Workshop Manual
Audi A8 2003 ➤

TDI injection and glow plug system (6-cyl. 3.0 ltr. 4-valve common rail)									
Engine ID	ASB	BNG							

Edition 11.2013

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

Repair Group

23 - Mixture preparation - injection

28 - Glow plug system

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

Contents

23 – Mixture preparation - injection

1 Servicing diesel direct injection system

(ARL003647; Edition 11.2013)

1.1 Safety precautions

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.

Injuries can also be caused if the passenger's airbag is triggered in a collision.

- *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.*

Caution

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

1.2 To avoid any risk of injuries to persons and/or damage to the injection and glow plug system, always observe the following safety precautions:

- ♦ Persons wearing a pacemaker should not lean over the engine compartment while the engine is running, as the injectors use high voltage pulses.
- ♦ Do not open any fuel line connections while the engine is running.
- ♦ Always switch off the ignition before connecting or disconnecting injection and glow plug system wiring or tester cables.
- ♦ Always switch off the ignition before cleaning the engine.
- ♦ Certain tests may lead to a fault being detected by the control unit and stored. The fault memory should therefore be interrogated and (if necessary) erased after completing the tests and any repair work that may be required.

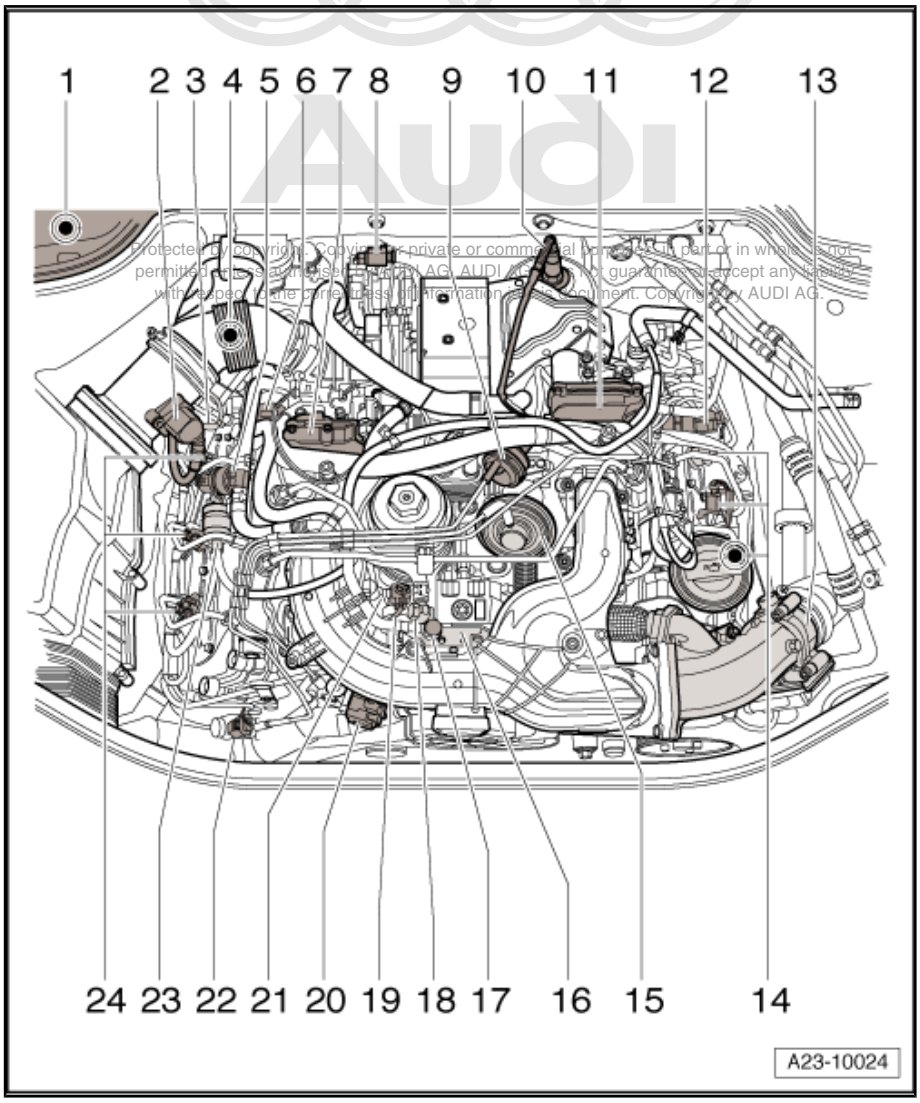
1.3 Rules for cleanliness and instructions for working on fuel system

- Clean tools and workbench etc. before working on the injection system.
- Thoroughly clean all unions and surrounding areas before disconnecting.
- 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. After removal, components should be kept in new, sealable plastic bags (use the original new part packaging if possible).
- Before installation, check the injectors and their surroundings visually; they must be undamaged and free of lint. 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 components are not being renewed, always mark the high-pressure fuel lines on removal. High-pressure fuel lines must always be re-installed in their original positions (i.e. on the same cylinder).
- The following components and seals/O-rings must always be renewed when the injectors are removed and installed: “copper seal”, “O-ring for injector bore”, “O-ring for injector return connection”.
- The following components and seals/O-rings must always be renewed when an injector is renewed: “clamping piece”, “copper seal”, “O-ring for injector bore”, “O-ring for injector return connection”.
- Always fit new copper seals for the injectors. Check all new O-rings for damage before installing. Lubricate O-rings lightly with assembly oil or clean engine oil before installing. Use assembly tool for installing the “O-ring for injector return connection”.
- Take care not to damage the injectors when removing the old copper seals.
- Align the high-pressure fuel lines so they are free of tension. 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 return lines 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 return lines are seated securely by pulling them by hand from above. Also check that they seal properly (fuel pressure in return line as far as pressure retention valve: between 8 and 10 bar).
- All cable ties which are released or cut open when removing must be refitted in the same position when installing.
- When the fuel system is open: Do not work with compressed air if this can be avoided. Do not move the vehicle unless absolutely necessary.

- Also ensure that no diesel fuel comes into contact with the coolant hoses. Should this occur, the hoses must be cleaned immediately. Damaged hoses must be renewed.

1.4 Overview of fitting locations

Components A to M are not shown in the illustration.



1 - Electronics box in plenum chamber

- ❑ Diesel direct injection system control unit - J248- with altitude sensor
- ❑ Removing and installing ⇒ page 88
- ❑ Fitting location of automatic glow period control unit - J179- ⇒ page 6
- ❑ Fitting location of terminal 30 voltage supply relay - J317- ⇒ page 6

2 - Air mass meter - G70-

- ❑ Removing and installing ⇒ page 18

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

4 - Coolant temperature sender - G62-

- ❑ Fitting location ⇒ page 8
- ❑ Removing and installing ⇒ Rep. gr. 19

5 - Fuel temperature sender - G81-

6 - Fuel pressure regulating valve - N276-

- ❑ Removing and installing

⇒ page 94

7 - Intake manifold flap motor - V157-

- ❑ Cylinder bank 1
- ❑ Removing and installing ⇒ page 35
- ❑ Exploded view - intake manifold ⇒ page 18

8 - Control unit for turbocharger 1 - J724-

9 - Vacuum unit

- ❑ For change-over flap for exhaust gas recirculation cooler

10 - Lambda probe - G39- with Lambda probe heater - Z19-

- ❑ Removing and installing ⇒ page 99

11 - Intake manifold flap 2 motor - V275-

- ❑ Cylinder bank 2
- ❑ Removing and installing ⇒ page 35
- ❑ Exploded view - intake manifold ⇒ page 18

12 - Fuel pressure sender - G247-

- ❑ Removing and installing ⇒ page 98

13 - Throttle valve module - J338-

14 - Injectors (piezo injectors)

- ❑ Cylinder bank 2
- ❑ Removing and installing ⇒ page 52

15 - Mechanical exhaust gas recirculation valve

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

16 - 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
- ❑ Overview: vehicles up to 08.2005 ⇒ page 69 ; vehicles from 08.2005 onwards ⇒ page 76
- ❑ Removing and installing: vehicles up to 08.2005 ⇒ “1.28 Removing and installing high-pressure pump - vehicles up to 08.2005”, page 72 ; vehicles from 08.2005 onwards ⇒ page 79

17 - Fuel supply line connection

18 - Fuel return line connection

19 - Fuel metering valve - N290-

20 - Exhaust gas recirculation valve - N18-

- ❑ Fitting location ⇒ page 8

21 - Oil pressure switch - F1-

- ❑ Fitting location ⇒ page 8
- ❑ Checking ⇒ Rep. gr. 17

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

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

23 - Pressure retention valve

- ❑ In 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

24 - Injectors (piezo injectors)

- ❑ Cylinder bank 1
- ❑ Removing and installing ⇒ page 52

A - Brake light switch - F- and brake pedal switch for cruise control system (diesel direct-injection system) - F47-

- ❑ In footwell on brake pedal

B - Accelerator position sender - G79-

- ❑ In footwell on accelerator pedal
- ❑ Fitting location ⇒ page 6

C - Fuel pump relay - J17-

- ❑ Relay and fuse holder in luggage compartment (right-side)
- ❑ Fitting location ⇒ page 7

D - Charge pressure sender - G31-

- ❑ With intake air temperature sender - G42-
- ❑ In charge air cooler (left-side) ⇒ page 7
- ❑ Removing and installing ⇒ Rep. gr. 21

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

- ❑ Relay and fuse holder in front footwell (right-side)
- ❑ Fitting location ⇒ page 7

F - Engine speed sender -G28-

- ❑ Fitting location ⇒ page 8

G - Automatic glow period control unit - J179-

- ❑ Relay and fuse holder in electronics box, plenum chamber
- ❑ Fitting location ⇒ page 6

H - Air cleaner 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

I - Exhaust gas pressure sensor 1 - G450-

- ❑ Only fitted on vehicles with particulate filter
- ❑ Exhaust gas pressure sensor 1 - G450- is mounted on gearbox (right-side in direction of travel)
- ❑ Removing and installing ⇒ page 101

Adaption must be performed after renewing exhaust gas pressure sensor 1 - G450- and/or particulate filter. (The procedure is described under Guided Functions.)

- Enter correct vehicle identification in Guided Fault Finding.
- Press “Go to” button.
- Press “Function/component selection”.
- Select “Drive train”.
- “01 - Self-diagnosis compatible systems”
- “01 - Engine electronics”
- Select “Functions”.
- “J248 Adapt particulate filter learned values”

J - Exhaust gas temperature sender 1 - G235-

- On turbocharger ⇒ page 9
- Removing and installing ⇒ Rep. gr. 26

K - Exhaust gas temperature sender 2 - G448-

- Only fitted on vehicles with particulate filter
- Located downstream of starter catalytic converter ⇒ page 9
- Removing and installing ⇒ Rep. gr. 26

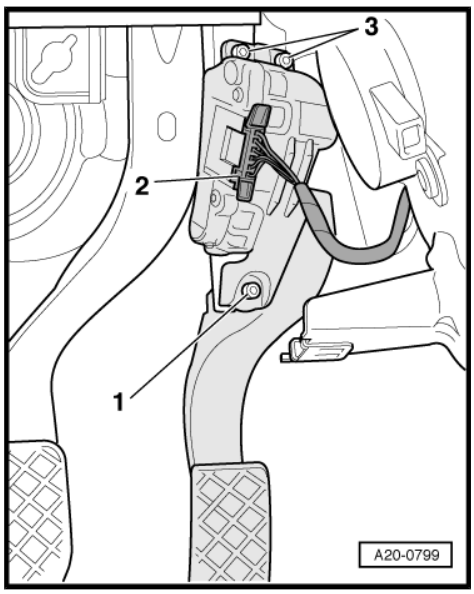
L - Temperature sender before particulate filter - G506-

- Only fitted on vehicles with particulate filter
- Located between main catalytic converter and particulate filter
- Removing and installing ⇒ Rep. gr. 26

M - Particulate filter

- Fitted on vehicle 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

Accelerator position sender - G79-

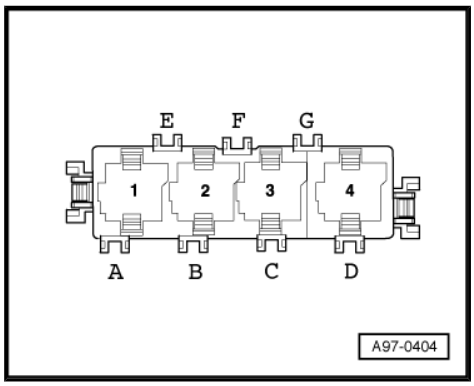


Relay and fuse holder in electronics box, plenum chamber

2 - Terminal 30 voltage supply relay - J317-

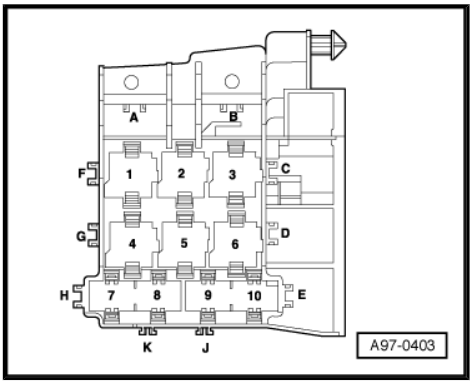
3 - Automatic glow period control unit - J179-

B - Glow plug fuse



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

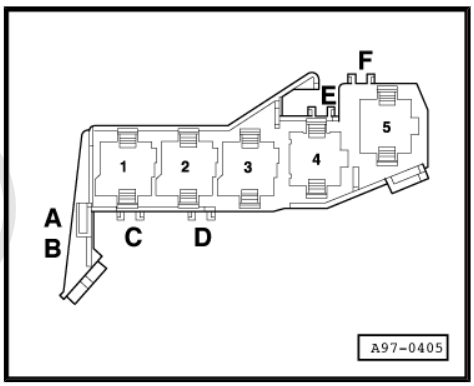
3 - Terminal 15 voltage supply relay - J329-



Relay carrier in passenger's footwell

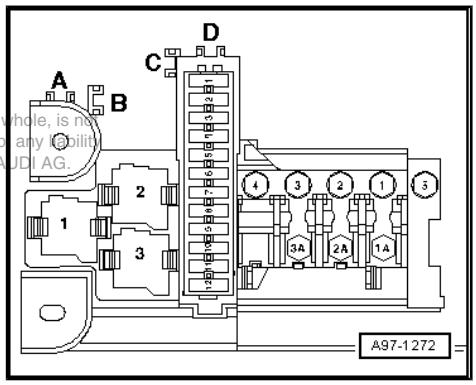
2 - Starter motor relay - J53-

3 - Starter motor relay 2 - J695-



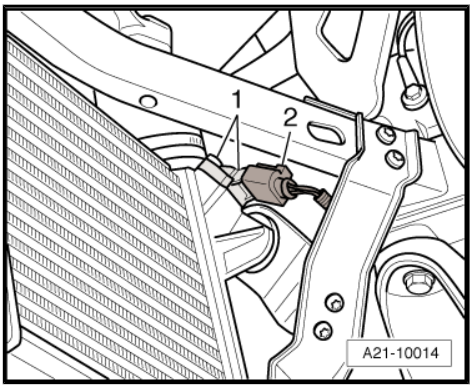
Relay and fuse holder in luggage compartment (right-side)

3 - Fuel pump relay - J17-



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

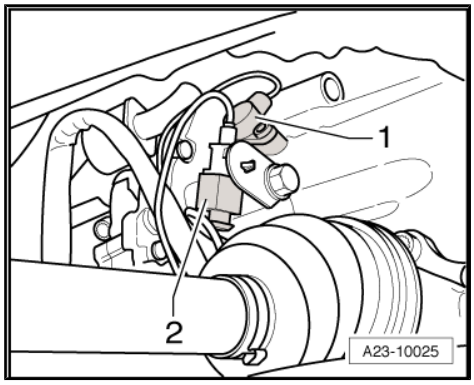
- Removing and installing ⇒ Rep. gr. 21



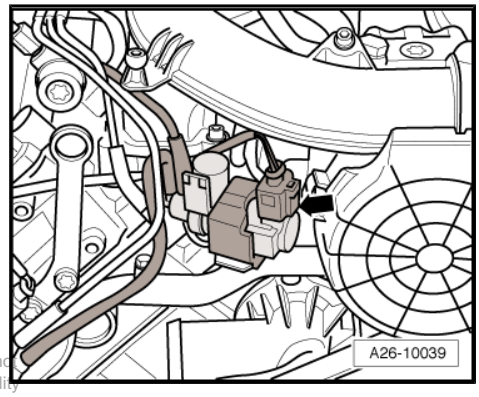
Engine speed sender - G28-

1 - Engine speed sender - G28-

2 - 3-pin connector



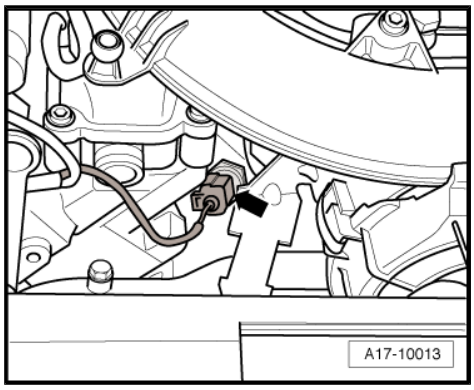
Exhaust gas recirculation valve - N18- -arrow-



Oil pressure switch - F1- -arrow-

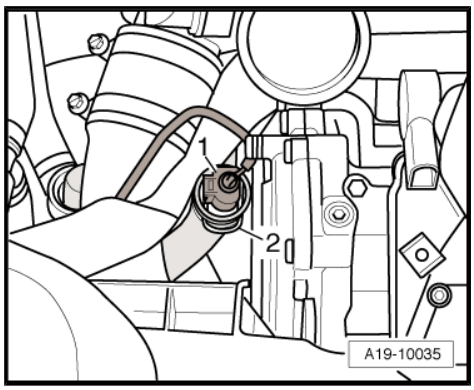
Removing and installing ⇒ Rep. gr. 17

Checking ⇒ Rep. gr. 17



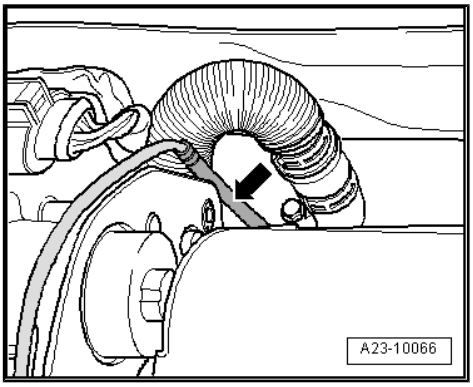
Coolant temperature sender - G62-

Removing and installing ⇒ Rep. gr. 19



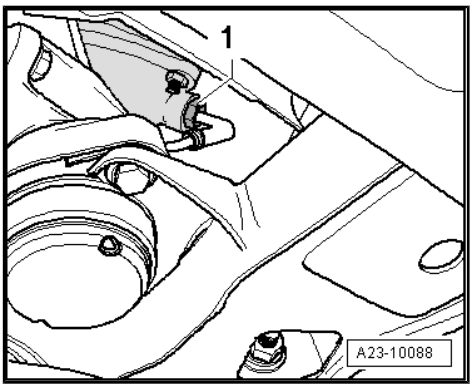
Exhaust gas temperature sender 1 - G235- -arrow-

Removing and installing ⇒ Rep. gr. 26



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

Removing and installing ⇒ Rep. gr. 26



1.5 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.

1 - Fuel metering valve - N290-

- ❑ Do not unscrew

2 - High-pressure fuel pump

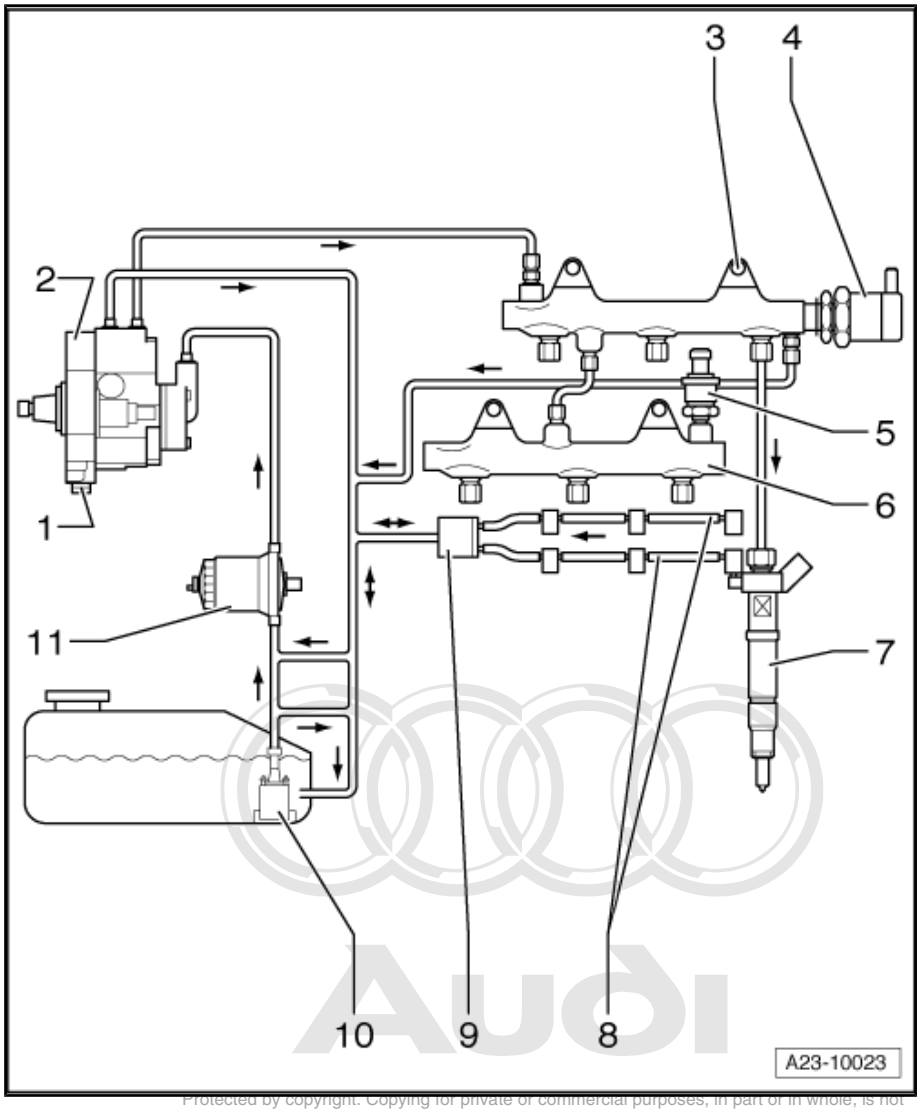
- ❑ With gear-type fuel system pressurisation pump
- ❑ High-pressure pump generates fuel pressure up to 1600 bar
- ❑ Gear-type fuel system pressurisation pump generates fuel pressure between 4 and 5 bar
- ❑ Overview: vehicles up to 08.2005 ⇒ page 69 ; vehicles from 08.2005 onwards ⇒ page 76
- ❑ Removing and installing: vehicles up to 08.2005 ⇒ “1.28 Removing and installing high-pressure pump - vehicles up to 08.2005”, page 72 ; vehicles from 08.2005 onwards ⇒ page 79

3 - Rail element (high-pressure reservoir)

- ❑ Cylinder bank 1

4 - Fuel pressure regulating valve - N276-

- ❑ On cylinder bank 1
- ❑ Removing and installing



⇒ page 94

5 - Fuel pressure sender - G247-

- On cylinder bank 2
- Removing and installing ⇒ page 98

6 - Rail element (high-pressure reservoir)

- For cylinder bank 2

7 - Injectors (piezo injectors)

- Injectors 1 ... 6
- Removing and installing ⇒ page 52

8 - Fuel return lines (from injectors)

- 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.
- 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 52

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

1.6 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.*

1 - Bracket with fuel filter

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

2 - Fuel return line

3 - Fuel supply line

4 - Clip

5 - Banjo bolt for fuel return line

6 - Fuel temperature sender - G81-

7 - Fuel pressure regulating valve - N276-

- ❑ Located on cylinder bank 1
- ❑ Removing and installing ⇒ page 94

8 - Banjo bolt for fuel return line

- ❑ 25 Nm

9 - Banjo bolt for fuel supply line

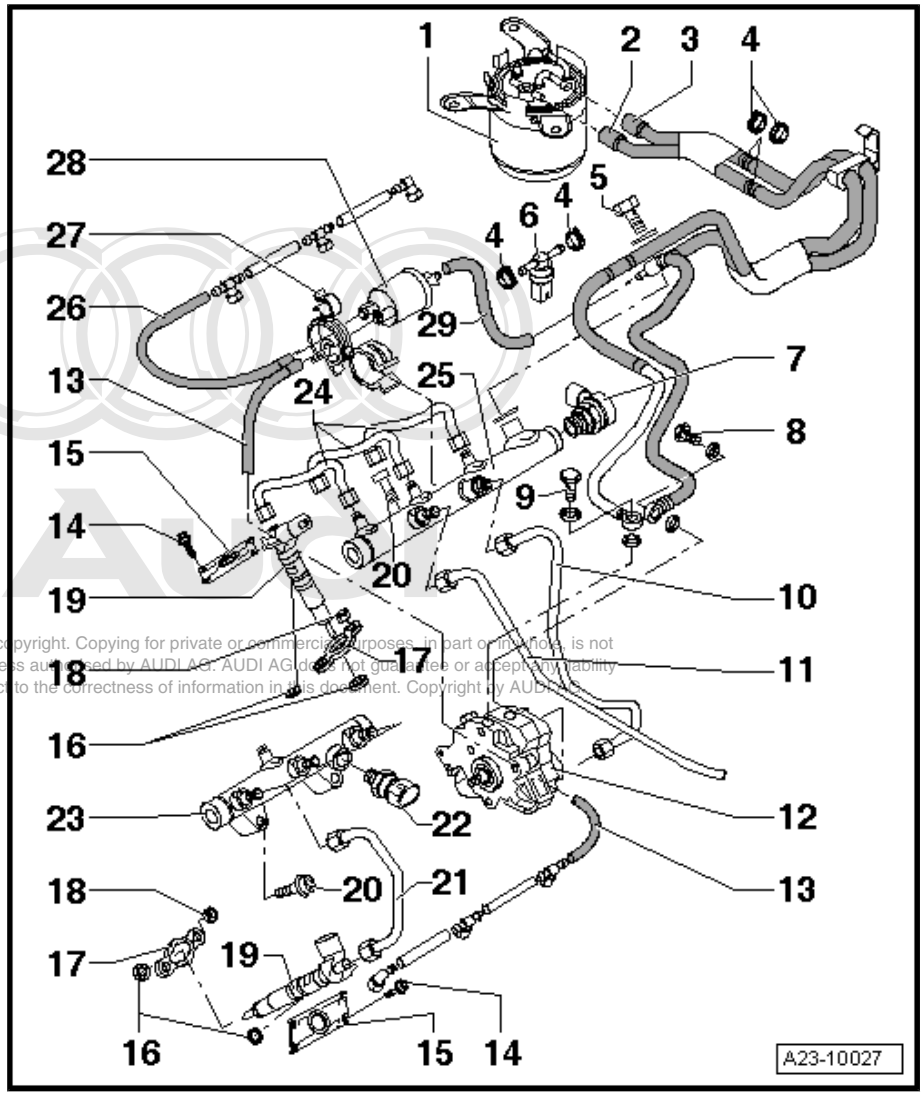
- ❑ 25 Nm

10 - High-pressure fuel pipe

- ❑ Between high-pressure pump and rail element for cylinder bank 1

11 - High-pressure fuel pipe

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



bank 2

12 - High-pressure fuel pump

- ❑ With gear-type fuel system pressurisation pump
- ❑ High-pressure pump generates fuel pressure up to 1600 bar
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- ❑ Overview: vehicles up to 08.2005 ⇒ page 69 ; vehicles from 08.2005 onwards ⇒ page 76
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13 - Fuel return lines (from injectors)

- ❑ 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.

14 - Bolt

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

15 - Cover for injector

16 - Seal

17 - Clamping piece

- ❑ Renew

18 - Hexagon flange nut

- ❑ For clamping piece
- ❑ 10 Nm

19 - Injector

- ❑ 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 52

20 - Bolt

- ❑ 22 Nm

21 - High-pressure pipes

- ❑ For cylinder bank 2
- ❑ 25 Nm

22 - Fuel pressure sender - G247-

- ❑ Located on cylinder bank 2
- ❑ Removing and installing ⇒ page 98
- ❑ 30 Nm

23 - High-pressure reservoir

- ❑ For cylinder bank 2

24 - High-pressure pipes

- ❑ For cylinder bank 1

25 - High-pressure reservoir

- ❑ For cylinder bank 1

26 - Fuel return lines (from injectors)

- ❑ 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.

27 - Retainer

- ❑ For fuel return lines (from injectors)

28 - Pressure retention valve

- ❑ In 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 52

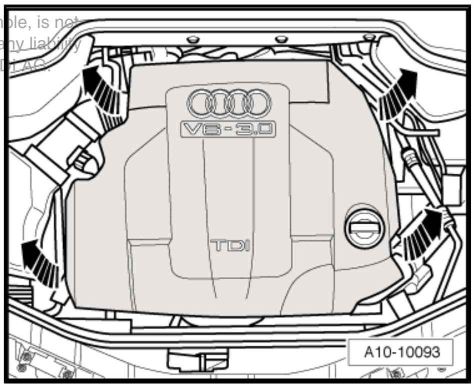
29 - Fuel return line

- ❑ Common return line to fuel tank

1.7 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.



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.

