw (1).

  Parts: Screw

- Tighten the screw (1) with the special tool **2 463 965**.

Sprocket to oil pump

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

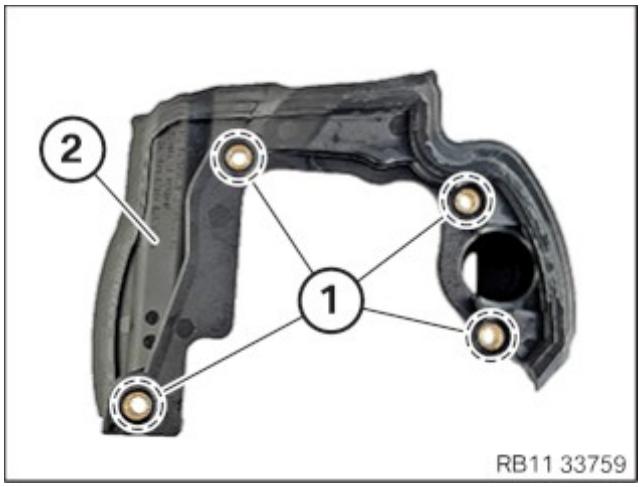


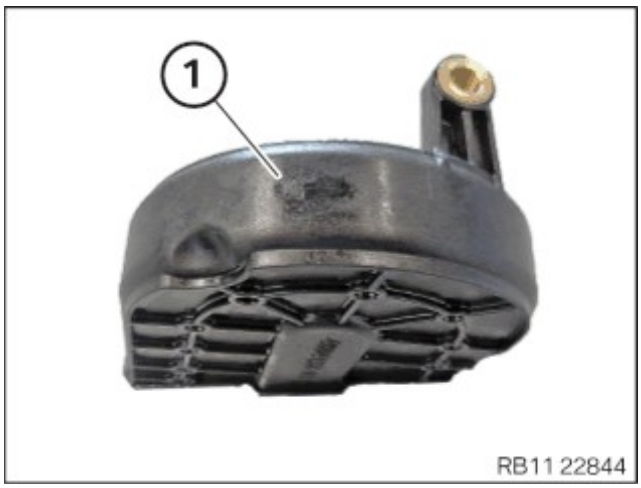
- **Variant with rear wheel drive:**

  Ensure that centering sleeves (1) are installed correctly on cover (2) in **the marked** areas.

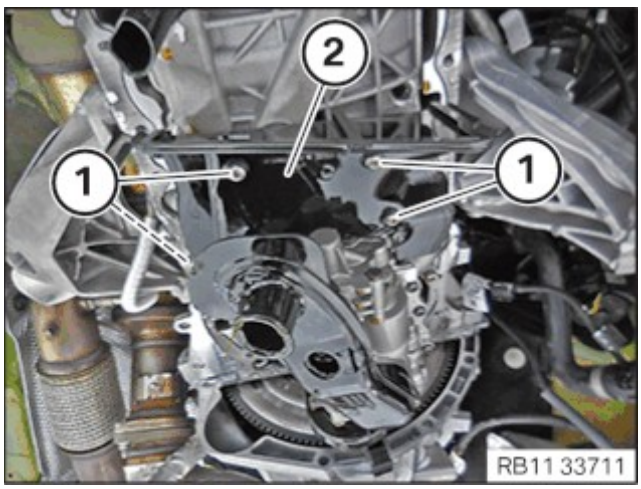
- **Version with all-wheel drive:**

  Ensure that centering sleeves (1) are installed correctly on cover (2) in **the marked** areas.





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



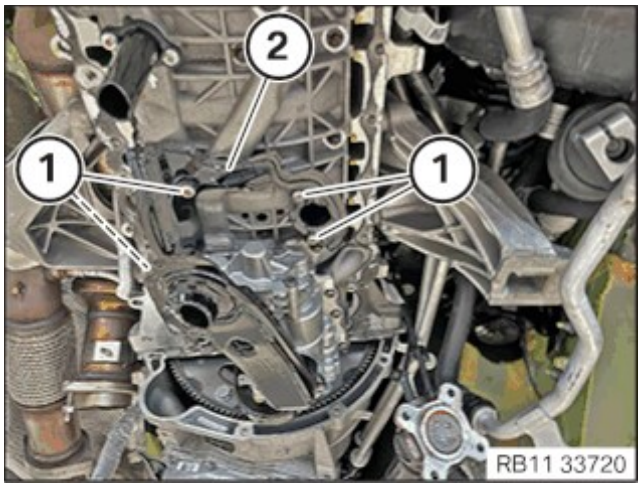
- **Variant with rear wheel drive:**

  Insert and install the cover (2).

- Tighten screws (1) on cover (2).

Cover to oil pump

M6X20		Tightening torque	8 Nm



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

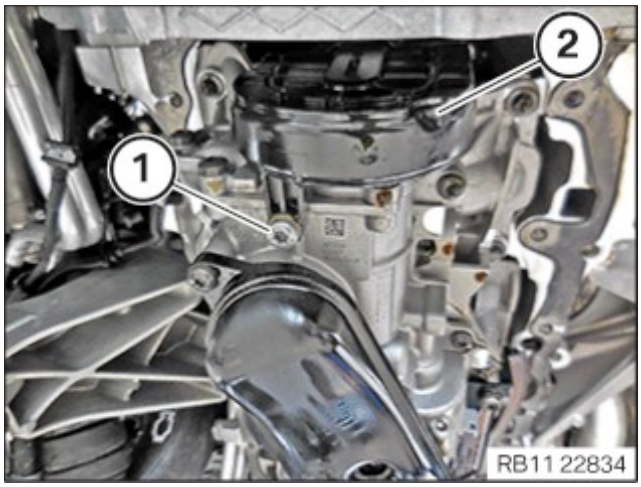
  Insert and install the cover (2).

- Tighten screws (1) on cover (2).

Cover to oil pump

M6X20		Tightening torque	8 Nm

- Insert and install the cover (2).



- Tighten down screw (1).

Sprocket cover to oil pump

M6X20		Tightening torque	8 Nm

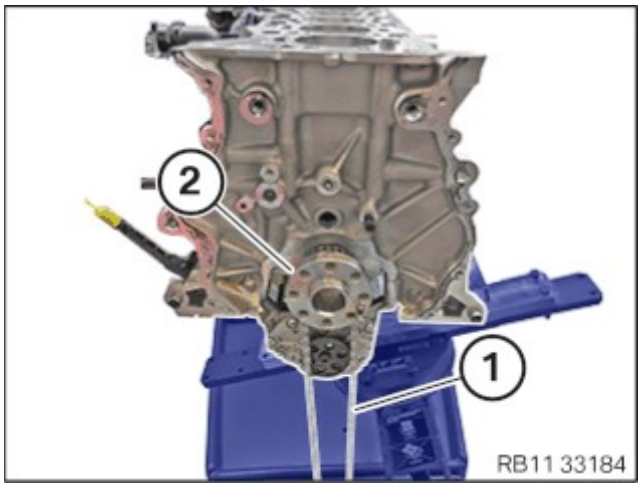
66–Installing timing chain

RISK OF DAMAGE

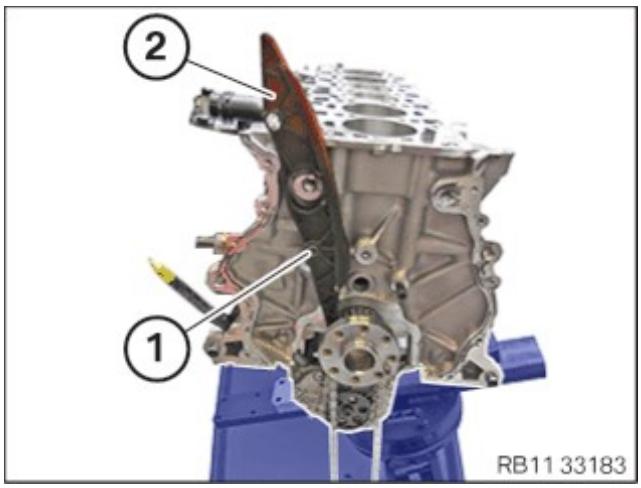
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

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



- Pull timing chain (1) in on the crankshaft (2) and install.



- Renew bearing journal (1).

  Parts: Bearing journal

- Insert and position the guide rail (2).

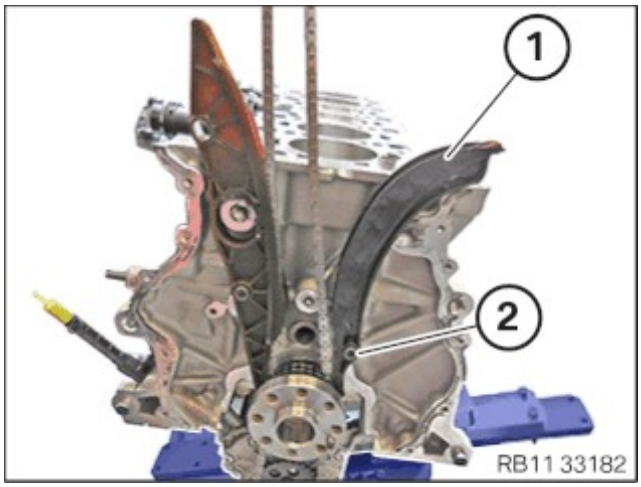
TECHNICAL INFORMATION

Clean screw thread.

- Tighten the bearing journals (1).

Bearing journal to crankcase

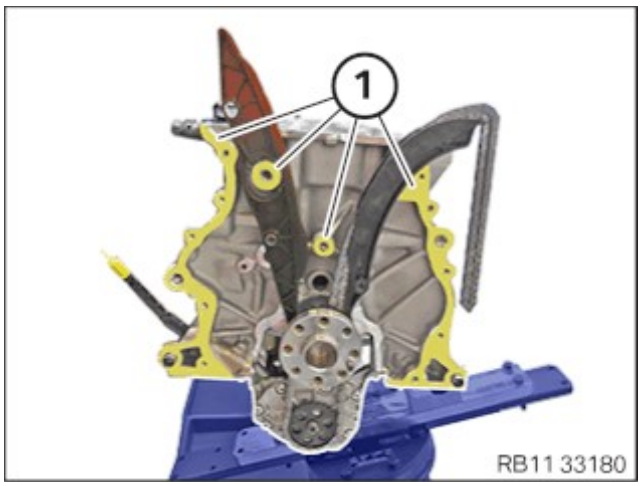
Bearing journal	Replace bearing journal.	Tightening torque	20 Nm



- Insert and install the tensioning rail (1) on the bearing journal (2).

67–Install the rear timing case cover

Additional information is available.



RISK OF DAMAGE

Damage to the surface.

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

- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

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

- Clean sealing surfaces (1) with special tool **0 495 102 (11 4 470)**.
- Clean sealing surface (1) with the brake cleaner.

Expendable materials

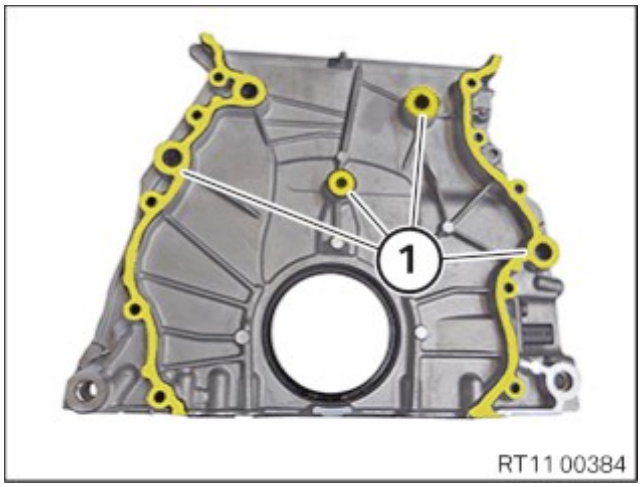
Brake cleaner2.0	500 ml, Spray can	83 19 2 365 214
	20 , Canister	83 19 2 365 215

RISK OF DAMAGE

Damage to the surface.

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

- Do not use any metal-cutting tools.



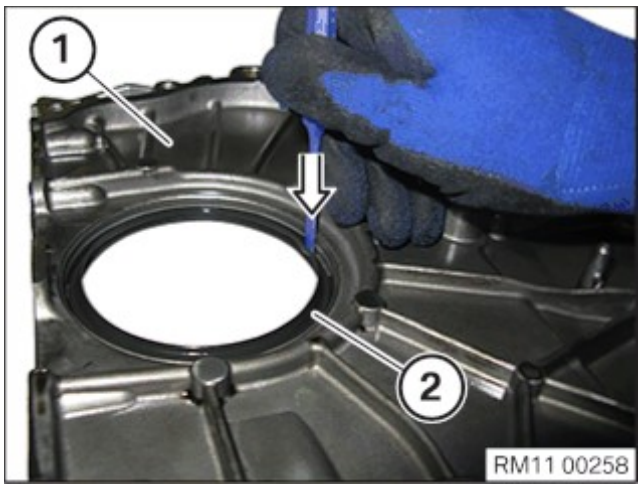
TECHNICAL INFORMATION

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

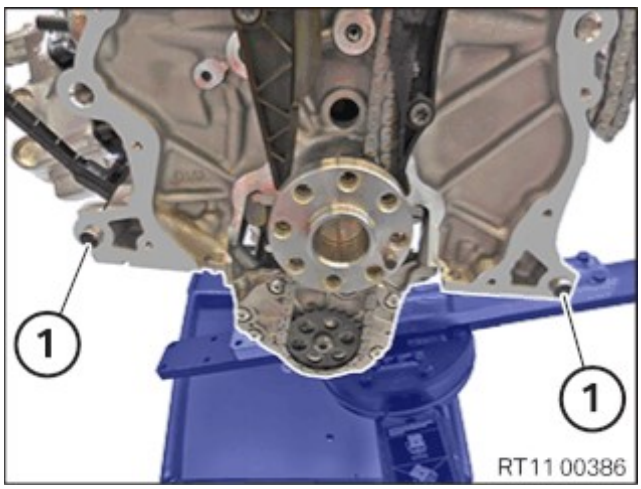
- Clean sealing surfaces (1) with special tool **0 495 102 (11 4 470)**.
- Clean sealing surface (1) with the brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83 19 2 365 214
	20 , Canister	83 19 2 365 215

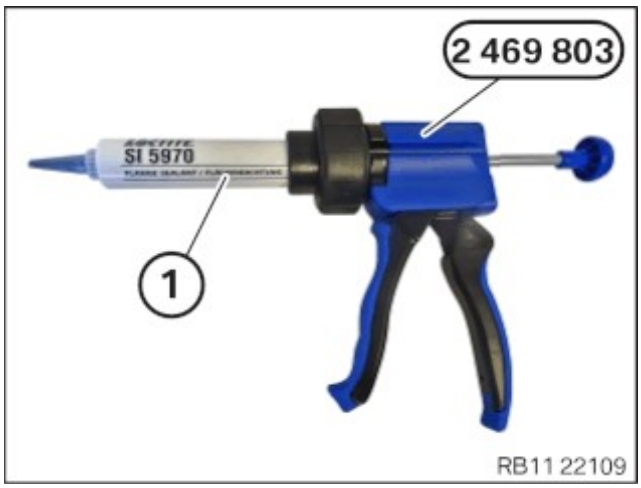


- Position the timing case cover (1) underneath.
- Position the punch inside in the crankshaft sealing ring (2).
- Remove the crankshaft sealing ring (2) outward in the direction of the arrow.



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

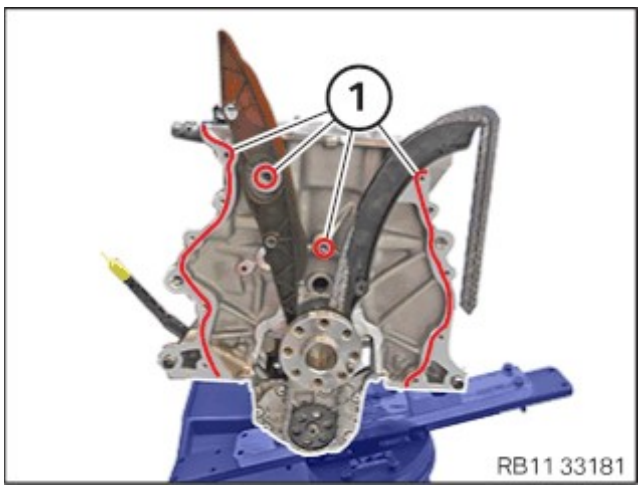
- Have the special tool **2 469 803** ready.



TECHNICAL INFORMATION

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

- Position the sealing compound (1) on special tool **2 469 803** as shown.



TECHNICAL INFORMATION

- The application time of the liquid sealing compound can be at a maximum of 10 min.
- Start-up of the assembly is not possible until 25 minutes after the application time.
- Non-observance can lead to leaks in the assembly.

- Apply the sealing compound in areas (1) along the inner edge.

Sealing compound

Loctite 5970 liquid sealing compound **Processing time <10 minutes at room temperature**	50 ml, Cartridge	83 19 0 404 517

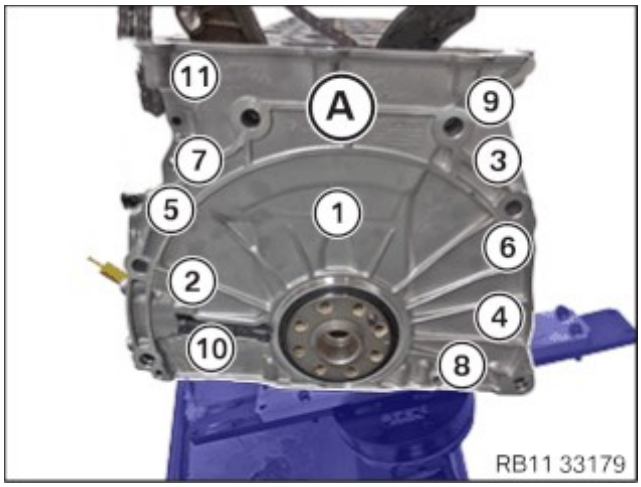
Overview of consumables (Electronic Parts Catalogue)

Height of the sealing bead

2,0 mm ... 2,5 mm

- Renew screws (1) to (11).

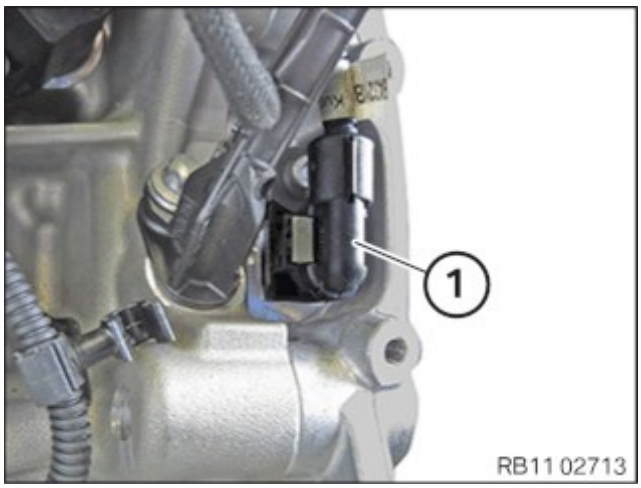
  Parts: Screws



- Carefully mount the timing case cover (A).
- Tighten the bolts in sequence (1) to (11) with the special tool **0 490 504 (00 9 120)**.

Rear timing case cover to crankcase

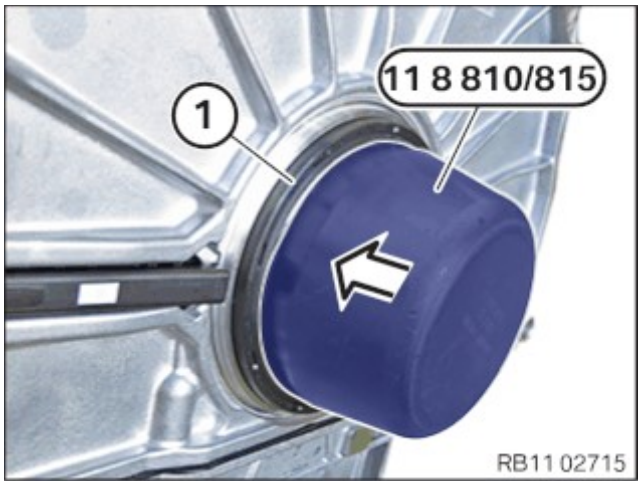
M6 x 27	Renew screws.	Tightening torque	4 Nm
		Angle of rotation	90 °



- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

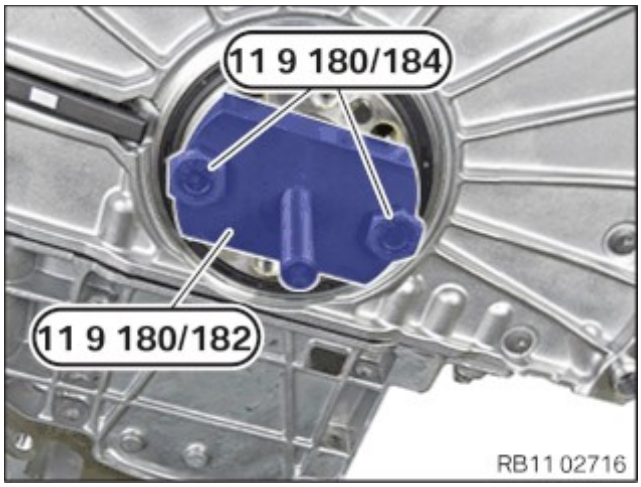
▶ Installing the rear crankshaft seal

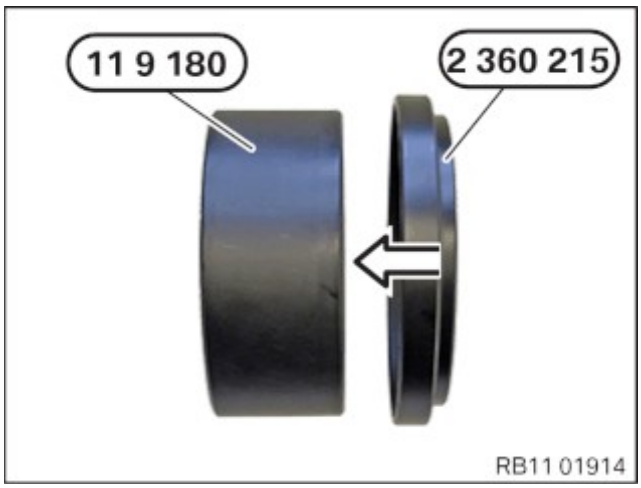


TECHNICAL INFORMATION

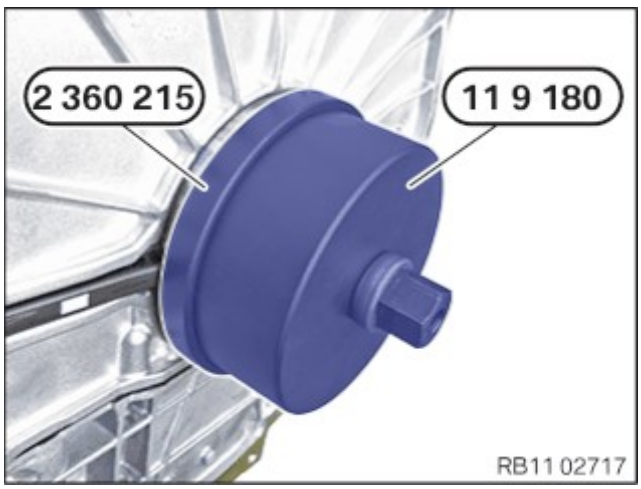
The radial shaft seal must be installed dry. Do not use engine oil or lubricant.

- Install special tool **0 496 137 (11 8 815)** on the crankshaft.
- Peel off the crankshaft sealing ring (1) in the direction of arrow over the special tool **0 496 137 (11 8 815)** so that the crankshaft sealing ring (1) is positioned around the timing case cover.
- Guide the special tool **0 496 137 (11 8 815)** out and remove.
- Secure special tool **0 494 029 (11 9 182)** to the crankshaft using special tool **0 494 031 (11 9 184)**.





- Connect the special tool **2 360 215** in the direction of arrow to the special tool **0 494 028 (11 9 181)**.



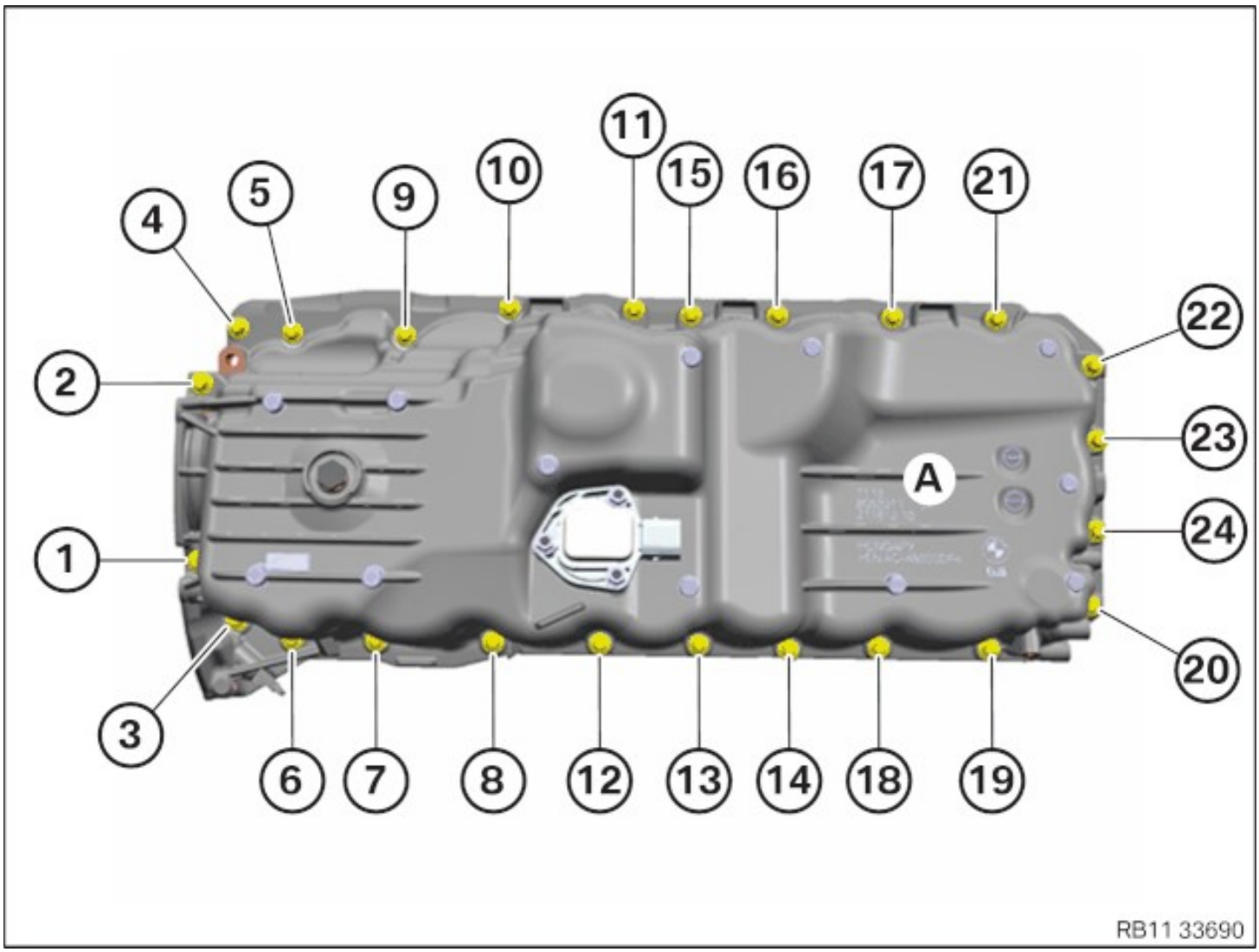
- Position special tools **0 494 028 (11 9 181)** and **2 360 215** and move them combined with special tool **0 494 030 (11 9 183)** until they rest against the crankshaft sealing ring.
- Check the freedom of movement between the special tool **2 360 215** and the crankshaft sensor during installation.
- Screw in the crankshaft sealing ring with the special tool **2 360 215** up to the limit position on the timing case cover.

◀

68–Refitting sump

Additional information is available.

Screws of the oil sump



1 - 24 Screws of the oil sump

A Oil sump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

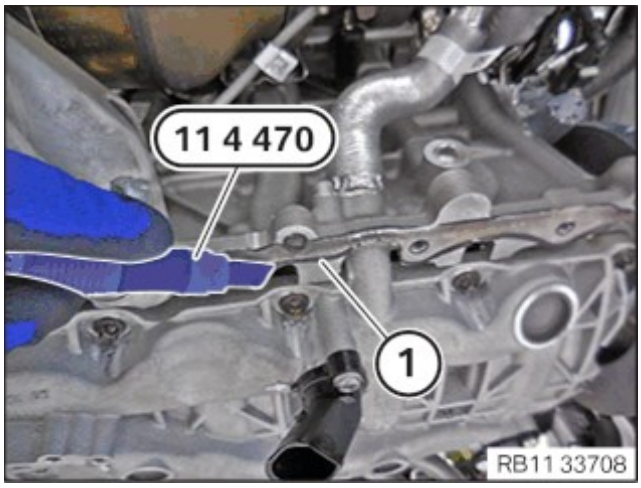
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

Damage to the surface.

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

- Do not use any metal-cutting tools.



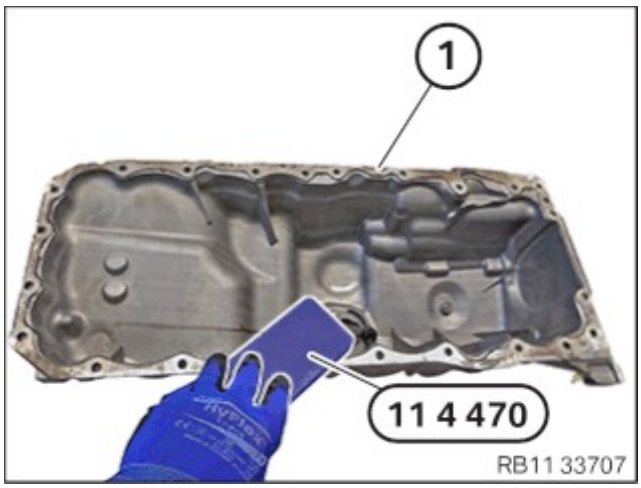
TECHNICAL INFORMATION

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

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

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83 19 2 365 214
	20 , Canister	83 19 2 365 215



TECHNICAL INFORMATION

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

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

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83 19 2 365 214
	20 , Canister	83 19 2 365 215

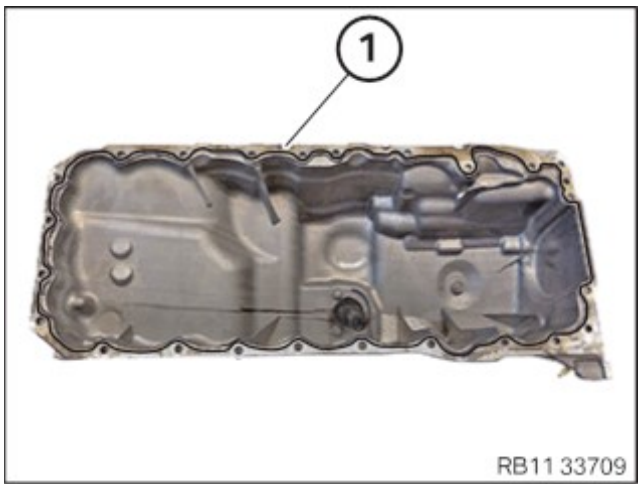
- Dry the sealing surface (1) with a clean, lint-free cleaning cloth.

- Have the special tool **2 469 803** ready.

TECHNICAL INFORMATION

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

- Position the sealing compound (1) on special tool **2 469 803** as shown.



TECHNICAL INFORMATION

- The application time of the liquid sealing compound can be at a maximum of 10 min.
- Start-up of the assembly is not possible until 25 minutes after the application time.
- Non-observance can lead to leaks in the assembly.

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

Sealing compound

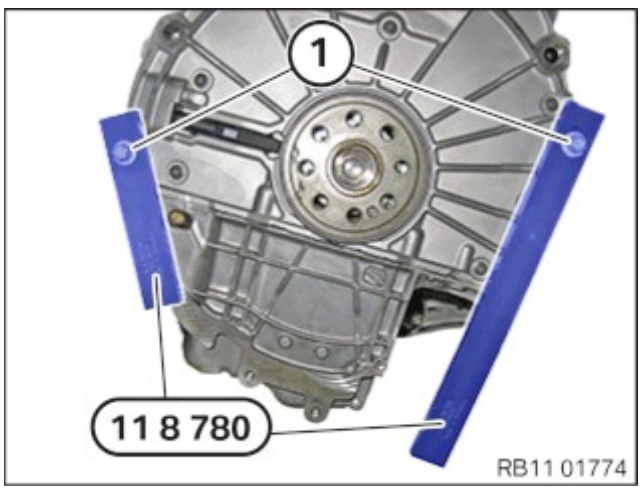
Loctite 5970 liquid sealing compound **Processing time <10 minutes at room temperature**	50 ml, Cartridge	83 19 0 404 517

Overview of consumables (Electronic Parts Catalogue)

Height of the sealing bead

2,0 mm ... 2,5 mm

- Completely encircle the oil return orifice with the sealing compound.

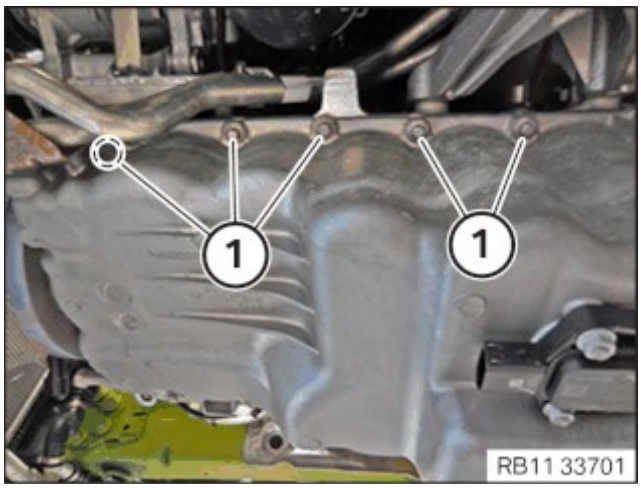


TECHNICAL INFORMATION

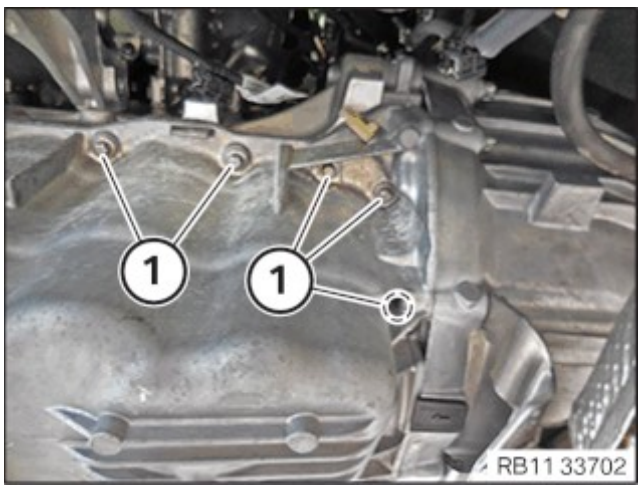
The special tool 11 8 780 is only required when the transmission is removed.

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

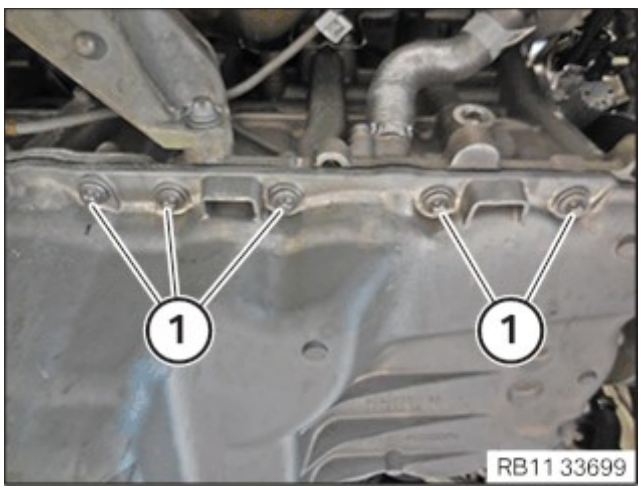
- Feed in the oil sump (1) forwards at the top and position it.



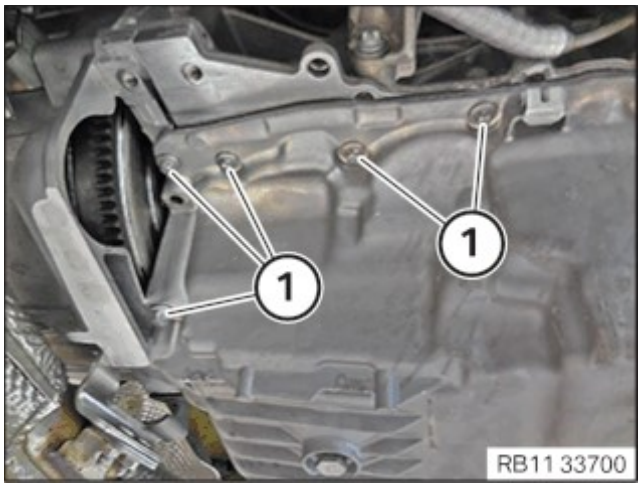
- Hand-tight the bolts (1).

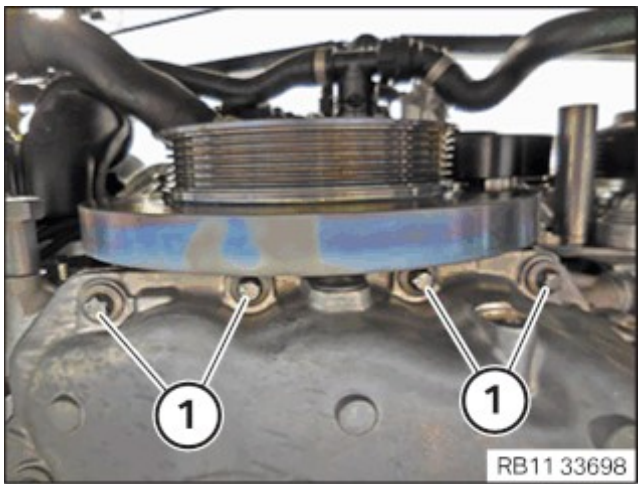


- Hand-tight the bolts (1).

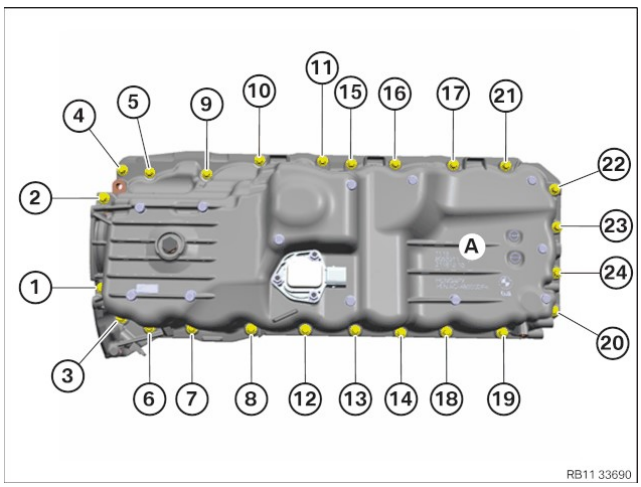


- Hand-tight the bolts (1).





- Hand-tight the 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.

- Tighten all screws in the sequence (1) to (24) on the oil sump (A).

Oil sump to crankcase

M8 x 30		Tightening torque	24 Nm

Oil sump to crankcase

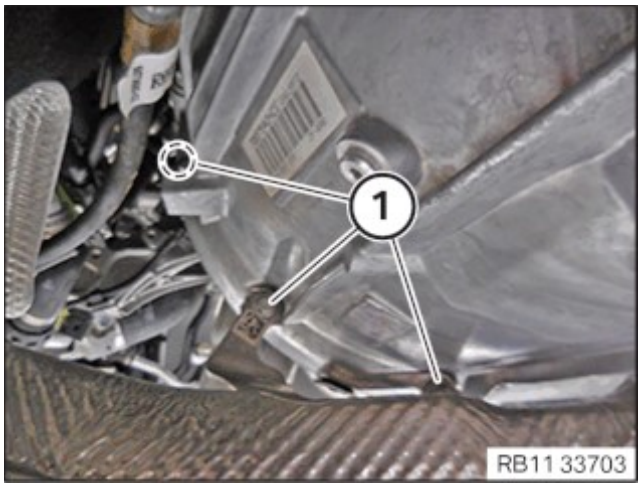
M8 x 110		Tightening torque	24 Nm

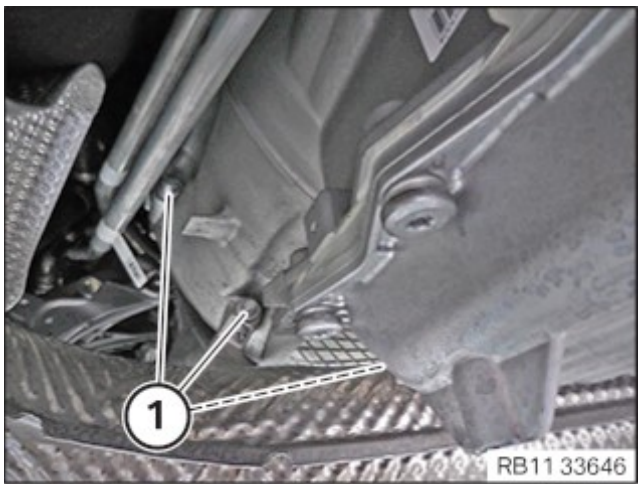
- **Version with manual transmission:**

  Tighten transmission screws (1).

Transmission to oil sump (manual gearbox and automatic transmission)

M8 x 50		Tightening torque	19 Nm



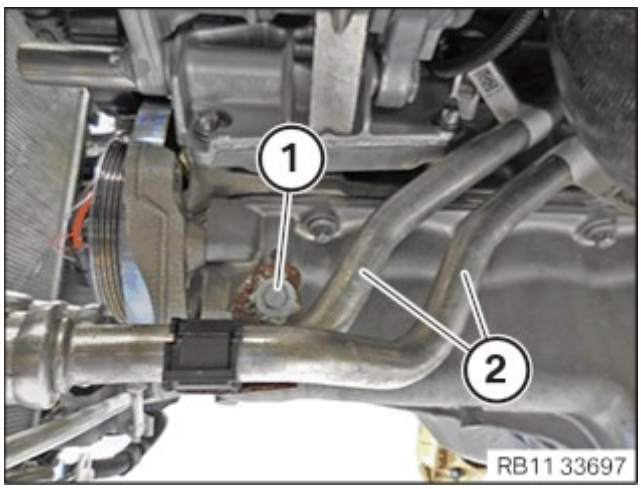


- **Version with automatic transmission:**

  Tighten transmission screws (1).

Transmission to oil sump (manual gearbox and automatic transmission)

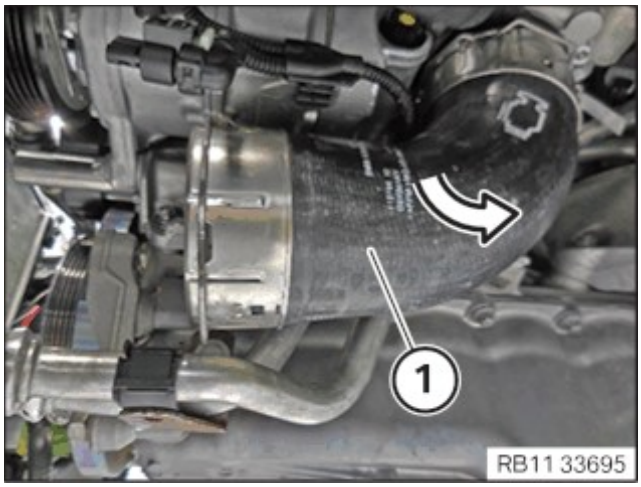
M8 x 50		Tightening torque	19 Nm



- Feed in and position the engine oil pipes (2).
- Tighten down screw (1).

Standard screw connection M6

M6		Tightening torque	8 Nm



- Position the charge air duct (1) in **the direction of arrow**.
- Insert and position the holders (3).

- Tighten the screws (1).

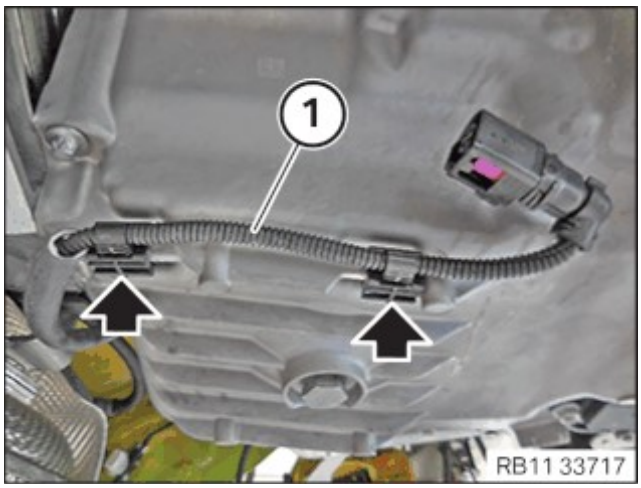
Holder for deflecting element to oil sump

M6		Tightening torque	10 Nm

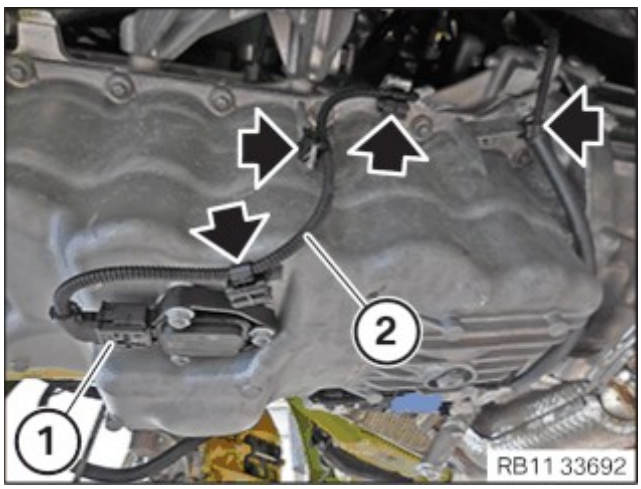
- Tighten spacer (2).

Holder for deflecting element to oil sump

M6		Tightening torque	10 Nm

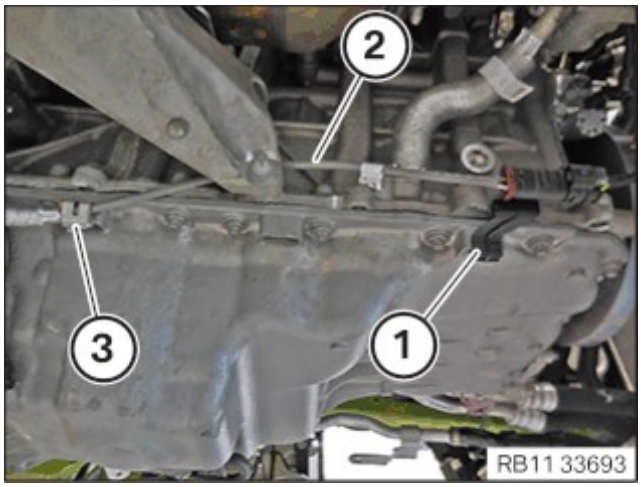


- Feed in and position the wiring harness section (1) for the **sensor system 1**.
- Secure the clamps (arrows).



- Guide in wiring harness section (2) for **sensor system 1** and position it.
- Secure the clamps (arrows).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



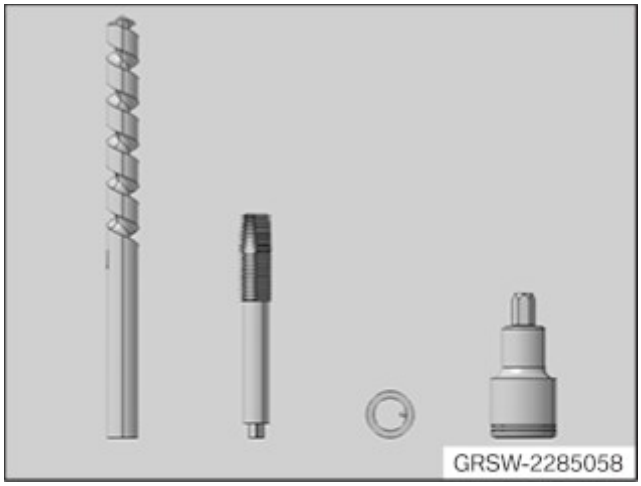
- Fasten the cable (2) to the clamp (3).
- Secure the clamp (1).

