Workshop Manual
Audi A8 2003 ➢

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

Engine ID	BVN	BMC							

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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

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23 – Mixture preparation - injection

1 Safety precautions and rules for cleanliness

(ARL003792; Edition 03.2014)

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

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

WARNING

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

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.*

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1.2 Safety precautions when working on the fuel system

When working on the fuel system note the following warnings:

WARNING

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

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

Risk of injury - fuel system operates under pressure.

- *If the battery is not disconnected, the fuse for the fuel pump control unit - J538- must be removed as a precautionary measure before opening the fuel system because the fuel pump will otherwise be activated by the contact switch on the driver's door.*
- *Wrap a clean cloth around the connection before opening the fuel system. Then release pressure by carefully loosening the connection.*
- *Wear protective gloves.*
- *Wear safety goggles.*

Caution

- *Observe notes on procedure for disconnecting the battery ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .*

Caution

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

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

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- Clean tools and workbench etc. before working on the injection system.
- Carefully clean connection points and the surrounding area with engine cleaner or brake cleaner and dry thoroughly before opening.

- When removing components, plug all open connections immediately with suitable clean sealing caps.
- Do not remove sealing caps from components until immediately prior to installation. Keep components that are to be re-used in new, sealable plastic bags.
- Before installing, check the injectors and their surroundings visually; they must be undamaged and clean. Make sure the injector bores in the cylinder head are clean. Wipe out if necessary using a clean cloth, taking care not to cause damage. Do not use sharp objects of any kind.
- If the high-pressure fuel lines are to be re-used, you must mark them before removal. High-pressure pipes must always be re-installed on the same cylinder.
- Take care not to damage the injectors when removing the old copper seals.
- Check all new O-rings for damage before installing. Lubricate O-rings with engine oil or assembly oil before installing.
- Position high-pressure pipes so they are free of stress. Tighten all unions lightly to start with before tightening to final torque.
- Never attempt to bend high-pressure fuel lines to shape.
- When working on any parts of the high-pressure fuel system, tools may only be used for loosening and tightening pipe unions. All other components must always be removed and installed by hand without using tools or other equipment.
- Press the fuel return hoses onto the injectors by hand from above so that they engage audibly on each injector (do not press in the release pins when doing this). Then press down the release pin after connecting the return line. Check that the fuel return hoses are seated securely and sealed properly by pulling them by hand from above.
- Do not dismantle individual common rail components. If there is a fault, the complete components must be renewed.
- When the engine is running, do not perform any repairs to the common rail system.
- Do not bleed the common rail system by unfastening high-pressure components after the engine has been started.
- All cable ties which are released or cut open when removing must be refitted in the same position when installing.
- When the fuel system is open: Do not work with compressed air if this can be avoided. Do not move the vehicle unless absolutely necessary.
- Also ensure that no diesel fuel comes into contact with the coolant hoses. Should this occur, the hoses must be cleaned immediately. Damaged hoses must be renewed.

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1.3 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:

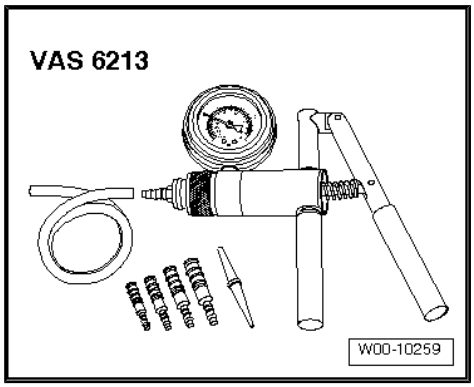
- ♦ Persons wearing a cardiac pacemaker must at all times maintain a safe distance from high-voltage components such as piezo systems and xenon headlights.
- ♦ Always switch off the ignition before connecting or disconnecting tester cables or electrical wiring for the injection or glow plug system.

- Do not open any fuel line connections while the engine is running.
- Always switch off ignition before washing engine.
- Certain tests may lead to faults being detected and stored by the engine control units. Therefore the event memory must be interrogated after completing all tests and repair work (“Interrogate event memory”).

1.4 Checking vacuum system

Special tools and workshop equipment required

- Hand vacuum pump - VAS 6213-



Procedure

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

- Cracks
- Traces of animal bites
- Kinked or crushed lines
- Lines porous or leaking

– Check vacuum line to solenoid valve and from solenoid valve to corresponding component.

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

– If it is not possible to build up a vacuum with the hand vacuum pump - VAS 6213- or if the vacuum pressure drops again immediately, check the hand vacuum pump and connecting hoses for leaks.

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2 Injection system

2.1 Overview of fitting locations

Components A to T are not shown in the illustration.

1 - Air mass meter - G70-

- ❑ Removing and installing ⇒ page 21

2 - Electronics box in plenum chamber

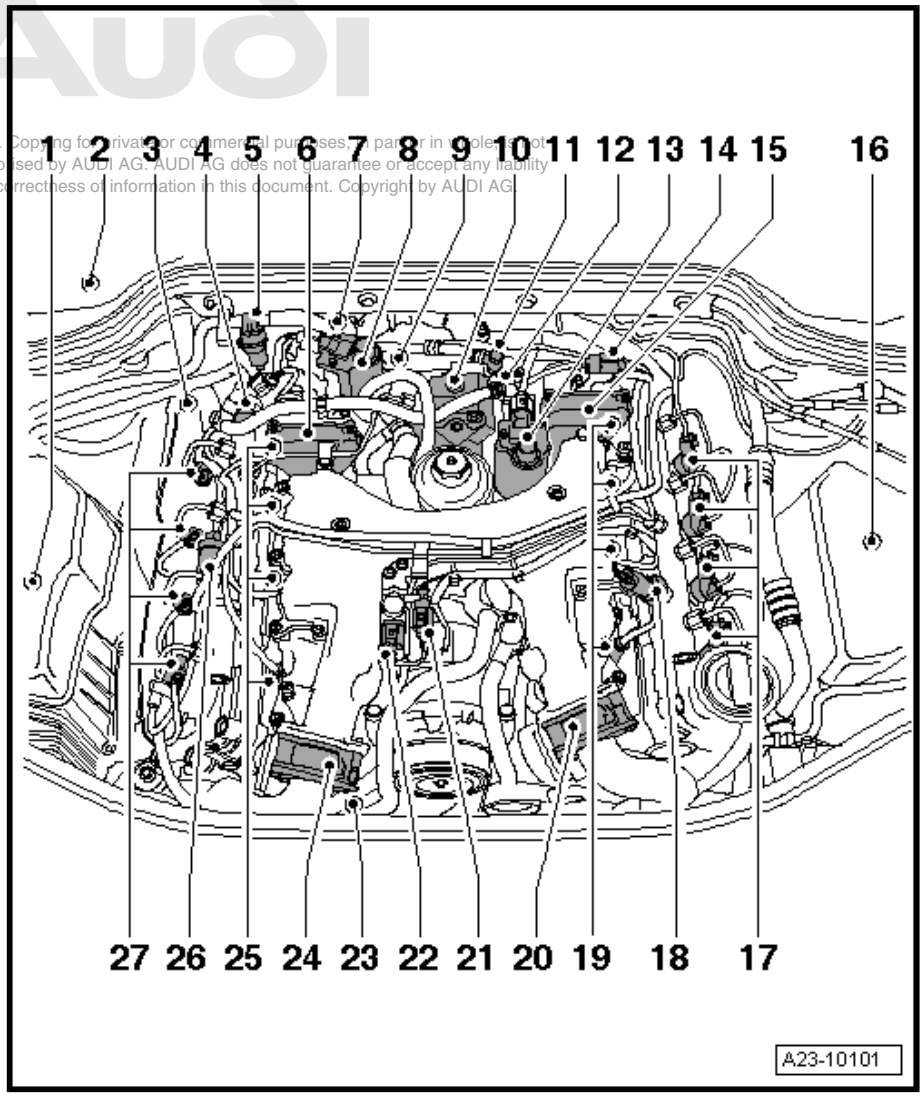
- ❑ Removing and installing engine control unit - J623- with altitude sensor (for cylinders 1, 4, 6, 7) ⇒ page 78
- ❑ Removing and installing engine control unit 2 - J624- (for cylinders 2, 3, 5, 8) ⇒ page 81
- ❑ Automatic glow period control unit - J179- ⇒ page 10
- ❑ Glow period control unit 2 - J703- ⇒ page 10
- ❑ Terminal 30 voltage supply relay - J317- ⇒ page 10

3 - Hall sender - G40- (camshaft position sensor)

- ❑ Fitted to rear of cylinder head 1
- ❑ 9 Nm

4 - Fuel pressure regulating valve - N276-

- ❑ Screwed into rail element (on cylinder bank



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1)

- ❑ Cannot be re-installed
- ❑ ⇒ page 9
- ❑ Removing and installing ⇒ page 65

5 - Fuel temperature sender - G81-

6 - Intake manifold flap motor - V157-

- ❑ Cylinder bank 1
- ❑ Can only be renewed as one unit with intake manifold (bottom section)
- ❑ Exploded view - intake manifold ⇒ page 26

7 - Connector for exhaust gas temperature sender 1 - G235-

- ❑ Electrical connector ⇒ page 12
- ❑ Removing and installing ⇒ Rep. gr. 26

8 - Exhaust gas recirculation control motor - V338-

- ❑ Removing and installing ⇒ Rep. gr. 26

9 - Coolant temperature sender - G62-

- ❑ ⇒ page 10
- ❑ Removing and installing ⇒ Rep. gr. 19

10 - High-pressure pump

- ❑ With gear-type fuel system pressurisation pump
- ❑ High-pressure pump generates fuel pressure up to 1600 bar
- ❑ Gear-type fuel system pressurisation pump generates fuel pressure between 4 and 5 bar
- ❑ Removing and installing ⇒ Rep. gr. 13

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11 - Fuel supply line connection

- ❑ 25 Nm

12 - Fuel return line connection

- ❑ To high-pressure pump: 25 Nm
- ❑ To fuel rail: 25 Nm

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

- ❑ Removing and installing ⇒ Rep. gr. 26

14 - Electrical connector for fuel metering valve - N290-

15 - Intake manifold flap 2 motor - V275-

- ❑ Cylinder bank 2
- ❑ Can only be renewed as one unit with intake manifold (bottom section)
- ❑ Exploded view - intake manifold ⇒ page 26

16 - Air mass meter 2 - G246-

- ❑ In air cleaner (bottom section)
- ❑ Removing and installing ⇒ page 24

17 - Injectors

- ❑ Cylinder bank 2
- ❑ Removing and installing ⇒ page 45

18 - Fuel pressure sender - G247-

- ❑ Removing and installing ⇒ page 67

19 - Glow plugs

- ❑ Cylinder bank 2
- ❑ Removing and installing ⇒ page 86

20 - Throttle valve module 2 - J544-

21 - Electrical connector for AC compressor

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

- ❑ Overview of exhaust gas recirculation system ⇒ Rep. gr. 26

23 - Oil pressure switch - F1- and oil temperature sender - G8-

- ❑ ⇒ page 13
- ❑ Removing and installing ⇒ Rep. gr. 17

24 - Throttle valve module - J338-

25 - Glow plugs

- ❑ Cylinder bank 1
- ❑ Removing and installing ⇒ page 86

26 - Pressure retention valve

- ❑ In fuel return lines from cylinder banks 1 and 2
- ❑ The pressure retention valve maintains a residual pressure of approx. 10 bar in the return lines.
- ❑ This residual pressure is required for the control function of the piezo injectors.
- ❑ The pressure retention valve may only be renewed together with the fuel return lines.
- ❑ After replacement, engine must be run at idling speed for approx. 2 minutes to bleed fuel system.
- ❑ Checking control quantity ⇒ page 42

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27 - Injectors

- ❑ Cylinder bank 1
- ❑ Removing and installing ⇒ page 45

A - Control unit for turbocharger 1 - J724-

- ❑ Removing and installing ⇒ Rep. gr. 21

B - Control unit for turbocharger 2 - J725-

- ❑ Removing and installing ⇒ Rep. gr. 21

C - Brake light switch - F- and brake pedal switch - F47-

- ❑ In footwell on brake pedal

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

- ❑ In footwell on accelerator pedal
- ❑ ⇒ page 9

E - Charge pressure sender - G31-

- ❑ With intake air temperature sender - G42-
- ❑ In charge air cooler (left-side)
- ❑ ⇒ page 10
- ❑ Removing and installing ⇒ Rep. gr. 21

F - Engine speed sender - G28-

- ❑ ⇒ page 13

G - Air filter bypass flap valve - N275-

- ❑ These components (bypass flap with air cleaner bypass flap valve - N275-) are not installed on certain equipment versions or on vehicles for certain export markets
- ❑ If fitted, the bypass flap is located in the air cleaner housing and the air cleaner bypass flap valve - N275- is located on the outside of the air cleaner housing

H - Fuel pump relay - J17-

- ❑ Relay and fuse holder in luggage compartment (right-side)
- ❑ ⇒ page 11

I - Starter motor relay - J53- and starter motor relay 2 - J695-

- ❑ Relay and fuse holder in passenger's footwell
- ❑ ⇒ page 11

J - Lambda probe - G39- with Lambda probe heater - Z19-

- Cylinder bank 1
- ⇒ page 12
- Removing and installing ⇒ page 70

K - Exhaust gas temperature sender 1 - G235-

- Cylinder bank 1
- Located on turbocharger
- ⇒ page 12
- Removing and installing ⇒ Rep. gr. 26

L - Exhaust gas temperature sender 2 for cylinder bank 1 - G448-

- Only fitted on vehicles with particulate filter
- Cylinder bank 1
- ⇒ page 12
- Removing and installing ⇒ Rep. gr. 26

M - Temperature sender before particulate filter - G506-

- Only fitted on vehicles with particulate filter
- Cylinder bank 1
- ⇒ page 11
- Located between catalytic converter and particulate filter
- Removing and installing ⇒ Rep. gr. 26

N - Pressure differential sender - G505-

- Only fitted on vehicles with particulate filter
- Cylinder bank 1
- ⇒ page 11
- Pressure differential sender - G505- is mounted on gearbox (right-side in direction of travel)
- Removing and installing ⇒ page 72
- Adaption must be performed after renewing pressure differential sender - G505-

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O - Lambda probe 2 - G108-

- Cylinder bank 2
- ⇒ page 12
- Removing and installing ⇒ page 70

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

- Cylinder bank 2
- Located on turbocharger
- ⇒ page 13
- Removing and installing ⇒ Rep. gr. 26

Q - Exhaust gas temperature sender 2 for cylinder bank 2 - G449-

- Only fitted on vehicles with particulate filter
- Cylinder bank 2
- ⇒ page 12
- Removing and installing ⇒ Rep. gr. 26

R - Temperature sender 2 before particulate filter - G498-

- Only fitted on vehicles with particulate filter
- Cylinder bank 2
- ⇒ page 11
- Removing and installing ⇒ Rep. gr. 26

S - Pressure differential sender 2 - G524-

- ❑ Only fitted on vehicles with particulate filter
- ❑ Cylinder bank 2
- ❑ ⇒ page 11
- ❑ Pressure differential sender 2 - G524- is mounted on gearbox (left-side in direction of travel)
- ❑ Removing and installing ⇒ page 72
- ❑ Adaption must be performed after renewing pressure differential sender 2 - G524-

T - Particulate filter

- ❑ Fitted on underbody
- ❑ Combined as one component with main catalytic converter (located upstream)
- ❑ Adaption must be performed after renewing this component
- ❑ Removing and installing ⇒ Rep. gr. 26

Adaption must be performed after renewing pressure differential sender - G505- or pressure differential sender 2 - G524- and/or particulate filter. (The procedure is described in Guided Functions)

Accelerator position sender - G79- and accelerator position sender 2 - G185- (combined in one component)

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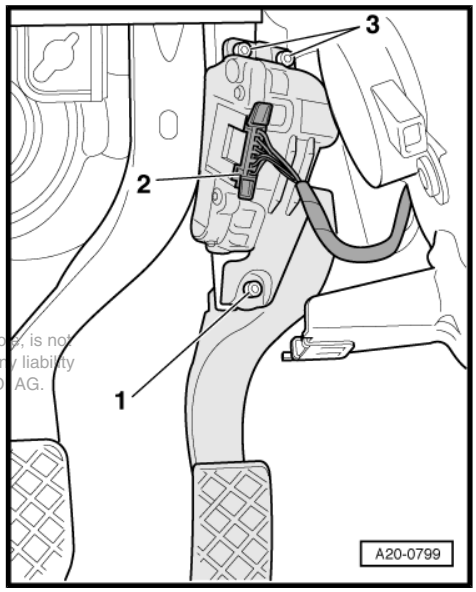
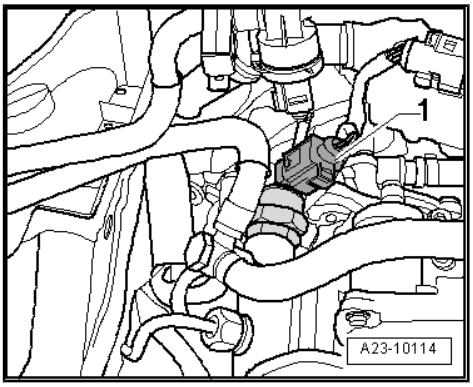


Fuel pressure regulating valve - N276- -1-

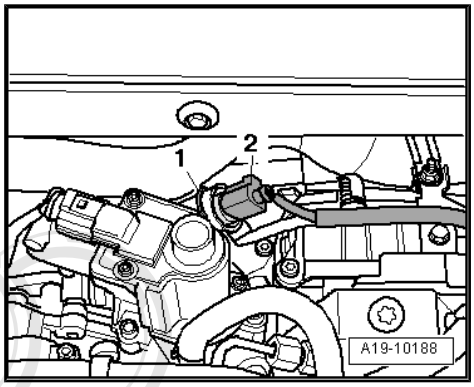
1 - The fuel pressure regulating valve - N276- cannot be re-used



Coolant temperature sender - G62- -1-

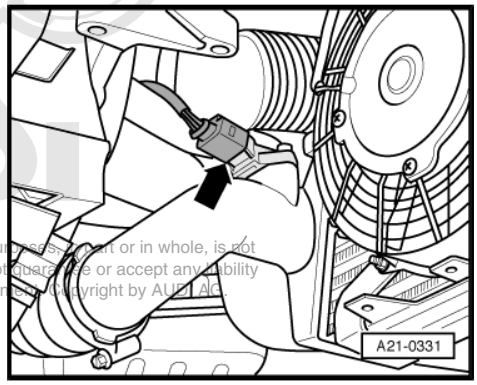
1 - Coolant temperature sender - G62-

2 - Electrical connector for coolant temperature sender - G62-



Charge pressure sender - G31- with intake air temperature sender - G42-

- In charge air cooler (left-side)
- Removing and installing ⇒ Rep. gr. 21



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Relay and fuse holder in electronics box, plenum chamber

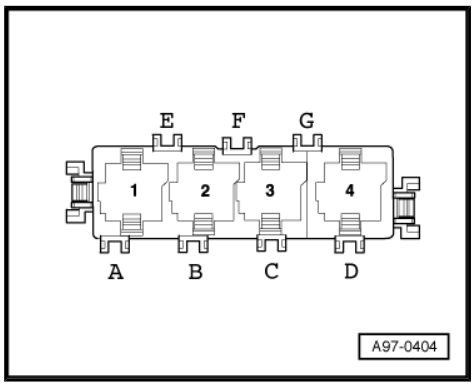
2 - Terminal 30 voltage supply relay - J317-

3 - Automatic glow period control unit - J179- (for cylinders 1, 4, 6 and 7)

4 - Glow period control unit 2 - J703- (for cylinders 2, 3, 5 and 8)

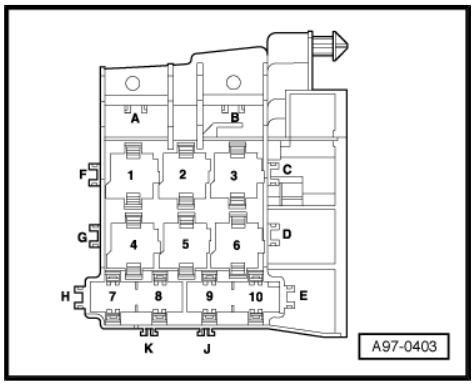
B - Fuse for automatic glow period control unit - J179-

C - Fuse 2 for glow period control unit 2 - J703-



Relay and fuse holder behind dash panel (left-side)

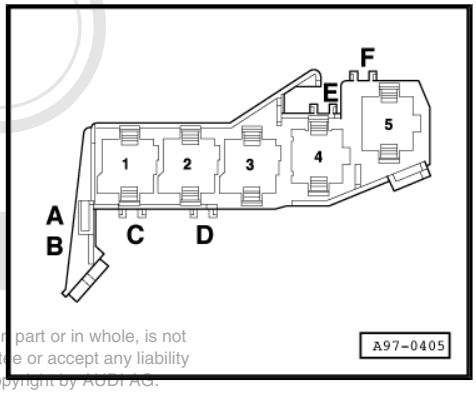
3 - Terminal 15 voltage supply relay - J329-



Relay carrier in passenger's footwell

2 - Starter motor relay - J53-

3 - Starter motor relay 2 - J695-



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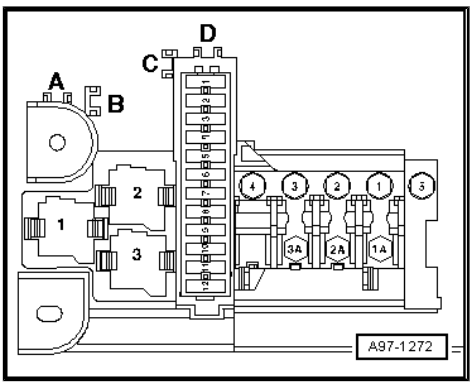
Relay and fuse holder in luggage compartment (right-side)

3 - Fuel pump relay - J17-



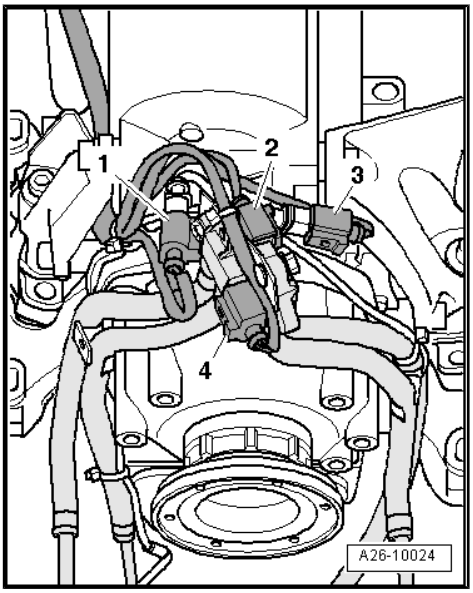
Electrical connectors for components listed below

1 - Temperature sender 2 before particulate filter - G498-

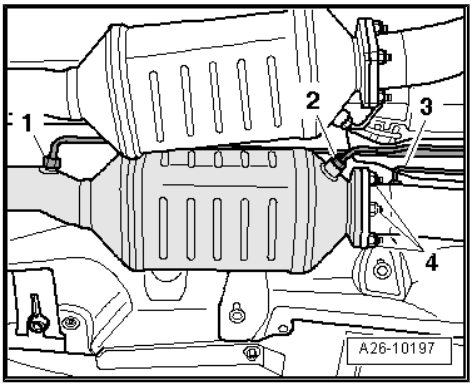
2 - Pressure differential sender - G505-

3 - Temperature sender before particulate filter - G506-

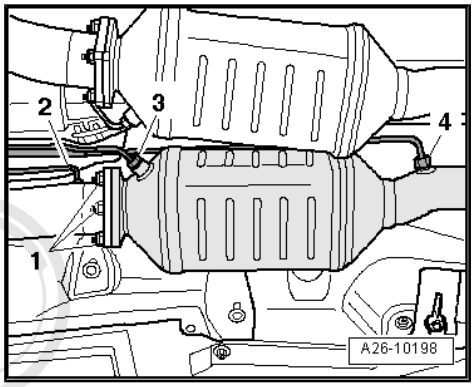
4 - Pressure differential sender 2 - G524-



Temperature sender 2 before particulate filter - G498- -2-



Temperature sender before particulate filter - G506- -3-



Lambda probe 2 - G108- and exhaust gas temperature sender 2, bank 2 - G449-

1 - Exhaust gas temperature sender 2 for cylinder bank 2 - G449-

2 - Electrical connector for Lambda probe 2 - G108-

3 - Electrical connector for bank 2 exhaust gas temperature sender 2 - G449-

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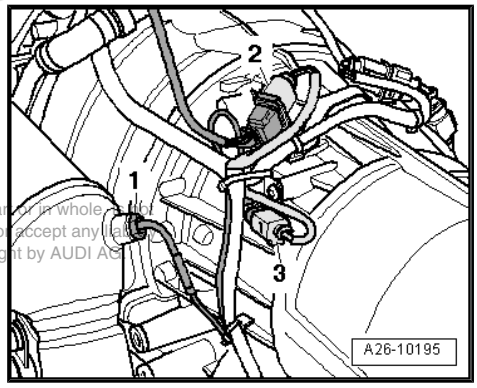
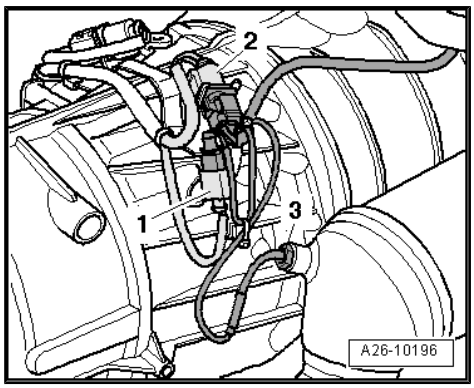


Exhaust gas temperature sender 2, bank 1 - G448- and Lambda probe - G39-

1 - Electrical connector for bank 1 exhaust gas temperature sender 2 - G448-

2 - Electrical connector for Lambda probe - G39-

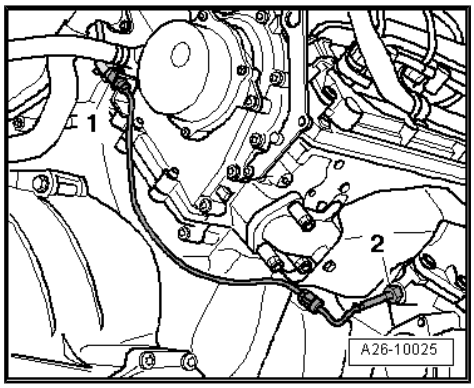
3 - Exhaust gas temperature sender 2 for cylinder bank 1 - G448-



Exhaust gas temperature sender 1 - G235- in turbocharger (right-side) (cylinder bank 1)

1 - Electrical connector for exhaust gas temperature sender 1 - G235-

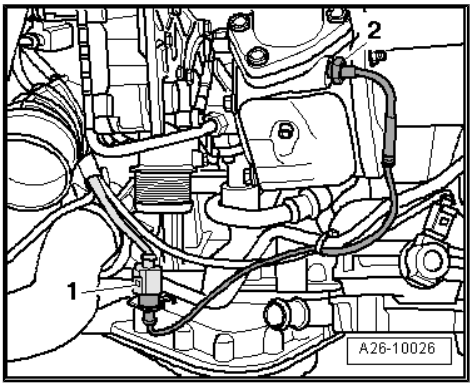
2 - Exhaust gas temperature sender 1 - G235-



Exhaust gas temperature sender 1, bank 2 - G236- in turbocharger (left-side) (cylinder bank 2)

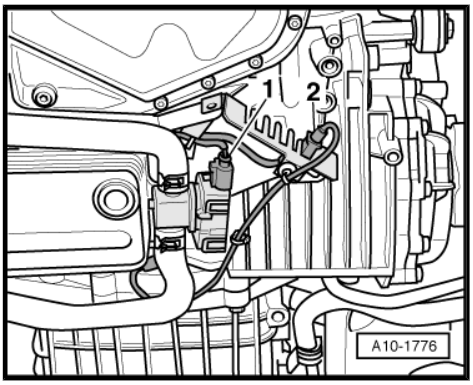
1 - Electrical connector for bank 1 exhaust gas temperature sender 2 - G236-

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



Engine speed sender - G28-

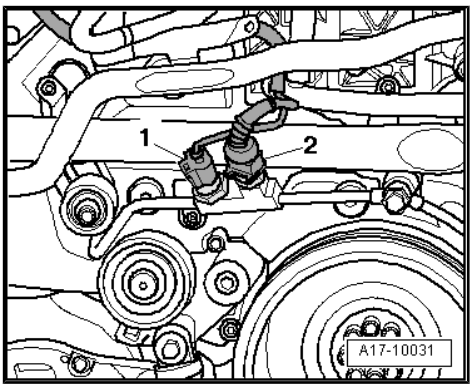
2 - 3-pin electrical connector for engine speed sender - G28-



Oil temperature sender - G8- and oil pressure switch - F1-

1 - Removing, installing and testing oil pressure switch - F1- ⇒ Rep. gr. 17

2 - Removing and installing oil temperature sender - G8- ⇒ Rep. gr. 17



2.2 System layout

Caution

Always read rules for cleanliness and instructions for working on fuel system ⇒ page 2 .

