

Workshop Manual

Audi A1 2011 ➤

Audi A1 Sportback 2012 ➤

TDI injection and glow plug system (4-cyl. 1.6 ltr. 4-valve common rail)

Engine ID	CAY B	CAY C							
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Edition 11.2013



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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



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

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Contents

23 - Mixture preparation - injection	1
1 Safety precautions and rules for cleanliness	1
1.1 Safety precautions when working on the fuel system	1
1.2 Safety precautions when working on the injection and glow plug system	2
1.3 Safety precautions when working on vehicles with start/stop system	2
1.4 Safety precautions when using testers and measuring instruments during a road test	3
1.5 Rules for cleanliness and instructions for working on fuel system	3
1.6 Checking vacuum system	4
2 Overview of fitting locations - injection system	6
3 Overview - fuel system	12
3.1 Conversion from 0.5 bar low-pressure fuel system to 6.0 bar low-pressure fuel system	13
4 Filling and bleeding fuel system	16
5 Air cleaner	17
5.1 Exploded view - air cleaner	17
5.2 Removing and installing engine cover panel	18
5.3 Removing and installing air filter element	19
5.4 Removing and installing air cleaner housing	20
6 Exploded view - intake manifold	22
6.1 Exploded view - intake manifold, vehicles with intake manifold flap V157	22
6.2 Exploded view - intake manifold, vehicles without intake manifold flap V157	23
6.3 Removing and installing intake manifold	24
7 Injectors/high-pressure reservoir (rail)	29
7.1 Exploded view - injectors, high-pressure reservoir	29
7.2 Removing and installing high-pressure reservoir	32
7.3 Exploded view - injectors with clamping piece	36
7.4 Performing adaption of injectors	38
7.5 Removing and installing injectors	38
7.6 Vacuum test for injectors	44
7.7 Checking pressure retention valve in fuel return line	46
7.8 Removing and installing high-pressure pipes	47
7.9 Installing fuel return lines	49
8 High-pressure pump	51
8.1 Exploded view - high-pressure pump	51
8.2 Removing and installing high-pressure pump	52
8.3 Performing first fuel filling after installing high-pressure pump	55
9 Senders and sensors	57
9.1 Removing and installing air mass meter G70	57
9.2 Removing and installing throttle valve module J338	57
9.3 Checking fuel pressure regulating valve N276	58
9.4 Removing and installing fuel pressure regulating valve N276	61
9.5 Removing and installing fuel pressure sender G247	63
9.6 Checking fuel pump delivery rate	65
9.7 Checking for leaks in the fuel system	66
10 Lambda probe	67
10.1 Exploded view - Lambda probe and exhaust gas temperature sensors	67
10.2 Exploded view - Lambda probe and exhaust gas temperature control with particulate filter installed away from engine	68
10.3 Removing and installing Lambda probe G39 with Lambda probe heater Z19	68
10.4 Removing and installing pressure differential sender G505	69
11 Engine control unit	71
11.1 Wiring and component check with test box V.A.G 1598/42	71



11.2	Removing and installing engine control unit J623	72
28	- Glow plug system	76
1	Glow plug system	76
1.1	Exploded view - glow plug system	76
1.2	Checking glow plug system	77
1.3	Removing and installing glow plugs	77
1.4	Removing and installing Hall sender G40	79
1.5	Removing and installing engine speed sender G28	80



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23 – Mixture preparation - injection

1 Safety precautions and rules for cleanliness

(ARL003680; Edition 11.2013)

⇒ [“1.1 Safety precautions when working on the fuel system”, page 1](#)

⇒ [“1.2 Safety precautions when working on the injection and glow plug system”, page 2](#)

⇒ [“1.3 Safety precautions when working on vehicles with start/stop system”, page 2](#)

⇒ [“1.4 Safety precautions when using testers and measuring instruments during a road test”, page 3](#)

⇒ [“1.5 Rules for cleanliness and instructions for working on fuel system”, page 3](#)

⇒ [“1.6 Checking vacuum system”, page 4](#)

1.1 Safety precautions when working on the fuel system

When working on the fuel system note the following warnings:



WARNING

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

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

- ◆ *Wear protective gloves.*

- ◆ *Wear safety goggles.*

Risk of injury - fuel system operates under pressure.

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

- ◆ *Wear protective gloves.*

- ◆ *Wear safety goggles.*

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Caution

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

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

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

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

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

- ◆ Persons wearing a cardiac pacemaker must at all times maintain a safe distance from high-voltage components such as xenon headlights.
- ◆ Always switch off the ignition before connecting or disconnecting tester cables or electrical wiring for the injection or glow plug system.
- ◆ Do not open any fuel line connections while the engine is running.
- ◆ Always switch off ignition before washing engine.
- ◆ Certain tests may lead to entries being stored in the event memory of the engine control unit. Therefore, interrogate and, if necessary, erase the event memory after all repairs and tests
⇒ Vehicle diagnostic tester.

1.3 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).***

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1.4 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.*

1.5 Rules for cleanliness and instructions for working on fuel system

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.

- ◆ *If components of the fuel system between the fuel tank and the high-pressure pump are removed or renewed, the first fuel filling operation must be performed in order to bleed the fuel system.*
- ◆ *Performing first fuel filling after installing high-pressure pump ➔ [page 55](#)*

General instructions:

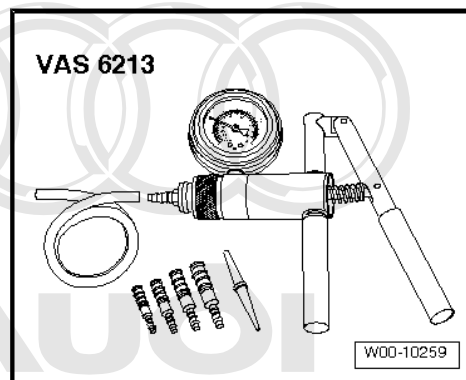
- Clean tools and workbench etc. before working on the injection system.
- Carefully clean connection points and the surrounding area with engine cleaner or brake cleaner and dry thoroughly before opening.
- When removing components, plug all open connections immediately with suitable clean sealing caps.
- Do not remove sealing caps from components until immediately prior to installation. Keep components that are to be re-used in new, sealable plastic bags.
- Before installing, check the injectors and their surroundings visually; they must be undamaged and clean. Make sure the injector bores in the cylinder head are clean. Wipe out if necessary using a clean cloth, taking care not to cause damage. Do not use sharp objects of any kind.

- If the high-pressure fuel lines are to be re-used, you must mark them before removal. High-pressure pipes must always be re-installed on the same cylinder.
- Take care not to damage the injectors when removing the old copper seals.
- Check all new O-rings for damage before installing. Lubricate O-rings with engine oil or assembly oil before installing.
- Position high-pressure pipes so they are free of stress. Tighten all unions lightly to start with before tightening to final torque.
- Never attempt to bend high-pressure fuel lines to shape.
- When working on any parts of the high-pressure fuel system, tools may only be used for loosening and tightening pipe unions. All other components must always be removed and installed by hand without using tools or other equipment.
- Press the fuel return hoses onto the injectors by hand from above so that they engage audibly on each injector (do not press in the release pins when doing this). Then press down the release pin after connecting the return line. Check that the fuel return hoses are seated securely by pulling them by hand from above. Also check that they seal properly (fuel pressure in return line as far as pressure retention valve: between 8 and 10 bar).
- 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.

1.6 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

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- ◆ Traces of animal bites
- ◆ Kinked or crushed lines
- ◆ Lines porous or leaking
- Check vacuum line to solenoid valve and from solenoid valve to corresponding component.
- If a fault is stored in the event memory, check all 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.



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2 Overview of fitting locations - injection system

Engine compartment

1 - Fuel temperature sender - G81-

- ☐ In fuel supply line

2 - Radiator outlet coolant temperature sender - G83-

- ☐ Removing and installing with resp. ⇒ Rep. gr. 19

3 - Pressure differential sender - G505-

- ☐ Exploded view ⇒ [page 67](#)

4 - Fuel pressure sender - G247-

- ☐ Exploded view ⇒ [page 51](#)

5 - Hall sender - G40-

- ☐ Camshaft position sensor
- ☐ Exploded view ⇒ [page 76](#)

6 - Injector, cylinder 1 - N30-

- ☐ Exploded view ⇒ [page 29](#)

7 - Injector, cylinder 2 - N31-

- ☐ Exploded view ⇒ [page 29](#)

8 - Injector, cylinder 3 - N32-

- ☐ Exploded view ⇒ [page 29](#)

9 - Heating element for crankcase breather - N79-

- ☐ Country-specific version

10 - Injector, cylinder 4 - N33-

- ☐ Exploded view ⇒ [page 29](#)

11 - Brake light switch - F- / brake pedal switch - F63-

- ☐ Fitting location ⇒ [page 10](#)
- ☐ Removing and installing ⇒ Rep. gr. 45

12 - Air mass meter - G70-

- ☐ Exploded view ⇒ [page 17](#)

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

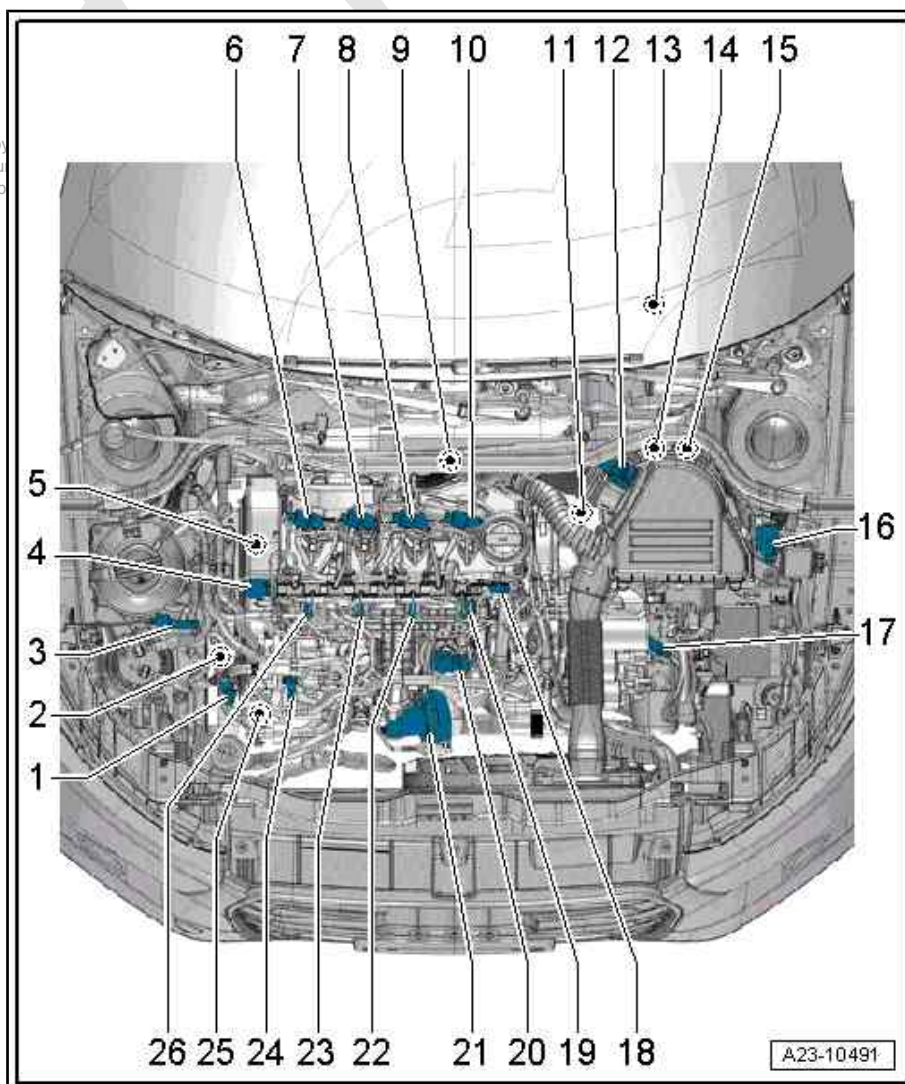
- ☐ Fitting location ⇒ [page 10](#)

14 - Clutch position sender - G476-

- ☐ For vehicles with manual gearbox
- ☐ Fitting location ⇒ [page 10](#)

15 - Engine control unit - J623-

- ☐ Fitting location ⇒ [page 9](#)



16 - Charge pressure control solenoid valve - N75-

17 - Gearbox neutral position sender - G701-

- ☐ For vehicles with manual gearbox
- ☐ Fitting location ⇒ [page 10](#)

18 - Fuel pressure regulating valve - N276-

- ☐ Exploded view ⇒ [page 29](#)

19 - Glow plug 4 - Q13-

- ☐ Exploded view ⇒ [page 76](#)

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

21 - Throttle valve module - J338-

- ☐ With throttle valve potentiometer - G69-
- ☐ Exploded view ⇒ [page 23](#)

22 - Glow plug 3 - Q12-

- ☐ Exploded view ⇒ [page 76](#)

23 - Glow plug 2 - Q11-

- ☐ Exploded view ⇒ [page 76](#)

24 - Fuel metering valve - N290-

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

- ☐ Removing and installing ⇒ Rep. gr. 21

26 - Glow plug 1 - Q10-

- ☐ Exploded view ⇒ [page 76](#)

Engine (gearbox end)



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1 - Engine speed sender - G28-

- ☐ Exploded view
⇒ [page 76](#)

2 - Coolant temperature sender - G62-

- ☐ Removing and installing
⇒ Rep. gr. 19

3 - Position sender for charge pressure positioner - G581-
4 - Oil pressure switch - F1-

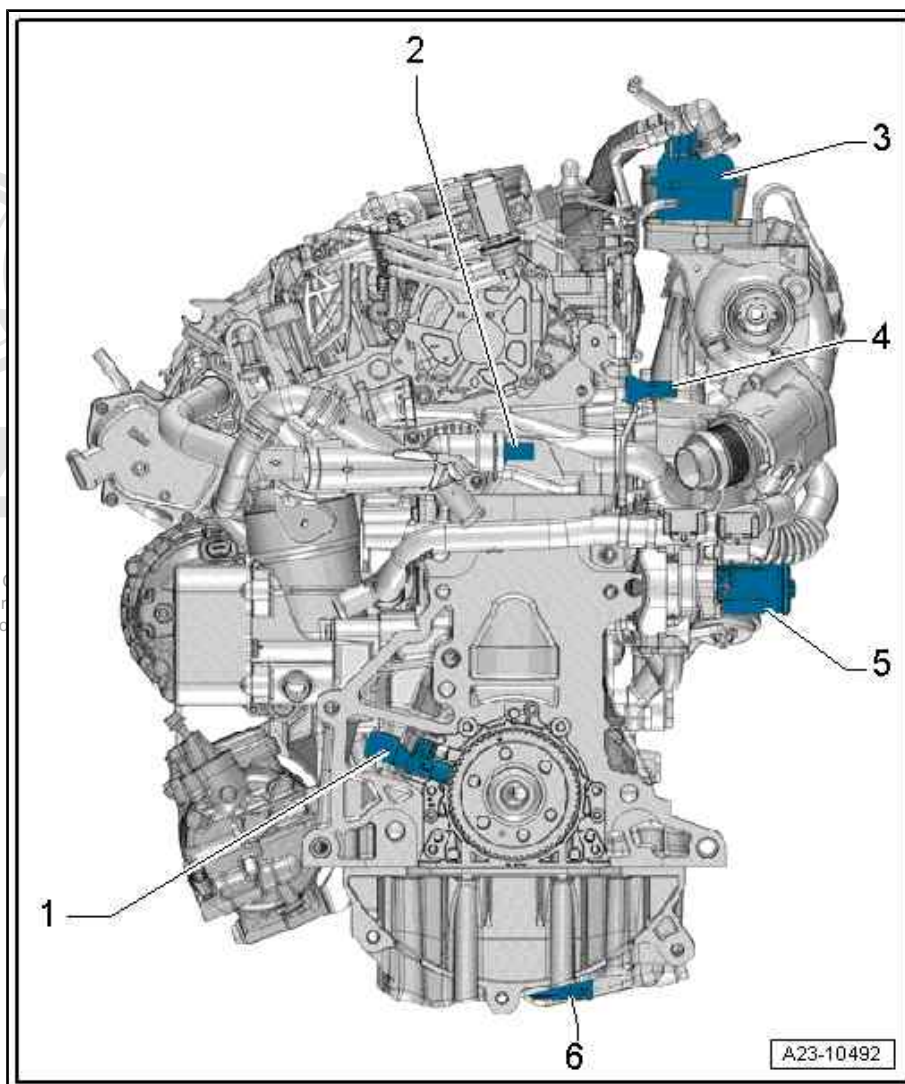
- ☐ Removing and installing
⇒ Rep. gr. 17

5 - Exhaust gas recirculation valve - N18- / exhaust gas recirculation potentiometer - G212-

- ☐ Removing and installing
⇒ Rep. gr. 21

6 - Oil level and oil temperature sender - G266-

- ☐ Removing and installing
⇒ Rep. gr. 17



1 - Exhaust gas temperature sender 4 - G648-

- ☐ Exploded view
 ⇒ [page 67](#)

2 - Exhaust gas temperature sender 1 - G235-

- ☐ Exploded view
 ⇒ [page 67](#)

3 - Exhaust gas temperature sender 3 - G495-

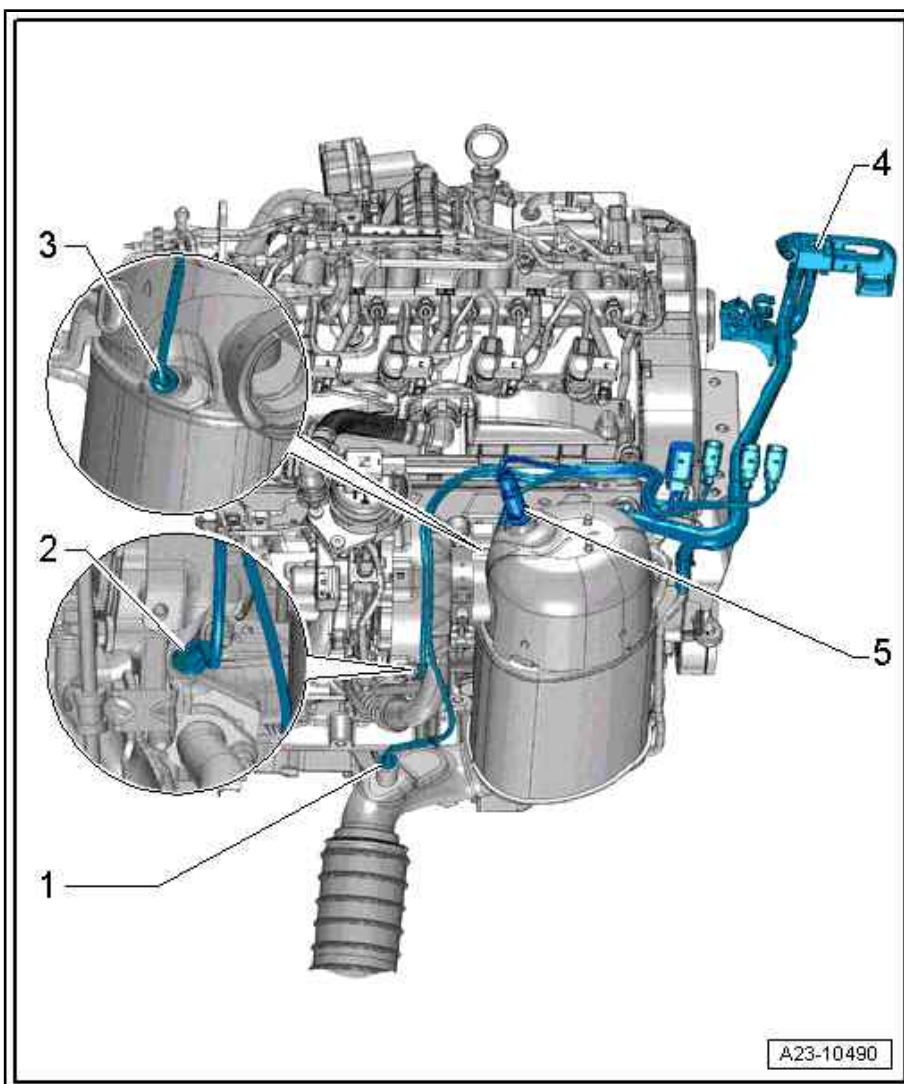
- ☐ Exploded view
 ⇒ [page 67](#)

4 - Pressure differential sender - G505-

- ☐ Exploded view
 ⇒ [page 67](#)

5 - Lambda probe - G39- with Lambda probe heater - Z19-

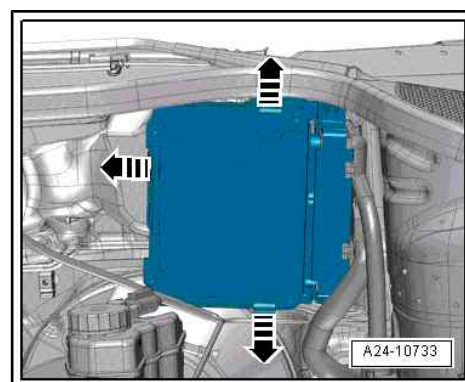
- ☐ Exploded view
 ⇒ [page 67](#)



Fitting location of engine control unit - J623-

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

Removing and installing ⇒ [page 72](#)



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

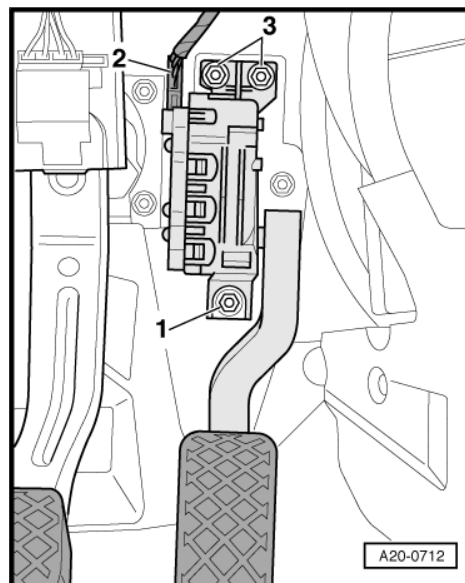
- ◆ In accelerator pedal module



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

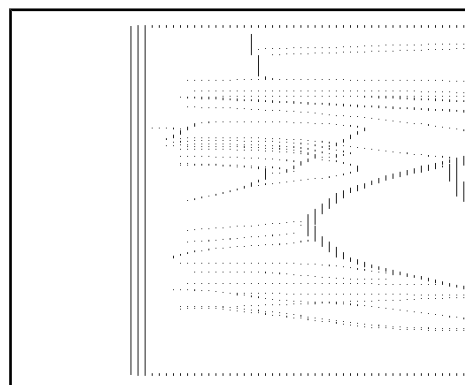


Fitting location of brake light switch - F- / brake pedal switch - F63-

- ◆ On brake master cylinder

C - Brake light switch - F- / brake pedal switch - F63-

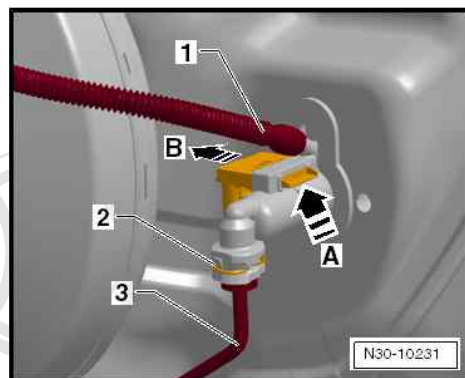
Removing and installing ⇒ Rep. gr. 45



Fitting location of clutch position sender - G476-

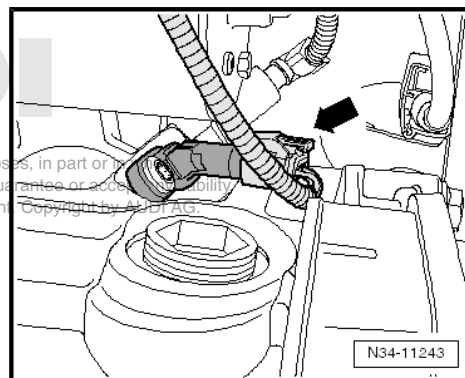
- ◆ On clutch master cylinder, next to brake servo

Removing and installing ⇒ Rep. gr. 30



Fitting location of gearbox neutral position sender - G701-

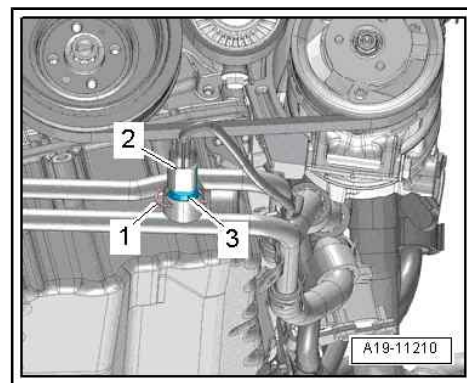
- ◆ At front of manual gearbox -arrow-



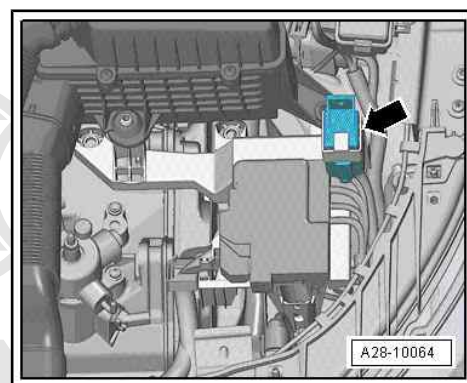
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Fitting location of radiator outlet coolant temperature sender - G83-

- ◆ -Item 3- in connection at coolant pipes (right-side)



Automatic glow period control unit - J179-



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3 Overview - fuel system



Caution

Risk of malfunctions caused by dirt.

