

Workshop Manual Audi A6 2005 ➤

**TDI injection and glow plug system (6-cyl. 2.7 ltr.,
3.0 ltr. 4-valve common rail)**

Engine ID	BMK	BPP	BSG	BNG	ASB	CAN A	CAN B	CAN C	CAN D
	CDY A	CDY B	CDY C						

Edition 07.2017



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List of Workshop Manual Repair Groups

Repair Group

23 - Mixture preparation - injection

28 - Glow plug system



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

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23 – Mixture preparation - injection

1 Safety precautions

(ARL005394; Edition 07.2017)

⇒ [“1.1 Safety precautions when using testers and measuring instruments during a road test”, page 1](#)

⇒ [“1.2 Safety precautions when working on vehicles with start/stop system”, page 1](#)

⇒ [“1.3 Safety precautions when working on the fuel system”, page 1](#)

⇒ [“1.4 Safety precautions when working on the exhaust system”, page 3](#)

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

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

Risk of injury if test equipment is not secured

If an accident occurs and the front passenger's airbag is triggered, test equipment which is not secured adequately may be catapulted through the vehicle with potentially serious consequences.

- Secure test equipment on the rear seat with a strap.

Or:

- Have a second mechanic operate test equipment on the rear seat.

1.2 Safety precautions when working on vehicles with start/stop system

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

Risk of injury - engine may start unexpectedly

The engine can start unexpectedly if the vehicle's start/stop system is activated. A message in the instrument cluster indicates whether the start/stop system is activated.

- To deactivate the start/stop system, switch off the ignition.

1.3 Safety precautions when working on the fuel system

When working on the fuel system note the following warnings:

Risk of fire due to escaping fuel

If the battery is connected, the door contact switch activates the fuel pump when the driver's door is opened. Escaping fuel may ignite, causing a fire.



- Before opening the fuel system, disconnect power supply to fuel pump.

Risk of injury - fuel system operates under high pressure

The fuel system is pressurised. There is a risk of injury as fuel may spray out.

Before opening the fuel system:

- Put on safety goggles.
- Put on protective gloves.
- Release pressure (wrap a clean cloth around connection and open connection carefully).

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If components of the fuel system between the fuel tank and the high-pressure pump are removed or renewed, the fuel system must be bled ⇒ [page 34](#) .

Risk of irreparable damage to fuel pump

After working on the fuel system, the fuel pump may be irreparably damaged if it is allowed to run while empty.

- Never allow fuel pump to run while it is empty.
- Fill/bleed fuel pump.

Risk of irreparable damage to electronic components.

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

- Always switch off the ignition before disconnecting the battery.

First fuel filling is only necessary on vehicles with engine codes CANA, CANB, CANC, CAND, CDYA, CDYB and CDYC.

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



Caution

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

- ◆ *If components of the fuel system between the fuel tank and the high-pressure pump are removed or renewed, the fuel system must be bled ⇒ [page 34](#).*
- ◆ *If the high-pressure pump is removed or renewed, the first fuel filling operation must be performed before the engine is started for the first time ⇒ [page 34](#).*

Observe the following points to prevent personal injuries and damage to the injection and glow plug system:

- ◆ Persons wearing a cardiac pacemaker must at all times maintain a safe distance from high-voltage components such as injectors and gas-discharge headlights.
- ◆ Always switch off the ignition before connecting or disconnecting tester cables or electrical wiring for the injection or glow plug system.
- ◆ Do not open any fuel line connections while the engine is running.
- ◆ Always switch off ignition before washing engine.
- ◆ When installing, note colour coding of plug-in connectors.
- ◆ Plug-in connectors should engage audibly when connecting.
- ◆ Pull plug-in connectors to check that they are correctly engaged.
- ◆ Erase any entries in event memory resulting from testing or installation ⇒ Vehicle diagnostic tester, Vehicle self-diagnosis, then Interrogate event memory.



Caution

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

- ◆ *Observe notes on procedure for disconnecting the battery.*
- ◆ *Always switch off the ignition before disconnecting the battery ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery*

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1.4 Safety precautions when working on the exhaust system

Risk of injury when disconnecting the exhaust system

There is a risk of eye irritation caused by soot particles in the air.

- Put on safety goggles.



Danger from toxic exhaust gases

Auxiliary/supplementary heater produces toxic exhaust gases.
There is a risk of poisoning and of damage to the respiratory tract.

- In enclosed spaces, only switch on the auxiliary/supplementary heater if there is an exhaust extraction system.
- In enclosed spaces without an exhaust extraction system, switch off the auxiliary/supplementary heater.

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Risk of damage to flexible joint

The flexible joint can be damaged or develop leaks if it is handled incorrectly.

- Do not bend flexible joint more than 10°.
- Install flexible joint so that it is not under tension.

2 Repair instructions

⇒ [“2.1 Rules for cleanliness”, page 5](#)

⇒ [“2.2 General notes”, page 5](#)

⇒ [“2.3 General repair instructions”, page 6](#)

⇒ [“2.4 Foreign particles in engine”, page 7](#)

⇒ [“2.5 Contact corrosion”, page 7](#)

⇒ [“2.6 Routing and attachment of pipes, hoses and wiring”, page 7](#)

⇒ [“2.7 Installing radiators and condensers”, page 7](#)

⇒ [“2.8 Checking vacuum system”, page 7](#)

2.1 Rules for cleanliness

Even small quantities of dirt can lead to defects. For this reason, please observe the following rules when working on the fuel supply system, injection system and turbocharger:

- ◆ Clean connections and surrounding area thoroughly with engine cleaner or brake cleaner and dry cleaned area before loosening.
- ◆ Immediately seal open lines and connections with clean plugs, for example from engine bung set - VAS 6122- .
- ◆ After removal, place parts on a clean surface and cover them. Only use lint-free cloths.
- ◆ Carefully cover or seal open components if repairs cannot be carried out immediately.
- ◆ Only install clean components; replacement parts should only be unpacked immediately prior to installation. Do not use parts that have not been stored in the proper packaging (e.g. in tool boxes etc.).
- ◆ Do not work with compressed air when the system is open. If possible, do not move vehicle.
- ◆ Protect unplugged electrical connectors against dirt and moisture and make sure connections are dry when attaching.
- ◆ 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.
- ◆ Protect unplugged electrical connectors against dirt and moisture and make sure connections are dry when attaching.

2.2 General notes

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- ◆ The engine control unit has a self-diagnosis capability. Before carrying out repairs and fault finding, the event memory must be interrogated. The vacuum hoses and connections must also be checked (unmetered air).
 - ◆ A voltage of at least 11.5 V is required for proper operation of the electrical components.
 - ◆ Do not use sealants containing silicone. Particles of silicone drawn into the engine will not be burnt in the engine and will damage the Lambda probe.
 - ◆ The vehicles are fitted with a crash fuel shut-off system. This system is designed to reduce the risk of a vehicle fire after a crash by deactivating the fuel pump.

- ◆ At the same time, this system also improves the engine's starting performance. When the driver's door is opened, the fuel pump is activated for 2 seconds in order to build up pressure in the fuel system ⇒ [page 1](#) .
- ◆ 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 event memory of the engine control unit - J623- if a fault occurs in the glow plug system.
- ◆ The procedure for checking the glow plug system is described in the "Guided Fault Finding".
- ◆ For faster starting, the vehicle is equipped with electronically controlled glow plugs and a separate glow period control unit.
- ◆ Each glow plug is activated and diagnosed separately.

2.3 General repair instructions



Caution

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

- ◆ ***If components of the fuel system between the fuel tank and the high-pressure pump are removed or renewed, the fuel system must be filled and bled before the engine is started for the first time ⇒ [page 34](#) .***

- ◆ Clean tools and workbench etc. before working on the injection system.
- ◆ Before installing, check the injectors and their surroundings visually; they must be undamaged and clean. Make sure the injector bores in the cylinder head are clean. Wipe out if necessary using a clean cloth, taking care not to cause damage. Do not use sharp objects of any kind.
- ◆ If the high-pressure fuel lines are to be re-used, you must mark them before removal. High-pressure pipes must always be re-installed on the same cylinder.
- ◆ Take care not to damage the injectors when removing the old copper seals.
- ◆ Check all new O-rings for damage before installing. Lubricate O-rings with engine oil or assembly oil before installing.
- ◆ Position high-pressure pipes so they are free of stress. Tighten all unions lightly to start with before tightening to final torque.
- ◆ Never attempt to bend high-pressure fuel lines to shape.
- ◆ When working on any parts of the high-pressure fuel system, tools may only be used for loosening and tightening pipe unions. All other components must always be removed and installed by hand without using tools or other equipment.
- ◆ Press the fuel return hoses onto the injectors by hand from above so that they engage audibly on each injector (do not press in the release pins when doing this). Then press down the release pin after connecting the return line. Check that the fuel return hoses are seated securely and sealed properly by pulling them by hand from above.
- ◆ Do not dismantle individual common rail components. If there is a fault, the complete components must be renewed.

- ◆ When the engine is running, do not perform any repairs to the common rail system.
- ◆ Do not bleed the common rail system by unfastening high-pressure components after the engine has been started.
- ◆ All cable ties which are released or cut open when removing must be refitted in the same position when installing.
- ◆ Fuel hoses in engine compartment must only be secured with spring-type clips. O-type clips or screw-type clips must not be used.

2.4 Foreign particles in engine

When performing assembly work on the engine, all open passages in the intake and exhaust systems must be sealed with suitable plugs (e.g. from engine bung set - VAS 6122-) to prevent foreign particles from entering the engine.

2.5 Contact corrosion

Contact corrosion can occur if unsuitable fasteners are used (e.g. bolts, nuts, washers, etc.).

For this reason, only fasteners with a special surface coating are fitted.

Additionally, all rubber and plastic parts and all adhesives are made of non-conductive materials.

Always install new parts if you are not sure whether used parts can be re-fitted ⇒ Electronic parts catalogue .

Please note:

- ◆ We recommend using only genuine replacement parts; these have been tested and are compatible with aluminium.
- ◆ We recommend the use of Audi accessories.
- ◆ Damage caused by contact corrosion is not covered by warranty.

2.6 Routing and attachment of pipes, hoses and wiring

- ◆ Mark fuel lines, hydraulic lines, vacuum lines, lines for activated charcoal filter and electrical wiring etc. before removal so they can be re-installed in the original positions and correctly connected. Make sketches or take photographs if necessary.
- ◆ To avoid damaging pipes, hoses and wiring, ensure sufficient clearance from all moving or hot components in engine compartment (limited space in engine compartment).

2.7 Installing radiators and condensers

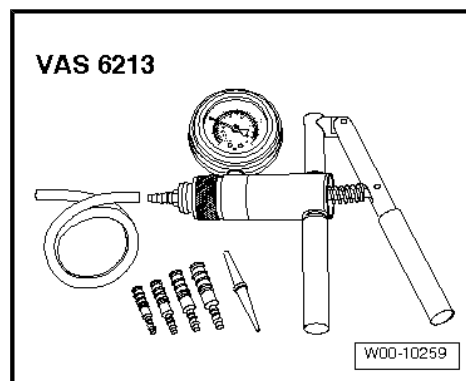
Even when the radiator, condenser and charge air cooler are correctly installed, slight impressions may be visible on the fins of these components. This does not mean that the components are damaged. If the fins are only very slightly distorted, this does not justify renewal of the radiator, charge air cooler or condenser.

2.8 Checking vacuum system

Special tools and workshop equipment required



◆ Hand vacuum pump - VAS 6213-



Procedure

- Check all vacuum lines in the complete vacuum system for:
 - ◆ Cracks
 - ◆ Traces of animal bites
 - ◆ Kinked or crushed lines
 - ◆ Porous or leaking lines
- Check vacuum line to solenoid valve and from solenoid valve to corresponding component.
- If an entry is stored in the event memory, check the vacuum lines leading to the corresponding component and also check the other vacuum lines leading to other components.
- If it is not possible to build up pressure with the hand vacuum pump - VAS 6213- or if the pressure drops again immediately, check the hand vacuum pump and connecting hoses for leaks.



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3 Injection system

3.1 Overview of fitting locations - injection system, vehicles with engine codes BMK, BPP, BSG, BNG, ASB

Components A to O are not shown in the illustration

1 - Electronics box in plenum chamber

- ☐ Engine control unit with altitude sender
- ☐ Removing and installing engine control unit
⇒ [page 145](#)

2 - Air mass meter - G70-

- ☐ Fitting location
⇒ [page 13](#)
- ☐ Removing and installing
⇒ [page 39](#)

3 - Hall sender - G40-

- ☐ Fitting location
⇒ [page 13](#)

4 - Fuel temperature sender - G81-

- ☐ Fitting location
⇒ [page 14](#)

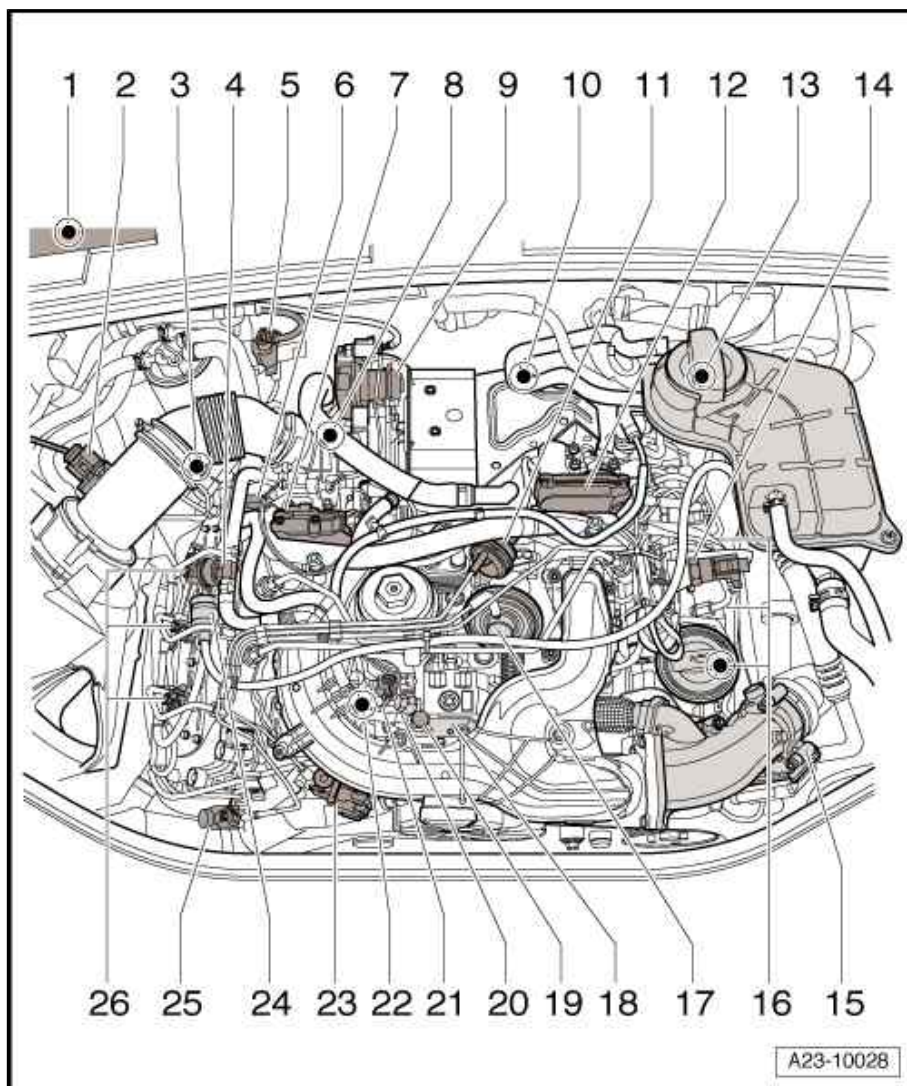
5 - Electrical connector for engine speed sender - G28-

6 - Fuel pressure regulating valve - N276-

- ☐ Fitting location
⇒ [page 14](#)
- ☐ Cannot be re-installed
- ☐ Removing and installing
⇒ [page 135](#)

7 - Intake manifold flap motor - V157-

- ☐ Cylinder bank 1
- ☐ Fitting location



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⇒ [page 13](#)

- ☐ Removing and installing ⇒ [page 55](#)
- ☐ Exploded view - intake manifold ⇒ [page 40](#)

8 - Coolant temperature sender - G62-

- ☐ Removing and installing ⇒ Rep. gr. 19

9 - Control unit for turbocharger 1 - J724-

- ☐ Fitting location ⇒ [page 13](#)
- ☐ Removing and installing ⇒ Rep. gr. 21

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

- ☐ Fitting location ⇒ [page 12](#)
- ☐ Removing and installing ⇒ [page 140](#)

11 - Vacuum unit

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

12 - Intake manifold flap 2 motor - V275-

- ☐ Cylinder bank 2
- ☐ Fitting location ⇒ [page 13](#)
- ☐ Removing and installing ⇒ [page 55](#)
- ☐ Exploded view - intake manifold ⇒ [page 145](#)

13 - Connector for Lambda probe - G39- with Lambda probe heater - Z19-

- ☐ Fitting location ⇒ [page 12](#)

14 - Fuel pressure sender - G247-

- ☐ Fitting location ⇒ [page 13](#)
- ☐ Removing and installing ⇒ [page 139](#)

15 - Throttle valve module - J338-

16 - Injectors

- ☐ Cylinder bank 2
- ☐ Removing and installing ⇒ [page 84](#)

17 - Mechanical exhaust gas recirculation valve

- ☐ Exploded view - exhaust gas recirculation system ⇒ Rep. gr. 26
- ☐ Removing and installing ⇒ Rep. gr. 26

18 - High-pressure fuel pump

- ☐ With gear-type fuel system pressurisation pump
- ☐ Exploded view: vehicles up to 10 2005 ⇒ [page 101](#); vehicles from 10 2005 onwards ⇒ [page 107](#)
- ☐ Removing and installing: vehicles up to 10 2005 ⇒ [page 104](#); vehicles from 10 2005 onwards ⇒ [page 110](#)

19 - Fuel supply line connection

20 - Fuel return line connection

21 - Fuel metering valve - N290-

22 - Oil pressure switch - F1-

- ☐ Checking ⇒ Rep. gr. 17

23 - Exhaust gas recirculation valve - N18-

- ☐ Engine code letters BMK and BNG: ⇒ [page 15](#)
- ☐ Engine code letters BPP and BSG: ⇒ [page 14](#)

24 - 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 injectors

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

- ☐ Engine code letters BMK and BNG: ⇒ [page 15](#)
- ☐ Engine code letters BPP and BSG: ⇒ [page 14](#)
- ☐ Exploded view - exhaust gas recirculation system ⇒ Rep. gr. 26

26 - Injectors

- ☐ Cylinder bank 1
- ☐ Removing and installing ⇒ [page 84](#)

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

- ☐ In footwell on pedal bracket near brake pedal

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

- ☐ In footwell on pedal bracket near accelerator pedal
- ☐ On vehicles with automatic gearbox the function of the kick-down switch must be re-adapted if this part is renewed
- ☐ Refer to Guided Fault Finding or ⇒ Rep. gr. 20 for adapting kick-down function

C - Charge pressure sender - G31-

- ☐ With intake air temperature sender - G42-
- ☐ In charge air cooler (left-side) ⇒ [page 12](#)
- ☐ Removing and installing ⇒ Rep. gr. 21

D - Engine speed sender - G28-

- ☐ In gearbox housing above starter ring gear

E - Air filter bypass flap valve - N275-

- ☐ These components (bypass flap with air filter 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 filter bypass flap valve - N275- is located on the outside of the air cleaner housing ⇒ [page 13](#)

F - Fuel pump relay - J17-

- ☐ Relay and fuse holder in electronics box in plenum chamber (left-side) ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

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

- ☐ 9-position relay and fuse holder behind driver's storage compartment ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

H - Automatic glow period control unit - J179-

- ☐ Relay and fuse holder in electronics box in plenum chamber (right-side) ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

I - Low heat output relay - J359- and high heat output relay - J360-

- ☐ Relay and fuse holder on steering cross member ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

J - Terminal 15 voltage supply relay - J329-

- ☐ 9-position relay and fuse holder behind driver's storage compartment ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

K - Exhaust gas temperature sender 1 - G235-

- ☐ Only fitted on 3.0 ltr. engine with code letters BMK and BNG
- ☐ In turbocharger
- ☐ Removing and installing ⇒ Rep. gr. 26

L - Exhaust gas temperature sender 2 - G448-

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

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M - Temperature sender before particulate filter - G506-

- ☐ Only fitted on vehicles with particulate filter
- ☐ Screwed directly into particulate filter
- ☐ Removing and installing ⇒ Rep. gr. 26

N - 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 141](#)
- ☐ After renewing, perform [Adaption](#) in [Guided Functions](#) ⇒ Vehicle diagnostic tester

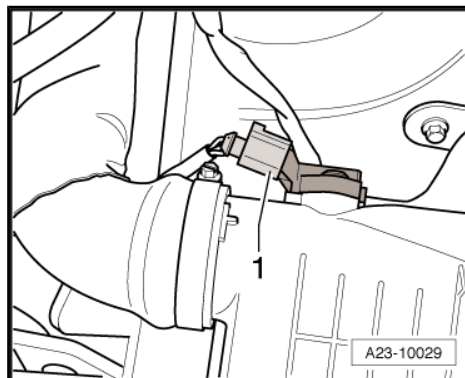
O - Particulate filter

- ☐ Fitted on underbody
- ☐ Combined with a catalytic converter
- ☐ After renewing, perform [Adaption](#) in [Guided Functions](#) ⇒ Vehicle diagnostic tester
- ☐ Removing and installing ⇒ Rep. gr. 26

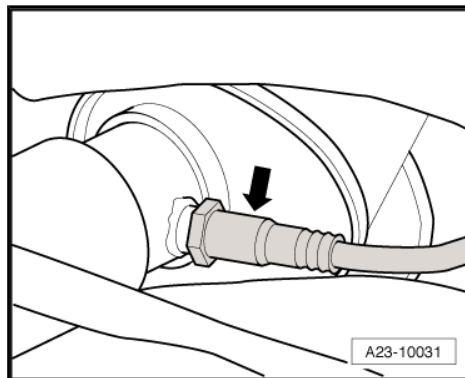
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Charge pressure sender - G31- with intake air temperature sender - G42-

1 - In charge air cooler (left-side)

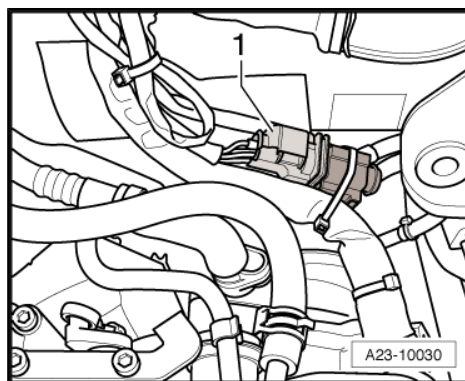


Lambda probe - G39- with Lambda probe heater - Z19- -arrow-



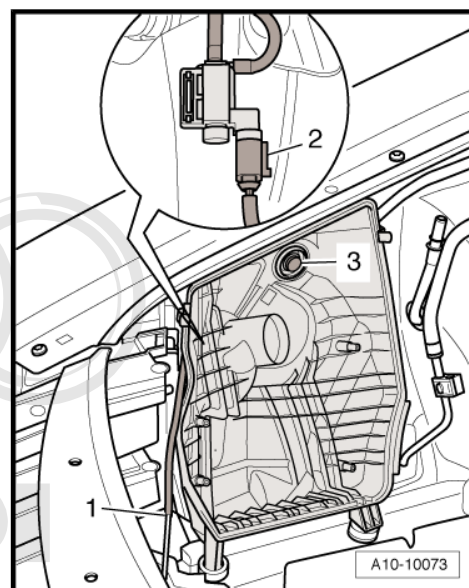
Connector

1 - Lambda probe - G39- with Lambda probe heater - Z19-



Air filter bypass flap valve - N275-

2 - On air cleaner housing

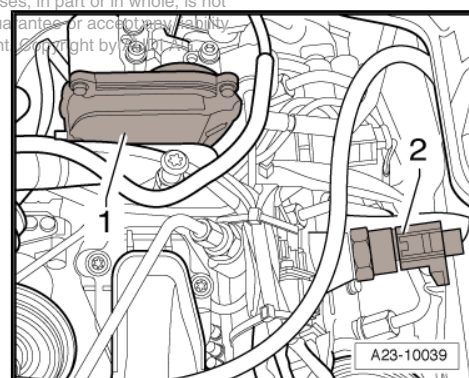


Fitting locations

1 - Intake manifold flap 2 motor - V275-

2 - Fuel pressure sender - G247-

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Fitting locations

1 - Air mass meter - G70-

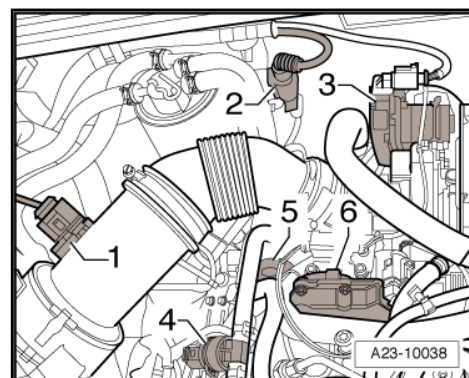
2 - Electrical connector for engine speed sender - G28-

3 - Control unit for turbocharger 1 - J724-

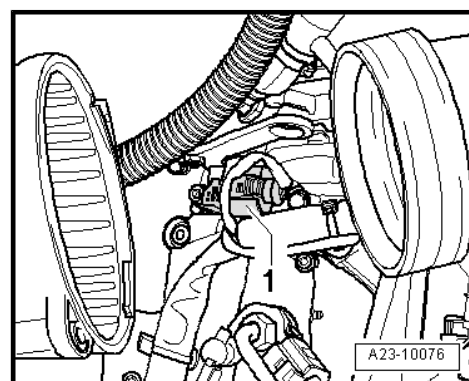
4 - Fuel temperature sender - G81-

5 - Fuel pressure regulating valve - N276-

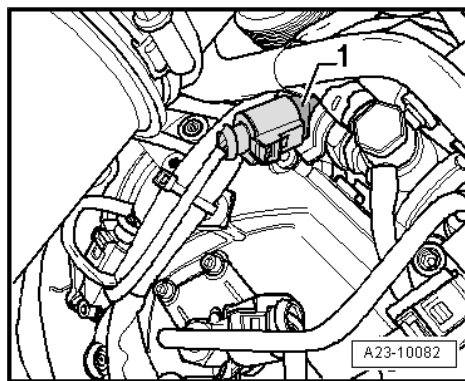
6 - Intake manifold flap motor - V157-



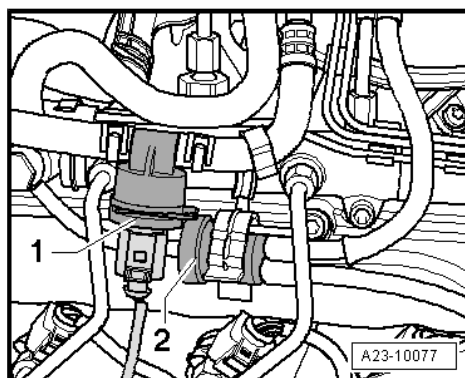
Hall sender - G40- -1- on cylinder bank 1



Fuel pressure regulating valve - N276- -1-

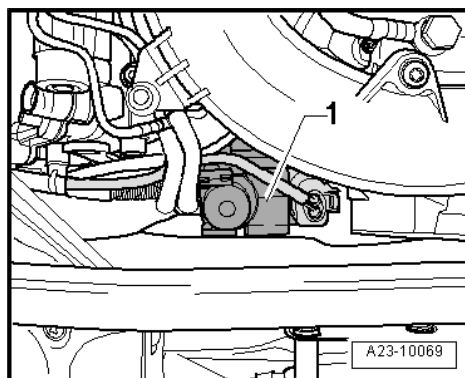


Fuel temperature sender - G81- -1- and pressure retention valve -2-



Component only on vehicles with engine code letters BPP and BSG:

1 - Exhaust gas recirculation valve - N18-

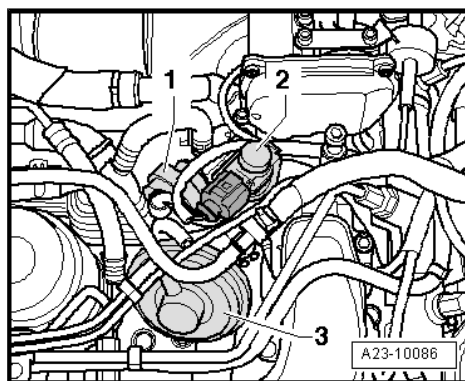


Components only on vehicles with engine code letters BPP and BSG:

1 - Vacuum unit for change-over flap for exhaust gas recirculation cooler

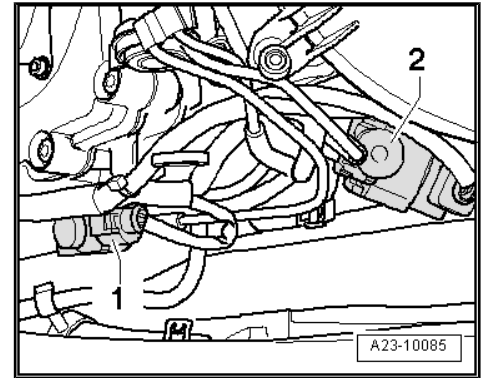
2 - Exhaust gas recirculation cooler change-over valve - N345-

3 - Mechanical exhaust gas recirculation valve



Engine code letters BMK and BNG:

- 1 - Exhaust gas recirculation cooler change-over valve - N345-
- 2 - Exhaust gas recirculation valve - N18-



3.2 Overview of fitting locations - injection system, vehicles with engine codes CANA, CANB, CANC, CAND, CDYA, CDYB, CDYC

Engine compartment (right-side)

1 - Air filter bypass flap valve - N275-

- ☐ These components (bypass flap with air filter bypass flap valve - N275-) are not installed on certain equipment versions or on vehicles for certain export markets
- ☐ Exploded view - air cleaner ⇒ [page 35](#)

2 - Air mass meter - G70-

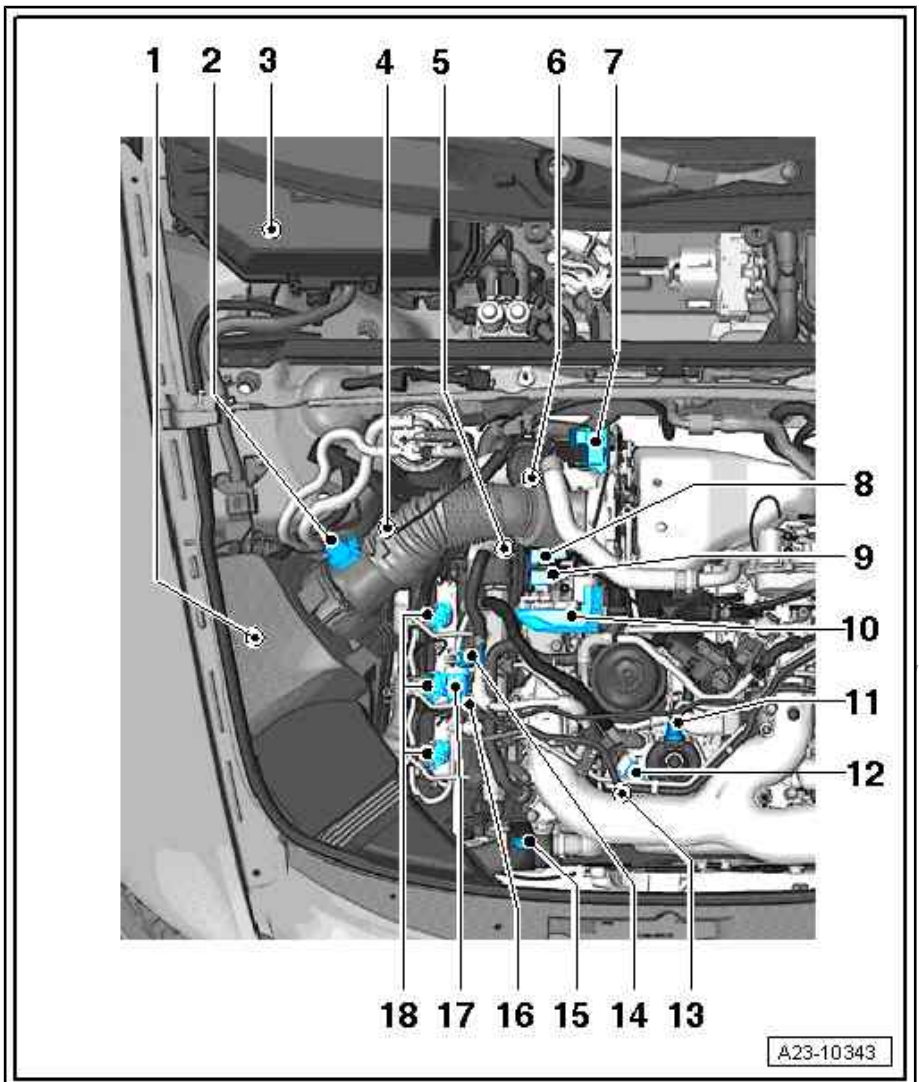
- ☐ Removing and installing ⇒ [page 39](#)

3 - Electronics box in plenum chamber (right-side)

- ☐ Engine control unit - J623-
- ☐ Fitting location ⇒ [page 19](#)
- ☐ Removing and installing ⇒ [page 145](#)
- ☐ Fitting locations, relay and fuse assignment ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

4 - Hall sender - G40-

- ☐ Fitting location





⇒ [page 13](#)

5 - Fuel pressure regulating valve - N276-

- ☐ Fitting location ⇒ [Fig. ““ Fuel pressure regulating valve -N276--1-””, page 14](#)
- ☐ Removing and installing ⇒ [page 135](#)

6 - Coolant temperature sender - G62-

- ☐ Fitting location ⇒ [page 20](#)
- ☐ Removing and installing ⇒ Rep. gr. 19

7 - Control unit for turbocharger 1 - J724-

- ☐ Removing and installing ⇒ Rep. gr. 21

8 - Connector for exhaust gas recirculation temperature sensor - G98-

- ☐ Fitting location ⇒ [page 21](#)

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

- ☐ Fitting location ⇒ [page 23](#)

10 - Intake manifold flap motor - V157-

- ☐ Cylinder bank 1
- ☐ Exploded view - intake manifold ⇒ [page 63](#)

11 - Connection for high-pressure fuel pipe

12 - High-pressure fuel pump

- ☐ With fuel metering valve - N290-
- ☐ After renewing high-pressure fuel pump, first fuel filling MUST be performed (it is important not to allow pump to run while it is still empty) ⇒ [page 132](#)
- ☐ Exploded view - high-pressure pump ⇒ [page 127](#)
- ☐ Removing and installing ⇒ [page 130](#)

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

- ☐ Removing and installing ⇒ Rep. gr. 17
- ☐ Checking: see Guided Fault Finding function of vehicle diagnostic, testing and information system - VAS 5051B-

14 - Fuel temperature sender - G81-

- ☐ Fitting location ⇒ [page 21](#)

15 - Pump for exhaust gas recirculation cooler - V400-

- ☐ Fitting location ⇒ [page 21](#)

16 - Radiator outlet coolant temperature sender - G83-

- ☐ Fitting location ⇒ [Fig. ““Components on cylinder bank \(right-side\)””, page 21](#)
- ☐ Removing and installing ⇒ Rep. gr. 17

17 - Pressure retention valve

- ☐ Fitting location ⇒ [page 21](#)
- ☐ In fuel return lines from cylinder banks 1 and 2
- ☐ The pressure retention valve maintains a residual pressure of approx. 10 bar in the return lines.
- ☐ This residual pressure is required for the control function of the injectors
- ☐ The pressure retention valve may only be renewed together with the fuel return lines.
- ☐ After renewing component, fuel system must be bled ⇒ [page 132](#)
- ☐ Checking pressure retention valve ⇒ [page 80](#)

18 - Injectors

- ☐ Cylinder bank 1
- ☐ Removing and installing ⇒ [page 84](#)

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Engine compartment (left-side)

Components A to J are not shown on the exploded view.

1 - Exhaust gas recirculation temperature sensor - G98-

- ☐ Fitting location
⇒ [page 21](#)
- ☐ Removing and installing
⇒ Rep. gr. 26

2 - Intake manifold flap 2 motor - V275-

- ☐ Cylinder bank 2
- ☐ Exploded view - intake manifold ⇒ [page 63](#)

3 - Lambda probe - G39- with Lambda probe heater - Z19-

- ☐ Fitting location
⇒ [page 23](#)
- ☐ Removing and installing
⇒ [page 140](#)
- ☐ 50 Nm

4 - Electrical connector for Lambda probe - G39-

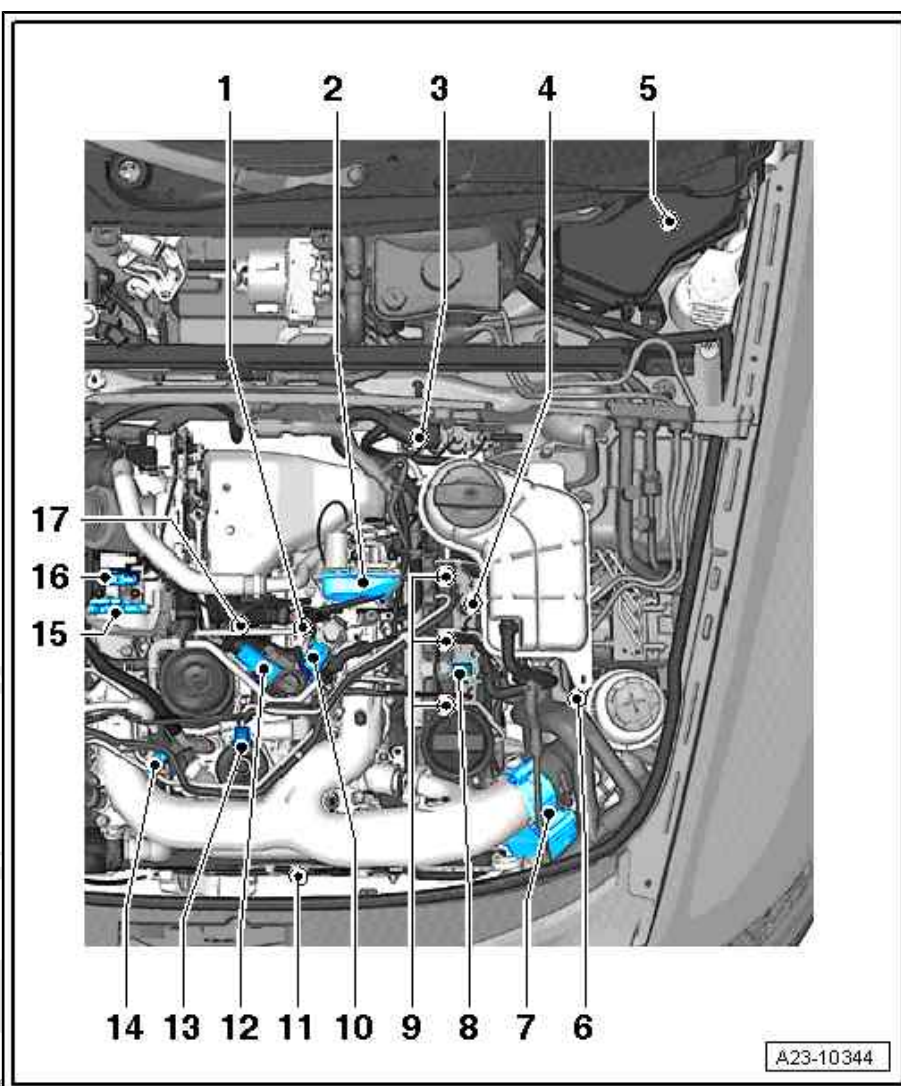
- ☐ Fitting location
⇒ [page 23](#)

5 - Electronics box in plenum chamber (left-side)

- ☐ Fitting locations, relay and fuse assignment
⇒ Current flow diagrams, Electrical fault finding and Fitting locations

6 - Charge pressure sender - G31-

- ☐ With intake air tempera



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ture sender - G42-

- ☐ Fitting location ⇒ [page 22](#)
- ☐ Removing and installing ⇒ Rep. gr. 21

7 - Throttle valve module - J338-

- ☐ 9 Nm

8 - Fuel pressure sender - G247-

- ☐ Fitting location ⇒ [page 20](#)
- ☐ Removing and installing ⇒ [page 139](#)
- ☐ 25 Nm

9 - Injectors

- ☐ Cylinder bank 2
- ☐ Removing and installing ⇒ [page 84](#)

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

- ☐ Fitting location ⇒ [page 21](#)
- ☐ Overview of exhaust gas recirculation system ⇒ Rep. gr. 26

11 - Oil pressure control

- ☐ Oil pressure switch - F22-
- ☐ Valve for oil pressure control - N428-
- ☐ Fitting location ⇒ [page 22](#)
- ☐ Removing and installing ⇒ Rep. gr. 17

12 - Exhaust gas recirculation control motor - V338-

- ☐ Fitting location ⇒ [page 21](#)
- ☐ Overview of exhaust gas recirculation system ⇒ Rep. gr. 26

13 - High-pressure fuel pump

- ☐ With fuel metering valve - N290-
- ☐ After renewing high-pressure fuel pump, first fuel filling MUST be performed (it is important not to allow pump to run while it is still empty) ⇒ [page 132](#)
- ☐ Exploded view - high-pressure pump ⇒ [page 127](#)
- ☐ Removing and installing ⇒ [page 130](#)

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

- ☐ Fitting location ⇒ [page 22](#)
- ☐ Removing and installing ⇒ Rep. gr. 17

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

- ☐ Fitting location ⇒ [page 23](#)

16 - Connector for exhaust gas recirculation temperature sensor - G98-

- ☐ Fitting location ⇒ [page 21](#)

17 - Vacuum unit

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

A - Low heat output relay - J359- and high heat output relay - J360-

- ☐ Fitting locations ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

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

- ☐ In footwell on brake pedal

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

- ☐ Fitting location ⇒ [page 20](#)
- ☐ Removing and installing ⇒ Rep. gr. 20

D - Engine speed sender - G28-

- ☐ Fitting location ⇒ [page 22](#)

E - Supplementary fuel pump - V393-

- ☐ Removing and installing ⇒ Rep. gr. 20

F - Exhaust gas temperature sender 1 - G235-

- ☐ On turbocharger
- ☐ 45 Nm
- ☐ Removing and installing ⇒ Rep. gr. 26

G - Exhaust gas temperature sender 3 - G495-

- ☐ Located downstream of starter catalytic converter
- ☐ Electrical connector ⇒ [page 24](#)
- ☐ Removing and installing ⇒ Rep. gr. 26
- ☐ 45 Nm

H - Exhaust gas temperature sender 4 - G648-

- ☐ Fitting location of electrical connector ⇒ [page 23](#)
- ☐ Removing and installing ⇒ Rep. gr. 26

I - Exhaust gas pressure sensor 1 - G450-

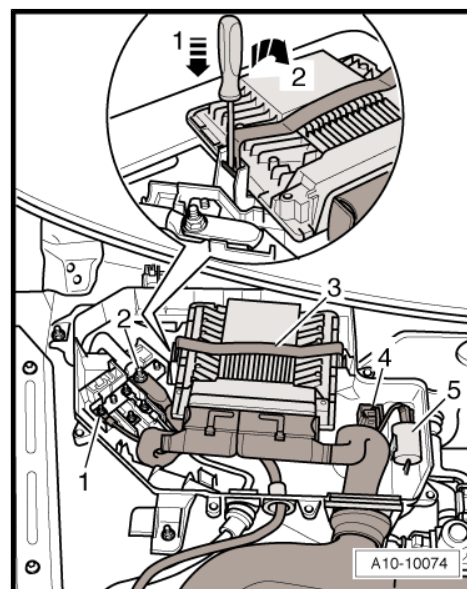
- ☐ Fitting location ⇒ [page 23](#)
- ☐ After renewing, perform **Adaption** in **Guided Functions** ⇒ Vehicle diagnostic tester
- ☐ Removing and installing ⇒ [page 141](#)

J - Particulate filter

- ☐ Fitted on underbody
- ☐ Combined with a catalytic converter
- ☐ After renewing, perform **Adaption** in **Guided Functions** ⇒ Vehicle diagnostic tester
- ☐ Removing and installing ⇒ Rep. gr. 26

Fitting location of engine control unit - J623-

- ◆ In right-side electronics box in engine compartment.





