

Workshop Manual Audi A8 2010 ➤

TDI injection and glow plug system (8-cyl. 4.2 ltr. 4-valve common rail)

Engine ID	CDS B								
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Edition 01.2013



Audi

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List of Workshop Manual Repair Groups

Repair Group

23 - Mixture preparation - injection

28 - Glow plug system



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Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.

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23 – Mixture preparation - injection

1 Safety precautions and rules for cleanliness

(ARL003213; Edition 01.2013)

1.1 Safety precautions when using testers and measuring instruments during a road test

Note the following if testers and measuring instruments have to be used during a road test:



WARNING

Accidents can be caused if the driver is distracted by test equipment while road-testing, or if test equipment is not properly secured.

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Persons sitting in the front passenger's seat could be injured if the airbag is triggered in an accident.

- *The use of test equipment while driving causes distraction.*
- *There is an increased risk of injury if test equipment is not secured.*
- ◆ *Test equipment must always be secured on the rear seat with a strap and operated from the rear seat by a second person.*

Press the DONE button when you are ready for the test drive.

1.2 Safety precautions when working on the fuel system

When working on the fuel system note the following warnings:



WARNING

The fuel can become extremely hot. This can cause injuries.

- ◆ *In extreme cases the fuel lines and the fuel can reach a temperature of 100 °C on vehicles with common rail engine, even after the engine is switched off. Allow the fuel to cool down before disconnecting the lines - danger of scalding.*

- ◆ *Wear protective gloves.*

- ◆ *Wear safety goggles.*

Risk of injury - fuel system operates under pressure.

- ◆ *Wrap a clean cloth around the connection before opening the fuel system. Then release pressure by carefully loosening the connection.*

- ◆ *Wear protective gloves.*

- ◆ *Wear safety goggles.*

**Caution**

To prevent irreparable damage to the electronic components when disconnecting the battery:

- ◆ *Observe notes on procedure for disconnecting the battery.*
- ◆ *Always switch off the ignition before disconnecting the battery.*

– Disconnect battery ⇒ Electrical system; Rep. gr. 27 .

1.3 Rules for cleanliness and instructions for working on fuel system

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To prevent the high-pressure pump from running while it is empty and to ensure that the engine starts quickly after parts have been renewed, it is important to observe the following:

**Caution**

Running when dry causes irreparable damage to high-pressure pump.

- ◆ *To prevent the high-pressure fuel pump from running while it is empty and to ensure that the engine starts quickly after parts have been renewed, it is important to observe the following:*
- ◆ *If components of the fuel system between the fuel tank and the high-pressure fuel pump are removed or renewed, the basic setting "Checking fuel system pressurisation pump" must be performed to bleed the fuel system.*
- ◆ *Performing first fuel filling after installing high-pressure pump ⇒ [page 44](#)*

General instructions:

- Clean tools and workbench etc. before working on the injection system.
- Carefully clean connection points and the surrounding area with engine cleaner or brake cleaner and dry thoroughly before opening.
- When removing components, plug all open connections immediately with suitable clean sealing caps.
- Do not remove sealing caps from components until immediately prior to installation. Keep components that are to be re-used in new, sealable plastic bags.
- Before installing, check the injectors and their surroundings visually; they must be undamaged and clean. Make sure the injector bores in the cylinder head are clean. Wipe out if necessary using a clean cloth, taking care not to cause damage. Do not use sharp objects of any kind.
- If the high-pressure fuel lines are to be re-used, you must mark them before removal. High-pressure pipes must always be re-installed on the same cylinder.
- Take care not to damage the injectors when removing the old copper seals.
- Check all new O-rings for damage before installing. Lubricate O-rings with engine oil or assembly oil before installing.

- Position high-pressure pipes so they are free of stress. Tighten all unions lightly to start with before tightening to final torque.
- Never attempt to bend high-pressure fuel lines to shape.
- When working on any parts of the high-pressure fuel system, tools may only be used for loosening and tightening pipe unions. All other components must always be removed and installed by hand without using tools or other equipment.
- Press the fuel return hoses onto the injectors by hand from above so that they engage audibly on each injector (do not press in the release pins when doing this). Then press down the release pin after connecting the return line.
- Do not dismantle individual common rail components. If there is a fault, the complete components must be renewed.
- When the engine is running, do not perform any repairs to the common rail system.
- Do not bleed the common rail system by unfastening high-pressure components after the engine has been started.
- All cable ties which are released or cut open when removing must be refitted in the same position when installing.
- When the fuel system is open: Do not work with compressed air if this can be avoided. Do not move the vehicle unless absolutely necessary.
- Also ensure that no diesel fuel comes into contact with the coolant hoses. Should this occur, the hoses must be cleaned immediately. Damaged hoses must be renewed.

1.4 Safety precautions when working on the injection and glow plug system

To prevent injuries to persons and/or damage to the fuel injection and glow plug system, note the following:

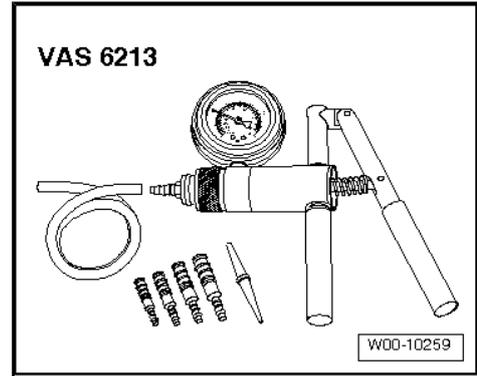
- ◆ The operation of piezo systems and control units requires very high voltages; certain components can cause injury if touched directly.
- ◆ Persons with a "cardiac pacemaker" should not lean over the engine compartment while the engine is running.
- ◆ Do not open any fuel line connections while the engine is running.
- ◆ Always switch off the ignition before connecting or disconnecting injection and glow plug system wiring or tester cables.
- ◆ Always switch off the ignition before cleaning the engine.
- ◆ Always switch off the ignition before connecting or disconnecting the battery; otherwise the engine control units may be damaged.
- ◆ Certain tests may lead to faults being detected and stored by the engine control units. Therefore the event memory must be interrogated after completing all tests and repair work ("Interrogate event memory").

1.5 Checking vacuum system

Special tools and workshop equipment required



◆ Hand vacuum pump -VAS 6213-



Procedure

– Check all vacuum lines in the complete vacuum system for:

- ◆ Cracks Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability in respect to the correctness of information in this document. Copyright by AUDI AG.
 - ◆ Traces of animal bites
 - ◆ Kinked or crushed lines
 - ◆ Lines porous or leaking
- Check vacuum line to solenoid valve and from solenoid valve to corresponding component.
- If a fault is stored in the event memory, check the vacuum lines leading to the corresponding component, and also check the remaining vacuum lines leading to other components.
- If it is not possible to build up a vacuum with the hand vacuum pump -VAS 6213- or if the vacuum pressure drops again immediately, check the hand vacuum pump and connecting hoses for leaks.

2 Fitting locations - overview

Engine compartment

1 - Air mass meter -G70-

- Exploded view
⇒ [page 20](#)
- Removing and installing
⇒ [page 57](#)

2 - Right electrohydraulic engine mounting solenoid valve -N145-

- On engine mounting (right-side)

3 - Gearbox mounting valve 1 -N262-

- On gearbox mounting (right-side)

4 - Engine control unit -J623-

- Removing and installing
⇒ [page 74](#)

5 - Accelerator position sender -G79- and accelerator position sender 2 -G185-

- Fitting location
⇒ [page 10](#)

6 - Brake light switch -F-

- Fitting location
⇒ [page 11](#)
- In footwell on brake pedal

7 - Instrument cluster with control unit in dash panel insert -J285-

- Removing and installing
⇒ Rep. gr. 90

8 - Gearbox mounting valve 2 -N263-

- On gearbox mounting (left-side)

9 - Engine control unit 2 -J624-

- Removing and installing ⇒ [page 74](#)

10 - Left electrohydraulic engine mounting solenoid valve -N144-

- On engine mounting (left-side)

11 - Air mass meter 2 -G246-

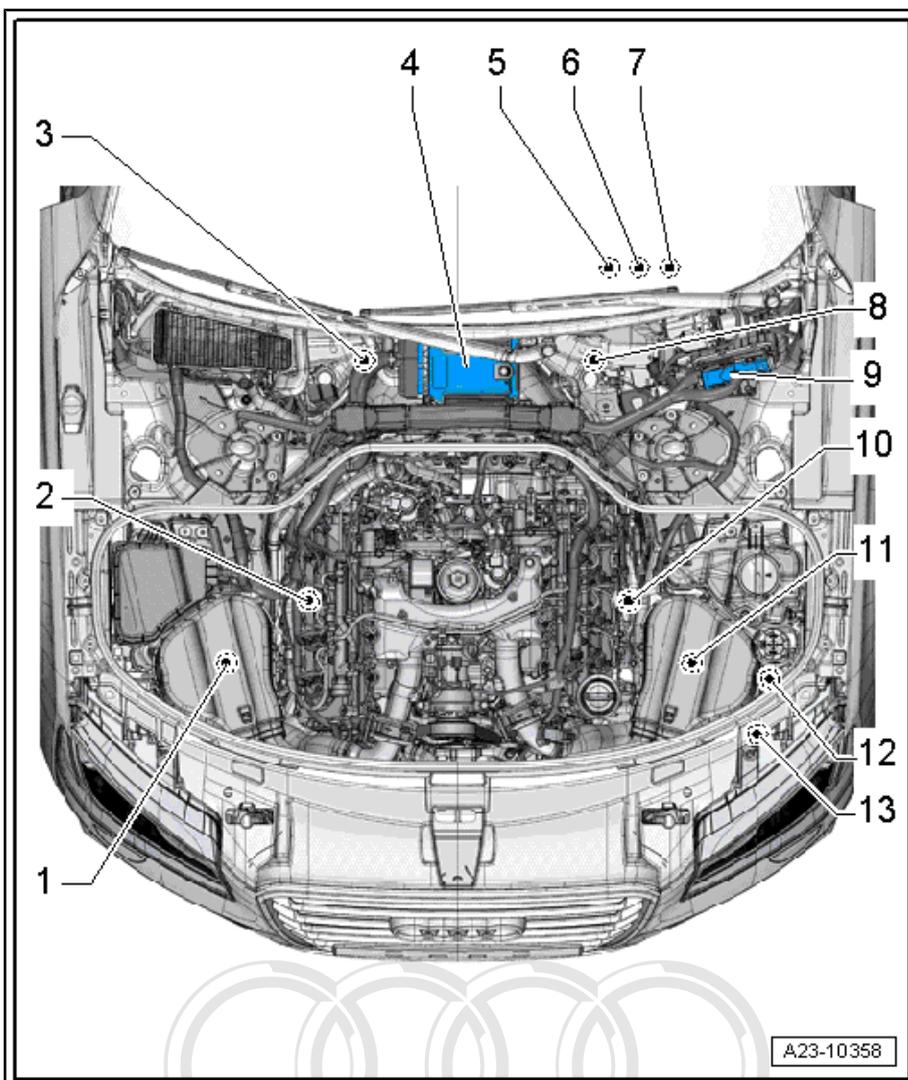
- Exploded view ⇒ [page 20](#)
- Removing and installing ⇒ [page 57](#)

12 - Continued coolant circulation pump -V51-

- Removing and installing ⇒ Rep. gr. 19
- Fitting location ⇒ [page 12](#)

13 - Coolant valve for gearbox -N488-

- Fitting location ⇒ [page 12](#)



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Engine (front view)

1 - Oil level and oil temperature sender -G266-

- Removing and installing
⇒ Rep. gr. 17

2 - Heating element for crank-case breather -N79-

3 - Pump for exhaust gas re-circulation cooler -V400-

- Removing and installing
⇒ Rep. gr. 19

4 - Radiator outlet coolant temperature sender -G83-

- Removing and installing
⇒ Rep. gr. 19

5 - Oil pressure switch for reduced oil pressure -F378-

- Removing and installing
⇒ Rep. gr. 17

6 - Oil temperature sender -G8-

- Removing and installing
⇒ Rep. gr. 17

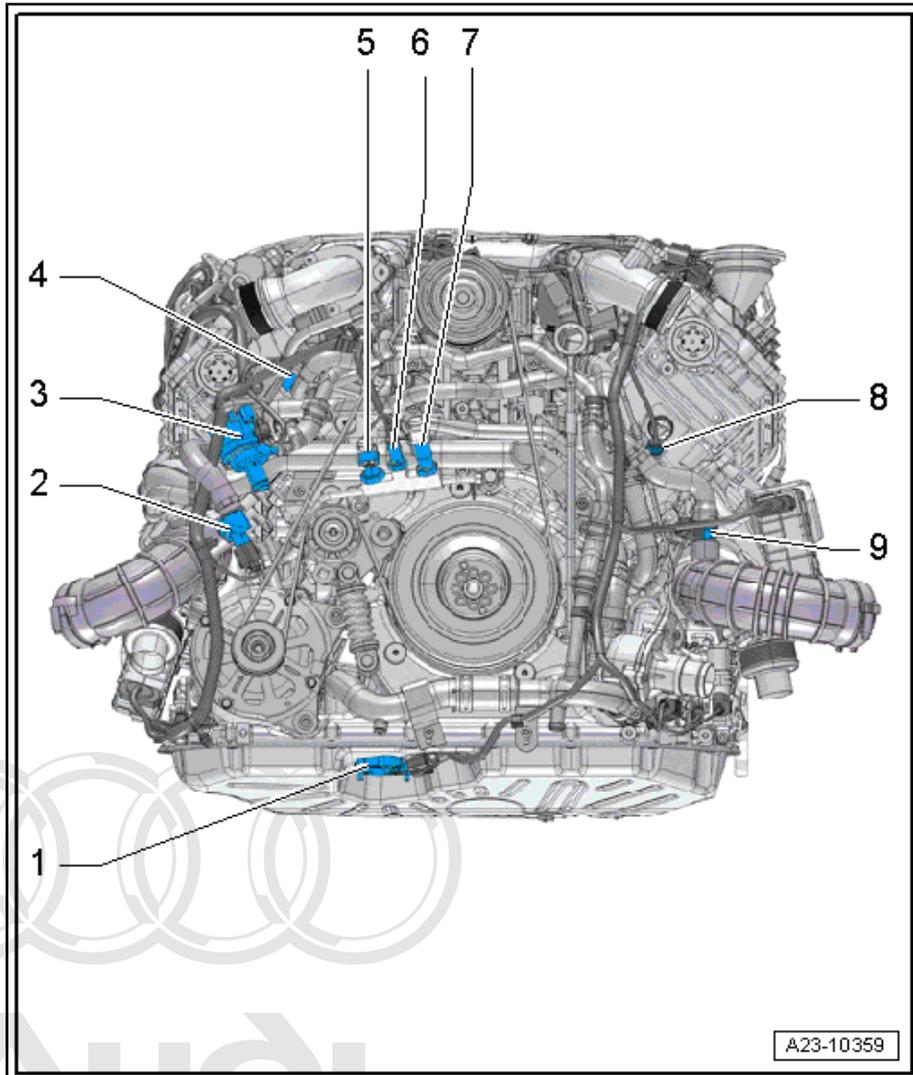
7 - Oil pressure switch -F22-

- Removing and installing
⇒ Rep. gr. 17

8 - Temperature sender for engine temperature regulation -G694-

- Removing and installing
⇒ Rep. gr. 19

9 - Heater element for 2 crank-case breather -N483-



Engine (side view, left-side)

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1 - Rotational speed sender 2 -G654-

- Removing and installing
⇒ Rep. gr. 21

2 - Control unit for turbocharger 2 -J725-

- On turbocharger (left-side)

3 - Injector, cylinder 5 -N83-

- Removing and installing
⇒ [page 52](#)

4 - Injector, cylinder 6 -N84-

- Removing and installing
⇒ [page 52](#)

5 - Injector, cylinder 7 -N85-

- Removing and installing
⇒ [page 52](#)

6 - Injector, cylinder 8 -N86-

- Removing and installing
⇒ [page 52](#)

7 - Exhaust gas temperature sender 4 for cylinder bank 2 -G649-

- Exploded view
⇒ [page 66](#)

8 - Exhaust gas temperature sender 3 for cylinder bank 2 -G497-

- Exploded view
⇒ [page 66](#)

9 - Engine speed sender -G28-

- Removing and installing
⇒ [page 79](#)

10 - Lambda probe 2 -G108- with Lambda probe heater 2 -Z28-

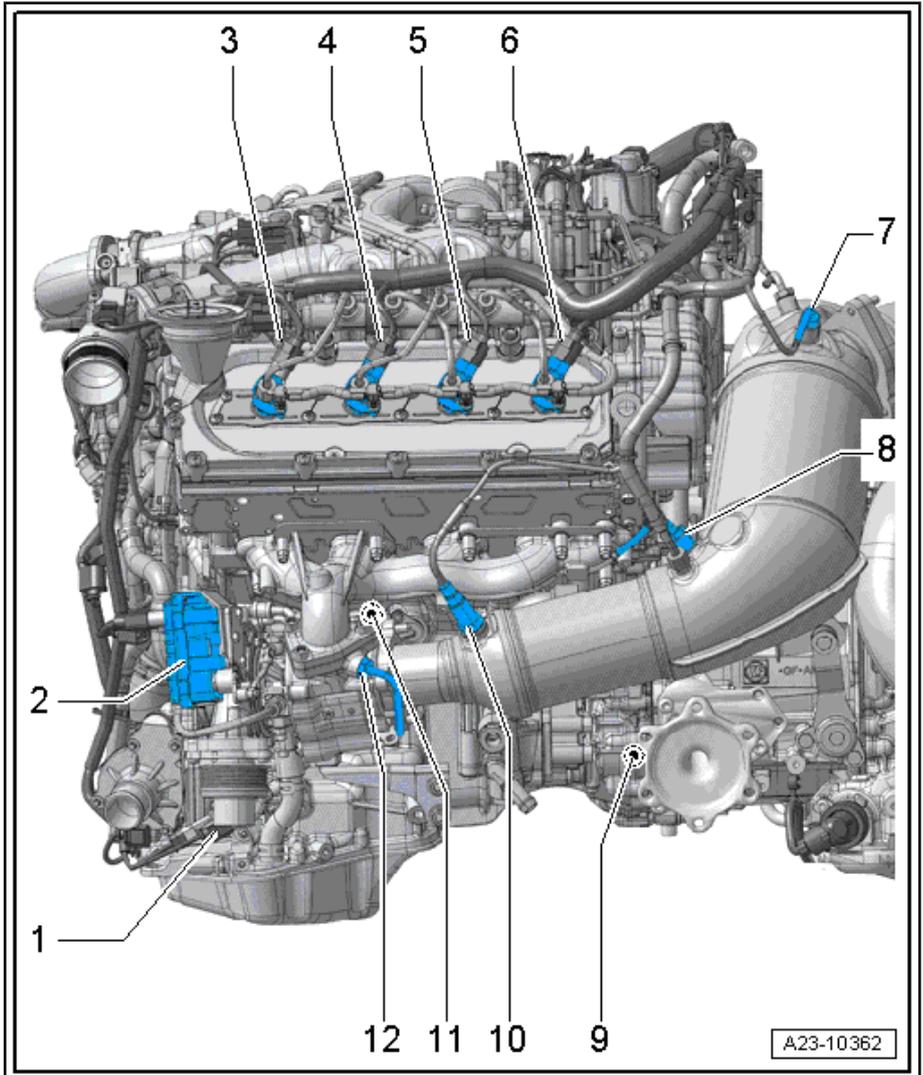
- Exploded view ⇒ [page 66](#)
- Removing and installing ⇒ [page 68](#)

11 - Valve for oil pressure control -N428-

- Removing and installing ⇒ Rep. gr. 17

12 - Exhaust gas temperature sender 1 for cylinder bank 2 -G236-

- Removing and installing ⇒ Rep. gr. 26



Engine (side view, right-side)



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1 - Exhaust gas temperature sender 1 -G235-

- Removing and installing ⇒ Rep. gr. 26

2 - Lambda probe -G39- with Lambda probe heater -Z19-

- Exploded view ⇒ [page 66](#)
- Removing and installing ⇒ [page 67](#)

3 - Exhaust gas temperature sender 3 -G495-

- Exploded view ⇒ [page 66](#)

4 - Exhaust gas temperature sender 4 -G648-

- Exploded view ⇒ [page 66](#)

5 - Hall sender -G40-

- Exploded view ⇒ [page 77](#)
- Removing and installing ⇒ [page 79](#)

6 - Injector, cylinder 4 -N33-

- Removing and installing ⇒ [page 52](#)

7 - Injector, cylinder 3 -N32-

- Removing and installing ⇒ [page 52](#)

8 - Injector, cylinder 2 -N31-

- Removing and installing ⇒ [page 52](#)

9 - Injector, cylinder 1 -N30-

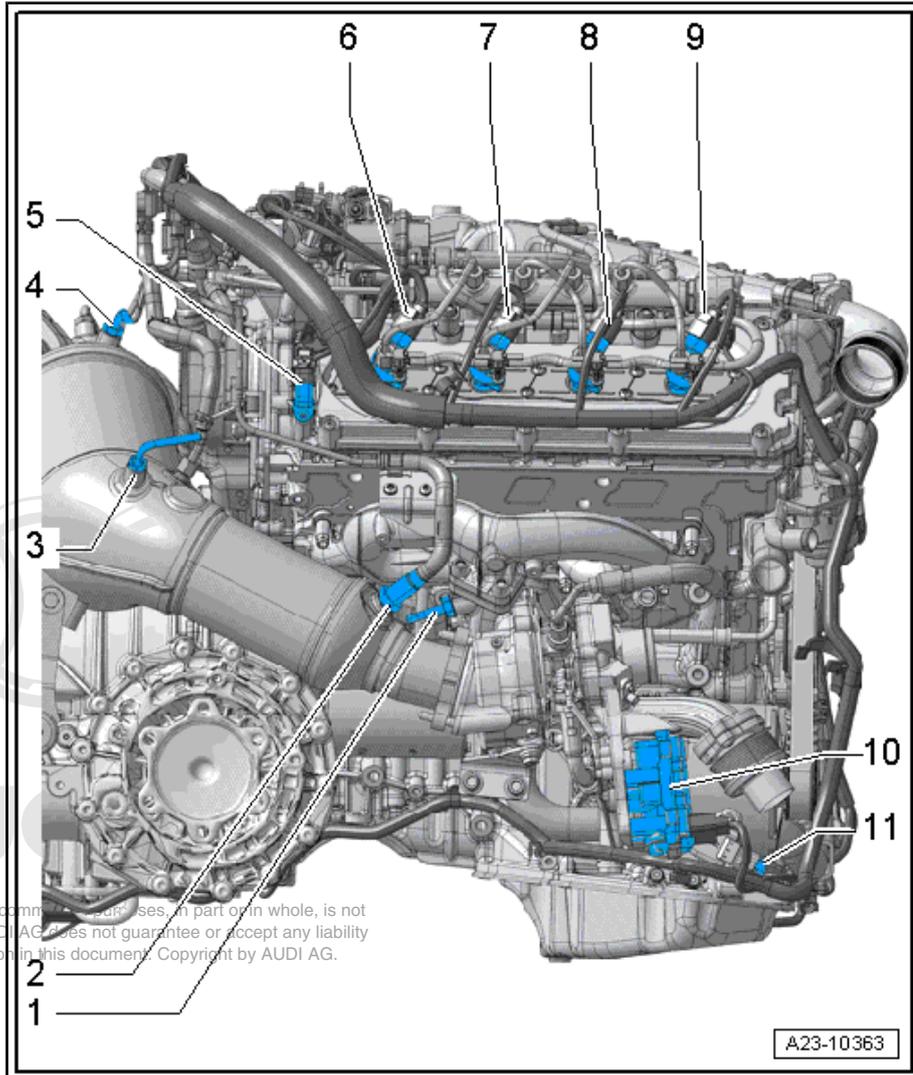
- Removing and installing ⇒ [page 52](#)

10 - Control unit for turbocharger 1 -J724-

- On turbocharger (left-side)

11 - Rotational speed sender 1 -G653-

- Removing and installing ⇒ Rep. gr. 21



Engine (top view)

1 - Throttle valve module - J338-

- Exploded view
⇒ [page 26](#)
- Removing and installing
⇒ [page 32](#)

2 - Fuel pressure regulating valve -N276-

- Removing and installing
⇒ [page 60](#)
- After renewing high-pressure pump or fuel pressure regulating valve -N276-, learnt values must be re-adapted; see "Guided Functions" in ⇒ Vehicle diagnostic tester

3 - Glow plug 1 -Q10-

- Removing and installing
⇒ [page 78](#)

4 - Glow plug 2 -Q11-

- Removing and installing
⇒ [page 78](#)

5 - Glow plug 3 -Q12-

- Removing and installing
⇒ [page 78](#)

6 - Intake manifold flap motor - V157-

- Integrated in intake manifold (bottom section)

7 - Glow plug 4 -Q13-

- Removing and installing ⇒ [page 78](#)

8 - Pressure sender for exhaust gas recirculation -G691-

- Removing and installing ⇒ Rep. gr. 26

9 - Exhaust gas recirculation control motor -V338-

- Removing and installing ⇒ Rep. gr. 26

10 - Fuel temperature sender -G81-

11 - Coolant temperature sender -G62-

- Removing and installing ⇒ Rep. gr. 19

12 - Pressure differential sender -G505-

- Exploded view ⇒ [page 66](#)