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:

Procedure for first fuel filling ➔ [page 55](#)



Note

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

1 - Fuel tank

- ☐ With fuel system presurisation pump - G6-

2 - Fuel filter

- ☐ Exploded view ➔ Rep. gr. 20
- ☐ Connections on fuel filter may differ
- ☐ Renewing fuel filter ➔ Rep. gr. 20

3 - High-pressure pump

- ☐ Exploded view
➔ [page 51](#)

4 - Fuel metering valve - N290-

- ☐ Do not unscrew

5 - Fuel pressure sender - G247-

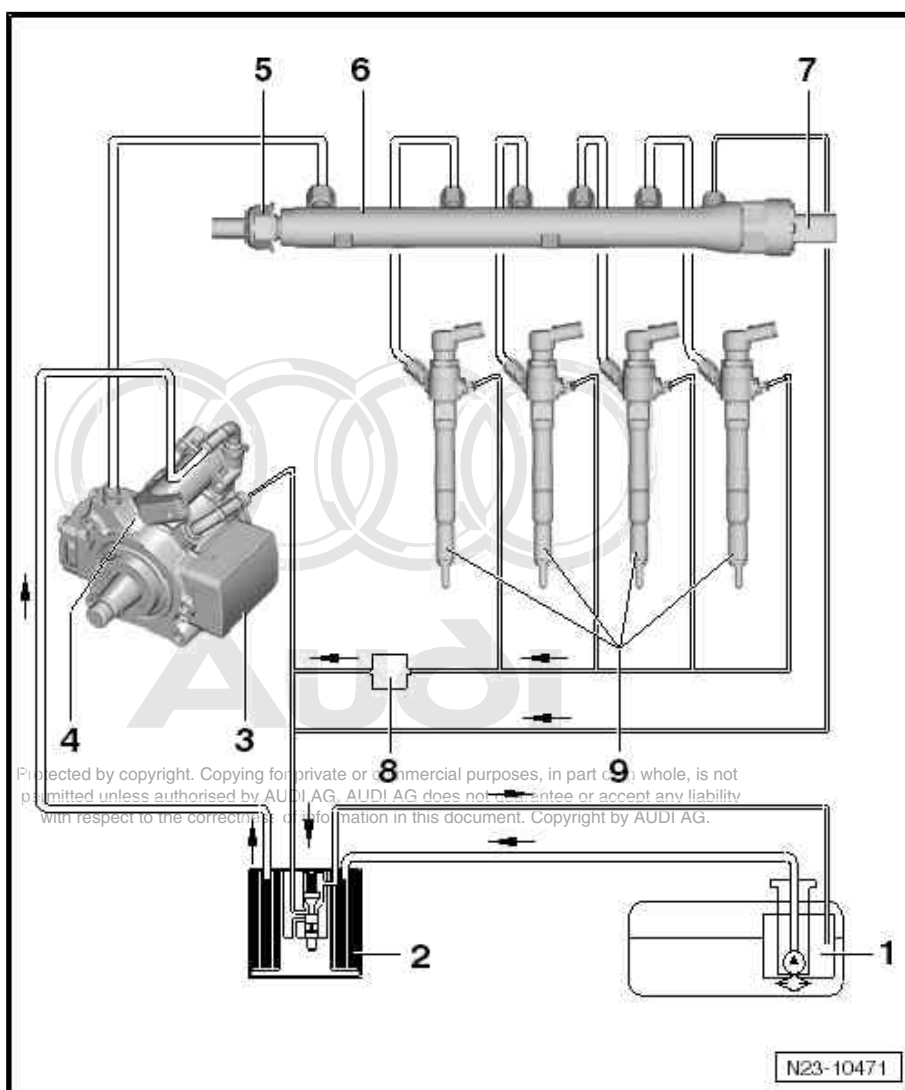
- ☐ Exploded view
➔ [page 51](#)
- ☐ 100 Nm

6 - Fuel rail

- ☐ Exploded view
➔ [page 51](#)

7 - Fuel pressure regulating valve - N276-

- ☐ Cannot be re-installed
- ☐ After renewing high-pressure pump or fuel pressure regulating valve - N276- , learnt values must be re-adapted; see "Guided Functions" in vehicle diagnostic tester
- ☐ 80 Nm
- ☐ Exploded view ➔ [page 51](#)



8 - Pressure retention valve

- ☐ The pressure retention valve maintains a residual pressure in the fuel return lines (required for control function).
- ☐ The pressure retention valve may only be renewed together with the fuel return lines.
- ☐ Removing and installing ⇒ [page 46](#)

9 - Injector

- ☐ Exploded view ⇒ [page 51](#)
- ☐ Removing and installing ⇒ [page 38](#)

3.1 Conversion from 0.5 bar low-pressure fuel system to 6.0 bar low-pressure fuel system

New components

- ◆ Fuel delivery unit, 6.0 bar (builds up required pressure for high-pressure pump).
- ◆ Fuel hoses in engine compartment, 6.0 bar (low-pressure fuel system) ⇒ Rep. gr. 20; Fuel hoses in engine compartment
- ◆ Fuel filter, 6.0 bar ⇒ Rep. gr. 20; Fuel filter; Removing and installing fuel filter .
- ◆ Fuel return line (flexible), 6.0 bar, with pressure retention valve.
- ◆ The procedure for checking the pressure retention valve remains unchanged for all engines with code beginning CAY.
- ◆ Fuel return lines (fixed), 6.0 bar.
- ◆ High-pressure pump without fuel system pressurisation pump (required pressure for high-pressure pump is built up by fuel delivery unit).
- ◆ Fuel pressure regulating valve - N 276- , 6.0 bar.

1 - Fuel return line for 0.5 bar low-pressure fuel system

- ☐ Flexible
- ☐ With pressure retention valve

2 - Fuel return line for 6.0 bar low-pressure fuel system

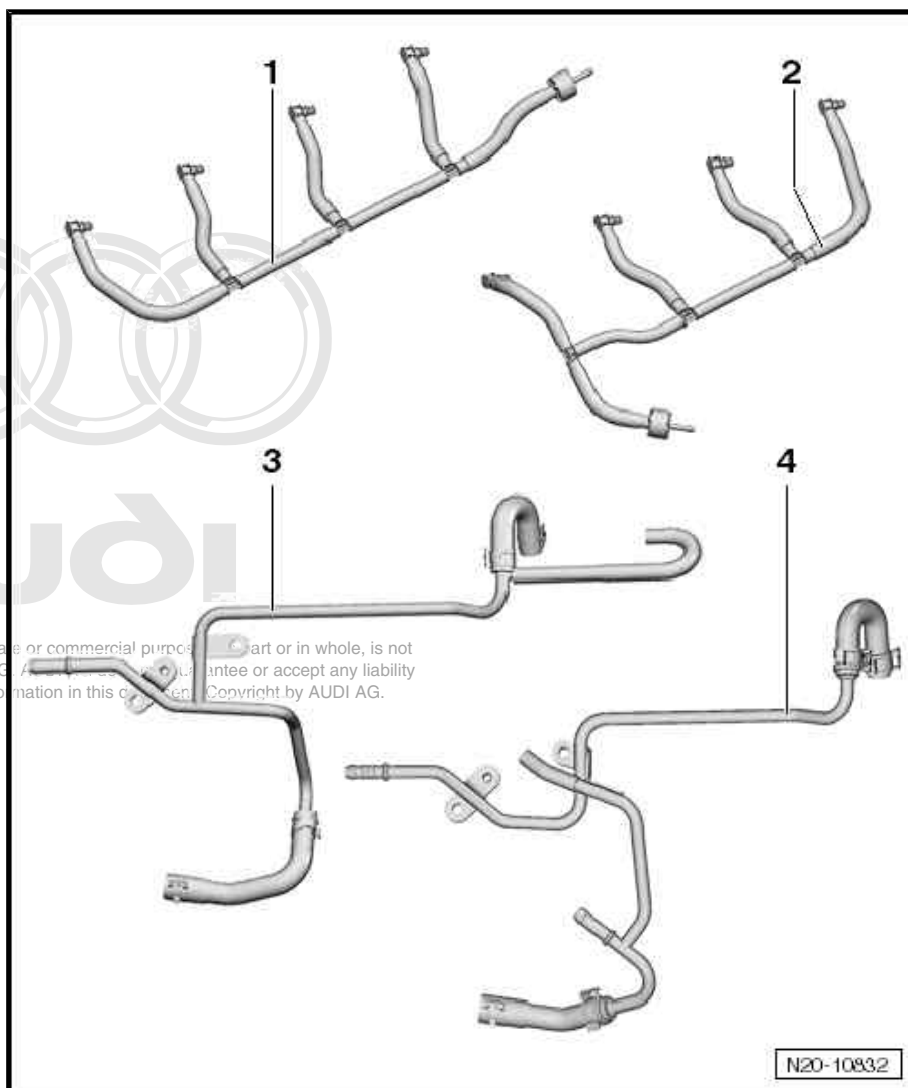
- ☐ Flexible
- ☐ With pressure retention valve

3 - Fuel return lines for 0.5 bar low-pressure fuel system

- ☐ Fixed

4 - Fuel return lines for 6.0 bar low-pressure fuel system

- ☐ Fixed



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N20-10832

Differences: high-pressure pumps and fuel pressure regulating valve - N 276-

1 - High-pressure pump for 0.5 bar low-pressure fuel system

- ❑ With fuel system pressurisation pump fitted on high-pressure pump

2 - High-pressure pump for 6.0 bar low-pressure fuel system

- ❑ Without fuel system pressurisation pump
- ❑ The required pressure of 6.0 bar in the low-pressure fuel system is built up by the fuel delivery unit ➔ Rep. gr. 20 ; Fuel delivery unit/fuel gauge senders; Exploded view - fuel delivery unit/fuel gauge senders .

3 - Fuel pressure regulating valve - N 276- , 0.5 bar low-pressure fuel system



Note

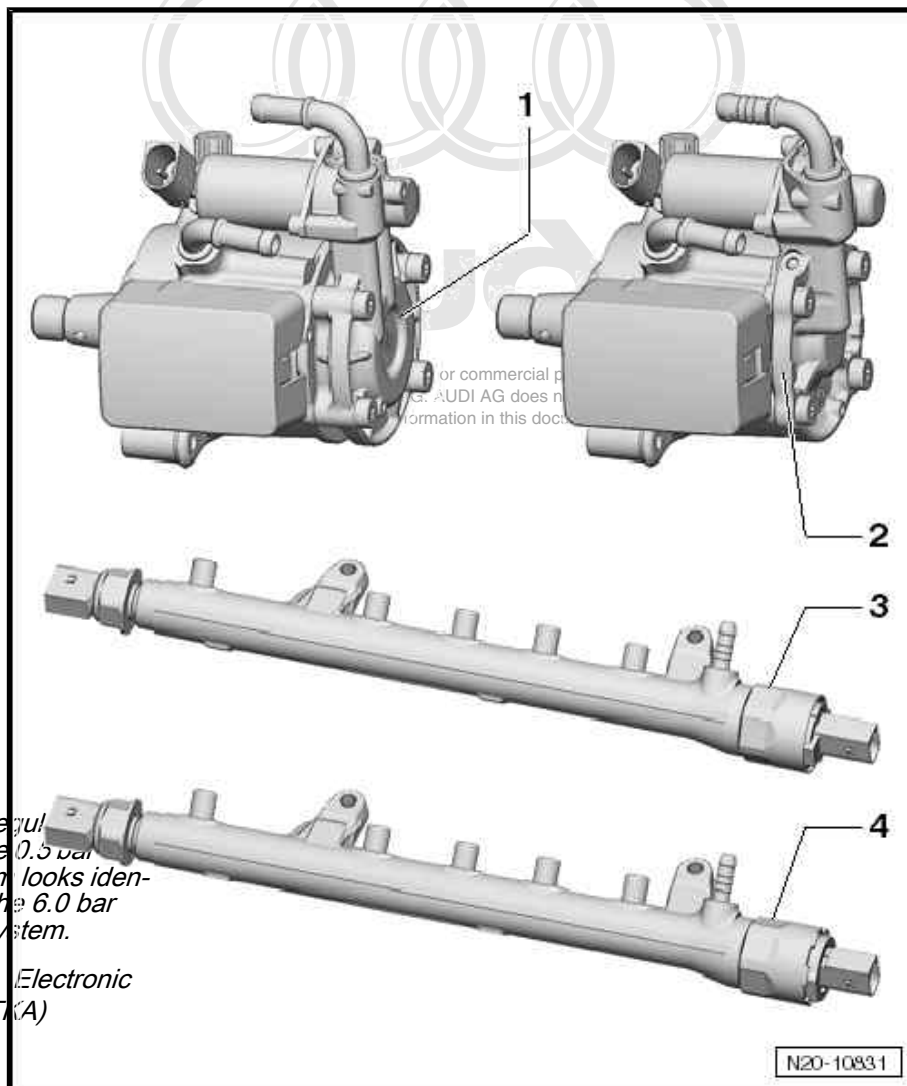
- ◆ The fuel pressure regulating valve - N 276- on the 0.5 bar low-pressure fuel system looks identical to the one on the 6.0 bar low-pressure fuel system.
- ◆ For index refer to ➔ Electronic parts catalogue (ETKA)

4 - Fuel pressure regulating valve - N 276- , 6.0 bar low-pressure fuel system



Note

- ◆ The fuel pressure regulating valve - N 276- on the 6.0 bar low-pressure fuel system looks identical to the one on the 0.5 bar low-pressure fuel system.
- ◆ For index refer to ➔ Electronic parts catalogue (ETKA)



4 Filling and bleeding fuel system

Special tools and workshop equipment required

- ◆ Vehicle diagnostic tester



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.*

Proceed as follows to fill fuel system with fuel:

- Connect a ➔ Vehicle diagnostic tester.
- Switch on ignition.
- Select “Engine electronics” in vehicle self-diagnosis.
- Select “Guided Functions”.
- Then select “Activate fuel pump”.
- Select “120 seconds”.
- The fuel pump starts running.
- The fuel pump must run for approx. 2 minutes to ensure that the fuel system is filled sufficiently with fuel.



Note

To repeat basic setting, switch ignition off and on once. Then start basic setting again.

- 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 again.

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5 Air cleaner

⇒ ["5.1 Exploded view - air cleaner", page 17](#)

⇒ ["5.2 Removing and installing engine cover panel", page 18](#)

⇒ ["5.3 Removing and installing air filter element", page 19](#)

⇒ ["5.4 Removing and installing air cleaner housing", page 20](#)

5.1 Exploded view - air cleaner

1 - Connecting piece

2 - Air duct

- ☐ To lock carrier
- ☐ Clean out salt deposits, dirt and leaves, etc.

3 - Air cleaner (bottom section)

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

4 - Air filter element

- ☐ Use genuine air filter element ⇒ Electronic parts catalogue
- ☐ Change intervals ⇒ Maintenance tables
- ☐ Removing and installing ⇒ [page 19](#)

5 - Air cleaner (top section)

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

6 - Air hose

- ☐ Country-specific version

7 - Air pipe

- ☐ Country-specific version

8 - Grommet

9 - Sleeve

10 - Bolt

- ☐ 9 Nm

11 - Air pipe

- ☐ To turbocharger
- ☐ Country-specific version with heater element for crankcase breather - N79- ⇒ [page 18](#)

12 - Air mass meter - G70-

- ☐ Removing and installing ⇒ [page 57](#)

13 - Bolt

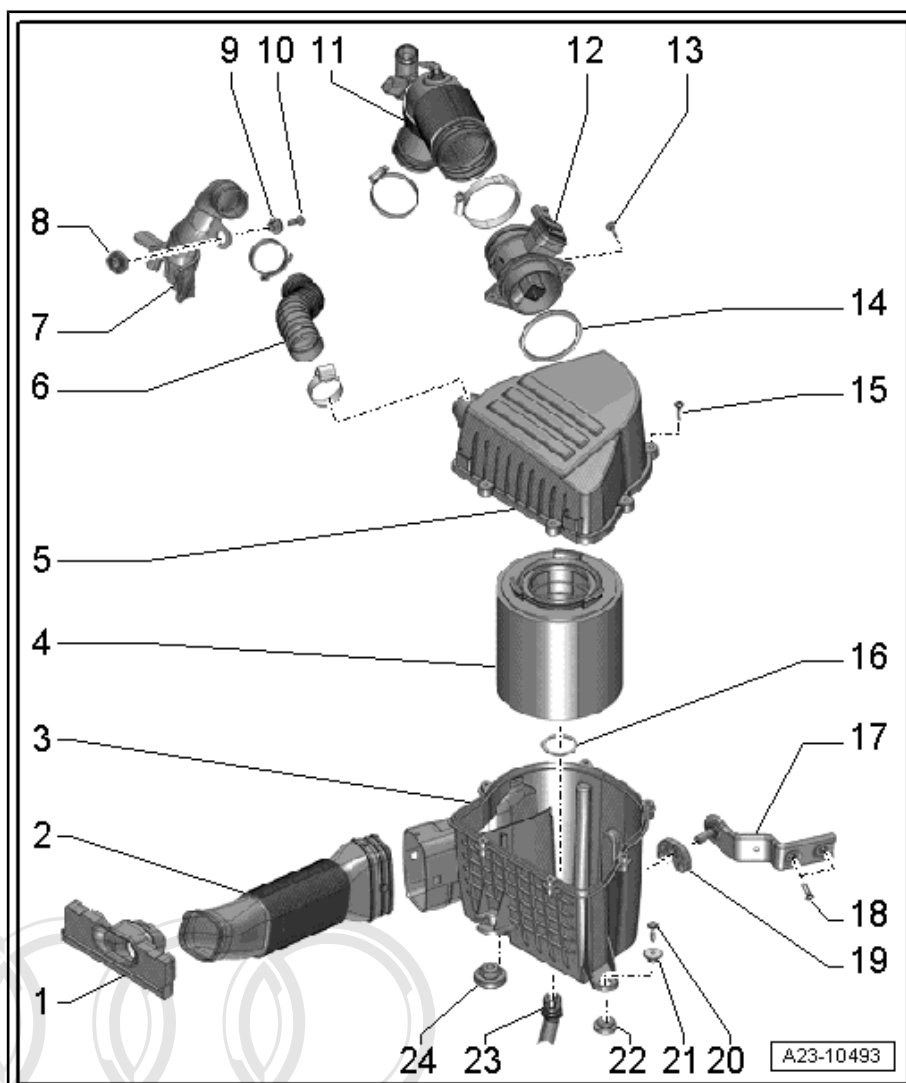
- ☐ 1.5 Nm

14 - O-ring

- ☐ Renew if damaged
- ☐ Use lubricant when installing

15 - Bolt

- ☐ 1.5 Nm



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16 - O-ring

- ☐ Renew

17 - Bracket

- ☐ For air cleaner (bottom section)
- ☐ Lug on bracket must not be deformed
- ☐ Lug on bracket must be fully inserted in rubber buffer

18 - Bolt

- ☐ 9 Nm

19 - Rubber buffer

- ☐ Clipped onto air cleaner (bottom section)

20 - Bolt

- ☐ 9 Nm

21 - Sleeve

22 - Grommet

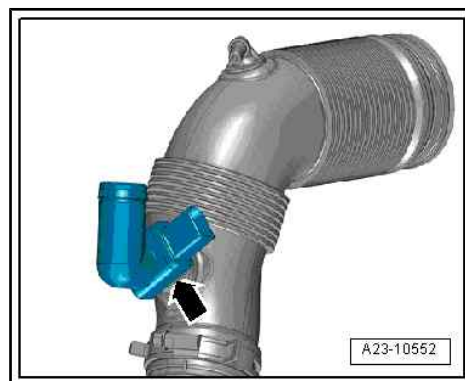
23 - Water drain hose

- ☐ Clean

24 - Rubber buffer

Country-specific version with heater element for crankcase breather - N79-

- ◆ In air pipe to turbocharger -arrow-



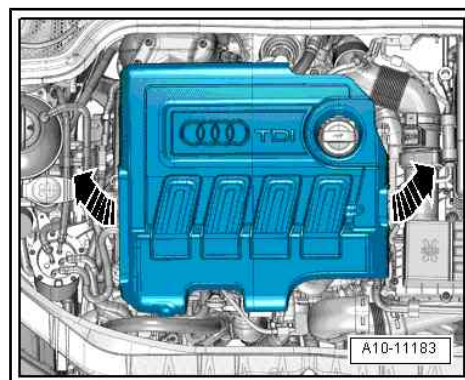
5.2 Removing and installing engine cover panel

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.



5.3 Removing and installing air filter element

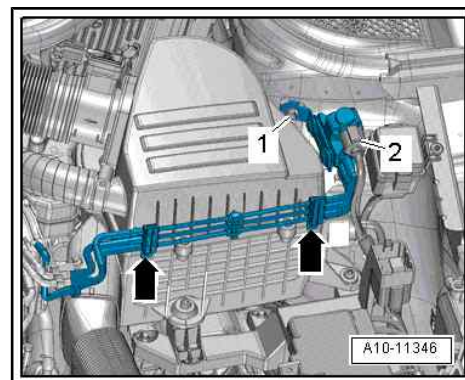
Removing

- Unclip bracket -arrows- from air cleaner housing (with vacuum hoses attached).

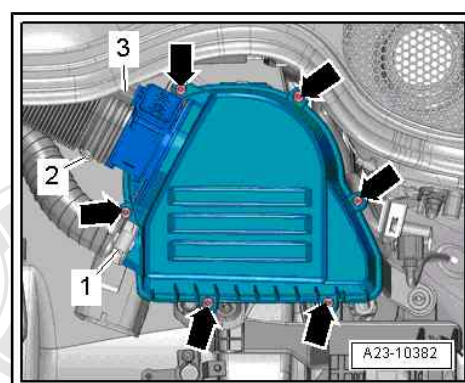


Note

Disregard -items 1, 2-.



- Unplug electrical connector -3-.
- Release hose clips -1, 2- and detach air hoses.
- Unscrew bolts -arrows- and detach air cleaner (top section).



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

Installing

Tightening torques

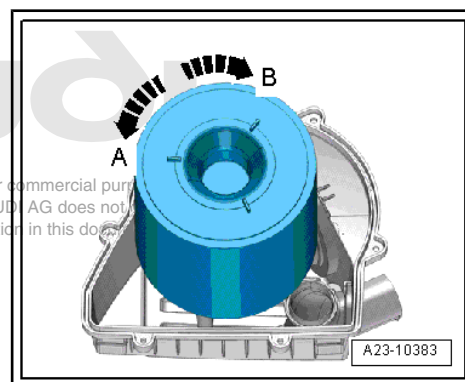
- ◆ ⇒ **"5.1 Exploded view - air cleaner", page 17**.

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

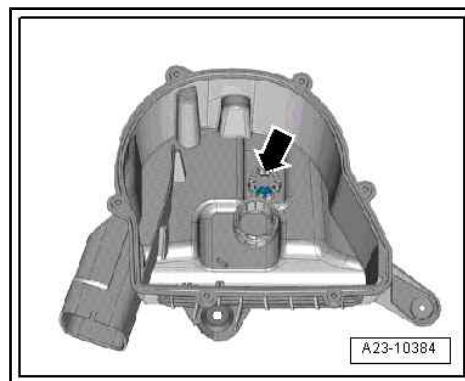


Note

- ◆ 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.

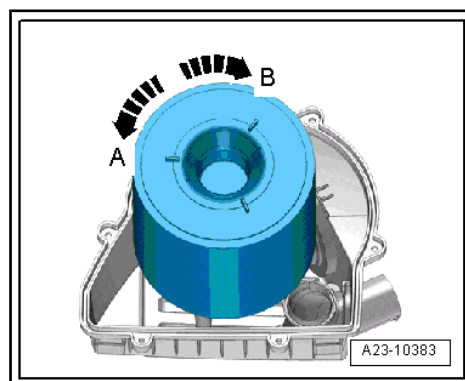


- Clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections) using a vacuum cleaner.
- Blow out water drain -arrow- with compressed air.
- Check for salt residue, dirt and leaves in air mass meter and air intake hose (engine intake side).
- Check for dirt and leaves in air duct going from lock carrier to air cleaner housing.
- When installing air filter element, check that it is properly centred in retainer in air cleaner (bottom section).