Follow these instructions before starting work and while working on the fuel system.

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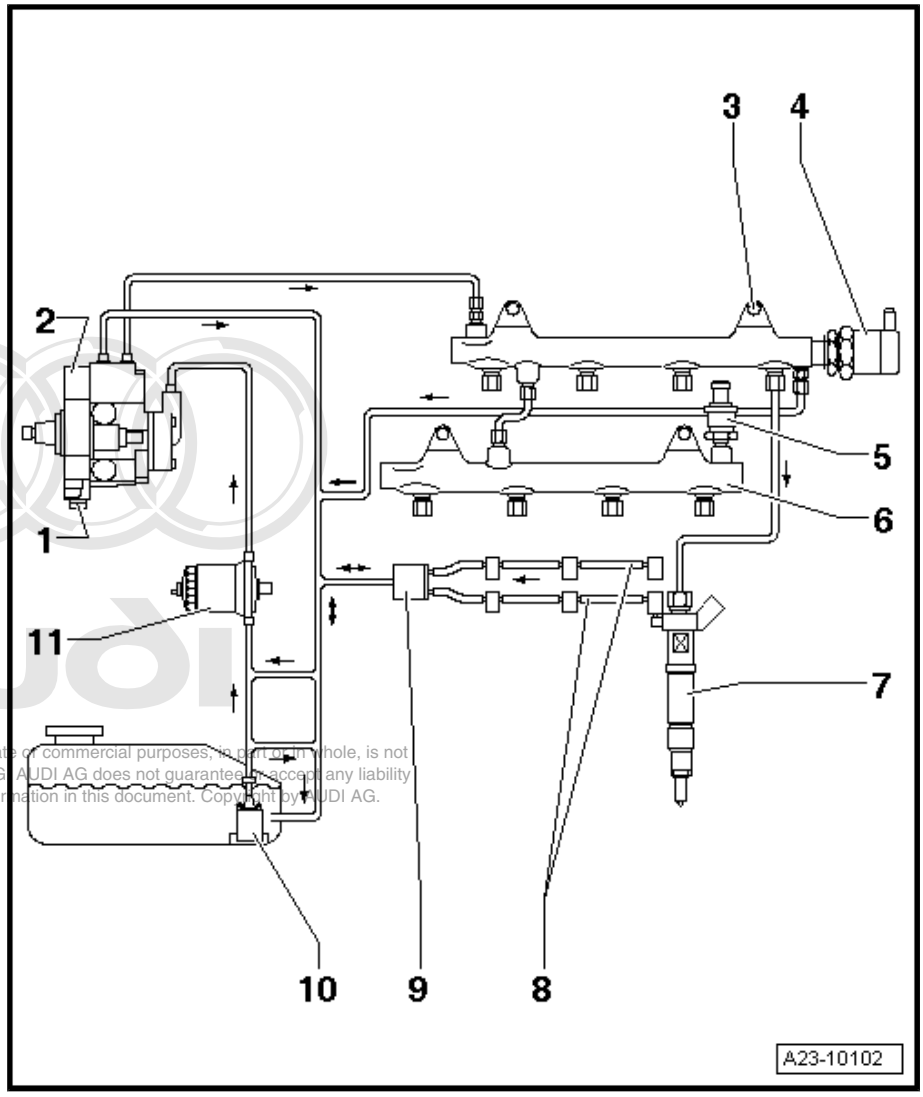

1 - Fuel metering valve - N290-

- Do not unscrew

2 - High-pressure fuel pump

- With gear-type fuel system pressurisation pump
- High-pressure pump generates fuel pressure up to 1600 bar
- Gear-type fuel system pressurisation pump generates fuel pressure between 4 and 5 bar
- Removing and installing ⇒ Rep. gr. 13

3 - Rail element (high-pressure reservoir)

- Cylinder bank 1

4 - Fuel pressure regulating valve - N276-

- On cylinder bank 1
- Cannot be re-installed
- Removing and installing ⇒ page 65

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5 - Fuel pressure sender - G247-

- On cylinder bank 2
- Removing and installing ⇒ page 67

6 - Rail element (high-pressure reservoir)

- For cylinder bank 2

7 - Injectors (piezo injectors)

- Injectors 1 ... 8
- Removing and installing ⇒ page 45

8 - Fuel return line

- The fuel return lines must not be dismantled; if necessary they must be renewed complete with pressure retention valve.
- After replacement, engine must be run at idling speed for approx. 2 minutes to bleed fuel system. Then check fuel return lines for leaks.

9 - Pressure retention valve

- The pressure retention valve maintains a residual pressure of approx. 10 bar in the return lines.
- Checking ⇒ page 42
- The pressure retention valve may only be renewed together with the fuel return lines.
- This residual pressure is required for the control function of the piezo injectors.
- After replacement, engine must be run at idling speed for approx. 2 minutes to bleed fuel system.

10 - Fuel system pressurisation pump - G6-

- Pressure from fuel system pressurisation pump approx. 1 bar

11 - Fuel filter

- Exploded view - fuel filter ⇒ Rep. gr. 20
- Renewing ⇒ Rep. gr. 20

2.3 Exploded view - fuel system

Caution

Always read rules for cleanliness and instructions for working on fuel system ⇒ page 2 .

Follow these instructions before starting work and while working on the fuel system.

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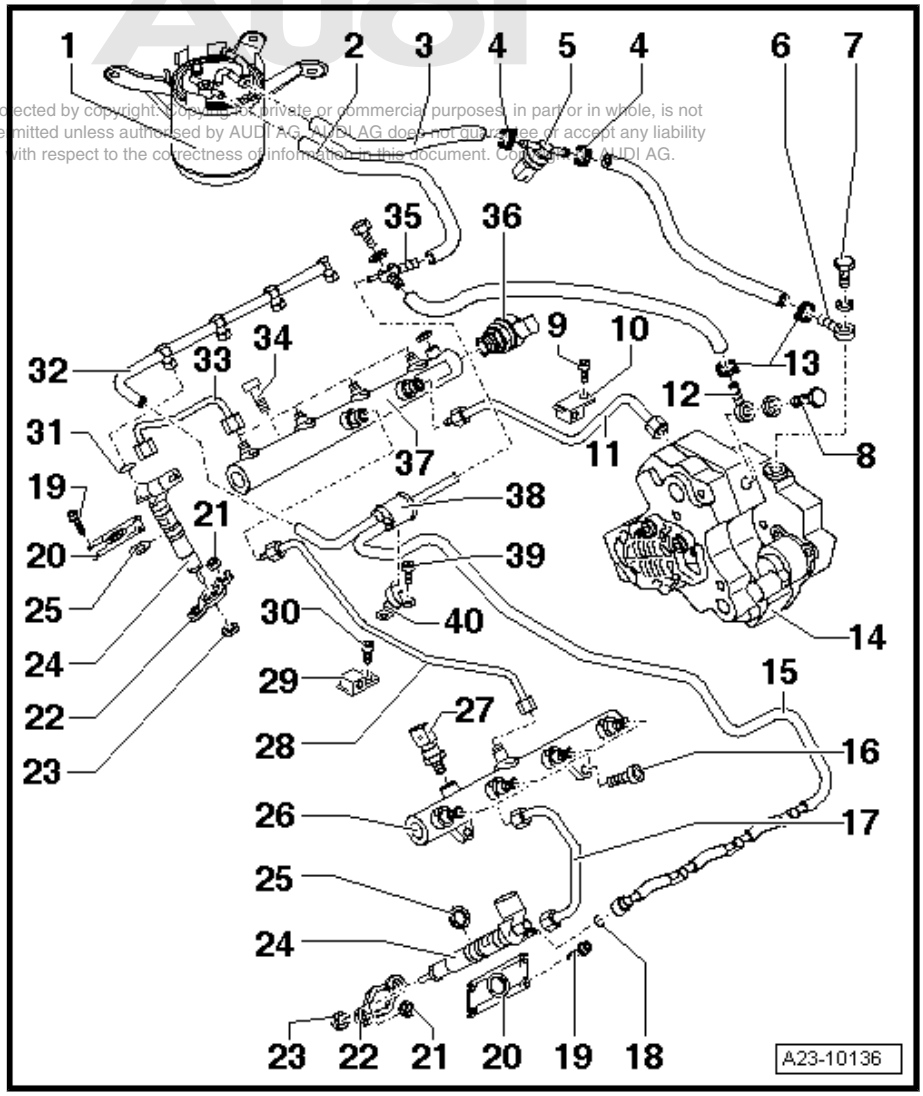

1 - Bracket with fuel filter

- ❑ Exploded view - fuel filter ⇒ Rep. gr. 20
- ❑ Renewing fuel filter ⇒ Rep. gr. 20

2 - Fuel return line

3 - Fuel supply line

4 - Clip

5 - Fuel temperature sender - G81-

6 - Fuel supply line connection

- ❑ To high-pressure pump

7 - Banjo bolt for fuel supply line connection

- ❑ 25 Nm
- ❑ Renew seals

8 - Banjo bolt for fuel return line connection

- ❑ 25 Nm
- ❑ Renew seals

9 - Bolt for high-pressure pipe bracket

- ❑ 10 Nm

10 - High-pressure pipe bracket

11 - High-pressure fuel pipe

- ❑ Between high-pressure pump and rail element

for cylinder bank 1

12 - Fuel return line connection

- ❑ To high-pressure pump

13 - Clip

14 - High-pressure fuel pump

- ❑ With gear-type fuel system pressurisation pump
- ❑ High-pressure pump generates fuel pressure up to 1600 bar
- ❑ Gear-type fuel system pressurisation pump generates fuel pressure between 4 and 5 bar
- ❑ Removing and installing ⇒ Rep. gr. 13

Caution

A new high-pressure pump must first be filled with fuel before the engine is started. The high-pressure pump must not be allowed to run while still empty. Bleed fuel system ***⇒ page 2***

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15 - Fuel return line

- ❑ Do not dismantle fuel return lines.
- ❑ The return lines can only be renewed together with the pressure retention valve as one unit.
- ❑ After replacement, engine must be run at idling speed for approx. 2 minutes to bleed fuel system. Then check fuel return lines for leaks.

16 - Bolt

- ❑ 22 Nm

17 - High-pressure pipes (injector pipe)

- ❑ For cylinder bank 2
- ❑ 25 Nm

18 - O-ring

- ❑ For injector return connection
- ❑ Renew

19 - Bolt

- ❑ Cover for injector on cylinder head cover
- ❑ 5.5 Nm

20 - Cover for injector

- ❑ 5 Nm

21 - Hexagon flange nut

- ❑ For clamping piece
- ❑ 10 Nm

22 - Clamping piece

- ❑ Renew

23 - Seal

- ❑ Check for damage

24 - Injector

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- ❑ Use a coloured pen to mark injectors and corresponding high-pressure pipes and 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 45

25 - Seal

26 - High-pressure reservoir

- ❑ For cylinder bank 2

27 - Fuel pressure sender - G247-

- ❑ Located on cylinder bank 2
- ❑ Removing and installing ⇒ page 67
- ❑ 30 Nm

28 - High-pressure fuel pipe

- ❑ Between rail element for cylinder bank 1 and rail element for cylinder bank 2

29 - High-pressure pipe bracket

30 - Bolt for high-pressure pipe bracket

- ❑ 10 Nm

31 - O-ring

- ❑ For injector return connection
- ❑ Renew

32 - Fuel return line

- ❑ Do not dismantle fuel return lines.
- ❑ The return lines can only be renewed together with the pressure retention valve as one unit.
- ❑ After replacement, engine must be run at idling speed for approx. 2 minutes to bleed fuel system. Then check fuel return lines for leaks.

33 - High-pressure pipes (injector pipe)

- ❑ For cylinder bank 1
- ❑ 25 Nm

34 - Bolt

- ❑ 22 Nm

35 - T piece for fuel return line

- ❑ With banjo bolt
- ❑ Renew O-rings

36 - Fuel pressure regulating valve - N276-

- ❑ Located on cylinder bank 1
- ❑ Cannot be re-installed
- ❑ Removing and installing ⇒ page 65

37 - High-pressure reservoir

- ❑ For cylinder bank 1

38 - Pressure retention valve

- ❑ In fuel return lines from cylinder banks 1 and 2
- ❑ The pressure retention valve maintains a residual pressure of approx. 10 bar in the return lines.
- ❑ This residual pressure is required for the control function of the piezo injectors.
- ❑ The pressure retention valve may only be renewed together with the fuel return lines.
- ❑ After replacement, engine must be run at idling speed for approx. 2 minutes to bleed fuel system.
- ❑ Checking pressure retention valve ⇒ page 42

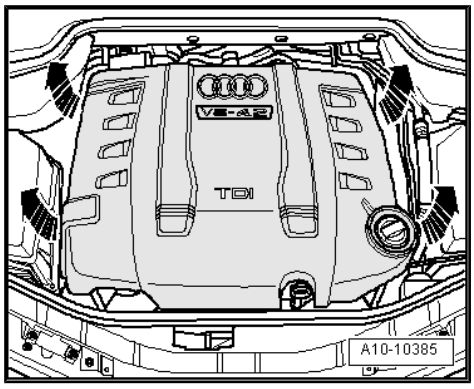
39 - Bolt

40 - Retaining clip for pressure retention valve

2.4 Removing and installing engine cover panel

Removing

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



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Installing

– To avoid damage, do not strike the engine cover panel with your fist or with any kind of tool.

– Position engine cover panel on engine (note locations of oil filler neck and oil dipstick).

– Press engine cover panel with both hands into the rubber grommets at the rear and then into the grommets at the front.

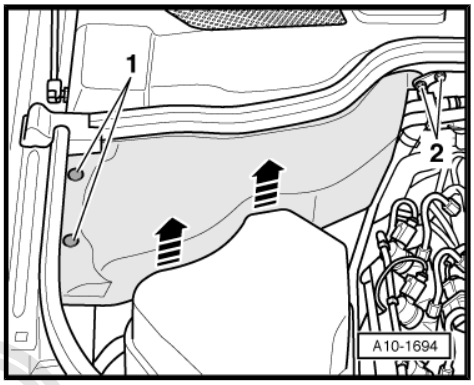
2.5 Removing and installing air filter element (right-side, cylinder bank 1)

Removing

– Remove engine cover panel (refer to instructions for removing and installing ⇒ page 18).

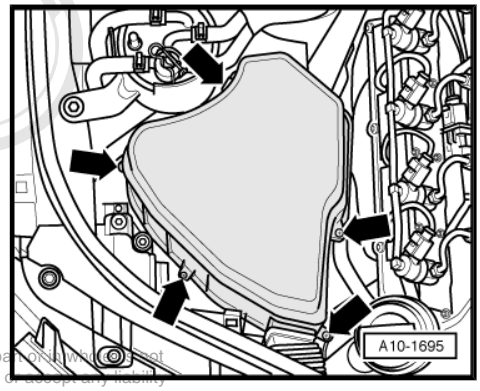
– Remove cover for suspension turret (right-side); to do so, detach spreader clips -1- and unscrew nut -2-.

– Pull cover out of retainers -arrows-.



– Remove bolts -arrows-.

– Detach air cleaner (top section).



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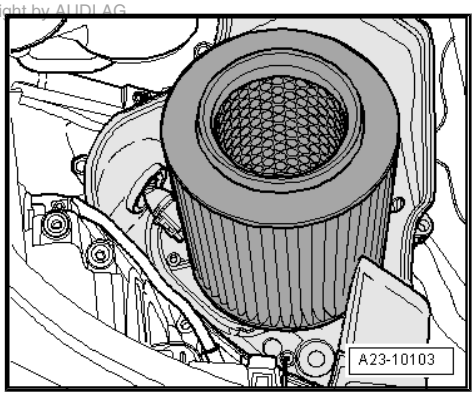
– Pull out air filter element.



Note

Make sure no dirt gets into the air cleaner housing or air mass meter - G70- .

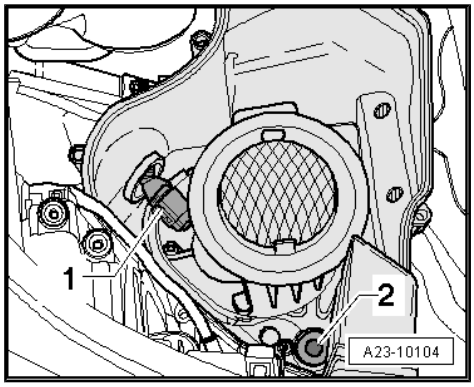
Installing

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

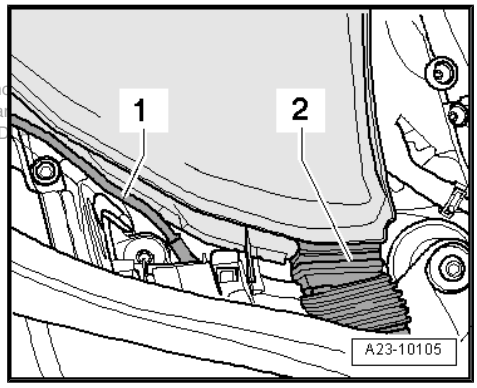
Note

- *If the air filter element is very dirty or wet, dirt or water could reach the air mass meter - G70- and affect the air mass value. This would lead to loss of power, since a smaller injection quantity is calculated.*
- *Always use genuine part for air filter element.*

– Check water drain hose -2- in air cleaner (bottom section) for dirt and other obstructions (clean if necessary).
– Clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); use a vacuum cleaner if necessary.
– Check for dirt in air duct leading to air filter element.
– When installing the air filter element, check that it is properly centred in the retainer in the air cleaner (bottom section).



– Fit the top section of the air cleaner carefully on the bottom section, without using force (make sure sealing lip and air duct -2- are positioned properly to prevent “unmetered air” from being drawn in).



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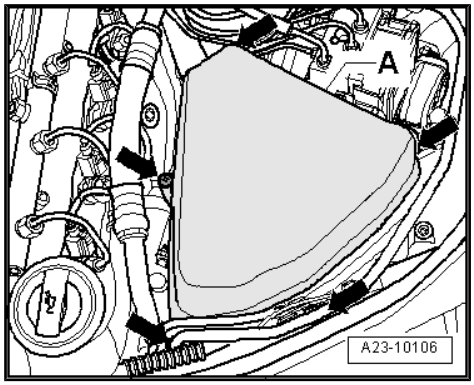
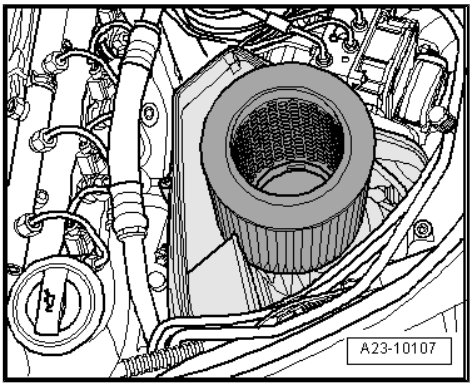
♦ Make sure that the electrical wiring -1- does not become trapped in the air cleaner housing when fitting top section of air cleaner housing.
– Then screw top section of air cleaner back onto bottom section.
– The remaining installation steps are carried out in the reverse sequence.

2.6 Removing and installing air filter element (left-side, cylinder bank 2)

– Remove engine cover panel (refer to instructions for removing and installing ⇒ page 18).
– Remove bolts -arrows-.
– Remove top section of air cleaner (detach retaining clip -A- if necessary).



– Pull out air filter element.



Note

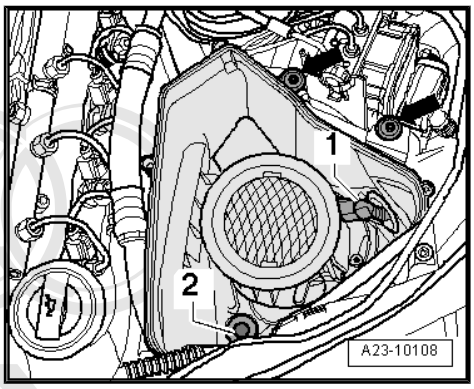
Make sure no dirt gets into the air cleaner housing or air mass meter 2 - G246- .

Installing

To ensure the proper function of the air mass meter 2 - G246- 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 2 - G246- 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.*



– Check water drain hose -2- in air cleaner (bottom section) for dirt and other obstructions (clean if necessary).
– Clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); use a vacuum cleaner if necessary.
– Check for dirt in air duct leading to air filter element.
– When installing the air filter element, check that it is properly centred in the retainer in the air cleaner (bottom section).
– Fit the top section of the air cleaner carefully on the bottom section, without using force (make sure sealing lip and air duct are positioned properly to prevent unmetered air from being drawn in).
– Then screw top section of air cleaner back onto bottom section.
– The remaining installation steps are carried out in the reverse sequence.

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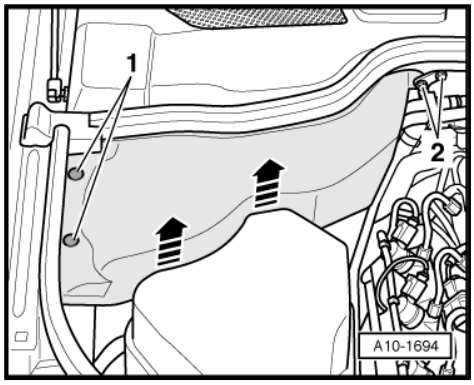
2.7 Removing and installing air mass meter - G70- (cylinder bank 1)

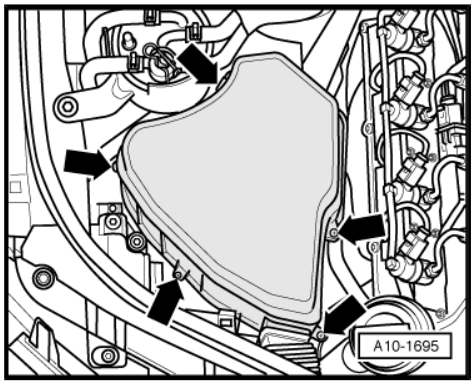
Removing

– Remove engine cover panel (refer to instructions for removing and installing ⇒ page 18).
– Remove cover for right suspension turret; to do so, detach spreader clips -1- and unscrew bolted joint -2-.

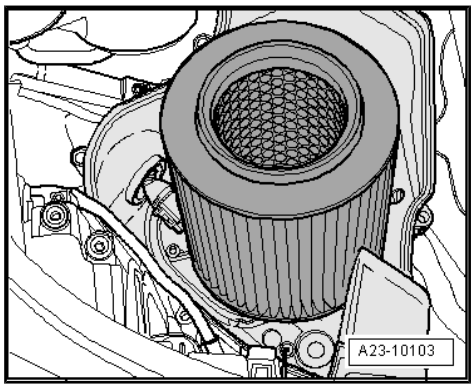
– Pull cover out of retainers -arrows-.



– Remove bolts -arrows-.
– Detach top section of air cleaner (right-side).



– Pull out air filter element.



