Workshop Manual

Audi A8 2010 ➢

TDI injection and glow plug system (6-cyl. 3.0 ltr. 4-valve common rail)									
Engine ID	CDT A	CDT B	CLAB	CMH A	CPN A				

Edition 12.2012

List of Workshop Manual Repair GroupsList of Workshop Manual Repair GroupsList of Workshop Manual Repair Groups

Repair Group

23 - Mixture preparation - injection

28 - Glow plug system

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.

Contents

23 – Mixture preparation - injection

1 Safety precautions and rules for cleanliness

(ARL003087; Edition 12.2012)

1.1 Safety precautions when working on the SCR system

The abbreviation SCR stands for Selective Catalytic Reduction.

When working on the reducing agent system note the following warnings:

WARNING

Reducing agent can cause skin irritation.

- *Avoid contact with the skin and eyes. Wear protective gloves.*
- *If your skin has come into contact with reducing agent, rinse it off with soap and water.*
- *If reducing agent gets into your eyes, rinse them out with water for several minutes.*
- *Do not breathe in or swallow reducing agent.*
- *If you have swallowed reducing agent, rinse your mouth, drink lots of water and consult a paramedic or doctor immediately.*

1.2 Adapting learnt value after draining reducing agent or renewing components

The learnt value in the engine control unit must be re-adapted using the ⇒ Vehicle diagnostic tester if reducing agent has been drained or any of the following components have been renewed:

- Active tank
- Pump for reducing agent
- Injector for reducing agent
- Reducing agent line
- Engine control unit

– Perform adaption using ⇒ Vehicle diagnostic tester at “01 - Adapt reduction agent tank learned values”.

1.3 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.

- *If the battery is not disconnected, the fuse for the fuel pump control unit -J538- must be removed as a precautionary measure before opening the fuel system because the fuel pump will otherwise be activated by the contact switch on the driver's door.*
- *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 .

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.*
- *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*
  ⇒ "2.3 Filling and bleeding fuel system", page 18

- 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. Check that the fuel return hoses are seated securely and sealed properly by pulling them by hand from above.

- 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 vehicles with start/stop system

When performing repairs on vehicles with start/stop system, note the following:

> **WARNING**
>
> *Risk of injury due to automatic engine start on vehicles with start/stop system.*
>
> - *On vehicles with activated start/stop system (this is indicated by a message in the instrument cluster display), the engine may start automatically on demand.*
> - *Therefore it is important to ensure that the start/stop system is deactivated when performing repairs (switch off ignition, if required switch on ignition again).*

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

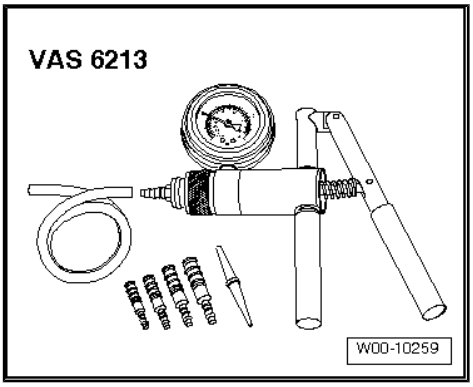
Note the following if testers and measuring instruments have to be used during a road test:

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

1.6 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
- 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.

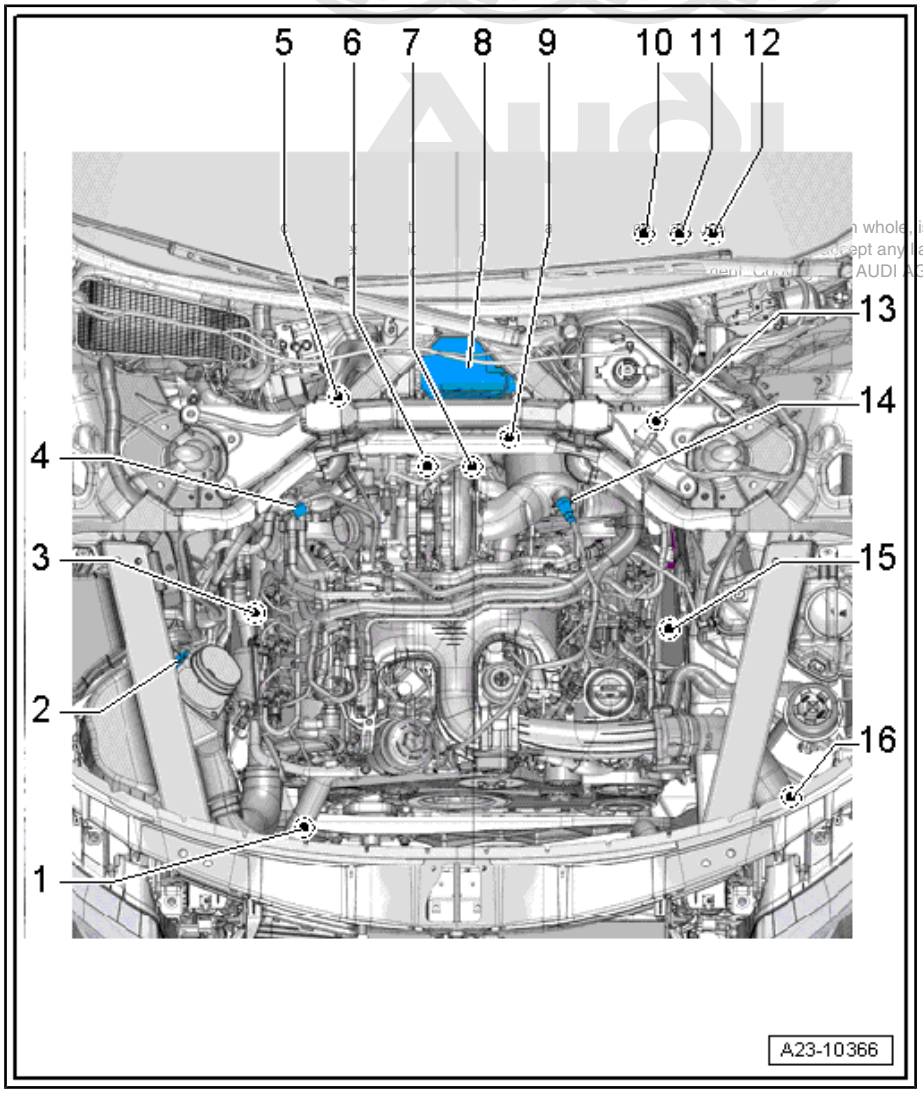
– If an entry is stored in the event memory, check the vacuum lines leading to the corresponding component, and also check the remaining vacuum lines leading to other components.

– 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 Injection system

2.1 Overview of fitting locations - injection system

Engine compartment



1 - Radiator outlet coolant temperature sender -G83-

- ❑ Removing and installing ⇒ Rep. gr. 19

2 - Air mass meter -G70-

- ❑ Exploded view ⇒ page 20
- ❑ Removing and installing ⇒ page 65

3 - Right electrohydraulic engine mounting solenoid valve -N145-

4 - Pressure differential sender -G505-

- ❑ Fitting location ⇒ page 11
- ❑ Exploded view ⇒ page 75

5 - Exhaust gas temperature sender 4 -G648-

- ❑ Exploded view ⇒ page 75

6 - Exhaust gas temperature sender 1 -G235-

- ❑ Removing and installing ⇒ Rep. gr. 26

7 - Engine control unit -J623-

- ❑ Removing and installing ⇒ page 81

8 - Engine speed sender -G28-

- ❑ Exploded view ⇒ page 85

9 - Exhaust gas temperature sender 3 -G495-

- ❑ Fitting location ⇒ page 13
- ❑ Removing and installing ⇒ Rep. gr. 26

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

- ❑ Fitting location ⇒ page 10

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

- ❑ Removing and installing ⇒ Rep. gr. 90

12 - Brake light switch -F-

- ❑ Fitting location ⇒ page 10

13 - Brake servo pressure sensor -G294-

- ❑ Fitting location ⇒ page 10

14 - Lambda probe -G39- with Lambda probe heater -Z19-

- ❑ Exploded view ⇒ page 75

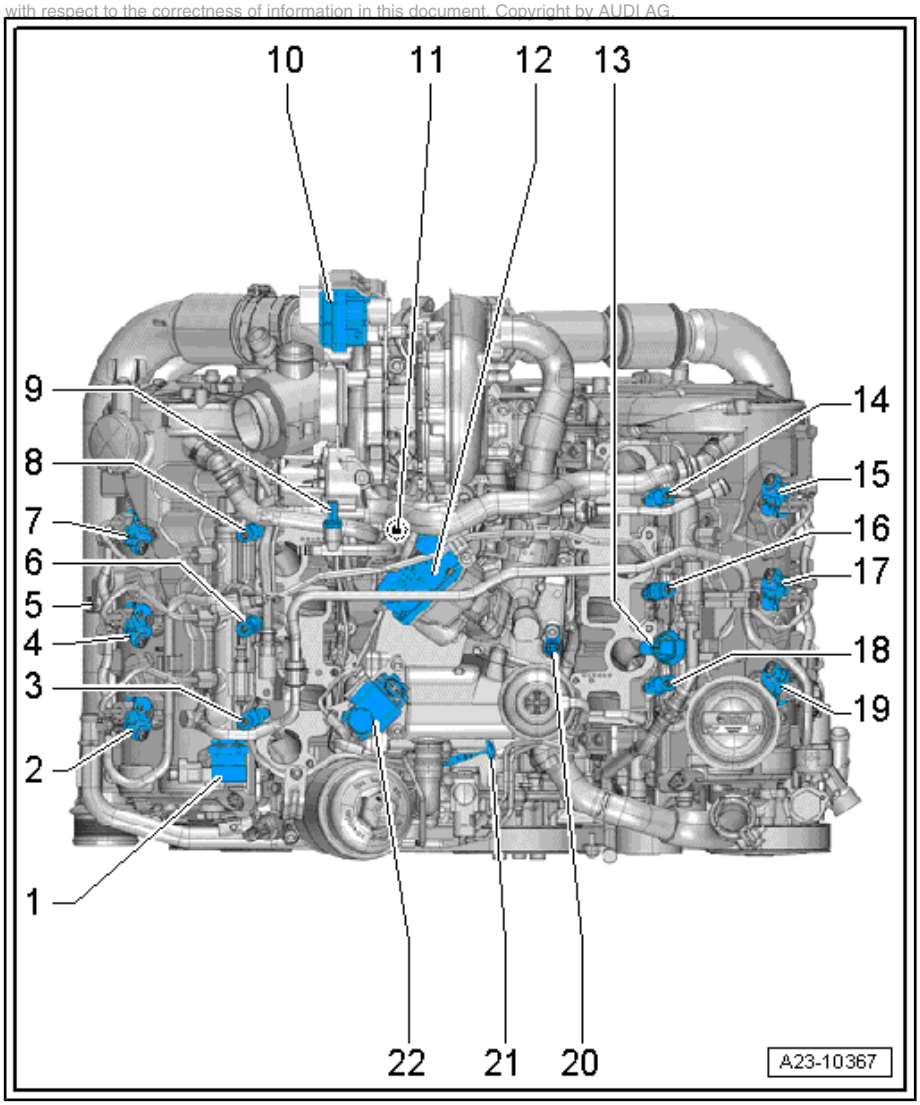
15 - Electrohydraulic engine mounting solenoid valve -N398-

- ❑ Removing and installing ⇒ Rep. gr. 10

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

- ❑ Fitting location ⇒ page 12

Engine (from above)



1 - Fuel pressure regulating valve -N276-

- ❑ After renewing high-pressure pump and/or fuel pressure regulating valve -N276- , adaption must be performed. Use ⇒ Vehicle diagnostic tester
- ❑ Exploded view ⇒ "6.1 Exploded view - injectors", page 45

2 - Injector, cylinder 1 -N30-

3 - Glow plug 1 -Q10-

- ❑ Exploded view ⇒ page 85

4 - Injector, cylinder 2 -N31-

5 - Hall sender -G40-

- ❑ Fitting location ⇒ page 11
- ❑ Exploded view ⇒ page 85

6 - Glow plug 2 -Q11-

- ❑ Exploded view ⇒ page 85

7 - Injector, cylinder 3 -N32-

8 - Glow plug 3 -Q12-

- ❑ Exploded view ⇒ page 85

9 - Fuel temperature sender -G81-

10 - Control unit for turbo-charger 1 -J724-

- ❑ On turbocharger
- ❑ Removing and installing ⇒ Rep. gr. 21

11 - Fuel metering valve -N290-

- ❑ Fitting location ⇒ page 11

12 - Exhaust gas recirculation control motor -V338-

- ❑ Removing and installing ⇒ Rep. gr. 26

13 - Fuel pressure sender -G247-

- ❑ Removing and installing ⇒ page 70
- ❑ Tightening torque ⇒ page 45

14 - Glow plug 6 -Q15-

- ❑ Exploded view ⇒ page 85

15 - Injector, cylinder 6 -N84-

16 - Glow plug 5 -Q14-

- ❑ Exploded view ⇒ page 85

17 - Injector, cylinder 5 -N83-

18 - Glow plug 4 -Q13-

- ❑ Exploded view ⇒ page 85

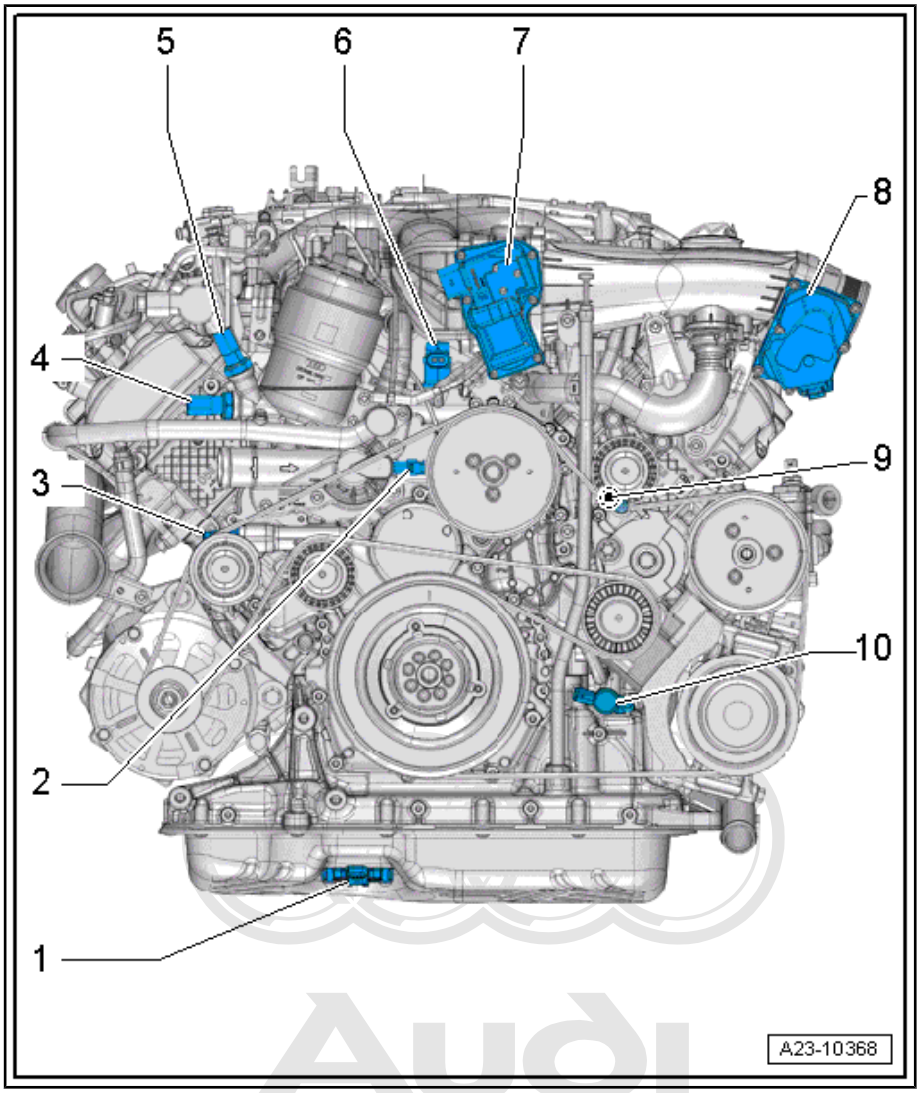
19 - Injector, cylinder 4 -N33-

20 - Coolant temperature sender -G62-

21 - Exhaust gas recirculation temperature sensor -G98-

- ❑ Removing and installing ⇒ Rep. gr. 26

22 - Coolant valve for cylinder head -N489-



1 - Oil level and oil temperature sender -G266-

- ❑ Removing and installing ⇒ Rep. gr. 17

2 - Map-controlled engine cooling system thermostat -F265-

- ❑ Removing and installing ⇒ Rep. gr. 19

3 - Oil temperature sender 2 -G664-

- ❑ Removing and installing ⇒ Rep. gr. 17

4 - Oil pressure switch -F22-

- ❑ Removing and installing ⇒ Rep. gr. 17

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

- ❑ Removing and installing ⇒ Rep. gr. 17

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

- ❑ Removing and installing ⇒ Rep. gr. 26

7 - Intake manifold flap motor -V157-

- ❑ Exploded view ⇒ page 26

8 - Throttle valve module -J338-

- ❑ Exploded view ⇒ page 26

9 - Temperature sender for engine temperature regulation -G694-

- ❑ Fitting location ⇒ page 12

10 - Valve for oil pressure control -N428-

- ❑ Removing and installing ⇒ Rep. gr. 17

A - Exhaust gas temperature sender 1 -G235-

- ❑ Removing and installing ⇒ Rep. gr. 26

B - Exhaust gas temperature sender 2 -G448- (engine code CPNA only)

- ❑ Fitting location ⇒ page 13
- ❑ Removing and installing ⇒ Rep. gr. 26

C - Exhaust gas temperature sender 3 -G495-

- ❑ Fitting location ⇒ page 13
- ❑ Removing and installing ⇒ Rep. gr. 26

D - Exhaust gas temperature sender 4 -G648- (engine codes CMHA, CPNA only)

- ❑ Fitting location ⇒ page 13
- ❑ Removing and installing ⇒ Rep. gr. 26

E - Particulate sensor -G784- (engine code CPNA only)

- ❑ Fitting location ⇒ page 14
- ❑ Removing and installing ⇒ Rep. gr. 26

F - Injector for reducing agent -N474- (engine codes CMHA, CPNA only)

- ❑ Fitting location ⇒ page 14
- ❑ Removing and installing ⇒ Rep. gr. 26

G - Control unit for NOx sender -J583- with NOx sender -G295- (engine codes CMHA, CPNA only)

- ❑ Fitting location ⇒ page 14
- ❑ Removing and installing

H - Control unit for NOx sender 2 -J881- and NOx sender 2 -G687- (engine codes CMHA, CPNA only)

- ❑ Removing and installing ⇒ page 80

I - Control unit for reducing agent metering system -J880- (engine codes CMHA, CPNA only)

- ❑ Removing and installing ⇒ Rep. gr. 26

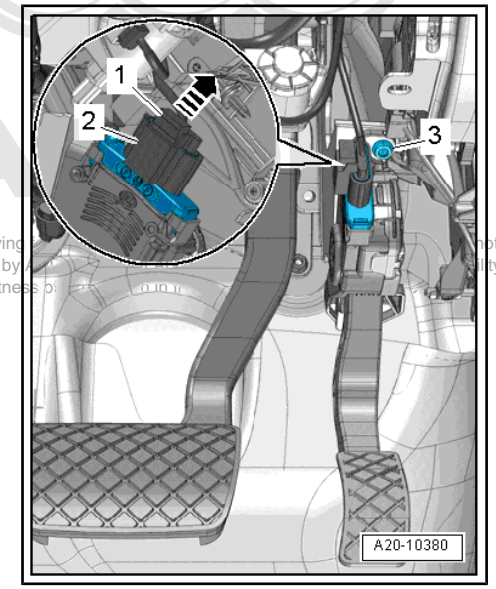
Fitting location of accelerator position sender -G79- / accelerator position sender 2 -G185-

- ♦ 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.

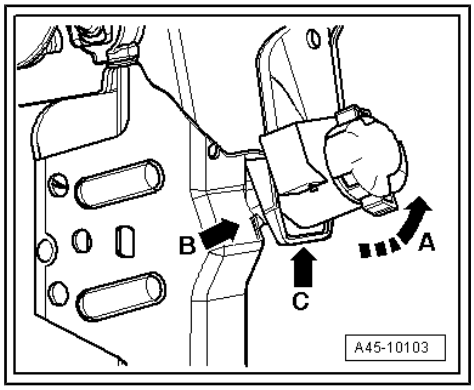
Removing and installing ⇒ Rep. gr. 20



Fitting location of brake light switch -F-

- ♦ In footwell on brake pedal

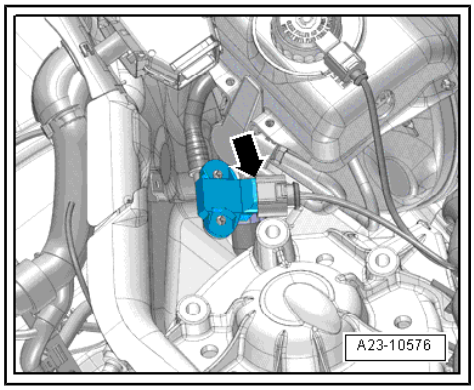
Removing and installing ⇒ Rep. gr. 45



Fitting location of brake servo pressure sensor -G294-

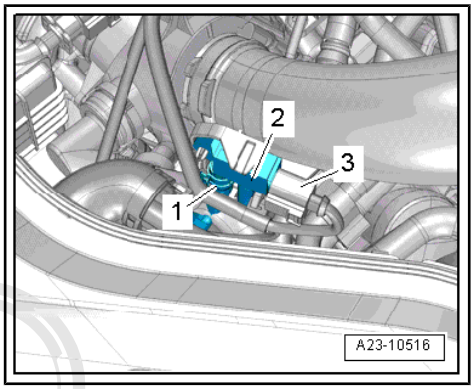
- ♦ Next to brake servo

Removing and installing ⇒ Rep. gr. 47



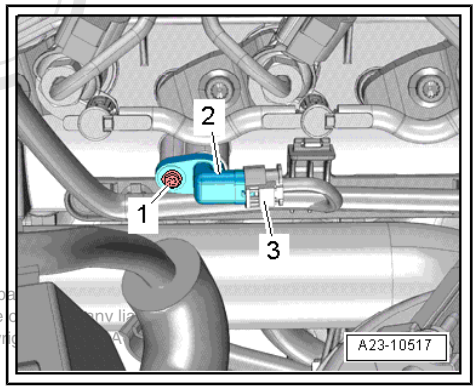
Fitting location of pressure differential sender -G505-

- -Item 2- at rear right of engine



Fitting location of Hall sender -G40-

- -Item 2- on cylinder head cover (right-side), cylinder bank 1

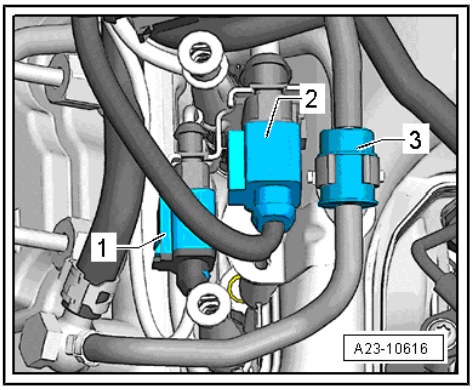


Electrical connectors

1 - For exhaust gas recirculation temperature sensor -G98-

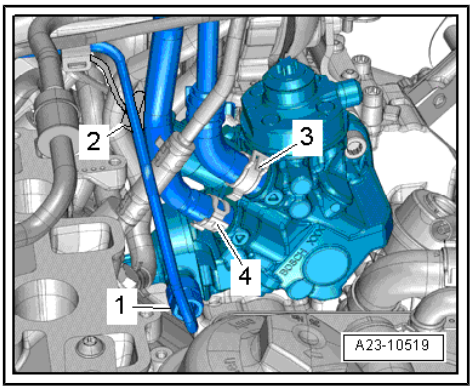
2 - For map-controlled engine cooling system thermostat -F265- , fuel metering valve -N290- and exhaust gas recirculation control motor -V338-