13 - Fuel metering valve -N290-

- In high-pressure pump

14 - Pressure differential sender 2 -G524-

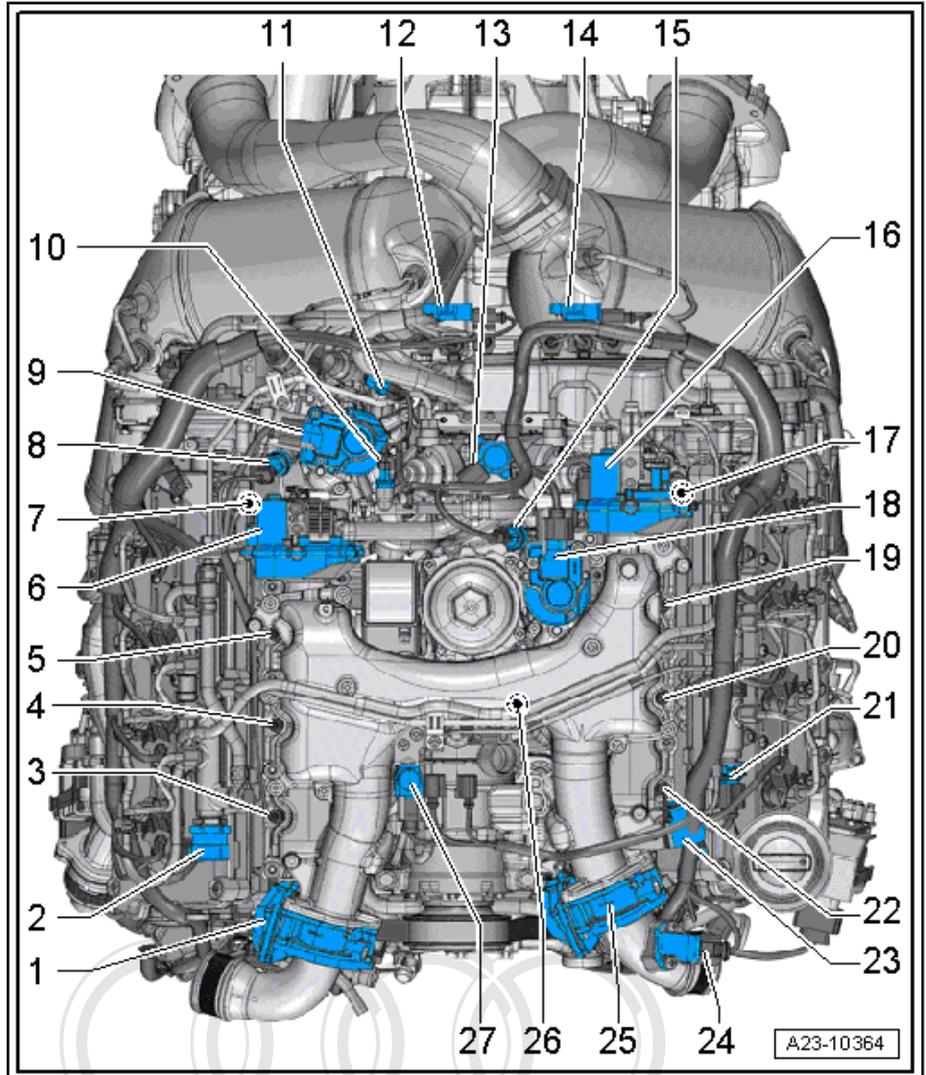
- Exploded view ⇒ [page 66](#)

15 - Pressure sender 2 for exhaust gas recirculation -G692-

- Removing and installing ⇒ Rep. gr. 26

16 - Intake manifold flap 2 motor -V275-

- Integrated in intake manifold (bottom section)



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17 - Glow plug 8 -Q17-

- Removing and installing ⇒ [page 78](#)

18 - Control motor 2 for exhaust gas recirculation -V339-

- Removing and installing ⇒ Rep. gr. 26

19 - Glow plug 7 -Q16-

- Removing and installing ⇒ [page 78](#)

20 - Glow plug 6 -Q15-

- Removing and installing ⇒ [page 78](#)

21 - Fuel pressure sender -G247-

- Removing and installing ⇒ [page 62](#)

22 - Glow plug 5 -Q14-

- Removing and installing ⇒ [page 78](#)

23 - Coolant valve for cylinder head -N489-

24 - Charge pressure sender -G31- / intake air temperature sender -G42-

- Removing and installing ⇒ Rep. gr. 21

25 - Throttle valve module 2 -J544-

- Exploded view ⇒ [page 26](#)
- Removing and installing ⇒ [page 32](#)

26 - Exhaust gas recirculation temperature sensor -G98-

- Removing and installing ⇒ Rep. gr. 26

27 - Exhaust gas recirculation cooler change-over valve -N345-

- Removing and installing ⇒ Rep. gr. 26

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Fitting location of accelerator position sender -G79- / accelerator position sender 2 -G185-

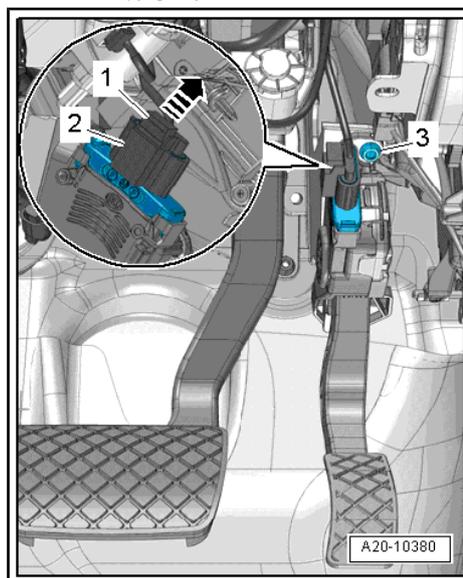
- ◆ In accelerator pedal module



Note

The accelerator position sender -G79- and accelerator position sender 2 -G185- are integrated in the accelerator pedal module and cannot be renewed individually.

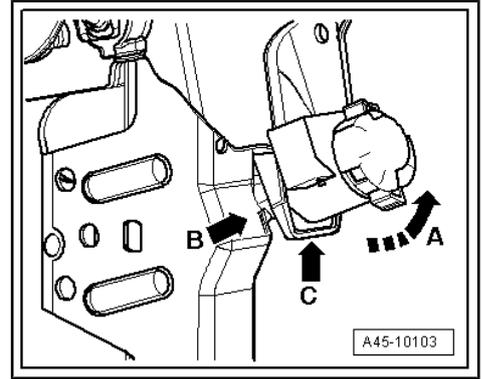
Removing and installing ⇒ Rep. gr. 20



Fitting location of brake light switch -F-

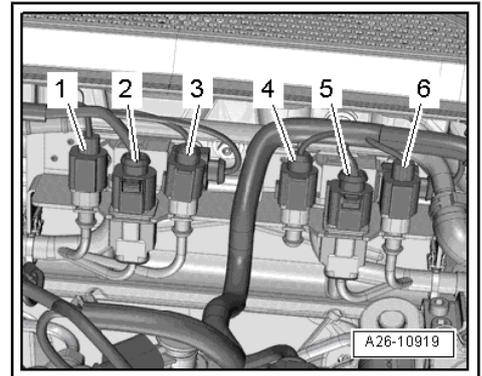
- ◆ In footwell on brake pedal

Removing and installing ⇒ Rep. gr. 45



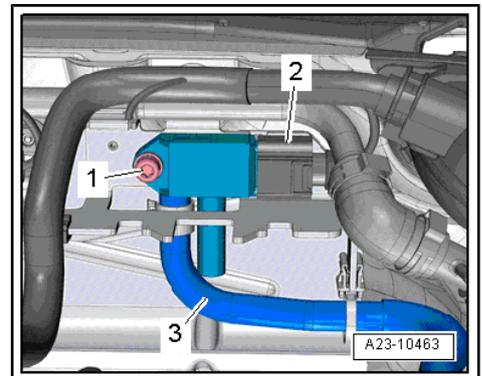
Fitting location of connectors at plenum chamber partition panel

- 1 - Exhaust gas temperature sender 4 -G648- for cylinder bank 1 (right-side)
- 2 - Lambda probe -G39- with Lambda probe heater -Z19- for cylinder bank 1 (right-side)
- 3 - Exhaust gas temperature sender 3 -G495- for cylinder bank 1 (right-side)
- 4 - Exhaust gas temperature sender 3 for cylinder bank 2 - G497-
- 5 - Lambda probe 2 -G108- with Lambda probe heater 2 -Z28-
- 6 - Exhaust gas temperature sender 4 for cylinder bank 2 - G649-



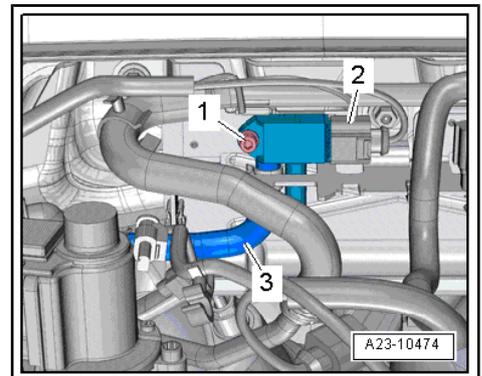
Fitting location of pressure differential sender -G505- for cylinder bank 1

- ◆ On plenum chamber partition panel (right-side)



Fitting location of pressure differential sender 2 -G524- for cylinder bank 2

- ◆ On plenum chamber partition panel (left-side)

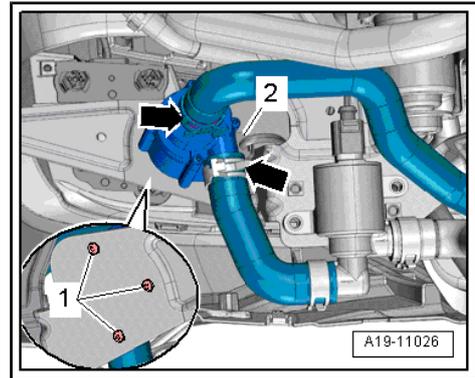


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Continued coolant circulation pump -V51-

A second solenoid valve (coolant valve for gearbox -N488-) is fitted behind the solenoid valve visible in this illustration.



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3 System layout



Caution

To prevent the high-pressure fuel pump from running while it is empty and to ensure that the engine starts quickly after parts have been renewed, it is important to observe the following:

- ◆ *If components of the fuel system between the fuel tank and the high-pressure pump are removed or renewed, the first fuel filling operation must be performed.*
- ◆ *If a fuel pump, fuel line (between fuel tank and high-pressure pump) or fuel filter is removed or renewed, the fuel system must be bled before the engine is started for the first time.*
- ◆ *If the high-pressure pump is removed or renewed, the fuel system must be bled before the engine is started for the first time.*

Procedure for first fuel filling ⇒ [page 44](#)



Caution

Risk of malfunctions caused by dirt.

- ◆ *Observe*
⇒ ["1.3 Rules for cleanliness and instructions for working on fuel system", page 2](#).

**1 - Fuel metering valve -N290-**

- Do not unscrew

2 - High-pressure pump

- After renewing, perform first fuel filling (it is important not to allow pump to run while it is still empty) ⇒ [page 44](#)
- After renewing high-pressure pump or fuel pressure regulating valve -N276-, learnt values must be re-adapted; see "Guided Functions" in ⇒ Vehicle diagnostic tester
- Removing and installing ⇒ [page 42](#)

3 - Fuel rail

- For cylinder bank 1 (right-side)

4 - Fuel pressure regulating valve -N276-

- In fuel rail for cylinder bank 1 (right-side)
- Cannot be re-installed
- After renewing high-pressure pump or fuel pressure regulating valve -N276-, learnt values must be re-adapted; see "Guided Functions" in ⇒ Vehicle diagnostic tester

- Removing and installing ⇒ [page 60](#)

- Tightening torque ⇒ [page 17](#)

5 - Fuel pressure sender -G247-

- In fuel rail for cylinder bank 2 (left-side)
- Removing and installing ⇒ [page 62](#)

6 - Fuel rail

- For cylinder bank 2 (left-side)

7 - Injector

- Removing and installing ⇒ [page 52](#)

8 - Fuel return lines

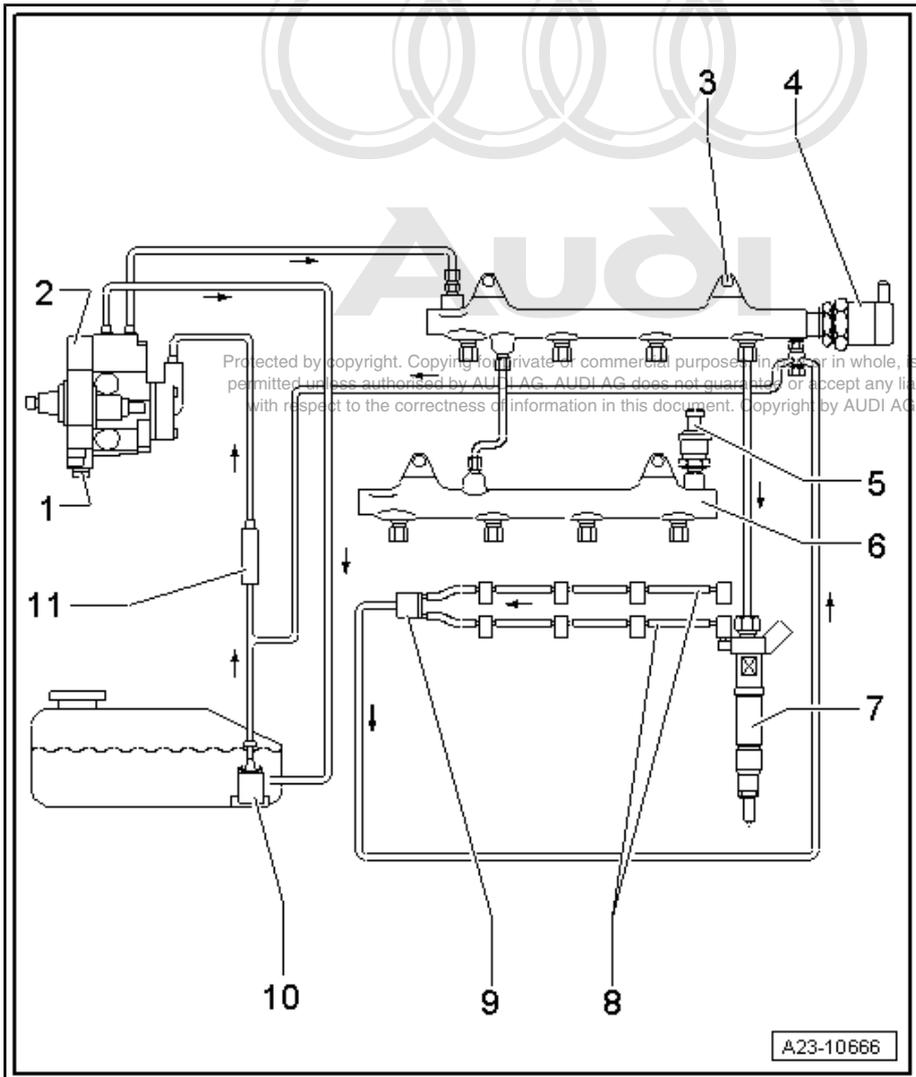
- Do not dismantle
- After renewing, engine must be run at idling speed for approx. 2 minutes to bleed fuel system
- Then check fuel return lines for leaks

9 - Restrictor

- Maintains a residual pressure in fuel return lines

10 - Fuel system pressurisation pump -G6-**11 - Fuel filter**

- Exploded view ⇒ Rep. gr. 20



4 Fuel rail, high-pressure pipes and injectors - exploded view



Caution

Risk of malfunctions caused by dirt.

◆ **Observe**

⇒ "1.3 Rules for cleanliness and instructions for working on fuel system", page 2 .

1 - Copper seal

- Renew

2 - O-ring

- Renew

3 - Clamping piece

- Mark allocation for re-installation; pay attention to marking when installing
- Must be renewed if injector is renewed

4 - Nut

- 9 Nm

5 - High-pressure pipe

- From fuel rail to injector
- Do not alter shape
- Mark allocation for re-installation; pay attention to marking when installing
- Check for damage before re-installing
- Installing ⇒ [page 57](#)
- Lubricate threads of union nuts with fuel
- 25 Nm

6 - High-pressure pipe

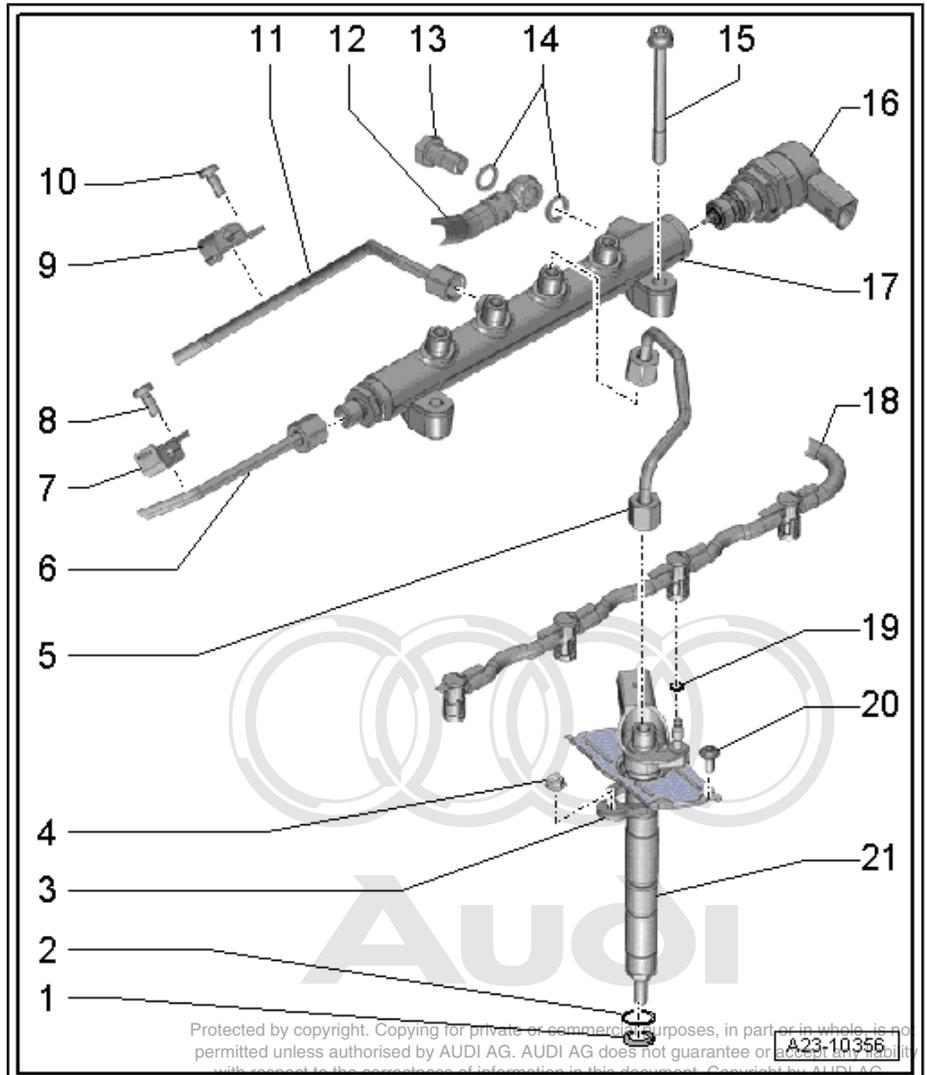
- From high-pressure pump to fuel rail
- Do not alter shape
- Mark allocation for re-installation; pay attention to marking when installing
- Check for damage before re-installing
- Installing ⇒ [page 57](#)
- Lubricate threads of union nuts with fuel
- 25 Nm

7 - Bracket

- For high-pressure pipe

8 - Bolt

- 9 Nm



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9 - Bracket

- For high-pressure pipe

10 - Bolt

- 9 Nm

11 - High-pressure pipe

- From fuel rail on opposite side
- Do not alter shape
- Mark allocation for re-installation; pay attention to marking when installing
- Check for damage before re-installing
- Installing ⇒ [page 57](#)
- Lubricate threads of union nuts with fuel
- 25 Nm

12 - Fuel return hose

13 - Banjo bolt

- 25 Nm

14 - Seals

- Renew

15 - Bolt

- 22 Nm

16 - Fuel pressure regulating valve -N276-

- With deformable sealing lip
- Cannot be re-installed
- After renewing high-pressure pump or fuel pressure regulating valve -N276- , learnt values must be re-adapted; see "Guided Functions" in ⇒ Vehicle diagnostic tester
- Removing and installing ⇒ [page 60](#)
- Tightening torque ⇒ [page 17](#)

17 - Fuel rail

18 - Fuel return line

- Do not dismantle
- Renew together with restrictor
- After renewing, engine must be run at idling speed for approx. 2 minutes to bleed fuel system
- Then check fuel return lines for leaks

19 - O-ring

- Renew

20 - Bolt

- 8 Nm

21 - Injector

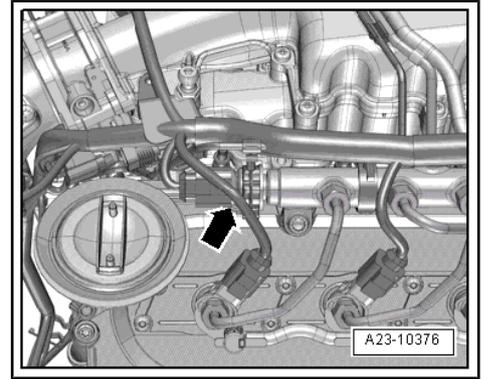
- Mark allocation for re-installation; pay attention to marking when installing
- Removing and installing ⇒ [page 52](#)

Fuel pressure sender -G247- - tightening torque

- Tighten fuel pressure sender -G247- in 4 stages as follows:

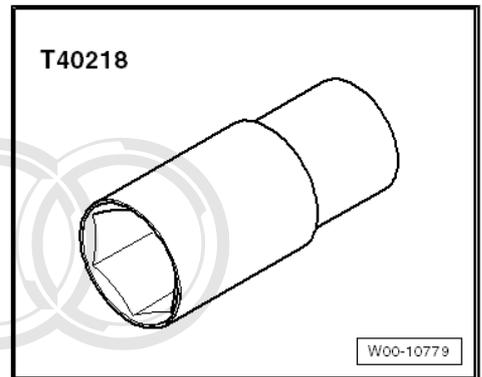
 **Note**

An open-end spanner must not be used for loosening or tightening.



Special tools and workshop equipment required

- ◆ Socket, 27 mm -T40218-



- ◆ Torque wrench

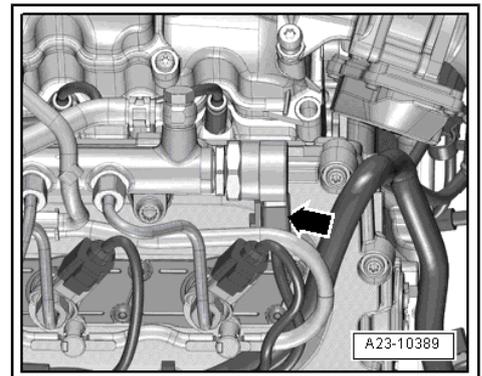
Stage	Tightening torque
1.	Screw in by hand until it makes contact
2.	60 Nm
3.	Turn back by 180°
4.	85 Nm

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Fuel pressure regulating valve -N276- - tightening torque

- Position fuel pressure regulating valve -N276- so that electrical wiring is not under tension when connector -arrow- is plugged in.
- Tighten union nut on regulating valve in 4 stages as follows (counterhold hexagon flats on housing during each step):

Stage	Tightening torque
1.	Screw in by hand until it makes contact
2.	60 Nm
3.	Turn back by 90°
4.	85 Nm





5 Bleeding fuel system

Special tools and workshop equipment required

- ◆ ⇒ Vehicle diagnostic tester



Caution

If a fuel pump, fuel line (between fuel tank and high-pressure pump) or fuel filter is removed or renewed, the fuel system must be bled before the engine is started for the first time.

Procedure

- There must be sufficient fuel in the tank.
- Connect a ⇒ Vehicle diagnostic tester.
- Switch on ignition.
- Select “Engine electronics” in vehicle self-diagnosis.
- Then select “Basic setting”.
- Select “Checking fuel system pressurisation pump” from the list.
- Press “start” button.
- The fuel pumps start running.
- The fuel pumps must run for approx. 1 minute to ensure that the high-pressure pump is filled with sufficient fuel.
- Start engine after filling fuel system.
- Run engine at moderate speed for several minutes and then switch off.
- Check fuel system for leaks.
- Erase entry in event memory using diagnostic tester.
- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.



Note

If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the event memory. Then continue the road test.

- Interrogate event memory.



6 Vacuum system - overview

1 - Coolant pump

2 - Coolant valve for cylinder head -N489-

3 - Vacuum unit

- For exhaust gas recirculation cooler

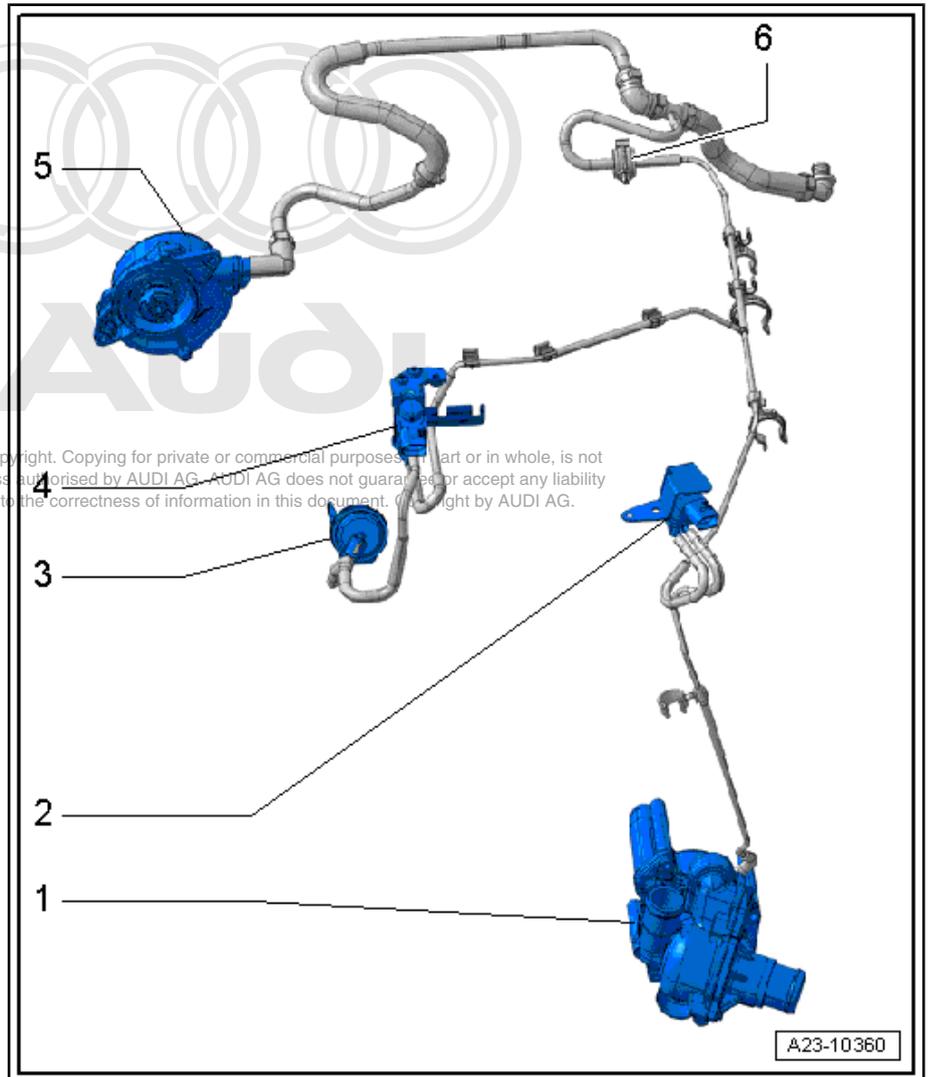
4 - Exhaust gas recirculation cooler change-over valve - N345-

5 -

- For brake servo

6 - Non-return valve

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7 Air cleaner

Overview

- ◆ ⇒ [“7.1 Air cleaner - exploded view”, page 20](#)
- ◆ ⇒ [“7.2 Removing and installing engine cover panel”, page 22](#)
- ◆ ⇒ [“7.3 Removing and installing air filter element”, page 22](#)
- ◆ ⇒ [“7.4 Removing and installing air cleaner housing”, page 24](#)

7.1 Air cleaner - exploded view



Note

The illustration shows the air cleaner on the left side.