Note

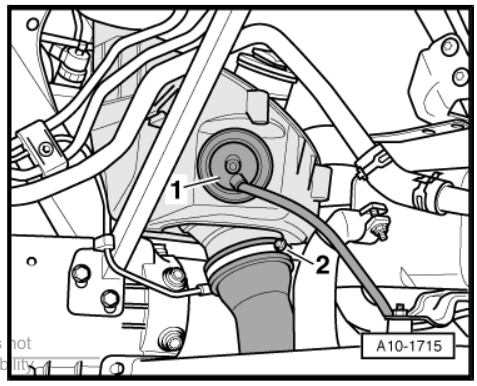
Make sure no dirt gets into the air cleaner housing or air mass meter - G70- .

– Remove front right wheel.

Note

Secure brake disc with one wheel bolt.

– Loosen front section of wheel housing liner (front right).
– Working from wheel housing (right-side), pull rubber grommet -1- off air cleaner (bottom section)
– Disconnect air hose -2- from air cleaner (bottom section).



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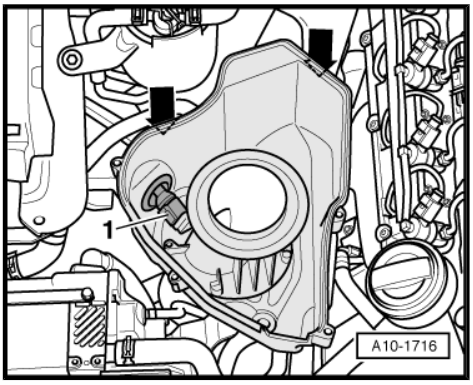
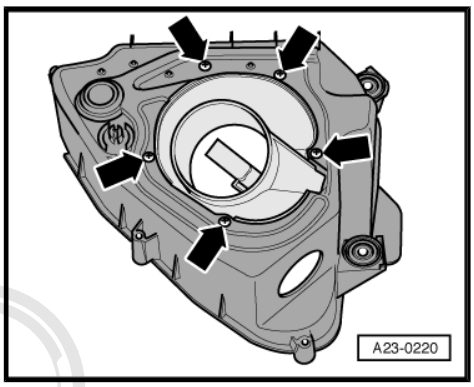
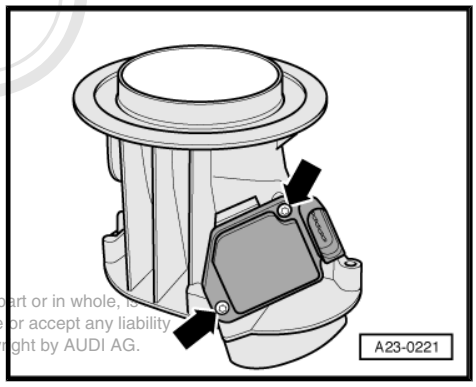
– Detach electrical connector -1- at air mass meter.
– Remove bolts -arrows-.
– Detach bottom section of air cleaner (right-side).



– Remove bolts -arrows-.
– Detach air duct from air cleaner (top section).



– Remove bolts -arrows-.
– Detach air mass meter from air duct.



Installing

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

Note

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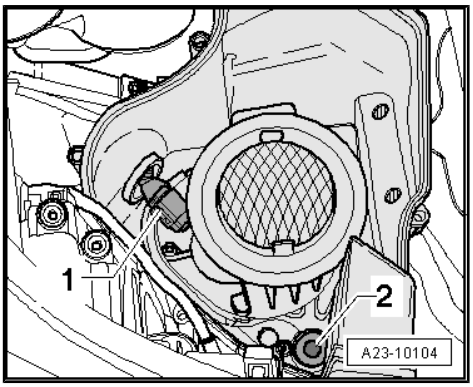
- *If the air filter element is very dirty or wet, dirt or water could reach the air mass meter - G70- and affect the air mass value (renew air filter element if necessary). This would lead to loss of power, since a smaller injection quantity is calculated.*
- *Always use genuine part for air filter element.*
- *Use a silicone-free lubricant when installing the air hose.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*

– Check water drain hose -2- in air cleaner (bottom section) for dirt and other obstructions (clean if necessary).
– Check for salt residue, dirt and leaves in air mass meter and air intake hose (engine intake side).
– Check for dirt in air duct leading to air filter element. If necessary, clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); wash out or use a vacuum cleaner as required.

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



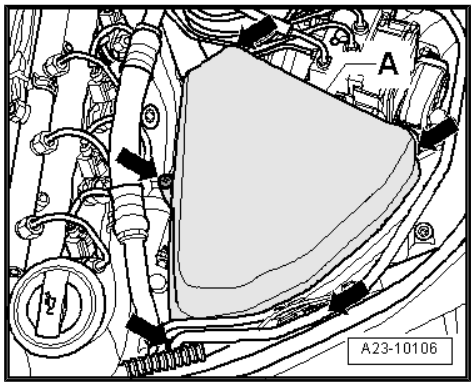
2.8 Removing and installing air mass meter 2 - G246- (cylinder bank 2)

Removing

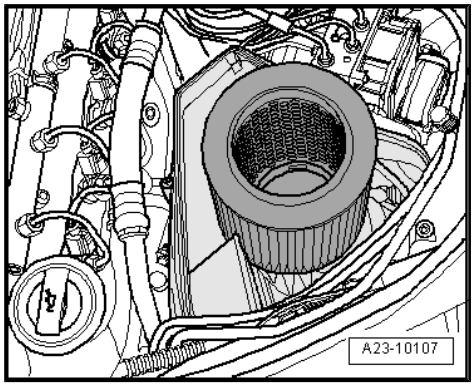
– Remove engine cover panel (refer to instructions for removing and installing ⇒ page 18).

– Remove bolts -arrows-.

– Remove top section of air cleaner (detach retaining clip -A- if necessary).



– Pull out air filter element.



Note

Make sure no dirt gets into the air cleaner housing or air mass meter 2 - G246- .

– Remove front left wheel.

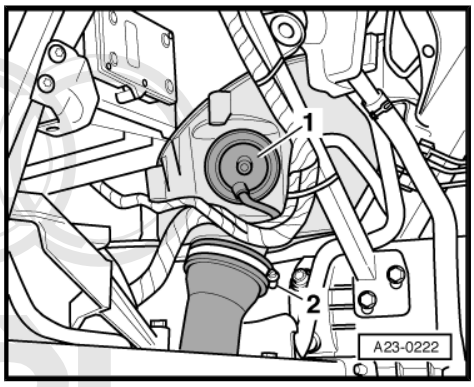
Note

Secure brake disc with one wheel bolt.

– Loosen front section of wheel housing liner (front left).

– Working from wheel housing (left-side), pull rubber grommet -1- off air cleaner (bottom section)

– Disconnect air hose -2- from air cleaner (bottom section).



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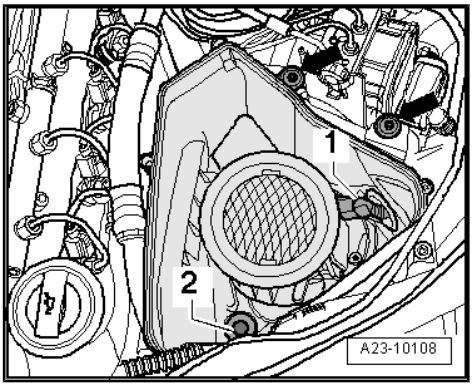
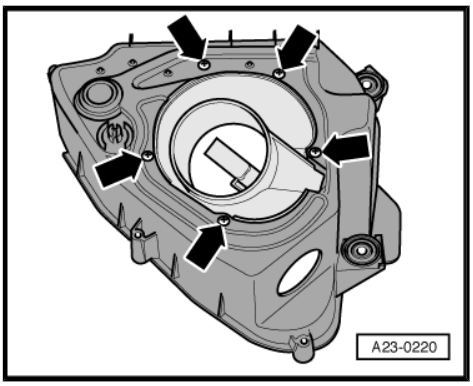
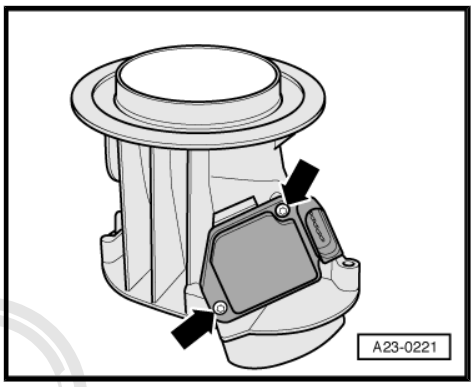
– Detach electrical connector -1- at air mass meter.
– Remove bolts -arrows-.
– Remove bottom section of air cleaner (left-side).



– Remove bolts -arrows-.
– Detach air duct from air cleaner (top section).



– Remove bolts -arrows-.
– Detach air mass meter from air duct.



Installing

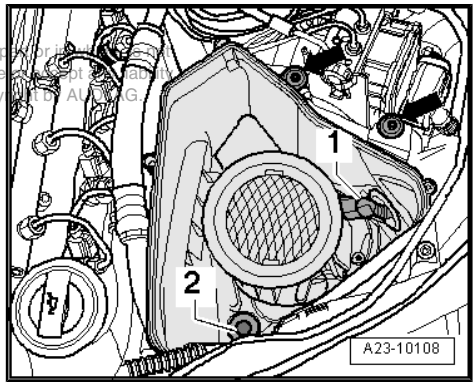
To ensure the proper function of the air mass meter 2 - G246- it is important to observe the following notes and instructions.

Note

- *If the air filter element is very dirty or wet, dirt or water could reach the air mass meter 2 - G246- and affect the air mass value (renew air filter element if necessary). This would lead to loss of power, since a smaller injection quantity is calculated.*
- *Always use genuine part for air filter element.*
- *Use a silicone-free lubricant when installing the air hose.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*

– Check water drain hose -2- in air cleaner (bottom section) for dirt and other obstructions (clean if necessary).
– Check for salt residue, dirt and leaves in air mass meter and air intake hose (engine intake side).
– Check for dirt in air duct leading to air filter element. If necessary, clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); wash out or use a vacuum cleaner as required.

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



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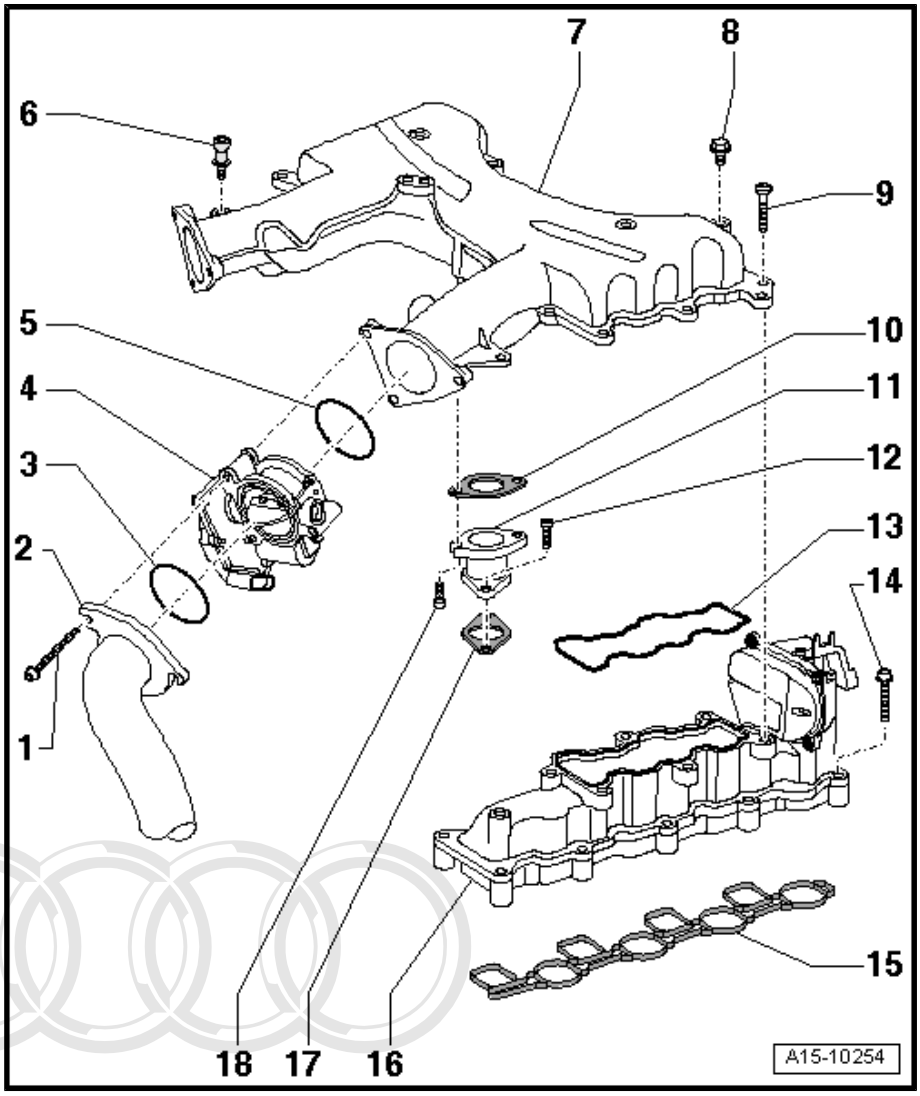
2.9 Exploded view - intake manifold

Note

Illustration shows top section of intake manifold and bottom section of intake manifold (left-side).



1 - Bolt
- ❑ 9 Nm

2 - Front air pipe

3 - O-ring
- ❑ Renew

4 - Throttle valve module
- ❑ On left-side in direction of travel: throttle valve module 2 - J544-
- ❑ On right-side in direction of travel: throttle valve module - J338-

5 - O-ring
- ❑ Renew

6 - Retaining pin for engine cover panel
- ❑ 9 Nm

7 - Intake manifold (top section)
- ❑ Removing and installing ⇒ page 27

8 - Screw plug
- ❑ 8 Nm

9 - Bolt
- ❑ Tighten in stages and in diagonal sequence to 9 Nm

10 - Gasket
- ❑ Renew

11 - Connection for exhaust gas recirculation
- ❑ Removing and installing ⇒ Rep. gr. 26

12 - Bolt
- ❑ 9 Nm

13 - Gasket
- ❑ Renew

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14 - Bolt
- ❑ Tighten in stages and in diagonal sequence to 9 Nm

15 - Gasket
- ❑ Renew

16 - Intake manifold
- ❑ With intake manifold flap motor
- ❑ On right-side in direction of travel: intake manifold flap motor - V157-

- ❑ On left-side in direction of travel: intake manifold flap 2 motor - V275-
- ❑ Removing and installing intake manifold (right-side) ⇒ page 28
- ❑ Removing and installing intake manifold (left-side) ⇒ page 29

17 - Gasket

- ❑ Renew

18 - Bolt

- ❑ 9 Nm

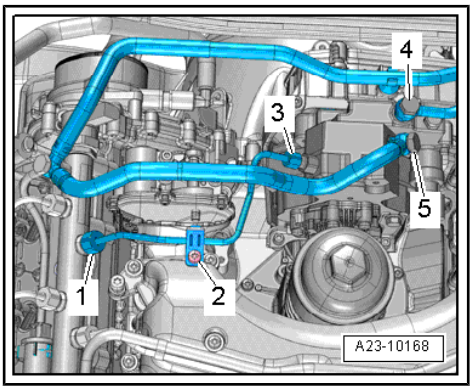
2.10 Removing and installing intake manifold (top section)

Removing

– Remove engine cover panel (refer to instructions for removing and installing ⇒ page 18).

– Pull off bonnet seal at lock carrier.

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



Note

Disregard items -1, 3, 4, 5-.

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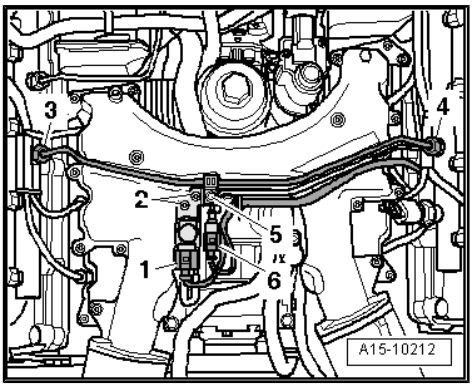
– Remove injector pipe; loosen connections -3-, -4- and -5- to do so.

– Remove bracket on intake manifold (bracket secures injector pipe between rail element and high-pressure pump).

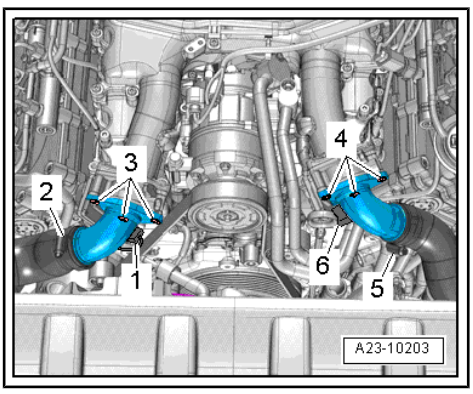
– Unplug electrical connectors -1- and -6-.

– Unscrew exhaust gas recirculation cooler change-over valve - N345- -2- and detach vacuum hose.



– Unplug electrical connector -1- for throttle valve module 2 - J544- and connector -6- for throttle valve module - J338- .

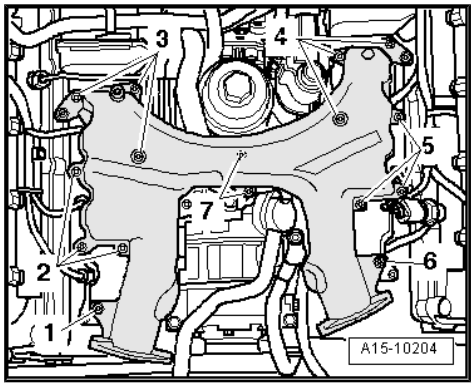
– Release hose clips -2- and -5- and disconnect air hoses.



Note

Disregard -items 3 and 4-.

– Unscrew retaining pins for engine cover panel -1- and -6-.
– Unscrew bolts -2, 3, 4, 5 and 7- and detach intake manifold (top section).



Installing

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

Note

- *Renew all seals and gaskets.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue. .*

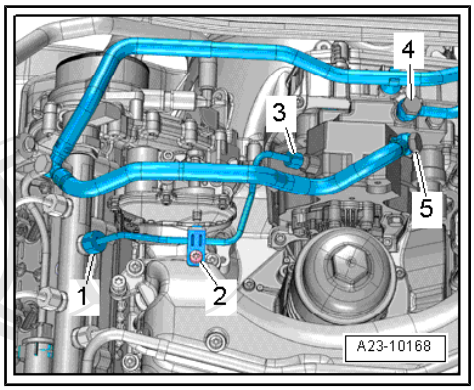
– Tighten bolts and retaining pins for intake manifold (top section) in diagonal sequence and in stages.
- Tightening torques: exploded view - intake manifold ⇒ page 26 .

– Install high-pressure pipes ⇒ page 30 .

2.11 Removing and installing bottom section of intake manifold (right-side) (cylinder bank 1)

Removing

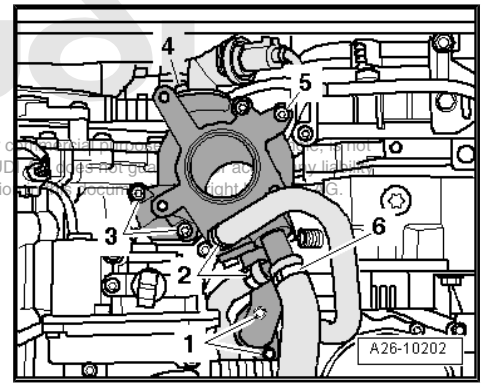
– Remove intake manifold (top section) ⇒ page 27 .
– Remove bolt -2- at retaining clamp for high-pressure pipe.
– Detach injector pipe by loosening connections -1- and -3-.



Note

Disregard -items 2, 4 and 5-.

– Unscrew bolts -3- and -5- and carefully push exhaust gas recirculation control motor - V338- with connection to one side until bolts at bottom section of intake manifold (right-side) are accessible.



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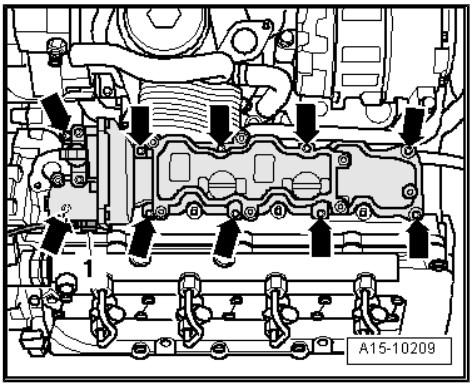
Note

Disregard -items 1, 2, 4, 6-.

– Unplug electrical connector -1- at intake manifold flap motor - V157- .
– Remove bolts -arrows-.
– Take off intake manifold together with intake manifold flap motor - V157- .



Caution

Risk of irreparable damage to engine.

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

Installing

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

Note

Renew all seals and gaskets, including seal for control motor for exhaust gas recirculation - V338- .

– Install exhaust gas recirculation control motor - V338- with connection ⇒ Rep. gr. 26 .
– Install top section of intake manifold ⇒ page 27 .
• Tightening torques: exploded view - intake manifold ⇒ page 26 .

2.12 Removing and installing bottom section of intake manifold (left-side) (cylinder bank 2)

Removing

– Remove intake manifold (top section) ⇒ page 27 .
– Unplug electrical connectors at glow plugs for cylinders 5, 6, 7 and 8.
– Take non-return valve out of holder.
– Detach electrical connector -1- for high-pressure pump.

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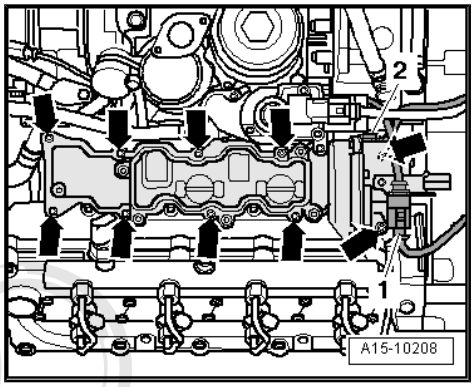
– Unplug electrical connector -2- at intake manifold flap 2 motor - V275- .
– Remove bolts -arrows-.
– Take off intake manifold together with intake manifold flap motor 2 - V275- .



Caution

Risk of irreparable damage to engine.

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

Installing

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

Note

Renew seals and/or gaskets.

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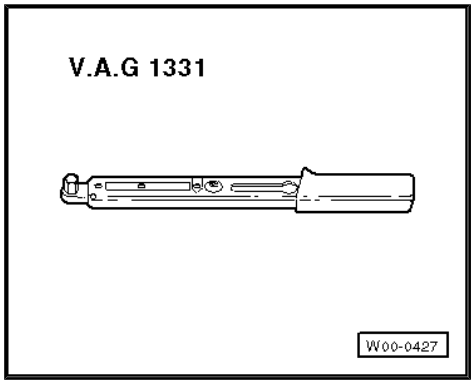
- Tightening torques: exploded view - intake manifold ⇒ page 26 .

– Install intake manifold (top section) ⇒ page 27 .

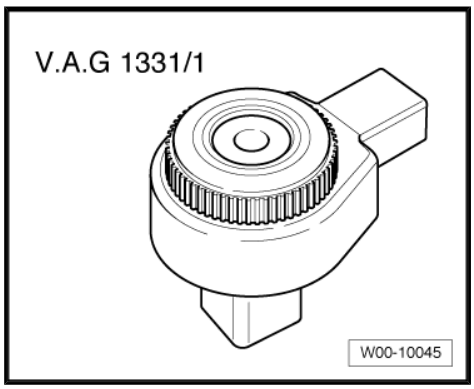
2.13 Installing high-pressure pipes

Special tools and workshop equipment required

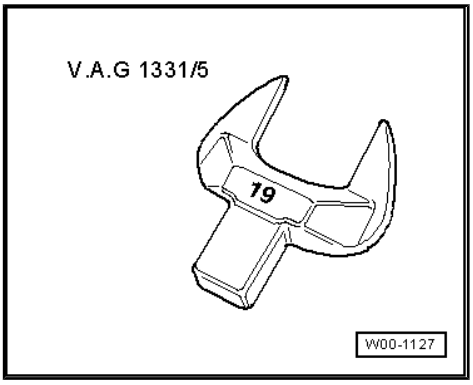
- Torque wrench - V.A.G 1331-



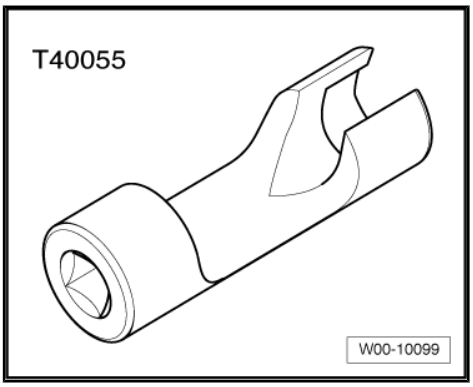
- Ratchet - V.A.G 1331/1-



♦ Open end spanner insert, AF 19 - V.A.G 1331/5-



♦ Socket - T40055-



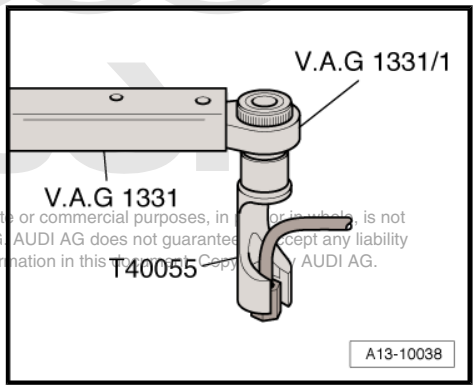
Procedure

– Lubricate threads of union nuts with fuel.

– Hand-tighten union nuts on high-pressure pipes (ensure that pipes are not under tension).

• Tightening torque: 25 Nm

– To tighten unions of high-pressure pipes, use torque wrench - V.A.G 1331- with ratchet - V.A.G 1331/1- and socket, 17 mm - T40055- .