69–Installing the flywheel

TECHNICAL INFORMATION

Clean all threads with a screw tap.

- Clean all the screw threads (1).

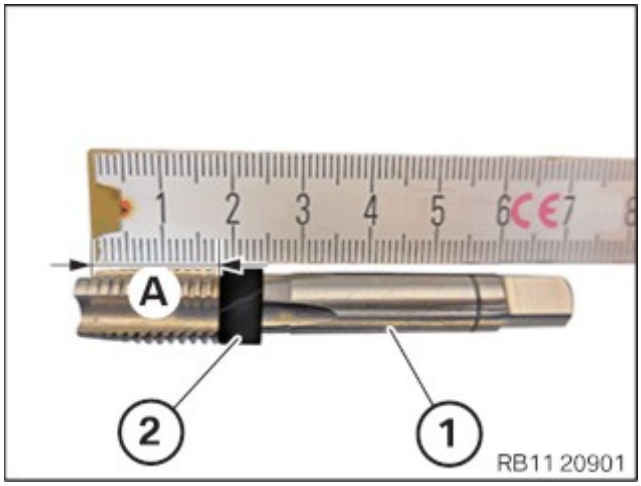


- Use the set of special tools **2 285 058**.

Description
Twist drill
Thread cutter M12x1.5
Depth
Insertion tool

- Assemble tool set.

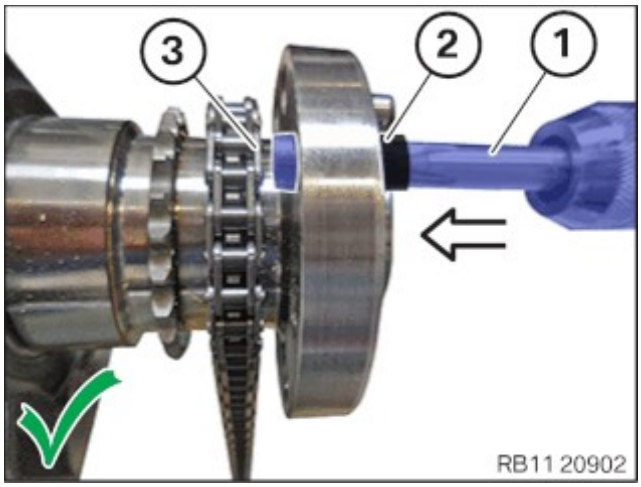
Number	Description
1	Tool holder
2	Thread cutter M12X1,5



- Mark insertion depth (A) on thread cutter (1) from set of special tools **2 285 058** with a standard tool (2).

Screw-in depth of thread cutter

Screw-in depth	18 mm



NOTICE

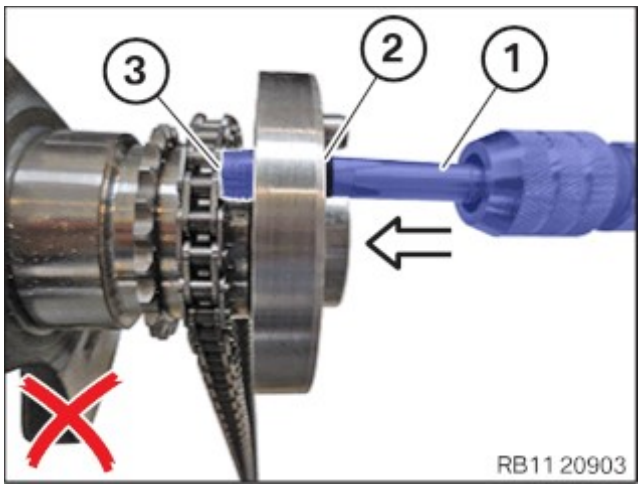
To provide a better overview: Shown with engine removed.

- Screw in the thread cutter (1) from set of special tools **2 285 058** in direction of arrow up to insertion depth (2).

Screw-in depth of thread cutter

Screw-in depth	18 mm

- Make sure that the thread cutter does (1) **not** rest on the timing chain (3).

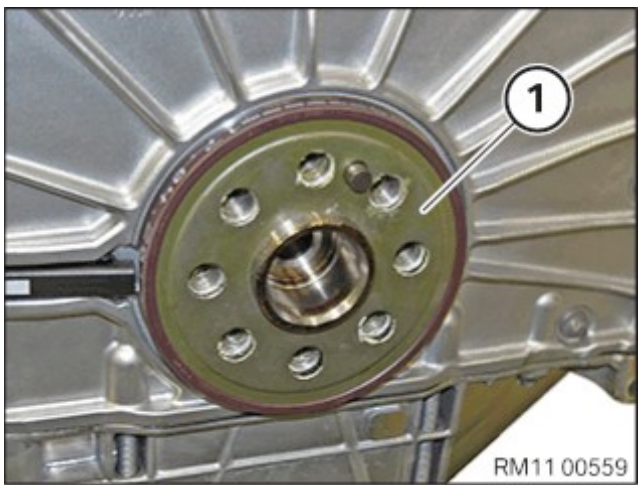


TECHNICAL INFORMATION

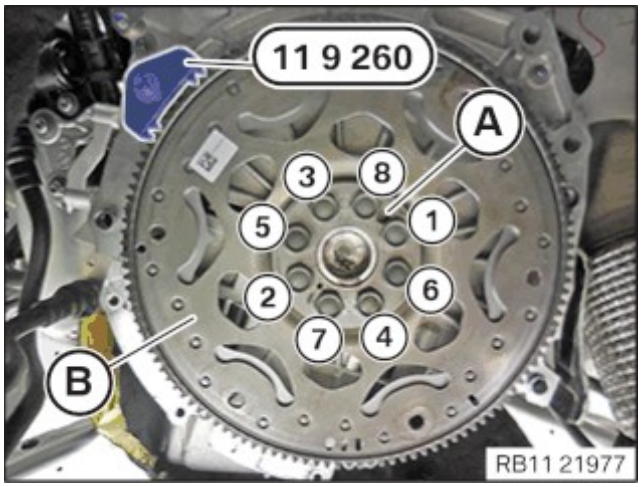
- **Carefully** handle the timing chain, to protect the timing chain and timing chain drive against damage.

- Do not exceed insertion depth (2) of screw tap (1).

  The thread cutter (1) may not rest on the timing chain (3).



- Note the installation position of the magnet wheel (1).
- Position the magnet wheel (1) on the crankshaft.



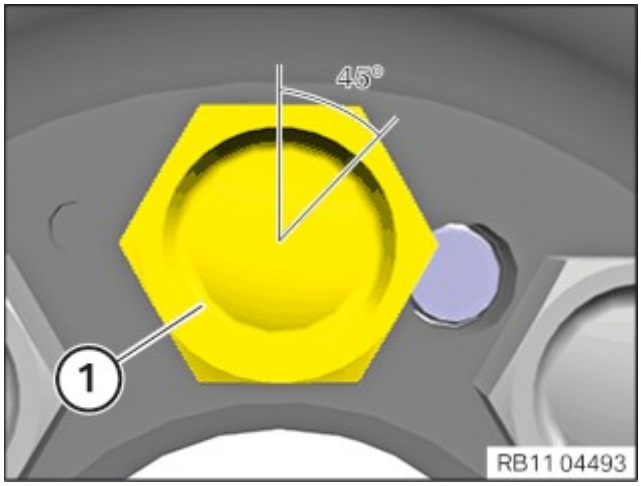
- Renew screws (1) to (8).

  Parts: Screws

- Position flywheel (B) .
- Screw in flywheel bolt (1) to (8) by hand.
- Fix the flywheel (B) with the special tool **0 494 034 (11 9 261)** and screw tightly using the special tool **0 494 130 (11 9 264)**.
- Make sure the tightening sequence starts at dowel pin (A).
- Tighten the flywheel bolts in the order (1) to (8) (note the angle of rotation in next step).

Flywheel to crankshaft

M12x1.5	Renew screws.	Tightening torque	45 Nm
		Angle of rotation	45 °



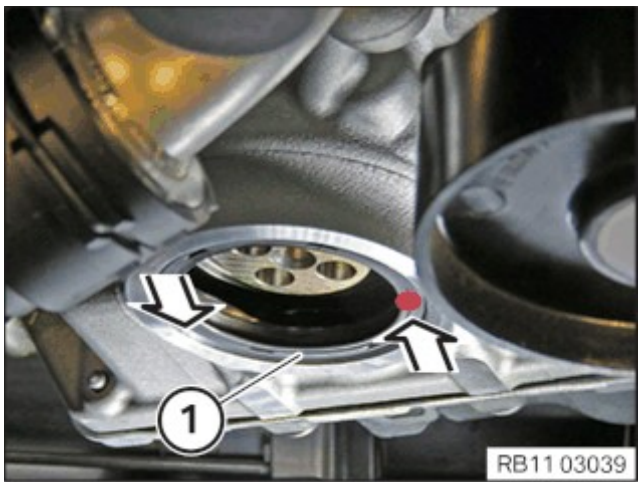
- Tighten all flywheel bolts (1) at an rotation angle of 45° using the special tool **0 490 504 (00 9 120)**.

Note: Mark all flywheel bolts (1) with a vertical line.

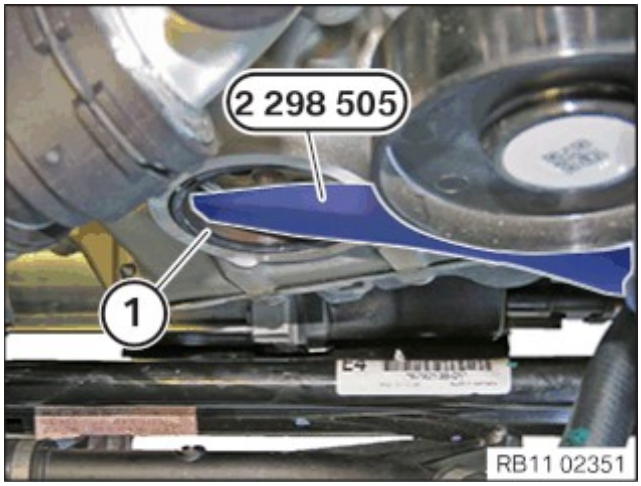
- Remove special tool **0 493 938 (11 9 260)**.

70–Replacing front crankshaft seal

▶ Removing the front crankshaft seal



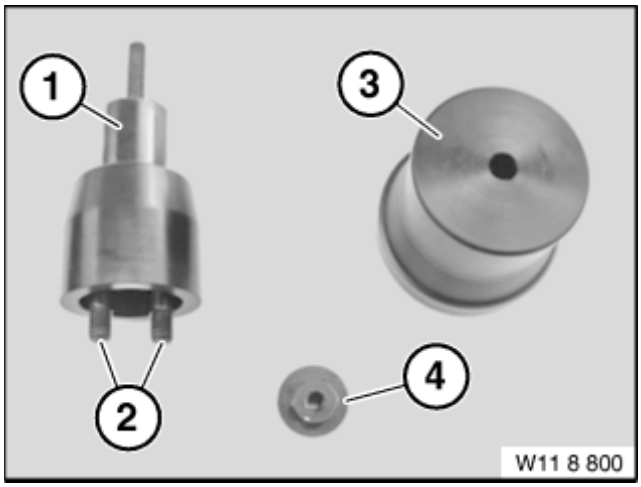
- Drive in the crankshaft seal (1) in the marked area with a punch to approx. 1 cm deep.



- Lever out the crankshaft seal (1) with the special tool **2 298 505**.
- Make sure that the sealing surface on the crankcase is **not** scratched.

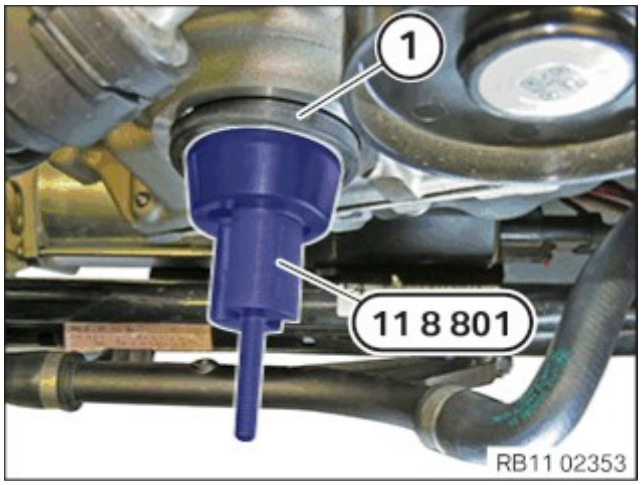
◀

▶ Installing the front crankshaft seal



- Prepare special tool **0 496 130 (11 8 803)**.

- Clean the special tool **0 496 128 (11 8 801)** from the set of special tools **0 496 127 (11 8 800)** and coat it with fresh engine oil.
- Secure special tool **0 496 128 (11 8 801)** using special tool **0 496 129 (11 8 802)** from the set of special tools **0 496 127 (11 8 800)** to the crankshaft.



RISK OF DAMAGE

Radial shaft seal damage.

Touching the sealing lip (inner) and applying oil to the radial shaft seal will lead to its destruction.

- Do not touch the sealing lip (inner) of the radial shaft seal.
- Do not apply oil to the radial shaft seal.
- Install the radial shaft seal dry.

- Carefully slide crankshaft sealing ring (1) straight **in a rotational movement** onto special tool **0 496 128 (11 8 801)** from the set of special tools **0 496 127 (11 8 800)** until the crankshaft sealing ring (1) rests against the crankcase.
- Mount special tool **0 496 130 (11 8 803)** on special tool **0 496 128 (11 8 801)** from the set of special tools **0 496 127 (11 8 800)** in the direction of the arrow.

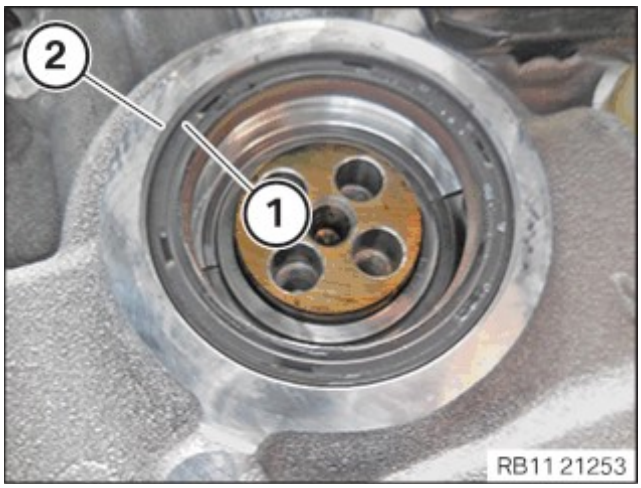
- Screw in special tool (sleeve) **0 496 130 (11 8 803)** using special tool **0 496 131 (11 8 804)** from the set of special tools **0 496 127 (11 8 800)** and a suitable tool until the sleeve rests flush against crankcase (1).

- Release and remove special tool **0 496 131 (11 8 804)**.

- Guide out and remove special tool **0 496 130 (11 8 803)** in the direction of the arrow from special tool **0 496 128 (11 8 801)** from the set of special tools **0 496 127 (11 8 800)**.

- Release special tool **0 496 129 (11 8 802)**.

- Guide out and remove special tool **0 496 128 (11 8 801)** I **0 496 129 (11 8 802)** on the crankshaft.



- Ensure that crankshaft sealing ring (1) is fitted correctly on crankcase (2).

◀

71–Installing the vibration damper

RISK OF DAMAGE

Radial shaft seal damage.

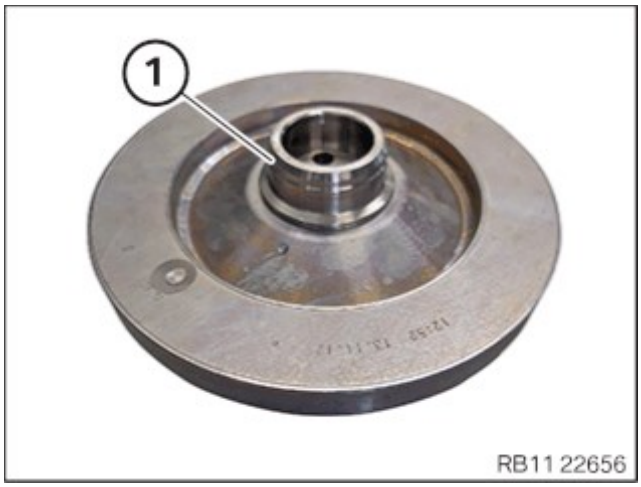
When installing the vibration damper, the rotary shaft seal can be damaged.

- The special tool must be used to install the vibration damper.

TECHNICAL INFORMATION

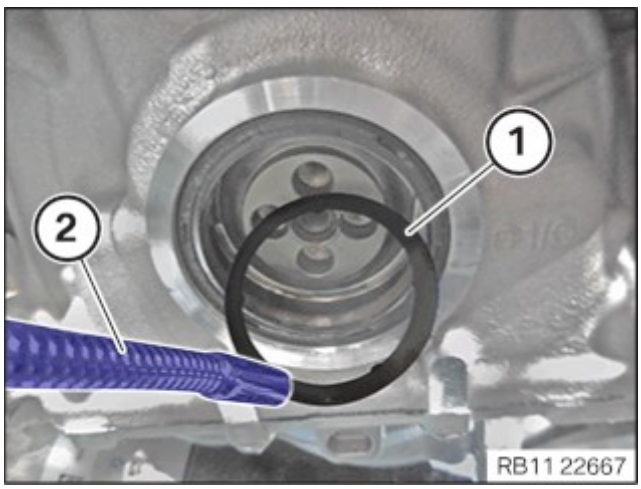
When removing and installing or replacing the vibration damper, the rotary shaft seal must be replaced.

- Clean the sealing surface (1) from oil and contamination.

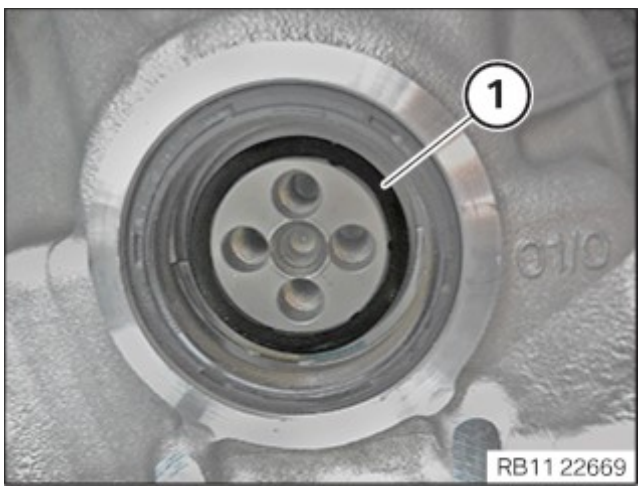


- Renew friction disc (1).

  Parts: Friction disc

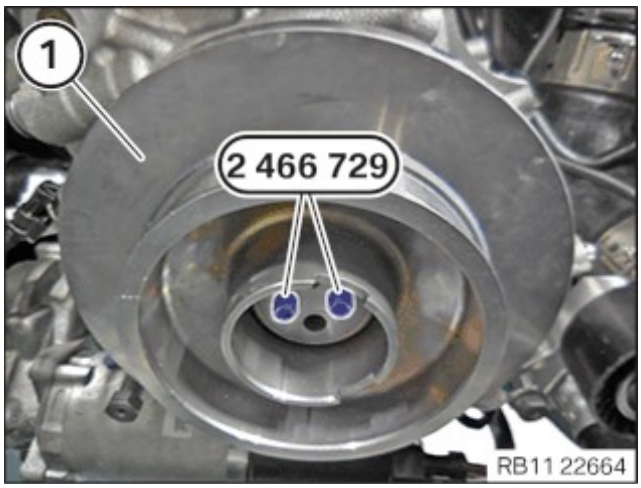


- Guide in friction disc (1) with a commercially available magnet (2) and install it.

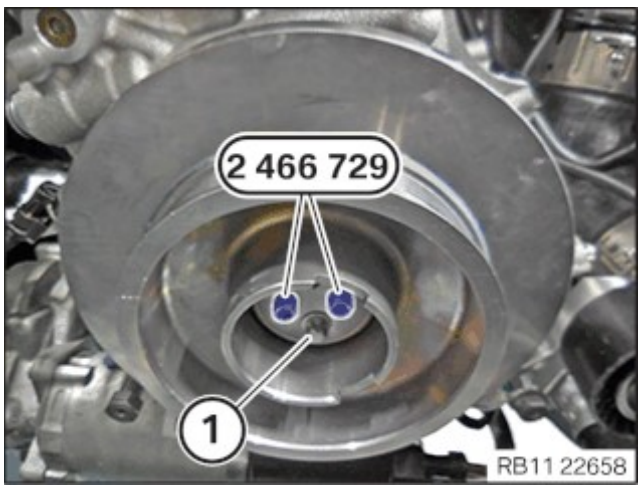


- Ensure that friction disc (1) is installed correctly.

- Screw special tool **2 466 729** into the crankshaft by hand.

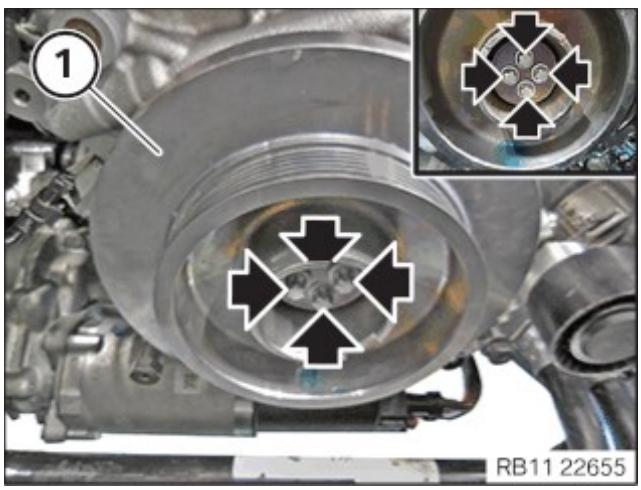


- Insert vibration damper (1) into the special tool **2 466 729** and install.



- Renew the screw (1).

  Parts: Screw
- Hand-tighten the bolt (1).
- Guide the special tool **2 466 729** out and remove.



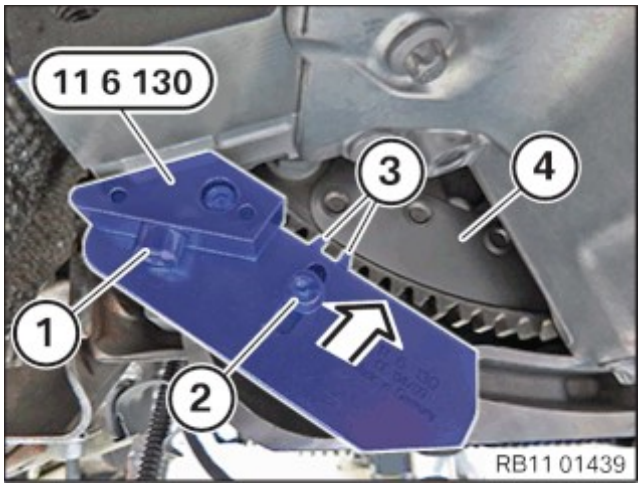
- Renew the bolts (arrows).

  Parts: Screws
- Tighten screws (arrows) on the vibration damper (1).

Vibration damper to crankshaft

M10 x 65	Renew screws.	Jointing torque	40 Nm
		Angle of rotation	120 °

- Loosen screw (2).



- Slide the counter support with the bolt (2) down until the teeth (3) are no longer engaged in the gearing of the flywheel (4).
- Release the screw (1) and feed out and remove special tool **0 496 595 (11 6 130)**.

72–Installing the component carrier

RISK OF DAMAGE

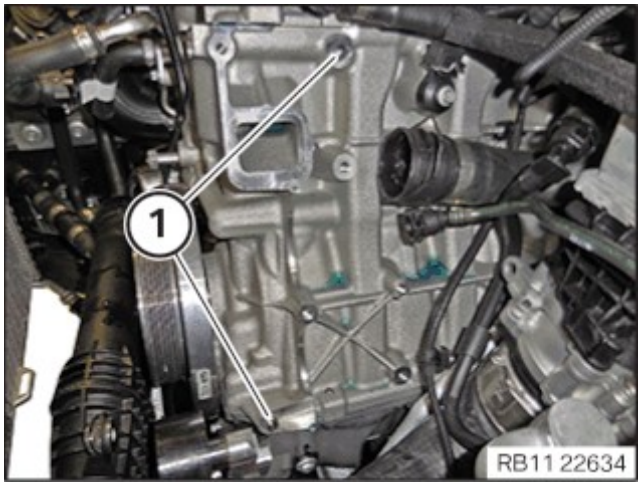
Damage to the surface.

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

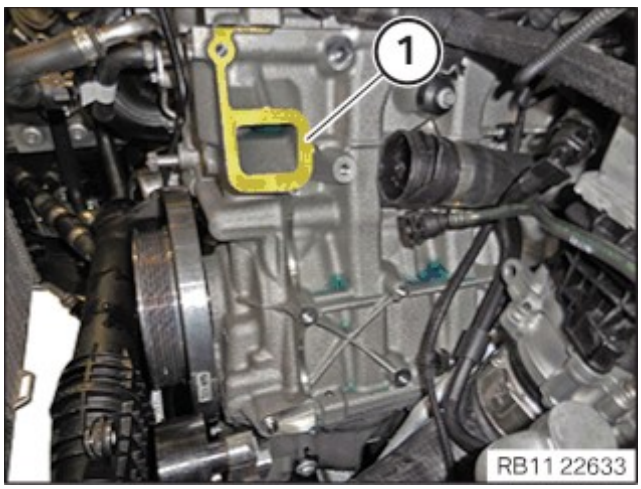
- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

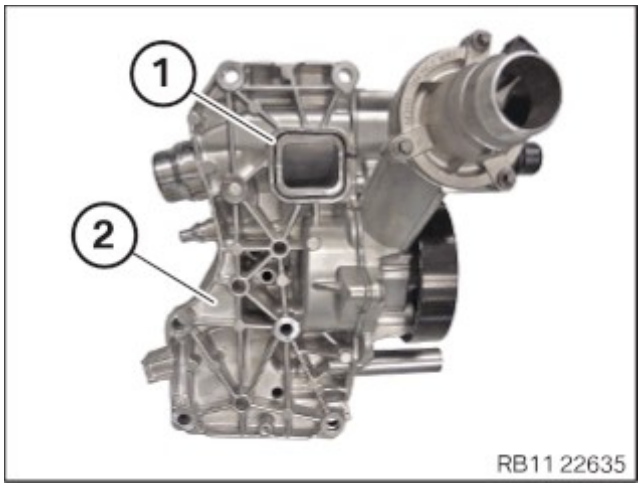
The sealing surfaces must be free from oils, grease and cleaning agents.



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

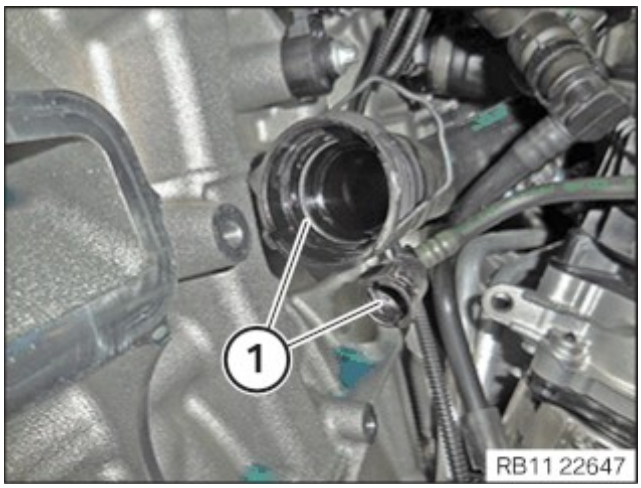


- Clean sealing surfaces (1) with special tool **0 495 102 (11 4 470)**.

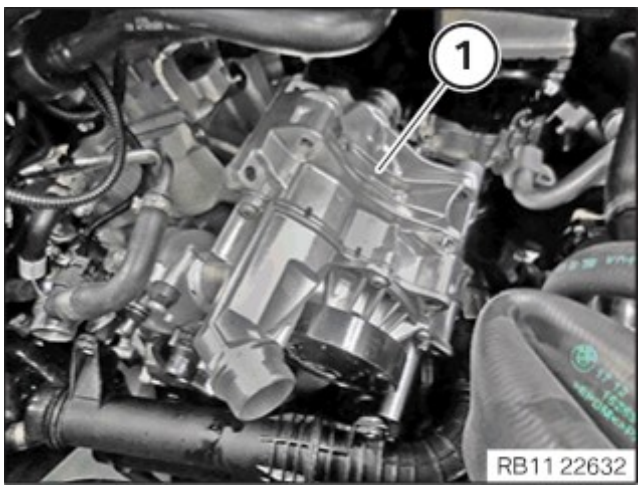


- Renew sealing ring (1) on component carrier (2).

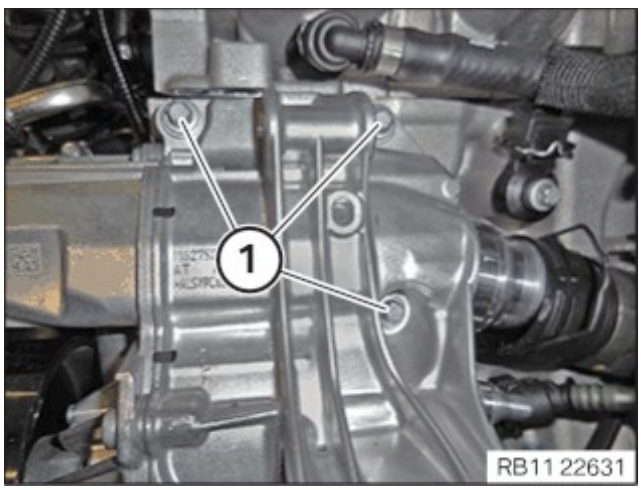
  Parts: Sealing ring



- Check sealing rings (1) for damage, renew coolant lines if necessary.

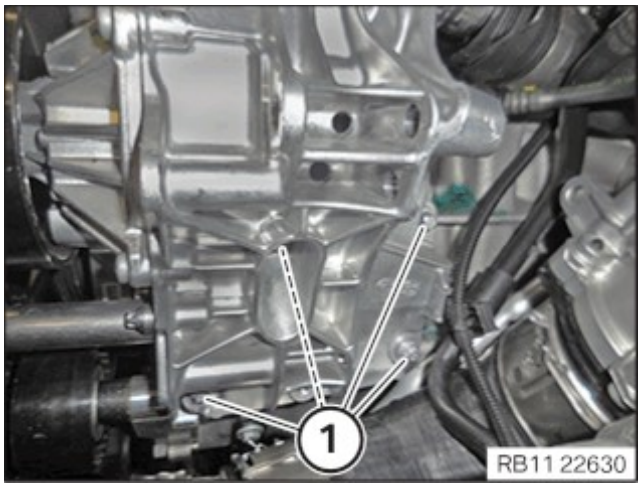


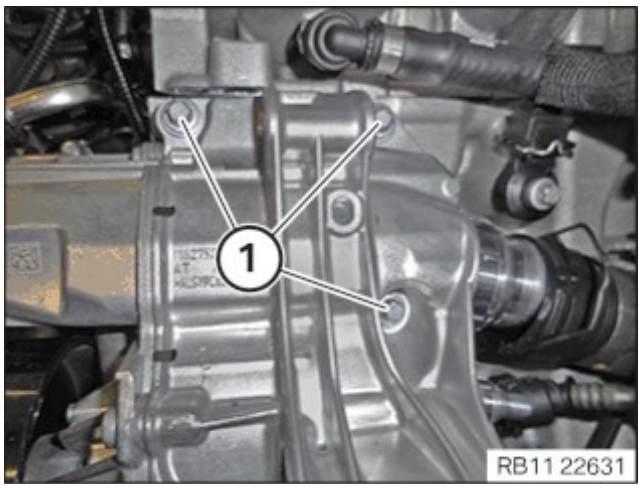
- Feed in and position component carrier (1).



- Hand-tighten the bolts (1).

- Hand-tighten the bolts (1).

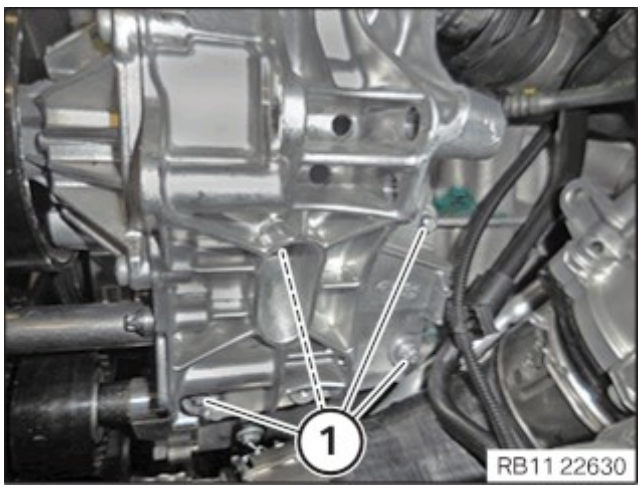




- Tighten the screws (1).

Coolant pump with component carrier on crankcase

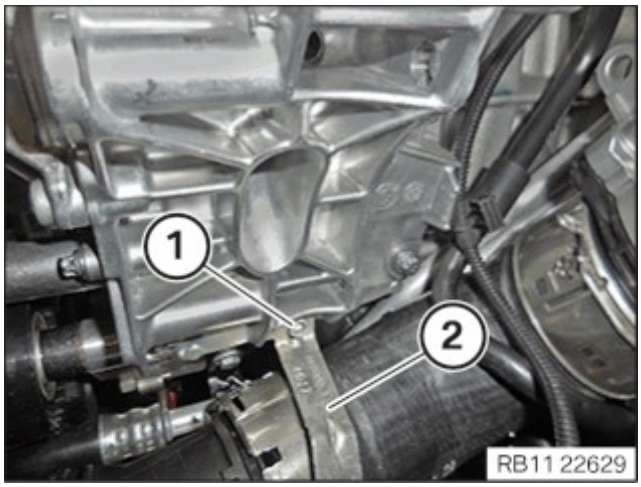
M8 x 35		Tightening torque	19 Nm



- Tighten the screws (1).

Coolant pump with component carrier on crankcase

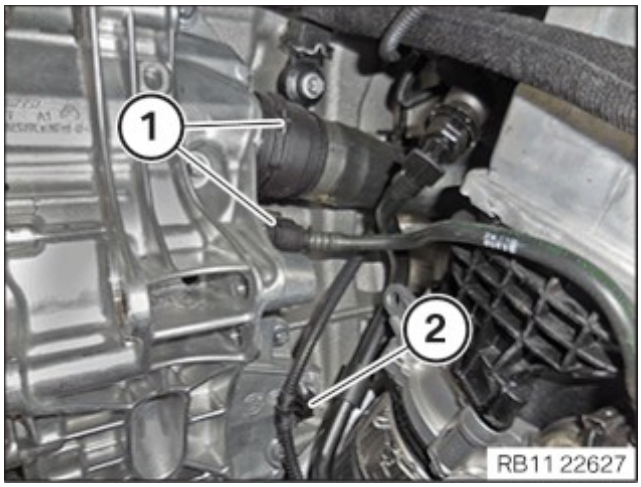
M8 x 35		Tightening torque	19 Nm



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

Standard screw connection M6

M6		Tightening torque	8 Nm



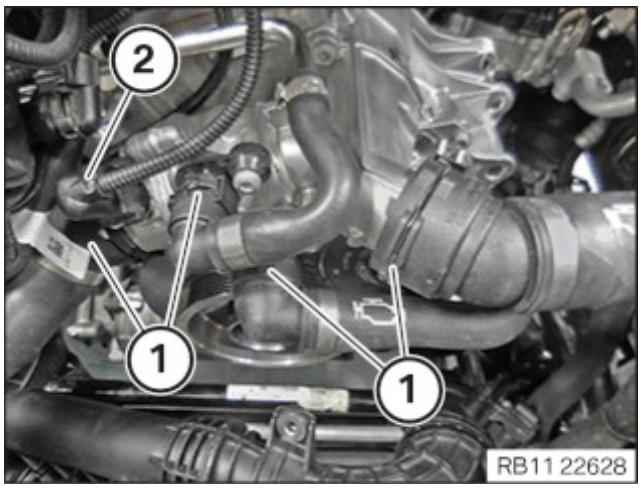
TECHNICAL INFORMATION

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

- Connect and lock coolant line (1).

  The coolant lines (1) must engage audibly.

- Secure the clamp (2).



TECHNICAL INFORMATION

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

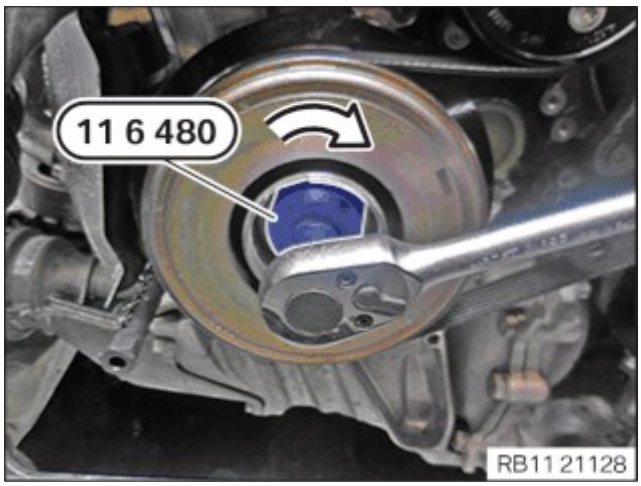
- Connect and lock coolant line (1).

  The coolant lines (1) must engage audibly.

- Connect connectors (2) and lock.

  The connector (2) must engage audibly.

73–Blocking the crankshaft in the TDC firing position of cylinder 1



RISK OF DAMAGE

Damage to the engine.

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

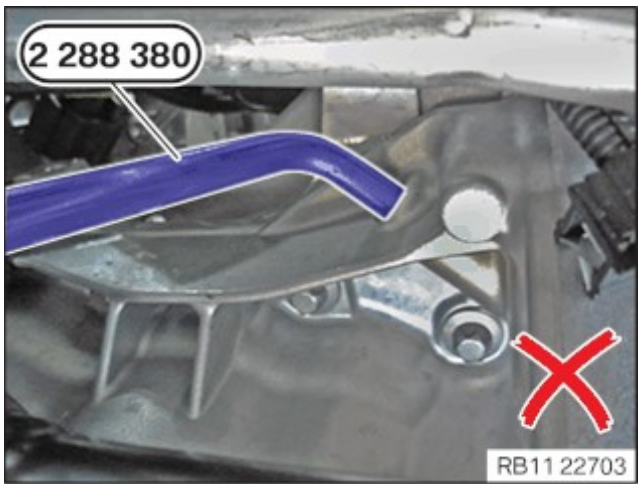
- Turn the combustion engine exclusively by hand in the correct direction of rotation: a) Clockwise, facing the vibration damper or b) Anticlockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

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

- **Vehicles with automatic transmission:**

  Insert special tool **2 288 380** into the dowel hole up to dimension (X).

  Dimensions (X) = 66 mm



- **Vehicles with automatic transmission:**

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

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

- **Vehicles with automatic transmission:**

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

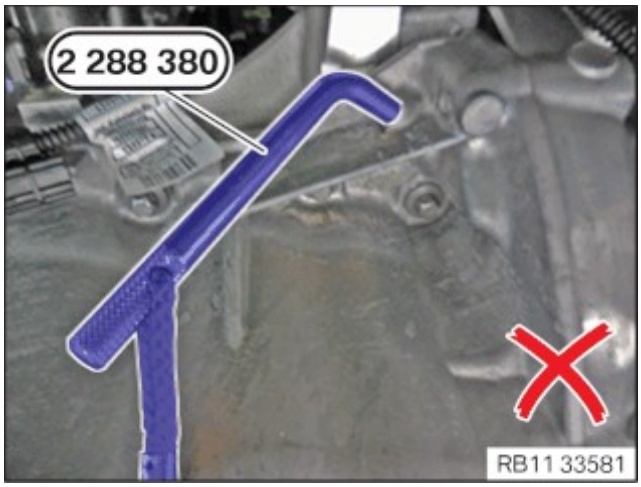
  Engine **is situated** in the TDC firing position of cylinder 1.

- **Vehicles with manual gearbox:**

  Insert special tool **2 288 380** into the dowel hole up to dimension (X).

  Dimension (X) = 61 mm

- **Vehicles with manual gearbox:**



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

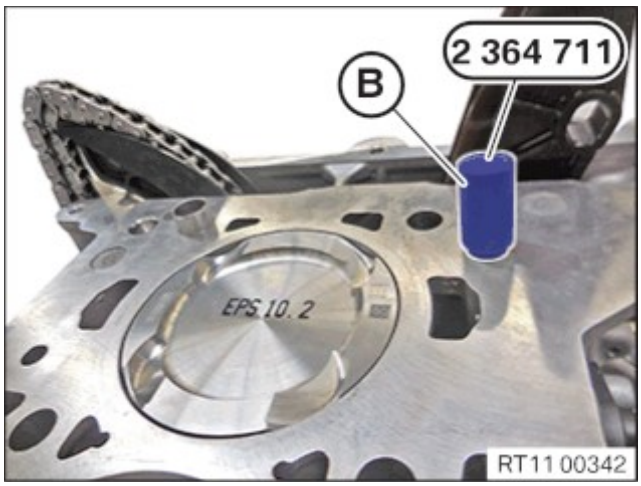
TDC firing position of cylinder 1 **not** reached.

- **Vehicles with manual gearbox:**

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

  Engine **is situated** in the TDC firing position of cylinder 1.

74–Sealing the oil duct



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

75–Clean sealing surfaces

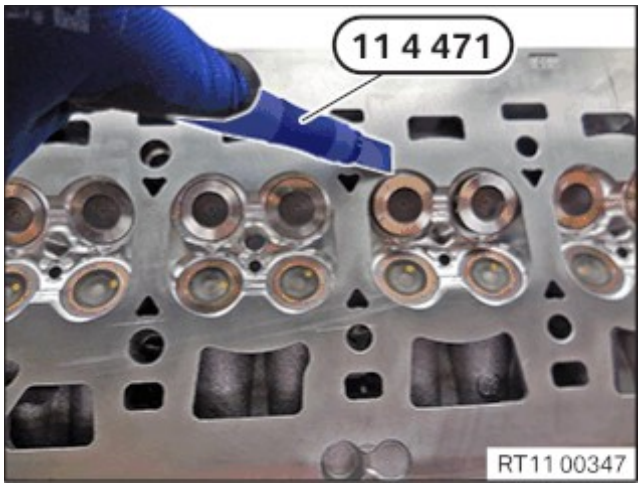
RISK OF DAMAGE

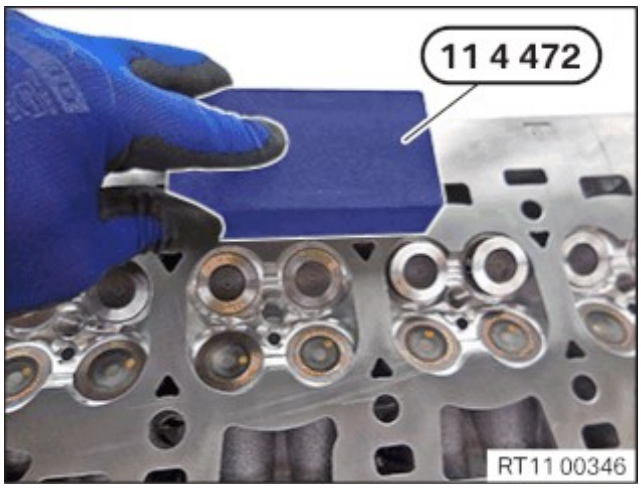
Damage to the surface.

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

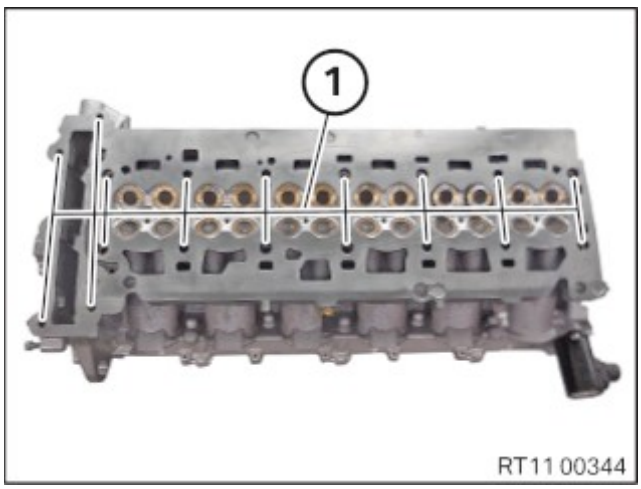
- Do not use any metal-cutting tools.

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





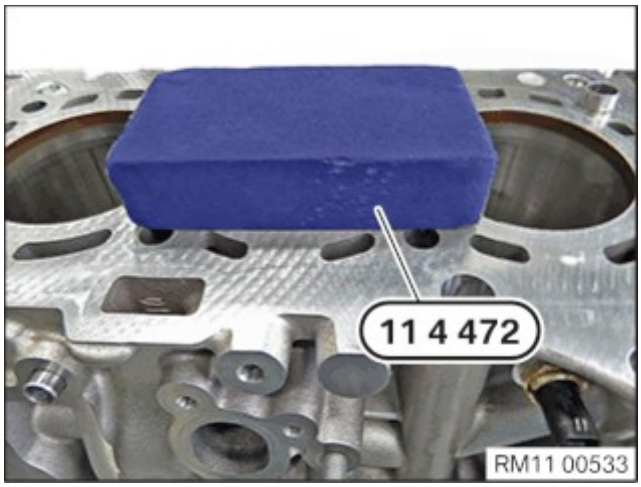
- Remove fine residues from the sealing surfaces of the cylinder head using special tool **0 495 104 (11 4 472)**.



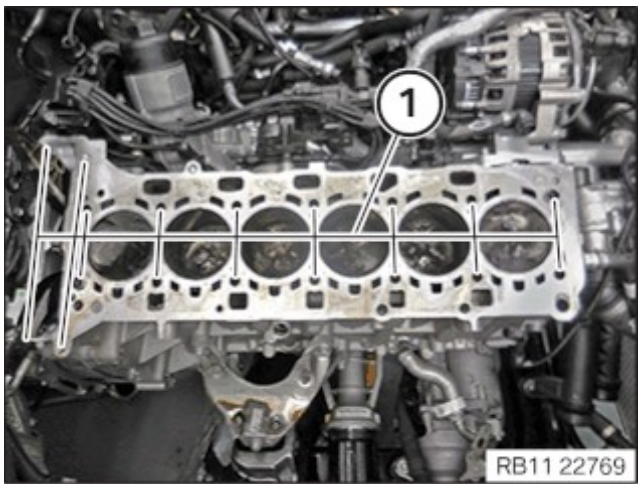
- Clean all blind holes (1) of the cylinder head.

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

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



- Clean all blind holes of the crankcase.