- 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.
- Make sure that air hose is securely fitted on air cleaner (top section).

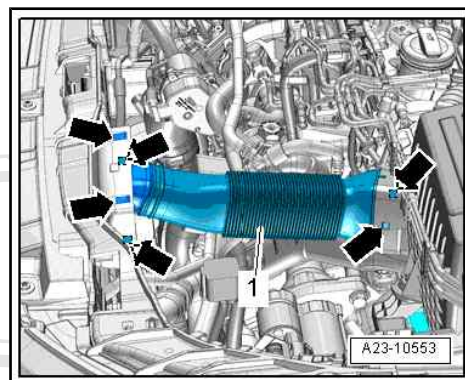
The remaining installation steps are carried out in the reverse sequence.



5.4 Removing and installing air cleaner housing

Removing

- Pull off engine cover panel ➔ [page 18](#) .
- Release fasteners -arrows- and detach air duct -1-.



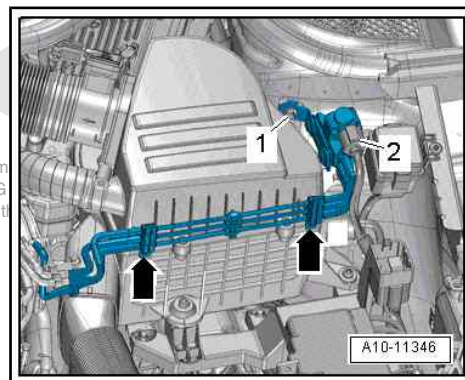
- Unclip bracket -arrows- from air cleaner housing (with vacuum hoses attached).



Note

Disregard -items 1, 2-.

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- Unplug electrical connector -3-.
- Release hose clips -1, 2- and detach air hoses.
- Unscrew bolt -4- and detach air cleaner housing.

Installing

Tightening torques

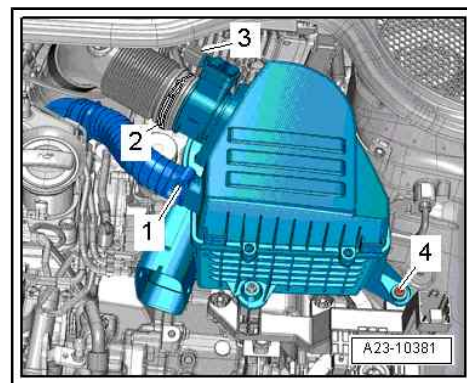
- ◆ ⇒ ["5.1 Exploded view - air cleaner", page 17](#) .



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 hose (engine intake side).
- Check for dirt and leaves in air duct going from lock carrier to air cleaner housing.
- Press release tabs and disconnect water drain hose
⇒ [Item 23 \(page 18\)](#) .
- Clean dirt and leaves out of connection and hose.

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



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6 Exploded view - intake manifold

⇒ ["6.1 Exploded view - intake manifold, vehicles with intake manifold flap V157", page 22](#)

⇒ ["6.2 Exploded view - intake manifold, vehicles without intake manifold flap V157", page 23](#)

⇒ ["6.3 Removing and installing intake manifold", page 24](#)

6.1 Exploded view - intake manifold, vehicles with intake manifold flap - V157-

1 - Intake manifold

- ☐ With intake manifold flap motor - V157- and intake manifold flap potentiometer - G336- (combined in one component)

Gradual discontinuation of intake manifold flap motor - V157-

- ☐ Must not be dismantled
- ☐ Removing and installing
⇒ [page 24](#)

2 - Bolt

- ☐ 8 Nm

3 - Gasket

- ☐ Renew

4 - Connecting pipe

- ☐ Between exhaust gas recirculation cooler and intake manifold

5 - Clamp

- ☐ Renew
- ☐ 5 Nm

6 - Seal

- ☐ Renew

7 - Bolt

- ☐ 20 Nm

8 - Throttle valve module - J338-

- ☐ Removing and installing
⇒ [page 57](#)

9 - Bolt

- ☐ 10 Nm

10 - Bolt

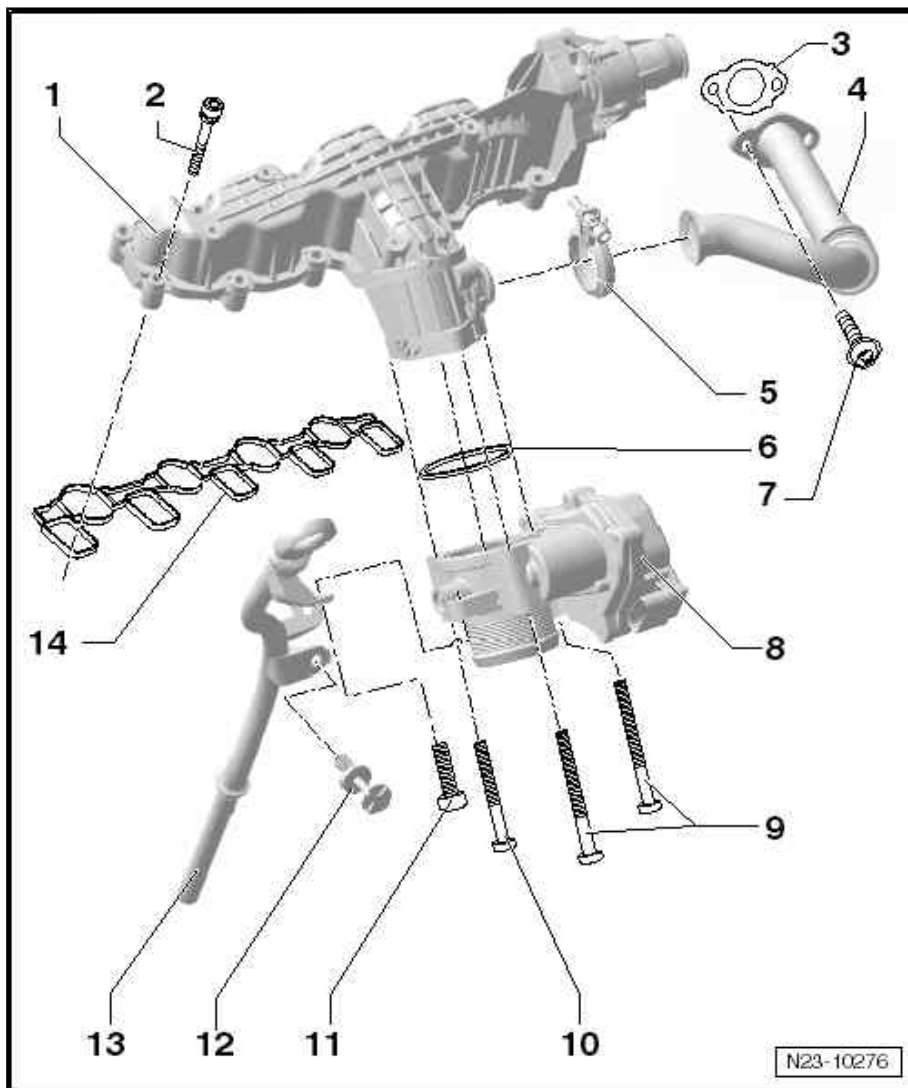
- ☐ 10 Nm

11 - Bolt

- ☐ 10 Nm

12 - Clip

- ☐ For securing tube for oil dipstick



13 - Tube for oil dipstick

14 - Gasket

☐ Renew

6.2 Exploded view - intake manifold, vehicles without intake manifold flap - V157-

1 - Guide tube

☐ For oil dipstick

2 - Seal

☐ Renew

3 - Seals

☐ Renew

4 - Bolt

☐ Tighten in diagonal sequence, working from centre outwards

☐ 8 Nm

5 - Fuel return line

6 - Bolt

☐ 9 Nm

7 - Bolt

☐ 9 Nm

8 - Intake manifold

☐ Removing and installing
 ⇒ [page 24](#)

9 - Bracket

☐ For exhaust gas recirculation cooler change-over valve - N345-

10 - Bolt

☐ 9 Nm

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

12 - Gasket

☐ Renew

13 - Bolt

☐ Tightening torque ⇒ Rep. gr. 26

14 - Pipe for exhaust gas recirculation

☐ To exhaust gas recirculation cooler

15 - Screw-type clip

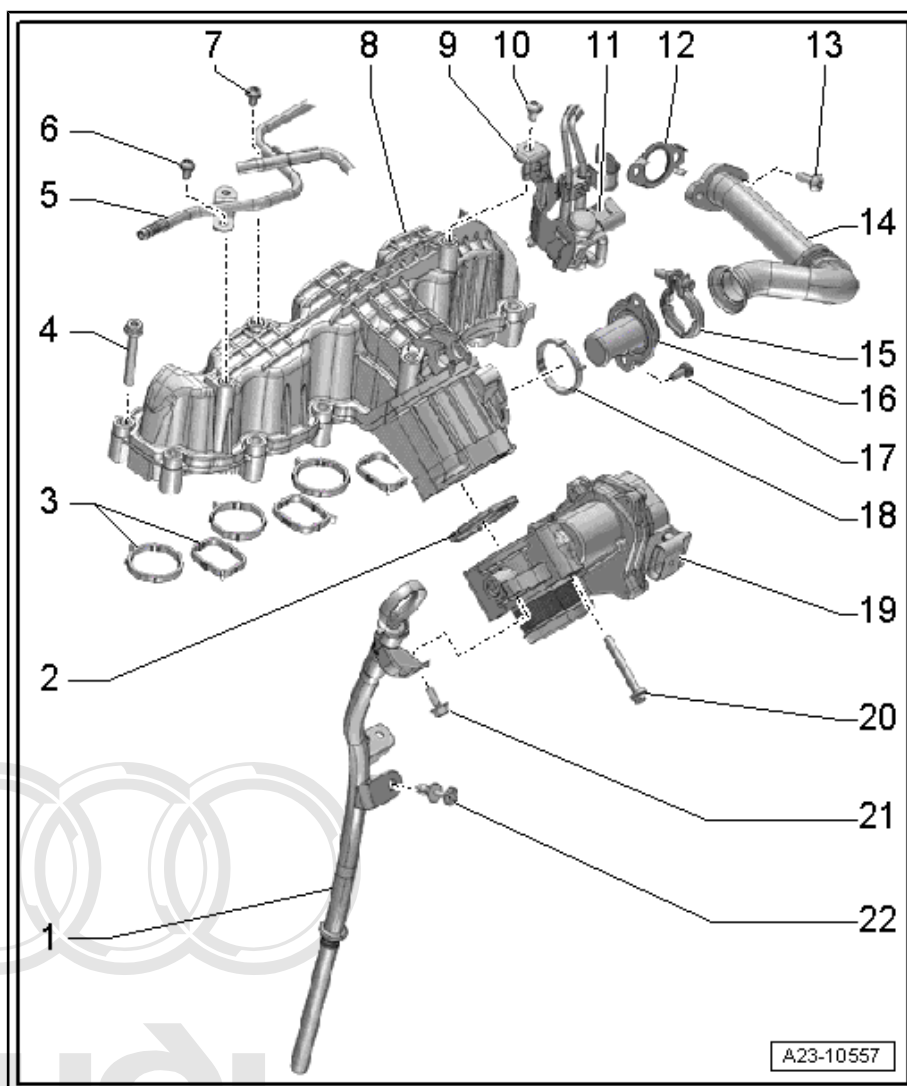
☐ Tightening torque ⇒ Rep. gr. 26

16 - Connection

☐ For exhaust gas recirculation

17 - Bolt

☐ 8 Nm



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18 - Seal

- ☐ Renew

19 - Throttle valve module - J338-

- ☐ With throttle valve potentiometer - G69-
- ☐ Removing and installing ⇒ [page 57](#)

20 - Bolt

- ☐ 8 Nm

21 - Bolt

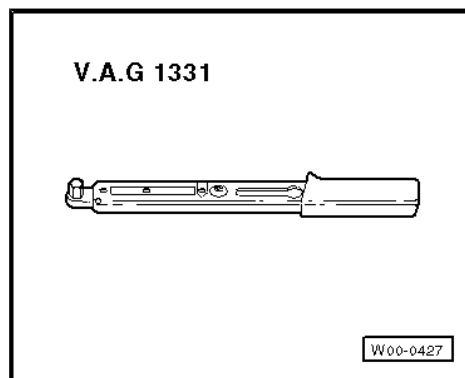
- ☐ Tightening torque ⇒ Rep. gr. 17

22 - Clip

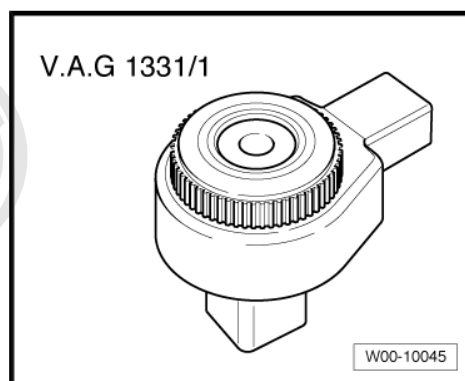
6.3 Removing and installing intake manifold

Special tools and workshop equipment required

- ◆ Torque wrench - V.A.G 1331-

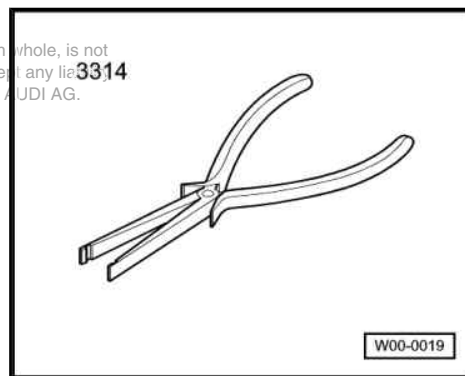


- ◆ Ratchet - V.A.G 1331/1-

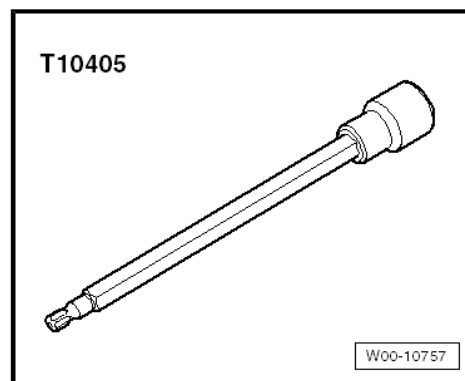


- ◆ Pliers - 3314-

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- ◆ Socket Torx T30 - T10405-



Removing

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WARNING

- ◆ *Always read rules for cleanliness and instructions for working on fuel system ➔ [page 1](#) .*
- ◆ *Follow these instructions and rules for cleanliness before starting work and while working on the fuel system.*

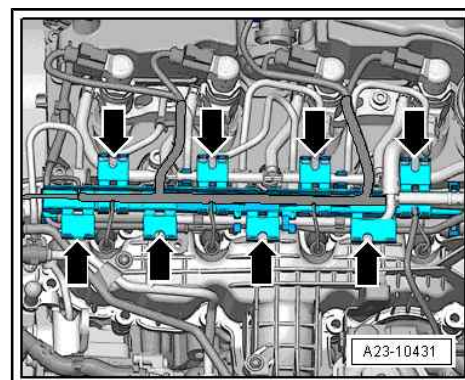
- Pull off engine cover panel ➔ [page 18](#) .
- Remove noise insulation ➔ Rep. gr. 66 .



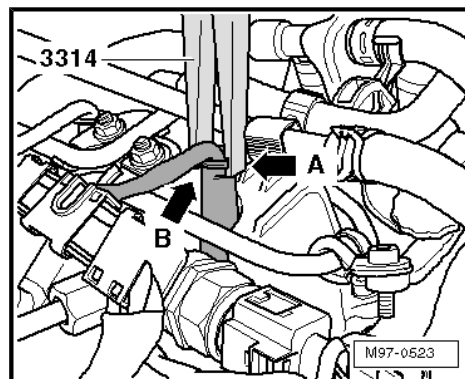
Caution

Make sure that no wire connection is damaged when unplugging the connectors; otherwise the entire wiring harness must be renewed. When unplugging the connectors, do not compress the pliers - 3314- with too much force so that the support sleeve is not damaged.

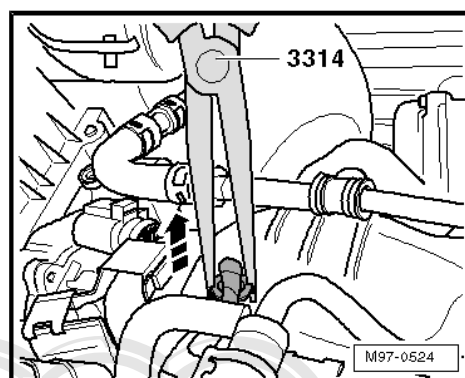
- Open catches -arrows- on cable duct to move clear wiring harness.



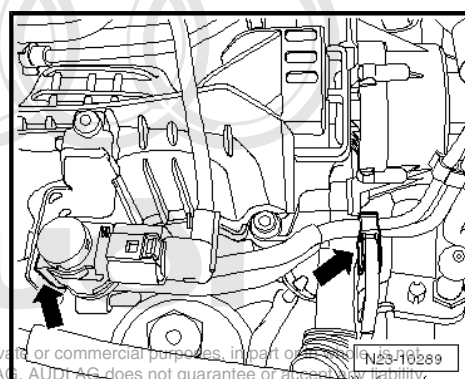
- Apply groove -arrow A- of pliers - 3314- to collar of support sleeve -arrow B-.



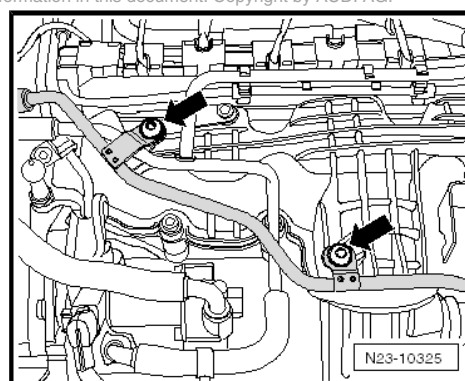
- Carefully unplug connectors from glow plugs in direction of -arrow-.



- Pull exhaust gas recirculation cooler changeover valve - N345- -left arrow- off bracket and move clear to one side.

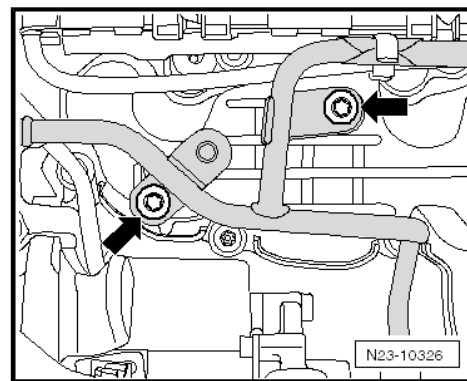


- Unscrew securing bolts -arrows- and move coolant return line clear to one side.

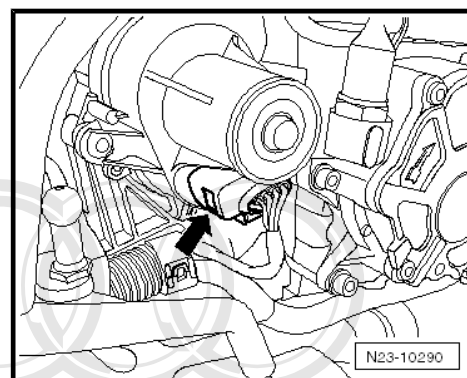


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- Unscrew securing bolts -arrows- and move fuel return line clear to one side.

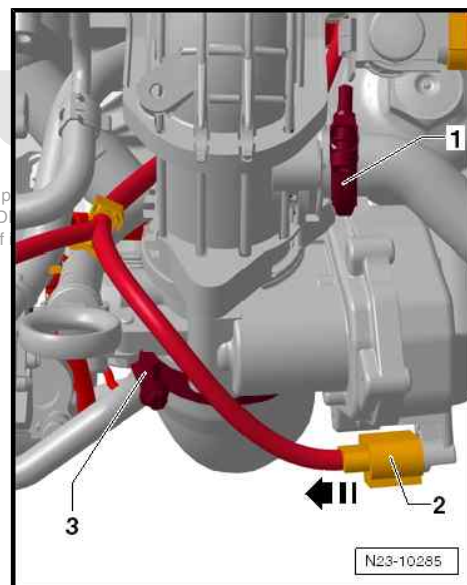


- Unplug connector -arrow- at intake manifold flap motor - V157- (if fitted).
- Remove fuel rail ➔ [page 32](#) .

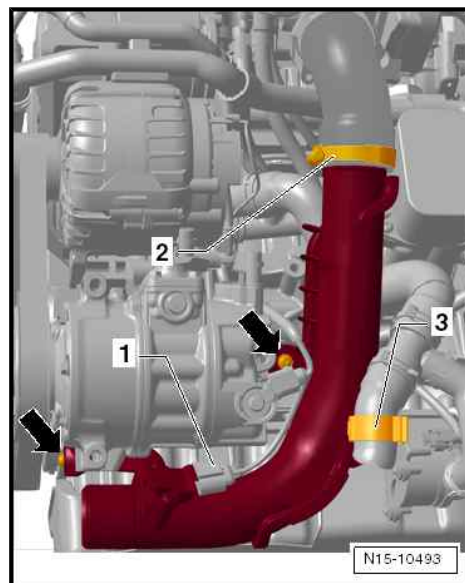


- Unplug connector -2- from throttle valve module - J338- .
- Open clamp -1- at connecting pipe for exhaust gas recirculation and remove connecting pipe.
- Remove bolt from mounting for oil dipstick tube.

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- Open clamp -2- on air pipe.
- Remove charge air hose between throttle valve module - J338- and air pipe. To do so, unscrew bolts -arrows-.

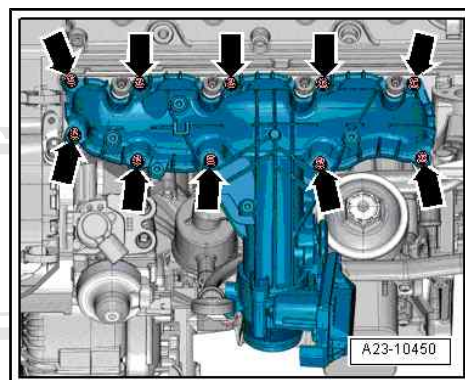


- Unscrew intake manifold bolts -arrows- in diagonal sequence starting from outside and working inwards using socket Torx T30 - T10405- .
- Carefully take out intake manifold.

Installing

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

- Renew seals and/or gaskets.
- Tighten bolts securing intake manifold in diagonal sequence starting from outside and working inwards.
- Carefully take out intake manifold.



Tightening torques



Note

- ♦ ⇒ ["6.1 Exploded view - intake manifold, vehicles with intake manifold flap V157", page 22](#)
- ♦ ⇒ ["6.2 Exploded view - intake manifold, vehicles without intake manifold flap V157", page 23](#).

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Note

Renew seals and/or gaskets.

- Tighten intake manifold bolts in diagonal sequence, working from inside to outside.
- Install fuel rail ⇒ [page 32](#) .
- Install air pipe ⇒ Rep. gr. 21 .
- Install noise insulation ⇒ Rep. gr. 66 .