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– To secure high-pressure pipes, use torque wrench - V.A.G 1331- with open end spanner insert, AF 19 - V.A.G 1331/5- .

– Check fuel system for leaks.

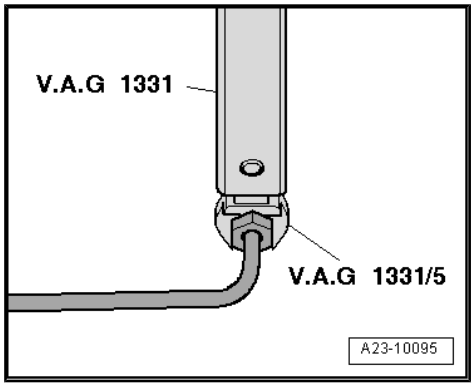
Bleeding fuel system and checking for leaks

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

– Check the entire fuel system for leaks.

Renew the affected component if leakage occurs.

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



Note

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

2.14 Checking injectors

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

- Performing adaption of correction values for injectors ⇒ page 32
- Checking for injectors sticking open ⇒ page 33
- Measuring return flow rate of injectors with engine running ⇒ page 36
- Checking return flow rate of injectors at starter cranking speed ⇒ page 39

2.15 Performing adaption of correction values for injectors

The “Injector delivery calibration” and “Injector voltage calibration” functions serve to correct the injection rates for each cylinder of a common rail system individually across the entire operating range.

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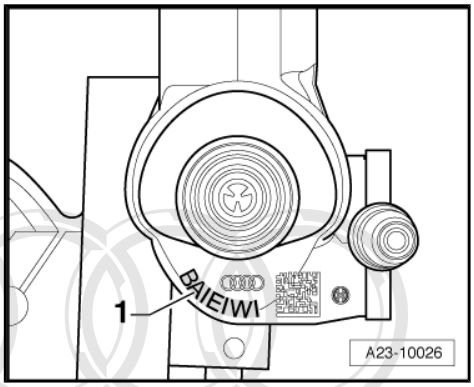
The 7-digit adaption values -1- (details in illustration are only an example) are marked separately on each injector. They may consist of letters and/or numbers (ASCII code).



When a new injector is installed, the adaption value for the new injector must be stored in the corresponding engine control unit.

Cylinders 1, 4, 6 and 7: master engine control unit (engine control unit - J623-)

Cylinders 2, 3, 5 and 8: slave engine control unit (engine control unit 2 - J624-)

When one or both of the engine control units are renewed, the appropriate “injector delivery calibration” values with “injector voltage calibration” values must be written into the new control units.

Examples:

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

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

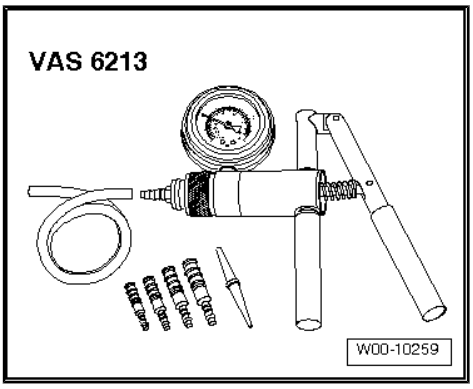
Additionally, check that the “injector delivery calibration values” with “injector voltage calibration values” are correctly entered for all the other injectors. Do NOT attempt to re-enter these calibration values if the correct values are already stored in the engine control unit.

2.16 Checking for injectors sticking open

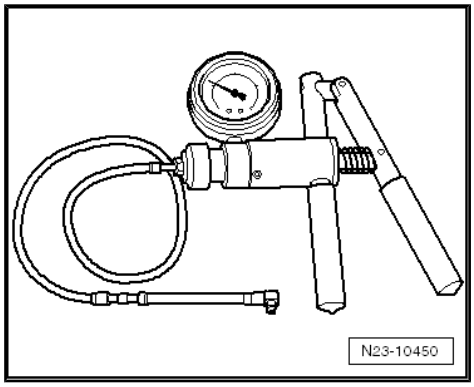
If one of the injectors is sticking open, this means that the injector needle is not closing fully and fuel escapes into the cylinder.

Special tools and workshop equipment required

- Hand vacuum pump - VAS 6213-



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



Caution

Always read rules for cleanliness and instructions for working on fuel system ⇒ page 2 .

Follow these instructions before starting work and while working on the fuel system.

– Erase event memories of both engine control units.
– Remove engine cover panel ⇒ page 18 .
– Clean all connections (with commercial cleaning solution or similar) before removing.

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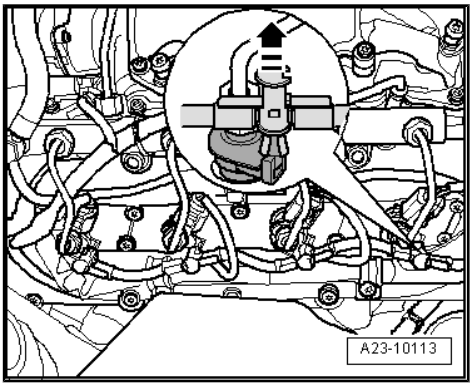

– Pull return line connections off injectors; to do so, press both tabs down and at the same time pull centre piece up to release connection -arrow-.
– Connect adapter to return line connection of injector to be tested after adapter has been cleaned and blown out.
– Generate a vacuum of -500 mbar using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

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

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

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

– Renew faulty injectors ⇒ page 45 .

Installing fuel return lines

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

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

Note

Lubricate all seals with engine oil or assembly oil before installing.

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

Bleeding fuel system and checking for leaks

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

Renew 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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2.17 Measuring return flow rate of injectors with engine running

Checking return flow rate of all injectors

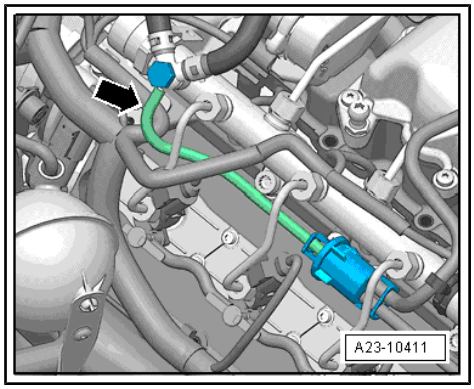
Caution

Always read rules for cleanliness and instructions for working on fuel system ⇒ page 2 .

Follow these instructions before starting work and while working on the fuel system.

– Remove engine cover panel ⇒ page 18 .

– Disconnect fuel return line -arrow- at banjo bolt connection.



– Seal off the open return connection with a plug -1-.

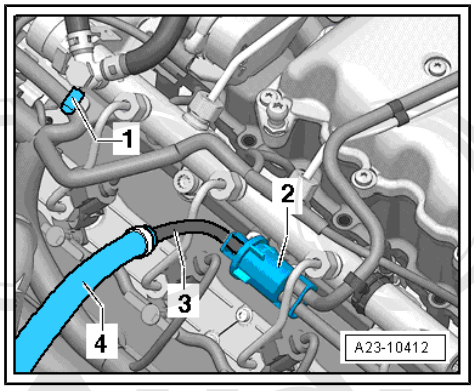
– Hold end of fuel return line -3- (lengthen with hose -4- if necessary) into a suitable container to measure total return flow rate.

– Start engine and let it idle for 2 minutes.

♦ Specification for 2 minutes: 0 ml to 60 ml

– If specification is attained, increase engine speed to 2000 ... 2500 rpm for approx. 2 minutes and then check return flow rate again.

• Specification for 2 minutes: less than 250 ml



Note

1000 ml = 1 litre

If specification is exceeded, this indicates that one or more injectors are defective. Check return flow rate from each injector individually.

Checking return flow rate of individual injectors

Special tools and workshop equipment required

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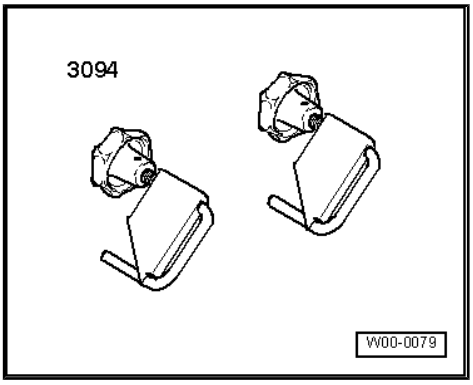
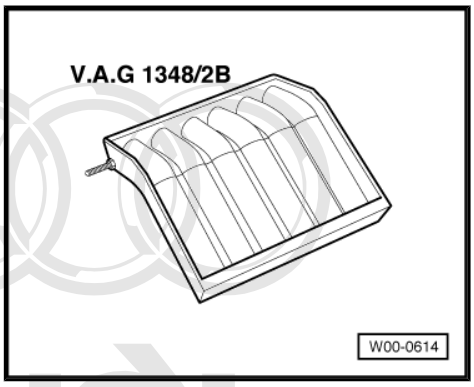
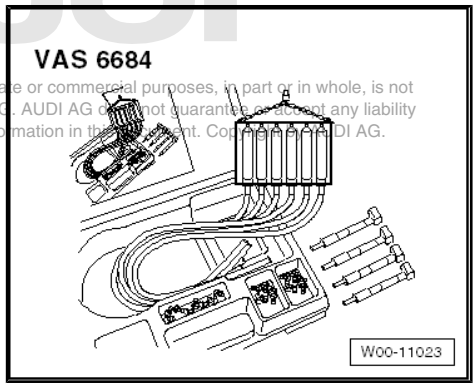
♦ Hose clamps, up to 25 mm - 3094-



♦ Injection rate comparison meter - V.A.G 1348/2B-



♦ or return flow meter - VAS 6684-



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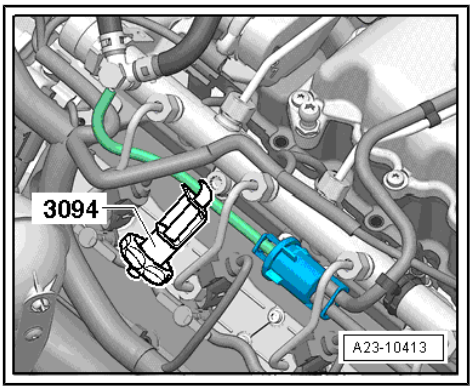
Each injector normally has a relatively low return flow rate. If the return flow rate at one injector is relatively high compared to the other injectors, that injector is probably defective.

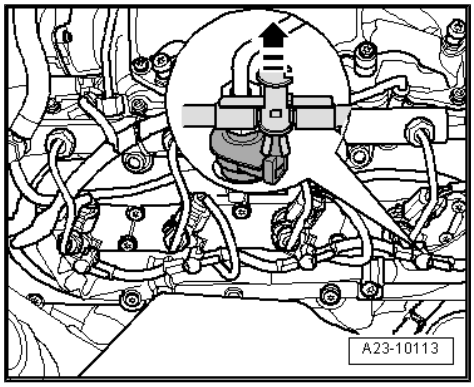
– Clean all return line connections (with commercial cleaning solution etc.) before removing.

– Dry all components after cleaning.

– Clamp off fuel return line downstream of pressure retention valve using hose clamp up to 25 mm - 3094- .



– Pull return line connections off injectors; to do so, press both tabs down and at the same time pull centre piece up to release connection -arrow-.



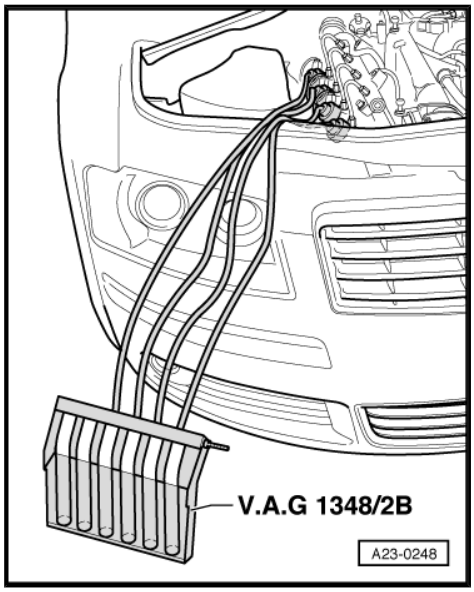
Note

- *Illustration shows cylinder bank 1.*
- *No dirt must be allowed to get into the disconnected return lines or the open connections on the injectors.*

– Connect hoses onto return line connections of all 4 injectors.

– Run the 4 hoses into injection rate comparison meter - V.A.G 1348/2 B- .

– Start engine and let it idle for several minutes.



Caution

Do NOT press the accelerator during this test; the engine must only run at idling speed. Running the engine at higher speeds with the return lines disconnected will cause damage to the injectors.

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

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– Also check return flow rate on other cylinder bank.
– If one injector has a significantly higher return flow rate than the others it must be renewed ⇒ page 45 .

Installing fuel return lines

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

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

Note

Lubricate all seals with engine oil or assembly oil before installing.

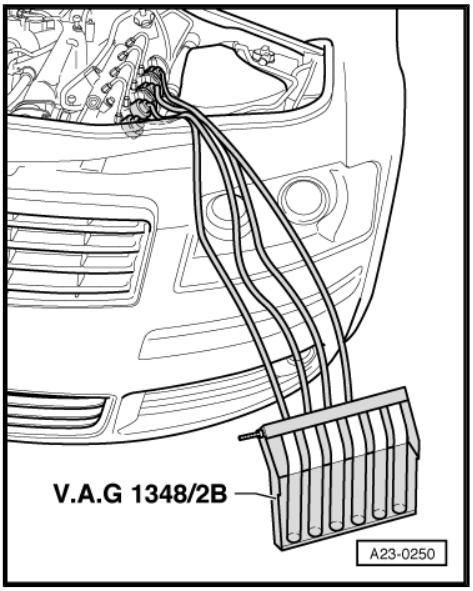
– Push return line connections carefully over seals and onto injectors. The catch should engage audibly. Then press release pin down carefully.

Bleeding fuel system and checking for leaks

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

Renew the affected component if leakage occurs.

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



Note

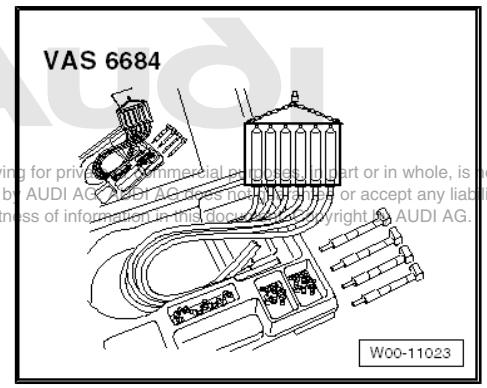
If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the event memory. Then continue the road test.

2.18 Checking return flow rate of injectors at starter cranking speed

Only perform this test if the engine does not start at all.

Special tools and workshop equipment required

- Return flow meter - VAS 6684-
- 6 lengths of hose to fit return line connections on injectors



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Caution

Always read rules for cleanliness and instructions for working on fuel system ⇒ page 2 .

Follow these instructions before starting work and while working on the fuel system.

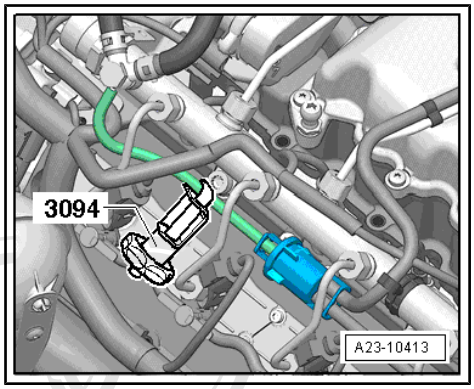
Procedure

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

– Remove engine cover panel ⇒ page 18 .

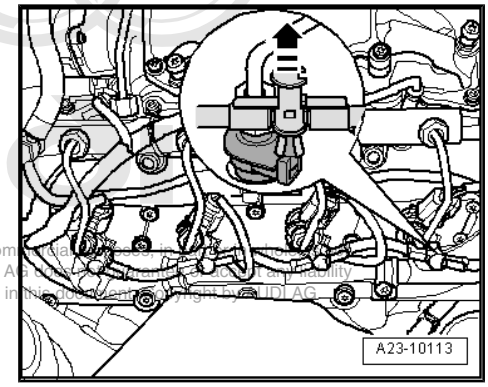
– Clamp off fuel return line downstream of pressure retention valve using hose clamp up to 25 mm - 3094- .

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



Checking return flow rate (cylinder bank 1):

– Pull return line connections off injectors on cylinder bank 1; to do so, press both tabs down and at the same time pull centre piece up to release connection -arrow-.



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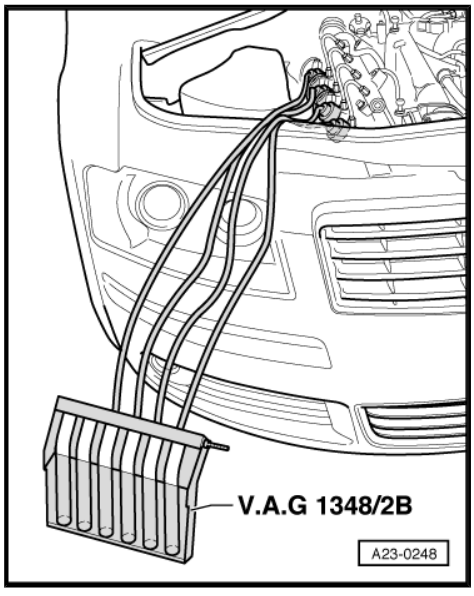
– Run the 4 hoses into injection rate comparison meter - V.A.G 1348/2 B- .

– Operate starter.

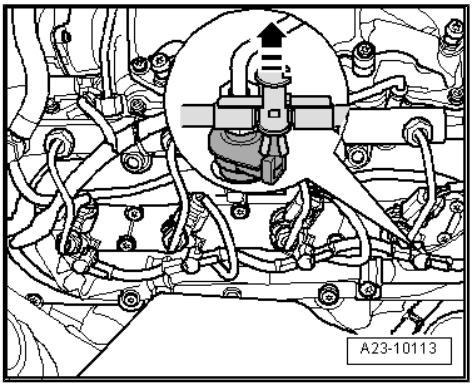
◆ Specification of return flow rate at starter cranking speed: 0 ml

– If fuel comes out of one injector, that injector must be renewed ⇒ page 45 .

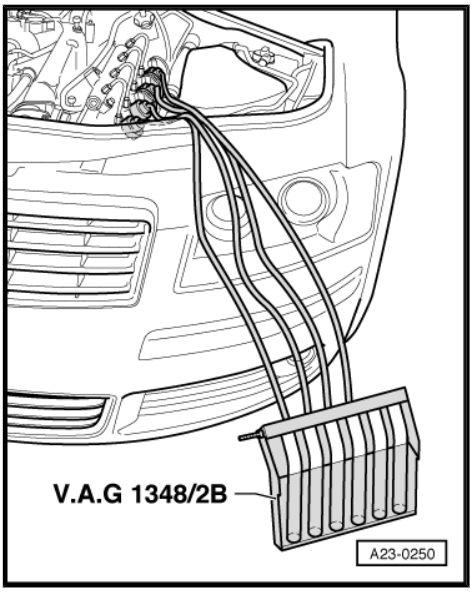


Checking return flow rate (cylinder bank 2):

– Pull return line connections off injectors on cylinder bank 2; to do so, press both tabs down and at the same time pull centre piece up to release connection -arrow-.



– Run the 4 hoses into injection rate comparison meter - V.A.G 1348/2 B- .
– Operate starter.
♦ Specification of return flow rate at starter cranking speed: 0 ml
– If fuel comes out of one injector, that injector must be renewed ⇒ page 45 .



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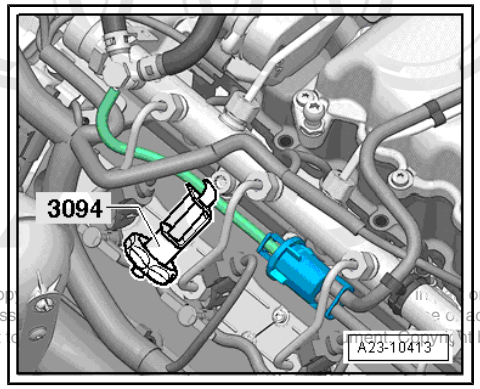
– Remove hose clamp up to 25 mm - 3094- from fuel return line.



Installing fuel return lines

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

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

Note

Lubricate all seals with engine oil or assembly oil before installing.

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

Bleeding fuel system and checking for leaks

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

– Check the entire fuel system for leaks.

Renew the affected component if leakage occurs.

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

Note

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

2.19 Checking pressure retention valve in fuel return line

The pressure retention valve maintains a residual pressure of approx. 10 bar in the fuel return line.

This residual pressure is required for the control function of the piezo injectors.

Special tools and workshop equipment required

♦ Tester for fuel return system - VAS 6330-

Caution

Always read rules for cleanliness and instructions for working on fuel system ⇒ page 2 .

Follow these instructions before starting work and while working on the fuel system.

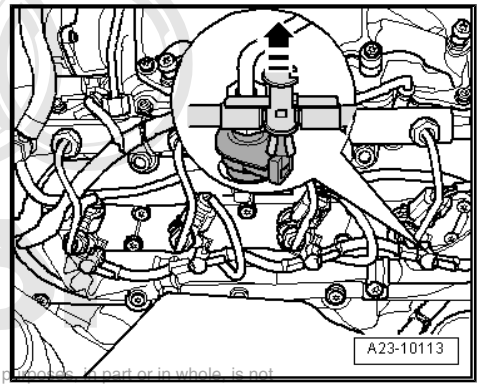
– Remove engine cover panel ⇒ page 18 .

– Clean return line connection on cylinder 1 (with commercial cleaning solution or similar) before removing.

– Dry return line connection on cylinder 1.

– Cover return line connection on cylinder 1 with a cloth.

– Pull return line connection off cylinder 1; to do so, press both tabs down and at the same time pull centre piece up to release connection -arrow-.



Note

Take care to keep all components clean. No dirt must be allowed to get into the disconnected return line or the open connection on the injector.

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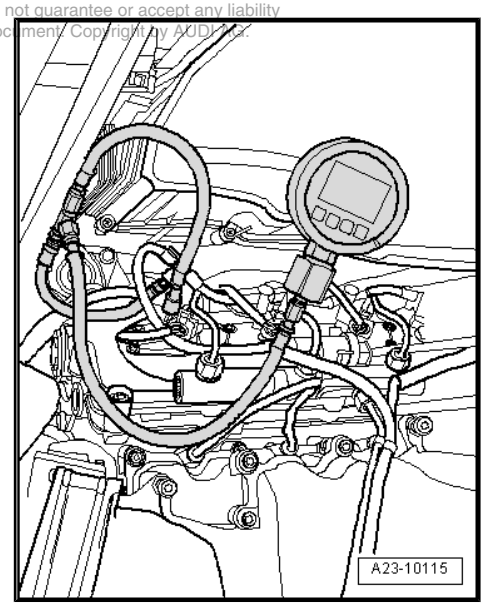
– Connect tester for fuel return system - VAS 6330- between return line connection on injector and return line.



– Start engine.

– Check pressure indicated on tester.

♦ Specification: approx. 10 bar

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

Installing fuel return lines

– Renew O-ring for return line connection.

Note

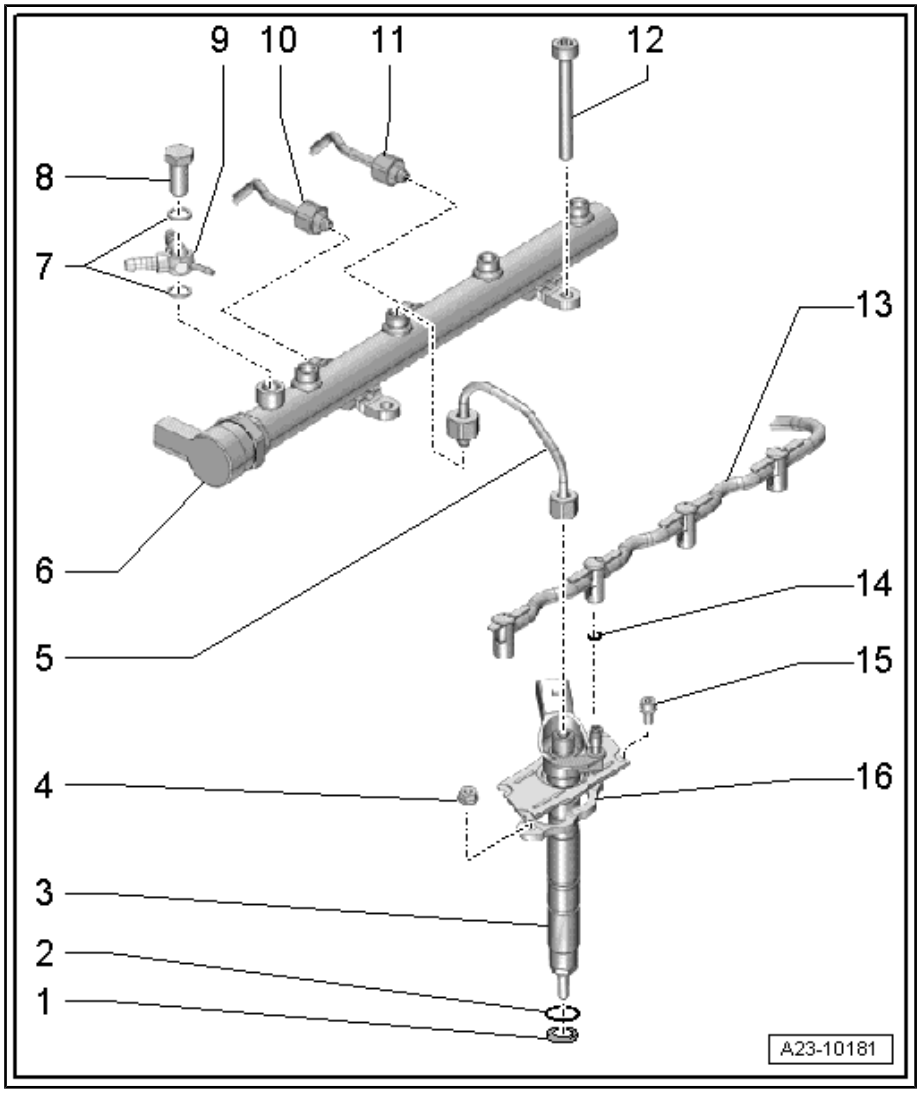
Lubricate all seals with engine oil or assembly oil before installing.