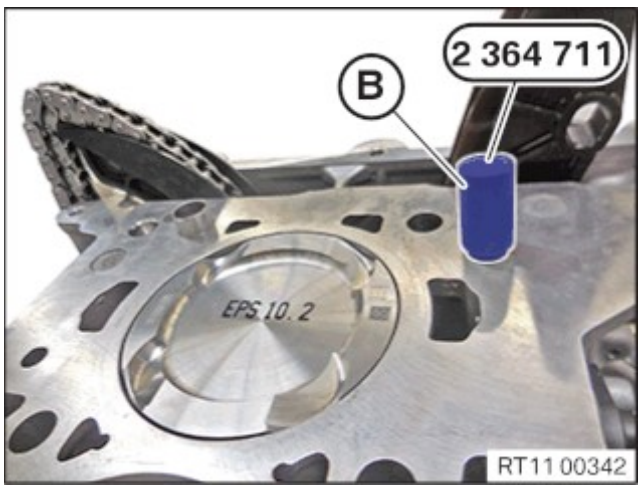
⚠ CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

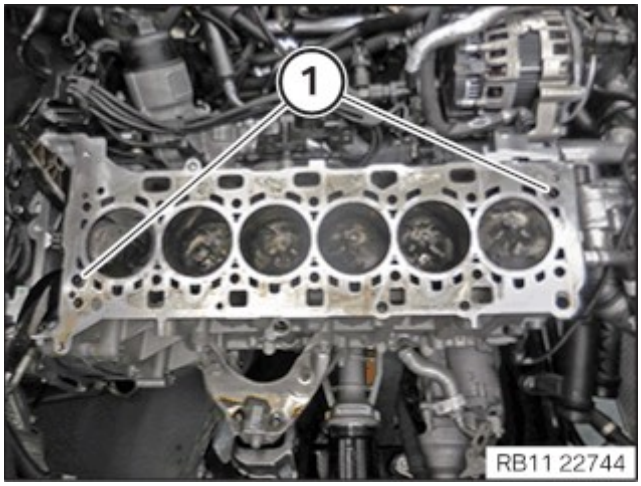
- Collect dirt particles, e.g. when blowing out, use cloth to do so.
- Wear safety goggles.

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

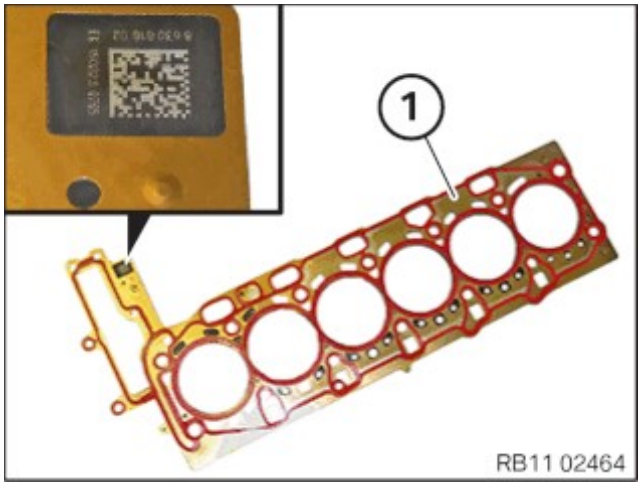


- Remove special tool (B) contained in the set of special tools **2 364 711**.

76–Installing the cylinder head gasket



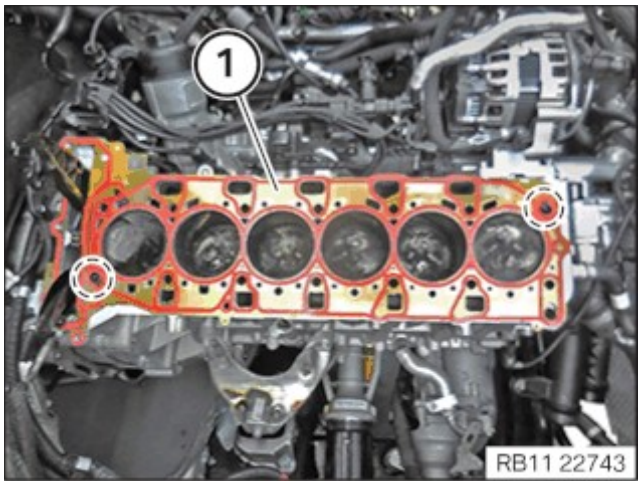
- Check the fitting sleeves (1) for damage and renew if necessary.



- Renew cylinder head gasket (1).

  Parts: Cylinder head gasket

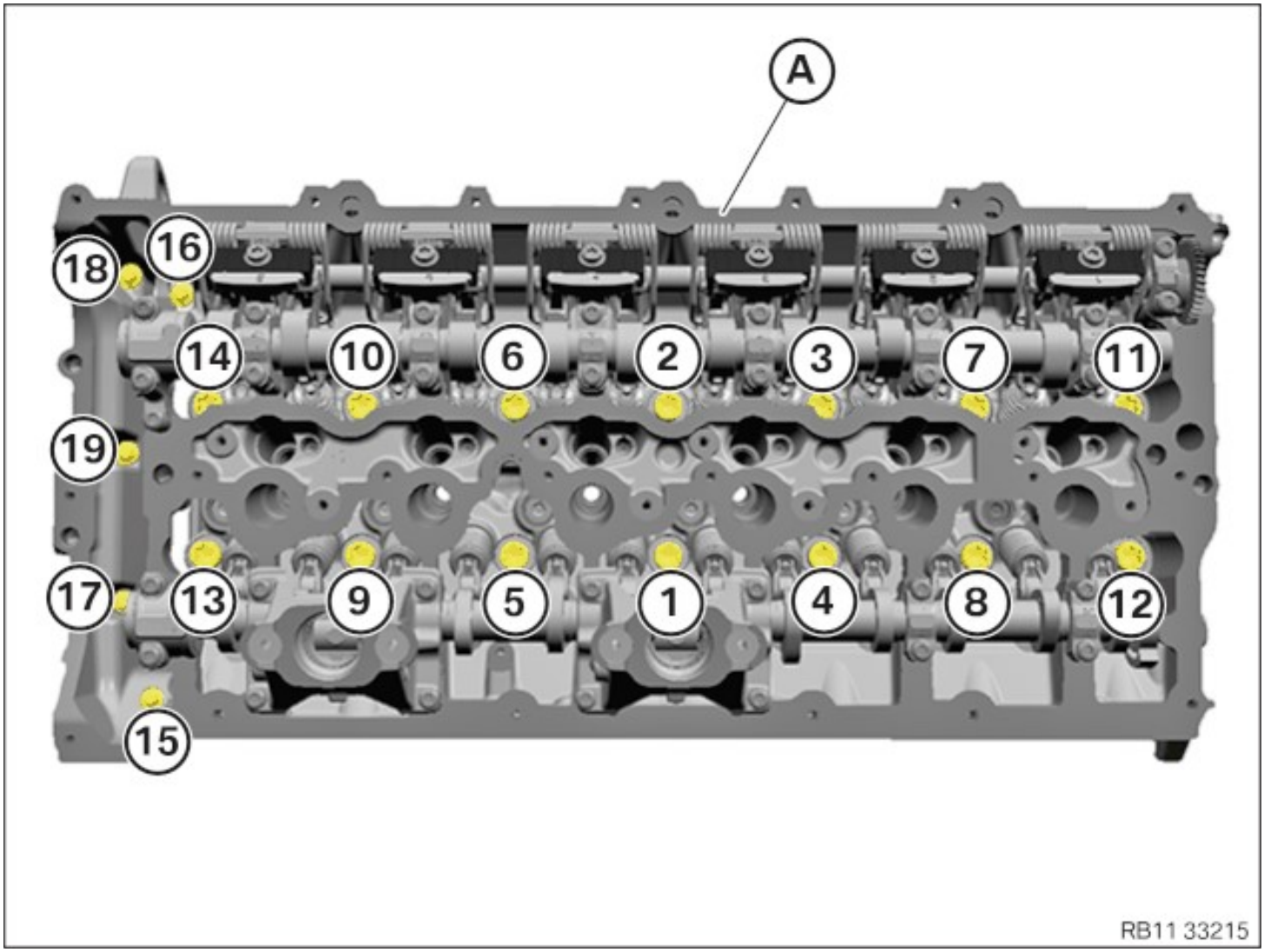
- Check cylinder head gasket (1) using the part number.



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

77–Installing the cylinder head

Bolts of the cylinder head



1 - 19 Bolts of the cylinder head

A 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.

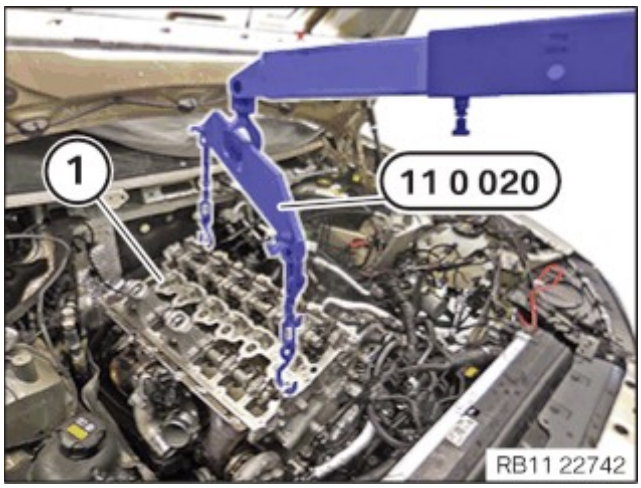
- Dry threaded holes (e.g. using compressed air).

i 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.



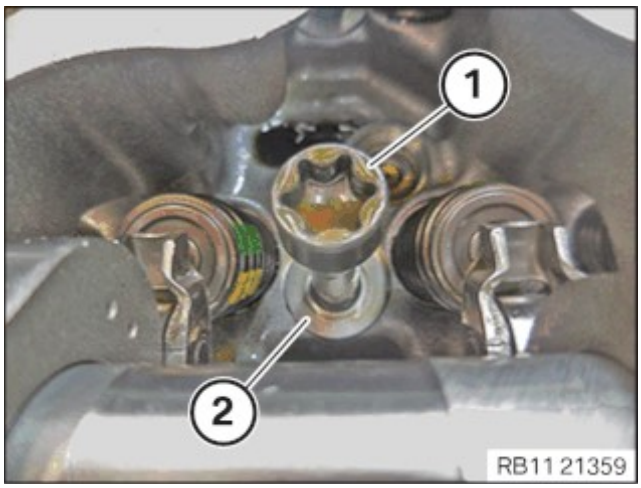
RISK OF DAMAGE

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.

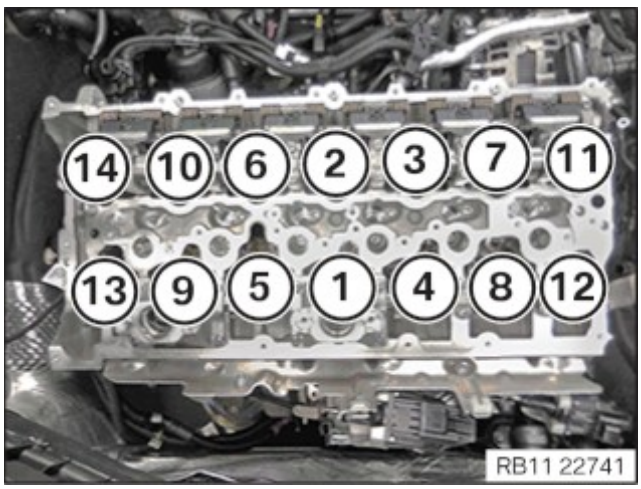
- Guide in, position and install cylinder head (1) and the exhaust turbocharger with the help of an auxiliary person, the workshop crane and special tool **0 490 567 (11 0 020)**.
- Ensure that the **guide rails** of the timing chain are **not** damaged.



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

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

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



TECHNICAL INFORMATION

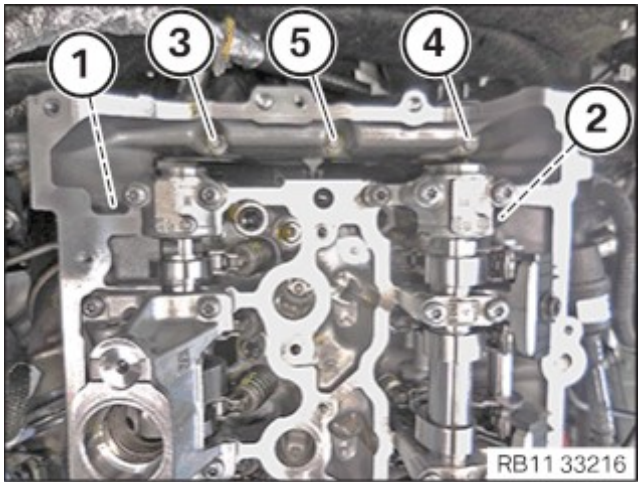
When assembling, it is essential to observe screwing sequences and tightening torques.

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

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

Cylinder head to crankcase

M11X188 13.9	Observe tightening sequence. Fit new cylinder head screws.	1. Tightening torque 2. Angle of rotation 3. Angle of rotation	50 Nm 180 ° 180 °

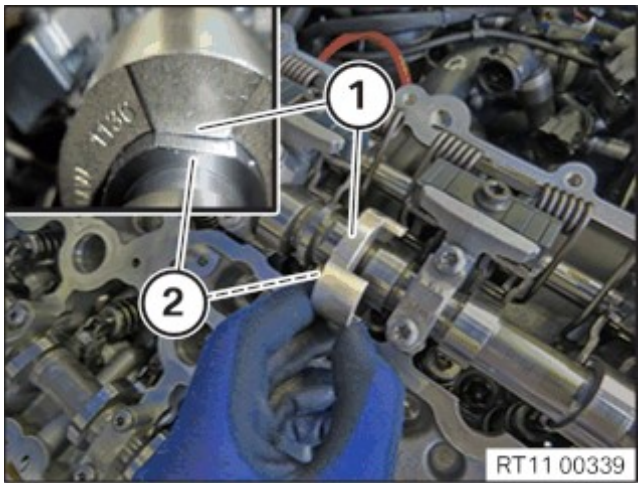


- Renew cylinder head bolts (1) to (5).

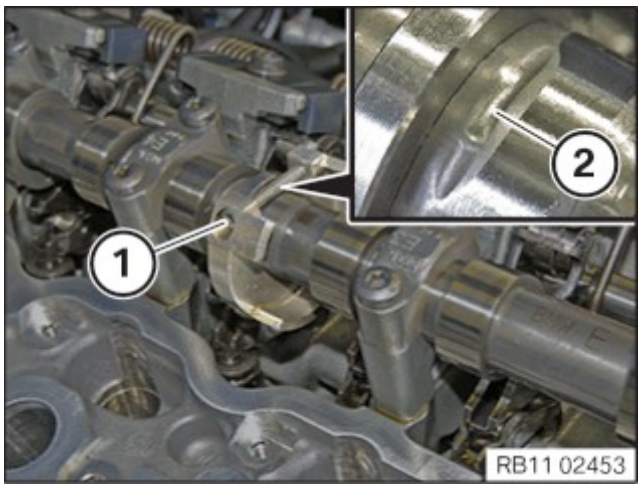
  Parts: Cylinder head bolts
- Make sure that there is **no** coolant, water or engine oil in the threaded holes of the timing case cover.
- Screw in cylinder head bolts (1) to (5).
- Tighten the cylinder head bolts in the order (1) to (5).

Cylinder head bolt to timing case cover

M8x40	Renew screws.	Tightening torque	19 Nm



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



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

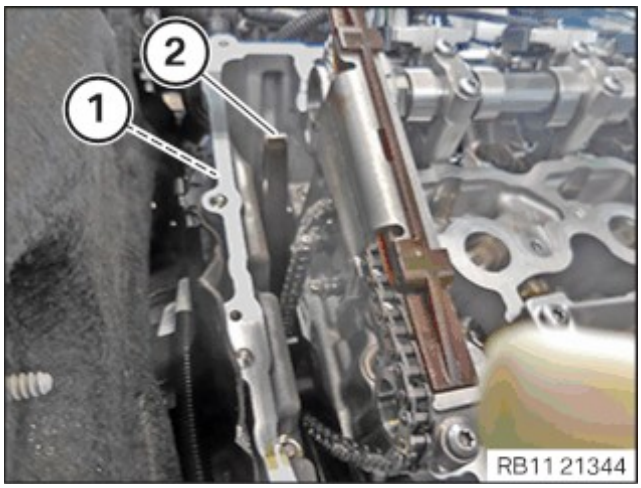
  The recess (2) must point upwards.
- Tighten down screw (1).

Camshaft sensor wheel to intake camshaft

M4 x35		4,5 Nm

- Renew bearing journal (1).

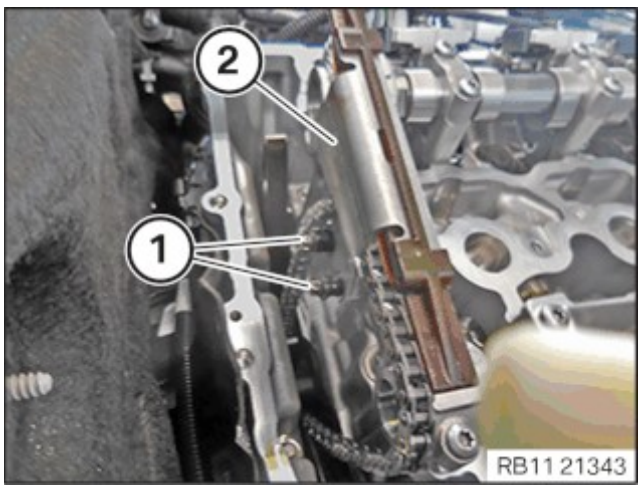
  Parts: Bearing journal



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

Bearing journal to cylinder head

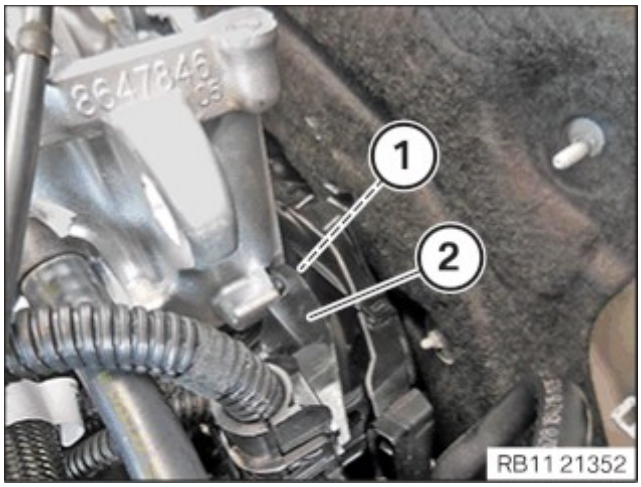
Bearing journal	Renew the bearing journal!	Tightening torque	22 Nm



- 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.

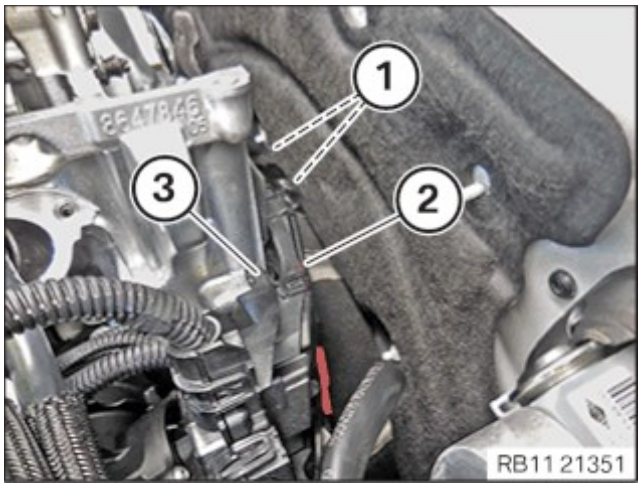
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- 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.

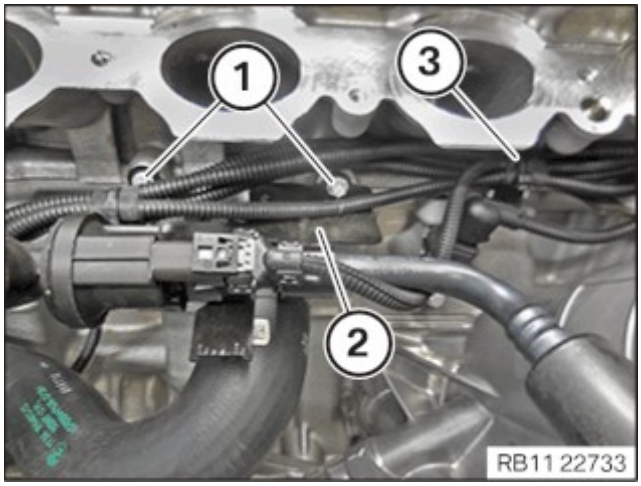
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- 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



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

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

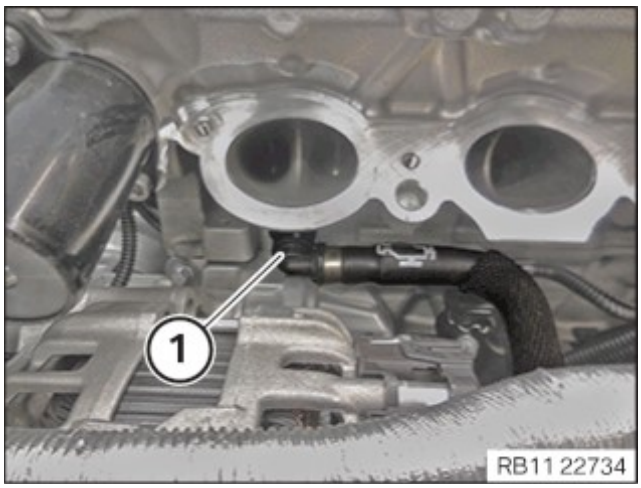
- Route all cables without abrasions, do not trap and crush.

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

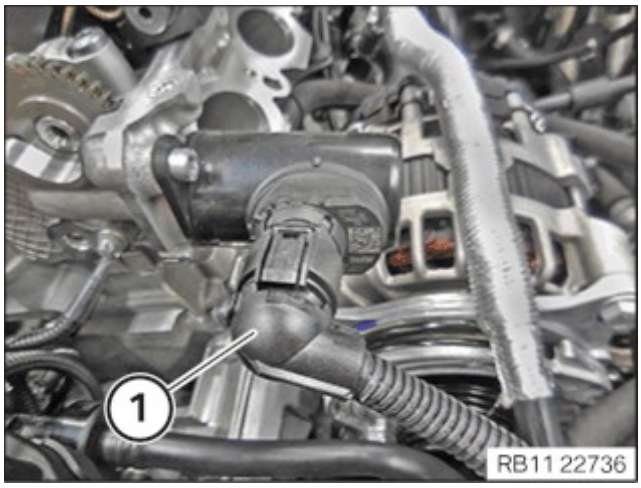
Holder for tank vent valve on crankcase

M6X16		Tightening torque	8 Nm

- Secure clamps (3).

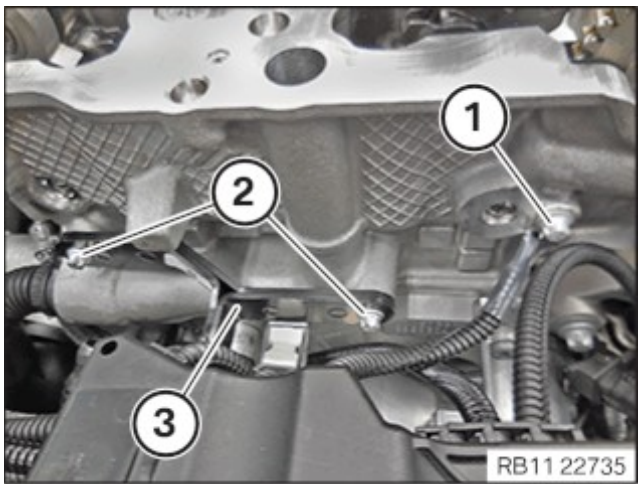


- Connect and lock coolant line (1).
- Make sure that the cooling line (1) engages audibly.



- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



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

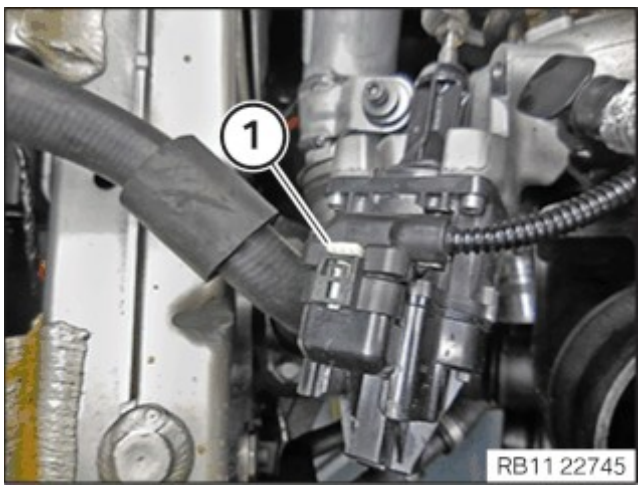
Auxiliary coolant pump holder to cylinder head

M6		Tightening torque	8 Nm

- Tighten down screw (1).

Grounding cable on cylinder head

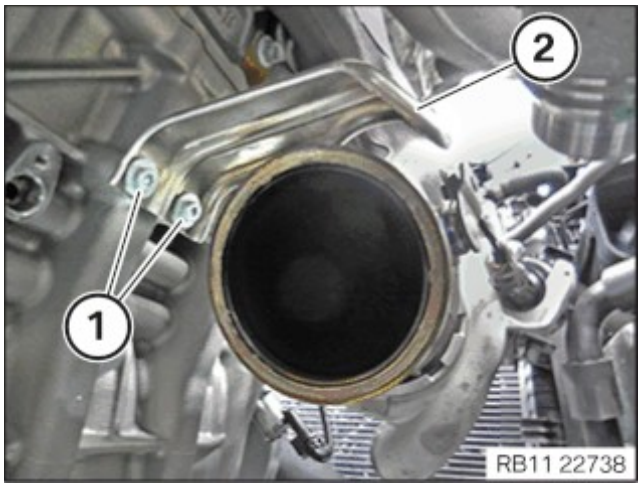
M6 x 16		8 Nm



- Connect connectors (1) and lock.

  The connector (1) must engage 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.
- Insert and position the holders (2).



- Tighten the screws (1).

Holder for heat shield on crankcase

M6X16		Tightening torque	8 Nm

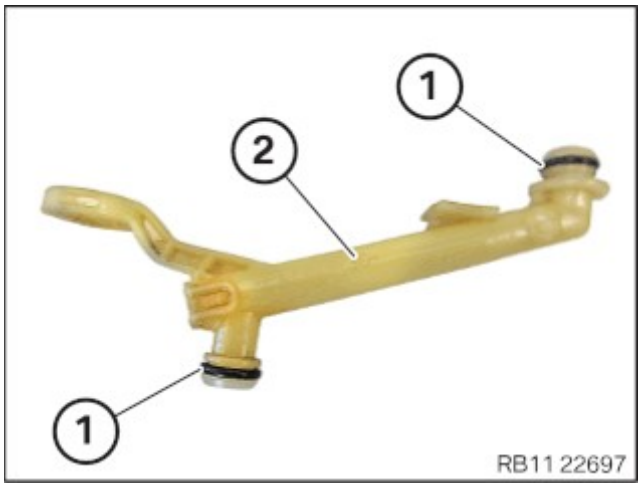
78–Installing the oil return line in the cylinder head

RISK OF DAMAGE

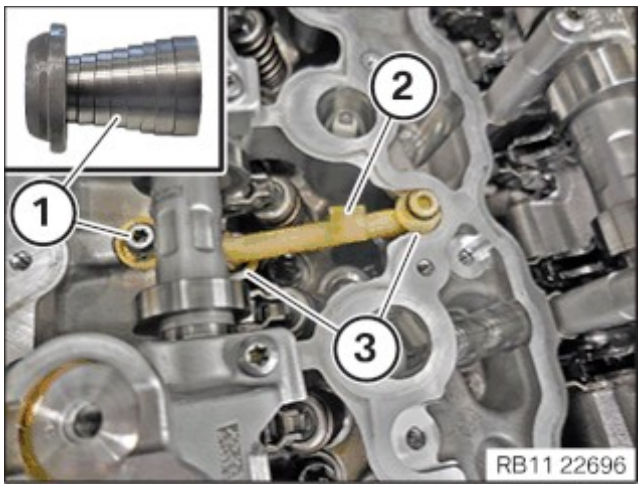
Contaminant or foreign body.

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.



- Check sealing rings (1) for damage and, if necessary, renew oil return line (2).



- Guide oil return line (2) into the cylinder head (3) and install it.
- Tighten down screw (1).

Oil return line in the cylinder head

M6X15		Tightening torque	6 Nm

79–Adjust the camshafts with the special tool

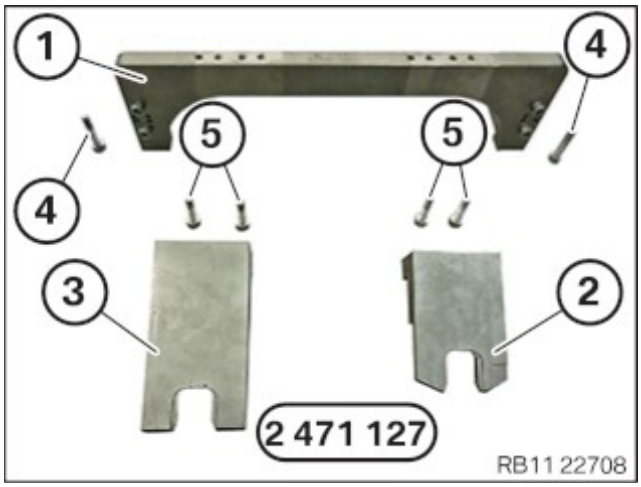
Additional information is available.

TECHNICAL INFORMATION

Alternative to the new special tool **SWZ: 2 471 127**, the already known special tool **SWZ: 2 456 372 can be used** in modified form.

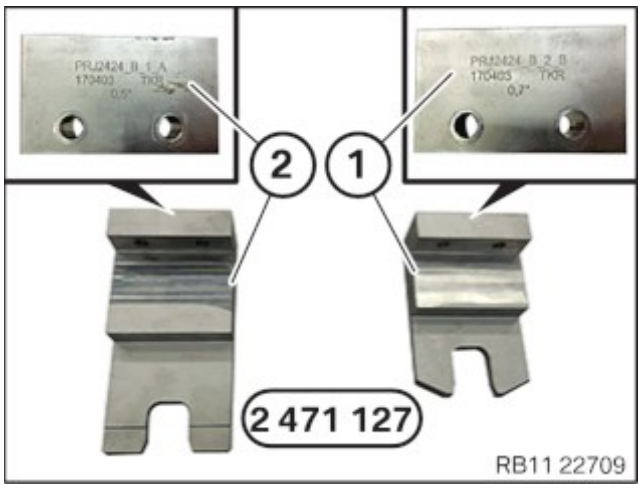
Information on modification can be found in the further information.

The modified special tool is downwards compatible.

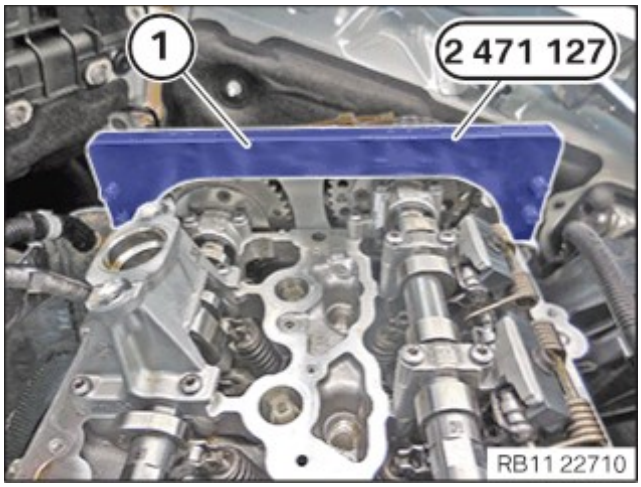


- Keep set of special tools **2 471 127** at hand:

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



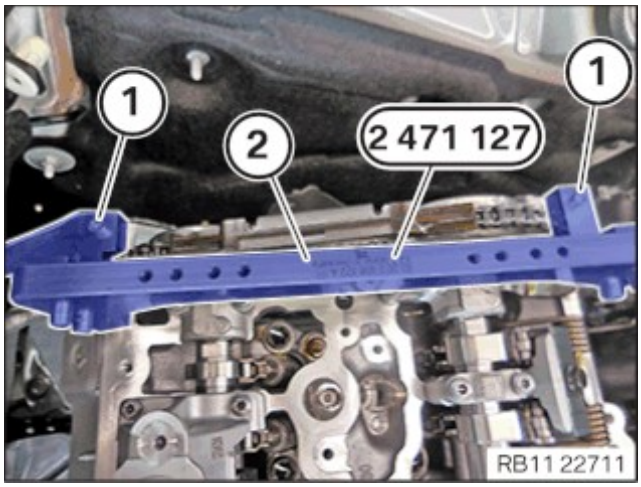
- Use the 0.7° setting gauge(1) from the set of special tools **2 471 127** to adjust **intake camshaft** .
- Use the 0.5° setting gauge(2) from the set of special tools **2 471 127** to adjust **exhaust camshaft** .

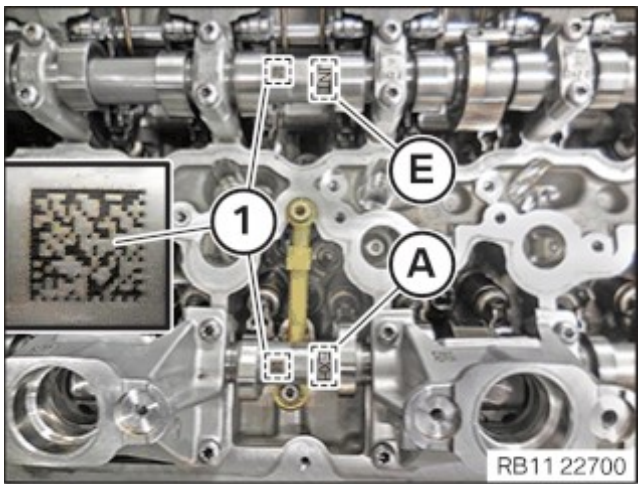


- Position basic carrier (1) from the set of special tools **2 471 127** on the cylinder head.
- Tighten screws (1) from the set of special tools **2 471 127** on basic carrier (2).

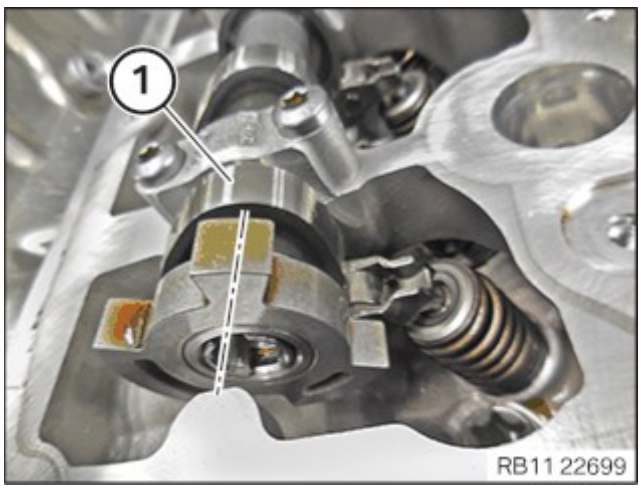
Basic carrier to cylinder head

M6		Tightening torque	8 Nm

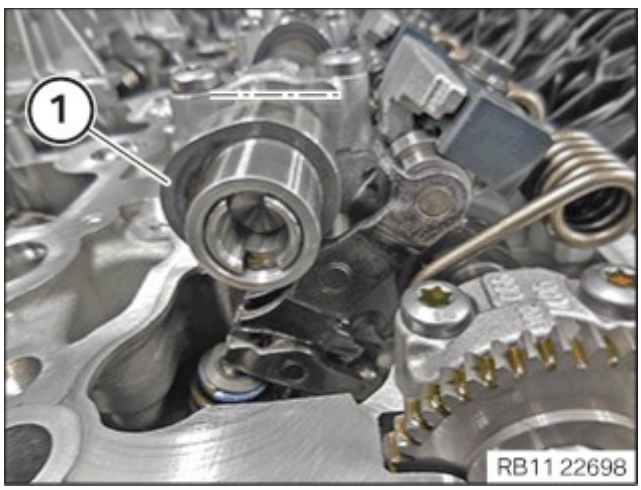




- Turn the intake camshaft (E) and the exhaust camshaft (A) such that the marks (1) can be read from the top.

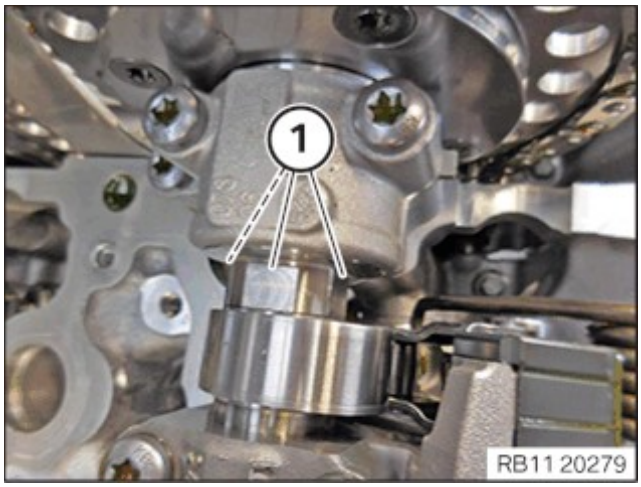


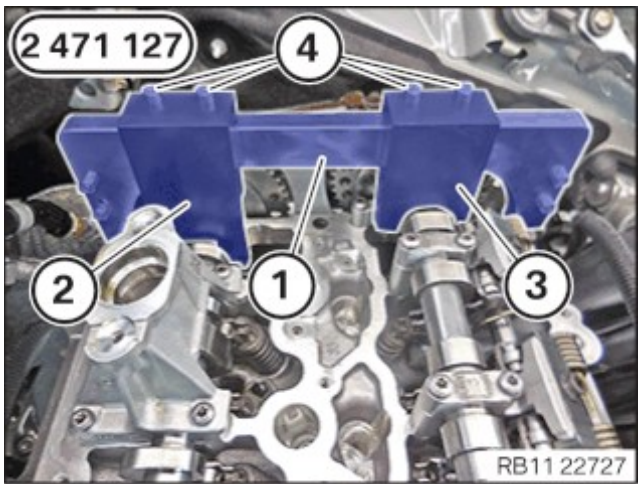
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



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

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





- Position the 0.5° setting gauge(2) from the set of special tools **2 471 127** between the exhaust camshaft and basic carrier (1) from the set of special tools **2 471 127**.
- Position the 0.7° setting gauge(3) from the set of special tools **2 471 127** between the intake camshaft and basic carrier (1) from the set of special tools **2 471 127**.
- Tighten the screws (4).

Test gauge to basic carrier

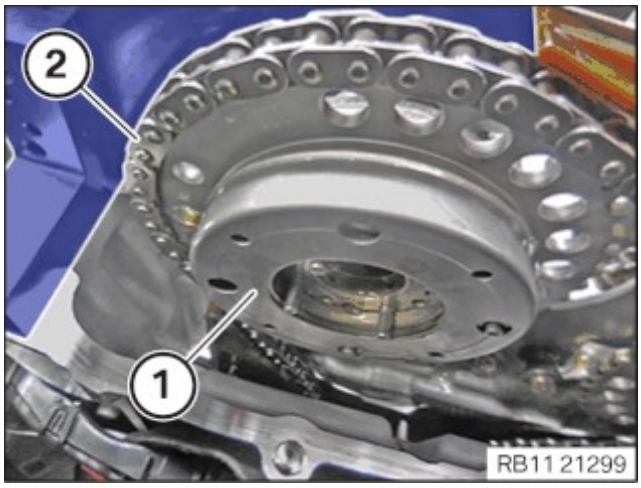
M6		Tightening torque	8 Nm

80–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 .

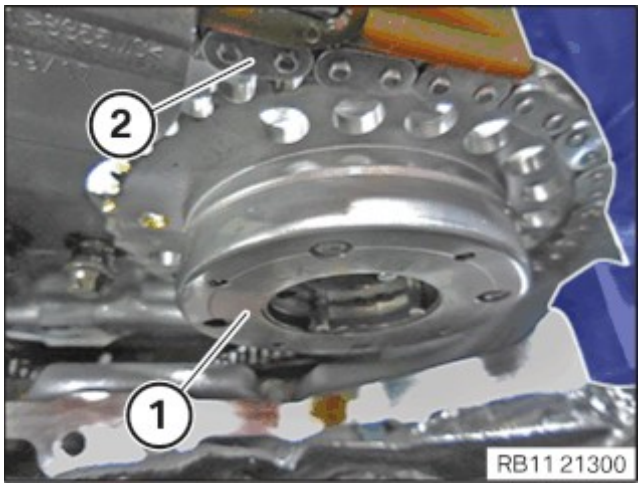


81–Install exhaust camshaft adjuster

NOTICE

The figure shows the rear side of the engine.

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

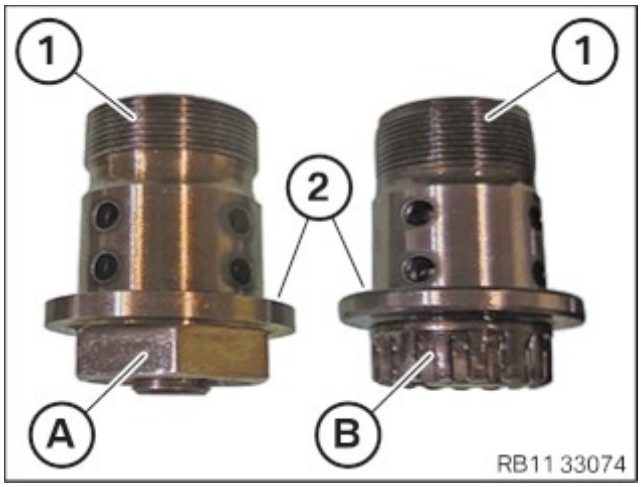


- Feed in exhaust camshaft adjuster (1) in the timing chain (2) and position on the exhaust camshaft .

82–Install the VANOS central valve of the intake adjuster

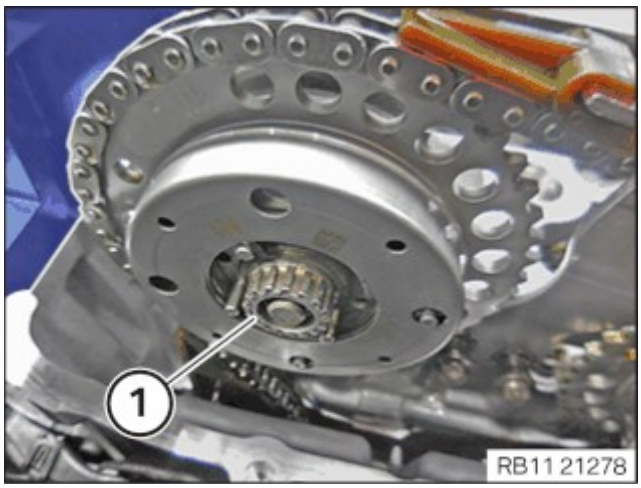
- **Equipment specification A with the thread M22:**

  Coat the VANOS central valve (A) on the thread (1) with **fresh** engine oil.

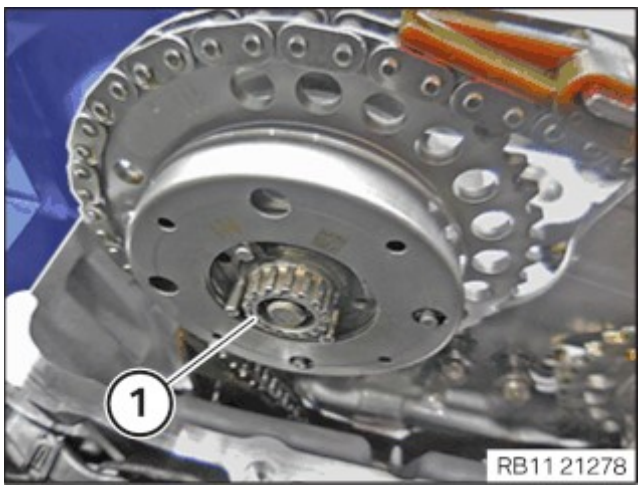


- Coat the VANOS central valve (A) on the contact surface (2) with **fresh** engine oil.
- **Equipment specification B with the thread M21:**

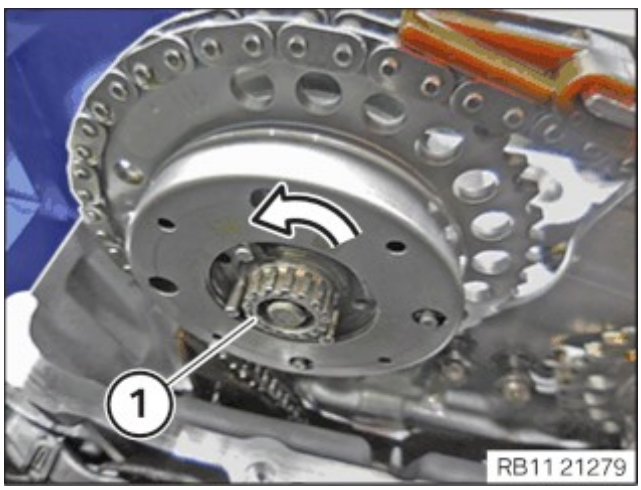
  Coat the VANOS central valve (B) on the thread (1) with **fresh** engine oil.
- Coat the VANOS central valve (B) on the contact surface (2) with **fresh** engine oil.



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

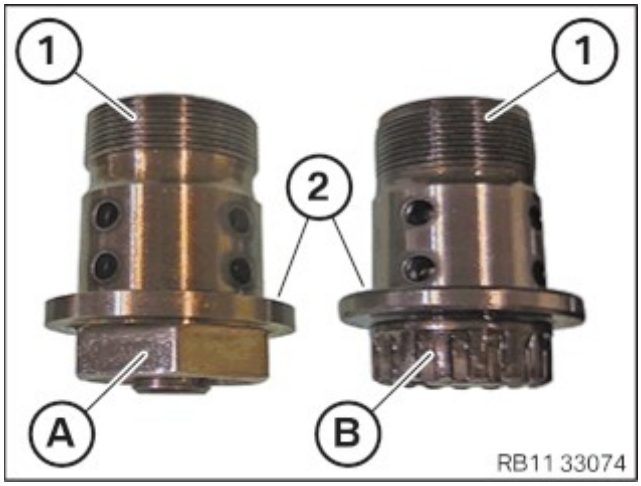


- Hand-tighten the VANOS central valve (1) of the intake adjuster.



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

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



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

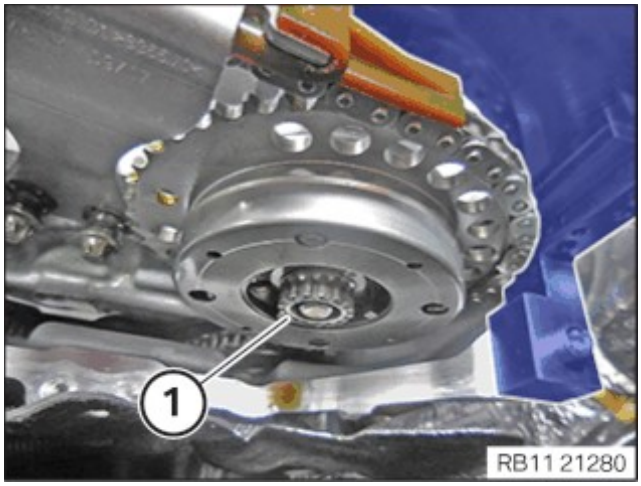
  Wet the VANOS central valve (A) at the thread (1) with **fresh** engine oil.

- Wet the VANOS central valve (A) on the contact surface (2) with **fresh** engine oil.

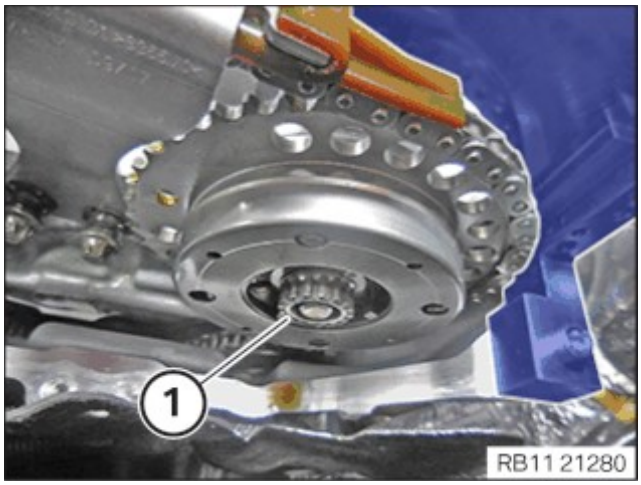
- **Version B with the thread M21:**

  Wet the VANOS central valve (B) at the thread (1) with **fresh** engine oil.