7 Injectors/high-pressure reservoir (rail)

⇒ [“7.1 Exploded view - injectors, high-pressure reservoir”,
page 29](#)

⇒ [“7.2 Removing and installing high-pressure reservoir”,
page 32](#)

⇒ [“7.3 Exploded view - injectors with clamping piece”,
page 36](#)

⇒ [“7.4 Performing adaption of injectors”, page 38](#)

⇒ [“7.5 Removing and installing injectors”, page 38](#)

⇒ [“7.6 Vacuum test for injectors”, page 44](#)

⇒ [“7.8 Removing and installing high-pressure pipes”, page 47](#)

⇒ [“7.9 Installing fuel return lines”, page 49](#)

7.1 Exploded view - injectors, high-pressure reservoir



WARNING

- ◆ *Always read rules for cleanliness and instructions for working on fuel system ⇒ [page 3](#).*
- ◆ *Follow these instructions and rules for cleanliness before starting work and while working on the fuel system.*



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1 - Bolt

- ☐ 8 Nm

2 - High-pressure pipe

- ☐ From high-pressure pump to fuel rail
- ☐ Do not alter shape
- ☐ Mark allocation for re-installation; pay attention to marking when installing
- ☐ Check for damage before re-installing
- ☐ Installing ⇒ [page 47](#)
- ☐ Lubricate threads of union nuts with clean engine oil
- ☐ 25 Nm

3 - Seal

- ☐ For injector
- ☐ In cylinder head cover
- ☐ Renew if leaking ⇒ Rep. gr. 15

4 - Copper seal

- ☐ Renew

5 - O-ring

- ☐ Renew

6 - Injector

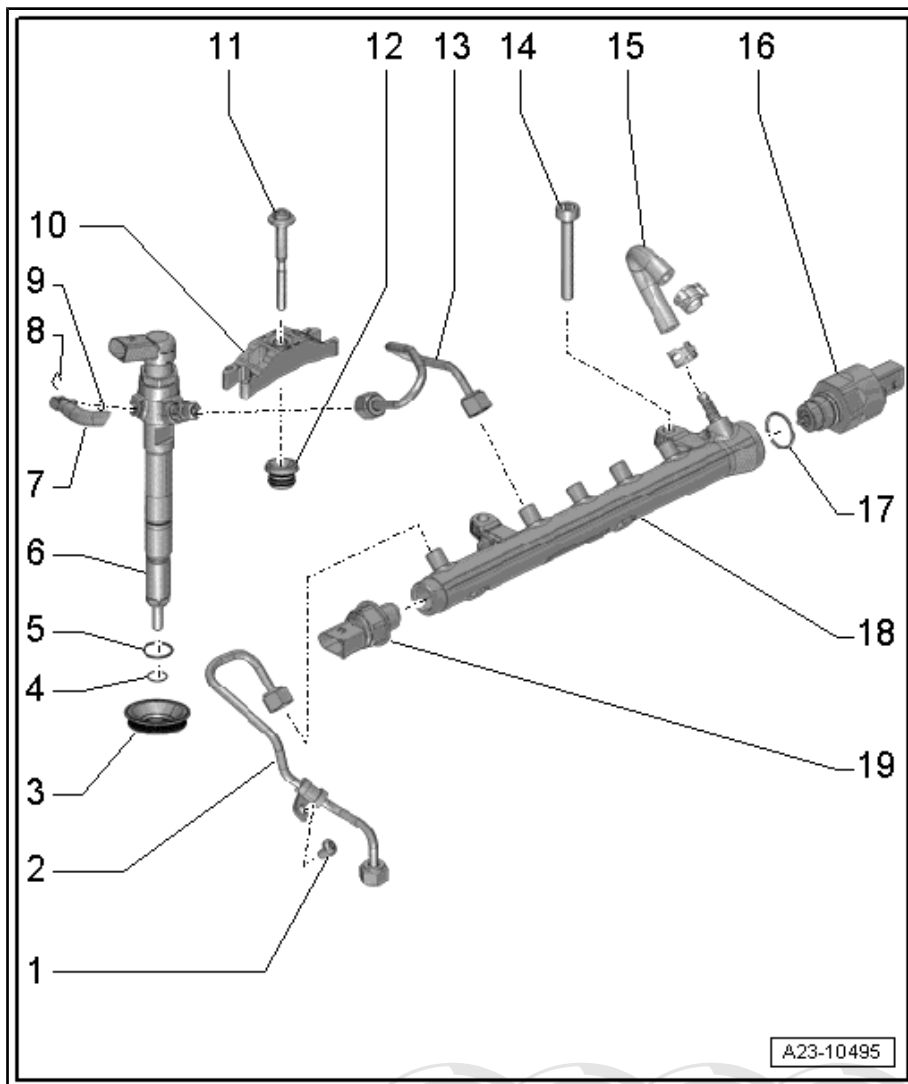
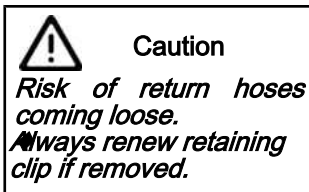
- ☐ Use a coloured pen to mark allocation of injectors to corresponding clamping piece and high-pressure pipe, and to corresponding cylinder for re-installation; pay attention to markings when installing
- ☐ Always renew copper seal when removing and installing
- ☐ To remove carbon deposits from the injector sealing surface, clean the injector bore in the cylinder head with cleaning kit - VAS 6811- (it is important to do this to avoid leaks)
- ☐ Removing and installing ⇒ [page 38](#)

7 - Fuel return lines

- ☐ Do not dismantle
- ☐ Only renew together with pressure retention valve
- ☐ Check for damage before re-installing
- ☐ Installing ⇒ [page 49](#)
- ☐ After renewing, engine must be run at idling speed for approx. 2 minutes to bleed fuel system
- ☐ Then check fuel return lines for leaks

8 - Retaining clip

- ☐ For fuel return lines



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- ☐ Grease lightly before fitting

9 - O-ring

- ☐ Renew

10 - Clamping piece

**Caution**
*Risk of damage to engine.
When installing a new base engine, it is essential that the clamping pieces for the injectors are tightened to the specified torque
⇒ **Item 11 (page 31)** after installing the high-pressure pipes. The clamping pieces are only secured hand-tight at the factory so the injectors can be aligned during installation.*

- ☐ Use a coloured pen to mark injectors and corresponding clamping piece and cylinder for re-installation; pay attention to markings when installing
- ☐ The clamping pieces can be re-used when installing new injectors
- ☐ Each clamping piece secures two injectors

11 - Bolt

- ☐ Renew
- ☐ Tighten initially to 2 Nm, then screw on union nuts for high-pressure pipes hand-tight and align injectors
- ☐ Then tighten to final torque (9 Nm +180°)

12 - Grommet

- ☐ In cylinder head cover

13 - High-pressure pipe

- ☐ From fuel rail to injector
- ☐ When loosening connection, always counterhold connection on injector
- ☐ Do not alter shape
- ☐ Mark allocation for re-installation; pay attention to marking when installing
- ☐ Check for damage before re-installing
- ☐ Lubricate threads of union nuts with clean engine oil
- ☐ 25 Nm

14 - Bolt

- ☐ 22 Nm

15 - Fuel return line

- ☐ To fuel tank

16 - Fuel pressure regulating valve - N276-

- ☐ With deformable sealing lip
- ☐ Cannot be re-installed
- ☐ Removing and installing ⇒ [page 61](#)
- ☐ Tightening torque ⇒ [page 32](#)

17 - O-ring

- ☐ Renew

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18 - High-pressure reservoir

- ❑ Removing and installing ➤ [page 32](#)

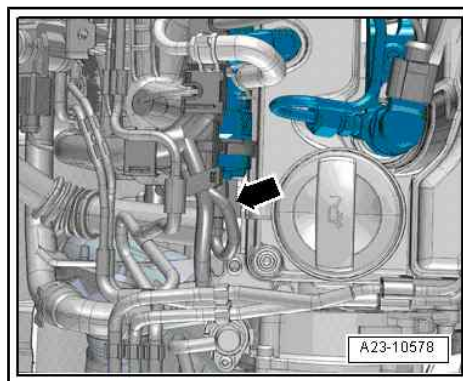
19 - Fuel pressure sender - G247-

- ❑ Removing and installing ➤ [page 63](#)
- ❑ 100 Nm

Fuel pressure regulating valve - N276- - tightening torque

- Tighten regulating valve -arrow- in 2 stages as follows:

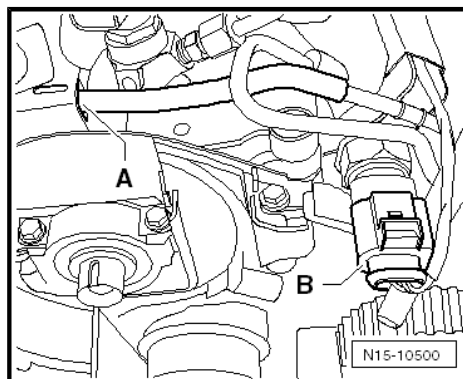
Stage	Tightening torque
1.	Screw in by hand until contact is made
2.	80 Nm



Fuel pressure sender - G247- - tightening torque

- Tighten fuel pressure sender - G247- in 2 stages as follows:

Stage	Fuel pressure sender - G247-	Tightening torque
1.	-Item B-	Screw in by hand until contact is made
2.	-Item B-	100 Nm

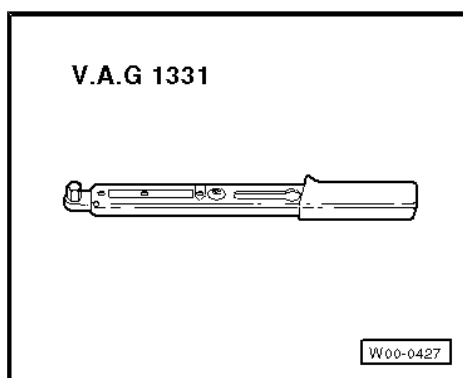


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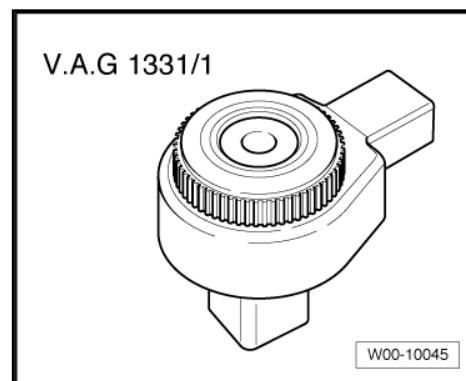
7.2 Removing and installing high-pressure reservoir

Special tools and workshop equipment required

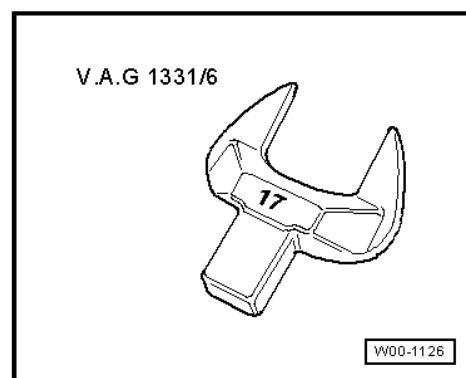
- ◆ Torque wrench - V.A.G 1331-



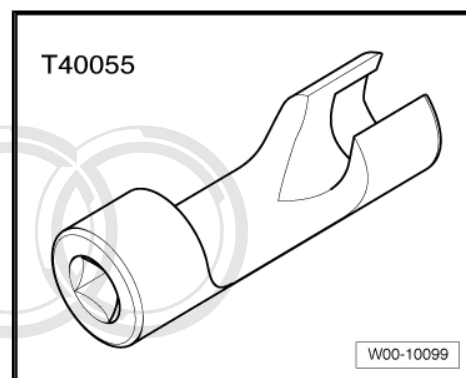
◆ Ratchet - V.A.G 1331/1-



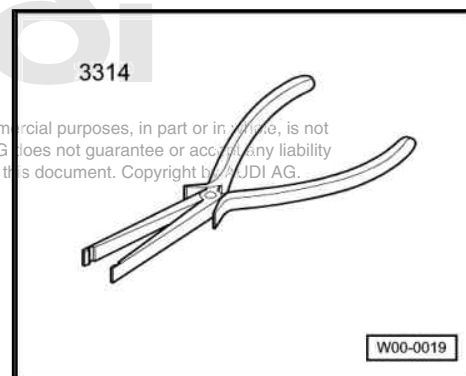
◆ Open end spanner insert, AF 17 - V.A.G 1331/6-



◆ Socket - T40055-



◆ Pliers - 3314-



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Removing

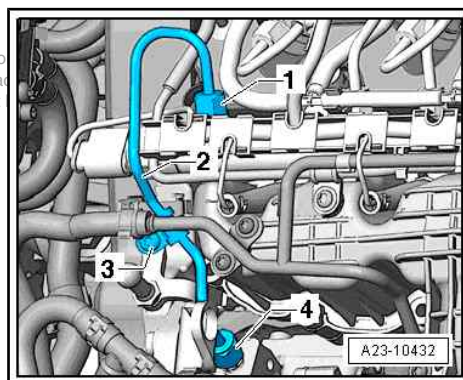


WARNING

- ◆ *Always read rules for cleanliness and instructions for working on fuel system ➔ [page 3](#).*
- ◆ *Follow these instructions and rules for cleanliness before starting work and while working on the fuel system.*

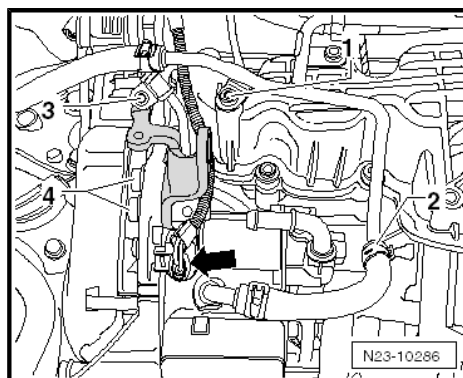
- Remove engine cover panel.
- Unscrew bolt -3- from bracket for high-pressure fuel pipe.
- Unscrew union nuts at high-pressure pump -4- and high-pressure reservoir -1- and remove high-pressure fuel pipe -2-.

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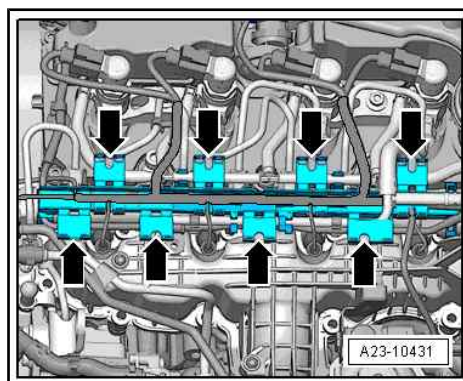


Note

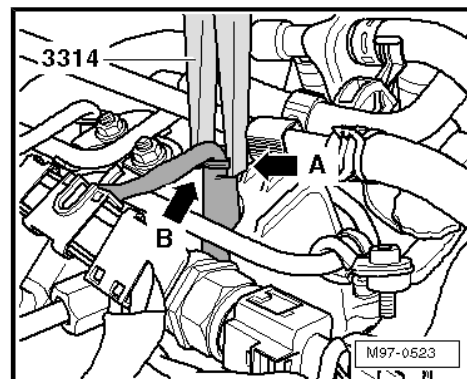
To remove union nut at high-pressure pump, it must be possible to move bracket (for engine lifting eye); for this, loosen bolts -4-.



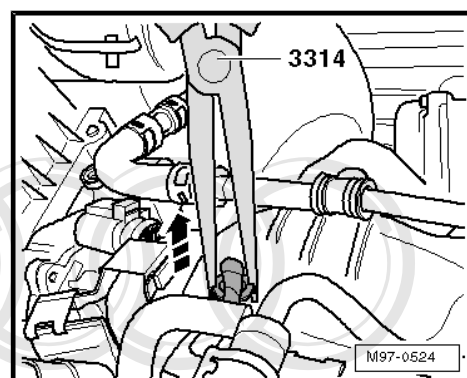
- Open catches -arrows- on cable duct to move clear wiring harness.



- Apply groove -arrow A- of pliers - 3314- to collar of support sleeve -arrow B-.



- Carefully unplug connectors from glow plugs in direction of -arrow-.



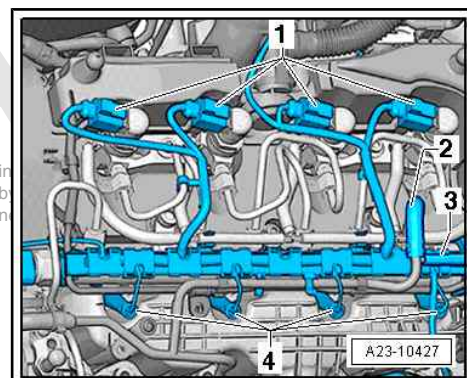
- Unplug electrical connectors -1 and 4-.
- Detach fuel return line -2-.



Note

Disregard -item 3-.

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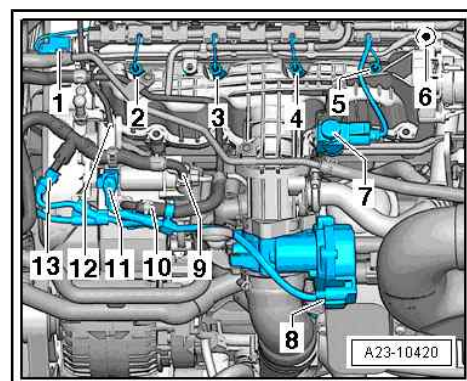


- Unplug electrical connectors -1, 6 and 7-.



Caution

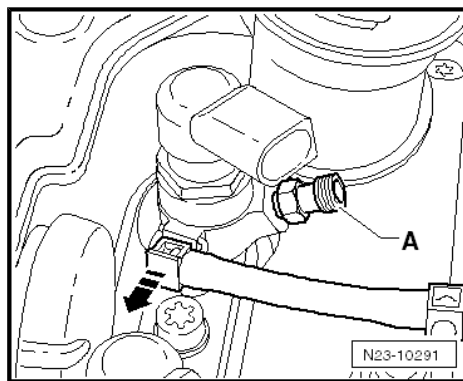
- ◆ **Mark cylinder numbers on high-pressure pipes. They must always be re-installed on the same cylinders.**
- ◆ **Observe rules for cleanliness when working on the injection system.**
- ◆ **Plug open connections with suitable sealing caps immediately.**



- Remove high-pressure pipes between injectors and high-pressure reservoir.


Note

- ◆ *Counterhold connection -A- to loosen union nuts at injectors.*
- ◆ *Disregard -arrow-.*
- After removal, lay high-pressure pipes on a clean cloth.



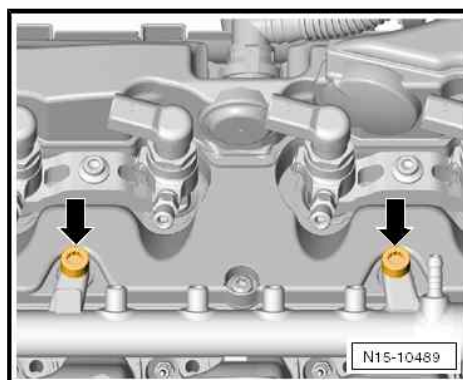
- Unscrew both bolts -arrows- and remove high-pressure reservoir.

Installing

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

Tightening torques

- ⇒ [“7.1 Exploded view - injectors, high-pressure reservoir”, page 29](#)
- Install high-pressure pipes ⇒ [page 47](#) .


Note

- ◆ *Retaining clips must be renewed.*
- ◆ *Note identification marks for cylinder allocation when re-installing high-pressure pipes.*
- ◆ *The high-pressure pipes can be re-used after performing the following checks:*
- ◆ *Check taper seats of high-pressure pipes for deformation and cracks.*
- ◆ *The bore of the pipe must not be distorted, restricted or otherwise damaged.*
- ◆ *Corroded pipes must not be used again.*
- Install engine lifting eye ⇒ Rep. gr. 15 .

7.3 Exploded view - injectors with clamping piece

1 - Injector

- ☐ Use a coloured pen to mark allocation of injectors to corresponding clamping piece and high-pressure pipe, and to corresponding cylinder for re-installation; pay attention to markings when installing
- ☐ Always renew copper seal when removing and installing
- ☐ To remove carbon deposits from the injector sealing surface, clean the injector bore in the cylinder head with cleaning kit - VAS 6811- (it is important to do this to avoid leaks)
- ☐ Removing and installing
 ⇒ [page 38](#)

2 - Bolt for clamping piece

- ☐ Renew
- ☐ Tighten initially to 2 Nm, then screw on union nuts for high-pressure pipes hand-tight and align injectors
- ☐ Then tighten to final torque (9 Nm +180°)
- ☐ Note warning instructions for clamping piece
 ⇒ [Item 10 \(page 31\)](#)

3 - High-pressure connection

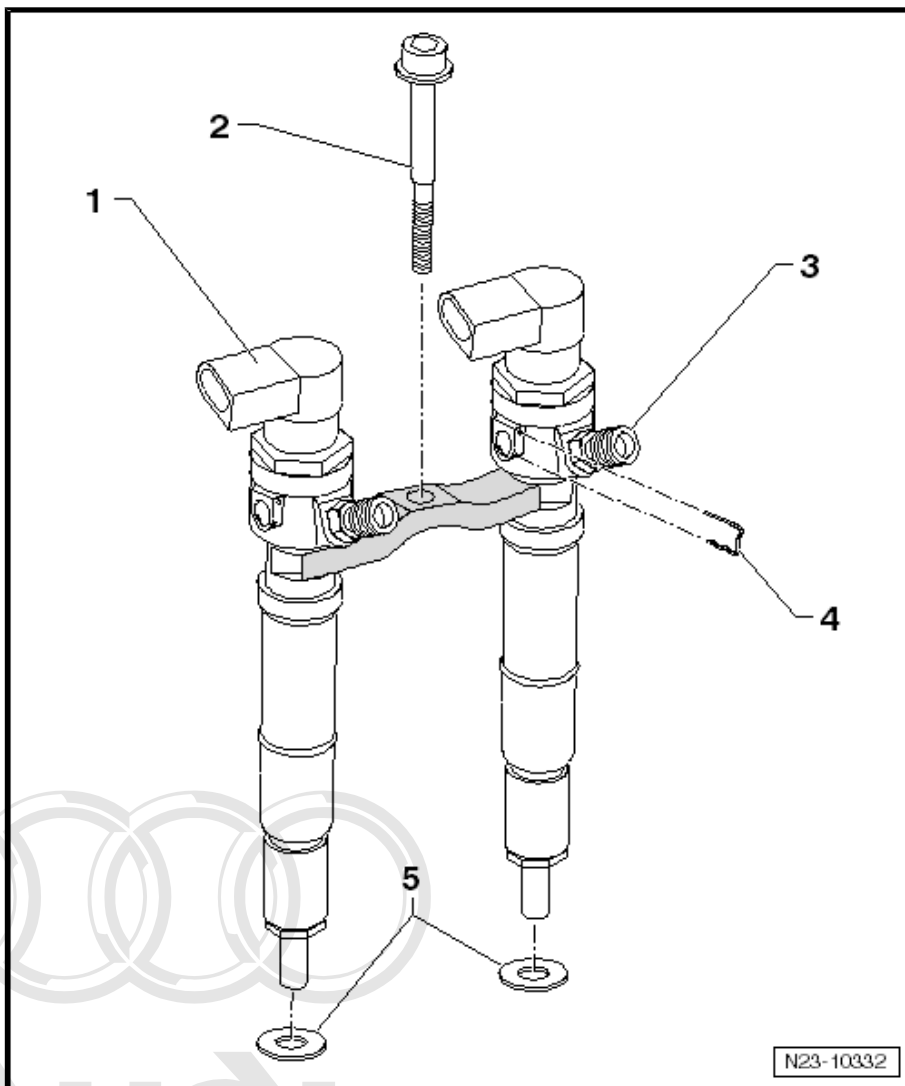
- ☐ Counterhold at high-pressure connection when loosening high-pressure pipes

4 - Retaining clip for return lines

- ☐ Renew
- ☐ Grease retaining clip lightly before fitting

5 - Copper seal

- ☐ Renew



7.4 Performing adaption of injectors

- ◆ The "Adaption for injectors" function serves to correct the injection rates for each cylinder of a common rail system individually across the entire operating range.
- ◆ The 6-digit adaption value -b- (details in illustration are only an example) is marked separately on each injector. The values may consist of letters and/or numbers.
- ◆ The 6-digit adaption value (example) is marked on each injector. It may consist of letters and/or numbers (ASCII code).

a - Injector number

b - Checksum

c - Part number

d - Type approval number

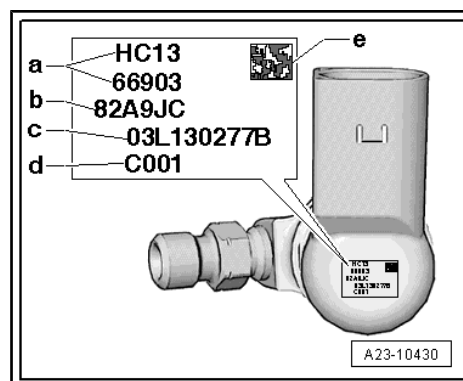
e - Data matrix code

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

When a new engine control unit is installed, the "Adaption values for injectors" must be written into the new control unit.

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

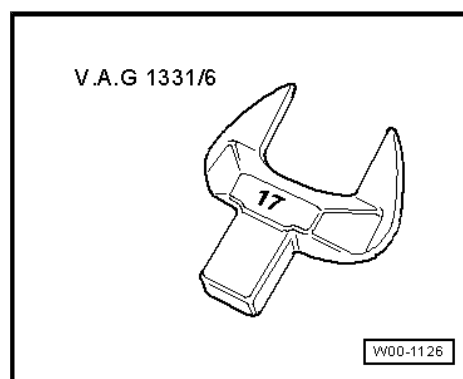
Also check that the values for the "Adaption for injectors" for all other injectors are stored in the engine control unit. Do NOT attempt to re-enter these values if the correct values are already stored in the engine control unit.