3 - Restrictor in fuel return line



Fitting location of fuel metering valve -N290-

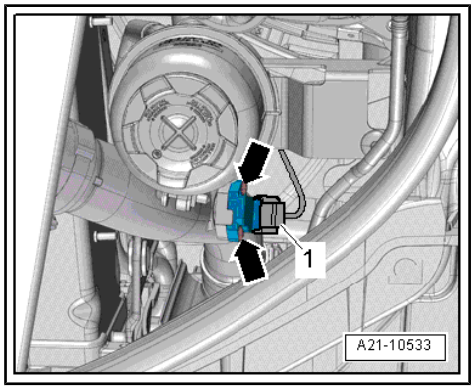
- -Item 2- in high-pressure pump



Fitting location of charge pressure sender -G31- / intake air temperature sender -G42-

- -Item 1- at air pipe (left-side) in engine compartment

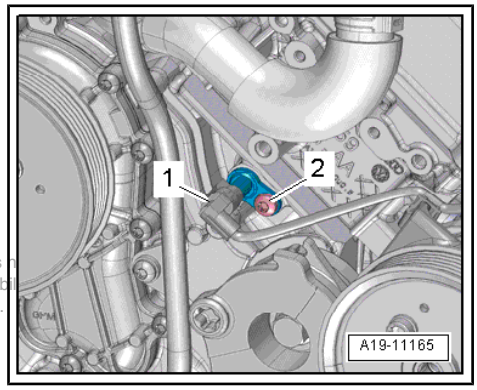
Removing and installing ⇒ Rep. gr. 21



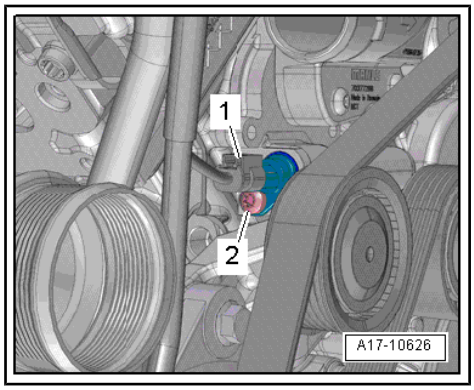
Fitting location of temperature sender for engine temperature regulation -G694-

- -Item 1- at front left of cylinder block

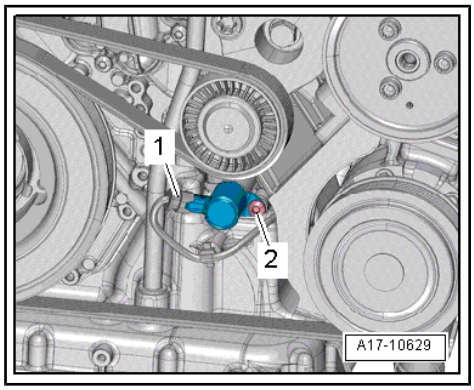
Removing and installing ⇒ Rep. gr. 19



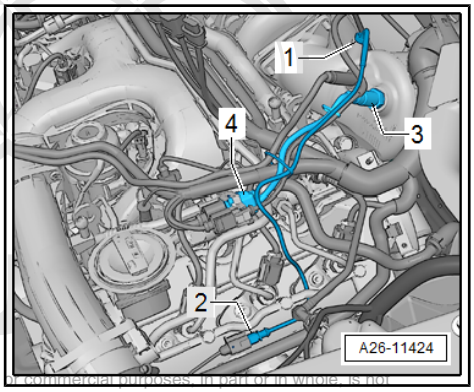
Oil temperature sender 2 -G664-



Valve for oil pressure control -N428-



Exhaust gas temperature sender 2 -G448- -1- (engine code CPNA only)



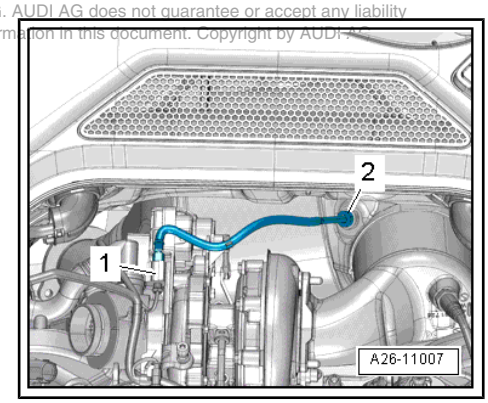
1 - Exhaust gas temperature sender 2 -G448-

2 - Electrical connector for exhaust gas temperature sender 2 -G448-

3 - Lambda probe -G39-

4 - Electrical connector for Lambda probe -G39-

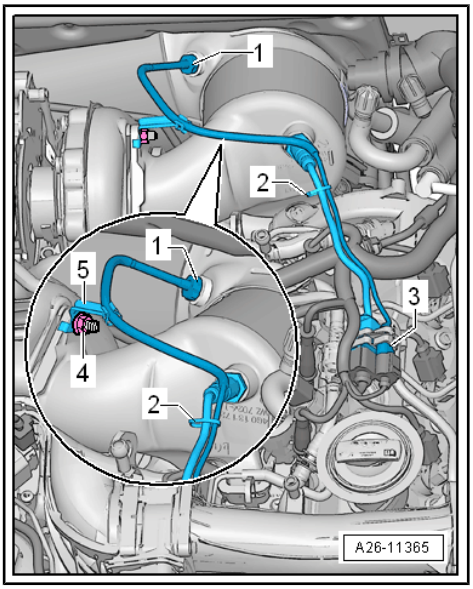
Exhaust temperature sender 3 -G495- - version 1



1 - Electrical connector for exhaust gas temperature sender 3 -G495-

2 - Exhaust gas temperature sender 3 -G495-

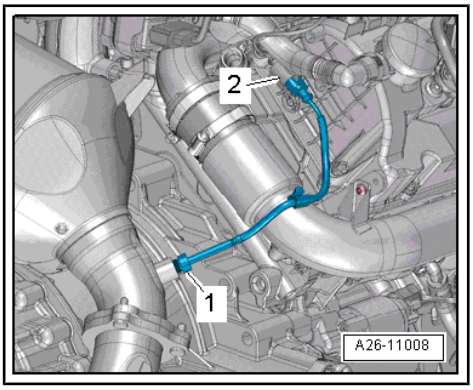
Exhaust temperature sender 3 -G495- - version 2



1 - Exhaust gas temperature sender 3 -G495-

3 - Electrical connector for exhaust gas temperature sender 3 -G495-

Exhaust gas temperature sender 4 -G648- -arrow- (engine codes CMHA, CPNA only)

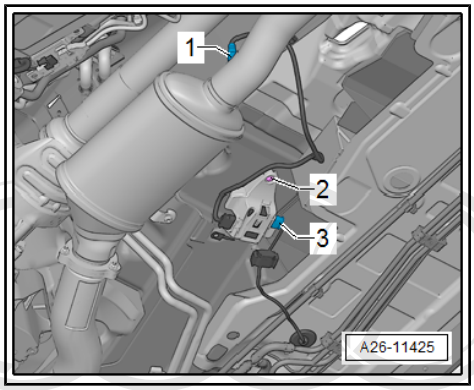


Particulate sensor -G784- (engine code CPNA only)

1 - Particulate sensor -G784-

2 - Bolt

3 - Electrical connector for particulate sensor -G784-



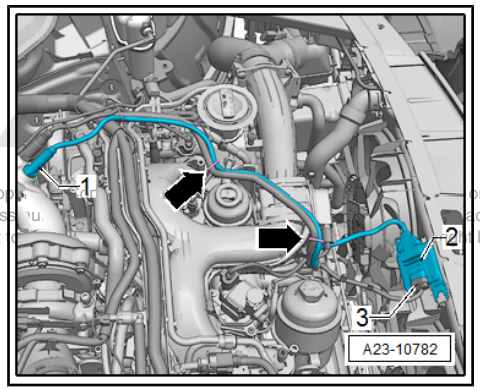
NOx sender -G295- (engine codes CMHA, CPNA only)

1 - NOx sender -G295-

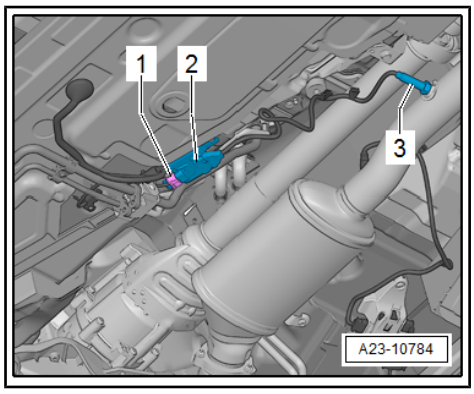
2 - Control unit for NOx sender -J583-

3 - Electrical connector for control unit for NOx sender -J583-

Pfeile - Cable tie

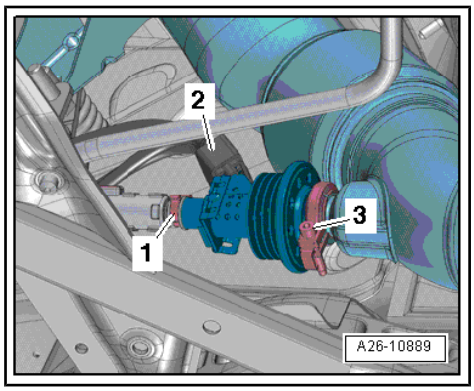


Control unit for NOx sender 2 -J881- with NOx sender 2 -G687- -1- (engine codes CMHA, CPNA only)



Injector for reducing agent -N474- (engine codes CMHA, CPNA only)

Removing and installing ⇒ Rep. gr. 26



2.2 Overview - fuel system

Caution

Risk of malfunctions caused by dirt.

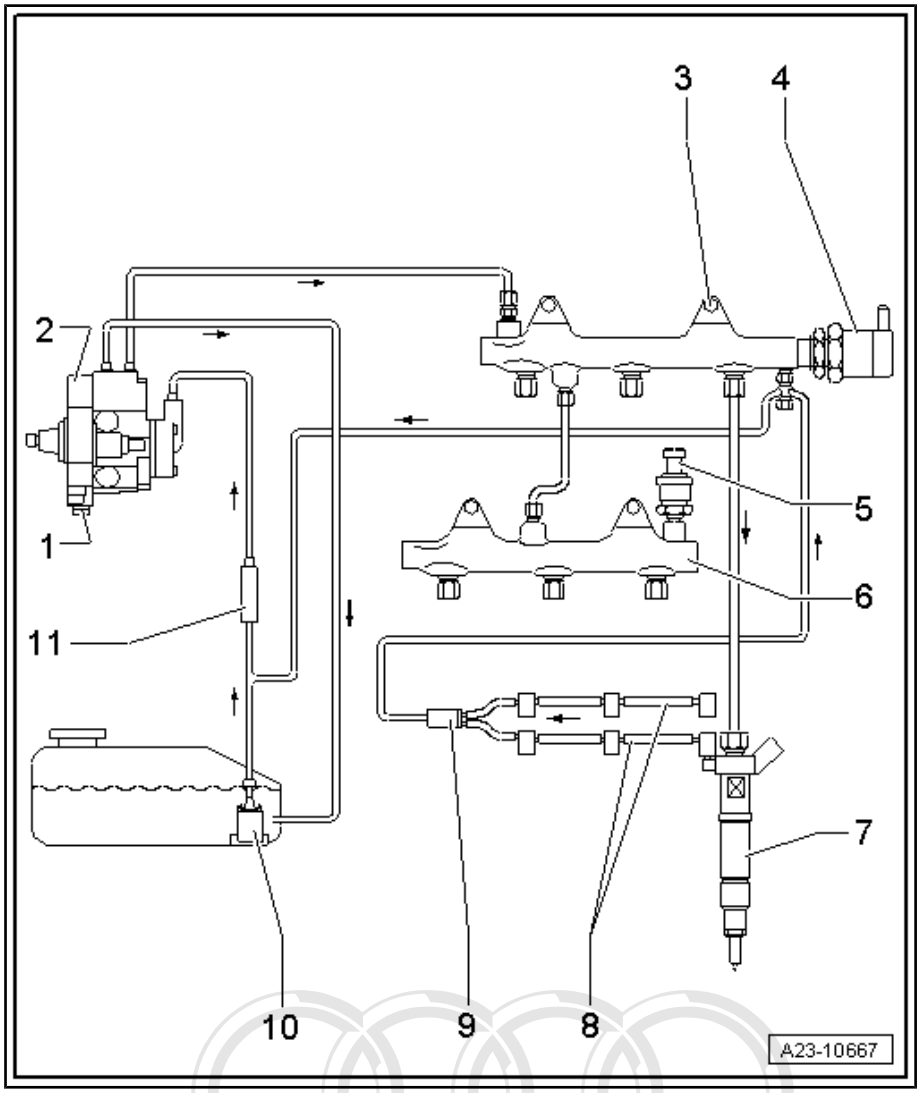
- *Observe*
  ⇒ "1.3 Safety precautions when working on the fuel system", page 2 .

The high-pressure fuel pump has very close tolerances and must not be allowed to run without fuel. To prevent this and to enable the engine to start 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 fuel system must be bled ⇒ page 18 .*
- *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*
  ⇒ "2.3 Filling and bleeding fuel system", page 18

Note

The high-pressure pump will be damaged if the first fuel filling operation is not performed.



1 - Fuel metering valve -N290-

- ❑ Do not unscrew

2 - High-pressure pump

- ❑ After renewing high-pressure pump and/or fuel pressure regulating valve -N276- , adaption must be performed. Use ⇒ Vehicle diagnostic tester
- ❑ Exploded view ⇒ page 36
- ❑ Removing and installing ⇒ page 37

3 - Fuel rail

- ❑ For cylinder bank 1 (right-side)

4 - Fuel pressure regulating valve -N276-

- ❑ Cannot be re-installed
- ❑ After renewing high-pressure pump and/or fuel pressure regulating valve -N276- , adaption must be performed. Use vehicle diagnostic tester
- ❑ Removing and installing ⇒ page 68
- ❑ Tightening torque ⇒ page 17

5 - Fuel pressure sender -G247-

- ❑ Removing and installing ⇒ page 70
- ❑ Tightening torque ⇒ page 17

6 - Fuel rail

- ❑ For cylinder bank 2 (left-side)

7 - Injector

- ❑ Removing and installing ⇒ page 58

8 - Fuel return hoses

- ❑ Do not dismantle
- ❑ Renew together with restrictor only

9 - Restrictor

- ❑ Maintains a low residual pressure in fuel return hoses
- ❑ Cannot be renewed separately; if defective, completely renew fuel return hoses
- ❑ Checking restrictor ⇒ page 57

10 - Fuel system pressurisation pump -G6-

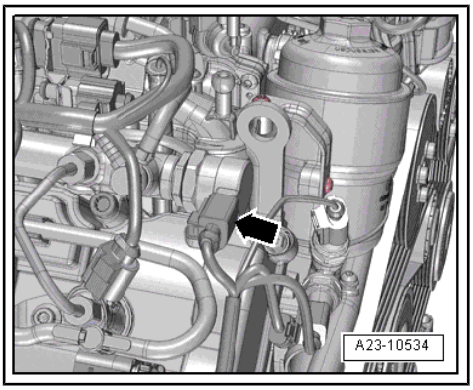
11 - Fuel filter

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.

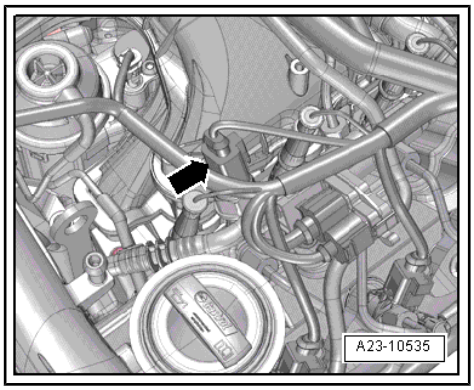
– Tighten union nut on regulating valve in 4 stages as follows (counterhold hexagon flats on housing):

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



Fuel pressure sender -G247- - tightening torque

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

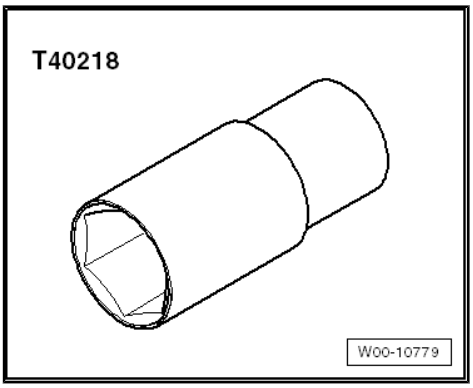


Note

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

2.3 Filling and bleeding fuel system

Caution

- *If components of the fuel system between the fuel tank and the high-pressure pump are removed or renewed, the fuel system must be bled.*
- *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*
  ⇒ "5.3 Performing first fuel filling after installing high-pressure pump", page 42

Special tools and workshop equipment required

- Vehicle diagnostic tester

Proceed as follows to fill fuel system with fuel:

- Check fuel gauge in instrument cluster; fuel gauge needle must indicate that fuel is above reserve level.
- 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" key: The fuel pump will start running.
- The fuel pump must run for approx. 1 minute to ensure that the fuel system is filled sufficiently with 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 event memory.
- 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.

2.4 Connection diagram - vacuum system

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

2 - Coolant valve for cylinder head -N489-

3 - Vacuum unit

- ❑ For exhaust gas recirculation cooler

4 - Non-return valve

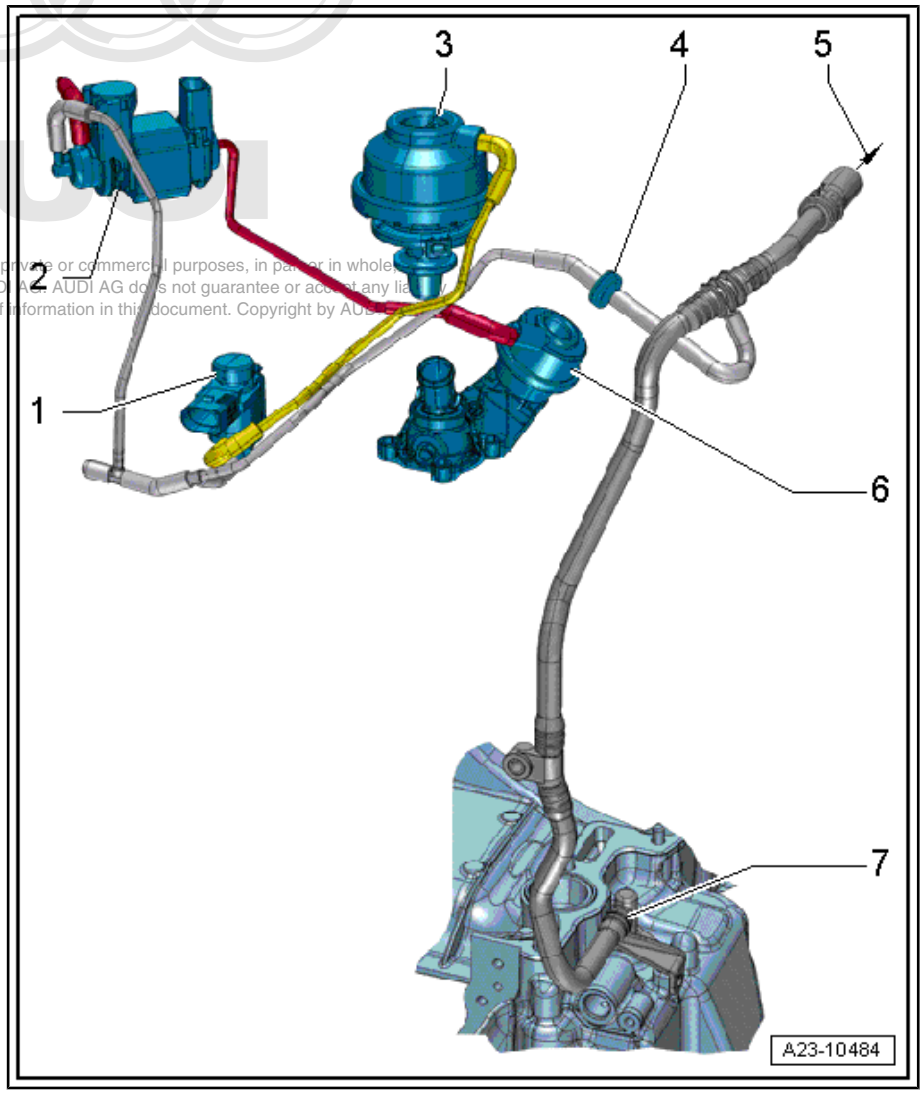
5 - To brake servo

6 - Shut-off valve

- ❑ For coolant

7 - Vacuum connection

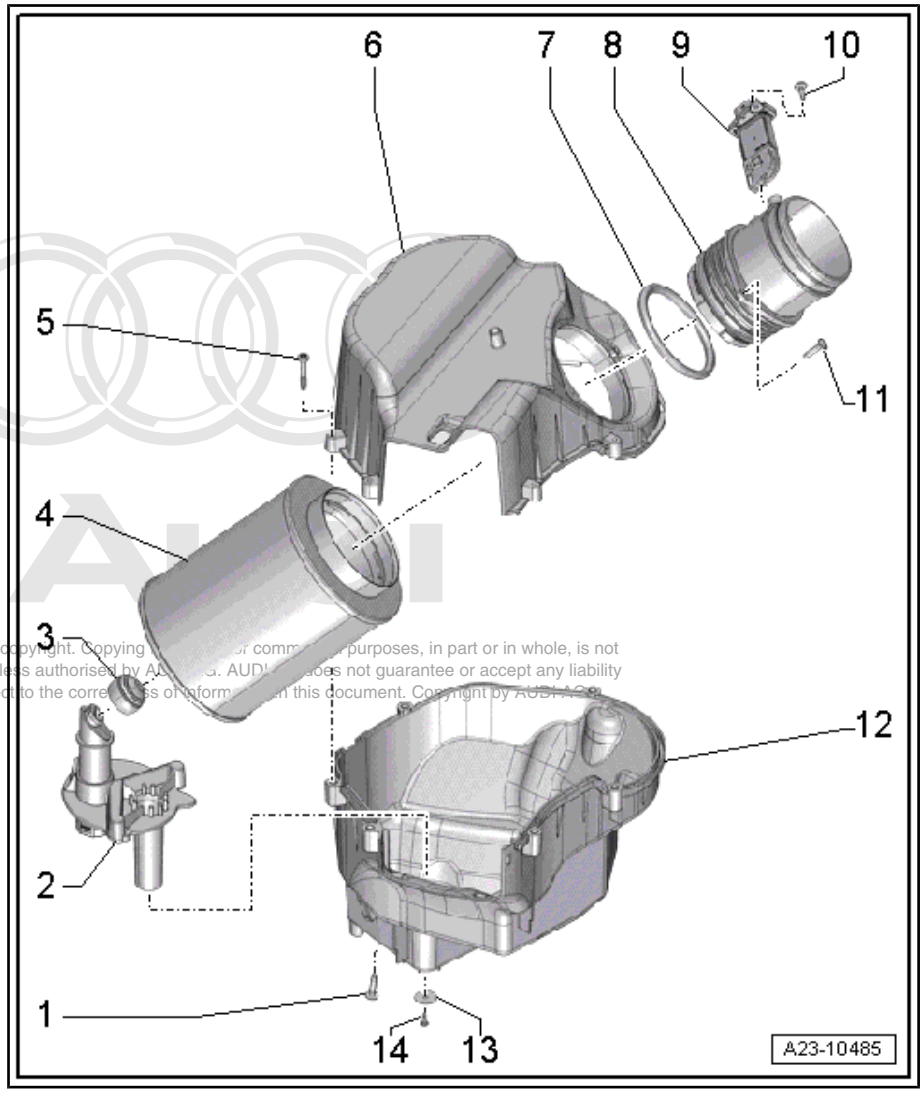
- ❑ On sump (top section)
- ❑ To vacuum pump



3 Air cleaner

3.1 Exploded view - air cleaner housing

Part 1



1 - Bolt
- ❑ 3.5 Nm

2 - Mounting
- ❑ For air filter element
- ❑ With water drain
- ❑ Clean water drain

3 - Rubber buffer

4 - Air filter element
- ❑ Use genuine air filter element ⇒ Electronic parts catalogue
- ❑ Change intervals ⇒ Maintenance tables
- ❑ Removing and installing ⇒ page 22

5 - Bolt
- ❑ 2.5 Nm

6 - Air cleaner (top section)
- ❑ Clean out salt deposits, dirt and leaves, etc.