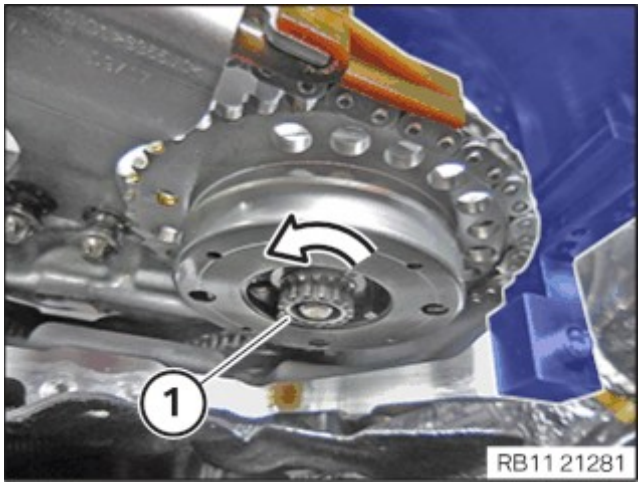
- Wet the VANOS central valve (B) on the contact surface (2) with **fresh** engine oil.



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

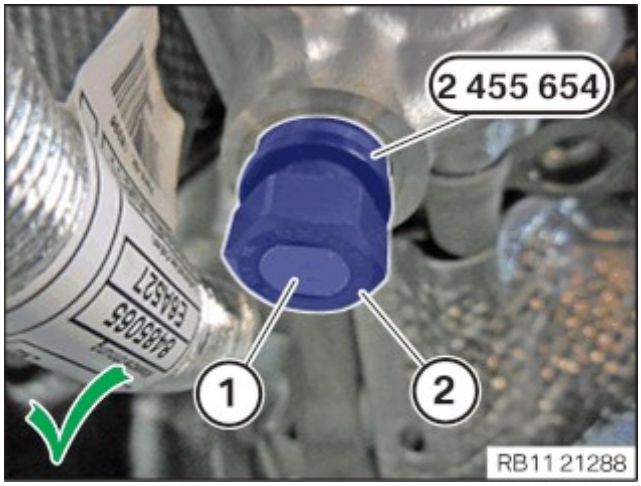


- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.



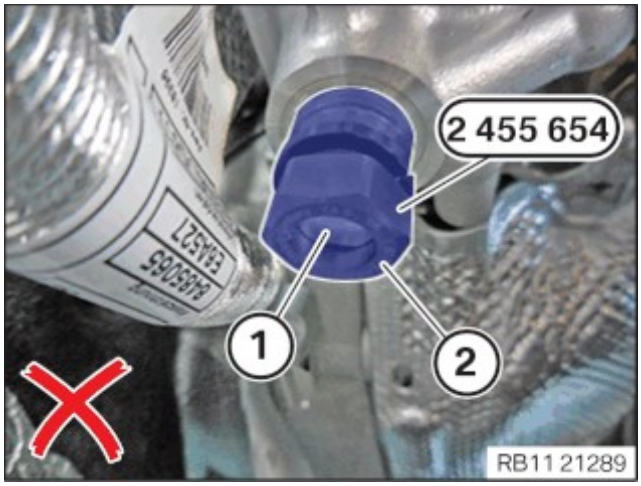
- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60°.

84–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**.

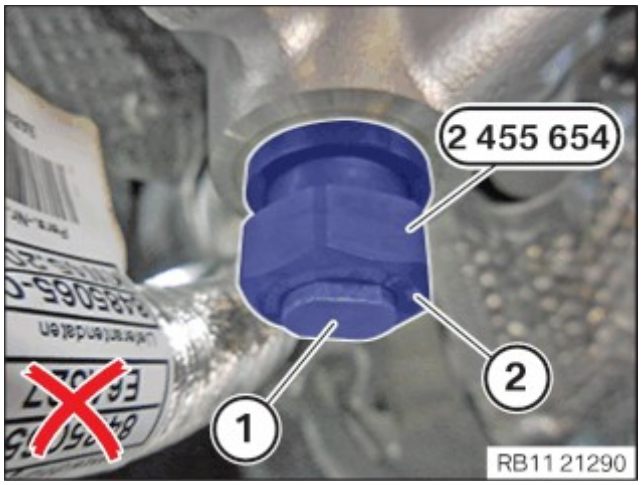
  The pin (1) must align **precisely** with housing (2).



- 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.



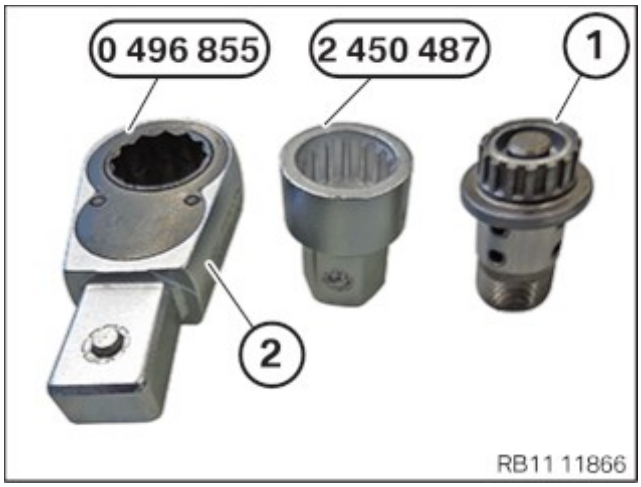
- Make sure that the preload of the timing chain is not **too high**.

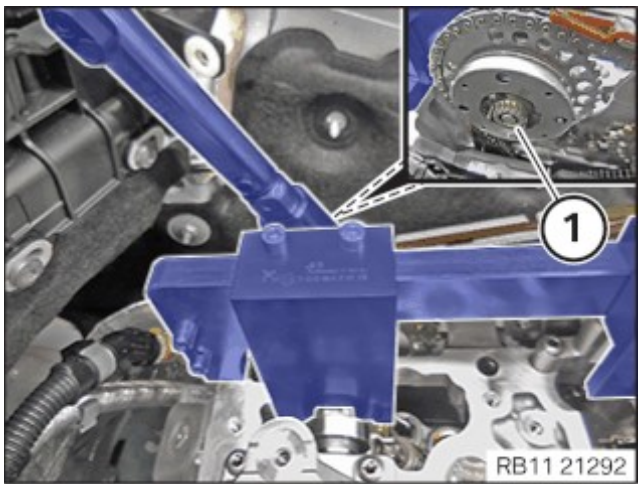
  The preload is too high when the pin (1) of the special tool **2 455 654** is not aligned flush with the housing (2).

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

85–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**.



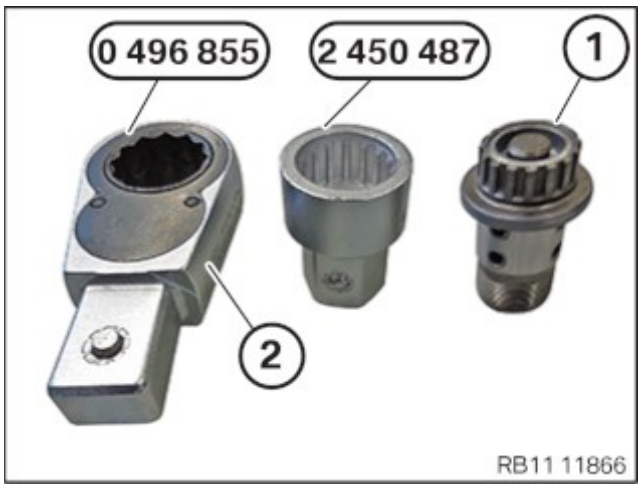


- Tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

VANOS central valve to camshaft

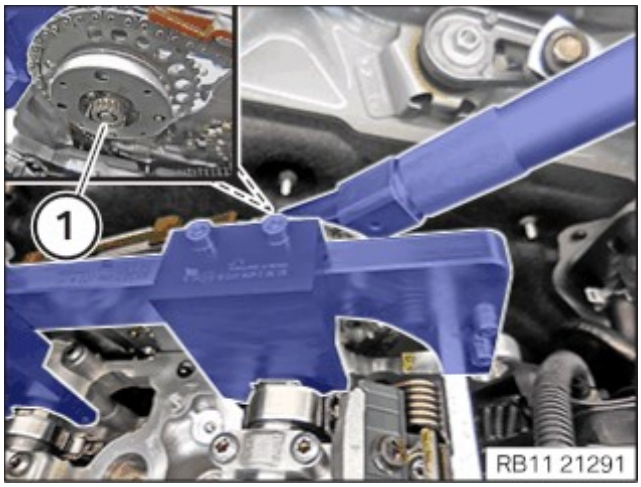
M21	*VANOS central valve on the thread and on the contact surface must be coated with engine oil.*	1. Tightening torque	50 Nm
		2. Tightening torque	140 Nm
M22	*VANOS central valve on the thread and on the contact surface must be coated with engine oil.*	1. Tightening torque	50 Nm
		2. Tightening torque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

86–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**.

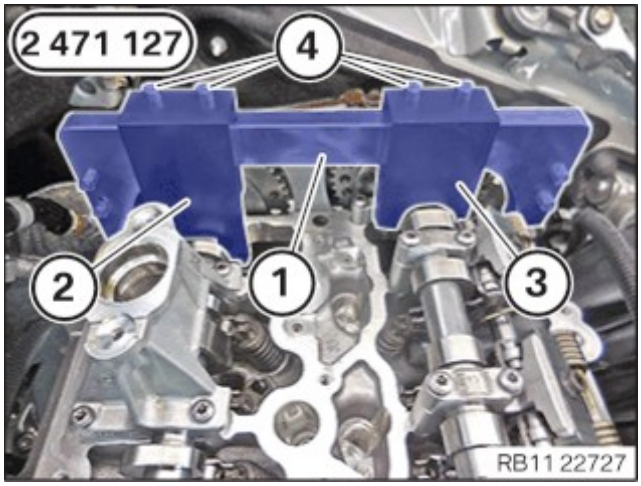
- Tighten the VANOS central valve (1) of the intake adjuster.



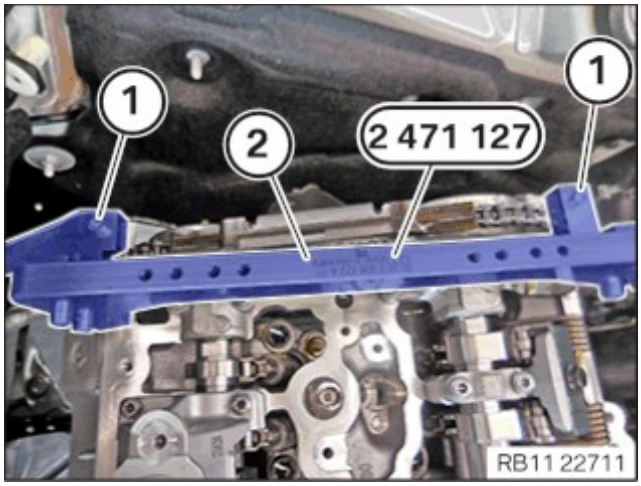
VANOS central valve to camshaft

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

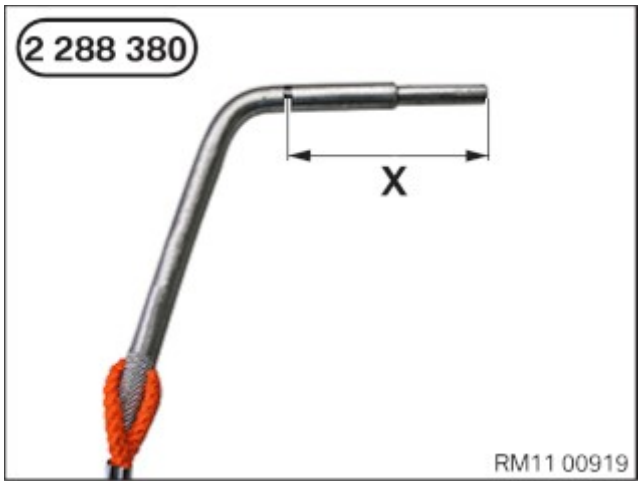
87–Remove all special tools



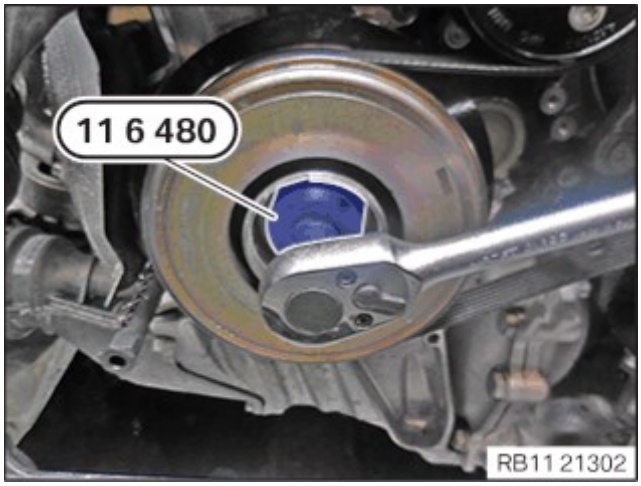
- Release the screws (4) from the set of special tools **2 471 127**.
- Guide out the setting gauge 0.5°(2) from the special tool **2 471 127** between the exhaust camshaft and the basic carrier (1) and remove.
- Guide out the setting gauge 0.7°(3) from the special tool **2 471 127** between the intake camshaft and the basic carrier (1) and remove.



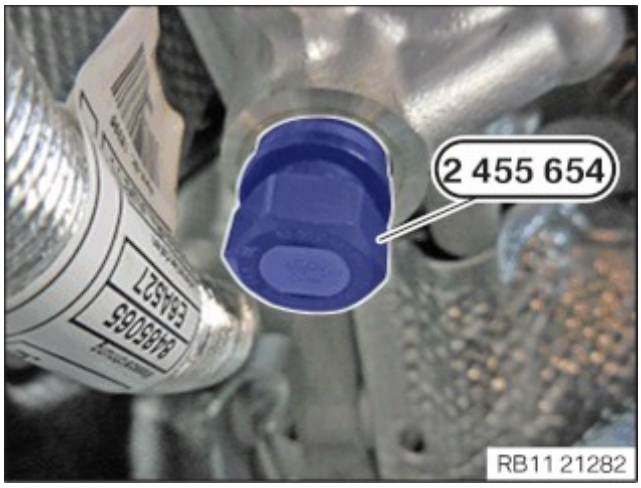
- Release the screws (1) from the set of special tools **2 471 127**.
- Guide out the basic carrier (2) from the special tool **2 471 127** and remove.



- 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 **2 455 654** out and remove.

88–Install chain tensioner

⚠ CAUTION

Improper routing of the positive battery cable.

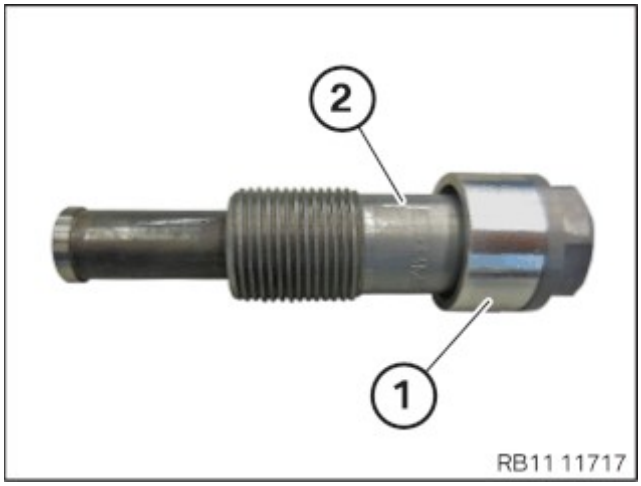
Risk of short circuits!

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

i TECHNICAL INFORMATION

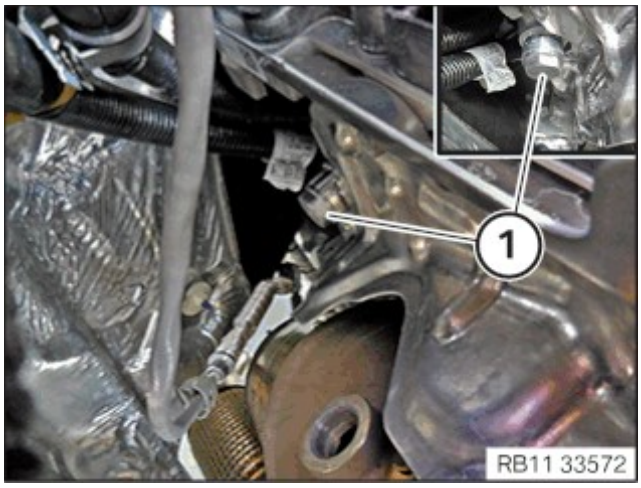
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

- 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.

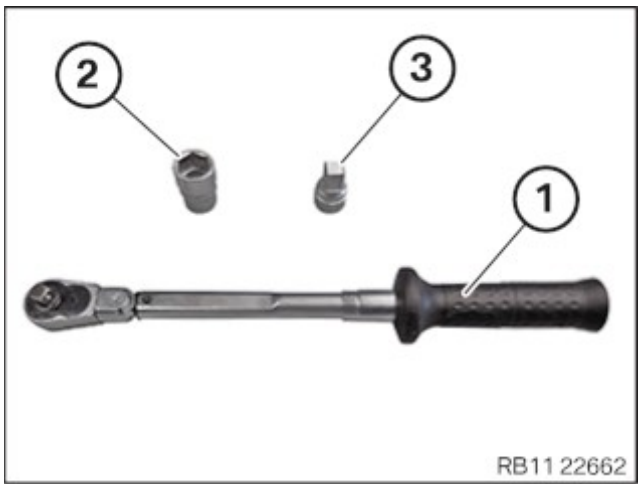


- Renew the sealing sleeve (1).

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

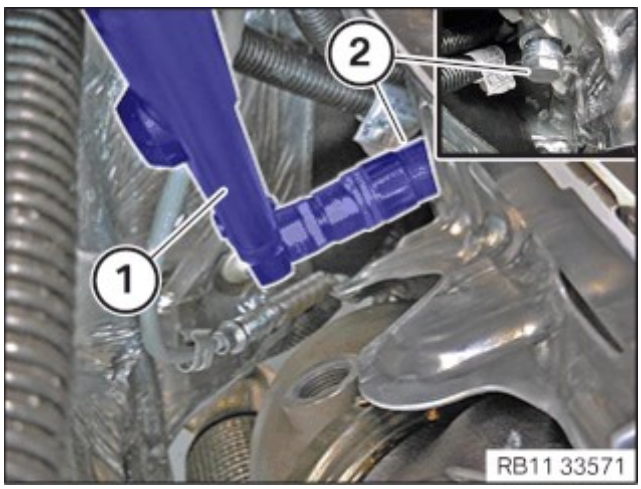


- Insert and install the chain tensioner (1).



- Provide commercially available tool.

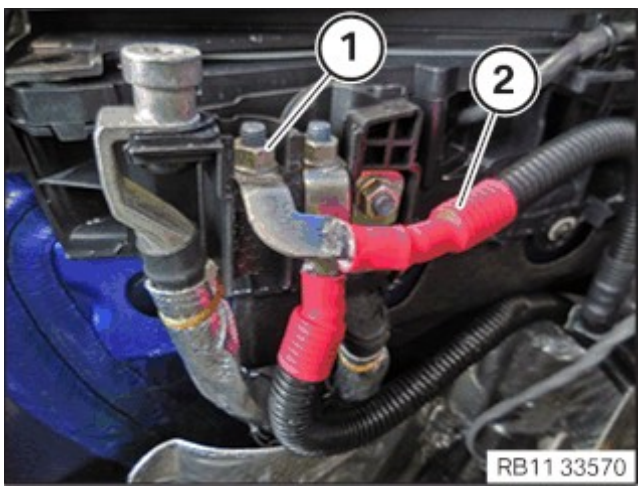
Number	Description
1	Torque wrench
2	Wrench socket SW19
3	Reduction from 1/2 inch to 3/8 inch



- 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 °

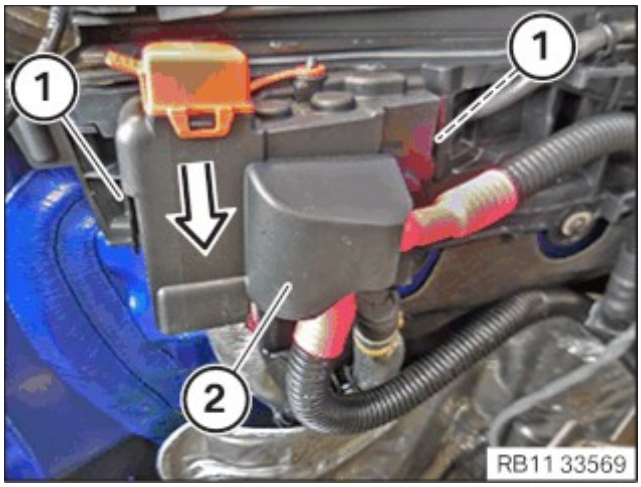


- Feed in and position the positive battery cable (2).
- Tighten nut (1).

Battery positive lead to battery positive terminal

M8		Tightening torque	19 Nm

- Feed in and install the cover (2) in the direction of the arrow.



The locks (1) must engage audibly.

89–Checking camshaft timing

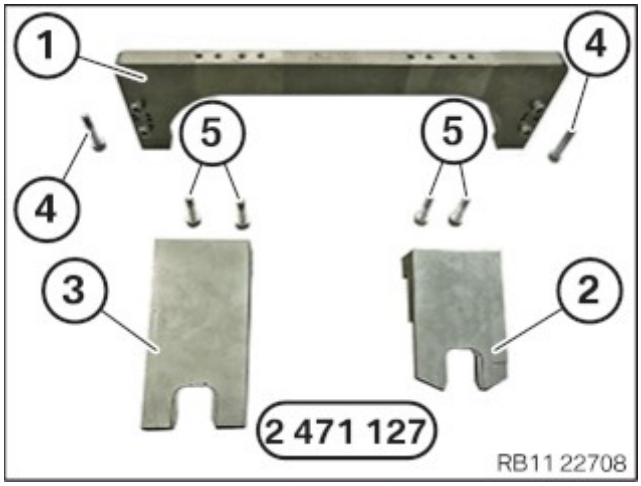
Additional information is available.

TECHNICAL INFORMATION

Alternative to the new special tool **SWZ: 2 471 127**, the already known special tool **SWZ: 2 456 372 can be used** in modified form.

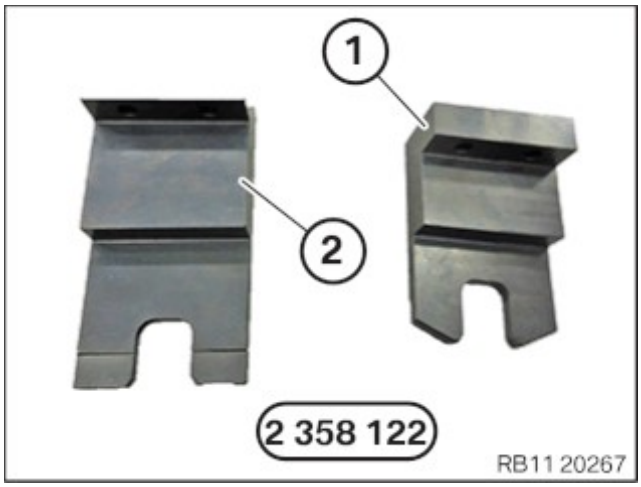
Information on modification can be found in the further information.

The modified special tool is downwards compatible.



- Keep the set of special tools **2 471 127** ready:

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



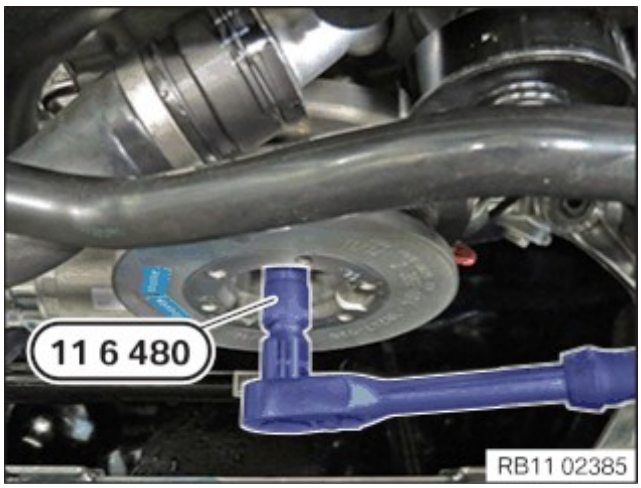
- Keep the test gauge from the set of special tools **2 358 122** ready.

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

- Have the special tool **2 288 380** ready.

Number	Description

Number	Description
1	Locating stud



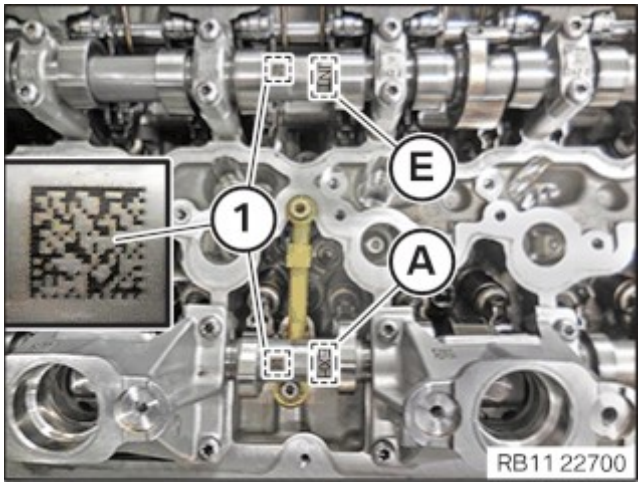
RISK OF DAMAGE

Damage to the engine.

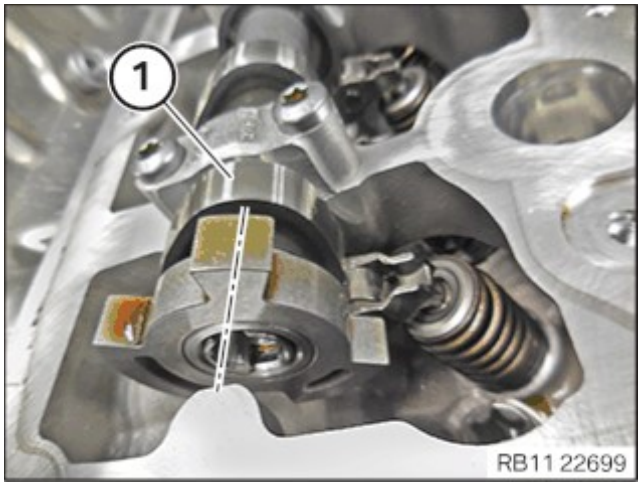
The engine may be damaged if it is manually rotated in the wrong direction.

- 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.

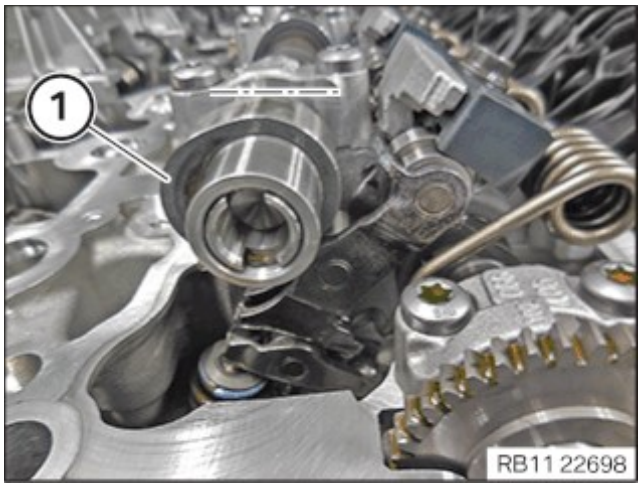
- Turn the engine with the special tool **0 493 380 (11 6 480)** to the TDC firing position of **cylinder 1**.



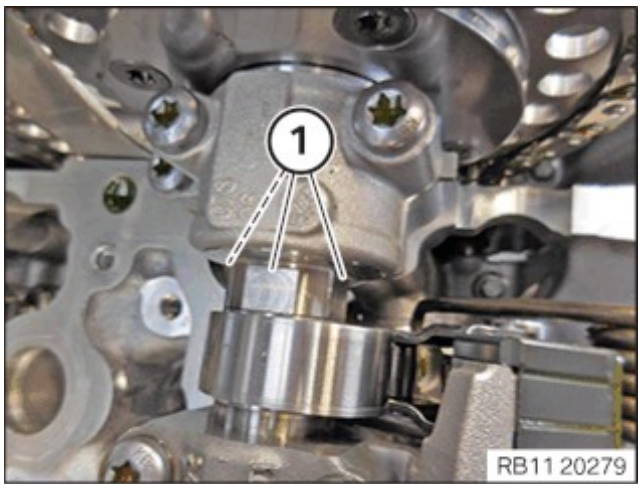
- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.



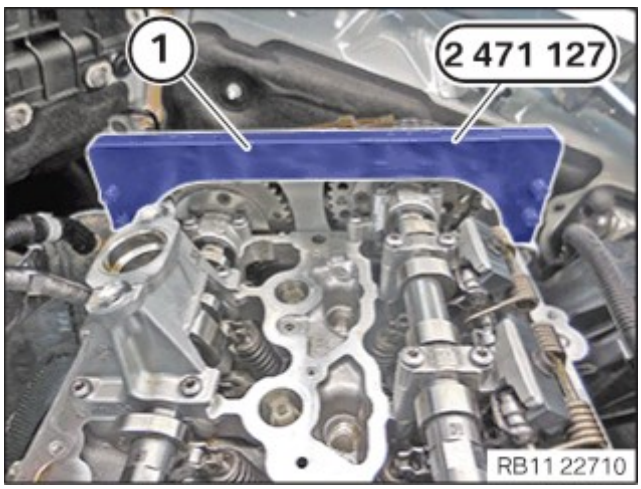
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



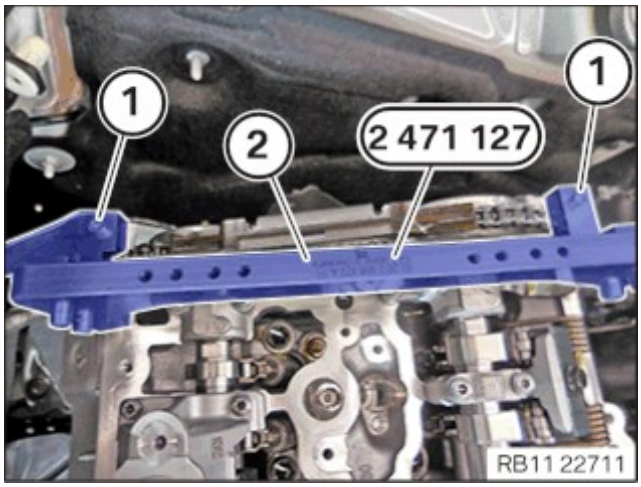
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the inside left at an angle.



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



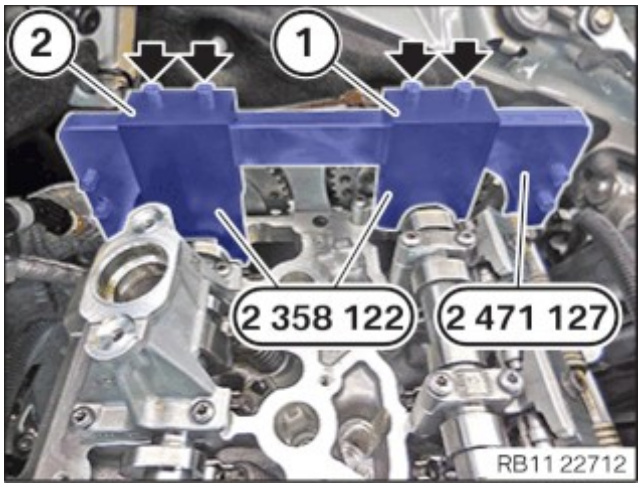
- Position the basic carrier (1) from the set of special tools **2 471 127** on the cylinder head.



- Tighten screws (1) from the set of special tools **2 471 127** on basic carrier (2).

Basic carrier to cylinder head

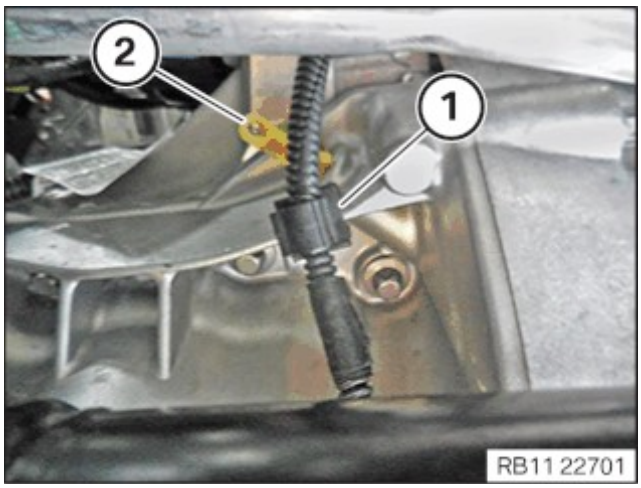
M6		Tightening torque	8 Nm



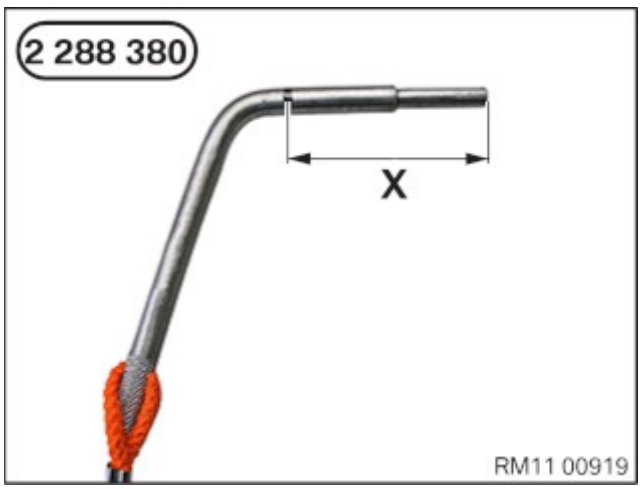
- Position the test gauge (1) from the set of special tools **2 358 122** between the intake camshaft and the basic carrier from the set of special tools **2 471 127**.
- Position the test gauge (2) from the set of special tools **2 358 122** between the exhaust camshaft and the basic carrier from the set of special tools **2 471 127**.
- Tighten screws (arrows).

Test gauge to basic carrier

M6		Tightening torque	8 Nm



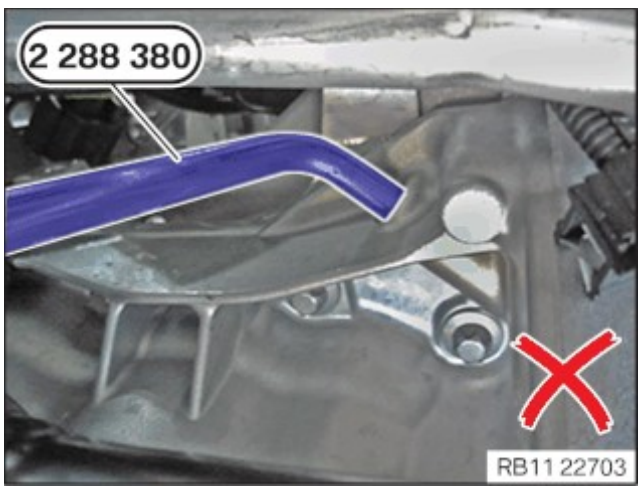
- Loosen clamp (1).
- Thread out the sealing cap (2) and remove it.



- **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:**

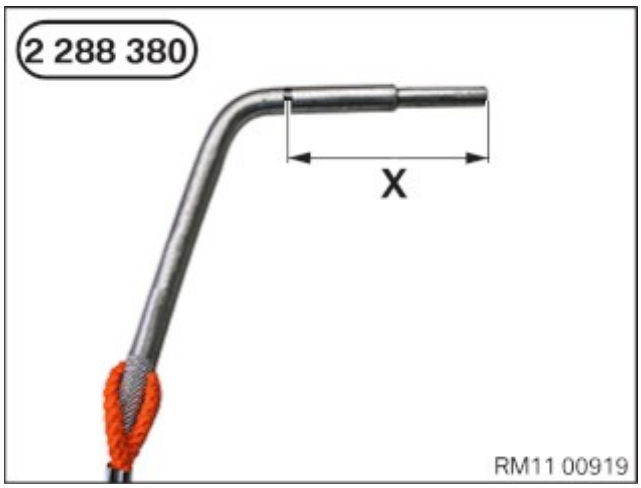
  Special tool **2 288 380** **incorrectly** positioned.

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

- **Vehicles with automatic transmission:**

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

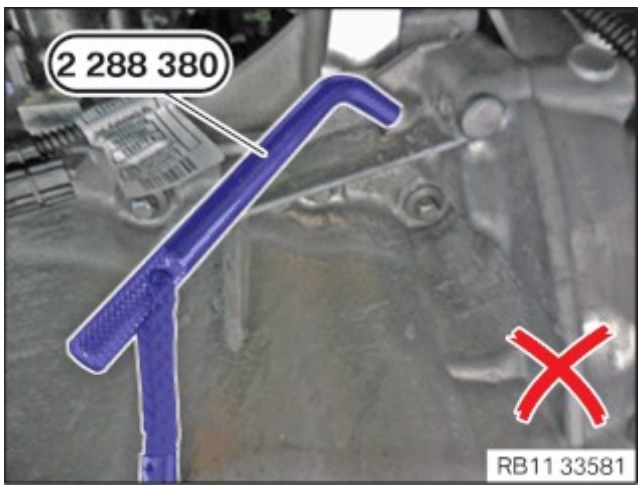
The engine **is in the** TDC firing position of cylinder 1.



- **Vehicles with manual gearbox:**

  Dimension (X) = 61 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.

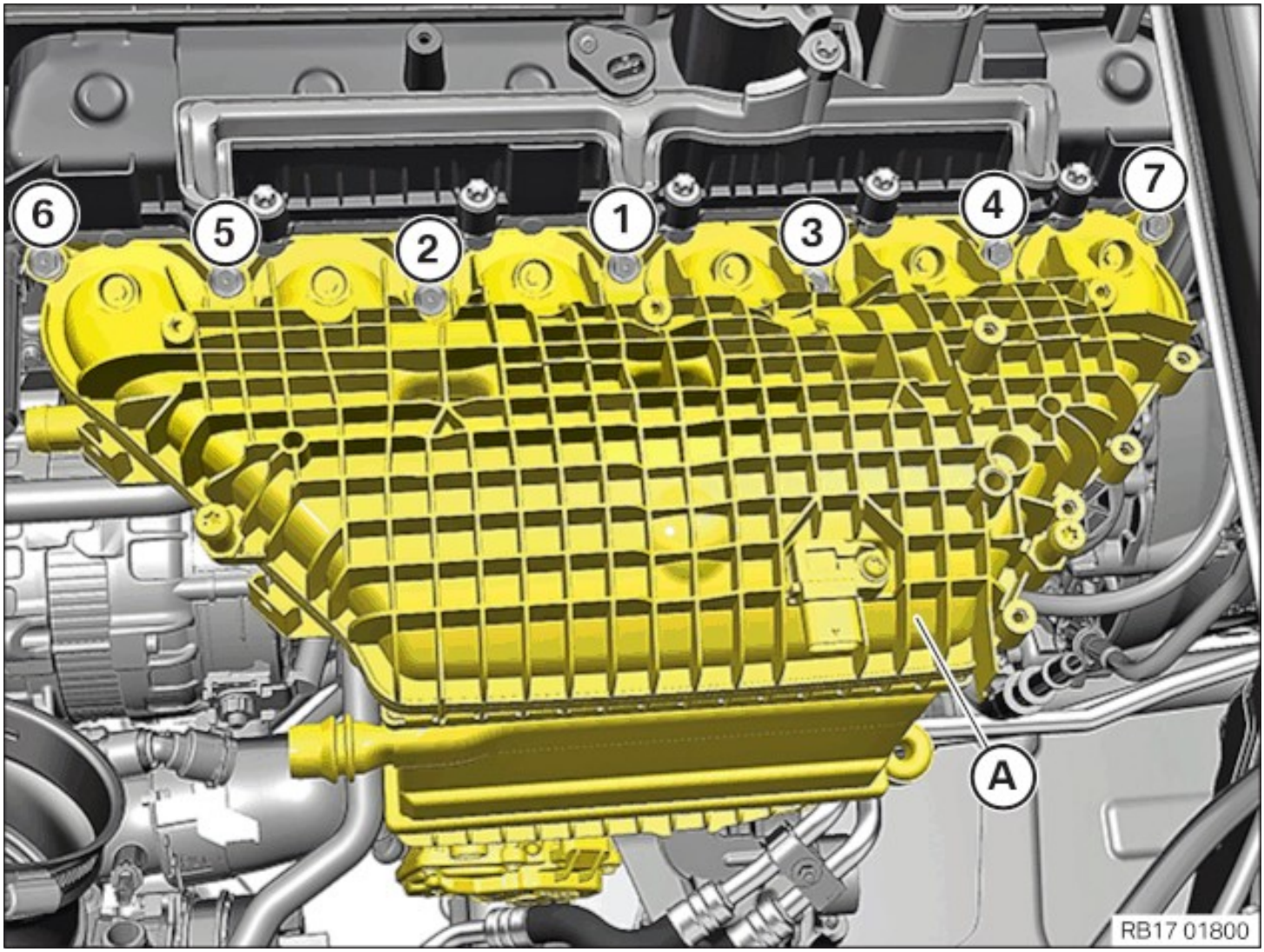
- **Vehicles with manual gearbox:**

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

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

90–Installing the intake plenum

Screws of the intake plenum



A Intake plenum

1-7 Screws

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

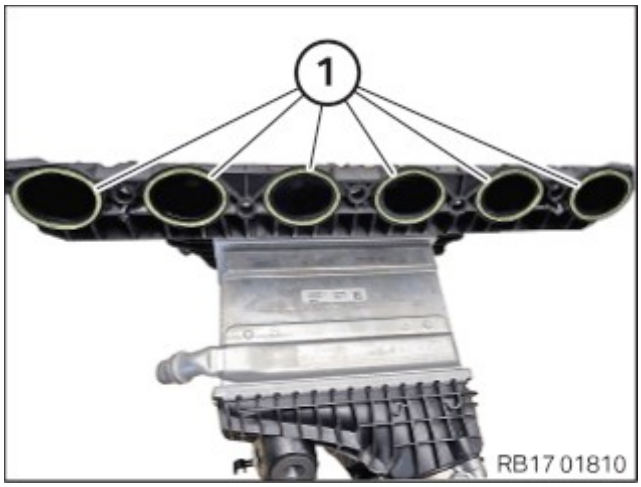
Make sure that the connections are locked correctly. The locks must engage audibly.

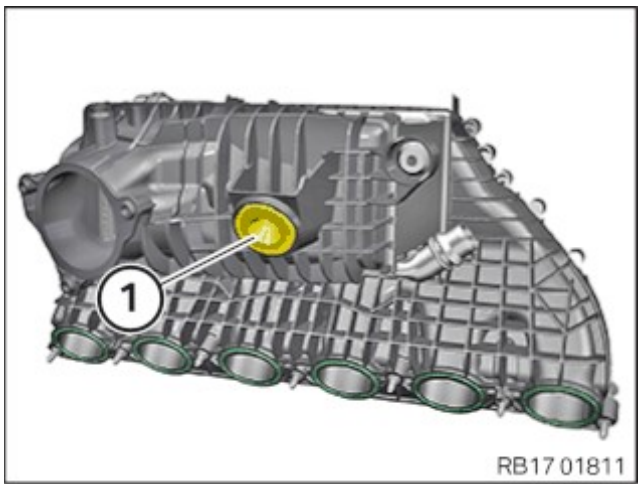
TECHNICAL INFORMATION

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

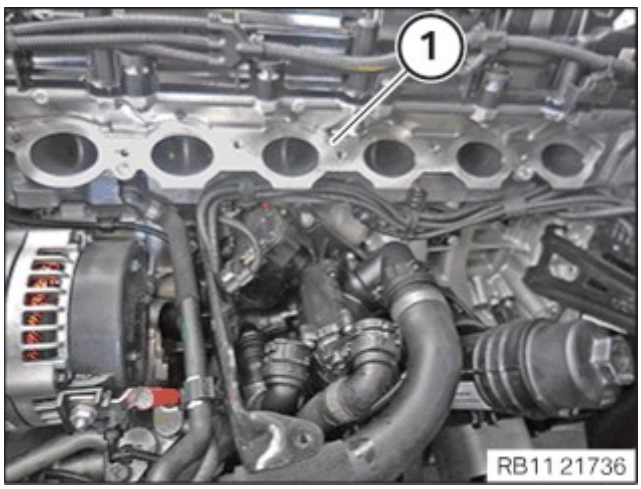
- Renew seals (1).

Parts: Seals





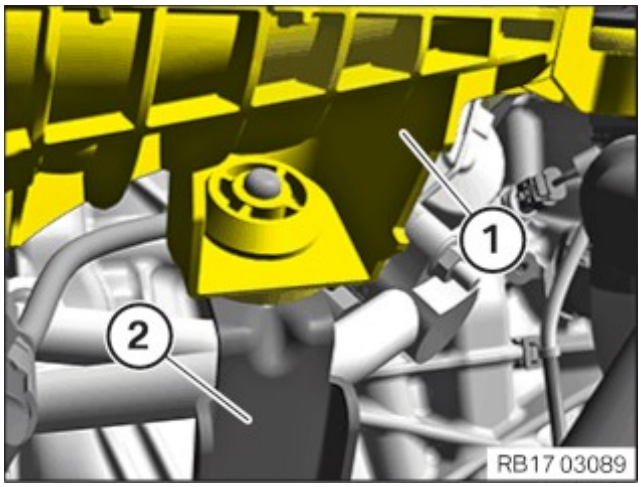
- Check the rubber mount (1) for a correct fit on the charge air cooler.



NOTICE

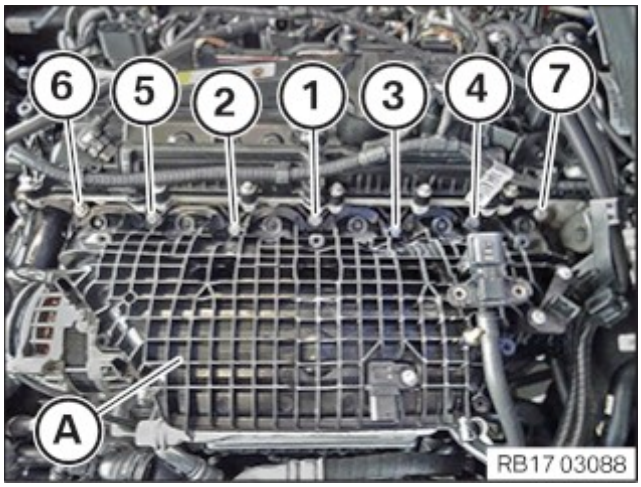
Schematic diagram is for example purposes. Some parts may differ in certain details.

- Clean contact surface (1).



- During installation, make sure that the charge air cooler (1) correctly sits below on the holder (2).

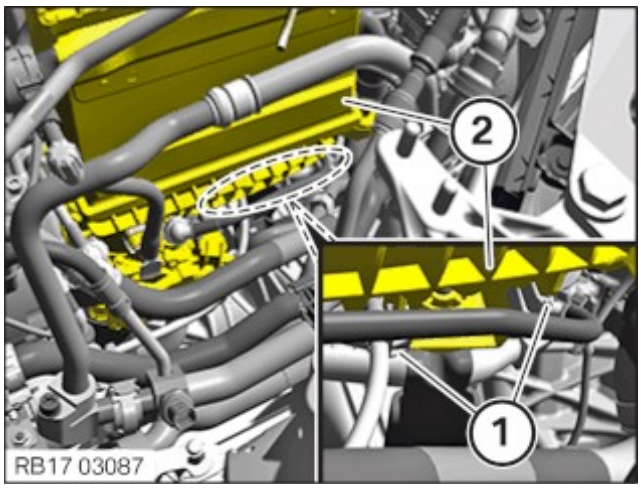
- Insert and position the charge air cooler (A).