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

– Erase entry in event memory using a diagnostic tester.

– Check fuel system for leaks.

2.20 Exploded view - injectors and high-pressure pipes



1 - Copper seal
- ❑ Renew

2 - O-ring
- ❑ Renew

3 - Injector
- ❑ 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)
- ❑ Always renew copper seal when removing and installing
- ❑ When an injector is renewed, also renew the high-pressure pipe and clamping piece at the same time
- ❑ Removing and installing ⇒ page 45

4 - Nut
- ❑ 10 Nm

5 - High-pressure pipe
- ❑ From rail to injector
- ❑ Observe rules for cleanliness ⇒ page 2
- ❑ Do not alter shape
- ❑ 25 Nm
- ❑ Installing ⇒ page 30

6 - High-pressure reservoir
- ❑ Observe rules for cleanliness ⇒ page 2

7 - Seals
- ❑ Renew

8 - Banjo bolt
- ❑ 25 Nm

9 - Connecting piece

10 - High-pressure pipe
- ❑ From high-pressure pump
- ❑ Observe rules for cleanliness ⇒ page 2
- ❑ Do not alter shape
- ❑ 25 Nm
- ❑ Installing ⇒ page 30

11 - High-pressure pipe
- ❑ From high-pressure reservoir on opposite side
- ❑ Observe rules for cleanliness ⇒ page 2
- ❑ Do not alter shape
- ❑ 25 Nm
- ❑ Installing ⇒ page 30

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12 - Bolt

- ❑ 22 Nm

13 - Return line

- ❑ Observe rules for cleanliness ⇒ page 2

14 - O-ring

- ❑ Renew

15 - Bolt

- ❑ 5 Nm

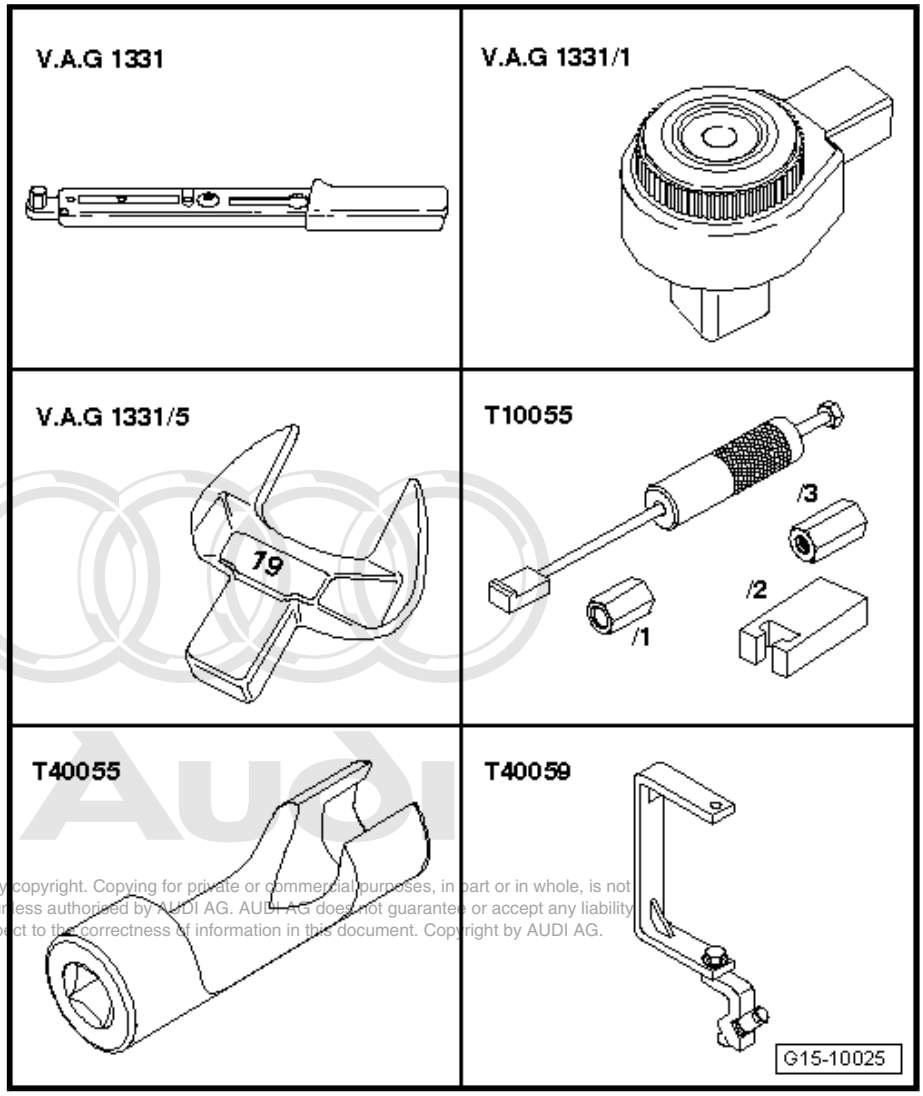
16 - Clamping piece

- ❑ Renew

2.21 Removing and installing injectors

Special tools and workshop equipment required

- ♦ Torque wrench - V.A.G 1331-
- ♦ Ratchet - V.A.G 1331/1-
- ♦ Open end spanner insert, AF 19 - V.A.G 1331/5-
- ♦ Puller - T10055- with adapter - T10055/1- and - T10055/3-
- ♦ Socket, 17 mm - T40055-
- ♦ Puller - T40059-
- ♦ Cleaning kit - VAS 6811-



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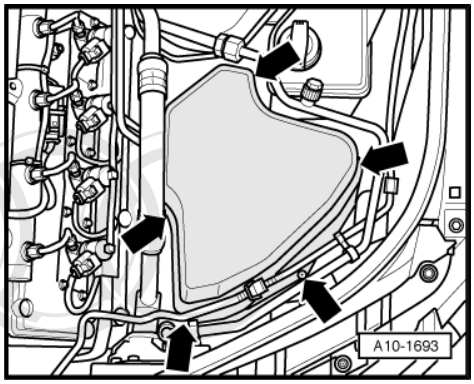
Removing

Note

- *The procedure is described for the cylinder bank 2 (left-side).*
- *All cable ties which are released or cut open when removing must be fitted in the same position when installing.*

– Remove engine cover panel ⇒ page 18 .

– Unscrew bolts -arrows- and remove top section of air cleaner (left-side).



– Remove oil filler neck on cylinder head cover (left-side). To do so, lift tab -1- and turn oil filler neck clockwise -arrow-.

– Detach electrical connectors at glow plugs.

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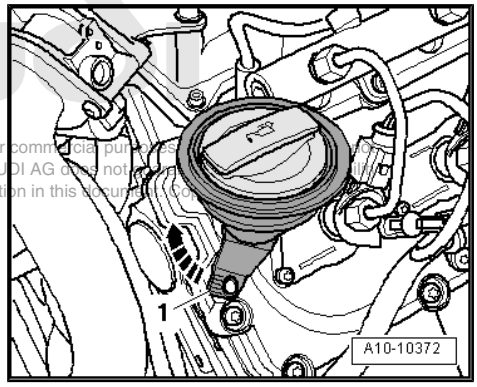
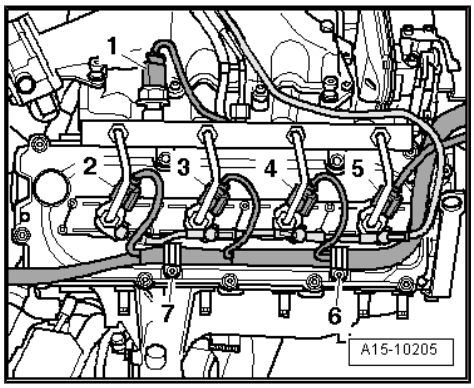
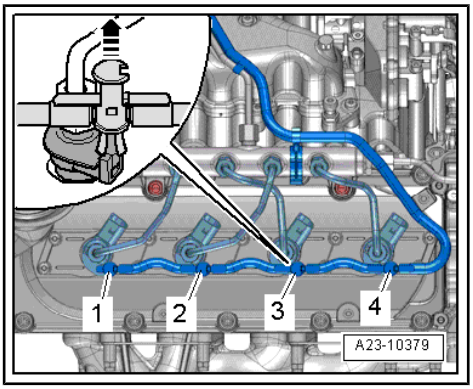


– Unplug electrical connectors for fuel pressure sender - G247- -1- at high-pressure reservoir and at injectors -2, 3, 4, 5-.

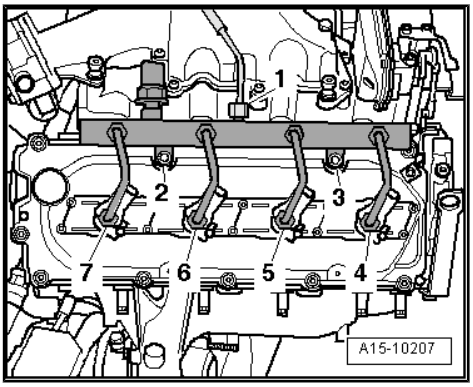
– Remove bolts -6- and -7-.



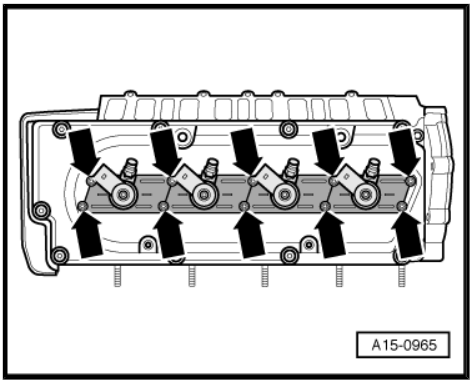
– Pull return line connections -1, 2, 3, 4- off injectors; to do so, press both tabs down and at the same time pull centre piece up to release connection -arrow-.



– Loosen union nuts for injector pipes -4, 5, 6, 7- using socket, 17 mm - T40055- .
– Loosen union nut for injector pipe -1- at high-pressure reservoir.
– Remove bolts -2- and -3- and detach high-pressure reservoir.



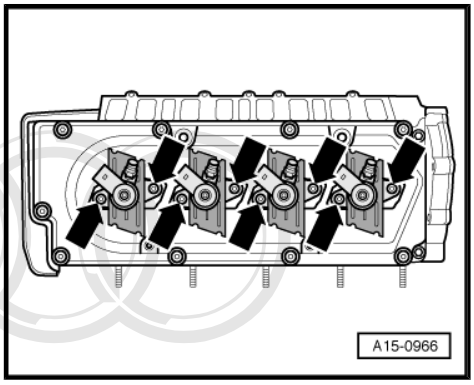
– Unbolt covers for injectors -arrows-.
– Pull cover plates upwards and turn through 90°.



– Unbolt clamping pieces for injectors -arrows-.

Caution

- *Mark cylinder numbers on injector units and injector pipes.*
- *Used injectors must always be re-installed on the same cylinder.*



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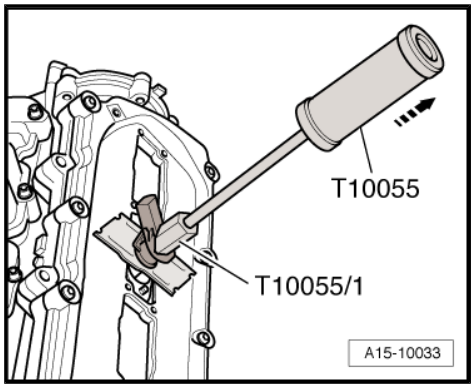
– Pull out injector units at front cylinders using puller - T10055- with adapter - T10055/1- .



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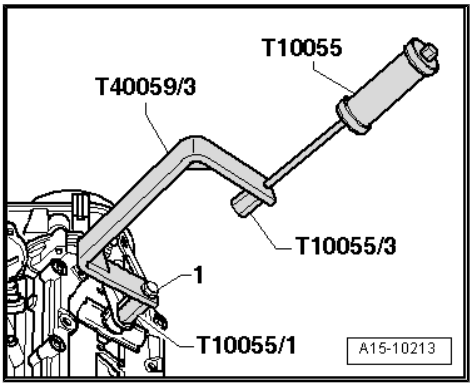
– Pull out in injectors at rear cylinders using frame - T40059/3- of puller - T40059- .
– Fit puller - T10055- and adapter - T10055/1- to frame - T40059/3- .
– Secure with hexagon bolt -1-.
– After removal, lay injectors on a clean cloth.



Installing used injectors

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

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

– Spray tip of injector nozzle with rust-solvent spray. Wait approx. 5 minutes and wipe off soot particles and oil with a cloth.
– If an injector is very dirty, the tip of the nozzle should also be cleaned with a soft brass wire brush to make it easier to remove the copper seal.

Note

Take care not to touch the bores in the nozzle with the bristles of the brass wire brush.

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

Note

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

Installing new injectors

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

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

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

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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- .***

– Install injectors.

Note

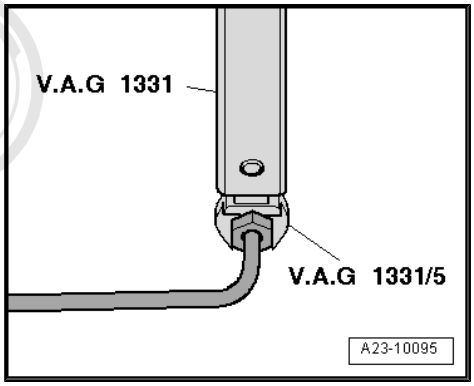
- *Note identification marks for cylinder allocation when re-installing high-pressure pipes.*
- *The high-pressure pipes can be re-used after performing the following checks:*
- *Check taper seats of high-pressure pipes for deformation and cracks.*
- *The bore of the pipe must not be distorted, restricted or otherwise damaged.*
- *Corroded pipes must not be used again.*

– Tighten union nuts on injector pipes finger-tight to start with.

– Ensure that injector pipes are not under tension.

• Tightening torques: exploded view - injectors and high-pressure pipes ⇒ page 43 .

– To tighten unions of injector pipes to high-pressure reservoir, use torque wrench - V.A.G 1331- with ratchet - V.A.G 1331/1- and socket (19 mm) - V.A.G 1331/5- .



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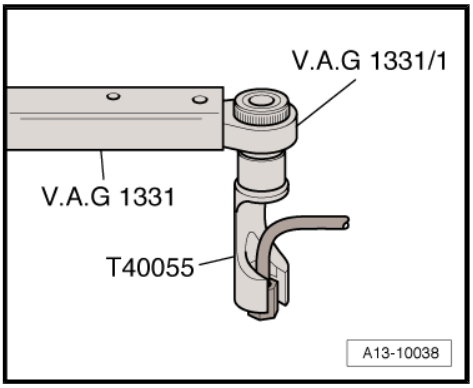
– To tighten unions of injector pipes at injectors, use torque wrench - V.A.G 1331- with ratchet - V.A.G 1331/1- and socket, 17 mm - T40055- .

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



After replacement of one or more injectors, the "injector delivery calibration values" and "injector voltage calibration values" for the new injectors must be written into the corresponding engine control unit ⇒ page 32 **.**

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

Bleeding fuel system and checking for leaks

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

Note

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

– Switch off ignition.

– Carefully check the entire fuel system including all 8 return line connections for leaks (the fuel return lines can only be renewed together with the pressure retention valve as one unit).

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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2.22 Exploded view - toothed belt for high-pressure pump

1 - Toothed belt cover

2 - Bolt

- ❑ 75 Nm
- ❑ Use counterhold tool - T10172- with - T10172/2- to loosen and tighten ⇒ page 52

3 - Toothed belt

- ❑ Before removing, mark direction of rotation with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage
- ❑ Check for wear
- ❑ Removing and installing ⇒ page 53

4 - Toothed belt sprocket

- ❑ Remove toothed belt sprocket using puller - T40064- ⇒ page 53 .

5 - Toothed belt cover (top)

6 - Bolts

- ❑ 9 Nm

7 - Toothed belt sprocket for high-pressure pump

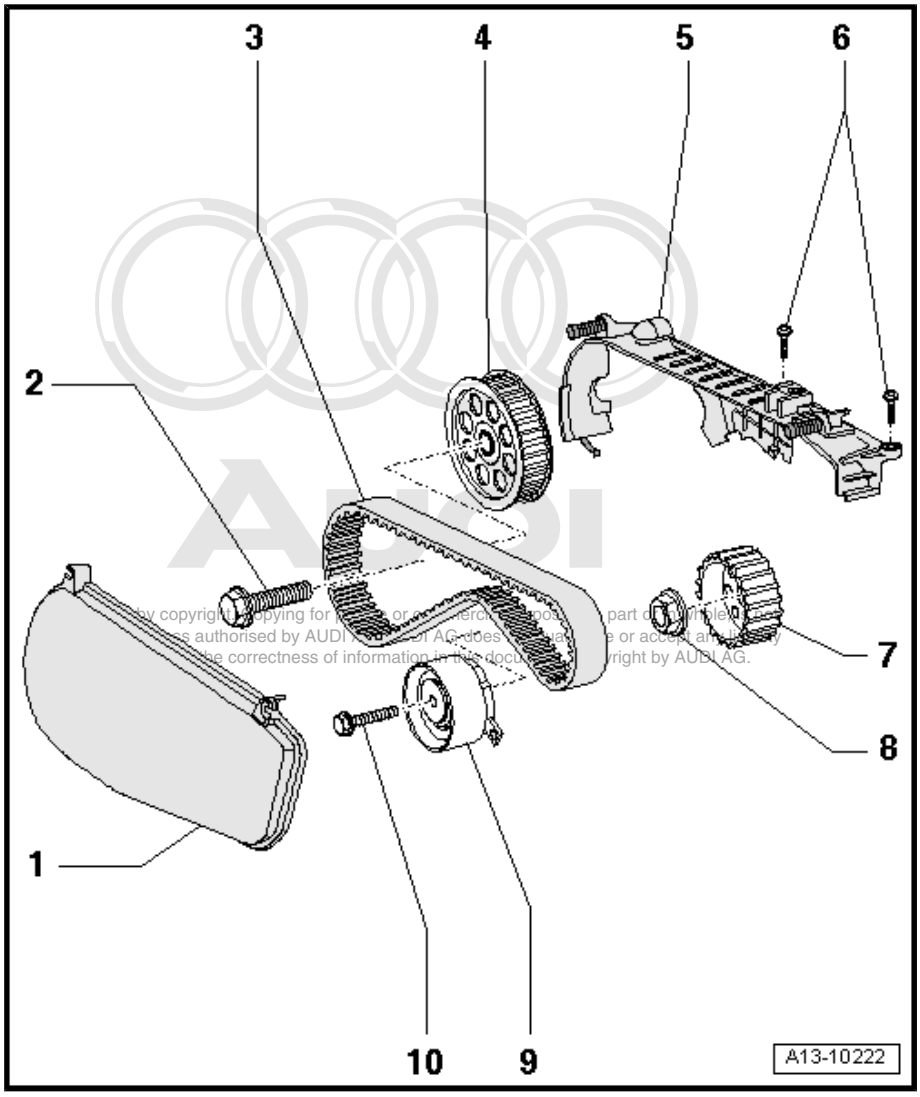
8 - Nut

- ❑ 70 Nm
- ❑ Use counterhold tool - T10172- with - T10172/1- to loosen and tighten ⇒ page 53

9 - Tensioning roller

10 - Bolt

- ❑ 22 Nm



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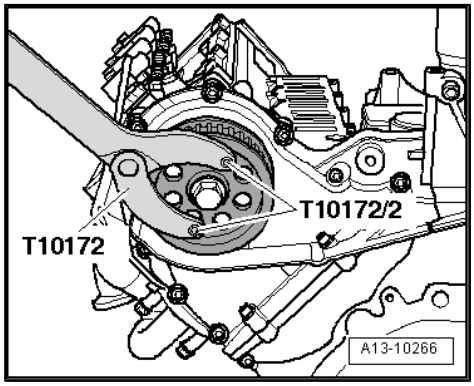
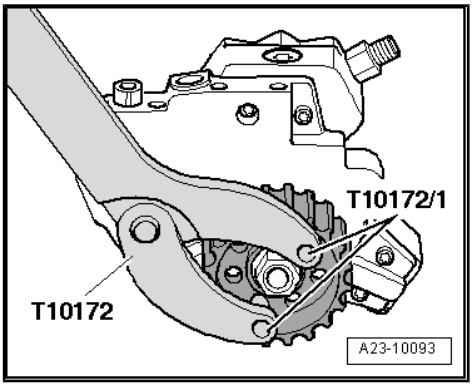
Loosening toothed belt sprocket

– Use counterhold tool - T10172- with -T10172/2- when loosening and tightening bolt.



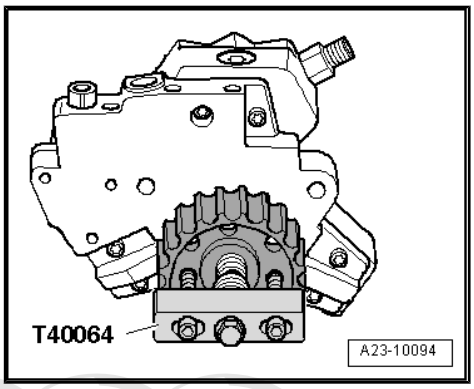
Loosening toothed belt sprocket for high-pressure pump

– Use counterhold tool - T10172- with -T10172/1- when loosening and tightening central nut.



Pulling off toothed belt sprocket for high-pressure pump

– Use puller - T40064- to pull off toothed belt sprocket.



2.23 Removing and installing toothed belt for high-pressure pump

Special tools and workshop equipment required

♦ Drill bit, ∅ 4.5 mm

Removing

Note

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

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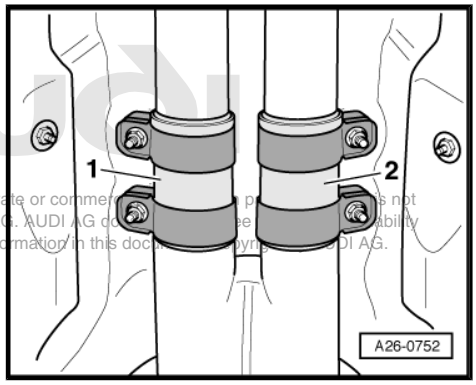
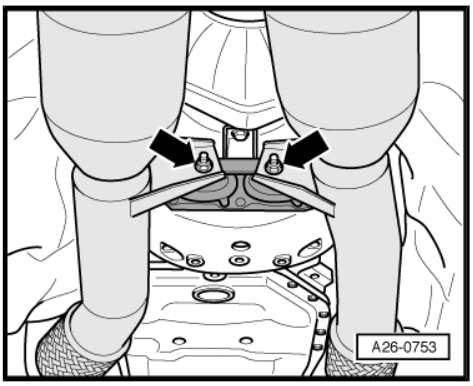
– Lower subframe for repair and assembly work ⇒ Rep. gr. 13 .

– Loosen clamps -1- and -2- and move to front.

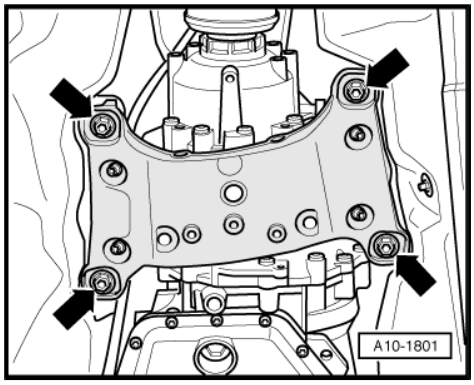


– Remove nuts on left and right -arrows- at centre bracket for exhaust pipes.

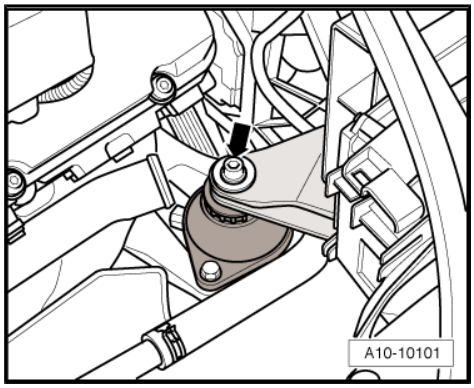
– Press studs in mounting forwards.



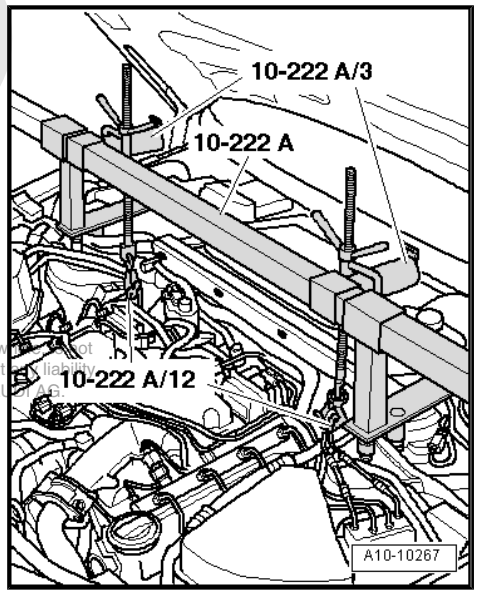
– Remove bolts -arrows- at tunnel cross member.



– Remove bolt -arrow- on mounting for torque reaction support.



– Lower engine/gearbox assembly via spindles of support bracket - 10 - 222 A- until air pipe (right-side) makes contact with radiator cowl.