7 - O-ring
- ❑ Renew if damaged

8 - Housing
- ❑ For air mass meter - G70-

9 - Air mass meter -G70-
- ❑ Removing and installing ⇒ page 65

10 - Bolt
- ❑ 3.5 Nm

11 - Bolt
- ❑ 3.5 Nm

12 - Air cleaner (bottom section)
- ❑ Clean out salt deposits, dirt and leaves, etc.

13 - Rubber washer

14 - Bolt

- ❑ 3.5 Nm

Part 2

1 - Air duct

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

2 - Air duct

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

3 - Air duct

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

4 - Sealing element

5 - Mounting

- ❑ For air cleaner housing

6 - Rubber grommet

7 - Air cleaner housing

- ❑ Removing and installing ⇒ page 24

8 - Rubber grommet

9 - Air pipe

10 - Rubber grommet

11 - Bracket

- ❑ For air cleaner housing

12 - Bolt

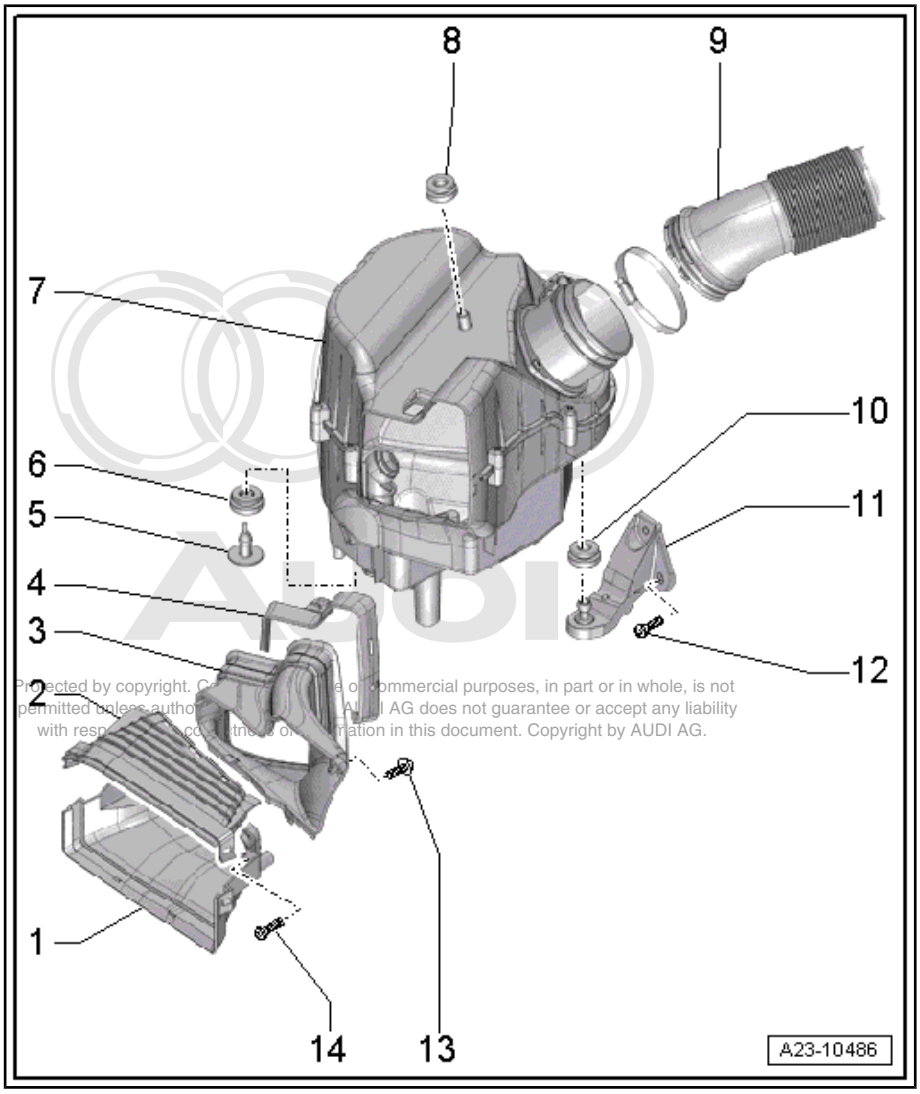
- ❑ 8 Nm

13 - Bolt

- ❑ 2.5 Nm

14 - Bolt

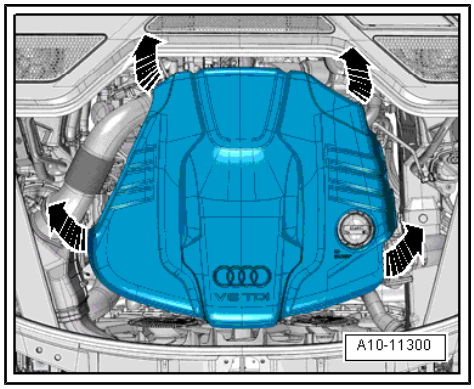
- ❑ 2.5 Nm



3.2 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.

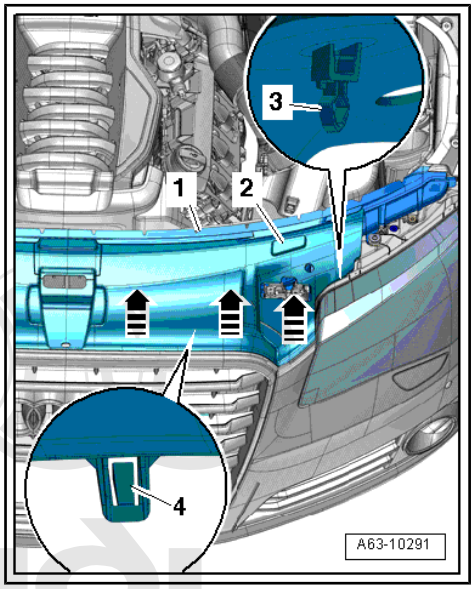
– Press engine cover panel with both hands first onto retaining pins at rear and then onto retaining pins at front.

3.3 Removing and installing air filter element

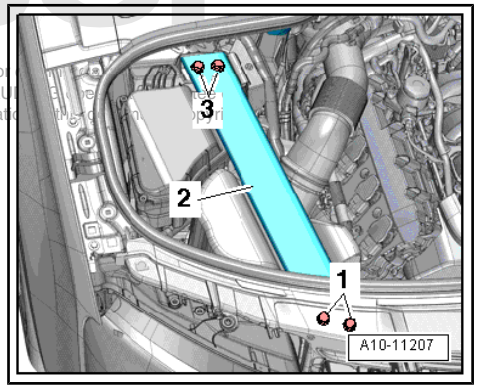
Removing

– Pull off engine cover panel ⇒ page 22 .

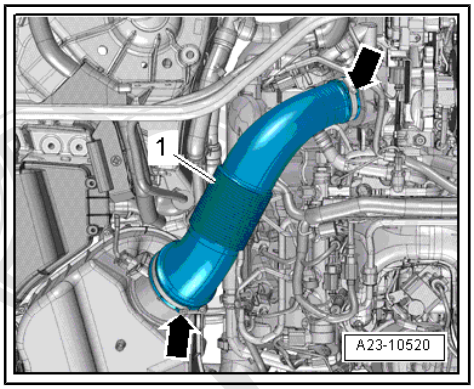
– Remove lock carrier cover -2- ⇒ Rep. gr. 63 .



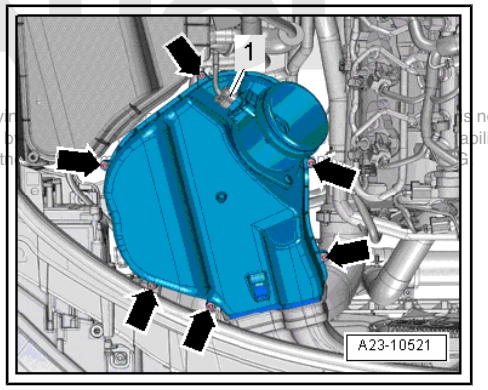
– Remove bolts -1, 3- and detach longitudinal member (top right) -2-.



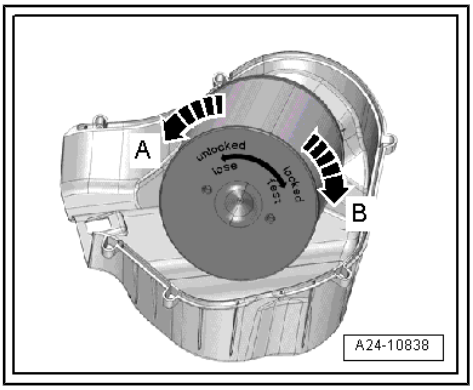
– Release hose clips -arrows- and remove air pipe -1-.



– Unplug electrical connector -1- for air mass meter -G70- .
– Unscrew bolts -arrows- and detach air cleaner (top section).



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



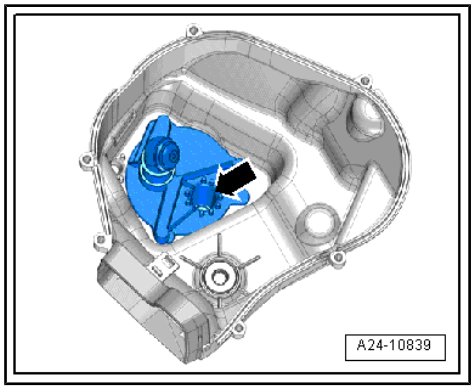
Installing

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

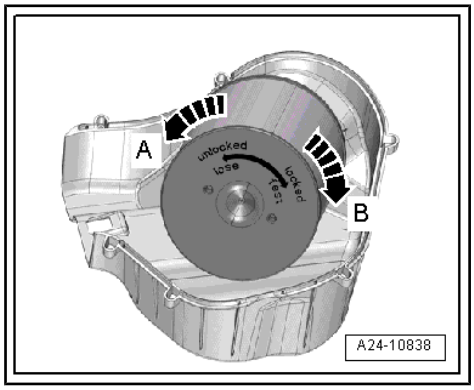
Note

- *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.*
- *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- *Use a silicone-free lubricant when installing the air hoses.*
- *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 pipe (engine intake side).
– Check for dirt and leaves in air duct going from lock carrier to air cleaner housing.



– Turn air filter element in clockwise direction -arrow B- so that it engages.
– Carefully fit top section of air cleaner onto bottom section, without using any force; check that air filter element is properly centred in retainer in air cleaner (bottom section).
– Make sure that air pipe is securely fitted on air cleaner (top section).



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

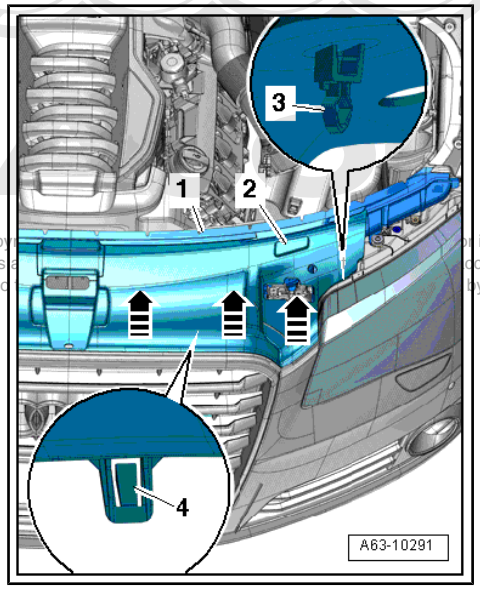
• Tightening torques
⇒ “3.1 Exploded view - air cleaner housing”, page 20

– Install longitudinal member (top right) ⇒ Rep. gr. 50 .
– Install lock carrier cover ⇒ Rep. gr. 63 .

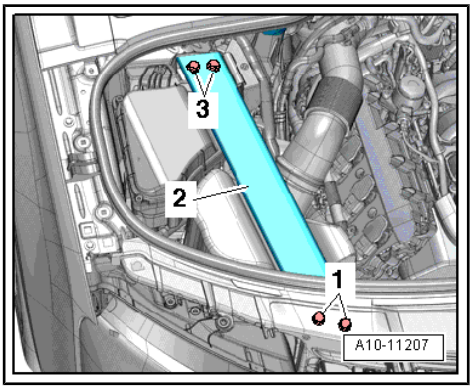
3.4 Removing and installing air cleaner housing

Removing

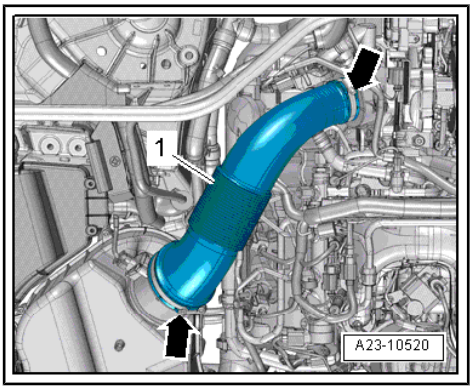
– Pull off engine cover panel ⇒ page 22 .
– Remove lock carrier cover -2- ⇒ Rep. gr. 63 .



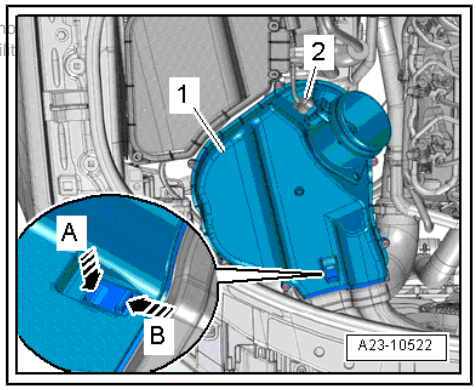
– Remove bolts -1, 3- and detach longitudinal member (top right) -2-.



– Release hose clips -arrows- and remove air pipe -1-.



– Unplug electrical connector -2-.
– Press catch down -arrow A- and push towards rear -arrow B-.
– Lift off air cleaner housing -1-.



Installing

Note

- *The air cleaner housing MUST be clean.*
- *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.*
- *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- *Use a silicone-free lubricant when installing the air hoses.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

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

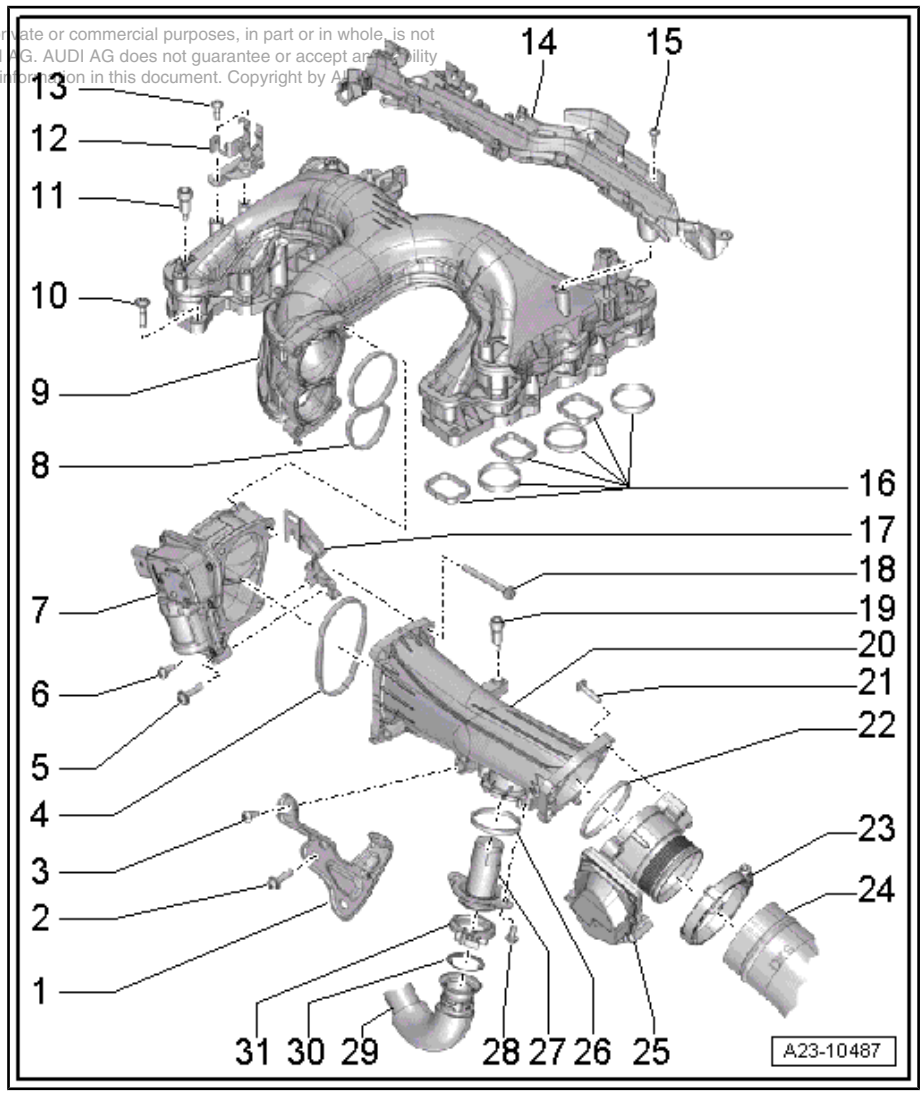
Remaining installation steps are carried out in reverse sequence; note the following:

- Tightening torque
⇒ “3.1 Exploded view - air cleaner housing”, page 20

– Install longitudinal member (top right) ⇒ Rep. gr. 50 .
– Install lock carrier cover ⇒ Rep. gr. 63 .

4 Intake manifold

4.1 Exploded view - intake manifold



1 - Bracket
- ❑ For air pipe

2 - Bolt
- ❑ 9 Nm

3 - Bolt
- ❑ 9 Nm

4 - Seal
- ❑ Check for damage and renew if necessary

5 - Bolt
- ❑ 9 Nm

6 - Bolt
- ❑ 9 Nm

7 - Intake manifold flap motor - V157-
- ❑ Removing and installing ⇒ page 33

8 - Gasket
- ❑ Check for damage and renew if necessary

9 - Intake manifold
- ❑ Removing and installing ⇒ page 27

10 - Bolt
- ❑ Tightening torque and sequence ⇒ page 27

11 - Mounting pin
- ❑ For engine cover
- ❑ 5 Nm

12 - Bracket
- ❑ For electrical connector

13 - Bolt
- ❑ 4 Nm

14 - Cable guide

15 - Bolt
- ❑ 4 Nm

16 - Gaskets
- ❑ Renew

17 - Bracket
- ❑ For exhaust gas recirculation cooler change-over valve -N345-

18 - Bolt
- ❑ 9 Nm

19 - Mounting pin
- ❑ For engine cover
- ❑ 5 Nm

20 - Air pipe

21 - Bolt
- ❑ 9 Nm

22 - Seal
- ❑ Check for damage and renew if necessary

23 - Screw-type clip
- ❑ Tightening torque ⇒ Rep. gr. 21

24 - Air hose

25 - Throttle valve module -J338-
- ❑ Removing and installing ⇒ page 32

26 - Seal
- ❑ Renew

27 - Pipe
- ❑ For exhaust gas recirculation

28 - Bolt
- ❑ 9 Nm

29 - Pipe
- ❑ For exhaust gas recirculation

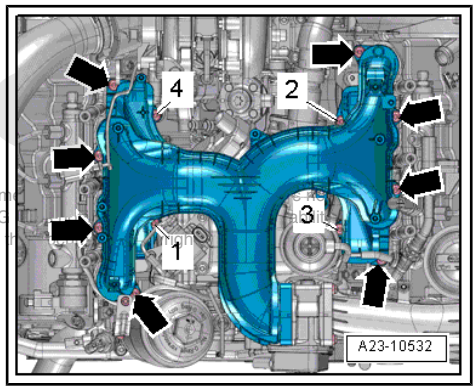
30 - Seal
- ❑ Renew

31 - Screw-type clip
- ❑ Tightening torque ⇒ Rep. gr. 26

Intake manifold - tightening torque and sequence

– Tighten bolts in 3 stages as follows:

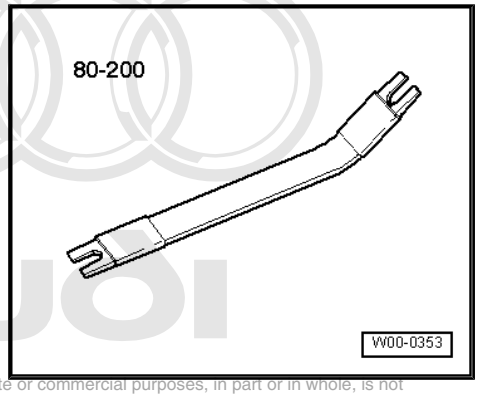
Stage	Bolts	Tightening torque
1.	-1 to 4-, -arrows-	Screw in bolts by hand until they make contact
2.	-1 to 4-	5 Nm, in sequence indicated
3.	-1 to 4- -arrows-	9 Nm, in any sequence



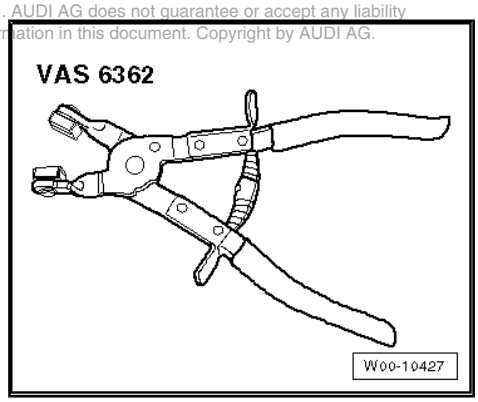
4.2 Removing and installing intake manifold

Special tools and workshop equipment required

- Removal lever -80 - 200-



- Hose clip pliers -VAS 6362-



Removing

Caution

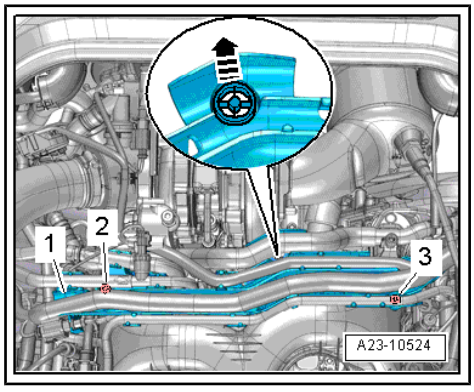
- *Use an absorbent cloth to catch escaping fuel.*
- *No fuel must be allowed to spill onto components or seals in the vicinity of the engine; this can ultimately lead to damage caused by leaking seals.*
- *Risk of malfunctions caused by dirt.*
- *Observe ⇒ "1.3 Safety precautions when working on the fuel system", page 2 .*

– Pull off engine cover panel ⇒ page 22 .

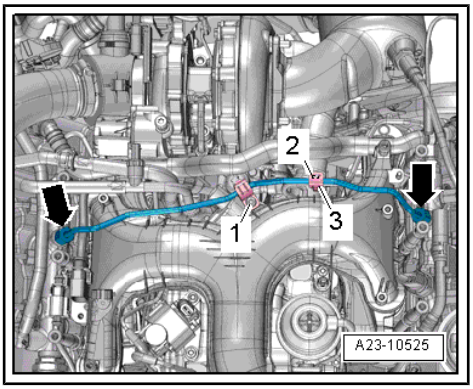
– Use removal lever -80 - 200- to move electrical wiring harness and hoses clear at cable guide -1-.

– Pull coolant hose off to rear -arrow-.

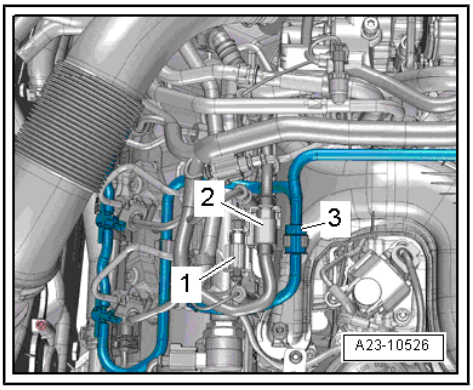
– Unscrew bolts -2 and 3- and remove cable guide -1-.