1 - Air cleaner (bottom section)

- Clean out salt deposits, dirt and leaves, etc.

2 - Air cleaner (top section)

- Clean out salt deposits, dirt and leaves, etc.

3 - Bolt

- 3.5 Nm

4 - Rubber buffer

5 - Air filter element

- Use genuine air filter element ⇒ Electronic parts catalogue
- Removing and installing ⇒ [page 22](#)
- Maintenance intervals ⇒ Maintenance tables

6 - O-ring

- Renew if damaged

7 - Air filter screen

- Clean

8 - Housing for air mass meter 2 -G246-

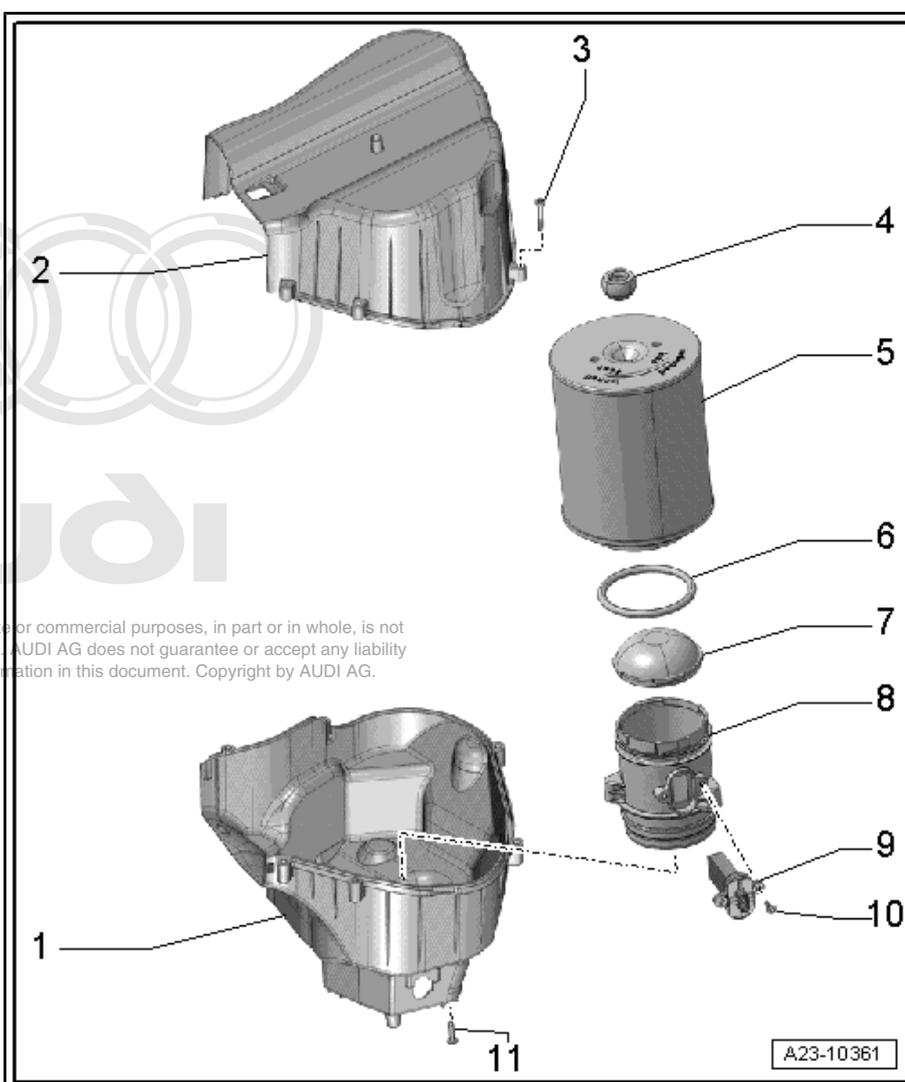
- On right side: for air mass meter -G70-

9 - Air mass meter 2 -G246-

- On right side: air mass meter -G70-
- Removing and installing ⇒ [page 57](#)

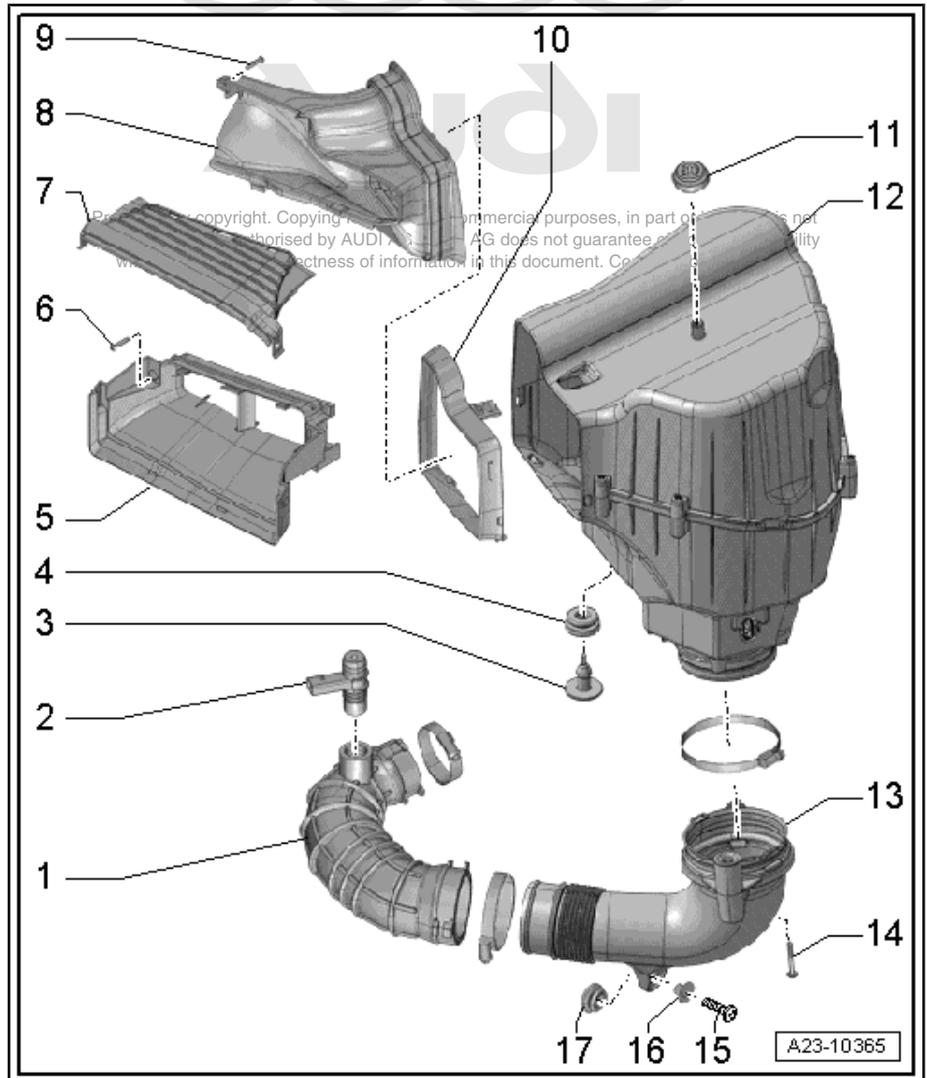
10 - Bolt

- 3.5 Nm



- 11 - Bolt
 - 3.5 Nm

- 1 - Air hose
- 2 - Heater element for 2 crankcase breather -N483-
 - On right side: heater element for crankcase breather -N79-
- 3 - Retainer
 - For air cleaner housing
- 4 - Rubber grommet
- 5 - Air duct
 - Clean out salt deposits, dirt and leaves, etc.
- 6 - Bolt
 - 1.5 Nm
- 7 - Air duct
- 8 - Air duct
 - Clean out salt deposits, dirt and leaves, etc.
- 9 - Bolt
 - 2.5 Nm
- 10 - Sealing element
- 11 - Rubber grommet
- 12 - Air cleaner housing
 - Removing and installing
⇒ [page 24](#)
- 13 - Air pipe
- 14 - Bolt
 - 3.5 Nm
- 15 - Bolt
 - 5 Nm
- 16 - Spacer sleeve
- 17 - Rubber grommet





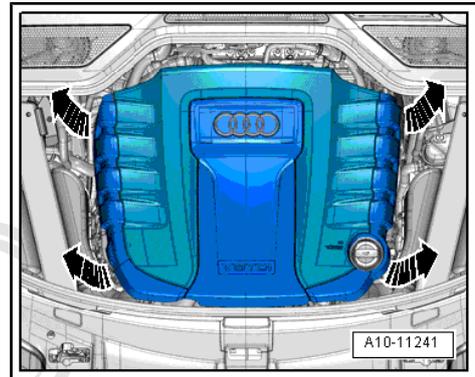
7.2 Removing and installing engine cover panel

Removing

- Carefully pull engine cover panel off retaining pins one after the other -arrows-. Do not jerk engine cover panel away, and do not try to pull on one side only.

Installing

- To avoid damage, do not strike the engine cover panel with your fist or with any kind of tool.
- Observe oil filler neck when positioning engine cover panel.
- Press engine cover panel with both hands first onto retaining pins at rear and then onto retaining pins at front.



7.3 Removing and installing air filter element



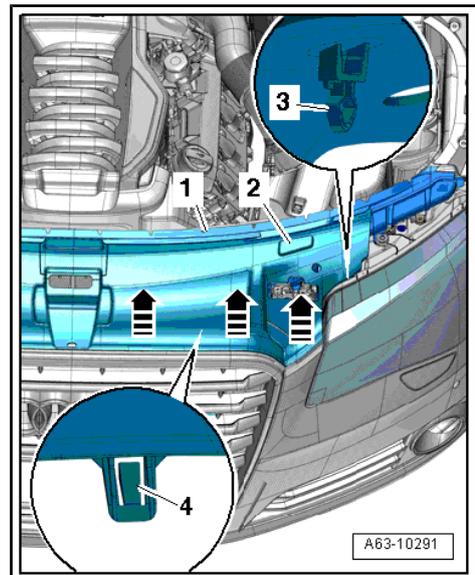
Note

The removal and installation procedures are described for the right side of the vehicle - the procedures are basically the same for the left side.

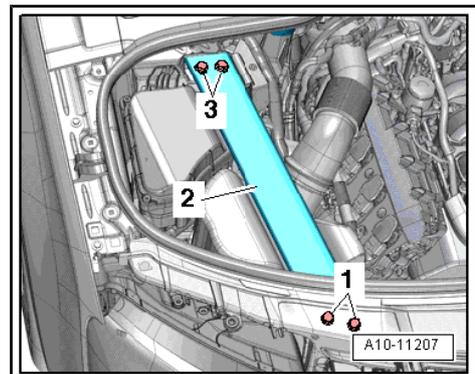
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Removing

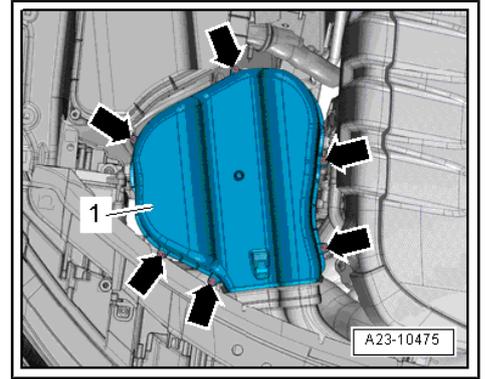
- Remove lock carrier cover => Rep. gr. 63 .



- Remove bolts -1, 3- and detach longitudinal member (top right) -2-.



- Remove bolts -arrows- and detach air cleaner (top section) -1-.



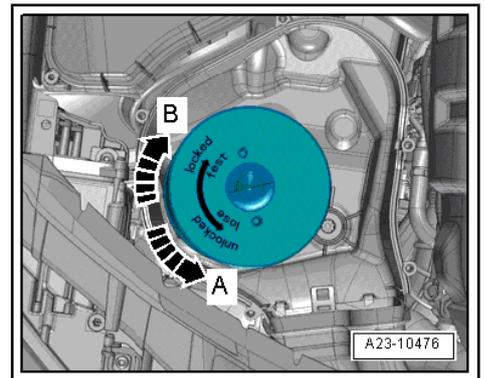
- Turn air filter element in anti-clockwise direction -arrow A- and detach it.

Installing

Installation is carried out in the reverse order; note the following:

- Tightening torques
 ⇒ ["7.1 Air cleaner - exploded view", page 20](#)

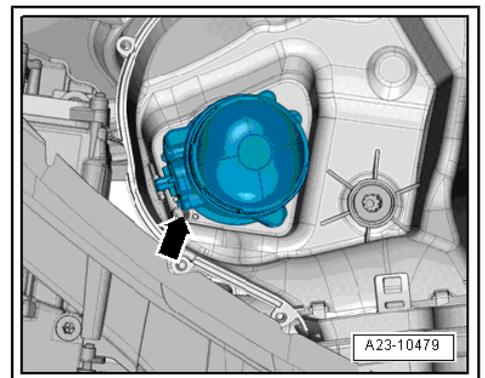
To ensure that the air mass meter -G70- / air mass meter 2 -G246- functions properly, it is important to observe the following notes and instructions.



 **Note**

- ◆ *If the air filter element is very dirty or wet, dirt or water could reach the air mass meter and affect the air mass value. This would lead to loss of power, since a smaller injection quantity is calculated.*
- ◆ *Always use genuine part for air filter element.*
- ◆ *The air cleaner housing MUST be clean.*
- ◆ *Use a silicone-free lubricant when installing the intake hose.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *To prevent malfunctions, cover critical parts of the engine air intake (air mass meter, air pipes, etc.) with a clean cloth when blowing out the air cleaner housing with compressed air.*
- ◆ *Observe environmental requirements for disposal.*

- Clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections) using a vacuum cleaner.
- Blow out water drain -arrow- with compressed air.
- Check for salt residue, dirt and leaves in air mass meter and air intake hose (engine intake side).
- Check for dirt and leaves in air duct going from lock carrier to air cleaner housing.
- When installing air filter element, check that it is properly centred in retainer in air cleaner (bottom section).
- Carefully fit top section of air cleaner onto bottom section, without using any force.

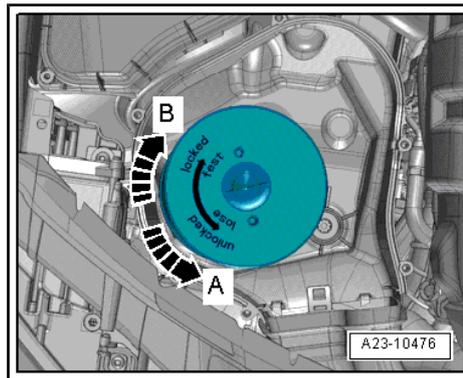




- Turn air filter element in clockwise direction -arrow B- so that it engages.

Remaining installation steps are carried out in reverse sequence; note the following:

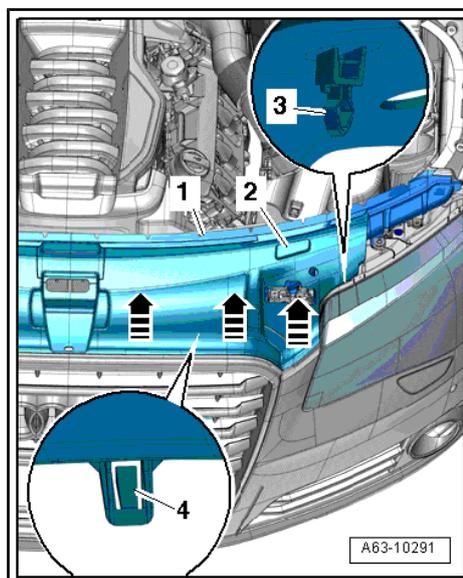
- Remove lock carrier cover ⇒ Rep. gr. 63 .



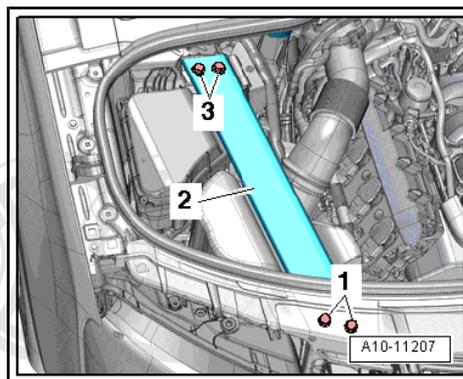
7.4 Removing and installing air cleaner housing

Removing

- Remove lock carrier cover ⇒ Rep. gr. 63 .



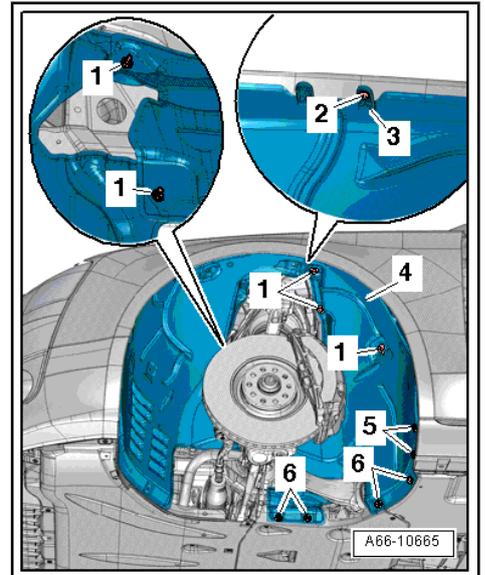
- Remove bolts -1, 3- and detach respective longitudinal member (top) -2-.



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- Remove relevant front wheel.



- Remove front section of relevant wheel housing liner ⇒ Rep. gr. 66 .
- Unplug electrical connector -1-.
- Remove bolt -3-.
- Open clamp -2- connecting air cleaner housing to air pipe.
- Press catch down -arrow A- and push towards rear -arrow B-.
- Lift off air cleaner housing.

Installing

- Tightening torque
⇒ ["7.1 Air cleaner - exploded view", page 20](#)

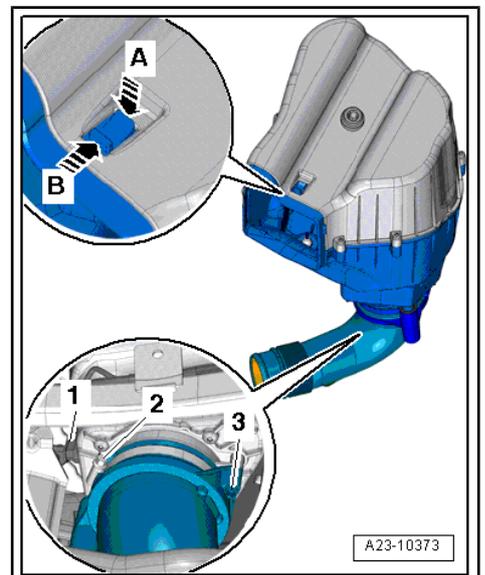


- ◆ **Both sections of the air cleaner housing MUST be clean.**
- ◆ **Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.**
- ◆ **To prevent malfunctions, cover all critical parts of the engine air intake tract (air mass meter, intake pipes, etc.) with a clean cloth when blowing out the air cleaner housing with compressed air.**

- Check for salt residue, dirt and leaves in air hose (engine intake side).
- Check for dirt and leaves in air duct going from lock carrier to air cleaner housing.

Remaining installation steps are carried out in reverse sequence; note the following:

- Install front wheel housing liner ⇒ Rep. gr. 66 .
- Fit front wheel ⇒ Rep. gr. 44 .
- Install front noise insulation ⇒ Rep. gr. 66 .
- Install longitudinal member (top) ⇒ Rep. gr. 50 .
- Remove lock carrier cover ⇒ Rep. gr. 63 .



8 Intake manifold

Overview

- ◆ ⇒ ["8.1 Intake manifold - exploded view", page 26](#)
- ◆ ⇒ ["8.2 Removing and installing intake manifold \(top section\)", page 28](#)
- ◆ ⇒ ["8.3 Removing and installing intake manifold \(bottom section\) for cylinder bank 1 \(right-side\)", page 29](#)
- ◆ ⇒ ["8.4 Removing and installing intake manifold \(bottom section\) for cylinder bank 2 \(left-side\)", page 31](#)
- ◆ ⇒ ["8.5 Removing and installing throttle valve module J338 / J544", page 32](#)

8.1 Intake manifold - exploded view



Note

The illustration shows the top and bottom sections of the intake manifold for cylinder bank 2 (left-side).

1 - Air intake connection

2 - Bolt

- 9 Nm

3 - O-ring

- Renew

4 - Throttle valve module 2 - J544-

- Cylinder bank 1 (right-side): throttle valve module -J338-

5 - O-ring

- Renew

6 - Gasket

- Renew

7 - Bolt

- 9 Nm

8 - Bolt

- 9 Nm

9 - Connection for exhaust gas recirculation cooler

10 - Gasket

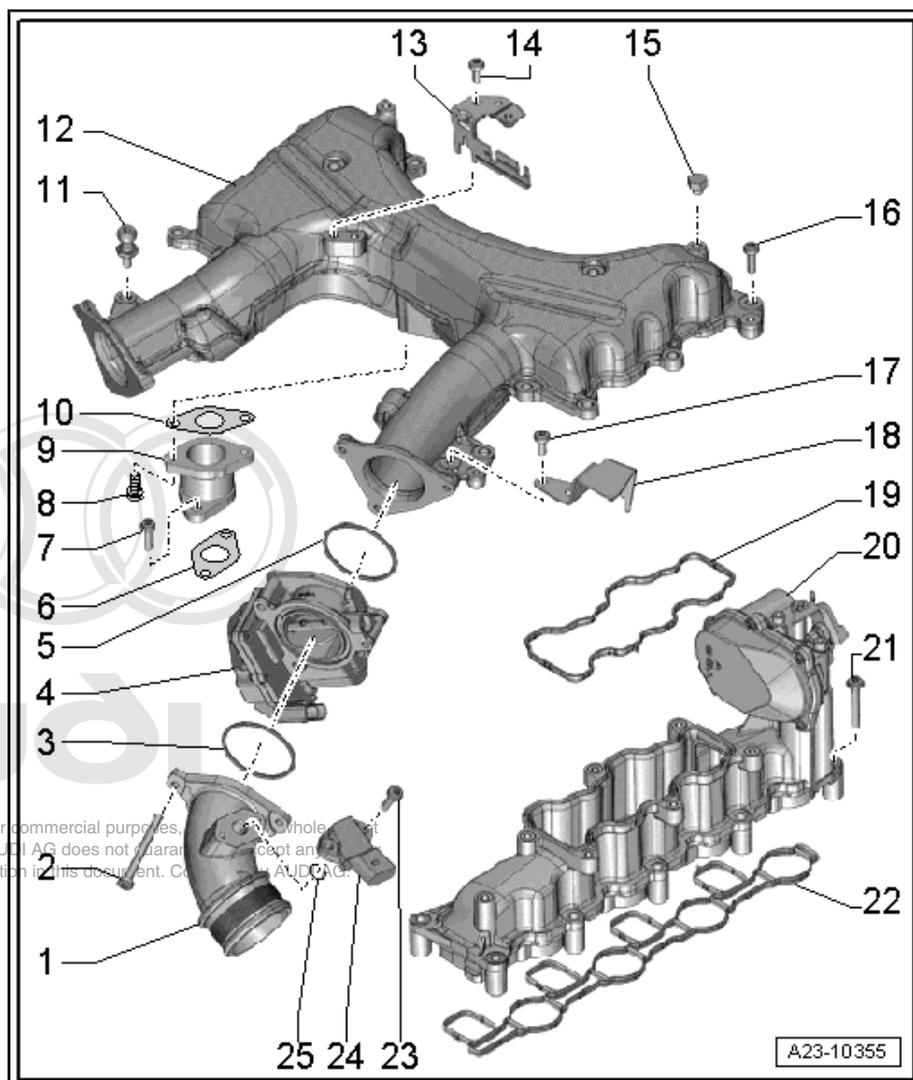
- Renew

11 - Mounting pin

- For engine cover
- 5 Nm

12 - Intake manifold (top section)

- Removing and installing ⇒ [page 28](#)



13 - Bracket

- For change-over valve and electrical connectors

14 - Bolt

- 9 Nm

15 - Screw plug

- 8 Nm

16 - Bolt

- Tighten in stages and in diagonal sequence
- 9 Nm

17 - Bolt

- 9 Nm

18 - Bracket

- For change-over valve

19 - Gasket

- Renew

20 - Intake manifold (bottom section) with intake manifold flap motor -V157-

- Cylinder bank 1 (right-side)
- Removing and installing ⇒ [page 29](#)
- Cylinder bank 2 (left-side) with intake manifold flap 2 motor -V275-
- Removing and installing ⇒ [page 31](#)
- Do not dismantle

21 - Bolt

- Tighten in stages and in diagonal sequence
- 9 Nm

22 - Gasket

- Renew

23 - Bolt

- 9 Nm

24 - Charge pressure sender -G31- / intake air temperature sender -G42-

- Removing and installing ⇒ Rep. gr. 21

25 - O-ring

- Renew

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8.2 Removing and installing intake manifold (top section)

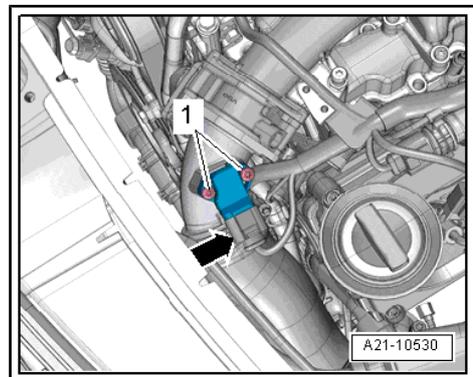
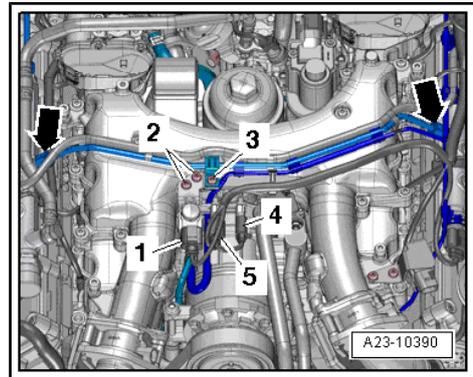
Removing

- Pull off engine cover panel => [page 22](#) .
- Unscrew union nuts -arrows-.
- Unscrew bolt -3- on retaining clip and detach high-pressure pipe.
- Detach electrical connectors -4 and 5- from bracket and unplug.
- Unplug electrical connector -1- and move electrical wiring harness clear to left side.
- Unscrew bolts -2-, detach exhaust gas recirculation cooler change-over valve -N345- and detach vacuum hose.
- Unplug electrical connector -arrow- at charge pressure sender -G31- .