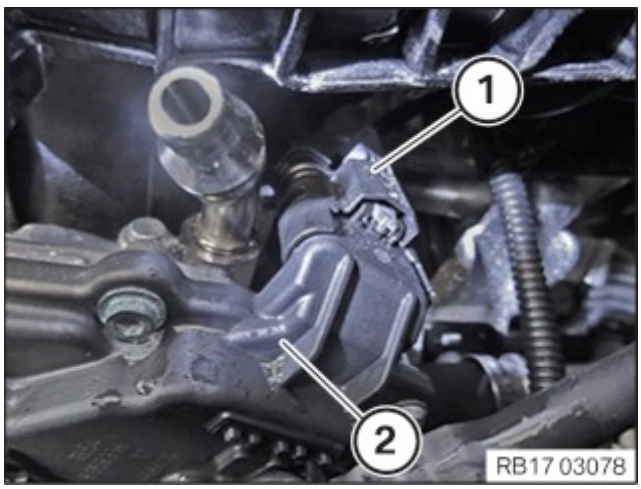
- Tighten screws in the sequence (1) to (7).

Intake plenum to cylinder head

M6		Tightening torque	10 Nm

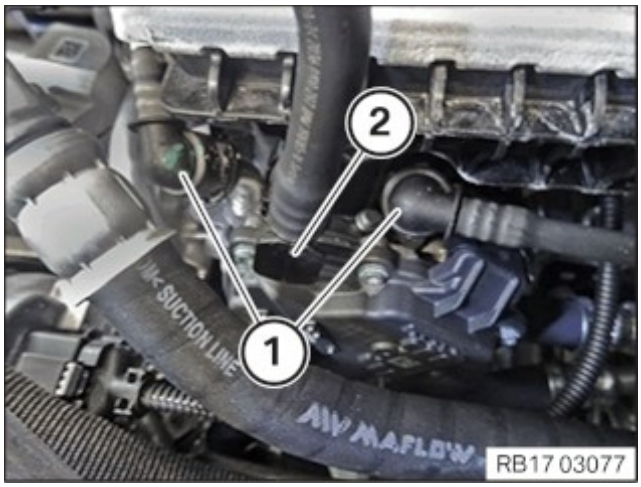


- Fasten the clamps (1) in the marked area on the charge air cooler (2).



- Connect the connector (1) to the throttle valve (2) and lock it.

  The connector (1) must engage audibly.



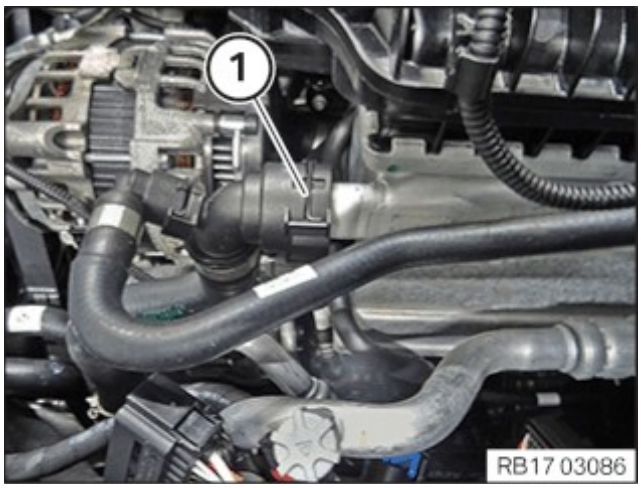
- Connect and lock the tank ventilation line (2).

  The tank ventilation line (2) must engage audibly.
- Connect and lock the coolant lines (1).

  The coolant lines (1) must engage audibly.

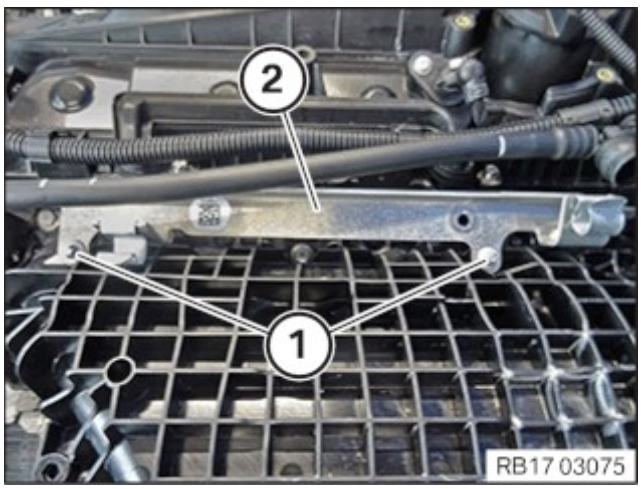
- Connect and lock coolant line (1).

The coolant line (1) must audibly engage.



- Connect and lock coolant line (1).

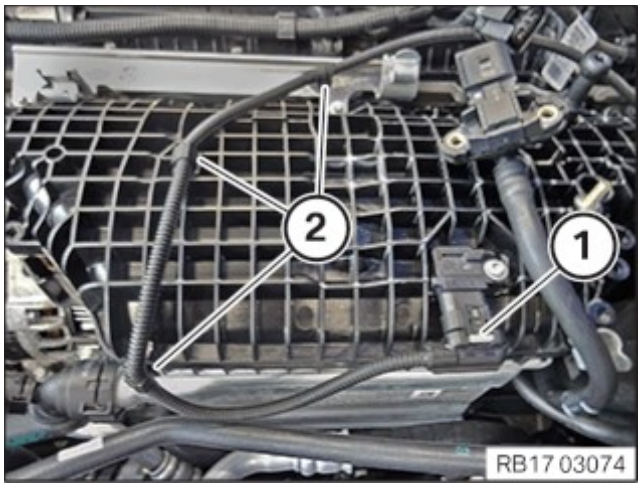
  The coolant line (1) must audibly engage.



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

Holder to intake plenum

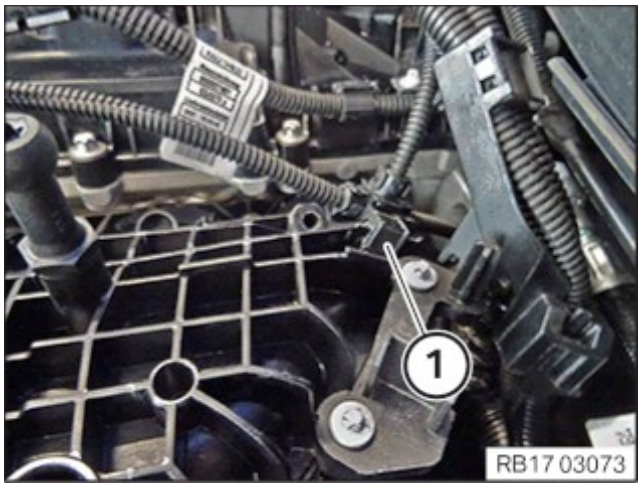
6x18 screw		Tightening torque	5.5 Nm

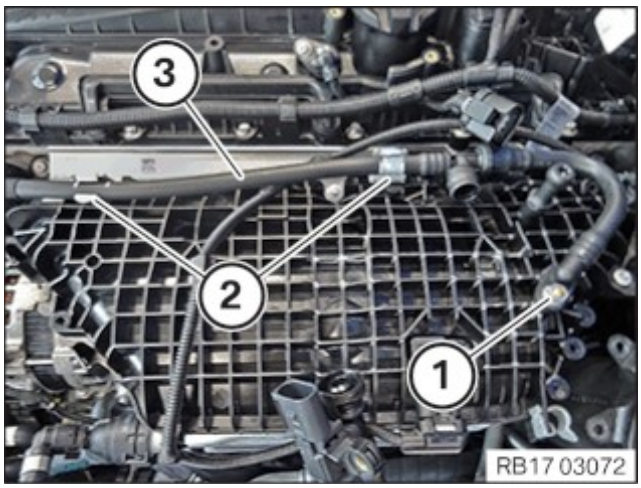


- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

- Secure the clamp (1).

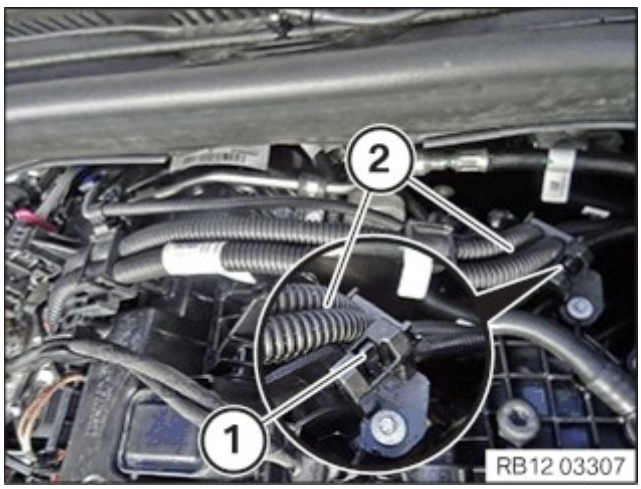




- Feed in the tank ventilation line (3) into the holder (2) and connection it to the charge air cooler.
- Tighten nut (1).

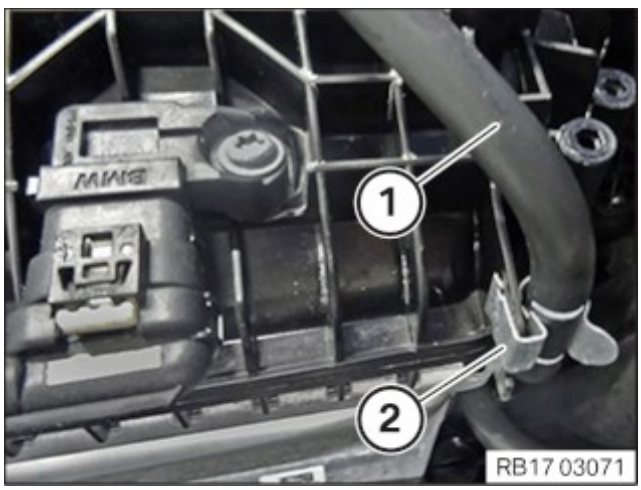
Tank ventilation line to intake plenum

M6		Tightening torque	4 Nm

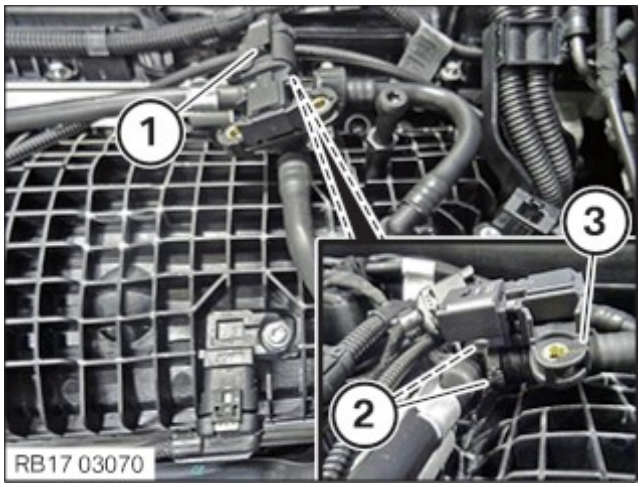


- Insert and install the wiring harness section (2).

  The lock (1) must engage audibly.

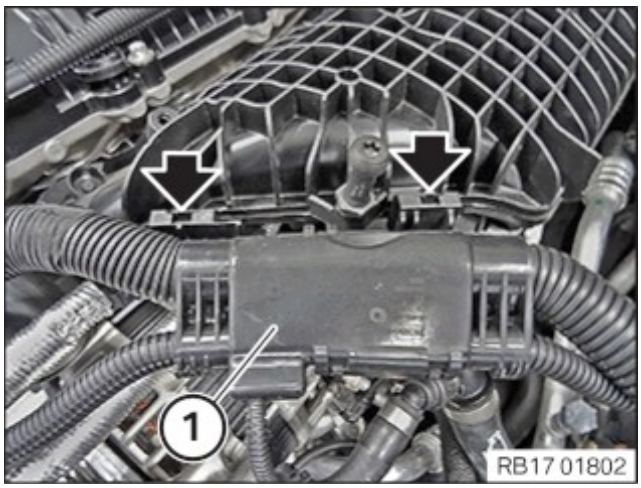


- Secure the tank ventilation line (1) to the clamp (2).
- Connect tank vent line with pressure sensor (3).



- Ensure that the locks (2)engage audibly.
- Connect connectors (1) and lock.

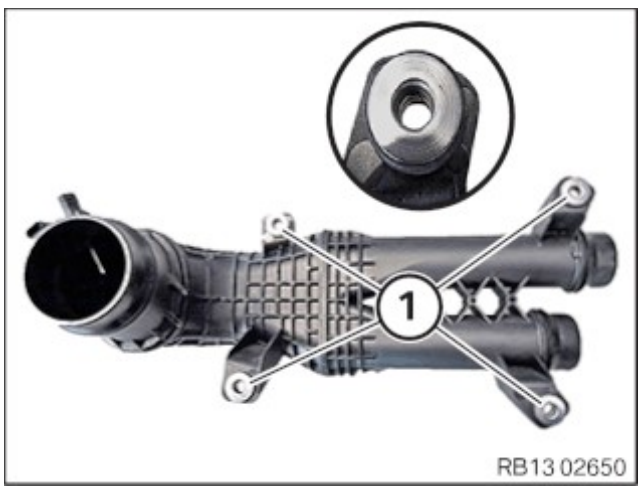
  The connector (1) must engage audibly.



- Guide in the wiring harness section (1) and install.

  The locks (arrows) must engage audibly.

- Ensure that guide sleeves (1) are present and have been installed correctly.

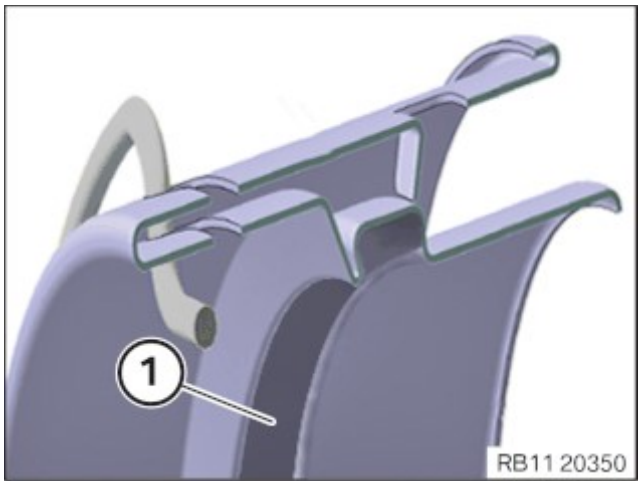


- Ensure that guide sleeves (1) are present and have been installed correctly.
- Check the seal (1) for damage, and renew if necessary.

▶ Replacing damaged seal

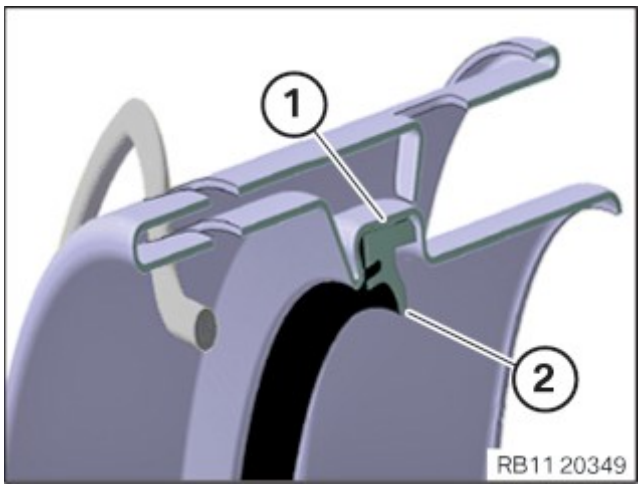
i TECHNICAL INFORMATION

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.

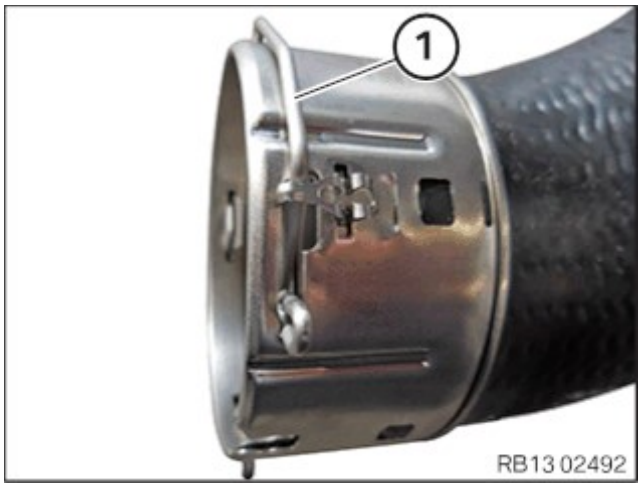
i TECHNICAL INFORMATION

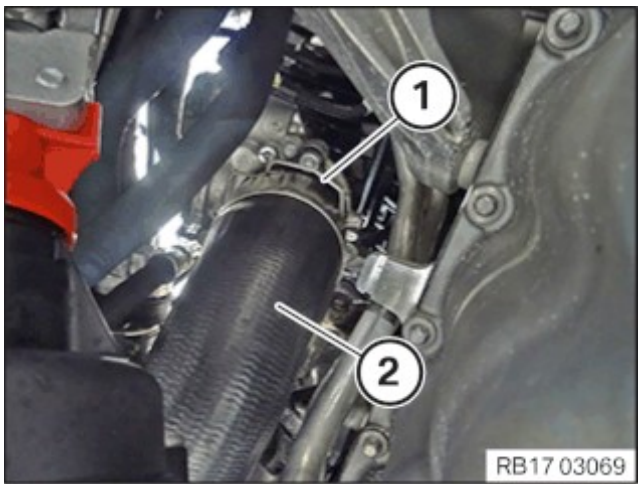
Incorrect assembly is possible. Ensure correct installation position.

- 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.

◀

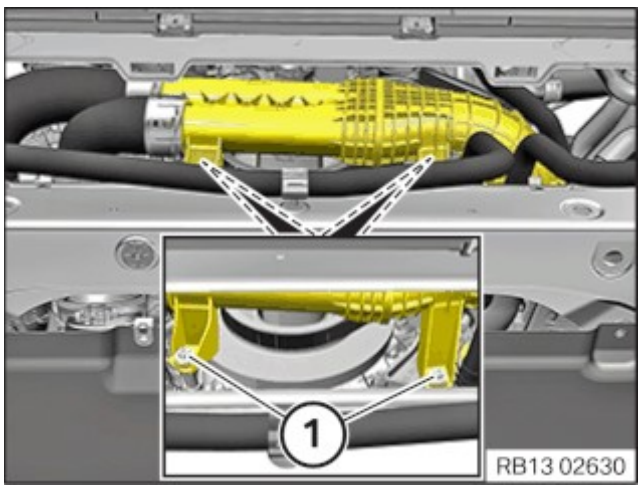
- Lock clamp (1).





- Connect and lock the charge air hose (2).

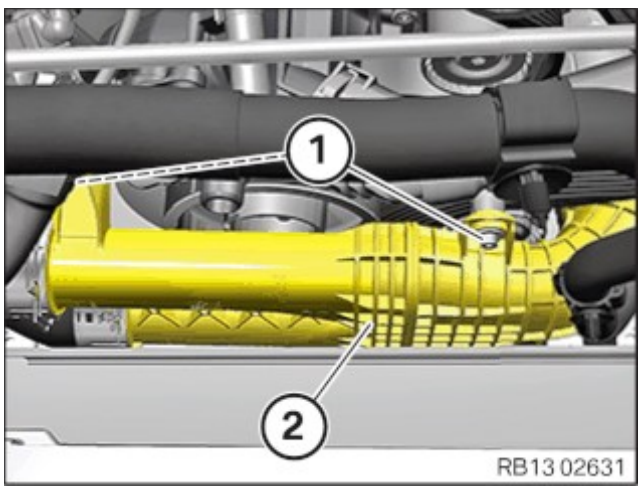
  Clamp (1) must engage audibly.



- Tighten the screws (1).

Charge air duct on spacers

M6x25 screw		Tightening torque	10 Nm



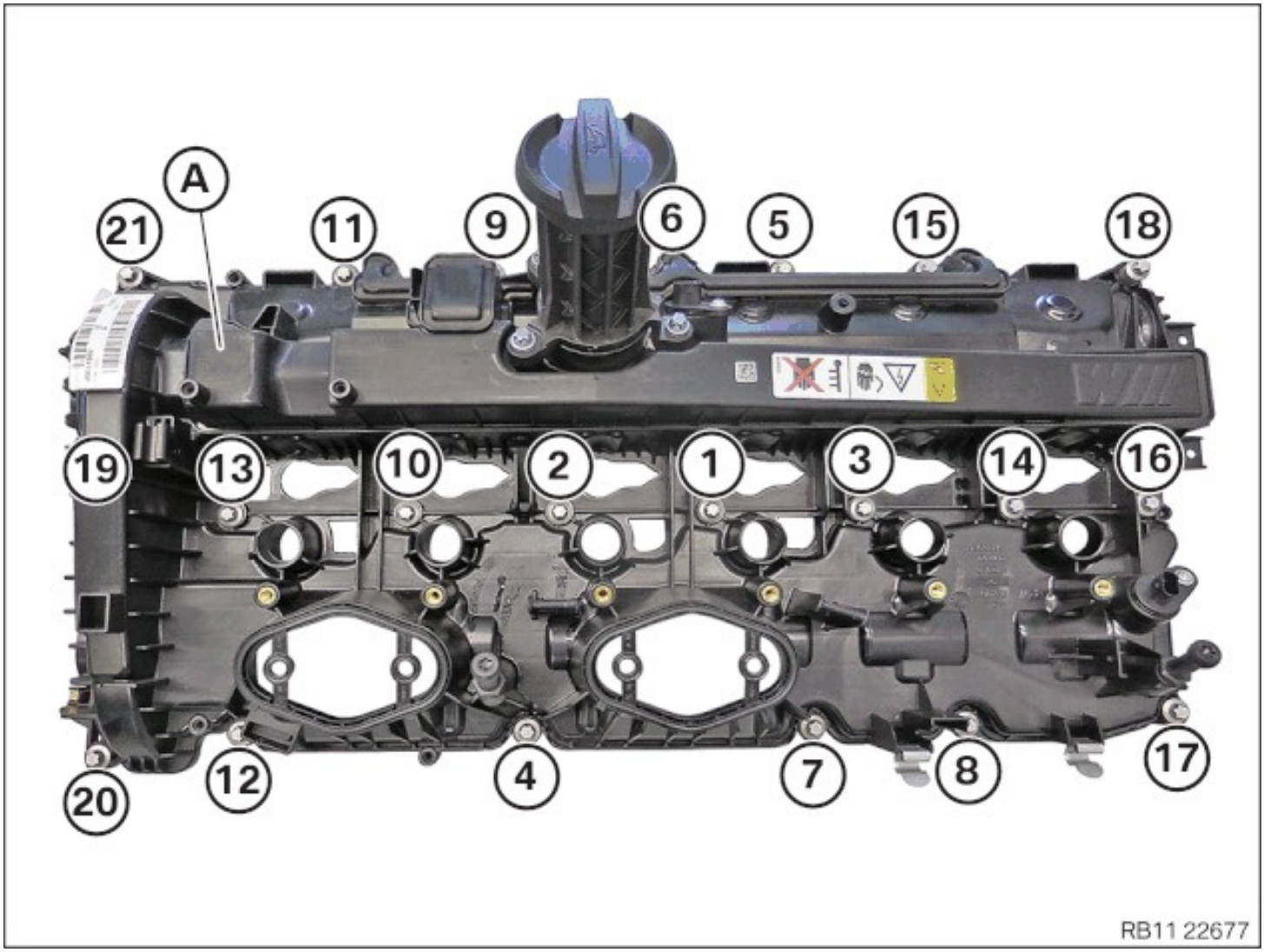
- Insert the charge air crossing (2) and position it.
- Tighten the screws (1).

Charge air duct on spacers

M6x25 screw		Tightening torque	10 Nm

91–Installing cylinder head cover

Bolts of the cylinder head cover



1 - 21 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

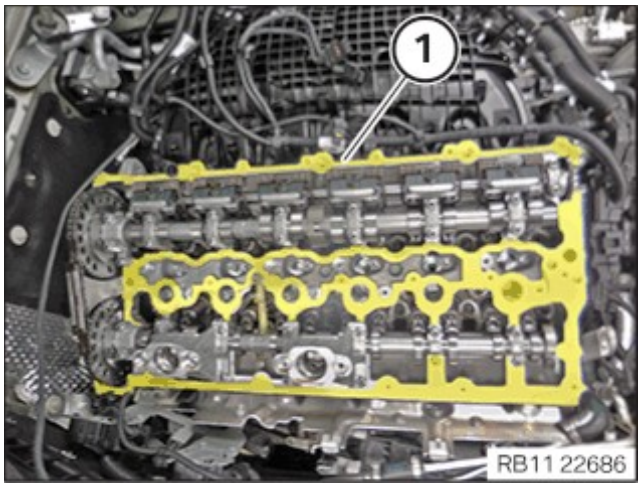
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

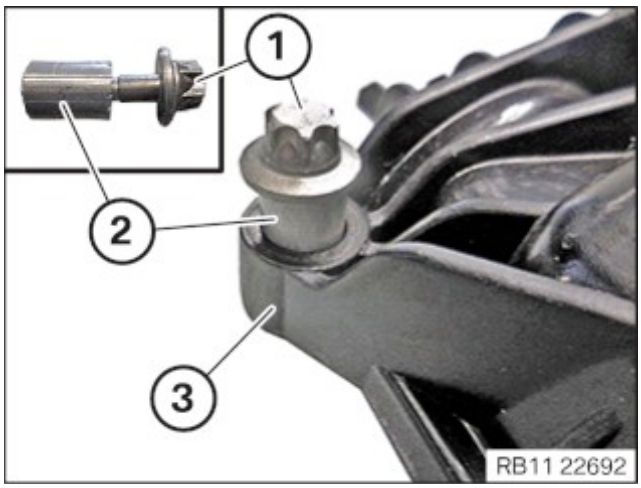
- Route all cables without abrasions, do not trap and crush.

TECHNICAL INFORMATION

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

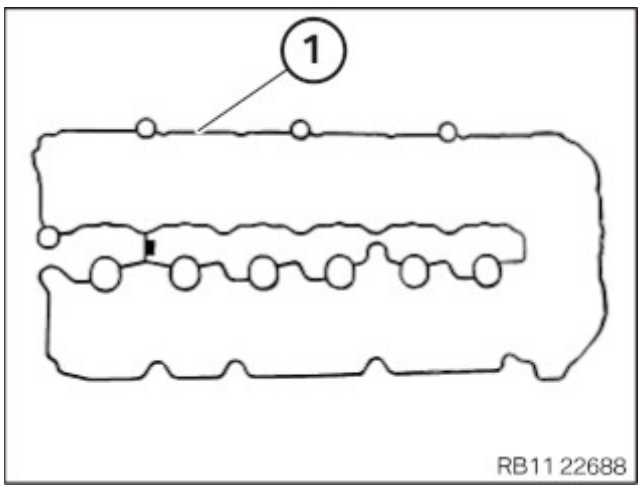
- The sealing surface (1) must be free of oil and grease.





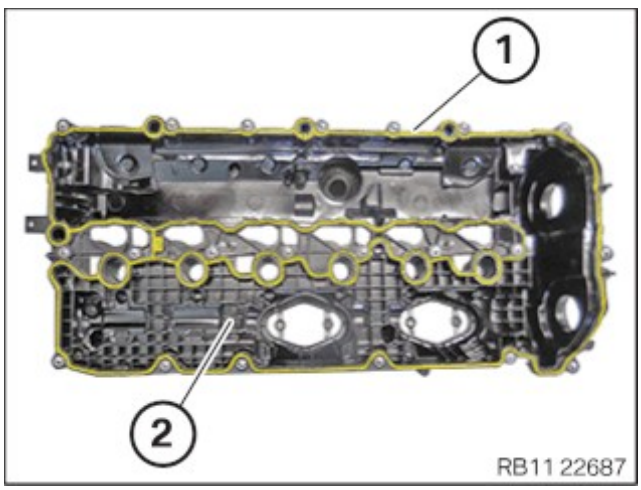
- Renew the screws (1) and sleeves(2) on the cylinder head cover (3).

  Parts: Screws



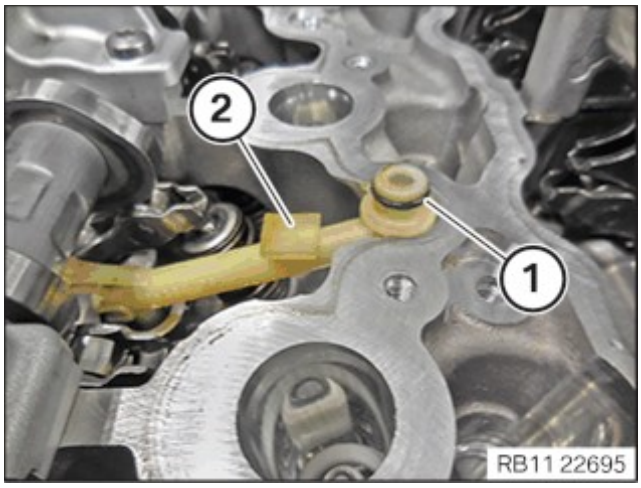
- Renew gasket (1).

  Parts: Gasket

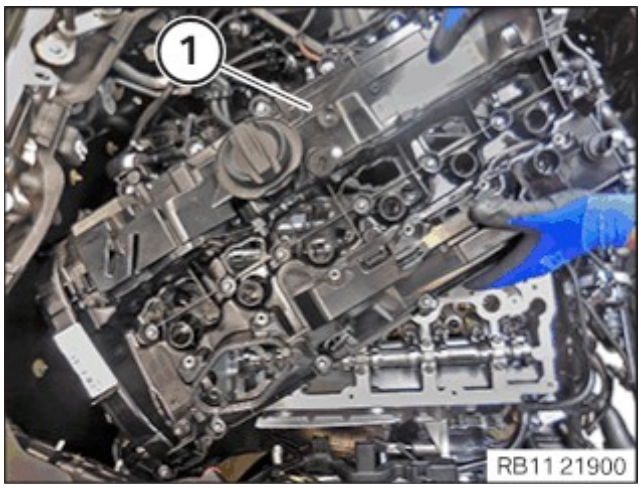


- Insert and install the seal (1) on the cylinder head cover (2).

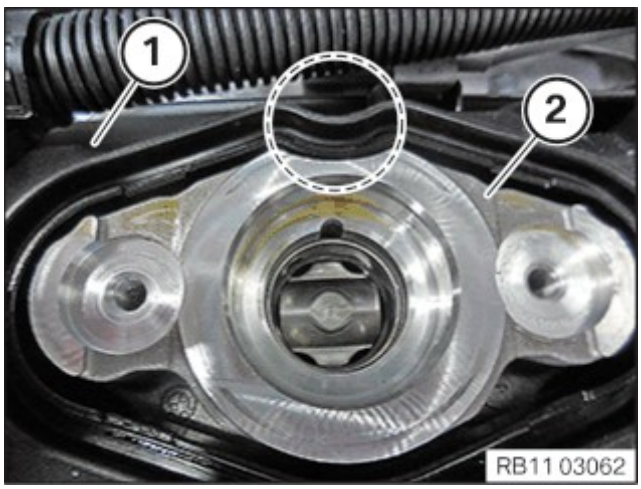
- Check the sealing ring (1) on the oil return line (2) for damage.



- If applicable, renew the oil return line (2).

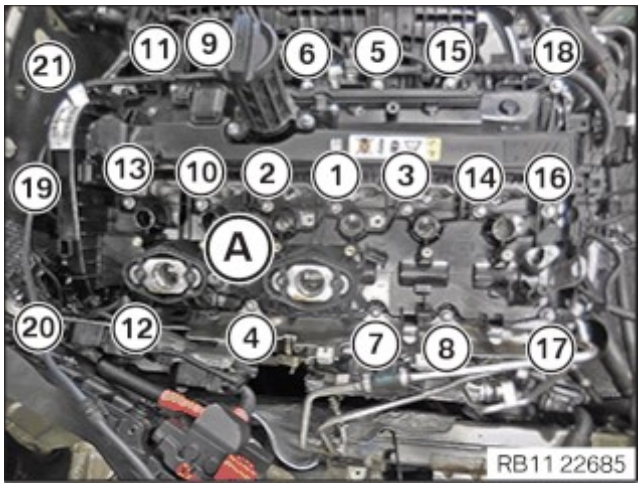


- Insert and install cylinder head cover (1).



- Make sure the cylinder head cover (1) in the **marked** area is correctly installed on **both** high pressure pump brackets(2).

  The cylinder head cover (1) must **not** rest on **both** high pressure pump brackets in the **marked** area (2).



i 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.

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

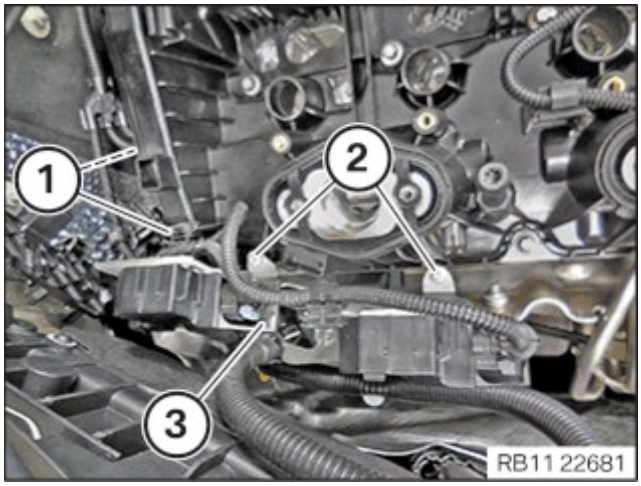
Cylinder head cover to cylinder head

M6	Renew screws.	Tightening torque	4 Nm

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

Cylinder head cover to cylinder head

M6		Angle of rotation	90 °

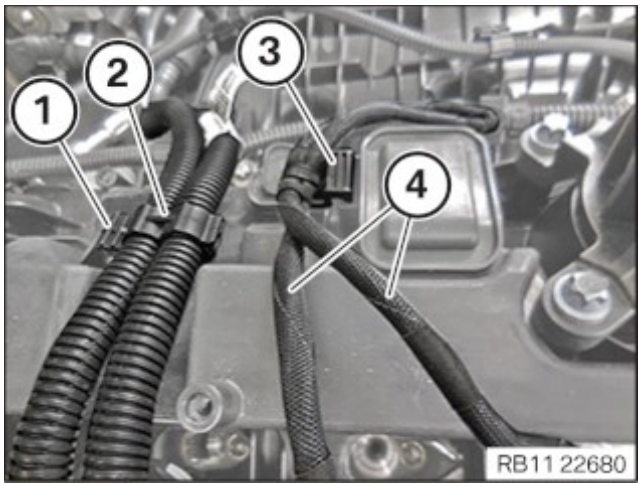


- Insert and install the holder (3) for the differential pressure sensor.
- Tighten the screws (2).

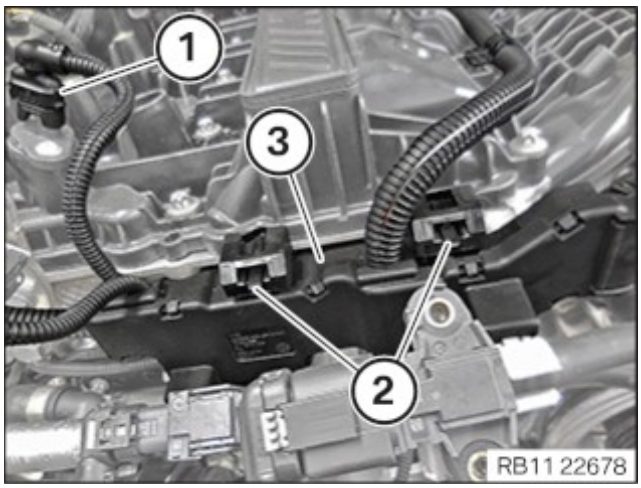
Holder, positive battery cable to cylinder head cover

Self-tapping plastic screw 6 x 18		Tightening torque	8 Nm

- Secure clamps (1).



- Guide in and Install the wiring harness section (2) for the injectors and ignition coils.
- Secure the clamp (1).
- Guide in and install the wiring harness section (4) for sensor system 2.
- Secure clamps (3).



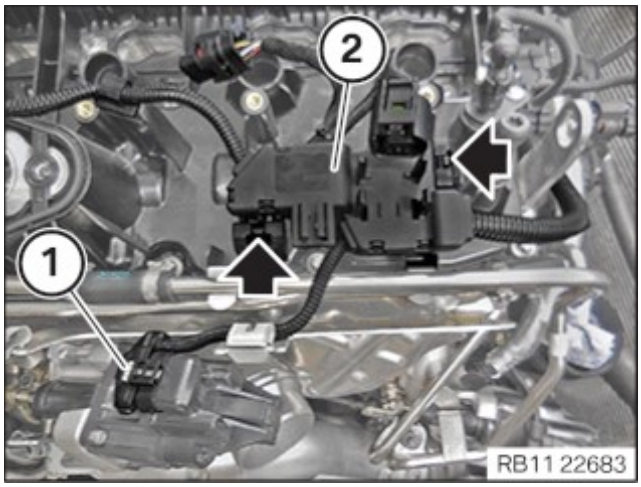
- Guide in and install the wiring harness section (3) for sensor system 2.

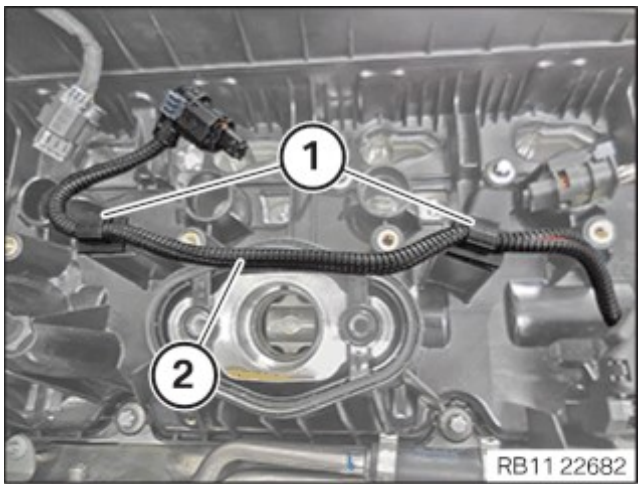
  The locks (2) must snap audibly into place.
- Connect the connector (1) to the exhaust camshaft sensor and connect.

  The connector (1) must engage audibly.
- Guide in and install the wiring harness section (2) for sensor system 2.

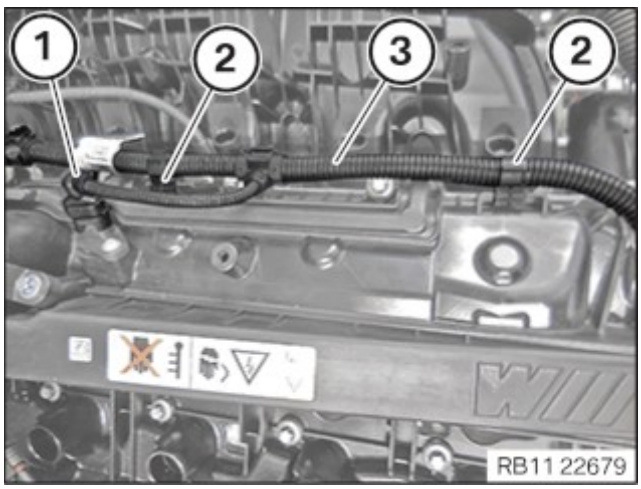
  The locks (arrows) must engage audibly.
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.





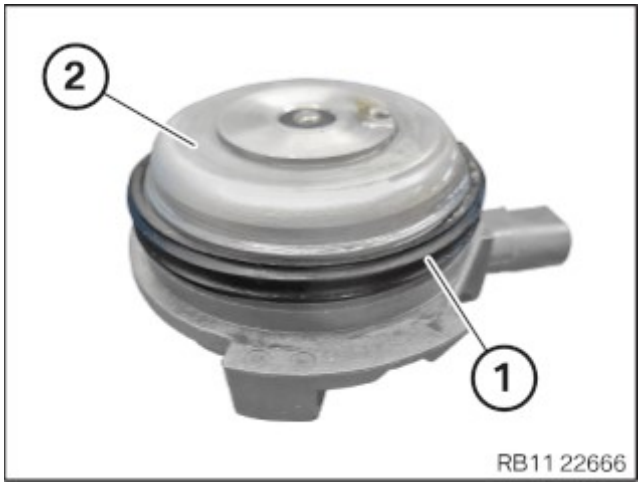
- Guide in and install the wiring harness section (2) for sensor system **2**.
- Secure clamps (1).



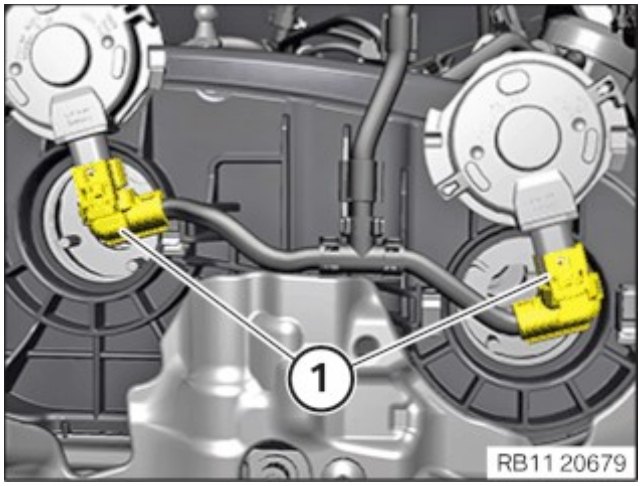
- Guide in and install the wiring harness section (3) for sensor system 2.
- Secure clamps (2).
- Connect and lock the connector (1) on the intake camshaft sensor.

  The connector (1) must engage audibly.

92–Installing both actuators



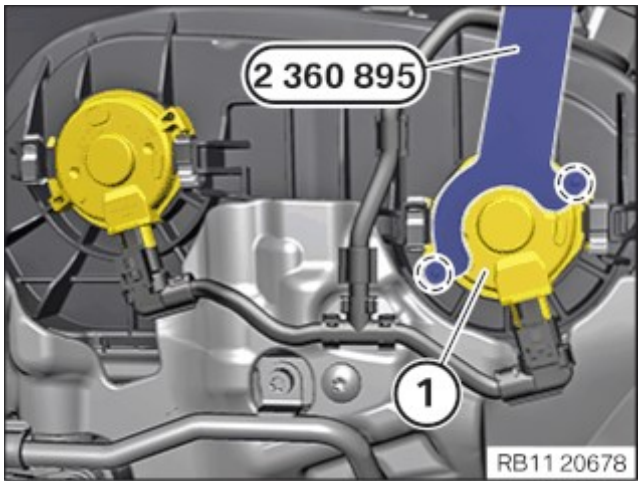
- Check seal (1) for damage and, if necessary, renew actuator (2).



NOTICE

The figure shows the rear side of the engine.

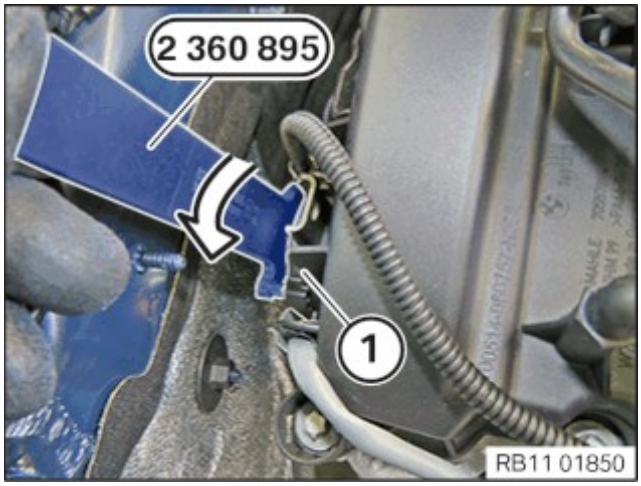
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



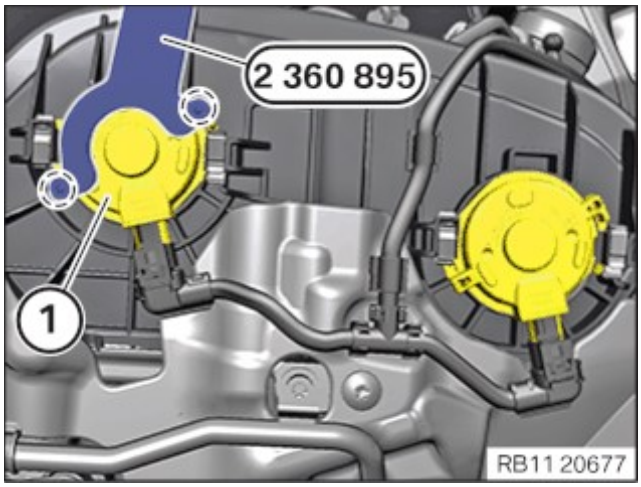
NOTICE

The figure shows the rear side of the engine.

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



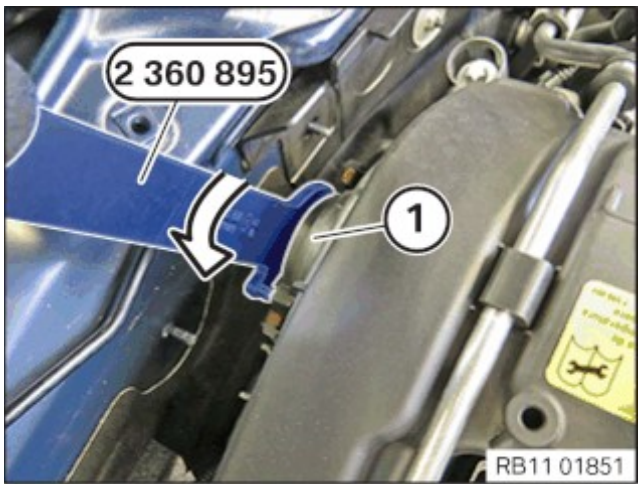
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool **2 360 895** until the limit stops touch the clamps.



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.

93–Installing both the high pressure pumps

▶ Installing high pressure pump of cylinders 4 to 6

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.

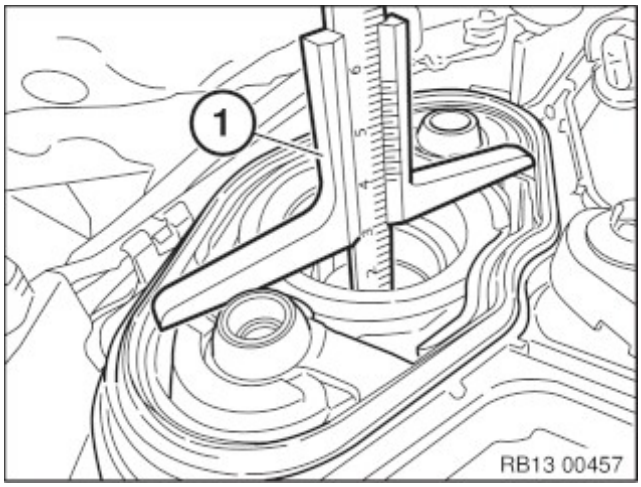
TECHNICAL INFORMATION

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

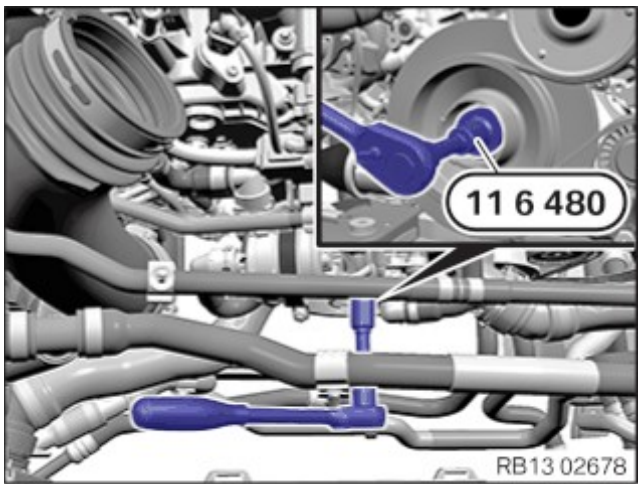
Before installing the high pressure pump, turn the cam of the high-pressure pump drive to the bottom dead centre.

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.



RISK OF DAMAGE

Damage to the engine.