1.8 Exploded view - air cleaner

1 - Intake air duct

2 - Air duct

- ❑ Clean dirt and leaves out of air duct

3 - Air duct

- ❑ Clean dirt and leaves out of air duct

4 - Air duct

- ❑ Clean dirt and leaves out of air duct

5 - Air duct

- ❑ Clean dirt and leaves out of air duct

6 - Air cleaner housing

- ❑ Clean any salt residue, leaves and dirt out of air cleaner housing

7 - Grommet

8 - Bush

9 - Bolt

10 - O-ring

- ❑ Renew if damaged

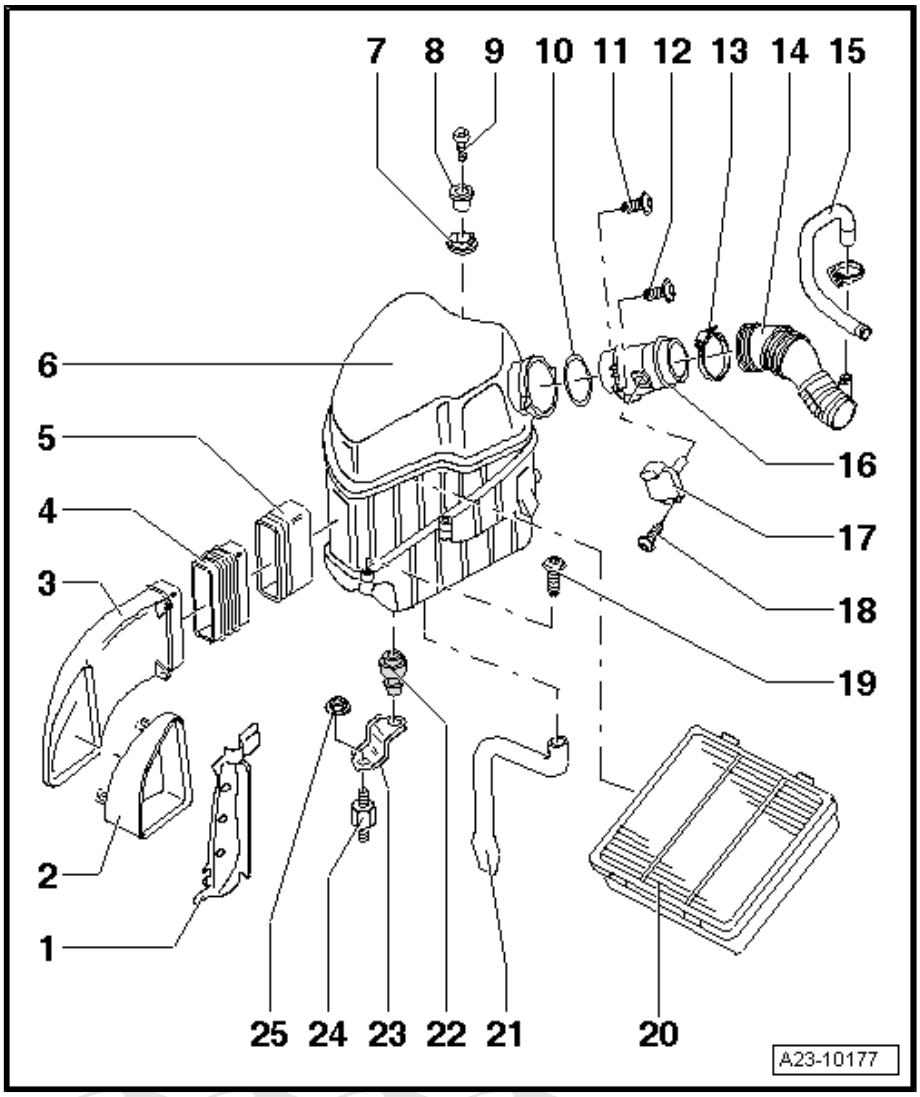
11 - Bolt

12 - Bolt

13 - Hose clip

14 - Air intake hose leading to throttle valve module - J338-

- ❑ Clean dirt and leaves



out of air duct

15 - Vent hose

16 - Housing for air mass meter - G70-

17 - Air mass meter - G70-

- ❑ Removing and installing ⇒ page 18

18 - Bolt

19 - Bolt

20 - Air filter element

- ❑ Always use genuine part for air filter element
- ❑ Removing and installing ⇒ page 16
- ❑ Observe service intervals ⇒ Maintenance ; Booklet 404
- ❑ Also clean snow screen (if fitted)

21 - Water drain hose

- ❑ Clean any leaves and dirt out of water drain hose
- ❑ Water drain must function properly

22 - Grommet

23 - Retaining clip

24 - Stop buffer

25 - Hexagon flange nut

1.9 Removing and installing air filter element

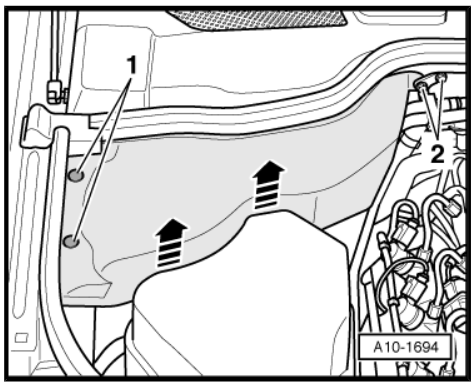
Removing

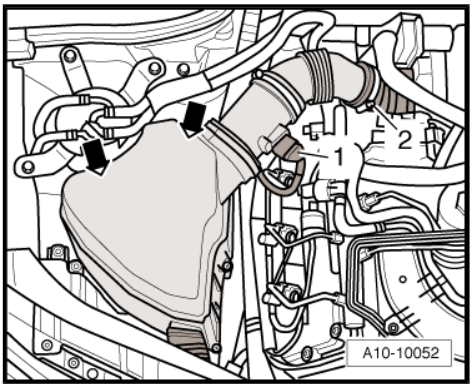
– Remove cover for suspension turret (right-side); to do so, detach spreader clips -1- and unscrew nut -2-.

– Pull cover out of retainers -arrows-.

– Unplug electrical connector -1- at air mass meter - G70- .

– Detach air intake hose -2- at turbocharger.





– Remove bolts -arrows-.
– Detach air cleaner housing (top section).
– Pull out air filter element.
– Cover the open air cleaner housing with a clean cloth.

Note

Make sure no dirt gets into the air cleaner housing.

Installing

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

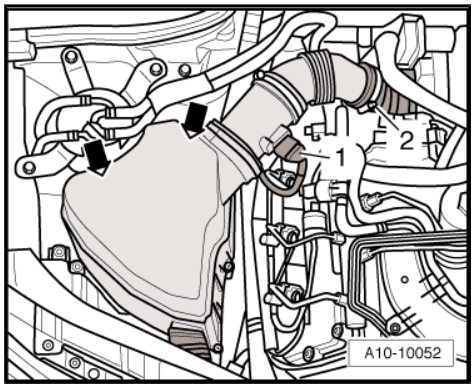
Note

- *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.*
- *Use a silicone-free lubricant when installing the intake hose.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*

– Check water drain hose in air cleaner (bottom section) for dirt and other obstructions.
– Clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); use a vacuum cleaner 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.
– 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 the top section of the air cleaner is fitted straight on the air filter element. Note position of sealing lip on air filter element (to prevent air leaks).
– Then screw top section of air cleaner back onto bottom section.
– The remaining installation steps are carried out in the reverse sequence.

1.10 Removing and installing air mass meter - G70-

Removing



– Unplug electrical connector at air mass meter - G70- -1-.

– Open two hose clips and carefully pull out 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.*
- *Use a silicone-free lubricant when installing the intake hose.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*

– 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. Removing and installing air cleaner ⇒ page 16

– If air cleaner has been removed, clean water drain hose in air cleaner housing (bottom section).

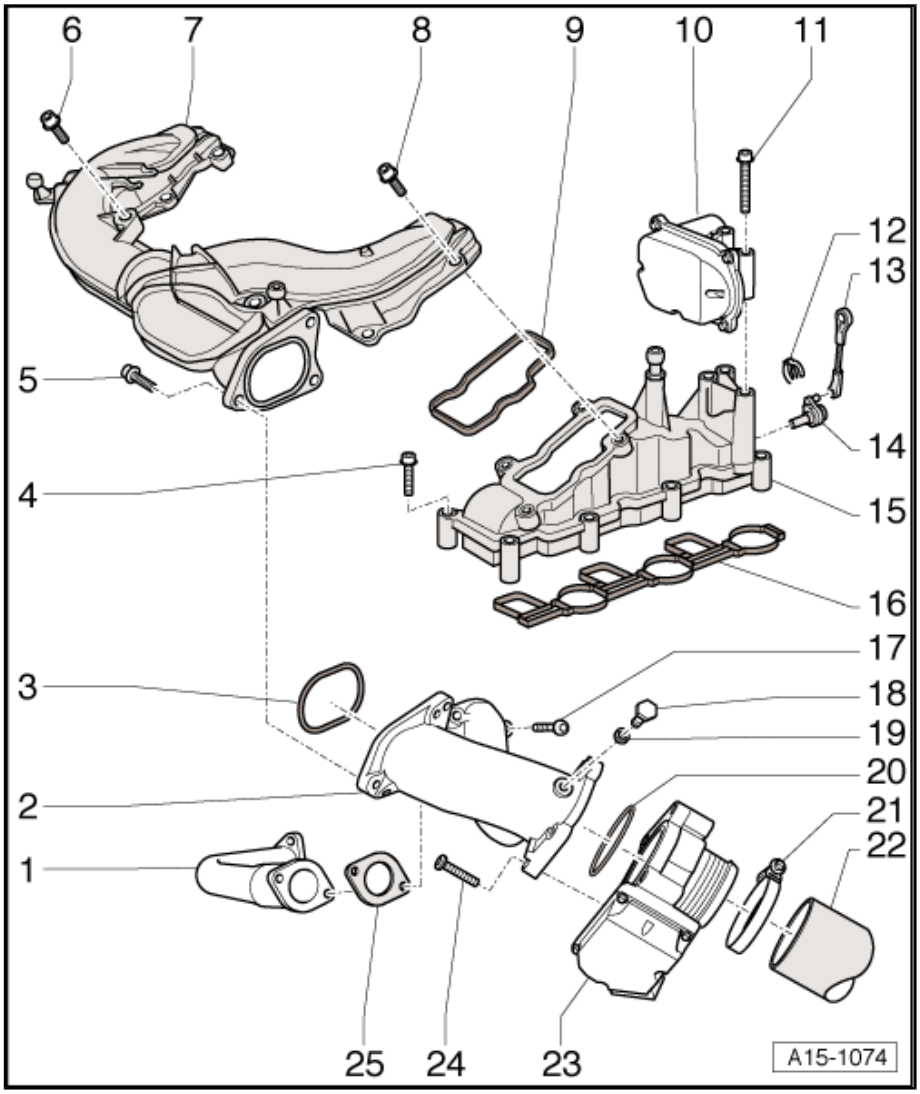
– Align seal in slot on air cleaner housing and carefully push air mass meter - G70- into air cleaner housing.

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

1.11 Exploded view - intake manifold

Note

The illustration shows the top section and bottom (left-side) section of the intake manifold.



1 - Connecting pipe for exhaust gas recirculation

2 - Intake connecting pipe

3 - Seal

- ❑ Renew

4 - Bolt

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

5 - Bolt

- ❑ 9 Nm

6 - Bolt

- ❑ 9 Nm

7 - Intake manifold (top section)

- ❑ Removing and installing ⇒ page 20

8 - Bolt

- ❑ 9 Nm

9 - Gasket

- ❑ Renew

10 - Intake manifold flap motor

- ❑ Cylinder bank 1 (right-side): intake manifold flap motor - V157-
- ❑ Cylinder bank 2 (left-side): intake manifold flap motor - V275-
- ❑ Removing and installing ⇒ page 35

11 - Bolt

12 - Securing clip

- ❑ Not available as separate replacement part

13 - Connecting rod

- ❑ Not available as separate replacement part

14 - Coupling

- ❑ Not available as separate replacement part

15 - Bottom section of intake manifold (left-side)

- ❑ Removing and installing: vehicles up to 10.2004 ⇒ page 21 ; vehicles from 10.2004 onwards ⇒ page 25 (left-side) and ⇒ page 30 (right-side)

16 - Gasket

- ❑ Renew

17 - Bolt

- ❑ 9 Nm

18 - Screw plug

- ❑ 25 Nm

19 - Seal

- ❑ Renew

20 - Seal

- ❑ Renew

21 - Retaining clamp

- ❑ Reinforced
- ❑ 5.5 Nm

22 - Air hose

- ❑ Must be free of oil and grease when installing

23 - Throttle valve module - J338-

24 - Bolt

- ❑ 9 Nm

25 - Gasket

- ❑ Renew

1.12 Removing and installing intake manifold (top section)

Removing

– Pull off engine cover ⇒ page 14 .

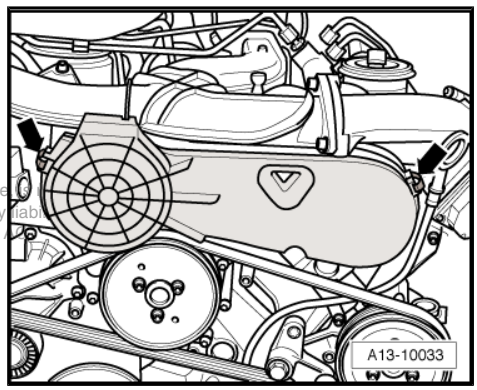
Caution

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

– Pull oil dipstick out of guide tube.

– Loosen clamps -arrows-.

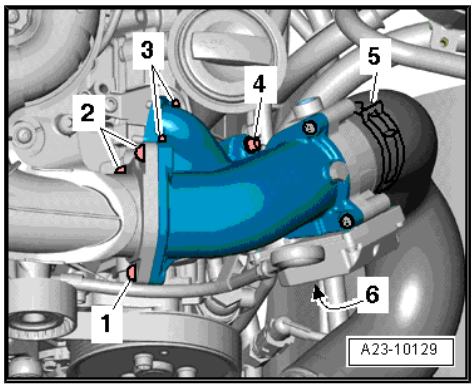
– Swing toothed belt cover forwards.



– Disconnect air intake hose -5- from throttle valve module - J338- .

– Unplug electrical connector -6- at throttle valve module - J338- .

– Remove bolts -3- and -4-.

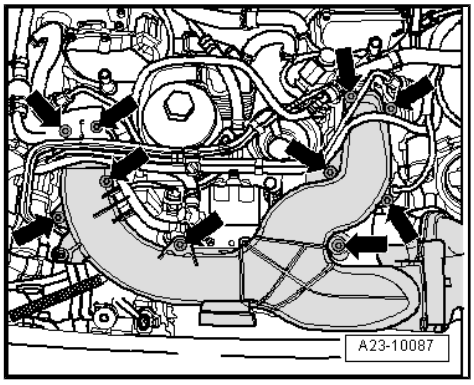


Note

Disregard items -1- and -2-.

– Remove bolts -arrows-.

– Detach intake manifold (top section) together with intake connecting pipe and throttle valve module - J338- .



Installing

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

Note

- *Renew gaskets and seals.*
- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*

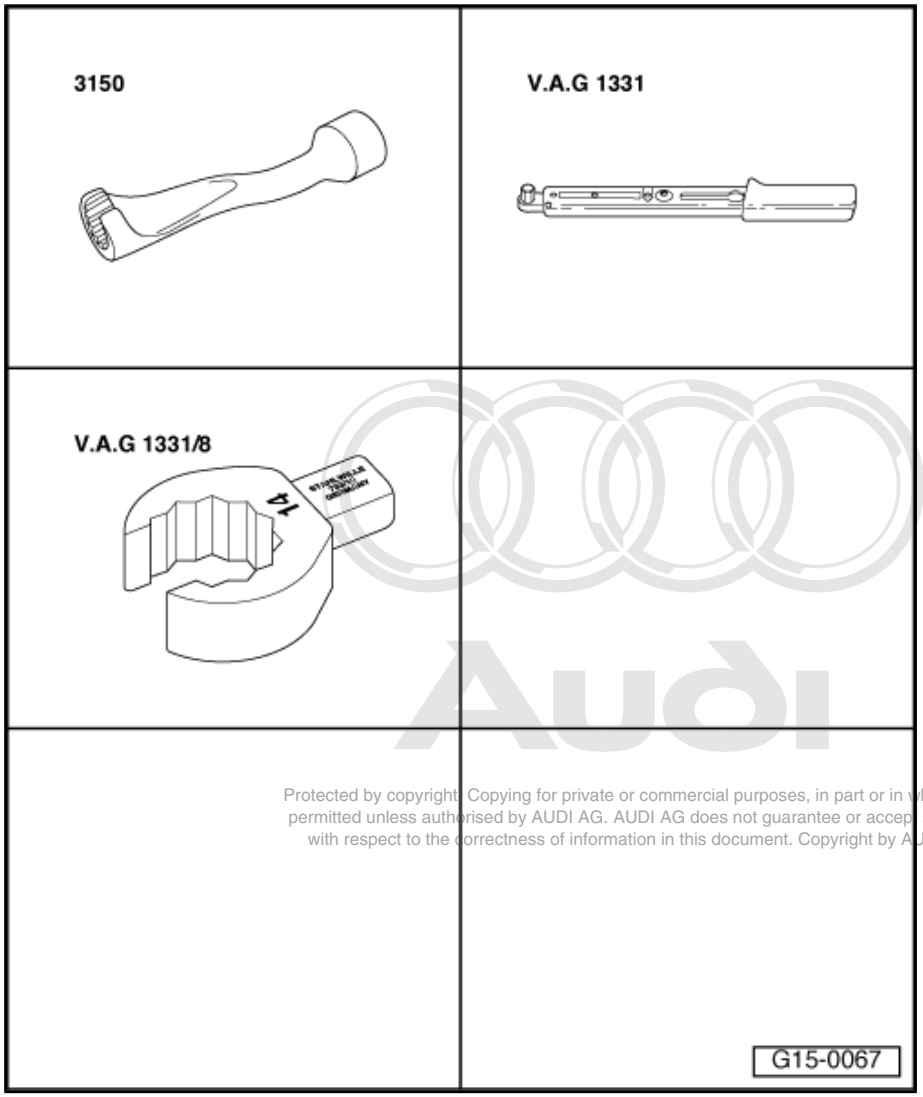
Tightening torques

Component	Nm
Intake manifold (top section) to intake manifold (bottom section)	9
Intake connecting pipe to intake manifold (top section)	9
Intake connecting pipe to connecting pipe	9
Hose clips (9 mm wide)	3
Hose clips (13 mm wide)	5.5

1.13 Removing and installing intake manifold (left and right bottom sections) - vehicles up to 10.2004

Special tools and workshop equipment required

- Socket, 14 mm - 3150-
- Torque wrench - V.A.G 1331- with ratchet - V.A.G 1331/1-
- Socket insert AF 14, flared ring spanner - V.A.G 1331/8-



Removing

Note

- *All cable ties which are released or cut open when removing must be fitted in the same position when installing.*
- *The intake manifold (bottom section) can only be renewed together with the intake manifold flap motor as one unit*

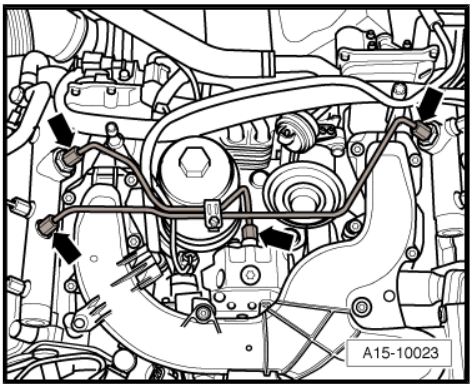
– Pull off engine cover ⇒ page 14 .

Caution

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

– Unscrew union nuts -arrows- and detach high-pressure pipes.

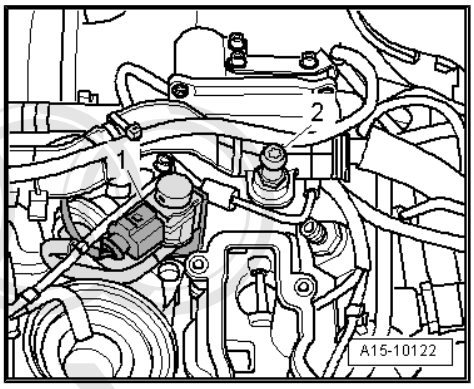
– Remove intake manifold (top section) ⇒ page 20 .



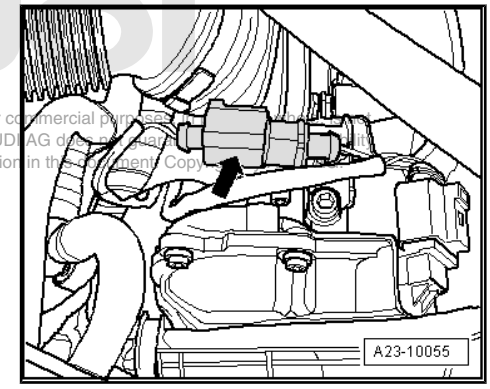
– Unscrew retaining pin -2- for engine cover panel at intake manifold (bottom section).

– If fitted, remove change-over valve for exhaust gas recirculation cooler - N345- -item 1- with bracket.

Bottom section of intake manifold (right-side):



– Take electrical connector -arrow- for exhaust gas temperature sender 1 - G235- out of bracket.

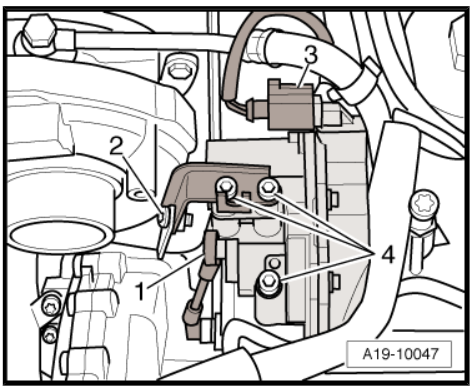


– Remove bolt -2-.

Note

Disregard -items 1, 3, 4-.

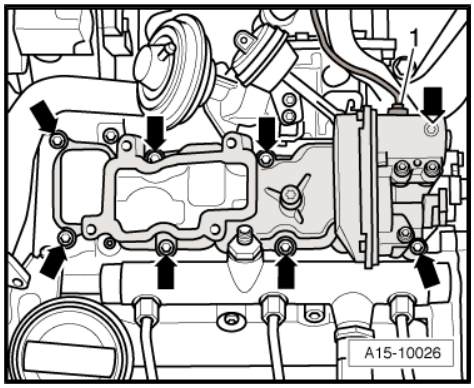
– Detach electrical connectors at glow plugs on cylinder bank (right-side).



Continuation for both sides:

– Detach electrical connector -1- at intake manifold flap motor.

– Remove bolts -arrows- and detach intake manifold (bottom section) with intake manifold flap motor.



Note

Block off intake ports in cylinder head with clean rags.

Installing

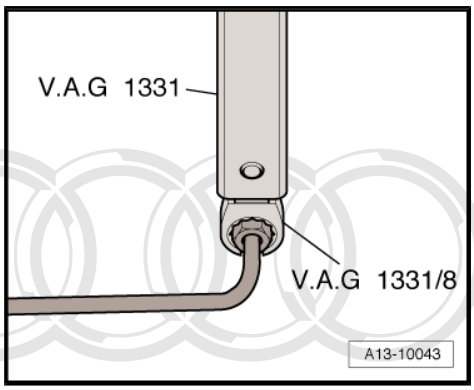
Installation is carried out in the reverse order; note the following:

Note

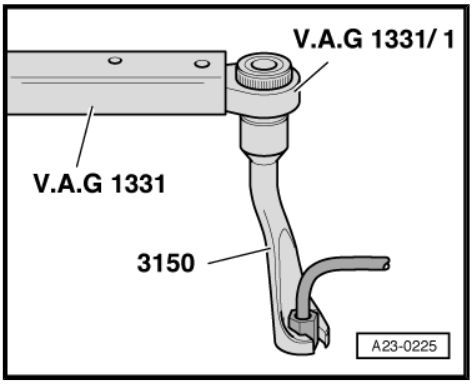
- *Renew seals and gaskets.*
- *Fit all cable ties in the original positions when installing.*

– Install intake manifold (top section) ⇒ page 20 .

– To tighten union of high-pressure pipe at high-pressure pump, use torque wrench - V.A.G 1331- with socket insert AF 14, flared ring spanner - V.A.G 1331/8- .



– To tighten unions of high-pressure pipes at rail elements, use torque wrench - V.A.G 1331- with ratchet - V.A.G 1331/1- and socket, 14 mm - 3150- .



Tightening torques

Component		Nm
Intake manifold (bottom section) to cylinder head		9
Retaining pin for engine cover panel to intake manifold (bottom section)		5
High-pressure pipes	High-pressure pump	25
to:	Rail element	25

– Check fuel system for leaks.

Bleeding fuel system and checking for leaks

– Run engine at idling speed for several minutes and then switch off.

– Switch off ignition.

– Check the complete fuel system including all 6 return line connections for leaks.

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

Note

The return lines can only be renewed together with the pressure retention valve as one unit.

– After completing the repair, road-test the vehicle over a distance of at least 20 km. Accelerate with full throttle at least once. Then inspect the high-pressure section of the fuel system again for leaks.

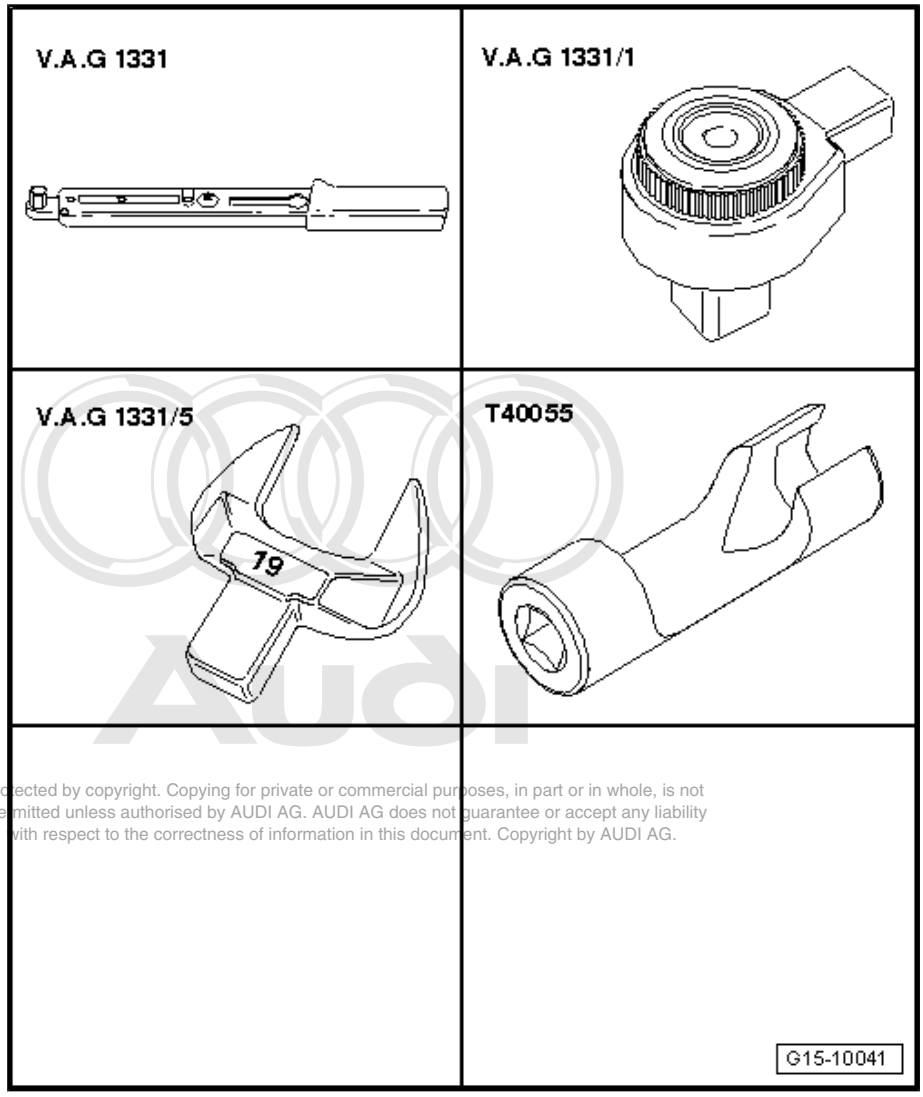
Note

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 fault memory. Then continue the road test.

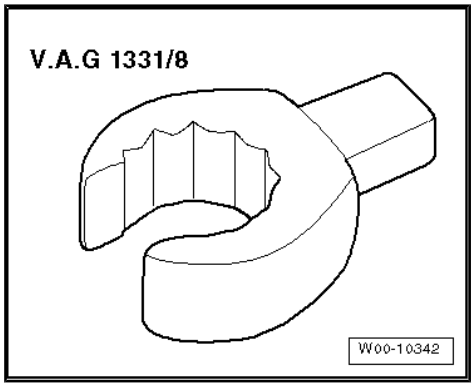
1.14 Removing and installing left-side intake manifold (bottom section) - vehicles from 10.2004 onwards

Special tools and workshop equipment required

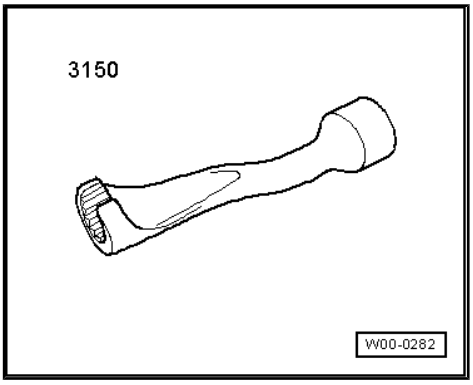
- Torque wrench - V.A.G 1331-
- Open end spanner insert, AF 19 - V.A.G 1331/5- (vehicles from 08.2005 onwards)
- Ratchet - V.A.G 1331/1-
- Socket - T40055- (17 mm), (vehicles from 08.2005 onwards)



- Socket insert AF 14, flared ring spanner - V.A.G 1331/8- (vehicles up to 08.2005)



♦ Socket, 14 mm - 3150- (vehicles up to 08.2005)



Removing

Caution

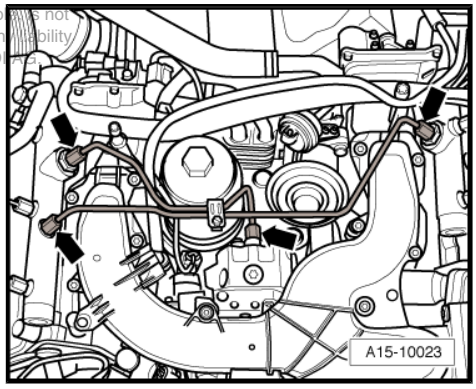
Observe rules for cleanliness when working on the injection system ⇒ page 2 .

– Remove intake manifold (top section) ⇒ page 20 .

– Drain off coolant ⇒ Rep. gr. 19 .

Vehicles up to 08.2005:

– Unscrew union nuts -arrows- and detach high-pressure pipes.

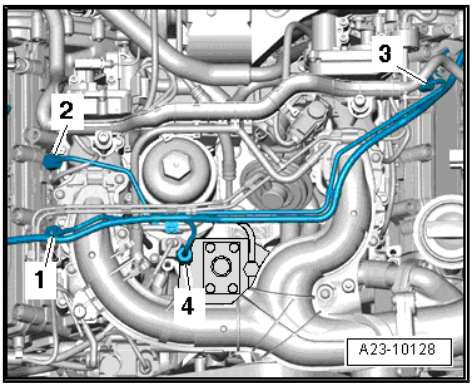


Vehicles from 08.2005 onwards:

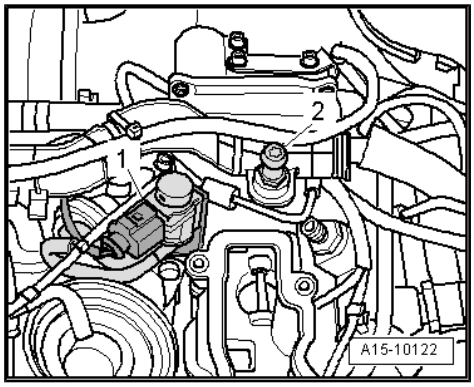
– Unscrew union nuts -1 ... 4- and detach high-pressure pipes.