– Unscrew bolts -1 and 2- and detach retaining clamp -3-.
– Unscrew union nuts -arrows- and detach high-pressure pipe (top).



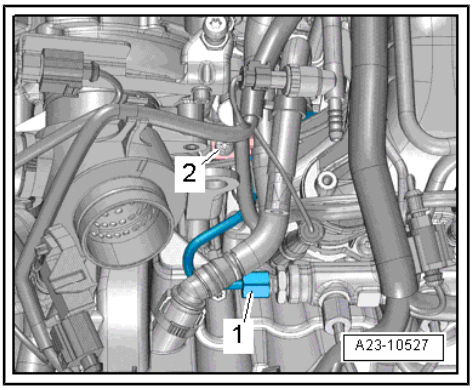
– Detach electrical connectors -1 and 2- and remove non-return valve -3- from bracket.



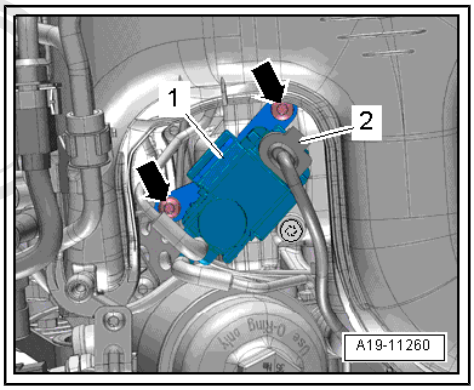
– Remove bolt -2- at retaining clamp for high-pressure pipe.

Note

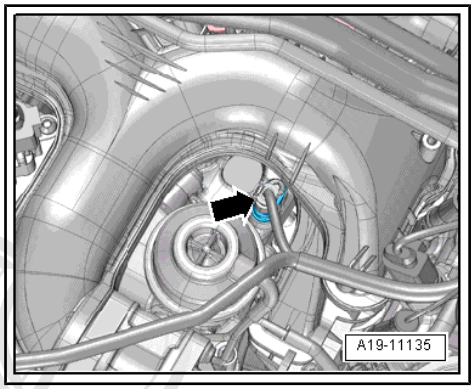
Disregard -item 1-.



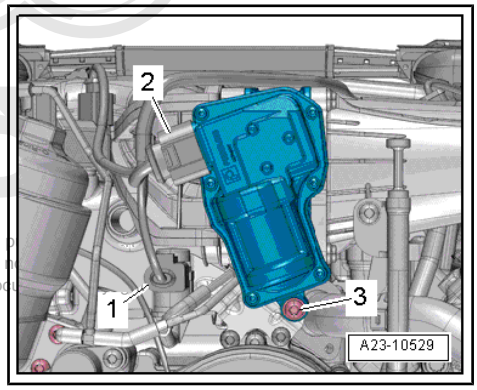
– Unplug electrical connector -2- at coolant valve for cylinder head -N489- -item 1-.
– Unscrew bolts -arrows- and place bracket with coolant valve for cylinder head -N489- to the side.



– Unplug electrical connector -arrow- at coolant temperature sender -G62- .



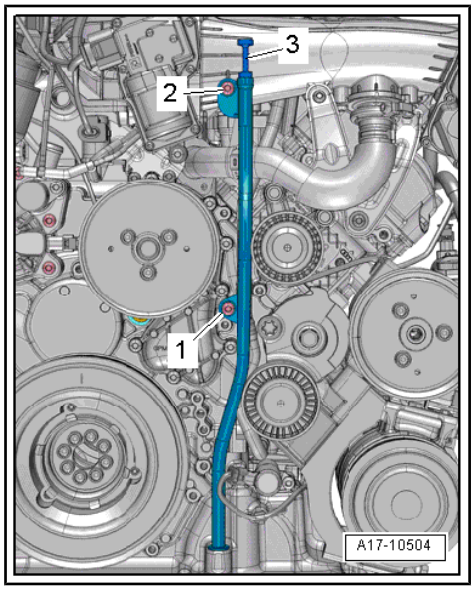
– Unplug electrical connectors -1 and 2- and move wiring harness clear to left side.
– Remove bolt -3- from bracket (centre) for intake manifold.



– Pull out plug -3-.
– Remove bolt -2- for dipstick guide tube.

Note

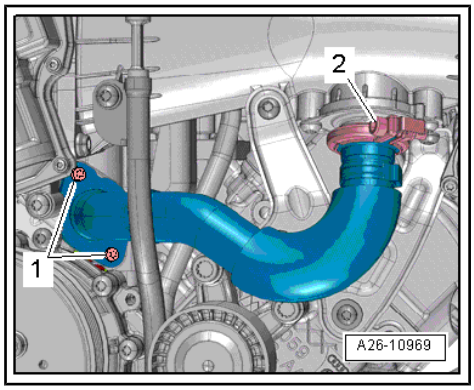
Disregard -item 1-.



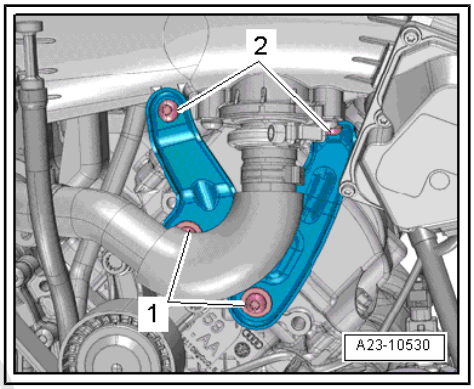
– Release screw-type clip -2- on exhaust gas recirculation pipe.

Note

Disregard -item 1-.



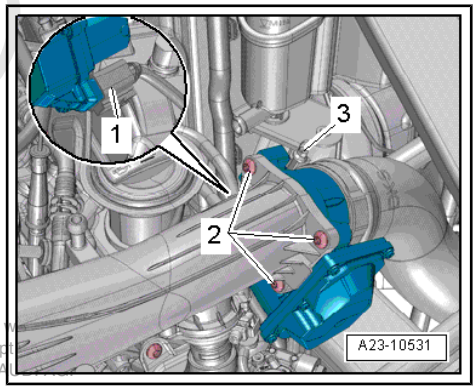
– Remove bolts -2- from bracket (left-side) for air pipe.



Note

Disregard -item 1-.

– Unplug electrical connector -1- at throttle valve module - J338- .
– Release screw-type clip -3- and detach air hose.

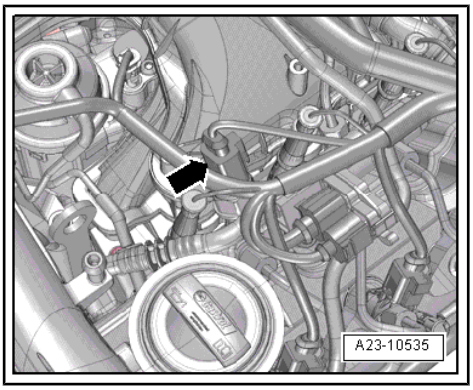


Note

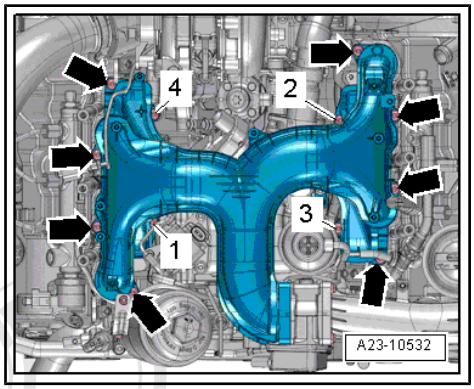
Disregard -item 2-.

– Unplug electrical connectors on glow plugs.

– Remove fuel pressure sender -G247- -arrow- ⇒ page 70 .



– Remove bolts -1 ... 4- and -arrows- and detach intake manifold.



Installing

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

Note

- *Renew seals and/or gaskets.*
- *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *To secure the air hoses at their connections, spray rust remover onto the worm thread of the used hose clips before installing.*

• Tightening torques
⇒ Fig. ""Intake manifold - tightening torque and sequence"" , page 27

– Tighten bolts for intake manifold ⇒ page 27.

– Install high-pressure pipe
⇒ "6.9 Installing high-pressure pipes", page 62 .

– Install fuel pressure sender -G247- -arrow- ⇒ page 70 .

– Install dipstick guide tube ⇒ Rep. gr. 17 .

– Install exhaust gas recirculation pipe ⇒ Rep. gr. 26 .

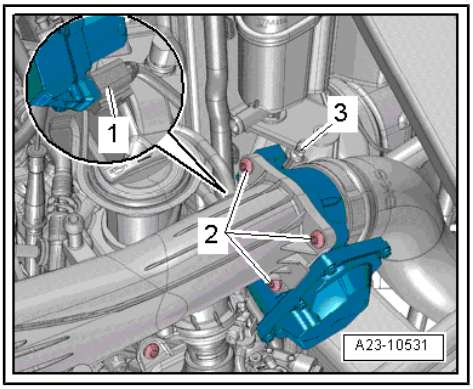
– Fill up with coolant ⇒ Rep. gr. 19 .

4.3 Removing and installing throttle valve module -J338-

Removing

– Pull off engine cover panel ⇒ page 22 .

– Release hose clip -3- and detach air hose.
– Unplug electrical connector -1-.
– Remove bolts -2- and detach throttle valve module -J338- .



Installing

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

Note

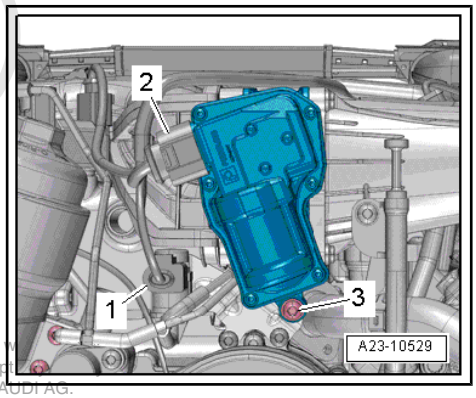
- *Renew gasket.*
- *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *To secure the air hoses at their connections, spray rust remover onto the worm thread of the used hose clips before installing.*

• Tightening torques
⇒ “4.1 Exploded view - intake manifold”, page 26

4.4 Removing and installing intake manifold flap motor -V157-

Removing

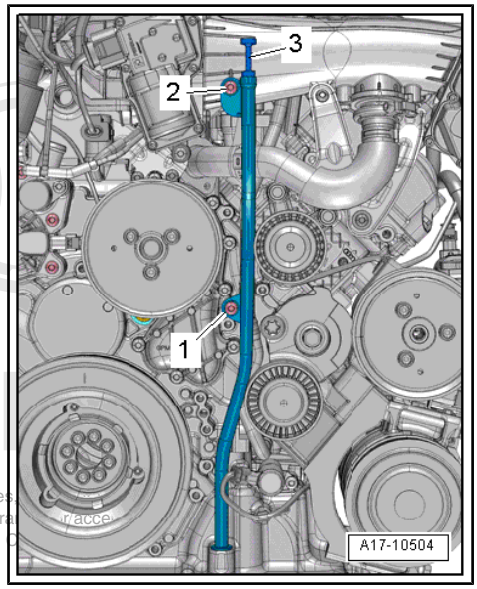
– Pull off engine cover panel ⇒ page 22 .
– Unplug electrical connector -2-.
– Remove bolt -3- from bracket (centre) for intake manifold.



Note

Disregard -item 1-.

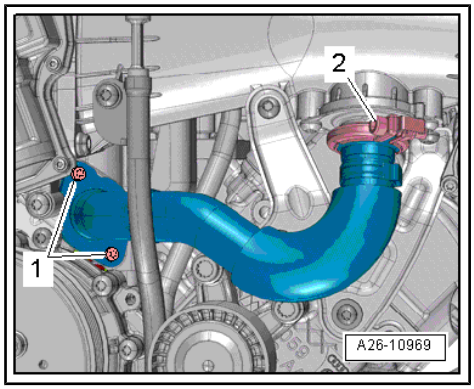
– Remove bolt -2- for dipstick guide tube.



Note

Disregard -items 1, 3-.

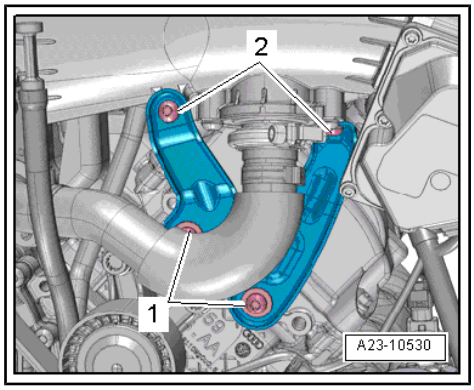
– Release screw-type clip -2- on exhaust gas recirculation pipe.



Note

Disregard -item 1-.

– Remove bolts -2- from bracket (left-side) for air pipe.

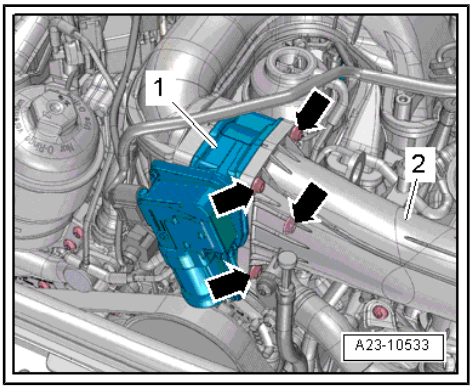


Note

Disregard -item 1-.

– Remove bolts -arrows-.

– Press air pipe -2- to left side and detach intake manifold flap motor -V157- -item 1-.



Installing

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

Note

- *Renew seals and/or gaskets.*
- *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*

• Tightening torques
⇒ “4.1 Exploded view - intake manifold”, page 26

– Install dipstick guide tube ⇒ Rep. gr. 17 .

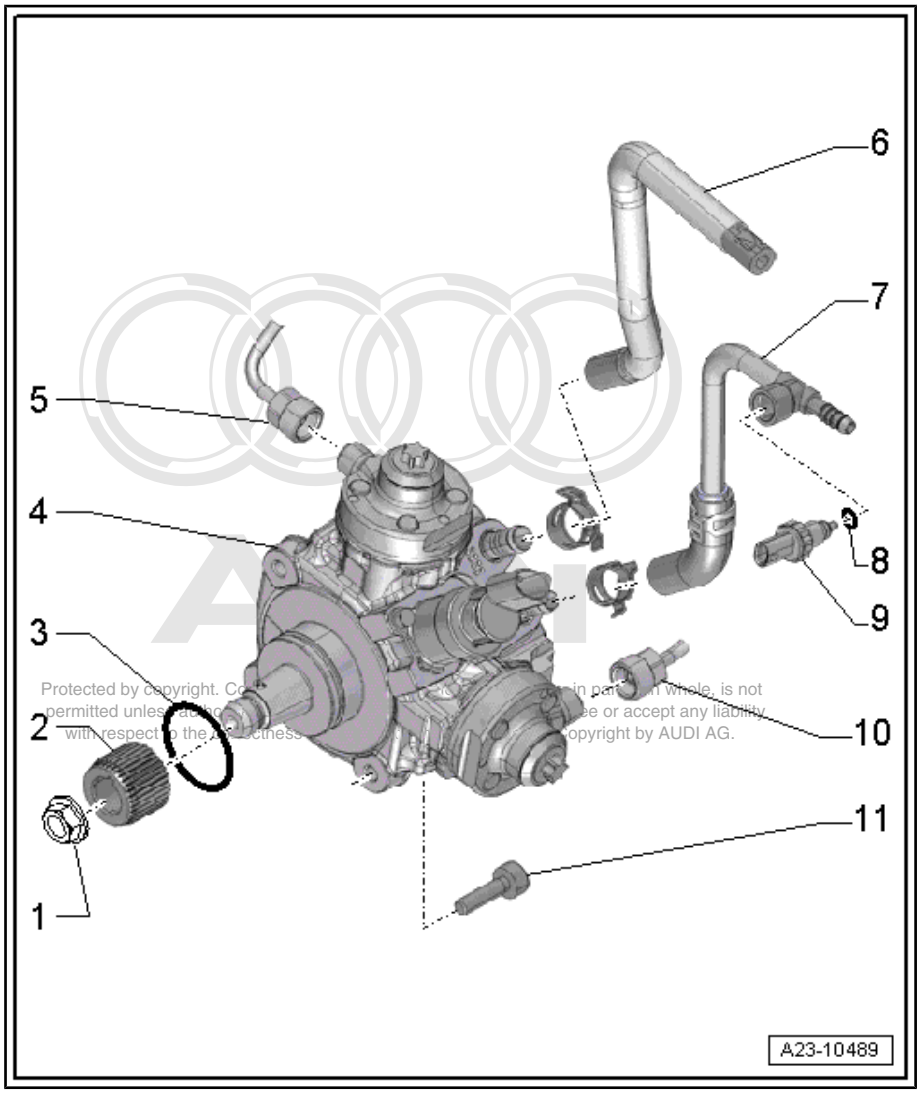
– Install exhaust gas recirculation pipe ⇒ Rep. gr. 26 .

5 High-pressure pump

⇒ “5.1 Exploded view - high-pressure pump”, page 36

⇒ “5.2 Removing and installing high-pressure pump”, page 37

5.1 Exploded view - high-pressure pump



1 - Nut

- To loosen, counterhold adapter -item 2- using counterhold tool -T40248-
- 70 Nm

2 - Adapter

- For chain sprocket for high-pressure pump
- Different types of adapters are fitted depending on version
- To loosen nut -item 1-, use counterhold tool -T40248- or counterhold tool -T40292-
- Install on new high-pressure pump when renewing high-pressure pump

3 - O-ring

- Renew

4 - High-pressure pump

Caution

Risk of malfunctions caused by dirt.
Observe
⇒ “1.3 Safety precautions when working on the 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
⇒ “2.3 Filling and bleeding fuel system”, page 18 .

- Removing and installing ⇒ page 37
- After renewing high-pressure pump and/or fuel pressure regulating valve -N276- , adaption must be performed. Use vehicle diagnostic tester .

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 ⇒ “6.9 Installing high-pressure pipes”, page 62
- ❑ Lubricate threads of union nuts with clean engine oil
- ❑ 25 Nm

6 - Fuel supply hose

7 - Fuel return hose

8 - O-ring

- ❑ Renew

9 - Fuel temperature sender -G81-

- ❑ 2 Nm

10 - High-pressure pipe

- ❑ Do not alter shape
- ❑ Check for damage before re-installing
- ❑ Always renew high-pressure pipe when renewing high-pressure pump
- ❑ Installing ⇒ “6.9 Installing high-pressure pipes”, page 62
- ❑ Lubricate threads of union nuts with clean engine oil
- ❑ 25 Nm

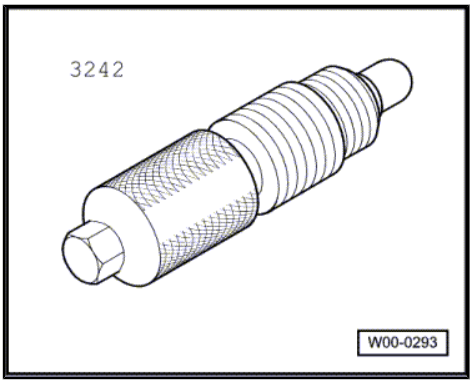
11 - Bolt

- ❑ 22 Nm

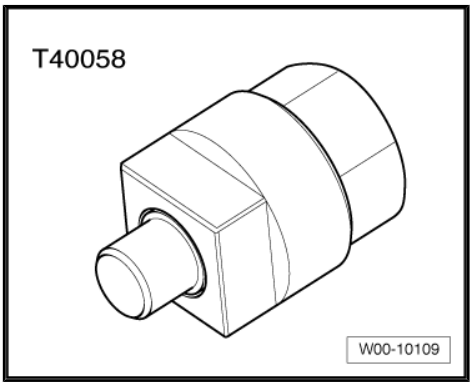
5.2 Removing and installing high-pressure pump

Special tools and workshop equipment required

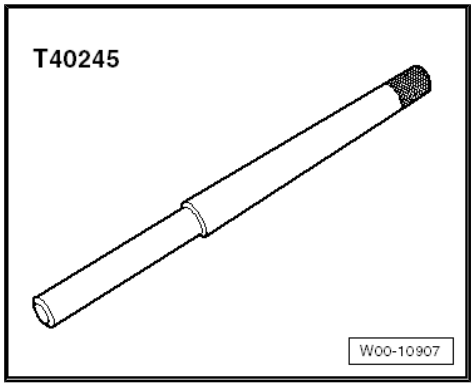
- ♦ Locking pin -3242-



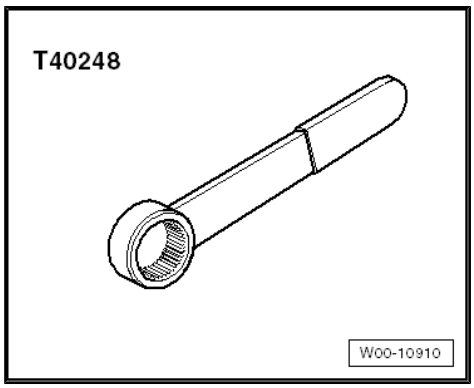
- ♦ Adapter -T40058-



♦ Locking pin -T40245-



♦ Counterhold tool -T40248- or counterhold tool -T40292- (different types of adapters are fitted depending on version)



Removing

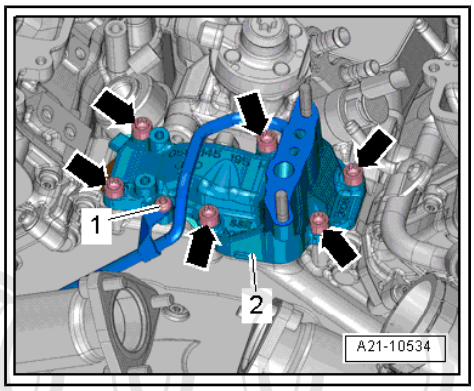
– Remove intake manifold ⇒ page 27 .

– Remove turbocharger ⇒ Rep. gr. 21 .

– Remove engine oil cooler ⇒ Rep. gr. 17 .

– Remove coolant shut-off valve ⇒ Rep. gr. 19 .

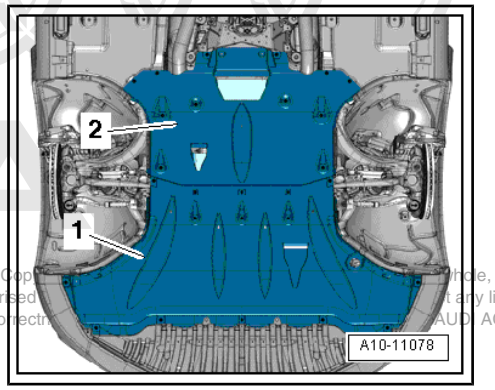
– Unscrew bolts -arrows- and swivel bracket -2- for turbocharger to side.



Note

Disregard -item 1-.

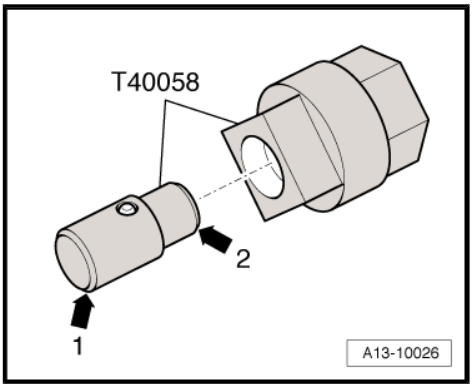
– Remove noise insulation -1- ⇒ Rep. gr. 66 .



– Insert guide pin of adapter -T40058- as follows:

• The larger-diameter section -arrow 1- faces towards the engine.