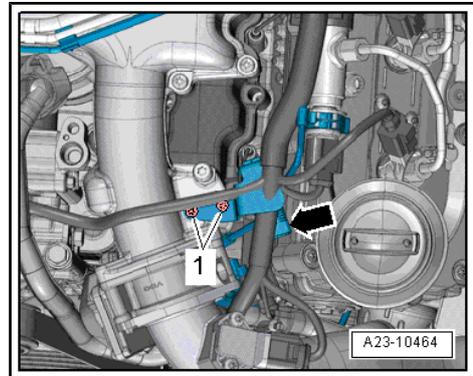


Note

Disregard -item 1-.



- Unscrew bolts -1- and press coolant valve for cylinder head -N489- -arrow- with bracket to the side.



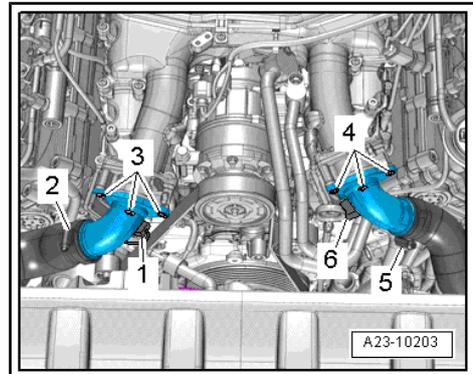
- Unplug electrical connectors:
 - 1 - Throttle valve module -J338-
 - 6 - Throttle valve module 2 -J544-
- Release hose clips -2- and -5- and disconnect air hoses.



Note

Disregard -items 3, 4-.

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- Unscrew mounting pins -1- and -6- for engine cover panel.
- Remove bolts -7- at connection for exhaust gas recirculation cooler.
- Unscrew bolts -2 ... 5- and detach intake manifold (top section).

Installing

Installation is carried out in the reverse order; note the following:

- Tightening torques
⇒ "8.1 Intake manifold - exploded view", page 26



Note

- ◆ Renew seals and/or gaskets.
- ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.
- Tighten bolts for top section of intake manifold and mounting pins for engine cover panel in diagonal sequence and in stages.
- Install high-pressure pipe ⇒ page 57 .

8.3 Removing and installing intake manifold (bottom section) for cylinder bank 1 (right-side)

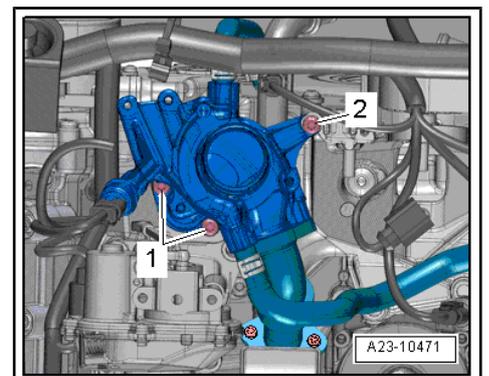
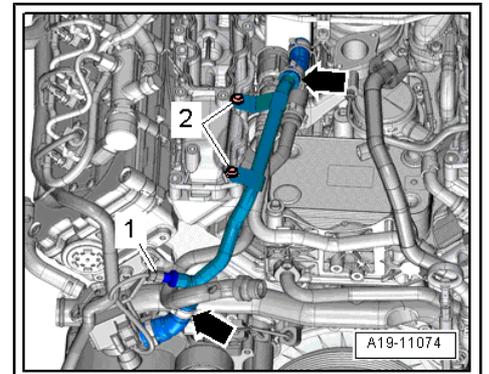
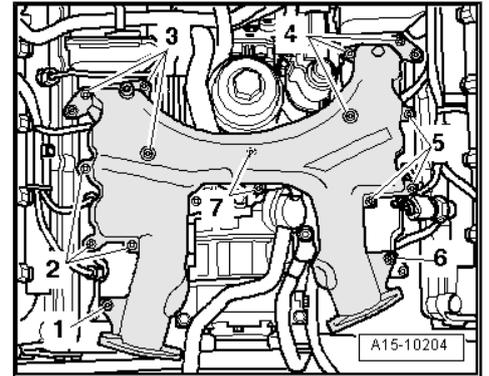
Removing

- Remove intake manifold (top section) ⇒ page 28 .
- Drain coolant ⇒ Rep. gr. 19 .
- Remove bolts -1 and 2- from coolant pipe.
- Disconnect coolant pipe -arrow- and move it clear to one side.
- Remove bolt -1- on retaining clip.



- Remove bolts -1 and 2-.
- Carefully press exhaust gas recirculation control motor -V338- with connection to one side until bolts at intake manifold (bottom section) are accessible.

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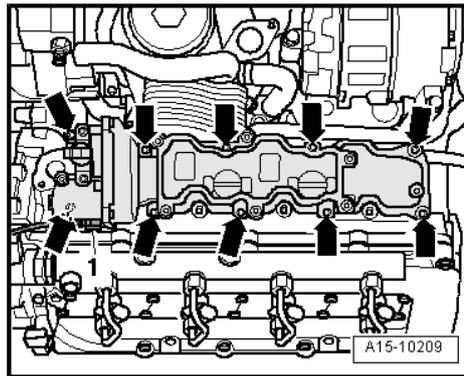
- Move fuel hoses clear.
- Unplug electrical connector -1-.
- Unscrew bolts -arrows- and remove bottom section of intake manifold (right-side) with intake manifold flap motor -V157- .



Caution

Risk of irreparable damage to engine.

- ◆ *Block off the openings of the intake ports with a clean cloth to prevent small items from dropping into the engine.*



Installing

Installation is carried out in the reverse order; note the following:

- Tightening torques
⇒ ["8.1 Intake manifold - exploded view", page 26](#)



Note

Renew seals and/or gaskets.

- Install exhaust gas recirculation control motor -V338- with connection ⇒ Rep. gr. 26 .
- Install coolant pipe (top) for exhaust gas recirculation ⇒ Rep. gr. 19 .
- Install intake manifold (top section) ⇒ [page 28](#) .

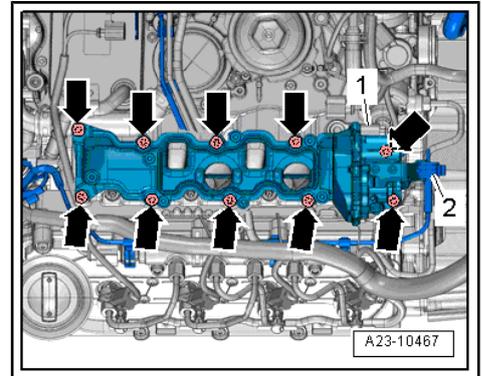


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8.4 Removing and installing intake manifold (bottom section) for cylinder bank 2 (left-side)

Removing

- Remove intake manifold (top section) ⇒ [page 28](#) .
- Unplug electrical connectors at glow plugs for cylinders 5, 6, 7 and 8.
- Take non-return valve -2- out of retainer.
- Unplug electrical connector -1-.
- Unscrew bolts -arrows- and detach intake manifold together with intake manifold flap 2 motor -V275- .



Caution

Risk of irreparable damage to engine.

- ◆ **Block off the openings of the intake ports with a clean cloth to prevent small items from dropping into the engine.**

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Installing

Installation is carried out in the reverse order; note the following:

- Tightening torques
⇒ ["8.1 Intake manifold - exploded view", page 26](#)



Note

Renew seals and/or gaskets.

- Install intake manifold (top section) ⇒ [page 28](#) .



8.5 Removing and installing throttle valve module -J338- / -J544-

Removing

- Pull off engine cover panel ⇒ [page 22](#) .
- Unplug electrical connectors:
 - 1 - Throttle valve module -J338-
 - 6 - Throttle valve module 2 -J544-
- Release hose clips -2- or -5- and disconnect air hoses.
- Remove bolts -3- or -4- and detach throttle valve module.

Installing

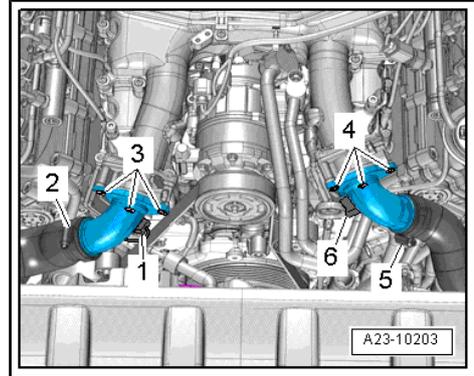
Installation is carried out in the reverse order; note the following:

- Tightening torques
⇒ ["8.1 Intake manifold - exploded view"](#), [page 26](#)



Note

- ◆ *Fit new O-rings.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ [Electronic parts catalogue](#) .*
- ◆ *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*



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9 High-pressure pump

Overview

- ◆ ⇒ [“9.1 Toothed belt for high-pressure pump - exploded view”, page 33](#)
- ◆ ⇒ [“9.2 Removing and installing toothed belt for high-pressure pump”, page 34](#)
- ◆ ⇒ [“9.3 High-pressure pump - exploded view”, page 41](#)
- ◆ ⇒ [“9.4 Removing and installing high-pressure pump”, page 42](#)
- ◆ ⇒ [“9.5 Performing first fuel filling operation after installing high-pressure pump”, page 44](#)

9.1 Toothed belt for high-pressure pump - exploded view

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1 - Toothed belt cover

2 - Bolt

- 9 Nm

3 - Bolt

- Renew
- 75 Nm + turn 45° further

4 - Toothed belt

- For high-pressure pump
- Before removing, mark direction of rotation with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage
- Check for wear
- Removing and installing ⇒ [page 34](#)

5 - Toothed belt drive sprocket

6 - Bracket

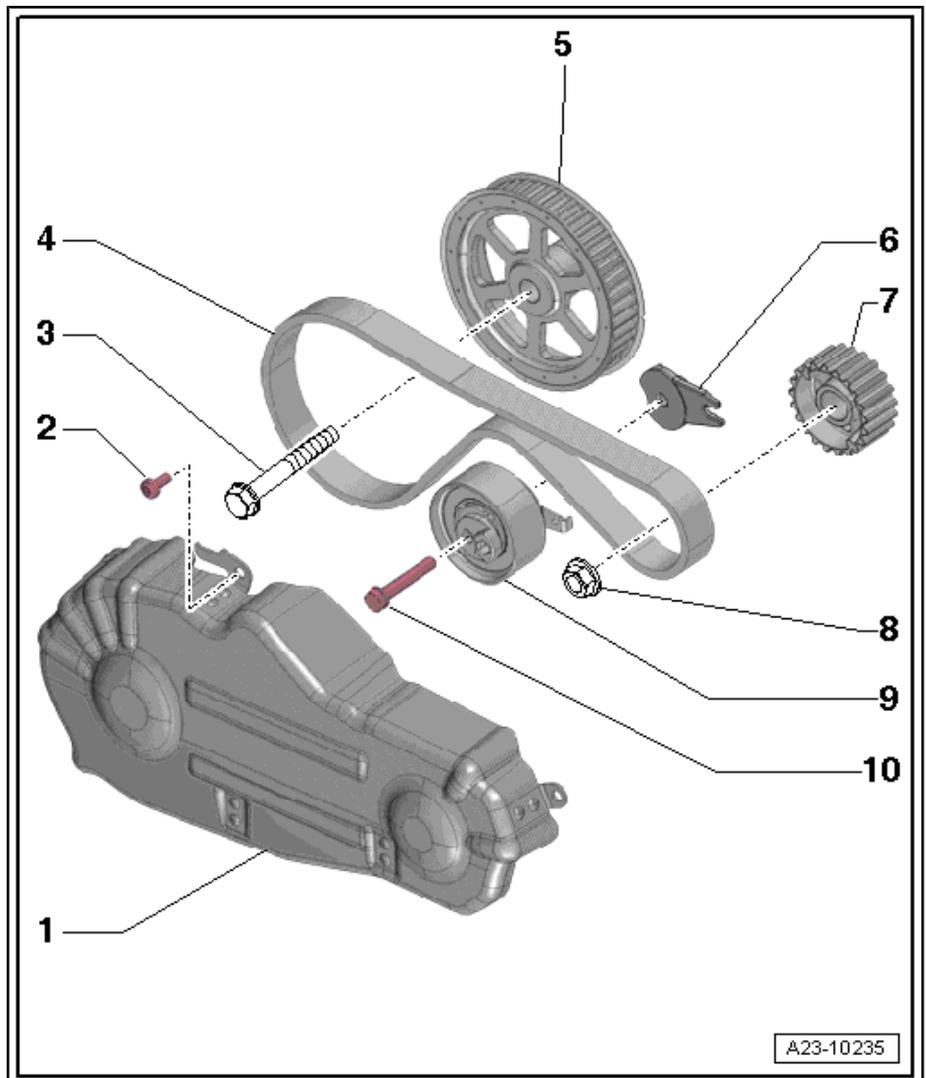
7 - Toothed belt sprocket

- For high-pressure pump

8 - Nut

- Tightening torque ⇒ [Item 1 \(page 41\)](#)

9 - Toothed belt tensioning roller





10 - Bolt

 **Caution**
Different depths of threads in cylinder head.

Before installation, check whether bolt is M8x70 or M8x75.

Use bolt with corresponding length. Risk of damage to engine.

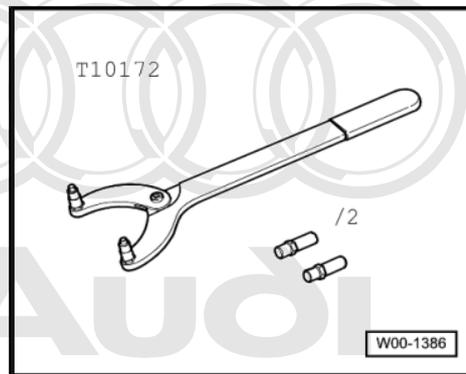
It is very important that the correct type of bolt is used => Electronic parts catalogue .

- Bolt thread must be free of oil and grease.
- Bolt M8 x 70 mm: 15 Nm + 180°
- Bolt M8 x 75 mm: 15 Nm + 180°
- Renew

9.2 Removing and installing toothed belt for high-pressure pump

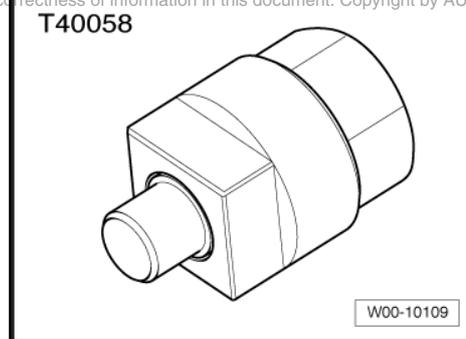
Special tools and workshop equipment required

- ◆ Counterhold tool -T10172- with -T10172/2-

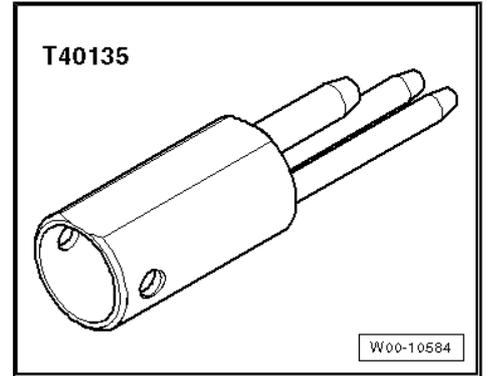


- ◆ Adapter -T40058-

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◆ Locking tool -T40135-



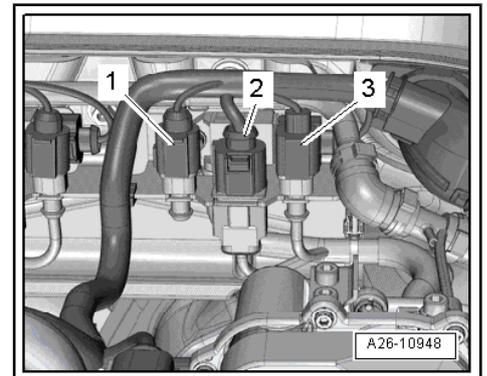
◆ Locking pin -T40237-

Removing

- Pull off engine cover panel => [page 22](#) .
- Detach electrical connectors from bracket, unplug connectors and move electrical wiring clear:

- 1 - Temperature sender 2 before particulate filter -G498-
- 2 - Lambda probe 2 -G108-
- 3 - Temperature sender after particulate filter -G527-

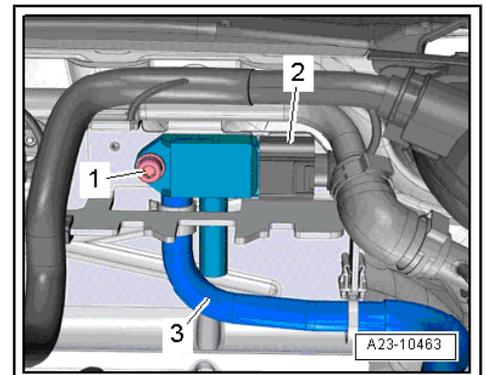
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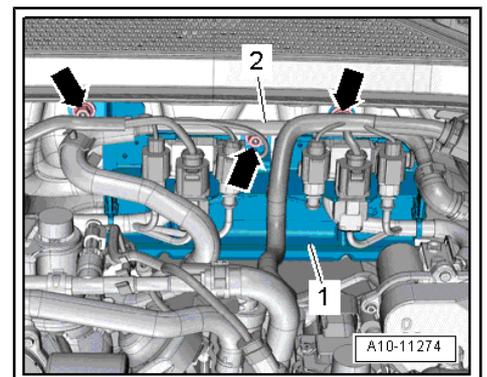
- Unplug electrical connector -2-.
- Remove bolt -1- and move pressure differential sender 2 - G524- clear.

 **Note**

Disregard -item 3-.

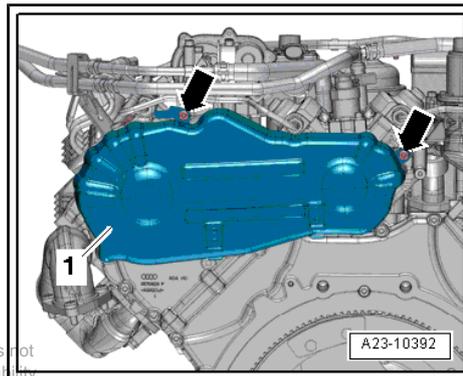


- Move clear vacuum line -2-.
- Remove bolts -arrows- and move bracket -1- clear to the right side.





- Remove bolts -arrows- and detach toothed belt cover -1-.



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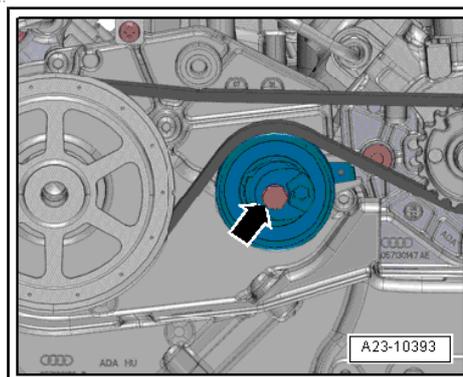
- Loosen bolt -arrow- for toothed belt tensioning roller approx. 1 turn.



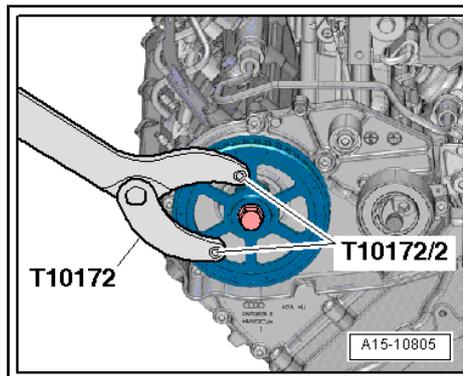
Caution

If a used belt runs in the opposite direction when it is refitted, this can cause breakage.

- ◆ *Before removing, mark direction of rotation of toothed belt with chalk or felt-tip pen for re-installation.*

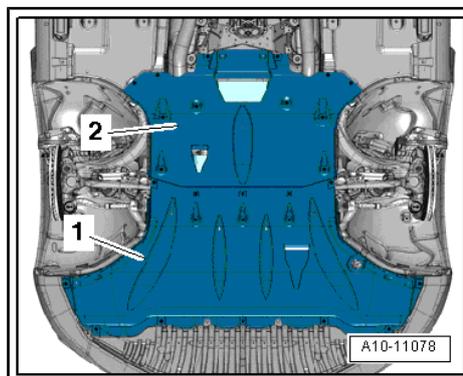


- First detach toothed belt from toothed belt sprocket for high-pressure pump and then from toothed belt drive sprocket.
- Loosen bolt for toothed belt drive sprocket using counterhold tool -T10172- with -T10172/2- .
- Unscrew bolt and insert new bolt.

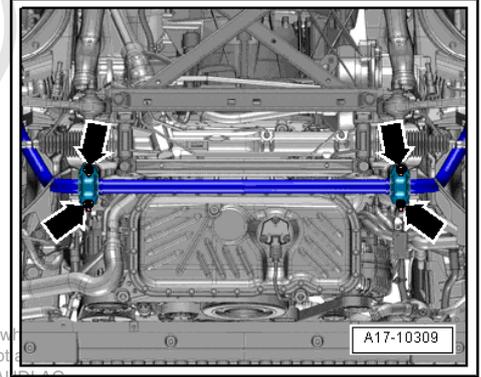


Installing

- Tightening torques
⇒ "9.1 Toothed belt for high-pressure pump - exploded view", page 33
- Remove front noise insulation -1- ⇒ Rep. gr. 66 .



- Remove nuts -arrows- and lower anti-roll bar.

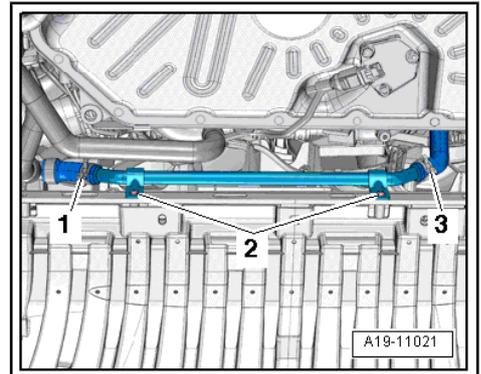


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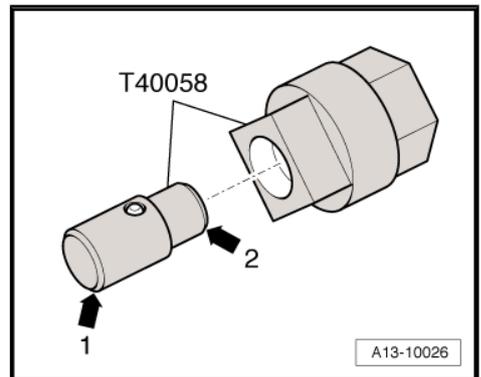
- Remove bolts -2- and press coolant pipe (bottom) to the side.

 **Note**

Disregard -items 1, 3-.



- Insert guide pin of adapter -T40058- as follows:
 - The larger-diameter section -arrow 1- faces towards the engine.
 - The smaller-diameter section -arrow 2- faces the adapter.

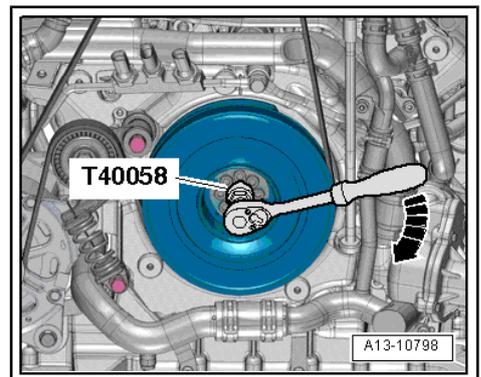


- Use adapter -T40058- to turn crankshaft to "TDC" position.

 **Caution**

Irreparable engine damage can be caused if the camshaft timing chains slip.

◆ *Turn crankshaft only in direction of engine rotation -arrow-.*





Note

Lay a cloth beneath sump (top section) to catch engine oil.

- Unscrew plug -arrow- from sump (top section).



- Screw locking pin -T40237- into hole (20 Nm); if necessary, turn crankshaft -1- backwards and forwards slightly to fully centralise locking pin.