All vehicles:

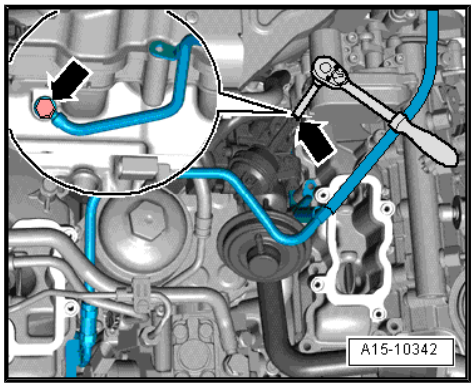
– Remove mechanical exhaust gas recirculation valve ⇒ Rep. gr. 26 .



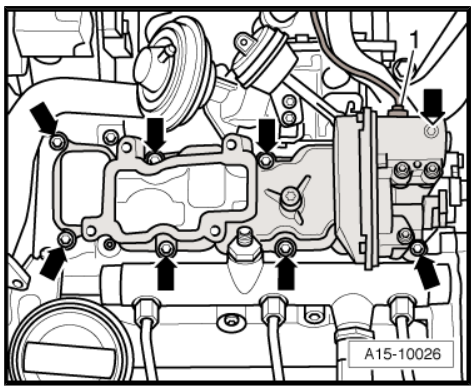
– Unscrew retaining pin -2- for engine cover panel at intake manifold (bottom section).
– Unclip exhaust gas recirculation cooler change-over valve - N345- -item 1- from bracket.
– Remove bracket for exhaust gas recirculation cooler change-over valve - N345- .



– Remove banjo bolt for coolant bleeder line using jointed wrench as illustrated.



– Unplug electrical connector -1- at intake manifold flap 2 motor - V275- .
– Remove bolts -arrows- and detach intake manifold (bottom section) with intake manifold flap motor 2 - V275- .
– Move coolant bleeder line to one side and remove left-side intake manifold (bottom section).



Note

Block off intake ports in cylinder head with clean rags.

Installing

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

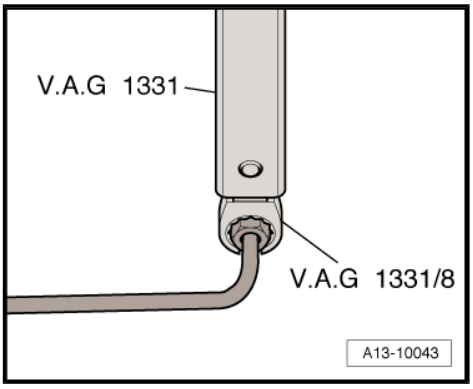
Note

Renew gaskets and seals.

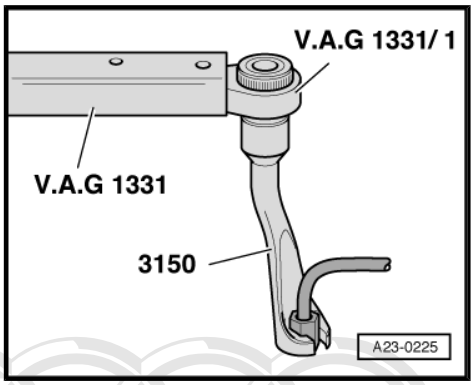
– Fit banjo bolt for coolant bleeder line with a new seal and screw in 2 … 3 turns, before installing left-side intake manifold (bottom section).
– Install mechanical exhaust gas recirculation valve ⇒ Rep. gr. 26 .
– Install intake manifold (top section) ⇒ page 20 .
– Tighten union nuts on high-pressure pipes hand-tight initially.
– Ensure that high-pressure pipes are not under tension.

Vehicles up to 08.2005:

– To tighten union of high-pressure pipe at high-pressure pump, use torque wrench - V.A.G 1331- with socket insert AF 14, flared ring spanner - V.A.G 1331/8- .

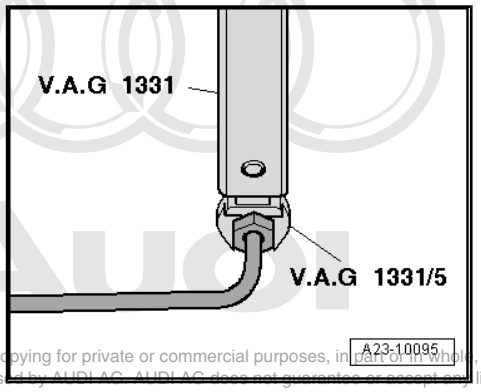


– To tighten unions of high-pressure pipes at rail elements, use torque wrench - V.A.G 1331- with ratchet - V.A.G 1331/1- and socket, 14 mm - 3150- .

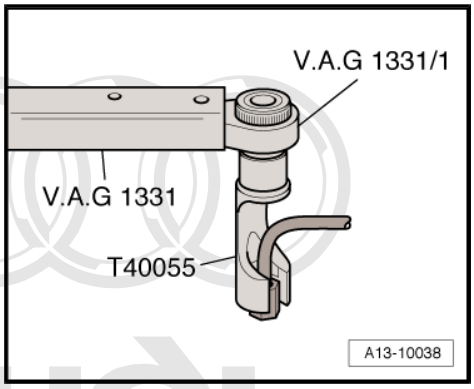


Vehicles from 08.2005 onwards:

– To tighten unions of high-pressure pipes at rail elements, use torque wrench - V.A.G 1331- with open end spanner insert, AF 19 - V.A.G 1331/5- .



– 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 socket - T40055- , 17 mm.



All vehicles:

– Fill cooling system ⇒ Rep. gr. 19 .

Tightening torques

Component	Nm
Intake manifold (bottom section) to cylinder head	9
High-pressure pipes	25
Banjo bolt for coolant bleeder line	15.5

– Check fuel system for leaks.

Bleeding fuel system and checking for leaks

– Run engine at idling speed for several minutes and then switch off.

– Switch off ignition.

– Check the complete fuel system including all 6 return line connections for leaks.

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

Note

The return lines can only be renewed together with the pressure retention valve as one unit.

– After completing the repair, road-test the vehicle over a distance of at least 20 km. Accelerate with full throttle at least once. Then inspect the high-pressure section of the fuel system again for leaks.

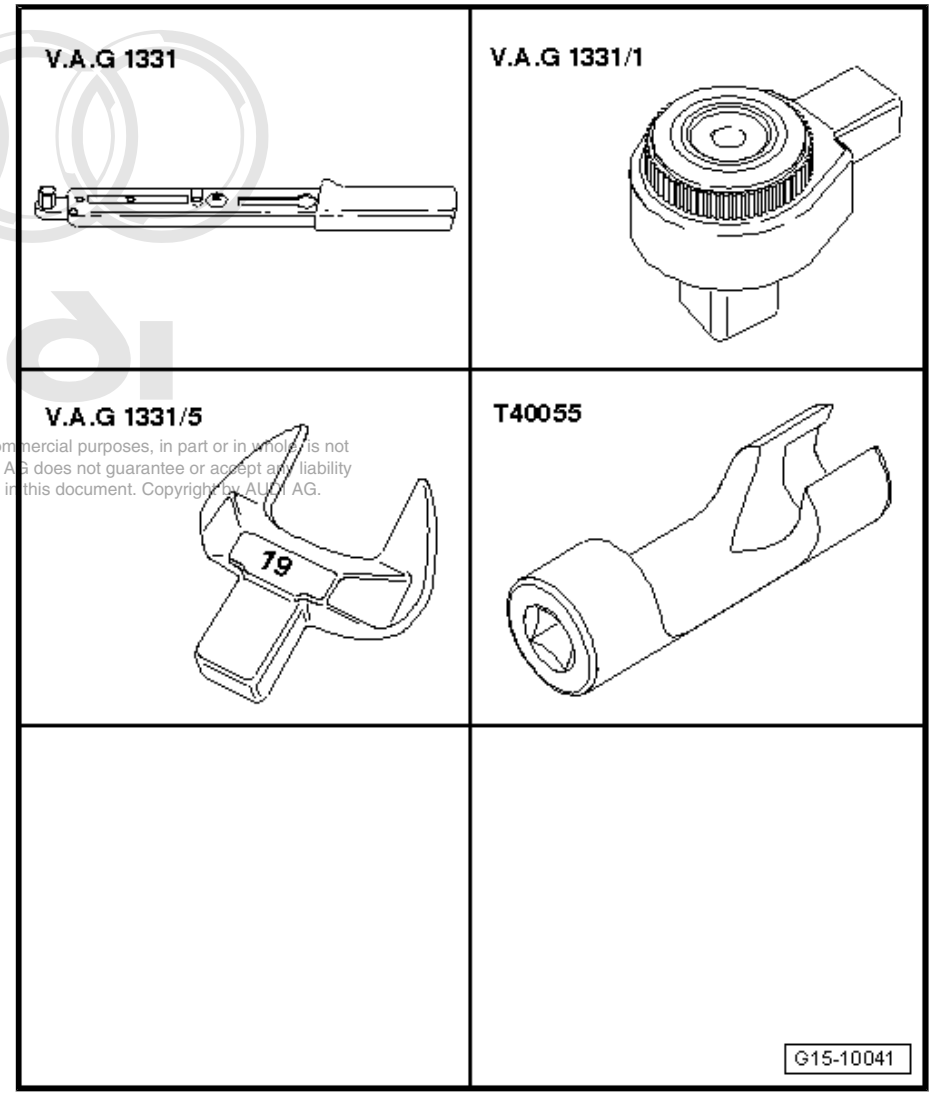
Note

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 fault memory. Then continue the road test.

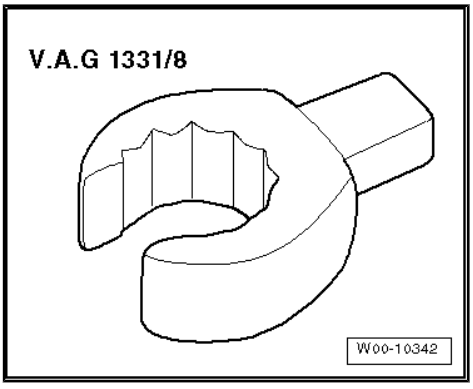
1.15 Removing and installing right-side intake manifold (bottom section) - vehicles from 10.2004 onwards

Special tools and workshop equipment required

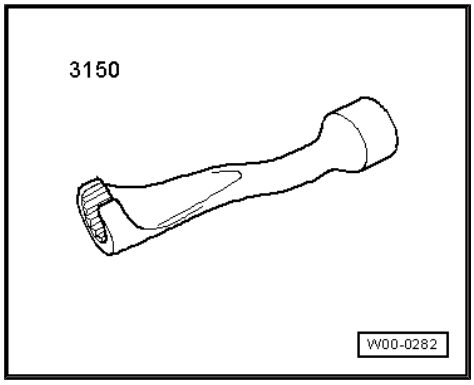
- Torque wrench - V.A.G 1331-
- Open end spanner insert, AF 19 - V.A.G 1331/5- (vehicles from 08.2005 onwards)
- Ratchet - V.A.G 1331/1-
- Socket - T40055- (17 mm), (vehicles from 08.2005 onwards)



- Socket insert AF 14, flared ring spanner - V.A.G 1331/8- (vehicles up to 08.2005)



♦ Socket, 14 mm - 3150- (vehicles up to 08.2005)



Removing

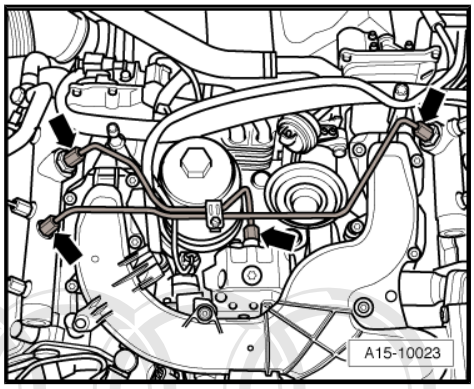
Caution

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

– Remove intake manifold (top section) ⇒ page 20 .

Vehicles up to 08.2005:

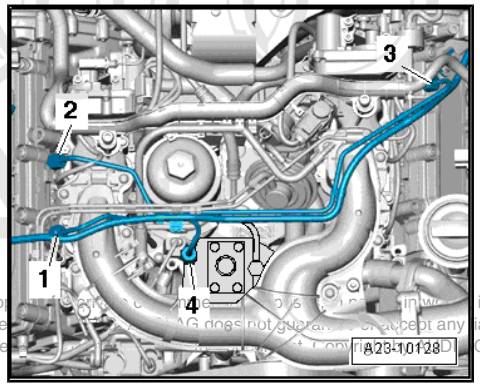
– Unscrew union nuts -arrows- and detach high-pressure pipes.



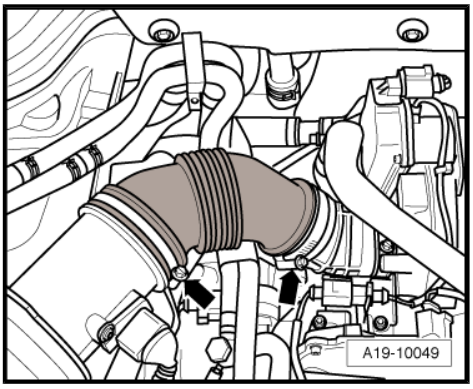
Vehicles from 08.2005 onwards:

– Unscrew union nuts -1 ... 4- and detach high-pressure pipes.

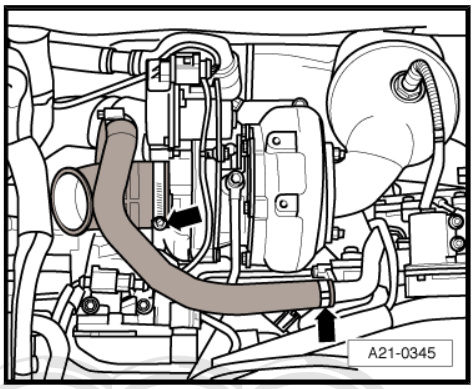
All vehicles:



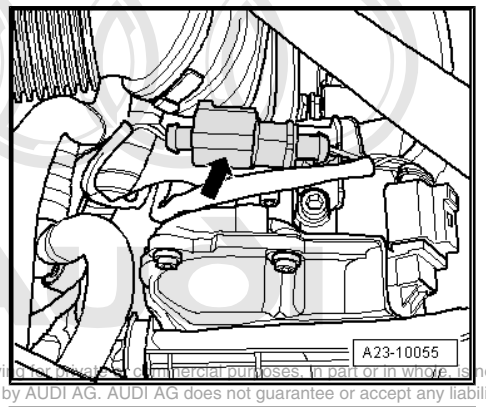
– Release hose clips -arrows- and remove air pipe between turbocharger and air mass meter - G70- .



– Remove air intake hose together with crankcase breather hose -arrows-.



– Take electrical connector -arrow- for exhaust gas temperature sender 1 - G235- out of bracket.
– Detach electrical connector -3- at intake manifold flap motor - V157- .

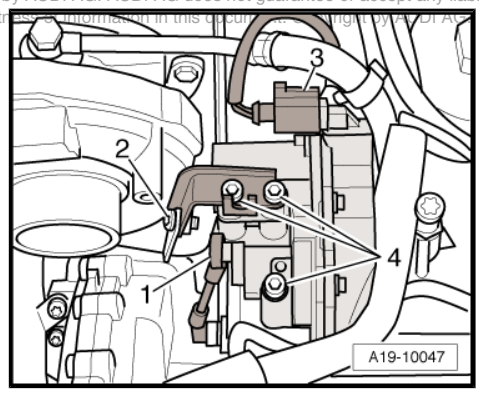


– Remove bolt -2-.

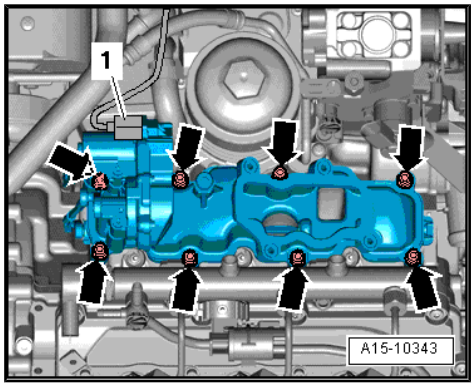
Note

Disregard items -1- and -4-.

– Unplug electrical connectors at glow plugs on cylinder bank (right-side).



– Remove bolts -arrows- and detach bottom section of intake manifold (right-side).



Note

- *Disregard -item 1-.*
- *Block off intake ports in cylinder head with clean rags.*

Installing

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

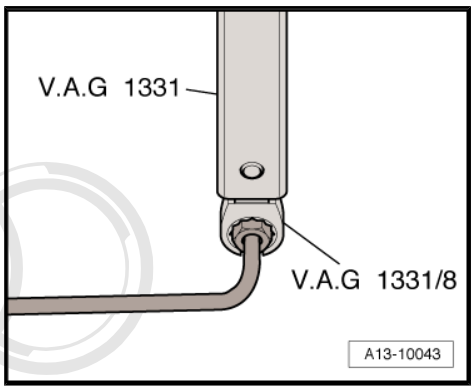
Note

Renew seals and gaskets.

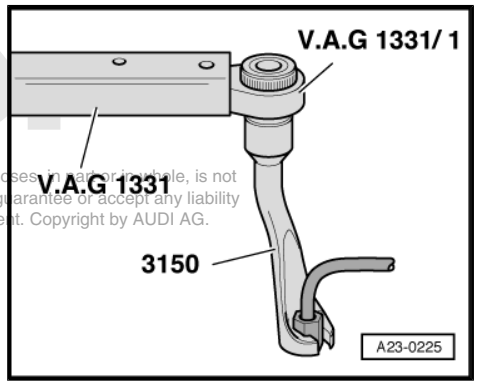
– Install intake manifold (top section) ⇒ page 20 .
– Tighten union nuts on high-pressure pipes hand-tight initially.
– Ensure that high-pressure pipes are not under tension.

Vehicles up to 08.2005:

– To tighten union of high-pressure pipe at high-pressure pump, use torque wrench - V.A.G 1331- with socket insert AF 14, flared ring spanner - V.A.G 1331/8- .

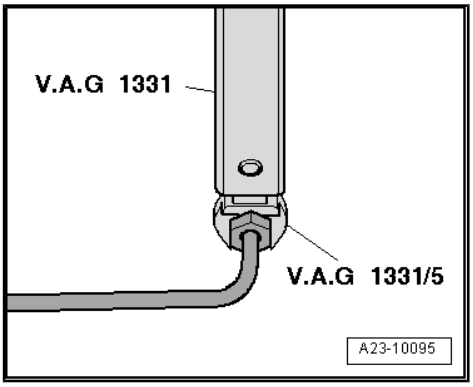


– To tighten unions of high-pressure pipes at rail elements, use torque wrench - V.A.G 1331- with ratchet - V.A.G 1331/1- and socket, 14 mm - 3150- .

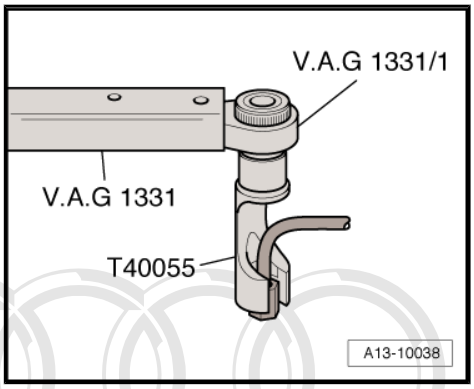


Vehicles from 08.2005 onwards:

– To tighten unions of high-pressure pipes at rail elements, use torque wrench - V.A.G 1331- with open end spanner insert - V.A.G 1331/5- .



– 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 socket - T40055- , 17 mm.



Tightening torques

Component	Nm
Intake manifold (bottom section) to cylinder head	9
High-pressure pipes	25

– Check fuel system for leaks.

Bleeding fuel system and checking for leaks

– Run engine at idling speed for several minutes and then switch off.

– Switch off ignition.

– Check the complete fuel system including all 6 return line connections for leaks.

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

Note

The return lines can only be renewed together with the pressure retention valve as one unit.

– After completing the repair, road-test the vehicle over a distance of at least 20 km. Accelerate with full throttle at least once. Then inspect 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 fault memory. Then continue the road test.

1.16 Removing and installing intake manifold flap motor - V157- or intake manifold flap 2 motor - V275-

Special tools and workshop equipment required

♦ Tester - VAS 6395/1-

♦ Connection lead - VAS 6395/4-2-

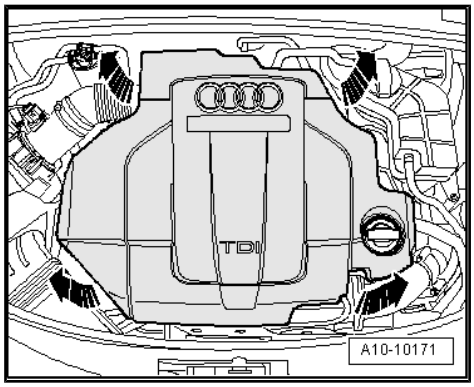
Removing

Note

In the following the procedures for removing and installing are described for the intake manifold flap motor - V157- for cylinder bank 1 (right-side). The procedure for the intake manifold flap 2 motor - V275- is basically the same.

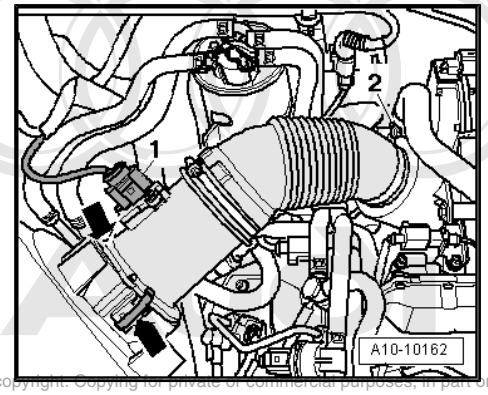
Proceed as follows:

– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



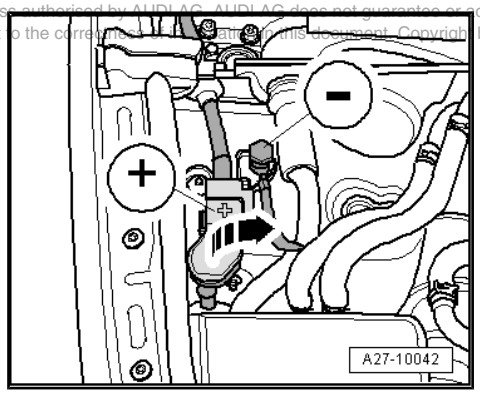
– Unplug electrical connector -1- at air mass meter - G70- .

– Remove air intake hose. To do so, release hose clip -2- and clamps -arrows-.



– Open cover -arrow- above positive terminal.

– Connect tester - VAS 6395/1- with connection lead - VAS 6395/4-2- to positive terminal “+” and negative terminal “–”.

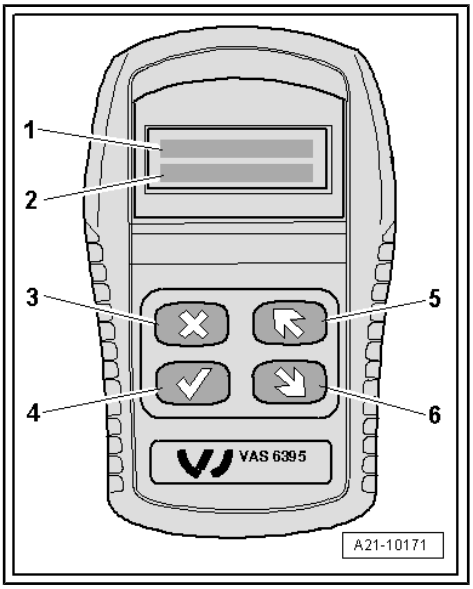


Checking software version of tester - VAS 6395/1- :

Caution

Risk of damage to intake manifold flap motor.

- *Before continuing, check whether the correct software version is loaded in the tester - VAS 6395/1- . To do so, proceed as follows:*



Display on -VAS 6395/1- (2 seconds after connecting to power supply) if correct software version is loaded:

1 - >TEST

2 - LEARN

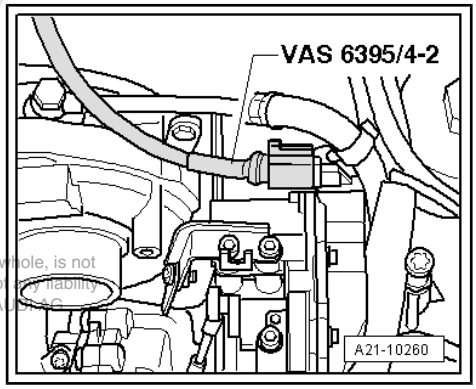
Note

- *If the following appears on the display, an incorrect software version has been loaded:*
- *1. START*
- *2. NEXT*
- *If this is the case, download the correct software version from the "Audi ServiceNet" under "Workshop Equipment".*

Continuation of procedure:

– Unplug electrical connector for intake manifold flap motor - V157- .

– Connect connecting wire - VAS 6395/4-2- to intake manifold flap motor - V157- and tester - VAS 6395/1- .

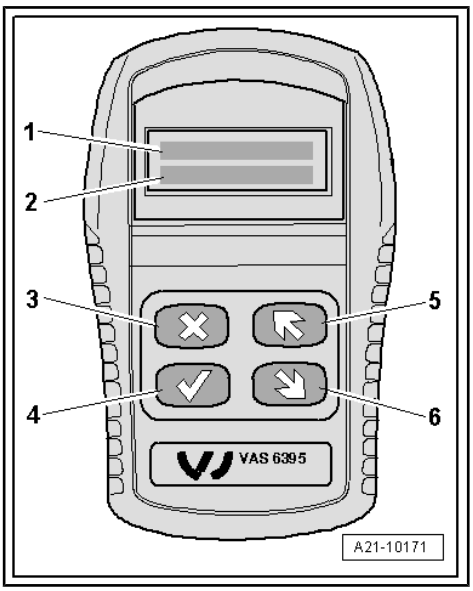


Display on -VAS 6395/1- :

1 - >TEST

2 - LEARN

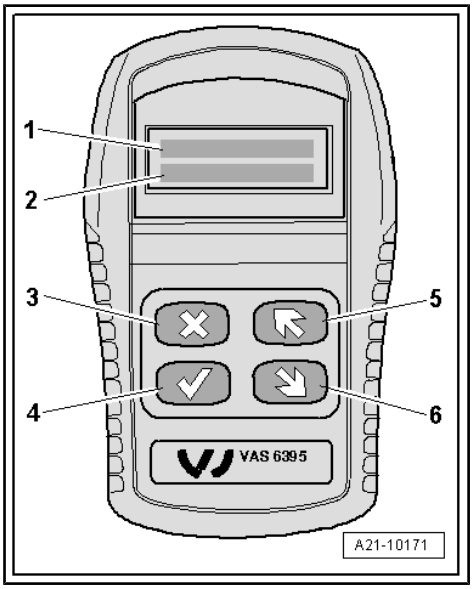
– To continue, press V button -item 4-.



Display on -VAS 6395/1- :

1 - CHECK

2 - S: XX % I: XX %



Note

- *S means specified value*
- *I means actual value*

- The tester - VAS 6395/1- runs through the adjustment range of the intake manifold flap motor - V157- and checks the feedback of the positions.

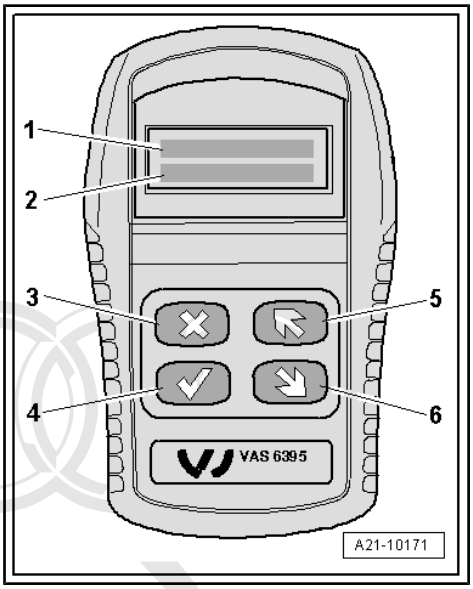
Display on -VAS 6395/1- if intake manifold flap motor is OK:

1 - ACTUATOR OK

- The test is completed.

– Unplug electrical connectors for tester - VAS 6395/1- .

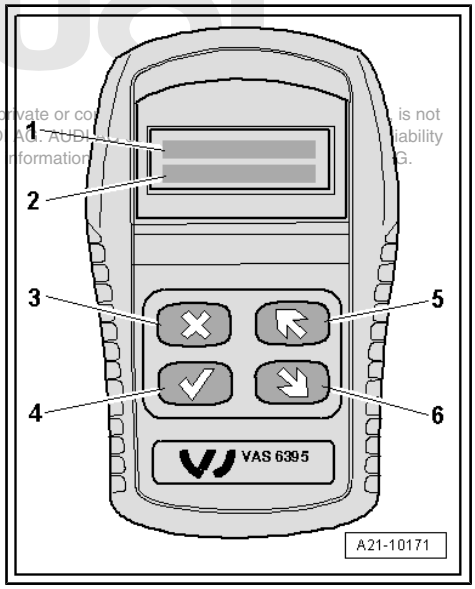
Assemble in reverse order.



Display on -VAS 6395/1- if intake manifold flap motor is not OK:

1 - PROBLEM

- Intake manifold flap motor - V157- must be renewed.



– To do so, proceed as follows:

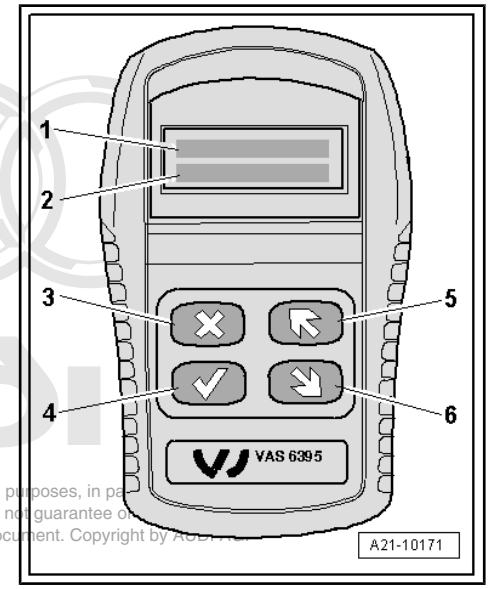
– To continue, press [V] button -item 4-.

Display on -VAS 6395/1- :

1 - >TEST

2 - LEARN

– Press [↓] button -item 6-.