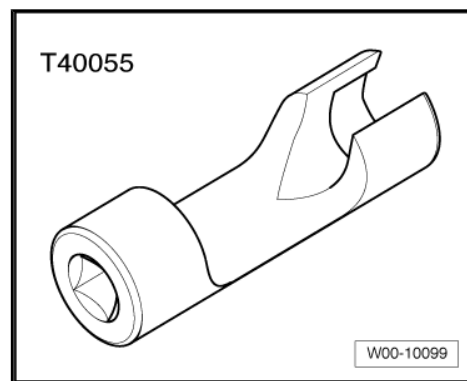
7.5 Removing and installing injectors

Special tools and workshop equipment required

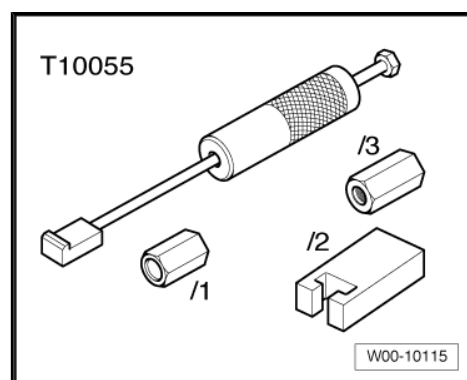
- ◆ Cleaning kit - VAS 6811-
- ◆ Open end spanner insert, AF 17 - V.A.G 1331/6-



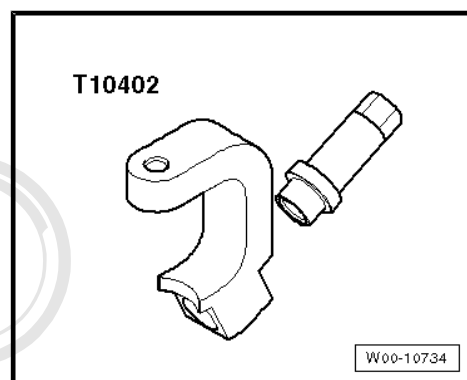
◆ Socket - T40055-



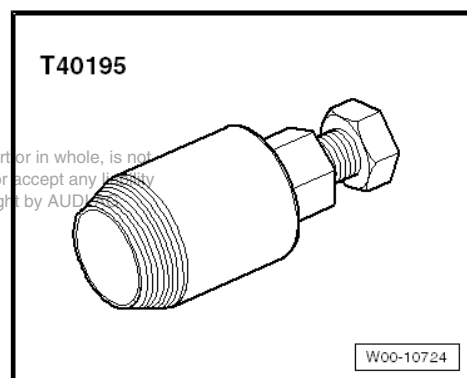
◆ Puller - T10055- with adapter - T10055/1-



◆ Puller - T10402-



◆ Oil seal extractor - T40195-



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Removing

- Pull off engine cover panel ➤ [page 18](#) .
- Unplug electrical connectors -arrows- at injectors.



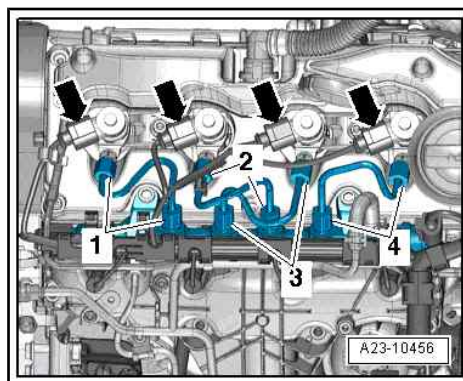
WARNING

- ◆ *Always read rules for cleanliness and instructions for working on fuel system ➤ [page 3](#) .*
- ◆ *Follow these instructions and rules for cleanliness before starting work and while working on the fuel system.*

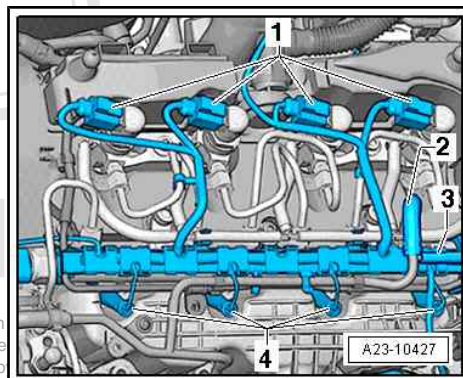


Caution

- ◆ *Mark cylinder numbers on injector units. They must always be re-installed on the same cylinders.*
- ◆ *Observe rules for cleanliness when working on the injection system.*
- ◆ *Plug open connections with suitable sealing caps immediately.*



- Unplug electrical connectors -1- at injectors which are to be removed.
- Remove high-pressure pipes between injectors and fuel rail.

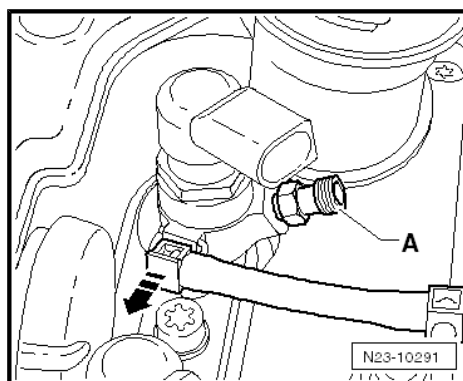


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Note

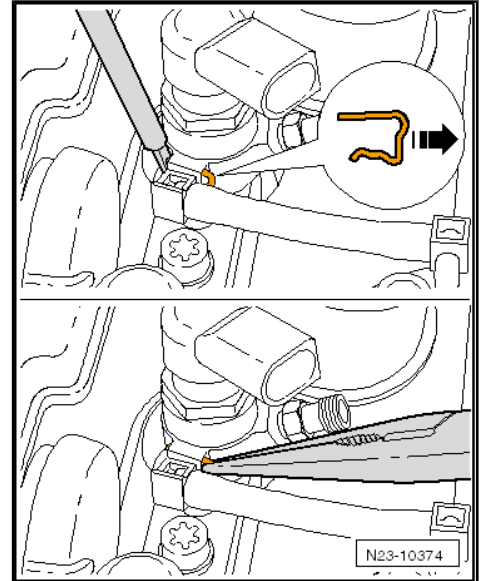
Counterhold at high-pressure connection -A- to loosen high-pressure pipes.



- Press retaining clips for return line connections out of all injectors using a screwdriver -arrow- and remove them using long-nose pliers.

Audi

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- Then detach fuel return line connections from injectors in direction of -arrow-.

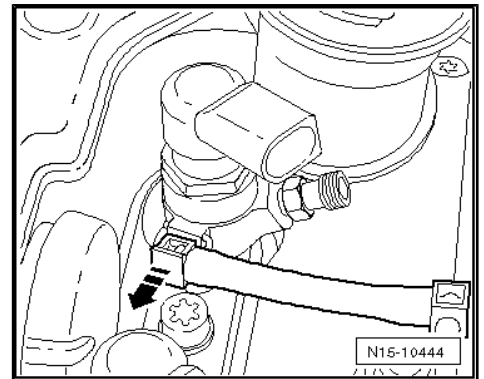
 Note

- ◆ No dirt must be allowed to get into the disconnected return lines or the open connections on the injectors.
- ◆ Each clamping piece secures two injectors.



Caution

Proceed very carefully to prevent unnecessary dismantling or further damage.



- Remove bolt securing clamping piece to injectors to be removed.

 Note

Leave clamping piece in position until adjacent injector is detached.



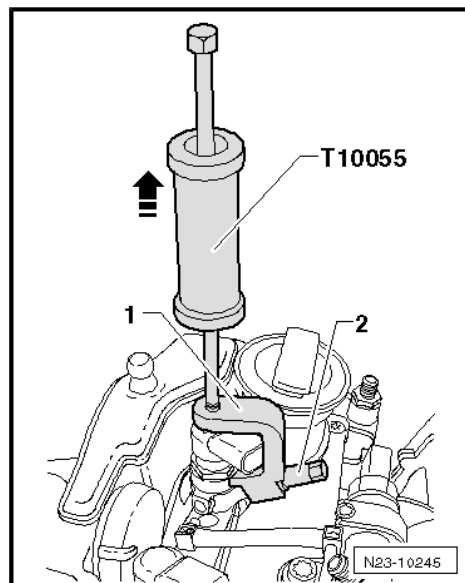
Caution

Risk of damage to injector if clamping piece is not kept straight.

- ◆ First detach injectors for cylinders 1 and 4; then detach injectors for cylinders 2 and 3.

- Apply puller - T10055- with puller - T10402- -1- and -2- as shown in illustration and pull injectors out upwards by tapping gently.
- After removal, lay injectors on a clean cloth.

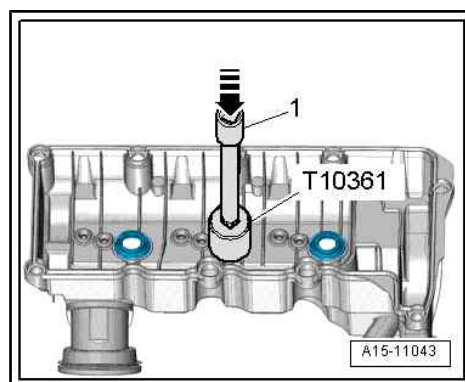
Removing seal from cylinder head cover



- Screw oil seal extractor - T40195- forcibly as far as possible into seal by hand.
- Fit striker -T10133/3- with adapter -T10133/2- on oil seal extractor, as shown in illustration, and pull out seal upwards by tapping gently.
- After removing seal, check whether spring ring is still attached to old seal.

If it is not, make sure that spring ring has been removed from bore.

Installing seal in cylinder head cover



Caution

Proceed very carefully to prevent unnecessary dismantling or further damage.

Remember that the cylinder head cover is made of plastic.

Check cylinder head cover for damage.



Note

Renew seal.

- Insert new seal initially by hand.

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- Apply carrier - 3390- and short extension -1- from socket set at top and press new injector seal in as far as stop.

Important instructions for installing injectors:

When installing injectors, the following components must be renewed:

- ◆ Bolt for clamping piece
- ◆ Copper seal
- ◆ O-ring for injector bore
- ◆ O-ring for fuel return line connection
- ◆ Retaining clip for fuel return line connection

If a used injector is being re-installed:

- Spray tip of injector nozzle with rust-releasing 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.
- Clean off deposits under the copper seal using a suitable scraper.

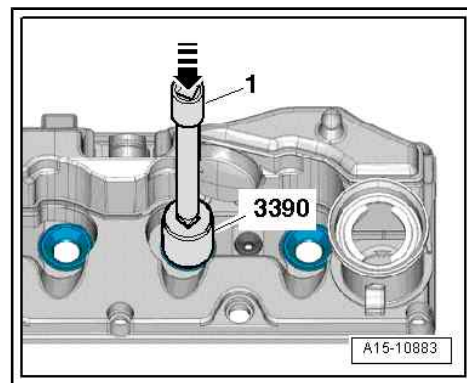
Continued (same procedure for used and new injectors):



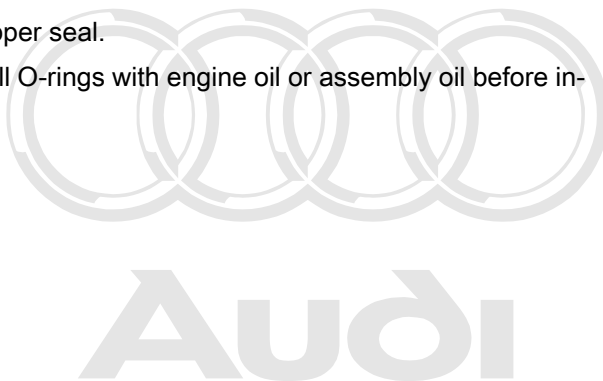
Caution

Risk of damage to injector sealing surface.

- ◆ *To remove carbon deposits from the injector sealing surface, clean the injector bore in the cylinder head with cleaning kit - VAS 6811- .*



- Fit new copper seal.
- Lubricate all O-rings with engine oil or assembly oil before installing.



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- Renew seal for injector using assembly sleeve - T10377- .
- Install injectors.
- Slide clamping piece onto injectors; observe installation position.
- Hand-tighten union nuts on high-pressure pipes. Make sure that connections are not under tension.
- Tighten clamping piece to specified torque.

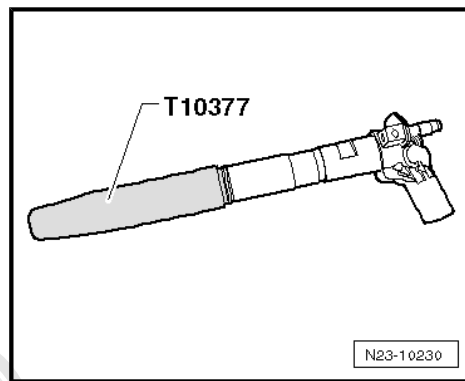
Tightening torques

- ◆ ⇒ ["7.1 Exploded view - injectors, high-pressure reservoir", page 29](#)
- Connect fuel return lines ⇒ [page 49](#) .

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

Also check that the values for the "Adaption for injectors" for all other injectors are stored in the engine control unit. Do NOT attempt to re-enter these values if the correct values are already stored in the engine control unit.

The adaption procedure is described in the "Guided Fault Finding". (The procedure is also described under "Guided Functions".)



7.6

Vacuum test for injectors

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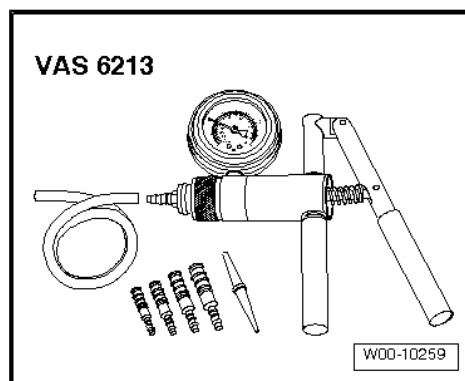


Note

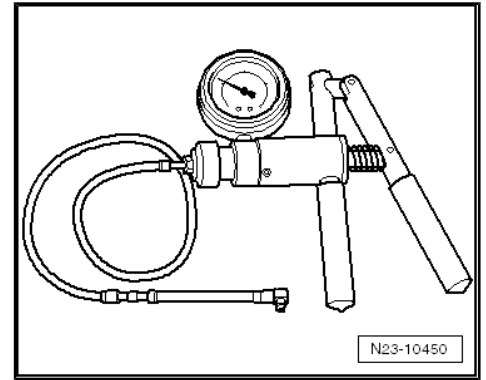
- ◆ *Leaking solenoid valves in the injectors can lead to the engine not running smoothly or not starting at all.*
- ◆ *To check the solenoid valves for dirt and thus an increased return flow rate, a vacuum test can be performed in addition to the "classic" return flow rate measurement.*

Special tools and workshop equipment required

- ◆ Hand vacuum pump - VAS 6213-

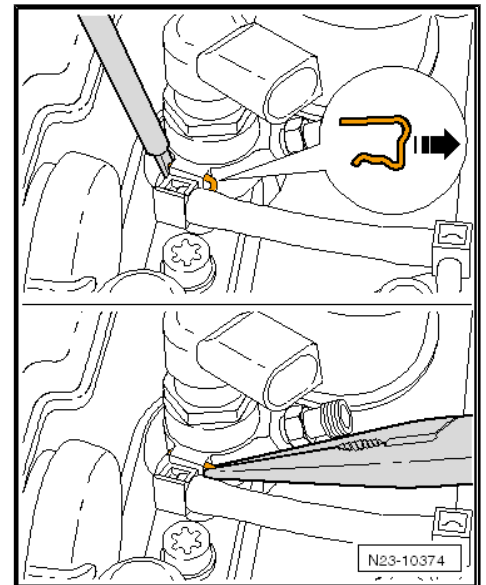


- ◆ Use a return line to make an -adapter-.



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- Remove engine cover panel.
- Press retaining clips for return line connections out of all injectors using a screwdriver -arrow- and remove them using long-nose pliers.



- Then detach fuel return line connections from injectors in direction of -arrow-.



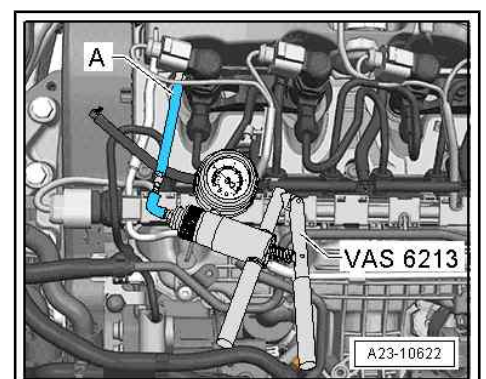
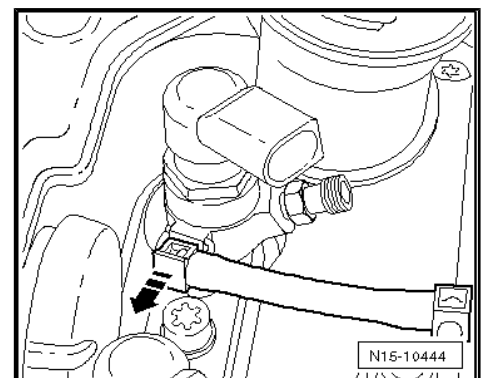
Note

No dirt must be allowed to get into the disconnected return lines or the open connections on the injectors.

- Connect adapter to the injectors to be checked.
- Generate a vacuum of -500 mbar using the hand vacuum pump - VAS 6213- .
- Specification: The vacuum should remain constant for 30 seconds.

In the case of a faulty injector, the vacuum will fall back to 0 bar within 2 to 3 seconds. Renew faulty injector ➔ [page 38](#) .

Install fuel return lines ➔ [page 49](#) .



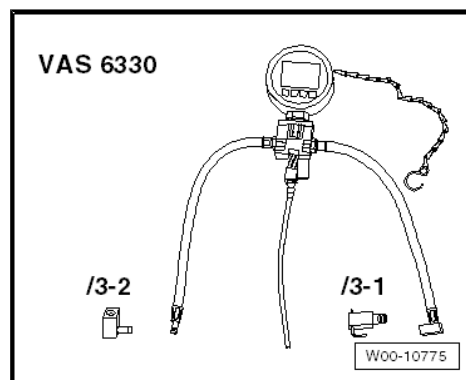
7.7 Checking pressure retention valve in fuel return line

The pressure retention valve maintains a 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-



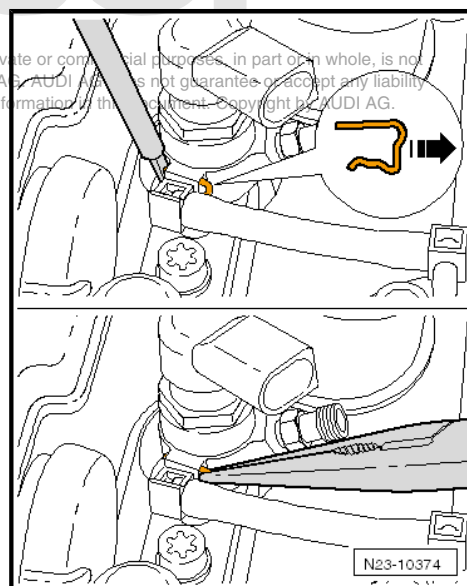
- ◆ Adapter - VAS 6330/3-1-
- ◆ Adapter - VAS 6330/3-2-
- Remove engine cover panel.
- Clean return line connection on cylinder 1 (with cleaning solution or similar) before removing.
- Dry return line connection on cylinder 1.
- Cover return line connection on cylinder 1 with a cloth.
- Pull out release clip and detach return line connection from cylinder 1.



Note

- ◆ *Open return line connection with a narrow screwdriver and long-nose pliers.*
- ◆ *Take care to keep all components clean. No dirt must be allowed to get into the disconnected return lines or the open connections on the injectors.*
- ◆ *Always renew clips.*

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- Connect tester for fuel return system - 6330- with adapters - VAS 6330/3-1- and -VAS 6330/3-2- between return line connection on injector and return line.
- Start engine.
- Check pressure indicated on tester.

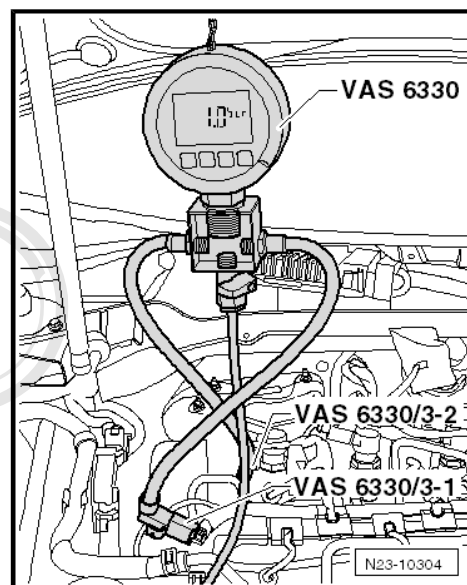


Note

- ◆ *There are different low-pressure fuel systems.*
- ◆ *To identify which low-pressure fuel system is installed, see ➔ [page 13](#).*
- ◆ Specification: approx. 1 bar
- ◆ or
- ◆ Specification: approx. 6 bar

If the value does not match the specification, fit a new pressure retention valve.

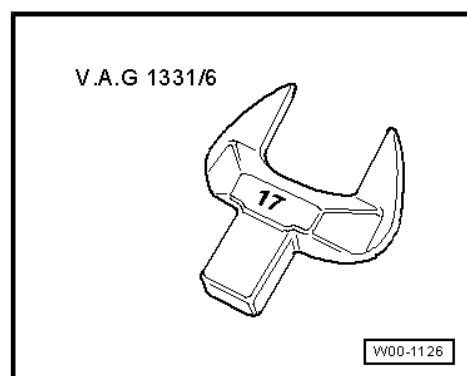
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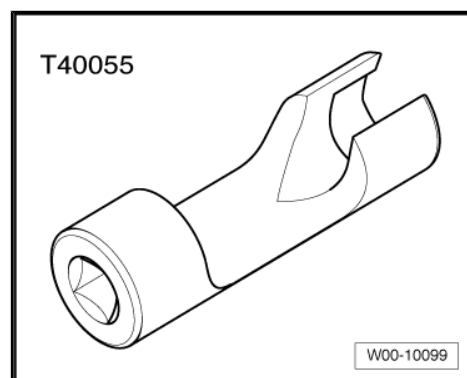
7.8 Removing and installing high-pressure pipes

Special tools and workshop equipment required

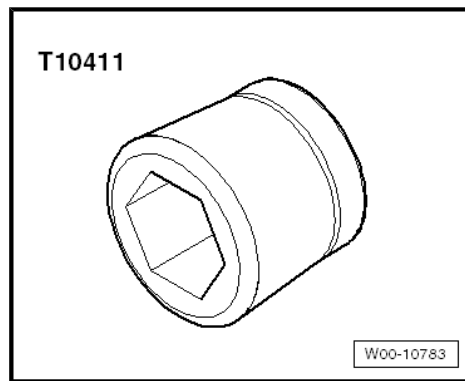
- ◆ Open end spanner insert, AF 17 - V.A.G 1331/6-



- ◆ Socket - T40055-

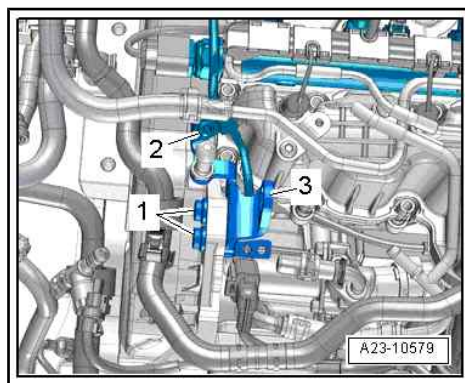


♦ Support sleeve -T10411-



Removing

- Pull off engine cover panel ➔ [page 18](#) .
- Remove bolts -1 and 2- and detach engine lifting eye -3-.



- Remove union nuts -1 and 4- and detach high-pressure pipe -2-.

Installing

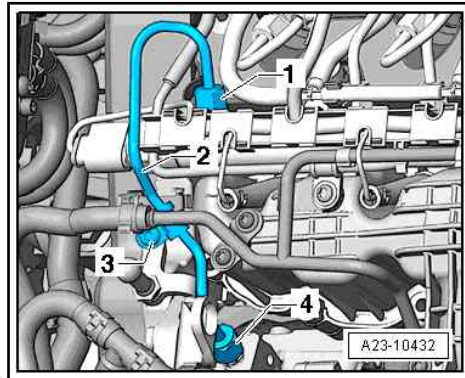
Tightening torques

- ♦ ➔ [“7.1 Exploded view - injectors, high-pressure reservoir”, page 29](#) .