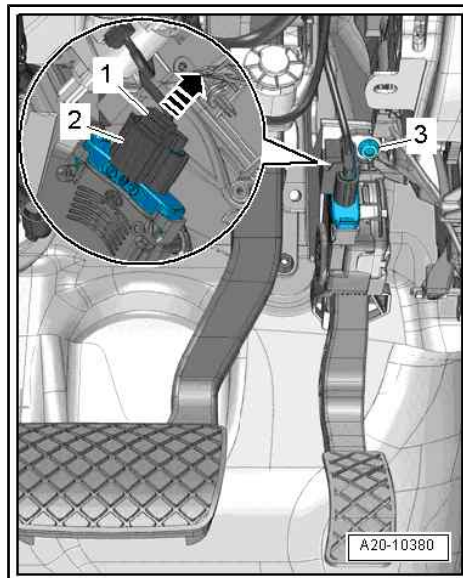
Accelerator position sender - G79- and accelerator position sender 2 - G185-

Removing and installing ⇒ Rep. gr. 20

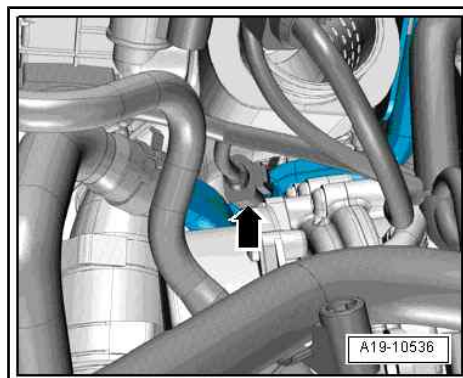


Note

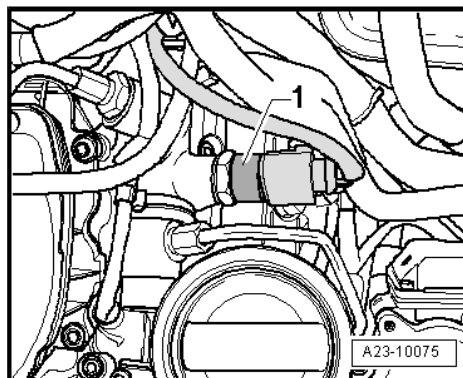
The accelerator position sender - G79- and accelerator position sender 2 - G185- are integrated in the accelerator pedal module and cannot be renewed individually.



Coolant temperature sender - G62-

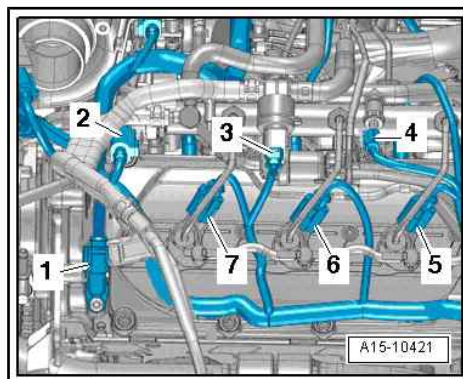


Fuel pressure sender - G247- -1- on cylinder bank 2

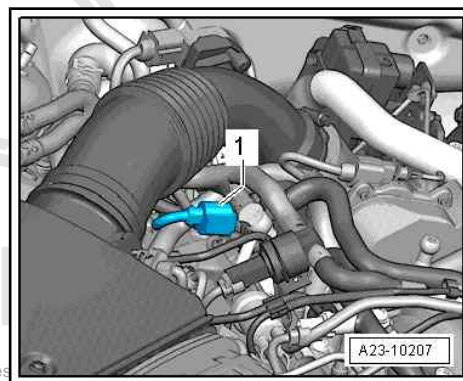


Fitting locations on cylinder bank 1

- 1 - Hall sender - G40-
- 2 - Fuel pressure regulating valve - N276-
- 3 - Fuel temperature sender - G81-
- 4 - Radiator outlet coolant temperature sender - G83-
- 5, 6, 7 - Injectors

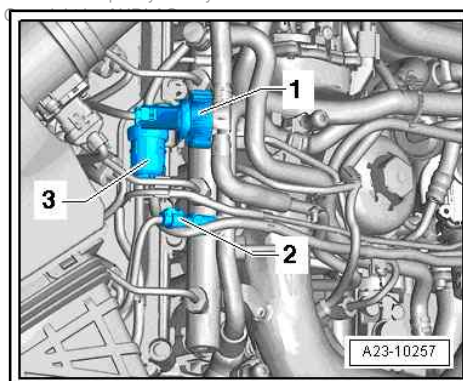


Fuel pressure regulating valve - N276- -1- on cylinder bank 1



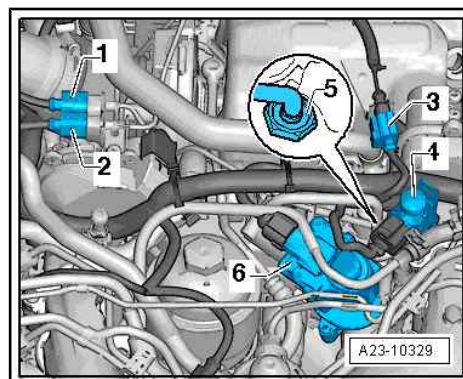
Components on cylinder bank (right-side)

- 1 - Fuel temperature sender - G81-
- 2 - Radiator outlet coolant temperature sender - G83-
- 3 - Pressure retention valve in fuel return line

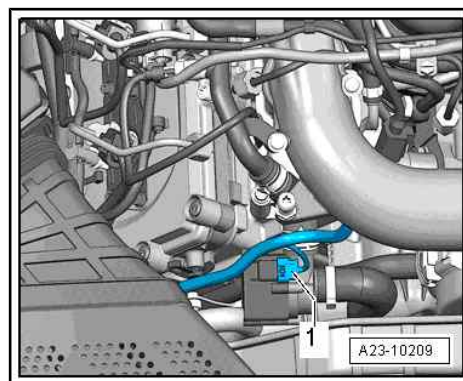


Fitting locations

- 1 - Electrical connector for exhaust gas recirculation temperature sensor - G98-
- 2 - Electrical connector for exhaust gas temperature sender 1 - G235-
- 3 - Not fitted at this location
- 4 - Exhaust gas recirculation cooler change-over valve - N345-
- 5 - Exhaust gas recirculation temperature sensor - G98-
- 6 - Exhaust gas recirculation control motor - V338-

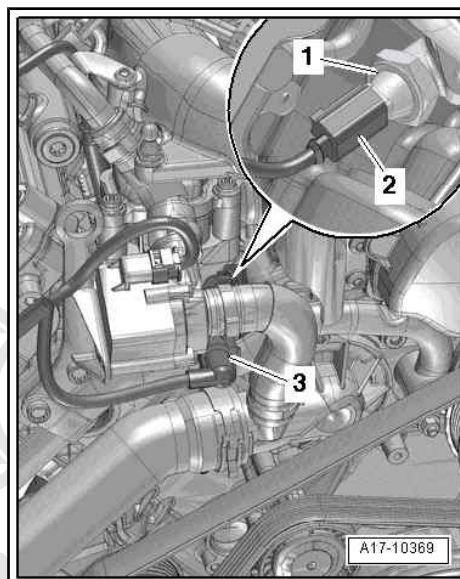


Pump for exhaust gas recirculation cooler - V400- -1-



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

◆ Removing and installing ⇒ Rep. gr. 17

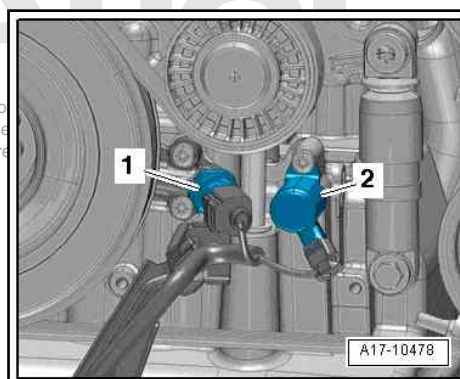


Oil pressure control

1 - Oil pressure switch - F22-

2 - Valve for oil pressure control - N428-

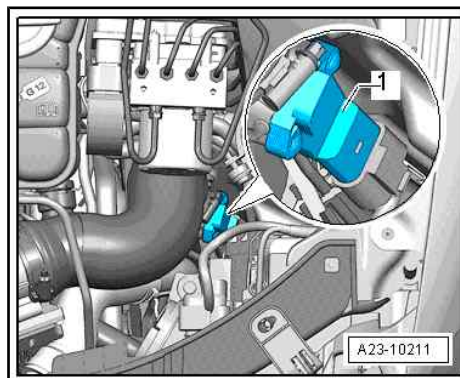
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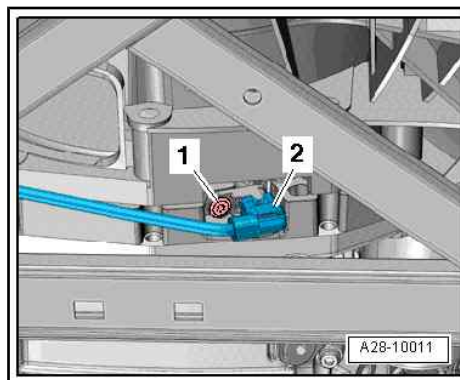
is not liability G.

Charge pressure sender - G31- with intake air temperature sender - G42- -1- in charge air cooler

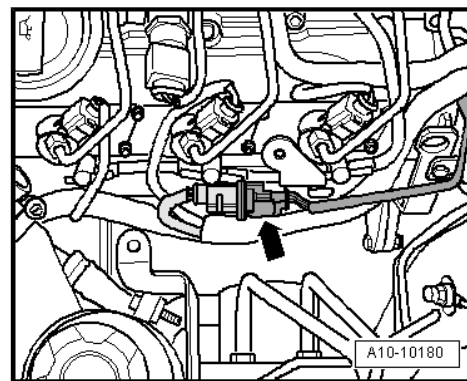
◆ Removing and installing ⇒ Rep. gr. 21



Engine speed sender - G28- -2-

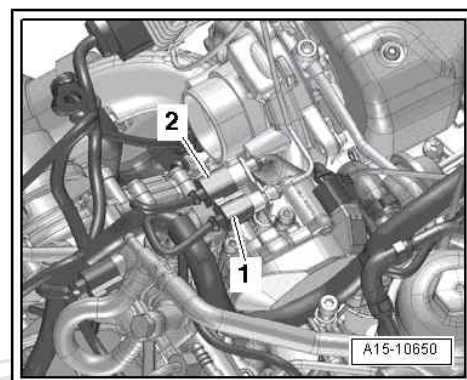


Fitting location of Lambda probe - G39- -arrow-



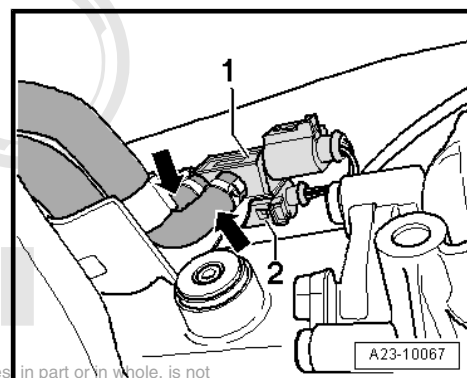
Fitting locations

- 1 - Electrical connector for exhaust gas temperature sender 1 - G235-
- 2 - Electrical connector for exhaust gas recirculation temperature sensor - G98-

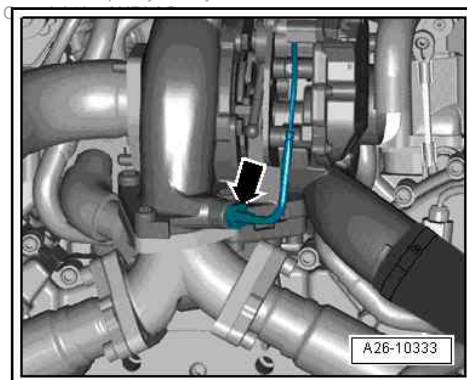


Components on gearbox end (right-side)

- 1 - Exhaust gas pressure sensor 1 - G450-
- 2 - Exhaust gas temperature sender 4 - G648-



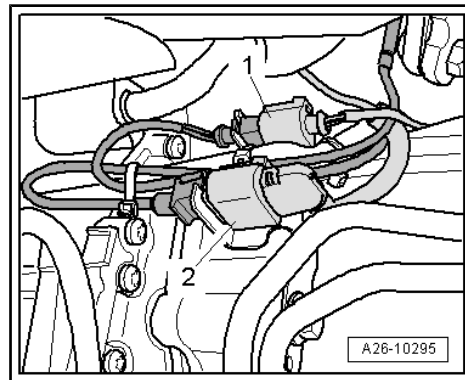
Exhaust gas temperature sender 1 - G235- -arrow-



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Exhaust gas temperature sender 3 - G495-

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



3.3 Overview - fuel system, vehicles with engine codes BMK, BPP, BSG, BNG, ASB

**Caution**

*Always read instructions on ⇒ **page 1** when working on injectors.*

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

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1 - Fuel metering valve - N290-

- ☐ Do not unscrew

2 - High-pressure fuel pump

- ☐ High-pressure pump generates fuel pressure up to 1600 bar
- ☐ Gear-type fuel system pressurisation pump generates fuel pressure between 4 and 5 bar
- ☐ Exploded view: vehicles up to 10.2005
⇒ [page 101](#) ; vehicles from 10.2005 onwards
⇒ [page 107](#)
- ☐ Removing and installing: vehicles up to 10.2005 ⇒ [page 104](#) ; vehicles from 10.2005 onwards ⇒ [page 110](#)

3 - Fuel rail

- ☐ For cylinder bank 1

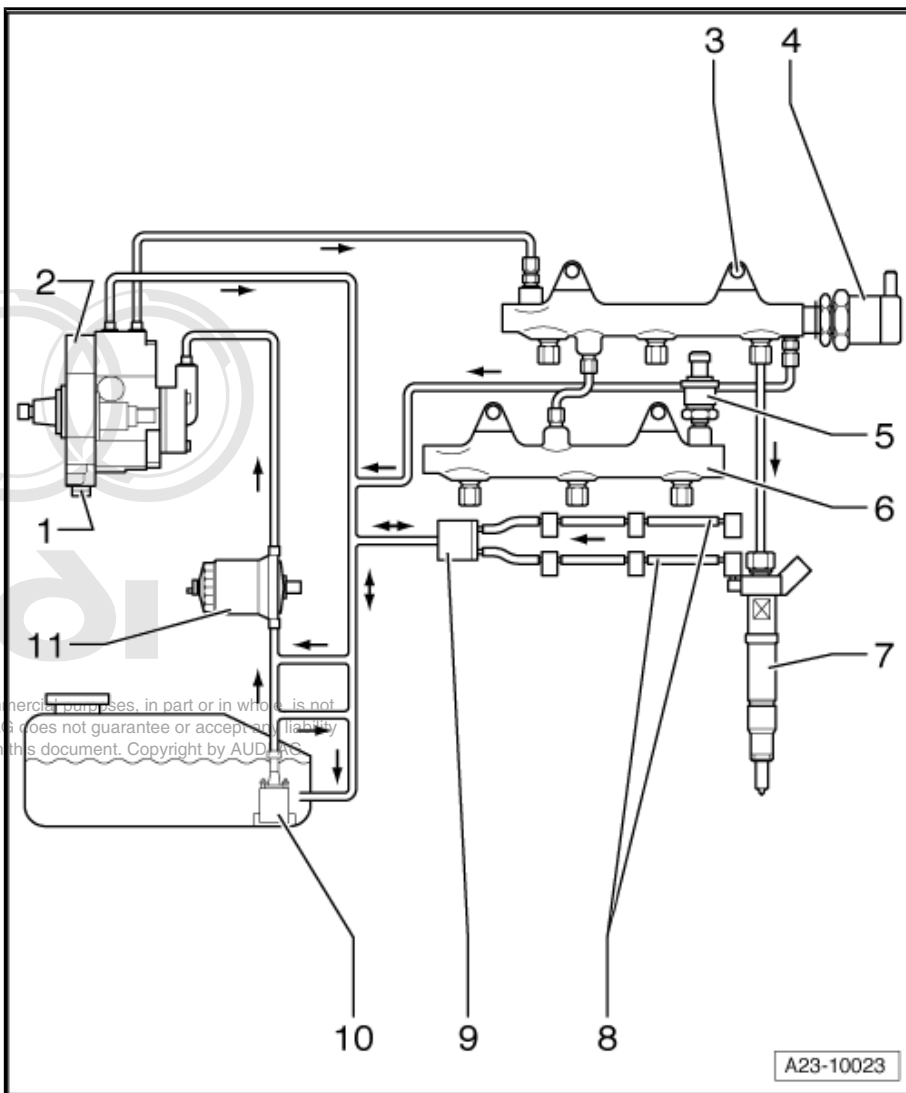
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4 - Fuel pressure regulating valve - N276-

- ☐ Screwed into fuel rail on cylinder bank 1
- ☐ Cannot be re-installed
- ☐ Removing and installing
⇒ [page 135](#)

5 - Fuel pressure sender - G247-

- ☐ Screwed into fuel rail on



cylinder bank 2

- ☐ 30 Nm
- ☐ Removing and installing ⇒ [page 139](#)

6 - Fuel rail

- ☐ For cylinder bank 2

7 - Injectors

- ☐ Removing and installing ⇒ [page 84](#)

8 - Fuel return line

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

9 - Pressure retention valve

- ☐ The pressure retention valve maintains a residual pressure of approx. 10 bar in the fuel return lines.
- ☐ This residual pressure is required for the control function of the 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
- ☐ If the pressure retention valve is defective there will be no entry in the event memory and the engine will lose power
- ☐ Checking pressure retention valve ⇒ [page 80](#)

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

3.4 Overview - fuel system, vehicles with engine codes CANA, CANB, CANC, CAND, CDYA, CDYB, CDYC



WARNING

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



Caution

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

If components of the fuel system between the tank and the high-pressure fuel pump are removed or renewed, the basic setting "Channel 35" must be performed to bleed the fuel system.

If the supplementary fuel pump, fuel line (between fuel tank and high-pressure fuel pump) or fuel filter is removed or renewed, the basic setting "Channel 35" must be performed ONCE before the engine is started for the first time.

If the high-pressure fuel pump is removed or renewed, the basic setting "Channel 35" must be performed THREE TIMES before the engine is started for the first time.

*Perform first fuel filling after installing high-pressure pump
⇒ [page 132](#).*

1 - Fuel metering valve - N290-

- ☐ Do not unscrew

2 - High-pressure fuel pump

- ☐ After renewing, first fuel filling MUST be performed (it is important not to allow pump to run while it is still empty)
⇒ [page 132](#)
- ☐ Exploded view - high-pressure pump
⇒ [page 127](#)
- ☐ Removing and installing
⇒ [page 130](#)

3 - Fuel rail

- ☐ Cylinder bank 1

4 - Fuel pressure regulating valve - N276-

- ☐ On cylinder bank 1
- ☐ Cannot be re-installed
- ☐ Removing and installing
⇒ [page 135](#)

5 - Fuel pressure sender - G247-

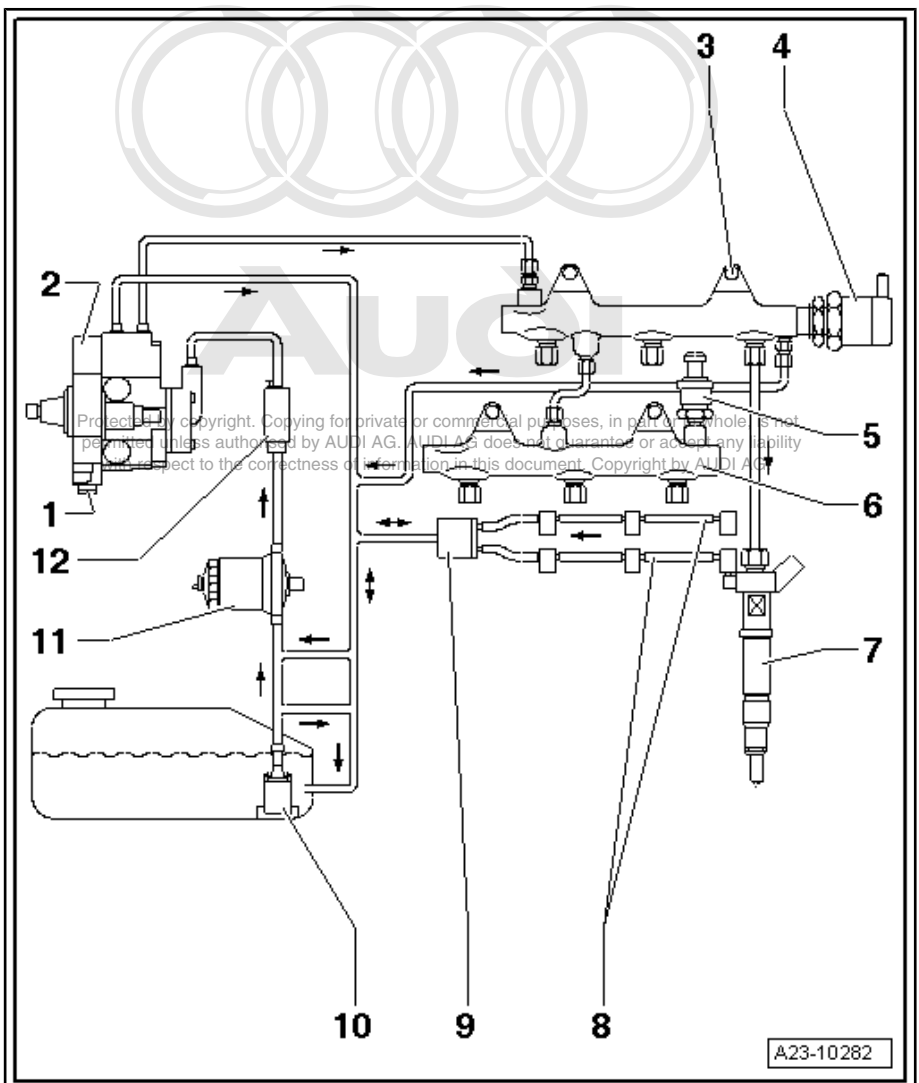
- ☐ On cylinder bank 2
- ☐ Removing and installing
⇒ [page 139](#)

6 - Fuel rail

- ☐ For cylinder bank 2

7 - Injectors

- ☐ Removing and installing



⇒ [page 84](#)

8 - Fuel return lines

- ☐ 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 fuel return lines.
- ☐ This residual pressure is required for the control function of the injectors
- ☐ The pressure retention valve may only be renewed together with the fuel return lines
- ☐ After renewing component, fuel system must be bled ⇒ [page 132](#)
- ☐ Checking pressure retention valve ⇒ [page 80](#)

10 - Fuel tank

- ☐ With fuel system pressurisation pump - G6-

11 - Fuel filter

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

12 - Supplementary fuel pump - V393-

3.5 Exploded view - fuel system, vehicles with engine codes BMK, BPP, BSG, BNG, ASB



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- ◆ ***Always read instructions on ⇒ [page 1](#) when working on injectors.***
- ◆ ***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 - Hose clip

5 - Banjo bolt for fuel return line

6 - Fuel temperature sender - G81-

7 - Fuel pressure regulating valve -N276-

- ☐ Screwed into fuel rail on cylinder bank 1
- ☐ Cannot be re-installed
- ☐ Removing and installing ⇒ [page 135](#)

8 - Banjo bolt for fuel return line

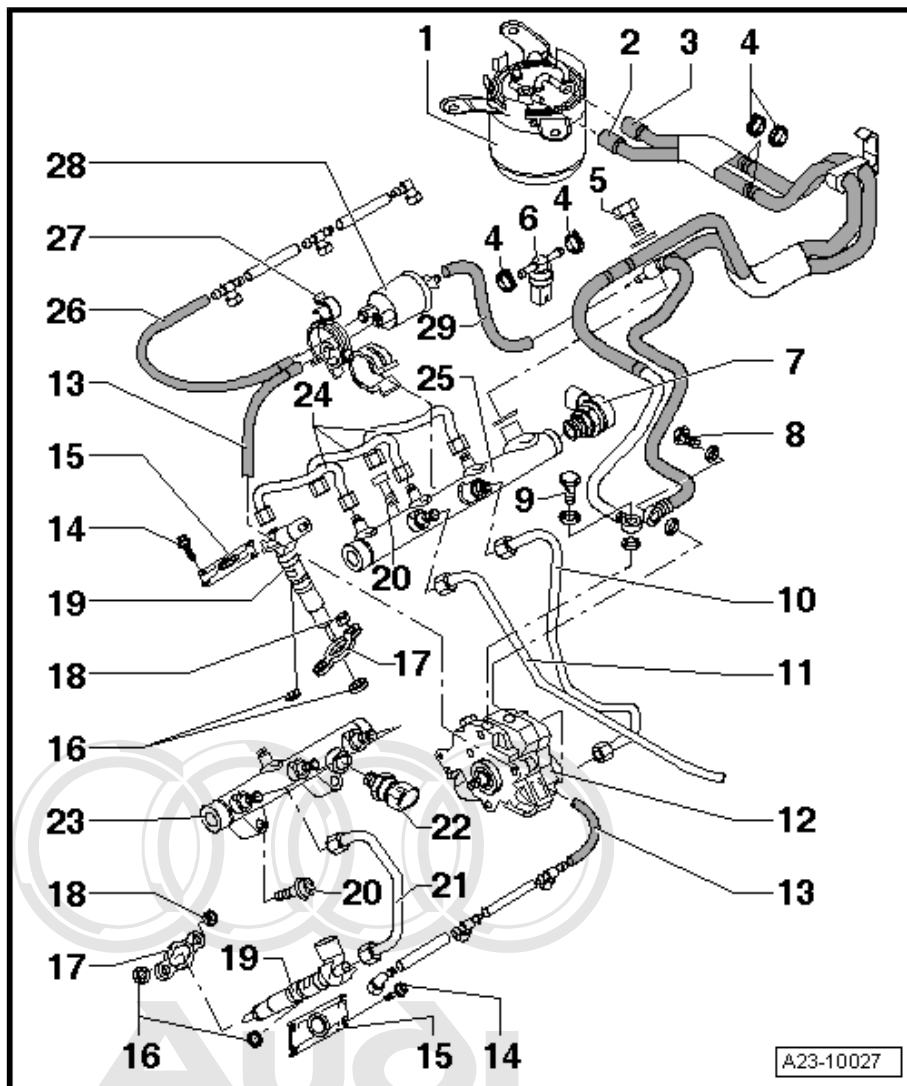
9 - Banjo bolt for fuel supply line

10 - High-pressure fuel pipe

- ☐ Between high-pressure pump and fuel rail on cylinder bank 1

11 - High-pressure fuel pipe

- ☐ Between fuel rail on cylinder bank 1 and fuel rail



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on 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
- ☐ Gear-type fuel system pressurisation pump generates fuel pressure between 4 and 5 bar
- ☐ Removing and installing: vehicles up to 10.2005 ⇒ [page 104](#) ; vehicles from 10.2005 onwards ⇒ [page 110](#)

13 - Fuel return lines

- ☐ 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 84](#)

20 - Bolt

- ☐ 22 Nm

21 - High-pressure pipes

- ☐ For cylinder bank 2
- ☐ 25 Nm

22 - Fuel pressure sender - G247-

- ☐ Screwed into fuel rail on cylinder bank 2
- ☐ 30 Nm
- ☐ Removing and installing ⇒ [page 139](#)

23 - Fuel rail

- ☐ For cylinder bank 2

24 - High-pressure pipes

- ☐ For cylinder bank 1

25 - Fuel rail

- ☐ For cylinder bank 1

26 - Fuel return lines

- ☐ 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

28 - Pressure retention valve

- ☐ In fuel return lines from cylinder banks 1 and 2
- ☐ The pressure retention valve maintains a residual pressure of approx. 10 bar in the return lines
- ☐ This residual pressure is required for the control function of the 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
- ☐ If the pressure retention valve is defective the event memory will not detect a fault and the engine will lose power
- ☐ Checking pressure retention valve ⇒ [page 80](#)

29 - Fuel return line

- ☐ Common return line to fuel tank

3.6 Exploded view - fuel system, vehicles with engine codes CANA, CANB, CANC, CAND, CDYA, CDYB, CDYC



WARNING

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



Caution

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

- ◆ *If components of the fuel system between the fuel tank and the high-pressure pump are removed or renewed, the fuel system must be bled ⇒ [page 34](#).*
- ◆ *If a fuel pump, fuel line (between fuel tank and high-pressure pump) or fuel filter is removed or renewed, the fuel system must be bled before the engine is started for the first time.*
- ◆ *If the high-pressure pump is removed or renewed, the fuel system must be bled before the engine is started for the first time.*

Perform first fuel filling after installing high-pressure pump ⇒ [page 132](#).

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1 - Fuel return line

- ☐ To fuel tank
- ☐ Fuel return line must not be kinked, damaged or clogged

2 - Fuel supply line

- ☐ From fuel filter

3 - Banjo bolt for fuel return line

- ☐ 25 Nm

4 - Fuel temperature sender - G81-
5 - Bolt
6 - Bracket
7 - Fuel pressure regulating valve - N276-

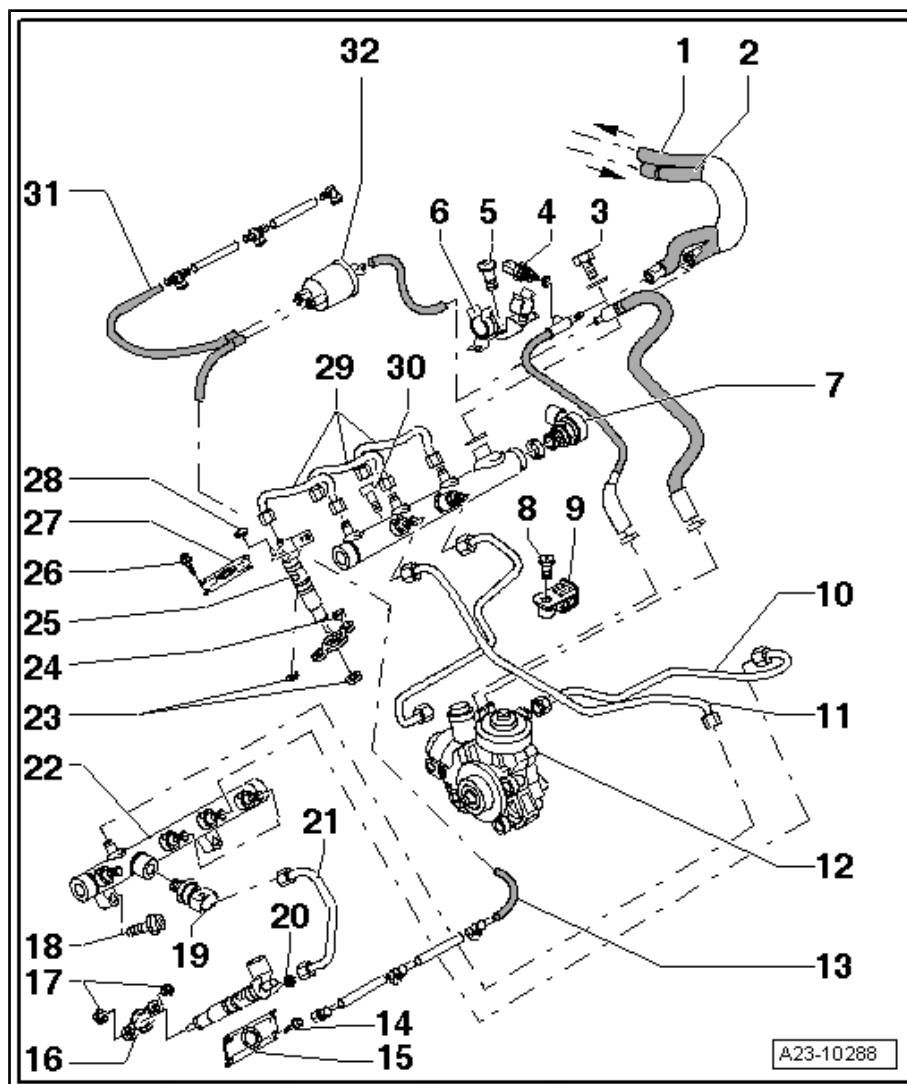
- ☐ Located on cylinder bank 1
- ☐ Cannot be re-installed
- ☐ Removing and installing
⇒ [page 135](#)

8 - Bolt
9 - Bracket
10 - High-pressure fuel pipe

- ☐ Between high-pressure pump and fuel rail

11 - High-pressure fuel pipe

- ☐ Between fuel rail on cylinder bank 1 and fuel rail



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on cylinder bank 2

- ☐ When re-installing high-pressure fuel pipe, check taper seats visually for damage, scores and corrosion (always renew if damaged)
- ☐ If high-pressure pipe is not OK, always renew high-pressure pipe

12 - High-pressure fuel pump

- ☐ With fuel metering valve - N290-
- ☐ After renewing high-pressure pump, first fuel filling MUST be performed (it is important not to allow pump to run while it is still empty) ⇒ [page 132](#)
- ☐ Exploded view - high-pressure pump ⇒ [page 127](#)
- ☐ Removing and installing ⇒ [page 130](#)

13 - Fuel return lines

- ☐ The fuel return lines must not be dismantled; if necessary they must be renewed complete with pressure retention valve
- ☐ After renewing component, fuel system must be bled ⇒ [page 132](#)

14 - Bolt

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

15 - Cover for injector

16 - Clamping piece

- ☐ Renew

17 - Hexagon flange nut

- ☐ For clamping piece
- ☐ 10 Nm

18 - Bolt

- ☐ For fuel rail on cylinder bank 2
- ☐ 22 Nm

19 - Fuel pressure sender - G247-

- ☐ Screwed into fuel rail on cylinder bank 2
- ☐ 30 Nm
- ☐ Removing and installing ⇒ [page 139](#)

20 - Seal

- ☐ Renew

21 - High-pressure fuel pipes

- ☐ For cylinder bank 2
- ☐ 25 Nm

22 - Fuel rail

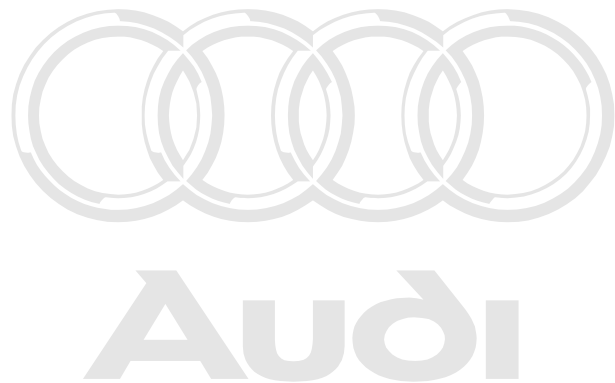
- ☐ For cylinder bank 2

23 - Seals

- ☐ Renew

24 - Hexagon flange nut

- ☐ For clamping piece
- ☐ 10 Nm



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25 - 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 84](#)

26 - Bolt

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

27 - Cover for injector

28 - Seal

- ☐ Renew

29 - High-pressure fuel pipes

- ☐ For cylinder bank 1

30 - Bolt

- ☐ For fuel rail on cylinder bank 1
- ☐ 22 Nm

31 - Fuel return lines

- ☐ 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

32 - Pressure retention valve

- ☐ In fuel return lines from cylinder banks 1 and 2
- ☐ The pressure retention valve maintains a residual pressure of approx. 10 bar in the return lines
- ☐ This residual pressure is required for the control function of the 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 80](#)

3.7 Bleeding fuel system and checking for leaks



Caution

If components of the fuel system between the fuel tank and the high-pressure fuel pump are removed or renewed, the basic setting "Checking fuel system pressurisation pump" must be performed to bleed the fuel system.

If the supplementary fuel pump, fuel line (between fuel tank and high-pressure fuel pump) or fuel filter is removed or renewed, the basic setting "Checking fuel system pressurisation pump" must be performed before the engine is started for the first time.

Proceed as follows to fill fuel system with fuel:

- Connect a vehicle diagnostic tester.
- Switch on ignition.
- Select "Engine electronics" in vehicle self-diagnosis.

- Then select "Basic setting".
- Select channel 35; "Pump off" appears in display zone 2.
- Press "activate" button.
- Fuel pumps will run for approx. 60 seconds; "Pump on" appears in display zone 2.
- Repeat procedure once.
- Then start engine.
- After filling fuel system, run engine at moderate speed for a few minutes and then switch off again.
- Check fuel system for leaks.
- Erase entry in event memory using diagnostic tester.
- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the complete high-pressure section of the fuel system again for leaks.
- Interrogate event memory.