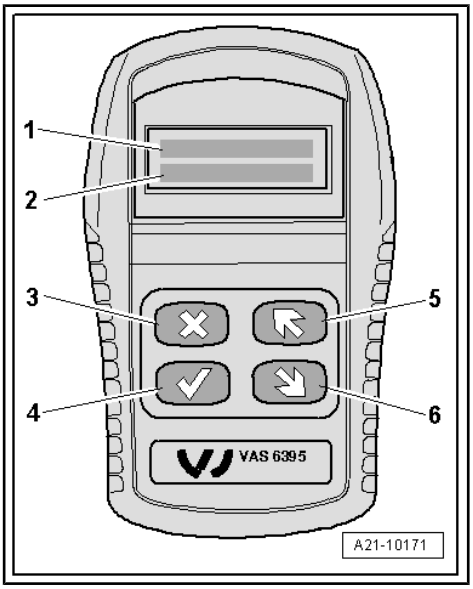


Display on -VAS 6395/1- :

1 - TEST

2 - >LEARN

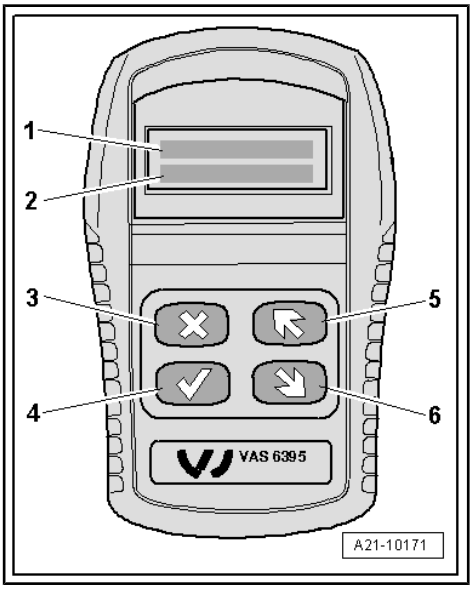
– To continue, press [V] button -item 4-.



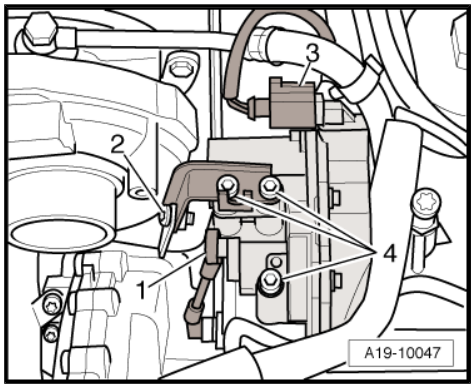
Display on -VAS 6395/1- :

1 - STEP 1

– By pressing buttons [↑] -item 5- and [↓] -item 6-, adjust intake manifold flap motor - V157- in such a way that coupling rod can be accessed easily for removal.



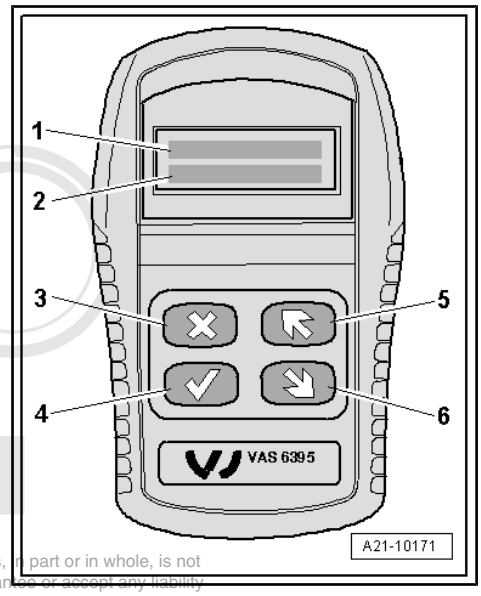
– Unclip coupling rod -1- from intake manifold flap motor - V157- .



Note

Disregard items -2, 3 and 4-.

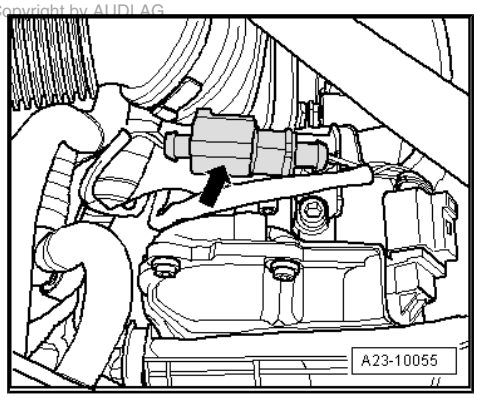
– To continue, press [V] button -item 4-.



Display on -VAS 6395/1- :

1 - STEP 2

– If fitted, take electrical connector -arrow- from intake manifold flap motor - V157- out of bracket.



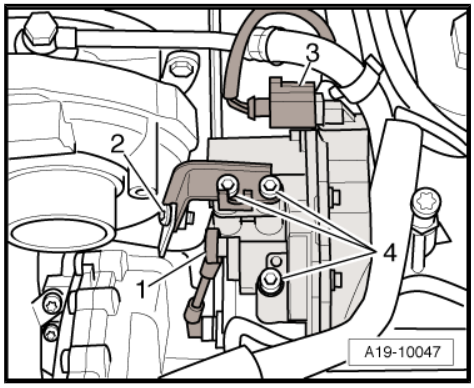
– Disconnect connecting wire - VAS 6395/4-2- -item 3- from intake manifold flap motor - V157- .

Caution

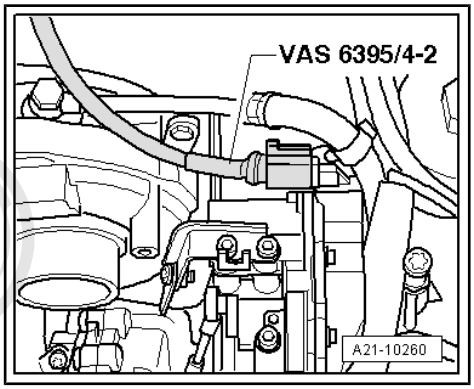
Power supply for tester - VAS 6395/1- must remain connected.

– Remove bolts -2- and -4-.

– Detach and dispose of old intake manifold flap motor - V157- .



– Install new intake manifold flap motor - V157- in reverse order of removal and clip coupling rod on.



Note

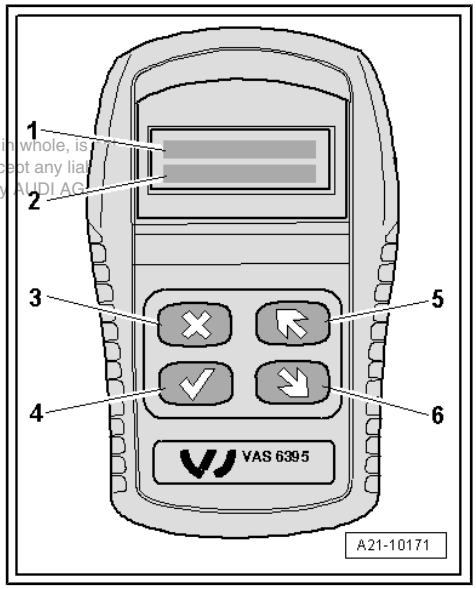
On version with thread-forming bolt, proceed as follows: Fit and screw in bolt by hand so that it is screwed into old thread. Then tighten bolts to torque.

– Connect connecting wire - VAS 6395/4-2- to intake manifold flap motor - V157- .

– To confirm that a new intake manifold flap motor - V157- has been installed, press V button -item 4-.

Display on -VAS 6395/1- :

1 - STEP 3

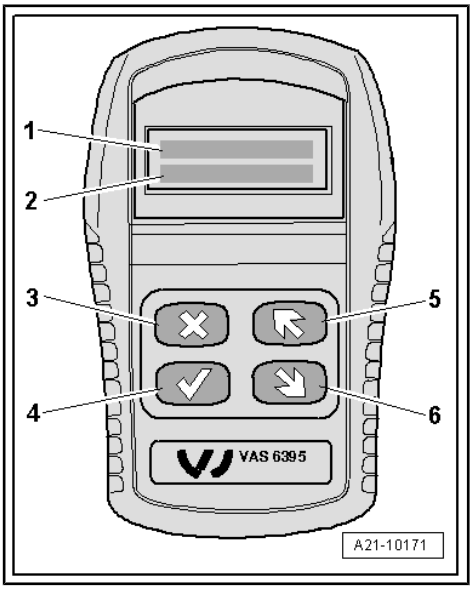


– To continue, press V button -item 4-.

Display on -VAS 6395/1- :

1 - WARNING

2 - LEARNING



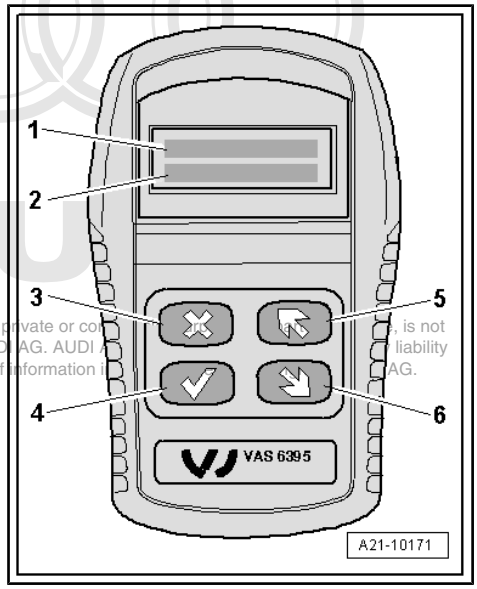
– To continue, press [V] button -item 4-.

Display on -VAS 6395/1- :

1 - TEST 1

2 - S: 84.0 % I: XX %

• Specification = 84 %



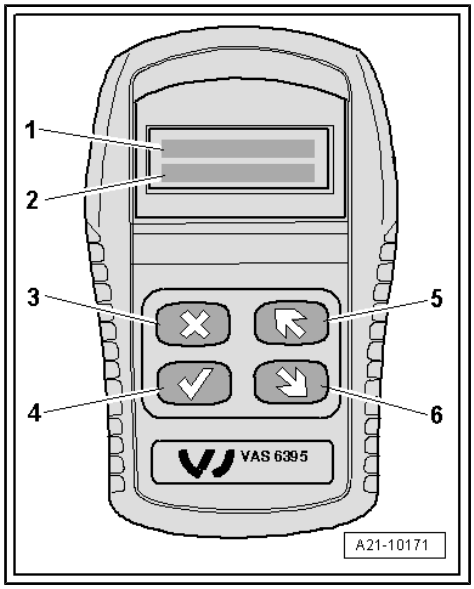
– To continue, press [V] button -item 4-.

Display on -VAS 6395/1- :

1 - TEST 2

2 - S: 16.0 % I: XX %

• Specification = 16 %



– To continue, press [V] button -item 4-.

Display on -VAS 6395/1- :

1 - TEST 3

2 - S: XX % I: XX %

• Adjustment range of intake manifold flap motor - V157- is checked.

Display on -VAS 6395/1- :

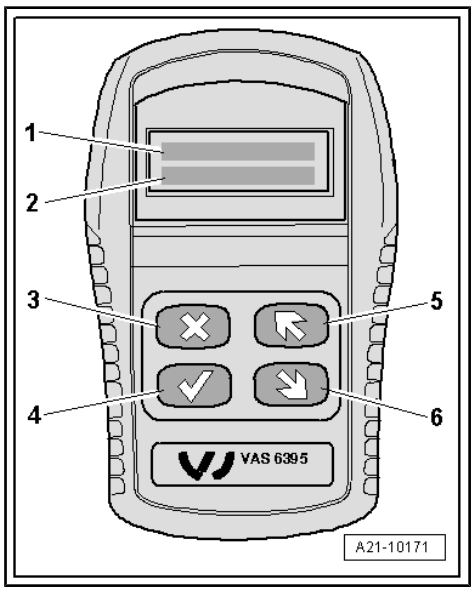
1 - OK

– To confirm, press [V] button -item 4-.

• Adjustment is completed.

– Unplug electrical connectors for tester - VAS 6395/1- .

Assemble in reverse order.



1.17 Checking injectors

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

- ⇒ “1.18 Adaption of injector delivery calibration values and injector voltage calibration values”, page 43 .
- ⇒ “1.19 Checking for injectors sticking open (piezo injectors)”, page 44
- ⇒ “1.20 Measuring return flow rate of injectors with engine running”, page 46
- ⇒ “1.21 Checking return flow rate of injectors at starter cranking speed”, page 49

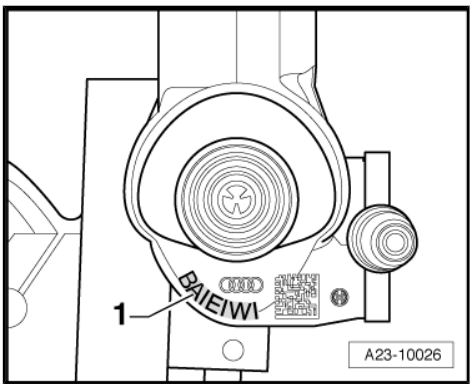
Perform the following tests first if the engine does not start at all:

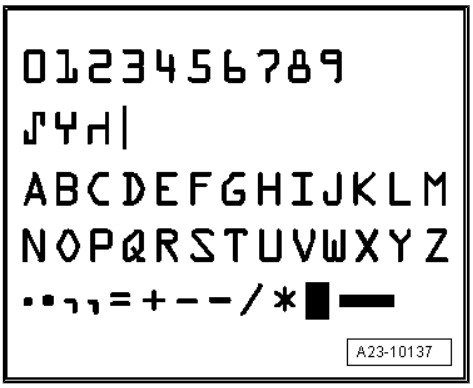
- ⇒ “1.19 Checking for injectors sticking open (piezo injectors)”, page 44
- ⇒ “1.21 Checking return flow rate of injectors at starter cranking speed”, page 49
- ⇒ “1.34 Checking fuel pressure regulating valve N276 ”, page 93

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

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.

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).





Reference table for reading out letters and/or numbers on each injector

After replacement of an injector, the “injector delivery calibration value” and “injector voltage calibration value” for the new injector must be written into the engine control unit.

After replacement of the engine control unit, the “injector delivery calibration values” and “injector voltage calibration values” for the injectors must be written into the new engine control unit.

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

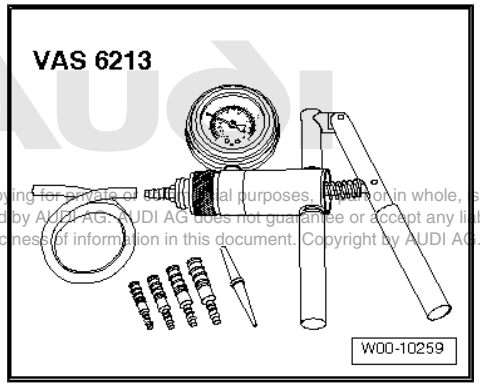
Additionally, check that the “injector delivery calibration values” with “injector voltage calibration values” are correctly entered for all the other injectors. Do NOT attempt to re-enter these calibration values if the correct values are already stored in the engine control unit.

1.19 Checking for injectors sticking open (piezo injectors)

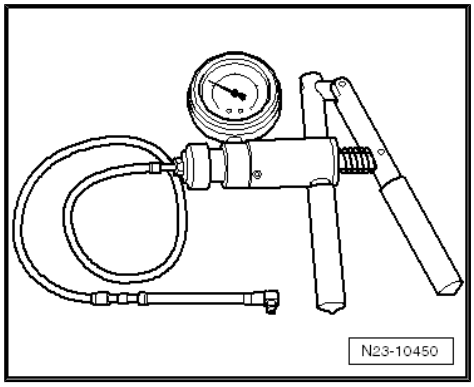
If one of the injectors is sticking open, this means that the injector needle is not closing fully and fuel escapes into the cylinder.

Special tools and workshop equipment required

- Hand vacuum pump - VAS 6213-



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



Procedure

– Pull off engine cover panel ⇒ page 14 .

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

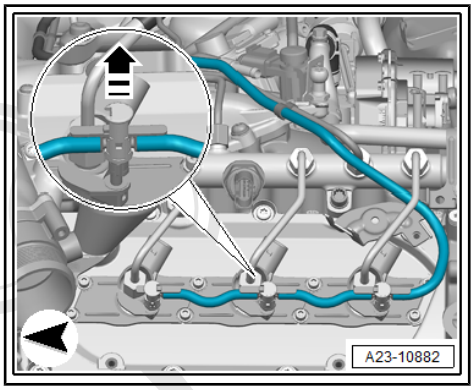
WARNING

- *Always read instructions on ⇒ page 2 when working on injectors.*
- *Follow these instructions before starting work and while working on the fuel system.*

Check all cylinders in turn.

Starting with cylinder 1

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



Note

Illustration shows cylinder bank 1.

– 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 52 .

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.

– Press the return lines firmly onto the injectors from above so that they engage audibly on each injector. Then re-fit the retaining clips. Check that the return lines are seated securely by pulling them by hand from above.

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.

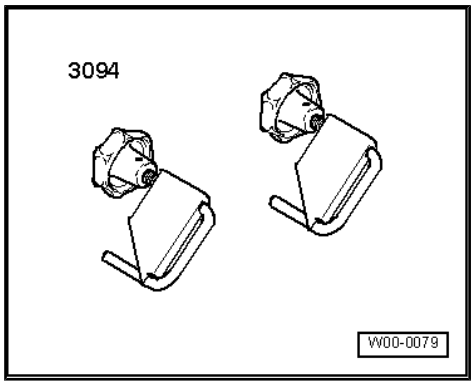
– Install engine cover panel ⇒ page 14 .

1.20 Measuring return flow rate of injectors with engine running

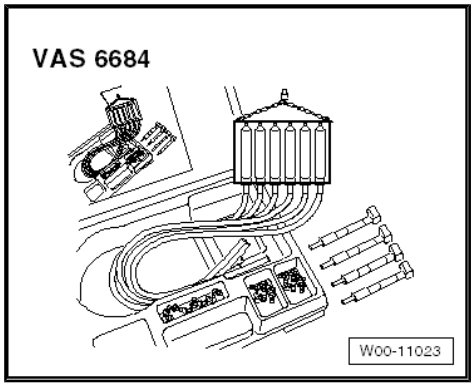
Checking return flow rate if engine does not start ⇒ page 49

Special tools and workshop equipment required

- Fuel-resistant measuring container
- Hose clamps, up to 25 mm - 3094-



- Return flow meter - VAS 6684-



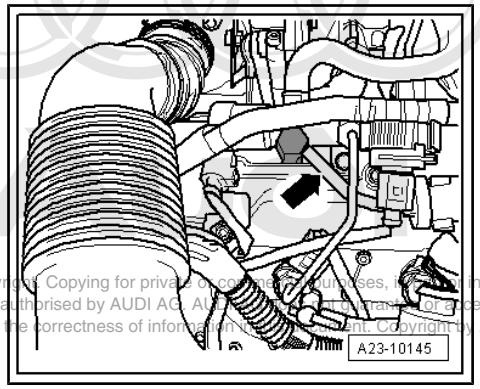
Checking return flow rate of all 6 injectors

– Remove engine cover panel ⇒ page 14 .

WARNING

- *Always read instructions on ⇒ page 2 when working on injectors.*
- *Follow these instructions before starting work and while working on the fuel system.*

– Disconnect hose connection -arrow- at banjo bolt connection.



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

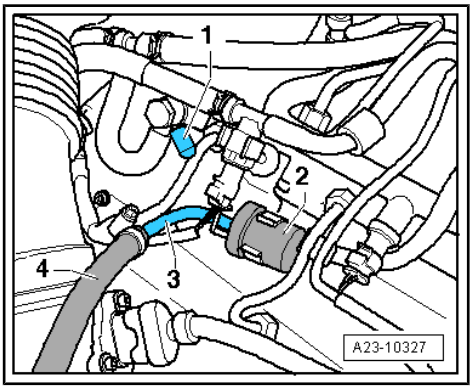
– Hold end of this hose -3- (lengthen with hose -4- if necessary) in a suitable container to measure total return flow rate.

– Start engine and let it idle for 2 minutes.

• Specification for 2 minutes: 0 ml to 50 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.

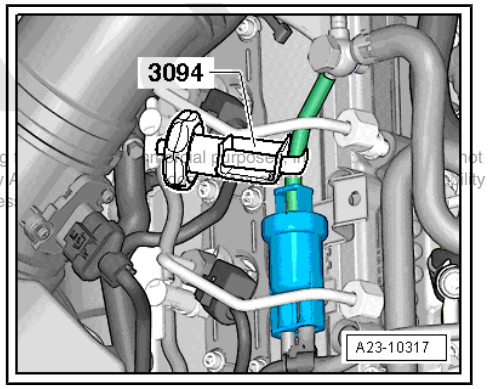
Checking return flow rate of individual injectors

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.

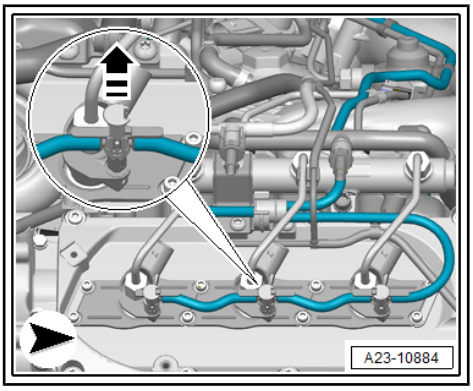
– Clean all return line connections (with commercial cleaning solution etc.) before removing.

– Dry all components after cleaning.

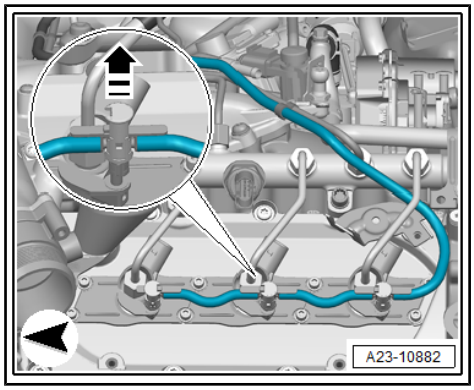
– Clamp off fuel return line downstream of pressure retention valve using hose clamp up to 25 mm - 3094- .



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



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



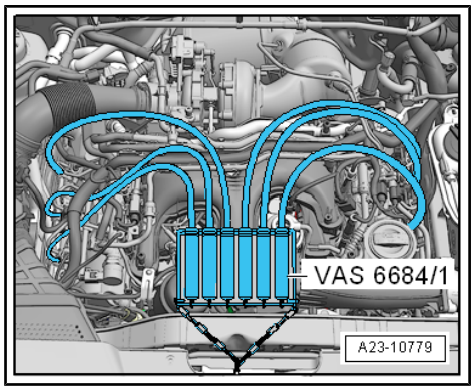
– Connect hoses of return flow meter - VAS 6684- to return line connections of all six injectors.

– Start engine and let it idle for several minutes.

Caution

Risk of damage to injectors due to increased engine speed.

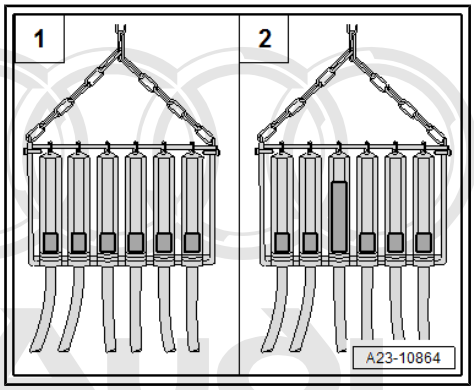
- ***Do NOT press the accelerator during this test; the engine must only run at idling speed.***



– When the engine is warm and running at idling speed, the return flow rates at each of the 6 return lines must not differ by more than a small amount.

Evaluating return flow rate:

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

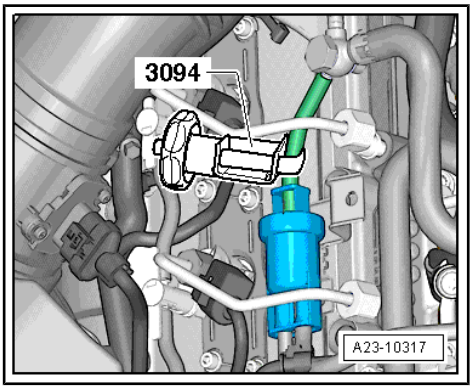


Note

There is a mechanical fault at the injector if the return flow rate is greater than three times the volume of the smallest measured return flow rate.

– If one injector has a significantly higher return flow rate than the others it must be renewed ⇒ page 52 .

– 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.

– Press the return lines firmly onto the injectors from above so that they engage audibly on each injector. Then re-fit the retaining clips. Check that the return lines are seated securely by pulling them by hand from above.

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

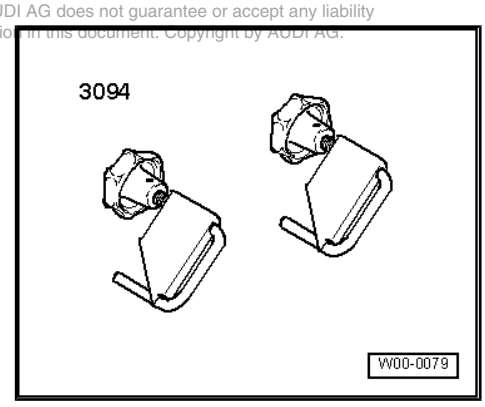
If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the fault memory. Then continue the road test.

1.21 Checking return flow rate of injectors at starter cranking speed

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

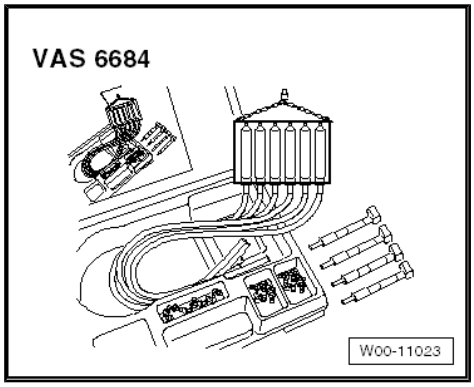
Special tools and workshop equipment required

♦ Hose clamps, up to 25 mm - 3094-



♦ Return flow meter - VAS 6684-

- 6 lengths of hose to fit return line connections on injectors



WARNING

- *Always read instructions on ⇒ page 2 when working on injectors.*
- *Follow these instructions before starting work and while working on the fuel system.*

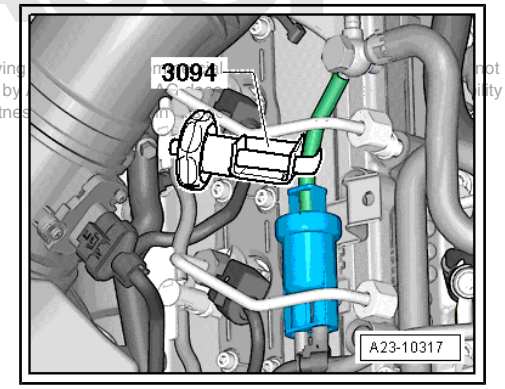
Procedure

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.

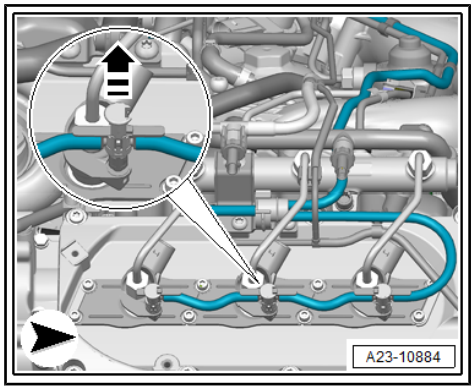
– Remove engine cover panel ⇒ page 14 .

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

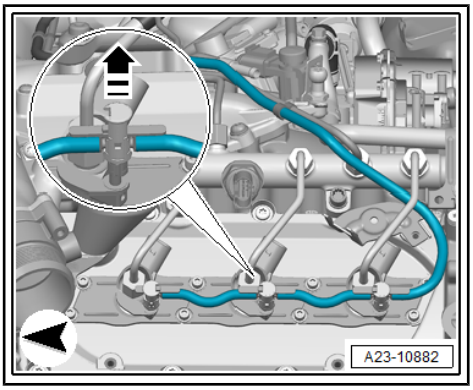
– Clamp off fuel return line downstream of pressure retention valve using hose clamp up to 25 mm - 3094- .



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



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

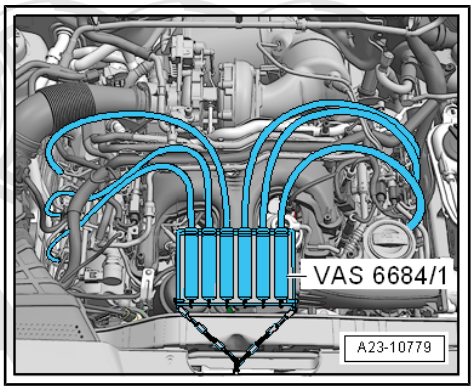


– Connect hoses of return flow meter - VAS 6684- to return line connections of all six injectors.

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

♦ Specification of return flow rate: 0 ml

– If fuel comes out of one injector, that injector must be renewed ⇒ page 52 .



Installing fuel return lines

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

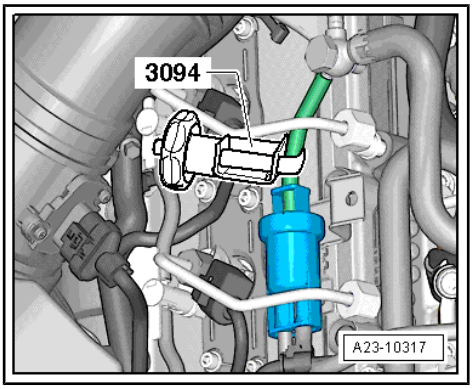
If O-ring is damaged or deformed, renew O-ring.

Note

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

– Press the return lines firmly onto the injectors from above so that they engage audibly on each injector. Then re-fit the retaining clips. Check that the return lines are seated securely by pulling them by hand from above.

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



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.

1.22 Checking pressure retention valve in fuel return line

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.

Special tools and workshop equipment required

- Tester for fuel return system - 6330-

WARNING

- *Always read rules for cleanliness and instructions for working on fuel system ⇒ page 2 .*
- *Follow these instructions and rules for cleanliness before starting work and while working on the fuel system.*

– Remove engine cover panel ⇒ page 14 .

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

– Dry return line connection on cylinder 1.

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

– Pull return line connection off 1st cylinder; 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.

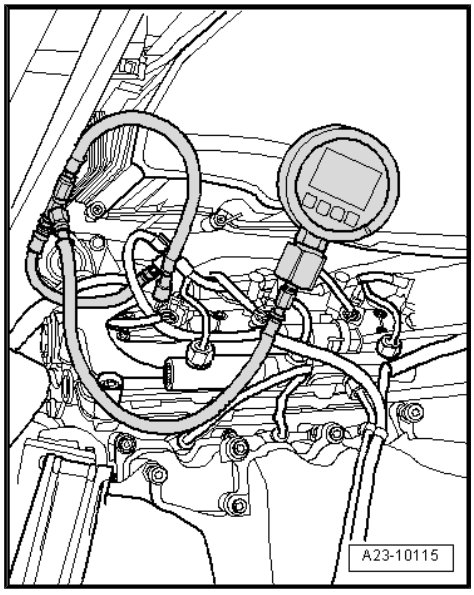
– Connect tester for fuel return system - 6330- between return line connection on injector and return line.

– Start engine.

– Check pressure indicated on tester.