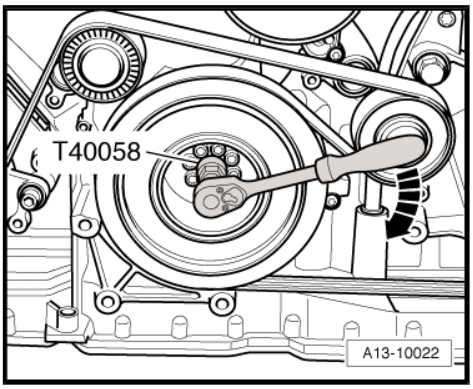
• The smaller-diameter section -arrow 2- faces the adapter.



Caution

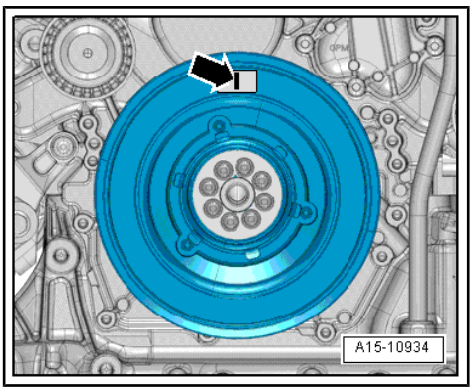
Irreparable damage can be caused if the camshaft timing chain slips.

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



– Use adapter -T40058- to turn crankshaft to “TDC” position.

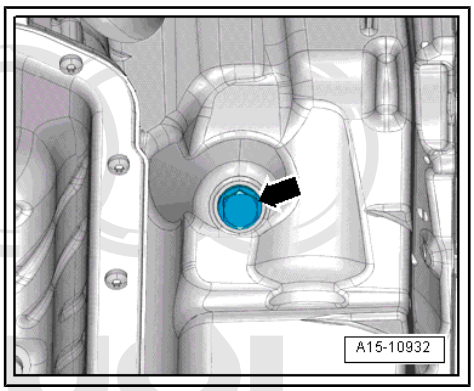
• Mark -arrow- must be perpendicular to centre of crankshaft, as shown in illustration.



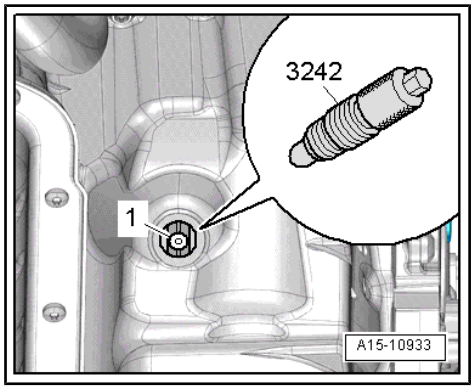
Note

Place a cloth beneath the sump (top section) to catch escaping oil.

– Unscrew plug -arrow- for “TDC” marking from sump (top section).



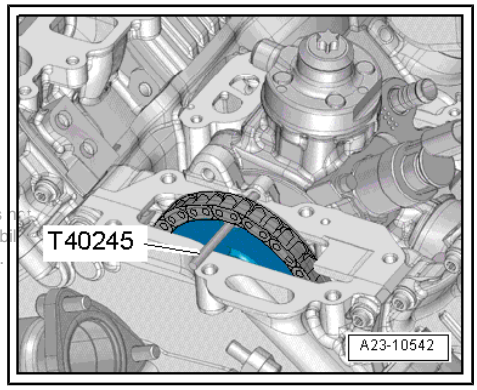
– Screw locking pin -3242- into hole (20 Nm); if necessary, turn crankshaft -1- backwards and forwards slightly to fully centralise locking pin.



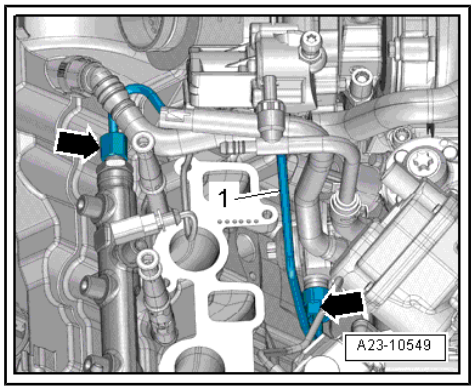
– Lock chain sprocket for high-pressure pump in position using locking pin -T40245- .

Caution

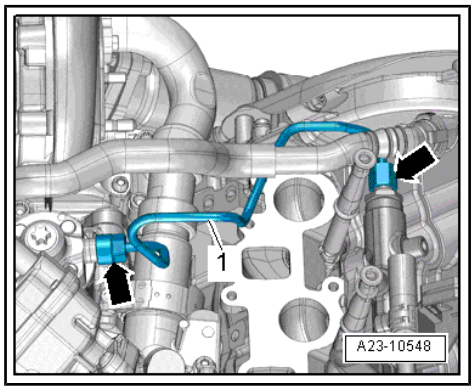
- *Use an absorbent cloth to catch escaping fuel.*
- *No fuel must be allowed to spill onto components or seals in the vicinity of the engine; this can ultimately lead to damage caused by leaking seals.*
- *Risk of malfunctions caused by dirt.*
- *Observe*
  ⇒ "1.3 Safety precautions when working on the fuel system", page 2 .



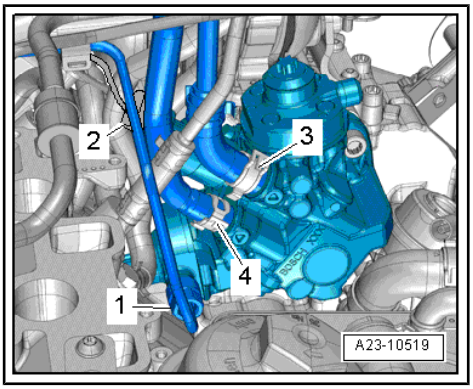
– Unscrew union nuts -arrows- and detach high-pressure pipe (right-side) -1-.



– Unscrew union nuts -arrows- and detach high-pressure pipe (left-side) -1-.
– Seal off open lines and connections with clean plugs.



– Unplug electrical connector -2-.
– Release hose clips -3 and 4- and detach fuel hoses.



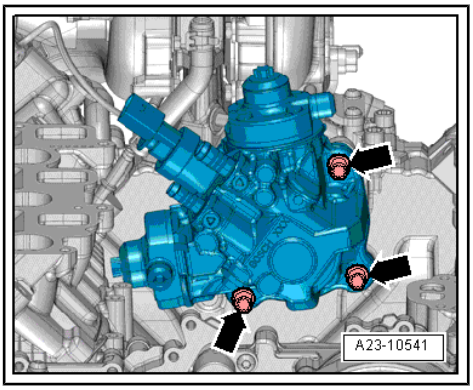
Note

Lay a cloth under the connection to catch escaping fuel.

Note

Disregard -item 1-.

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

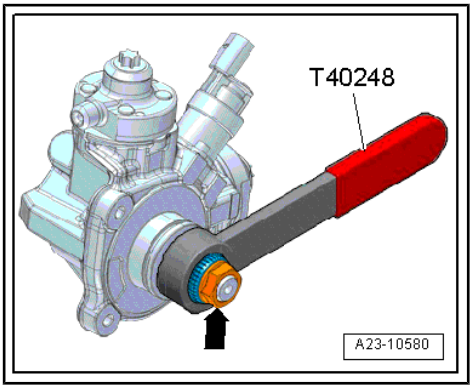


Installing

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

- Tightening torques
  ⇒ “5.1 Exploded view - high-pressure pump”, page 36

– When renewing high-pressure pump, install adapter from old high-pressure pump on new pump.
– Use counterhold tool -T40248- or counterhold tool -T40292- to loosen and tighten nut -arrow-.

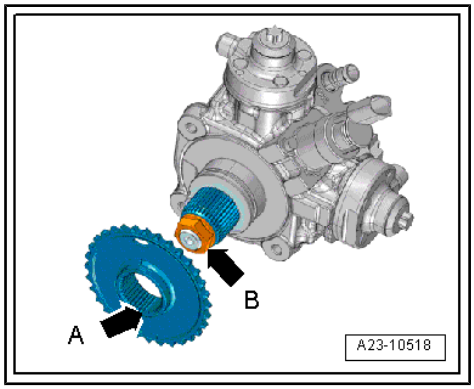


Note

- *Different types of adapters are fitted depending on version.*
- *Always renew high-pressure pipes when renewing high-pressure pump.*

– Insert high-pressure pump into chain sprocket.

• The dual toothing -arrow A- on the chain sprocket must align with the groove -arrow B- in the adapter on the high-pressure pump shaft.



– Remove locking pin -3242- and locking pin -T40245- .

– Tighten plug for “TDC” drilling in sump (top section) ⇒ Rep. gr. 17 .

– Install high-pressure pipes ⇒ “6.9 Installing high-pressure pipes”, page 62 .

– Install coolant shut-off valve ⇒ Rep. gr. 19 .

– Install engine oil cooler ⇒ Rep. gr. 17 .

– Install turbocharger ⇒ Rep. gr. 21 .

– Install intake manifold ⇒ page 27 .

– Install rear noise insulation ⇒ Rep. gr. 66 .

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 ⇒ “5.3 Performing first fuel filling after installing high-pressure pump”, page 42 .*

After renewing high-pressure pump and/or fuel pressure regulating valve -N276- , adaption must be performed. Use vehicle diagnostic tester .

5.3 Performing first fuel filling after installing high-pressure pump

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.*

Special tools and workshop equipment required

♦ Vehicle diagnostic tester

Procedure

• There must be sufficient fuel in the tank.

– Connect ⇒ 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” key: The fuel pump will 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 event memory.
– 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 Injectors

6.1 Exploded view - injectors

Caution

Risk of malfunctions caused by dirt.

- *Observe ⇒ “1.3 Safety precautions when working on the fuel system”, page 2 .*

1 - Support bracket

- ❑ For clamping piece
- ❑ Different tightening torques:
- ♦ To camshaft bearing: 2.5 Nm
- ♦ To cylinder head: 9 Nm

2 - Clamping piece

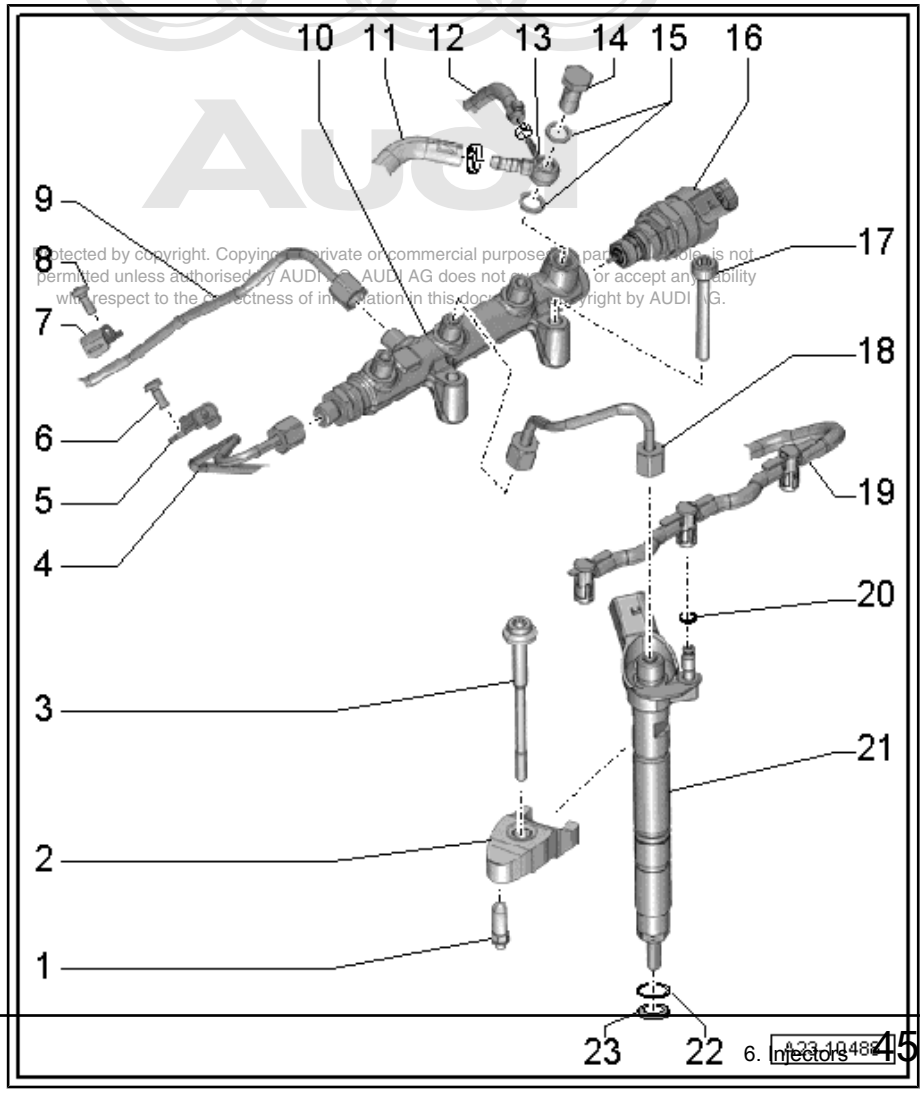
- ❑ Mark allocation for re-installation; pay attention to marking when installing
- ❑ Renew clamping piece if injector is renewed

3 - Bolt

- ❑ Renew
- ❑ Tighten initially to 8 Nm
- ❑ Then tighten 90° further

4 - High-pressure pipe

- ❑ From high-pressure pump to fuel rail
- ❑ Do not alter shape
- ❑ Check for damage before re-installing
- ❑ Installing ⇒ “6.9 Installing high-pressure pipes”,



page 62

- ❑ Lubricate threads of union nuts with clean engine oil
- ❑ 25 Nm

5 - Retaining clamp

- ❑ For high-pressure pipe

6 - Bolt

- ❑ 9 Nm

7 - Retaining clamp

- ❑ For high-pressure pipe

8 - Bolt

- ❑ 9 Nm

9 - High-pressure pipe

- ❑ From fuel rail on opposite side
- ❑ Do not alter shape
- ❑ Check for damage before re-installing
- ❑ Installing ⇒ “6.9 Installing high-pressure pipes”, page 62
- ❑ Lubricate threads of union nuts with clean engine oil
- ❑ 25 Nm

10 - Fuel rail

11 - Fuel return hose

- ❑ To fuel tank

12 - Fuel return hose

- ❑ From injectors
- ❑ 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 hoses for leaks

13 - Ring connection for hose

14 - Banjo bolt

- ❑ 25 Nm

15 - Seals

- ❑ Renew

16 - Fuel pressure regulating valve -N276-

- ❑ With deformable sealing lip
- ❑ Cannot be re-installed
- ❑ After renewing high-pressure pump and/or fuel pressure regulating valve -N276- , adaption must be performed. Use ⇒ Vehicle diagnostic tester
- ❑ Removing and installing ⇒ page 68
- ❑ Tightening torque ⇒ page 47

17 - Bolt

- ❑ 22 Nm

18 - 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 ⇒ “6.9 Installing high-pressure pipes”, page 62

- ❑ Lubricate threads of union nuts with clean engine oil
- ❑ 25 Nm

19 - Fuel return hose

- ❑ From injectors
- ❑ 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 hoses for leaks

20 - O-ring

- ❑ Renew

21 - Injector

- ❑ Mark allocation for re-installation; pay attention to marking when installing
- ❑ Removing and installing ⇒ page 58

22 - O-ring

- ❑ Renew

23 - Copper seal

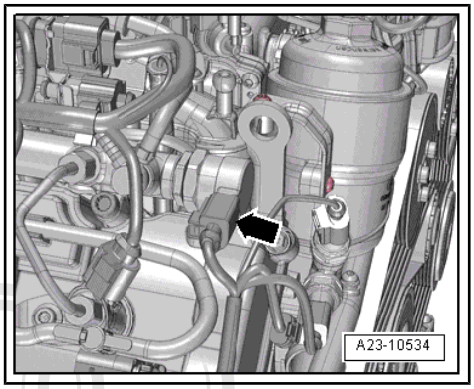
- ❑ Renew

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):

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

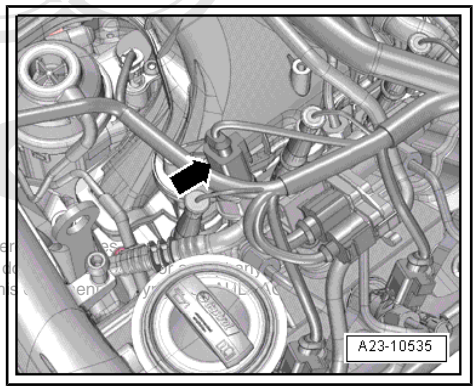


Fuel pressure sender -G247- - tightening torque

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

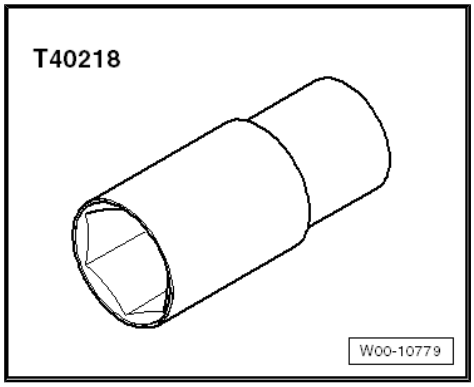
Note

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



Special tools and workshop equipment required

♦ Socket, 27 mm -T40218-



♦ Torque wrench

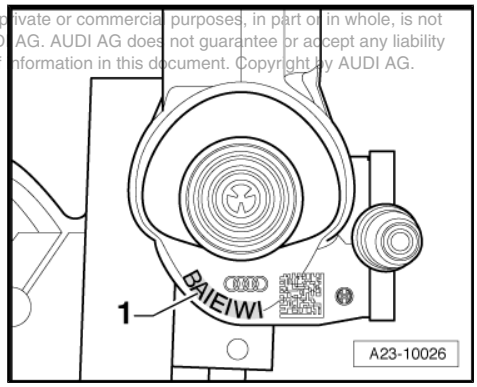
Stage	Tightening torque
1.	Screw in by hand until it makes contact
2.	60 Nm
3.	Turn back by 180°
4.	85 Nm

6.2 Checking injectors

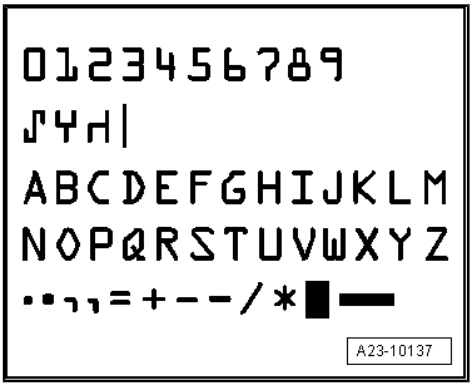
There are four different tests for checking the operation of the injectors.

- Performing adaption of correction values for injectors ⇒ page 48
- Checking return flow rate of injectors with engine running ⇒ page 49
- Checking return flow rate of injectors at starter cranking speed ⇒ page 53
- Checking for injectors sticking open ⇒ page 55

6.3 Performing adaption of correction values for injectors



- 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. It may consist of letters and/or numbers (ASCII code).
- Reference table for reading out letters and/or numbers on each injector



Special tools and workshop equipment required

- -Fahrzeugdiagnosetester-

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

When a new injector is installed, the adaption value must be written into the engine control unit.

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

– When the engine control unit is renewed, the appropriate “Injector delivery calibration values” with “Injector voltage calibration” values must be written into the new engine control unit.

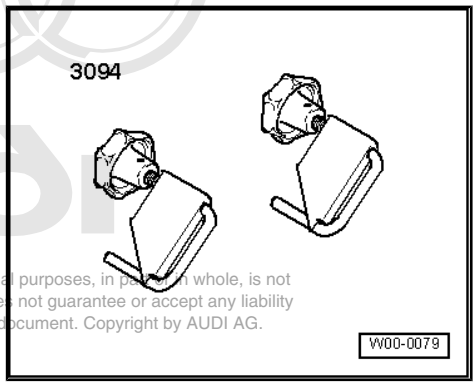
6.4 Checking return flow rate of injectors with engine running

Note

Checking return flow rate if engine does not start *⇒ page 53*

Special tools and workshop equipment required

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



- Return flow meter -VAS 6684-
- Fuel-resistant measuring container

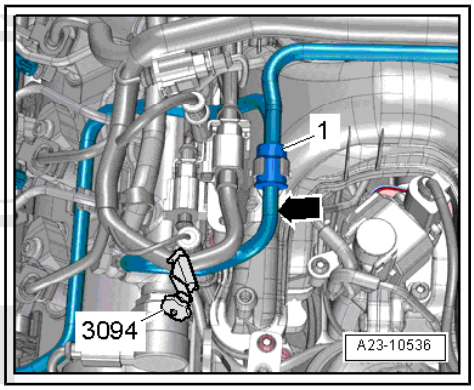
Measuring return flow rate of all injectors

– Pull off engine cover panel ⇒ page 22 .

Caution

Risk of malfunctions caused by dirt.

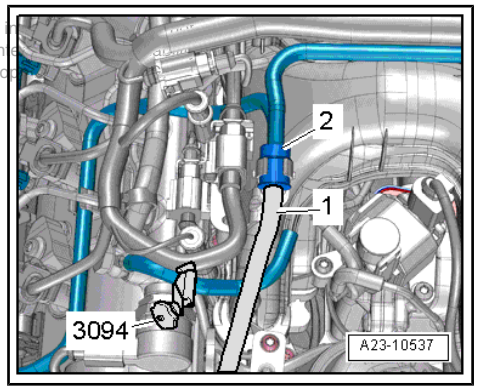
- *Observe ⇒ "1.3 Safety precautions when working on the fuel system", page 2 .*



– Clamp off fuel return hose -arrow- downstream of restrictor -1- using hose clamp up to 25 mm -3094- and disconnect fuel return hose.

– 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.

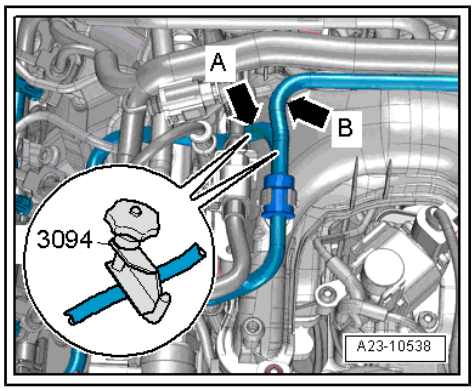
– Clean all return line connections with engine cleaner or brake cleaner and dry.

Measuring, cylinder bank 1:

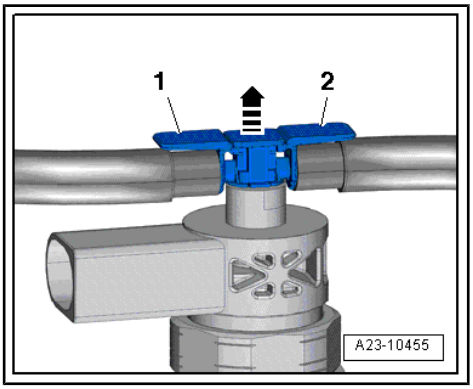
– Clamp off fuel return hose -arrow A- on cylinder bank 1 (right-side) using hose clamp up to 25 mm -3094- .

Note

Disregard -arrow B-.



– Disconnect fuel return hoses from injectors; to do so, press down both tabs -1 and 2- and at the same time pull centre piece up to release connection -arrow-.



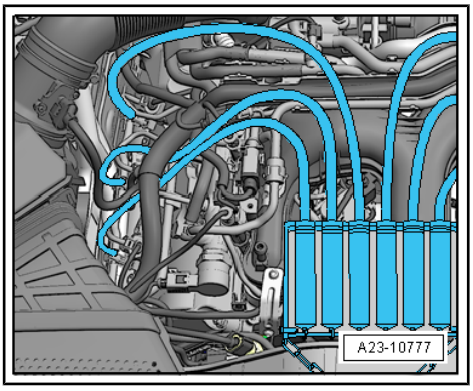
– Connect hoses of return flow meter -VAS 6684- to return line connections of all three injectors for cylinder bank 1.

– Start engine and run at idling speed for several minutes:

Caution

Risk of damage to injectors due to increased engine speed.