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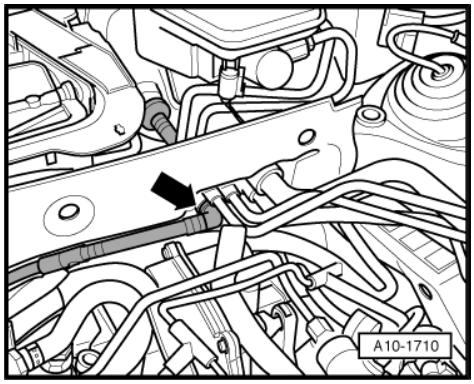
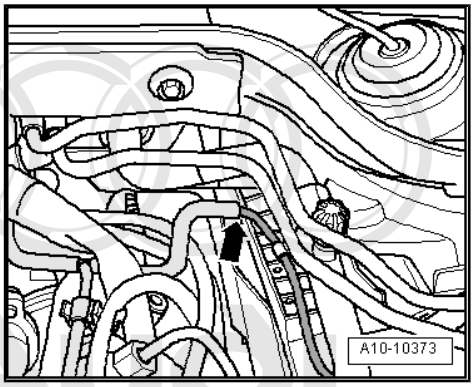
– Disconnect vacuum hose -arrow- leading to brake servo.



– Disconnect vacuum hose -arrow-.



– Unplug electrical connectors -1, 3, 5, 6-.
– Remove nut -2- and bolt -7- and detach bracket (right-side).
– Unscrew bolts -4- and remove bracket (left-side).

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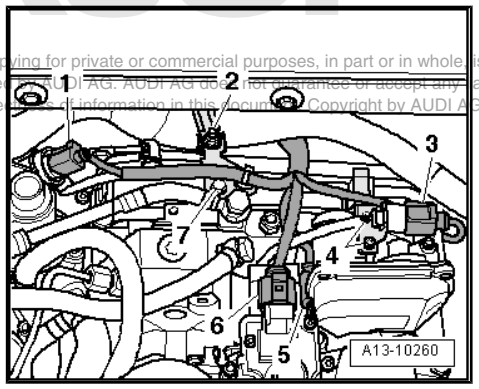
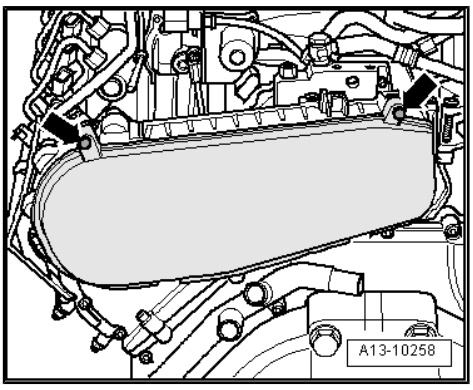


Note

The work sequence is illustrated from the rear end of the removed engine/gearbox assembly.

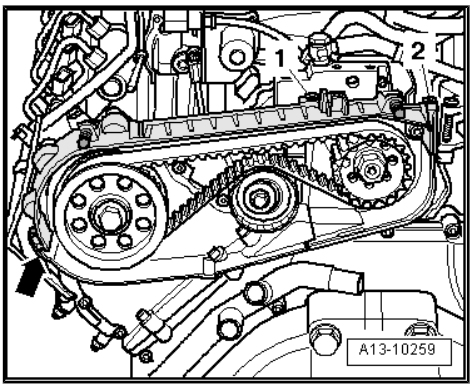
– Release retaining pegs -arrows- and detach toothed belt cover.
– Pivot toothed belt cover towards rear and disengage hooks on bottom side of toothed belt cover.



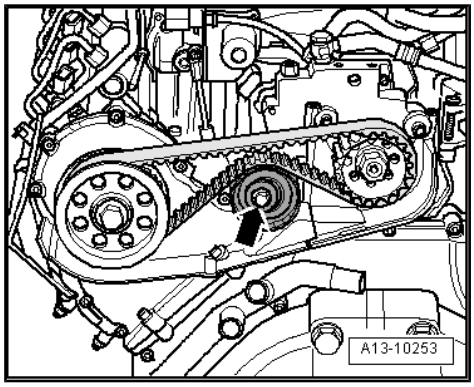
– Remove bolts -1- and -2-.
– Release clamp -arrow- and detach toothed belt cover (top section).

Note

The radio release tool - T10057- or another suitable tool can also be used to release the clamp.



– Unscrew bolt -arrow- for tensioning roller.
– Take off tensioning roller and toothed belt for high-pressure pump.



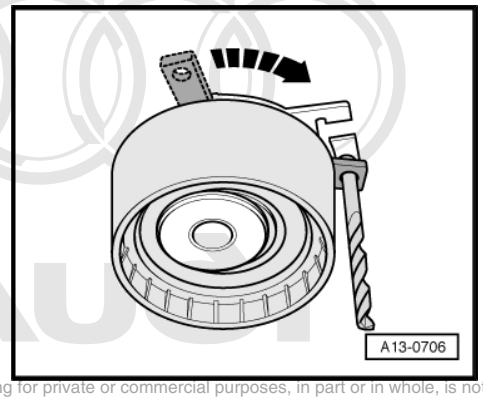
Installing

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

Note

Fit all cable ties in the original positions when installing.

– Fit toothed belt for high-pressure pump onto camshaft sprocket and high-pressure pump.
– Wrap insulating tape around tip and shaft of 4.5 mm ∅ drill bit to avoid cuts.
– Pre-tension tensioning roller by hand -arrow- and lock in place using 4.5 mm ∅ drill bit.



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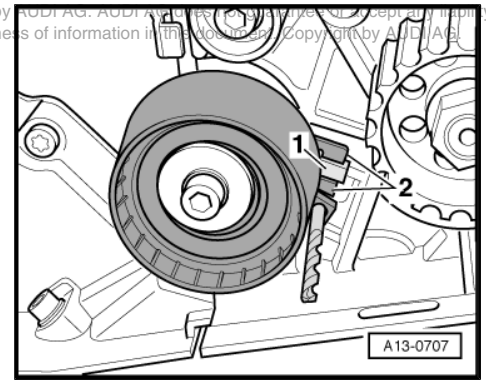
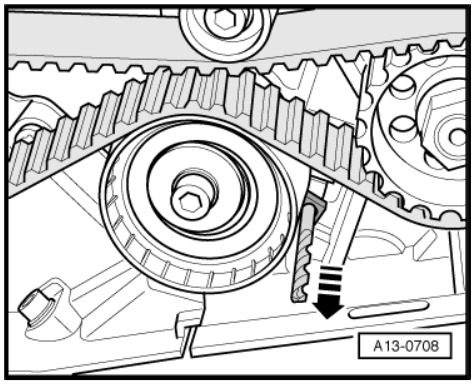
– Note correct installation position when securing tensioning roller.
• Retaining lugs -2- on tensioning roller must contact cast projection -1- on bracket for high-pressure pump, as illustrated.



– Pull drill bit out of locating holes -arrow-.
– Install subframe ⇒ Rep. gr. 40 .
– Tighten subframe bolts only to specified torque (do not turn further). Do not tighten bolts to final setting until after wheel alignment check has been performed ⇒ Rep. gr. 40 .

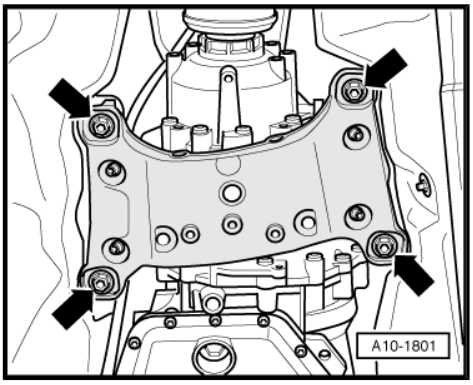
WARNING

The vehicle must not be driven at this stage.



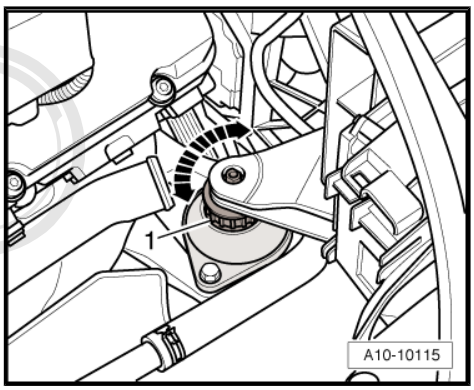
– Install anti-roll bar ⇒ Rep. gr. 40 .

– Tighten bolts -arrows- at tunnel cross member.
– Install particulate filter/catalytic converter ⇒ Rep. gr. 26 .
– Align exhaust system so it is free of stress ⇒ Rep. gr. 26 .

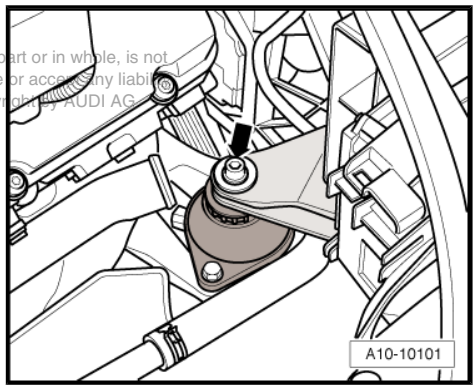


Adjust mounting for torque reaction support before tightening torque reaction support:

– To do this, turn adjuster ring -1- anti-clockwise until it comes into contact with torque reaction support.
– Then turn adjuster ring one turn clockwise.



– Tighten bolt -arrow- on mounting for torque reaction support.
– Perform wheel alignment check ⇒ Rep. gr. 44 .



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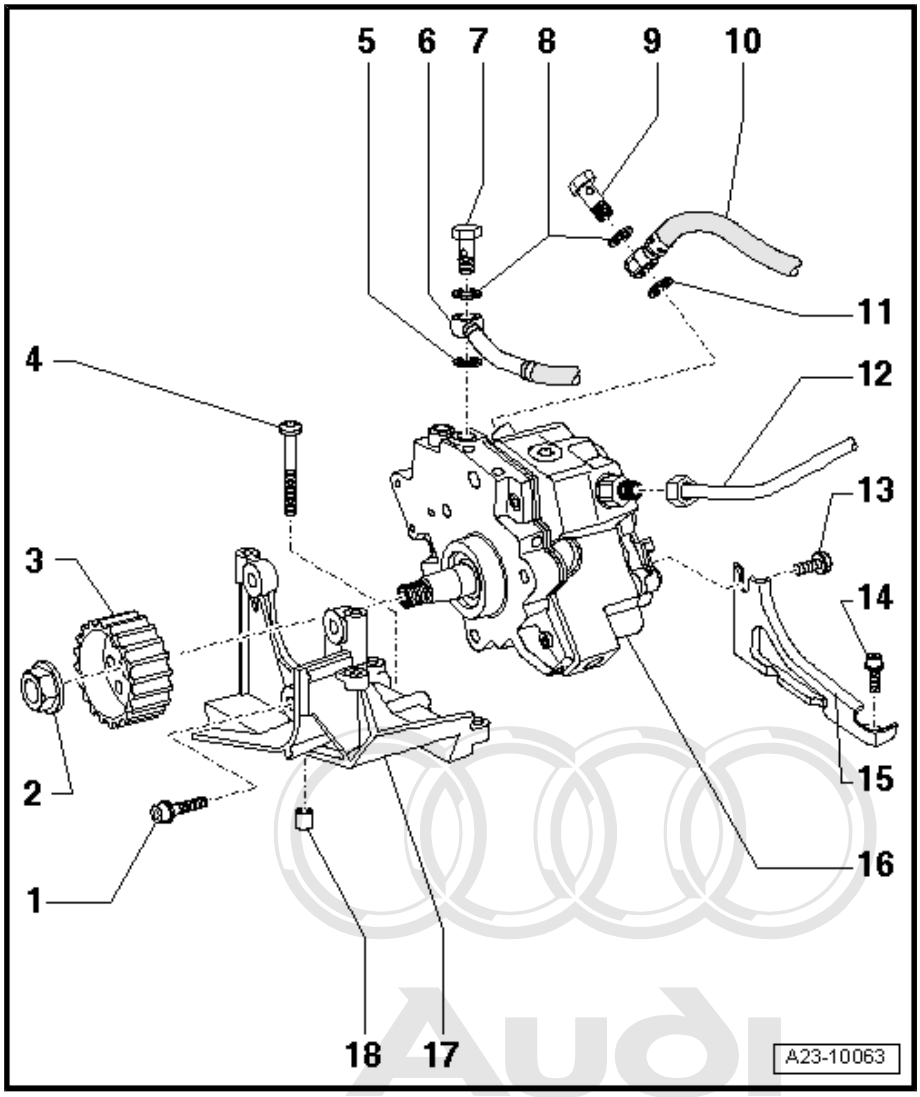
WARNING

Tighten bolts for subframe to final setting after performing wheel alignment check.

Tightening torques

Component	Nm
Tensioning roller to cover (left-side)	22
Toothed belt cover (top section) to bracket	9
Bracket to intake manifold (bottom section)	9
Tunnel cross member to body	40
Bracket for torque reaction support to mounting for torque reaction support	40

2.24 Exploded view - high-pressure pump



1 - Bolt
- ❑ 22 Nm

2 - Nut
- ❑ 70 Nm
- ❑ Use counterhold tool - T10172- with - T10172/1- to loosen and tighten ⇒ page 59
- ❑ 70 Nm

3 - Toothed belt sprocket for high-pressure pump
- ❑ Remove using puller - T40064- ⇒ page 59

4 - Bolt
- ❑ 22 Nm

5 - Seal
- ❑ Renew

6 - Fuel supply hose

7 - Banjo bolt
- ❑ 25 Nm

8 - Seals
- ❑ Renew

9 - Banjo bolt
- ❑ 25 Nm

10 - Fuel return hose

11 - Seal
- ❑ Renew

12 - High-pressure pipe
- ❑ 25 Nm

13 - Bolt
- ❑ 22 Nm

14 - Bolt
- ❑ 9 Nm

15 - Bracket for high-pressure pump

16 - High-pressure pump

Caution

Observe rules for cleanliness when working on the injection system ⇒ page 2 .

The high-pressure pump must first be filled with fuel before the engine is started. The high-pressure pump must not be allowed to run while still empty.

- ❑ Removing and installing ⇒ page 60
- ❑ Fuel system must be bled after installing high-pressure pump ⇒ page 63 .

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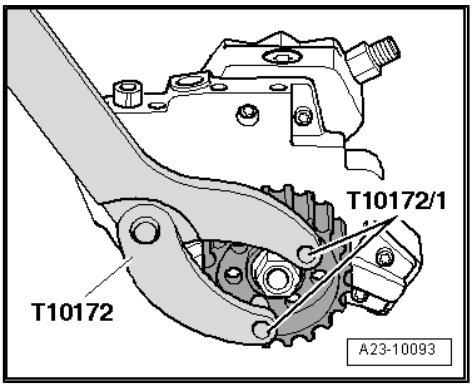
17 - Front bracket for high-pressure pump

18 - Dowel sleeve

- ❑ 2x

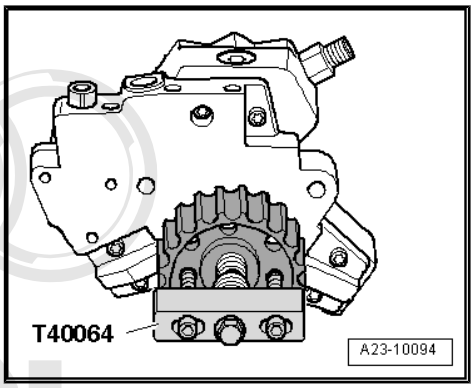
Loosening and tightening nut for toothed belt sprocket for high-pressure pump

– Use counterhold tool - T10172- with -T10172/1- when loosening and tightening nut.



Pulling off toothed belt sprocket for high-pressure pump

– Use puller - T40064- to pull off toothed belt sprocket.



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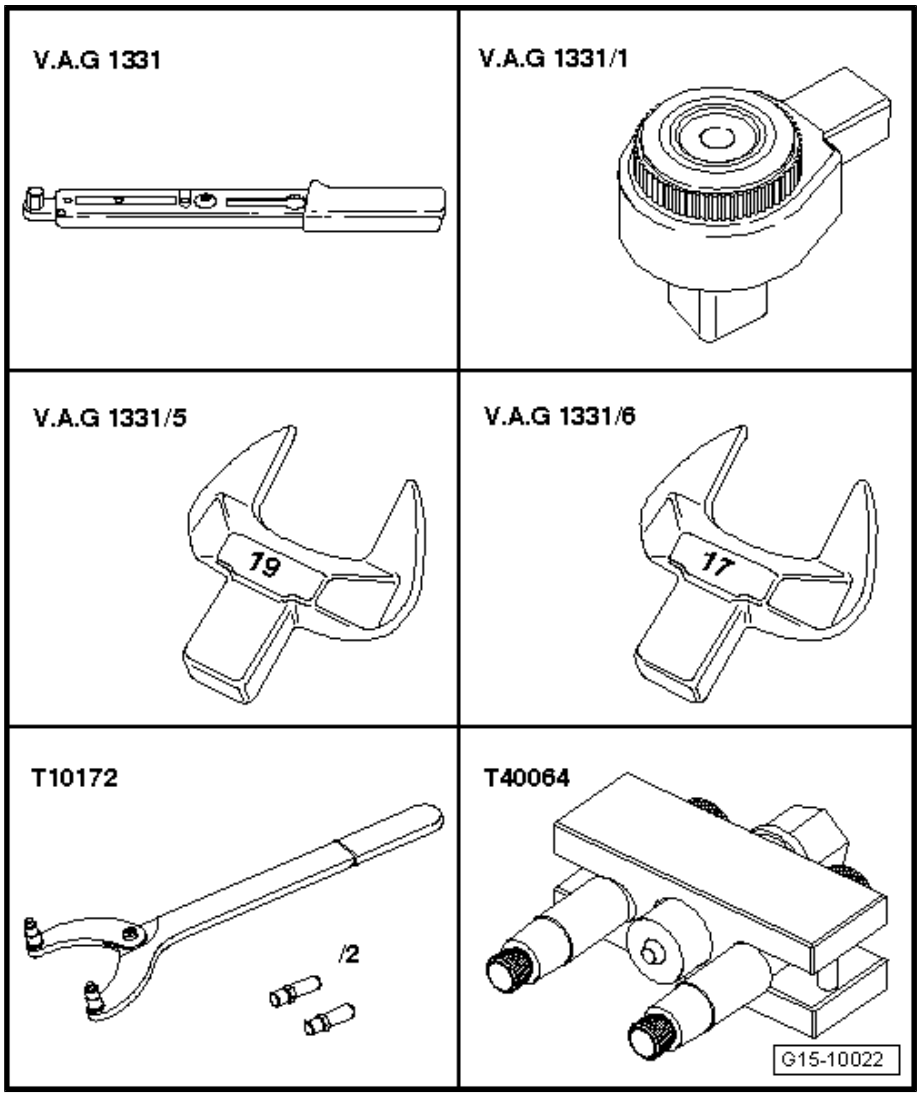
2.25 Removing and installing high-pressure pump

Special tools and workshop equipment required

- Torque wrench - V.A.G 1331-
- Ratchet - V.A.G 1331/1-
- Open end spanner insert, AF 19 - V.A.G 1331/5-
- Open end spanner insert, AF 17 - V.A.G 1331/6-
- Counterhold tool - T10172- with -T10172/1-
- Puller - T40064-



Removing

Caution

Observe rules for cleanliness when working on the injection system ⇒ page 2 .

– Remove toothed belt for high-pressure pump ⇒ page 53 .
– Drain off coolant ⇒ Rep. gr. 19 .
– Remove toothed belt for high-pressure pump ⇒ page 53 .

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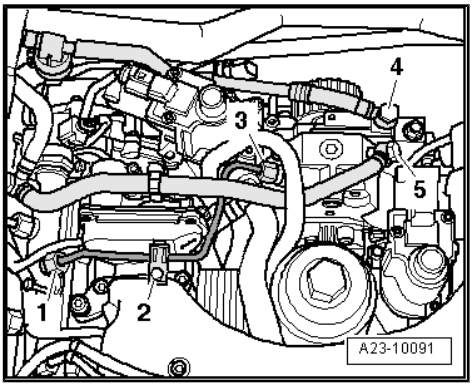
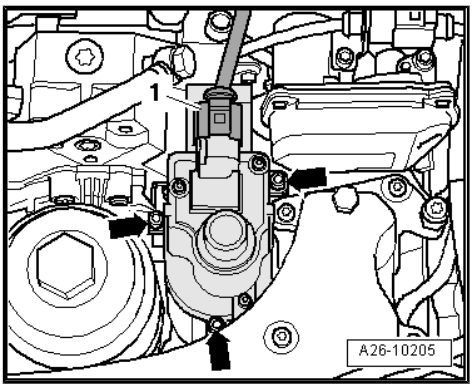
– Loosen union nuts -1- and -3-.
– Unscrew bolt -2- and detach high-pressure pipe.
– Remove banjo bolts -4- and -5- and move fuel lines clear to one side.



– Unplug electrical connector -1-.
– Remove bolts -arrows- and take off control motor 2 for exhaust gas recirculation - V339- .



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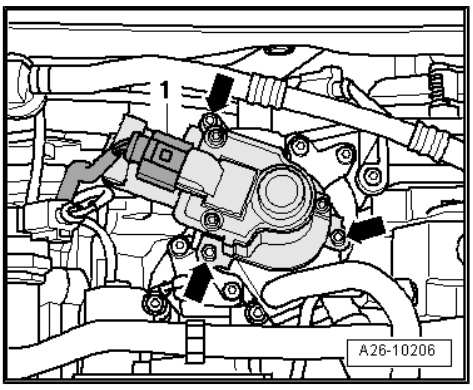
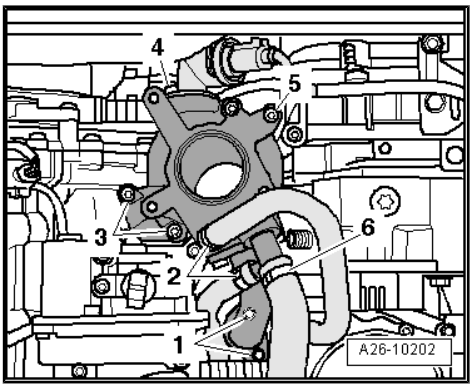
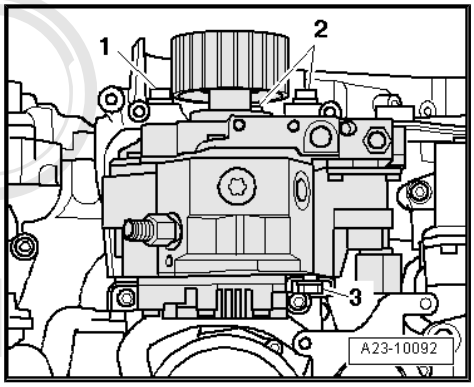
– Unplug electrical connector -1-.
– Remove bolts -arrows- and take off control motor for exhaust gas recirculation - V338- .



– Unscrew bolt -4- and remove coolant hose/pipe connection.
– Detach coolant hoses -2- and -6-.
– Remove bolts -1-, -3- and -5- and detach hose connection for exhaust gas recirculation (right-side).



– Unscrew bolts -1, 2, 3- and remove high-pressure pump.



Installing

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

Caution

The high-pressure pump must first be filled with fuel before the engine is started. The high-pressure pump must not be allowed to run while still empty.

Note

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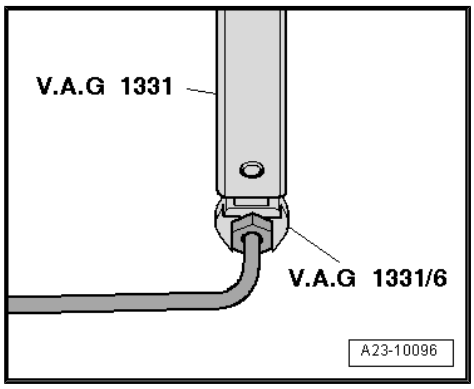
- *Renew gaskets and seals.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue. .*
- *Always renew high-pressure pipe when renewing high-pressure pump.*

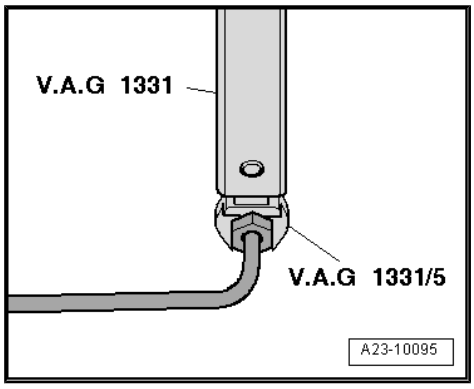
– Tighten union nuts on high-pressure pipes hand-tight initially.

– Ensure that high-pressure pipes are not under tension.

– To tighten union of high-pressure pipe at high-pressure pump, use torque wrench - V.A.G 1331- with ratchet - V.A.G 1331/1- and open end spanner insert AF 17 - V.A.G 1331/6- .



– To tighten unions of high-pressure pipes to high-pressure reservoir, use torque wrench - V.A.G 1331- with ratchet - V.A.G 1331/1- and open end spanner insert AF 19 - V.A.G 1331/5- .



- Tightening torques: exploded view - high-pressure pump ⇒ page 57 .

– Install control motors for exhaust gas recirculation ⇒ Rep. gr. 26 .

– Install toothed belt for high-pressure pump ⇒ page 53 .

– Fill cooling system ⇒ Rep. gr. 19 .

– Check fuel system for leaks ⇒ page 63 .

2.26 Bleeding fuel system after installing high-pressure pump

Caution

After installation, the high-pressure pump must first be filled with fuel before the engine is started (the pump must NOT be allowed to run while still empty).

Note

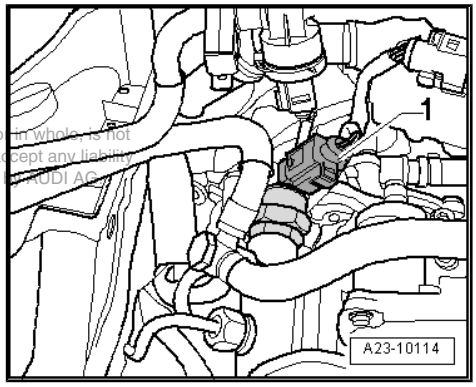
- *When installing the high-pressure fuel pump, it is essential to ensure that no dirt enters the fuel system.*
- *Only remove sealing plugs immediately prior to installation of fuel lines.*
- *There must be sufficient fuel in the tank.*

Bleeding fuel system

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

– Connect battery charger if necessary. ⇒ Rep. gr. 27

– Unplug electrical connector -1- from fuel pressure regulating valve - N276- so that engine does not start when starter motor is operated.