- Specification: approx. 10 bar

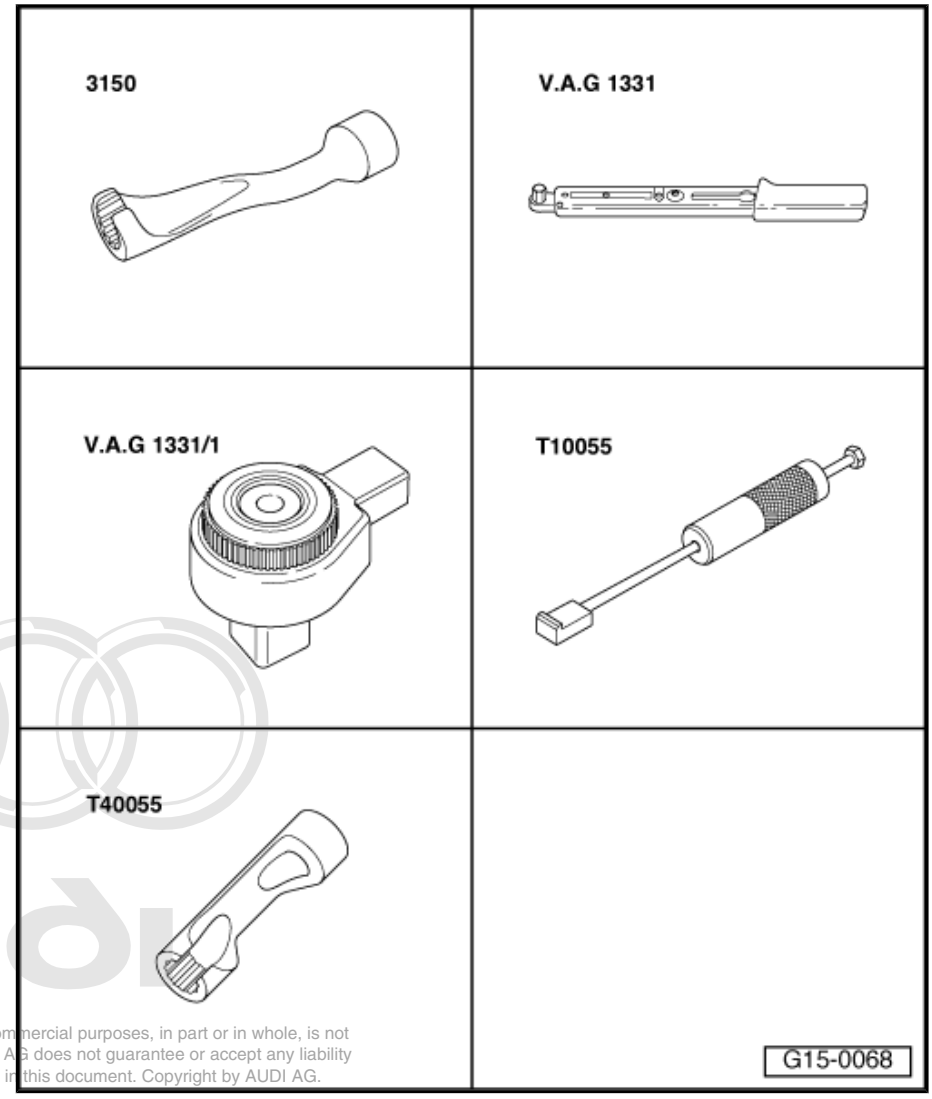
If the value does not match the specification, fit a new pressure retention valve.



1.23 Removing and installing injectors

Special tools and workshop equipment required

- Socket, 14 mm - 3150-
- Torque wrench - V.A.G 1331-
- Ratchet - V.A.G 1331/1-
- Puller - T10055- with adapter - T10055/1-
- Socket, 17 mm - T40055-
- Open end spanner insert, AF 19 - V.A.G 1331/5-
- Cleaning kit - VAS 6811-



Removing

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.

When a new injector is installed, the adaption value for the new injector must be written into the engine control unit. ⇒ page 43

Note

The following description shows the removal and installation of the injectors on cylinder bank 2 (left-side). The procedure for cylinder bank 1 is the same, except that some steps are not required.

– Remove engine cover panel ⇒ page 14 .

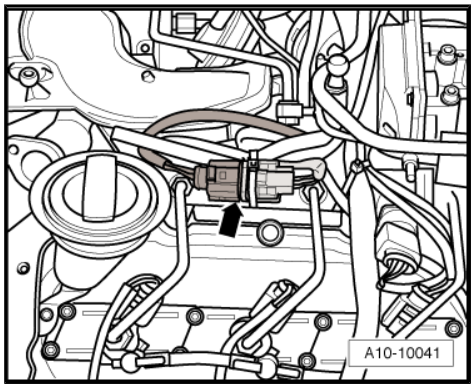
WARNING

Mark cylinder numbers on injector units.

Observe rules for cleanliness when working on the injection system.

Plug open connections with suitable sealing caps immediately.

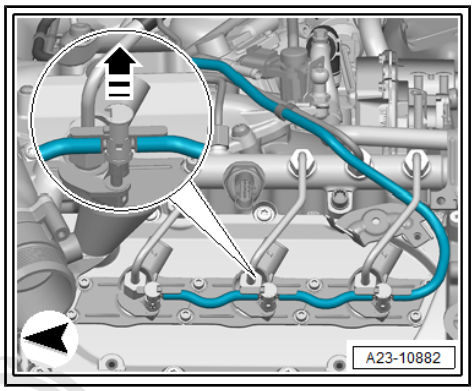
– Step required only for cylinder bank 2: Open cable tie securing electrical connector -arrow- for Lambda probe - G39- .



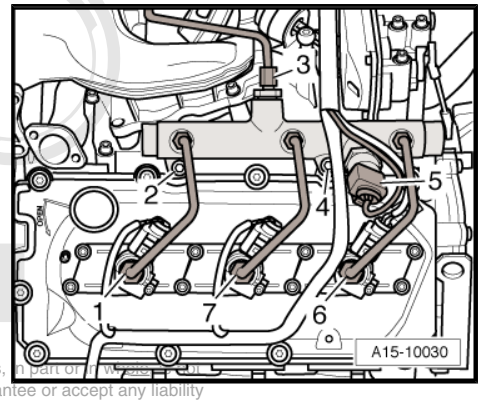
Note

Step required only for cylinder bank 1: Remove top section of air cleaner with air mass meter ⇒ page 16 .

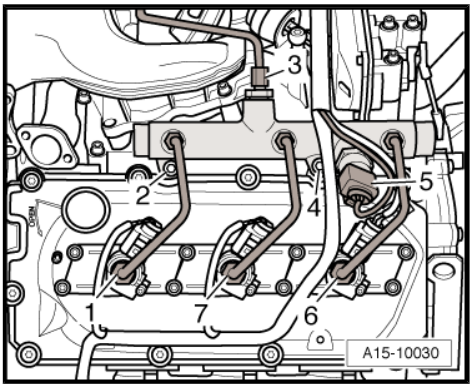
– Pull return line connections off injectors; to do so, press both tabs down and at the same time pull centre piece up to release connection -arrow-.
– Detach electrical connectors at injectors which are to be removed.



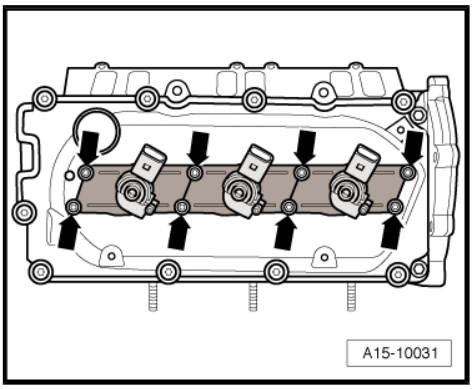
– Loosen union nuts for injector pipes -1-, -6- and -7- at injectors.



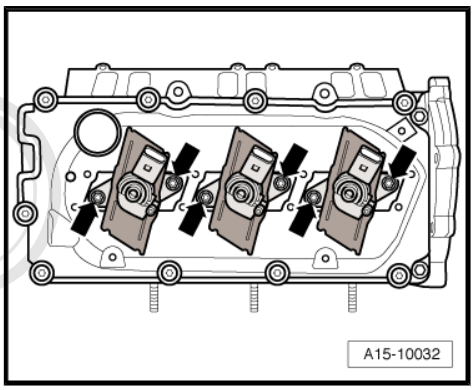
– Loosen union nuts for injector pipes -1-, -6- and -7- at rail element.



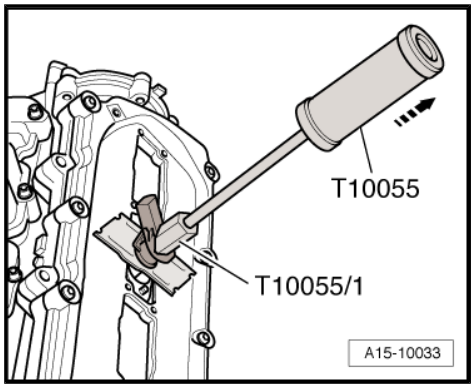
– Unbolt covers for injectors -arrows-.
– Pull covers upwards and turn them $^{1}/_{4}$ turn (90°).



– Unbolt clamping pieces for injectors -arrows-.



– Pull out injectors using puller - T10055- with adapter - T10055/1- .
– After removal, lay injectors on a clean cloth.



Important instructions for installing injectors:

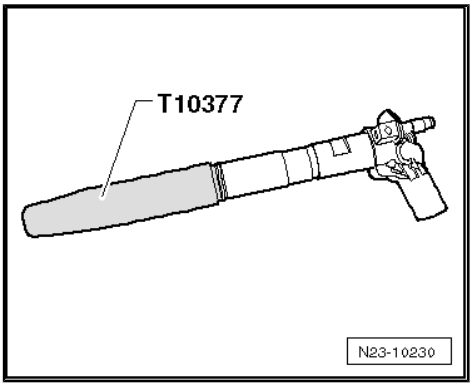
- Clamping piece
- Copper seal
- O-ring for injector bore
- O-ring for fuel return line connection

If a used injector is being re-installed:

– Spray tip of injector nozzle with rust-releasing spray. Wait approx. 5 minutes and wipe off soot particles and oil with a cloth.
– To remove the old copper seal from the injector, clamp the seal carefully in a vice so that it is just held between the jaws without turning. Then carefully pull and twist the injector out of the copper seal by hand.
– Clean off deposits under the copper seal using a suitable scraper.
– Clean off deposits under the copper seal using a suitable scraper.

– Renew seal for injector using assembly sleeve - T10377- .

– To prevent damage to the new O-ring, lubricate it with oil and carefully push it onto the fuel return line connection.



Continued (same procedure for used and new injectors):

Note

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

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 high-pressure pipes and injector pipes hand-tight to start with.

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

– Tighten union nuts to 25 Nm.

– 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 engine control unit ⇒ page 43 .

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

Bleeding fuel system and checking for leaks

– Run engine at idling speed for several minutes 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 6 return line connections for leaks (the fuel return lines can only be renewed together with the pressure retention valve as one unit).

Renew the affected component if leakage still occurs after tightening to the 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.

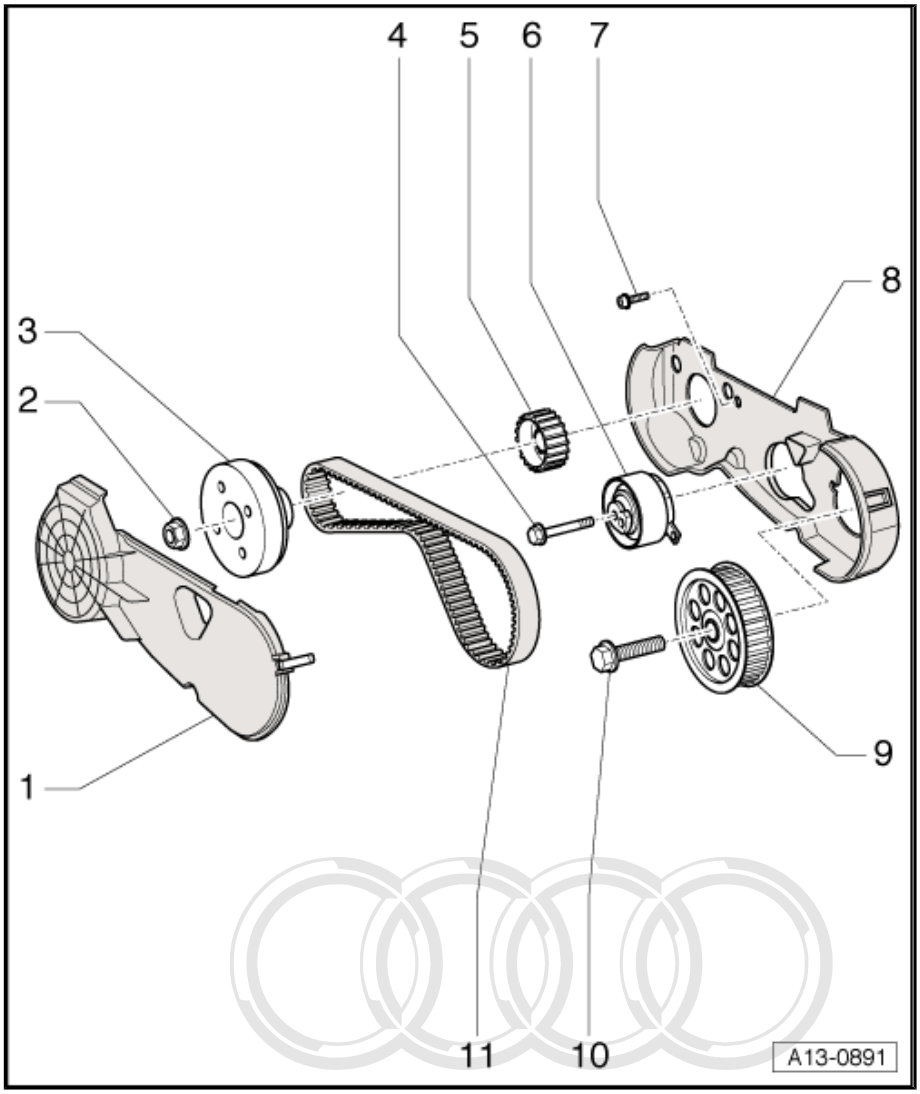
Note

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 fault memory. Then continue the road test.

Tightening torques

Component		Nm
Injector in cylinder head		10
Cover for injector to cylinder head		5
Rail element to cylinder head		22
High-pressure pipes and injector pipes		25
Bracket for intake connecting pipe to cylinder head		9
Intake connecting pipe	Intake manifold	9
to:	Bracket	9
Hose clips for air intake hose (13 mm wide)		5.5

1.24 Exploded view - toothed belt for high-pressure pump



1 - Toothed belt cover (front)

- ❑ Engage in position at the bottom at clip on at the side

2 - Nut

- ❑ 70 Nm
- ❑ Use counterhold tool - 3036- when loosening and tightening ⇒ page 60

3 - Damper weight

- ❑ Use counterhold tool - 3036- when loosening and tightening central nut ⇒ page 60

4 - Bolt

- ❑ 23 Nm

5 - Toothed belt sprocket for high-pressure pump

- ❑ Remove using puller - T40064- ⇒ page 60

6 - Toothed belt tensioning roller

7 - Bolt

- ❑ 9 Nm

8 - Toothed belt cover (rear)

9 - Toothed belt drive sprocket

- ❑ Use counterhold tool - 3036- when loosening and tightening central bolt ⇒ page 60
- ❑ Pulling off: up to 03.2006 ⇒ page 60 , from 03.2006 onwards ⇒ page 61

10 - Bolt

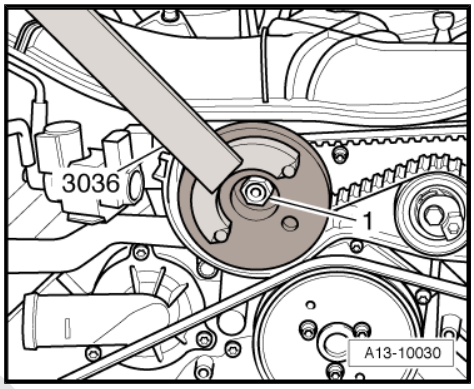
- ❑ 75 Nm
- ❑ With washer
- ❑ Use counterhold tool - 3036- when loosening and tightening ⇒ page 60

11 - Toothed belt for high-pressure pump

- ❑ Before removing, mark direction of rotation with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.
- ❑ Check for wear
- ❑ Removing and installing: vehicles up to 03.2006 ⇒ page 61 ; vehicles from 03.2006 onwards ⇒ page 65

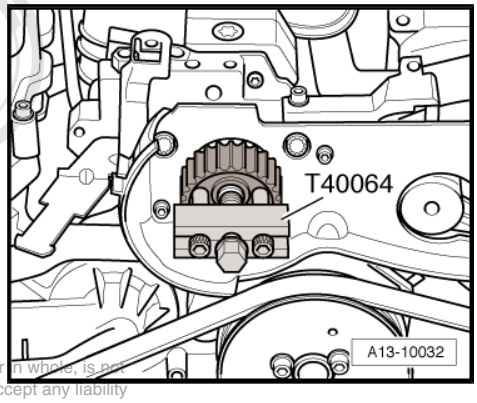
Loosening and tightening central nut for high-pressure pump

– Use counterhold tool - 3036- when loosening and tightening central nut -1-.



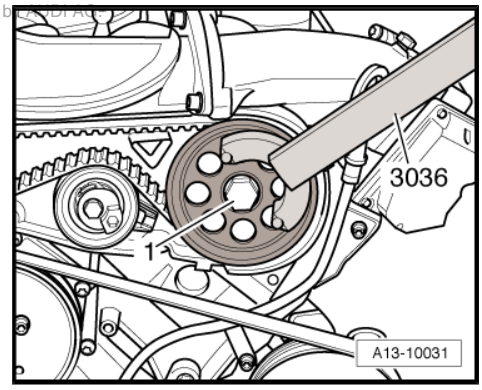
Pulling off toothed belt sprocket for high-pressure pump

– Use puller - T40064- to pull off belt sprocket for high-pressure pump.



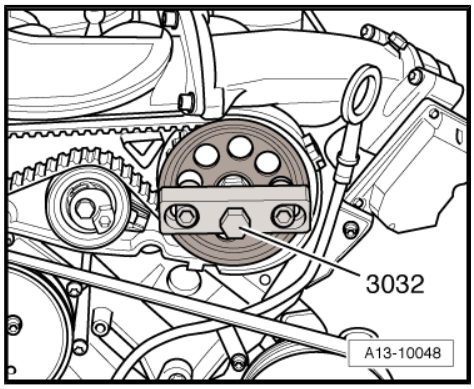
Loosening and tightening central bolt for toothed belt drive sprocket

– Use counterhold tool - 3036- when loosening and tightening central bolt -1-.



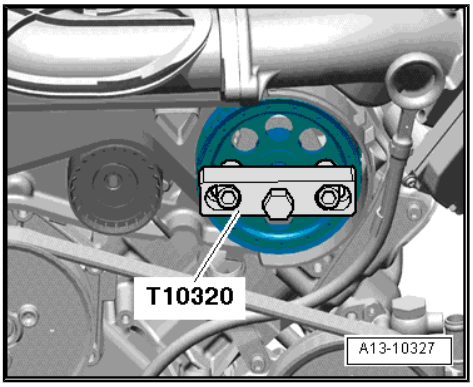
Pulling off toothed belt drive sprocket (versions up to 03.2006)

– Use puller - 3032- to pull off toothed belt drive sprocket.



Pulling off toothed belt drive sprocket (versions from 03.2006 onwards)

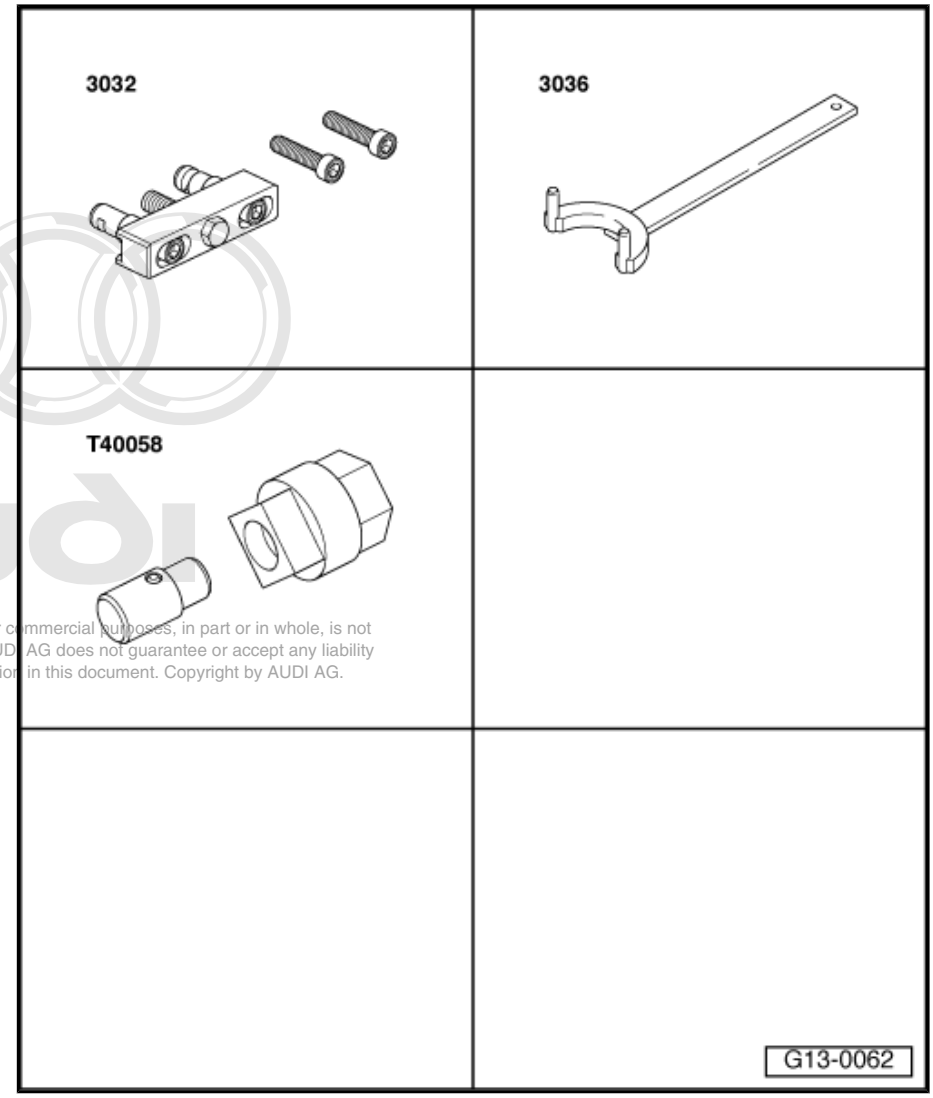
– Use puller - T10320- to pull off toothed belt drive sprocket.



1.25 Removing and installing toothed belt for high-pressure pump - vehicles up to 03.2006

Special tools and workshop equipment required

- Puller - 3032-
- Counterhold tool - 3036-
- Adapter - T40058-

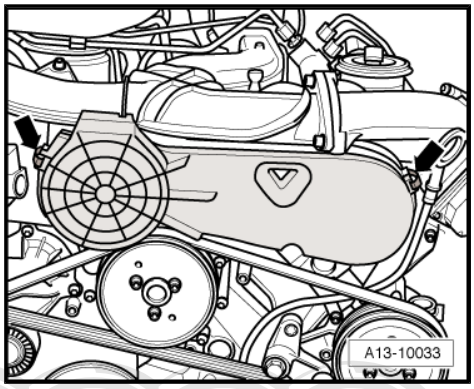


Removing

– Move lock carrier to service position ⇒ Rep. gr. 50 .

– Loosen clamps -arrows-.

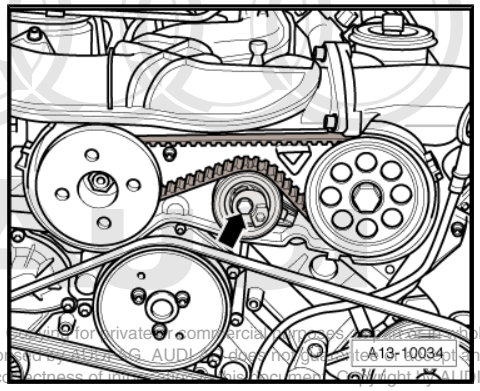
– Pivot toothed belt cover forward and disengage retaining pegs on bottom side of toothed belt cover.



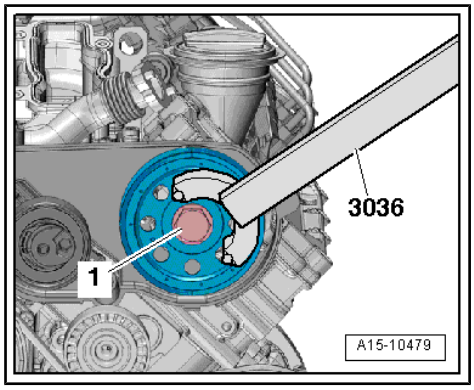
Note

Before removing, mark rotation direction of toothed belt with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

– Loosen bolt -arrow- for toothed belt tensioning roller approx. 2 turns.

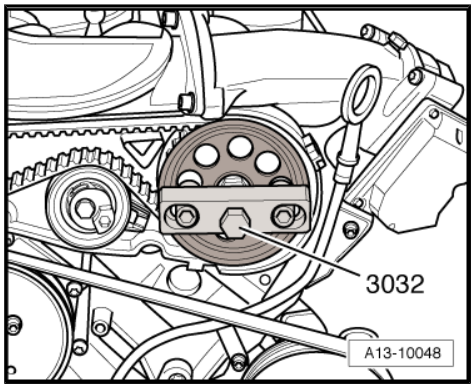


– Loosen central bolt -1- for toothed belt drive sprocket approx. 2 turns using counterhold tool - 3036- .



– Use puller - 3032- to pull off toothed belt drive sprocket.

– Take off drive sprocket together with toothed belt.



Installing

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

– Check installation position of toothed belt tensioning roller:

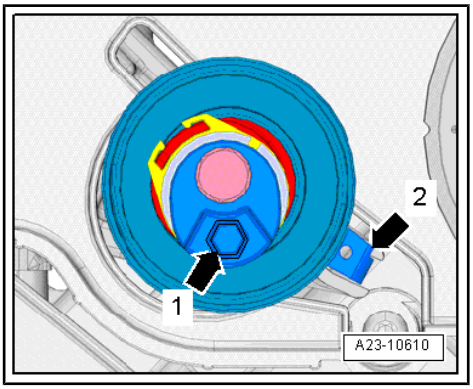
• Retaining lug -arrow 2- must engage in slot on bracket for high-pressure pump.

• Tensioning roller must be slack and hexagon socket -arrow 1- must face downwards.

– Fit toothed belt together with toothed belt drive sprocket.

– Install toothed belt tensioning roller; to do so, screw in bolt for toothed belt tensioning roller without applying force until eccentric adjuster of toothed belt tensioning roller can just still be turned without axial movement.

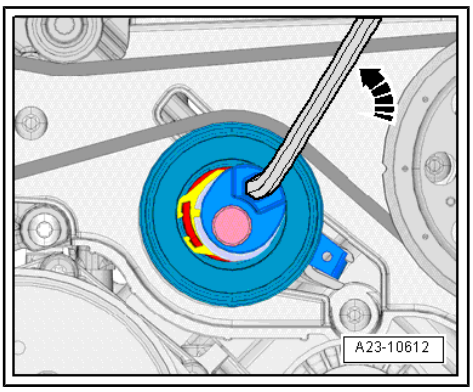
– Screw in bolt for toothed belt drive sprocket until toothed belt drive sprocket can just still be turned without axial movement.



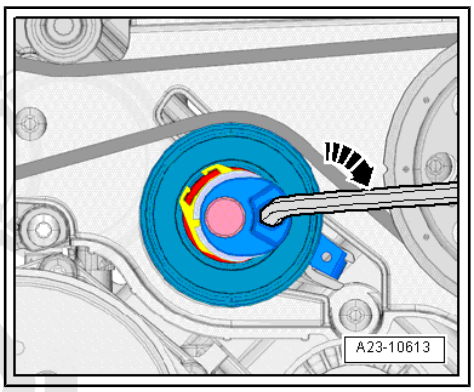
– Tension toothed belt tensioning roller slightly by turning in direction of -arrow- using hexagon key until hexagon socket is in "1 o'clock" position.

Caution

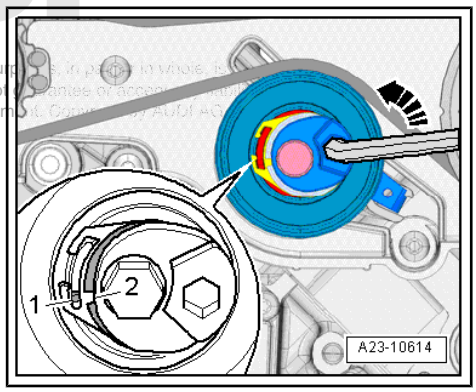
Do NOT turn tensioning roller up to or beyond "12 o'clock" position.



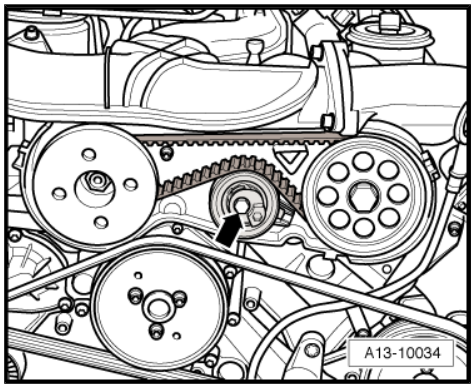
– Now release toothed belt tensioning roller -arrow- to such an extent that hexagon socket moves into "3 o'clock" position.



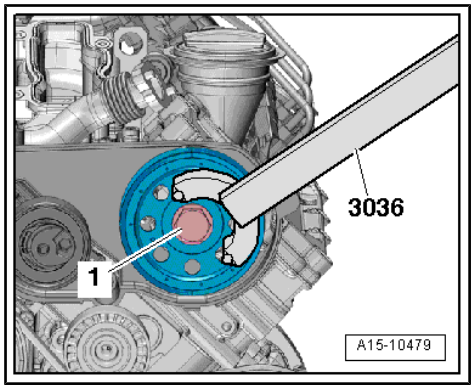
– Tension tensioning roller slightly from "3 o'clock" position -arrow- until lug -1- and notch -2- are exactly in line.



– Hold toothed belt tensioning roller in this position and tighten bolt -arrow- ⇒ Item 4 (page 59) .



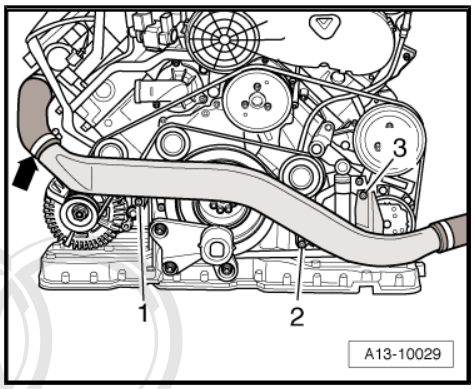
– Tighten bolt -1- for toothed belt drive sprocket using counter-hold tool - 3036- ⇒ Item 10 (page 59) .