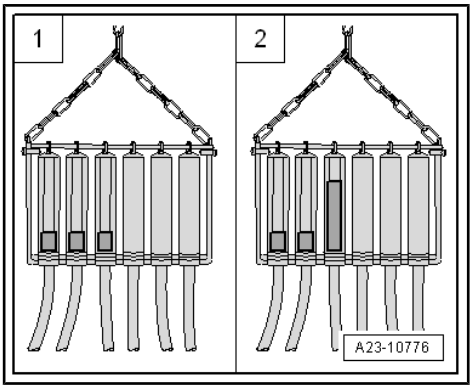
- *Do NOT press the accelerator during this test; the engine must only run at idling speed.*



– When the engine is warm and running at idling speed, the return flow rates at each of the 3 injectors must not differ by more than a small amount.

Evaluating return flow rate:

- 1 = injectors OK; return flow rate approx. identical on all injectors.
- 2 = injector for cylinder 3 not OK; return flow rate surpasses value three times the volume of smallest measured return flow rate.

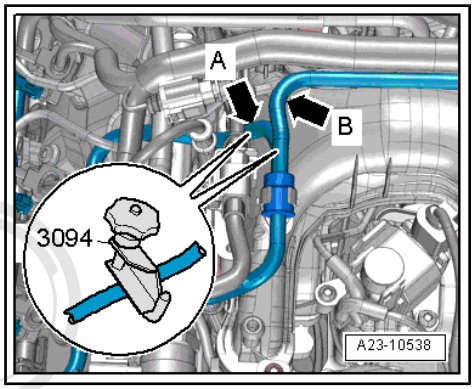


Note

There is a mechanical fault at the injector if the return flow rate is greater than three times the volume of the smallest measured return flow rate; this injector must be renewed
⇒ "6.8 Removing and installing injectors", page 58 .

Measuring, cylinder bank 2:

– Clamp off fuel return hose -arrow B- on cylinder bank 2 (left-side) using hose clamp up to 25 mm -3094- .



Note

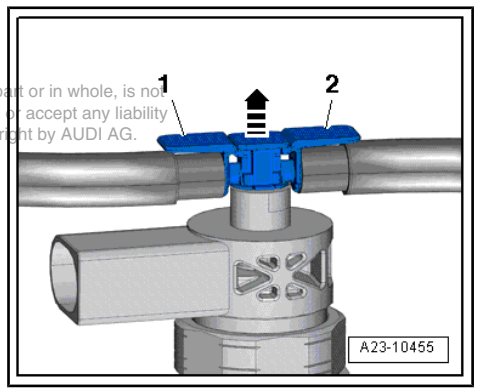
Disregard -arrow A-.

Caution

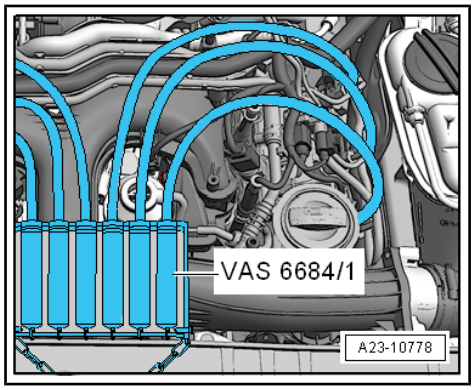
Risk of malfunctions caused by dirt.

- ***Observe***
  ⇒ "1.3 Safety precautions when working on the fuel system", page 2 .

– Disconnect fuel return hoses from injectors; to do so, press down both tabs -1 and 2- and at the same time pull centre piece up to release connection -arrow-.



– Connect hoses of return flow meter -VAS 6684- to return line connections of all three injectors for cylinder bank 2.



– Start engine and run at idling speed for several minutes:

Caution

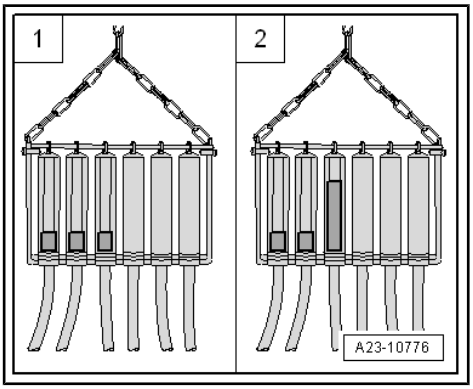
Risk of damage to injectors due to increased engine speed.

- ***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 3 injectors must not differ by more than a small amount.

Evaluating return flow rate:

- 1 = injectors OK; return flow rate approx. identical on all injectors.
- 2 = injector for cylinder 3 not OK; return flow rate surpasses value three times the volume of smallest measured return flow rate.



Note

There is a mechanical fault at the injector if the return flow rate is greater than three times the volume of the smallest measured return flow rate; this injector must be renewed
⇒ "6.8 Removing and installing injectors", page 58 .

– If one injector has a significantly higher return flow rate than the others, it must be renewed ⇒ page 58 .

Assembling

– Check O-ring for fuel return line connection for damage and deformation.

If O-ring is damaged or deformed, renew O-ring.

Note

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

– Push the return line connections carefully over the new seals and onto the injectors. The catch should engage audibly. Then press release pin down carefully.

Bleeding fuel system and checking for leaks

– Run engine at idling speed for several minutes (do not press accelerator) and then switch off. Fuel system will bleed itself automatically.

– Check the entire fuel system for leaks.

Renew the affected component if leakage occurs.

– 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.

6.5 Checking 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

- Return flow meter -VAS 6684-

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.

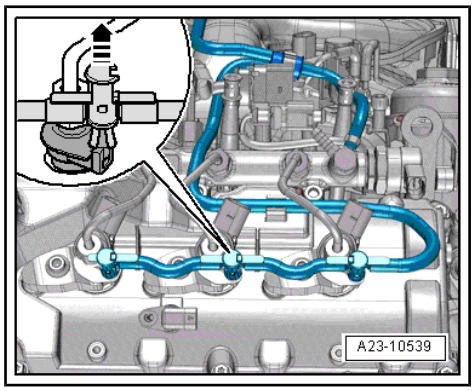
– Pull off engine cover panel ⇒ page 22 .

– Clean all return line connections with engine cleaner or brake cleaner and dry.

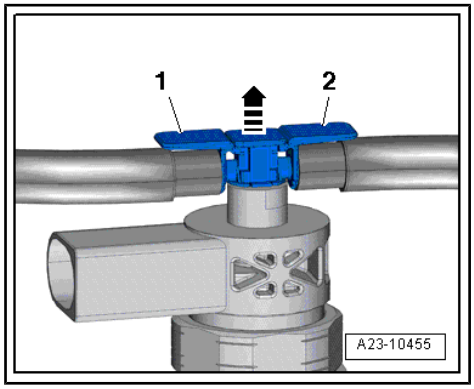
Caution

Risk of malfunctions caused by dirt.

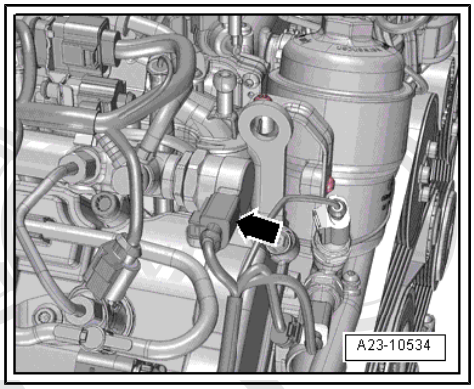
- *Observe ⇒ "1.3 Safety precautions when working on the fuel system", page 2 .*



– Disconnect fuel return hoses from injectors; to do so, press down both tabs -1 and 2- 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-.

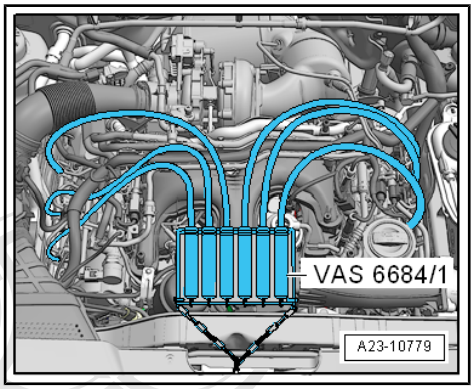


– Connect hoses of return flow meter -VAS 6684- to all return line connections of the six injectors.

– 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 58 .



Assembling

– Plug in electrical connector at fuel pressure regulating valve -N276- .

– Check O-ring for fuel return line connection for damage and deformation.

If O-ring is damaged or deformed, renew O-ring.

Note

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

– Push the return line connections carefully over the new seals and onto the injectors. The catch should engage audibly. Then press release pin down carefully.

– Entries are stored in the event memory of the engine control unit because electrical connectors were unplugged: Interrogate and erase event memory.

Bleeding fuel system and checking for leaks

– Run engine at idling speed for several minutes (do not press accelerator) and then switch off. Fuel system will bleed itself automatically.

– Check the entire fuel system for leaks.

Renew the affected component if leakage occurs.

– 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

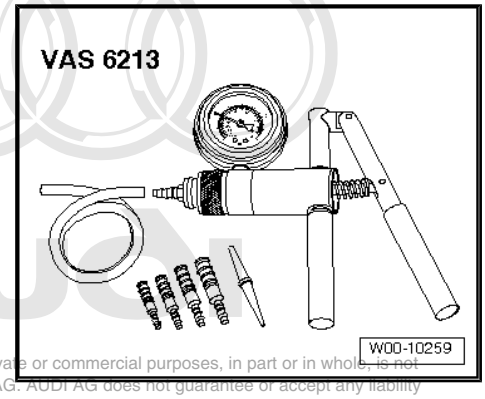
If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the event memory. Then continue the road test.

6.6 Checking for injectors sticking open

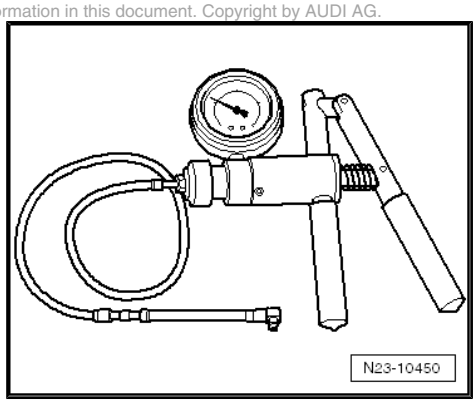
If one of the injectors is sticking open, this means that the injector needle is not closing fully and fuel escapes into the cylinder.

Special tools and workshop equipment required

- Hand vacuum pump -VAS 6213-



- Use a return line to make an -adapter-.



Procedure

– Interrogate and erase event memory using ⇒ Vehicle diagnostic tester.

– Pull off engine cover panel ⇒ page 22 .

– Clean all fuel rail connections with engine cleaner or brake cleaner and dry.

Note

- *Make sure all parts are clean; no dirt must be allowed to enter the fuel system.*
- *Check all cylinders in turn.*

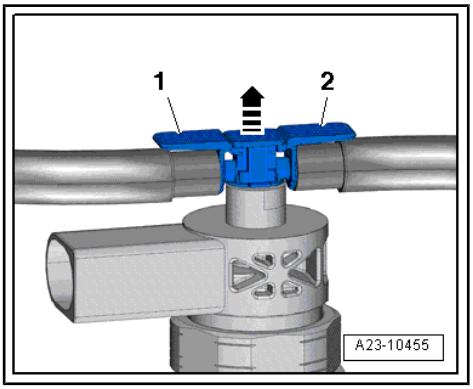
Caution

Risk of malfunctions caused by dirt.

- ***Observe***
  ⇒ "1.3 Safety precautions when working on the fuel system", page 2 .

Start with cylinder No. 1.

– Disconnect fuel return hoses from injectors; to do so, press down both tabs -1 and 2- and at the same time pull centre piece up to release connection -arrow-.
– Connect adapter to return line connection of injector to be tested after adapter has been cleaned and blown out.
– Generate a vacuum of -500 mbar using the hand vacuum pump -VAS 6213- .



If the vacuum reading remains the same for 30 seconds, the injector is OK.

In the case of a faulty injector, the vacuum will fall back to 0 bar within 2 to 3 seconds.

Repeat test if necessary; note drop in vacuum reading on hand vacuum pump -VAS 6213- .

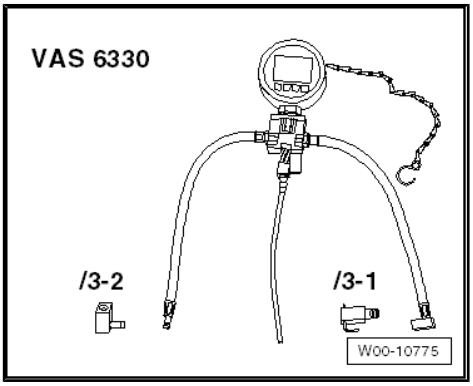
– Renew faulty injectors ⇒ page 58 .

6.7 Checking restrictor in fuel return line

On vehicles with fuel systems with 6 bar, the restrictor maintains a constant residual pressure in the fuel return line. This residual pressure is required for the control function of the injectors.

Special tools and workshop equipment required

♦ Tester for fuel return system -VAS 6330-



Caution

Risk of malfunctions caused by dirt.

♦ *Observe*
⇒ "1.3 Safety precautions when working on the fuel system", page 2 .

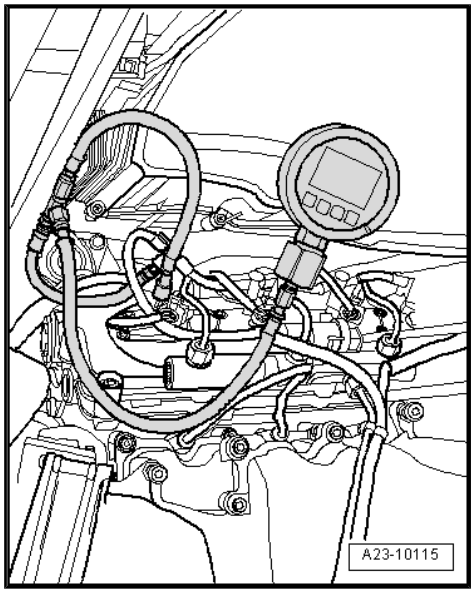
– Pull off engine cover panel ⇒ page 22 .
– Clean return line connection on cylinder 1 (with commercial cleaning solution or similar) before removing.
– Dry return line connection on cylinder 1.
– Cover return line connection on cylinder 1 with a cloth.
– Detach return line connection from cylinder 1. To do so, press tabs down and pull centre piece up to release connection.

Note

No dirt must be allowed to get into the disconnected return line or the open connection on the injector.

– Connect tester for fuel return system -VAS 6330- between return line connection on injector and return line.
– Start engine.
– Check pressure indicated on tester.
♦ Specification: approx. 4 bar

If specification is not attained, renew fuel return line with restrictor.



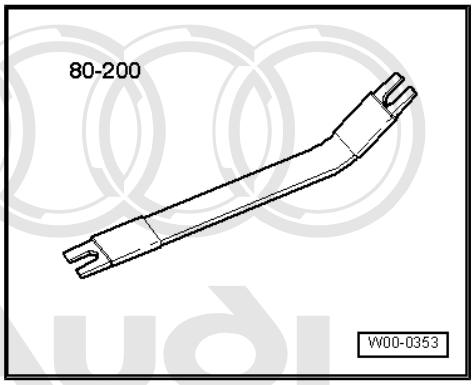
6.8 Removing and installing injectors

Note

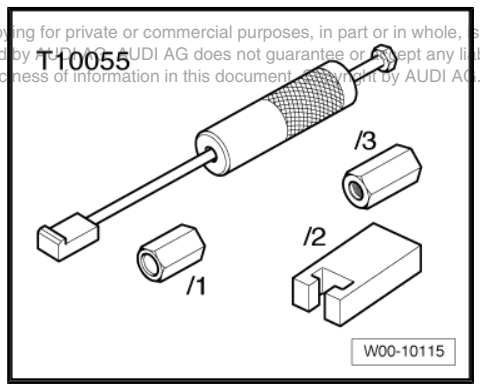
The removal and installation procedures are described for cylinder bank 2 (left-side).

Special tools and workshop equipment required

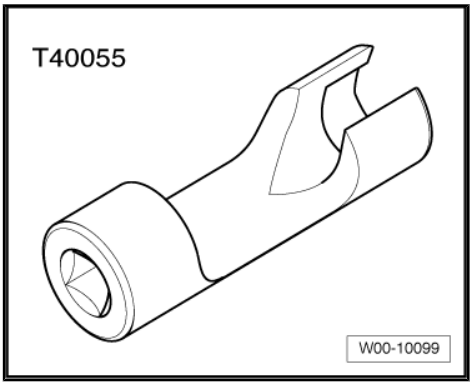
♦ Removal lever -80 - 200-



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



- Socket -T40055-



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 housing ⇒ page 24 .

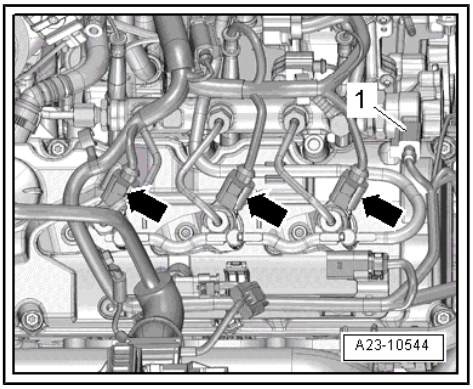
Caution

Risk of malfunctions caused by dirt.

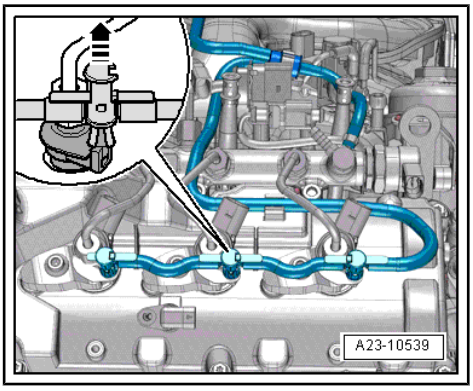
- *Observe ⇒ "1.3 Safety precautions when working on the fuel system", page 2 .*

– Unplug electrical connectors at injectors -arrows- and at fuel pressure regulating valve -N276- -item 1-.

– Move clear electrical wiring harness at cylinder head cover and fuel rail.



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

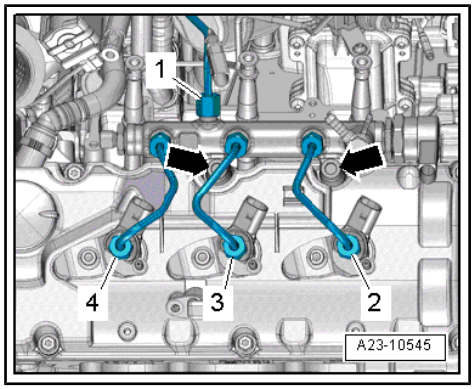


Caution

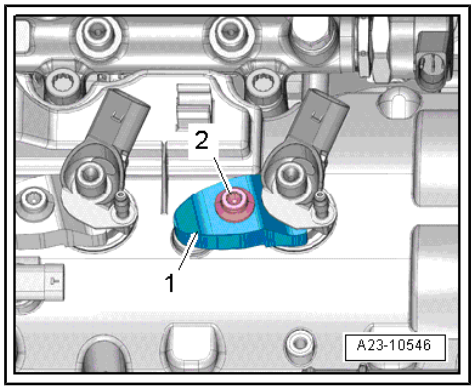
Used injectors must always be re-installed on the same cylinder.

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

– Loosen union nuts -2, 3 and 4- using socket -T40055- and remove high-pressure pipes.
– Seal off open lines and connections with clean plugs.

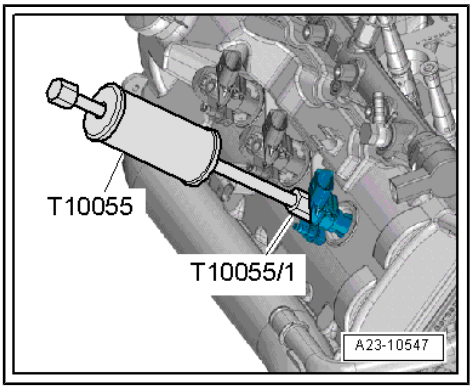


– Mark position of clamping piece -1- in relation to injector with paint for re-installation.
– Unscrew bolt -2- and detach clamping piece.
– Repeat work steps on remaining injectors.



– Apply puller -T10055- with adapter -T10055/1- to injector, as shown in illustration. Pull off injector by tapping gently.

– Place removed injectors on a clean cloth.



Installing used injectors

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

- ♦ Bolt for clamping piece
- ♦ Copper seal
- ♦ Renew O-ring for injector bore.
- ♦ O-ring for fuel return line connection

– Spray tip of injector nozzle with rust-solvent spray. Wait approx. 5 minutes and wipe off soot particles and oil with a cloth.

– To remove the old copper seal from the injector, clamp the 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.

Installing new injectors

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

- ♦ Clamping piece
- ♦ Bolt for clamping piece
- ♦ Copper seal
- ♦ Renew 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):

– Use a plastic bush to fit the new copper seal.

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

– Fit new O-ring for injector bore.

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 torques
  ⇒ “6.1 Exploded view - injectors”, page 45

– Install high-pressure pipes
  ⇒ “6.9 Installing high-pressure pipes”, page 62 .

Note

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

– Push the return line connections carefully over the new seals and onto the injectors. The catch should engage audibly. Then press release pin down carefully.

After renewing one or more injectors, the "injector delivery calibration values" and "injector voltage calibration values" for the new injectors must be written into the engine control unit ⇒ page 48 **.**

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.

Bleeding fuel system and checking for leaks

– Run engine at idling speed for several minutes (do not press accelerator) and then switch off.

Note

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

– Switch off ignition.

– Carefully check the complete fuel system including all 6 return line connections 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 inspect high-pressure section of fuel system again for leaks.

Note

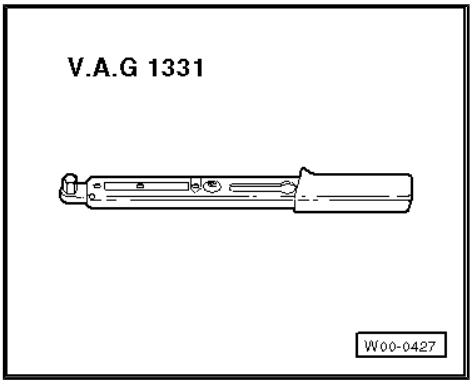
If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the event memory. Then continue the road test.

– Interrogate the event memory again after road-testing.

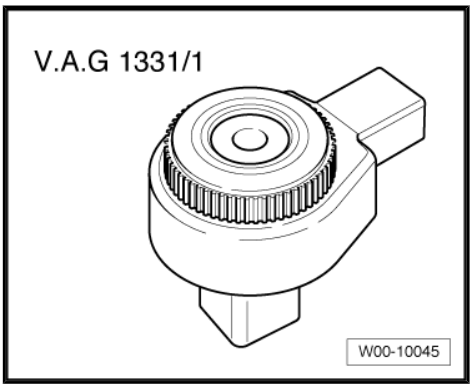
6.9 Installing high-pressure pipes

Special tools and workshop equipment required

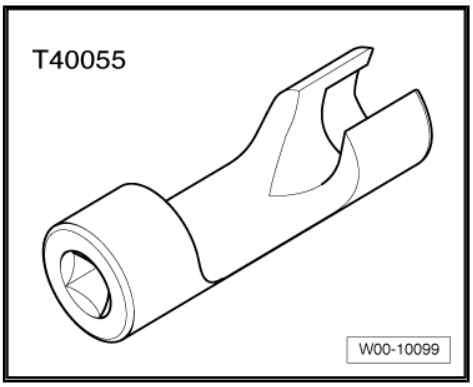
- Torque wrench -V.A.G 1331-



- Ratchet -V.A.G 1331/1-



- Socket -T40055-



Procedure

Note

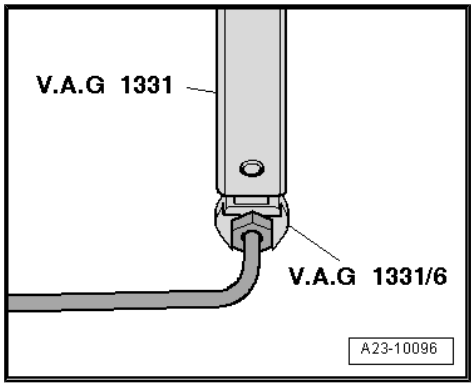
- *Before re-installation, check taper seats for deformation, cracks, damage, scores and corrosion. Renew high-pressure pipes if they are damaged or corroded.*
- *Check that bore in pipe is not distorted, restricted or damaged in any other way.*
- *When re-installing "old" high-pressure pipe, observe marking for installation position.*

– Use vacuum cleaner to remove dirt from taper seat at fuel rail.
– Clean fuel pipe and end of pipe with engine cleaner or brake cleaner and dry.
– Lubricate threads of union nuts with clean engine oil.
– Hand-tighten union nuts on high-pressure pipes until they make contact (ensure that pipes are not under tension).