3.8 Exploded view - air cleaner

1 - Water drain

- ☐ Check for dirt and clean as required (inspect valve)
- ☐ Water drain must function properly

2 - Air filter bypass flap valve - N275-

- ☐ These components (bypass flap with air filter bypass flap valve - N275-) are not installed on certain equipment versions or on vehicles for certain export markets

3 - Air cleaner (bottom section)

- ☐ Clean any salt residue, leaves and dirt out of air cleaner (bottom section)
- ☐ Check for dirt in water drain (inspect valve)

4 - Rubber grommet

5 - Air duct

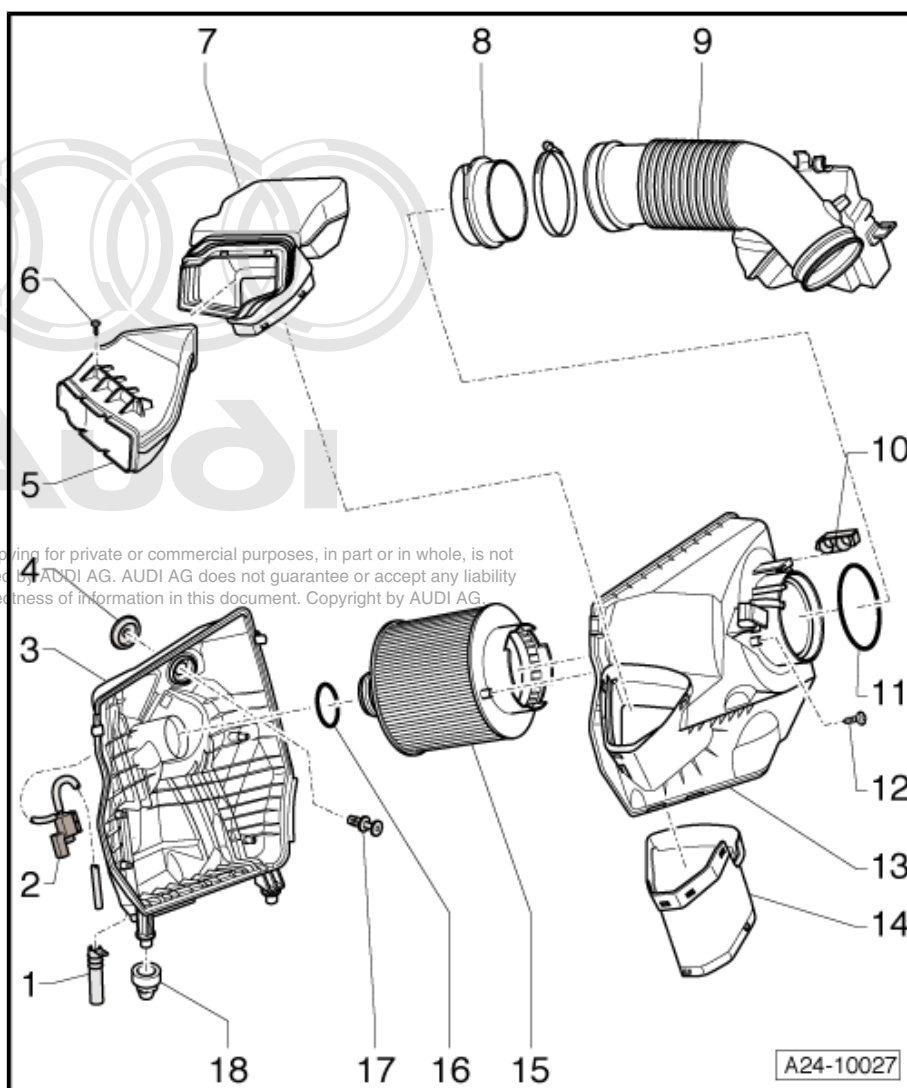
- ☐ To lock carrier
- ☐ Clean dirt and leaves out of air duct

6 - Bolt

- ☐ 1.5 Nm

7 - Air duct

- ☐ Clean dirt and leaves out of air duct





8 - Connection

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

- ☐ With resonator

10 - Cable guide

11 - O-ring

- ☐ Renew

12 - Bolt

- ☐ 1.5 Nm
- ☐ Secures air filter element ⇒ [Item 15 \(page 36\)](#)

13 - Air cleaner (top section)

- ☐ Clean any salt residue, leaves and dirt out of air cleaner (top section)

14 - Air duct

- ☐ Clipped into air cleaner (top section)
- ☐ Clean dirt and leaves out of air duct

15 - Air filter element

- ☐ Always use a genuine Audi air filter element
- ☐ Removing and installing ⇒ [page 37](#)
- ☐ Maintenance intervals ⇒ Maintenance ; Booklet 405
- ☐ Also clean snow screen (if fitted)

16 - O-ring

- ☐ Renew

17 - Fastener

18 - Grommet

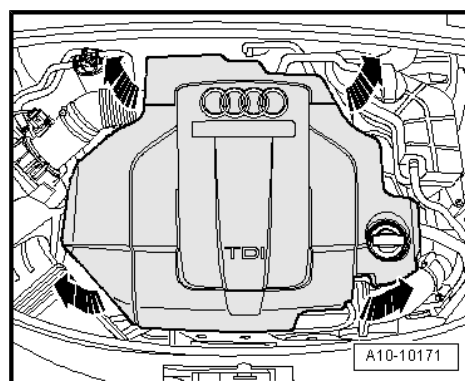
3.9 Removing and installing engine cover panel

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).
- First press engine cover panel into rear rubber grommets and then into front rubber grommets with both hands.

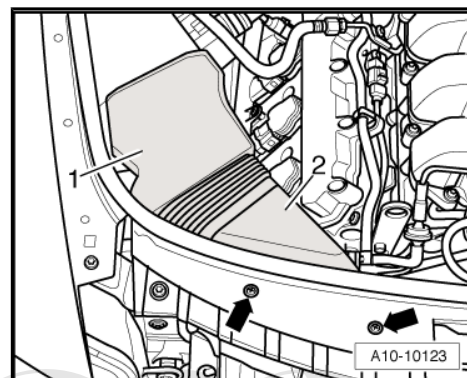


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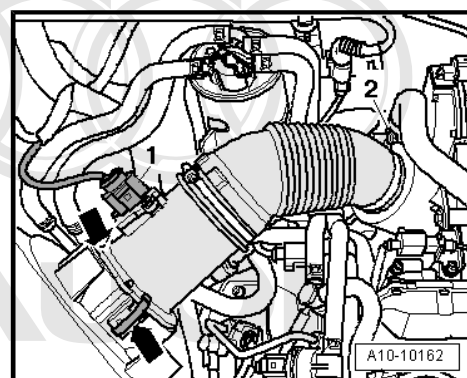
3.10 Removing and installing air filter element

Removing

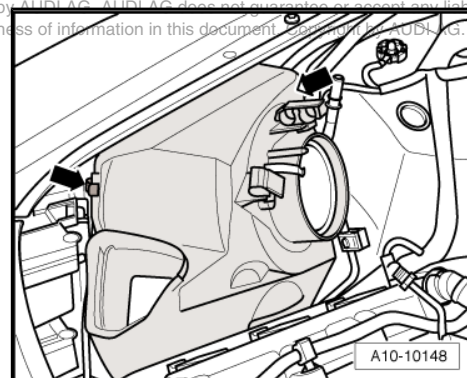
- Remove bolts -arrows-.
- Remove air duct -1- and -2-.



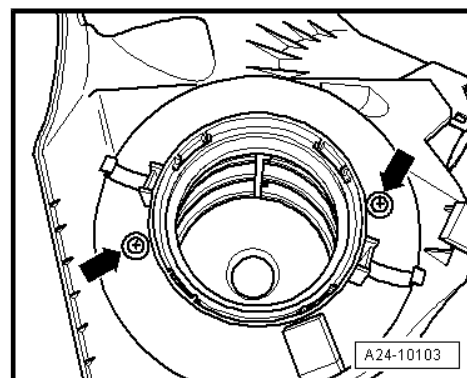
- Unplug electrical connector -1- at air mass meter - G70- .
- Remove air hose. To do so, loosen hose clip -2- and release clamps -arrows-.



- Release clamps -arrows- from air cleaner (top section) and detach air cleaner (top section).



- Remove the two bolts -arrows- securing the air filter element.



Removing air cleaner (bottom section)

- Disconnect vacuum line -1-.
- Pull out pin of fastener -3-.
- Remove air cleaner (bottom section) and unplug electrical connector -2- on reverse side at variable intake manifold change-over valve - N335- .

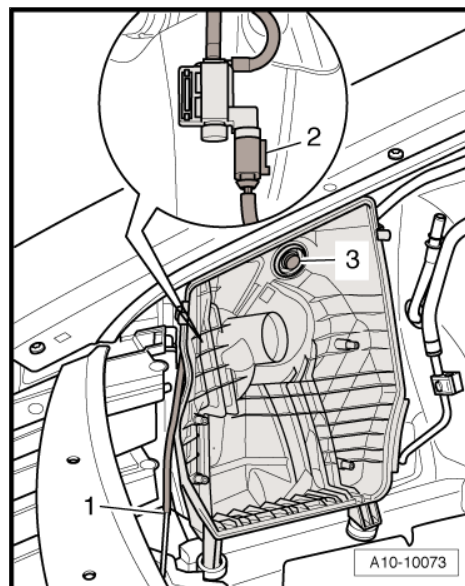
Installing

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



Note

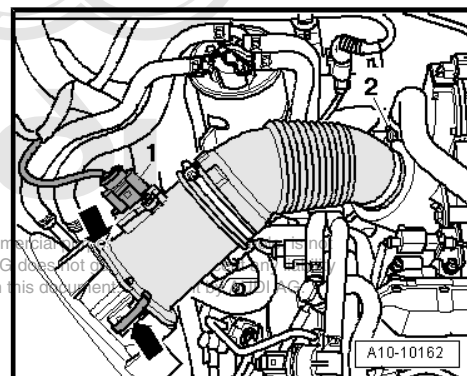
- ◆ *If the air filter element is very dirty or wet, dirt particles or water can reach the air mass meter - G70- and falsify the detected air mass values. This will cause a loss of power, as the calculated injection quantities will be too low.*
- ◆ *Always use genuine air filter elements (same as original equipment).*
- ◆ *Use a silicone-free lubricant when installing the intake hose.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- Check whether the water drain hose in the bottom section of the air cleaner is dirty or blocked (clean if necessary).
- Clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); use a vacuum cleaner if necessary.
- Check air mass meter and intake hose (engine intake side) for salt residue, dirt and leaves.
- Check intake duct as far as air filter element for dirt.
- When installing air filter element, make sure it is positioned centrally on mounting in air cleaner (bottom section).
- Carefully fit air cleaner (top section) on air cleaner (bottom section) without applying any force. When fitting air cleaner (top section), make sure it is NOT positioned on air filter element at an angle. Note position of sealing lip on air filter element (to prevent air leaks).
- Then secure top section of air cleaner to bottom section.
- The remaining installation steps are carried out in the reverse sequence.



3.11 Removing and installing air mass meter - G70-

Removing

- Unplug electrical connector -1- at air mass meter - G70- .
- Release hose clip securing air hose and disconnect hose from air mass meter - G70- .



- Open retaining clips -arrows- and pull air mass meter - G70- out of air cleaner housing.

Installing

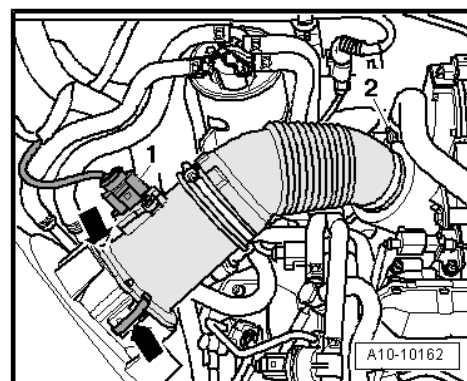
To ensure the proper function of the air mass meter - G70- it is important to observe the following instructions.



Note

- ◆ *If the air filter element is very dirty or wet, dirt particles or water can reach the air mass meter - G70- and falsify the detected air mass values. This will cause a loss of power, as the calculated injection quantities will be too low.*
- ◆ *Always use genuine air filter elements (same as original equipment).*
- ◆ *Always renew seal if damaged (air leaks in intake system).*
- ◆ *Use a silicone-free lubricant when installing the air hose and seal.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- Check air mass meter and intake hose (engine intake side) for salt residue, dirt and leaves.
- Check intake duct as far as air filter element for dirt. 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 37](#) .
- If air cleaner has been removed, blow out water drain hose in air cleaner (bottom section) with compressed air.
- 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.



3.12 Exploded view - intake manifold, vehicles with engine codes BMK, BPP, BSG, BNG, ASB



Note

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

1 - Connecting pipe for exhaust gas recirculation

2 - Intake connecting pipe

3 - Gasket

- ☐ Renew

4 - Bolt

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

5 - Bolt

- ☐ 9 Nm

6 - Bolt

- ☐ Allow self-tapping bolt to engage in existing thread on intake manifold
- ☐ 7.5 Nm

7 - Intake manifold (top section)

- ☐ Removing and installing [⇒ page 41](#)

8 - Bolt

- ☐ Allow self-tapping bolt to engage in existing thread on intake manifold
- ☐ 7.5 Nm

9 - Gasket

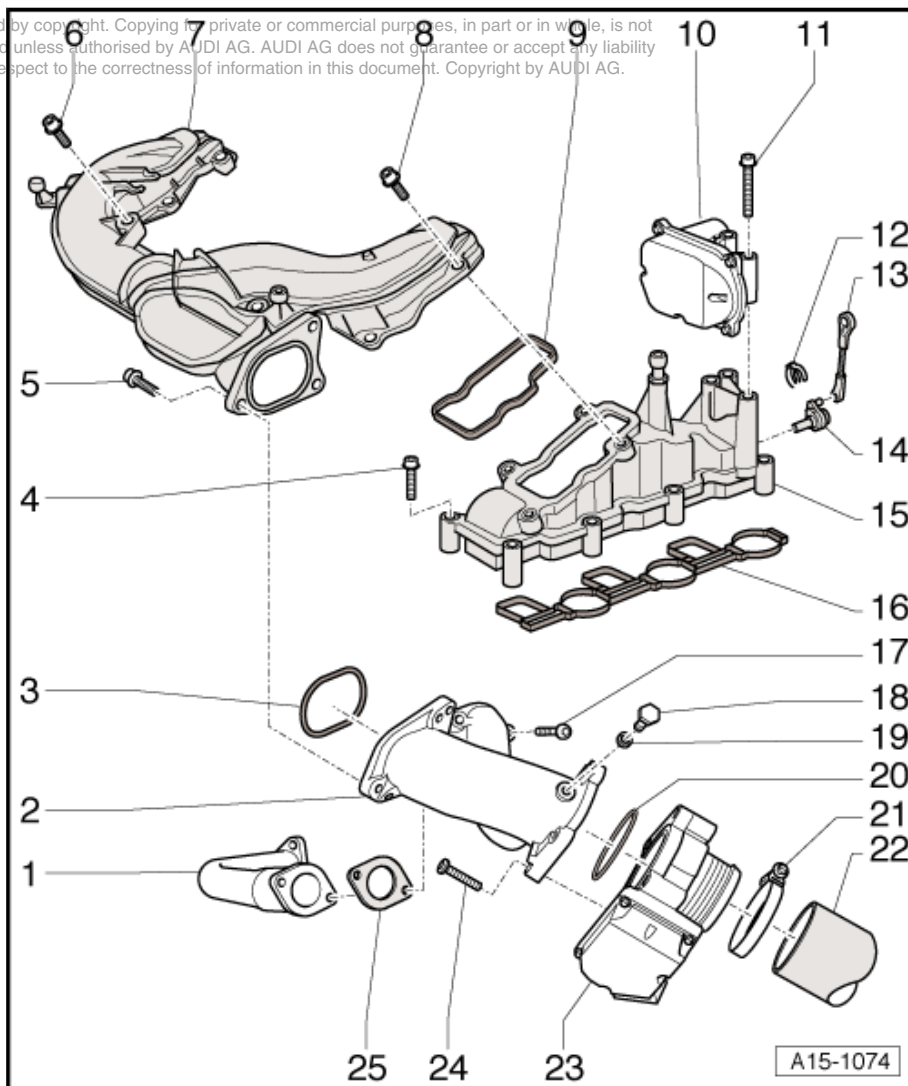
- ☐ Renew

10 - Intake manifold flap motor

- ☐ Cylinder bank 1 (right-side as seen in direction of travel): intake manifold flap motor - V157-
- ☐ Cylinder bank 2 (left-side as seen in direction of travel): intake manifold flap 2 motor - V275-
- ☐ Removing and installing [⇒ page 55](#)

11 - Bolt

- ☐ Allow self-tapping bolt to engage in existing thread on intake manifold
- ☐ Torx bolt: 7.5 Nm
- ☐ Hexagon socket head bolts, 10 Nm



12 - Securing clip

13 - Connecting rod

14 - Actuator

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

- ☐ Removing and installing: vehicles up to 08.2004 ➔ [page 42](#) ; vehicles from 08.2004 onwards ➔ [page 45](#) (left-side) and ➔ [page 50](#) (right-side)

16 - Gasket

- ☐ Renew

17 - Bolt

9 Nm

18 - Plug

- ☐ 25 Nm

19 - Seal

- ☐ Renew

20 - Gasket

- ☐ Renew

21 - Retaining clamp

- ☐ 5.5 Nm
- ☐ Reinforced

22 - Air hose

- ☐ Must be free of oil and grease when installing

23 - Throttle valve module - J338-

24 - Bolt

- ☐ 9 Nm

25 - Gasket

- ☐ Renew

3.12.1 Removing and installing intake manifold (top section)

Removing



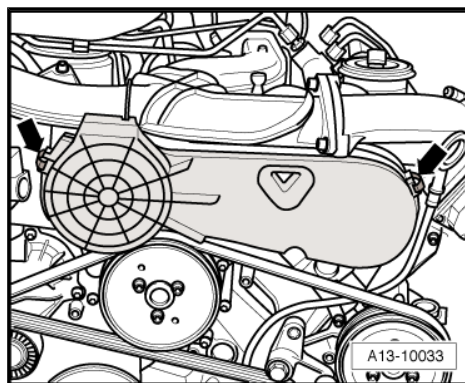
Caution

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

- Remove engine cover panel ➔ [page 36](#) .
- Pull oil dipstick out of guide tube.

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- Loosen clamps -arrows-.
- Pivot toothed belt cover forwards.

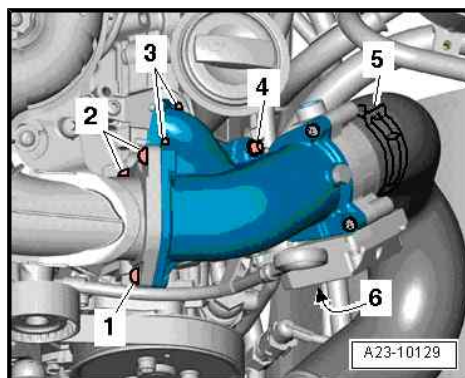


- Disconnect air hose -5- from throttle valve module - J338- .
- Unplug electrical connector -6- at throttle valve module - J338- .
- Remove bolts -3- and -4-.



Note

Disregard items marked -1- and -2-.



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

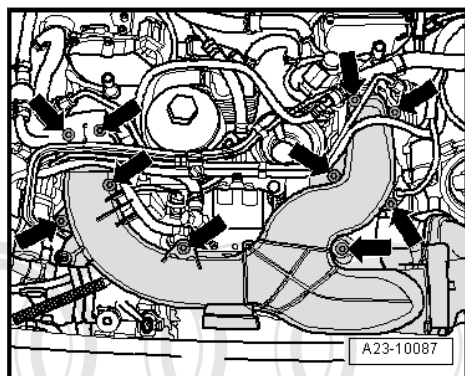
Installing

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



Note

- ◆ *Renew gaskets and seals.*
- ◆ *Hose connections and charge air system hoses must be free of oil and grease prior to fitting.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*



Tightening torques

- ◆ ⇒ ["3.12 Exploded view - intake manifold, vehicles with engine codes BMK, BPP, BSG, BNG, ASB", page 40](#)

3.12.2 Removing and installing intake manifold (bottom section) - vehicles up to 08.2004

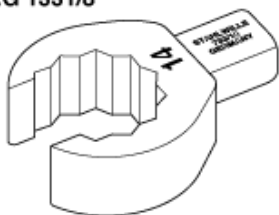


Note

The following description shows the removal and installation procedures for the bottom section of the intake manifold (left-side). The procedure for the other side is identical.

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Special tools and workshop equipment required

3150 	V.A.G 1331 
V.A.G 1331/8 	
	 G15-0067

- ◆ 14 mm socket wrench - 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-

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Removing



Note

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

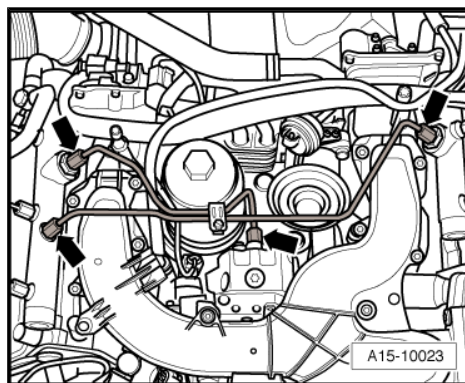
- Remove engine cover panel ⇒ [page 36](#) .



Caution

Observe rules for cleanliness when working on the injection system ⇒ [page 1](#) .

- Unscrew union nuts -arrows- and detach high-pressure pipes.
- Remove intake manifold (top section) ⇒ [page 41](#) .



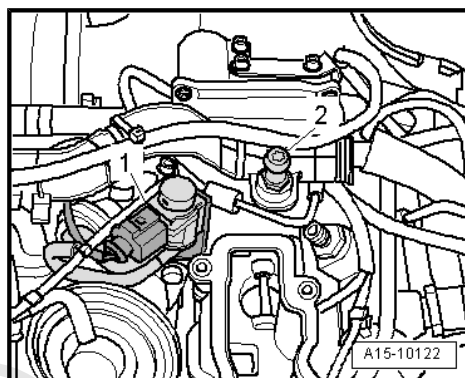
- Unscrew retaining pin -2- for engine cover panel at intake manifold (bottom section).



Note

Disregard -item 1-.

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



Bottom section of intake manifold (right-side)

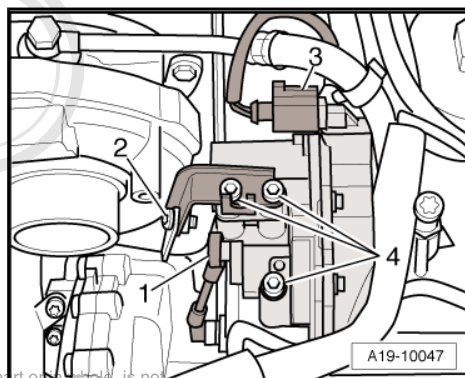
- Take electrical connector -3- for exhaust gas temperature sender 1 - G235- out of bracket.
- Remove bolt -2-.



Note

Disregard items marked -1- and -4-.

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



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Both sides (continued)

- 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:

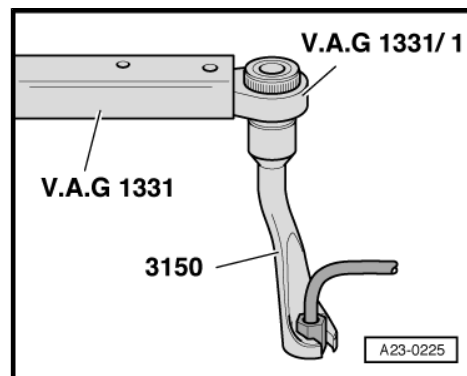
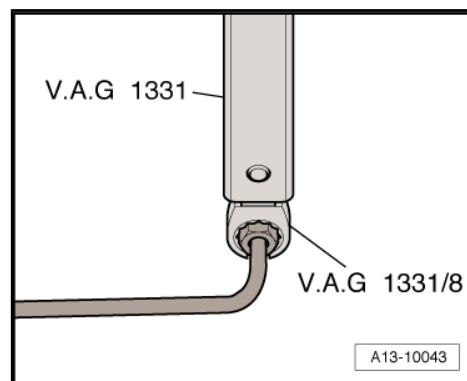
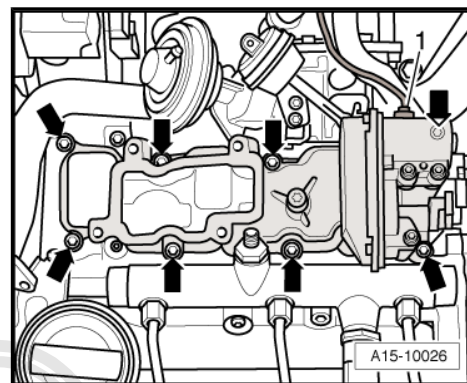


Note

- ◆ Renew seals and gaskets.
- ◆ Fit all cable ties in the original positions when installing.
- Install intake manifold (top section) ⇒ [page 41](#) .
- ◆ Tightening torques for intake manifold: exploded view - intake manifold ⇒ [page 40](#)
- ◆ Tightening torque for high-pressure pipes: exploded view - fuel system ⇒ [page 28](#)

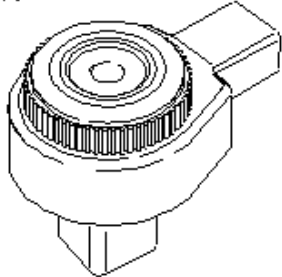
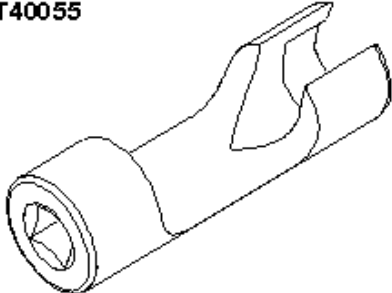
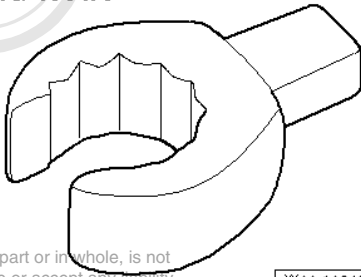
- Hand-tighten union nuts on high-pressure pipes. Make sure that connections are not under tension.
- To tighten union of high-pressure pipe at high-pressure pump, use torque wrench - V.A.G 1331- with socket insert AF 14, flared ring spanner - V.A.G 1331/8- .

- To tighten unions of high-pressure pipes to fuel rail, use torque wrench - V.A.G 1331- with ratchet - V.A.G 1331/1- and socket (14 mm) - 3150- .
- Check fuel system for leaks ⇒ [page 113](#) .



3.12.3 Removing and installing bottom section of intake manifold (left-side) - vehicles from 08.2004 onwards

Special tools and workshop equipment required

V.A.G 1331 	V.A.G 1331/1 
V.A.G 1331/5 	T40055 
	

G15-10041

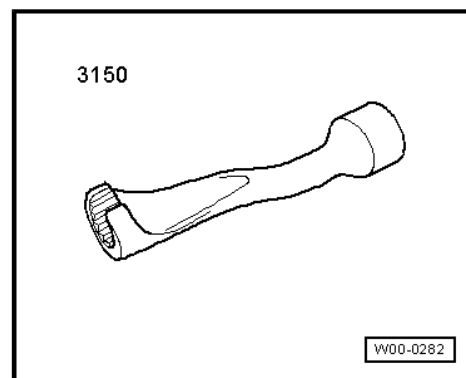
- ◆ Torque wrench - V.A.G 1331-
- ◆ Ratchet - V.A.G 1331/1-
- ◆ Open end spanner insert, AF 19 - V.A.G 1331/5- for vehicles from 10.2005 onwards
- ◆ Socket - T40055- , 17 mm for vehicles from 10.2005 onwards
- ◆ Socket insert AF 14, flared ring spanner - V.A.G 1331/8- for vehicles up to 10.2005

V.A.G 1331/8

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W00-10342

- ◆ Socket, 14 mm - 3150- for vehicles up to 10.2005



Removing



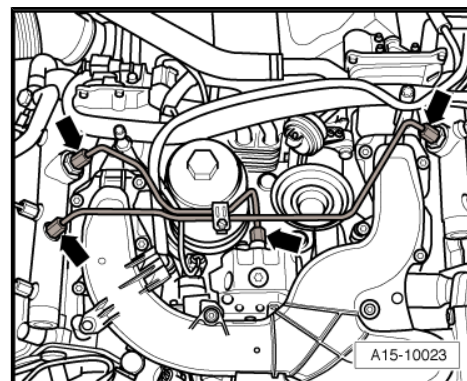
Caution

Observe rules for cleanliness when working on the injection system ⇒ [page 1](#).

- Drain off coolant ⇒ Rep. gr. 19 .
- Remove engine cover panel ⇒ [page 36](#) .

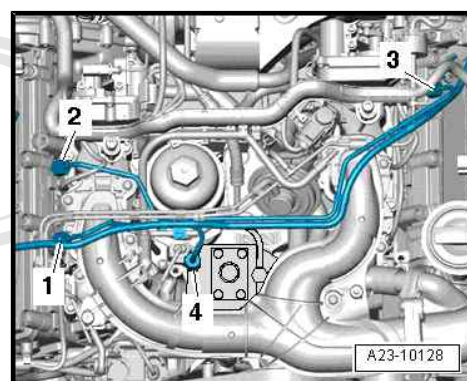
Vehicles up to 10.2005:

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



Vehicles from 10.2005 onwards:

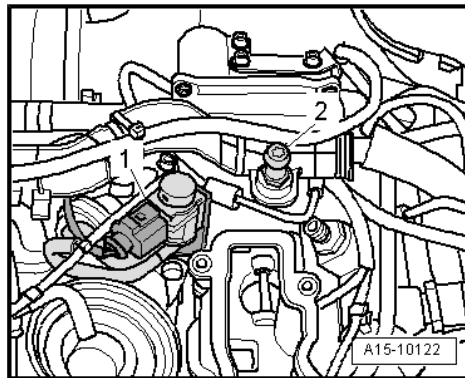
- Unscrew union nuts -1 ... 4- and detach high-pressure pipes.



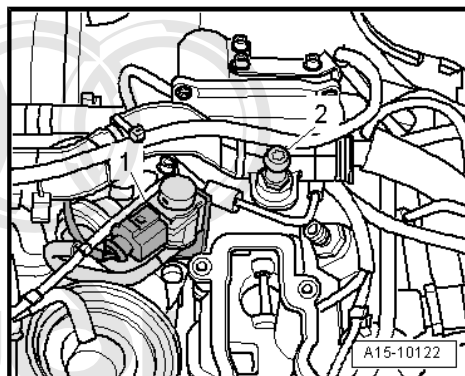
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All vehicles:

- Remove intake manifold (top section) ⇒ [page 41](#) .
- Remove mechanical exhaust gas recirculation valve ⇒ Rep. gr. 26 .

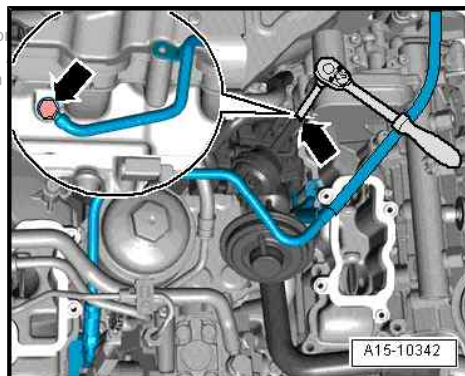


- Unscrew retaining pin -2- for engine cover panel at intake manifold (bottom section).
- Unclip exhaust gas recirculation cooler change-over valve - N345- -item 1- from bracket.
- Remove bracket for exhaust gas recirculation cooler change-over valve - N345- .



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

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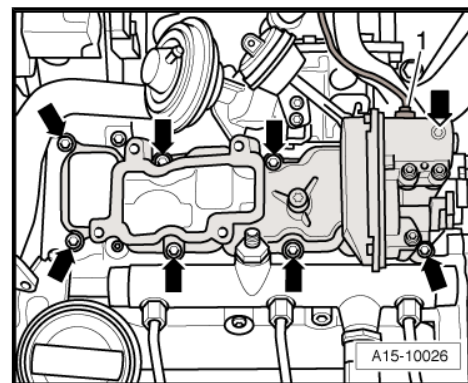


- Unplug electrical connector -1- at intake manifold flap 2 motor - V275- .
- Remove bolts -arrows-.
- Push coolant bleeder line to one side and take out bottom section of intake manifold (left-side) together with intake manifold flap motor.



Note

Block off intake ports in cylinder head with clean rags.



Installing

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



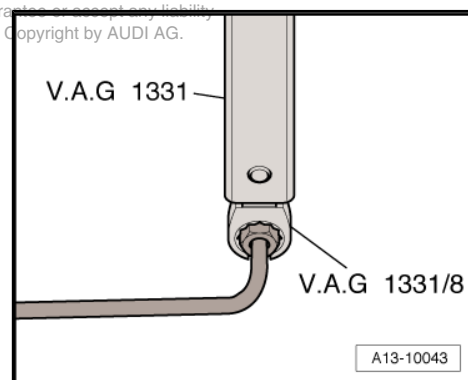
Note

Renew gaskets and seals.

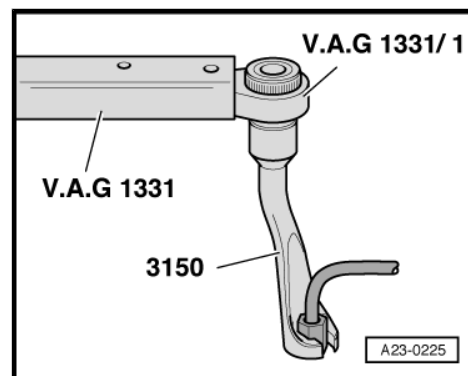
- Fit banjo bolt for coolant bleeder line with a new seal and screw in 2 ... 3 turns, before installing left-side intake manifold (bottom section).
- Install mechanical exhaust gas recirculation valve ⇒ Rep. gr. 26 .
- Install intake manifold (top section) ⇒ [page 41](#) .
- ♦ Tightening torques for intake manifold: exploded view - intake manifold ⇒ [page 40](#)
- ♦ Tightening torque for high-pressure pipes: exploded view - fuel system ⇒ [page 28](#)
- Hand-tighten union nuts on high-pressure pipes. Make sure that connections are not under tension.

Vehicles up to 10.2005:

- 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- .

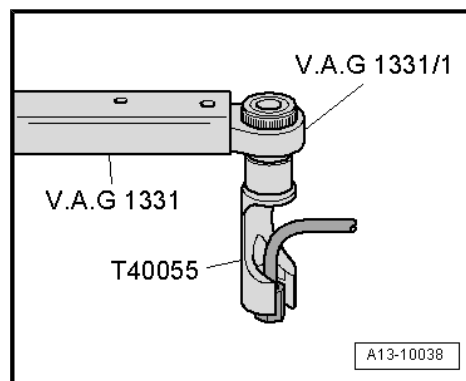


- To tighten unions of high-pressure pipes to fuel rail, use torque wrench - V.A.G 1331- with ratchet - V.A.G 1331/1- and socket (14 mm) - 3150- .



Vehicles from 10.2005 onwards:

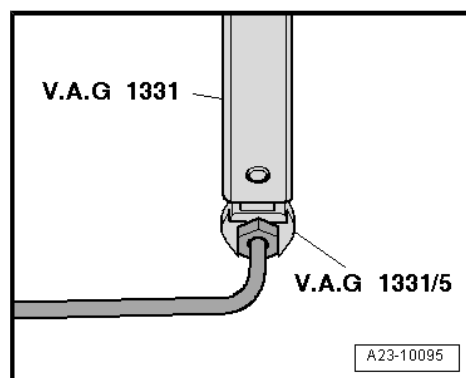
- To tighten union of high-pressure pipe at high-pressure pump, use torque wrench - V.A.G 1331- with ratchet - V.A.G 1331/1- and socket - T40055- , 17 mm.



- To tighten unions of high-pressure pipes to fuel rail, use torque wrench - V.A.G 1331- and tool insert, AF 19 - V.A.G 1331/5- .

All vehicles:

- Fill up coolant ⇒ Rep. gr. 19 .
- Check fuel system for leaks ⇒ [page 113](#) .

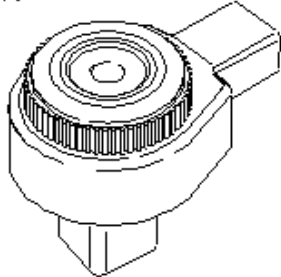
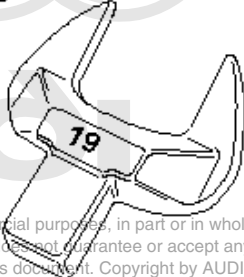
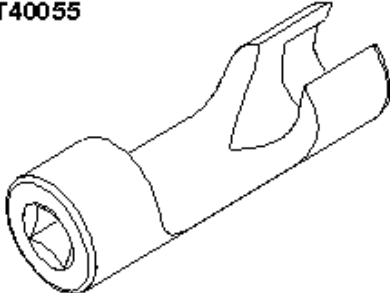
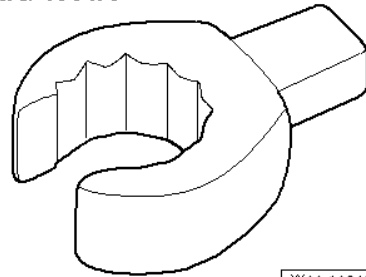


3.12.4 Removing and installing bottom section of intake manifold (right-side) - vehicles from 08.2004 onwards



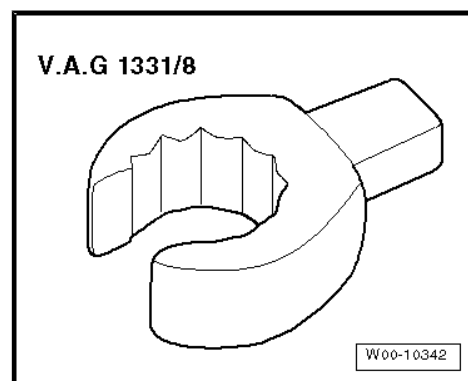
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Special tools and workshop equipment required

V.A.G 1331 	V.A.G 1331/1 
V.A.G 1331/5 	T40055 
	

G15-10041

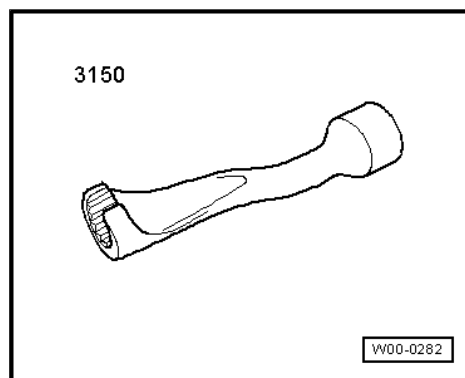
- ◆ Torque wrench - V.A.G 1331-
- ◆ Ratchet - V.A.G 1331/1-
- ◆ Open end spanner insert, AF 19 - V.A.G 1331/5- for vehicles from 10.2005 onwards
- ◆ Socket - T40055- , 17 mm for vehicles from 10.2005 onwards
- ◆ Socket insert AF 14, flared ring spanner - V.A.G 1331/8- for vehicles up to 10.2005



W00-10342



- ◆ Socket, 14 mm - 3150- for vehicles up to 10.2005



Removing



Caution

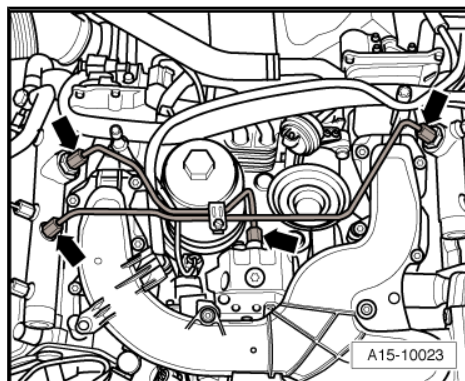
Observe rules for cleanliness when working on the injection system ⇒ page 1.

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- Remove engine cover panel ⇒ [page 36](#) .

Vehicles up to 10.2005:

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

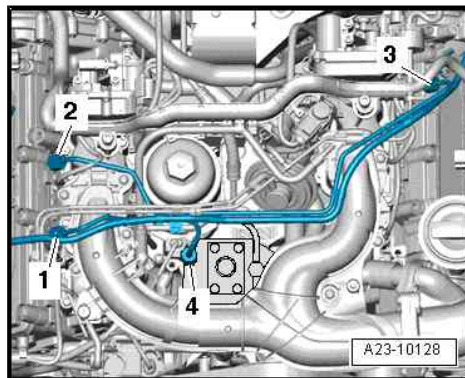


Vehicles from 10.2005 onwards:

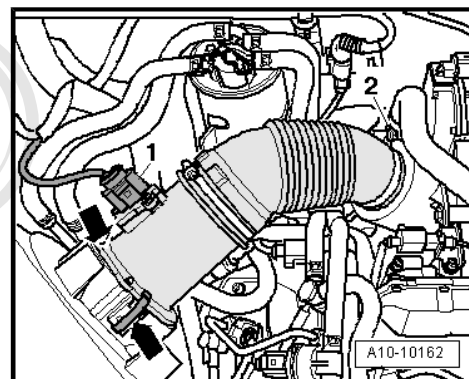
- Unscrew union nuts -1 ... 4- and detach high-pressure pipes.

All vehicles:

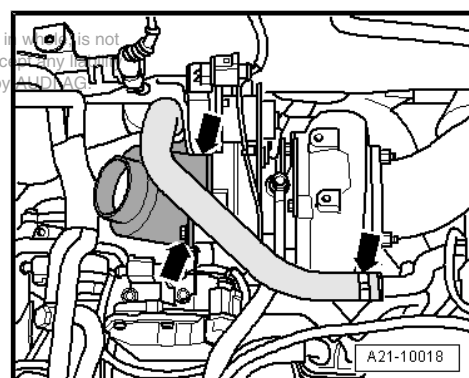
- Remove intake manifold (top section) ⇒ [page 41](#) .



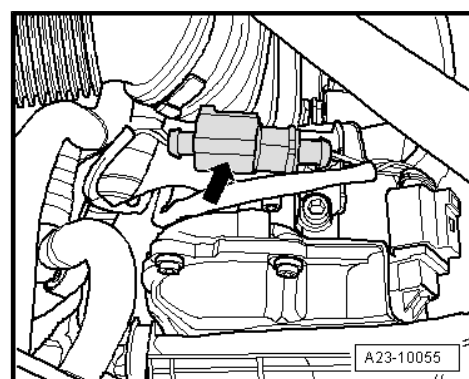
- Unplug electrical connector -1- at air mass meter - G70- .
- Remove air hose. To do so, loosen hose clip -2- and release clamps -arrows-.



- Remove intake connecting piece together with crankcase breather hose -arrows-.



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



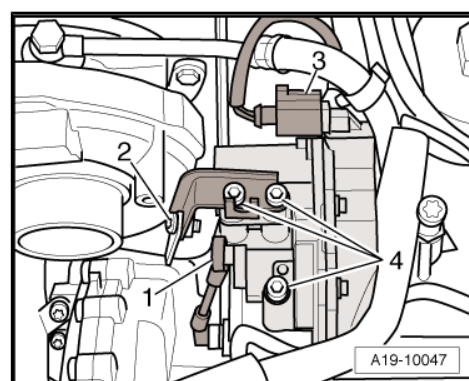
- Detach electrical connector -3- at intake manifold flap motor - V157- .
- Remove bolt -2-.



Note

Disregard items marked -1- and -4-.