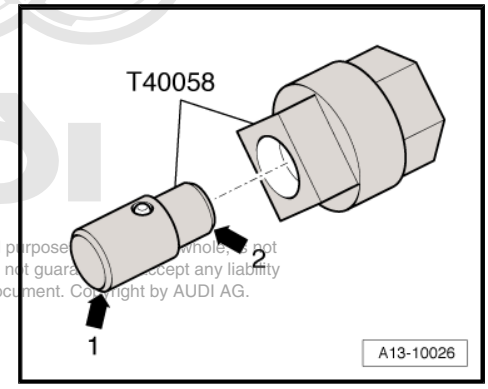
Turn crankshaft one complete revolution to check toothed belt tension. To do this:

– Disconnect air intake hose -arrow- from air pipe (top).

– Unscrew bolts -1 ... 3- and detach air pipe (top).

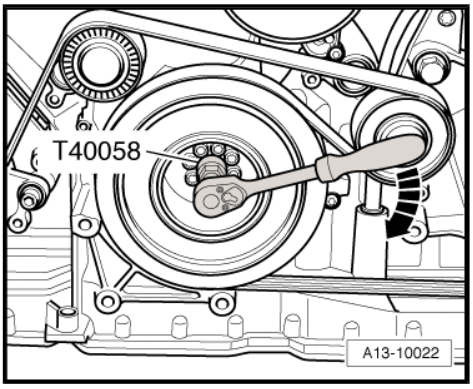


– Insert guide pin of adapter -T40058- with the larger-diameter section -arrow 1- pointing towards the engine. The smaller-diameter section -arrow 2- faces the adapter.

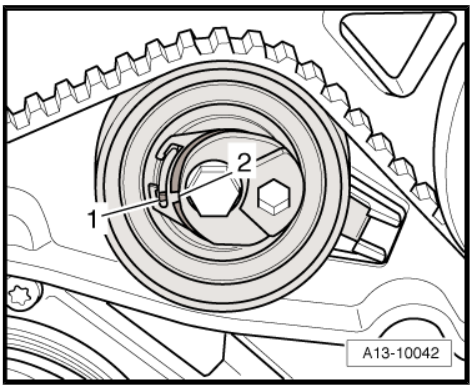


Caution

Do not rotate crankshaft in opposite direction of engine rotation.



– Turn crankshaft at least one complete revolution in normal running direction -arrow-.



– Check toothed belt tension.

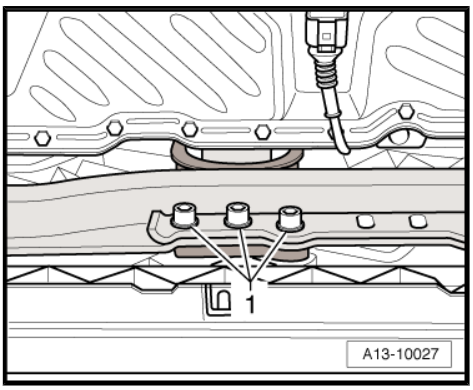
• Lug -1- should align with notch -2-.

If specification is not obtained:

– Adjust the toothed belt tension again.

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

– Install lock carrier with attachments ⇒ Rep. gr. 50 .



– Slacken bolts -1-.

– Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight, and tighten bolts.

– Install bumper cover (front) ⇒ Rep. gr. 63 .

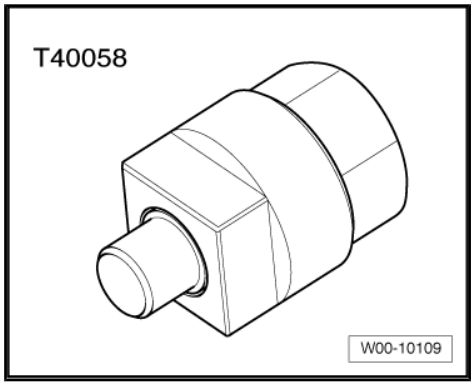
Tightening torques

Component		Nm
Toothed belt drive sprocket to camshaft	M14	75
	M10	75
Toothed belt tensioning roller to front bracket		23
Air pipe (top) to engine		9
Stop for torque reaction support to tubular cross member		40
Hose clips	Width 9 mm	3
	Width 13 mm	5.5

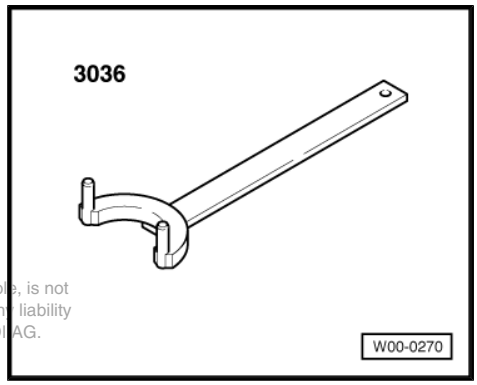
1.26 Removing and installing toothed belt for high-pressure pump - vehicles from 03.2006 onwards

Special tools and workshop equipment required

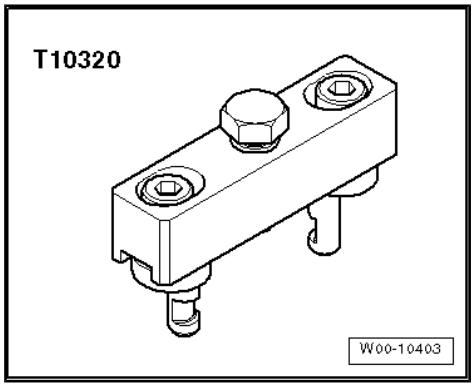
- Adapter - T40058-



- Counterhold tool - 3036-



- Puller - T10320-

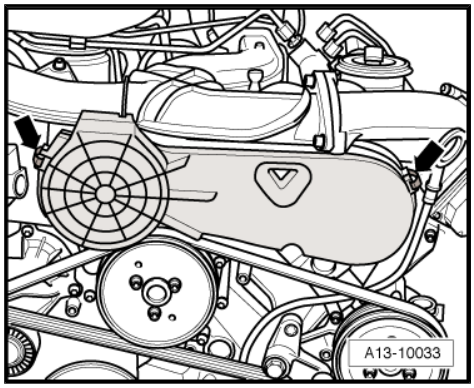


Removing

– Move lock carrier to service position ⇒ Rep. gr. 50 .

– Loosen clamps -arrows-.

– Pivot toothed belt cover forward and disengage retaining pegs on bottom side of toothed belt cover.

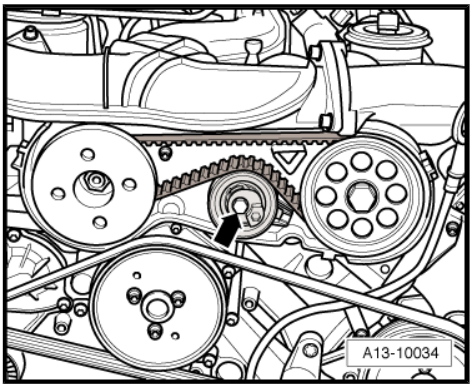


Note

Before removing, mark rotation direction of toothed belt with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

– Unscrew bolt -arrow- and detach tensioning roller.

– Take off toothed belt first from toothed belt drive sprocket and then from toothed belt sprocket at high-pressure pump.



Installing

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

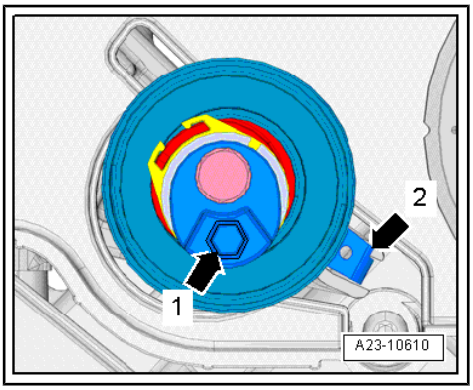
Note

Before installing toothed belt make sure high-pressure pump and toothed belt sprockets are firmly in position.

– Check installation position of toothed belt tensioning roller:

• Retaining lug -arrow 2- must engage in slot on bracket for high-pressure pump.

• Tensioning roller must be slack and hexagon socket -arrow 1- must face downwards.



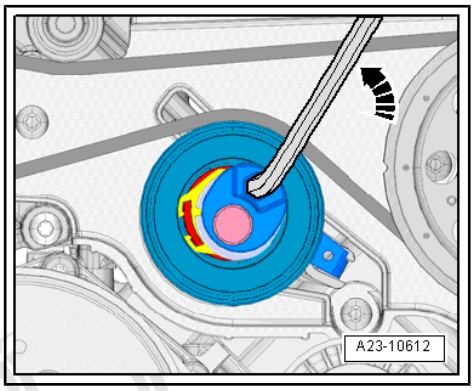
– Fit toothed belt.

– Install toothed belt tensioning roller; to do so, screw in bolt for toothed belt tensioning roller without applying force until eccentric adjuster of toothed belt tensioning roller can just still be turned without axial movement.

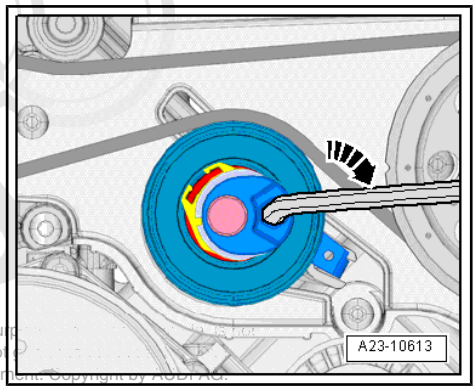
– Tension toothed belt tensioning roller slightly by turning further in direction of -arrow- using hexagon key until hexagon socket is in "1 o'clock" position.

Caution

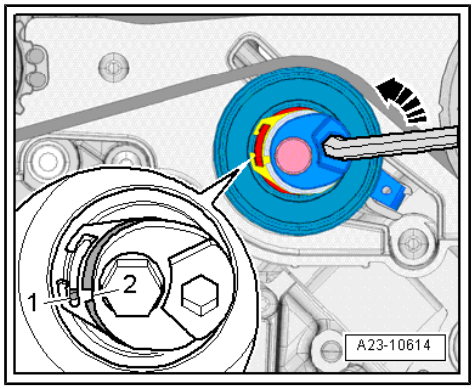
Do NOT turn tensioning roller up to or beyond "12 o'clock" position.



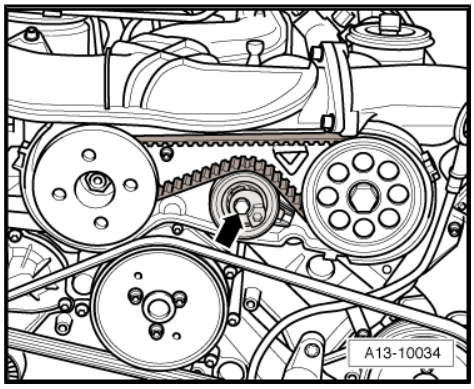
– Now release toothed belt tensioning roller -arrow- to such an extent that hexagon socket moves into "3 o'clock" position.



– Tension tensioning roller slightly from "3 o'clock" position -arrow- until lug -1- and notch -2- are exactly in line.



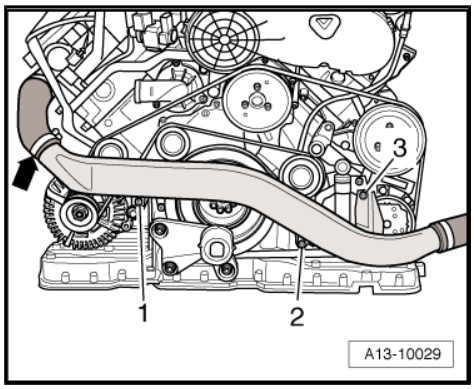
– Hold toothed belt tensioning roller in this position and tighten bolt -arrow- ⇒ Item 4 (page 59) .



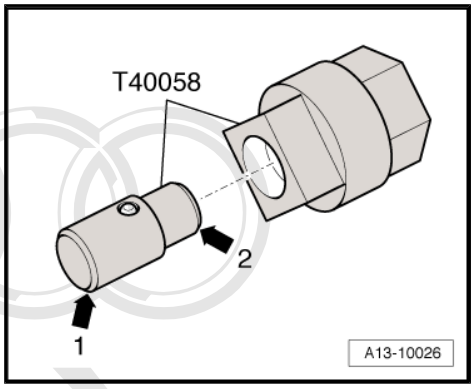
Turn crankshaft one complete revolution to check toothed belt tension. To do this:

– Disconnect air intake hose -arrow- from air pipe (top).

– Unscrew bolts -1 ... 3- and detach air pipe (top).



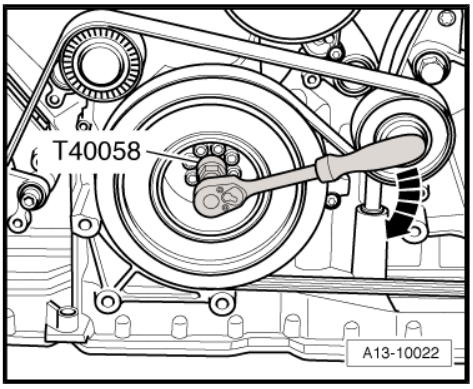
– Insert guide pin of adapter -T40058- with the larger-diameter section -arrow 1- pointing towards the engine. The smaller-diameter section -arrow 2- faces the adapter.



Caution

Do not rotate crankshaft in opposite direction of engine rotation.

– Turn crankshaft at least one complete revolution in normal running direction -arrow-.

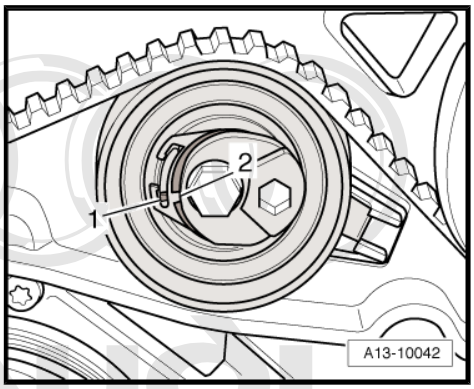


– Check toothed belt tension.

• Lug -1- should align with notch -2-.

If specification is not obtained:

– Adjust the toothed belt tension again.



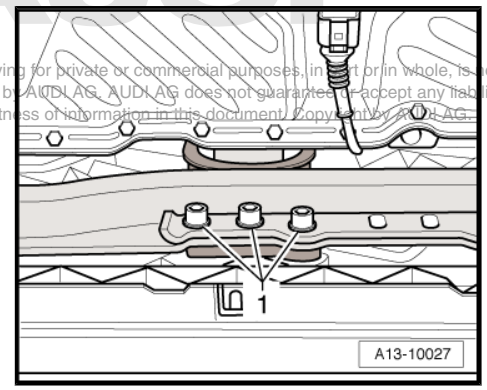
Installation is carried out in the reverse order; note the following:

– Install lock carrier with attachments ⇒ Rep. gr. 50 .

– Slacken bolts -1-.

– Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight, and tighten bolts.

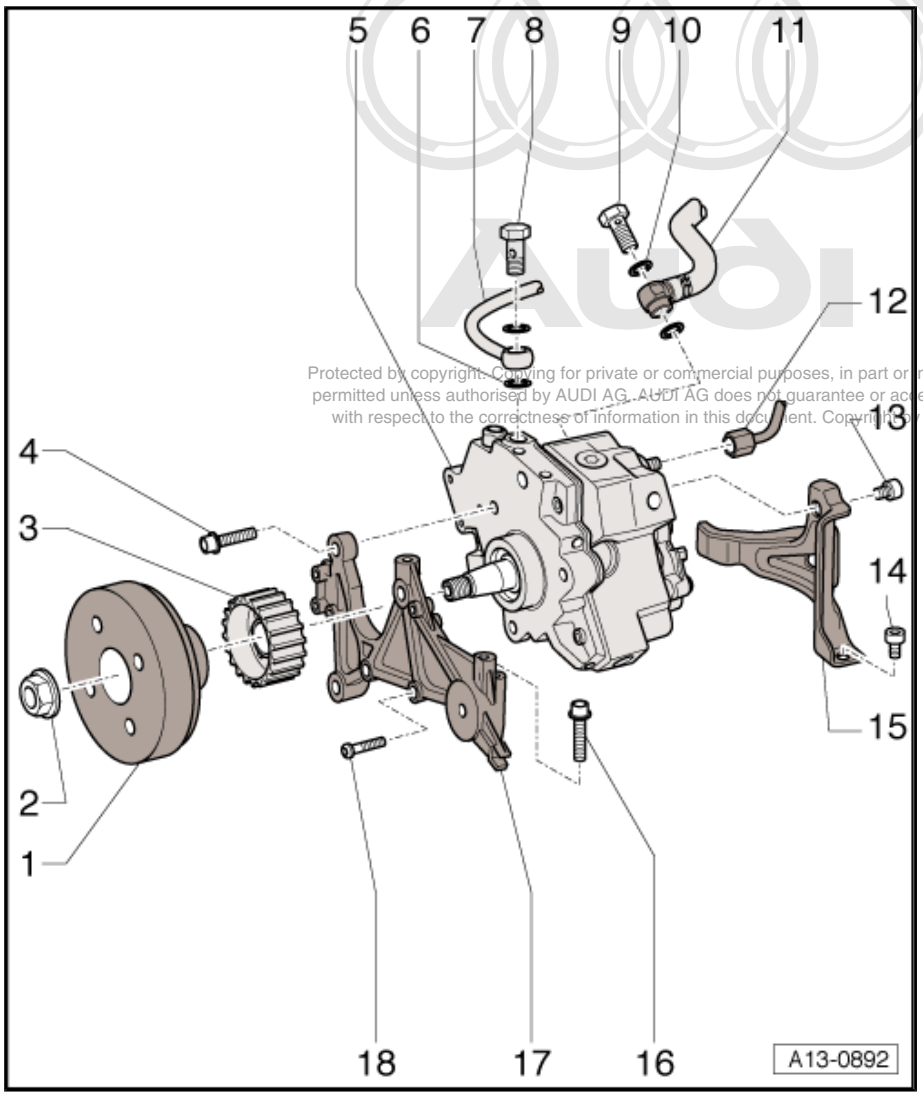
– Install bumper cover (front) ⇒ Rep. gr. 63 .



Tightening torque

Component		Nm
Toothed belt tensioning roller to front bracket		23
Air pipe (top) to engine		9
Stop for torque reaction support to tubular cross member		40
Hose clips	Width 9 mm	3
	Width 13 mm	5.5

1.27 Exploded view - high-pressure pump on vehicles up to 08.2005



1 - Damper weight

- ❑ Use counterhold tool - 3036- when loosening and tightening central nut ⇒ page 71

2 - Nut

- ❑ 70 Nm
- ❑ Use counterhold tool - 3036- when loosening and tightening ⇒ page 71

3 - Toothed belt sprocket for high-pressure pump

- ❑ Remove using puller - T40064- ⇒ page 71

4 - Bolt

- ❑ 22 Nm

5 - 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 72
- ❑ Fuel system must be bled after installing high-pressure pump ⇒ page 83 .

6 - Seals

- ❑ Renew

7 - Fuel supply line

8 - Banjo bolt

- ❑ 25 Nm

9 - Banjo bolt

- ❑ 25 Nm

10 - Seals

- ❑ Renew

11 - Fuel return line

12 - Union nut for high-pressure pipe

- ❑ 25 Nm
- ❑ Use socket insert AF 14, flared ring spanner - V.A.G 1331/8- to tighten ⇒ page 71

13 - Bolt

- ❑ 22 Nm

14 - Bolt

- ❑ 22 Nm

15 - Bracket for high-pressure pump

16 - Bolt

- ❑ 22 Nm

17 - Front bracket for high-pressure pump

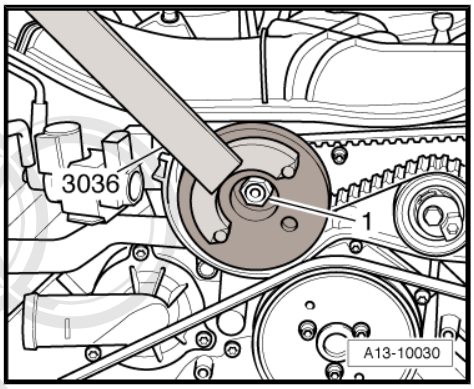
18 - Bolt

- ❑

9 Nm

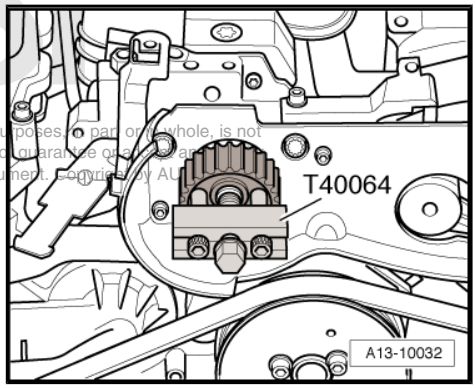
Loosening and tightening central nut for high-pressure pump shaft

– Use counterhold tool - 3036- when loosening and tightening central nut -1-.



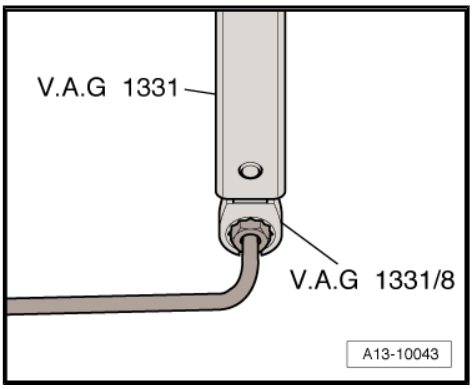
Pulling off toothed belt sprocket for high-pressure pump

– Use puller - T40064- to pull off belt sprocket for high-pressure pump.



Tightening union nut for high-pressure pipe at high-pressure pump

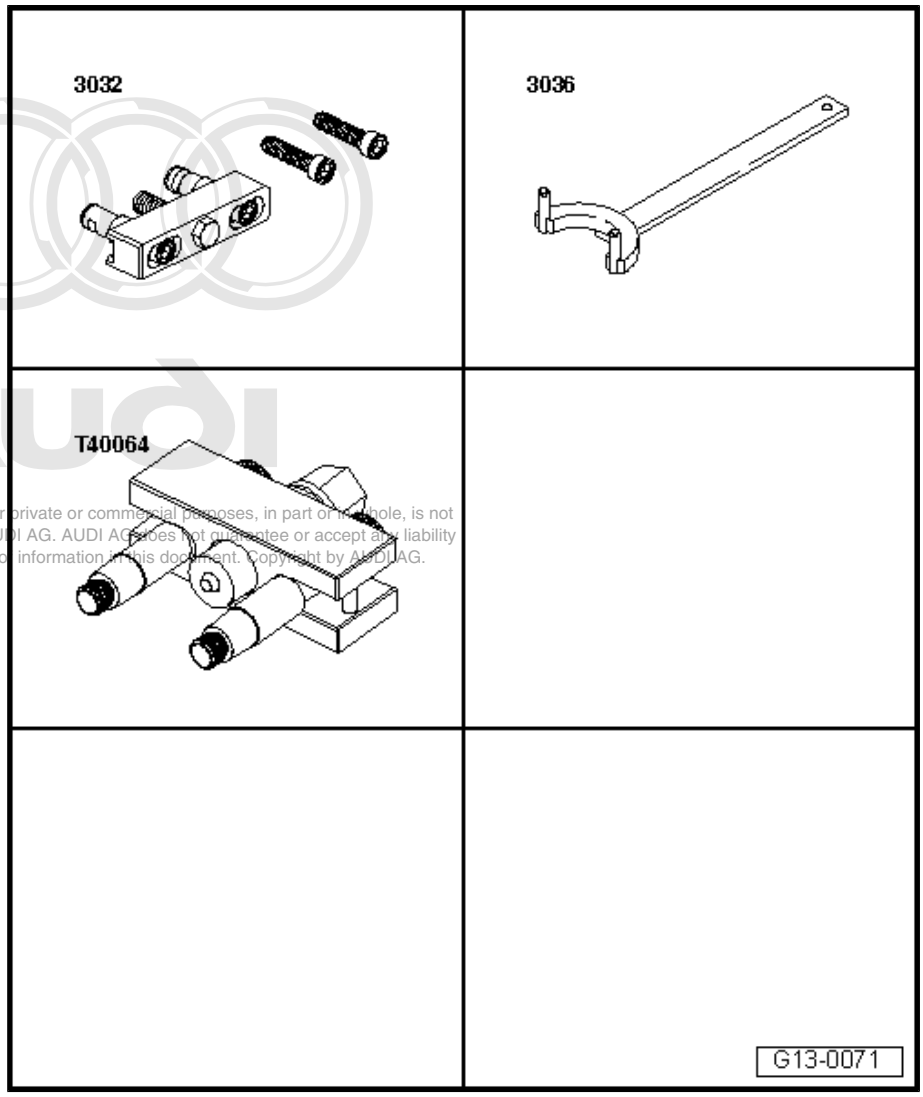
– Use socket insert AF 14, flared ring spanner - V.A.G 1331/8- for tightening.



1.28 Removing and installing high-pressure pump - vehicles up to 08.2005

Special tools and workshop equipment required

- Puller - 3032-
- Counterhold tool - 3036-
- Puller - T40064-



Removing

Caution

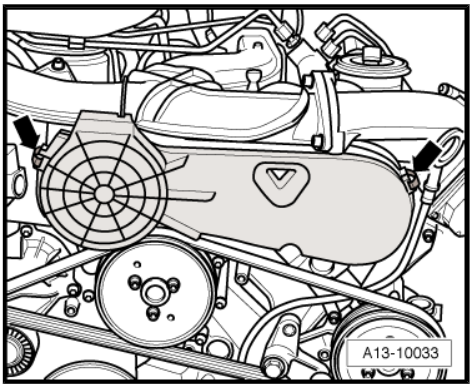
Observe rules for cleanliness when working on the injection system ⇒ page 2 .

– Move lock carrier to service position ⇒ Rep. gr. 50 .

– Remove intake manifold (top section) ⇒ page 20 .

– Loosen clamps -arrows-.

– Pivot toothed belt cover forward and disengage retaining pegs on bottom side of toothed belt cover.

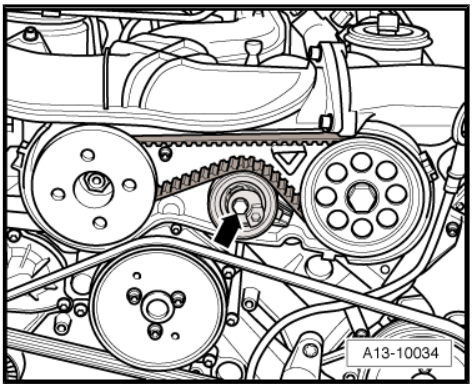


Note

Before removing, mark rotation direction of toothed belt with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

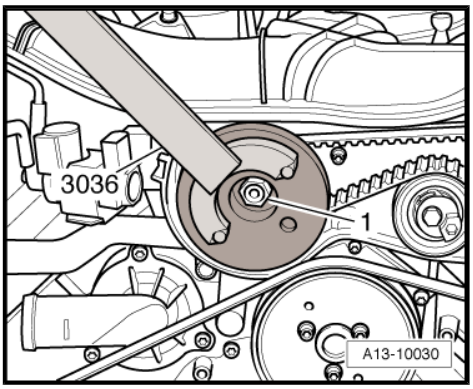
– Remove bottom section of intake manifold (left-side): vehicles up to 10.2004 ⇒ page 21 ; vehicles from 10.2004 onwards ⇒ page 25 .

– Remove bolt -arrow- for tensioning roller and take off tensioning roller.

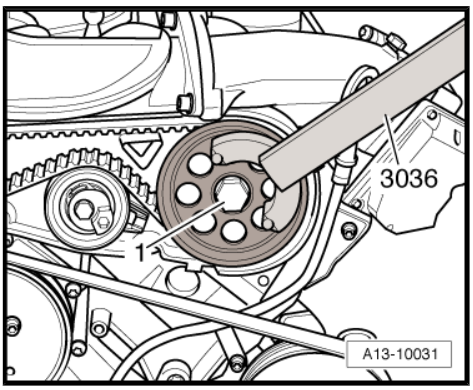


– Loosen central nut -1- for high-pressure pump shaft using counterhold tool - 3036- .

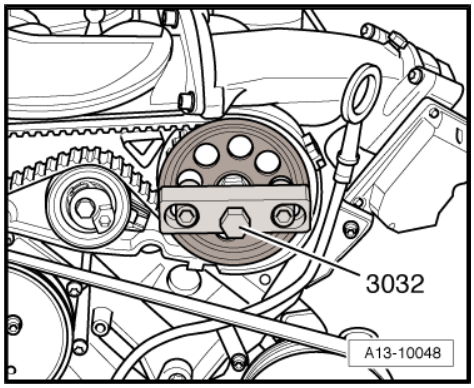
– Remove damper weight.



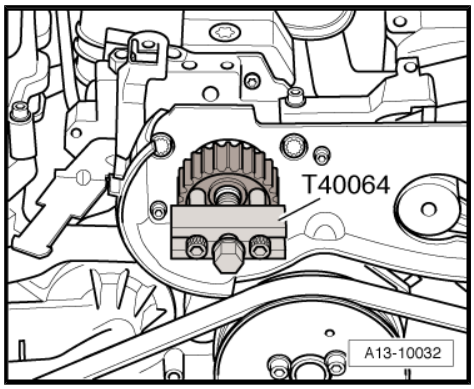
– Loosen central bolt -1- for toothed belt drive sprocket approx. 2 turns using counterhold tool - 3036- .



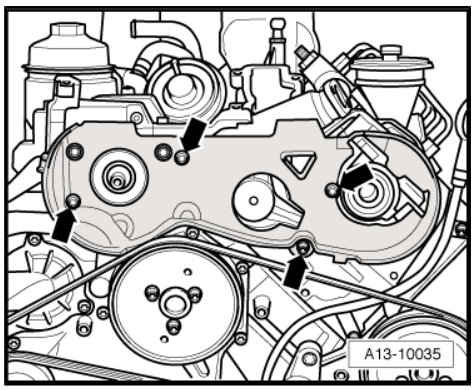
– Use puller - 3032- to pull off toothed belt drive sprocket.
– Take off toothed belt drive sprocket together with toothed belt.



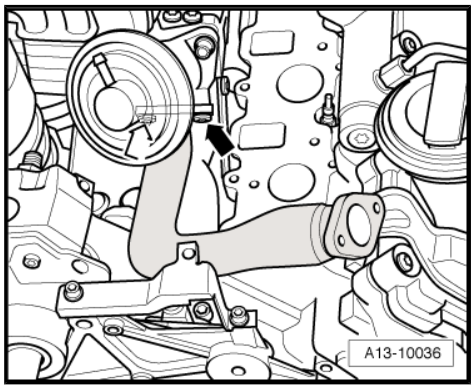
– Use puller - T40064- to pull off belt sprocket for high-pressure pump.