- Tightening torques
  ⇒ “6.1 Exploded view - injectors”, page 45

Union nuts (AF 17) on fuel rail:

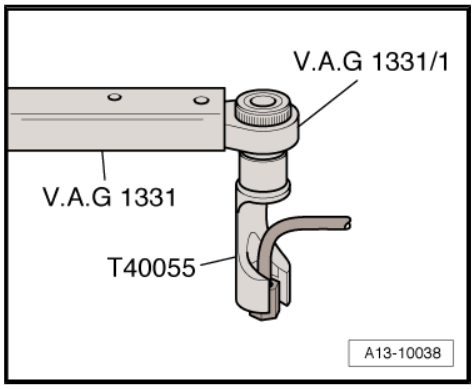
– To secure high-pressure pipes, use torque wrench -V.A.G 1331- with tool insert, AF 17 -V.A.G 1331/6- .



Union nuts (AF 17) on 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
  ⇒ “2.3 Filling and bleeding fuel system”, page 18 .

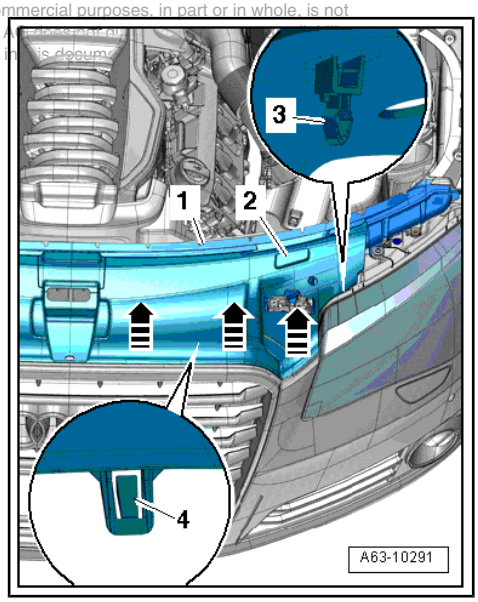


7 Senders and sensors

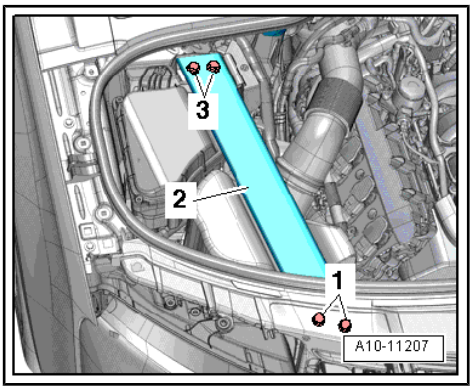
7.1 Removing and installing air mass meter -G70-

Removing

– Remove lock carrier cover -2- ⇒ Rep. gr. 63 .

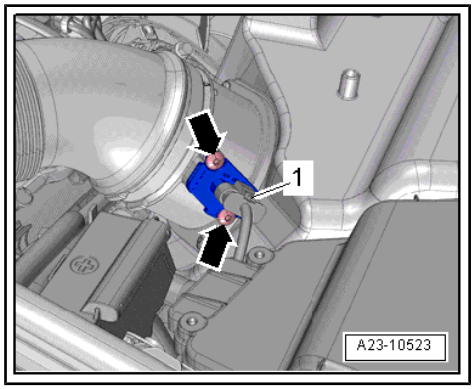


– Remove bolts -1, 3- and detach longitudinal member (top right) -2-.



– Unplug electrical connector -1-.

– Unscrew bolts -arrows- and pull out air mass meter -G70- carefully.



Installing

To ensure the proper function of the air mass meter -G70- it is important to observe the following instructions.

Note

- *If the air filter element is very dirty or wet, dirt or water could reach the air mass meter -G70- 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.*
- *Always renew seal if damaged (air leaks in intake system).*
- *Use a silicone-free lubricant when installing the air hose and seal.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue*

Tightening torques:

- ⇒ “3.1 Exploded view - air cleaner housing”, page 20

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

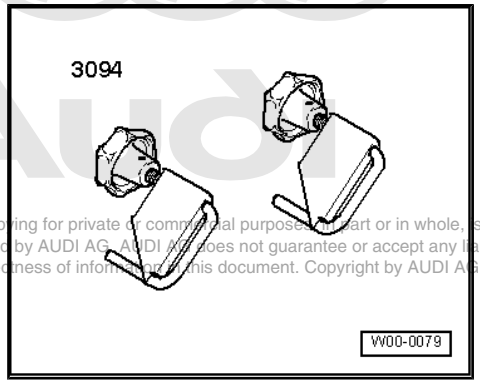
– Install longitudinal member (top right) ⇒ Rep. gr. 50 .

– Install lock carrier cover ⇒ Rep. gr. 63 .

7.2 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
- Test hose for return line connection

Procedure

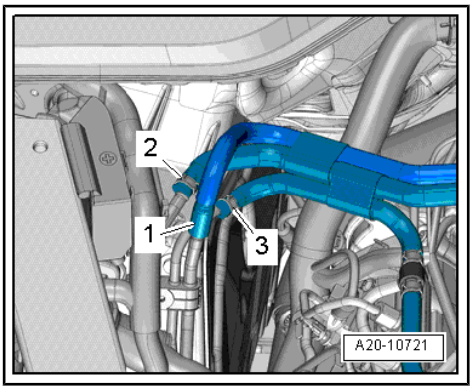
– Pull off engine cover panel ⇒ page 22 .

WARNING

Risk of malfunctions caused by dirt.

- *Observe*
  ⇒ "1.3 Safety precautions when working on the fuel system", page 2 .

– Disconnect fuel return hose -3-.

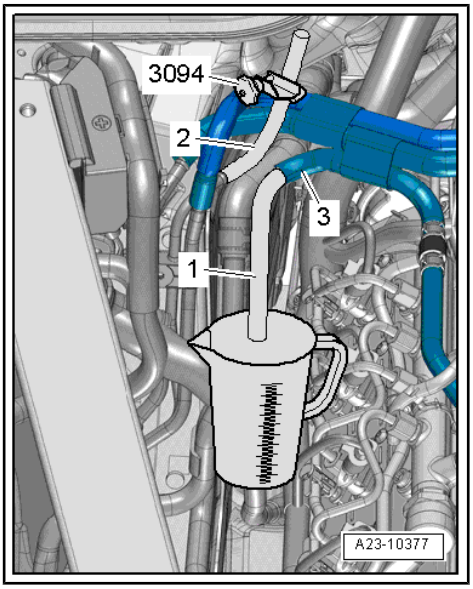


Note

Disregard -items 1, 2-.

– Seal off open return line connection with a test hose -2- and a hose clamp up to 25 mm -3094- .
– Connect another test hose -1- to fuel return hose -3- and hold end of test hose in measuring container.
– Start the engine and run at idling speed.
• Return flow rate (engine start): 0 ml
• Return flow rate after 2 minutes: 30 ... 55 ml

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



7.3 Removing and installing fuel pressure regulating valve -N276-

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 hose.*
- *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.*

Removing

– Pull off engine cover panel ⇒ page 22 .

WARNING

Risk of malfunctions caused by dirt.

- *Observe ⇒ "1.3 Safety precautions when working on the fuel system", page 2 .*

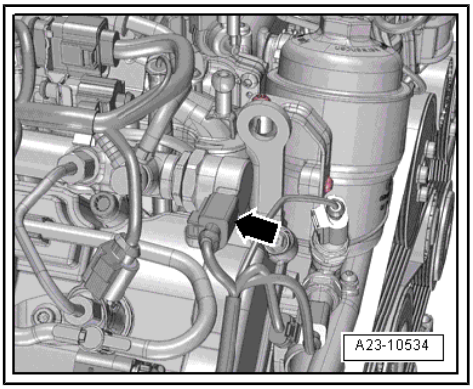
– Clean thread and area all around fuel pressure regulating valve with engine cleaner or brake cleaner and dry.

Note

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

– Remove banjo bolt for fuel return hoses.

– Unplug electrical connector -arrow- at fuel pressure regulating valve -N276- .
– Loosen union nut at regulating valve (counterhold at fuel rail). 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 opening in fuel rail immediately with a suitable plug to prevent dirt from entering.

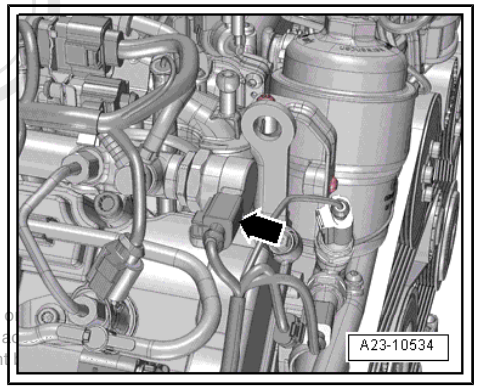
Installing

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

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 and the deformable sealing lip of the fuel pressure regulating valve -N276- must be coated with diesel fuel.*

– 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 (counterhold hexagon flats on housing):



Tightening torques:

◆ ⇒ Fig. "" Fuel pressure regulating valve -N276- - tightening torque"" , page 47

– Tighten banjo bolt for fuel return lines with new seals to 25 Nm.

Bleeding fuel system and checking for leaks

– After installation, run engine at moderate speed for several minutes and then switch off.

Note

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

– Interrogate event memory and erase it if necessary.
– Switch off ignition.
– Carefully check the entire fuel system for leaks.

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

After renewing high-pressure pump and/or fuel pressure regulating valve -N276- , adaption must be performed. Use ⇒ Vehicle 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

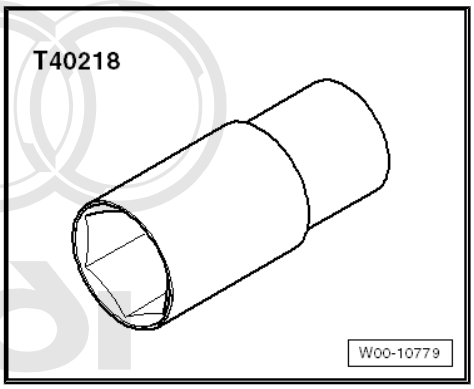
If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the event memory. Then continue the road test.

– After road test, interrogate event memory again.

7.4 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

Caution

Risk of malfunctions caused by dirt.

- ***Observe***
  ⇒ "1.3 Safety precautions when working on the fuel system", page 2 .

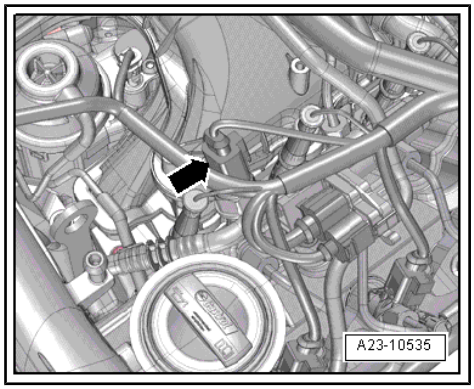
– Pull off engine cover panel ⇒ page 22 .

– Clean thread and area all around fuel pressure sender with engine cleaner or brake cleaner and dry.

Note

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

– 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 opening in fuel rail immediately with a suitable plug to prevent dirt from entering.

Installing

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

Note

- *If the deformable sealing lip and the thread of the fuel pressure sender -G247- are not damaged, the sender can be re-used once.*
- *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:

- Note tightening sequence and tightening torque ⇒ Fig. “ Fuel pressure sender -G247- - tightening torque” , page 47 .

Bleeding fuel system and checking for leaks

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.

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.

7.5 Removing and installing pressure differential sender -G505-

Note

The pressure differential sender -G505- detects the amount of deposits in the particulate filter.

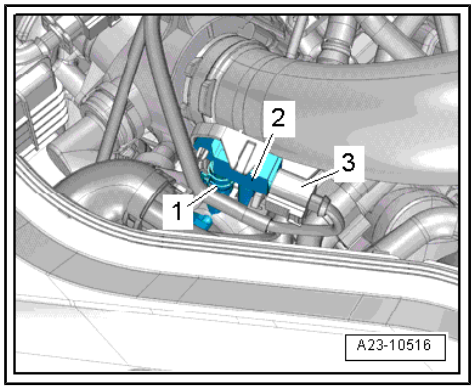
Special tools and workshop equipment required

♦ Vehicle diagnostic tester

Removing

– Pull off engine cover panel ⇒ page 22 .

– Unplug electrical connector -3-.
– Unclip pressure differential sender -G505- -2- from bracket and detach.
– Before disconnecting, spray the hoses for the pressure differential sender -G505- with suitable release agent.
– Carefully disconnect the hoses from their connections (take care to keep the hoses straight: the connections on pressure differential sender -G505- can break off easily).



Note

The short measuring line can be pulled off with the pressure differential sender -G505- removed.

Installing

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

Note

- *Before installing, blow out hose for pressure differential sender -G505- towards particulate filter with compressed air (hose can become obstructed or may ice up due to condensation).*
- *Make sure that hoses are securely fitted and seal properly.*
- *If pressure pipes have been detached from particulate filter, tighten connections to specified torque.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

Tightening torques:

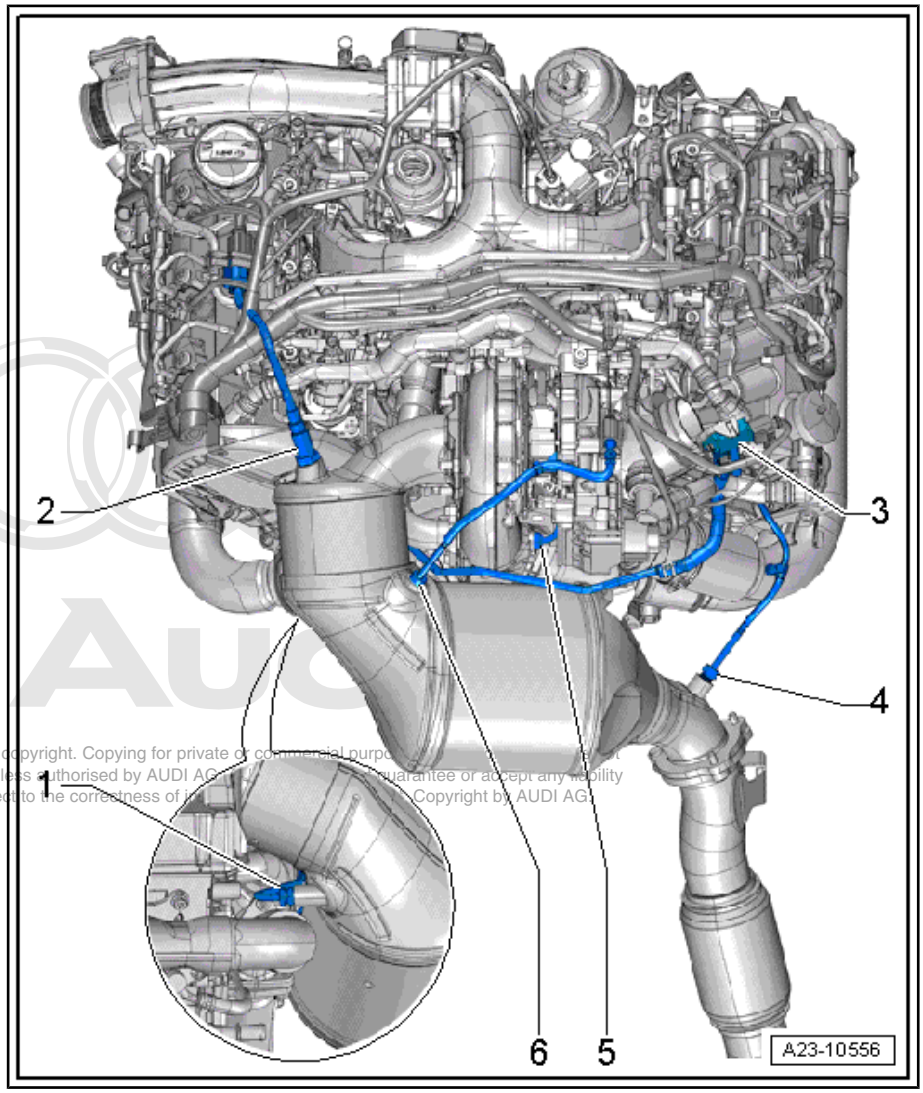
- ⇒ “8.1 Exploded view - Lambda probe (rest-of-world vehicles without SCR)”, page 75
- ⇒ “8.2 Exploded view - Lambda probe (USA vehicles with SCR)”, page 76

Adaption must be performed after renewing pressure differential sender -G505- and/or particulate filter. Use ⇒ Vehicle diagnostic tester.

8 Lambda probe

8.1 Exploded view - Lambda probe (rest-of-world vehicles without SCR)

Vehicles without SCR catalytic converter



1 - Pressure pipe

- ❑ For pressure differential sender -G505-
- ❑ Tightening torque ⇒ Rep. gr. 26

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

- ❑ 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
- ❑ Removing and installing ⇒ page 77
- ❑ 55 Nm

3 - Pressure differential sender -G505-

- ❑ Removing and installing ⇒ “7.5 Removing and installing pressure differential sender G505 ”, page 73
- ❑ Adaption must be performed after renewing this component

4 - Exhaust gas temperature sender 4 -G648-

- ❑ Removing and installing ⇒ Rep. gr. 26

5 - Exhaust gas temperature sender 1 -G235-

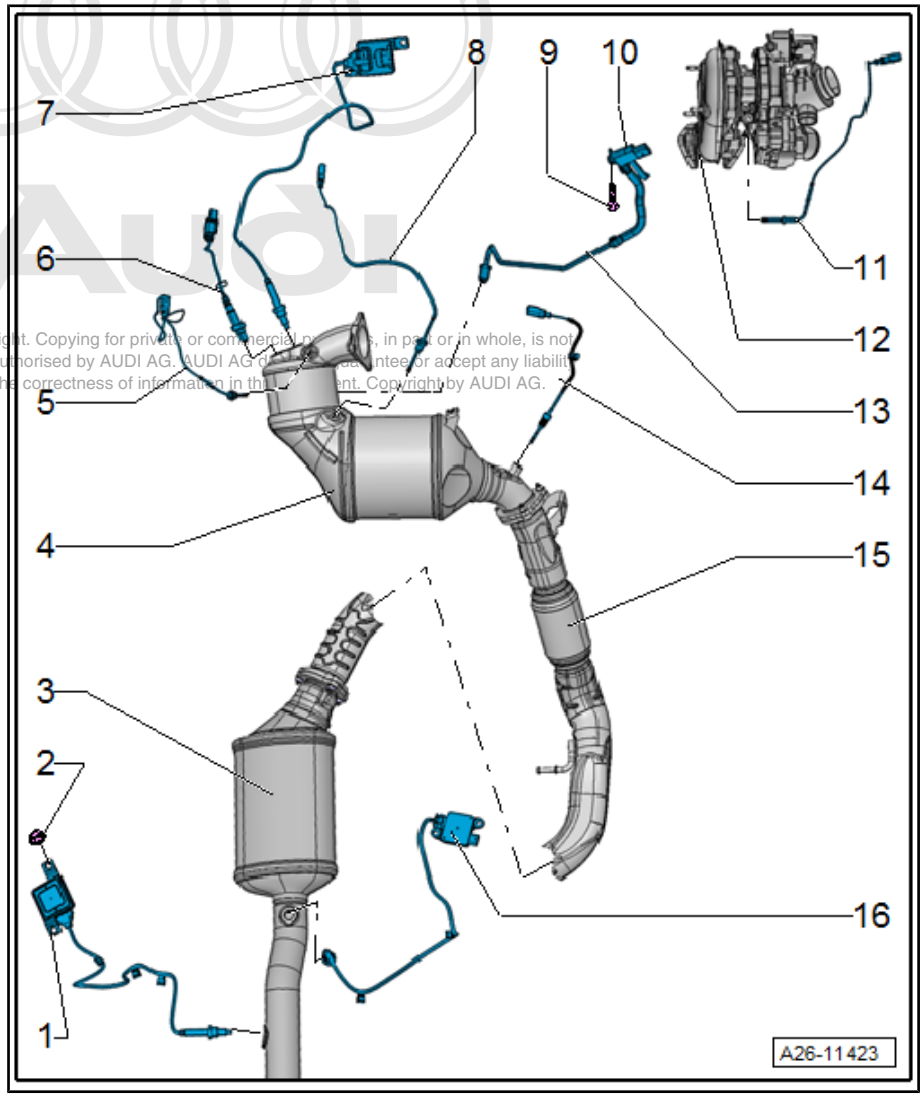
- ❑ Removing and installing ⇒ Rep. gr. 26

6 - Exhaust gas temperature sender 3 -G495-

- ❑ Removing and installing ⇒ Rep. gr. 26

8.2 Exploded view - Lambda probe (USA vehicles with SCR)

Vehicles with SCR catalytic converter



1 - Control unit for NOx sender 2 -J881- with NOx sender 2 -G687-

- ❑ Installed on left side (as seen in direction of travel)
- ❑ Removing and installing ⇒ page 80
- ❑ 50 Nm

2 - Bolt

- ❑ 6 Nm

3 - SCR catalytic converter

4 - Particulate filter

5 - Exhaust gas temperature sender 2 -G448-

- ❑ Installed on certain country-specific versions ⇒ Electronic parts catalogue
- ❑ Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue
- ❑ Removing and installing ⇒ Rep. gr. 26
- ❑ 45 Nm

6 - Lambda probe -G39- with Lambda probe heater -Z19-

- ❑ 55 Nm
- ❑ Removing and installing ⇒ page 77

7 - NOx sender -G295- with control unit for NOx sender -J583-

- ❑ NOx sender -G295- : 50 Nm
- ❑ Control unit for NOx sender -J583- : 8 Nm
- ❑ Removing and installing ⇒ “8.4 Removing and installing control unit for NOx sender J583 with NOx sender G295 ”, page 78

8 - Exhaust gas temperature sender 3 -G495-

- ❑ Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue
- ❑ Removing and installing ⇒ Rep. gr. 26
- ❑ 45 Nm

9 - Bolt

- ❑ 4.5 Nm

10 - Pressure differential sender -G505-

- ❑ Adaption must be performed with a ⇒ Vehicle diagnostic tester after renewing this component
- ❑ Removing and installing ⇒ “7.5 Removing and installing pressure differential sender G505 ”, page 73
- ❑ 45 Nm

11 - Exhaust gas temperature sender 1 -G235-

- ❑ Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue
- ❑ 45 Nm

12 - Turbocharger

13 - Pressure line for exhaust gas pressure sensor 1 -G450-

- ❑ Fit into particulate filter, clip into bracket and tighten.
- ❑ 45 Nm

14 - Exhaust gas temperature sender 4 -G648-

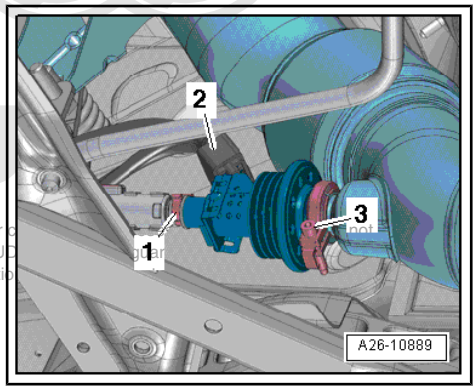
- ❑ Removing and installing ⇒ Rep. gr. 26
- ❑ Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue
- ❑ 45 Nm

15 - Front exhaust pipe

16 - Particulate sensor -G784-

- ❑ Installed on certain country-specific versions ⇒ Electronic parts catalogue
- ❑ Installed on right side (as seen in direction of travel)
- ❑ Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue
- ❑ Removing and installing ⇒ Rep. gr. 26
- ❑ 50 Nm

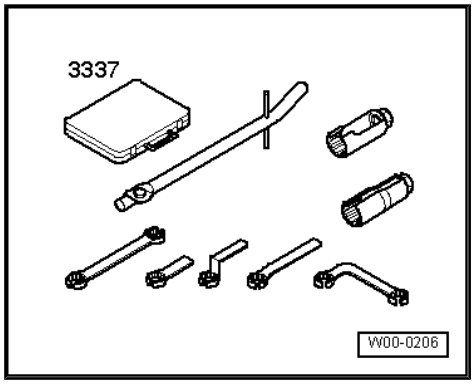
Injector for reducing agent -N474-



8.3 Removing and installing Lambda probe -G39- with Lambda probe heater -Z19-

Special tools and workshop equipment required

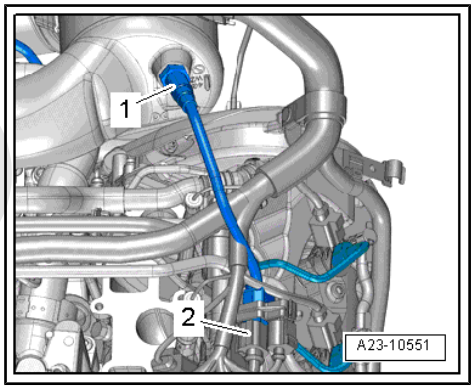
- Lambda probe open ring spanner set -3337-



Removing

– Pull off engine cover panel ⇒ page 22 .