- Detach 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:



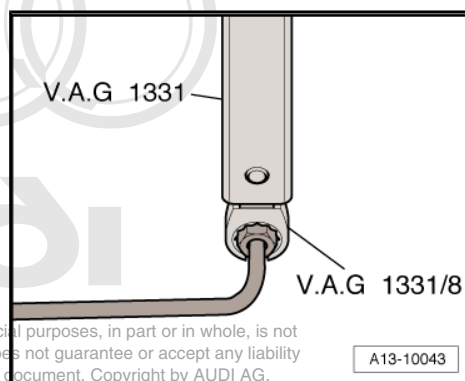
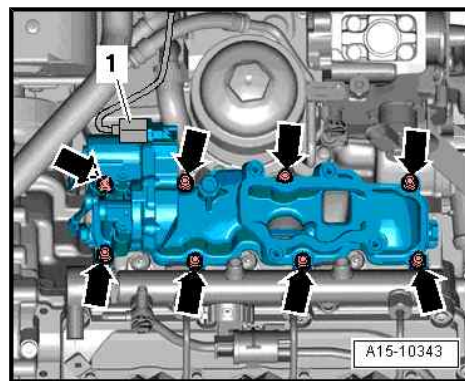
Note

Renew seals and gaskets.

- Install intake manifold (top section) ⇒ [page 41](#) .
- ◆ Tightening torques for intake manifold: exploded view - intake manifold ⇒ [page 40](#)
- ◆ Tightening torque for high-pressure pipes: exploded view - fuel system ⇒ [page 28](#)
- Hand-tighten union nuts on high-pressure pipes. Make sure that connections are not under tension.

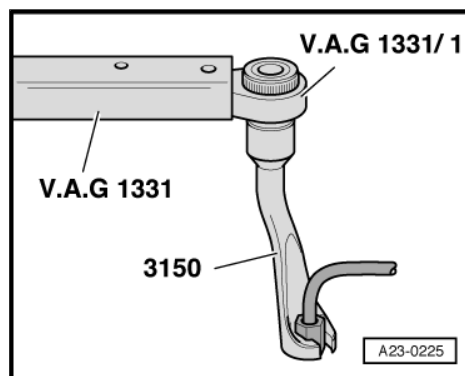
Vehicles up to 10.2005:

- 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- .



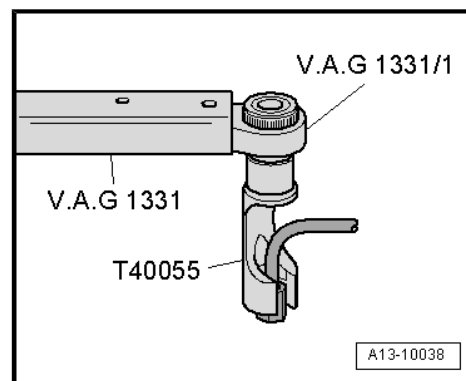
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- To tighten unions of high-pressure pipes to fuel rail, use torque wrench - V.A.G 1331- with ratchet - V.A.G 1331/1- and socket (14 mm) - 3150- .



Vehicles from 10.2005 onwards:

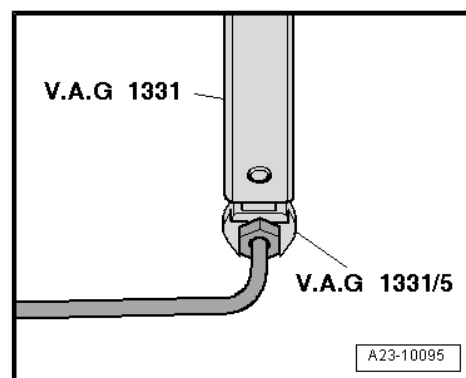
- To tighten union of high-pressure pipe at high-pressure pump, use torque wrench - V.A.G 1331- with ratchet - V.A.G 1331/1- and socket - T40055- , 17 mm.



- To tighten unions of high-pressure pipes to fuel rail, use torque wrench - V.A.G 1331- and tool insert, AF 19 - V.A.G 1331/5- .

All vehicles:

- Check fuel system for leaks ⇒ [page 113](#) .



3.13 Removing and installing intake manifold flap motor - V157- or intake manifold flap 2 motor - V275- - vehicles with engine codes BMK, BPP, BSG, BNG, ASB

Special tools and workshop equipment required

- ◆ Tester - VAS 6395/1-
- ◆ Connection lead - VAS 6395/4-2-

Removing



Note

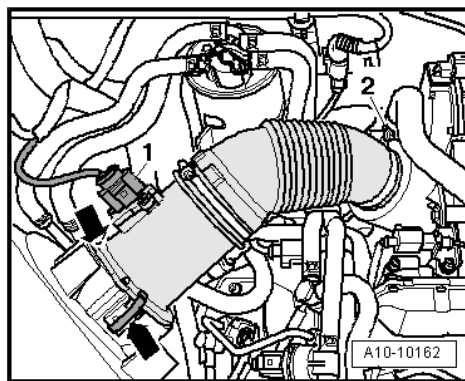
In the following the procedures for removing and installing are described for the intake manifold flap motor - V157- for cylinder bank 1 (right-side). The procedure for the intake manifold flap 2 motor - V275- is basically the same.

Proceed as follows:

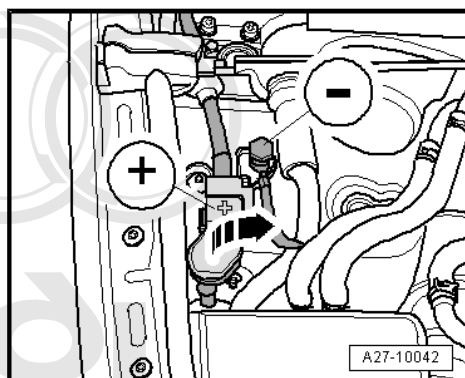
- Remove engine cover panel ⇒ [page 36](#) .

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- Unplug electrical connector -1- at air mass meter - G70- .
- Remove air hose. To do so, loosen hose clip -2- and release 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:**

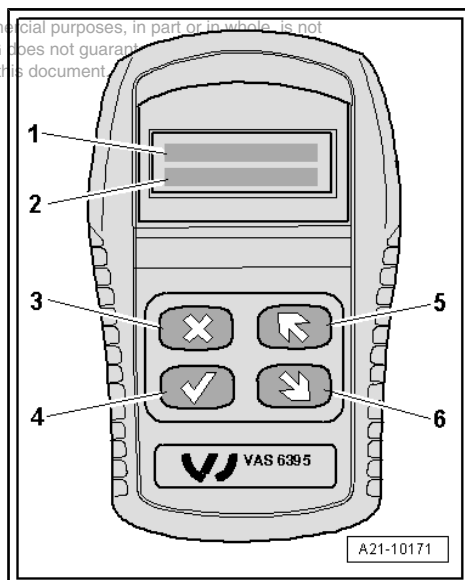
Display on -VAS 6395/1- (2 seconds after connecting to power supply) if correct software version is loaded:

- 1 - >TEST
- 2 - LEARN



Note

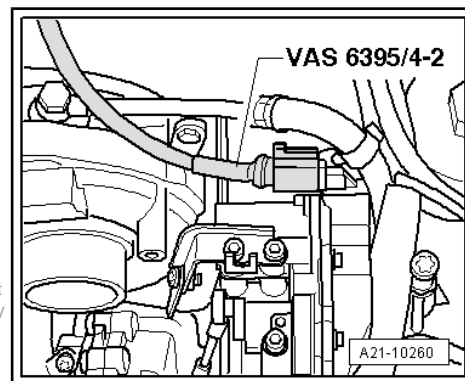
- ◆ **If the following appears on the display, an incorrect software version has been loaded:**
- ◆ 1. START
- ◆ 2. NEXT
- ◆ **If this is the case, download the correct software version from the “Audi ServiceNet” under “Workshop Equipment”.**



Continuation of procedure:

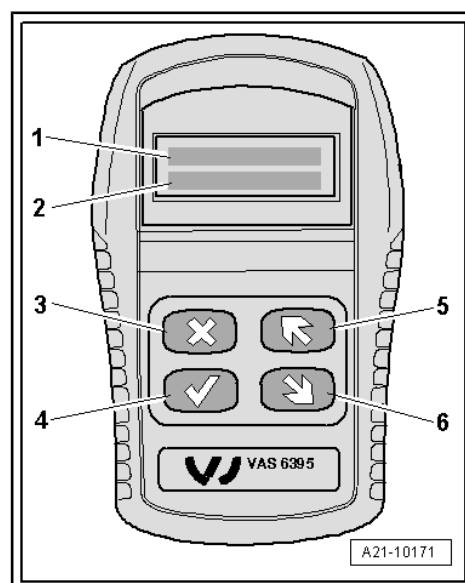
- Unplug electrical connector for intake manifold flap motor.
- Connect connection lead - VAS 6395/4-2- to intake manifold flap motor and tester - VAS 6395/1- .

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Display on -VAS 6395/1- :

- 1 - >TEST
 - 2 - LEARN
- To continue, press  button -item 4-.



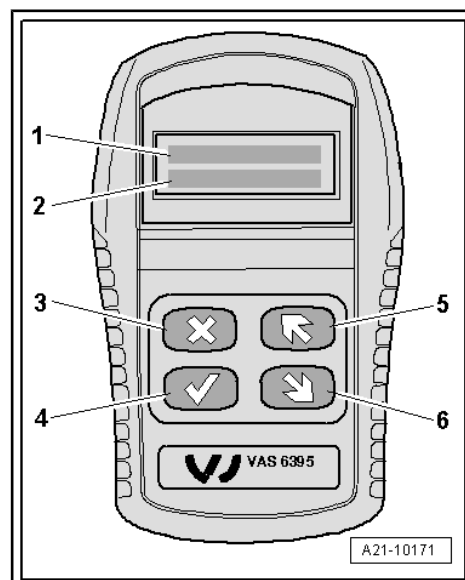
Display on -VAS 6395/1- :

- 1 - CHECK
- 2 - S: XX % I: XX %



Note

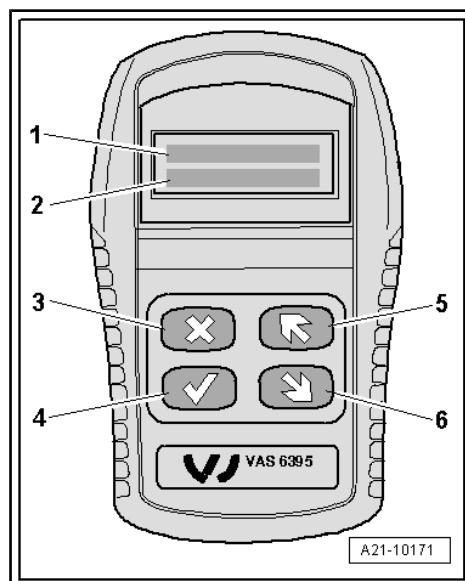
- ◆ "S" means specified value.
- ◆ "I" means actual value.
- The tester - VAS 6395/1- runs through the adjustment range of the intake manifold flap motor and checks the feedback of the positions.



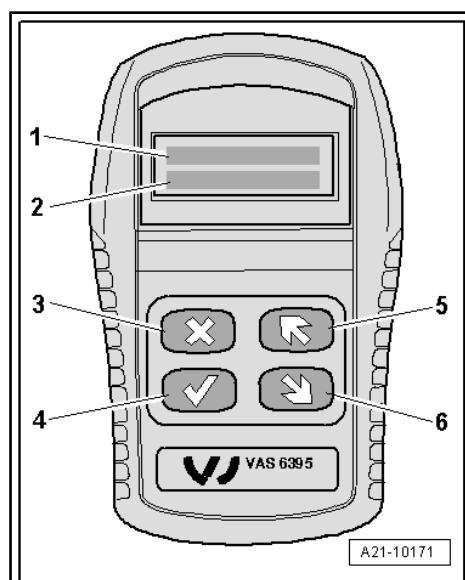
Display on -VAS 6395/1- if intake manifold flap motor is OK:
1 - ACTUATOR OK

- 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

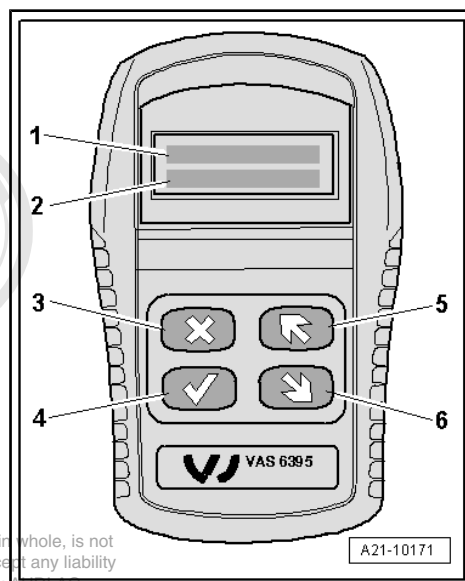
- Intake manifold flap motor must be renewed.



- To do so, proceed as follows:
- To continue, press  button -item 4-.

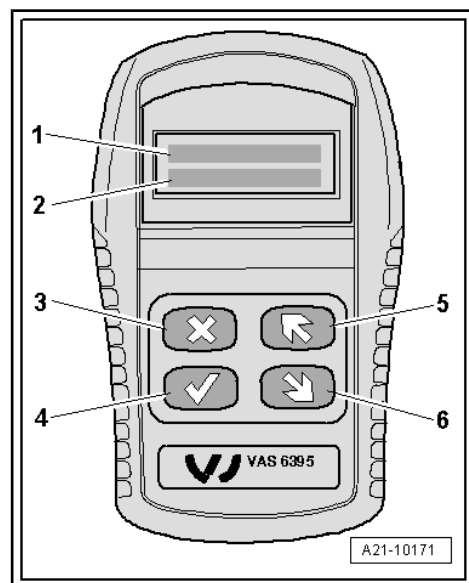
Display on -VAS 6395/1- :

- 1 - >TEST
 - 2 - LEARN
- Press  button -item 6-.



Display on -VAS 6395/1- :

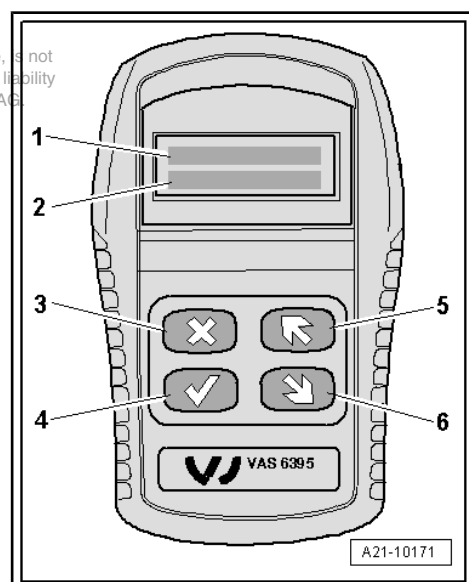
- 1 - TEST
 - 2 - >LEARN
- To continue, press  button -item 4-.



Display on -VAS 6395/1- :

- 1 - STEP 1
- By pressing buttons  -item 5- and  -item 6-, adjust intake manifold flap motor in such a way that coupling rod can be accessed easily for removal.

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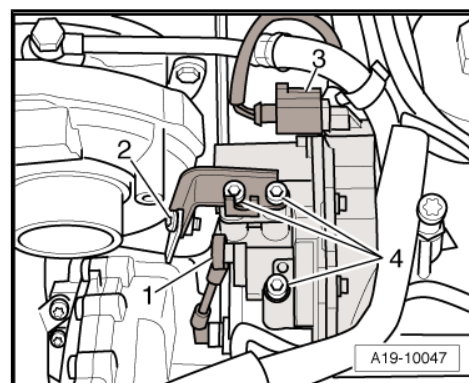


- Unclip coupling rod -1- from intake manifold flap motor.



Note

Disregard items -2, 3, 4-.



- To continue, press button -item 4-.

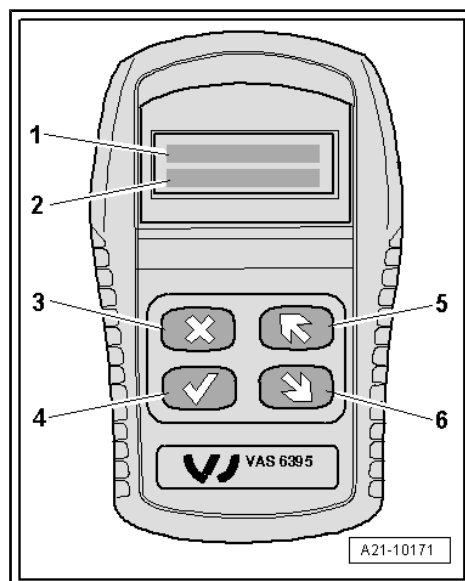
Display on -VAS 6395/1- :

1 - STEP 2

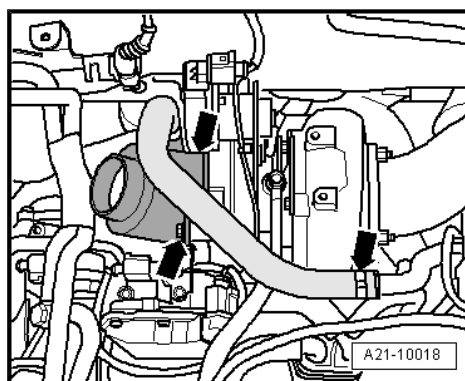


Caution

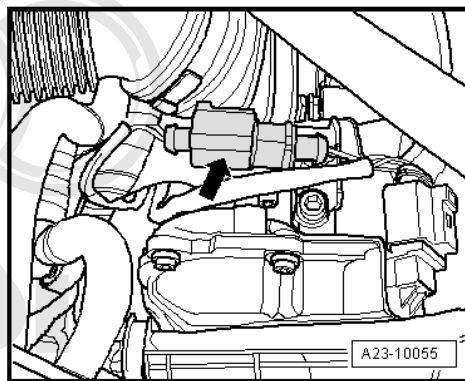
Power supply for tester - VAS 6395/1- must remain connected.



- Unscrew connecting piece for air intake hose (pulsation damper) -arrows- from turbocharger.



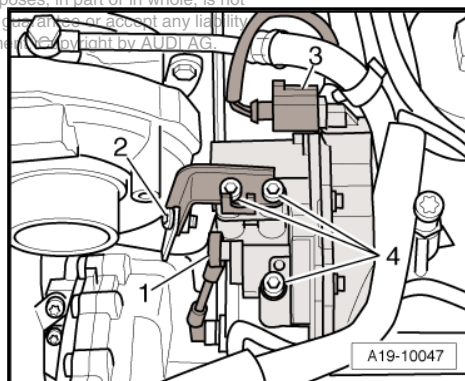
- If fitted, take electrical connector -arrow- for exhaust gas temperature sender 1 - G235- out of bracket.



- Disconnect connection lead -VAS 6395/4-2- item 3- from intake manifold flap motor.

- Remove bolts -2- and -4-.

- Detach old intake manifold flap motor.



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



Note

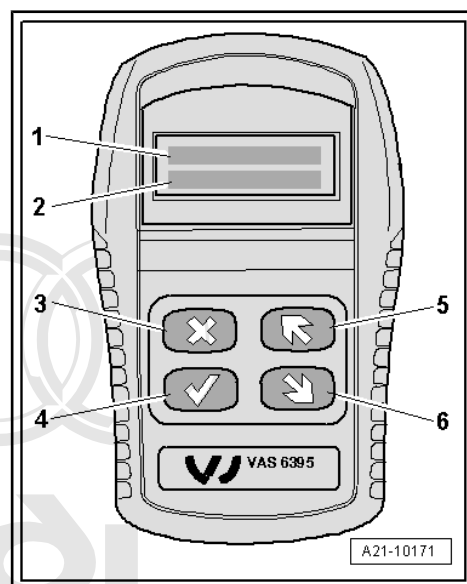
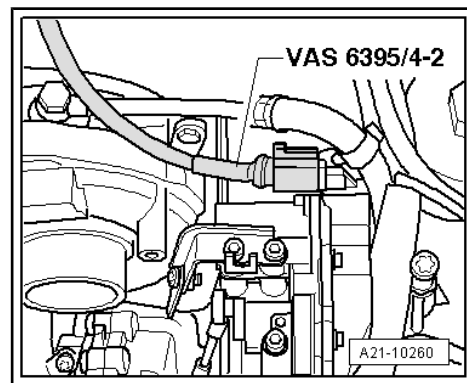
- ◆ Allow thread-forming bolt to engage in existing thread on intake manifold. Then tighten bolts to torque.
- ◆ Torx bolt: 6.5 Nm
- ◆ Hexagon socket head bolts, 9 Nm

- Connect connection lead - VAS 6395/4-2- to intake manifold flap motor.

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

Display on -VAS 6395/1- :

1 - STEP 3

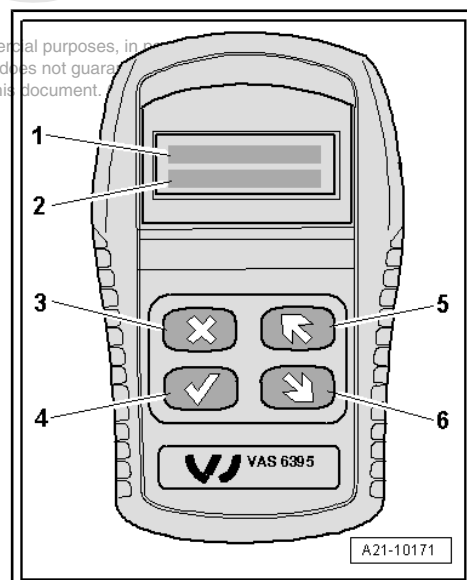


- To continue, press  button -item 4-.

Display on -VAS 6395/1- :

1 - WARNING

2 - LEARNING

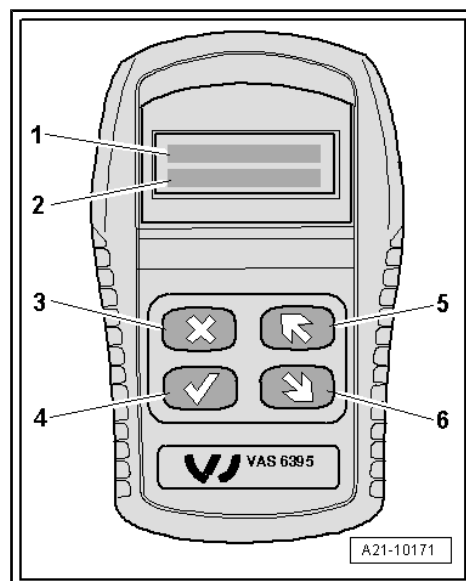


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- To continue, press  button -item 4-.

Display on -VAS 6395/1- :

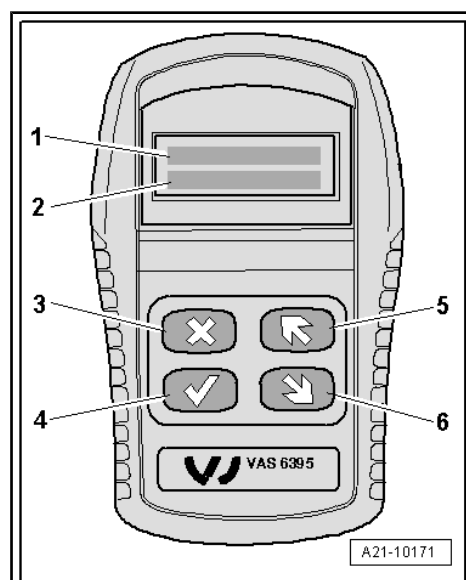
- 1 - TEST 1
 - 2 - S: 84.0 % I: XX %
- Specification = 84 %



- To continue, press  button -item 4-.

Display on -VAS 6395/1- :

- 1 - TEST 2
 - 2 - S: 16.0 % I: XX %
- Specification = 16 %



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- To continue, press  button -item 4-.

Display on -VAS 6395/1- :

1 - TEST 3

2 - S: XX % I: XX %

- Adjustment range of intake manifold flap motor is checked.

Display on -VAS 6395/1- :

1 - OK

- To confirm, press  button -item 4-.

- Adjustment is completed.

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

Assemble in reverse order.



Note

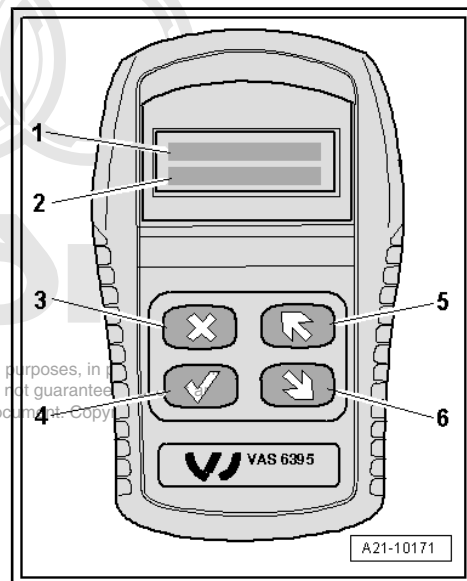
- ◆ Connection for air hose (pulse damper) must be free of oil and grease when installing.
- ◆ Tightening torque: 9 Nm

3.14 Exploded view - intake manifold, vehicles with engine codes CANA, CANB, CANC, CAND, CDYA, CDYB, CDYC



Note

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



1 - Retaining clamp

- ☐ 5.5 Nm
- ☐ Reinforced

2 - Throttle valve module - J338-

- ☐ 9 Nm

3 - O-ring

- ☐ Renew

4 - Bolt

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

5 - Bolt

- ☐ 9 Nm

6 - Gasket

- ☐ Renew

7 - Connecting pipe for exhaust gas recirculation
8 - Intake manifold (top section)

- ☐ Removing and installing
⇒ [page 65](#)

9 - Seal

- ☐ Renew

10 - Plug

- ☐ 10 Nm

11 - Bolt

- ☐ 9 Nm

12 - Mounting pin for engine cover panel

- ☐ 5 Nm

13 - Bolt

- ☐ 9 Nm

14 - Gasket

- ☐ Check for damage and renew if necessary

15 - Intake manifold flap motor

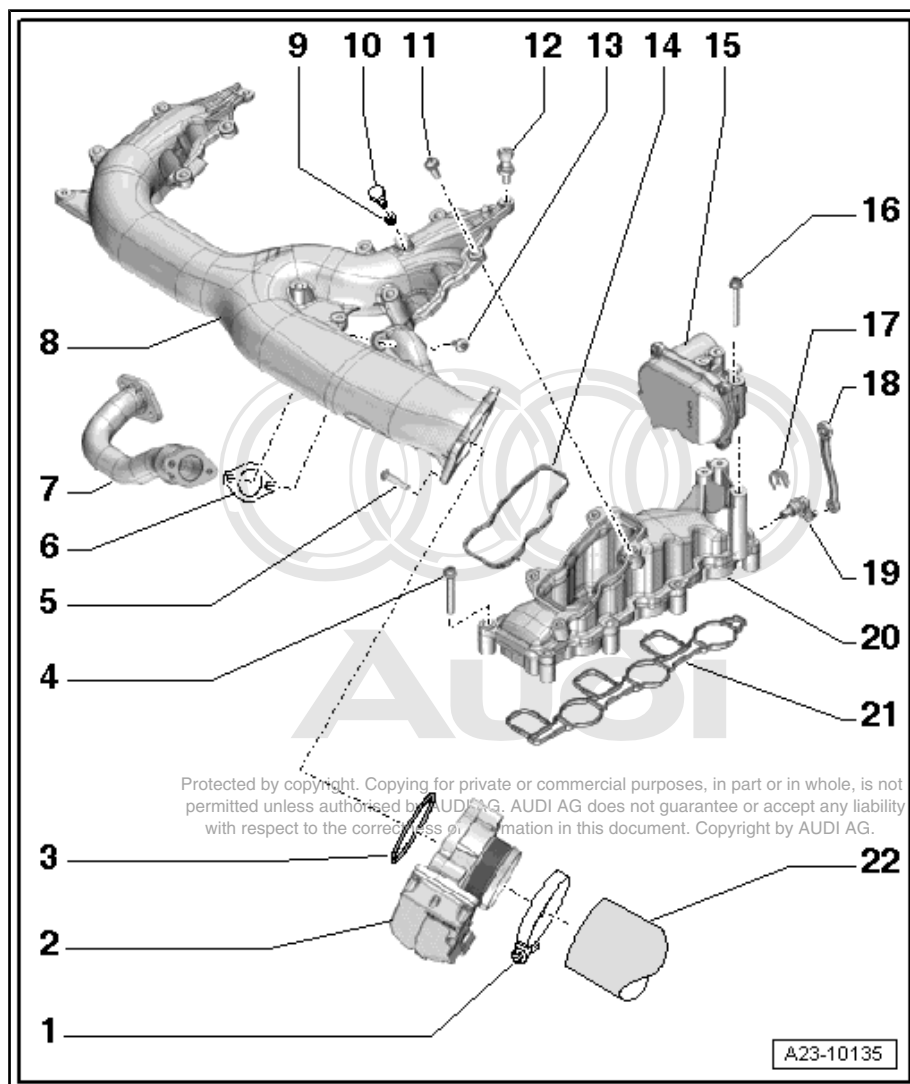
- ☐ Cylinder bank 1 (right-side): intake manifold flap motor - V157-
- ☐ Cylinder bank 2 (left-side): intake manifold flap motor - V275-

16 - Bolt

- ☐ 10 Nm

17 - Securing clip
18 - Connecting rod
19 - Actuator
20 - Intake manifold (bottom section)

- ☐ Removing and installing bottom section of intake manifold (left-side) ⇒ [page 67](#)
- ☐ Removing and installing bottom section of intake manifold (right-side) ⇒ [page 69](#)



21 - Gasket

- ☐ Check for damage and renew if necessary

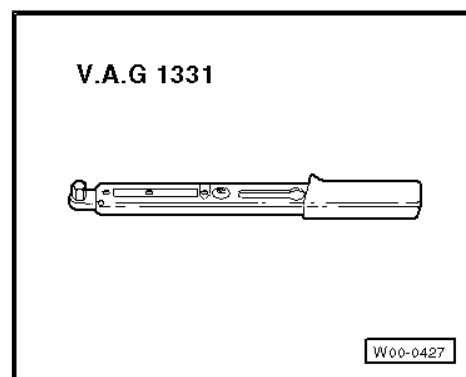
22 - Air hose

- ☐ Must be free of oil and grease when installing

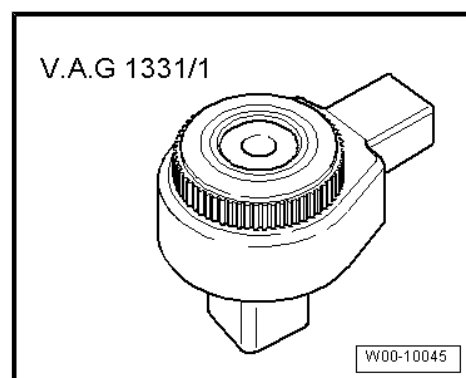
3.14.1 Removing and installing intake manifold (top section)

Special tools and workshop equipment required

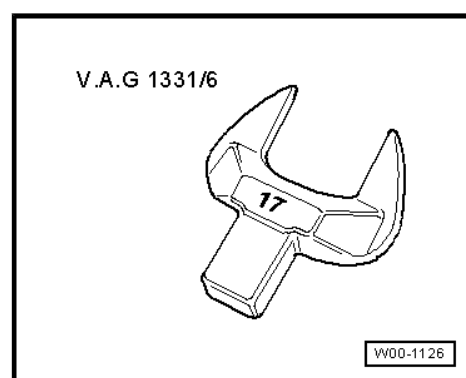
- ◆ Torque wrench - V.A.G 1331-



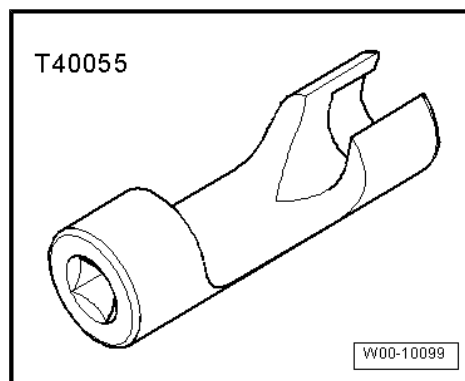
- ◆ Ratchet - V.A.G 1331/1-



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



◆ Socket - T40055-



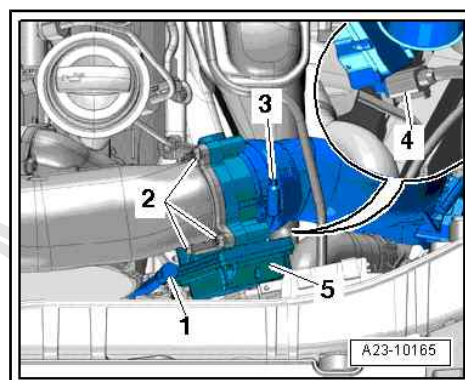
Removing



WARNING

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

- Remove engine cover panel ⇒ [page 36](#) .
- Pull oil dipstick -1- out of guide tube.
- Loosen hose clip -3- and remove air hose.
- Remove bolt -2- and unplug electrical connector -4-.
- Detach throttle valve module - J338- -item 5-.



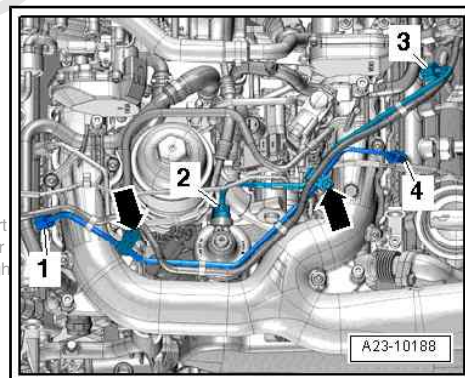
- Unscrew bolts for retaining clips -arrows- and remove retaining clips.
- Remove union nuts -1- and -4- and detach high-pressure pipe.



Note

Disregard -items 2 and 3-

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- Unscrew mounting pins for engine cover panel -1- and -2-.
- Unscrew bolts -arrows- and remove top section of intake manifold.

Installing

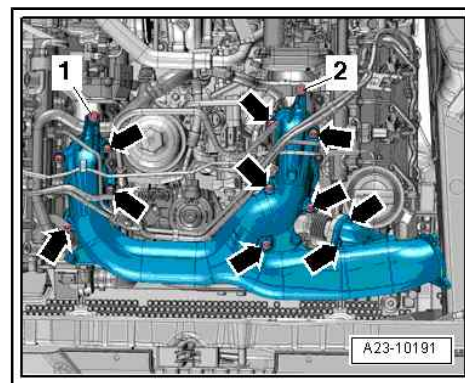
Installation is carried out in the reverse order; note the following:

- Tightening torques: exploded view - intake manifold
⇒ [page 63](#)



Note

- ◆ *Renew seals and gaskets.*
- ◆ *Hose connections and charge air system hoses must be free of oil and grease prior to fitting.*
- ◆ *Check for dirt or leaves in intake passages; clean as required.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*



3.14.2 Removing and installing bottom section of intake manifold (left-side)

Removing



WARNING

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

- Remove top section of intake manifold ⇒ [page 65](#) .
- Carefully press connecting rod -2- off intake manifold flap 2 motor - V275- in direction of arrow (observe note).

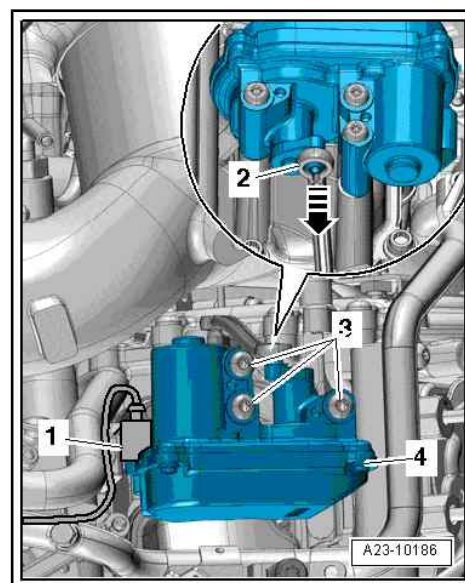


Note

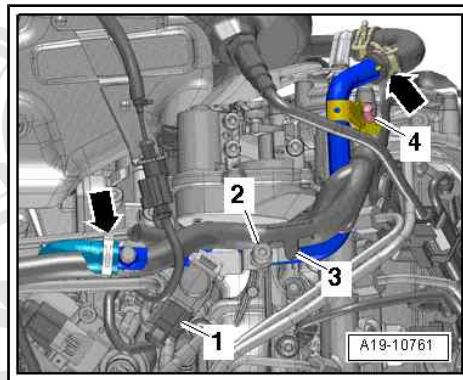
Proceed carefully when pressing connecting rod off ball stud (risk of breaking).

- Unplug electrical connector -1-.
- Unscrew bolts -3- and detach intake manifold flap motor - V275- -item 4-.
- Unplug electrical connectors for glow plugs on cylinders 4 5 and 6.

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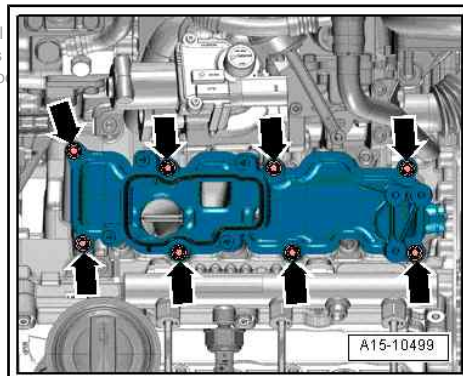


- Take exhaust gas recirculation cooler change-over valve - N345- -item 1- out of bracket.
- Remove bolt -4-.



- Remove bolts -arrows-.

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- Release clamp -arrow- and detach exhaust gas recirculation pipe -1-.
- Carefully take out intake manifold (bottom section).



Note

Block off intake ports in cylinder head with a clean rag.

Installing

- Tightening torques: exploded view - intake manifold
⇒ [page 63](#)

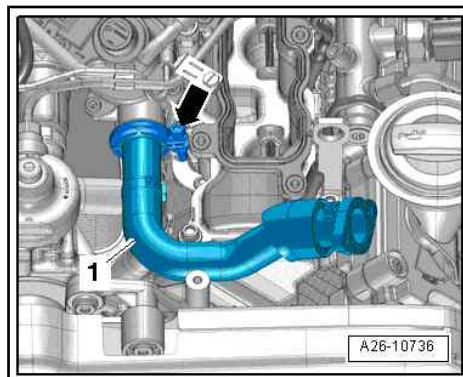
Installation is carried out in the reverse order; note the following:



Note

Renew seals and gaskets.

- Install top section of intake manifold ⇒ [page 65](#) .
- Install high-pressure pipes ⇒ [page 71](#) .



3.14.3 Removing and installing bottom section of intake manifold (right-side)

Removing



WARNING

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

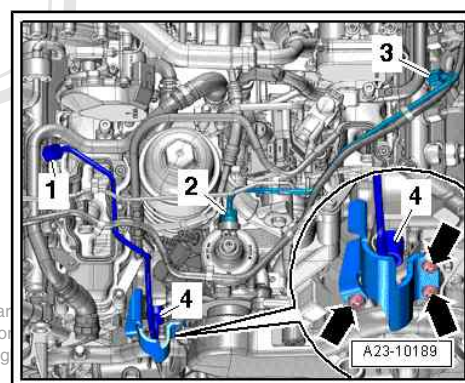
- Remove engine cover panel ➔ [page 36](#).
- Remove top section of intake manifold ➔ [page 65](#).
- Unscrew bolts -arrows- and remove protective plate for high-pressure pipe.
- Remove union nuts -1- and -4- and detach high-pressure pipe.



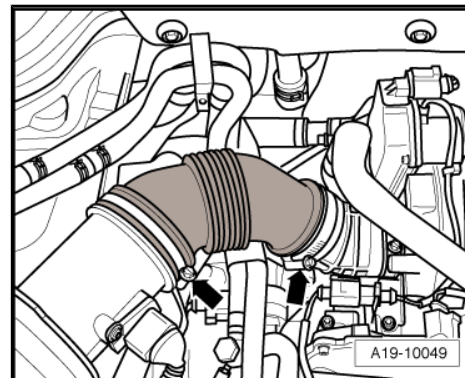
Note

Disregard -items 2 and 3-.

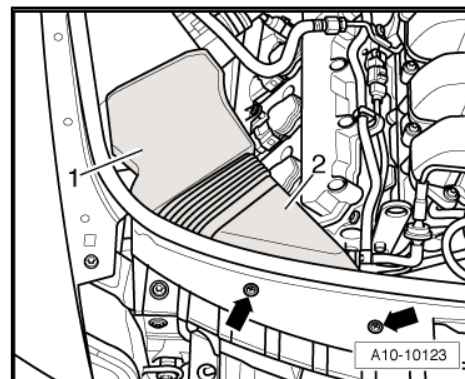
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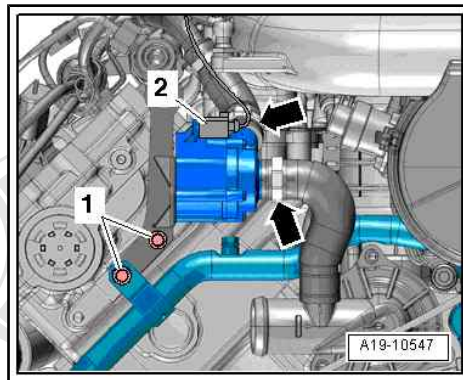
- Remove air pipe -arrows-.



- Remove air duct -2-.