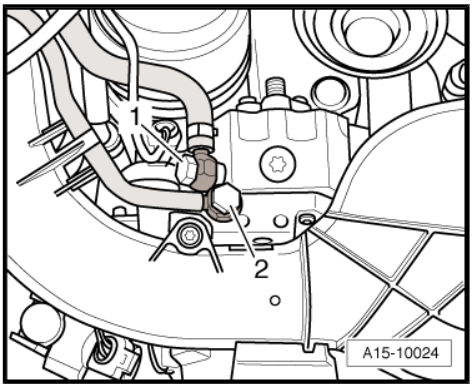
– Remove bolts -arrows- and detach toothed belt cover (rear).



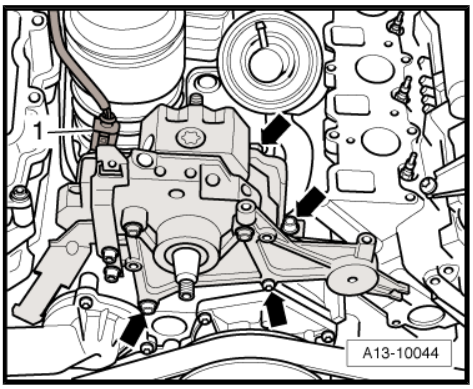
– Remove bolts -arrows- and take off connecting pipe for exhaust gas recirculation.



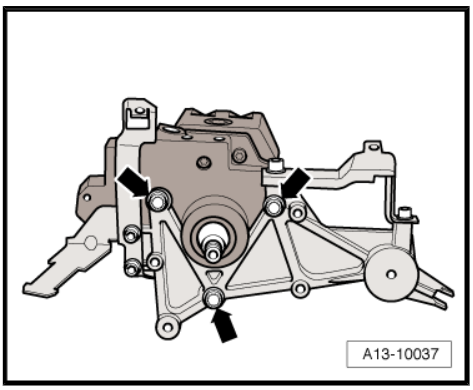
– Disconnect fuel supply line -2- and fuel return line -1- from high-pressure pump and move lines clear to the side.



– Unplug electrical connector -1-.
– Remove bolts -arrows-.
– Take off high-pressure pump together with front bracket.



– Remove bolts -arrows-.
– Detach front bracket from 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

Renew gaskets and seals.

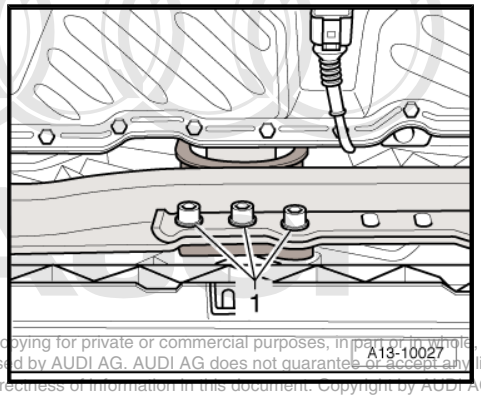
– Install toothed belt for high-pressure pump ⇒ page 61 .
– Install bottom section of intake manifold (left-side): vehicles up to 10.2004 ⇒ page 21 ; vehicles from 10.2004 onwards ⇒ page 25 .
– Install intake manifold (top section) ⇒ page 20 .
– Install lock carrier with attachments ⇒ Rep. gr. 50 .

– Slacken bolts -1-.

– Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight, and tighten bolts.

– Install bumper cover (front) ⇒ Rep. gr. 63 .

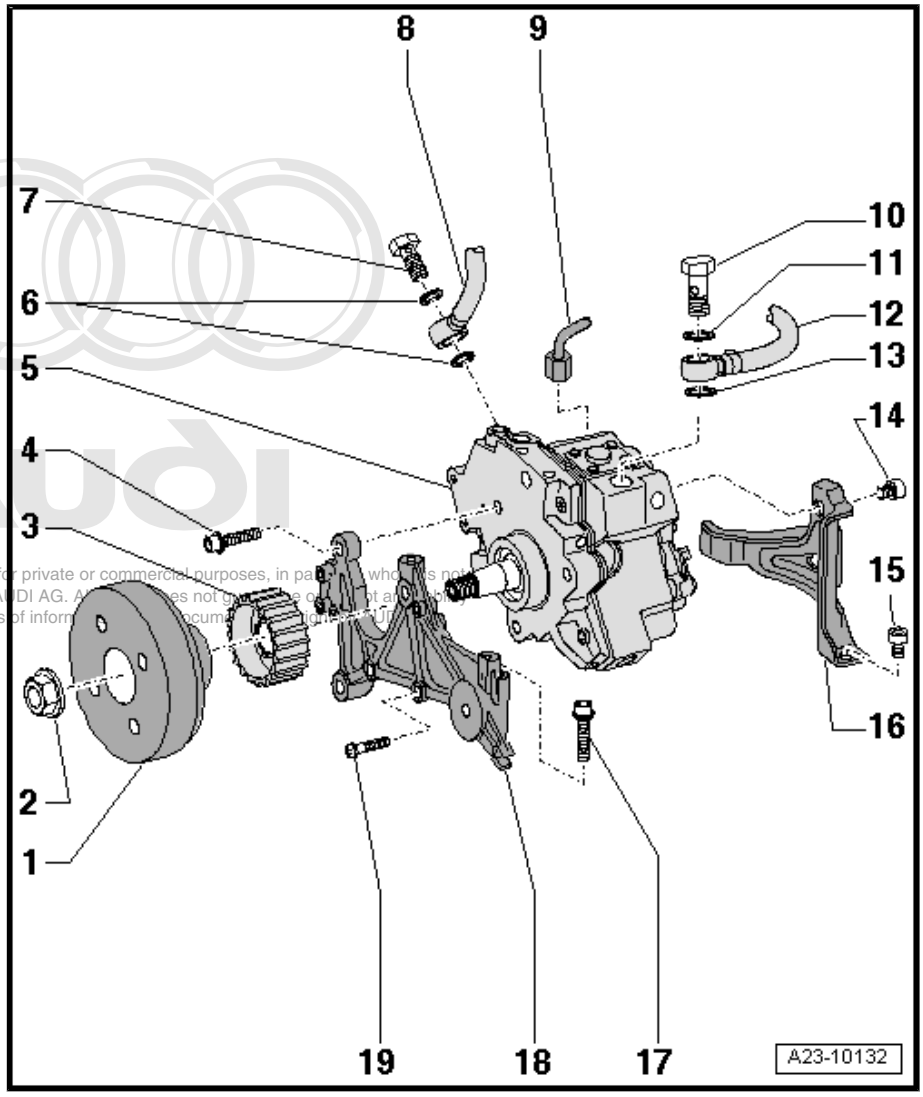
– Check fuel system for leaks ⇒ page 83 .



Tightening torques

Component		Nm
Front bracket to high-pressure pump		22
High-pressure pump with front bracket to bracket (rear)		22
High-pressure pump with	M6	9
front bracket to engine	M8	22
Fuel supply and return lines to high-pressure pump		25
EGR connecting pipe to exhaust gas recirculation valve - N18-		9
Toothed belt cover (rear) to engine		9
High-pressure pipe to high-pressure pump		25
Air pipe (top) to engine		9
Stop for torque reaction support to tubular cross member		40
Hose clips	Width 9 mm	3
	Width 13 mm	5.5

1.29 Exploded view - high-pressure pump on vehicles from 08.2005 onwards



1 - Damper weight

- ❑ Use counterhold tool - 3036- when loosening and tightening central nut ⇒ page 78

2 - Nut

- ❑ 70 Nm
- ❑ Use counterhold tool - 3036- when loosening and tightening ⇒ page 78

3 - Toothed belt sprocket for high-pressure pump

- ❑ Remove using puller - T40064- ⇒ page 78

4 - Bolt

- ❑ 22 Nm

5 - 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 79
- ❑ Fuel system must be bled after installing high-pressure pump ⇒ page 83 .

6 - Seals

- ❑ Renew

7 - Banjo bolt

- ❑ 25 Nm

8 - Fuel supply line

9 - Union nut for high-pressure pipe

- ❑ Tighten to 25 Nm
- ❑ Use socket - T40055- , 17 mm to tighten ⇒ page 78

10 - Banjo bolt

- ❑ 25 Nm

11 - Seal

- ❑ Renew

12 - Fuel return line

13 - Seal

- ❑ Renew

14 - Bolt

- ❑ 22 Nm

15 - Bolt

- ❑ 22 Nm

16 - Bracket for high-pressure pump

17 - Bolt

- ❑ 22 Nm

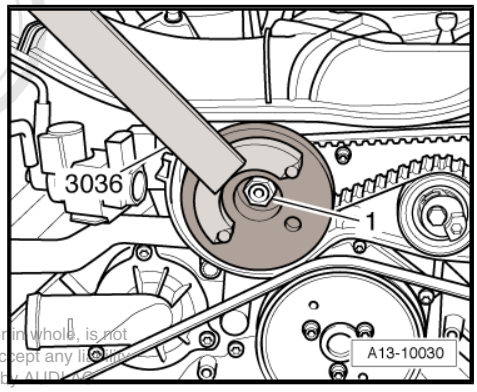
18 - Front bracket for high-pressure pump

19 - Bolt

- ❑ 9 Nm

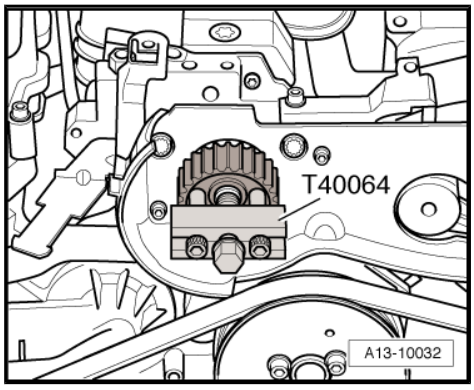
Loosening and tightening central nut for high-pressure pump shaft

– Use counterhold tool - 3036- when loosening and tightening central nut -1-.



Pulling off toothed belt sprocket for high-pressure pump

– Use puller - T40064- to pull off belt sprocket for high-pressure pump.

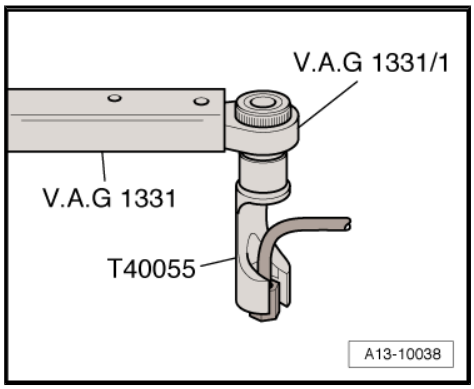


Tightening high-pressure pipe at high-pressure pump

– Tighten union nut on high-pressure pipe hand-tight initially.

– Ensure that high-pressure pipe is not under tension.

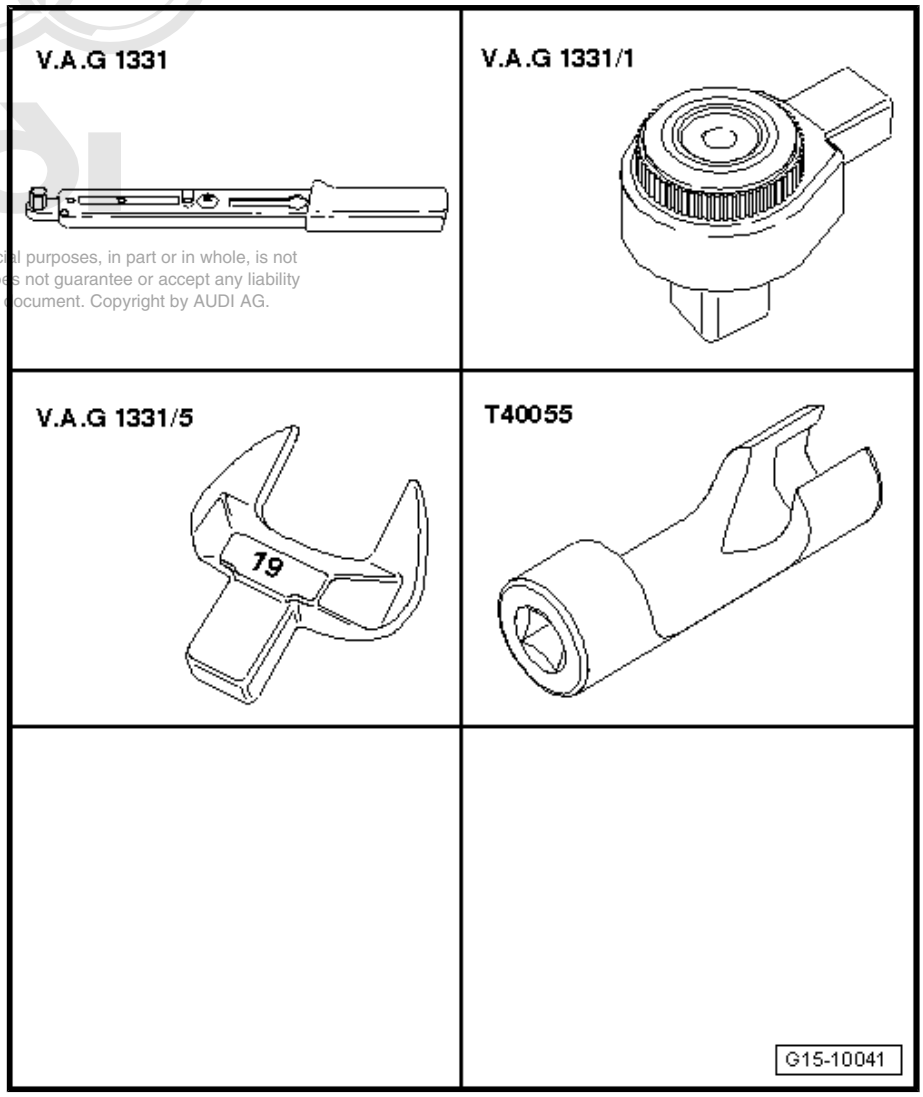
– To tighten union of high-pressure pipe at high-pressure pump, use torque wrench - V.A.G 1331- with ratchet - V.A.G 1331/1- and socket - T40055- , 17 mm.



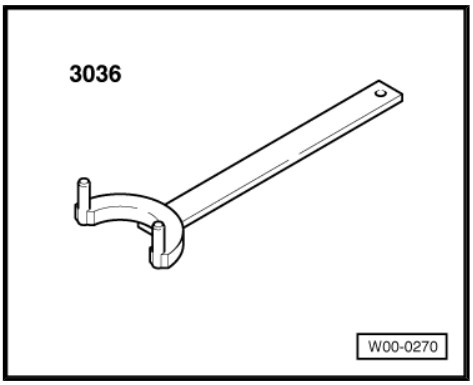
1.30 Removing and installing high-pressure pump - vehicles from 08.2005 onwards

Special tools and workshop equipment required

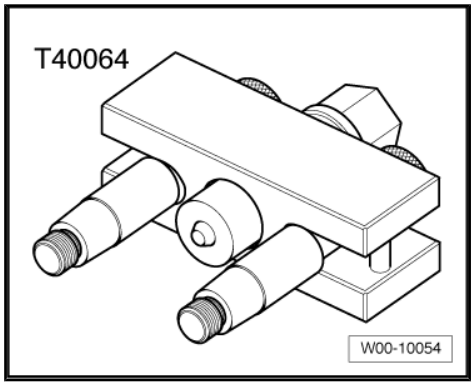
- Torque wrench - V.A.G 1331-
- Open end spanner insert, AF 19 - V.A.G 1331/5-
- Ratchet - V.A.G 1331/1-
- Socket - T40055- (17 mm)



- Counterhold tool - 3036-



♦ Puller - T40064-



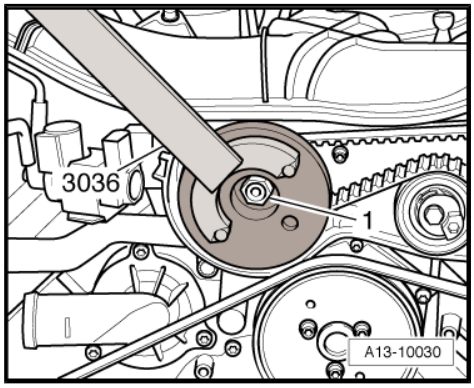
Removing

– Move lock carrier to service position ⇒ Rep. gr. 50 .

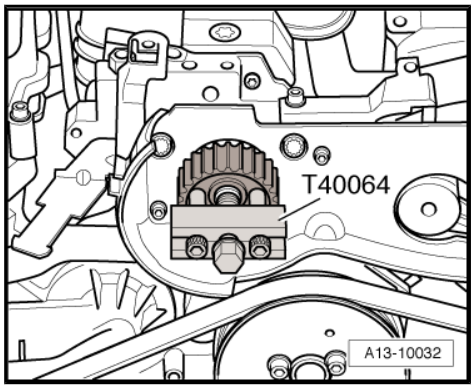
Caution

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

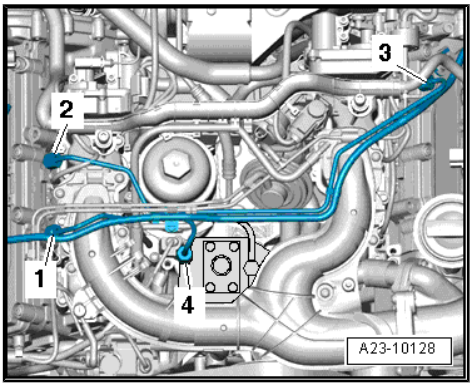
– Remove intake manifold (top section) ⇒ page 20 .
– Remove toothed belt for high-pressure pump.
– Loosen central nut -1- for high-pressure pump shaft using counterhold tool - 3036- .
– Remove damper weight.



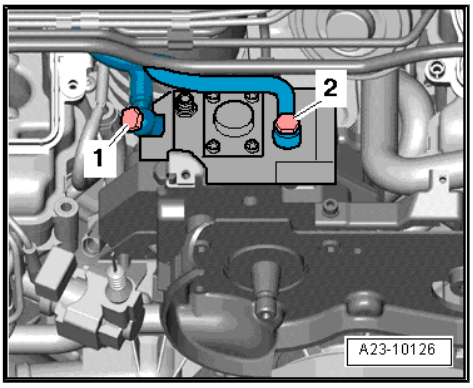
– Use puller - T40064- to pull off belt sprocket for high-pressure pump.



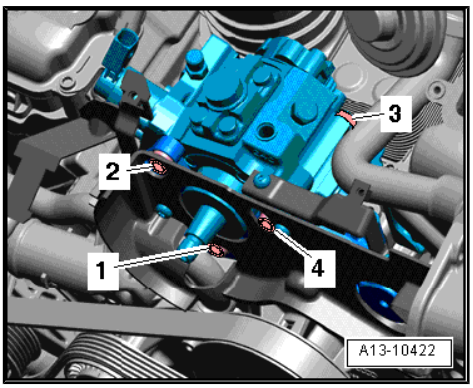
– Unscrew union nuts -1 ... 4- and detach high-pressure pipes.



– Disconnect fuel supply line -2- and fuel return line -1- from high-pressure pump and move lines clear to the side.

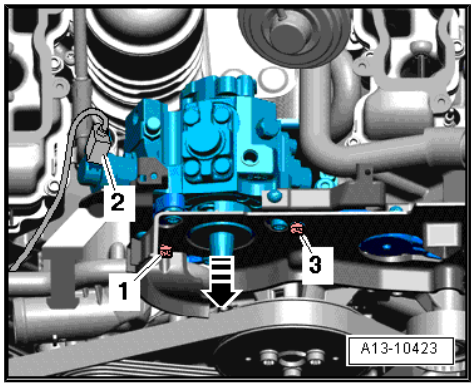


– Unscrew bolts -1 ... 4-.
– Unplug electrical connector -2-.



– Remove bolts -1- and -3-.

– Carefully pull toothed belt cover in direction of -arrow- and lift out 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.

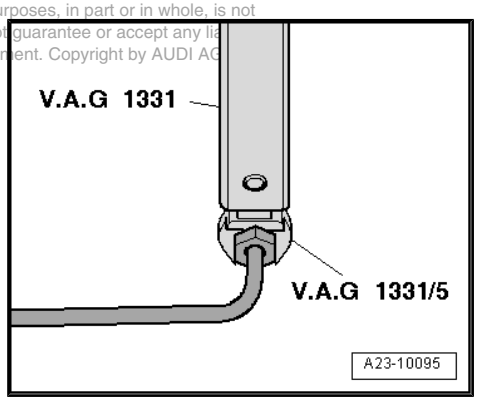
Note

- *Renew seals and gaskets.*
- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*

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

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

– To tighten unions of high-pressure pipes at rail elements, use torque wrench - V.A.G 1331- with open end spanner insert, AF 19 - V.A.G 1331/5- .

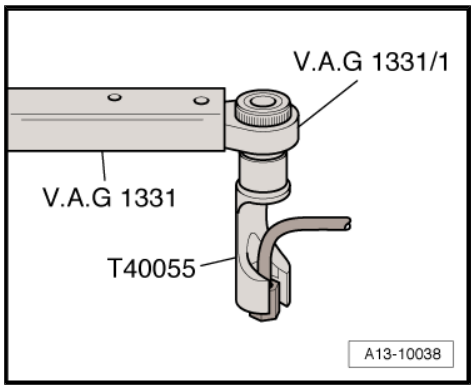


– To tighten union of high-pressure pipe at high-pressure pump, use torque wrench - V.A.G 1331- with ratchet - V.A.G 1331/1- and socket - T40055- , 17 mm.

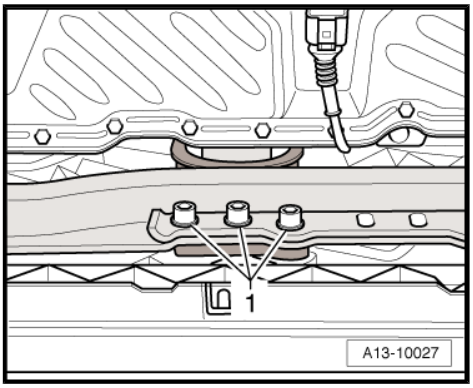
– Install toothed belt for high-pressure pump.

– Install intake manifold (top section) ⇒ page 20 .

– Install lock carrier with attachments ⇒ Rep. gr. 50 .



– Slacken bolts -1-.
– Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight, and tighten bolts.
– Install bumper cover (front) ⇒ Rep. gr. 63 .
– Bleed high-pressure pump ⇒ page 83 .
– Check fuel system for leaks.



Tightening torques

Component		Nm
High-pressure pump to front bracket		22
High-pressure pump with front bracket to bracket (rear)		22
Fuel supply and return lines to high-pressure pump		25
Toothed belt cover (rear) to engine		9
Damper weight to high-pressure pump		70
Toothed belt drive sprocket to camshaft		75
High-pressure pipe to high-pressure pump		25
Air pipe (top) to engine		9
Stop for torque reaction support to tubular cross member		40
Hose clips	Width 9 mm	3
	Width 13 mm	5.5

1.31 Bleeding fuel system after installing high-pressure pump

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).

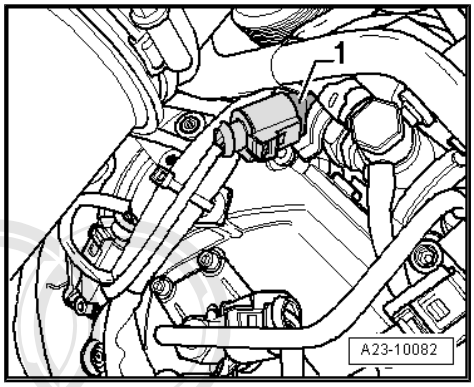
Note

- *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. ⇒ Electrical system; Rep. Gr. 27; Charging battery



- Unplug connector from fuel pressure regulating valve - N276- so that engine does not start when starter motor is operated.
- Operate starter motor for 3 x 13 seconds. (Wait approx. 20 seconds each time after operating starter to prevent it from overheating.)
- Re-attach connector on fuel pressure regulating valve - N276- .
- Erase fault in fault memory using diagnostic tester.
- Start engine.
- After bleeding fuel system, leave engine running at moderate speed for a few minutes and then switch off again.
- Check fuel system for leaks.
- After completing the repair, road-test the vehicle over a distance of at least 20 km. Accelerate with full throttle at least once. Then inspect the high-pressure section of the fuel system again for leaks.

Note

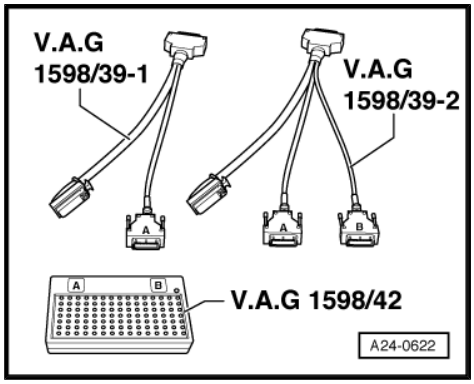
If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the fault memory. Then continue the road test.

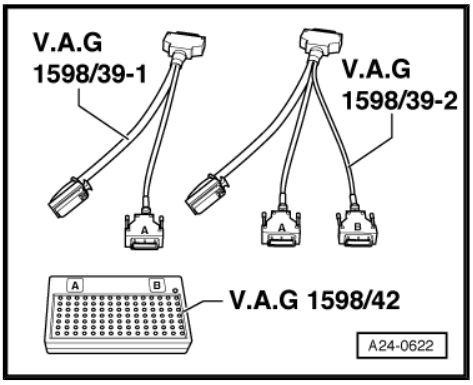
- Interrogate fault memory.

1.32 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-





Note

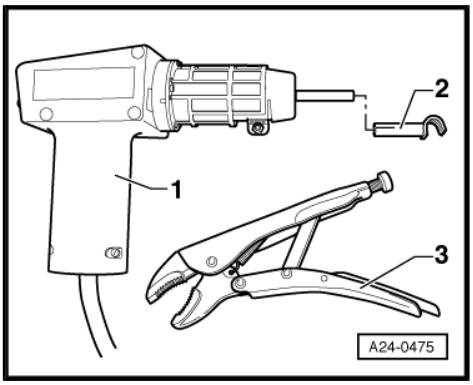
- *Persons wearing a pacemaker should not lean over the engine compartment while the engine is running, as the injectors use high voltage pulses.*
- *The test box has 105 contacts. The connecting cable can be disconnected from the test box. This means that only the cable (and not the test box) has to 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.

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-

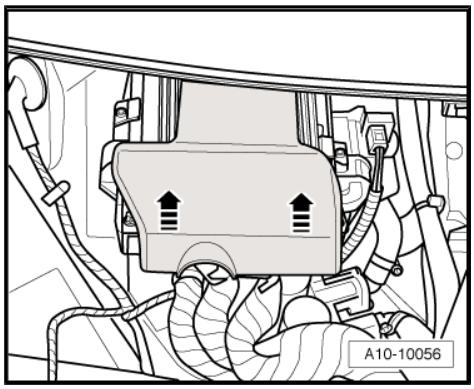


Procedure

– Switch off ignition.

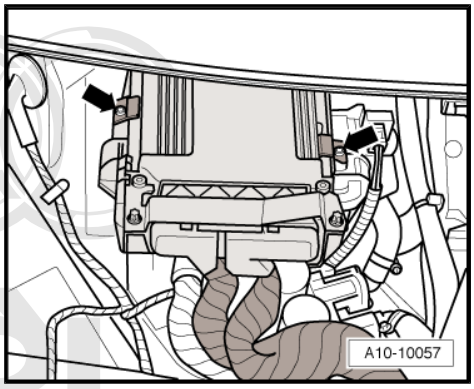
– Remove cover from plenum chamber (right-side).

– Detach cover above engine control unit -arrows-.



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 metal casing.

– Remove bolts -arrows-.

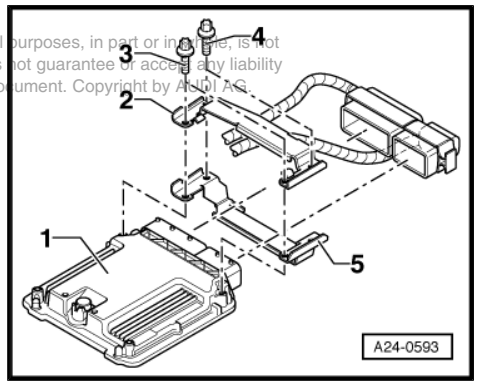


Remove retaining clip and engine control unit from electronics box (plenum chamber).

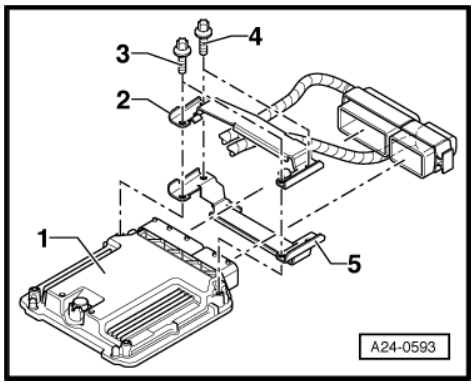
Note

Not every engine control unit is bolted to a protective housing. Whether a protective housing is fitted depends on the engine/ gearbox combination.

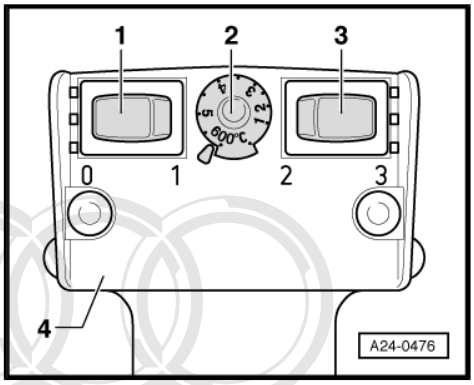
The threads of the two shear bolts -4- which are not screwed into the engine control unit are secured with locking fluid. To unscrew these two bolts, the threads must therefore be heated with the hot air blower.



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.



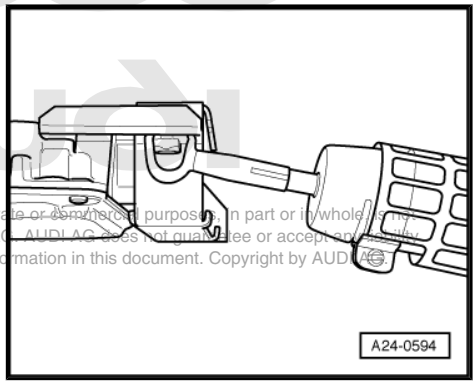
– Select settings on hot air blower as shown in illustration, i.e. set temperature potentiometer -2- to maximum heat output and two-stage air flow switch -3- to position 3.



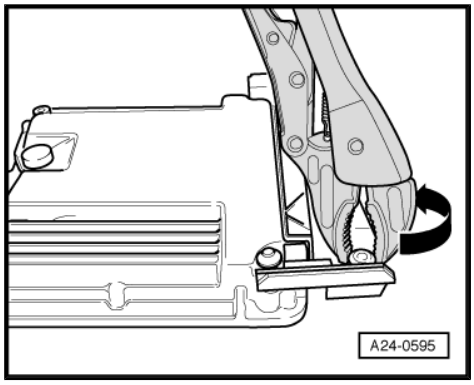
WARNING

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).