– Operate starter three times. (Wait approx. 20 seconds each time after operating starter to prevent it from overheating.)

– Re-attach electrical connector on fuel pressure regulating valve - N276- .

– Start engine.

– After bleeding fuel system, run engine at moderate speed for a few minutes and then switch off again.

– Check fuel system for leaks.

– Erase entry in event memory using a 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.

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2.27 Checking fuel pressure regulating valve - N276-

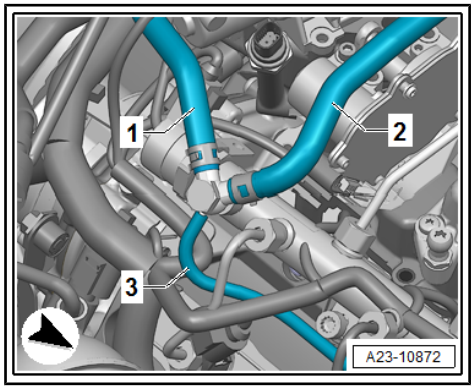
WARNING

Always read rules for cleanliness and instructions for working on fuel system ⇒ page 2 .

Follow these instructions before starting work and while working on the fuel system.

– Remove engine cover panel.

– Disconnect fuel return lines -1, 2 and 3- at banjo bolt.

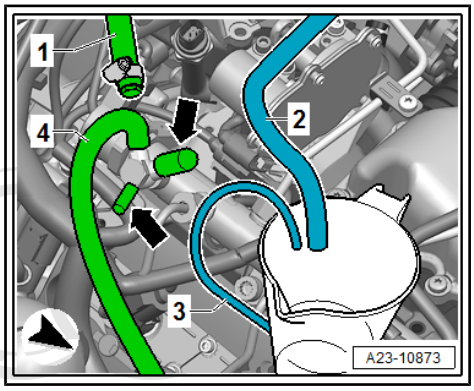


– Seal off open return line connection -1- with plug.

– Seal off open connections at banjo bolt with plugs -arrows-.

– Hold hoses -2 and 3- into a suitable container.

– Attach hose -4- to open connection at banjo bolt.



– Hold hose -4- into a suitable measuring container.

– Measure return flow rate of hose -4- as follows.

Note

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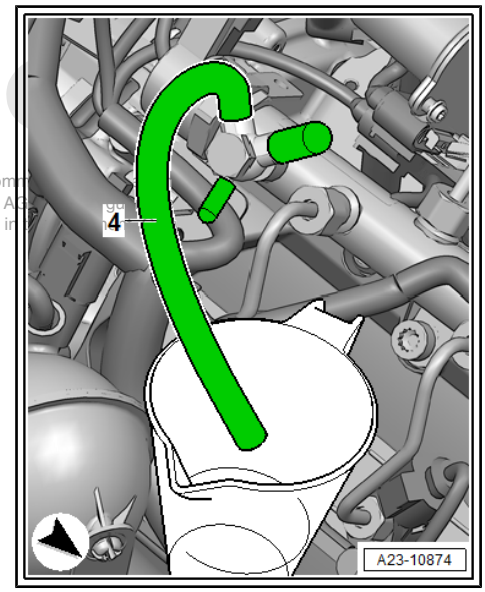
- *Return flow rate from hoses -2 and 3- can be disregarded for this test.*
- *Fuel temperature above 10 °C.*

– Start the engine and run at idling speed.

- Return flow rate (engine start): 0 ml
- Return flow rate after 2 minutes: 0 ... 60 ml

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

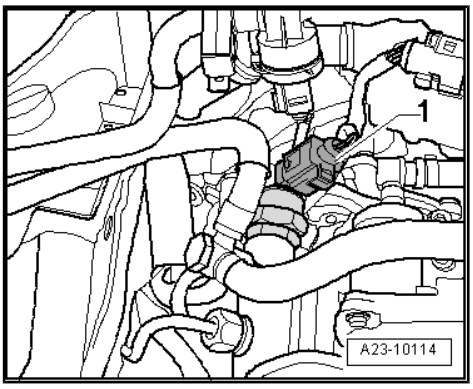
– Renew fuel pressure regulating valve - N276- ⇒ page 65 .



2.28 Removing and installing fuel pressure regulating valve - N276-

Special tools and workshop equipment required

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



The fuel pressure regulating valve - N276- is located in the right-side high-pressure reservoir (cylinder bank 1). It maintains a constant pressure in the high-pressure reservoir and the injector pipes (high-pressure fuel circuit).

The fuel pressure regulating valve - N276- maintains a constant pressure in the fuel rail and the injector pipes (high-pressure fuel circuit).

It is not possible to start engine if fuel pressure regulating valve - N276- is defective.

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

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

The fuel pressure regulating valve - N276- has a deformable sealing lip and can only be used once. Do not install it for test purposes.

Removing

Caution

Always read rules for cleanliness and instructions for working on fuel system ⇒ page 2 .

Follow these instructions before starting work and while working on the fuel system.

– Remove engine cover panel ⇒ page 18 .
– Clean thread and area all around fuel pressure regulating valve with engine cleaner or brake cleaner and dry.

Note

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

– Dry off fuel pressure regulating valve - N276-.
– Remove banjo bolt for fuel return lines (make sure that all parts are clean).

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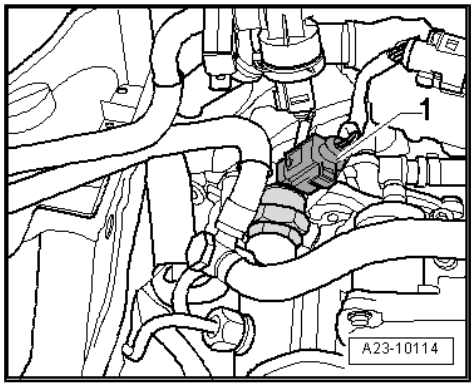
– Detach electrical connector -1- on fuel pressure regulating valve - N276- .

– Slacken union nut (counterhold at hexagon flats on housing). Then unscrew and remove by hand.

– Extract dirt from opening in rail (threads and sealing surface). Do not use metal tools, etc.



Note

Seal off opening in fuel rail 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 opening in fuel rail.*
- *The beginning of the thread, the deformable sealing lip and the O-ring of the fuel pressure regulating valve - N276- must be coated with diesel fuel.*

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– Screw on union nut by hand.

– Align fuel pressure regulating valve - N276- so that connecting wire is free of tension after electrical connector is attached.

– Hold regulating valve in this position by holding hexagon flats on housing of regulating valve with pliers (water pump pliers or similar).

– Use suitable torque wrench with an open-end spanner insert (30 mm) to tighten union nut.

Tighten union nut in 2 stages.

Stage 1: 60 +/-5 Nm (counterhold hexagon flats on housing)

Then back off union nut $^{1}/_{4}$ turn (90°); counterhold hexagonal flats on housing.

Stage 2: 95 + 5 Nm (counterhold hexagon flats on housing)

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

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

– Check fuel system for leaks.

Bleeding fuel system and checking for leaks

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

Note

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

– 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

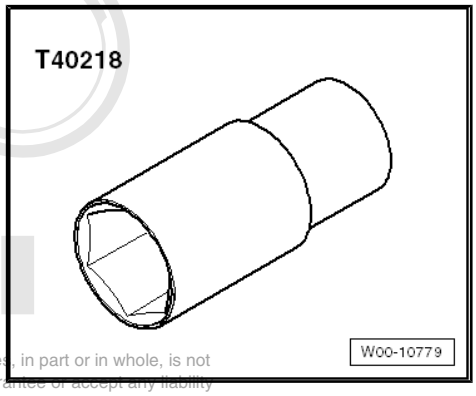
If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the event memory. Then continue the road test.

– After road test, interrogate event memory again.

2.29 Removing and installing fuel pressure sender - G247-

Special tools and workshop equipment required

♦ Socket, 27 mm - T40218-



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♦ Torque wrench

Note

♦ *The fuel pressure sender - G247- continuously measures the fuel pressure in the high-pressure system. It transmits a corresponding voltage signal to the engine control unit - J623- .*

♦ *Should the fuel pressure sender fail, the engine control unit will control the fuel pressure via a mapped open-loop backup function. Maximum engine speed in this mode is restricted.*

♦ *The fuel pressure sender - G247- has a deformable sealing lip.*

Removing

Caution

Always read rules for cleanliness and instructions for working on fuel system ⇒ page 2 .

Follow these instructions before starting work and while working on the fuel system.

– Remove engine cover panel ⇒ page 18 .

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

Note

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

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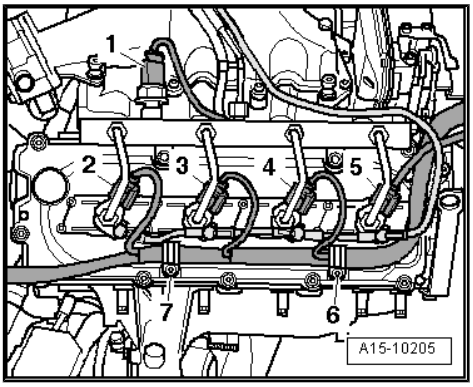
– Dry off fuel pressure sender - G247-.



– Unplug electrical connector -1- at fuel pressure sender - G247- .
– Unscrew fuel pressure sender - G247- .
– Extract dirt from opening in rail (threads and sealing surface) if necessary. Do not use metal tools, etc.

Note

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

– Remove dirt from opening in fuel rail using a vacuum cleaner. Do not use metal tools, etc.

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

Installing

Note

- *If the deformable sealing lip and the thread of the fuel pressure sender - G247- are not damaged, the sender can be re-used once.*
- *Check that the deformable sealing lip and the thread on the new fuel pressure sender - G247- are not damaged.*
- *Check sealing surface at opening in fuel rail.*
- *The beginning of the thread and the deformable sealing lip of the fuel pressure sender - G247- must be coated with diesel fuel.*

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– Screw in fuel pressure sender - G247- by hand.
– Then tighten fuel pressure sender - G247- to specified torque.
• Tightening torque: exploded view - fuel system ⇒ page 15

Bleeding fuel system and checking for leaks

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

Note

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

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

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

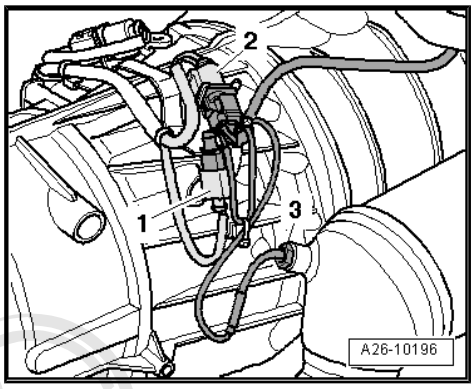
– After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.

Note

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

– After road test, interrogate event memory again.

2.30 Removing and installing Lambda probe - G39-



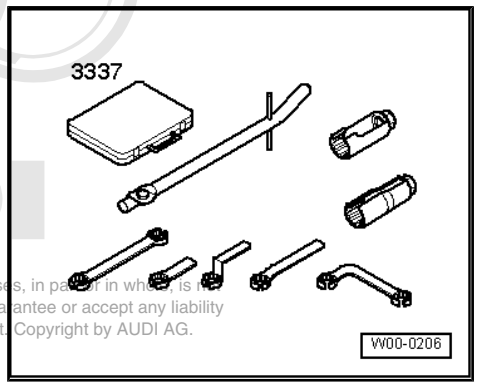
Electrical connector

2 - Electrical connector for Lambda probe - G39-

Removing

Special tools and workshop equipment required

♦ Lambda probe open ring spanner set - 3337-



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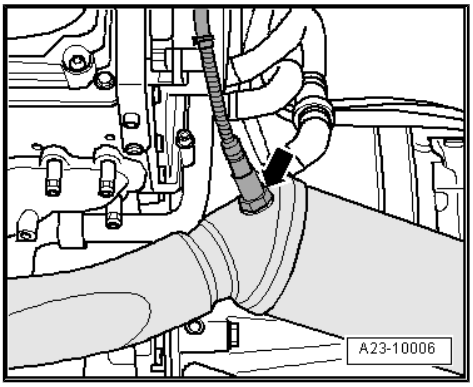
– Remove starter catalytic converter (right-side) ⇒ Rep. gr. 26 .

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



Installing

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

Note

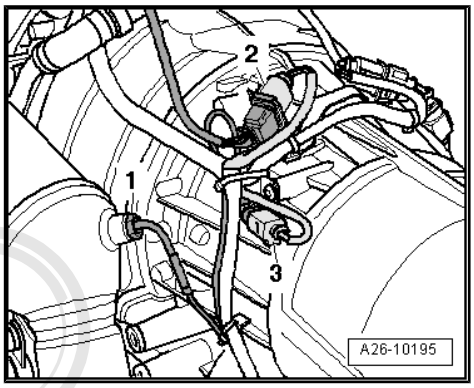
- *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*
- *In the case of a used Lambda probe grease only the thread with high-temperature paste. The paste must not get into the slots on the Lambda probe body. For high-temperature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

Tightening torque	Nm
Lambda probe - G39-	55

– Install starter catalytic converter (right-side) ⇒ Rep. gr. 26 .

– Align exhaust system so it is free of stress ⇒ Rep. gr. 26 .

2.31 Removing and installing Lambda probe 2 - G108-



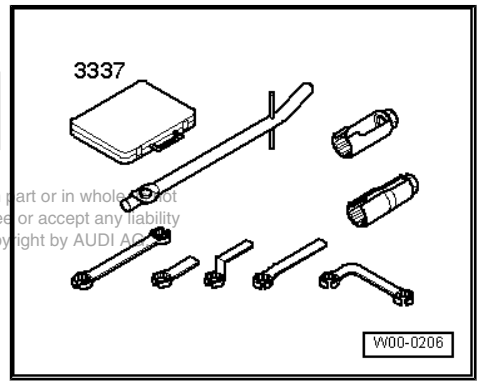
Electrical connector

2 - Electrical connector for Lambda probe 2 - G108-

Removing

Special tools and workshop equipment required

- Lambda probe open ring spanner set - 3337-



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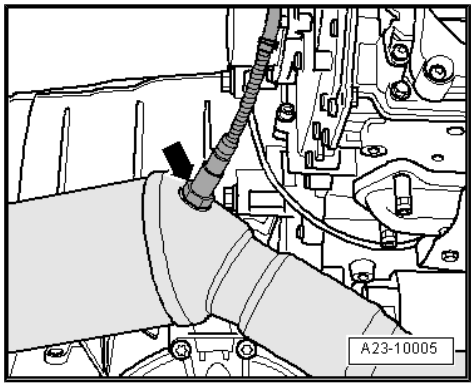
– Remove starter catalytic converter (left-side) ⇒ Rep. gr. 26 .

– Unscrew Lambda probe 2 - G108- -1- using tool from Lambda probe open ring spanner set - 3337- .



Installing

– When installing, note the following:

Note

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

Tightening torque	Nm
Lambda probe 2 - G108-	55

– Install starter catalytic converter (left-side) ⇒ Rep. gr. 26 .

– Align exhaust system so it is free of stress ⇒ Rep. gr. 26 .

2.32 Removing and installing pressure differential sender - G505- or pressure differential sender 2 - G524-

Pressure differential sender - G505- and pressure differential sender 2 - G524- are only installed on vehicles with particulate filter.

Pressure differential sender - G505- and pressure differential sender 2 - G524- are each connected via two pipes to the take-off points upstream and downstream of the particulate filter.

The pressure differential sender - G505- -item 2- and pressure differential sender 2 - G524- -item 4- determine the condition of the two particulate filters.

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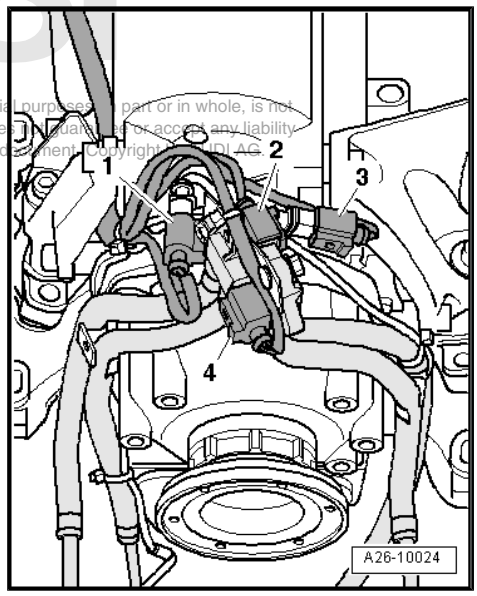
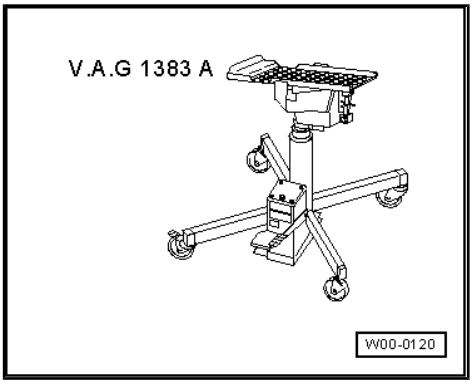


Special tools and workshop equipment required

♦ Engine and gearbox jack - V.A.G 1383 A-

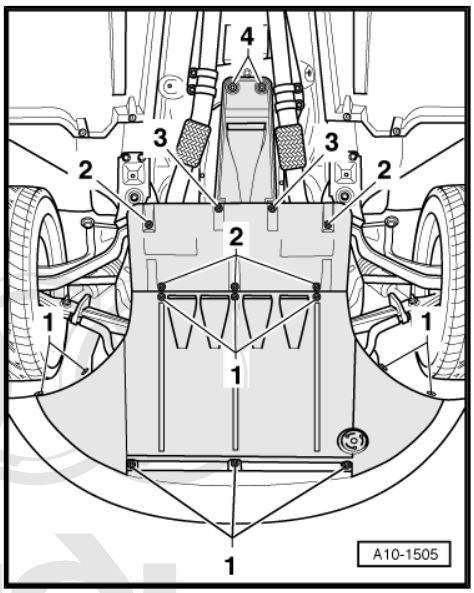


Removing

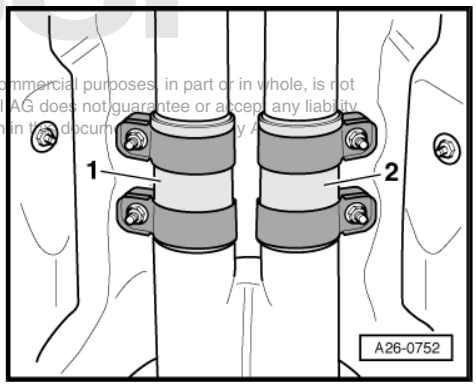
– Release fasteners -2- and -4- and remove rear noise insulation.

Note

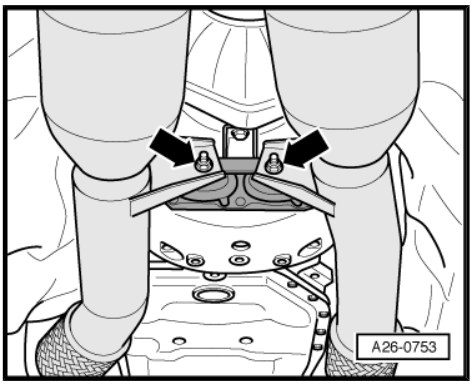
All cable ties which are released or cut open when removing must be fitted in the same position when installing.



– Loosen clamps -1- and -2- and move to front.



– Unscrew nuts -arrows- on brackets for exhaust pipes (left and right).
– Press studs in mounting forwards.



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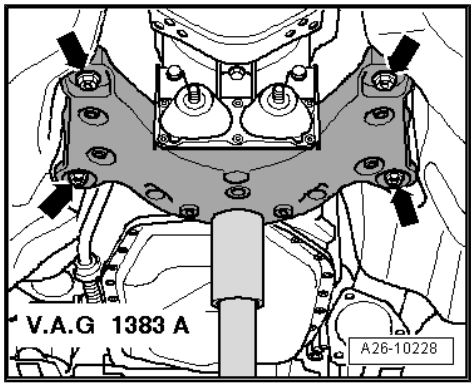
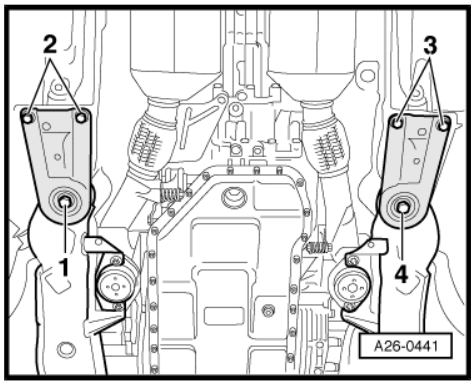
– Support tunnel cross member using engine and gearbox jack - V.A.G 1383 A- .
– Remove bolts -arrows- at tunnel cross member.



– First remove bolts -2- and -3- and then subframe bolts -1- and -4-.
– Lower gearbox and subframe slowly using engine and gearbox jack - V.A.G 1383 A- .



Note

Propshaft must be kept straight.

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– Unplug corresponding electrical connector.

2 - Pressure differential sender - G505-

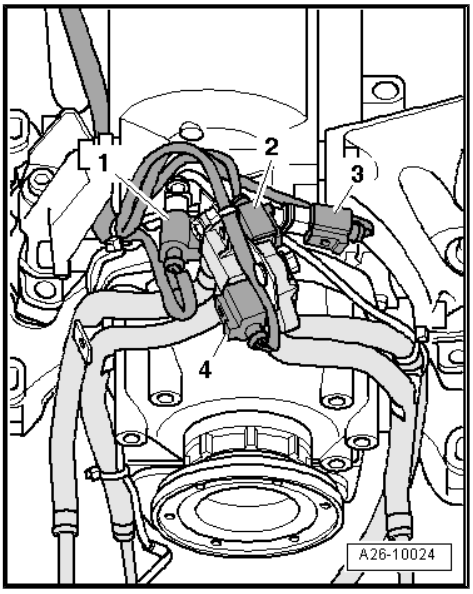
4 - Pressure differential sender 2 - G524-

– Unscrew both bolts from corresponding pressure sender.

– Mark hoses at pressure sensor for re-installation.

– Release hose clips and spray both hoses with silicone-free lubricant.

– Carefully disconnect the hoses from their connections (take care to keep the hoses straight: the connections on pressure sensor can break off easily).



Installing

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

– Blow through hoses (towards particulate filter) with compressed air to remove dirt or ice (frozen condensation).

– Connect hoses to corresponding pressure sensor according to markings made earlier. Check for secure seating.

– Re-fit corresponding pressure sensor on bracket.

• Tightening torque: 4 Nm

– Align exhaust system so it is free of stress ⇒ Rep. gr. 26 .

– Install subframe ⇒ Rep. gr. 40 .

Note

Tighten subframe bolts only to specified torque (do not turn further) ⇒ Rep. gr. 40 .

Adaption must be performed after renewing pressure differential sender - G505- or pressure differential sender 2 - G524- and/or particulate filter. (The procedure is described in Guided Functions)

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3 Engine control units

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

Special tools and workshop equipment required

- Adapter cable - V.A.G 1598/39-1-
- Adapter cable - V.A.G 1598/39-2-
- Test box - V.A.G 1598/42-

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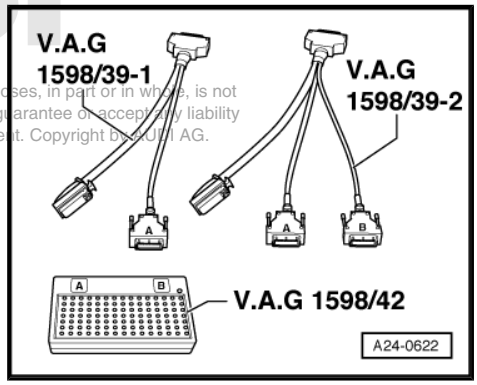

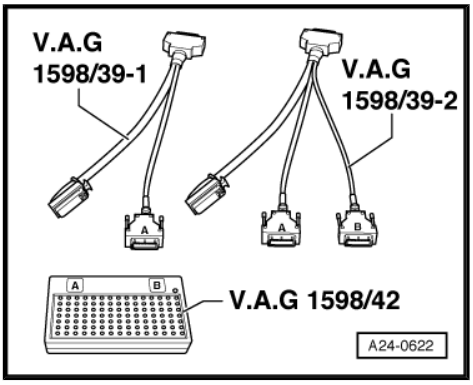

Note

- *The test box has 105 sockets. The connecting cable can be disconnected from the test box. This means that only the cable (and not the test box) has to be purchased for future engine control units with different types of connectors.*
- *The smaller of the two connectors on the engine control unit has the contacts 1 to 60. The larger of the two connectors has the contacts 1 to 94.*
- *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).*
- *The relevant test procedure will state whether it is necessary to also connect the engine control unit to the test box.*

Caution

To prevent irreparable damage to the electronic components, select appropriate measuring range before connecting the measuring cables and observe the test requirements.

– Switch off ignition.

– Remove cover from plenum chamber (right-side).