Note

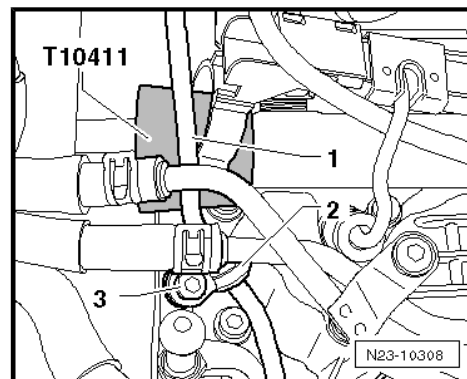
- ♦ *Before re-installation, check taper seats for deformation, cracks, damage, scores and corrosion. Renew high-pressure pipes if they are damaged or corroded.*
- ♦ *Check that bore in pipe is not distorted, restricted or damaged in any other way.*
- ♦ *When re-installing "old" high-pressure pipe, observe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



- Use vacuum cleaner to remove dirt from taper seat at fuel rail.
- Clean fuel pipe and end of pipe using cleaning solution and dry with compressed air.
- Lubricate threads of union nuts with fuel.
- Initially hand-tighten union nuts on high-pressure pipes (ensure that pipes are not under tension):
- Tighten high-pressure pipes between injectors and fuel rail first at injector and then at fuel rail.

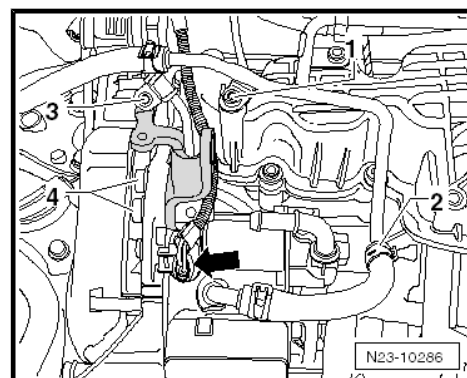
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- To install high-pressure pipe between high-pressure pump and fuel rail, slide support sleeve -T10411- onto fuel pressure sender - G247- .



Note

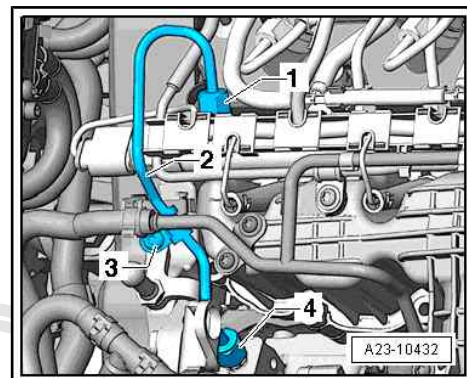
- ◆ To position union nut on high-pressure pump, it must be possible to move bracket (for engine lifting eye); for this, loosen bolts -4-.
- ◆ Support sleeve -T10411- gives correct distance between fuel pressure sender - G247- and high-pressure pipe.



- Tighten high-pressure pipe -2- between high-pressure pump and fuel rail first at high-pressure pump -4- and then at fuel rail -1-.
- Tighten bolt -3- for bracket for high-pressure fuel pipe.
- Secure bracket (for engine lifting eye).

Tightening torques

- ◆ ⇒ ["7.1 Exploded view - injectors, high-pressure reservoir", page 29](#)
- ◆ ⇒ ["7.1 Exploded view - injectors, high-pressure reservoir", page 29](#)
- ◆ ⇒ ["8.1 Exploded view - high-pressure pump", page 51](#)
- Check fuel system for leaks ⇒ [page 16](#) .



7.9 Installing fuel return lines

Procedure

- Prise O-rings off all return lines. Do not use sharp-edged tools to avoid damaging the return lines.



Caution

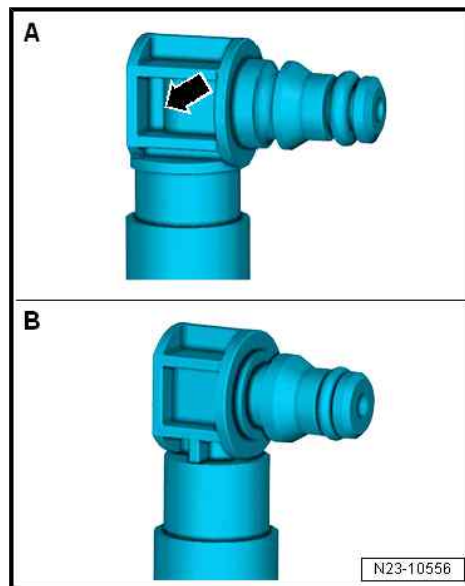
Gradual introduction of a new fuel return line; it is essential to ensure the correct assignment of components when renewing O-rings. The new return line can be recognised by the notch-arrow- on the connection pieces; the orange O-rings MUST be fitted on this return line ⇒ Electronic parts catalogue (ET-KA) . Mixed installation is not permissible as this results in leakage and therefore failure of the return line.

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Differences in fuel return lines

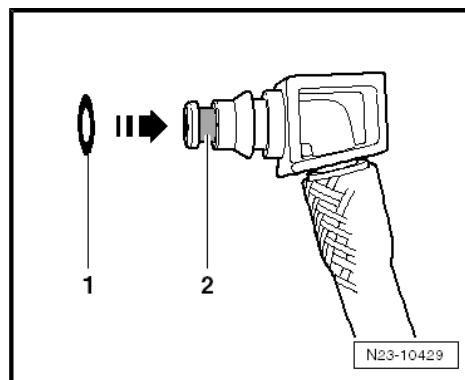
A - Connection for new fuel return line, with notch -arrow-: use orange O-rings.

B - Connection for old fuel return line, without notch: use green O-rings.



Note

- ◆ *Renew O-rings and retaining clips for return lines.*
- ◆ *Lubricate all O-rings with engine oil or assembly oil before installing.*
- ◆ *Carefully clean contact surface -2- for O-ring.*
- Prevent O-rings -1- from rolling when sliding them on. O-rings must not be twisted when fitted on fuel return line.
- Coat new retaining clips for return lines with grease.
- Press return lines onto side of injector and press on retaining clip using long-nose pliers.
- Check that return lines are properly secured by pulling them.
- Bleed fuel system and then check it for leaks ➔ [page 16](#) .



8 High-pressure pump

⇒ ["8.1 Exploded view - high-pressure pump", page 51](#)

⇒ ["8.2 Removing and installing high-pressure pump", page 52](#)

⇒ ["8.3 Performing first fuel filling after installing high-pressure pump", page 55](#)

8.1 Exploded view - high-pressure pump

1 - Bracket for ancillaries

- ☐ Removing and installing
⇒ Rep. gr. 13

2 - Bolt

- ☐ 2x
- ☐ Renew
- ☐ 20 Nm + turn 180° further

3 - Hub

- ☐ Use counterhold tool - T10051- to loosen and tighten
- ☐ To remove, use puller - T40064-

4 - High-pressure pump sprocket

5 - Bolt

- ☐ 3x
- ☐ Renew
- ☐ 20 Nm

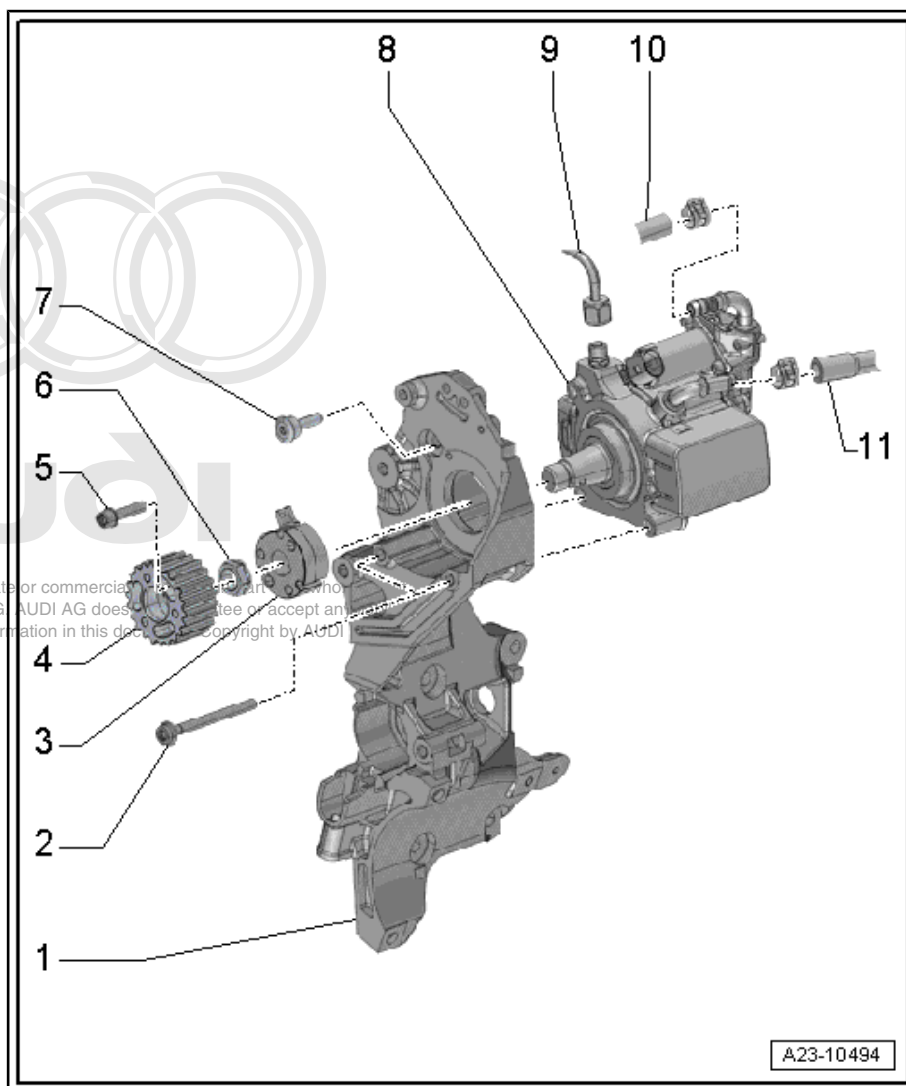
6 - Nut

- ☐ 95 Nm

7 - Bolt

- ☐ Renew
- ☐ 20 Nm + turn 45° further

8 - High-pressure pump



Caution

Risk of malfunctions caused by dirt.

Observe

⇒ ["1.5 Rules for cleanliness and instructions for working on fuel system", page 3](#).

Running when dry causes irreparable damage to high-pressure pump. After installing the high-pressure pump, the pump must first be filled with fuel before the engine is started for the first time ⇒ [page 55](#).

- ☐ With fuel metering valve - N290- (do not open)
- ☐ After renewing high-pressure pump or fuel pressure regulating valve - N276- , learnt values must be re-adapted; see "Guided Functions" in ➔ Vehicle diagnostic tester
- ☐ Removing and installing ➔ [page 52](#)

9 - High-pressure pipe

- ☐ Between high-pressure pump and fuel rail
- ☐ Do not alter shape
- ☐ Check for damage before re-installing
- ☐ Always renew high-pressure pipe when renewing high-pressure pump.
- ☐ Removing and installing ➔ [page 47](#)
- ☐ Lubricate threads of union nuts with clean engine oil
- ☐ 25 Nm

10 - Fuel supply hose

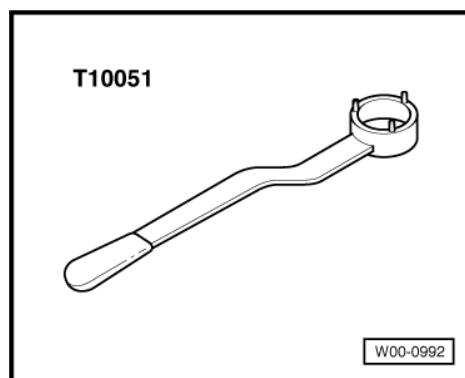
11 - Fuel return line

8.2 Removing and installing high-pressure pump

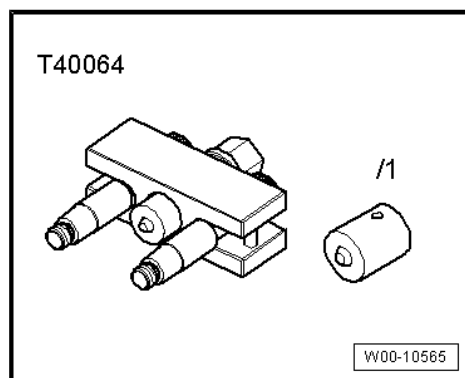
Special tools and workshop equipment required

- ◆ Counterhold tool - T10051-

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- ◆ Puller - T40064- with T40064/1



Removing



Caution

Risk of malfunctions caused by dirt.

◆ **Observe**

⇒ ***"1.5 Rules for cleanliness and instructions for working on fuel system", page 3.***

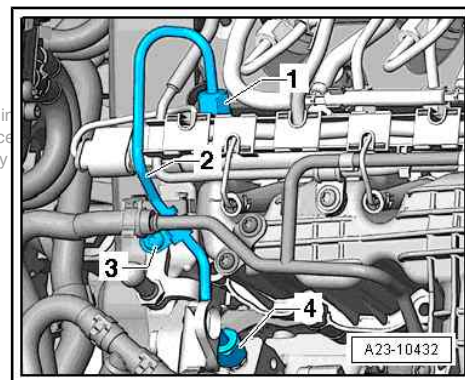
The high-pressure fuel pump has very close tolerances and must not be allowed to run without fuel. To prevent this and to enable the engine to start quickly after parts have been renewed, it is important to observe the following:

- ◆ *If the high-pressure pump is removed or renewed, the fuel system must be bled before the engine is started for the first time.*

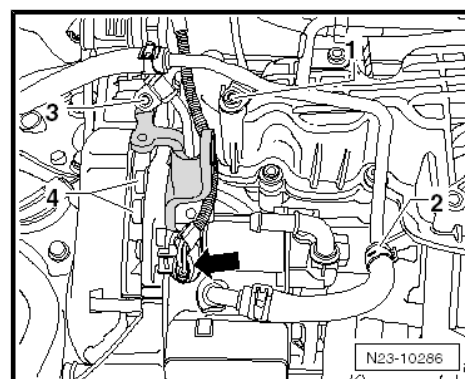
*Procedure for first fuel filling ⇒ **page 55***

- Remove toothed belt from camshaft and high-pressure pump
 ⇒ Rep. gr. 15 .
- Unscrew bolt -3- from bracket for high-pressure fuel pipe.

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- Remove bracket (for engine lifting eye). To do so, loosen bolts -4-.

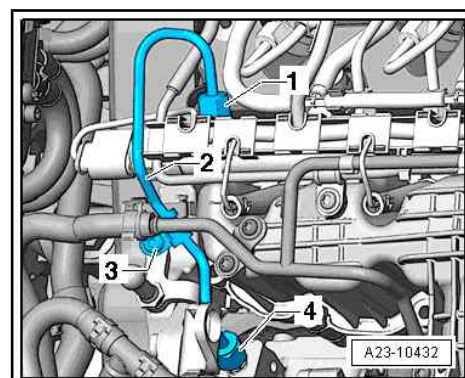


- Unscrew union nuts at high-pressure pump -4- and fuel rail -1- and remove high-pressure fuel pipe -2-.

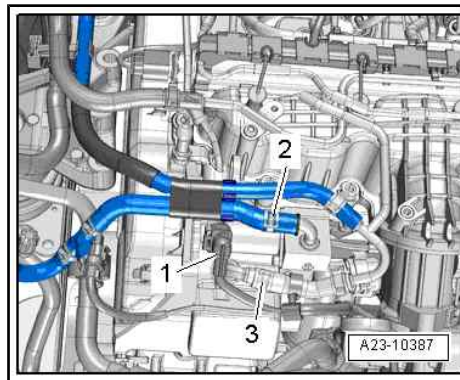


Note

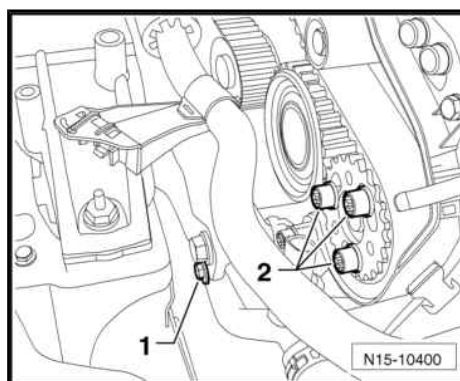
Do not bend fuel lines.



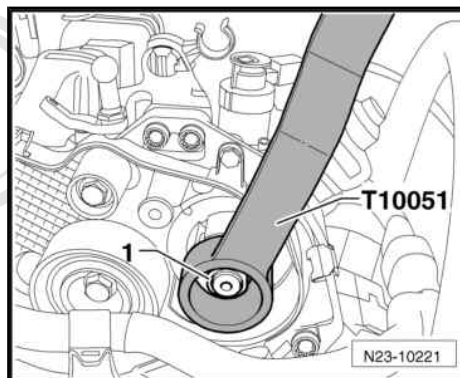
- Unplug electrical connector -1- at fuel metering valve - N290- .
- Detach fuel lines -2 and 3- from high-pressure pump.



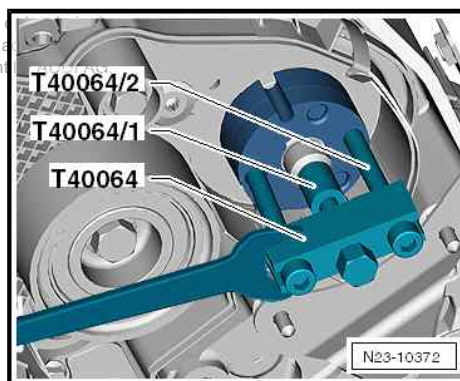
- Remove bolts -2- and detach toothed belt sprocket from high-pressure pump.



- Counterhold hub of high-pressure pump using counterhold tool - T10051- and unscrew securing nut -1-.



- Apply puller - T40064- with thrust piece T40064/1 and pin T40064/2- as shown in illustration and pull hub off high-pressure pump. If necessary, counterhold using an open-end spanner (24 mm).



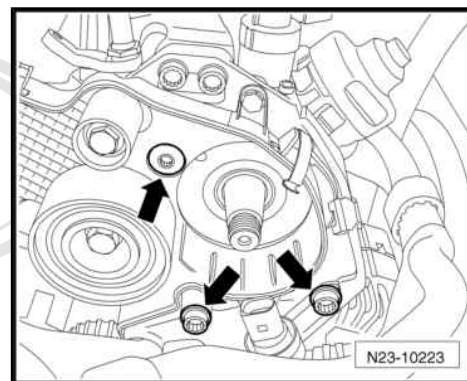
- Unscrew securing bolts -arrows- for high-pressure pump.
- Carefully take out high-pressure pump.

Installing

Install in reverse order.

Tightening torques

- ◆ ⇒ [“8.1 Exploded view - high-pressure pump”, page 51](#).
- Install high-pressure pipe ⇒ [page 47](#).
- Install toothed belt for camshaft and high-pressure pump ⇒ Rep. gr. 15.



Caution

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

- ◆ ***After installing the high-pressure pump, the pump must first be filled with fuel before the engine is started for the first time ⇒ [page 55](#).***

After renewing high-pressure pump and/or fuel pressure regulating valve - N276- , adaption must be performed. The adaption procedure is described in the Guided Fault Finding or Guided Functions; use ⇒ Vehicle diagnostic tester.

8.3 Performing first fuel filling after installing high-pressure pump

Special tools and workshop equipment required

- ◆ Vehicle diagnostic tester



Caution

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

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



Note

- ◆ *When installing the high-pressure fuel pump, it is essential to ensure that no dirt enters the fuel system.*
- ◆ *Only remove sealing plugs immediately prior to installation of fuel lines.*
- ◆ *There must be sufficient fuel in the tank.*

Proceed as follows to fill high-pressure pump with fuel.

- Connect a ⇒ Vehicle diagnostic tester.
- Switch on ignition.
- Select “Engine electronics” in vehicle self-diagnosis.
- Select “Guided Functions”.



- Then select "Activate fuel pump".
- Select "120 seconds".
- The fuel pump starts running.
- The fuel pump must run for approx. 2 minutes 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 entry in event memory ⇒ 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.

- Interrogate event memory again.



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9 Senders and sensors

⇒ [“9.1 Removing and installing air mass meter G70 ”, page 57](#)

⇒ [“9.2 Removing and installing throttle valve module J338 ”, page 57](#)

⇒ [“9.3 Checking fuel pressure regulating valve N276 ”, page 58](#)

⇒ [“9.4 Removing and installing fuel pressure regulating valve N276 ”, page 61](#)

⇒ [“9.5 Removing and installing fuel pressure sender G247 ”, page 63](#)

⇒ [“9.6 Checking fuel pump delivery rate”, page 65](#)

⇒ [“9.7 Checking for leaks in the fuel system”, page 66](#)

9.1 Removing and installing air mass meter - G70-

Removing

- Pull off engine cover panel ⇒ [page 18](#) .
- Unplug electrical connector -1-.
- Release hose clip -2- and detach air hose.
- Unscrew bolts -arrows- and carefully pull air mass meter - G70- out of guide in air cleaner housing.

Installing

Tightening torques

- ◆ ⇒ [“5.1 Exploded view - air cleaner”, page 17](#) .

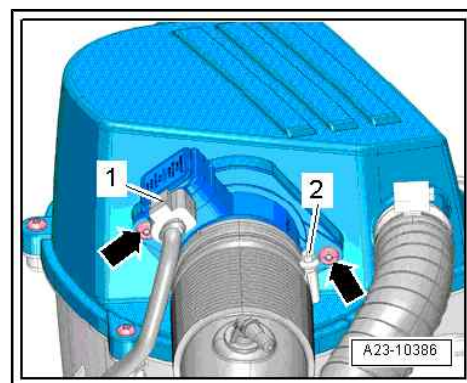
To ensure that the air mass meter -G70- functions properly, it is important to observe the following notes and instructions.



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 renew O-ring for air mass meter if damaged (air leak).*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

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



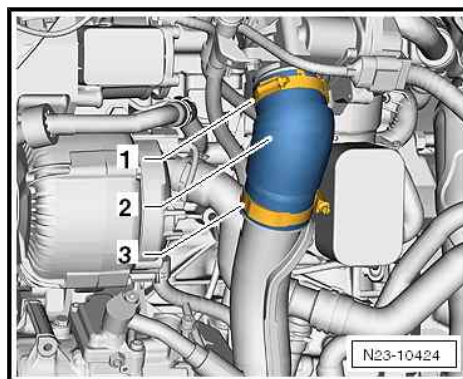
9.2 Removing and installing throttle valve module - J338-

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Removing

- Pull off engine cover panel ⇒ [page 18](#) .

- Release hose clips -1 and 3- and remove charge air hose -2- between throttle valve module - J338- and charge air pipe.



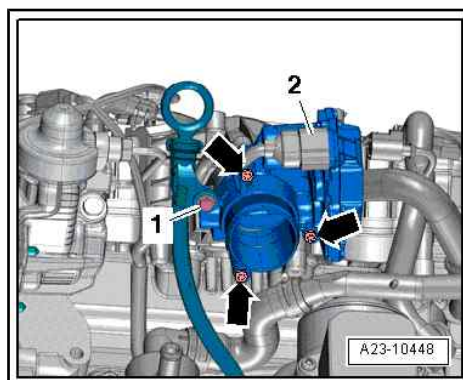
- Unplug electrical connector -2-.
- Remove bolt -1- for dipstick guide tube.
- Remove bolts -arrows- and detach throttle valve module - J338- from air hose.

Installing

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

Tightening torques

- ♦ ⇒ ["6.2 Exploded view - intake manifold, vehicles without intake manifold flap V157", page 23](#)



Note

Fit new O-ring.

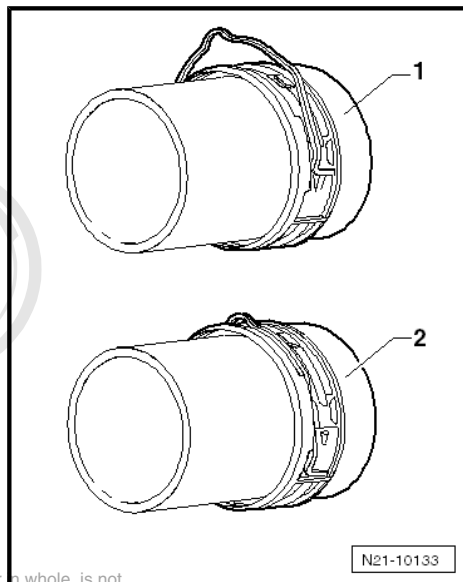
- Install air pipe: Exploded view - charge air cooler ⇒ Rep. gr. 21 .

Installing air hoses with plug-in connectors



Note

- ♦ *Renew seal if damaged.*
- ♦ *Make sure that the seal is correctly seated in the groove on the complete circumference of the air pipe/hose.*
- ♦ *Apply a thin coating of silicon-free lubricant to the sealing area and the seal.*
- Release retaining clip (position -1-).
- Push air pipe/hose in as far as stop and press retaining clip to lock -2-.
- Press air pipe/hose again and pull again to check that plug-in connector is correctly engaged.
- Install noise insulation ⇒ Rep. gr. 66 .