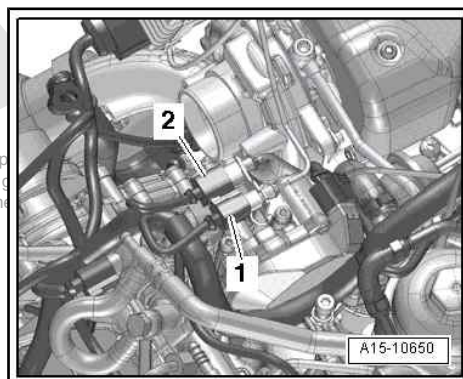


- Unplug electrical connector -2- for pump for exhaust gas re-circulation cooler - V400- .
- Remove bolts -1-.



- Pull electrical connectors -1 and 2- out of bracket.
- Unplug electrical connector -3- at intake manifold flap motor - V157- .

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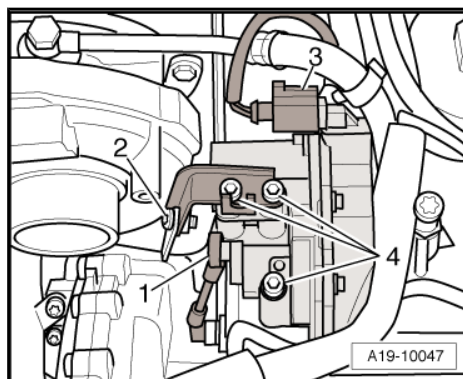


- Carefully press connecting rod -1- off intake manifold flap motor - V157- (observe note).



Note

- ◆ *Proceed carefully when pressing connecting rod off ball stud (risk of breaking).*
- ◆ *Item -2- is not installed.*
- Remove bolts -4-.
- Unplug electrical connectors at glow plugs for cylinders 1, 2 and 3.
- Move wiring harness clear to the side.



- Remove bolts -arrows-.
- Press coolant pipe to one side and take out bottom section of intake manifold (right-side).



Note

- ◆ -Item 1- can be disregarded.
- ◆ Block off intake ports in cylinder head with a clean rag.

Installing

- Tightening torques: exploded view - intake manifold
⇒ [page 63](#)

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



Note

Renew seals and/or gaskets.

- Install top section of intake manifold ⇒ [page 65](#) .
- Install high-pressure pipes ⇒ [page 71](#) .
- Check fuel system for leaks ⇒ [page 113](#) .

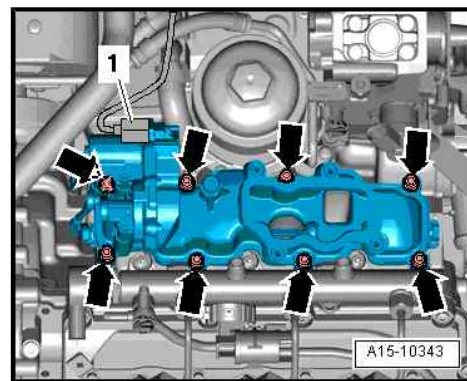
3.15 Installing high-pressure pipes

Procedure



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.*
- Use vacuum cleaner to remove dirt from taper seat at fuel rail.
- Clean fuel pipe and end of pipe using cleaning solution and dry with compressed air.
- Lubricate threads of union nuts with fuel.
- Hand-tighten union nuts on high-pressure pipes (ensure that pipes are not under tension).
- Tightening torque: 25 Nm
- To tighten unions of high-pressure pipes, use torque wrench - V.A.G 1331- with ratchet - V.A.G 1331/1- and suitable socket set.
- Check fuel system for leaks ⇒ [page 113](#) .



3.16 Checking injectors

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

- ⇒ [“3.17 Performing adaption of correction values for injectors”, page 72](#)
- ⇒ [“3.18 Checking for injectors sticking open”, page 73](#)
- ⇒ [“3.19 Measuring return flow rate of injectors with engine running”, page 74](#)
- ⇒ [“3.20 Checking return flow rate of injectors at starter cranking speed”, page 78](#)

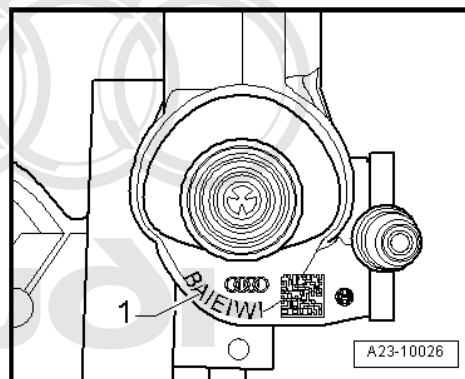
Perform the following tests first if the engine does not start at all:

- ◆ ⇒ [“3.18 Checking for injectors sticking open”, page 73](#)
- ◆ ⇒ [“3.20 Checking return flow rate of injectors at starter cranking speed”, page 78](#)
- ◆ ⇒ [“3.32 Checking fuel pressure regulating valve N276”, page 133](#)

3.17 Performing adaption of correction values for injectors

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

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

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

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

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 adaption values if the correct values are already stored in the engine control unit.

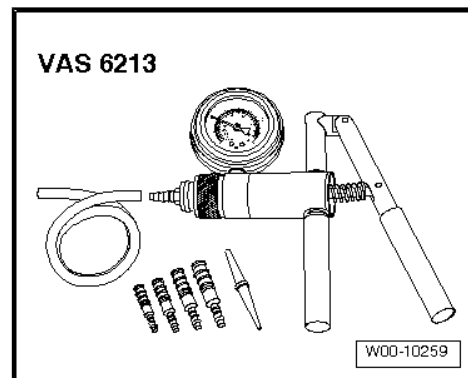


3.18 Checking for injectors sticking open

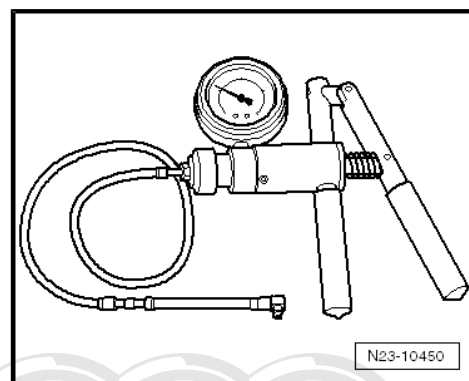
If one of the injectors is sticking open, this means that the injector needle is not closing fully and fuel escapes into the cylinder.

Special tools and workshop equipment required

- ◆ Hand vacuum pump - VAS 6213-



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



Procedure

- Remove engine cover panel ⇒ [page 36](#) .
- Clean all fuel rail connections with engine cleaner or brake cleaner and dry.



WARNING

- ◆ *Always read instructions on ⇒ [page 1](#) when working on injectors.*
- ◆ *Follow these instructions before starting work and while working on the fuel system.*

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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 84](#) .

Assembling

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

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


Note

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

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

Checking fuel system 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.

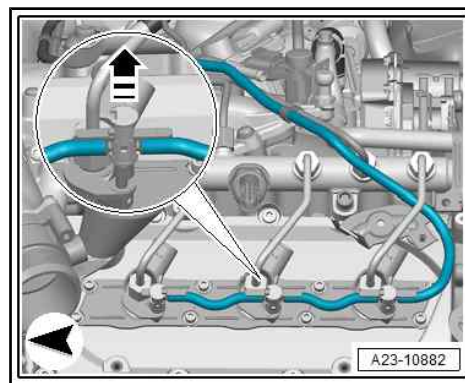
- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the complete high-pressure section of the fuel system again for leaks.
- Install engine cover panel ⇒ [page 36](#) .

3.19 Measuring return flow rate of injectors with engine running

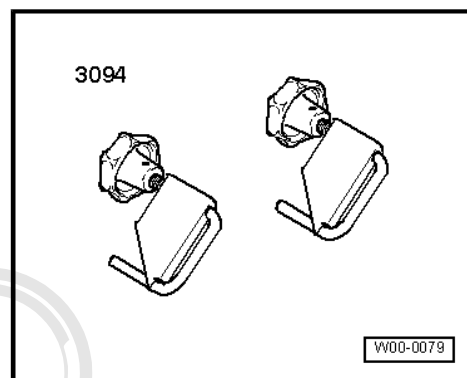
Checking return flow rate if engine does not start ⇒ [page 78](#)

Special tools and workshop equipment required

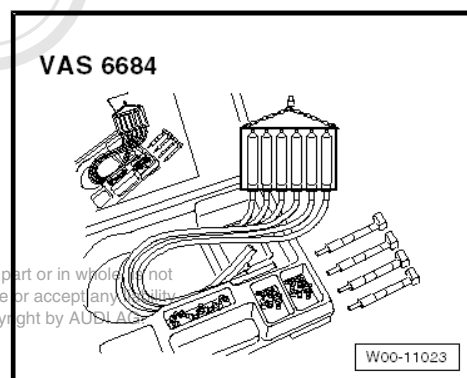
- ♦ Fuel-resistant measuring container



- ◆ Hose clamps, up to 25 mm - 3094-



- ◆ Return flow meter - VAS 6684-



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Checking return flow rate of all 6 injectors

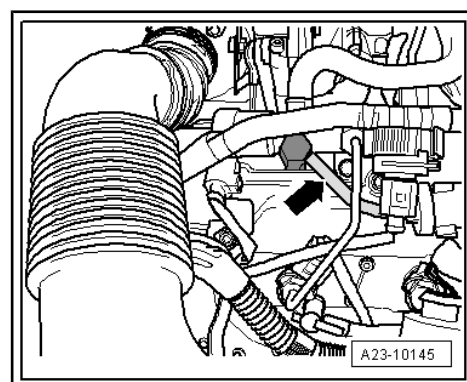
- Remove engine cover panel ⇒ [page 36](#) .



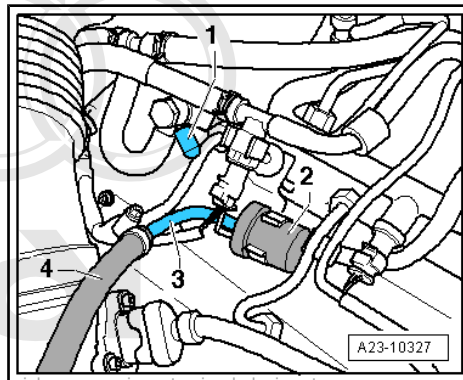
WARNING

- ◆ *Always read instructions on ⇒ [page 1](#) 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 line 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

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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.

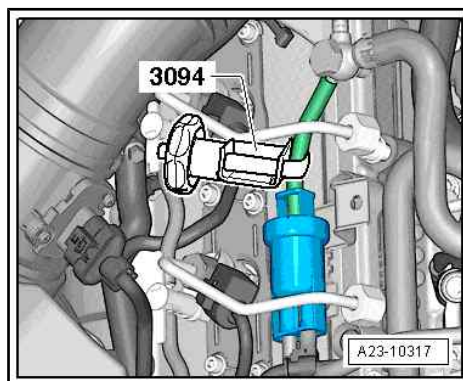
Checking return flow rate of individual injectors

Note

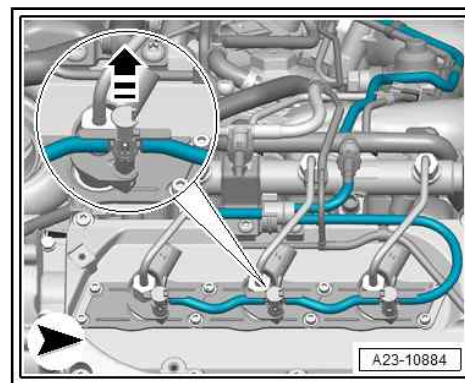
On cylinder bank 2 the coolant expansion tank must be detached; coolant hoses remain connected.

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.

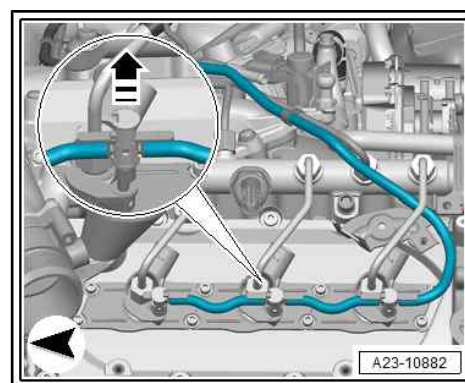
- Clean all return line connections (with commercial cleaning solution or similar) before removing.
- Dry all components after cleaning.
- Clamp off fuel return line downstream of pressure retention valve using hose clamp up to 25 mm - 3094- .



- 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-.



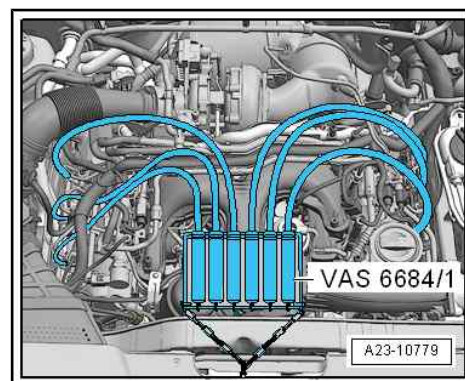
- Connect hoses of return flow meter - VAS 6684- to all return line connections of the six injectors.
- Start engine and let it idle for several minutes.



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:

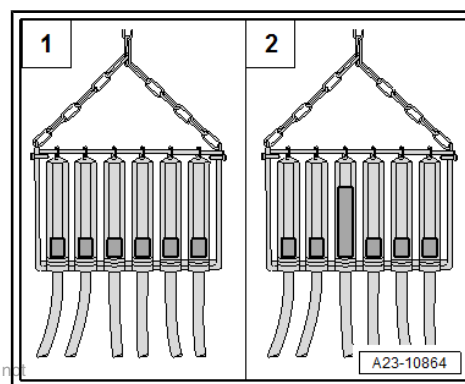
- ◆ 1. Injectors OK. Return flow rate approx. identical on all injectors.
- ◆ 2. Injector for cylinder 3 not OK. Return flow rate greater than three times the volume of smallest measured return flow rate.



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 84](#).





- 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.



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

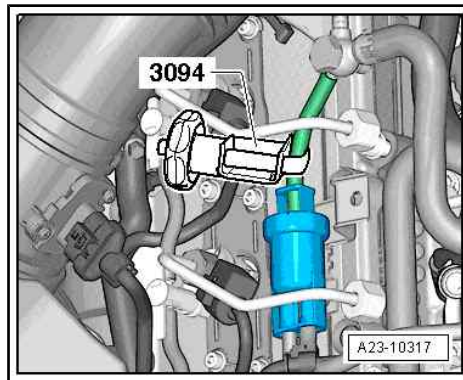
- Push return line connections carefully over seals and onto injectors. The catch should engage audibly. Then press release pin down carefully.

Checking fuel system 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 complete high-pressure section of the fuel system again for leaks.

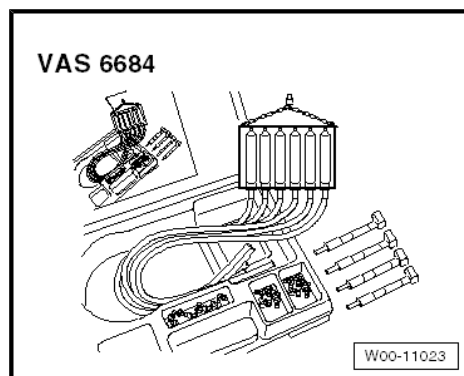
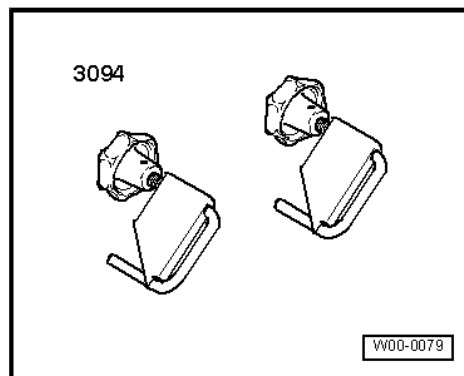


3.20 Checking return flow rate of injectors at starter cranking speed

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





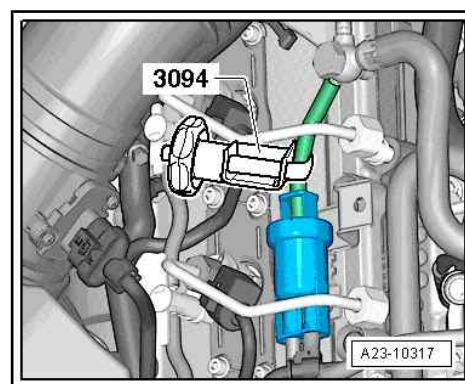
WARNING

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

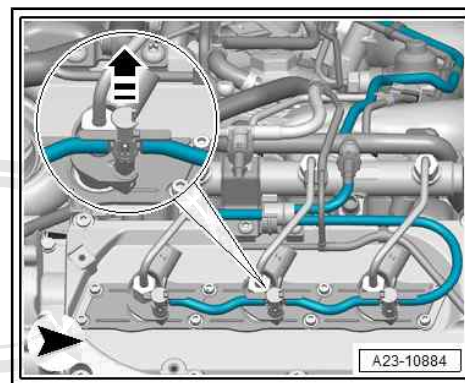
Procedure

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.

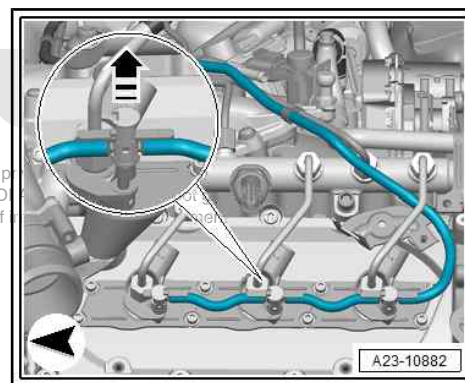
- Remove engine cover panel [⇒ page 36](#) .
- Clean all return line connections with engine cleaner or brake cleaner and dry.
- Clamp off fuel return line downstream of pressure retention valve using hose clamp up to 25 mm - 3094- .



- 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-.



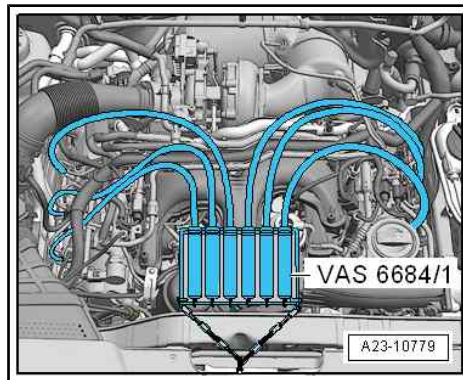
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- Connect hoses of return flow meter - VAS 6684- to return line connections of all six injectors.
- Operate starter three times (wait approx. 20 seconds each time after operating starter to prevent it from overheating).
- ◆ Specification of return flow rate: 0 ml
- If fuel comes out of one injector, that injector must be renewed ⇒ [page 84](#).

Installing fuel return lines

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

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



Note

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

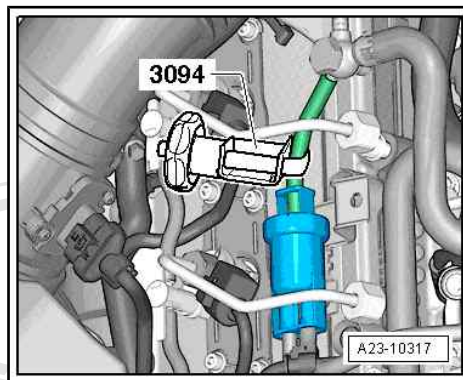
- Push return line connections carefully over seals and onto injectors. The catch should engage audibly. Then press release pin down carefully.
- Remove hose clamp up to 25 mm - 3094- from fuel return line.

Checking fuel system 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 complete high-pressure section of the fuel system again for leaks.



3.21 Checking pressure retention valve in fuel return line

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

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

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Special tools and workshop equipment required

- ◆ Tester for fuel return system - VAS 6330-



WARNING

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

- Remove engine cover panel ⇒ [page 36](#).
- Clean return line connection on cylinder 1 (with commercial cleaning solution or similar) before removing.
- Dry return line connection on cylinder 1.

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

 Note

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

- Fit tester for fuel return system - VAS 6330- between return line connection and fuel return line.
- Start engine.
- Check pressure indicated on tester.
- ◆ Specification: approx. 10 bar

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

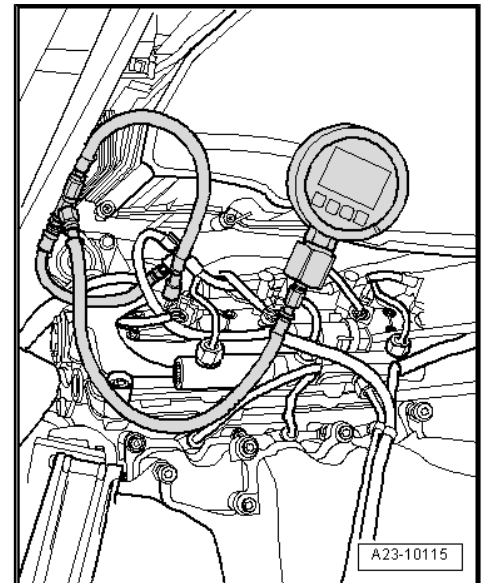
Installing fuel return lines

- Renew O-ring for return line connection.

 Note

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

- Push the return line connection carefully over the new seal and onto the injector. The catch should engage audibly. Then press release pin down carefully.
- Erase entry in event memory using a diagnostic tester.
- Check fuel system for leaks ⇒ [page 113](#) .



3.22 Exploded view - injectors and high-pressure pipes



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1 - Copper seal

- ☐ Renew

2 - O-ring

- ☐ Renew

3 - Injectors

- ☐ 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 84](#)

4 - Hexagon flange nut

- ☐ For clamping piece
- ☐ 10 Nm

5 - High-pressure pipes

- ☐ Ensure parts are kept clean.
- ☐ Do not alter shape
- ☐ Removing and installing
⇒ [page 71](#)

6 - Fuel rail

- ☐ Fuel pressure regulating valve - N276- is screwed into fuel rail for cylinder bank 1
- ☐ Fuel pressure sender - G247- is screwed into fuel rail for cylinder bank 2

7 - Seals

- ☐ Renew

8 - Banjo bolt

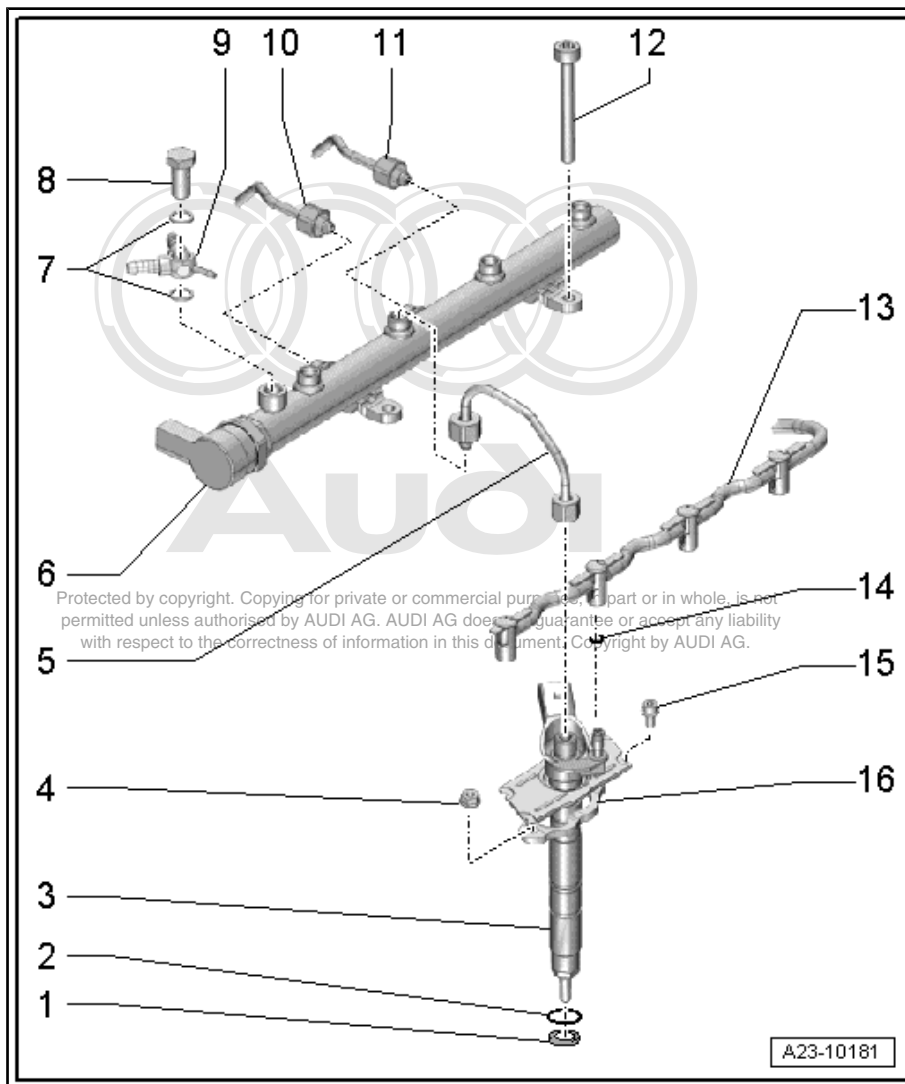
- ☐ 25 Nm

9 - Connecting piece
10 - High-pressure pipe

- ☐ From high-pressure pump
- ☐ Ensure parts are kept clean.
- ☐ Do not alter shape
- ☐ 25 Nm

11 - High-pressure pipe

- ☐ From fuel rail on opposite side
- ☐ Ensure parts are kept clean.
- ☐ Do not alter shape
- ☐ 25 Nm



12 - Bolt

- ☐ 22 Nm

13 - Fuel return lines

- ☐ 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 - O-ring

- ☐ Renew

15 - Bolt

- ☐ 5 Nm
- ☐ Cover for injector on cylinder head cover

16 - Clamping piece

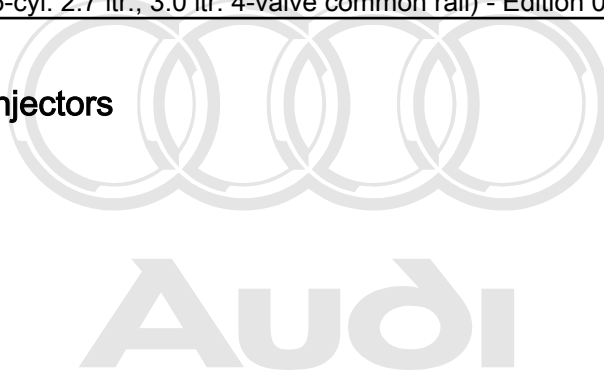
- ☐ Renew



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3.23 Removing and installing injectors



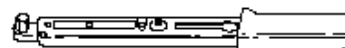
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Special tools and workshop equipment required

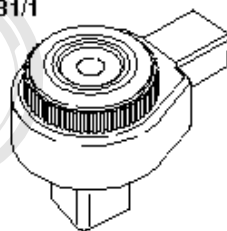
3150



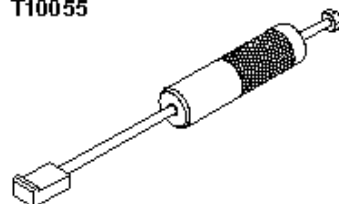
V.A.G 1331



V.A.G 1331/1



T10055



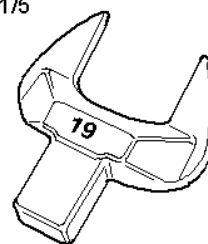
T40055



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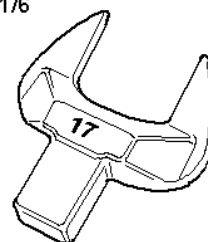
G15-0068

V.A.G 1331/5



W00-1127

V.A.G 1331/6



W00-1126

T10377

3. Injection system

- ◆ Socket, 14 mm - 3150- for vehicles up to 10.2005
- ◆ Torque wrench - V.A.G 1331-
- ◆ Ratchet - V.A.G 1331/1-
- ◆ Puller - T10055- with adapter - T10055/1-
- ◆ Socket - T40055- (17 mm)
- ◆ Open end spanner insert, AF 19 - V.A.G 1331/5-
- ◆ Open end spanner insert, AF 17 - V.A.G 1331/6-
- ◆ Assembly sleeve - T10377-
- ◆ Cleaning kit - VAS 6811-

Removing



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- ◆ **Always read instructions on ⇒ [page 1](#) when working on injectors.**
- ◆ **Follow these instructions before starting work and while working on the fuel system.**



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 36](#) .
- Coolant expansion tank must be detached in order to remove injectors 5 and 6.



Note

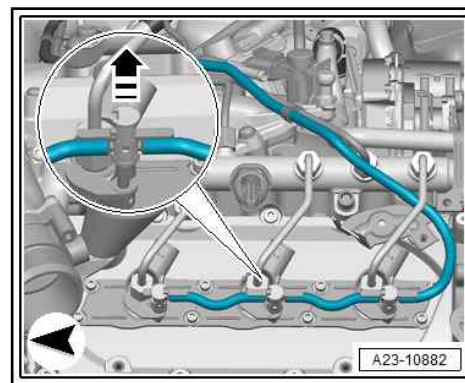
Step required only for cylinder bank 1: Remove air cleaner housing with air mass meter.



WARNING

- ◆ **Mark cylinder numbers on injector units.**
- ◆ **Observe rules for cleanliness when working on the injection system.**

- 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.

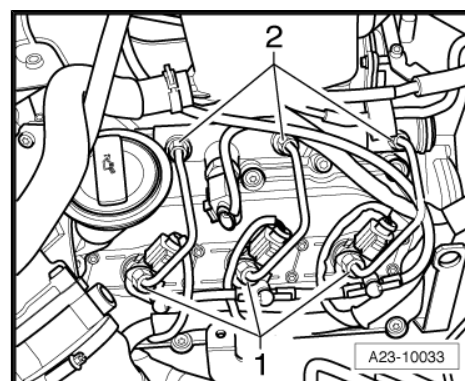


- Loosen union nuts for injector pipes -1 and 2- using corresponding socket.

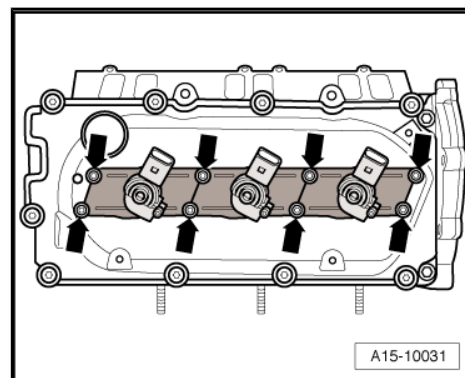


Note

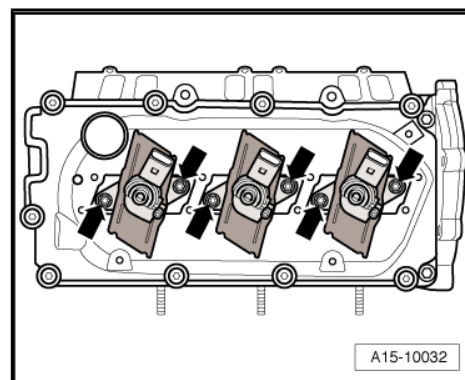
- ◆ Plug open connections with suitable sealing caps immediately.
- ◆ If the injectors are to be re-installed, mark the respective cylinder numbers on the injector pipes on removal. They must always be re-installed on the same cylinders.



- Unbolt covers for injectors -arrows-.
- Pull covers upwards and turn them $\frac{1}{4}$ turn (90°).



- Unbolt clamping pieces for injectors -arrows-.



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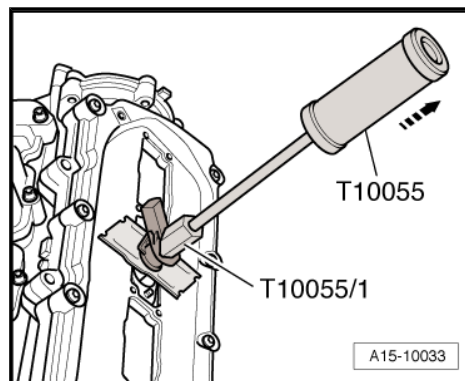
- Pull out injectors using puller - T10055- with adapter - T10055/1- .
- After removal, lay injectors on a clean cloth.

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.



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- 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

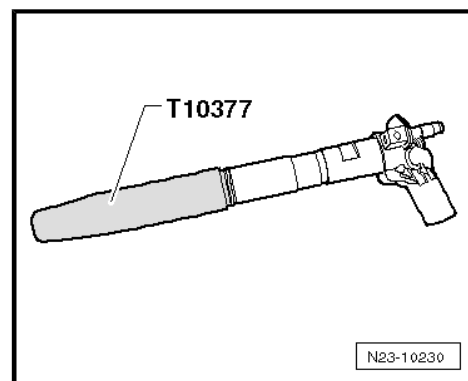
Lubricate all O-rings with assembly oil, engine oil or diesel fuel before installing.



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

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- Tighten union nuts on high-pressure pipes and injector pipes hand-tight to start with.
- Install high-pressure pipes ⇒ [page 71](#) .
- Push the return line connections carefully over the new seals and onto the injectors. The catch should engage audibly. Then press release pin down carefully.

After renewing one or more injectors, the “injector delivery calibration values” and “injector voltage calibration values” for the new injectors must be written into the engine control unit
⇒ [page 72](#) .

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 adaption values if the correct values are already stored in the engine control unit.

Bleeding fuel system and checking for leaks

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



Note

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

- Switch off ignition.
- Carefully check the 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 affected component if leakage still occurs after tightening to correct torque.

- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the complete 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.

3.24 Exploded view - toothed belt for high-pressure pump, vehicles with engine codes BMK, BPP, BSG, BNG, ASB



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1 - Toothed belt cover (front)

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

2 - Nut

- ☐ Use counterhold tool - 3036- when loosening and tightening
⇒ [page 92](#)
- ☐ 70 Nm

3 - Damper weight

- ☐ Use counterhold tool - 3036- when loosening and tightening central nut ⇒ [page 92](#)

4 - Bolt

- ☐ 23 Nm

5 - Toothed belt sprocket for high-pressure pump

- ☐ Remove using puller - T40064- ⇒ [page 92](#)

6 - Toothed belt tensioning roller

7 - Bolt

- ☐ 9 Nm

8 - Toothed belt cover (rear)

9 - Toothed belt drive sprocket

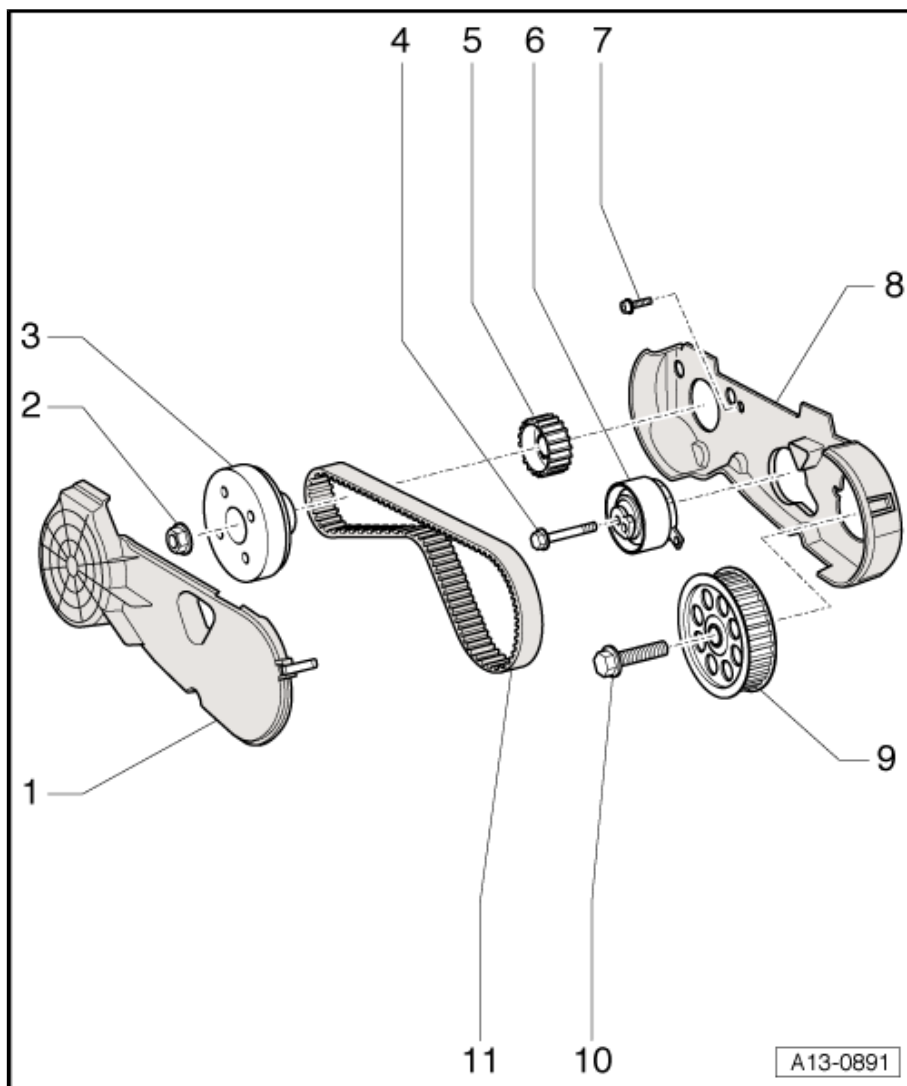
- ☐ Use counterhold tool - 3036- when loosening and tightening central bolt ⇒ [page 92](#)
- ☐ Pulling off: versions up to 12.2005 ⇒ [page 92](#) ; versions from 12.2005 onwards ⇒ [page 93](#)

10 - Bolt

- ☐ 75 Nm
- ☐ With washer
- ☐ Use counterhold tool - 3036- when loosening and tightening ⇒ [page 92](#)

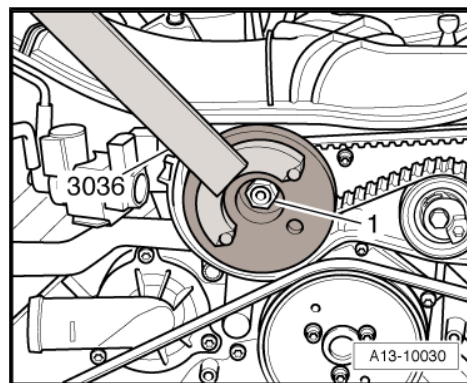
11 - Toothed belt for high-pressure pump

- ☐ 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 ⇒ [page 93](#)



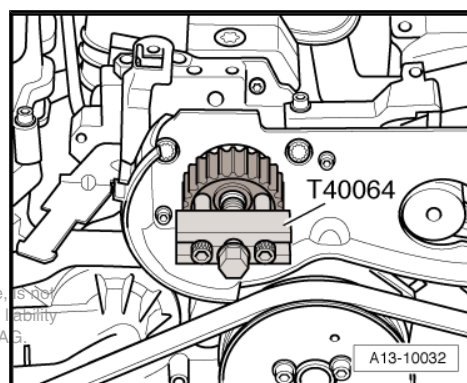
Loosening and tightening central nut for high-pressure pump shaft

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



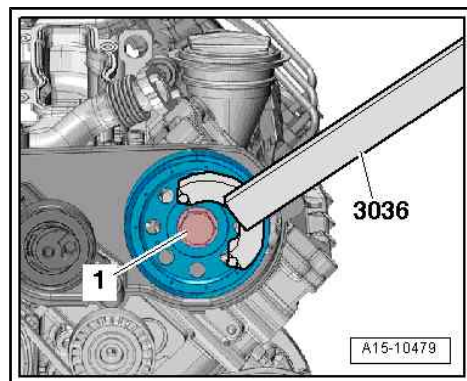
Pulling off toothed belt sprocket for high-pressure pump

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



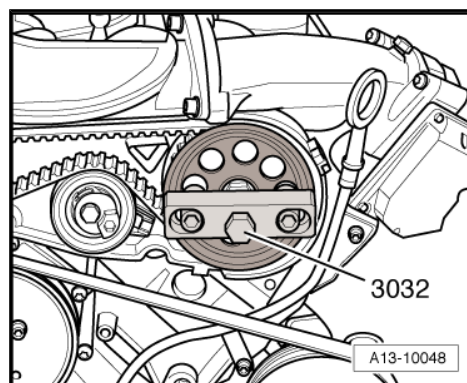
Loosening and tightening central bolt for toothed belt drive sprocket

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



Pulling off toothed belt drive sprocket (versions up to 12.2005)

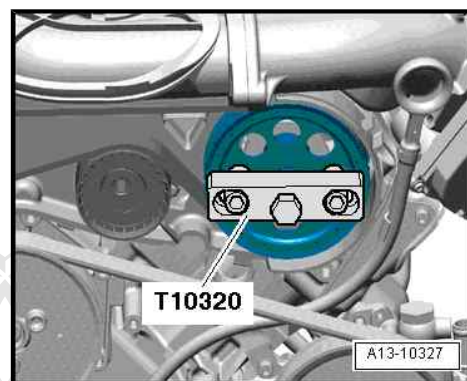
- Use puller - 3032- to pull off toothed belt drive sprocket.



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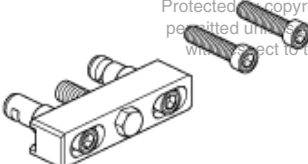
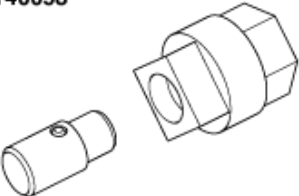
Pulling off toothed belt drive sprocket (versions from 12.2005 onwards)

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



3.24.1 Removing and installing toothed belt for high-pressure pump - vehicles up to 12.2005

Special tools and workshop equipment required

3032 	3036 
T40058 	
	G13-0062

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

Removing

- Remove intake manifold (top section) ⇒ [page 41](#) .
- Loosen clamps -arrows-.
- Pivot toothed belt cover forward and disengage retaining pegs on bottom side of toothed belt cover.
- Remove toothed belt cover.