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- Check installation position of toothed belt tensioning roller:
 - Pin -4- must engage in hole -3- in cylinder head.
 - Locating element -5- must engage in recess in bracket -2-.
- Screw in bolt -1- by hand as far as stop.

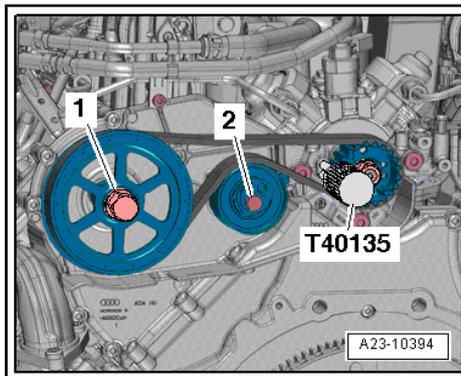
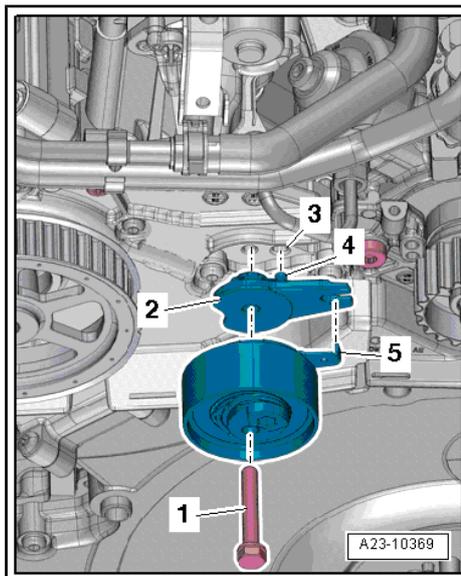
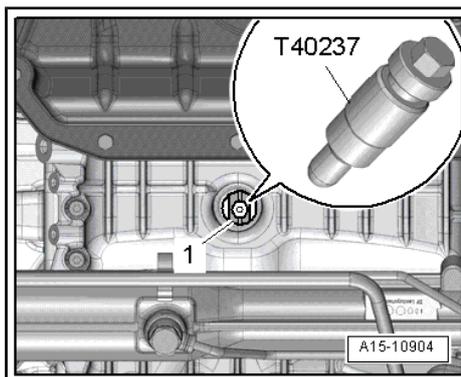
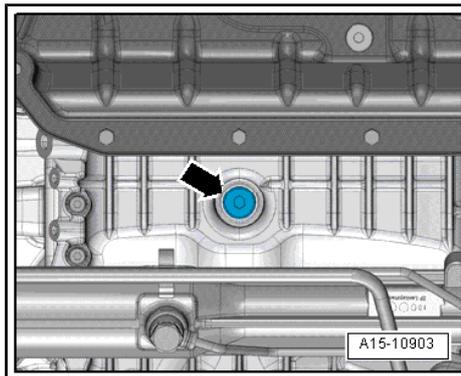


Note

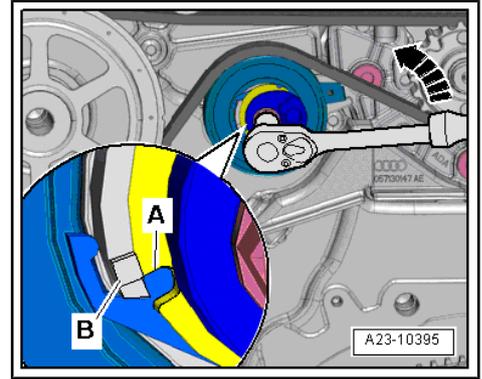
Different depths of threads in cylinder head. Check thread depth => [Item 10 \(page 33\)](#).

- Fit toothed belt.

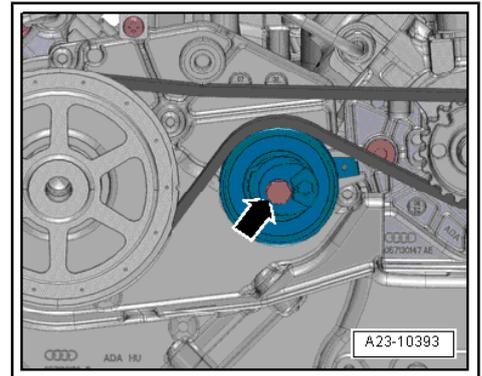
- Screw in bolt -2- for toothed belt tensioning roller without applying force until eccentric adjuster of toothed belt tensioning roller can just still be turned without axial movement.
- Screw in bolt -1- for toothed belt drive sprocket without force until toothed belt drive sprocket can just still be turned without axial movement.
- Lock toothed belt sprocket for high-pressure pump in position using locking tool -T40135- .



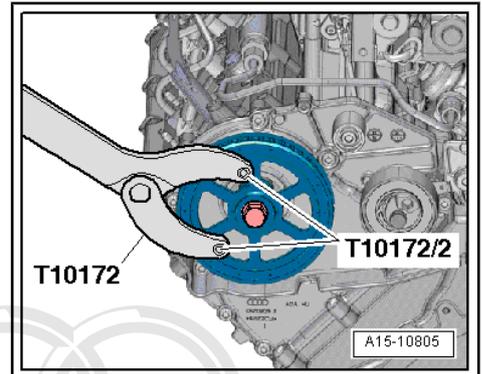
- Using hexagon key, apply tension to toothed belt by turning tensioning roller in direction of -arrow- until lug -B- is above notch -A-.



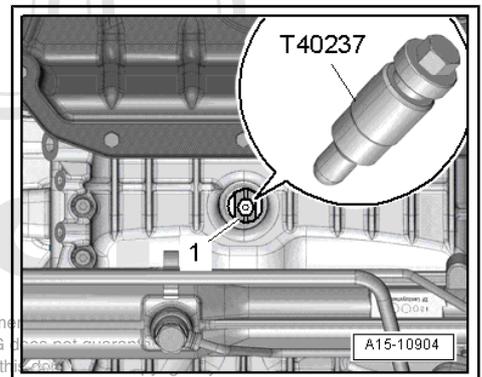
- Hold toothed belt tensioning roller in this position and tighten bolt -arrow-.



- Tighten bolt for toothed belt drive sprocket using counterhold tool -T10172- with -T10172/2- .



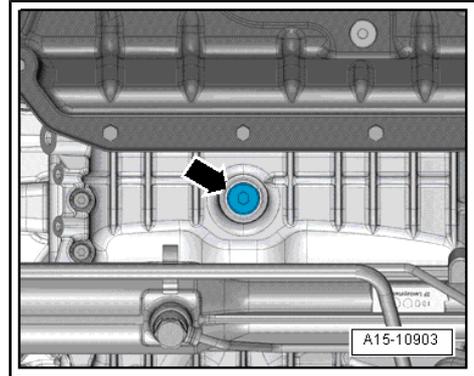
- Remove locking pin -T40237- .



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- Tighten plug -arrow- for "TDC" marking in sump (top section)
⇒ Rep. gr. 17 .
- Remove locking tool -T40135- .

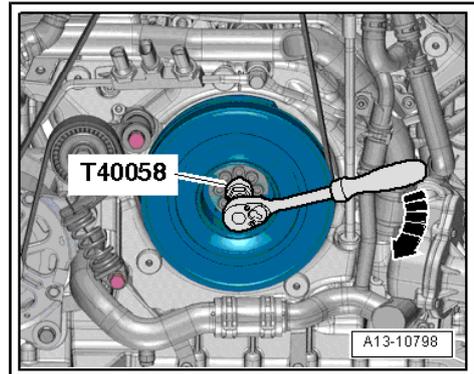


Caution

Irreparable engine damage can be caused if the camshaft timing chains slip.

- ◆ *Turn crankshaft only in direction of engine rotation -arrow-.*

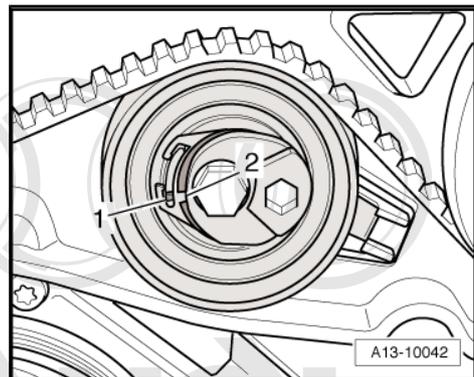
- Turn crankshaft 1 rotation using adapter -T40058- .



- Check toothed belt tension:
 - Lug -1- should align with notch -2-.
 - Maximum deviation: ± 2 mm
- If the specification is not attained, re-adjust toothed belt tension.

Remaining installation steps are carried out in reverse sequence; note the following:

- Install noise insulation ⇒ Rep. gr. 66 .



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9.3 High-pressure pump - exploded view

1 - Nut

- 70 Nm

2 - Toothed belt sprocket

- For high-pressure pump

3 - Bolt

- 22 Nm

4 - Retainer

- For high-pressure pump

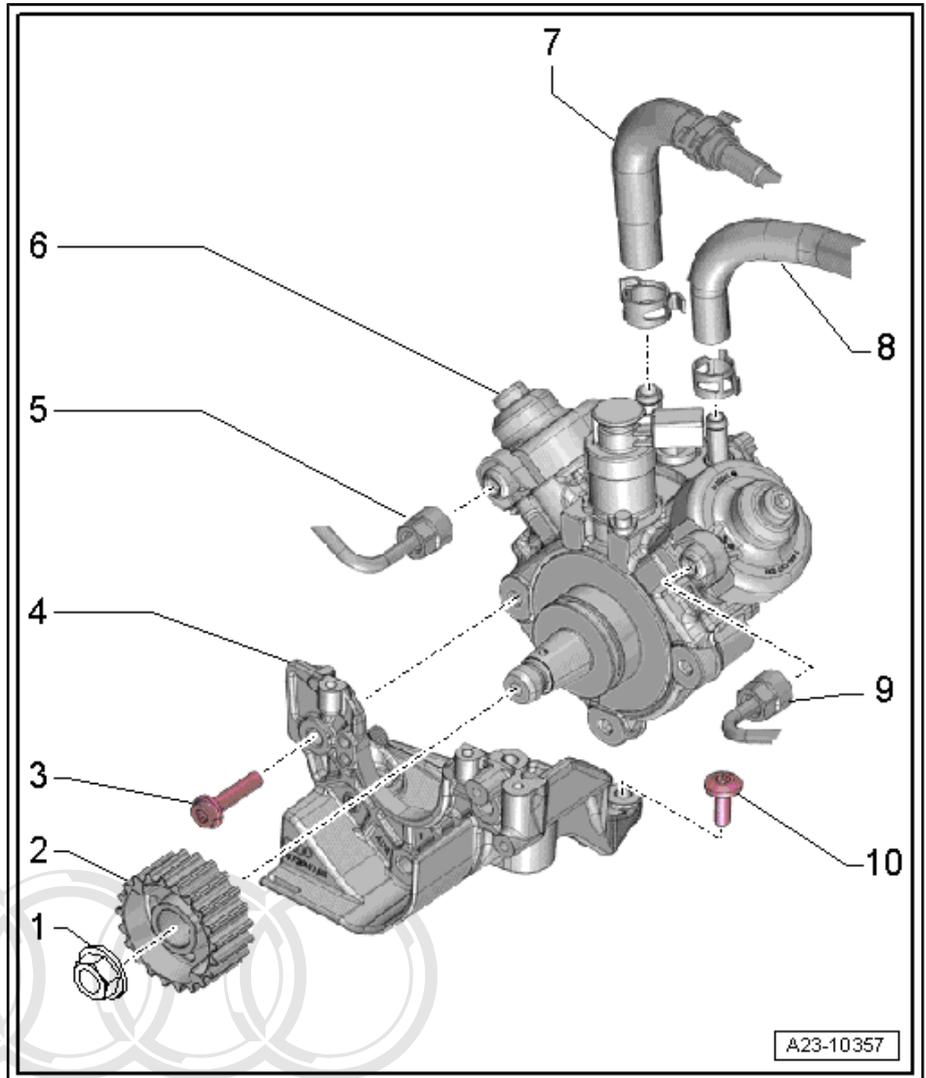
5 - High-pressure pipe

- Do not alter shape
- Check for damage before re-installing
- Always renew high-pressure pipe when renewing high-pressure pump
- Installing ⇒ [page 57](#)
- Lubricate threads of union nuts with fuel
- 25 Nm

6 - High-pressure pump

 **Caution**
Risk of malfunctions caused by dirt.
Observe
 ⇒ ***"1.3 Rules for cleanliness and instructions for working on fuel system", page 2.***

Running when dry causes irreparable damage to high-pressure pump. After installing the high-pressure pump, the pump must first be filled with fuel before the engine is started for the first time ⇒ [page 44](#).



- Removing and installing ⇒ [page 42](#)

7 - Fuel supply hose

8 - Fuel return hose

9 - High-pressure pipe

- Do not alter shape
- Check for damage before re-installing
- Always renew high-pressure pipe when renewing high-pressure pump
- Installing ⇒ [page 57](#)
- Lubricate threads of union nuts with fuel
- 25 Nm



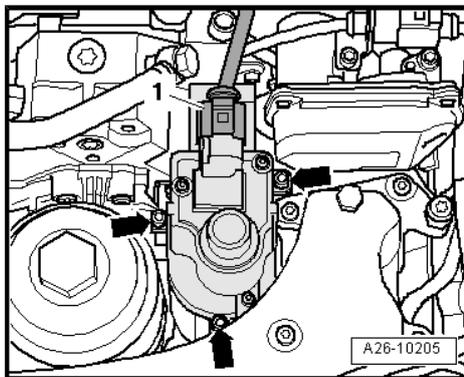
10 - Bolt

- 22 Nm

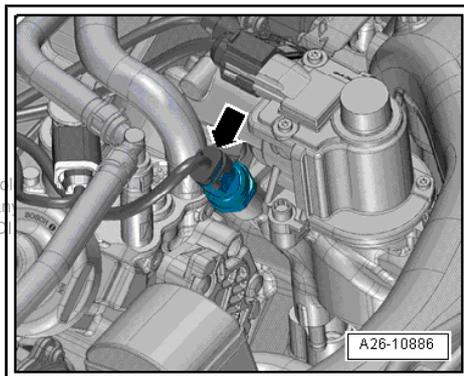
9.4 Removing and installing high-pressure pump

Removing

- Remove toothed belt for high-pressure pump => [page 34](#) .
- Remove exhaust gas recirculation control motor 2 -V339- => Rep. gr. 26 .

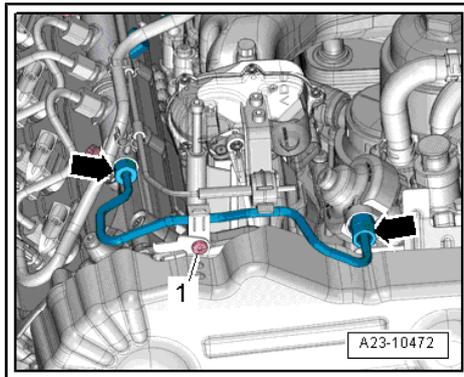


- Unplug electrical connector -arrow- and remove pressure sender 2 for exhaust gas recirculation -G692- .



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- Loosen union nuts -arrows- and detach high-pressure pipe.



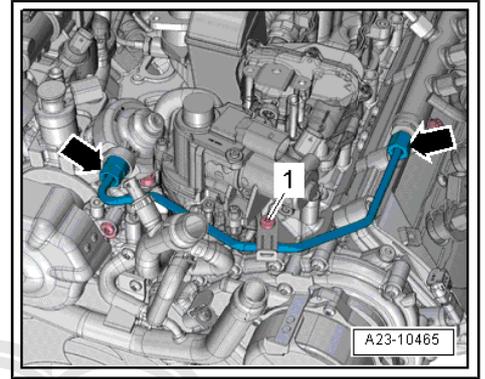
- Seal off open lines and connections with clean plugs.



Caution

Risk of malfunctions caused by dirt.

- ◆ **Observe**
⇒ "1.3 Rules for cleanliness and instructions for working on fuel system", page 2 .



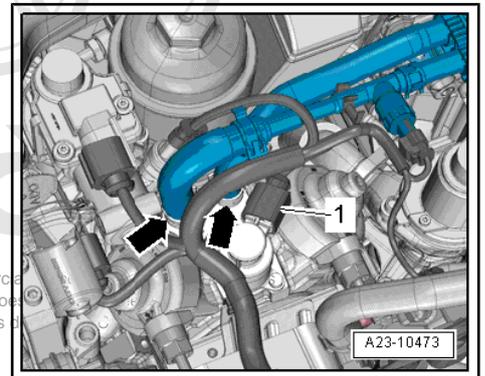
- Loosen union nuts -arrows-, remove bolt -1- and detach high-pressure pipe.
- Seal off open pipes/lines and connections with clean plugs from engine bung set -VAS 6122- .
- Unplug electrical connector -1- for fuel metering valve -N290- .
- Release hose clips -arrows- and detach fuel hoses.



Note

Lay a cloth under the connection to catch escaping fuel.

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- Unscrew bolts -arrows- and detach high-pressure pump.

Installing

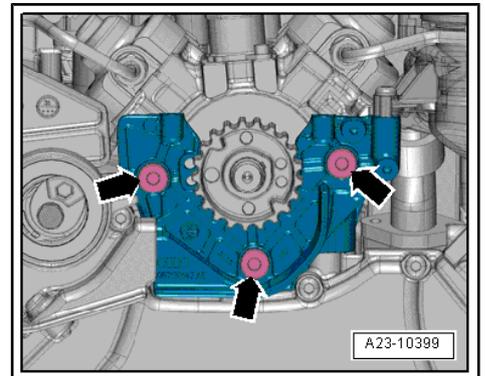
- Tightening torques
⇒ "9.3 High-pressure pump - exploded view", page 41

Installation is carried out in the reverse order; note the following:



Note

Always renew high-pressure pipes when renewing high-pressure pump.



- Install toothed belt for high-pressure pump ⇒ page 34 .
- Install exhaust gas recirculation control motor 2 -V339- and pressure sender 2 for exhaust gas recirculation -G692- ⇒ Rep. gr. 26 .
- Install high-pressure pipes ⇒ page 57 .



Caution

Running when dry causes irreparable damage to high-pressure pump.

- ◆ **After installing the high-pressure pump, the pump must first be filled with fuel before the engine is started for the first time** ⇒ page 44 .



9.5 Performing first fuel filling operation after installing high-pressure pump

Special tools and workshop equipment required

- ◆ ⇒ Vehicle diagnostic tester



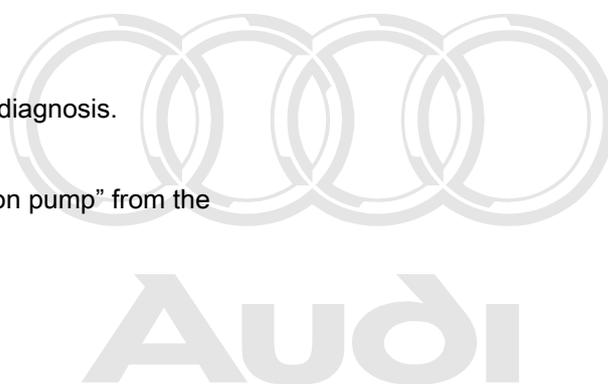
Caution

Running when dry causes irreparable damage to high-pressure pump.

- ◆ *After installing the high-pressure pump, the pump must first be filled with fuel before the engine is started for the first time.*

Procedure

- There must be sufficient fuel in the tank.
- Connect a ⇒ Vehicle diagnostic tester.
- Switch on ignition.
- Select “Engine electronics” in vehicle self-diagnosis.
- Then select “Basic setting”.
- Select “Checking fuel system pressurisation pump” from the list.
- Press “start” button.
- The fuel pumps start running.
- Let fuel pump run for three minutes.
- Start engine after filling fuel system.
- Run engine at moderate speed for several minutes and then switch off.
- Check fuel system for leaks.
- Erase entry in event memory using diagnostic tester.
- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.



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Note

If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the event memory. Then continue the road test.

- Interrogate event memory.

10 Injectors

Overview

- ◆ ⇒ [“10.1 Checking injectors”, page 45](#)
- ◆ ⇒ [“10.2 Adaption of injector delivery calibration values and injector voltage calibration values”, page 45](#)
- ◆ ⇒ [“10.3 Measuring return flow rate of injectors with engine running”, page 46](#)
- ◆ ⇒ [“10.4 Measuring return flow rate of injectors at starter cranking speed”, page 49](#)
- ◆ ⇒ [“10.5 Checking for injectors sticking open”, page 50](#)
- ◆ ⇒ [“10.6 Installing fuel return lines”, page 51](#)
- ◆ ⇒ [“10.7 Removing and installing injectors”, page 52](#)

10.1 Checking injectors

There are four different tests for checking the operation of the injectors.

- Checking adaption of “Injector delivery calibration values” and “Injector voltage calibration values” ⇒ [page 45](#)
- Checking return flow rate of injectors with engine running ⇒ [page 46](#)
- Checking return flow rate of injectors at starter cranking speed ⇒ [page 49](#)
- Checking for injectors sticking open ⇒ [page 50](#)

10.2 Adaption of injector delivery calibration values and injector voltage calibration values

Special tools and workshop equipment required

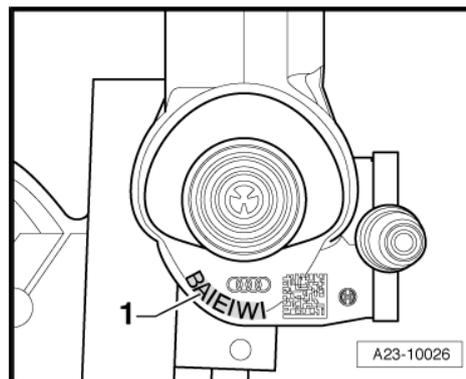
- ◆ ⇒ Vehicle diagnostic tester



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- ◆ The "Injector delivery calibration" and "Injector voltage calibration" serve to correct the injection rates for each cylinder of a common rail system individually across the entire operating range.
- ◆ The 7-digit adaption value -1- (example) is marked separately on each injector. They may consist of letters and/or numbers (ASCII code).
- When a new injector is installed, the adaption value for the new injector must be stored in the corresponding engine control unit.
- When one or both of the engine control units are renewed, the appropriate »Injector delivery calibration« values and the »Injector voltage calibration« values must be written into the new control unit(s).



Example:

- ◆ If the engine control unit -J623- (master) is renewed, the injector calibration values must be re-adapted for cylinders 1, 4, 6 and 7.
- ◆ If the engine control unit 2 -J624- (slave) is renewed, the injector calibration values must be re-adapted for cylinders 2, 3, 5 and 8.

The adaption procedure is described in the Guided Fault Finding. (The procedure is also described in Guided Functions.) Use ⇒ Vehicle diagnostic tester.

Additionally, check that the "injector delivery calibration values" and "injector voltage calibration values" are correctly entered for all the other injectors. Do NOT attempt to re-enter these calibration values if the correct values are already stored in the engine control unit.

10.3 Measuring return flow rate of injectors with engine running

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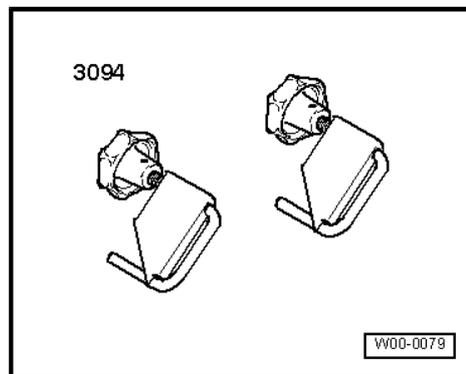


Note

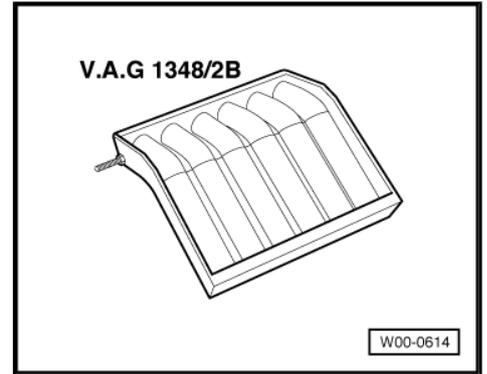
Checking return flow rate if engine does not start ⇒ [page 49](#)

Special tools and workshop equipment required

- ◆ Hose clamps for hoses up to 25 mm -3094-



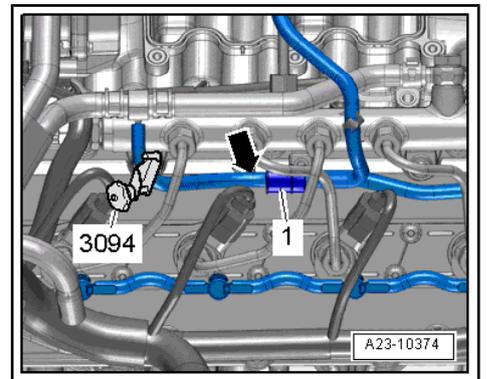
- ◆ Injector rate comparison meter -V.A.G 1348/2B- for measuring return flow rate of each injector



- ◆ Fuel-resistant measuring container
- ◆ 4 lengths of hose (made up in the workshop) to fit return line connections on injectors

Measuring return flow rate of all injectors

- Pull off engine cover panel ⇒ [page 22](#) .
- Clamp off fuel line downstream of restrictor -1- using hose clamp up to 25 mm -3094- .
- Disconnect fuel return line -arrow- downstream of restrictor.

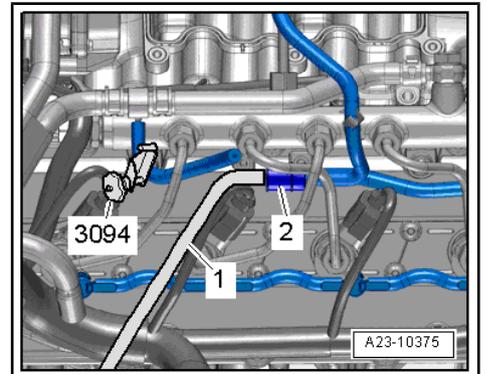


Caution

Risk of malfunctions caused by dirt.