– Unplug electrical connector -2- for Lambda probe -G39- .



Note

Fit all cable ties in the original positions when installing.

– Unscrew Lambda probe -G39- -1- using tool from Lambda probe open ring spanner set -3337- .

Installing

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

Note

- *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*
- *In the case of a used Lambda probe grease only the thread with high-temperature paste. The paste must not get into the slots on the Lambda probe body. For high-temperature paste refer to ⇒ Parts catalogue .*
- *When installing, the Lambda probe wiring must always be reattached at the same locations to prevent it from coming into contact with the exhaust pipe.*

Tightening torques:

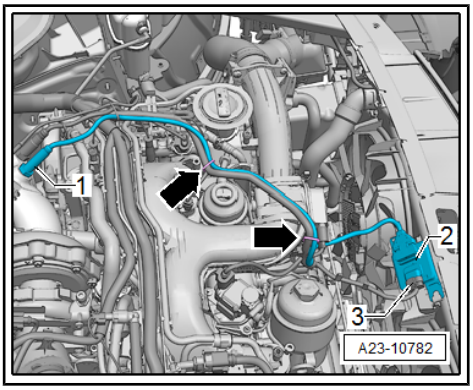
- ⇒ “8.1 Exploded view - Lambda probe (rest-of-world vehicles without SCR)”, page 75
- ⇒ “8.2 Exploded view - Lambda probe (USA vehicles with SCR)”, page 76

8.4 Removing and installing control unit for NOx sender -J583- with NOx sender -G295-

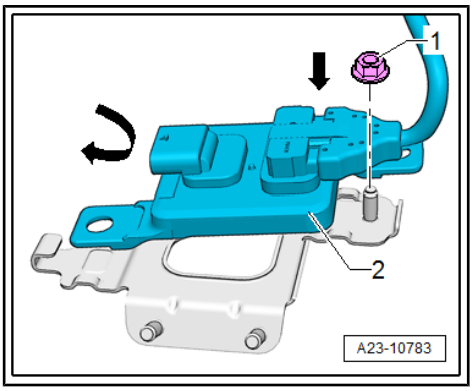
Removing

– Pull off engine cover panel ⇒ page 22 .

– Unplug electrical connector -3-.



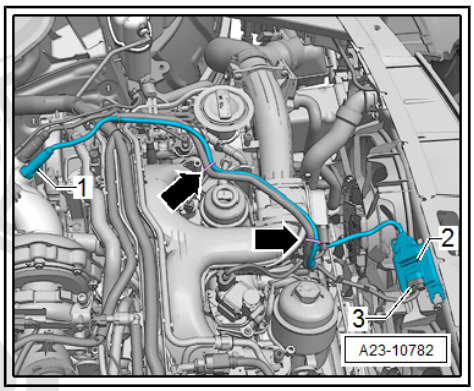
– Unscrew nut -1- and detach control unit for NOx sender -J583- -2-.



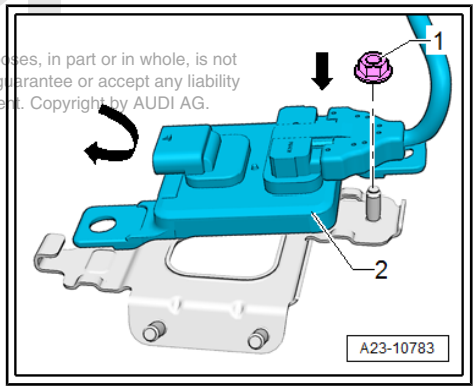
– Remove cable ties -arrows- and move wiring harness clear.

Unscrew NOx sender -G295- -1-.

Installing



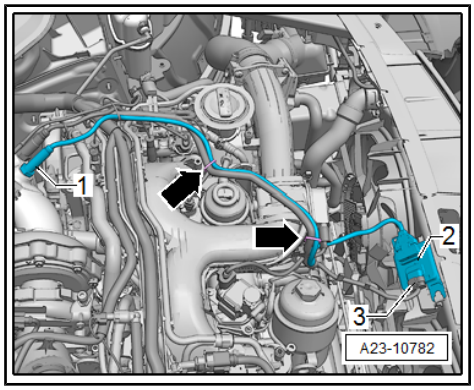
– Fit control unit for NOx sender -J583- into bracket -left arrow- and secure with nut -1-.



– Secure NOx sender -G295- -1-.
– Fit cable ties -arrows-.
– Plug in electrical connector -3-.

Tightening torques

◆ ⇒ “8.2 Exploded view - Lambda probe (USA vehicles with SCR)”, page 76



8.5 Removing and installing control unit for NOx sender 2 -J881- with NOx sender 2 -G687-

Removing

– Install centre underbody cover ⇒ Rep. gr. 66 ; Underbody trim panels; Removing and installing underbody cover (centre) .
– Unplug electrical connector -1-.
– Remove control unit for NOx sender 2 -J881- .
– Unscrew and detach NOx sender 2 -G687- -2-.

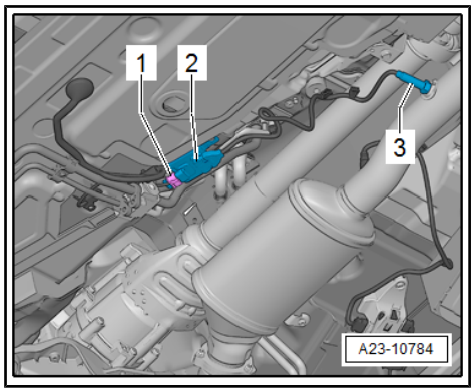
Installing

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

Tightening torques

◆ ⇒ “8.2 Exploded view - Lambda probe (USA vehicles with SCR)”, page 76

– Install underbody cover ⇒ Rep. gr. 66 .



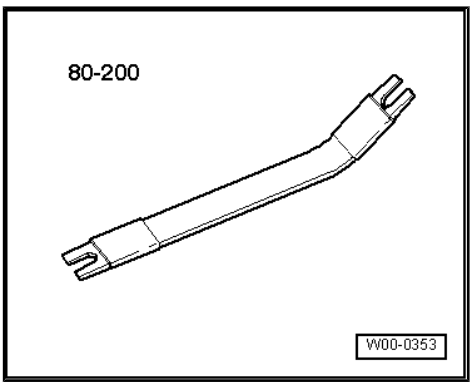
9 Engine control unit

⇒ “9.1 Removing and installing engine control unit J623 ”, page 81

9.1 Removing and installing engine control unit -J623-

Special tools and workshop equipment required

- Removal lever -80 - 200-



- Vehicle diagnostic tester

Removing

– Before removing the engine control unit -J623- , the adaption values of the injectors and the ash deposit mass must be read out. Use ⇒ Vehicle diagnostic tester.

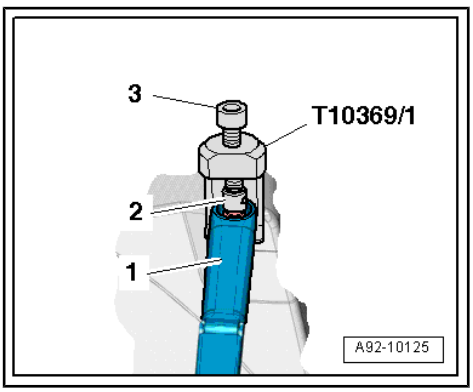
The adaption values for the injectors in the old (defective) engine control unit can be read out via the Guided Fault Finding or Guided Functions mode and can be stored as an electronic file in the ⇒ Vehicle diagnostic tester.

– Switch off ignition and remove ignition key after storing electronic file containing adaption values.

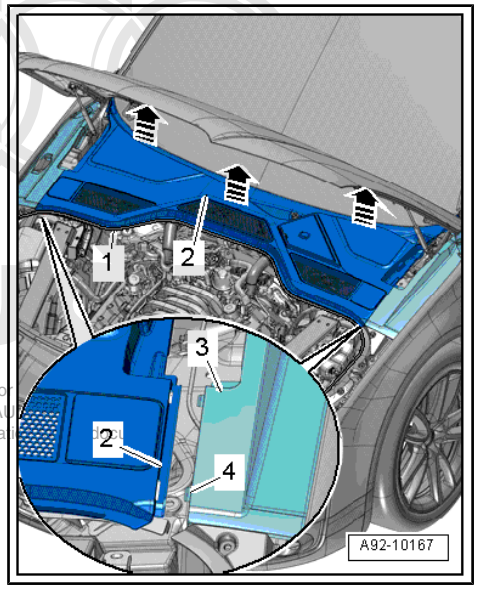
Note

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.

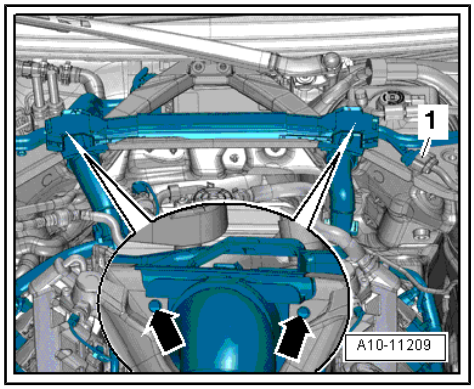
– Remove wiper arms ⇒ Electrical system; Rep. gr. 92 .



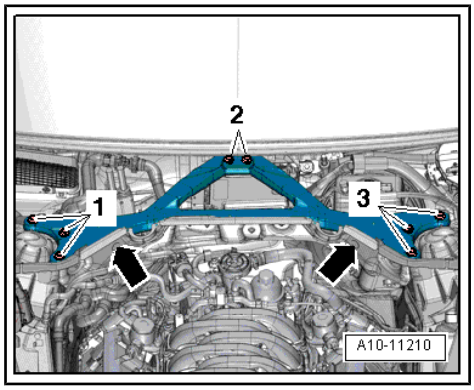
– Remove plenum chamber cover -2- ⇒ General body repairs, exterior; Rep. gr. 50 .



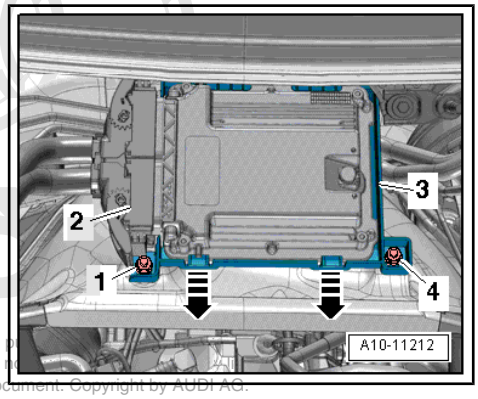
– Move clear wiring harness at plenum chamber cover on bulkhead on both sides (release catches -arrows-).
– Detach electrical connector -1- from bracket and unplug.
– Use removal lever -80 - 200- to move electrical wiring harness at body brace clear.



– Remove body brace ⇒ Rep. gr. 40 .



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



Note

Disregard -items 1, 3, 4-.

Installing

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

– Install body brace ⇒ Rep. gr. 40 .

– After the engine control unit -J623- has been renewed, the “Injector delivery calibration” and the “Injector voltage calibration” must also be re-adapted in the engine control unit (these functions influence engine power and exhaust emissions).

– On vehicles with particulate filter the current mileage (km) reading must be stored in the engine control unit -J623- via an adaption procedure.

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

28 – Glow plug system

1 Glow plug system

1.1 Checking glow plug system

- The glow plug system is activated via the automatic glow period control unit -J179- . The control unit is self-diagnosis compatible.
- The automatic glow period control unit -J179- is located in the relay and fuse holder in the electronics box in the engine compartment (right-side) ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- A fault is stored in the engine control unit -J623- 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.

Note

- *Wait for 60 seconds each time after performing final control diagnosis of the glow period control unit. The ignition must remain switched on.*
- *If you do not wait for 60 seconds (if ignition is switched off and immediately switched on again), the glow plugs can be damaged (due to repeated pre-heating).*
- *The activation of the glow plugs is controlled according to coolant temperature.*

1.2 Exploded view - glow plugs, Hall sender, engine speed sender

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-
- ❑ Depending on emission standard, cylinder 2 combustion chamber pressure sender -G678- may be fitted on cylinder 2

Cylinder bank 2 (left-side):

- ❑ Glow plug 4 -Q13- , glow plug 5 -Q14- , glow plug 6 -Q15-
- ❑ Removing and installing ⇒ page 86
- ❑ 12 Nm

3 - Electrical connector

4 - Bolt

- ❑ 9 Nm

5 - Hall sender -G40-

- ❑ Removing and installing ⇒ page 88

6 - O-ring

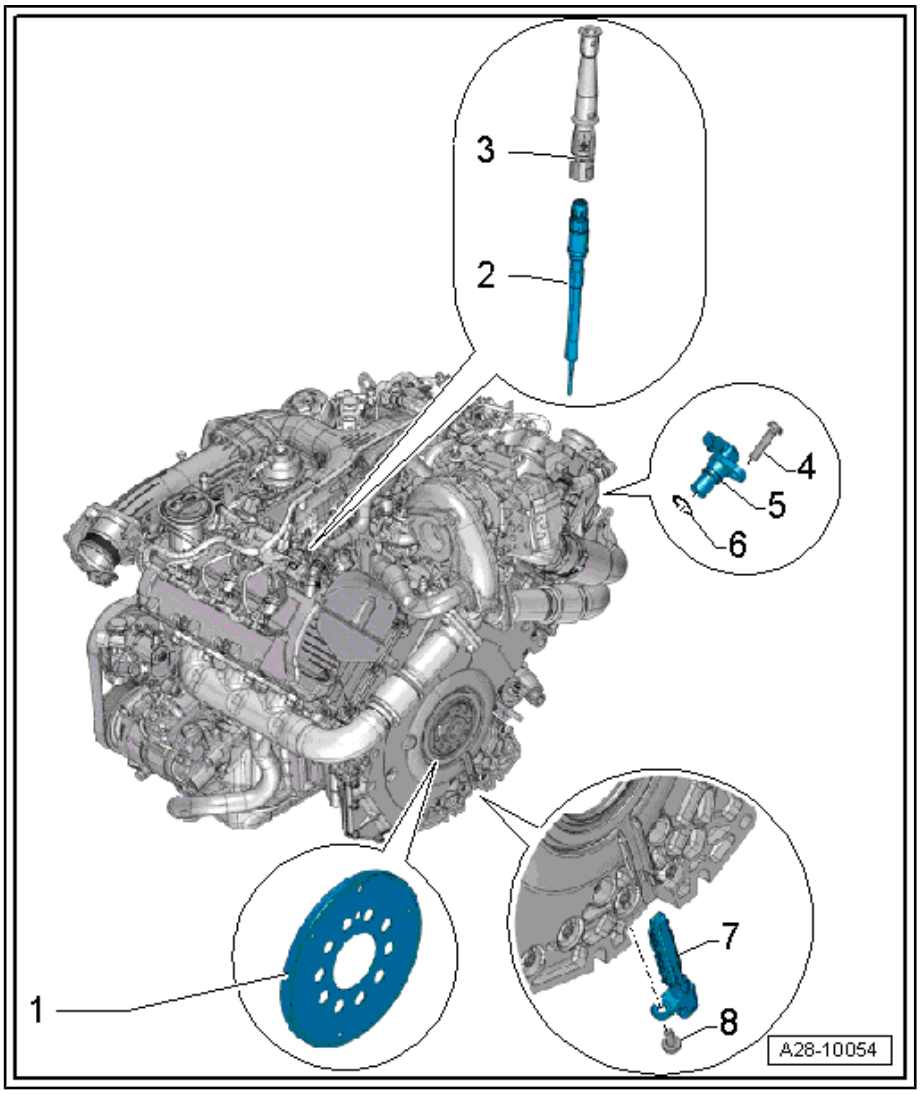
- ❑ Renew

7 - Engine speed sender -G28-

- ❑ Removing and installing ⇒ page 88

8 - Bolt

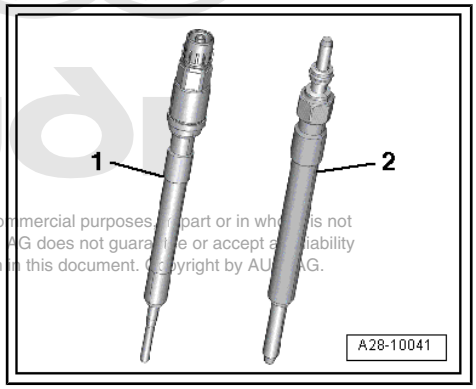
- ❑ 9 Nm



Glow plug versions (depends on emission standard)

1 - Glow plug with combustion chamber pressure sender (only installed on cylinder 2)

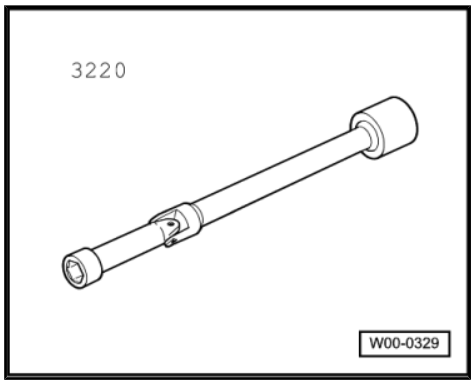
2 - Glow plug without combustion chamber pressure sender



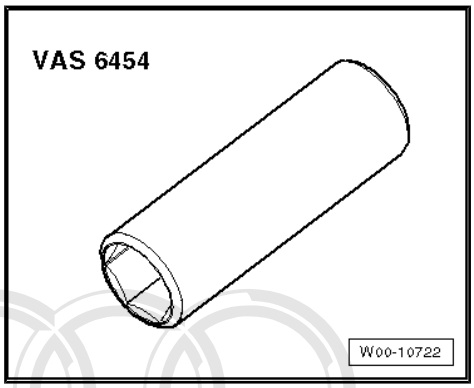
1.3 Removing and installing glow plugs

Special tools and workshop equipment required

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



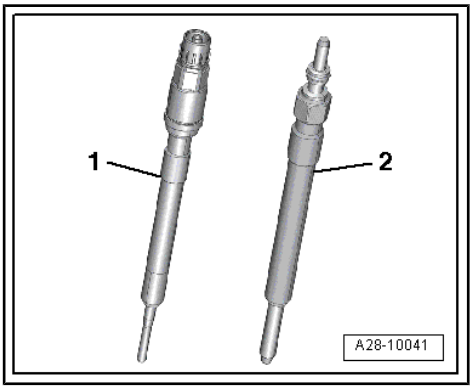
- Socket insert AF 12 for glow plugs 4-cyl.TDI CR diesel -VAS 6454- (for glow plug for cylinder 2, depends on emission standard)



Removing

– Switch off ignition.

– Pull off engine cover panel ⇒ page 22 .



Note

- *Depending on emission standard, a combustion chamber pressure sender may be integrated in the glow plug on cylinder 2.*
- *Designation: glow plug 2 -Q11- with cylinder 2 combustion chamber pressure sender -G678-*

Glow plug versions

1 - Glow plug with combustion chamber pressure sender (only installed on cylinder 2)

2 - Glow plug without combustion chamber pressure sender

– Unplug connectors from glow plugs.

– Clean glow plug aperture to make sure no dirt gets into cylinders.

– Clean glow plug apertures in cylinder head; make sure no dirt gets into cylinder.

Note

- *Cleaning procedure:*
- *Use a vacuum cleaner to remove coarse dirt.*
- *Spray brake cleaner or suitable cleaning agent into glow plug apertures, let it work in briefly, and blow out with compressed air.*
- *Then clean the glow plug apertures using a cloth moistened with oil.*

WARNING

Protect eyes against injuries.

- ***Wear safety goggles.***

– Loosen glow plugs using suitable special tool.

– Then unscrew glow plugs carefully by hand or using a suitable hose. Keep the glow plugs straight while unscrewing.

Installing

– Fit glow plugs carefully by hand or using a suitable hose. Keep the glow plugs straight while screwing them back in.

– To tighten the glow plugs use appropriate special tool with a suitable torque wrench.

Tightening torques

- ⇒ “1.2 Exploded view - glow plugs, Hall sender, engine speed sender”, page 85

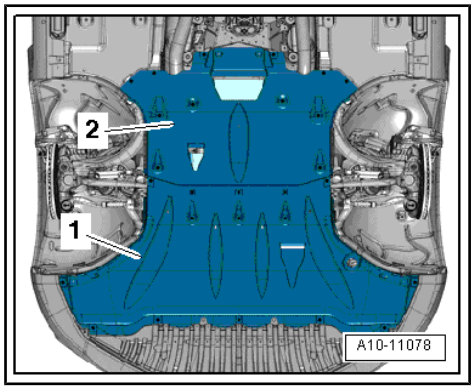
– Attach glow plug connectors correctly and make sure connectors are securely fitted.

The remaining installation steps are carried out in the reverse sequence.

1.4 Removing and installing engine speed sender -G28-

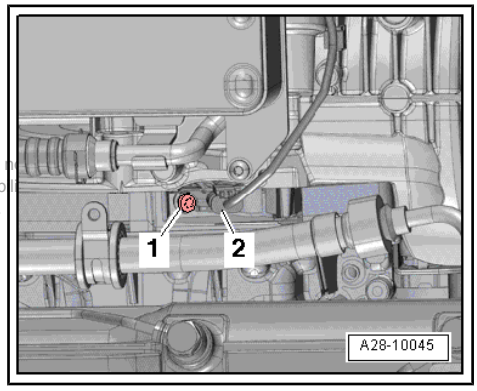
Removing

– 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 torques

♦ ⇒ “1.2 Exploded view - glow plugs, Hall sender, engine speed sender”, page 85

– Install noise insulation ⇒ Rep. gr. 66 .

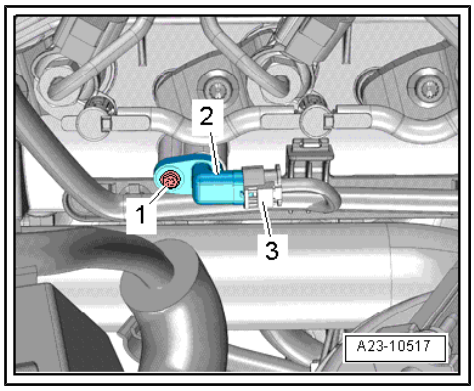
1.5 Removing and installing Hall sender - G40-

Removing

– Pull off engine cover panel ⇒ page 22 .

– Unplug electrical connector -3-.

– Unscrew bolt -1- and remove Hall sender -G40- -item 2-.



Installing

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

Note

Fit new O-ring.

Tightening torques

♦ ⇒ “1.2 Exploded view - glow plugs, Hall sender, engine speed sender”, page 85