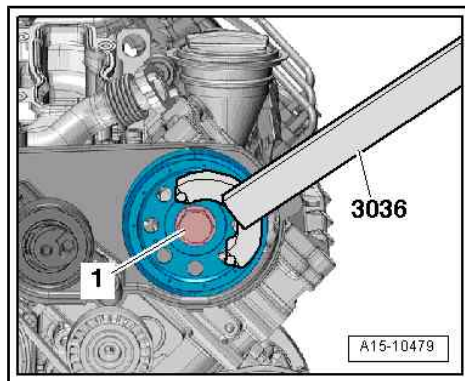
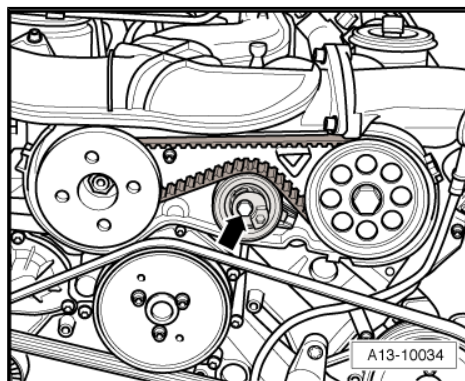
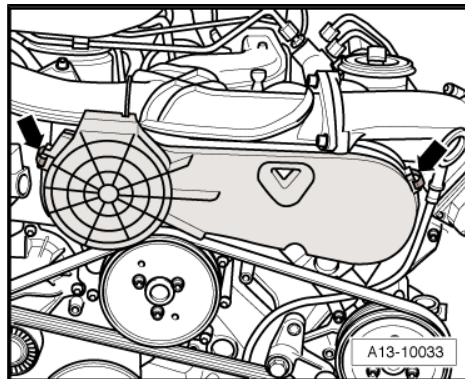
Caution

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

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

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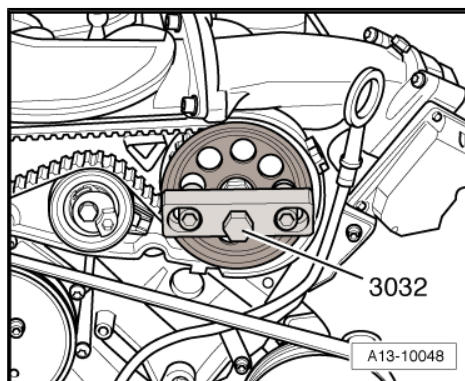
- Loosen bolt -arrow- for toothed belt tensioning roller approx. 2 turns.
- Loosen central bolt -1- for toothed belt drive sprocket approx. 2 turns using counterhold tool - 3036- .



- 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:

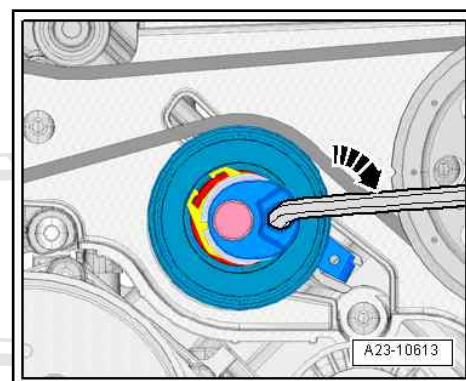
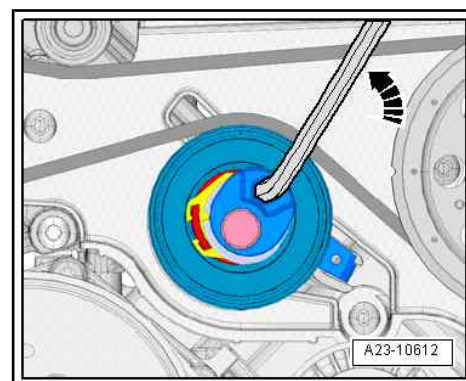
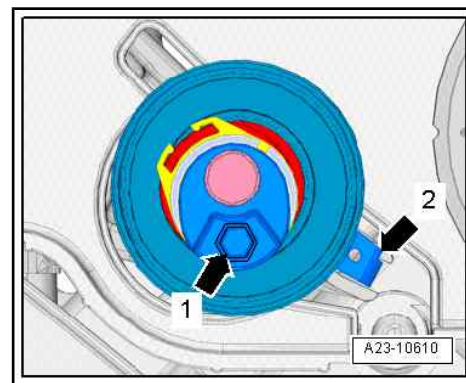


- Check installation position of toothed belt tensioning roller:
 - Retaining lug -arrow 2- must engage in slot on bracket for high-pressure pump.
 - Tensioning roller must be slack and hexagon socket -arrow 1- must face downwards.
- Fit toothed belt together with toothed belt drive sprocket.
- Install 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 further in direction of -arrow- using hexagon key until hexagon socket is in "1 o'clock" position.



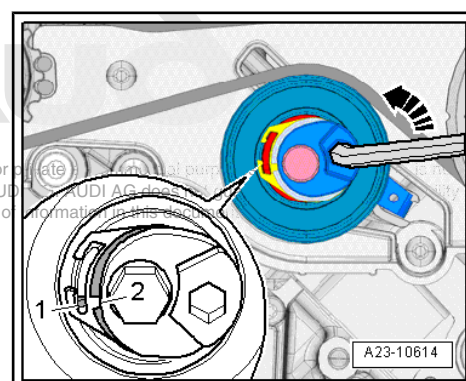
Caution

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



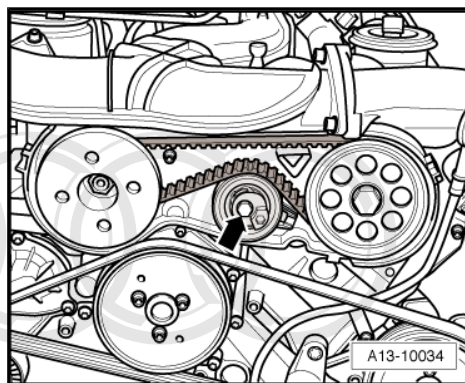
- Now release toothed belt tensioning roller -arrow- to such an extent that hexagon socket moves into "3 o'clock" position.

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

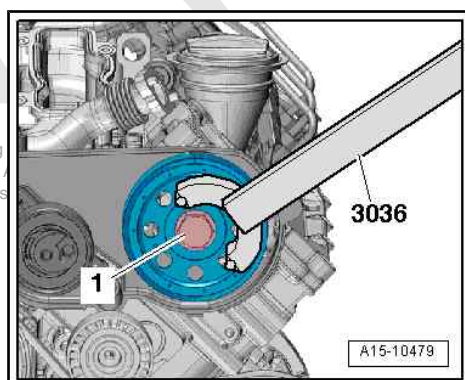


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- Hold toothed belt tensioning roller in this position and tighten bolt -arrow- ⇒ [Item 4 \(page 91\)](#) .



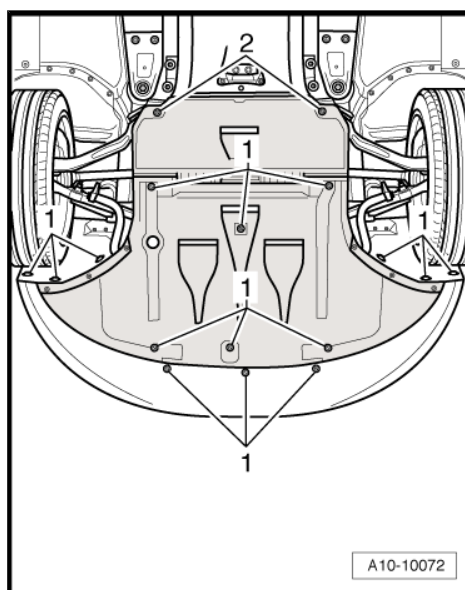
- Tighten bolt -1- for toothed belt drive sprocket using counter-hold tool - 3036- ⇒ [Item 11 \(page 116\)](#) .



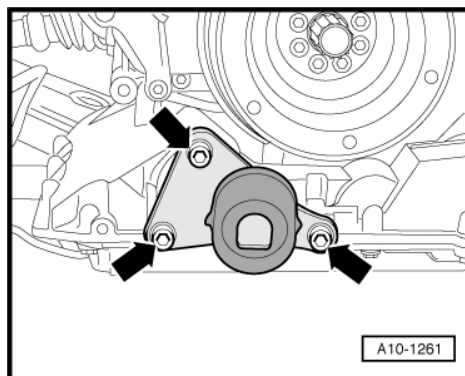
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Turn crankshaft one complete revolution to check toothed belt tension. To do this:

- Release quick-release fasteners -1- and -2- and take off front and rear noise insulation.



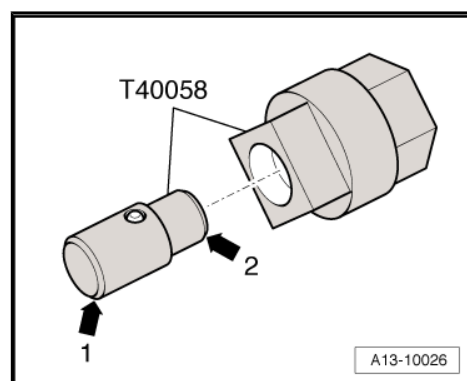
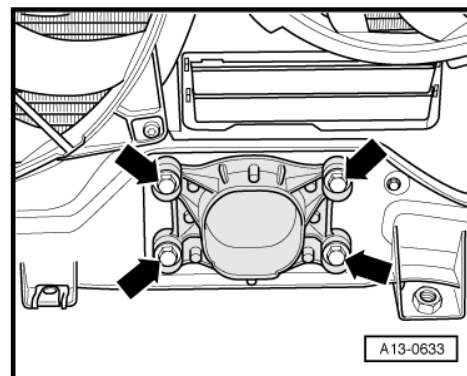
- Unscrew bolts -arrows- and detach torque reaction support from engine.



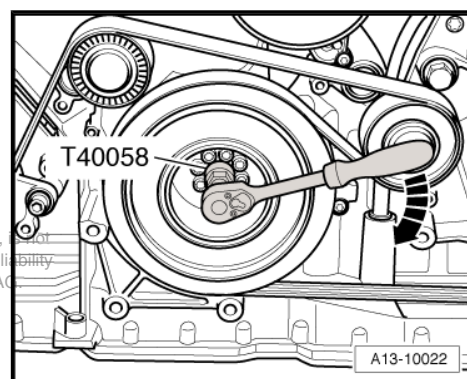
 Note

Stop for torque reaction support can also be removed if there is insufficient space.

- 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.



- 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:

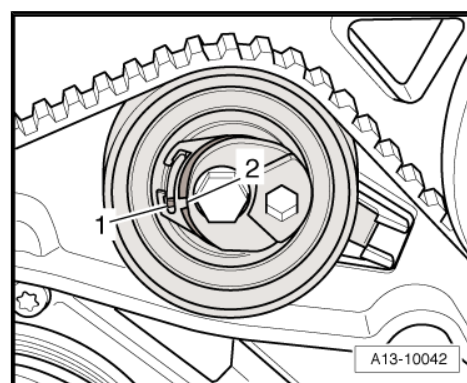
- Adjust the toothed belt tension again.

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

- Install intake manifold (top section) ⇒ [page 41](#) .
- Install torque reaction support on engine ⇒ Engine, Mechanics; Rep. gr. 10 ; Assembly mountings .

Tightening torque

- ⇒ [“3.24 Exploded view - toothed belt for high-pressure pump, vehicles with engine codes BMK, BPP, BSG, BNG, ASB”, page 90](#)

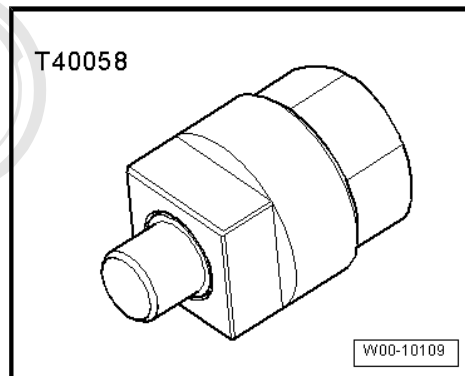


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3.24.2 Removing and installing toothed belt for high-pressure pump - vehicles from 12.2005 onwards

Special tools and workshop equipment required

- ◆ Adapter - T40058-



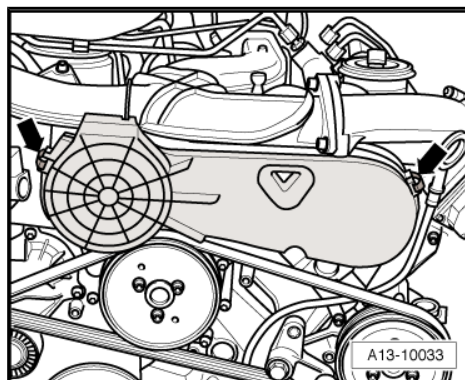
Removing

- Remove intake manifold (top section) ⇒ [page 41](#) .
- Loosen clamps -arrows-.
- Pivot toothed belt cover forward and disengage retaining pegs on bottom side of toothed belt cover.
- Remove 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.

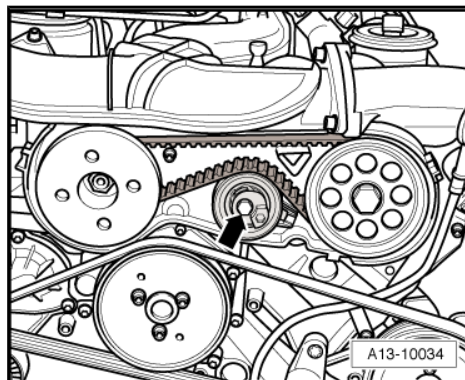
Installing

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



Note

Before installing toothed belt, make sure high-pressure pump with toothed belt sprocket and toothed belt drive sprocket are firmly secured.

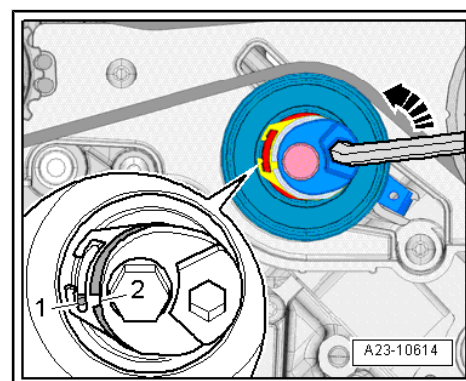
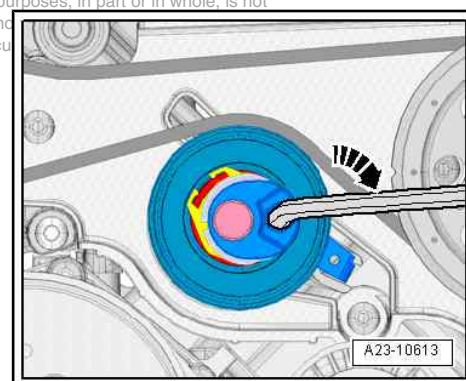
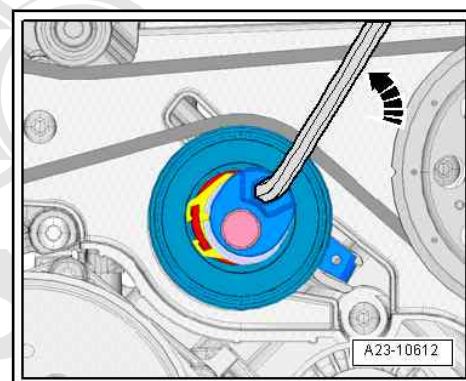
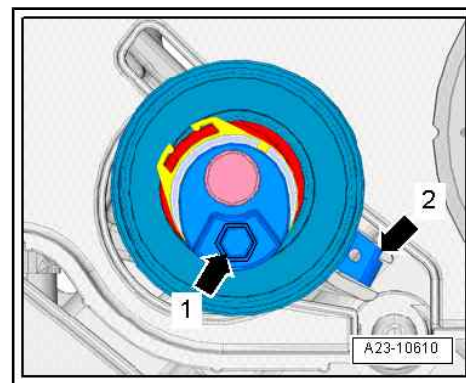


- Check installation position of toothed belt tensioning roller:
 - Retaining lug -arrow 2- must engage in slot on bracket for high-pressure pump.
 - Tensioning roller must be slack and hexagon socket -arrow 1- must face downwards.
- Fit toothed belt.
- Install toothed belt tensioning roller; to do so, 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.



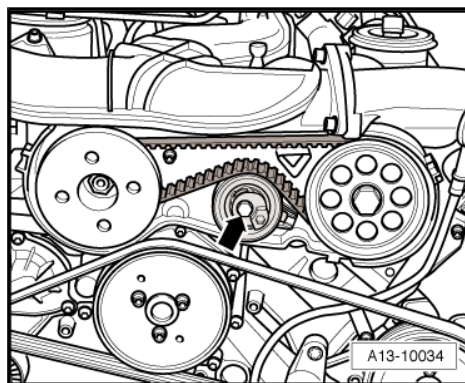
Caution

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



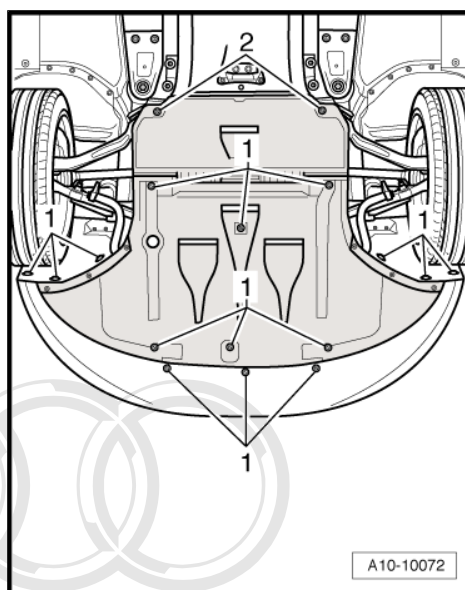
- Now release toothed belt tensioning roller -arrow- to such an extent that hexagon socket moves into "3 o'clock" position.
- Tension toothed belt tensioning roller slightly from "3 o'clock" position -arrow- until lug -1- and notch -2- are exactly in line.

- Hold toothed belt tensioning roller in this position and tighten bolt -arrow- ⇒ [Item 4 \(page 91\)](#) .

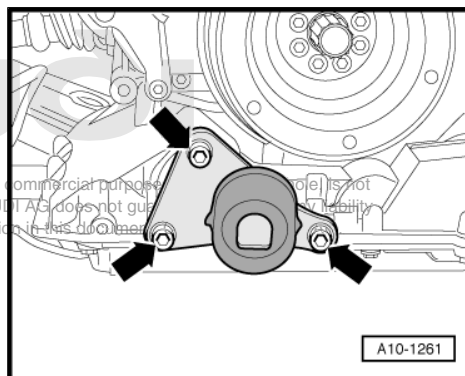


Turn crankshaft one complete revolution to check toothed belt tension. To do this:

- Release quick-release fasteners -1- and -2- and take off front and rear noise insulation.

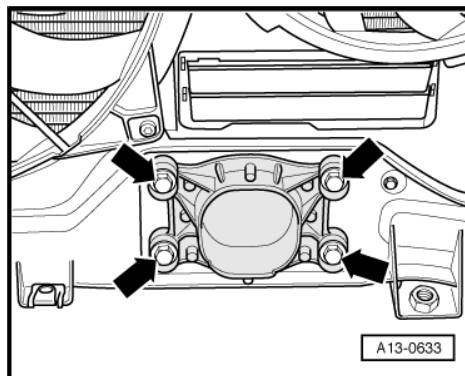


- Unscrew bolts -arrows- and detach torque reaction support from engine.



Note

Stop for torque reaction support can also be removed if there is insufficient space.

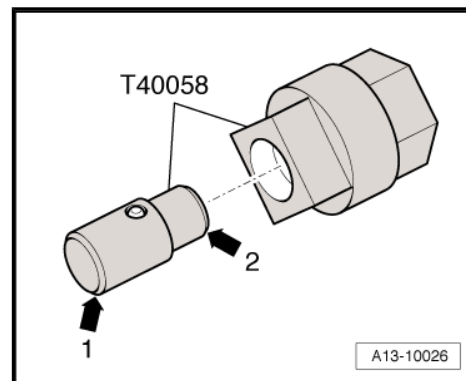


- Insert guide pin of adapter -T40058- with the larger-diameter section -arrow 1- pointing towards the engine. The smaller-diameter section -arrow 2- faces the adapter.

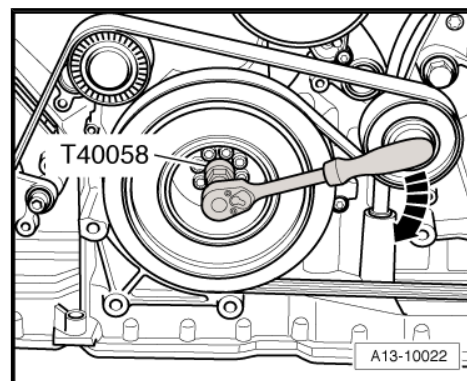


Caution

Do not rotate crankshaft in opposite direction of engine rotation.



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



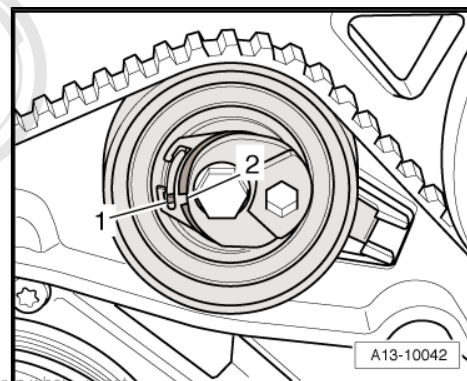
- Check toothed belt tension.
- Lug -1- should align with notch -2-.

If specification is not obtained:

- Adjust the toothed belt tension again.

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

- Install intake manifold (top section) ⇒ [page 41](#).
- Install torque reaction support on engine ⇒ Engine, Mechanics; Rep. gr. 10 ; Assembly mountings.



Tightening torque

- ⇒ ["3.24 Exploded view - toothed belt for high-pressure pump, vehicles with engine codes BMK, BPP, BSG, BNG, ASB", page 90](#)

3.25 Exploded view - high-pressure pump, vehicles up to 10.2005 with engine codes BMK, BPP, BSG, BNG, ASB

1 - Damper weight

- ☐ Use counterhold tool - 3036- when loosening and tightening central nut ⇒ [page 103](#)

2 - Nut

- ☐ 70 Nm
- ☐ Use counterhold tool - 3036- when loosening and tightening ⇒ [page 103](#)

3 - Toothed belt sprocket for high-pressure pump

- ☐ Remove using puller - T40064- ⇒ [page 103](#)

4 - Bolt

- ☐ 23 Nm

5 - High-pressure pump



Caution

Observe rules for cleanliness when working on the injection system
⇒ [page 1](#).

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 104](#)

- ☐ Fuel system must be bled after installing high-pressure pump ⇒ [page 114](#)

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

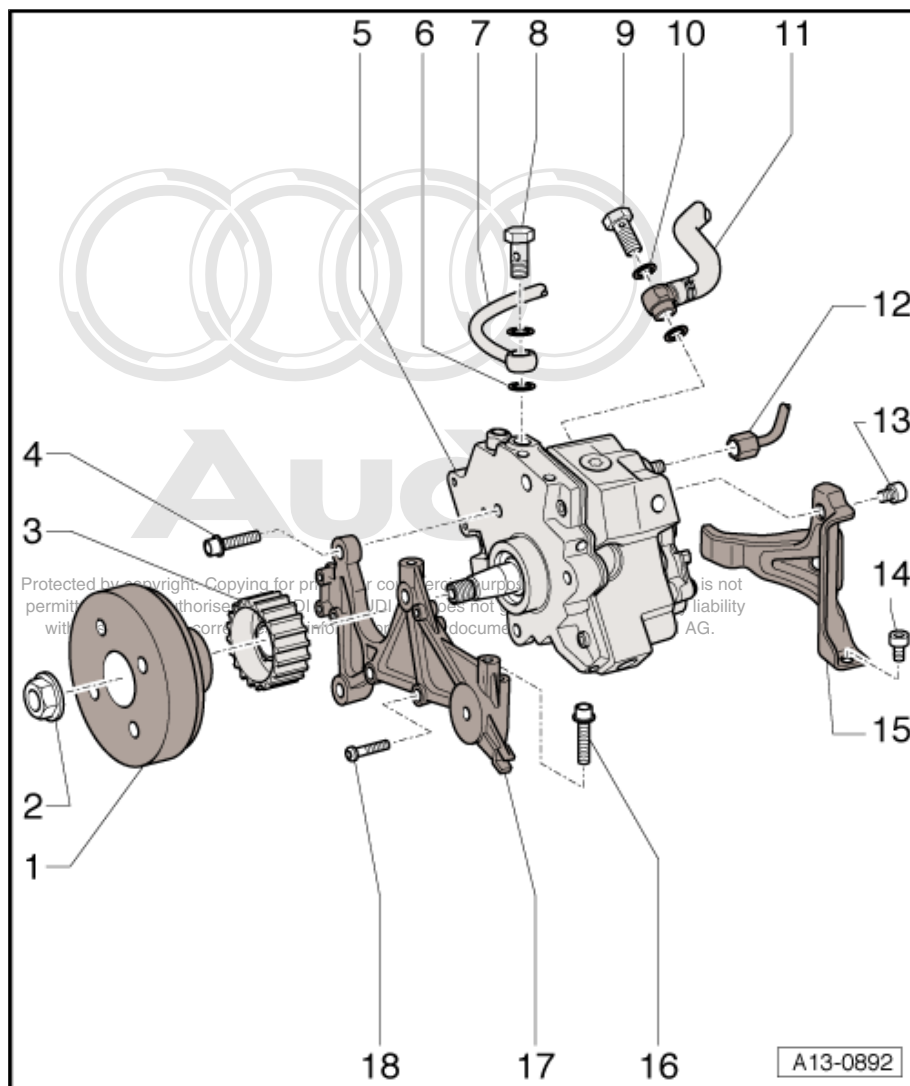
- ☐ Tighten to 25 Nm
- ☐ Use socket insert AF 14, flared ring spanner - V.A.G 1331/8- to tighten ⇒ [page 103](#)

13 - Bolt

- ☐ 22 Nm

14 - Bolt

- ☐ 22 Nm



15 - Bracket for high-pressure pump

16 - Bolt

- 22 Nm

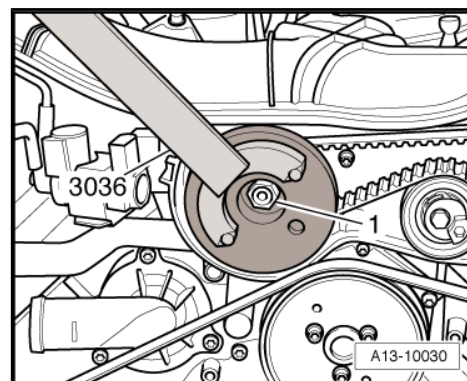
17 - Front bracket for high-pressure pump

18 - Bolt

- 9 Nm

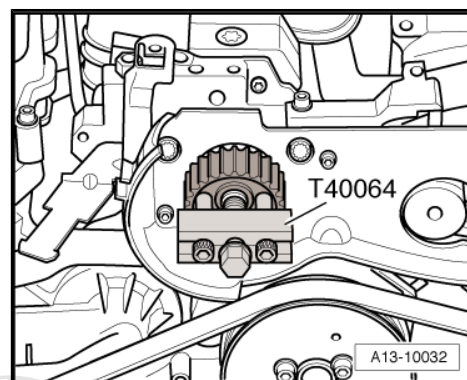
Loosening and tightening central nut for high-pressure pump shaft

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



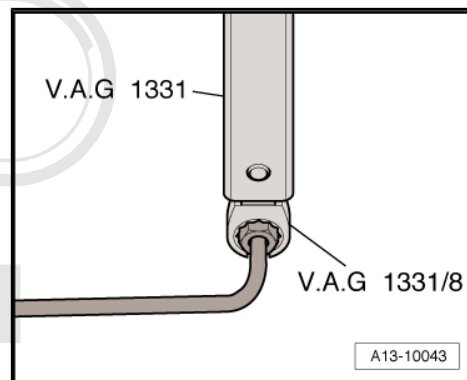
Pulling off toothed belt sprocket for high-pressure pump

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



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

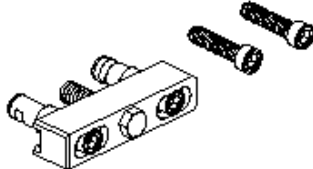
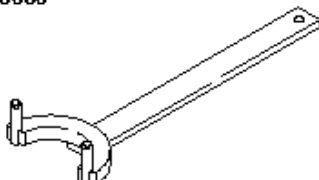
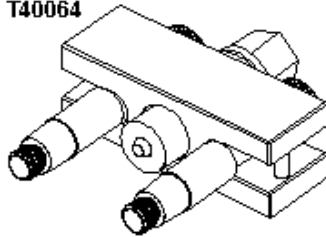
- Use socket insert AF 14, flared ring spanner - V.A.G 1331/8- for tightening.



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3.25.1 Removing and installing high-pressure pump - vehicles up to 10.2005

Special tools and workshop equipment required

3032 	3036 
T40064 	
	G13-0071

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

Removing



Caution

Rules for cleanliness when working on the injection system

⇒ [page 1](#)

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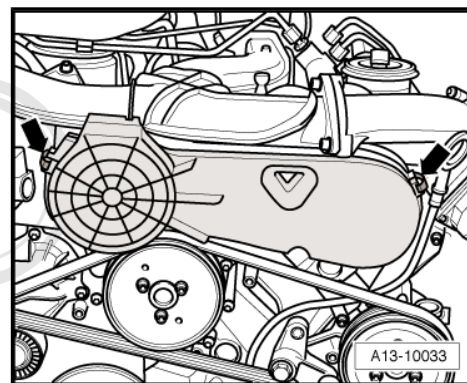


Note

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.

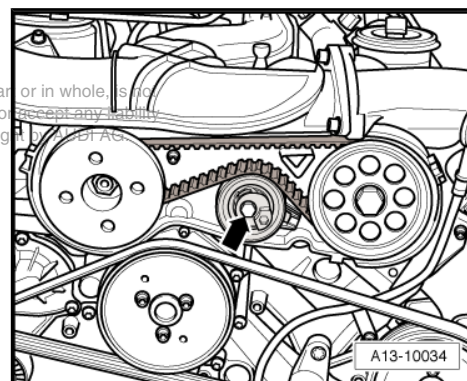
- Remove intake manifold (top section) ⇒ [page 41](#) .

- Loosen clamps -arrows-.
- Pivot toothed belt cover forward and disengage retaining pegs on bottom side of toothed belt cover.
- Remove toothed belt cover.
- Remove bottom section of intake manifold (left-side): vehicles up to 08.2004 ⇒ [page 42](#) ; vehicles from 08.2004 onwards ⇒ [page 45](#) .

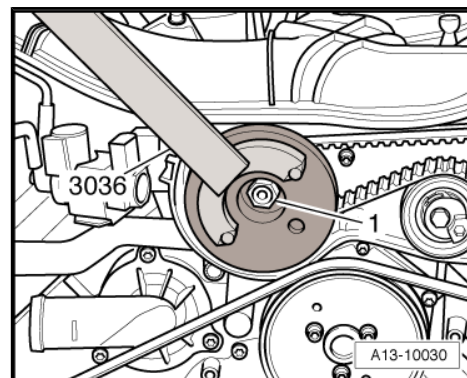


- Remove bolt -arrow- for tensioning roller and take off tensioning roller.

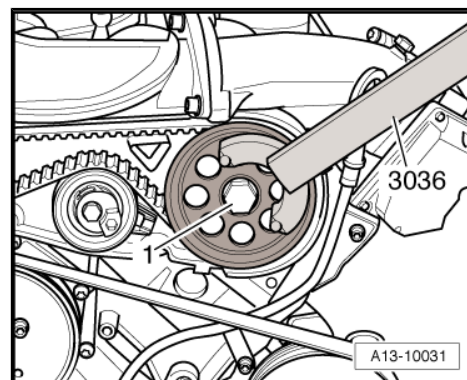
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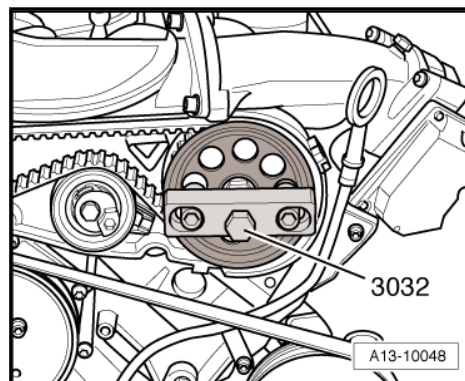
- Loosen central nut -1- for high-pressure pump shaft using counterhold tool - 3036- .
- Remove damper weight.



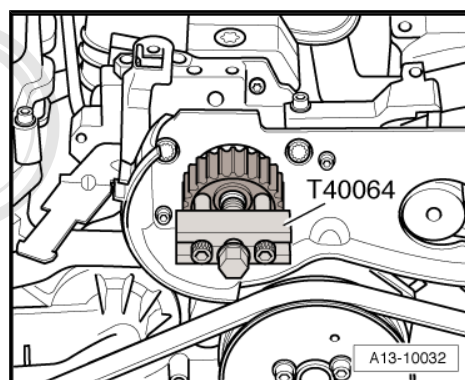
- Loosen central bolt -1- for toothed belt drive sprocket approx. 2 turns using counterhold tool - 3036- .



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

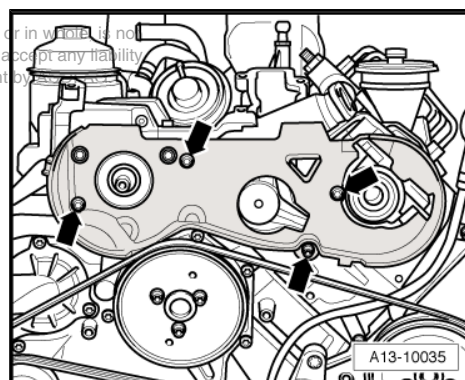


- Use puller - T40064- to pull off belt sprocket for high-pressure pump.

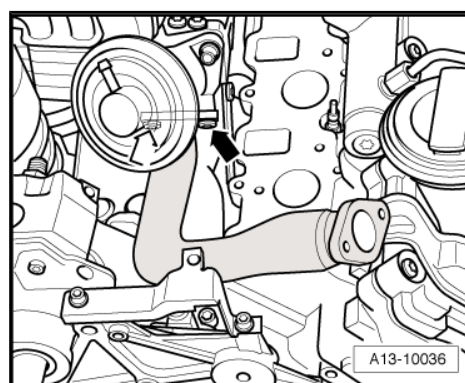


- Remove bolts -arrows- and detach toothed belt cover (rear).

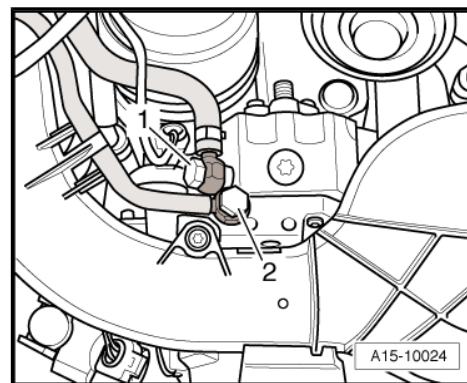
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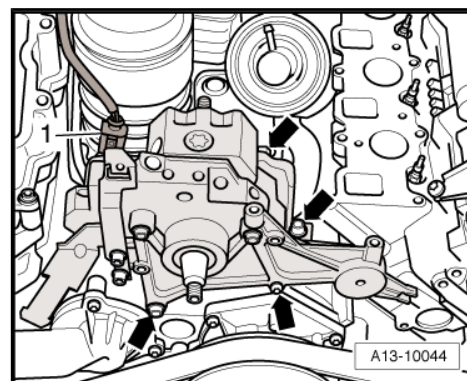
- Remove bolts -arrows- and take off connecting pipe for exhaust gas recirculation.



- Disconnect fuel supply line -2- and fuel return line -1- from high-pressure pump and move clear to one 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.

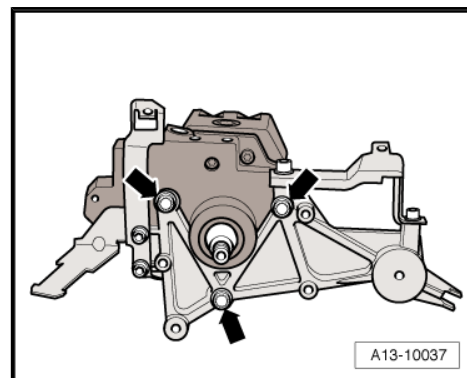
Installing

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.

- Tightening torques: exploded view - high-pressure pump, vehicles up to 10.2005 ⇒ [page 101](#)
- Install toothed belt for high-pressure pump.
- ◆ Vehicles up to 12.2005 ⇒ [page 93](#)
- Install bottom section of intake manifold (left-side).
- ◆ Vehicles up to 08.2004 ⇒ [page 45](#)
- Install intake manifold (top section) ⇒ [page 41](#) .
- Bleed fuel system and check for leaks ⇒ [page 114](#) .

3.26 Exploded view - high-pressure pump, vehicles from 10.2005 onwards with engine codes BMK, BPP, BSG, BNG, ASB

1 - Damper weight

- ☐ Use counterhold tool - 3036- when loosening and tightening central nut ⇒ [page 109](#)

2 - Nut

- ☐ 70 Nm
- ☐ Use counterhold tool - 3036- when loosening and tightening ⇒ [page 109](#)

3 - Toothed belt sprocket for high-pressure pump

- ☐ Remove using puller - T40064- ⇒ [page 109](#)

4 - Bolt

- ☐ 22 Nm

5 - High-pressure pump

Caution

Observe rules for cleanliness when working on the injection system
⇒ [page 1](#).