- ◆ **Observe**
⇒ ***"1.3 Rules for cleanliness and instructions for working on fuel system", page 2 .***

- Connect test hose -1- to restrictor -2- and hold end of hose in measuring container.
- Start engine and run at idling speed for two minutes:
- ◆ Return flow rate after 2 minutes: 30 ... 55 ml
- If specification is attained, increase engine speed to 2000 ... 2500 rpm for approx. two minutes:
- Return flow rate after 2 minutes: less than 250 ml



If specification is exceeded, this indicates that one or more injectors are defective. You must then check the return flow rate from each injector individually.

Measuring return flow rate of individual injectors

Each injector normally has a relatively low return flow rate. If the return flow rate at one injector is relatively high compared to the other injectors, that injector is probably defective.

- Clean and dry all return line connections (e.g. with commercial cleaning solution etc.) before removing.

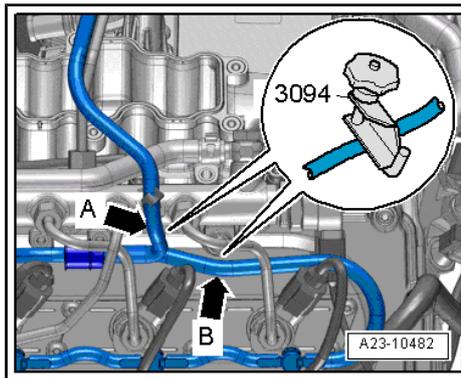


- Clamp off fuel return line on cylinder bank 1 (right-side) upstream of restrictor using hose clamp up to 25 mm -3094- -arrow B-



Note

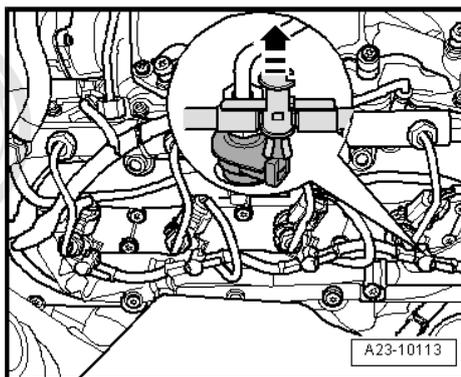
Disregard -arrow A-



Caution

Risk of malfunctions caused by dirt.

- ◆ **Observe**
⇒ ***"1.3 Rules for cleanliness and instructions for working on fuel system", page 2.***



- Disconnect return lines from injectors; to do so, press both tabs down and at the same time pull centre piece up to release connection -arrow-
- Connect hoses onto return line connections of all four injectors.
- Run hoses into meter -V.A.G 1348/2 B- .
- Start engine and run at idling speed for several minutes:

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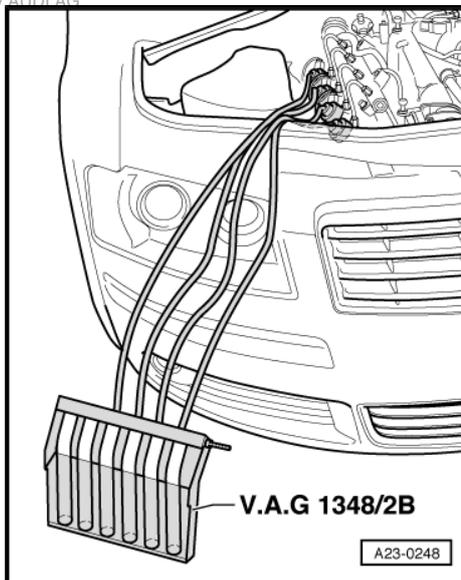


Caution

Risk of damage to injectors due to increased engine speed.

- ◆ **Do NOT press the accelerator during this test; the engine must only run at idling speed.**

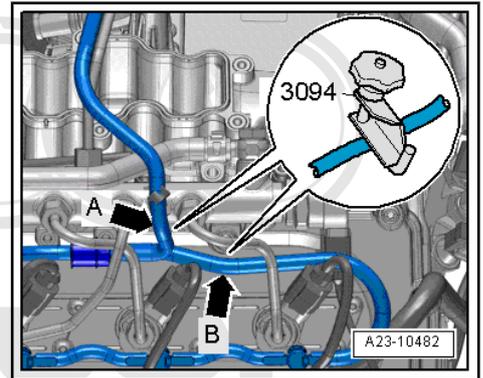
- When the engine is warm and running at idling speed, the return flow rates at each of the 4 return lines must not differ by more than a small amount.



- Clamp off fuel return line on cylinder bank 2 (left-side) upstream of restrictor using hose clamp up to 3094 -arrow A-.

 **Note**

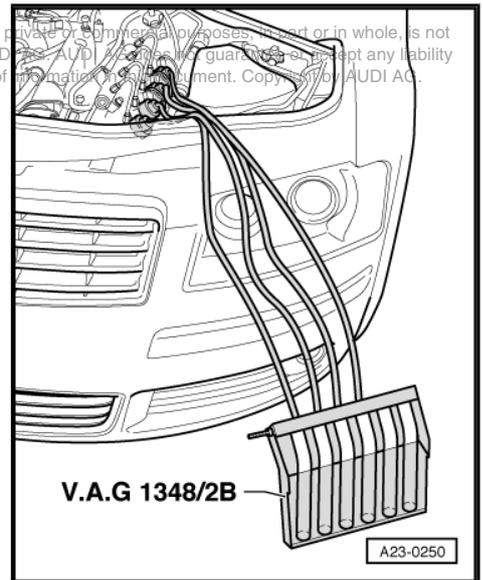
Disregard -arrow B-.



- Repeat measurement of return flow rate for cylinder bank 2.
- If one injector has a significantly higher return flow rate than the others, it must be renewed ⇒ [page 52](#) .

Assembling

- Install fuel return lines ⇒ [page 51](#) .
- Bleed fuel system and then check it for leaks ⇒ ["5 Bleeding fuel system", page 18](#) .



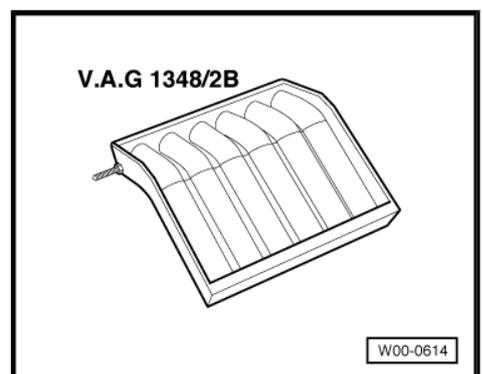
10.4 Measuring return flow rate of injectors at starter cranking speed

 **Note**

If it is not possible to start the engine, you can check the return flow rate of the injectors at starter cranking speed.

Special tools and workshop equipment required

- ◆ 2 injector rate comparison meters -V.A.G 1348/2B-



- ◆ 8 lengths of hose (made up in the workshop) to fit return line connections on injectors



Procedure

Each injector normally has a relatively low return flow rate. If the return flow rate at one injector is relatively high compared to the other injectors, that injector is probably defective.

- Pull off engine cover panel ⇒ [page 22](#) .
- Clean and dry all return line connections (e.g. with commercial cleaning solution etc.) before removing.



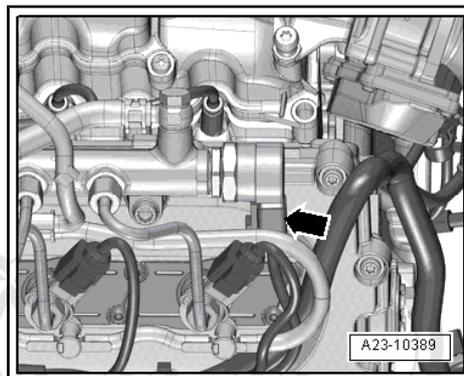
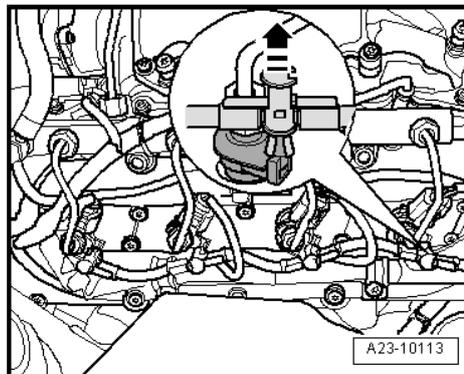
Caution

Risk of malfunctions caused by dirt.

◆ Observe

⇒ ***"1.3 Rules for cleanliness and instructions for working on fuel system", page 2*** .

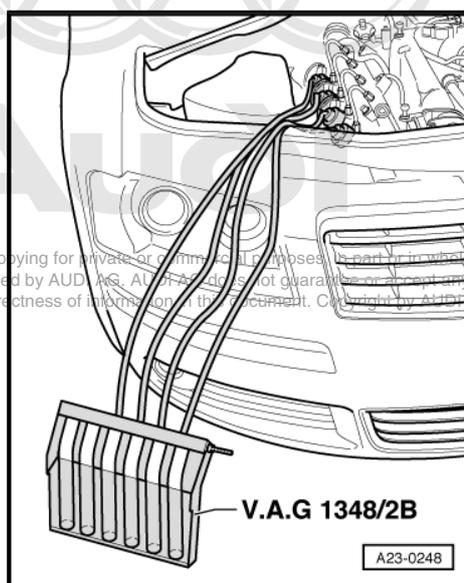
- Disconnect return lines from injectors; to do so, press both tabs down and at the same time pull centre piece up to release connection -arrow-.
- To prevent fuel from being injected when starter is operated, unplug electrical connector at fuel pressure regulating valve - N276- -arrow- in fuel rail (right-side).
- Connect hoses onto return line connections of all eight injectors.



- Run the eight hoses into the two meters -V.A.G 1348/2 B- (both sides).
- Operate starter three times (wait approx. 20 seconds each time after operating starter to prevent it from overheating).
- Specification of return flow rate: 0 ml
- If fuel comes out of one of the injectors, that injector must be renewed ⇒ [page 52](#) .

Assembling

- Plug in electrical connector at fuel pressure regulating valve - N276- .
- Install fuel return lines ⇒ [page 51](#) .
- Faults are stored in the engine control units because electrical connectors were unplugged: "Interrogate event memory" and erase event memory.
- Bleed fuel system and then check it for leaks ⇒ [page 18](#) .



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10.5 Checking for injectors sticking open

If one of the injectors is sticking open, this means that the injector needle is not closing fully and fuel escapes into the cylinder.

Special tools and workshop equipment required

- ◆ Screw plug -T40204-

Procedure

- “Interrogate event memory” and erase event memory ⇒ Vehicle diagnostic tester.
- Pull off engine cover panel ⇒ [page 22](#) .
- Clean and dry all return line connections (e.g. with commercial cleaning solution etc.) before removing.

Note

The following test is described for cylinder 1 as an example. The test must be repeated for all fuel rail connections until the defective injector is identified.



Caution

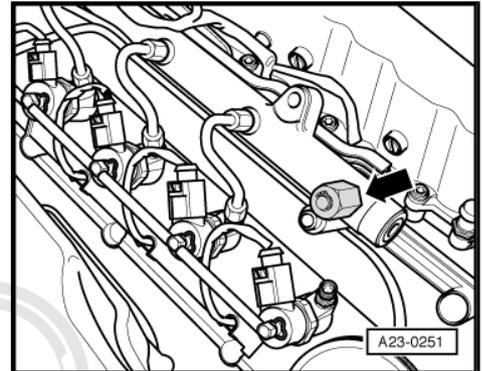
Risk of malfunctions caused by dirt.

- ◆ **Observe**
⇒ ***“1.3 Rules for cleanliness and instructions for working on fuel system”, page 2*** .

- Unscrew union nut for cylinder 1 on fuel rail; also loosen union nut on injector slightly.
- Seal open connection of high-pressure pipe.
- Seal open connection of fuel rail with plug -T40204- -arrow-.

Note

- ◆ The fault “positive control deviation” should no longer be indicated when the defective injector has been located.
- ◆ Other fault messages may possibly be stored in the memory. These result from previous steps and can be disregarded.
- The electrical connector of the relevant injector must remain connected.
- Perform road test.
- After road test “Interrogate event memory” ⇒ Vehicle diagnostic tester.
- If a fault relating to “Fuel pressure control - control limit not reached” or “Lambda probe” is still being indicated, repeat the above steps for all fuel rail connections until the fault is no longer indicated after the road test.



Assembling

- Install high-pressure pipes ⇒ [page 57](#)
- Bleed fuel system and then check it for leaks ⇒ [page 18](#) .

10.6 Installing fuel return lines

Procedure

- Renew O-rings on all return line connections.



Note

Lubricate O-rings lightly with assembly oil or engine oil before installing.

- Push return line connections carefully over new O-rings and onto injectors.
- The connection must engage audibly.
- Carefully press down release pin.
- Bleed fuel system and then check it for leaks
=> ["5 Bleeding fuel system", page 18](#) .

10.7 Removing and installing injectors

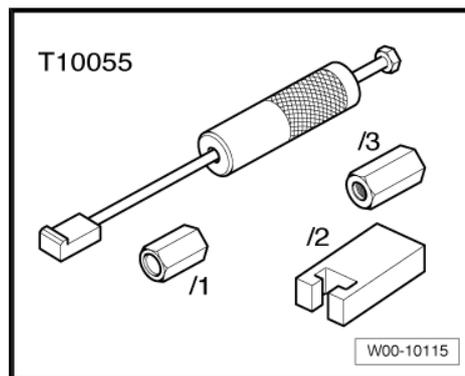


Note

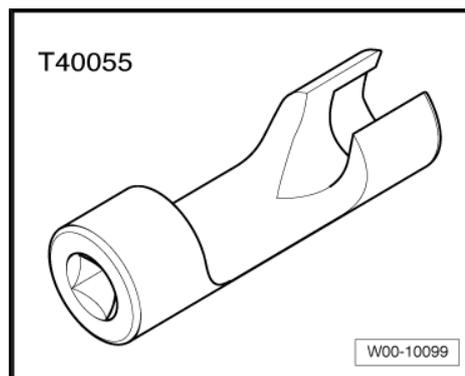
The removal and installation procedures are described for cylinder bank 2 (left-side).

Special tools and workshop equipment required

- ◆ Puller -T10055- with adapter -T10055/1- and -T10055/3-



- ◆ Socket -T40055-



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Removing



Note

All cable ties which are released or cut open when removing must be fitted in the same position when installing.

- Pull off engine cover panel => [page 22](#) .

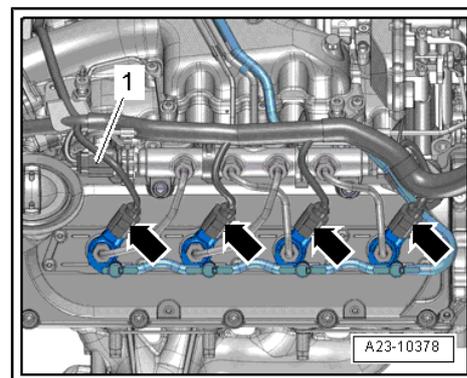
- Remove air cleaner (top section)
 ⇒ "7.3 Removing and installing air filter element", page 22 .

Caution

Risk of malfunctions caused by dirt.

◆ **Observe**
 ⇒ "1.3 Rules for cleanliness and instructions for working on fuel system", page 2 .

- Seal off open lines and connections with clean plugs.
- Unplug electrical connectors at injectors -arrows- and at fuel pressure sender -G247- -item 1-.
- Move clear electrical wiring harness at cylinder head cover and fuel rail.

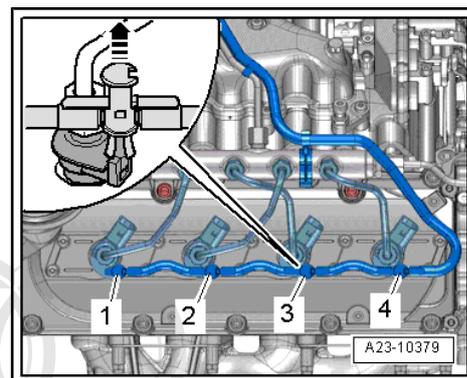


- Disconnect return lines -1 ... 4- from injectors; to do so, press both tabs down and at the same time pull centre piece up to release connection -arrow-.

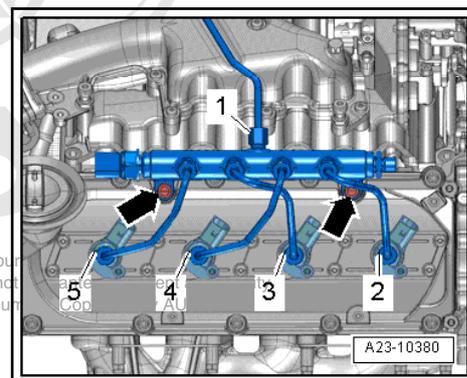
Caution

Used injectors must always be re-installed on the same cylinder.

◆ **Mark injectors for to ensure that they are re-installed at the correct cylinders.**



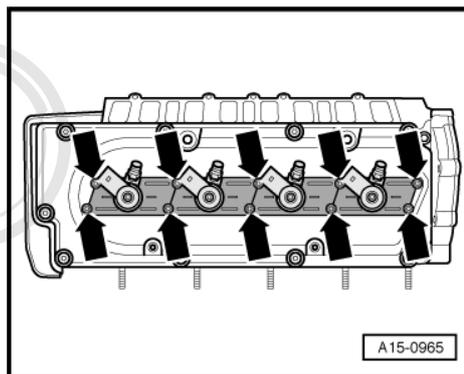
- Loosen union nuts for high-pressure pipes -2 ... 5- using socket -T40055- .



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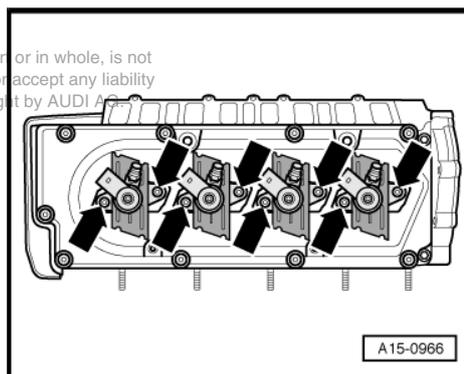


- Remove bolts -arrows-, pull cover plates for injectors upwards and turn them by 90°.

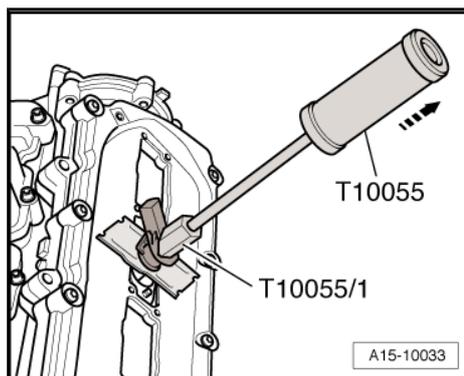


- Remove nuts -arrows- at clamping pieces for injectors.

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- Pull out injectors using puller -T10055- with adapter -T10055/1-.

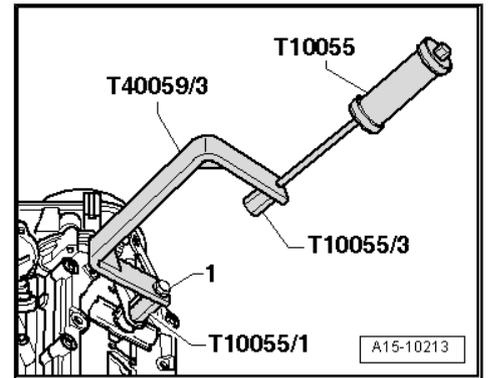


- To make it easier to pull off the injectors when they are difficult to reach, fit bracket -T40059/3- with bolt -1- between puller -T10055- and adapter -T10055/1- .
- Place removed injectors on a clean cloth.

Installing used injectors

When re-installing used injectors, the following components must be renewed:

- ◆ Copper seal
- ◆ O-ring for injector bore
- ◆ O-ring for fuel return line connection



Note

Take care not to damage bores in nozzle.

- To detach the old copper seal from the injector, clamp the copper seal carefully in a vice so that it is just held between the jaws without turning. Then carefully pull and twist the injector out of the copper seal by hand.
- Remove deposits beneath the copper seal with a scraper.
- Renew O-rings at all return line connections.

Note

Lubricate all O-rings with engine oil or assembly oil before installing.

Push the return line connection carefully over the new seal and onto the injector. The catch should engage audibly. Then press release pin down carefully.

Installing new injectors

When installing new injectors, the following components must be renewed:

- ◆ Clamping piece
- ◆ Copper seal
- ◆ O-ring for injector bore
- ◆ O-ring for fuel return line connection
- Lubricate all O-rings with engine oil or assembly oil before installing.

Continued (same procedure for used and new injectors):

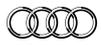
 **Caution**

Risk of damage to injector sealing surface.

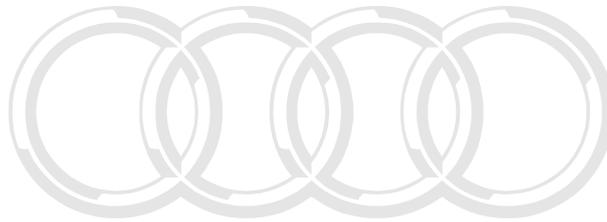
- ◆ ***To remove carbon deposits from the injector sealing surface, clean the injector bore in the cylinder head using the cleaning kit -VAS 6811- or a cloth soaked in engine oil.***

Remaining installation steps are carried out in reverse sequence; note the following:

- Tightening torque ⇒ [page 15](#)



- Install high-pressure pipes ⇒ [page 57](#) .
- “Injector delivery calibration values” and “Injector voltage calibration values” for new injectors ⇒ [page 45](#)



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11 Senders and sensors

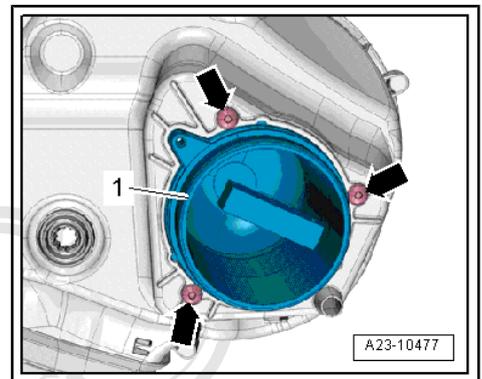
Overview

- ◆ ⇒ [“11.1 Removing and installing air mass meter G70 / G246”](#), page 57
- ◆ ⇒ [“11.2 Installing high-pressure pipes”](#), page 57
- ◆ ⇒ [“11.3 Checking fuel pressure regulating valve N276”](#), page 59
- ◆ ⇒ [“11.4 Removing and installing fuel pressure regulating valve N276”](#), page 60
- ◆ ⇒ [“11.5 Removing and installing fuel pressure sender G247”](#), page 62

11.1 Removing and installing air mass meter -G70- / -G246-

Removing

- Remove corresponding air cleaner housing ⇒ [page 24](#) .
- Remove air filter element ⇒ [page 22](#) .
- Unscrew bolts -arrows- and detach intake connecting pipe -1-.



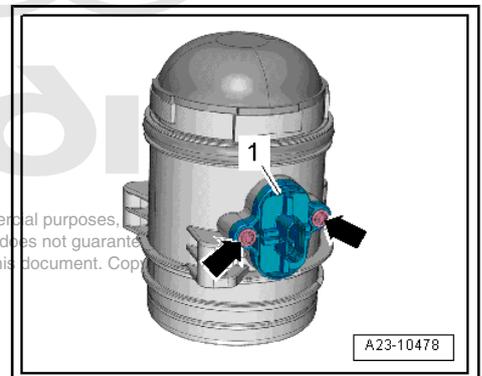
- Unscrew bolts -arrows- and detach air mass meter -1-.

Installing

Installation is carried out in the reverse order; note the following:

- Tightening torques
⇒ [“7.1 Air cleaner - exploded view”](#), page 20

To ensure that the air mass meter -G70- / air mass meter 2 -G246- functions properly, it is important to observe the following notes and instructions.



Note

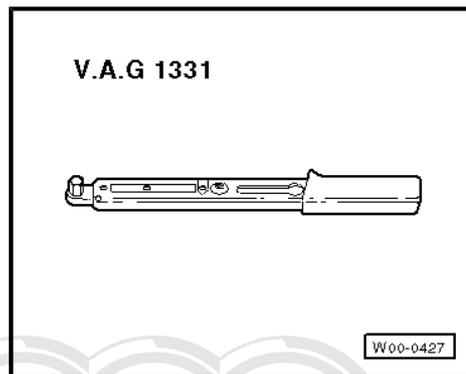
- ◆ *If the air filter element is very dirty or wet, dirt or water could reach the air mass meter and affect the air mass value. This would lead to loss of power, since a smaller injection quantity is calculated.*
- ◆ *Always renew seal for air mass meter if damaged (air leaks in intake system).*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue*
- Install air filter element ⇒ [page 22](#) .
- Install air cleaner housing ⇒ [page 24](#) .

11.2 Installing high-pressure pipes

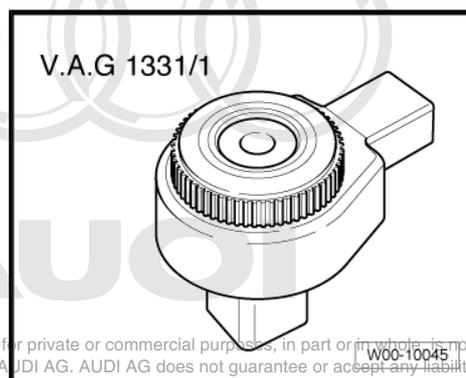
Special tools and workshop equipment required



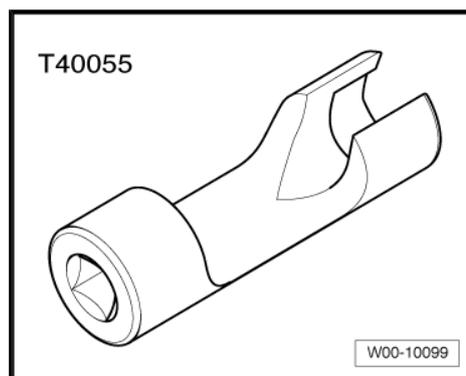
- ◆ Torque wrench -V.A.G 1331-



- ◆ Ratchet -V.A.G 1331/1-



- ◆ Socket -T40055-



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Procedure

- Tightening torques
⇒ ["4 Fuel rail, high-pressure pipes and injectors - exploded view", page 15](#)



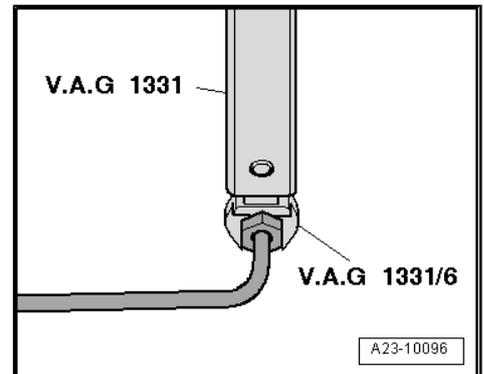
Note

- ◆ *Before re-installation, check taper seats for deformation, cracks, damage, scores and corrosion; renew high-pressure pipes if they are damaged or corroded.*
- ◆ *Check that bore in pipe is not distorted, restricted or damaged in any other way.*
- ◆ *When re-installing "old" high-pressure pipe, observe marking for installation position.*
- Use vacuum cleaner to remove dirt from taper seat at fuel rail.
- Clean fuel pipe and end of pipe using cleaning solution and dry with compressed air.