9.3 Checking fuel pressure regulating valve - N276-

Special tools and workshop equipment required

- ♦ Fuel-resistant measuring container
- ♦ Hose for return line connection

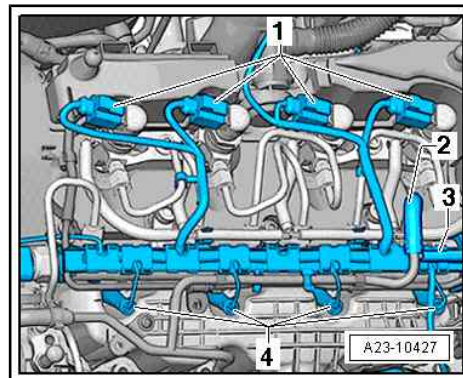


WARNING

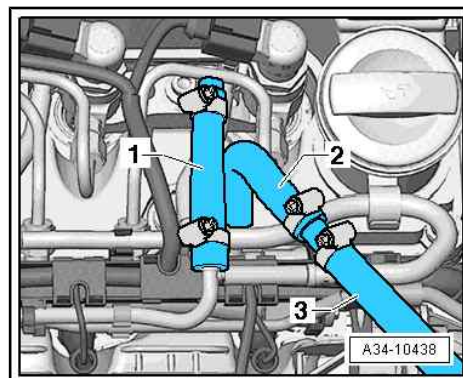
- ◆ *Always observe rules for cleanliness and instructions for working on fuel system*
⇒ "1.5 Rules for cleanliness and instructions for working on fuel system", page 3 .
- ◆ *Follow these instructions and rules for cleanliness before starting work and while working on the fuel system.*

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- Remove engine cover panel ⇒ [page 18](#) .
- Release clamp -2- and detach fuel return line.



- Seal off the open return line connection with a plug -1-.
- Attach a suitable hose -3- to return line -2-.



- Hold this hose -1- in a suitable container -2- to measure the return flow rate.

1) Checking while engine is running

- Start the engine and run at idling speed.
- Specification: more than 75 ml in 30 seconds

If specification is not obtained, fuel pressure regulating valve - N276- is defective.

2) Checking while engine is running

If condition for 1) is met, increase engine speed to ≥ 2000 rpm.

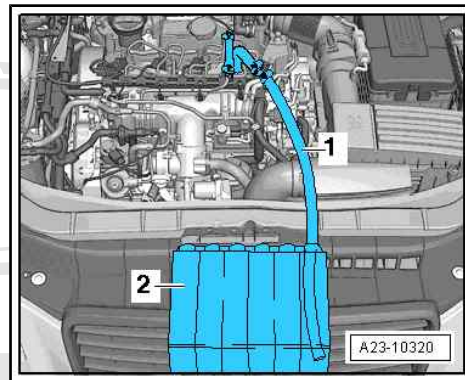
- Specification of return flow rate: 0 ml
- Drip leaks are permissible
- If specification is not obtained, fuel pressure regulating valve - N 276- is defective.

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3) If engine can no longer be started

Perform check at cranking speed.

- Specification of return flow rate: 0 ml
- Drip leaks are permissible
- If specification is not obtained, fuel pressure regulating valve - N 276- is defective.



9.4 Removing and installing fuel pressure regulating valve - N276-

The fuel pressure regulating valve - N276- -6- is located in the fuel rail. It maintains a constant pressure in the fuel rail and the injector pipes.

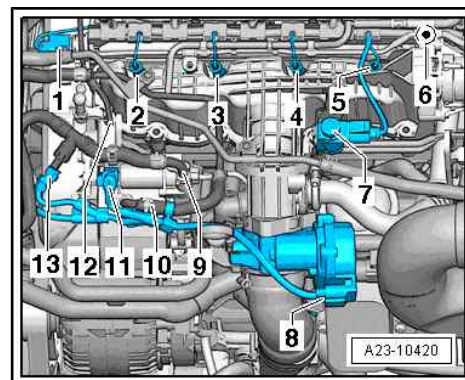
If the pressure in the high-pressure fuel circuit is too high, the fuel pressure regulating valve - N276- opens to allow some of the fuel to flow back from the fuel rail to the fuel tank via a return line.

If the pressure in the high-pressure fuel circuit is too low, the fuel pressure regulating valve - N276- closes and seals off the high-pressure section of the system from the low-pressure section.



Note

The fuel pressure regulating valve - N276- cannot be re-used.



Removing

- Remove engine cover panel ➔ [page 18](#) .



WARNING

- ◆ *Always observe rules for cleanliness and instructions for working on fuel system
 ➔ **"1.5 Rules for cleanliness and instructions for working on fuel system", page 3** .*
- ◆ *Follow these instructions and rules for cleanliness before starting work and while working on the fuel system.*

- Remove fuel rail ➔ [page 32](#) .
- Before removal, clean area around thread for fuel pressure regulating valve - N276- using commercial cleaning solution etc. (no dirt must enter hole in fuel rail).



Note

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

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- Dry off fuel pressure regulating valve - N276- .
- Loosen union nut at fuel pressure regulating valve - N276- (counterhold at fuel rail). Then remove by hand.
- Remove dirt from thread and sealing surface using vacuum cleaner. Do not use metal tools, etc.



Note

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

Installing



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 bore.*
- ◆ *The beginning of the thread, the deformable sealing lip and the O-ring of the fuel pressure regulating valve - N276- must be coated with diesel fuel.*
- Use suitable torque wrench with an open-end spanner insert (36 mm) to tighten.

Tightening torques

- ◆ ⇒ Fig. ““ Fuel pressure regulating valve -N276- - tightening torque””, page 32 .
- Install fuel rail
⇒ “7.2 Removing and installing high-pressure reservoir”, page 32 .
- After installation, run engine at moderate speed for several minutes and then switch off.
- Check fuel system for leaks.
- Interrogate event memory.

After renewing high-pressure pump and/or fuel pressure regulating valve - N276- , adaption must be performed. (The procedure is described in Guided Functions)

- 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.
- Interrogate event memory again.

9.5 Removing and installing fuel pressure sender - G247-

The fuel pressure sender - G247- -1- is located in the fuel rail and continuously measures the fuel pressure in the high-pressure system. It transmits a corresponding voltage signal to the engine control unit - J623- .

Should the sender fail, the engine control unit will control the fuel pressure via a mapped open-loop backup function, allowing a maximum of approx. 3000 rpm.

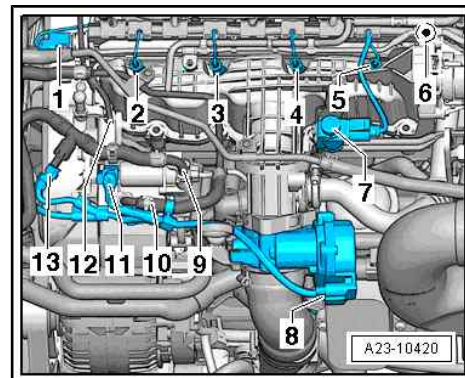
Removing

- Pull off engine cover panel ➔ [page 18](#) .



WARNING

- ◆ *Always observe rules for cleanliness and instructions for working on fuel system
➔ **"1.5 Rules for cleanliness and instructions for working on fuel system", page 3** .*
- ◆ *Follow these instructions and rules for cleanliness before starting work and while working on the fuel system.*



- Before removal, clean area around thread for fuel pressure sender using commercial cleaning solution etc. (no dirt must enter opening in fuel rail).



Note

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

- Dry off fuel pressure sender - G247- .

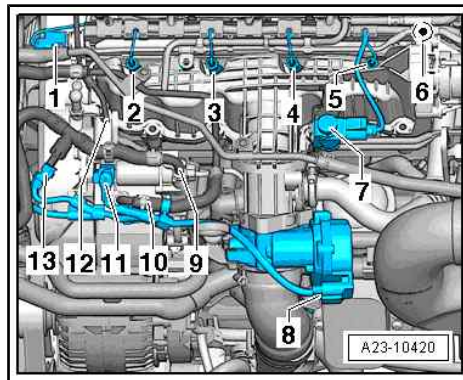


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- Unplug electrical connector -1- at fuel pressure sender - G247- .
- Unscrew fuel pressure sender - G247- .
- Extract dirt from opening in fuel rail (thread and sealing surface) using a vacuum cleaner. Do not use metal tools, etc.


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 sender - G247- does not have a seal; instead, it has a deformable sealing lip.*
- ◆ *Check that sealing surfaces (deformable sealing lip) and threads on fuel pressure sender - G247- are not damaged. If inspection of fuel pressure sender - G247- shows that it is OK, it can be used again.*
- ◆ *Also 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.*
- Screw in fuel pressure sender - G247- by hand.
- Then tighten fuel pressure sender - G247- to specified torque.

Tightening torques

- ◆ ➔ [Fig. "Fuel pressure sender -G247- - tightening torque", page 32](#)

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

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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 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.

9.6 Checking fuel pump delivery rate

Test conditions:

- Battery voltage at least 12.5 Volt.
- Fuel filter OK.
- Fuel tank at least $\frac{1}{2}$ full.
- Ignition switched off

Checking fuel delivery rate

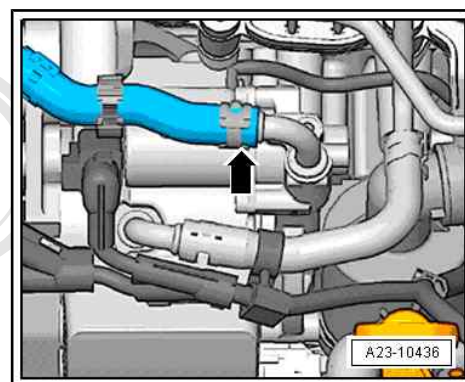
- Remove engine cover panel ➔ [page 18](#) .



WARNING

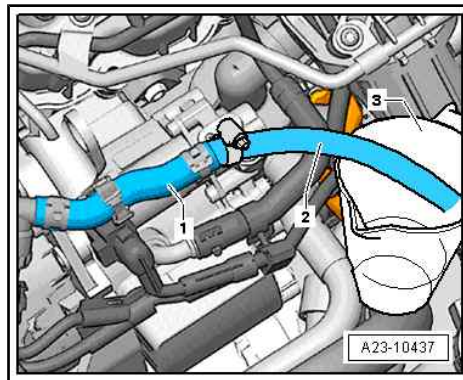
- ◆ *Always read rules for cleanliness and instructions for working on fuel system ➔ [page 1](#) .*
- ◆ *Follow these instructions and rules for cleanliness before starting work and while working on the fuel system.*
- ◆ *To reduce the pressure in the fuel system, wrap a clean cloth around the connection and carefully loosen the connection.*

- Disconnect fuel supply line -arrow- at high-pressure pump.



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- Hold fuel supply line -1- (lengthen with suitable hose -2-) into a measuring container -3-.
- 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.
- The fuel pump starts running.
- Let fuel pump run for 30 seconds and exit activation function.
- Specification for minimum delivery rate: at least 600 ml in 30 seconds



If minimum delivery rate is not reached, check for the following causes:

- ◆ Fuel pump was not running for 30 seconds
- ◆ Battery voltage below 12.5 Volts (connect battery charger)
- ◆ Fuel lines have been crushed
- ◆ Fuel filter is blocked
- ◆ Fuel pumps defective: Checking ➔ Rep. gr. 20



Note

Check fuel system for leaks.

9.7 Checking for leaks in the fuel system

- 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 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.

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10 Lambda probe

⇒ [“10.1 Exploded view - Lambda probe and exhaust gas temperature sensors”, page 67](#)

⇒ [“10.2 Exploded view - Lambda probe and exhaust gas temperature control with particulate filter installed away from engine”, page 68](#)

⇒ [“10.3 Removing and installing Lambda probe G39 with Lambda probe heater Z19”, page 68](#)

⇒ [“10.4 Removing and installing pressure differential sender G505”, page 69](#)

10.1 Exploded view - Lambda probe and exhaust gas temperature sensors

1 - Exhaust gas temperature sender 4 - G648-

- ☐ Removing and installing
⇒ Rep. gr. 26

2 - Exhaust gas temperature sender 1 - G235-

- ☐ Removing and installing
⇒ Rep. gr. 26

3 - Exhaust gas temperature sender 3 - G495-

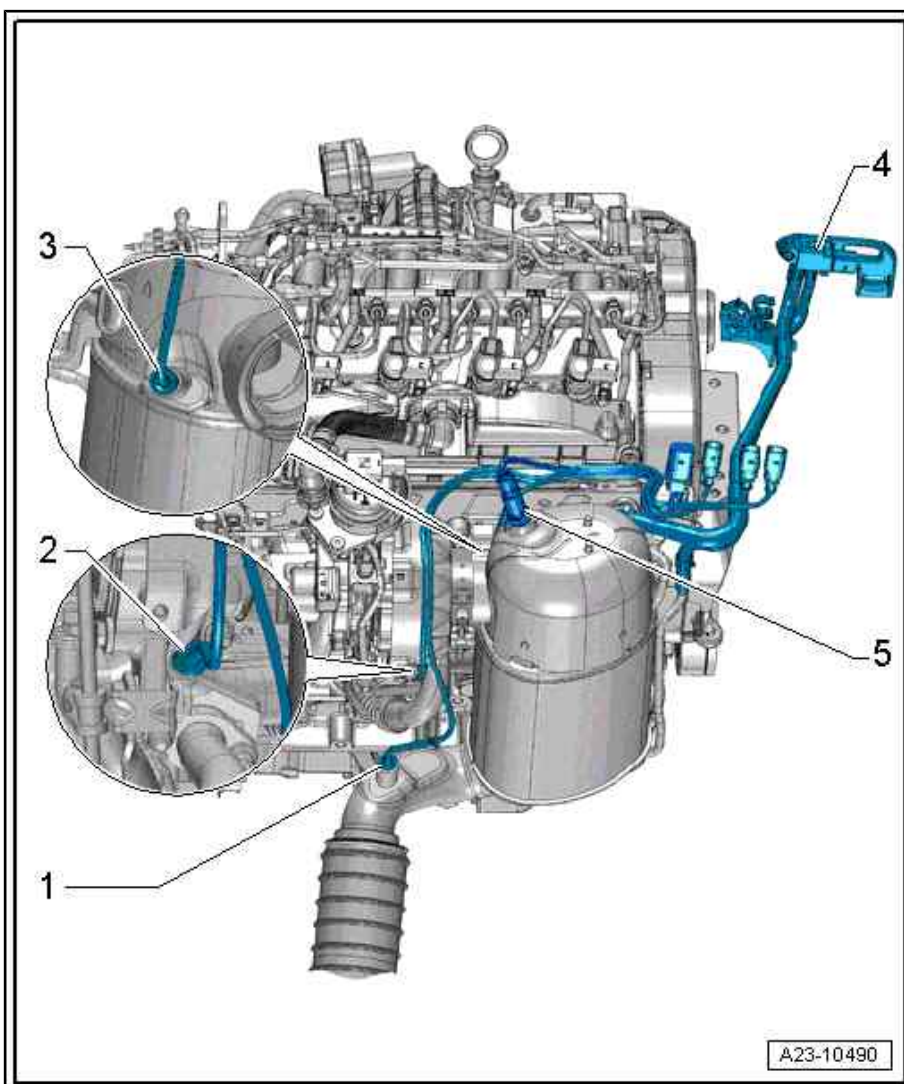
- ☐ Removing and installing
⇒ Rep. gr. 26

4 - Pressure differential sender - G505-

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

5 - Lambda probe - G39- with Lambda probe heater - Z19-

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



10.2 Exploded view - Lambda probe and exhaust gas temperature control with particulate filter installed away from engine

1 - Lambda probe - G 39-

- ☐ Removing and installing
⇒ [page 68](#)

2 - Seal

- ☐ Renew
- ☐ Note installation position

3 - Clamp

4 - Exhaust gas temperature sender 4 - G 648-

- ☐ Removing and installing
⇒ Rep. gr. 26

5 - Exhaust gas temperature sender 3 - G 495-

- ☐ Removing and installing
⇒ Rep. gr. 26

6 - Bracket for pressure differential sender - G 505-

7 - Clamps

8 - Control pipes

9 - Pressure differential sender - G 505-

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

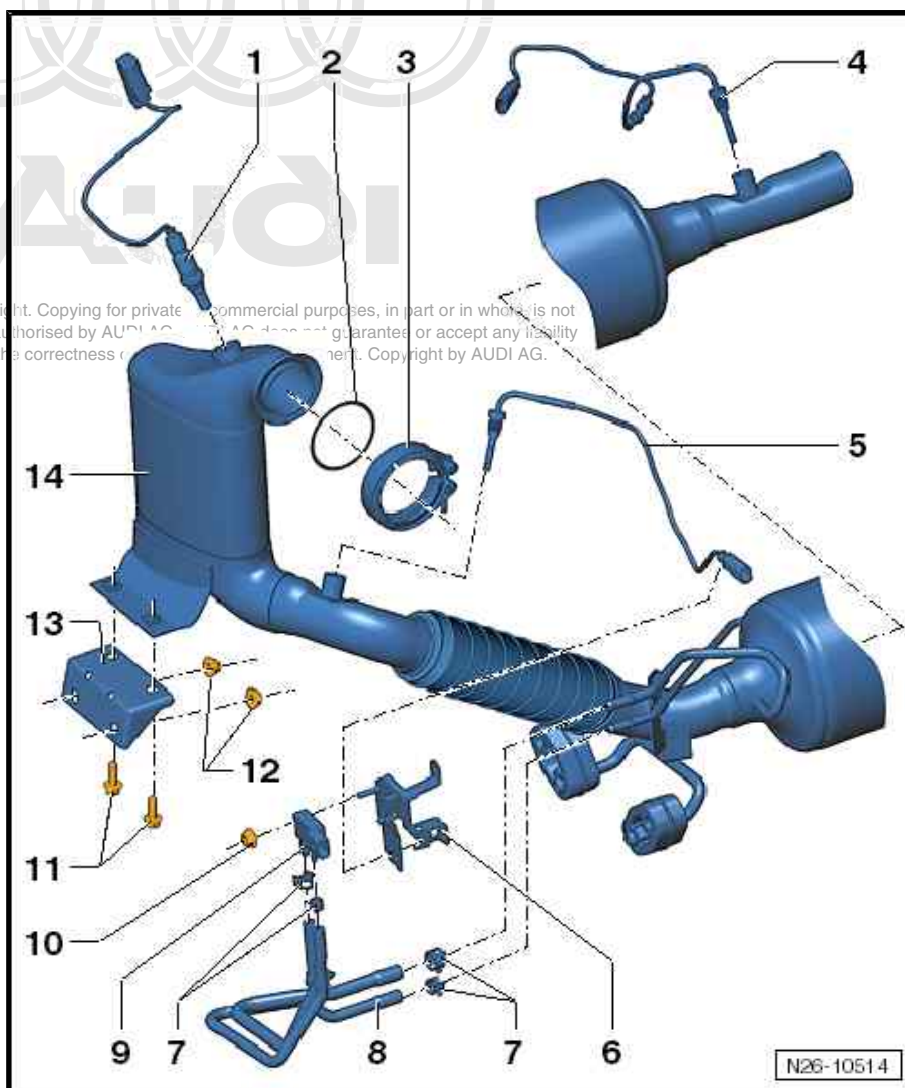
10 - Nut

11 - Bolt

12 - Nut

13 - Bracket

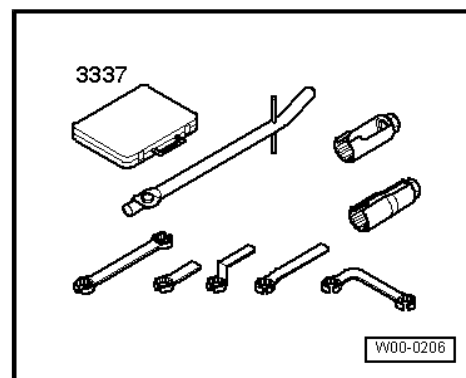
14 - Catalytic converter with particulate filter installed away from engine



10.3 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 18](#) .
- Unplug electrical connector -4- for Lambda probe - G39- .
- Unscrew Lambda probe - G39- -2- using tool from Lambda probe open ring spanner set - 3337- .

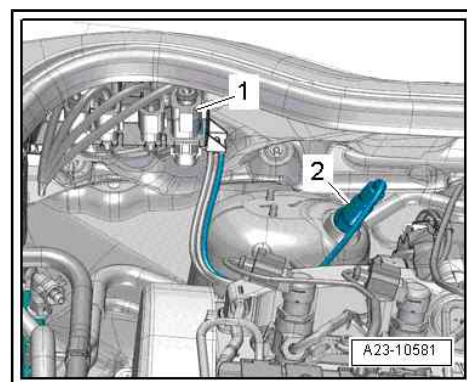
Installing

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 re-attached at the same locations to prevent it from coming into contact with the exhaust pipe.*



Tightening torques

- ◆ ➔ ["10.1 Exploded view - Lambda probe and exhaust gas temperature sensors", page 67](#)

10.4 Removing and installing pressure differential sender - G505-

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 18](#) .

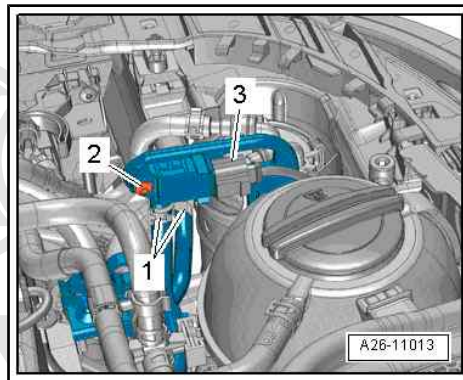
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- Unplug electrical connector -3-.
- Release hose clips -1- and spray hoses at pressure differential sender - G505- with silicone-free lubricant before detaching.


Note

The two connections can easily break off the pressure differential sender - G505-.

- Carefully disconnect the hoses from their connections (take care to keep the hoses straight).
- Remove bolt -2- and detach pressure differential sender - G505- from bracket -arrow-.


Installing

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

Tightening torques

- ◆ ⇒ ["10.1 Exploded view - Lambda probe and exhaust gas temperature sensors", page 67](#).


Note

- ◆ *Before installing, blow out control pipes from pressure differential sender - G505- to particulate filter towards particulate filter with compressed air (pipes can become obstructed or may ice up due to condensation).*
- ◆ *Make sure that hoses are securely fitted and seal properly.*
- ◆ *If control pipes have been released from particulate filter, tighten to 45 Nm.*

After renewing pressure differential sender - G505- and/or particulate filter, adaption must be performed in order to reset learnt values. The adaption procedure is described in the Guided Fault Finding or Guided Functions; use ⇒ Vehicle diagnostic tester.

11 Engine control unit

⇒ ["11.1 Wiring and component check with test box V.A.G 1598/42", page 71](#)

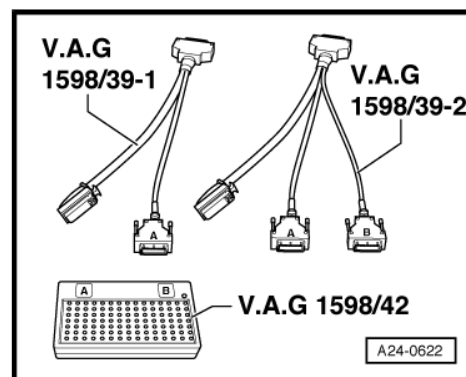
⇒ ["11.2 Removing and installing engine control unit J623", page 72](#)

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

Special tools and workshop equipment required

- ◆ Adapter cable - V.A.G 1598/39-

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- ◆ Test box - V.A.G 1598/42-
- ◆ Vehicle diagnostic tester



Note

- ◆ The test box - V.A.G 1598/42- has 105 sockets. It can be connected to the engine control unit via 2 different adapter cables.
- ◆ The engine control unit is connected to the vehicle's wiring harness via two connectors, one of which has 60 pins, the other has 94 pins.
- ◆ To carry out tests on the 60-pin wiring harness connector, the adapter cable - V.A.G 1598/39-1- is connected to connector -A- on the test box. For components connected to 60-pin wiring harness connector ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- ◆ To carry out tests on the 94-pin wiring harness connector, the adapter cable - V.A.G 1598/39-2- must be connected to connectors -A- and -B- on the test box. For components connected to 94-pin wiring harness connector ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- ◆ The test box - V.A.G 1598/42- is designed so it can be connected both to the wiring harness for the engine control unit and to the engine control unit itself at the same time. The advantage of this is that the electronic engine control system remains fully functional when the test box is connected (for example, for measuring signals when the engine is running).
- ◆ Always use auxiliary measuring set - V.A.G 1527B- to connect test equipment (e.g. voltage tester - V.A.G 1526D- , hand-held multimeter - V.A.G 1594C- etc.).

The engine control unit has to be removed before connectors can be unplugged from engine control unit ⇒ [page 72](#) .



Caution

Electronic components are susceptible to damage.