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 110](#)

- ☐ Fuel system must be bled after installing high-pressure pump ⇒ [page 114](#)

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 109](#)

10 - Banjo bolt

- ☐ 25 Nm

11 - Seal

- ☐ Renew
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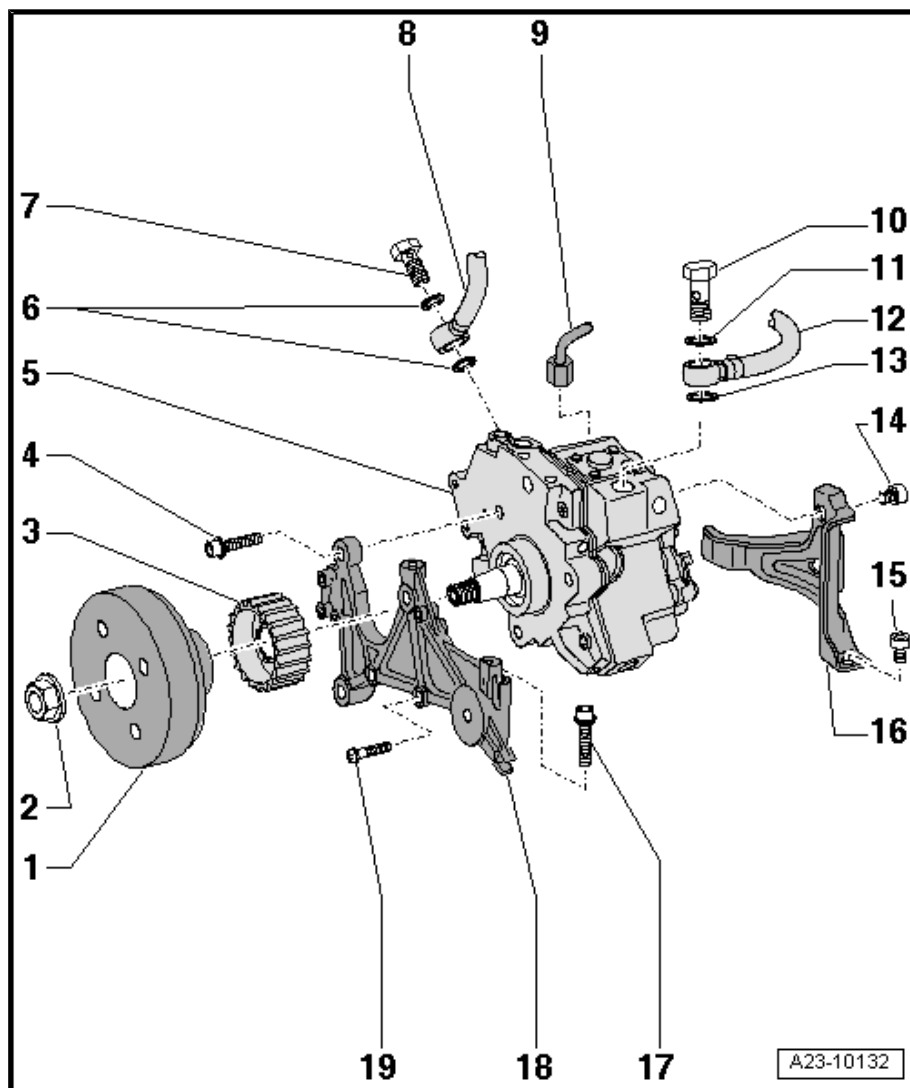
12 - Fuel return line

13 - Seal

- ☐ Renew

14 - Bolt

- ☐ 22 Nm



15 - Bolt

- 22 Nm

16 - Bracket for high-pressure pump

17 - Bolt

- 23 Nm

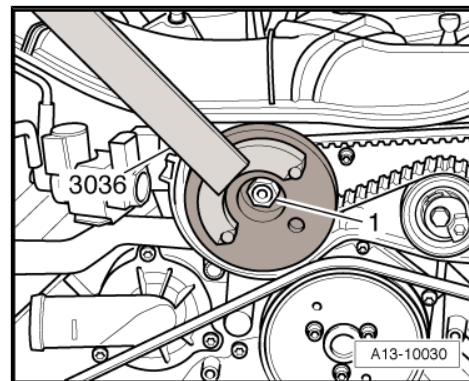
18 - Front bracket for high-pressure pump

19 - Bolt

- 9 Nm

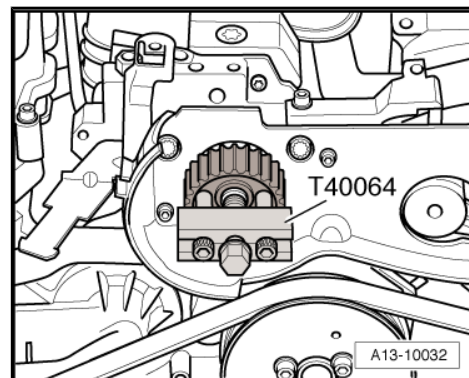
Loosening and tightening central nut for high-pressure pump shaft

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



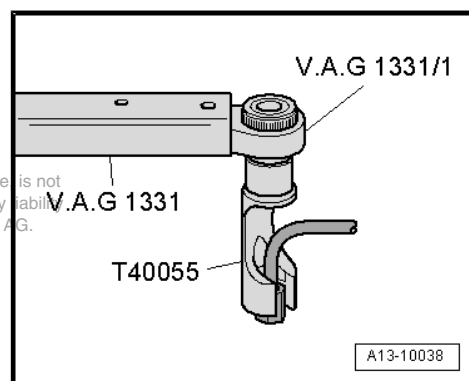
Pulling off toothed belt sprocket for high-pressure pump

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



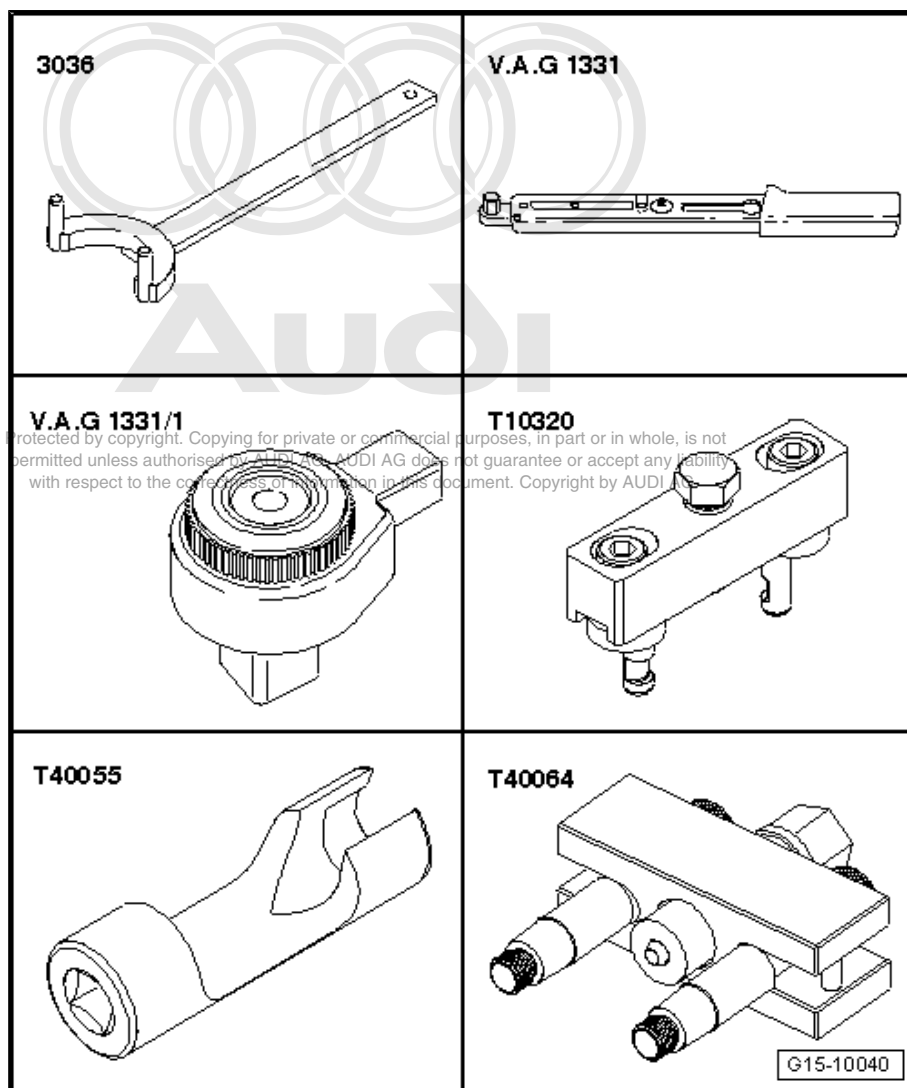
Tightening high-pressure pipe at high-pressure pump

- 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-



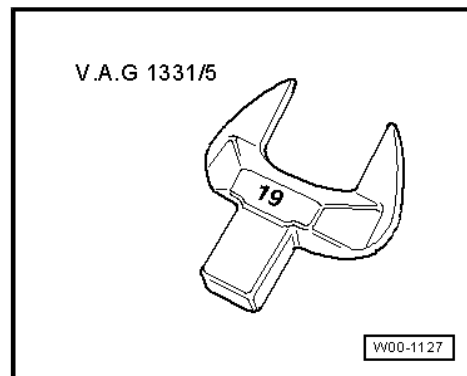
3.26.1 Removing and installing high-pressure pump - vehicles from 10.2005 onwards

Special tools and workshop equipment required



- ◆ Counterhold tool - 3036-
- ◆ Torque wrench - V.A.G 1331-
- ◆ Ratchet - V.A.G 1331/1-
- ◆ Puller - T10320-
- ◆ Socket - T40055- (17 mm)
- ◆ Puller - T40064-

- ◆ Open end spanner insert, AF 19 - V.A.G 1331/5- for vehicles from 09.2005 onwards



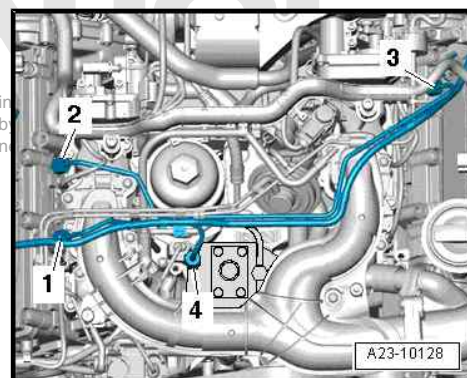
Removing



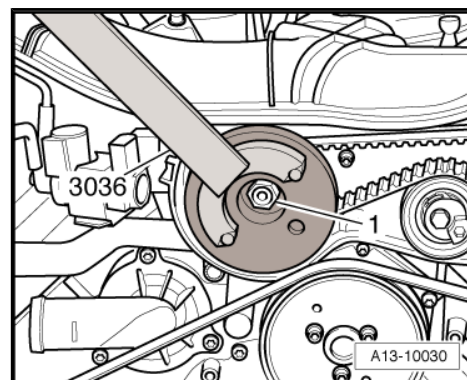
Caution

Observe rules for cleanliness when working on the injection system ⇒ [page 1](#).

- Remove engine cover panel ⇒ [page 36](#).
- Unscrew union nuts -1 ... 4- and detach high-pressure pipes.
- Remove intake manifold (top section) ⇒ [page 41](#).
- Remove toothed belt for high-pressure pump ⇒ [page 98](#).

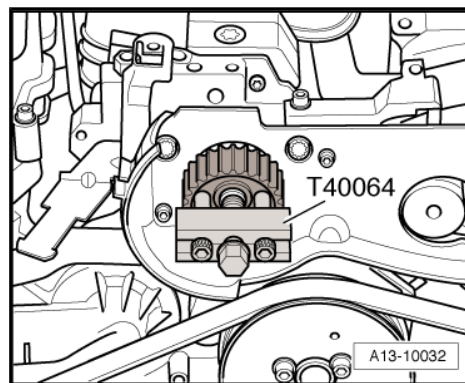


- Loosen central nut -1- for high-pressure pump shaft using counterhold tool - 3036-.
- Remove damper weight.

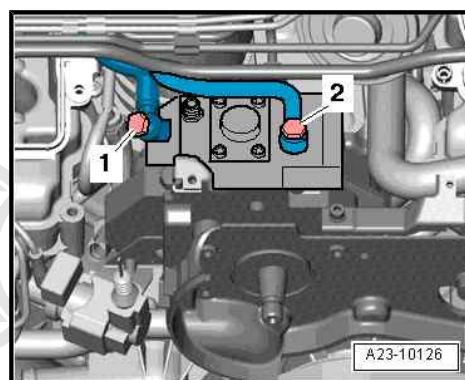




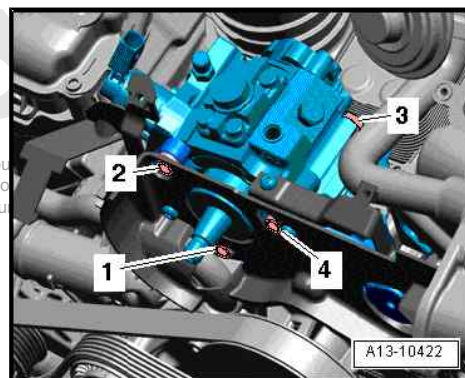
- Use puller - T40064- to pull off belt sprocket for high-pressure pump.



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



- Remove bolts -1 ... 4-.



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- Remove bolts -1- and -3-.
- Unplug electrical connector -2-.
- Carefully pull toothed belt cover in direction of -arrow- and lift out high-pressure pump.

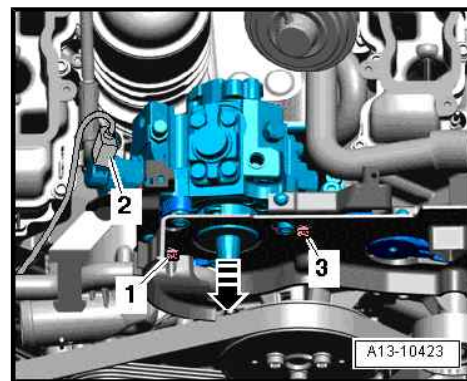
Installing

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



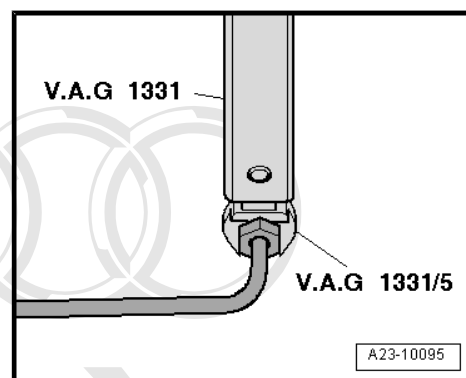
Caution

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.

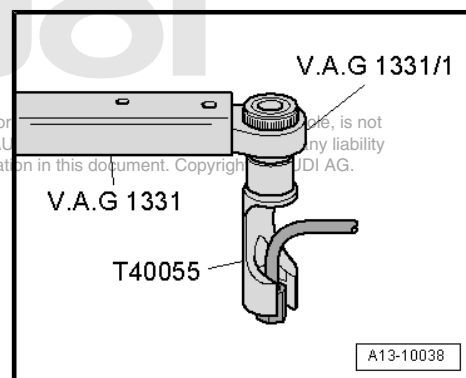


Note

- ◆ *Renew seals and gaskets.*
- ◆ *Hose connections and charge air system hoses must be free of oil and grease prior to fitting.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- Hand-tighten union nuts on high-pressure pipes. Make sure that connections are not under tension.
- To tighten unions of high-pressure pipes to fuel rail, use torque wrench - V.A.G 1331- and tool 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 ⇒ [page 98](#)
- Install intake manifold (top section) ⇒ [page 41](#) .
- Bleed high-pressure pump ⇒ [page 114](#) .
- Bleed fuel system and check for leaks ⇒ [page 114](#) .
- Tightening torques: exploded view - high-pressure pump, vehicles from 10.2005 onwards ⇒ [page 107](#)



3.27 Bleeding fuel system and checking for leaks

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



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

- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the complete 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.

3.28 Bleeding fuel system after installing high-pressure pump - vehicles with engine codes BMK, BPP, BSG, BNG, ASB

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

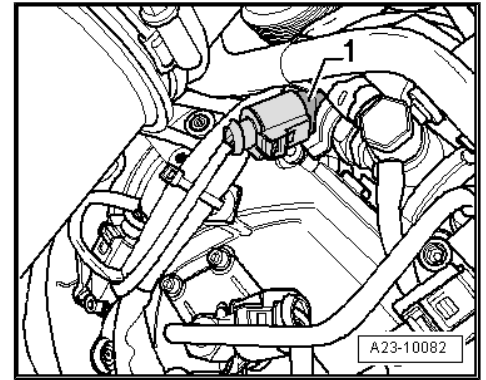
Proceed as follows to fill high-pressure pump with fuel:

- Connect battery charger if necessary. → Electrical system; Rep. gr. 27 ; Charging battery



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- 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 entry in event memory using a diagnostic tester.
- Start engine.
- After bleeding fuel system, run engine at moderate speed for a few minutes and then switch off again.
- Check fuel system for leaks.
- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the complete high-pressure section of the fuel system again for leaks.



 Note

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

- Interrogate the event memory again after road-testing.

3.29 Exploded view - toothed belt for high-pressure pump, vehicles with engine codes CANA, CANB, CANC, CAND, CDYA, CDYB, CDYC

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1 - Toothed belt cover (front)

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

2 - Nut

- ☐ 70 Nm

3 - Bolt

- ☐ 23 Nm

4 - Toothed belt sprocket for high-pressure pump

- ☐ Remove using puller - T40064- ➔ [page 117](#)

5 - Idler roller

6 - 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



Caution

Prerequisites for fitting toothed belt:

TDC of crankshaft
➔ [page 117](#) and **TDC of camshaft** ➔ [page 117](#)
must be aligned.

In addition, toothed belt sprocket for high-pressure pump must be locked in position using locking tool - T40135- . This is important to prevent oscillation of toothed belt ➔ [page 117](#) .

- ☐ Removing and installing ➔ [page 118](#)

7 - Bolt

- ☐ 9 Nm

8 - Toothed belt cover (rear)

9 - Toothed belt tensioning roller

10 - Toothed belt drive sprocket

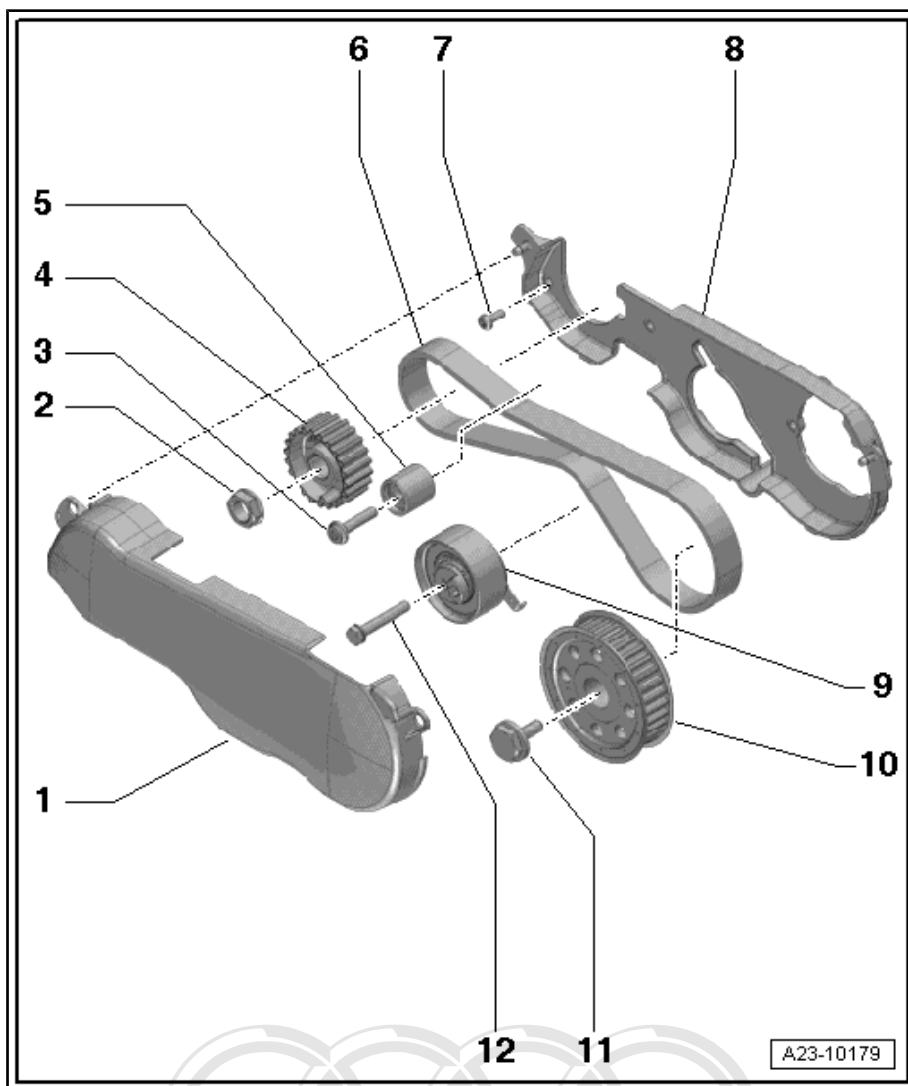
- ☐ Remove using puller - T10320- ➔ [page 118](#)

11 - Bolt

- ☐ 75 Nm
- ☐ Use counterhold tool - 3036- when loosening and tightening

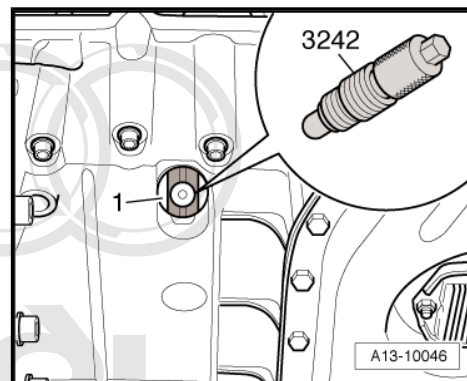
12 - Bolt

- ☐ 23 Nm



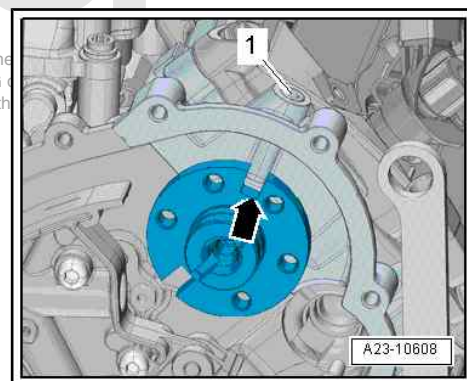
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TDC of crankshaft -1-

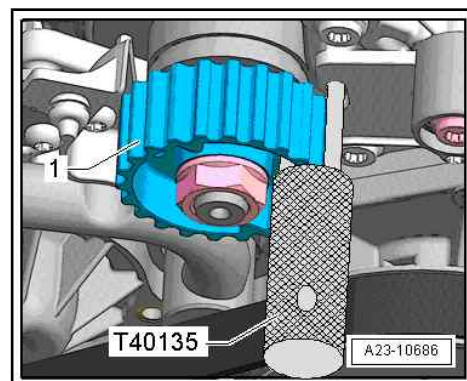


TDC of camshaft -arrow-

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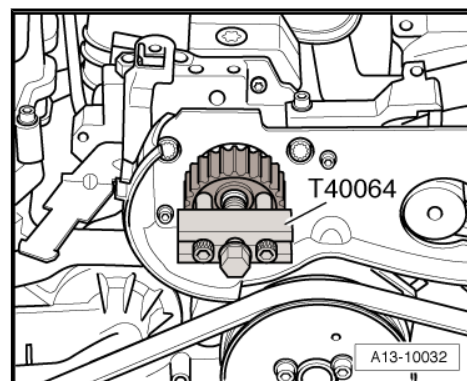


Locking tool - T40135- for toothed belt sprocket for high-pressure pump



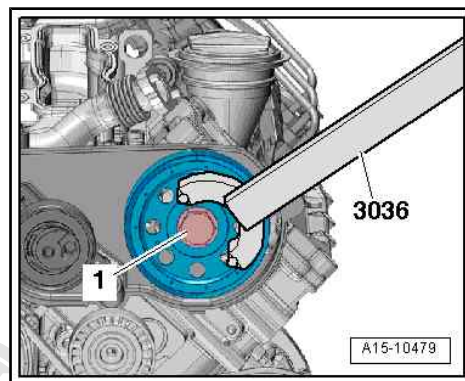
Pulling off toothed belt sprocket for high-pressure pump

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



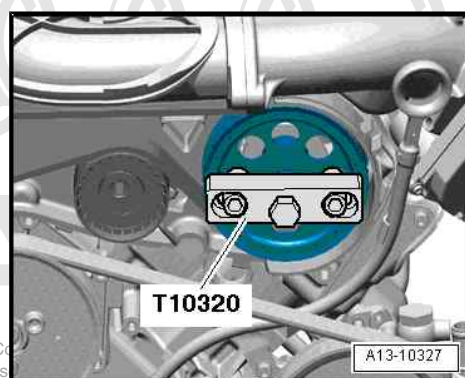
Loosening and tightening central bolt for toothed belt drive sprocket

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



Removing toothed belt drive sprocket

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

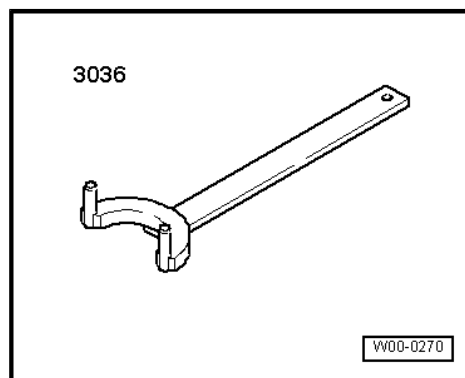


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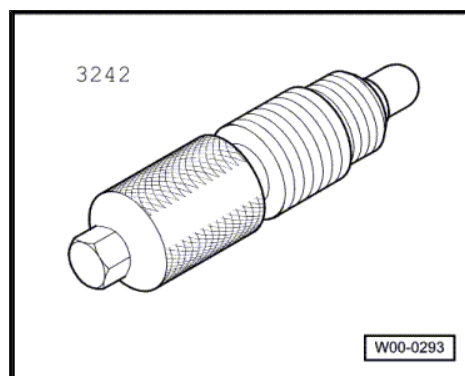
3.29.1 Removing and installing toothed belt for high-pressure pump

Special tools and workshop equipment required

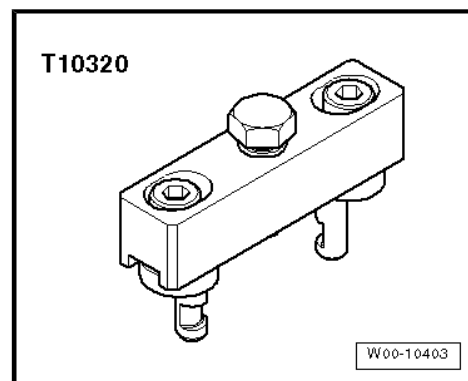
- ◆ Counterhold tool - 3036-



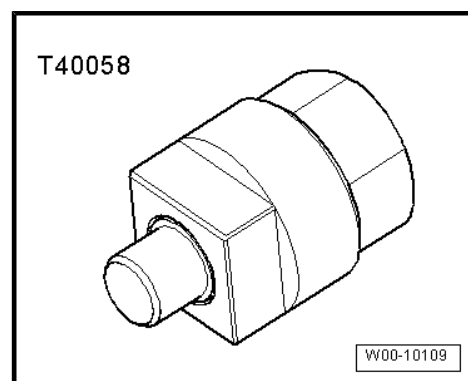
- ◆ Locking pin - 3242-



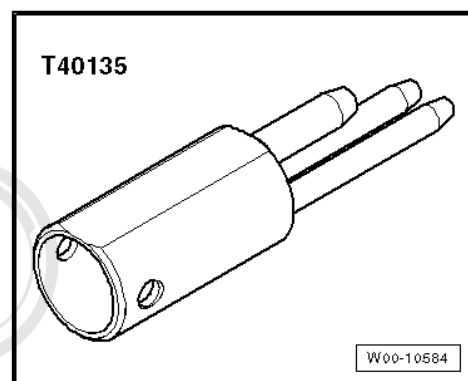
◆ Puller - T10320-



◆ Adapter - T40058-



◆ Locking tool - T40135- for adjusting high-pressure pump



Removing

- Remove engine cover panel ⇒ [page 36](#) .
- Remove intake manifold (top section) ⇒ [page 41](#) .

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- Pivot toothed belt cover forwards -arrows- and disengage retaining pegs on bottom side of toothed belt cover.



Note

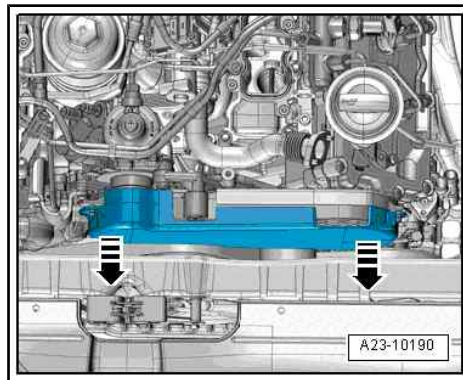
For illustration purposes, the toothed belt cover is shown with the top section of the intake manifold removed.



Caution

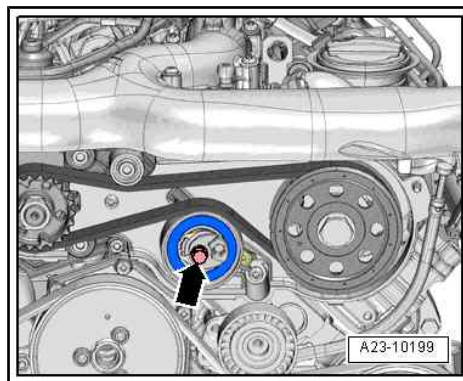
If a used belt runs in the opposite direction when it is refitted, this can cause breakage.

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

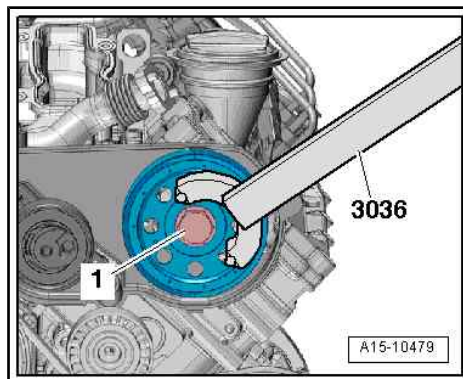


- Loosen bolt -arrow- for toothed belt tensioning roller approx. 2 turns.

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



- Remove toothed belt drive sprocket using puller - T10320- .



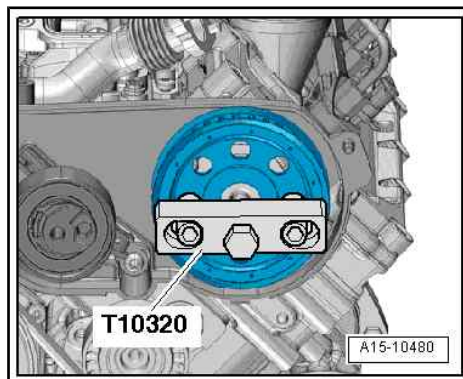
Note

Leave toothed belt drive sprocket on camshaft.

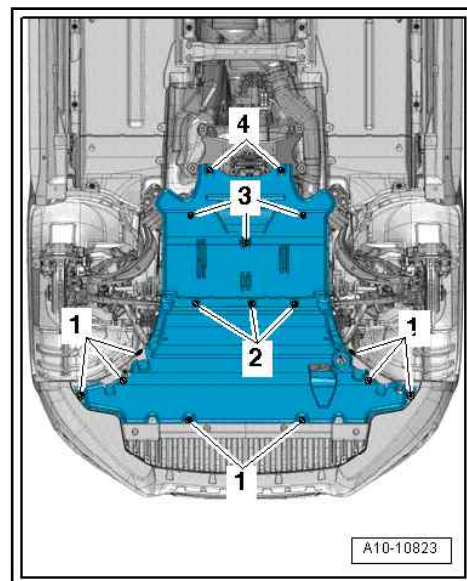
- First detach toothed belt from toothed belt sprocket for high-pressure pump and then from toothed belt drive sprocket.

Installing

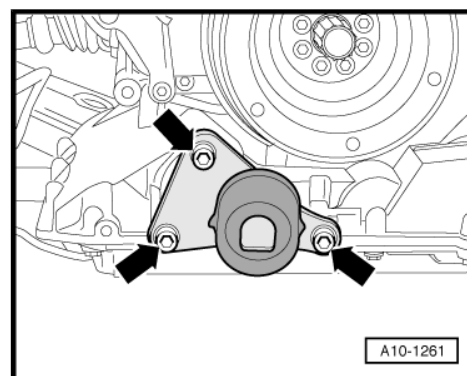
Installation is carried out in the reverse order; note the following:



- Release fasteners -1 ... 4- and remove noise insulation panels.

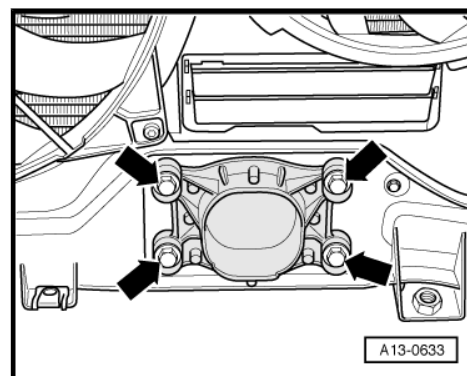


- Unscrew bolts -arrows- and detach torque reaction support from engine.

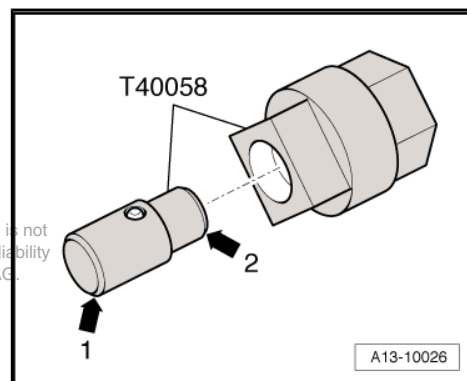


Note

Stop for torque reaction support can also be removed if there is insufficient space.



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



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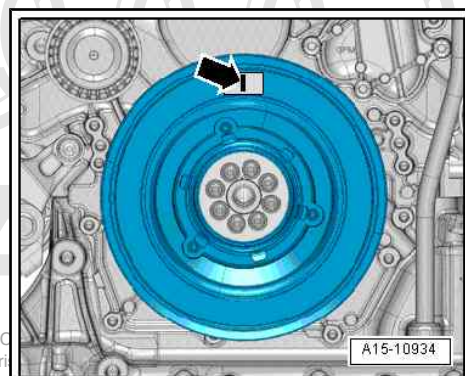
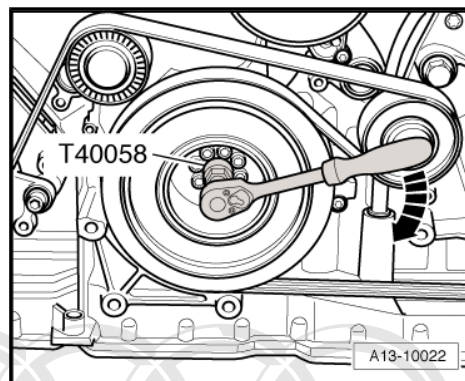
Caution

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

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

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

- Mark -arrow- must be perpendicular to centre of crankshaft, as shown in illustration.
- Remove air intake hoses.



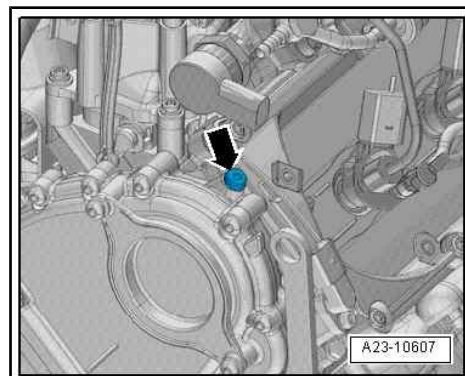
- Remove sealing plug -arrow- at rear of cylinder head (right-side).



Note

For illustration purposes, the installation position is shown from rear and with engine removed.

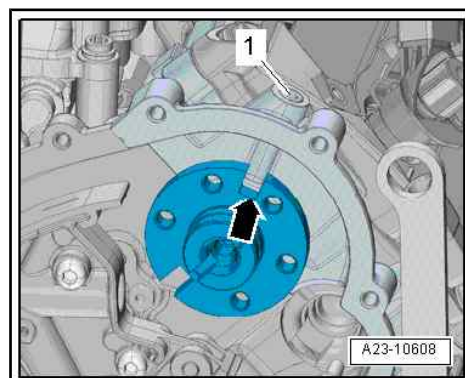
- Check whether groove -arrow- in camshaft flange can be seen through bore -1- for sealing plug.
- To do so, shine a small torch into bore for sealing plug.



Note

For illustration purposes, camshaft flange is shown without chain drive and timing chain cover.

- If groove is not positioned under bore, turn crankshaft 360° further in direction of engine rotation.

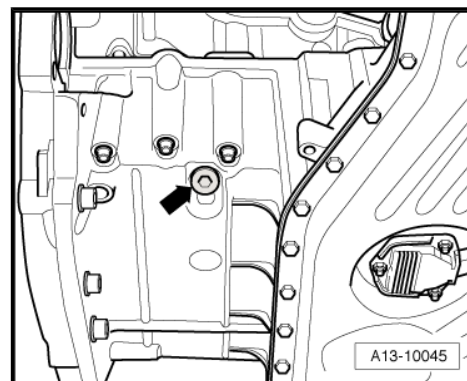




Note

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

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

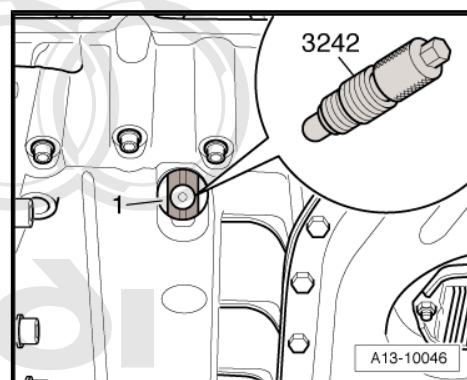


WARNING

Risk of injury while feeling for the "TDC" hole with your finger.

- ◆ **Do NOT turn crankshaft -1-.**

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

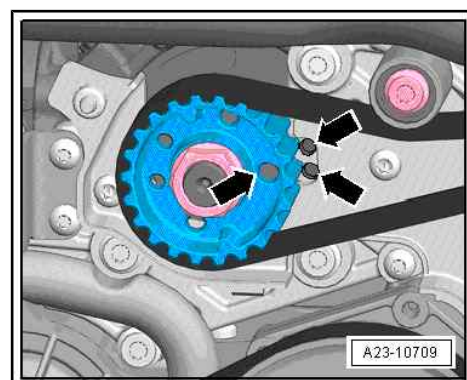
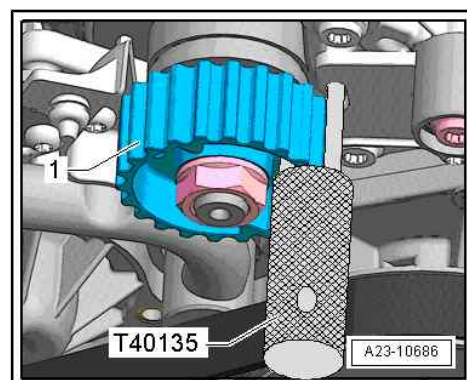


Note

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

- Lock toothed belt sprocket for high-pressure pump in position using locking tool - T40135- .

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Note

- ◆ Before fitting toothed belt, toothed belt sprocket for high-pressure pump must be locked in position using locking tool - T40135-. This is important to prevent oscillation of toothed belt.
- ◆ The hole -arrow on toothed belt sprocket- is located at "3 o'clock" position.
- ◆ Locking tool - T40135- must be inserted all the way.

- 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.

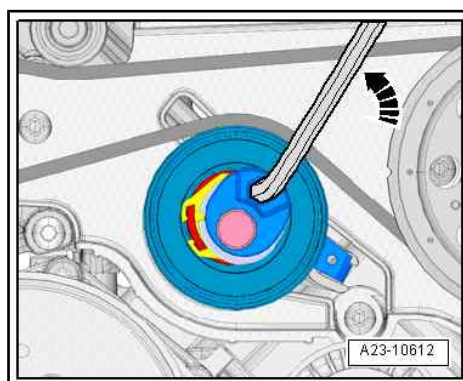
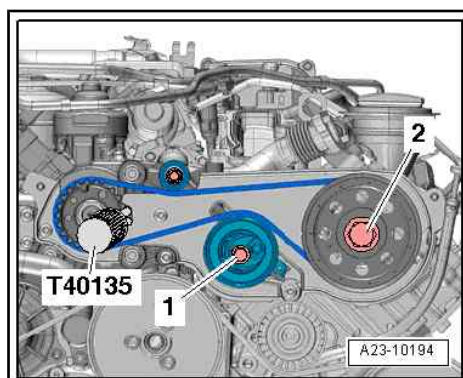
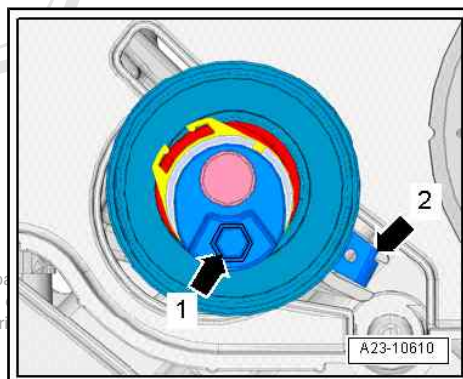
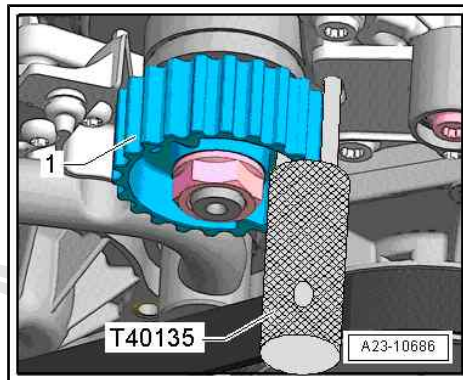
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- Fit toothed belt.
- Screw in bolt -1- for toothed belt tensioning roller without applying force until eccentric adjuster of toothed belt tensioning roller can just still be turned without axial movement.
- Screw in bolt -2- for toothed belt drive sprocket until toothed belt drive sprocket can just still be turned without axial movement.
- Lock toothed belt sprocket for high-pressure pump in position using locking tool - T40135-.
- Tension toothed belt tensioning roller slightly by turning in direction of -arrow- using hexagon key until hexagon socket is in "1 o'clock" position.

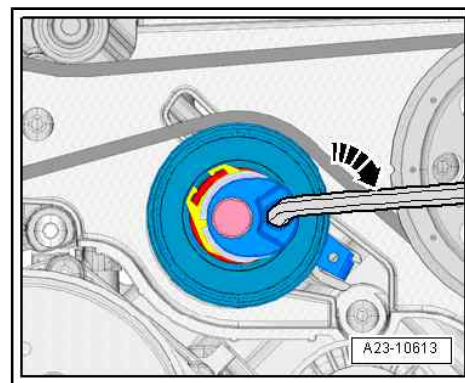


Caution

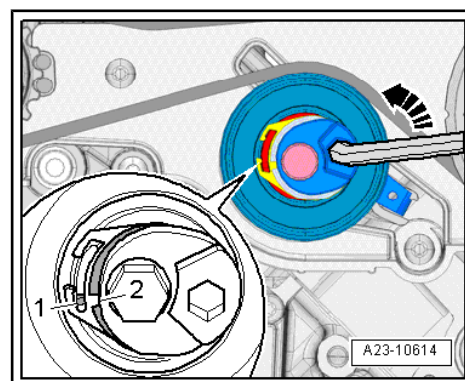
Do NOT turn tensioning roller up to or beyond "12 o'clock" position.



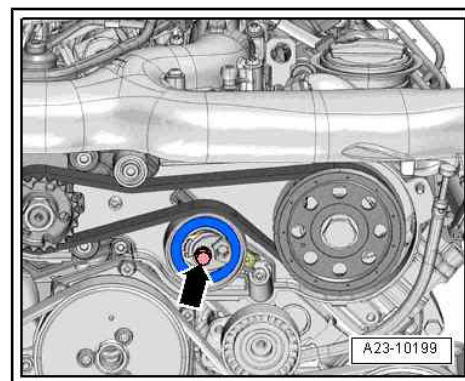
- Now release toothed belt tensioning roller -arrow- to such an extent that hexagon socket moves into "3 o'clock" position.