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

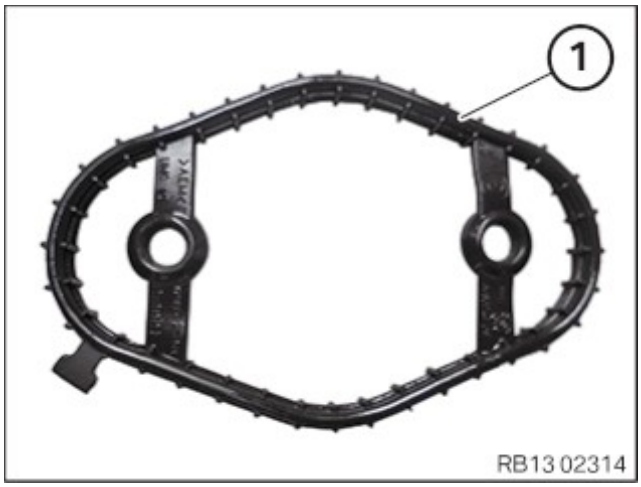
- Turn the combustion engine exclusively by hand in the correct direction of rotation: a) Clockwise, facing the vibration damper or b) Anticlockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

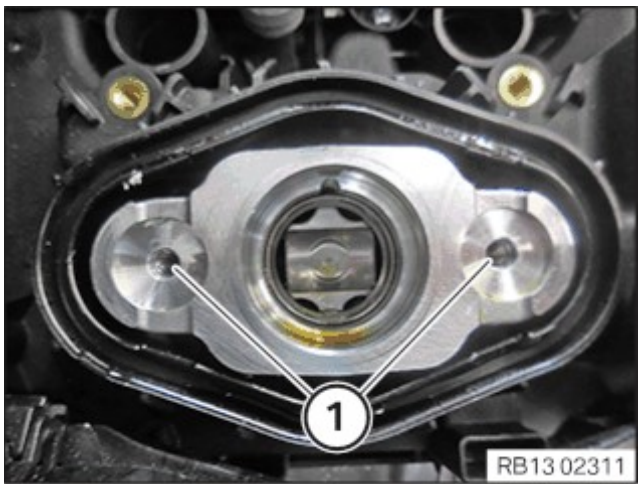
- Rotate the engine with the special tool **0 493 380 (11 6 480)**until the cam of the high-pressure pump drive is at the **BDC position** .

- 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.

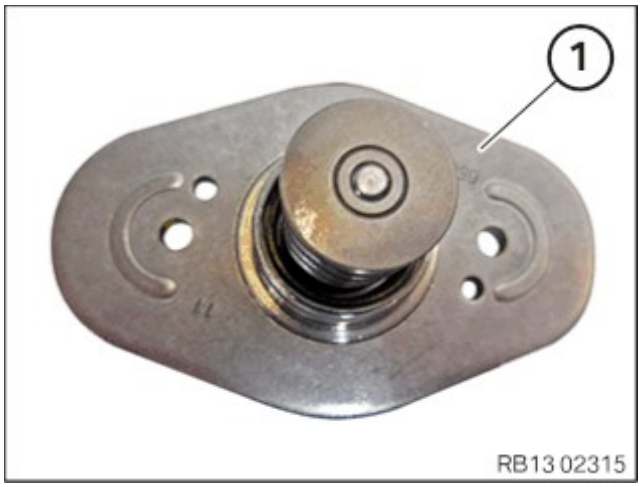
- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.

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.

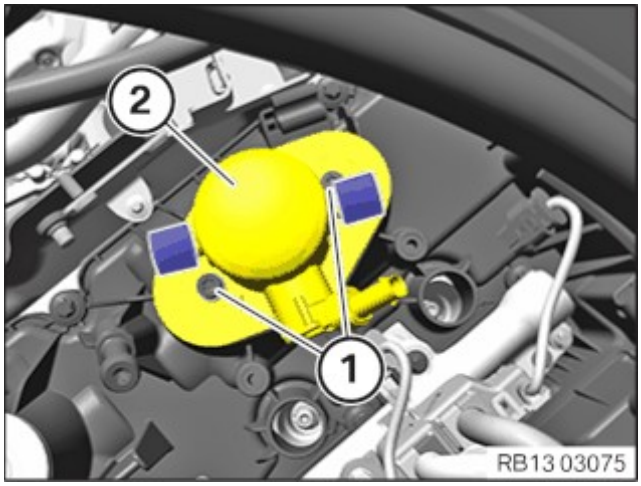
The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- 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 screws(1).

  Parts: Screws

- Position the screws (1) on the high pressure pump (2) and tighten them **in alternating order** in increments of **90°**.

  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 °

◀

▶ Installing the high pressure pump for cylinders 1 to 3

RISK OF DAMAGE

Damage to the engine.

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

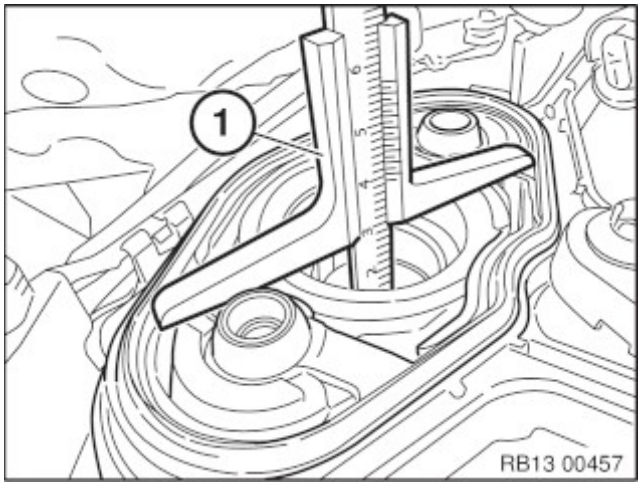
- Turn the combustion engine exclusively by hand in the correct direction of rotation: a) Clockwise, facing the vibration damper or b) Anticlockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

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

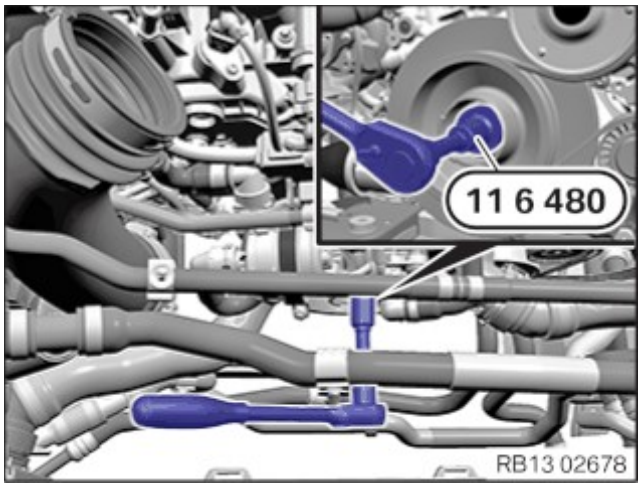
Before installing the high pressure pump, turn the cam of the high-pressure pump drive to the bottom dead centre.

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.



RISK OF DAMAGE

Damage to the engine.

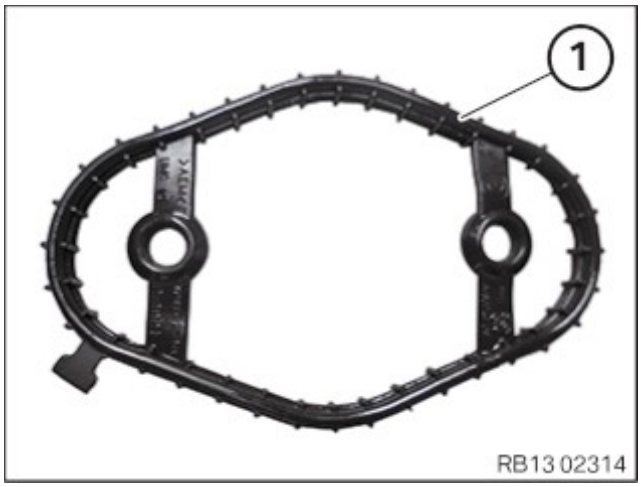
The engine may be damaged if it is manually rotated in the wrong direction.

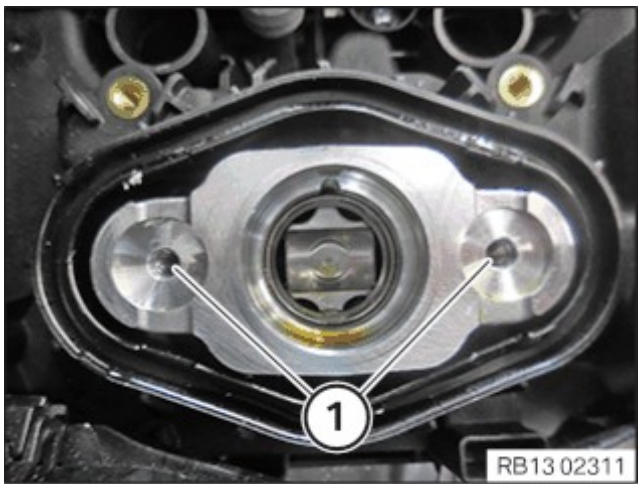
- Turn the combustion engine exclusively by hand in the correct direction of rotation: a) Clockwise, facing the vibration damper or b) Anticlockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

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

- Guide out and remove gasket (1).
- Renew the gasket (1).

  Parts: Gasket





TECHNICAL INFORMATION

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

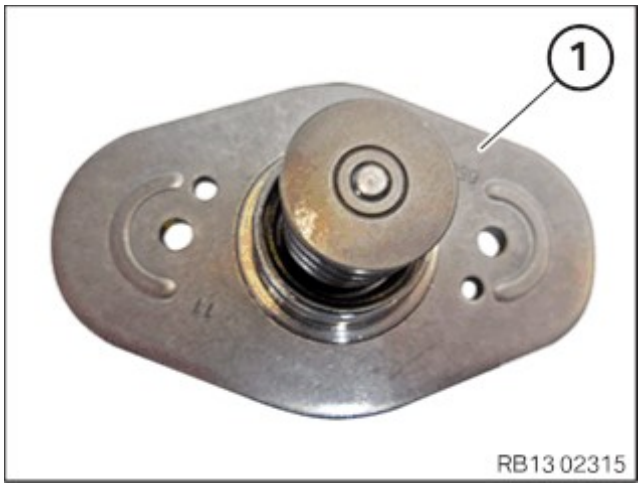
- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.

TECHNICAL INFORMATION

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

- Clean sealing surface (1).

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



RISK OF DAMAGE

Damage to the surface.

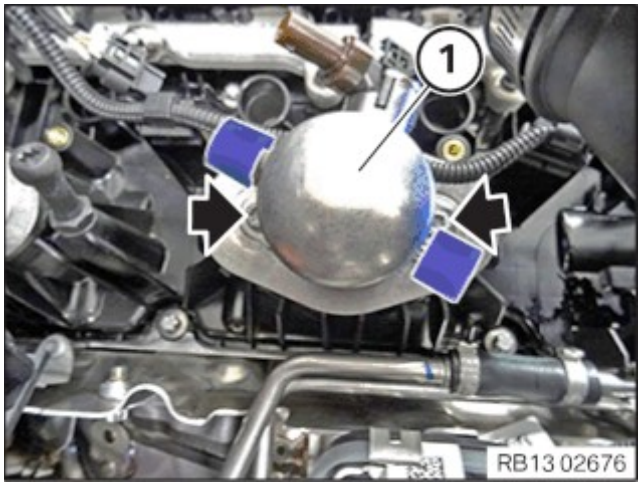
The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

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

- Clean sealing surface (1).



- Insert and install the high pressure pump (1).
- Renew the bolts (arrows).

  Parts: Bolts
- Position the screws (arrows) on the high pressure pump (1) and tighten them in **alternating** order in steps of **90°** each.

  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 °

◀

94–Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

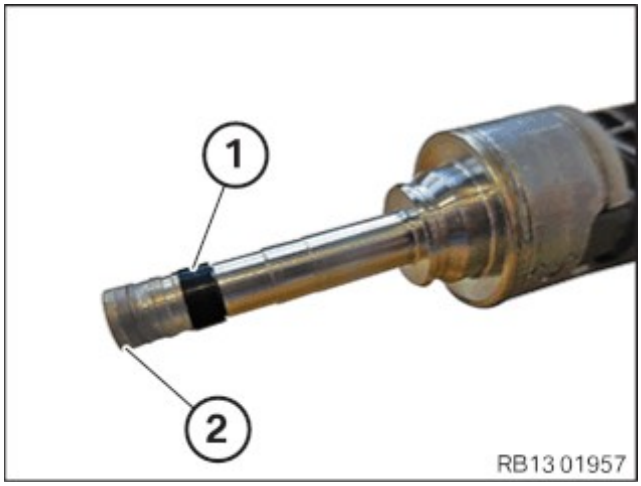
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- 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.

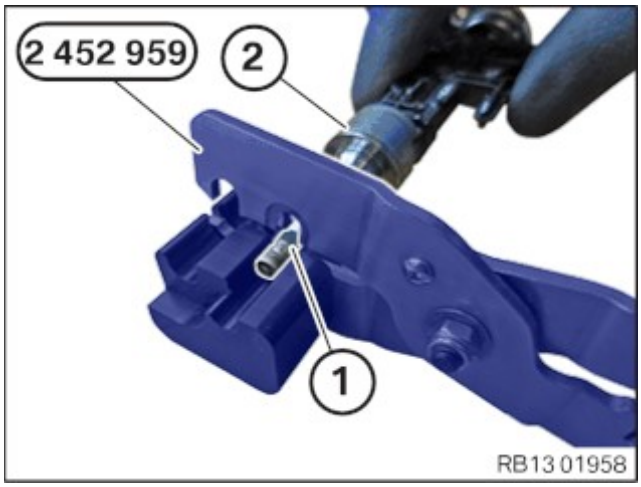
After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.



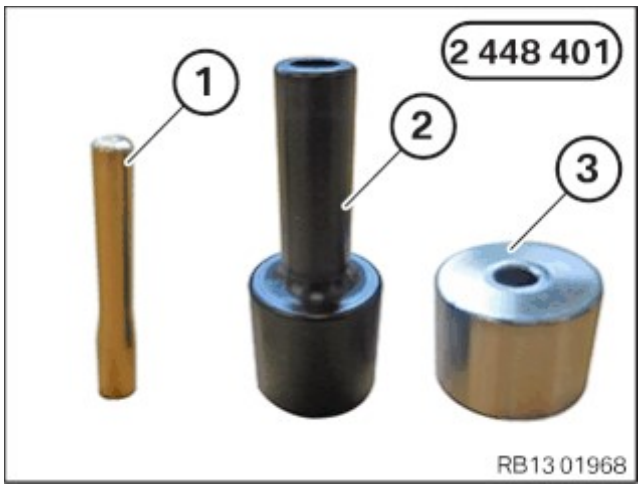
- Before installing the injectors: Renew the Teflon rings (1).

  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.



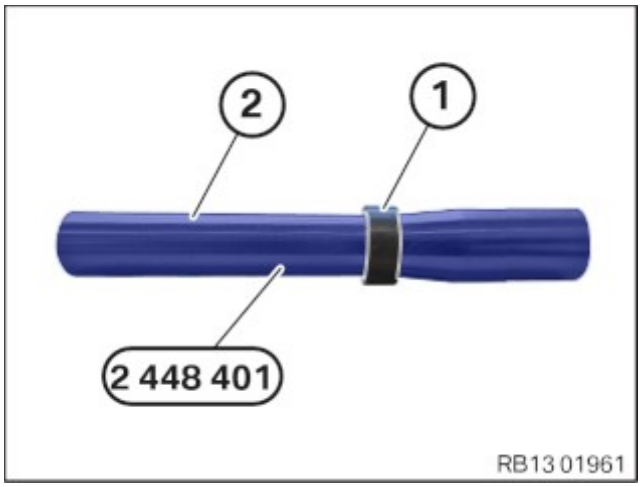
- For the installation of the new Teflon rings: Use the set of special tools **2 448 401**:

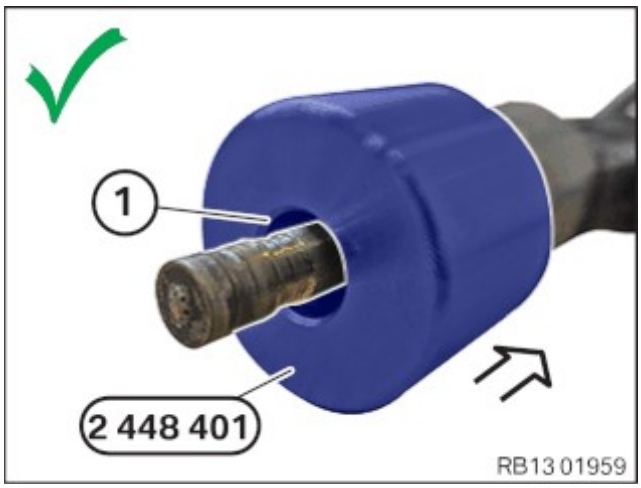
  (1) Installation cone

  (2) Sliding sleeve

  (3) Assembly sleeve

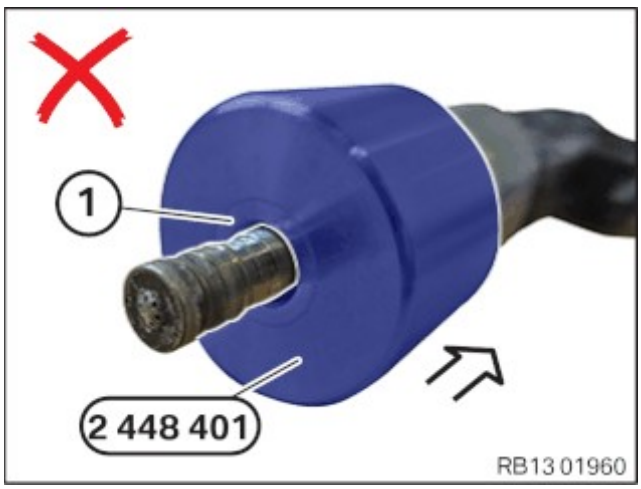
- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools **2 448 401**.





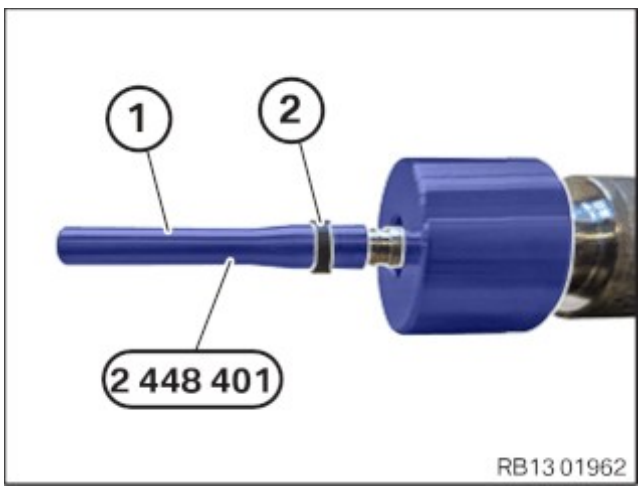
- Make sure the installation position of the assembly sleeve (1) from the set of special tools **2 448 401** is correct:

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

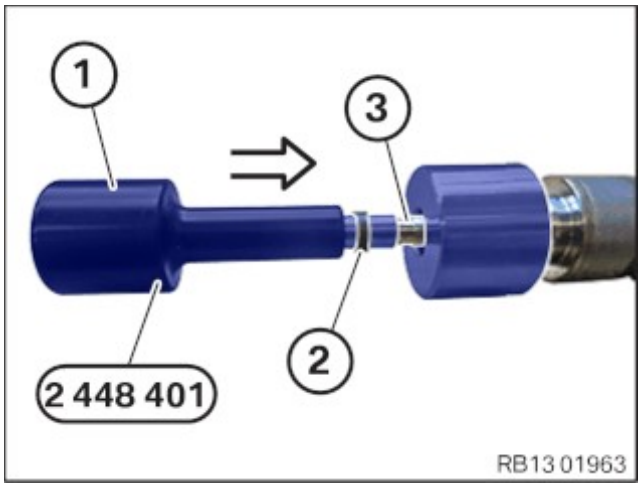


- Make sure the installation position of the assembly sleeve (1) from the set of special tools **2 448 401** is correct:

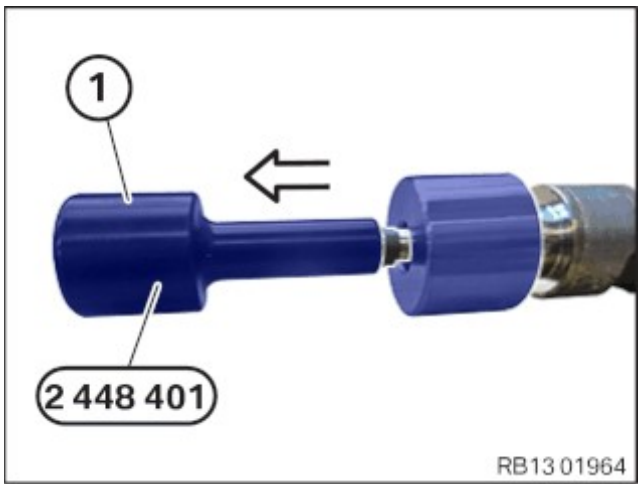
  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.



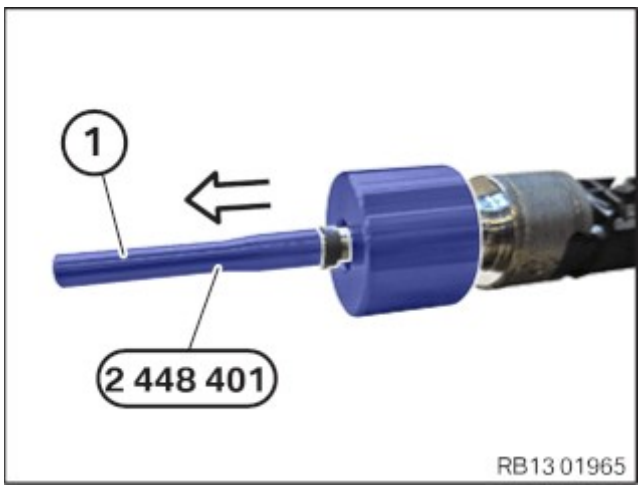
- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools **2 448 401** on the injector tip .



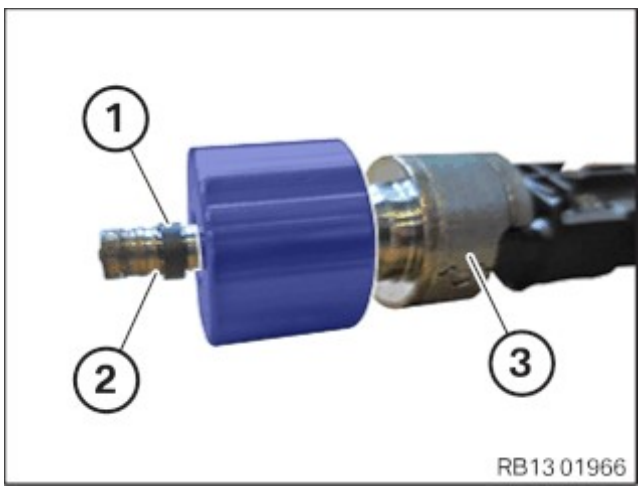
- Use the sliding sleeve (1) from the set of special tools **2 448 401** to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.



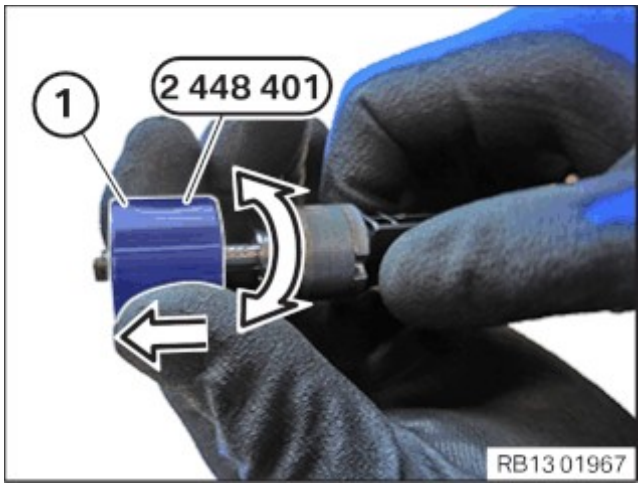
- Thread out the sliding sleeve (1) from the set of special tools **2 448 401** in the direction of the arrow and remove.



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

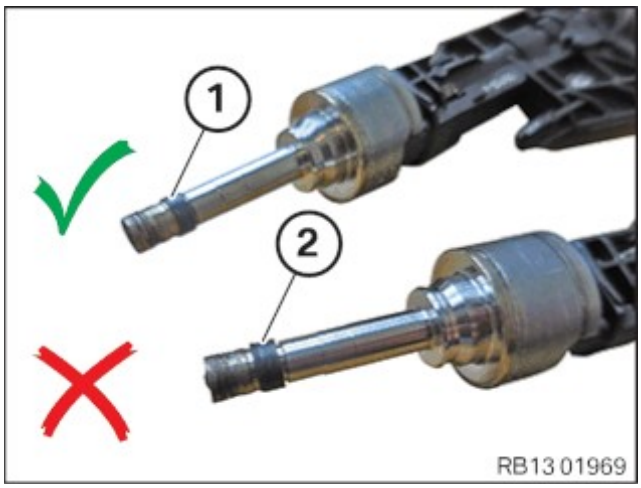


- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.



- 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).



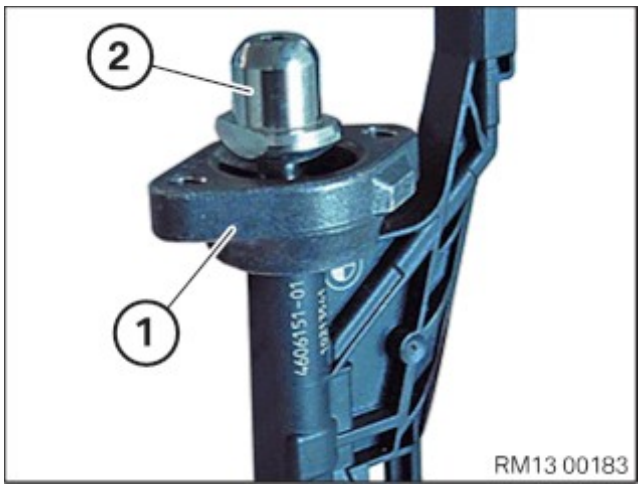
- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

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

TECHNICAL INFORMATION

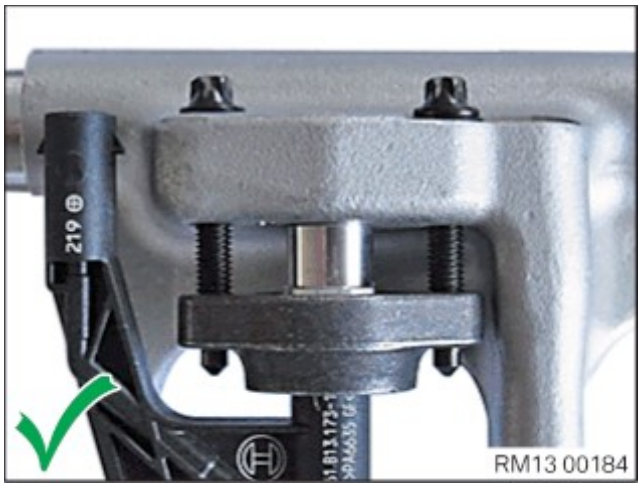
When assembling, it is essential to observe screwing sequences and tightening torques.

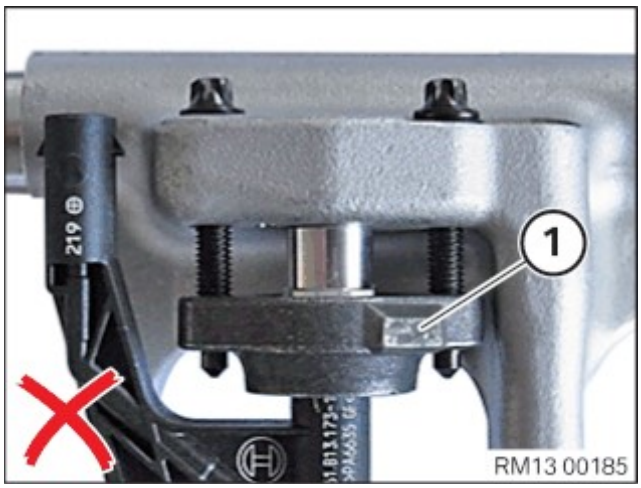
Non-observance of these requirements may result in leaks and damage.



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

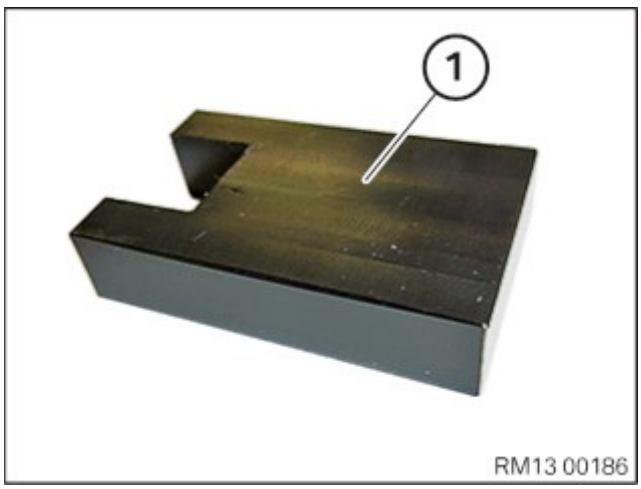
  The holder is mounted **correctly** when the cast lug is located at the rear.





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

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



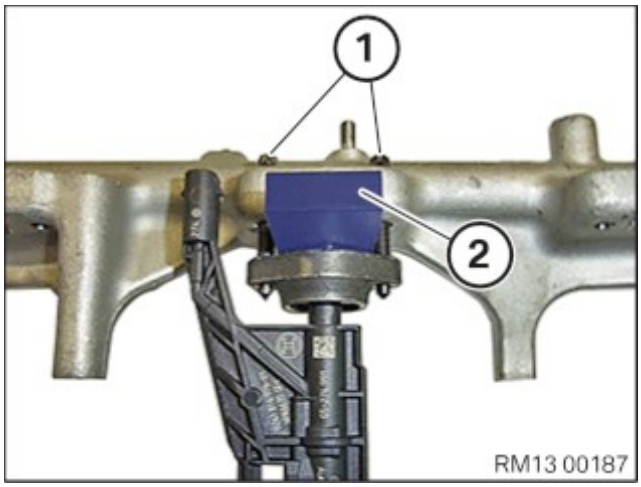
RISK OF DAMAGE

Damage to injectors.

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

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

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



- Replace (M5x30) screws.

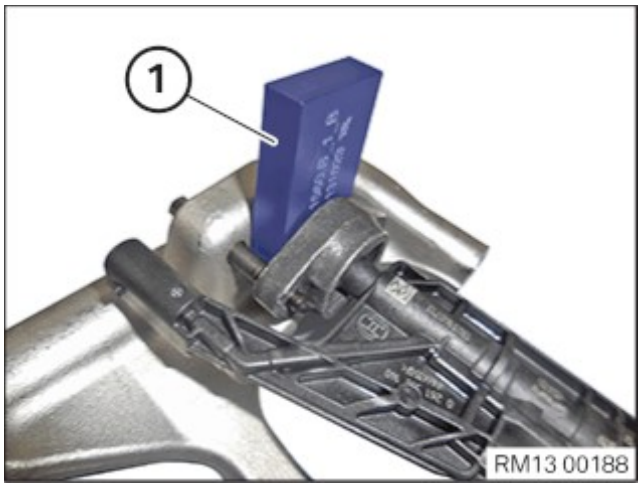
  Parts: Screws (M5x30)

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

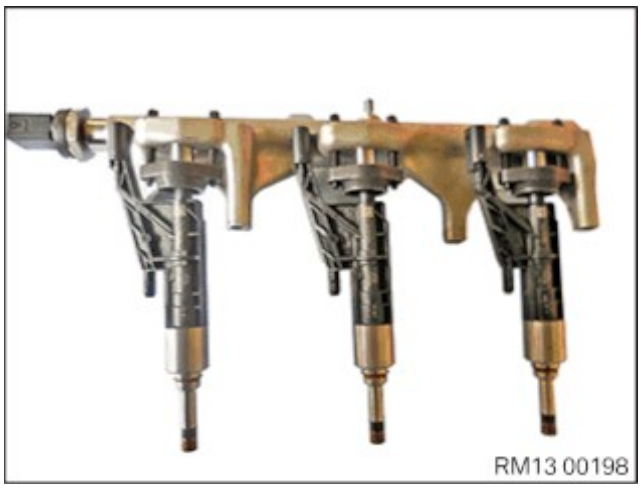
  The electrical injector connections must point to the fuel pressure sensor.

- Slide the special tool (distance gauge) **2 358 022** (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) **2 358 022** (2) rests flat on the retaining bridge.

- Hand-tighten both screws (M5x30) (1) evenly until the special tool (distance gauge) **2 358 022** (2) rests flat on the rail and the holder.

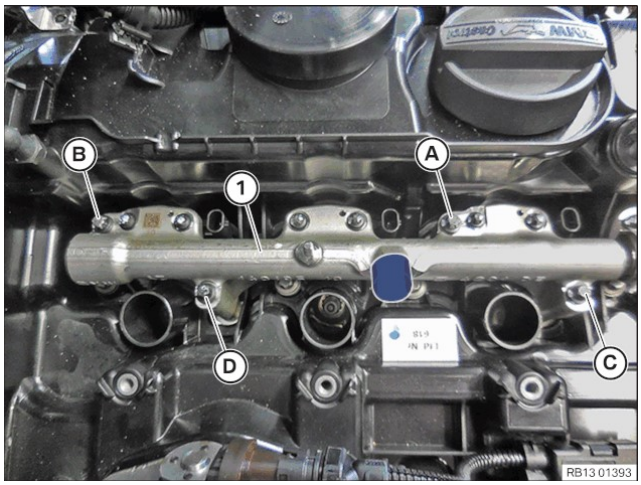


- Remove the special tool (distance gauge)**2 358 022** (1) .
- Repeat this operation for all injectors.



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

  The injectors must move freely.



- Change screws (A) to (D).

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

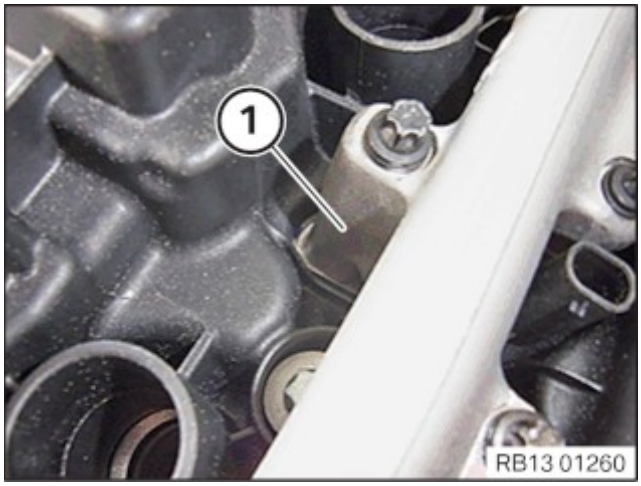
  The figure shows the rail resting flat against the cylinder head.
- Insert screws (C) and (D).

TECHNICAL INFORMATION

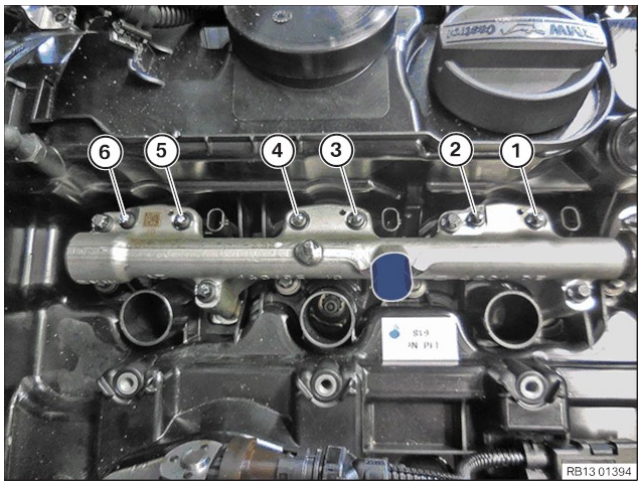
When assembling, it is essential to observe screwing sequences and tightening torques.

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

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



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



- Connect wrench socket to an extension.

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

TECHNICAL INFORMATION

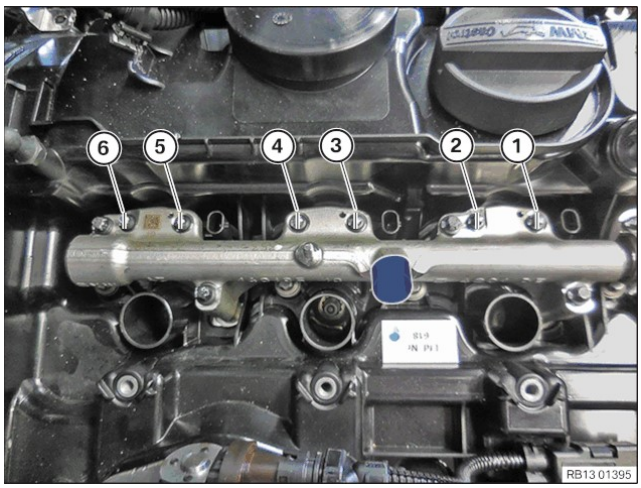
When assembling, it is essential to observe screwing sequences and tightening torques.

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

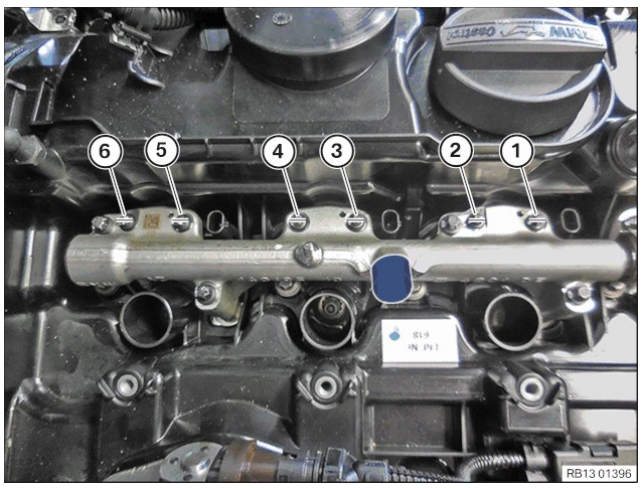
- **Screw the (M5x30) bolts according to the following plan:**
  - **Fuel injector 4:**
  - Tighten screw (1) at an angle of rotation of 90° ±15° with the torque wrench.
  - Tighten screw (2) at an angle of rotation of 90° ±15° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until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

Tighten screw (3) at an angle of rotation of 90° ±15° with the torque wrench.

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



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



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

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

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

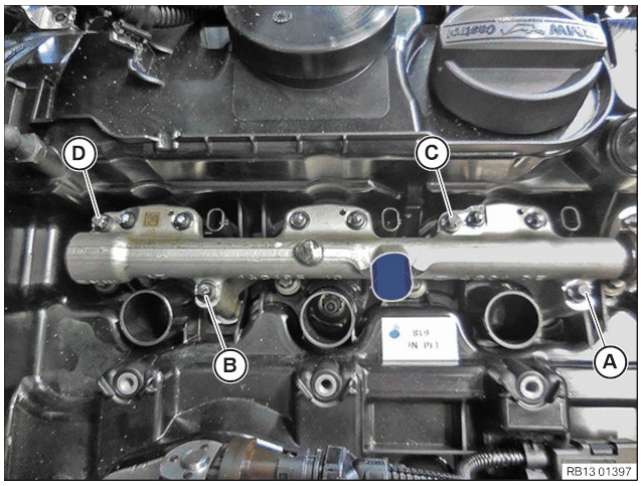
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

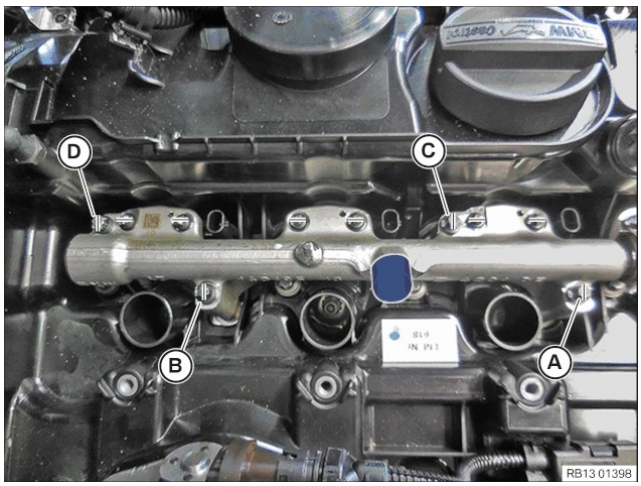
When assembling, it is essential to observe screwing sequences and tightening torques.

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

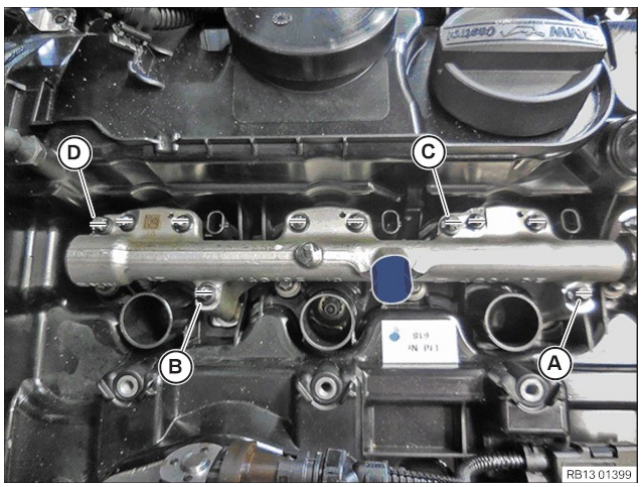
- Tighten screw (A) by 5 Nm.



- Tighten screw (D) by 5 Nm.
- Tighten screw (B) by 5 Nm.
- Tighten screw (C) by 5 Nm.

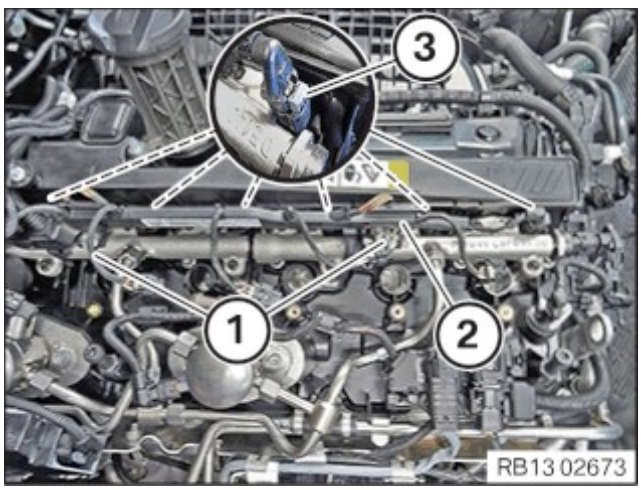


- Mark all the bolts (A) to (D) with a vertical line (see Figure).
- Tighten bolts (M6x70) (A) to (D) with an angle of rotation of 90°.



- Check if all screws (A) to (D) were tightened with an angle of rotation of 90°.

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



- Connect connector (3) to the injectors and lock.

  All the connectors (3) must engage audibly.
- Feed in cable channel (2) and install.
- Tighten nuts (1).

Ground cable to rail

M6		Tightening torque	5 Nm

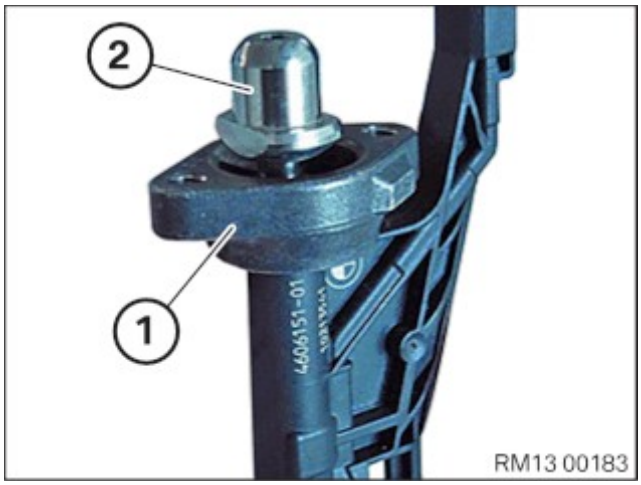
-

96–Installing rail with injectors of cylinders 1 to 3

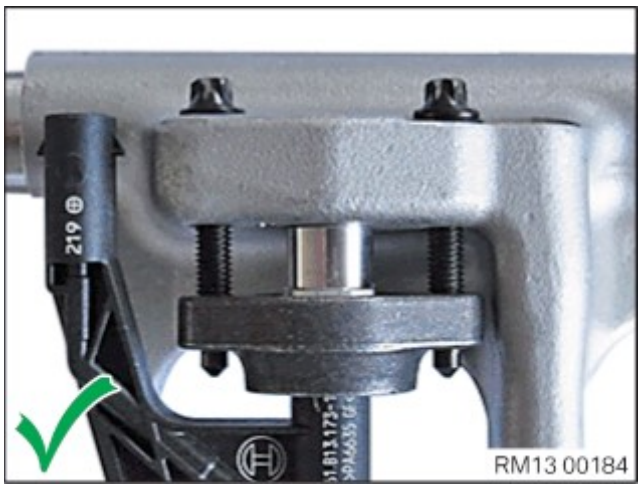
TECHNICAL INFORMATION

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

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

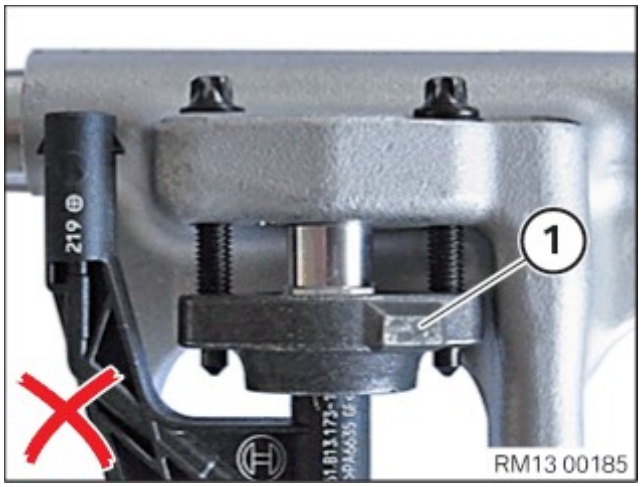


- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder (1) has a cast lug:** Make sure that the holder is installed in the correct position.



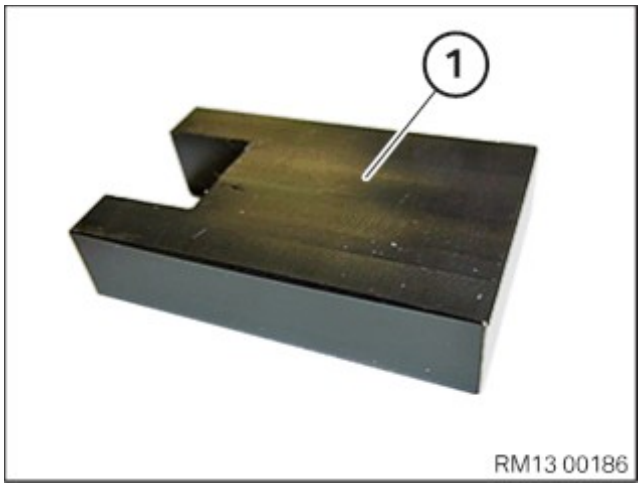
- Observe the position of the cast lug:

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



- Observe the position of the cast lug:

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



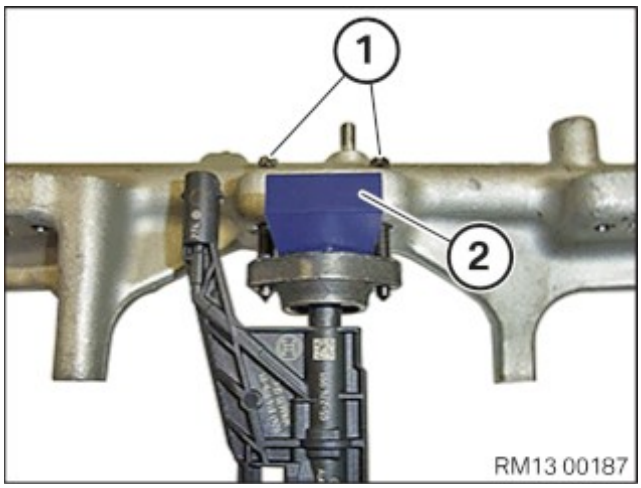
RISK OF DAMAGE

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 special tool **2 358 022** (1).