– Unscrew shear bolts using mole grips (see arrow in illustration).
– The two shear bolts screwed into the control unit do not need to be heated. They should be removed without being heated.
– Detach metal locking plate from connectors.
– Release connectors on diesel direct injection system control unit - J248- and unplug connectors.
– Connect test box - V.A.G 1598/42- to wiring harness connector. The earth clip on the test box must be connected to the negative battery terminal. 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

Installation is performed in the reverse sequence.

– Make sure you fit metal casing back on engine control unit.
– Always use new shear bolts.
– Clean threaded holes for new shear bolts to remove any residue from locking fluid. This can be done using a thread tap.
– Interrogate and, if necessary, erase fault memory. Vehicle diagnostic, testing and information system - VAS 5051B-

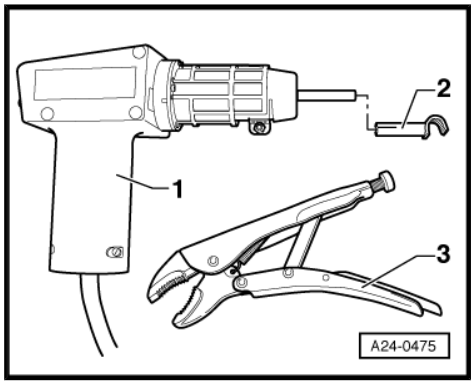
Note

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

1.33 Renewing diesel direct injection system control unit - J248-

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-



Caution

The engine control unit must be matched to the glow plugs.

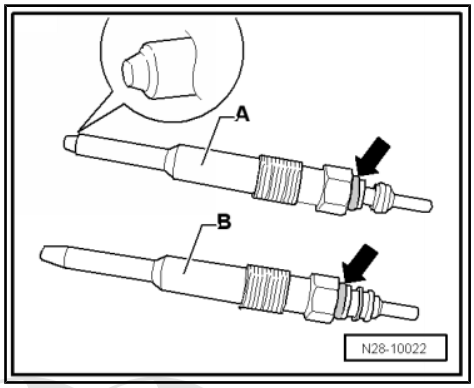
An engine control unit with software adapted to the Bosch ceramic glow plugs may only be installed in a vehicle with Bosch ceramic glow plugs.

An engine control unit with software adapted to the Beru metal glow plugs may only be installed in a vehicle with Beru metal glow plugs.

Check whether Bosch or Beru glow plugs are installed in the vehicle.

The glow plugs will be irreparably damaged when the ignition is switched on if the control unit does not have the CORRECT SOFTWARE for the glow plugs.

If the ceramic glow plugs (Bosch) have been replaced with metal glow plugs (Beru) the software of the engine control unit must be flashed accordingly before connecting the glow plug connectors. If this is not done, the metal glow plugs will be IRREPARABLY DAMAGED when the ignition is switched on.



Note

- *Ceramic glow plugs were only installed in model years 2004 and 2005.*
- *Identification of glow plugs:*
- *Ceramic glow plugs -A- are colour-coded with a "white seal" -arrow- and have a chamfered shoulder at the tip.*
- *Metal glow plugs -B- are colour-coded with a "red seal" -arrow-.*

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

Removing

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

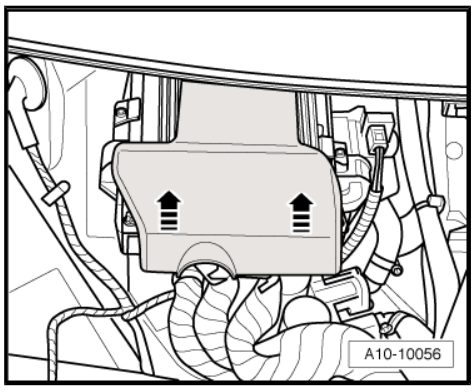
– Enter correct vehicle identification in Guided Fault Finding.
– Press "Go to" button.
– Press "Function/component selection".
– Select "Drive train".
– "01 - Self-diagnosis compatible systems"
– "01 - Engine electronics"
– Select "Functions".
– Select "J248 Injector delivery calibration (quantity adjustment) with injector voltage calibration (ISA/IVA)"

Note

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

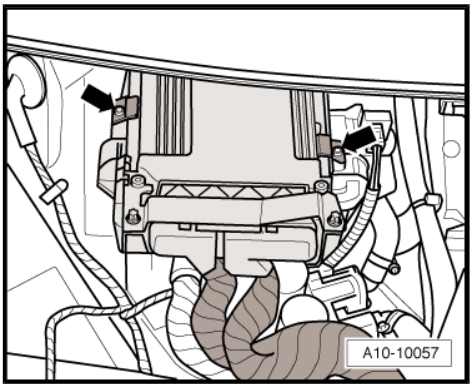
– Switch off ignition after storing file containing adaption values.
– Switch off ignition.
– Remove cover from plenum chamber (right-side).

– Detach cover above engine control unit -arrows-.



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 metal casing.

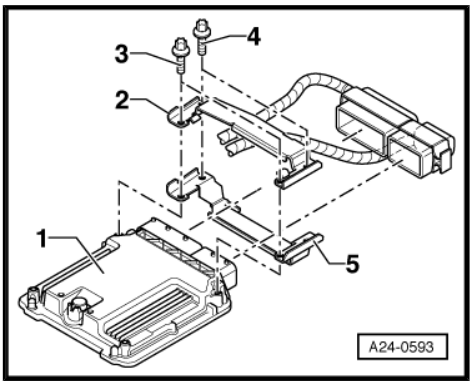
– Remove bolts -arrows-.



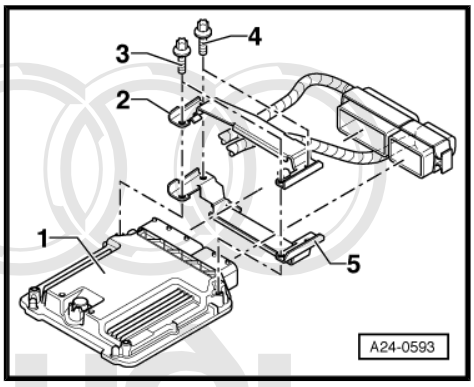
Remove retaining clip and engine control unit from electronics box (plenum chamber).

Note

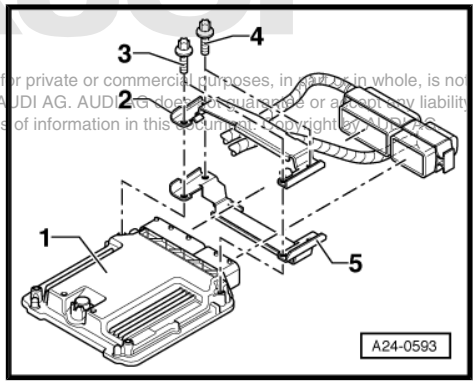
Not every engine control unit is bolted to a protective housing. Whether a protective housing is fitted depends on the engine/ gearbox combination.



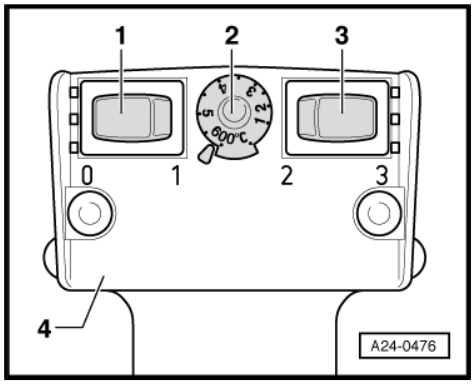
The threads of the two shear bolts -4- which are not screwed into the engine control unit are secured with locking fluid. To unscrew these two bolts, the threads must therefore be heated with the hot air blower.



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.



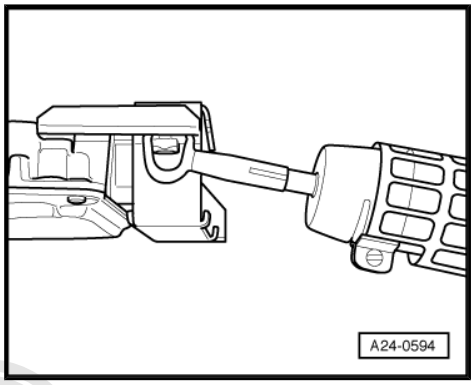
Select settings on hot air blower as shown in illustration, i.e. set temperature potentiometer -2- to maximum heat output and two-stage air flow switch -3- to position 3.



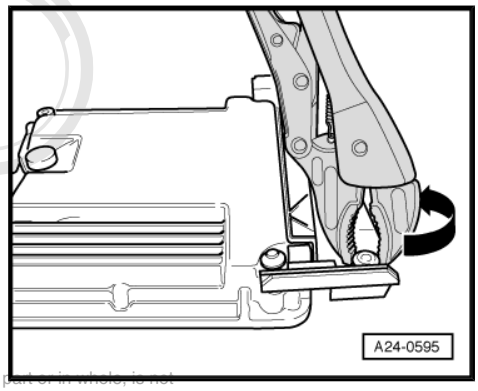
WARNING

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 control unit do not need to be heated. They should be removed without being heated.
- Detach metal locking plate from connectors.
- Remove two bolts securing diesel direct injection system control unit - J248- and pull control unit forwards.
- Release connectors on diesel direct injection system control unit - J248- and unplug connectors.
- Remove old diesel direct injection system control unit - J248- and install new diesel direct injection system control unit - J248- .



Installing

Installation is performed in the reverse sequence.

- After installation, the locking plate must be re-fitted on the diesel direct injection system control unit - J248- .
- Always use new shear bolts.
- After the control unit has been renewed, the injector delivery calibration and the injector voltage calibration must additionally be re-adapted in the diesel direct injection system control unit - J248- (these functions influence engine power and exhaust emissions).
- On vehicles with particulate filter the current mileage (km) reading must be stored in the engine control unit via an adaption procedure.

The procedure required after connecting the new engine control unit is described in the Guided Fault Finding or Guided Functions.

1.34 Checking fuel pressure regulating valve - N276-

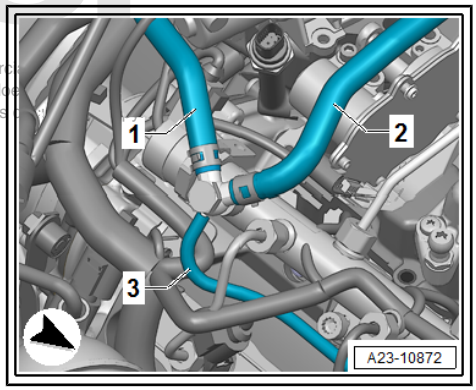
Caution

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 14 .

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

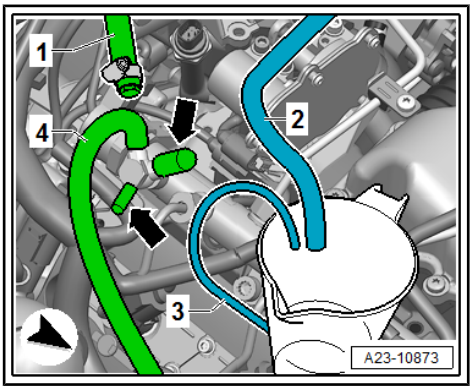


– Seal off open return line connection -1- with plug.

– 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

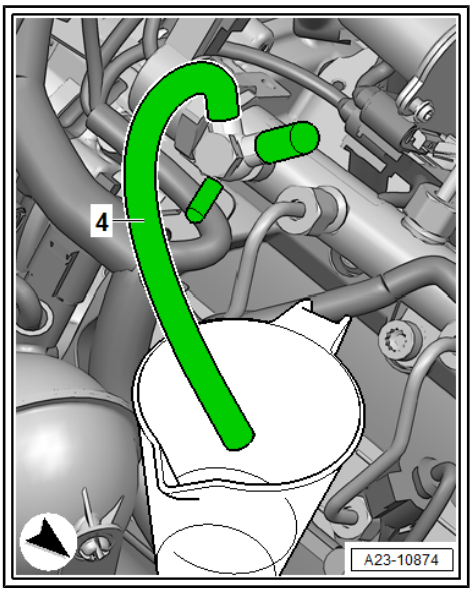
- *Return flow rate from hoses -2 and 3- can be disregarded for this test.*
- *Fuel temperature above 10 °C.*

– Start the engine and run at idling speed.

- Return flow rate from hose -4- (engine start): 0 ml
- Return flow rate from hose -4- after 2 minutes: 50 ml

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

– Renew fuel pressure regulating valve - N276- ⇒ page 94 .

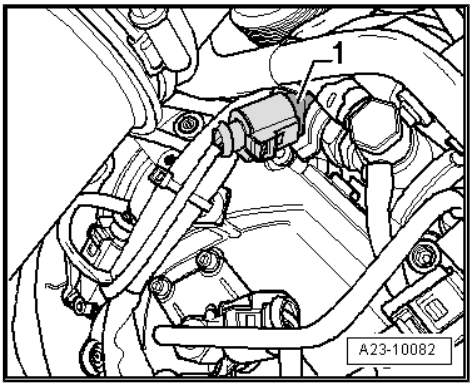


1.35 Removing and installing fuel pressure regulating valve - N276-

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



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- cannot be re-used.

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 14 .
– Before removal, clean area around thread for fuel pressure regulating valve using commercial cleaning solution etc. (no dirt must enter the bore in the rail element).

Note

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

– Unscrew banjo bolt for fuel return lines.
– Dry off fuel pressure regulating valve - N276- .
– Remove banjo bolt for fuel return lines (make sure that all parts are clean).
– Detach electrical connector at 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 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 rail.*
- *Thread on fuel pressure regulating valve - N276- must be free of oil and grease.*

– Screw on union nut by hand.

– Align regulating valve so that connecting wire is free of tension after 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.

Note

- *There are different tightening torques for vehicles manufactured »before« November 2005 and for vehicles manufactured »after« November 2005.*
- *To find out whether the vehicle was manufactured before or after November 2005: unplug electrical connector from throttle valve module - J338- and count the pins.*
- *4 pins = manufactured before November 2005*
- *5 pins = manufactured after November 2005*

Tightening torques for vehicles manufactured before November 2005

Tighten union nut in 2 stages.

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

Then back off union nut 90° ($^1/_4$ turn; counterhold hexagon flats on housing).

Stage 2: 80 + 5 Nm (counterhold hexagon flats on housing)

Tightening torques for vehicles manufactured after November 2005

Tighten union nut in 2 stages.

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

Then back off union nut 90° ($^1/_4$ turn; counterhold hexagon flats on housing).

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

– Tighten banjo bolt with new seals.

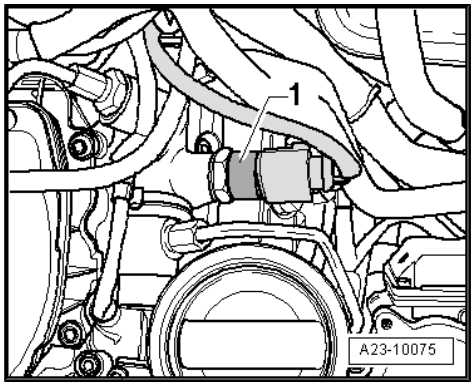
- Tightening torque: 25 Nm

– After installation, run engine at moderate speed for several minutes and then switch off.
– Check fuel system for leaks.
– Interrogate fault memory.
– After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.
– Interrogate fault memory again.

1.36 Removing and installing fuel pressure sender - G247-

The fuel pressure sender - G247- (rail pressure sensor) -1- is located in the left-side fuel rail (cylinder bank 2) and continuously measures the fuel pressure in the high-pressure system. It transmits a corresponding voltage signal to the diesel direct injection system control unit - J248- .

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



Removing

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 14 .
- Before removal, clean area around thread for fuel pressure sender using commercial cleaning solution etc. (no dirt must enter the opening in the rail).

Note

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

- Dry off fuel pressure sender - G247- .
- Detach electrical connector at fuel pressure sender - G247- .
- Unscrew and remove fuel pressure sender - G247- .
- Extract dirt from opening in rail (threads and sealing surface). Do not use metal tools, etc.

Note

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

Installing

Note

- *The fuel pressure sender - G247- does not have a seal; instead, it has a deformable sealing lip.*
- *Check that sealing surfaces (deformable sealing lip) and threads on fuel pressure sender - G247- are not damaged. If inspection of fuel pressure sender - G247- shows that it is OK, it can be used again.*
- *Also check sealing surface at opening in rail.*
- *The beginning of the thread and the deformable sealing lip of the fuel pressure sender - G247- must be lubricated with Molykote grease.*

– Screw in fuel pressure sender - G247- by hand.

– Then tighten fuel pressure sender - G247- to specified torque.

- Tightening torque: 30 +/-3 Nm

Bleeding fuel system and checking for leaks

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

Note

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

– Interrogate fault memory and erase, if necessary.

– Switch off ignition.

– Carefully check the entire fuel system for leaks.

Renew the affected component if leakage still occurs after tightening to the 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

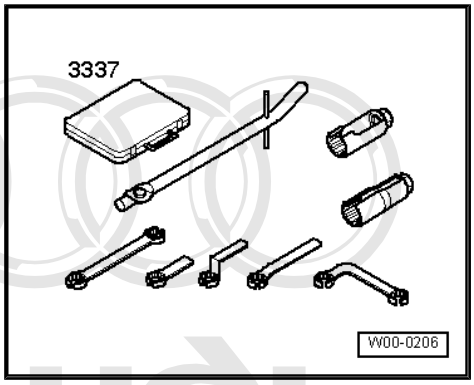
If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the fault memory. Then continue the road test.

– After road test interrogate the fault memory again.

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

Special tools and workshop equipment required

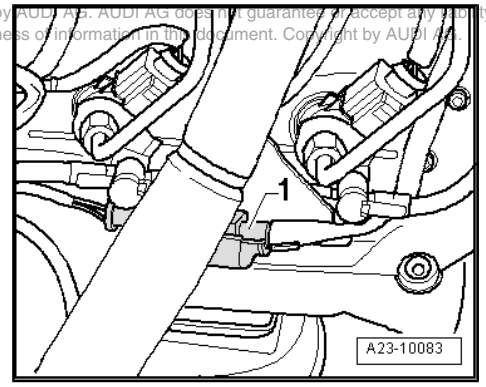
- Lambda probe open ring spanner set - 3337-



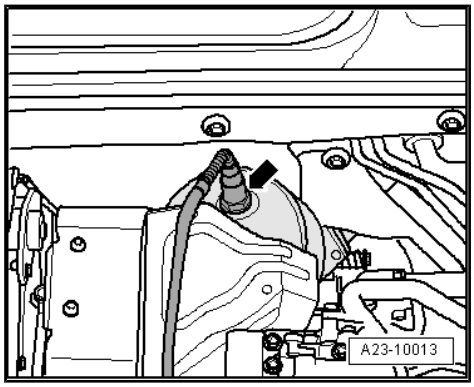
Removing

– Remove engine cover panel ⇒ page 14 .

– Unplug electrical connector -1- for Lambda probe.



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



Installing

When installing, note the following:

Note

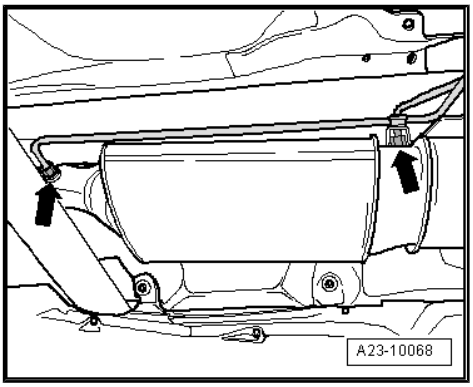
- *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*
- *In the case of a used Lambda probe grease only the thread with an assembly paste (high-temperature paste). For high-temperature paste refer to ⇒ Parts catalogue .*
- *The paste must not get into the slots on the probe body.*
- *When installing, the Lambda probe wiring must always be re-attached at the same locations to prevent it from coming into contact with the exhaust pipe.*
- *Tightening torque: 55 Nm*

1.38 Removing and installing exhaust gas pressure sensor 1 - G450-

Exhaust gas pressure sensor 1 - G450- is only installed on vehicles with particulate filter.

Exhaust gas pressure sensor 1 - G450- is connected via two pipes -arrows- to the take-off points upstream and downstream of the particulate filter.

Exhaust gas pressure sensor 1 - G450- detects the amount of deposits in the particulate filter.

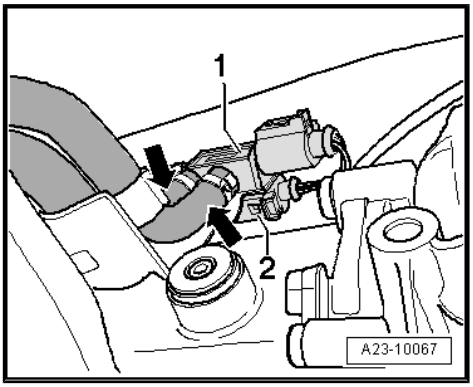


Removing

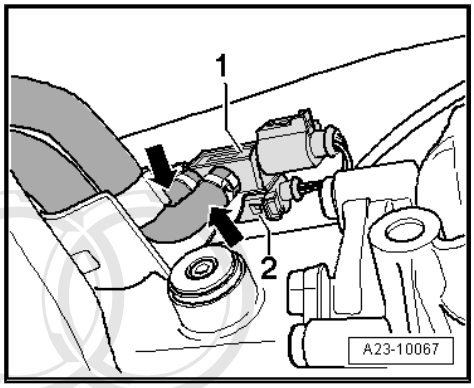
– Exhaust gas pressure sensor 1 - G450- -1- is mounted on gearbox (right-side).

– Before disconnecting, spray the two hoses -arrows- with suitable release agent.

– Carefully pull hoses off connections (take care to keep the hoses straight; the connections can easily break off exhaust gas pressure sensor 1 - G450-).



– Detach electrical connector from exhaust gas pressure sensor 1 - G450- -1-.
– Unscrew the two bolts and remove exhaust gas pressure sensor 1 - G450- .



Installing

– When installing, note the following:

Note

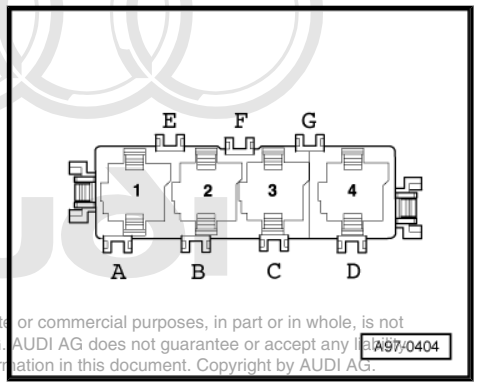
- *Before installing, blow out hoses for exhaust gas pressure sensor 1 - G450- towards particulate filter with compressed air (hoses can become obstructed or may ice up due to condensation).*
- *Make sure that hoses are securely fitted and seal properly.*
- *Tightening torque: 3.5 Nm*
- *If pressure connections are detached from particulate filter, tighten to 30 Nm.*

Adaption must be performed after renewing exhaust gas pressure sensor 1 - G450- and/or particulate filter. (The procedure is described under Guided Functions.)

– Enter correct vehicle identification in Guided Fault Finding.
– Press “Go to” button.
– Press “Function/component selection”.
– Select “Drive train”.
– “01 - Self-diagnosis compatible systems”
– “01 - Engine electronics”
– Select “Functions”.
– “Adapt particulate filter learned values”

28 – Glow plug system

1 Checking glow plug system



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

3 - Automatic glow period control unit - J179-

B - Glow plug fuse

The glow plug system is activated via the automatic glow period control unit - J179- . The automatic glow period control unit - J179- is capable of self-diagnosis. A fault is stored in the engine control unit if a fault occurs in the glow plug system.

The procedure for checking the glow plug system is described in the Guided Fault Finding.

For faster starting, the vehicle is equipped with electronically controlled glow plugs and a separate glow period control unit. The ceramic glow plugs require extra care when handling.

The individual glow plugs (metal or ceramic) are activated and diagnosed separately.

The ceramic glow plugs require extra care when handling.

The individual glow plugs (metal or ceramic) are activated and diagnosed separately.

Note

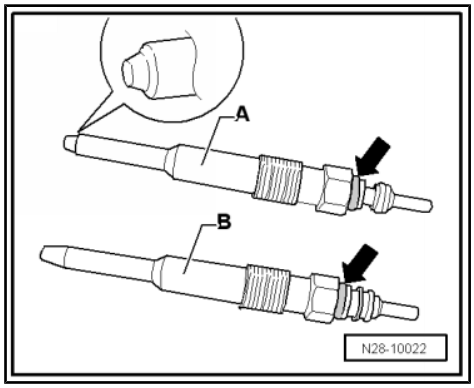
- *Wait for 60 seconds each time after performing final control diagnosis of the glow period control unit. The ignition must remain switched on.*
- *If you do not wait for 60 seconds (if ignition is switched off and immediately switched on again), the glow plugs can be damaged (due to repeated pre-heating).*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

1.1 Removing and installing glow plugs

Note

- *Two different types of glow plugs are fitted in the 3.0 ltr. common rail engine: Bosch ceramic glow plugs or Beru metal glow plugs.*
- *Metal glow plugs are always fitted in the 2.7 ltr. common rail engine.*
- *It is very important to use the correct type of glow plugs depending on the software version of the engine control unit, otherwise the glow plugs will be irreparably damaged when the ignition is switched on.*

Identifying the different types of glow plugs for the 3.0 ltr. engine:



A - Ceramic glow plugs are colour-coded with a “white seal” -arrow- and have a chamfered shoulder at the tip.

B - Metal glow plugs are colour-coded with a “red seal” -arrow-.

Caution

Mixed installation of ceramic glow plugs and metal glow plugs on the same engine is not permissible.

The software of the engine control unit is specifically adapted to either the ceramic or the metal glow plugs, so it is important to install the correct type.

The glow plugs must not be removed when checking cylinder compression. The compression test is performed via the Guided Fault Finding function.

Transport and store only in original packaging or packed separately in bubble wrap.

Do not remove from packaging until immediately prior to installation.

After removal, the cylinder head must not be put down on the gasket side with the glow plugs still installed, because the glow plugs project beyond the gasket surface.

Removing ceramic glow plugs (Bosch)

Caution

Due to the special properties of the material used, the ceramic glow plugs (Bosch type GSK3) are easily damaged and require extra care when handling and installing.

Always install a new ceramic glow plug if you are not sure the old one is in perfect condition.

If a ceramic glow plug has been damaged or the heater pin is broken, this will invariably cause engine damage.

If the heater pin of the glow plug is broken, the fragments must be removed from the engine before starting for the first time, otherwise this will cause mechanical damage (piston seizure). Remove the relevant cylinder head if necessary.

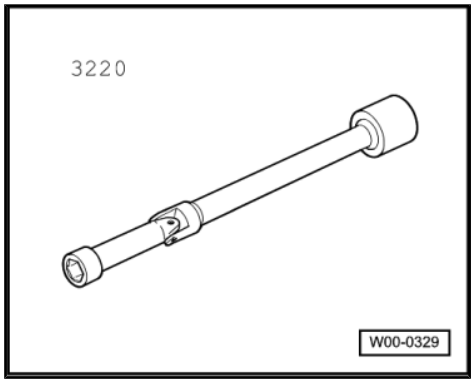
– Before removal, the ceramic glow plugs must be burnt clean using the final control diagnosis function in the diagnostic tester.

– 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.*

– When loosening and tightening ceramic glow plugs, use special tool U/J extension and socket, 10 mm - 3220- and a suitable torque wrench.
– Before removing the ceramic glow plugs, always detach any ancillary components which restrict access (e.g. upper and lower sections of intake manifold).
– Unplug the connector from the glow plug to be removed.
– When loosening a ceramic glow plug, do not exceed the “maximum release torque” of 20 Nm. When loosening, always use U/J extension and socket, 10 mm - 3220- and a torque wrench.



Note

- *If the ceramic glow plugs are difficult to remove (release torque more than 20 Nm), use a suitable penetrating oil spray and try again.*
- *If one of the ceramic glow plugs cannot be loosened by applying the maximum release torque of 20 Nm, the cylinder head must first be removed ⇒ Rep. gr. 15 so the glow plug can be unscrewed.*

– Then unscrew the ceramic glow plug carefully by hand or using a suitable length of hose (approx. 25 cm; Part No. N 020 150 5, sold by the metre). Keep the glow plug straight while unscrewing.
– Carefully pull ceramic glow plugs out from above using a suitable tool (such as a length of hose). Take care to prevent glow plugs from contacting other parts.

Installing ceramic glow plugs

Caution

IMPORTANT: always observe the precautions listed above.

The threads in the cylinder head and on the ceramic glow plugs must be dry, and free of oil and grease.

Note

Before installing glow plugs, clean combustion deposits out of glow plug openings in cylinder head.

– Screw in ceramic glow plugs finger-tight.

It is important to keep to the specified tightening torque for glow plugs: “12 Nm” (threads dry and free of oil and grease). The heater pins of the glow plugs can break if this torque setting is not observed, which invariably causes engine damage.

– Check function of ceramic glow plugs after installation and before starting engine for the first time.

After installation, check electrical resistance directly at glow plug contacts: not greater than 1 Ohm

– If this specification is not obtained (resistance greater than 1 Ohm), remove defective ceramic glow plug again and check whether heater pin is broken. If a broken heater pin is visible, it is very important to remove the fragments from the engine before starting for the first time. Remove cylinder head if necessary, otherwise this will result in mechanical damage to the engine.
– Reconnect electrical connectors on ceramic glow plugs. Make sure that connector engages properly.
– Install any ancillary units that were previously detached.

Additionally check ceramic glow plugs via self-diagnosis.

– Erase fault memory of engine control unit. Do not start engine at this stage.
– Perform final control diagnosis (automatic glow period control unit - J179-).
– Interrogate fault memory again. Do not start engine at this stage.
– The engine must not be started if the fault memory has registered a fault relating to the ceramic glow plugs. Check electrical connectors and renew relevant ceramic glow plug if necessary.

Removing metal glow plugs (Beru)

Caution

Mixed installation of ceramic glow plugs and metal glow plugs on the same engine is not permissible.

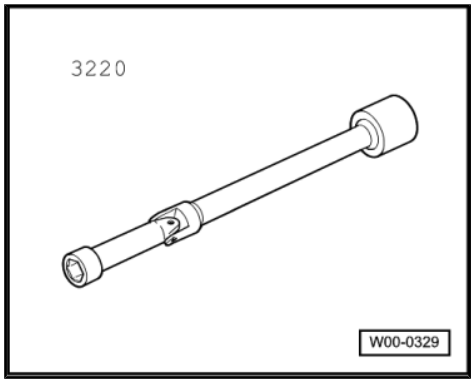
– Switch off ignition.
– Detach glow plug connectors from glow plugs which are to be removed.
– Clean glow plug openings in cylinder head; make sure no dirt gets into cylinder.

Note

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

– Before removal, always detach any ancillary components which restrict access.

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



Installing metal glow plugs

– Before installing glow plugs, clean out combustion deposits from glow plug bores in cylinder head.

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

– Tighten glow plugs.

♦ Tightening torque: 17 Nm

Caution

If the ceramic glow plugs (Bosch) have been replaced with metal glow plugs (Beru) the software of the engine control unit must be flashed accordingly before connecting the glow plug connectors. If this is not done, the metal glow plugs will be IR-REPARABLY DAMAGED when the ignition is switched on.

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

– Install any ancillary units that were previously detached.