- Lubricate threads of union nuts with fuel.
- Hand-tighten union nuts on high-pressure pipes until they make contact (ensure that pipes are not under tension).

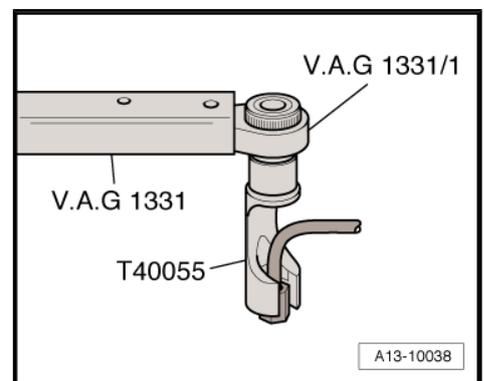
17 mm union nuts:

- To secure high-pressure pipes, use torque wrench -V.A.G 1331- with open end spanner insert, AF 17 -V.A.G 1331/6- .



17 mm union nuts at injectors:

- To tighten unions of injectors, use torque wrench -V.A.G 1331- with ratchet -V.A.G 1331/1- and socket -T40055- .
- Bleed fuel system and then check it for leaks => [page 18](#) .

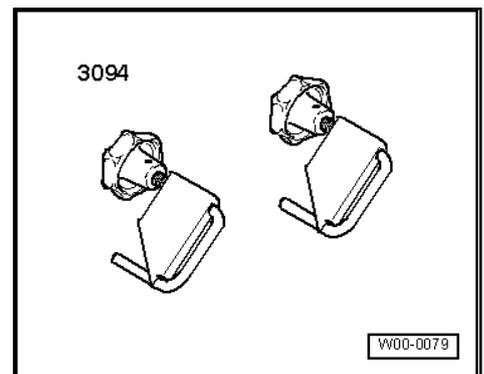


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11.3 Checking fuel pressure regulating valve -N276-

Special tools and workshop equipment required

- ◆ Hose clamps for hoses up to 25 mm -3094-



- ◆ Fuel-resistant measuring container



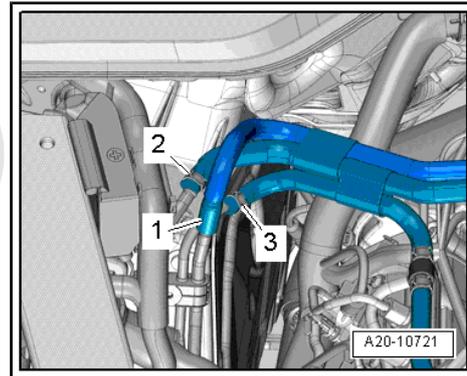
Procedure

- Pull off engine cover panel ⇒ [page 22](#) .

WARNING

Risk of malfunctions caused by dirt.

◆ **Observe**
⇒ ***"1.3 Rules for cleanliness and instructions for working on fuel system", page 2.***



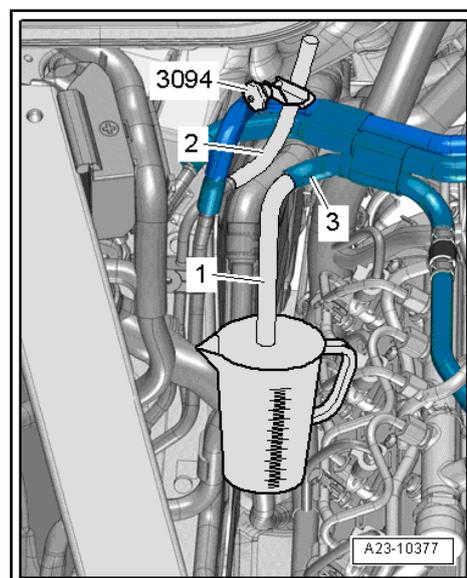
- Detach fuel return line -3-.

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Disregard -items 1, 2-.

- Clamp off return line connection with extension hose -2- and hose clamp up to 25 mm -3094- .
- To measure return flow rate, attach another extension hose -1- to fuel return hose -3- and hold end of extension hose in measuring container.
- Start the engine and run at idling speed.
 - Return flow rate during first 5 ... 10 seconds: 0 ml
 - Return flow rate after 2 minutes: 30 ... 55 ml

If specified values are not obtained, fuel pressure regulating valve -N276- is defective.



11.4 Removing and installing fuel pressure regulating valve -N276-

Special tools and workshop equipment required

- ◆ Torque wrench
- ◆ Open-end spanner insert, 30 mm
- ◆ Pliers (e.g. water pump pliers)

**Note**

- ◆ *The fuel pressure regulating valve -N276- maintains a constant pressure in the fuel rail and the injector pipes (high-pressure fuel circuit).*
- ◆ *It is not possible to start engine if fuel pressure regulating valve -N276- is defective.*
- ◆ *If the pressure in the high-pressure fuel circuit is too high, the regulating valve opens to allow some of the fuel to flow back from the fuel rail to the fuel tank via a return line.*
- ◆ *If the pressure in the high-pressure fuel circuit is too low, the valve closes and seals off the high-pressure section of the system from the low-pressure section.*
- ◆ *The fuel pressure regulating valve -N276- has a deformable sealing lip and can only be used once. Do not install it for test purposes.*
- ◆ *After renewing high-pressure pump or fuel pressure regulating valve -N276- , learnt values must be re-adapted; see "Guided Functions" in ⇒ Vehicle diagnostic tester*

Removing

- Pull off engine cover panel ⇒ [page 22](#) .
- Before removal, clean and dry area around thread for fuel pressure regulating valve using e.g. **commercial cleaning solution**.

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**Note**

- ◆ *Clean carefully; cleaning solution must not enter the electrical connector.*
- ◆ *Make sure no dirt gets into opening in fuel rail.*

**WARNING**

Risk of malfunctions caused by dirt.

- ◆ **Observe**
⇒ ***"1.3 Rules for cleanliness and instructions for working on fuel system", page 2*** .

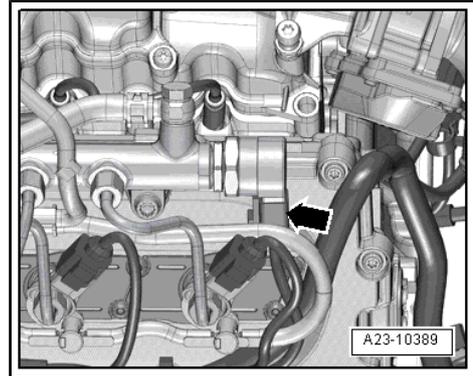
- Remove banjo bolt on fuel return lines.



- Unplug electrical connector -arrow- at fuel pressure regulating valve -N276- .
- Loosen union nut at regulating valve (counterhold at hexagon flats on housing). Then remove by hand.
- Remove dirt from thread and sealing surface of fuel rail using a vacuum cleaner. Do not use metal tools, etc.

**Note**

Seal off fuel rail immediately with a suitable plug to prevent dirt from entering.

**Installing**

Installation is carried out in the reverse order; note the following:

- Screw on union nut by hand.
- Align fuel pressure regulating valve -N276- so that connecting wire is free of tension after electrical connector is attached.
- Hold regulating valve in this position by holding hexagon flats on housing of regulating valve with pliers (water pump pliers or similar).
- Use suitable torque wrench with an open-end spanner insert (30 mm) to tighten union nut.
- Tightening torques
⇒ Fig. ““ Fuel pressure regulating valve -N276- - tightening torque””, page 17

**Note**

- ◆ *The fuel pressure regulating valve -N276- has a deformable sealing lip and no separate seal; it can therefore be used only once.*
- ◆ *Check that sealing surfaces (deformable sealing lip) and threads on new fuel pressure regulating valve -N276- are not damaged.*
- ◆ *Check sealing surface at opening in fuel rail.*
- ◆ *The beginning of the thread, the deformable sealing lip and the O-ring of the fuel pressure regulating valve -N276- must be coated with diesel fuel.*

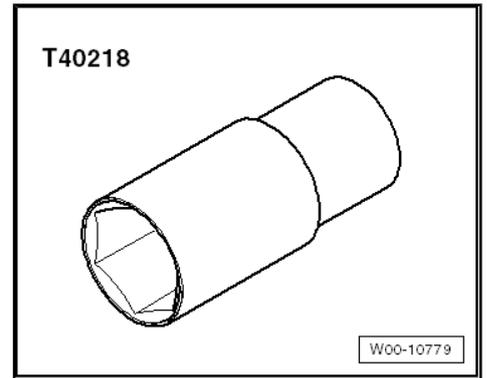
After renewing high-pressure pump and/or fuel pressure regulating valve -N276- , adaption must be performed; see “Guided Functions” in ⇒ Vehicle diagnostic tester.

- Bleed fuel system and then check it for leaks ⇒ page 18 .
- After road test “Interrogate event memory”.

11.5 Removing and installing fuel pressure sender -G247-

Special tools and workshop equipment required

- ◆ Socket, 27 mm -T40218-



- ◆ Torque wrench

 Note

- ◆ *The fuel pressure sender -G247- continuously measures the fuel pressure in the high-pressure system. It transmits a corresponding voltage signal to the engine control unit -J623- .*
- ◆ *Should the fuel pressure sender fail, the engine control unit will control the fuel pressure via a mapped open-loop backup function. Maximum engine speed in this mode is restricted.*
- ◆ *The fuel pressure sender -G247- has a deformable sealing lip.*

Removing

- Pull off engine cover panel ⇒ [page 22](#) .
- Before removal, clean and dry area around thread for fuel pressure sender using e.g. commercial cleaning solution.



Caution

Risk of malfunctions caused by dirt.

- ◆ **Observe**
⇒ ***"1.3 Rules for cleanliness and instructions for working on fuel system", page 2 .***

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 Note

Clean carefully; cleaning solution must not enter the electrical connector.



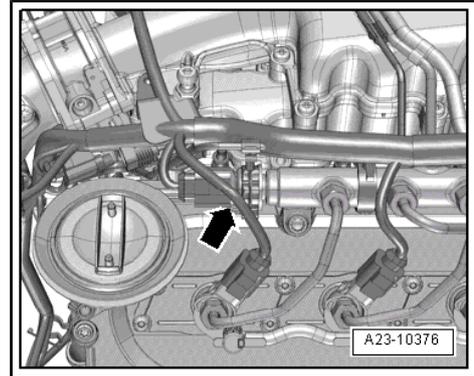
- Unplug electrical connector at fuel pressure sender -G247- -arrow-.
- Unscrew fuel pressure sender -G247- using socket, 27 mm - T40218- .



Note

An open-end spanner must not be used for loosening or tightening.

- Remove dirt from opening in fuel rail using a vacuum cleaner. Do not use metal tools, etc.
- Seal off open fuel rail connections with clean plugs.



Installing

Installation is carried out in the reverse order; note the following:



Note

- ◆ *Check that sealing surfaces (deformable sealing lip) and threads on fuel pressure sender -G247- are not damaged. If inspection of fuel pressure sender -G247- shows that it is OK, it can be used again.*
- ◆ *Check that the deformable sealing lip and the thread on the new fuel pressure sender -G247- are not damaged.*
- ◆ *Check sealing surface at opening in fuel rail.*
- ◆ *The beginning of the thread and the deformable sealing lip of the fuel pressure sender -G247- must be coated with diesel fuel.*

- Screw in fuel pressure sender -G247- by hand.
- Then tighten fuel pressure sender -G247- to specified torque.
- Tightening torques
⇒ [Fig. "Fuel pressure sender -G247- - tightening torque"](#), [page 17](#)

After installing fuel pressure sender -G247- , leave engine running at moderate speed for a few minutes when bleeding fuel system and then switch off again.



Note

The fuel system is "self-bleeding"; do NOT open the high-pressure connections.

- Interrogate event memory.
- Switch off ignition.
- Carefully check the entire fuel system for leaks.

Renew affected component if leakage still occurs after tightening to correct torque.

- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.

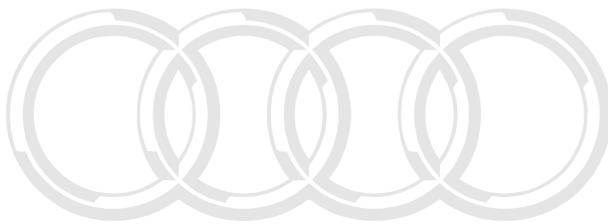


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**Note**

If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the event memory. Then continue the road test.

- After road test, interrogate event memory again.



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12 Lambda probes and exhaust gas temperature senders

Overview

- ◆ ⇒ [“12.1 Lambda probes, exhaust gas temperature senders and pressure senders - exploded view”, page 66](#)
- ◆ ⇒ [“12.2 Removing and installing Lambda probe G39”, page 67](#)
- ◆ ⇒ [“12.3 Removing and installing Lambda probe 2 G108”, page 68](#)
- ◆ ⇒ [“12.4 Removing and installing pressure differential sender G505 / G524”, page 69](#)

12.1 Lambda probes, exhaust gas temperature senders and pressure senders - exploded view

1 - Exhaust gas temperature sender 4 for cylinder bank 2 - G649-

- Removing and installing ⇒ Rep. gr. 26

2 - Exhaust gas temperature sender 3 for cylinder bank 2 - G497-

- Removing and installing ⇒ Rep. gr. 26

3 - Pressure pipe for pressure differential sender 2 - G524-

- Tightening torque ⇒ Rep. gr. 26

4 - Pressure differential sender 2 - G524-

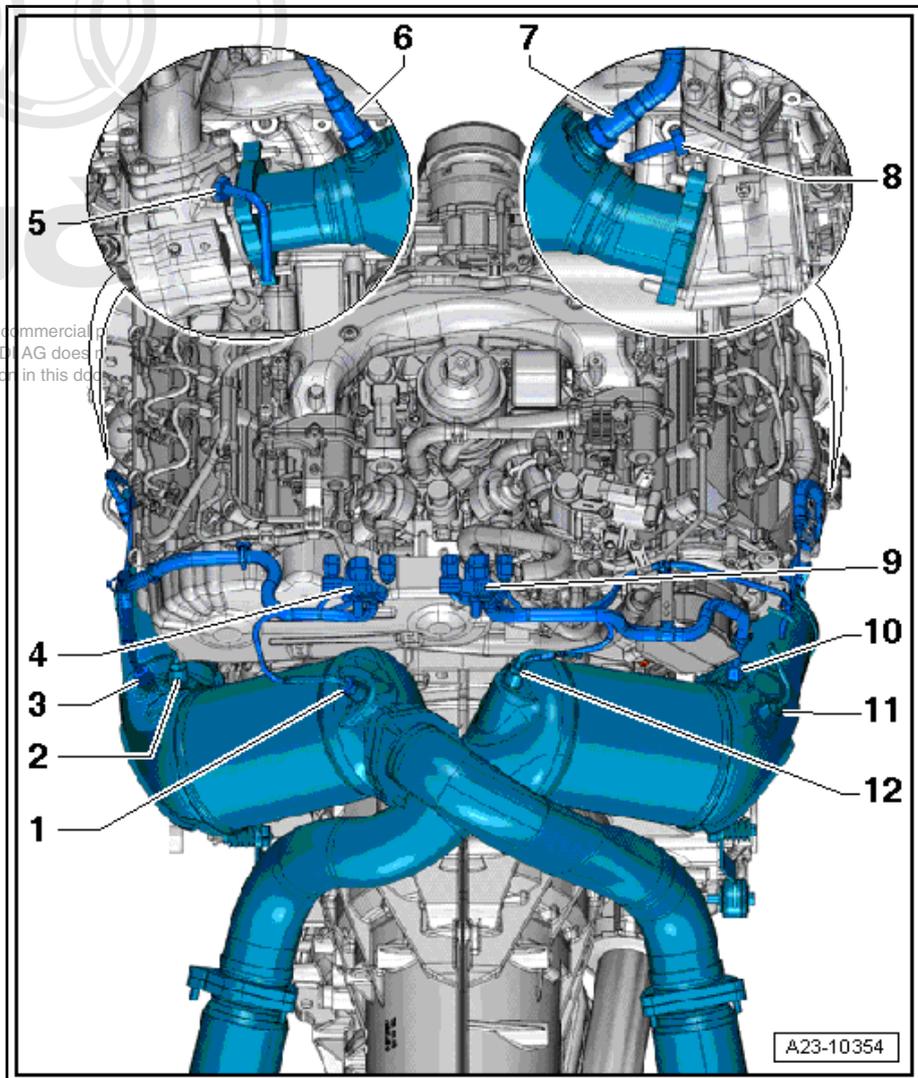
- Removing and installing ⇒ [page 69](#)
- 4.5 Nm

5 - Exhaust gas temperature sender 1 for cylinder bank 2 - G236-

- Removing and installing ⇒ Rep. gr. 26

6 - Lambda probe 2 - G108- with Lambda probe heater 2 - Z28-

- Removing and installing ⇒ [page 68](#)
- New Lambda probes are coated with an assembly paste
- If you are re-using Lambda probe, coat only thread with high-temperature paste; refer to ⇒ Electronic parts catalogue for high-temperature paste
- The assembly paste/high-temperature paste must not get into the slots on the Lambda probe body
- 55 Nm



7 - Lambda probe -G39- with Lambda probe heater -Z19-

- Removing and installing ⇒ [page 67](#)
- New Lambda probes are coated with an assembly paste
- If you are re-using Lambda probe, coat only thread with high-temperature paste; refer to ⇒ Electronic parts catalogue for high-temperature paste
- The assembly paste/high-temperature paste must not get into the slots on the Lambda probe body
- 55 Nm

8 - Exhaust gas temperature sender 1 -G235-

- Removing and installing ⇒ Rep. gr. 26

9 - Pressure differential sender -G505-

- Removing and installing ⇒ [page 69](#)
- 4.5 Nm

10 - Pressure pipe for pressure differential sender -G505-

- Tightening torque ⇒ Rep. gr. 26

11 - Exhaust gas temperature sender 3 -G495-

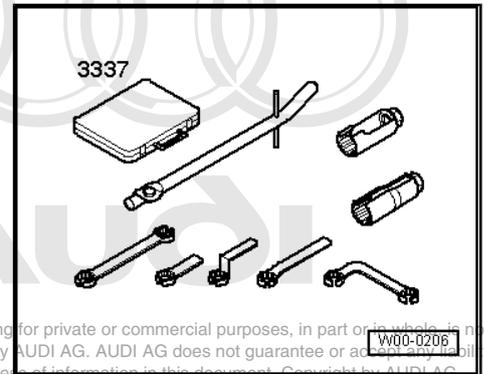
- Removing and installing ⇒ Rep. gr. 26

12 - Exhaust gas temperature sender 4 -G648-

- Removing and installing ⇒ Rep. gr. 26

12.2 Removing and installing Lambda probe -G39-**Special tools and workshop equipment required**

- ◆ Lambda probe open ring spanner set -3337-



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Removing**Note**

Fit insulating hose and all cable ties in their original positions when installing.

- Pull off engine cover panel ⇒ [page 22](#) .
- Remove air cleaner housing (right-side) ⇒ [page 24](#) .



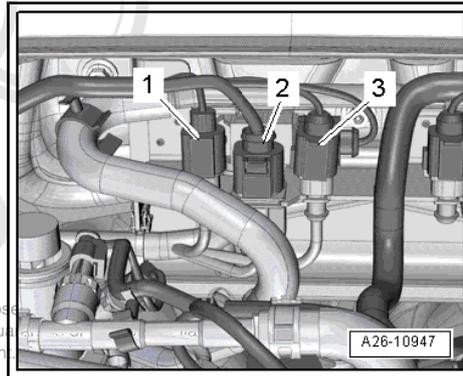
- Take electrical connector -2- out of bracket, unplug it and move electrical wiring clear.



Note

Disregard -items 1, 3-

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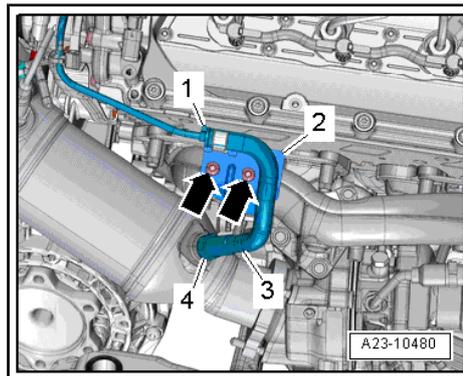


- Remove bolts -arrows-.
- Move clear electrical wiring harness and detach bracket -2-.
- Unscrew Lambda probe -G39- -item 4- using a tool from Lambda probe open ring spanner set -3337- .

Installing

Installation is carried out in the reverse order; note the following:

- Tightening torque
=> ["12.1 Lambda probes, exhaust gas temperature senders and pressure senders - exploded view", page 66](#)



Note

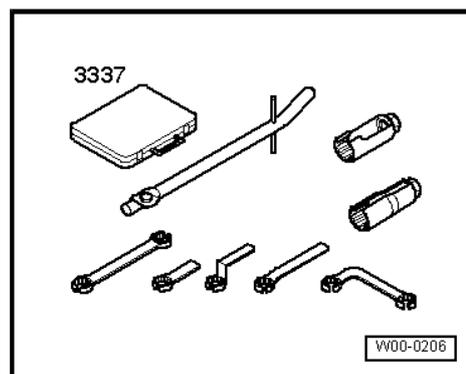
- ◆ *New Lambda probes are coated with an assembly paste.*
- ◆ *If you are re-using the Lambda probe, coat only the thread with high-temperature paste; refer to the => [Electronic parts catalogue for the high-temperature paste.](#)*
- ◆ *The assembly paste/high-temperature paste must not get into the slots on the Lambda probe body.*
- ◆ *When installing, the Lambda probe wiring must always be re-attached at the same locations to prevent it from coming into contact with the exhaust pipe.*

- Install heat shield for longitudinal member => Rep. gr. 66 .
- Install air cleaner housing (right-side) => [page 24](#) .

12.3 Removing and installing Lambda probe 2 -G108-

Special tools and workshop equipment required

- ◆ Lambda probe open ring spanner set -3337-



Removing



Note

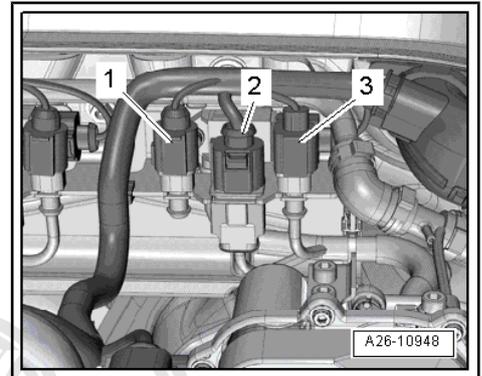
Fit all cable ties in the original positions when installing.

- Pull off engine cover panel ⇒ [page 22](#) .
- Take electrical connector -2- out of bracket, unplug it and move electrical wiring clear.



Note

Disregard -items 1, 3-.



- Unscrew Lambda probe 2 -G108- -arrow- using a tool from Lambda probe open ring spanner set -3337- .

Installing

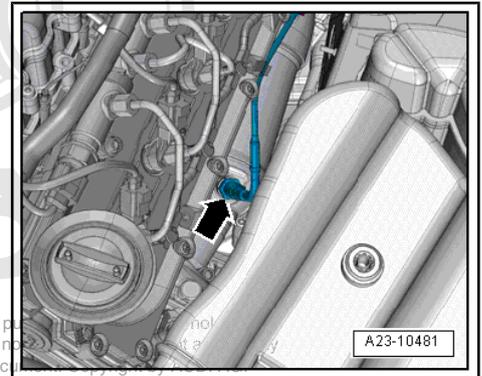
Installation is carried out in the reverse order; note the following:

- Tightening torque
 ⇒ ["12.1 Lambda probes, exhaust gas temperature senders and pressure senders - exploded view"](#), [page 66](#)



Note

- ◆ *New Lambda probes are coated with an assembly paste.*
- ◆ *If you are re-using the Lambda probe, coat only the thread with high-temperature paste; refer to the ⇒ [Electronic parts catalogue for the high-temperature paste](#).*
- ◆ *The assembly paste/high-temperature paste must not get into the slots on the Lambda probe body.*
- ◆ *When installing, the Lambda probe wiring must always be re-attached at the same locations to prevent it from coming into contact with the exhaust pipe.*



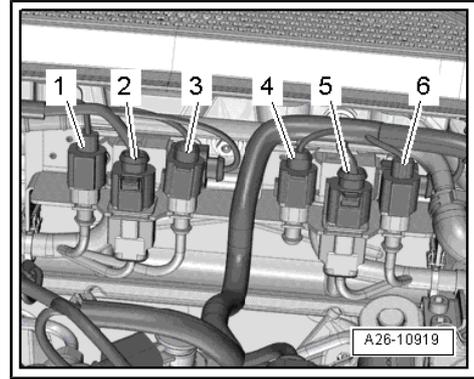
12.4 Removing and installing pressure differential sender -G505- / -G524-

Removing

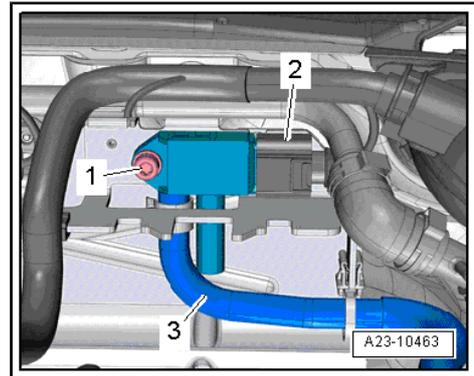
- Pull off engine cover panel ⇒ [page 22](#) .