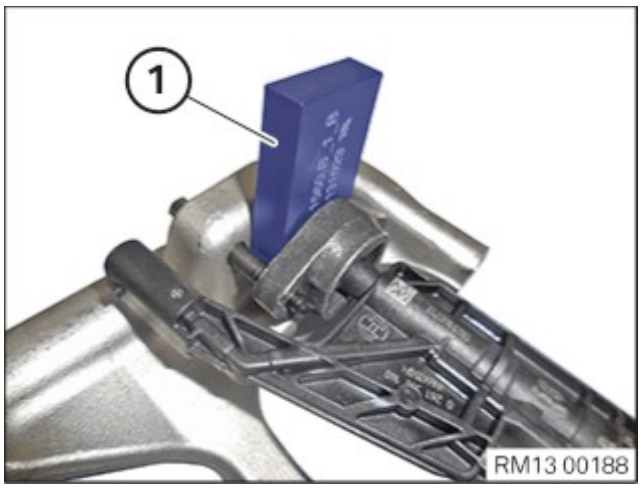
- Replace (M5x30) screws.

  Parts: Screws (M5x30)

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

  The electrical injector connections must point to the fuel pressure sensor.

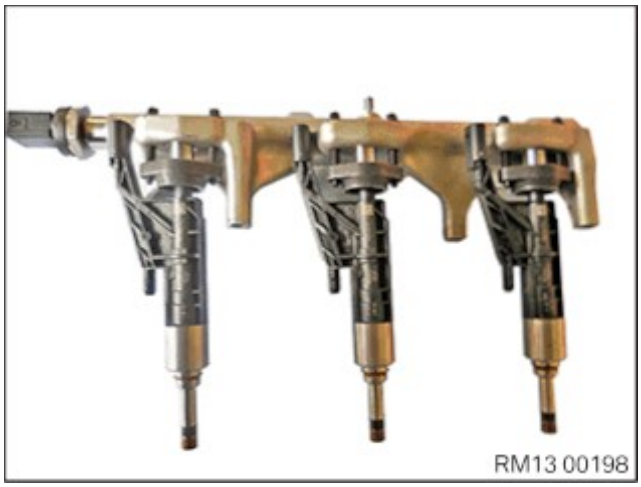
- Slide special tool **2 358 022** (2) between the holders and the rail onto the injector head.
- Make sure that the special tool **2 358 022** (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) evenly until the special tool **2 358 022** (2) rests flat against the rail and the holder.

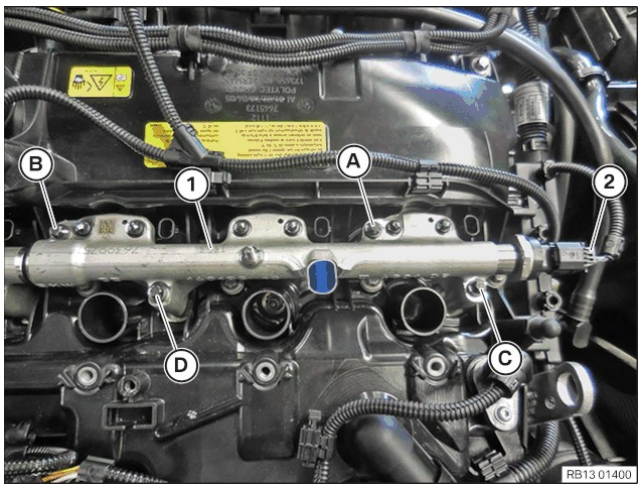


- Remove special tool **2 358 022** (1).
- Repeat this operation for all injectors.

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

  The injectors must move freely.





- Change screws (A) to (D).

  Parts: Screws

- 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 downwards until resistance is felt; position the screws (M6x70) (A), (B), (C) and (D) and hand-tighten them.
- 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.

TECHNICAL INFORMATION

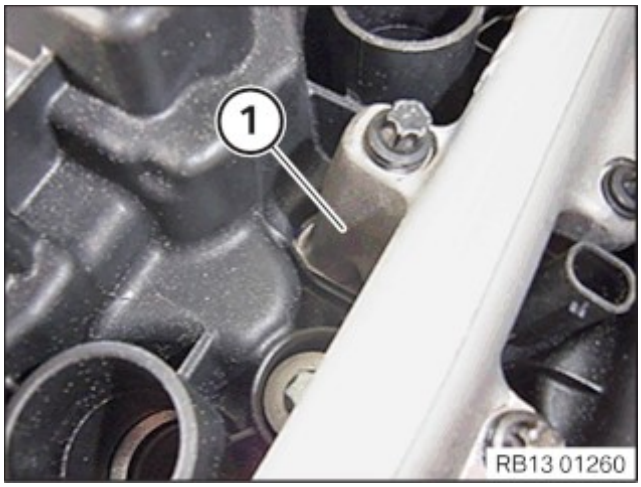
When assembling, it is essential to observe screwing sequences and tightening torques.

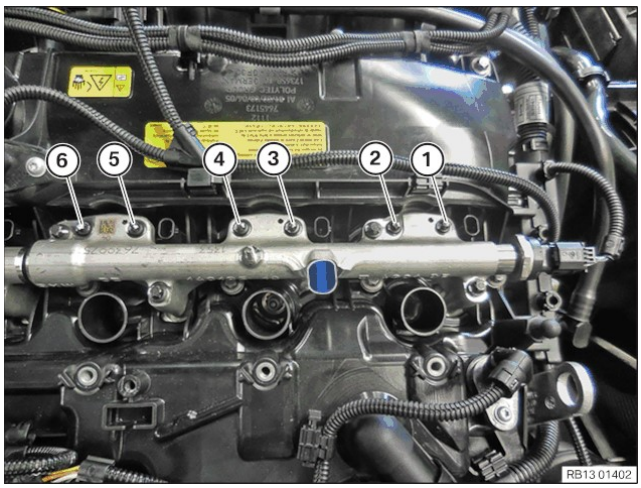
Non-observance of these requirements may result in leaks and damage.

- 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 and lock the connector (2).

  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 screws (M5x30) in pairs ((1) with (2), (3) with (4), (5) with (6)) alternately by **90°**.
- Set torque wrench to 5 Nm.

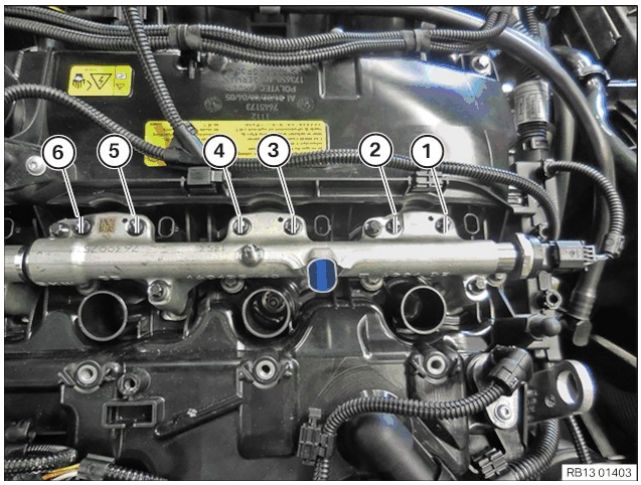
TECHNICAL INFORMATION

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

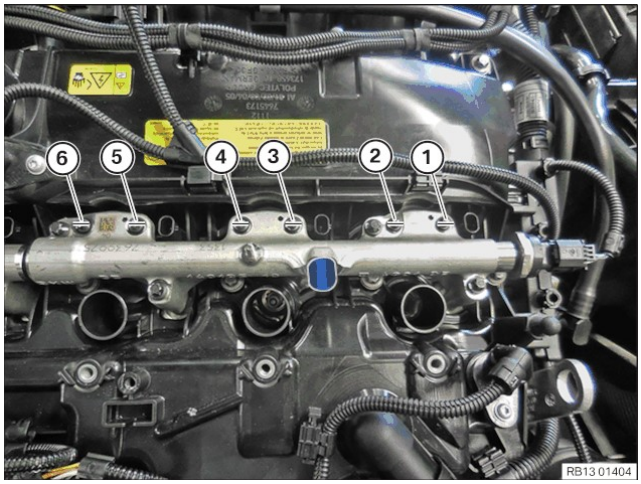
Non-observance of these requirements may result in leaks and damage.

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

Repeat the operations for bolts (5) and (6) until both bolts reach a torque of 5 Nm.

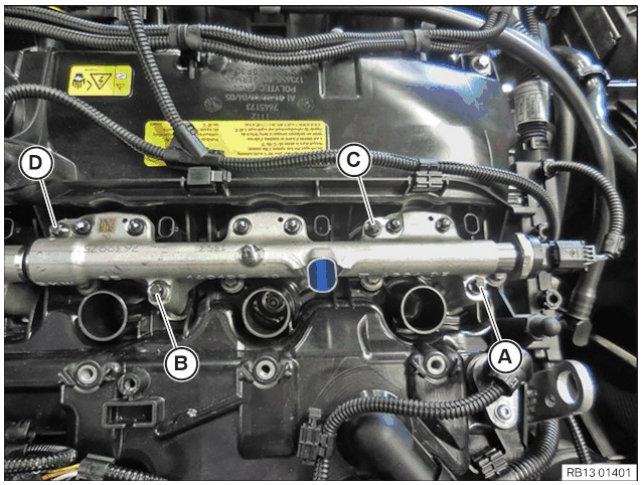


- Mark all bolts (1) to (6) with a line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the screw (1) with an angle of rotation of 90° ±15°.
  - Tighten the screw (2) with an angle of rotation of 90° ±15°.
  - Tighten the screw (3) with an angle of rotation of 90° ±15°.
  -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



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

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



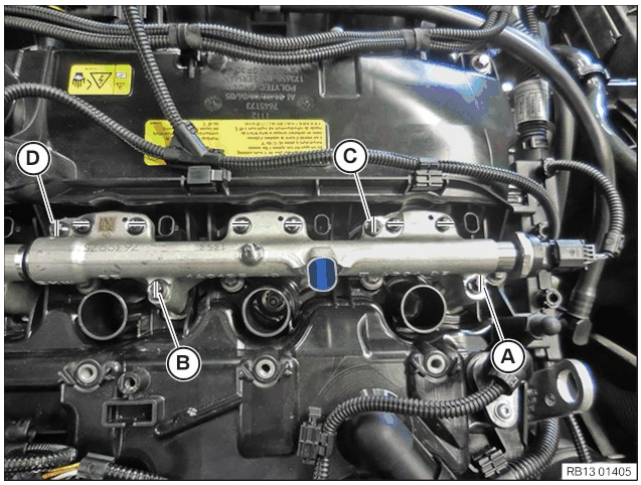
- Screws (M6x70) (A) to (D) **must** be loosened.

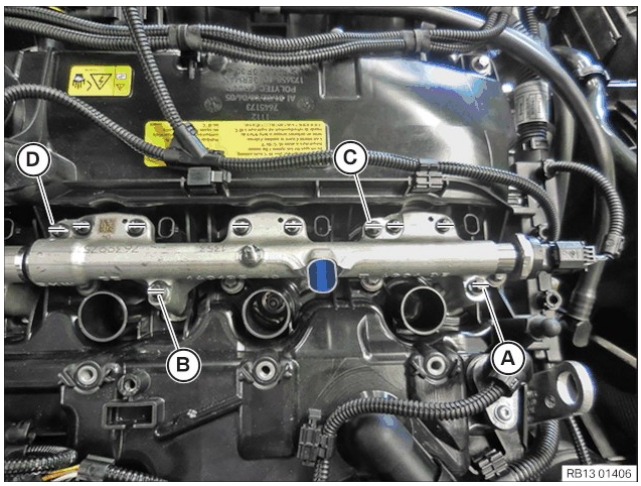
TECHNICAL INFORMATION

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

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

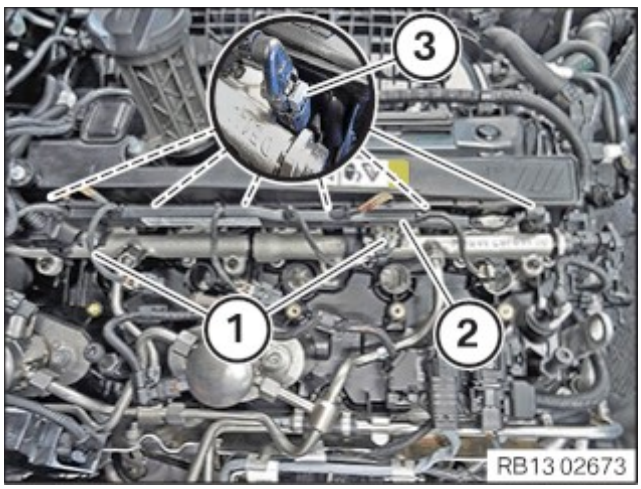
- Tighten screw (A) by 5 Nm.
- Tighten screw (D) by 5 Nm.
- Tighten screw (B) by 5 Nm.
- Tighten screw (C) by 5 Nm.
- Mark all the bolts (A) to (D) with a vertical line (see Figure).
- Tighten bolts (M6x70) (A) to (D) with an angle of rotation of 90°.





- Check if all screws (A) to (D) were tightened with an angle of rotation of 90°.

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



- Connect connector (3) to the injectors and lock.

  All the connectors (3) must engage audibly.
- Feed in cable channel (2) and install.
- Tighten nuts (1).

Ground cable to rail

M6		Tightening torque	5 Nm

-

97–Removing the high pressure line between the high pressure pump and the rail for cylinders 1 to 6

⚠ 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

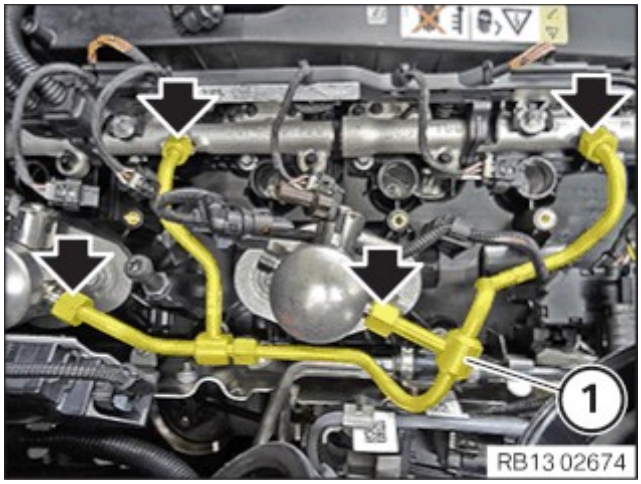
On releasing high pressure line, fuel may emerge at high speed.

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.

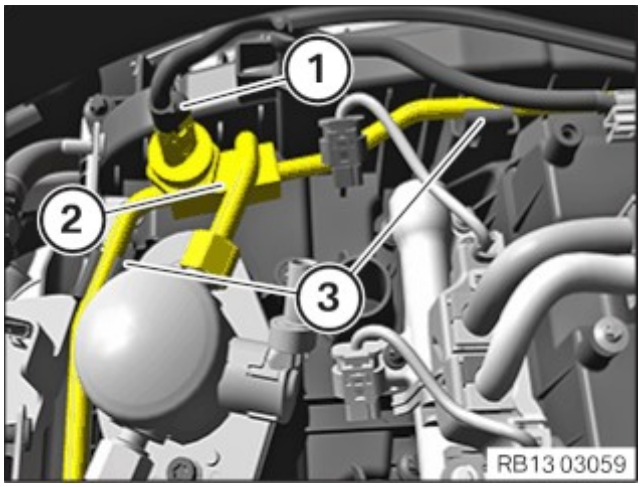
i TECHNICAL INFORMATION

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



- Position a lint-free rag under the union nuts.
- Unscrew union nuts (arrows) with the special tool **0 495 280 (13 0 140)**.
- Catch and dispose of escaping fuel.
- Pull the high pressure line (1) out and remove it.
- Feed out and dispose of the lint-free cleaning clothes .

98–Installing fuel delivery line



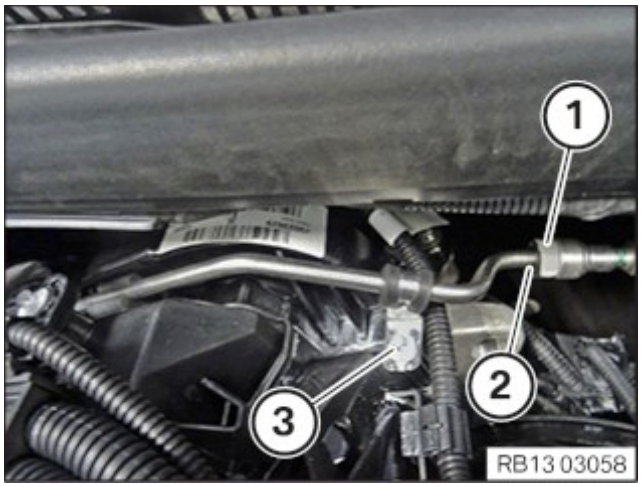
- Insert the fuel feed line (2) in the clamps (3) and position it.
- Connect connectors (1) and lock.

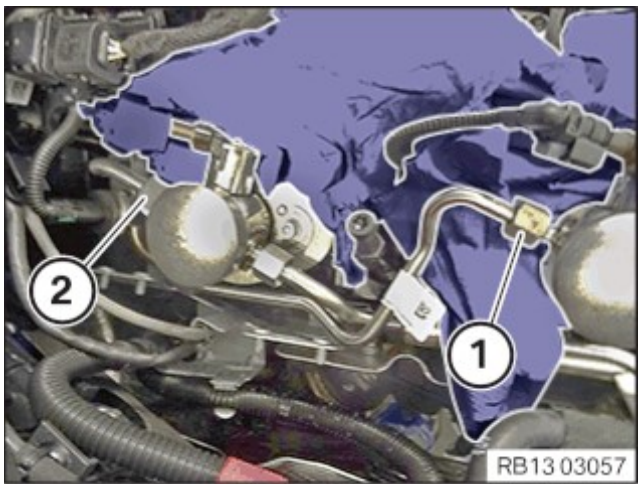
  The connector (1) must engage audibly.
- Insert the fuel feed line in the snap fastener (2) and lock it.

  The fuel feed line must be audibly engage in the snap fastener (2).
- Tighten down screw (3).

Fuel line to cylinder head cover

6x18		Tightening torque	7 Nm





- Hand-tighten the union nut (2).
- Hand-tighten the union nut (1).
- Tighten the union nut (2).

Fuel delivery line to high pressure pump

Coupling nut		Tightening torque	33 Nm

- Tighten the union nut (1).

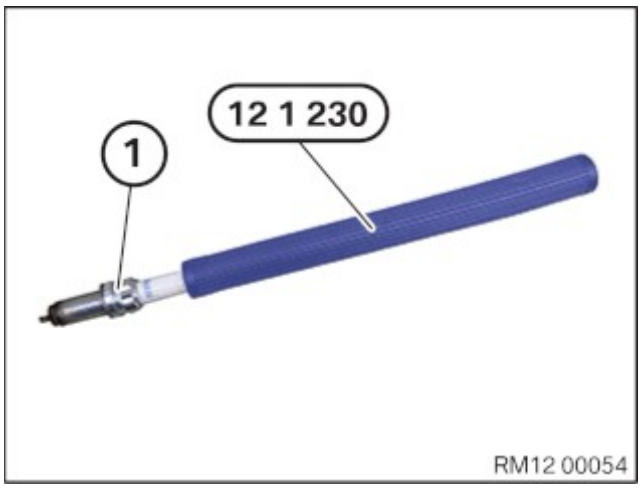
Fuel delivery line to high pressure pump

Coupling nut		Tightening torque	33 Nm

99–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

100–Installing all ignition coils

NOTICE

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

▶ Install ignition coil.

- Feed in and install the ignition coil (3).
- Tighten down screw (2).

Ignition coil

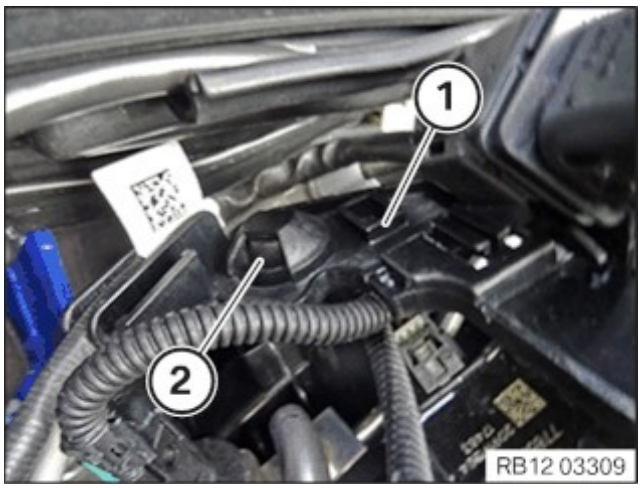
Screw		Tightening torque	8 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

◀

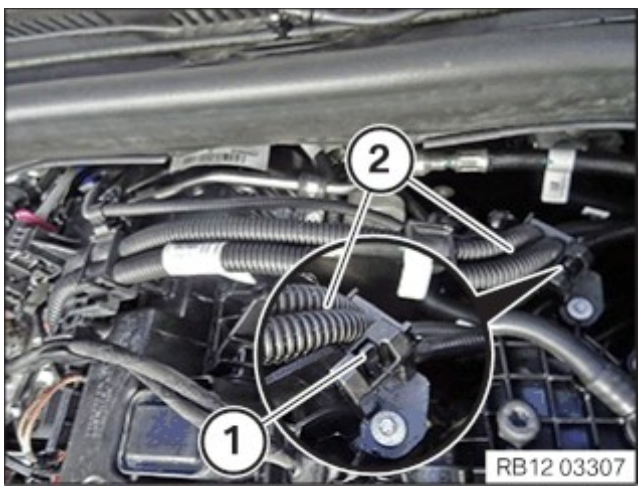
- Insert and install the holder (1).



- Fasten the holder (1) to the ball stud (2).

- Guide in the wiring harness section (1) and install.

  The locks (arrows) must engage audibly.

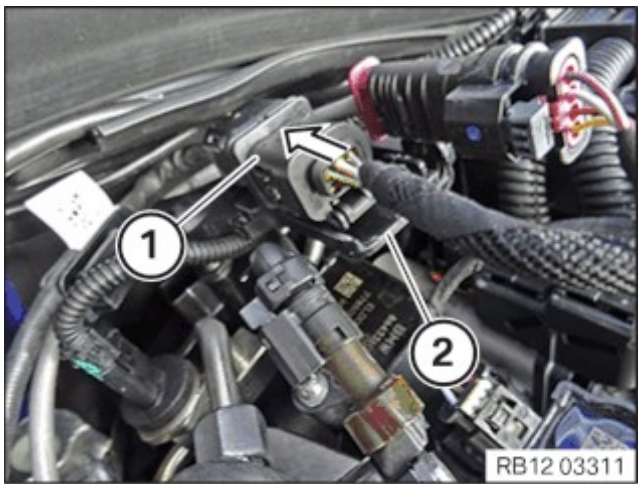


- Insert and install the wiring harness section (2).

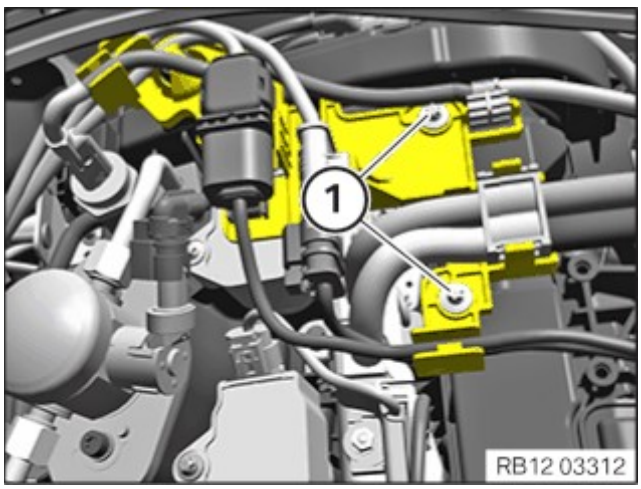
  The lock (1) must engage audibly.

- Connect connectors (1) and lock.

The connector (1) must engage audibly.



- Feed in the plug connection (1) in the direction of arrow into the holder (2) and install it.



- Tighten the screws (1).

Oxygen sensors holder to cylinder head cover

Self-tapping screw M6		Tightening torque	5.5 Nm

101–Installing the holder of the positive battery cable

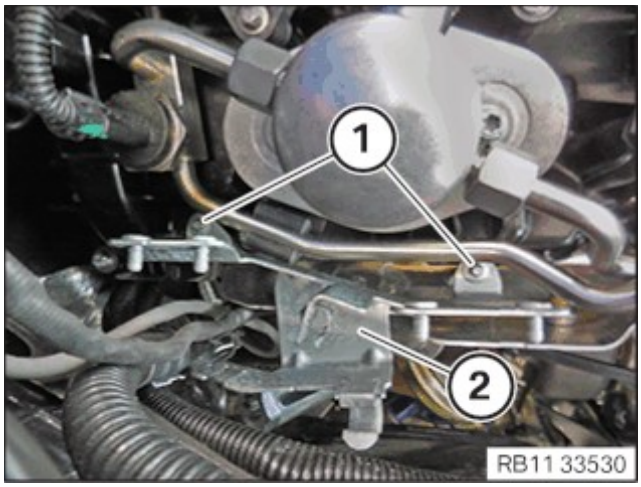
⚠ CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

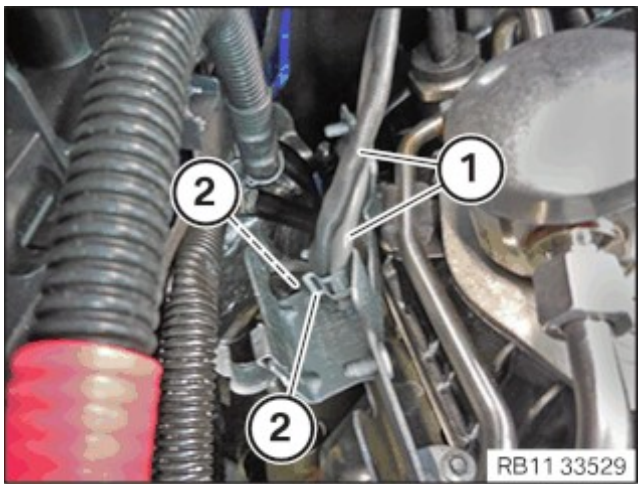
- Route the positive battery cable without abrasions and do not trap.

- Insert and position the bracket (2) of the positive battery cable.
- Tighten the screws (1).

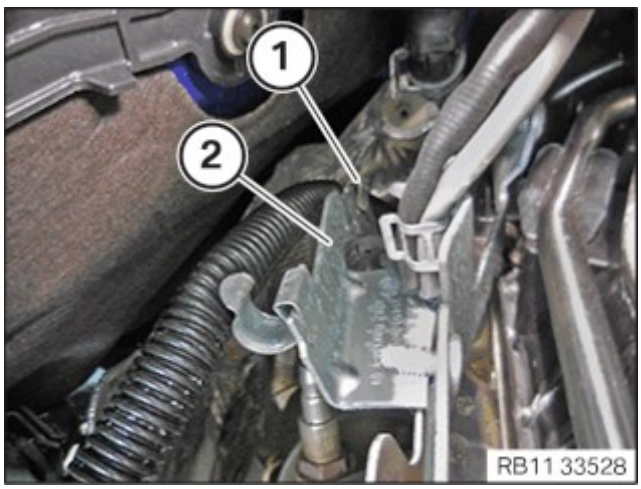


Holder, positive battery cable to cylinder head cover

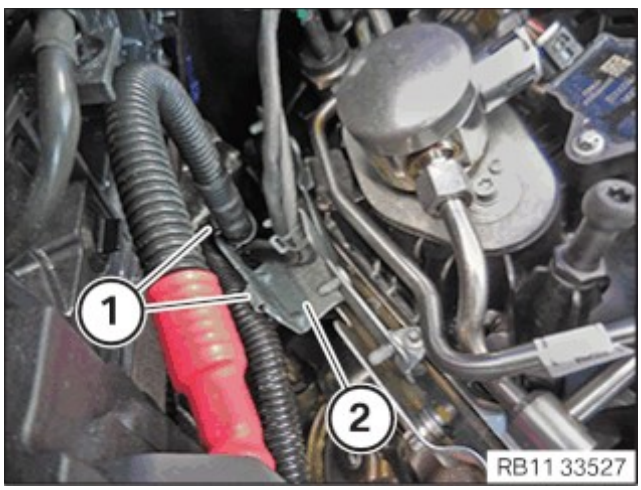
Self-tapping plastic screw 6 x 18		Tightening torque	8 Nm



- Mount the cables (1) to the clamps (2).



- Secure clamp (1) to holder (2).

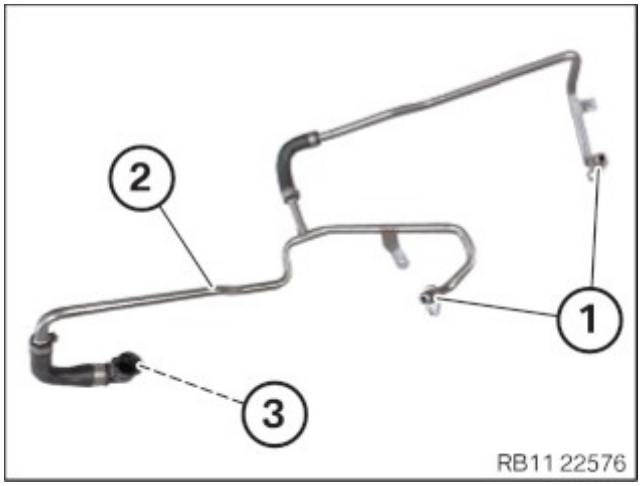


- Secure the clamps (1) to holder (2).

102–Installing the coolant return line between the exhaust turbocharger and thermostat

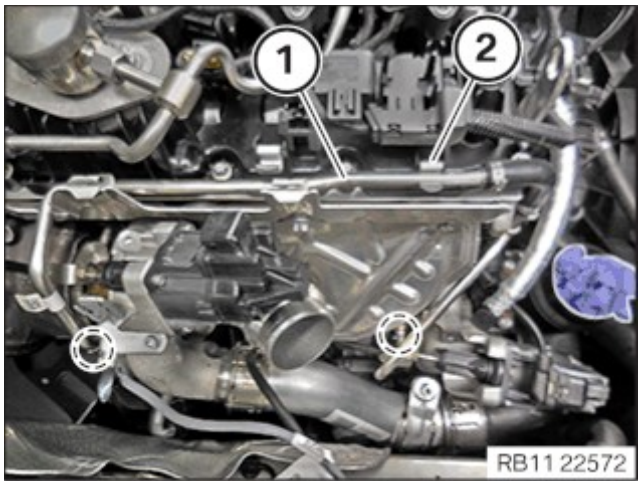
TECHNICAL INFORMATION

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

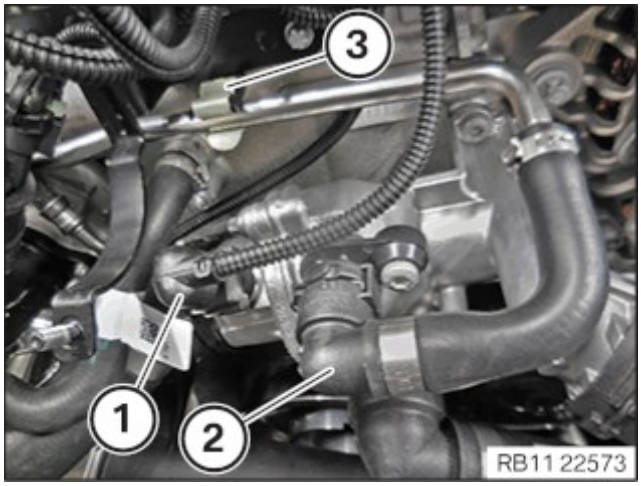


- Renew the sealing rings (1) on the coolant return line (2) with the special tool **0 496 714 (00 9 030)**.

  Parts: Sealing ring
- Check sealing ring (3) on the coolant return line (2) for damage and if required, renew the coolant return line (2).



- Guide in and position the coolant return line (1).
- Insert the coolant return line (1) in the **marked** area and install it.
- Secure coolant return line (1) to the clamp (2).

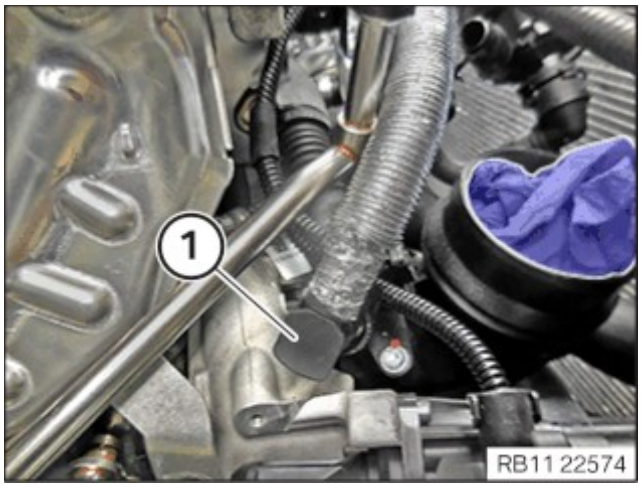


- Secure coolant return line (2) to the clamp (3).
- Connect and lock the coolant return line (2).

  The coolant return line (2) must engage audibly.
- Connect connectors (1) and lock.

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

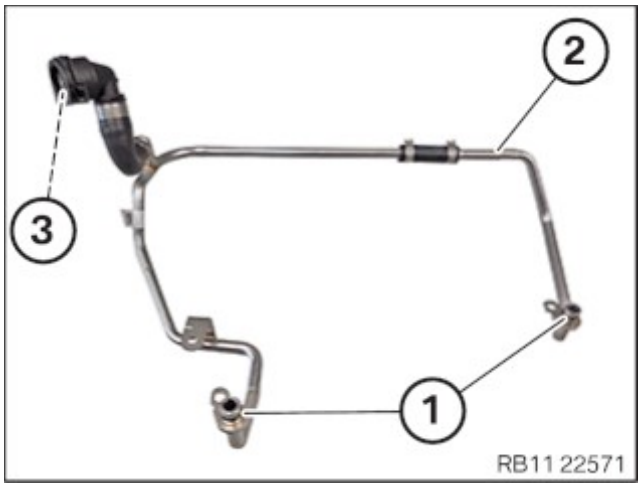
  The tank ventilation line (1) must engage audibly.



103–Installing the coolant feed line part 2 between the auxiliary coolant pump and exhaust turbocharger

TECHNICAL INFORMATION

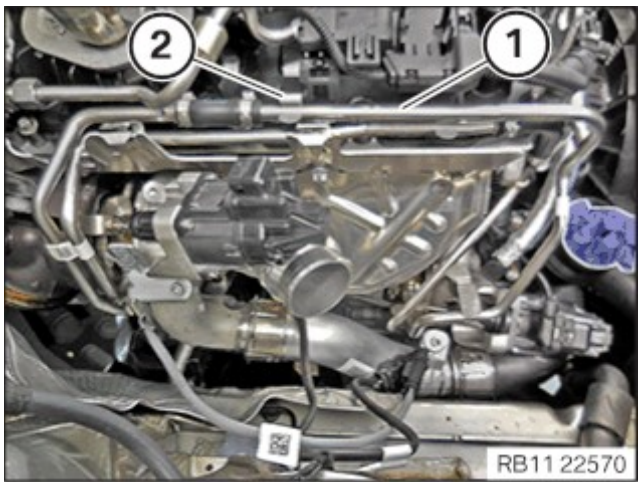
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Renew sealing rings (1) on the coolant feed line (2) part 2 using the special tool **0 496 714 (00 9 030)**.

  Parts: Sealing ring

- Check the sealing ring (3) on the coolant feed line (2) part 2 for damage and if required, renew the coolant feed line (2) part 2.

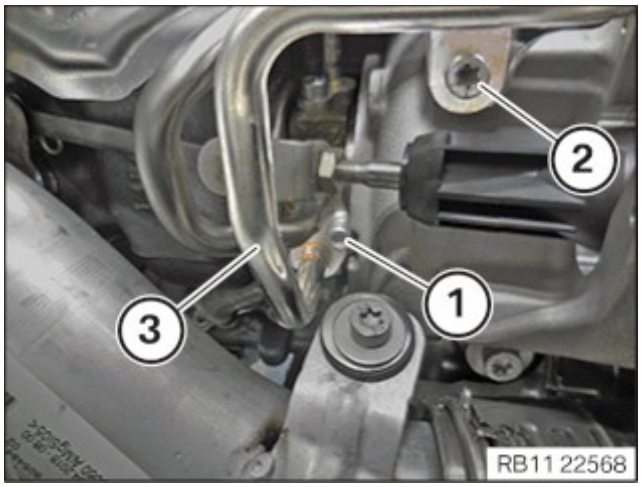


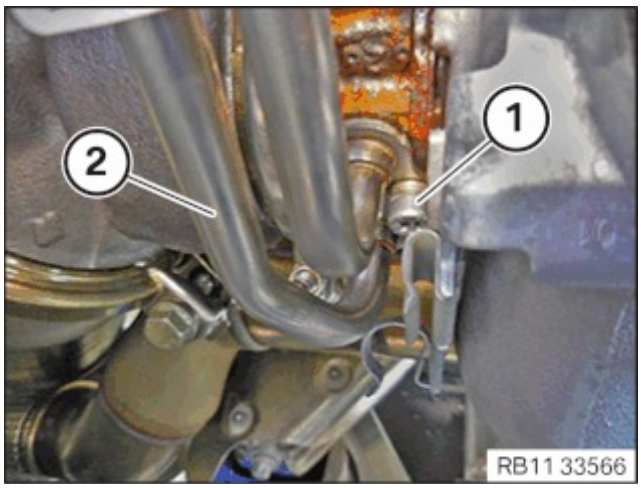
- Feed in and position coolant feed line (1) part 2 on the clamp (2) .

- Insert and install the coolant feed line (3) part 2.
- Tighten the screw (1)and (2).

Coolant feed line part 2 on exhaust turbocharger

M6X12		Tightening torque	8 Nm

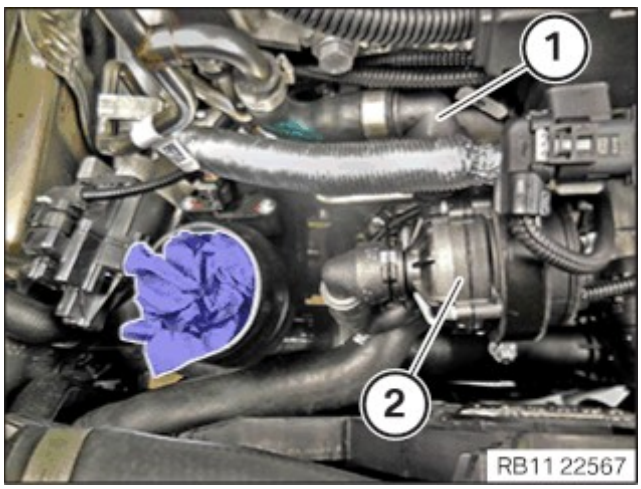




- Insert and install the coolant feed line (2) part 2.
- Tighten screw (1).

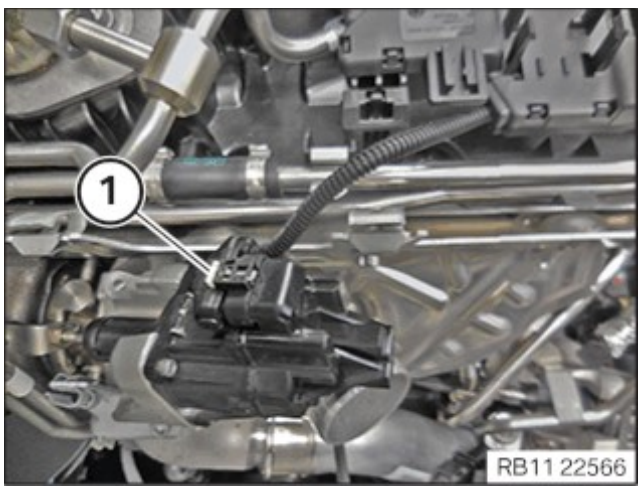
Coolant feed line part 2 on exhaust turbocharger

M6X12		Tightening torque	8 Nm



- Feed in and install coolant feed line (1) part 2 on the auxiliary coolant radiator (2).

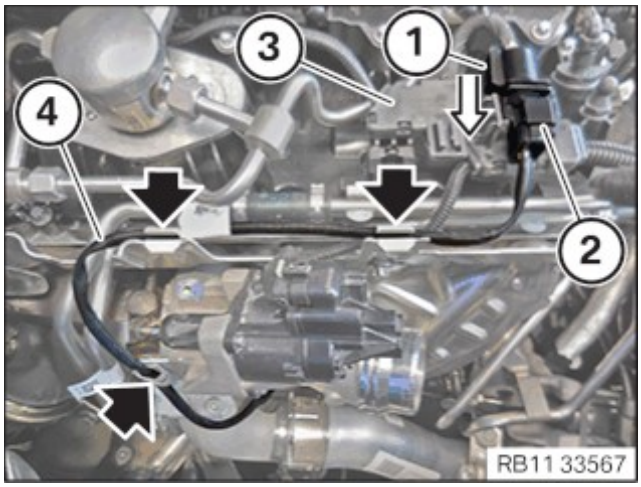
  The coolant feed line (1) part 2 must engage audibly on the auxiliary coolant radiator (2).



- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

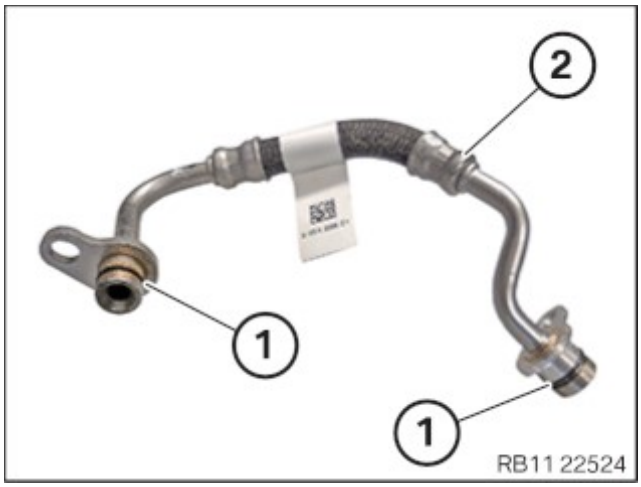
- Feed in the cable (4) along the arrows and install.



- Connect connectors (1) and (2), then lock.

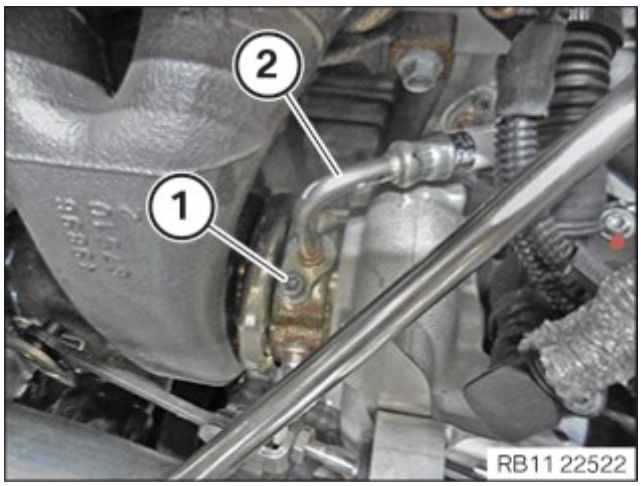
  The connector (1) must engage audibly.
- Guide in the connectors (1) and (2) in the direction of arrow at the carrier plate (3) and install.

104–Installing the oil feed line for the cylinders 1 to 3



- Renew sealing rings (1) of oil feed line (2) for cylinders 1 to 3 with special tool **0 496 714 (00 9 030)**.

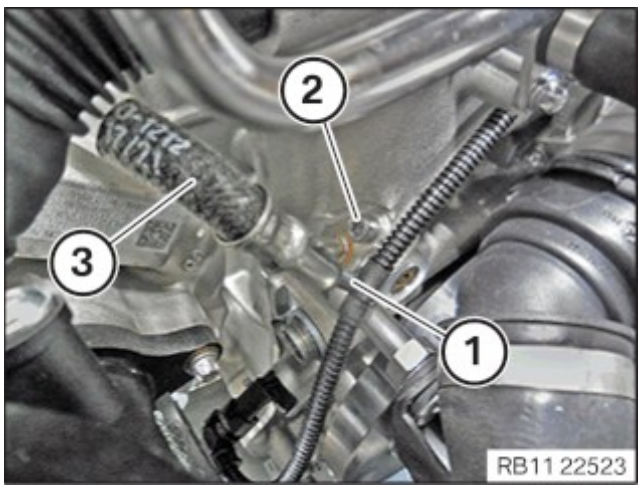
  Parts: Sealing ring



- Feed in and install the oil feed line (2) for the cylinders 1 to 3.
- Tighten down screw (1).

Oil feed line to exhaust turbocharger

M6 x 12		Tightening torque	8 Nm



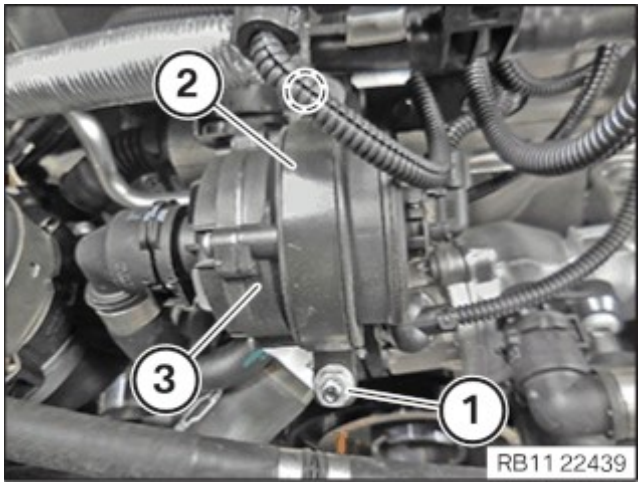
- Feed in and install the oil feed line (3) for the cylinders 1 to 3.
- Tighten down screw (2).

Oil feed line for exhaust turbocharger to crankcase

M6 x 12	Replace sealing ring.	Tightening torque	8 Nm

- Secure the clamp (1).

105–Fastening the auxiliary coolant pump for the exhaust turbocharger

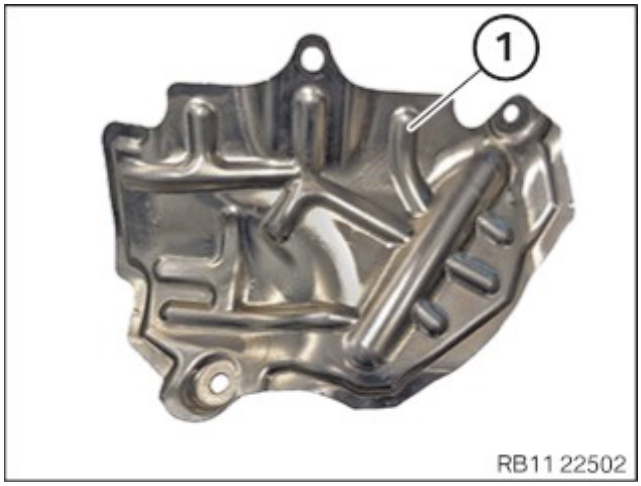


- Insert the auxiliary coolant pump (3) and position it.
- Insert the retaining bracket (2) in the **marked** area and install it.
- Tighten nut (1).