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

- Connect test box - V.A.G 1598/42- to wiring harness with adapter cable - V.A.G 1598/39-1- or adapter cable - V.A.G 1598/39-2- . Connect earth clip of test box to negative terminal of battery. The instructions for performing the individual tests indicate whether or not the engine control unit itself also needs to be connected to the test box.
- Carry out test as described in repair procedure.
- Make sure you fit protective housing back on engine control unit.
- After finishing tests, install engine control unit ➔ [page 72](#) and interrogate and erase event memory ➔ Vehicle diagnostic tester.



Note

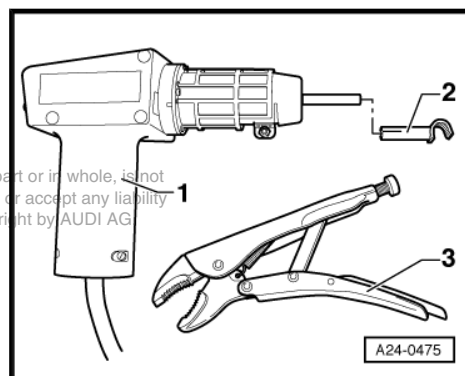
After completing the "Guided Functions" routine, the ➔ Vehicle diagnostic tester will attempt to erase the event memories of all control units. If this is not successful, the remaining faults registered in the memories must be rectified before all event memories can be erased.

11.2 Removing and installing engine control unit - J623-

Special tools and workshop equipment required

- ◆ Hot air blower - VAS 1978/14A- -item 1- with shrink element for hot air blower - VAS 1978/15A- -2- from wiring harness repair set - VAS 1978B-

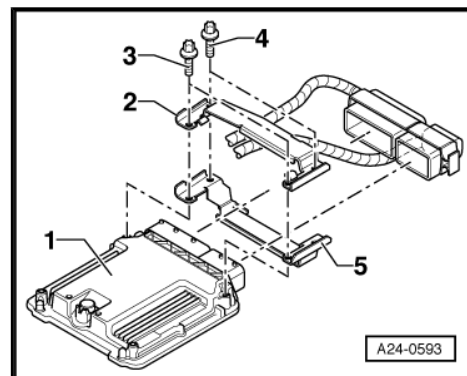
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- ◆ Small mole grips -3- (commercially available)
- ◆ Vehicle diagnostic tester

 Note

- ◆ *Not every engine control unit is bolted to a protective housing. Whether a protective housing is fitted depends on the engine/gearbox combination.*
- ◆ *The engine control unit -1- is bolted to the protective housing -5-. To make it more difficult to unscrew the shear bolts -4- for locking plate -2-, their threads have been coated with locking fluid.*
- ◆ *The protective housing has to be removed before the connectors can be unplugged from the engine control unit (e.g. to connect the test box or renew the engine control unit).*



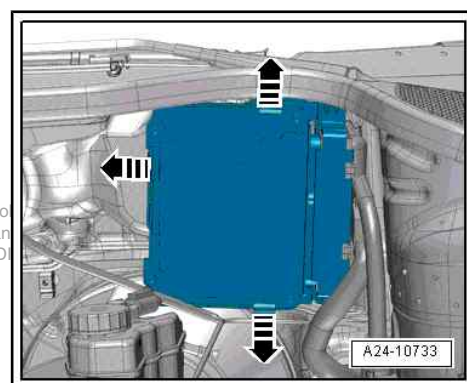
Removing

- If the engine control unit - J623- is renewed, the adaption values must be read out and stored before -J623- is removed
 ⇒ Vehicle diagnostic tester, Guided Functions, 01 - Replace control unit.
- Switch off ignition and remove ignition key after storing electronic file containing adaption values.

 Note

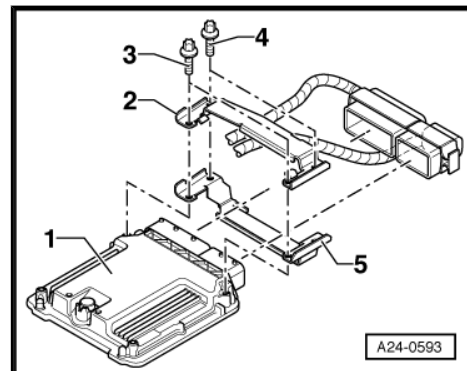
If the adaption values of the injectors cannot be read out of the old (defective) engine control unit, they must be entered into the new engine control unit manually and the adaption procedure must be performed accordingly.

- Switch off ignition and remove ignition key after storing electronic file containing adaption values.
- Remove air cleaner housing ⇒ [page 20](#).
- Release fasteners -arrows- and detach engine control unit - J623- from bracket.

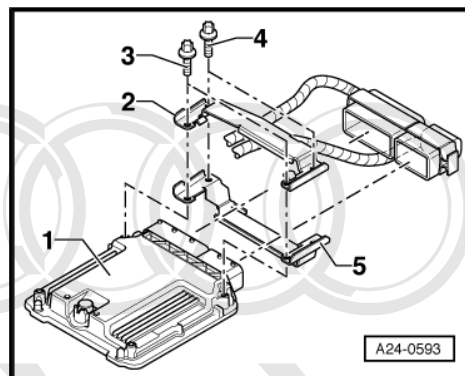


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The threads of the two shear bolts -4- which are not screwed into the engine control unit are secured with locking fluid. To unscrew these two bolts, the threads must therefore be heated with the hot air blower.



The threads of the two shear bolts -3- which are screwed into the engine control unit are not secured with locking fluid. Do not apply heat to the threads in the control unit housing; this is not necessary and would cause overheating of the control unit.



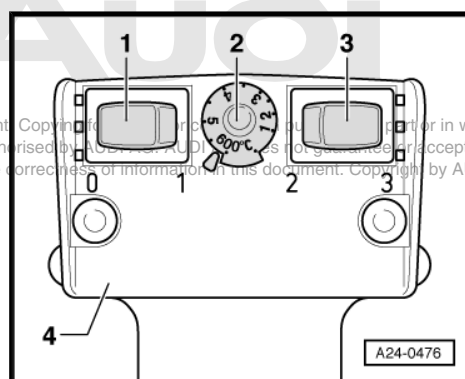
Select settings on hot air blower as shown in illustration, i.e. set temperature potentiometer -2- to maximum heat output and two-stage air flow switch -3- to position 3.



WARNING

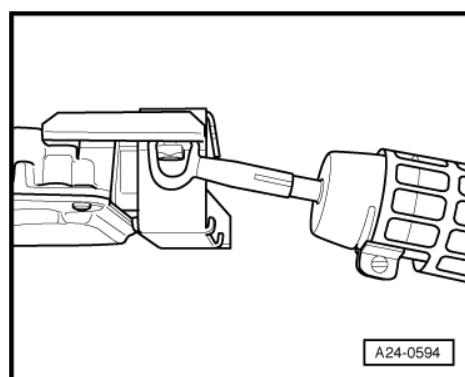
Heating the thread of the locking plate also heats up the shear bolts and parts of the metal housing. Take care to avoid burns. It is also important to ensure that only the thread is heated and none of the surrounding components if at all possible. These should be covered if necessary.

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Apply heat to the threads of the shear bolts on the connector side as shown in the illustration.

Switch on the hot air blower and heat the bolt for approximately 20 ... 30 seconds.



- Unscrew shear bolts using suitable vice-grip pliers (see arrow in illustration).
- The two shear bolts screwed into the engine control unit do not need to be heated. They should be removed without being heated.
- Unscrew both securing bolts from engine control unit - J623- .
- Detach protective housing from connectors.
- Release connectors on engine control unit - J623- and unplug connectors.

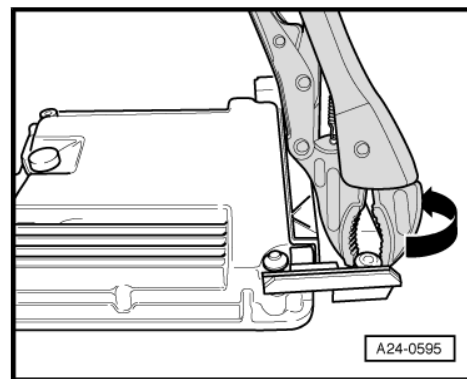
Installing

Installation is performed in the reverse sequence.

- It is important that the protective housing is re-fitted on the engine control unit (if fitted previously).
- Clean threaded holes for shear bolts to remove any residue from locking fluid. This can be done using a thread tap.
- Always use new shear bolts.

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

- The injector delivery calibration and the injector voltage calibration must additionally be re-adapted in the engine control unit - J623- after the control unit has been renewed (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 via an adaptation procedure.



28 – Glow plug system

1 Glow plug system

⇒ "1.1 Exploded view - glow plug system", page 76

⇒ "1.2 Checking glow plug system", page 77

⇒ "1.3 Removing and installing glow plugs", page 77

⇒ "1.4 Removing and installing Hall sender G40 ", page 79

⇒ "1.5 Removing and installing engine speed sender G28 ", page 80

1.1 Exploded view - glow plug system

1 - Hall sender - G40-

- ❑ Removing and installing
⇒ page 79

2 - Bolt

- ❑ 9 Nm

3 - Glow plug

- ❑ Glow plug 1 - Q10- ,
glow plug 2 - Q11- , glow
plug 3 - Q12- , glow
plug 4 - Q13-
- ❑ Removing and installing
⇒ page 77
- ❑ 17 Nm

4 - Electrical connector

- ❑ For glow plug

5 - Bolt

- ❑ 4.5 Nm

6 - Engine speed sender - G28-

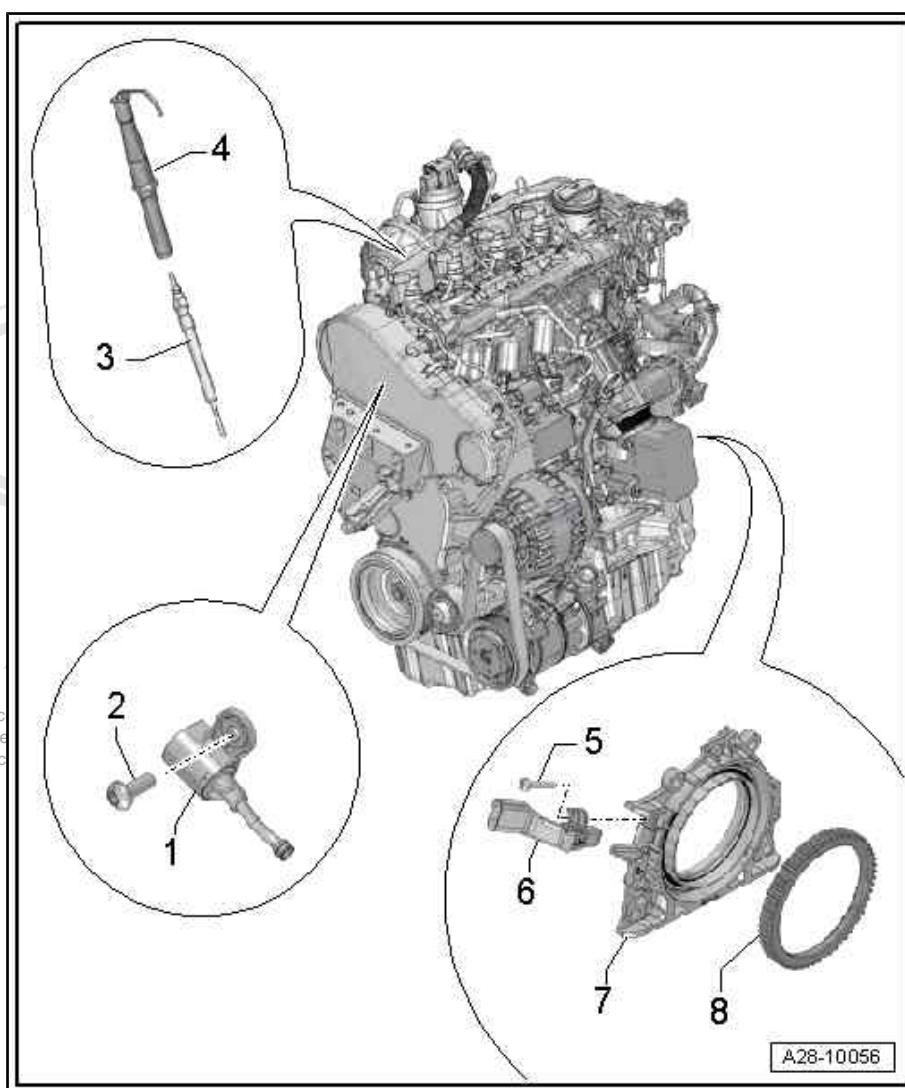
- ❑ Removing and installing
⇒ page 80

7 - Sealing flange (gearbox end)

- ❑ With oil seal
- ❑ Renewing ⇒ Rep. gr. 13

8 - Sender wheel

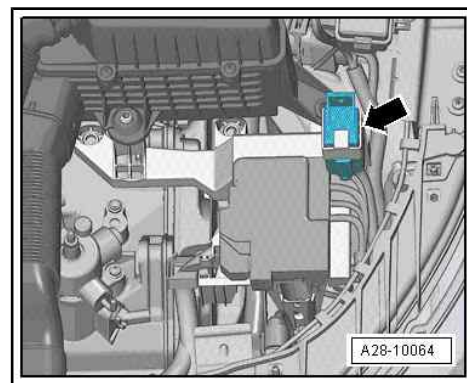
- ❑ For engine speed sender - G28-
- ❑ Removing and installing
⇒ Rep. gr. 13



1.2 Checking glow plug system

Fitting location of automatic glow period control unit - J179-

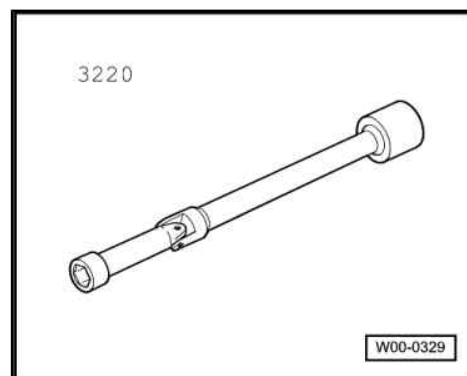
- ◆ The glow plug system is activated via the automatic glow period control unit - J179-. The automatic glow period control unit - J179- is capable of self-diagnosis.
- ◆ The control unit for the glow plug system is located in the mounting for the fuse holder B - SB- in the engine compartment (front left) ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- ◆ A fault is stored in the event memory of 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.



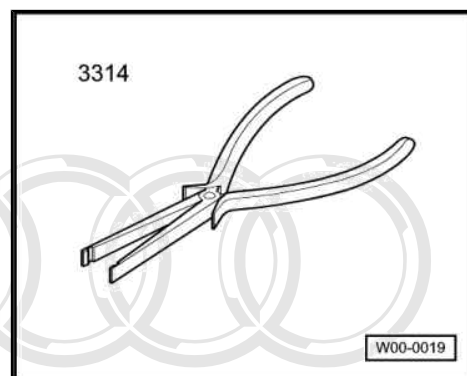
1.3 Removing and installing glow plugs

Special tools and workshop equipment required

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



- ◆ Pliers - 3314-



- ◆ Safety goggles

Removing

- Switch off ignition.
- Remove engine cover panel ⇒ [page 18](#) .
- Clean glow plug openings in cylinder head; **make sure no dirt gets into cylinder.**

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Note

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



WARNING

Risk of eye injury.

- ◆ *Wear safety goggles.*

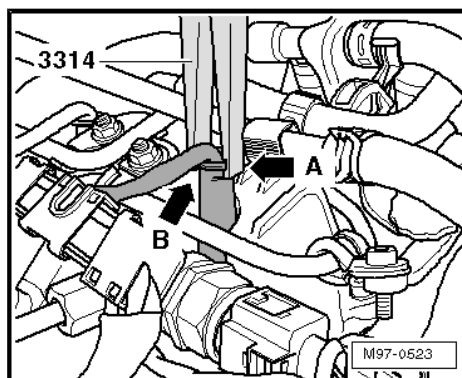
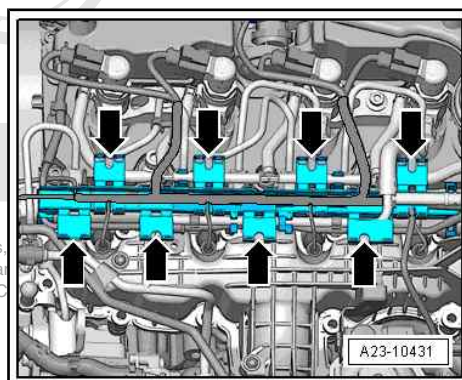
- Open catches on cable duct to move clear wiring harness.



Caution

- ◆ *Make sure that no wire connection is damaged when unplugging the glow plug connectors; otherwise the entire wiring harness must be renewed.*
- ◆ *When unplugging the glow plug connectors, do not compress the pliers - 3314- with too much force so that the support sleeve is not damaged.*

- Apply groove -arrow A- of pliers - 3314- to collar of support sleeve -arrow B- and pull glow plug connectors off glow plugs.



- To slacken the glow plugs use special tool U/J extension and socket, 10 mm - 3220- .

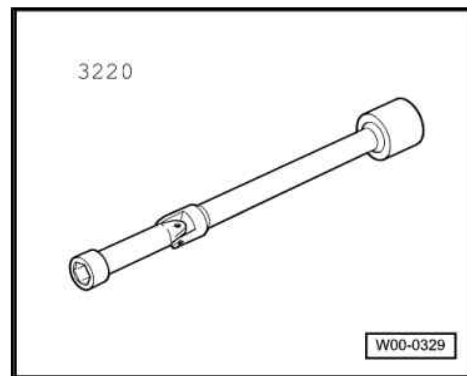
Installing

- To tighten the glow plugs use special tool U/J extension and socket, 10 mm - 3220- with a suitable torque wrench.
- Then tighten glow plugs to specified torque.

Tightening torques

◆ ⇒ ["1.1 Exploded view - glow plug system", page 76](#)

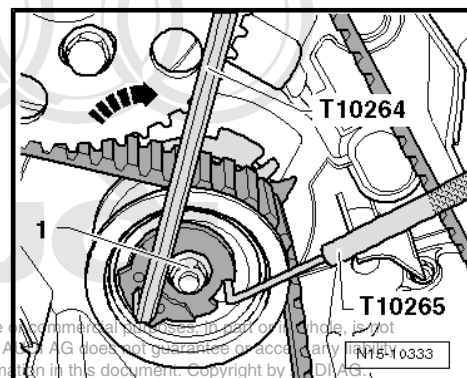
- Attach glow plug connectors correctly and make sure they are securely fitted.
- Secure wiring harness in cable duct again.
- The remaining installation steps are carried out in the reverse sequence.



1.4 Removing and installing Hall sender - G40-

Removing

- Detach toothed belt from idler roller and high-pressure pump
 ⇒ Rep. gr. 15 ; Removing and installing toothed belt .

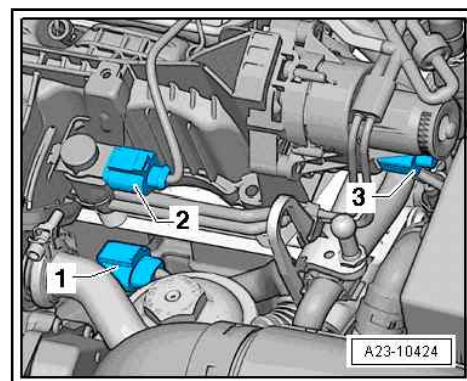


- Unplug connector -1- for Hall sender - G40- and detach connector from retainer.

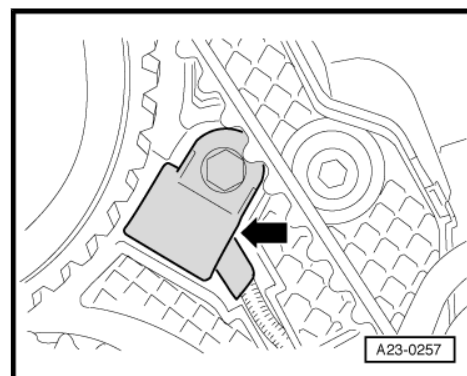


Note

Disregard -items 2, 3-.



- Unbolt Hall sender - G40- -arrow-.

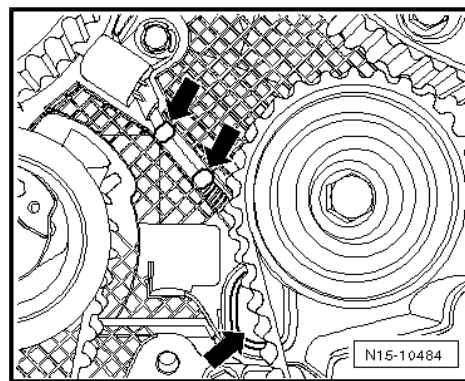


- Using a screwdriver, remove projections and take out cover for repair opening -arrows-.
- Take Hall sender - G40- off cylinder head and guide connector through repair opening in toothed belt cover.

Installing

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

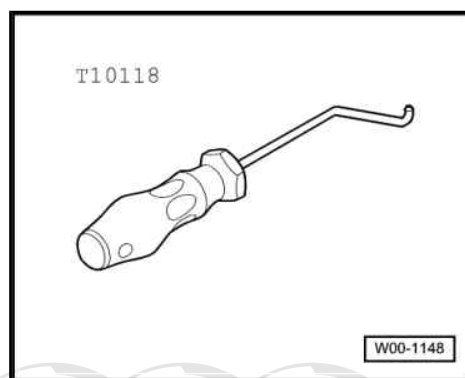
- Seal repair opening in toothed belt cover with plug; for plug refer to ⇒ Electronic parts catalogue .
- Install toothed belt ⇒ Rep. gr. 15 .



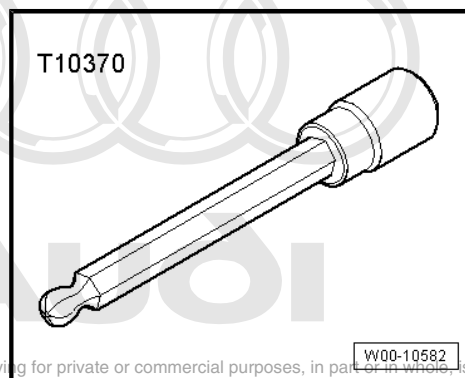
1.5 Removing and installing engine speed sender - G28-

Special tools and workshop equipment required

- ◆ Assembly tool - T10118-



- ◆ Socket AF 4 mm - T10370-



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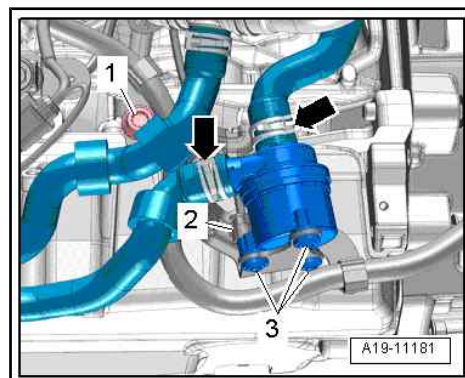
Removing

- Remove noise insulation -1- ⇒ Rep. gr. 66 .
- Unscrew bolts -3- and tie pump for exhaust gas recirculation cooler - V400- up to the right side (with coolant hoses -arrows- attached).



Note

Disregard -items 1, 2-.

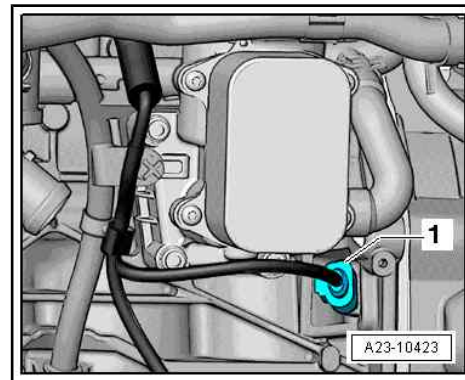


- Unplug electrical connector -1- at engine speed sender - G28- using assembly tool - T10118- .



Note

To release electrical connector without assembly tool - T10118- , press connector on engine speed sender in with a screwdriver and at the same time lift release tab with a thin wire hook.



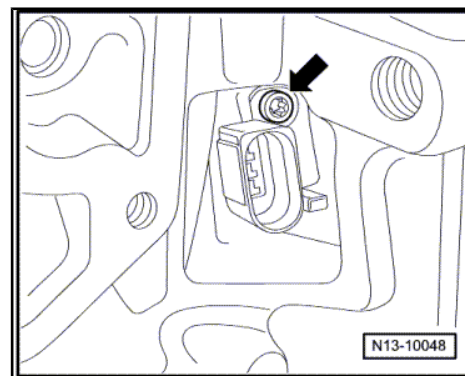
- Unscrew securing bolt -arrow- for engine speed sender - G28- using socket AF 4 mm - T10370- .

Installing

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

Tightening torques

- ◆ ⇒ [“1.1 Exploded view - glow plug system”, page 76](#) .
- Install pump for exhaust gas recirculation cooler - V400- ⇒ Rep. gr. 19 .
- Install noise insulation ⇒ Rep. gr. 66 .



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