- Detach electrical connectors -1 ... 6- from bracket and move clear to side.



- Unplug electrical connector -2-.
- Remove bolt -1-, move clear pressure differential sender and detach it from hose -3-.
- If hoses are to be disconnected from pressure differential sender, release hose clips (if fitted) and spray both hoses with silicone-free lubricant.
- Unplug electrical connector -2- and remove bolt -3-.
- To prevent hose connections from breaking off, carefully disconnect hoses and keep them straight when pulling them off.



Installing

Installation is carried out in the reverse order; note the following:

- Tightening torque
 ⇒ 12.1 Lambda probes, exhaust gas temperature senders and pressure senders - exploded view", page 66



Note

- ◆ Blow through hoses (towards particulate filter) with compressed air to remove dirt or ice (frozen condensation).
- ◆ Make sure that hoses are securely fitted and that there are no leaks.
- ◆ If pressure pipe has been detached from particulate filter, tighten pressure pipe connection.
- ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .

If pressure differential sender or particulate filter has been renewed, perform adaption in "Guided Fault Finding".

The procedure required after renewing a pressure differential sender is described in Guided Fault Finding or Guided Functions; use ⇒ Vehicle diagnostic tester.

13 Engine control units

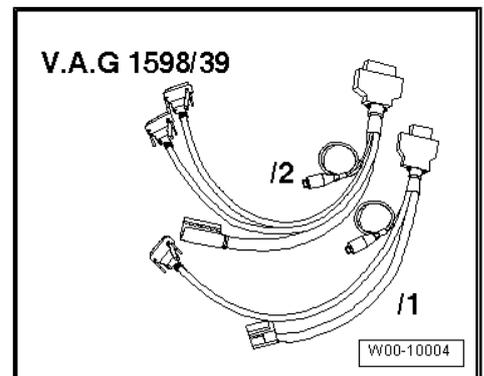
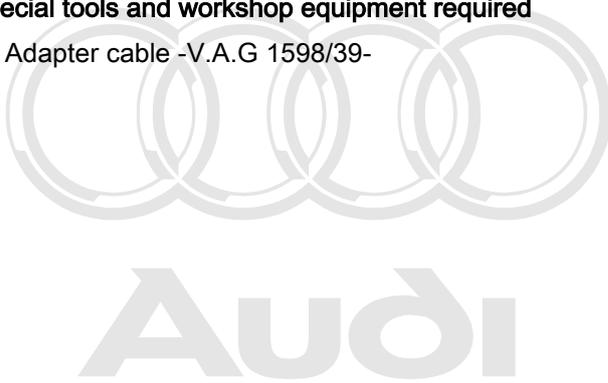
Overview

- ◆ ⇒ [“13.1 Wiring and component check with test box V.A.G 1598/42”, page 71](#)
- ◆ ⇒ [“13.2 Checking wiring and components with isolator box, 198-pin VAS 6606”, page 73](#)
- ◆ ⇒ [“13.3 Removing and installing engine control unit J623 \(master\) / J624 \(slave\)”, page 74](#)

13.1 Wiring and component check with test box -V.A.G 1598/42-

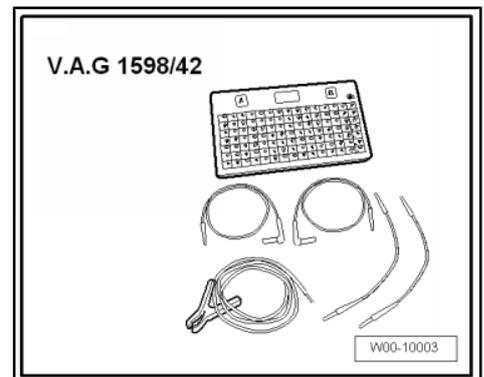
Special tools and workshop equipment required

- ◆ Adapter cable -V.A.G 1598/39-



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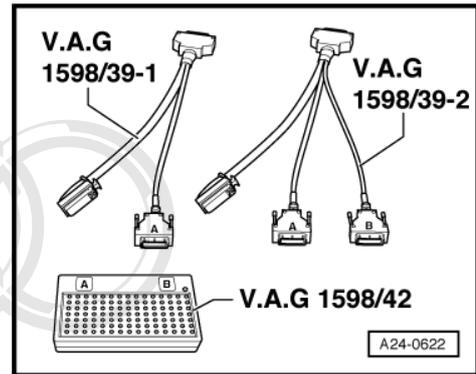
- ◆ **Test box V.A.G 1598/42** - edition in this document. Copyright by AUDI AG.



- ◆ ⇒ Vehicle diagnostic tester

**Note**

- ◆ The test box -V.A.G 1598/42- has 105 sockets. It can be connected to the engine control unit via 2 different adapter cables.
- ◆ Each engine control unit is connected to the vehicle's wiring harness via two connectors, one of which has 60 pins, the other has 94 pins.
- ◆ To carry out tests on the 60-pin wiring harness connector, the adapter cable -V.A.G 1598/39- is connected to connector -A- on the test box. For components connected to 60-pin wiring harness connector ⇒ *Current flow diagrams, Electrical fault finding and Fitting locations.*
- ◆ To carry out tests on the 94-pin wiring harness connector, the adapter cable -V.A.G 1598/39- must be connected to connectors -A- and -B- on the test box. For components connected to 94-pin wiring harness connector ⇒ *Current flow diagrams, Electrical fault finding and Fitting locations.*
- ◆ The test box -V.A.G 1598/42- is designed so it can be connected both to the wiring harness for the engine control unit and to the engine control unit itself at the same time. The advantage of this is that the electronic engine control system remains fully functional when the test box is connected (for example, for measuring signals when the engine is running).
- ◆ Always use auxiliary measuring set -V.A.G 1527B- to connect test equipment (e.g. voltage tester -V.A.G 1526D-, hand-held multimeter -V.A.G 1594C- etc.).



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The relevant engine control unit has to be removed before the connectors can be unplugged ⇒ [page 74](#) .

**Caution**

Electronic components are susceptible to damage.

- ◆ **Select the appropriate measuring range before connecting the test leads and observe test requirements.**

- Connect test box -V.A.G 1598/42- to wiring harness with adapter cable -V.A.G 1598/39- or adapter cable -V.A.G 1598/39- . Connect earth clip of test box to negative terminal of battery. The instructions for performing the individual tests indicate whether or not the engine control unit itself also needs to be connected to the test box.
- Carry out test as described in appropriate repair procedures.
- Interrogate event memory and erase if necessary. Use ⇒ Vehicle diagnostic tester.

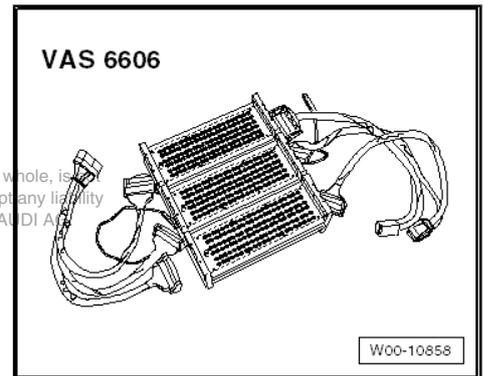
**Note**

After completing the "Guided Functions" routine, the ⇒ Vehicle diagnostic tester will attempt to erase the event memories of all control units. If this is not successful, the remaining faults registered in the memories must be rectified before all event memories can be erased.

13.2 Checking wiring and components with isolator box, 198-pin -VAS 6606-

Special tools and workshop equipment required

- ◆ Isolator box, 198-pin -VAS 6606/1-1-
- ◆ Isolator box, 198-pin -VAS 6606/1-2-
- ◆ Isolator box, 198-pin -VAS 6606/1-3-
- ◆ Sheets -VAS 6606/1-1-
- ◆ Sheets -VAS 6606/2-1-
- ◆ Sheets -VAS 6606/3-1-
- ◆ Set of cables -VAS 6606/7-1- and -VAS 6606/7-2-



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Note

- ◆ *Always make sure that the cables are properly connected.*
 - ◆ *Do not use damaged or worn tools and accessories.*
 - ◆ *Observe operating instructions.*
- Connect both cable sets -VAS 6606/7-1- and -VAS 6606/7-2- to the three isolator boxes -VAS 6606- .
 - Use the following sheets:
 - ◆ -VAS 6606/1-1- for isolator box, 198-pin -VAS 6606/1-1-
 - ◆ -VAS 6606/2-1- for isolator box, 198-pin -VAS 6606/1-2-
 - ◆ -VAS 6606/3-1- for isolator box, 198-pin -VAS 6606/1-3-

Note

Make sure that all plug-in bridges are inserted completely in all isolator boxes.

- Connect earth strap to an isolator box and to an earth point on the vehicle.
- Remove engine control unit ⇒ [page 74](#) .
- Connect engine control unit to cable set -VAS 6606/7-1- .
- Connect vehicle wiring harness to cable set -VAS 6606/7-2- .

The connection on the engine control unit consists of a large and a small connector.

The large connector has 105 pins and is assigned to the sheets for the isolator box marked "A 1 to A 105".



The small connector has 91 pins and is assigned to the sheets for the isolator box marked "B 1 to B 91".

When a push-in bridge is pulled out, the corresponding wiring connection is disconnected.

**Note**

- ◆ The "In" contact -1- (red socket) leads to the engine control unit.
- ◆ The "Out" contact -2- (blue socket) leads to the wiring harness.

– Carry out test as described in appropriate repair procedures.

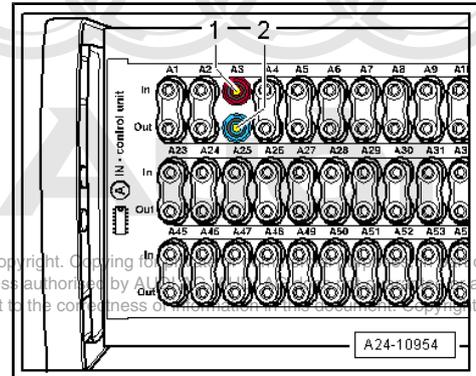
Installing engine control unit

Installation is performed in the reverse sequence.

- Interrogate event memory and erase if necessary. Use ⇒ Vehicle diagnostic tester.

**Note**

After completion of the Guided Fault Finding routine, the tester will attempt to erase the event memories of all control units. If this is not successful, the remaining faults registered in the memories must be rectified until all fault entries can be erased.



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13.3 Removing and installing engine control unit -J623- (master) / -J624- (slave)

- ◆ Electronic engine control for the V8 (common rail) is handled by two engine control units.
- ◆ The two engine control units communicate via a separate CAN bus.
- ◆ Engine control unit -J623- (master control unit) informs engine control unit 2 -J624- (slave control unit) which functions it has to perform.

Removing

- If an engine control unit is to be renewed, select "Replace engine control unit" under "Function/component selection" in "Guided Functions" mode.
- Before removing the relevant engine control unit, the adaption values of the injectors must be read out ⇒ [page 45](#) and stored in the ⇒ Vehicle diagnostic tester.

**Note**

If the adaption values of the injectors cannot be read out of the old (defective) engine control unit, the adaption values must be entered into the new engine control unit manually and the adaption procedure must be performed accordingly.

- Switch off ignition and remove ignition key.
- Remove wiper arms ⇒ Electrical system; Rep. gr. 92 .

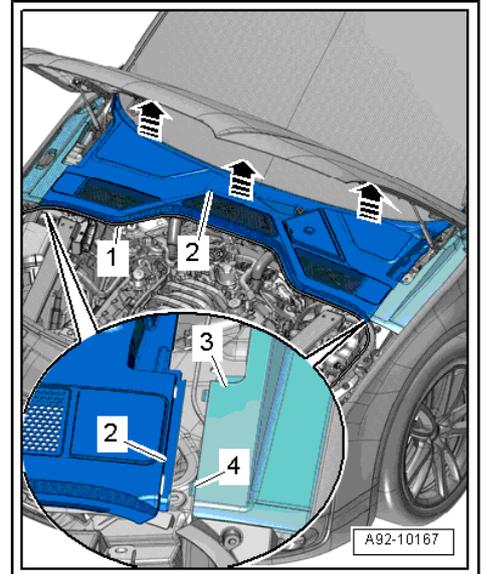


Caution

Risk of damage to plenum chamber cover.

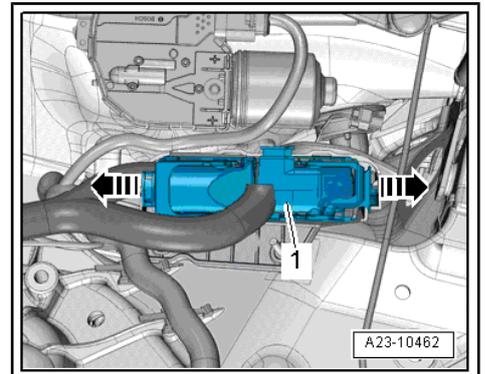
- ◆ *Apply a small amount of soap solution to transition between windscreen and plenum chamber cover.*

- Detach seal -1- from plenum chamber cover.
- Starting at edge of windscreen, carefully pull plenum chamber cover -2- vertically upwards off retainer at windscreen -arrows-.
- Disengage plenum chamber cover at outer plenum chamber covers -3-; lift plenum chamber cover at centre and disengage from guides -4- at side.



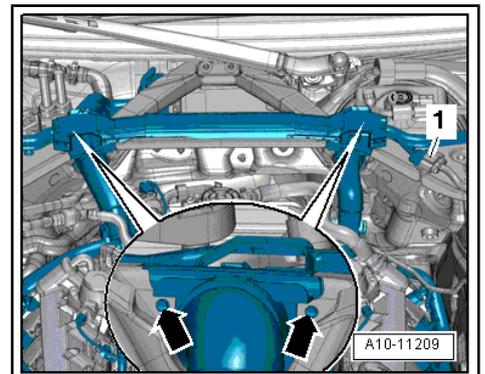
Engine control unit 2 -J624- :

- Release catches -arrows-, detach engine control unit 2 -J624- and move clear electrical wiring harness.



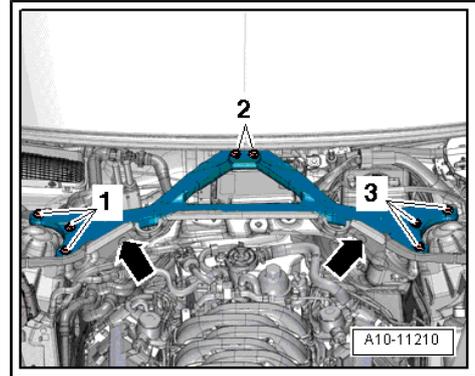
Engine control unit -J623- :

- Move clear wiring harness at plenum chamber cover on bulkhead on both sides (release catches -arrows-).
- Detach electrical connector -1- from bracket and unplug.
- Use removal lever -80 - 200- to move electrical wiring harness at body brace clear.





- Remove bolts -1, 2, 3- and -arrows- and detach body brace.



- Release clips -arrows- and detach engine control unit -J623- -item 2-.

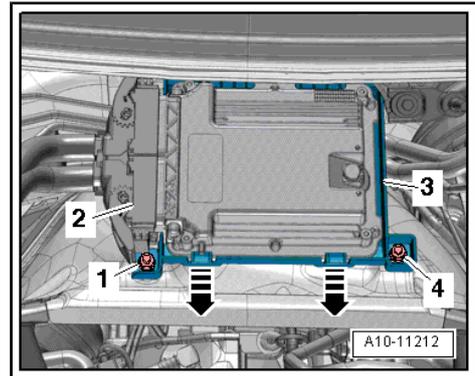


Note

Disregard -items 1, 3, 4-.

- Release connectors on engine control unit -J623- and unplug connectors.

- Take out relevant old engine control unit and connect new engine control unit.



Installing

Installation is carried out in the reverse order; note the following:

- Install body brace ⇒ Rep. gr. 40 .
- Carefully clip cowl panel trim into retainer at windscreen.
- Install wiper arms.
- After renewing an engine control unit, perform adaption of injector delivery calibration values and injector voltage calibration values ⇒ [page 45](#) .

After renewing high-pressure pump or fuel pressure regulating valve -N276- , learnt values must be re-adapted.



Note

The injector delivery calibration and injector voltage calibration influence the engine power and exhaust emissions.

The procedure required after connecting the new engine control unit is described in the Guided Fault Finding or Guided Functions; use a ⇒ Vehicle diagnostic tester.

28 – Glow plug system

1 Glow plug system

Overview

- ◆ ⇒ [“1.1 Glow plugs, Hall sender, engine speed sender - exploded view”](#), page 77
- ◆ ⇒ [“1.2 Checking glow plug system”](#), page 78
- ◆ ⇒ [“1.3 Removing and installing glow plugs”](#), page 78
- ◆ ⇒ [“1.4 Removing and installing engine speed sender G28”](#), page 79
- ◆ ⇒ [“1.5 Removing and installing Hall sender G40”](#), page 79

1.1 Glow plugs, Hall sender, engine speed sender - exploded view

1 - Sender wheel

- For engine speed sender -G28-
- Removing and installing ⇒ Rep. gr. 13

2 - Glow plug

Cylinder bank 1 (right-side):

- Glow plug 1 -Q10- , glow plug 2 -Q11- , glow plug 3 -Q12- , glow plug 4 -Q13-

Cylinder bank 2 (left-side):

- Glow plug 5 -Q14- , glow plug 6 -Q15- , glow plug 7 -Q16- , glow plug 8 -Q17-
- Removing and installing ⇒ [page 78](#)
- 17 Nm

3 - Electrical connector

4 - Bolt

- 9 Nm

5 - Hall sender -G40-

- Removing and installing ⇒ [page 79](#)

6 - O-ring

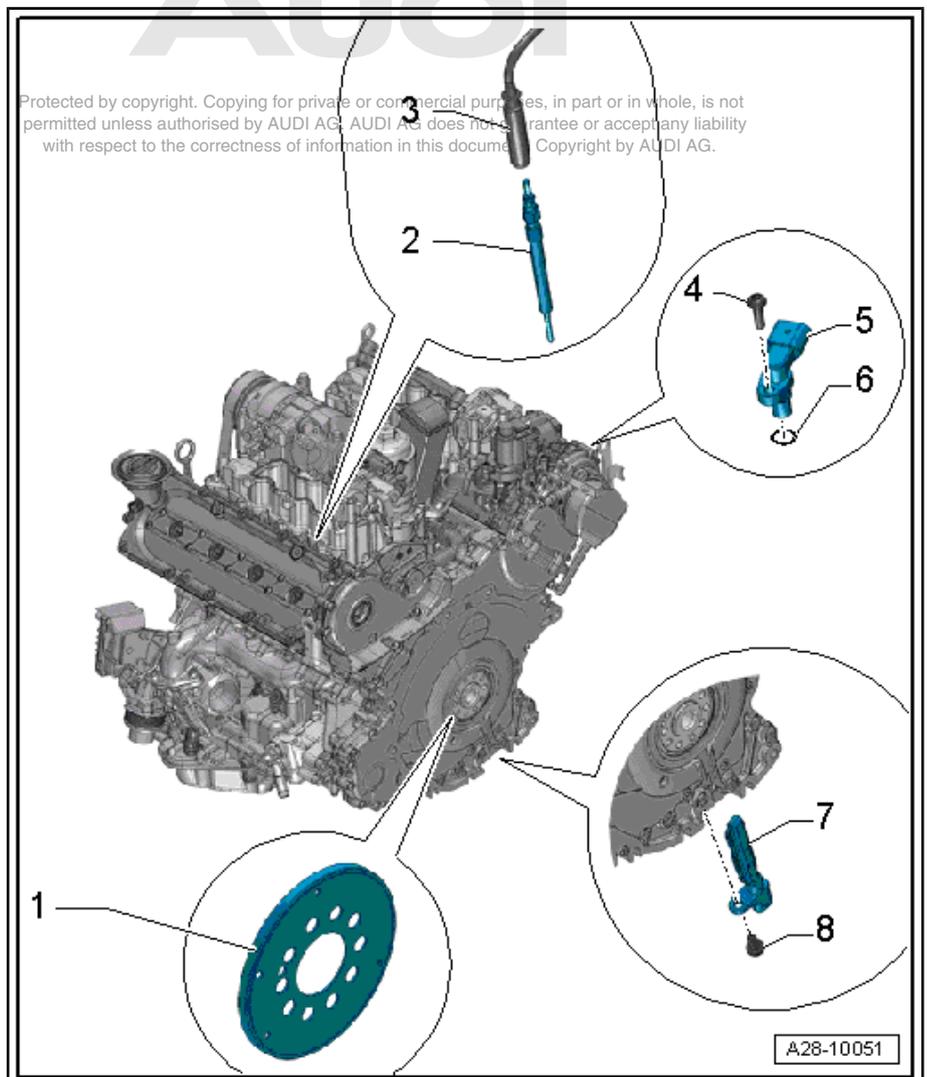
- Renew

7 - Engine speed sender -G28-

- Removing and installing ⇒ [page 79](#)

8 - Bolt

- 9 Nm





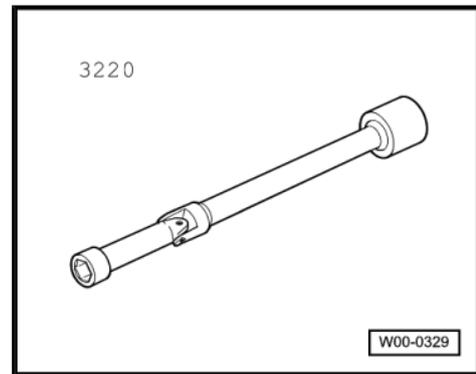
1.2 Checking glow plug system

- ◆ The glow plug system is activated via the automatic glow period control unit -J179- and the glow period control unit 2 -J703-. The control units are capable of self-diagnosis.
- ◆ Automatic glow period control units are located in relay and fuse holder (in electronics box in plenum chamber, left-side) ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- ◆ A fault is stored in the event memory of the engine control unit -J623- / -J624- if a fault occurs in the glow plug system.
- ◆ The procedure for checking the glow plug system is described in the “Guided Fault Finding”.
- ◆ For faster starting, the vehicle is equipped with electronically controlled glow plugs and a separate glow period control unit.
- ◆ Each glow plug is activated and diagnosed separately.

1.3 Removing and installing glow plugs

Special tools and workshop equipment required

- ◆ U/J extension and socket, 10 mm -3220-



Removing

- Switch off ignition.
- Pull off engine cover panel ⇒ [page 22](#).
- Unplug electrical connectors on glow plugs.
- Clean glow plug opening; make sure no dirt gets into cylinders:
 - ◆ Use a vacuum cleaner to remove coarse dirt.
 - ◆ Spray with brake cleaner and wait for it to take effect, then blow out with compressed air - wear safety goggles.
 - ◆ Clean glow plug opening with an oily cloth.
- Loosen glow plugs using U/J extension and socket, 10 mm -3220-.

Installing

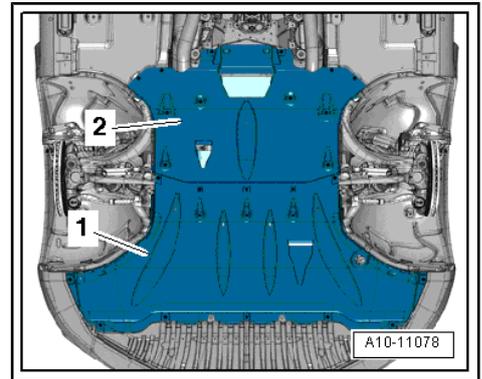
Installation is carried out in the reverse order; note the following:

- Tightening torque
 - ⇒ [“1.1 Glow plugs, Hall sender, engine speed sender - exploded view”, page 77](#)
- Ensure that electrical connectors are securely seated.

1.4 Removing and installing engine speed sender -G28-

Removing

- Remove rear noise insulation panel -2- ⇒ Rep. gr. 66 .

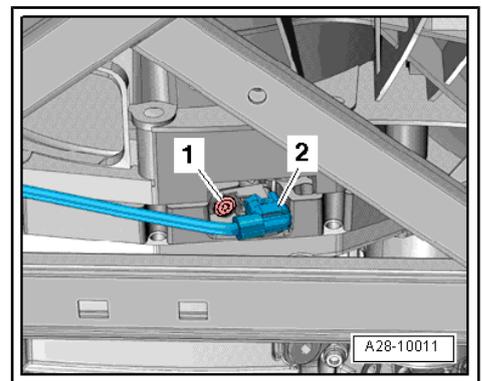


- Unplug electrical connector -2-.
- Unscrew bolt -1- and detach engine speed sender -G28- .

Installing

Installation is carried out in the reverse order; note the following:

- Tightening torque
⇒ ["1.1 Glow plugs, Hall sender, engine speed sender - exploded view", page 77](#)
- Install noise insulation ⇒ Rep. gr. 66 .



1.5 Removing and installing Hall sender - G40-

Removing

- Pull off engine cover panel ⇒ [page 22](#) .
- Unplug electrical connector -1-.
- Unscrew bolt -1- and detach Hall sender -G40- .

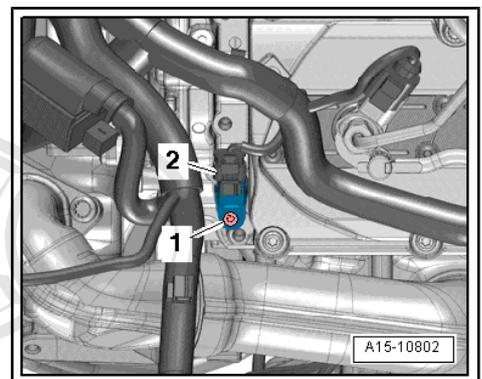
Installing

Installation is carried out in the reverse order; note the following:



Fit new O-ring.

- Tightening torque
⇒ ["1.1 Glow plugs, Hall sender, engine speed sender - exploded view", page 77](#)



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