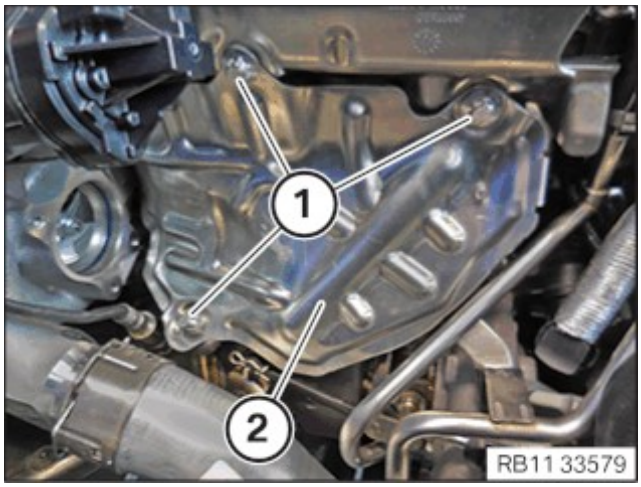
Auxiliary coolant pump holder to cylinder head

M6		Tightening torque	8 Nm

106–Installing exhaust turbocharger heat shield for cylinders 1 to 3



- Check the heat shield (1) for damage and renew the heat shield (1) if necessary.



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

Heat shield to cylinder head

M8X17.5	Renew screws.	Tightening torque	10 Nm

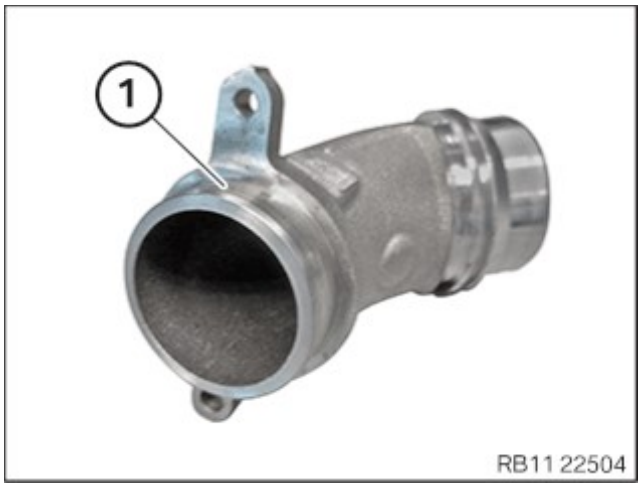
107–Installing connecting branch on exhaust turbocharger for cylinders 4 to 6

RISK OF DAMAGE

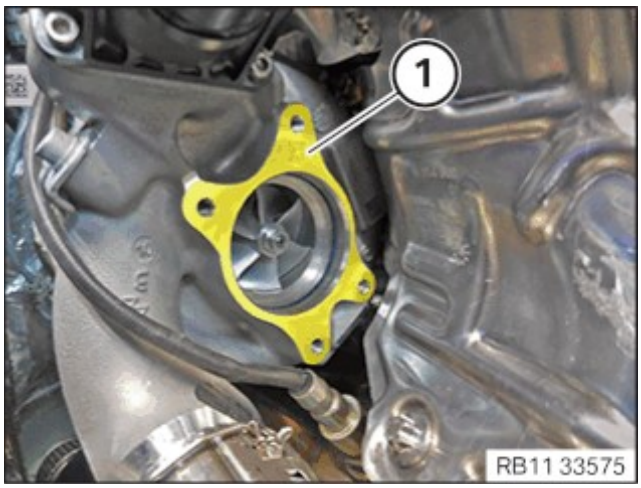
Damage to the surface.

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

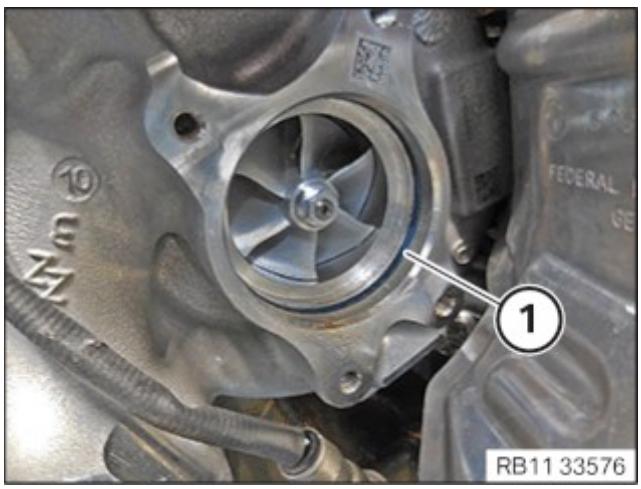
- Do not use any metal-cutting tools.



- Clean the sealing surface (1) using special tool **0 495 102 (11 4 470)**.



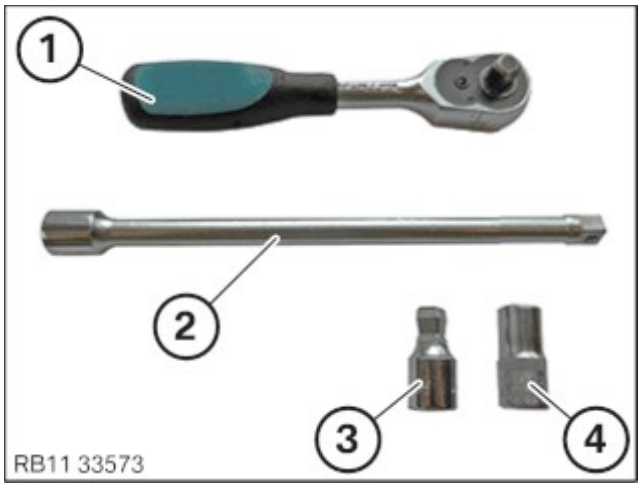
- Clean the sealing surface (1) with the special tool **0 495 102 (11 4 470)**.



- Check the sealing ring (1) for damage and renew where required.
- Grease the sealing ring (1).

Assembly aids

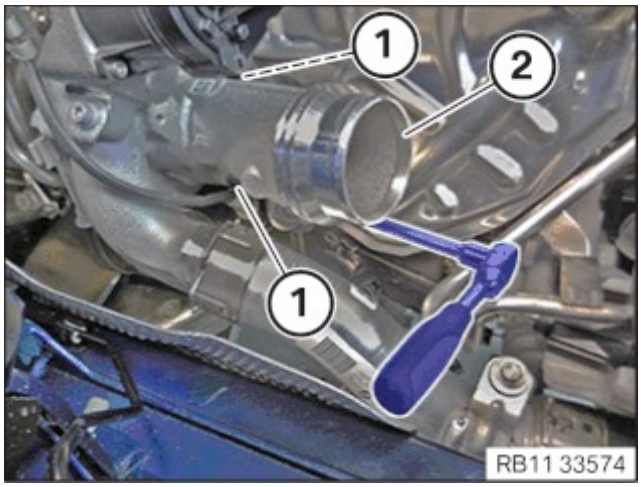
Lubricants G14	900 ml, Can	83 23 2 360 412



- Have all the standard tools ready:

Number	Description
1	Standard reversible ratchet (1/4)
2	Extension (1/4)
3	Pivoted extension (1/4)
4	External Torx E8

- Feed in and install the connecting branches (2) for the cylinders 4 to 6.

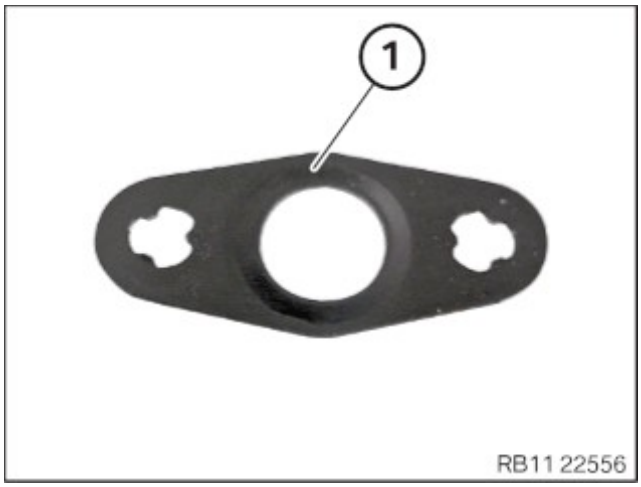


- Tighten the screws (1).

Connecting branch to exhaust turbocharger

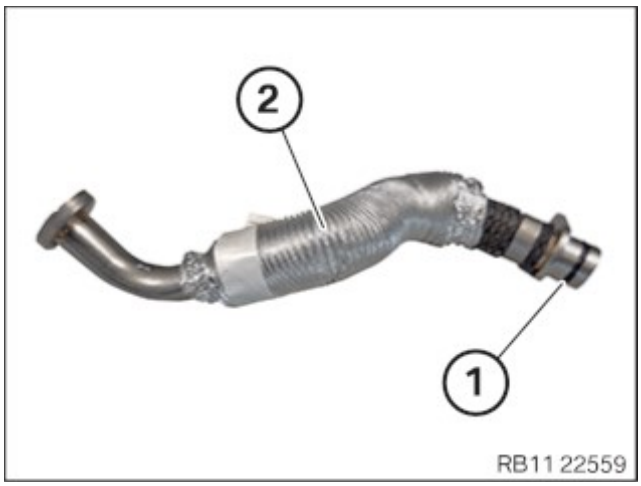
M6		Tightening torque	8 Nm

108–Installing the oil return line for the cylinders 1 to 3



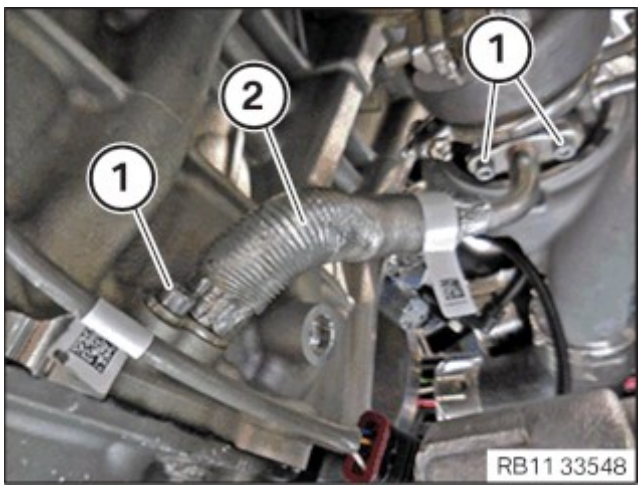
- Renew seal (1).

  Parts: Gasket



- Renew sealing ring (1) on oil return line (2) for cylinders 1 to 3 with special tool **0 496 714 (00 9 030)**.

  Parts: Sealing ring



- Insert and install the oil return line (2) for the cylinders 1 to 3.
- Tighten the screw (1) on the crankcase.

Oil return line to crankcase

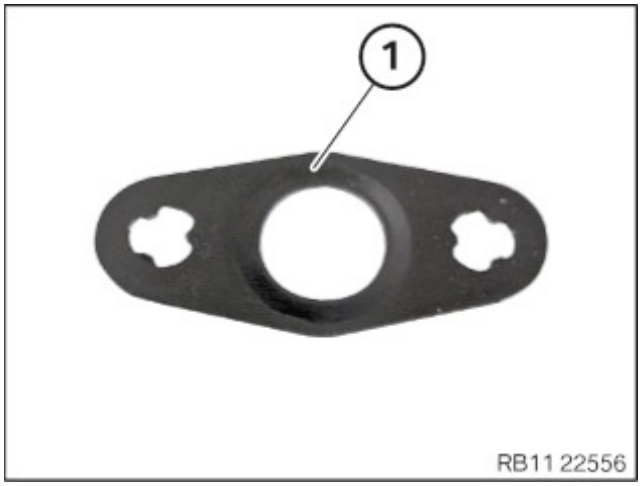
M6 x 12		8 Nm

- Tighten the screws (1) on exhaust turbocharger.

Oil return line to turbocharger

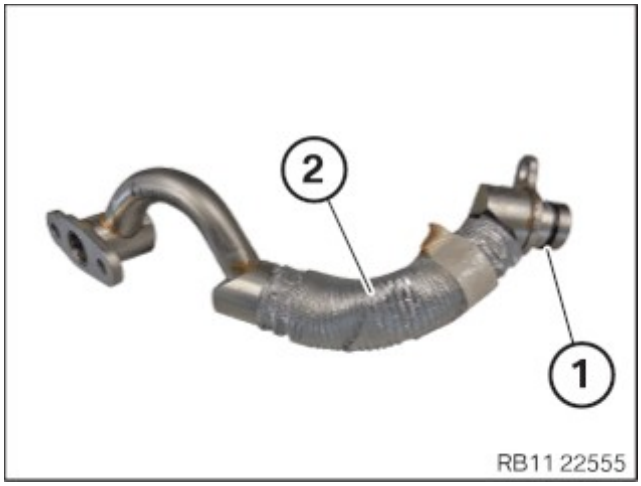
M6 x 12		8 Nm

109–Installing the oil return line for the cylinders 4 to 6



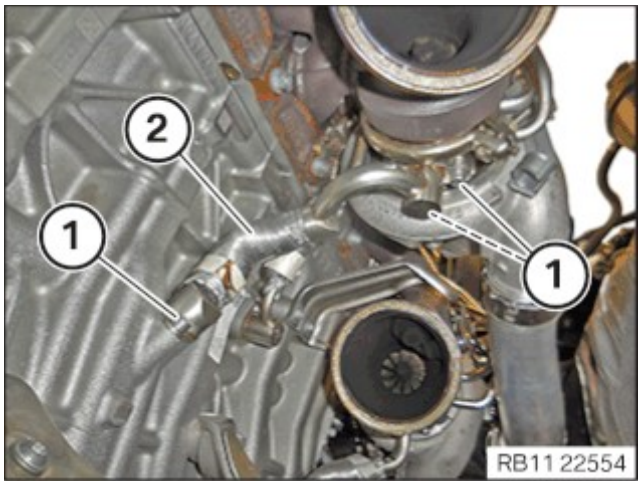
- Renew gasket (1).

  Parts: Gasket



- Renew sealing ring (1) on oil return line (2) for cylinders 4 to 6 with special tool **0 496 714 (00 9 030)**.

  Parts: Sealing ring



- Insert and install the oil return line (2) for the cylinders 4 to 6.
- Tighten the screws (1) on the exhaust turbocharger.

Oil return line to turbocharger		
M6 x 12		8 Nm

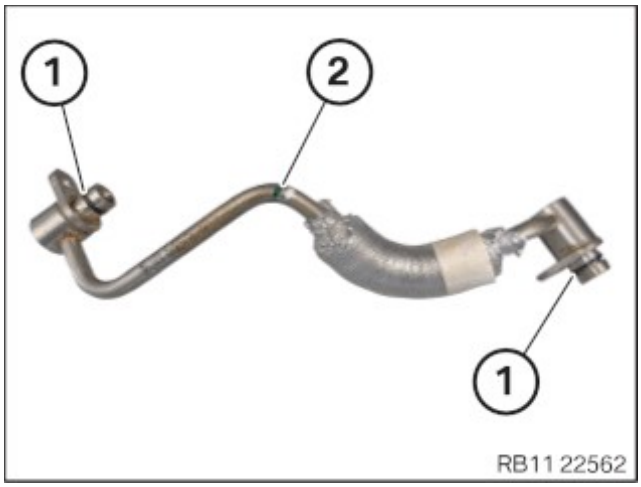
- Tighten the screw (1) on the crankcase.

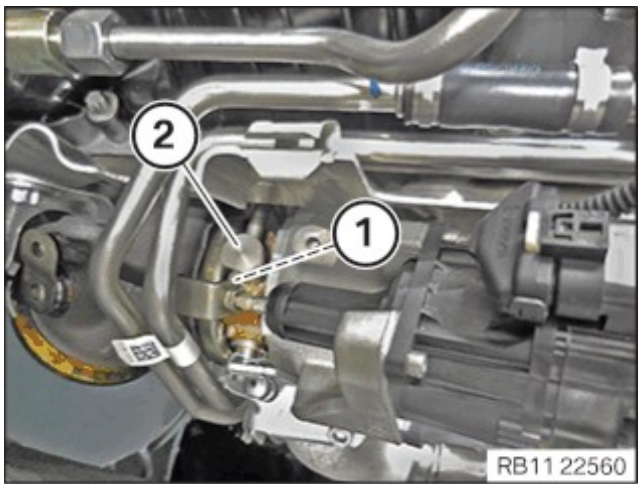
Oil return line to crankcase		
M6 x 12		8 Nm

110–Installing the oil feed line for cylinders 4 to 6

- Renew the sealing rings (1) of the oil feed line (2) for cylinders 4 to 6 using the special tool **0 496 714 (00 9 030)**.

  Parts: Sealing ring

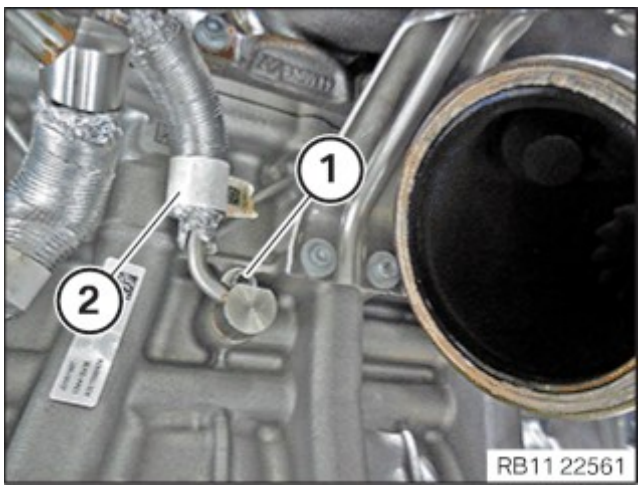




- Feed in the oil feed line (2) for cylinders 4 to 6 from the bottom and install.
- Tighten down screw (1).

Oil feed line to exhaust turbocharger

M6 x 12		Tightening torque	8 Nm



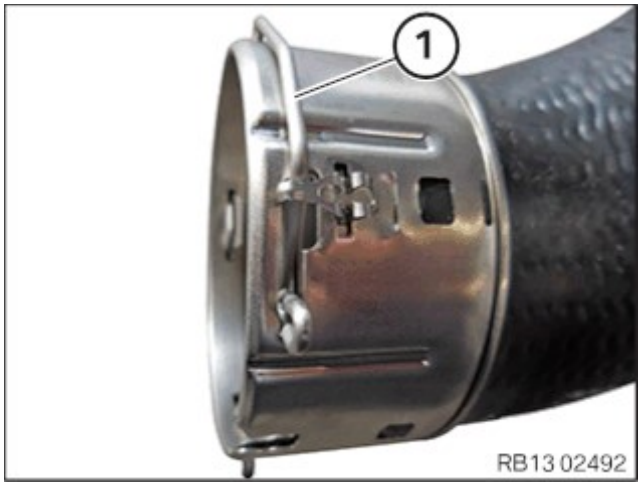
- Feed in the oil feed line (2) for cylinders 4 to 6 and install.
- Tighten down screw (1).

Oil feed line for exhaust turbocharger to crankcase

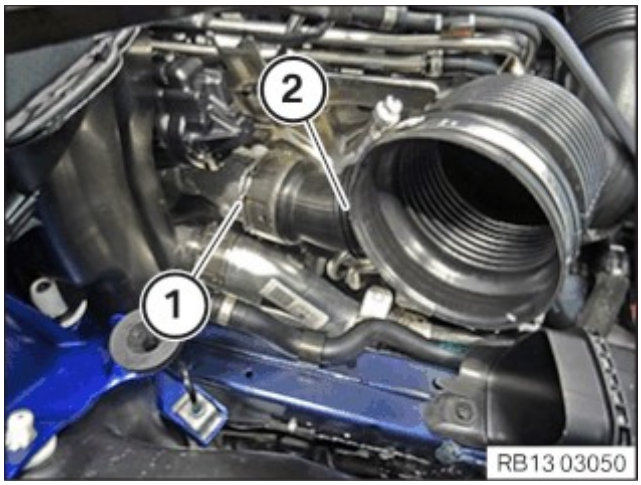
M6 x 12	Replace sealing ring.	Tightening torque	8 Nm

111–Installing the clean air pipe of cylinders 4-6

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



- Lock clamp (1).



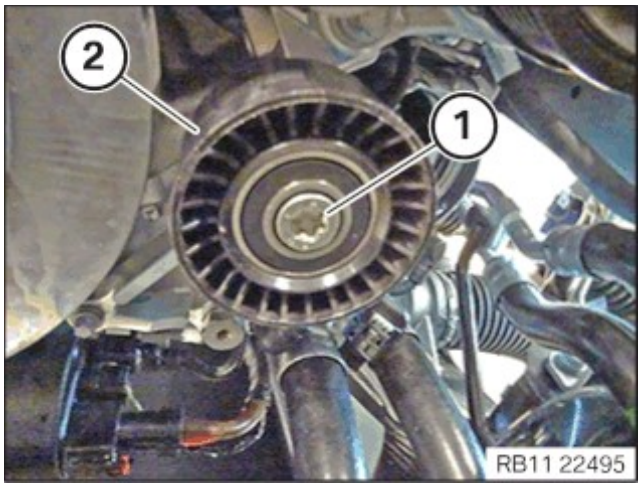
- Feed in and install the clean air pipe (2) for the cylinders 4-6.
- Make sure that the clamp (1) locks audibly.

112–Installing the deflecting element

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

Idler pulley to holder

M10		Tightening torque	60 Nm

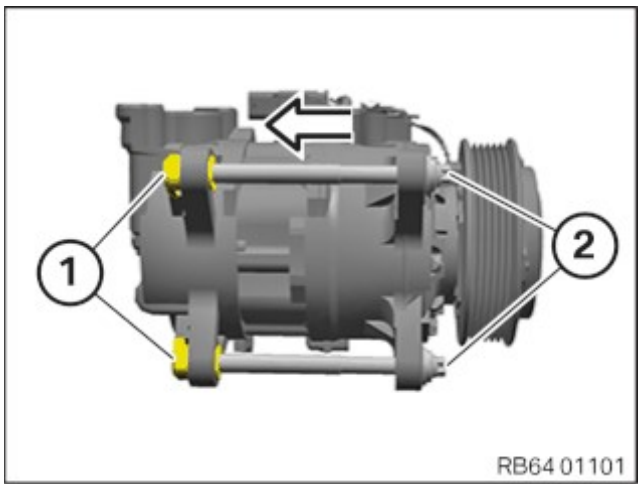


- Insert and install the protective cap (1).

  The protective cap (1) must engage audibly.

113–Installing air conditioning compressor

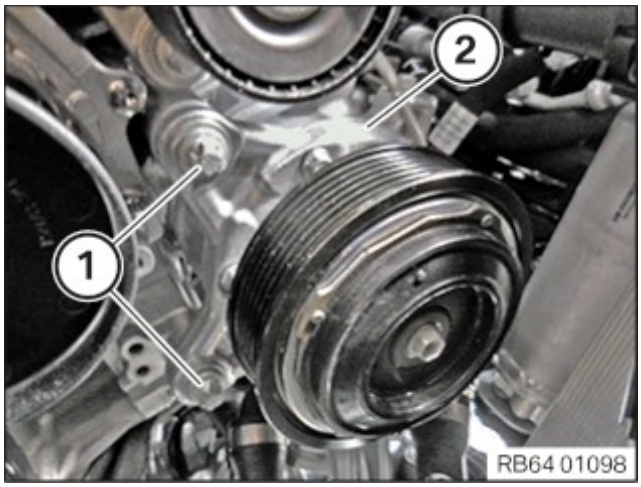
▶ Prepare for the installation of the air conditioning compressor



- Screw the screws (2) in the threaded support sleeves (1).
- Slightly press back the threaded support sleeves (1) with the help of screws (2) in the direction of arrow.
- Screw the screws (2) out of the threaded support sleeves (1) once again.

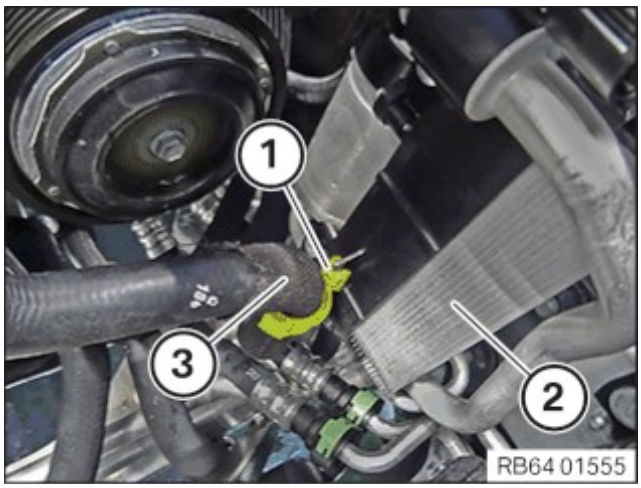
◀

- Insert and install the air conditioning compressor (2).
- Tighten the screws (1).

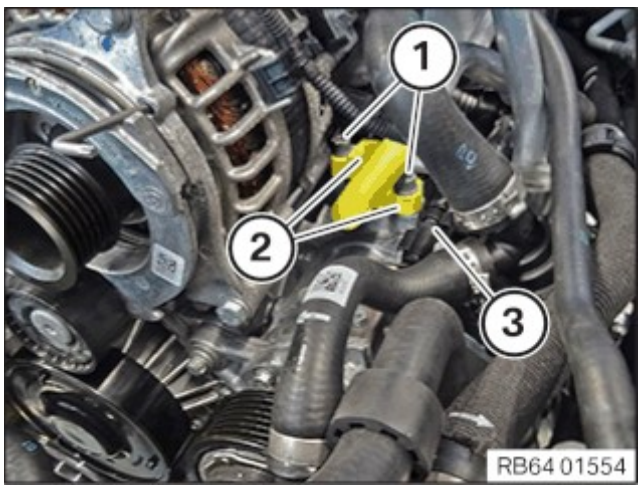


Air conditioning compressor in component carrier

M10		Tightening torque	38 Nm



- Position the coolant hose (3).
- Secure hose support (1) on air conditioning condenser (2).



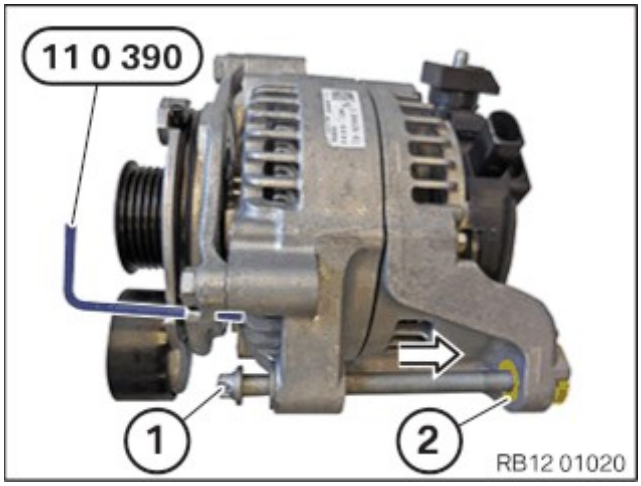
- Renew O-rings.

  Parts: O-rings
- Connect connectors (3) and lock.
- Fit the refrigerant lines (2).
- Tighten the screws (1).

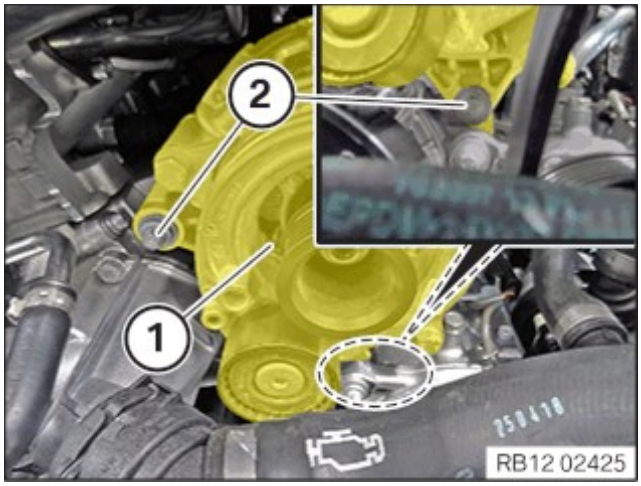
Refrigerant line on air conditioning compressor

M8		Tightening torque	19 Nm

114–Installing the alternator



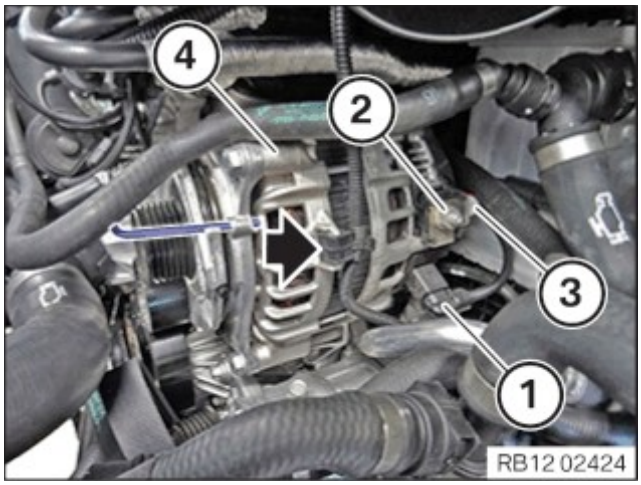
- Slightly push back the threaded support sleeve (2) in the direction of arrow to facilitate the installation of the alternator.
- Screw the screw (1) into the threaded support sleeve (2).
- Push back the threaded support sleeve (2) using screw (1).
- Once again unscrew the screw (1) from the threaded support sleeve (2).



- Feed in and install the alternator (1).
- Tighten the screws (2).

Alternator to component carrier

M10x75		Tightening torque	38 Nm
M10x125		Tightening torque	38 Nm
M10x90		Tightening torque	38 Nm



- Fasten the clamp (arrow) to the alternator (4).
- Feed in and position the positive battery cable (3).
- Tighten nut (2).

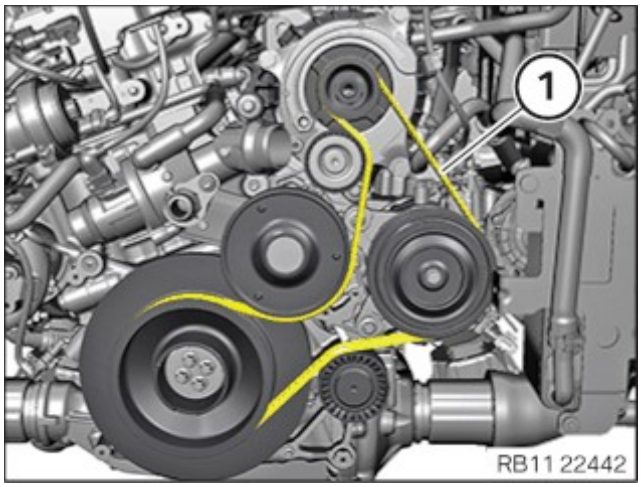
Positive battery cable to the alternator

M8		Tightening torque	19 Nm

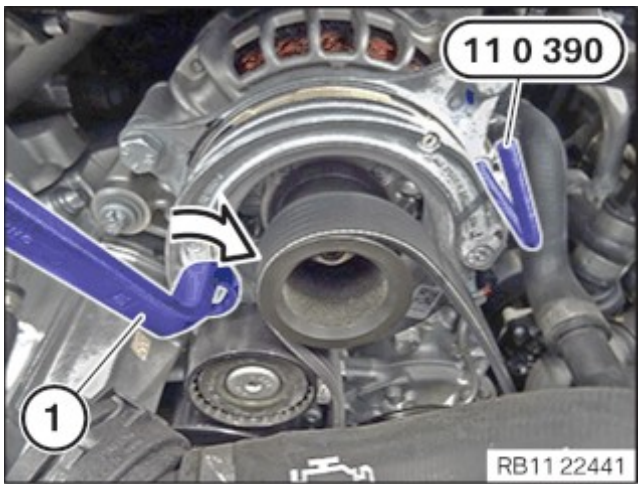
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

- Put the drive belt (1) onto the belt pulley (2) of the alternator.



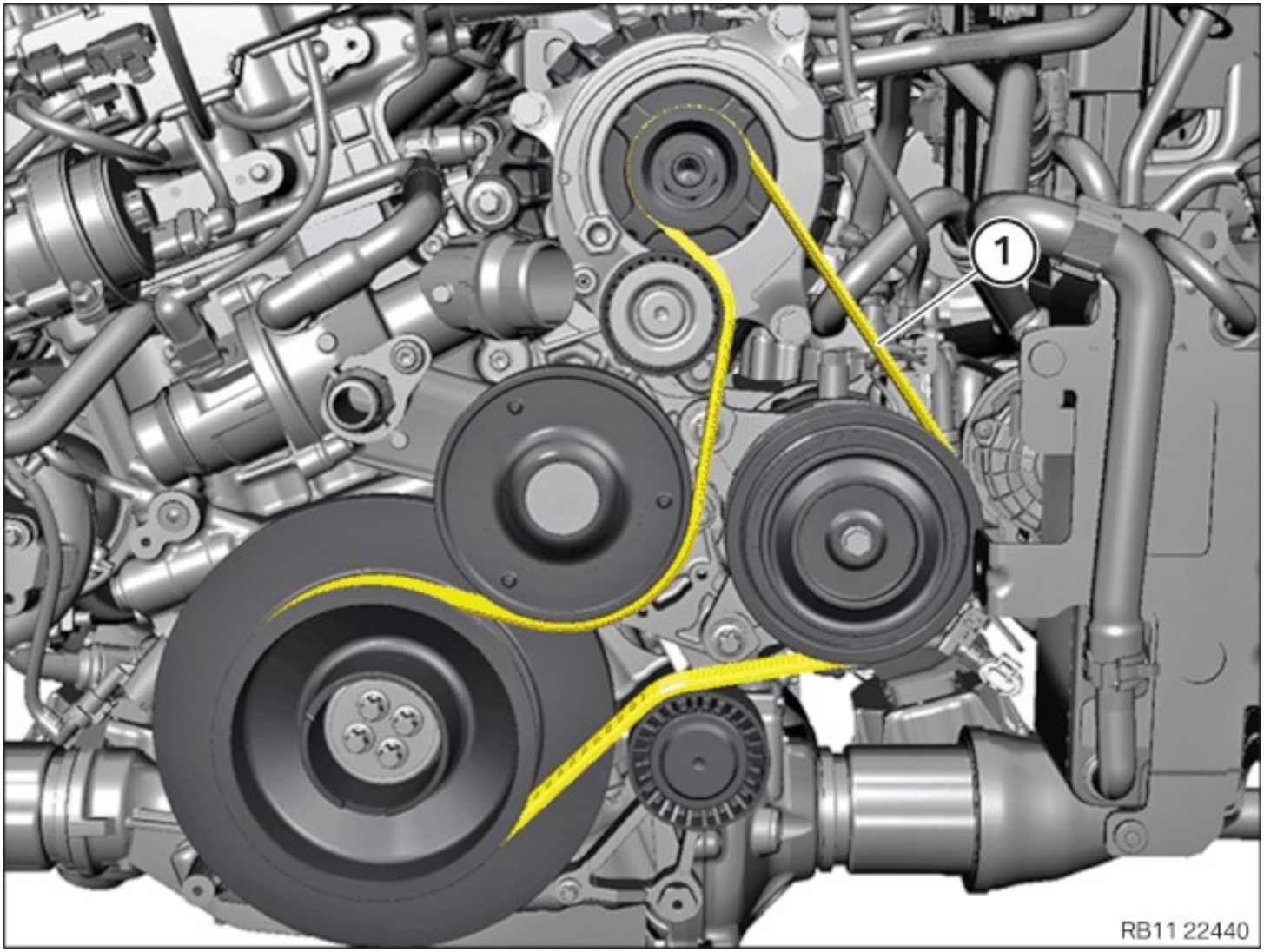
- Check the drive belt for the alternator (1) for the correct fit.



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

115–Installing the drive belt for alternator

Drive belt for alternator



1 Drive belt for alternator

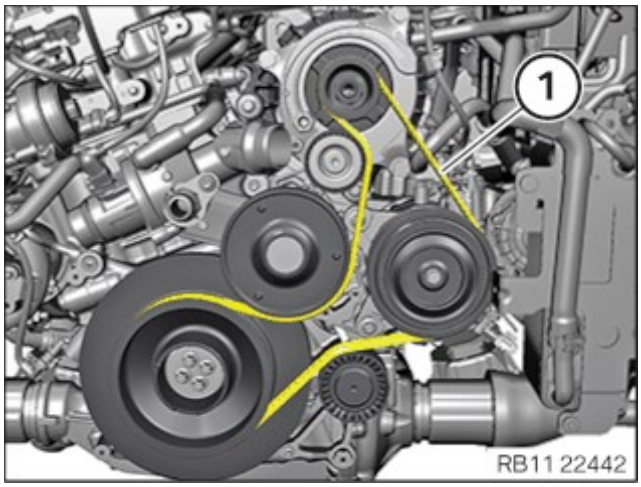
TECHNICAL INFORMATION

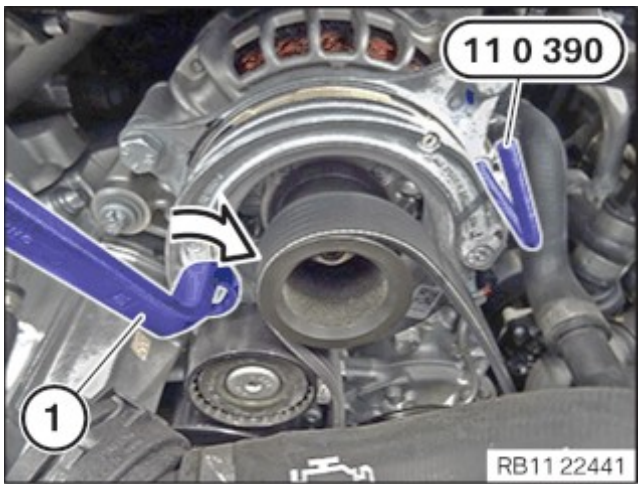
If the drive belt is reused: Mark direction of travel and reinstall drive belt in same direction of travel.

TECHNICAL INFORMATION

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

- Insert the drive belt for alternator (1) in the ancillary components and position it.





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

116–Topping up the engine oil

RISK OF DAMAGE

Damage to the petrol particulate filter.

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

- Only use engine oils approved by BMW for the respective engine.
- For additional information see: Summary of technically suitable engine oils for BMW Group engines.

RISK OF DAMAGE

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

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

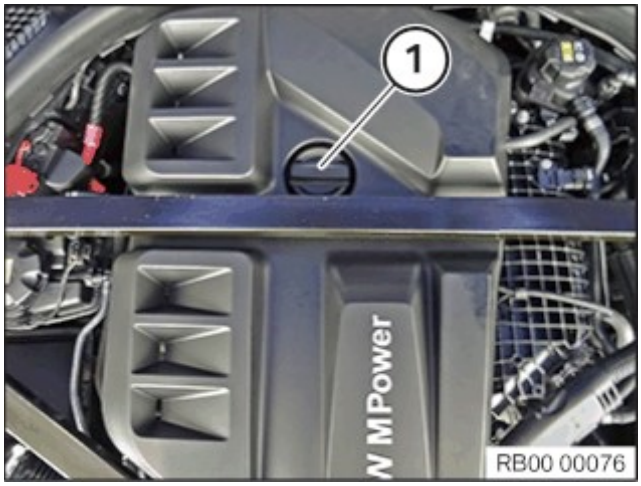
- Observe the exact engine oil filling capacity.
- Allow engine oil to drip off when draining.

- Pour in engine oil.

Engine oilS58B30T0	
Capacity of engine oil	7 l

Engine oil : Technically suitable engine oils for BMW Group engines

117–Installing the oil filler cap



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.

- Close oil filler cap (1).

118–Removing the engine from assembly stand

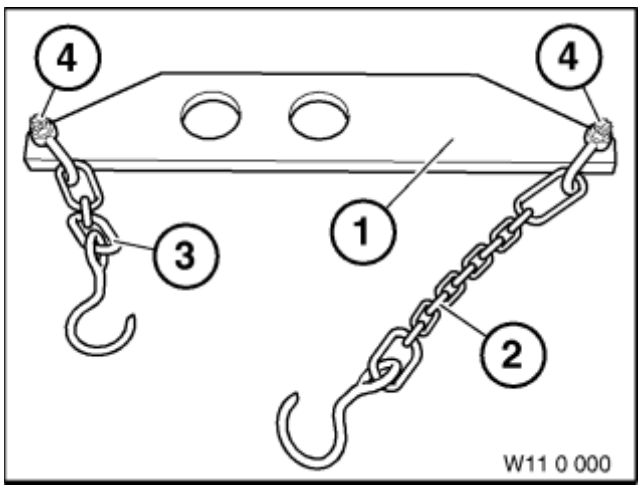
CAUTION

Heavy component.

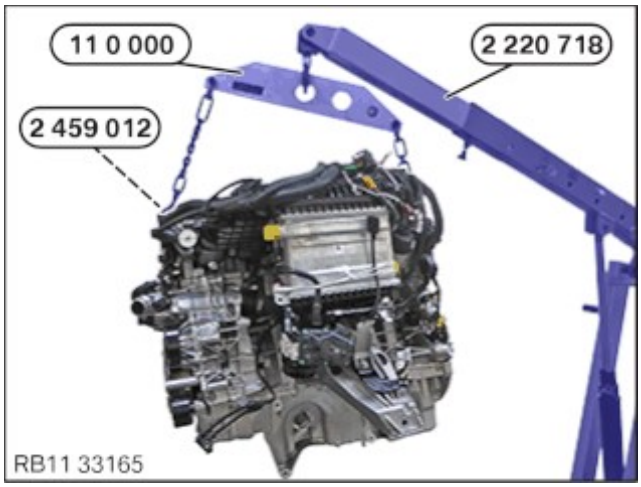
Heavy components can lead to injury or damage.

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

- Prepare the special tool **2 220 718**.



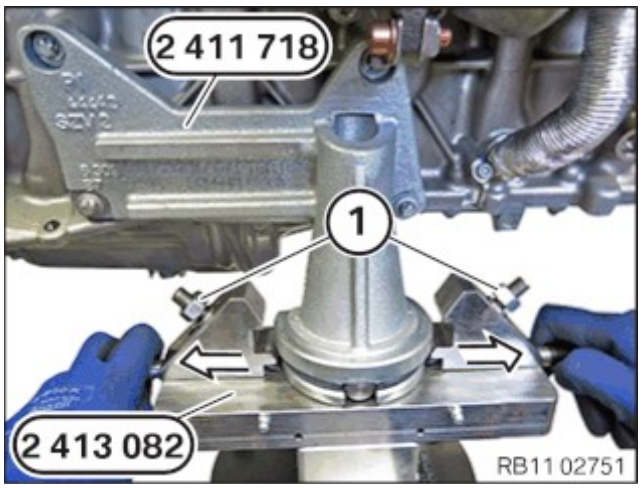
- Provide the special tool **0 490 561 (11 0 000)**.



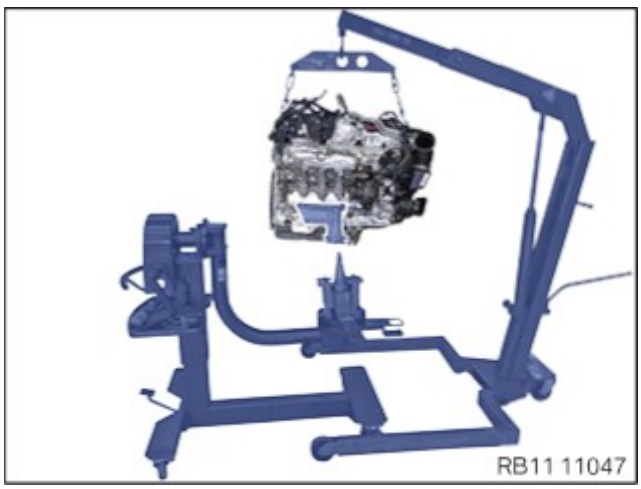
TECHNICAL INFORMATION

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

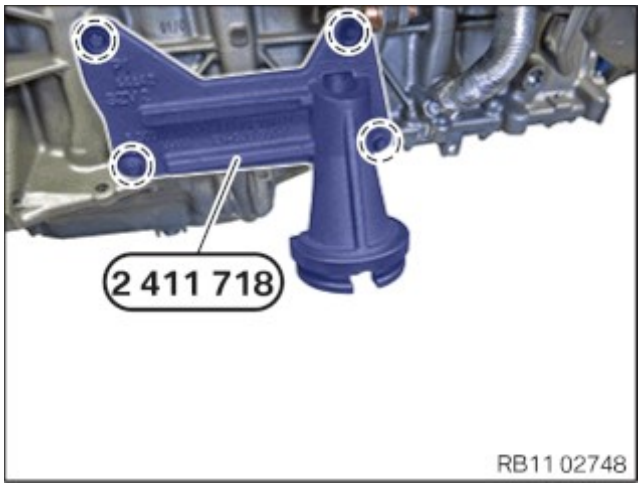
- Connect both hooks of special tool **2 459 012** front with special tool **0 490 561 (11 0 000)** and rear on the engine with the mounting brackets.
- Connect the special tool **2 220 718** with the special tool **0 490 561 (11 0 000)**.



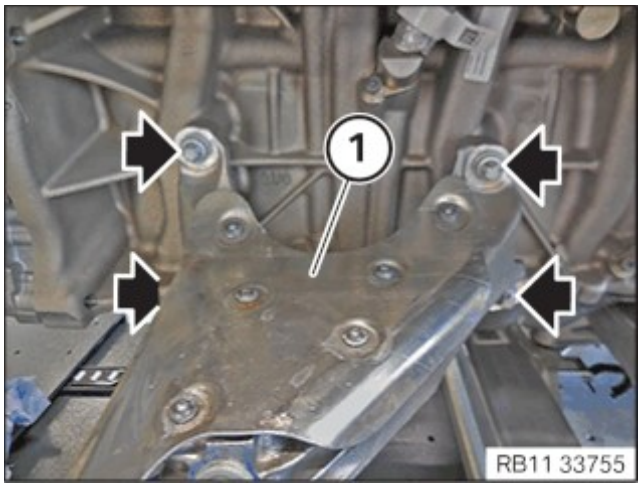
- Slacken nuts (1).
- Unlock the clamping jaws of the special tool **2 413 082** in the direction of arrow.



- Raise the engine slowly.



- Release the screws (marks) and remove the special tool (engine fixture) **2 411 718**.
- Insert and install the engine mounting bracket (1) on the right.



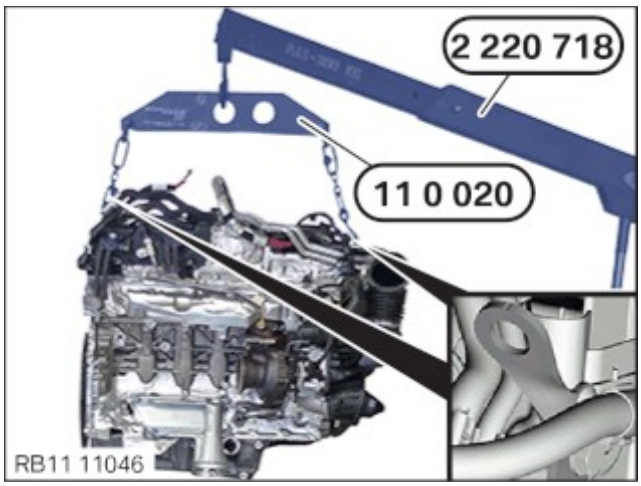
- Tighten screws (arrows).

Transmission mounting bracket to transmission

M10		Tightening torque	38 Nm

119–Installing the engine on the front axle

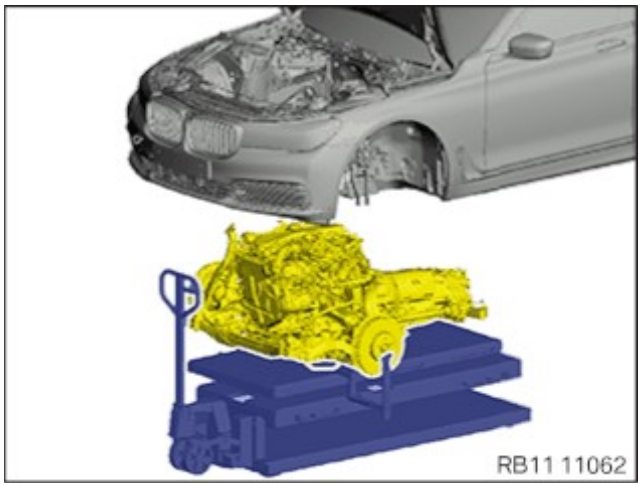
Additional information is available.



- See additional information.

120–Installing the complete front axle including engine and transmission

Additional information is available.



- See additional information.