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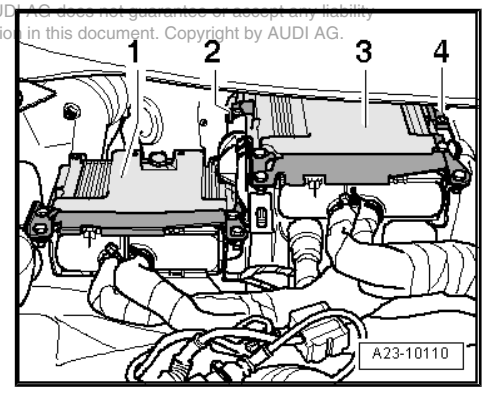
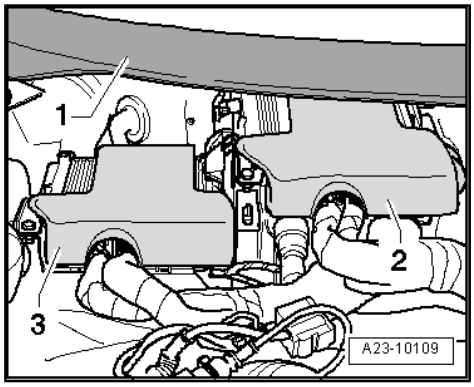


Note

- *The two engine control units are identical from the outside. However, if both control units are removed, they must be marked before removal so they are not interchanged on re-installation.*
- *Master engine control unit 1: mark "M" (for example)*
- *Slave engine control unit 2: mark "S" (for example)*
- *Item -3- is engine control unit - J623- (master).*
- *Item -1- is engine control unit 2 - J624- (slave).*

– Carefully pull cowl panel trim -1- off retainer at windscreen (only pull off as far as necessary).

– Detach cover -2 or 3- above corresponding engine control unit.



To help prevent unauthorised access to the connectors on the engine control units, the control units are secured by means of shear bolts to a locking plate and a metal casing.

- Removing and installing engine control unit - J623- ⇒ page 78
- Removing and installing engine control unit 2 - J624- ⇒ page 81

– 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 appropriate repair procedures.

Installing engine control unit

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Installation is performed in the reverse sequence.

– After installation, the locking plate must be re-fitted on the control unit.

– 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.

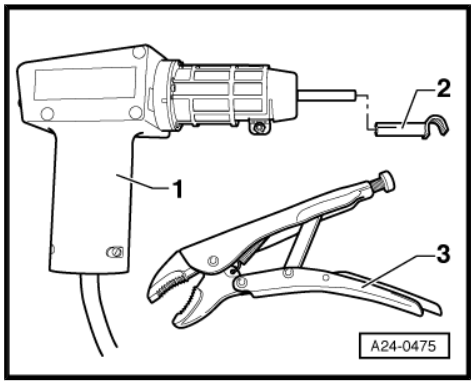
Note

After completion of the Guided Fault Finding routine, the tester will attempt to erase the event memories of all control units. If this is not successful, the remaining events saved in the memories must be dealt with so that all event memory entries can be erased.

3.2 Renewing engine control unit - J623- (master control unit)

Special tools and workshop equipment required

- Hot air blower - VAS 1978/14A- -item 1- with nozzle attachment -2- from wiring harness repair set - VAS 1978 B-
- Small, commercially available mole grips -3-

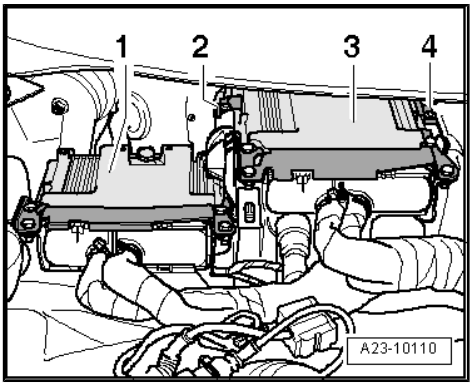


- Vehicle diagnostic tester

Electronic engine control for the V8 (common rail) is handled by two engine control units.

The two engine control units communicate via a separate CAN bus.

Engine control unit - J623- (master control unit) informs engine control unit 2 - J624- (slave control unit) which functions it has to perform.



Note

- *The two engine control units are identical from the outside. However, if both control units are removed, they must be marked before removal so they are not interchanged on re-installation.*
- *Master engine control unit 1: mark "M" (for example)*
- *Slave engine control unit 2: mark "S" (for example)*
- *Item -3- is engine control unit - J623- (master).*
- *Item -1- is engine control unit 2 - J624- (slave).*

Removing

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

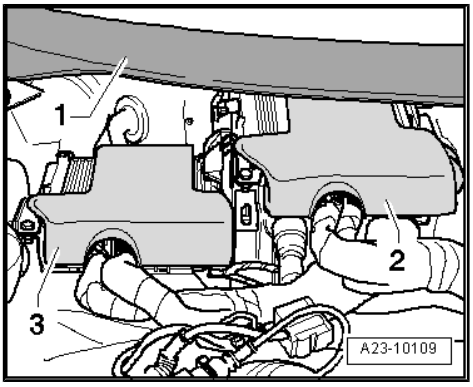
The adaption values for the injectors in the old (defective) engine control unit can be read out via the Guided Fault Finding or Guided Functions mode and can be stored as an electronic file in the ⇒ Vehicle diagnostic tester.

Note

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

– Switch off ignition and remove ignition key after storing electronic file containing adaption values.
– Remove cover from plenum chamber (right-side).
– Carefully pull cowl panel trim -1- off retainer at windscreen (only pull off as far as necessary).

– Detach cover -2- above engine control unit - J623- .



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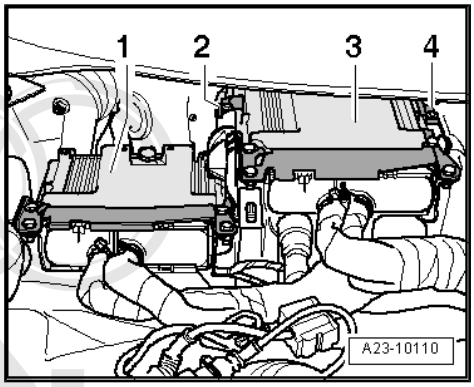
– Remove engine control unit - J623- (unscrew bolts -2 and 4-).



To help prevent unauthorised access to the connectors on the engine control unit, the control unit is secured by means of shear bolts to a locking plate and a protective casing.

Take out engine control unit - J623- as far as possible.

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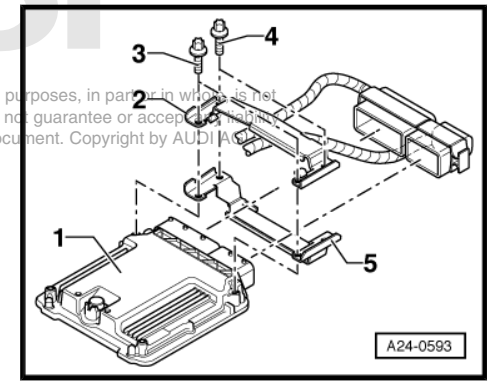
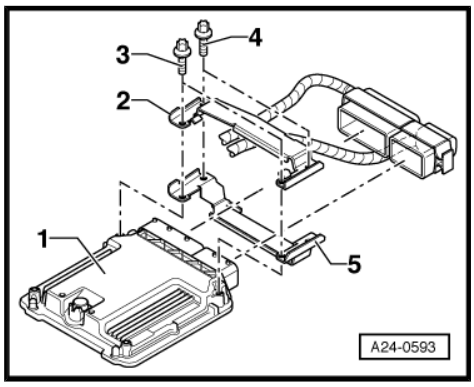
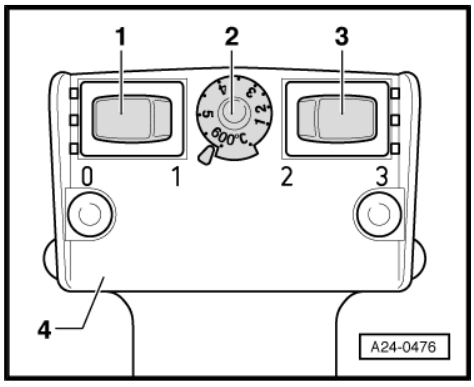


The threads of the two shear bolts -4- which are not screwed into the engine control unit are secured with locking fluid. To unscrew these two bolts, the threads must therefore be heated with the hot air blower.

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.



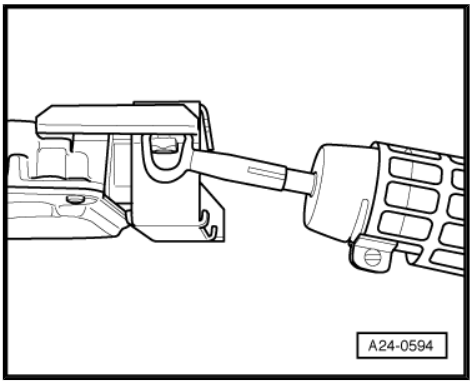
Select settings on hot air blower as shown in illustration, i.e. set temperature potentiometer -2- to maximum heat output and two-stage air flow switch -3- to position 3.

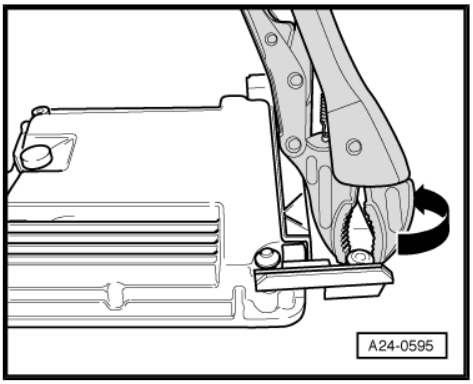


WARNING

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.

Apply heat to the threads of the shear bolts on the connector side as shown in the illustration for approx. 25 to 30 seconds.





– Unscrew shear bolts using mole grips (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.
– Detach protective housing from connectors.
– Unscrew two bolts securing retainers for engine control unit - J623- .
– Release connectors on engine control unit - J623- and unplug connectors.
– Take out old engine control unit - J623- and connect new engine control unit - J623- .

Installing

Installation is performed in the reverse sequence.

– After installation, the locking plate must be re-fitted on the engine control unit - J623- .
– 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.
– Re-attach cover for engine control unit - J623- (protection from moisture).
– Carefully clip cowl panel trim into retainer at windscreen.

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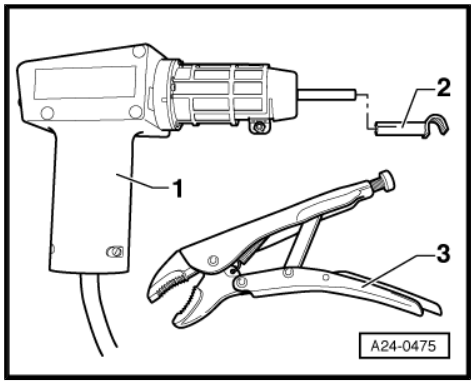
The procedure required after connecting the new engine control unit is described in the Guided Fault Finding or Guided Functions. Use ⇒ Vehicle diagnostic tester.

3.3 Renewing engine control unit 2 - J624- (slave control unit)

Special tools and workshop equipment required

♦ Hot air blower - VAS 1978/14A- -item 1- with nozzle attachment -2- from wiring harness repair set - VAS 1978 B-

♦ Small, commercially available mole grips -3-



♦ Vehicle diagnostic tester

Electronic engine control for the V8 (common rail) is handled by two engine control units.

The two engine control units communicate via a separate CAN bus.

Engine control unit - J623- (master control unit) informs engine control unit 2 - J624- (slave control unit) which functions it has to perform.

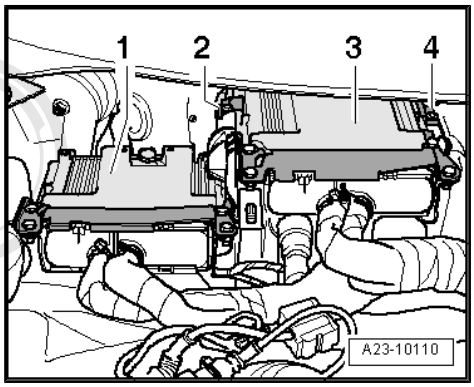
The two engine control units are identical from the outside. However, if both control units are removed, they must be marked before removal so they are not interchanged on re-installation.

Master engine control unit 1: mark “M” (for example)

Slave engine control unit 2: mark “S” (for example)

Item -3- is engine control unit - J623- (master).

Item -1- is engine control unit 2 - J624- (slave).



Removing

– The adaption values of the injectors must be stored before removing the engine control unit - J623- .

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

Note

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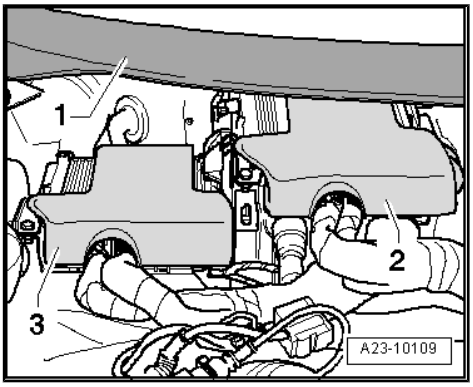
If the adaption values of the injectors cannot be read out of the old (defective) engine control unit, the adaption values must be entered into the new engine control unit manually and the adaption procedure must be performed accordingly.

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

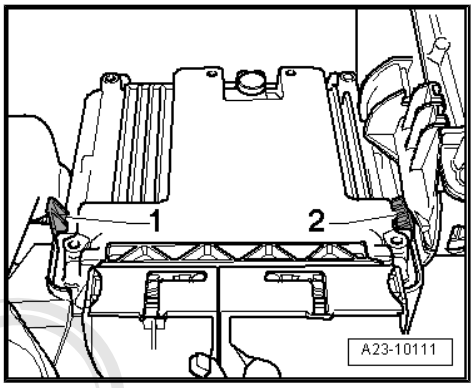
– Remove cover from plenum chamber (right-side).

– Carefully pull cowl panel trim -1- off retainer at windscreen (only pull off as far as necessary).

– Detach cover -3- above engine control unit 2 - J624- .



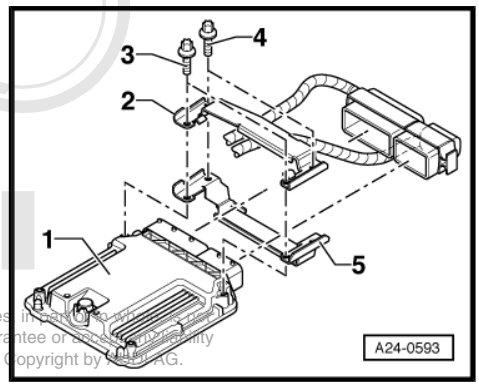
– Remove engine control unit 2 - J624- . Release retaining clip -1- and detach engine control unit 2 - J624- from guide -2-.



To help prevent unauthorised access to the connectors on the engine control unit, the control unit is secured by means of shear bolts to a locking plate and a protective casing.

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.



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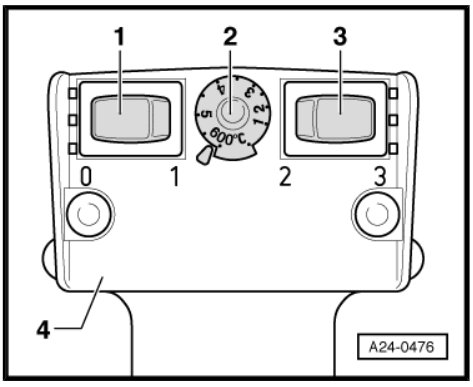
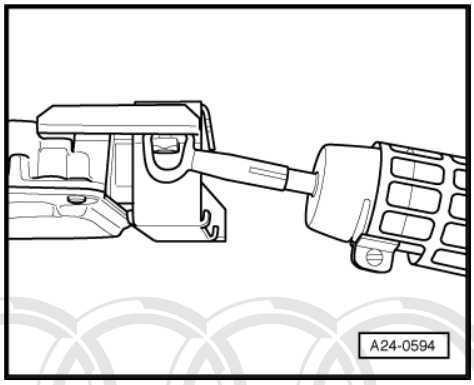
Select settings on hot air blower as shown in illustration, i.e. set temperature potentiometer -2- to maximum heat output and two-stage air flow switch -3- to position 3.

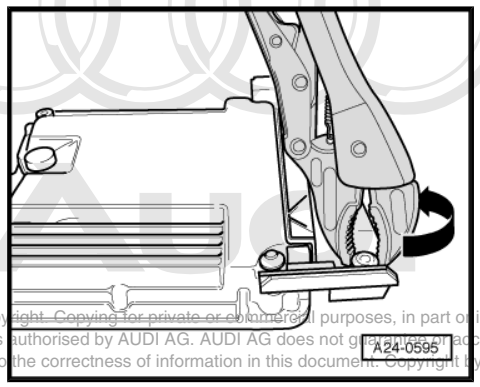


WARNING

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.

Apply heat to the threads of the shear bolts on the connector side as shown in the illustration for approx. 25 to 30 seconds.





- Unscrew shear bolts using mole grips (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.
- Detach protective housing from connectors.
- Unscrew two bolts securing retainers for engine control unit 2 - J624- .
- Release connectors on engine control unit 2 - J624- and unplug connectors.
- Take out old engine control unit 2 - J624- and install new engine control unit 2 - J624- .

Installing

Installation is performed in the reverse sequence.

- After installation, the locking plate must be re-fitted on the engine control unit 2 - J624- .
- 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.
- Re-attach cover for engine control unit 2 - J624- (moisture protection).
- Carefully clip cowl panel trim into retainer at windscreen.

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

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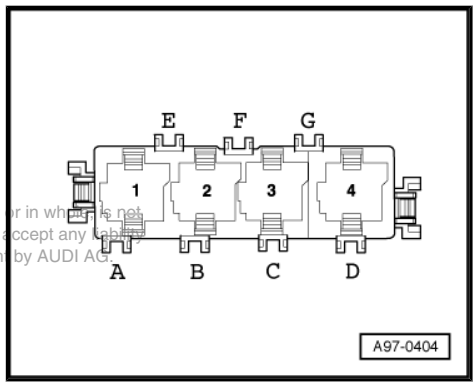
28 – Glow plug system

1 Checking glow plug system



Automatic glow period control unit - J179- and automatic glow period control unit 2 - J703- are located in relay and fuse holder (in electronics box in plenum chamber).

3 - Automatic glow period control unit - J179- (for cylinders 1, 4, 6 and 7)

4 - Glow period control unit 2 - J703- (for cylinders 2, 3, 5 and 8)

B - Fuse for automatic glow period control unit - J179-

C - Fuse for glow period control unit 2 - J703-

The glow plug system is monitored via the automatic glow period control unit - J179- and the glow period control unit 2 - J703- .

An entry is stored in the event memory of the corresponding engine control unit if a fault occurs in the glow plug system.

For faster starting, the vehicle is equipped with electronically controlled glow plugs and a glow period control unit.

Each glow plug is activated and diagnosed separately.

Note

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

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

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1 - Sender wheel

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

2 - Glow plug

Cylinder bank 1 (right-side):

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

Cylinder bank 2 (left-side):

- ❑ Glow plug 5 - Q14- , glow plug 6 - Q15- , glow plug 7 - Q16- , glow plug 8 - Q17-
- ❑ Removing and installing ⇒ page 86
- ❑ 17 Nm

3 - Electrical connector for glow plug

4 - Bolt

- ❑ 9 Nm

5 - Hall sender - G40-

- ❑ Removing and installing ⇒ page 88

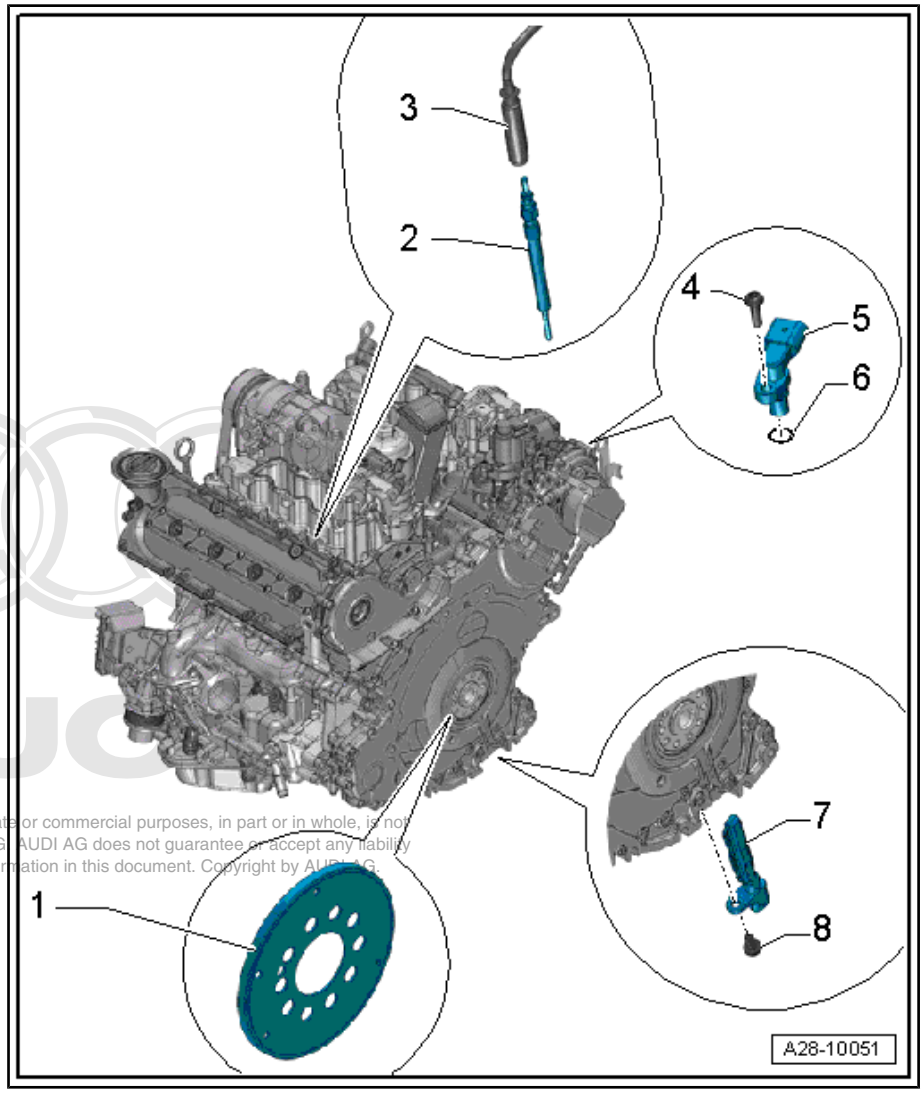
6 - O-ring

- ❑ Renew

7 - Engine speed sender - G28-

8 - Bolt

- ❑ 9 Nm



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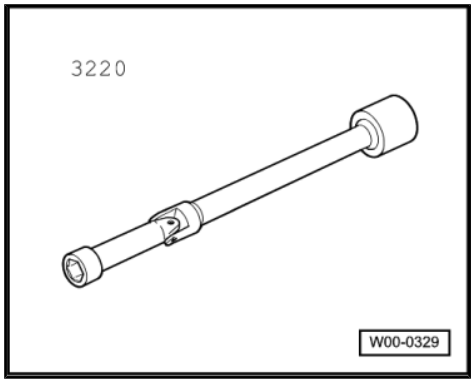
1.2 Removing and installing glow plugs

Special tools and workshop equipment required

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



Removing glow plugs

– Switch off ignition.

– Remove engine cover panel ⇒ page 18 .

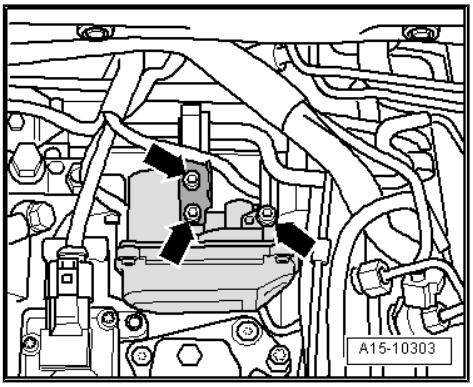
– Clean glow plug openings in cylinder head; make sure no dirt gets into cylinder.

Note

- *Cleaning procedure:*
- *Use a vacuum cleaner to remove coarse dirt.*
- *Spray brake cleaner or suitable cleaning agent into glow plug openings, let it work in briefly, and blow out with compressed air.*
- *Then clean the glow plug openings using a cloth moistened with oil.*
- *All cable ties which are released or cut open when removing must be refitted in the same position when installing.*

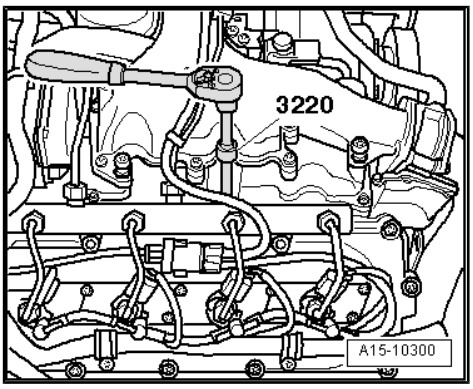
Note

- *To improve access to the glow plugs on cylinders 4 and 8, push intake manifold flap motors on left and right slightly to the side.*
- *Unscrew bolts -arrows- on intake manifold (left and right) and push intake manifold flap motor - V157- / intake manifold flap motor 2 - V275- slightly to the side. The linkage remains connected.*



– Detach electrical connectors at glow plugs.

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



Installing glow plugs

Installation is performed in the reverse sequence.

– 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 torque
⇒ “1.1 Exploded view - glow plugs, Hall sender, engine speed sender”, page 85

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

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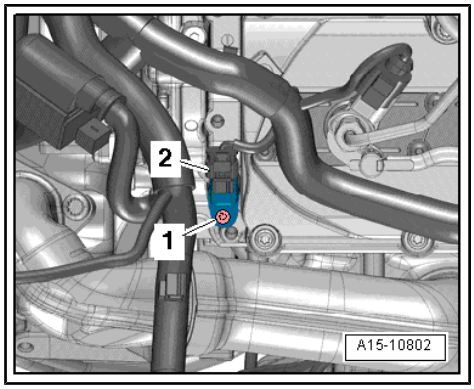
1.3 Removing and installing Hall sender - G40-



Removing

– Pull off engine cover panel ⇒ page 18 .
– Unplug electrical connector -1-.
– Unscrew bolt -1- and detach Hall sender - G40- .

Installing

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

Note

Fit new O-ring.

• Tightening torque ⇒ page 85

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