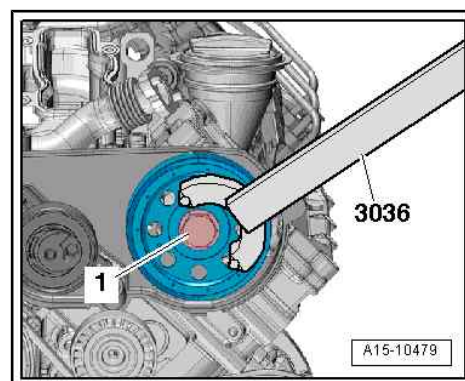
- Tension toothed belt tensioning roller slightly from "3 o'clock" position -arrow- until lug -1- and notch -2- are exactly in line.



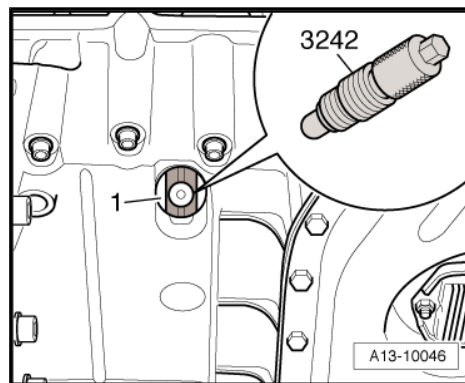
- Hold toothed belt tensioning roller in this position and tighten bolt -arrow- ⇒ [Item 12 \(page 116\)](#) .



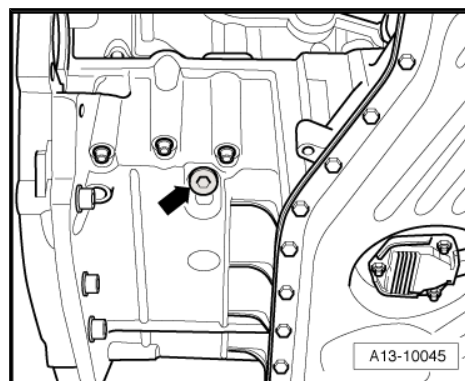
- Tighten bolt -1- for toothed belt drive sprocket using counter-hold tool - 3036- ⇒ [Item 11 \(page 116\)](#) .



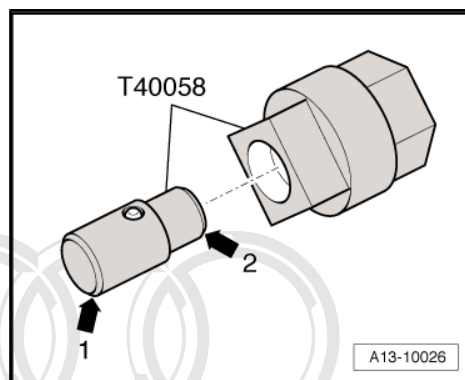
- Remove locking pin - 3242- .



- Screw plug -arrow- for “TDC” marking into sump (top section)
⇒ Rep. gr. 17 .



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

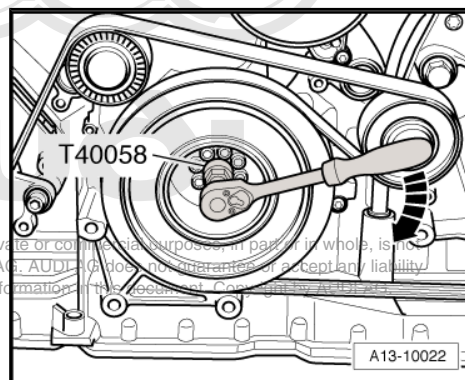


Caution

- ◆ **Irreparable damage can be caused if the camshaft timing chain slips.**
- ◆ **Turn crankshaft only in direction of engine rotation -arrow-.**

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- Turn crankshaft 1 rotation using adapter - T40058- .



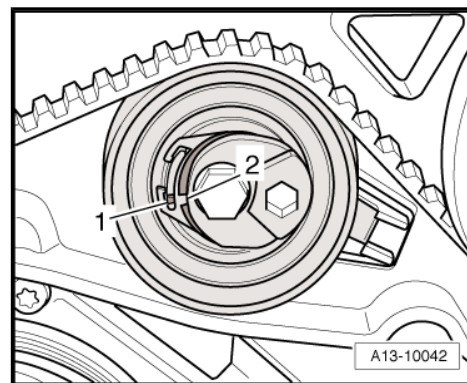
- Check toothed belt tension:
- Lug -1- should align with notch -2-.
- If the specification is not attained, re-adjust toothed belt tension.

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

- Install intake manifold (top section) ⇒ [page 41](#) .
- Install torque reaction support on engine ⇒ Engine, Mechanics; Rep. gr. 10 ; Assembly mountings .

Tightening torque

- ⇒ [“3.29 Exploded view - toothed belt for high-pressure pump, vehicles with engine codes CANA, CANB, CANC, CAND, CDYA, CDYB, CDYC”, page 115](#)



3.30 Exploded view - high-pressure pump, vehicles with engine codes CANA, CANB, CANC, CAND, CDYA, CDYB, CDYC



Caution

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

If components of the fuel system between the tank and the high-pressure fuel pump are removed or renewed, the basic setting “Channel 35” must be performed to bleed the fuel system.

*If the supplementary fuel pump, fuel line (between fuel tank and high-pressure fuel pump) or fuel filter is removed or renewed, the basic setting “Channel 35” must be performed **ONCE** before the engine is started for the first time.*

*If the high-pressure fuel pump is removed or renewed, the basic setting “Channel 35” must be performed **THREE TIMES** before the engine is started for the first time.*

Perform first fuel filling after installing high-pressure pump ⇒ [page 132](#) .

1 - Bolt

- ☐ M6: 9 Nm
- ☐ M8: 23 Nm

2 - Front bracket for high-pressure pump
3 - Bolt

- ☐ 9 Nm

4 - Protective plate
5 - Union nut for high-pressure pipe

- ☐ 25 Nm

6 - High-pressure pump

Caution

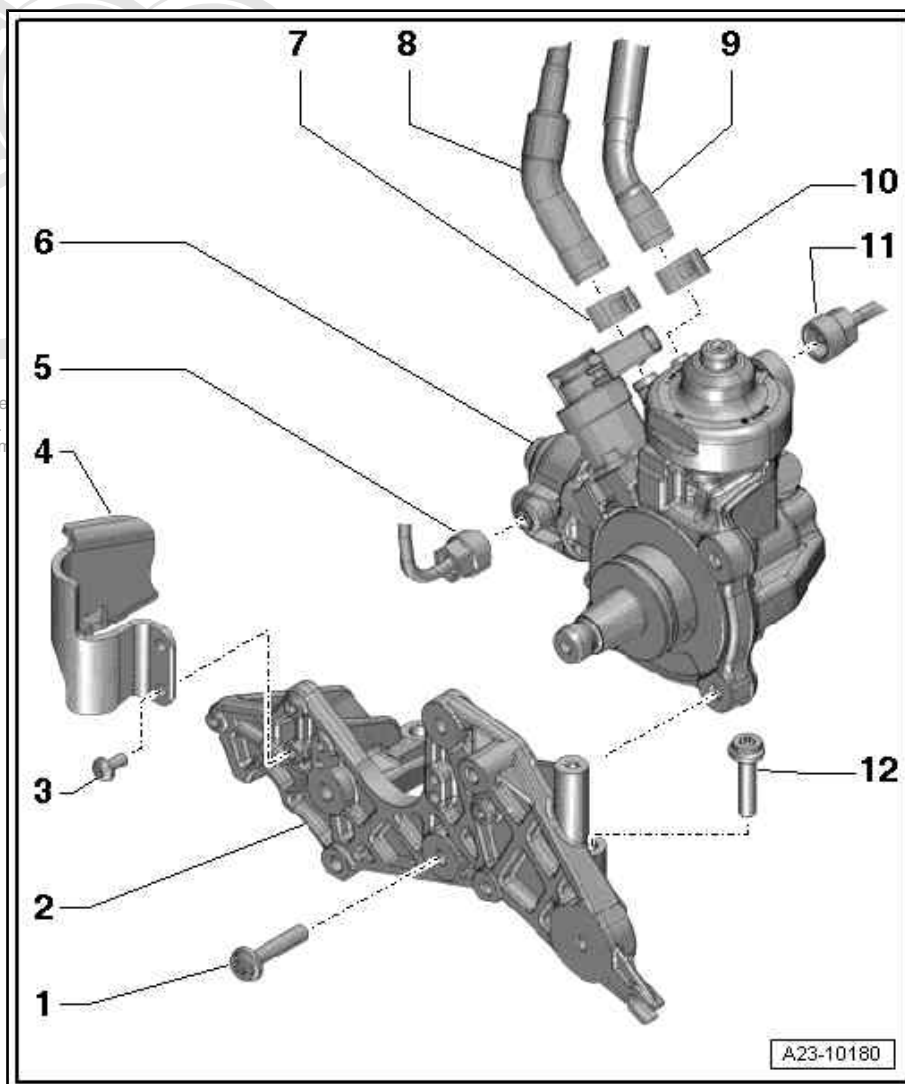
Prerequisites for fitting toothed belt:

TDC of crankshaft
⇒ [page 129](#) and **TDC of camshaft** ⇒ [page 129](#)
must be aligned.

In addition, toothed belt sprocket for high-pressure pump must be locked in position using locking tool - T40135-. This is important to prevent oscillation of toothed belt. ⇒ [page 129](#)

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. First fuel filling ⇒ [page 132](#)

Observe rules for cleanliness when working on the injection system ⇒ [page 1](#).



- ☐ After renewing high-pressure pump or fuel pressure regulating valve - N276- , learnt values must be re-adapted; see "Guided Functions" in ⇒ Vehicle diagnostic tester
- ☐ Removing toothed belt sprocket for high-pressure pump using puller - T40064- ⇒ [page 129](#)
- ☐ Removing and installing ⇒ [page 130](#)

7 - Hose clip

- ☐ Use only correct type of hose clips (as original equipment) ⇒ Parts catalogue

8 - Fuel supply hose
9 - Fuel return hose

- ☐ Fuel return line must not be kinked, damaged or clogged

10 - Hose clip

- ☐ Use only correct type of hose clips (as original equipment) ⇒ Parts catalogue

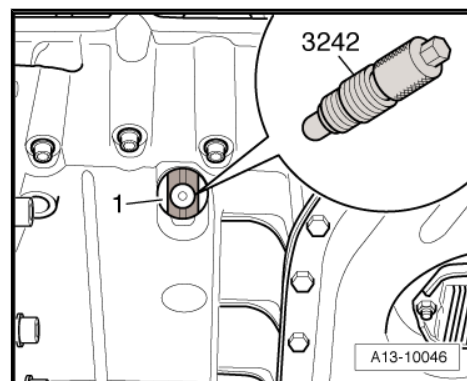
11 - Union nut for high-pressure pipe

- ☐ 25 Nm

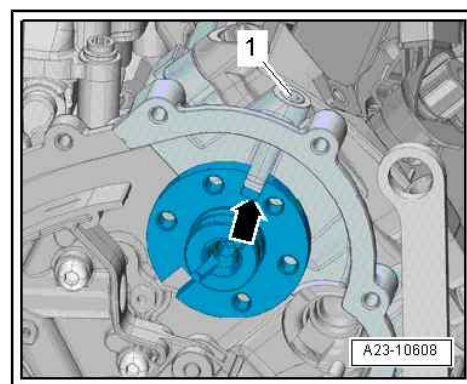
12 - Bolt

- 23 Nm

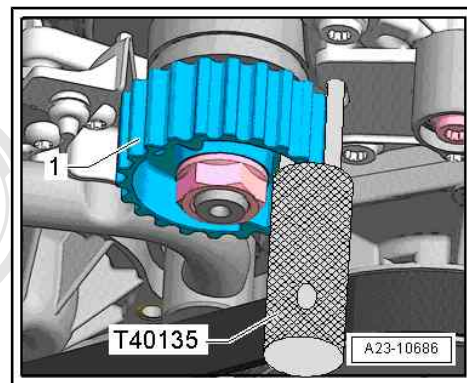
TDC of crankshaft -1-



TDC of camshaft -arrow-



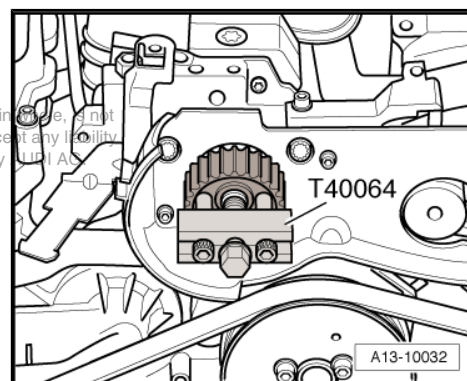
Locking tool - T40135- for toothed belt sprocket for high-pressure pump



Pulling off toothed belt sprocket for high-pressure pump

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

- ◆ Tightening torque for nut for toothed belt sprocket: 70 Nm



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3.30.1 Removing and installing high-pressure pump



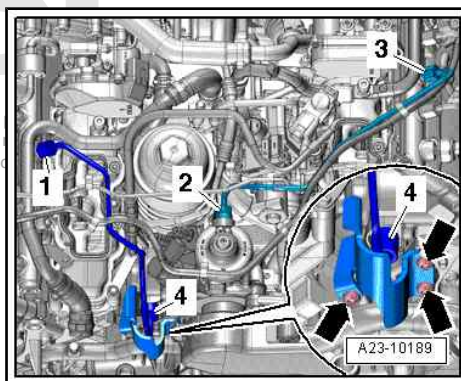
Caution

- ◆ *Observe rules for cleanliness when working on the injection system ⇒ [page 1](#) .*
- ◆ *Follow these instructions and rules for cleanliness before starting work and while working on the fuel system.*
- ◆ *Before fitting toothed belt, toothed belt sprocket for high-pressure pump must be locked in position using locking tool - T40135- . This is important to prevent oscillation of toothed belt.*
- ◆ *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. First fuel filling ⇒ [page 132](#) .*

Removing

- Remove top section of intake manifold ⇒ [page 65](#) .
- Remove toothed belt for high-pressure pump ⇒ [page 118](#) .
- Unscrew bolts -arrows- and remove protective plate for high-pressure pipe.
- Unscrew union nuts -1 ... 4- and move high-pressure pipes clear.

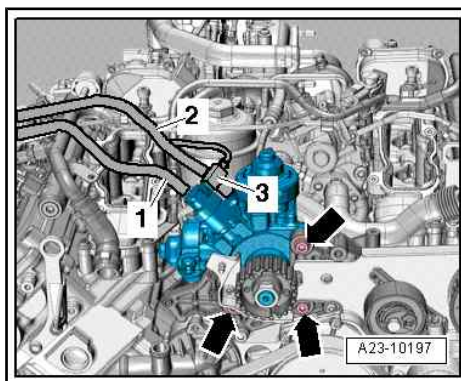
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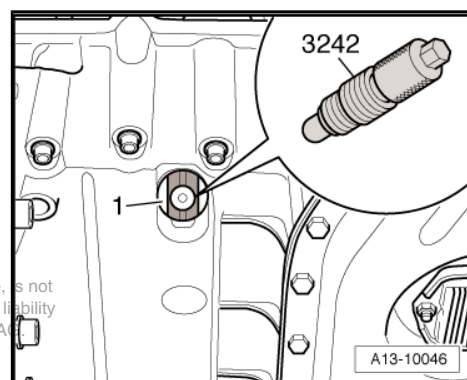
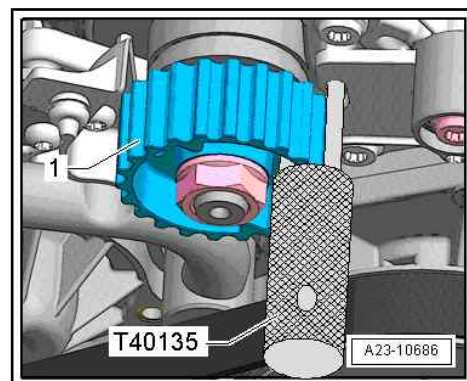
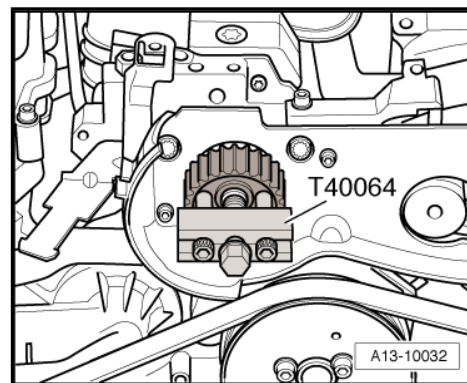


- Unplug electrical connector -3-.
- Remove fuel supply hose -1- and fuel return hose -2-.
- Unscrew bolts -arrows- and detach high-pressure pump.

Installing

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



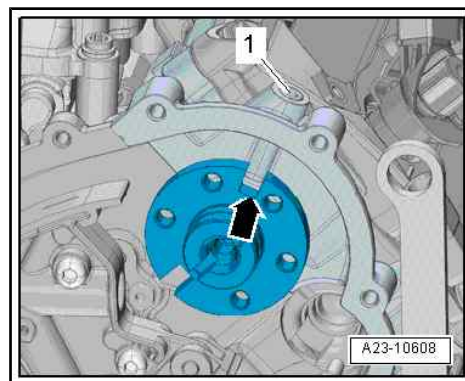


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Note

- ◆ *Renew seals and gaskets.*
- ◆ *Fuel return line must not be kinked, damaged or clogged.*
- ◆ *Renew seals and gaskets.*
- ◆ *Fuel return lines must not be kinked, damaged or clogged.*
- ◆ *If toothed belt sprocket for high-pressure pump must be renewed, use puller - T40064- to pull it off.*
- ◆ *Before fitting toothed belt, toothed belt sprocket -1- for high-pressure pump must be locked in position using locking tool - T40135- . This is important to prevent oscillation of toothed belt.*
- ◆ *Two TDC points must be aligned in order to correctly adjust toothed belt for high pressure pump.*
- ◆ *TDC of crankshaft -1-*
- ◆ *TDC of camshaft -arrow-*
- Tightening torques: exploded view - high-pressure pump
⇒ [page 127](#)
- Tightening torque for nut for toothed belt sprocket: 70 Nm
- Install toothed belt for high-pressure pump ⇒ [page 118](#) .
- Install high-pressure pipes ⇒ [page 71](#) .
- Install top section of intake manifold ⇒ [page 65](#) .



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. First fuel filling
⇒ [page 132](#)*
- ◆ *Running when dry causes irreparable damage to high-pressure pump.*

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

3.31 Performing first fuel filling after installing high-pressure pump - vehicles with engine codes CANA, CANB, CANC, CAND, CDYA, CDYB, CDYC

Special tools and workshop equipment required

- ◆ ⇒ Vehicle diagnostic tester



Caution

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

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

Test requirement:

- Check fuel gauge in instrument cluster; fuel gauge needle must indicate that fuel is above reserve level.
- Connect ⇒ Vehicle diagnostic tester.
- Switch on ignition.
- Select “Engine electronics” in vehicle self-diagnosis.
- Then select “Basic setting”.
- Select channel 35; “Pump off” appears in display zone 2.
- Press “activate” button.
- Fuel pumps will run for approx. 60 seconds; “Pump on” appears in display zone 2.
- Repeat this procedure THREE TIMES to ensure that high-pressure pump is sufficiently filled with fuel.
- Start engine after filling fuel system.
- Run engine at moderate speed (greater than 2000 rpm) for approx. 2 minutes and then switch off.
- Check fuel system for leaks.
- Erase entry in event memory using diagnostic tester.
- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the complete high-pressure section of the fuel system again for leaks.
- Interrogate event memory.

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3.32 Checking fuel pressure regulating valve - N276-



WARNING

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

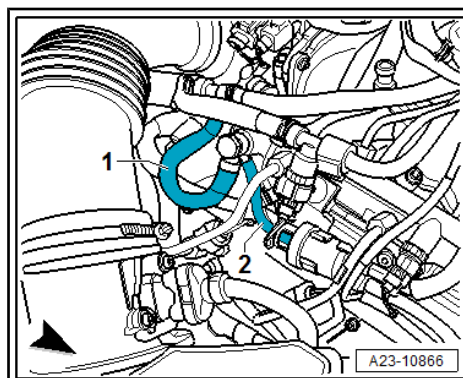
- Remove engine cover panel ⇒ [page 36](#).

Observe different number of connections at banjo bolt:

- ◆ Checking on vehicles with 2 connections at banjo bolt
⇒ [page 134](#)
- ◆ Checking on vehicles with 3 connections at banjo bolt
⇒ [page 134](#)

Checking on vehicles with 2 connections at banjo bolt

- Detach fuel return lines -1- and -2- at banjo bolt.



- Seal off open return line -1- with plug.
- Seal off open connection at banjo bolt with plug -2-.
- Attach hose -4- to open connection at banjo bolt.
- Hold hose -4- into a suitable measuring container.
- Hold return line -3- into a suitable container.
- Measure return flow rate of hose -4- as follows.



Note

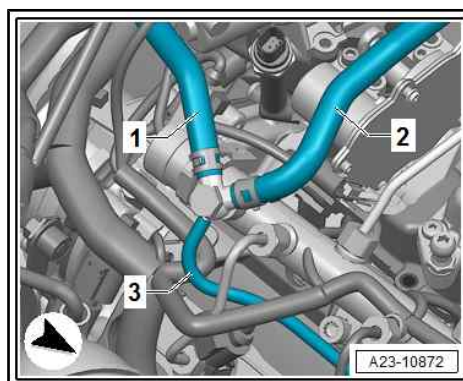
- ◆ Fuel return rate of injectors from hose -3- can be disregarded for this test.
- ◆ Fuel temperature above 10 °C.
- Start engine and run at idling speed.
 - Return flow rate from hose -4- (engine start): 0 ml
 - Return flow rate from hose -4- after 2 minutes: 0 ... 50 ml

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

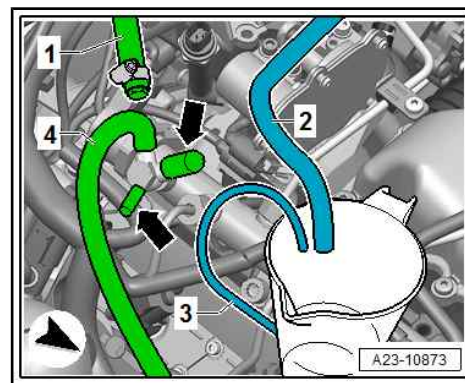
- Renew fuel pressure regulating valve - N276- → [page 135](#)

Checking on vehicles with 3 connections at banjo bolt

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



- Seal off open return line -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.



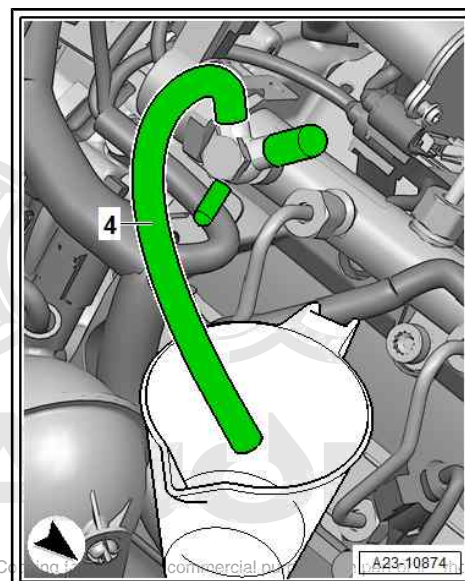
Note

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

- Start 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: 0 ... 50 ml

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

- Renew fuel pressure regulating valve - N276- → [page 135](#)



3.33 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 fuel rail to the fuel tank via a return line.

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

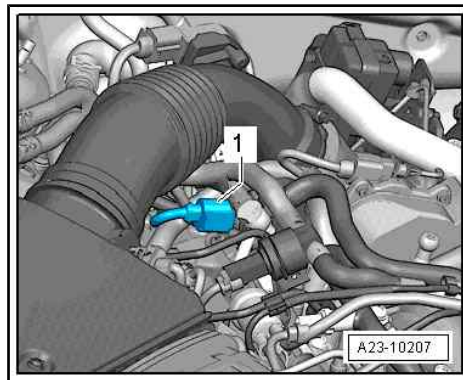
The fuel pressure regulating valve - N276- cannot be re-used.

Removing



Caution

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



- Remove engine cover panel ⇒ [page 36](#) .
- Remove intake hose between air mass meter - G70- and turbocharger.
- Before removal, clean area around thread for fuel pressure regulating valve using commercial cleaning solution or similar (no dirt must enter opening in fuel rail).



Note

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

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



Note

Only unscrew the banjo bolt on vehicles with the following engine codes: BMK, BPP, BSG, BNG, ASB.

- 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 fuel rail (thread and sealing surface) using a vacuum cleaner. Do not use metal tools, etc.



Note

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

Installing



Note

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

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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).

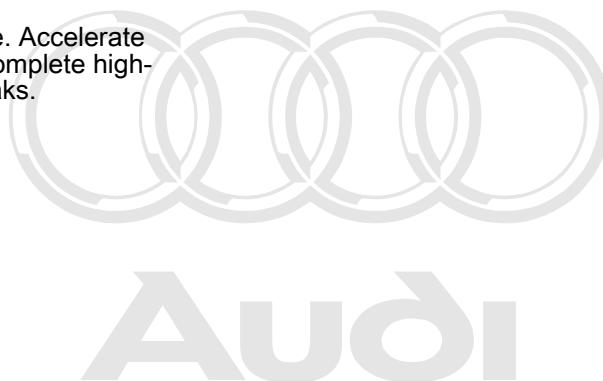
Then back off union nut 90° (1/4 turn; counterhold hexagon flats on housing).

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



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3.34 Removing and installing fuel pressure sender - G247-

The fuel pressure sender - G247- 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 engine control unit.

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.

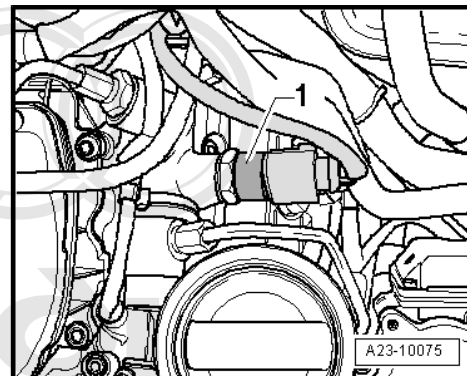
Removing



Caution

- ◆ **Always read rules for cleanliness and instructions for working on fuel system ⇒ page 1.**
- ◆ **Follow these instructions before starting work and while working on the fuel system.**

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- Remove engine cover panel ⇒ page 36 .
- Before removal, clean area around thread for fuel pressure sender using commercial cleaning solution etc. (no dirt must enter opening in fuel rail).



Note

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

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



Note

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

Installing



Note

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

- Screw in fuel pressure sender - G247- by hand.
- Then tighten fuel pressure sender - G247- to specified torque.
- Tightening torque: exploded view - fuel system ⇒ [page 28](#)

Bleeding fuel system and checking for leaks

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



Note

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

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

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

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



Note

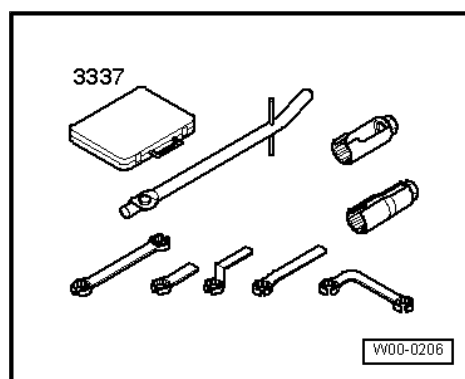
If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the event memory. Then continue the road test.

- After road test, interrogate event memory again.

3.35 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



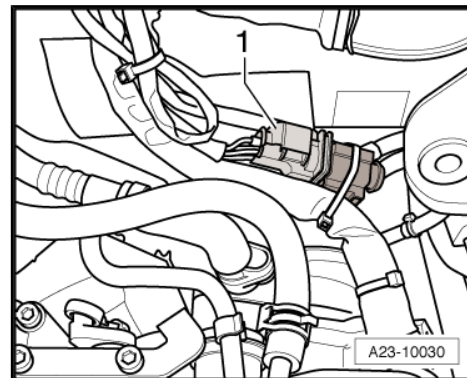
WARNING

When working on all parts of the exhaust system:

- ◆ *Observe safety precautions when working on the exhaust system
⇒ "1.4 Safety precautions when working on the exhaust system", page 3.*

- Remove engine cover panel ⇒ [page 36](#).
- Unplug electrical connector for Lambda probe.

Fitting location on vehicles with engine codes: BMK, BPP, BSG, BNG, ASB



Fitting location on vehicles with engine codes: CANA, CANB, CANG, CAND, CDYA, CDYB, CDYC

- Unscrew Lambda probe using tool from Lambda probe opening spanner set - 3337-.

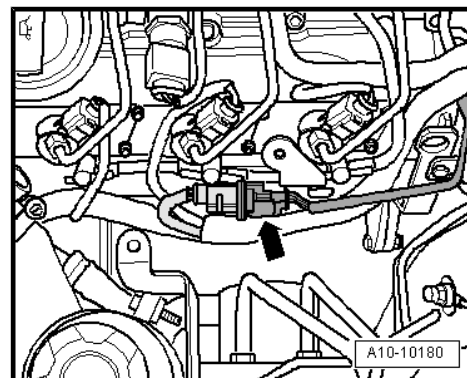
Installing

When installing, note the following:



Note

- ◆ *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*
- ◆ *In the case of a used Lambda probe grease only the thread with high-temperature paste. The paste must not get into the slots on the Lambda probe body. High-temperature paste ⇒ Electronic parts catalogue*
- ◆ *When installing, the Lambda probe wire must always be reattached at the same locations to prevent it from coming into contact with the exhaust pipe.*
- ◆ *Tightening torque: 50 Nm*



3.36 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- detects the amount of deposits in the particulate filter.

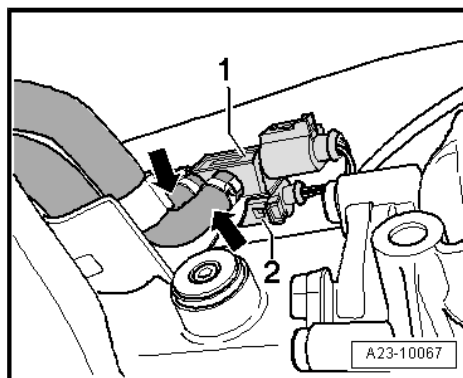
Removing

- 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-).



Note

- ◆ *On Euro 5 vehicles, the second measuring line is approx. 7 cm in length and free to atmosphere (relative pressure sensor concept).*
- ◆ *The short measuring line can also be pulled off with the exhaust gas pressure sensor 1 - G450- removed.*



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

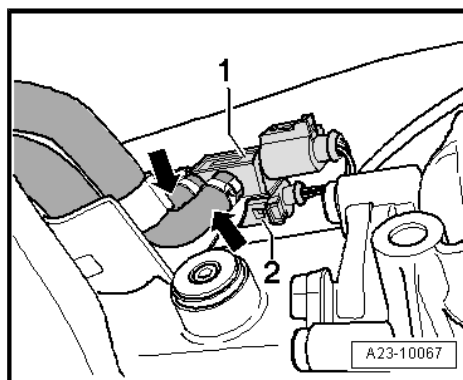
Installing

- When installing, note the following:

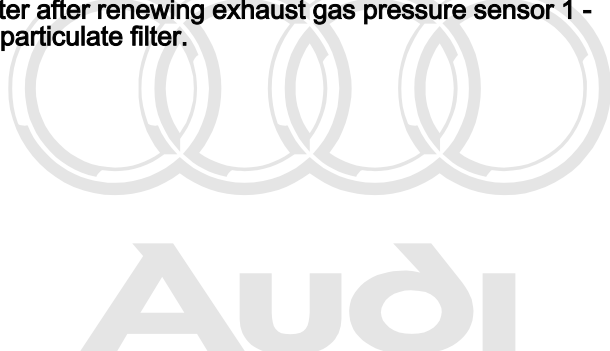


Note

- ◆ *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 45 Nm.*



Adaption must be performed in **Guided Functions** of ⇒ Vehicle diagnostic tester after renewing exhaust gas pressure sensor 1 - G450- and/or particulate filter.



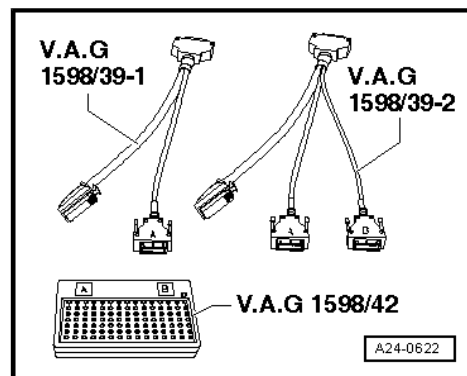
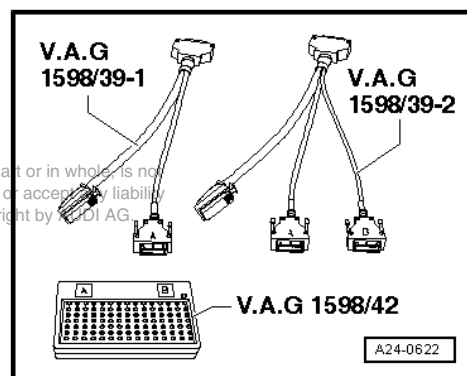
4 Engine control unit

4.1 Checking wiring and components with test box - V.A.G 1598/42- (154-pin)

Special tools and workshop equipment required

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

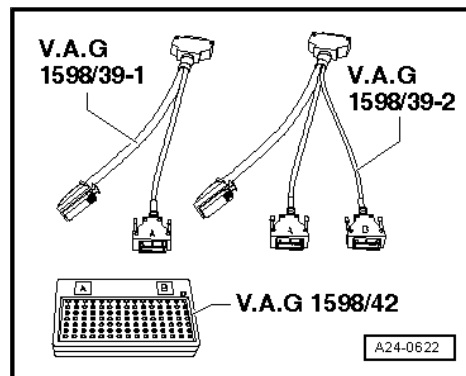
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Note

- ◆ The test box has 105 sockets. The connecting cable can be disconnected from the test box. This means that only the cable (and not the test box) has to be purchased for future engine control units with different types of connectors.
- ◆ The smaller of the two connectors on the engine control unit has the contacts 1 to 60. The larger of the two connectors has the contacts 1 to 94.
- ◆ To carry out tests on the 60-pin wiring harness connector, the adapter cable -V.A.G 1598/39-1- is connected to connector "A" on the test box. For components connected to 60-pin wiring harness connector ⇒ *Current flow diagrams, Electrical fault finding and Fitting locations.*
- ◆ To carry out tests on the 94-pin wiring harness connector, the adapter cable -V.A.G 1598/39-2- must be connected to connectors "A" and "B" on the test box. For components connected to 94-pin wiring harness connector ⇒ *Current flow diagrams, Electrical fault finding and Fitting locations.*
- ◆ The test box - V.A.G 1598/42- is designed so it can be connected both to the wiring harness for the engine control unit and to the engine control unit itself at the same time.
- ◆ The advantage of this is that the electronic engine control system remains fully functional when the test box is connected (for example, for measuring signals when the engine is running).
- ◆ The relevant test procedure will state whether it is necessary to also connect the engine control unit to the test box.



WARNING

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

- Remove engine control unit ⇒ [page 145](#) .
- Connect the test box - V.A.G 1598/42- to wiring harness with adapter cable - V.A.G 1598/39-1- or adapter cable - V.A.G 1598/39-2- . Connect earth clip of test box to negative terminal of battery. The instructions for performing the individual tests indicate whether or not the engine control unit itself also needs to be connected to the test box.
- Carry out test as described in appropriate repair procedures.

Installing engine control unit

Installation is performed in the reverse sequence.

- After installation, the protective housing must be re-fitted on the control unit.
- Clean threaded holes for new shear bolts to remove any residue from locking fluid. This can be done using a thread tap.
- Always use new shear bolts.

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



Note

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

4.2 Renewing engine control unit

The following safety precautions are only required on 3.0 ltr. common rail engines with engine code letters BMK and BNG up to and including model year 2005.



Caution

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

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

An engine control unit with the software version for 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 VERSION** 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 **IR-REPARABLY DAMAGED** when the ignition is switched on.*



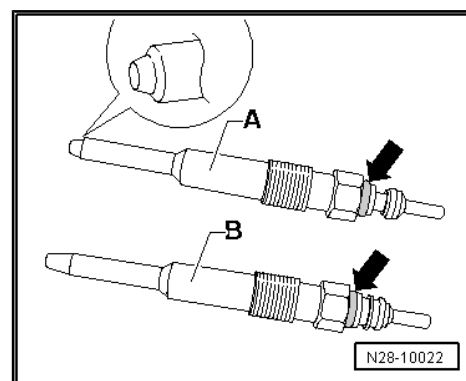
Note

- ◆ 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-.

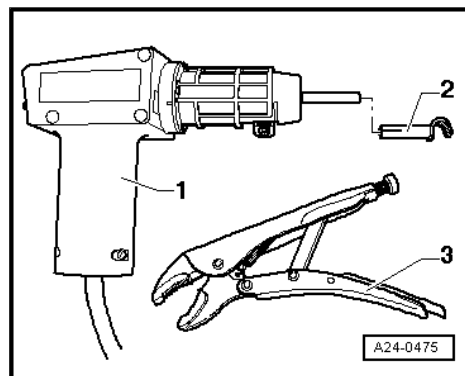
Removing engine control unit

Special tools and workshop equipment required

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



- ◆ Small, commercially available mole grips -3-


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.

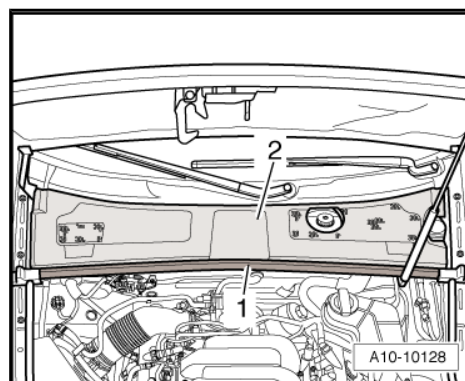
- The adaption values of the injectors must be stored before removing engine control unit - J623- .

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

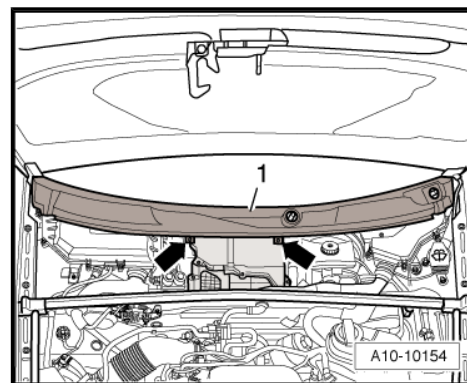

Note

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

- Switch off ignition after storing file containing adaption values.
- Remove ignition key.
- Detach rubber seal -1- from plenum chamber cover.
- Detach plenum chamber cover -2-.
- Use screwdriver to pry off cover caps on windscreen wiper arms and unscrew hexagon nuts.
- Pull windscreen wiper arms off wiper shafts.



- Unscrew bolts (left and right) -arrows- from cowl panel -1-.

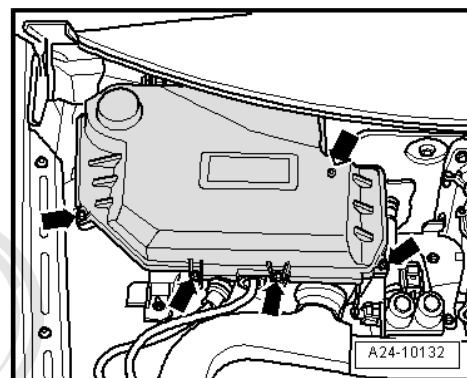


- Unscrew bolts -arrows- and take off lid for electronics box.

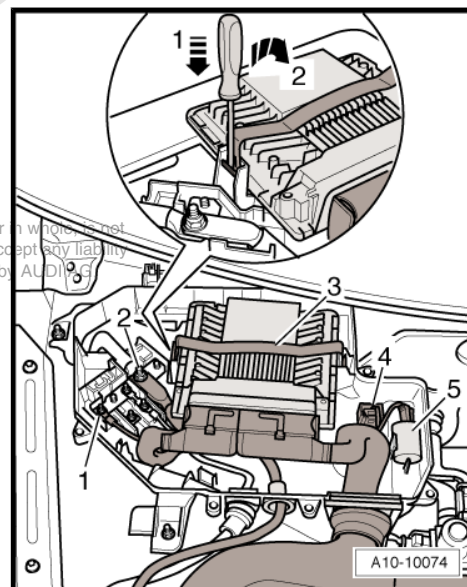


WARNING

The pump valve unit for the heating system (left-side in front of electronics box) gets very hot when the ignition is on - risk of burns!



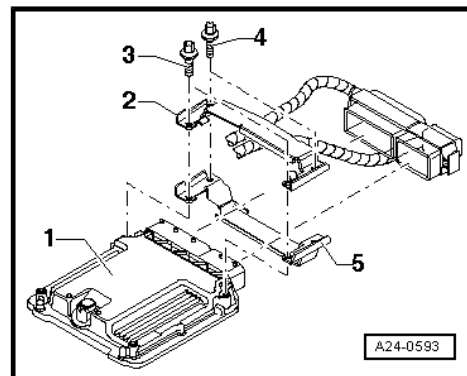
- Carefully lever out the retaining strap -3- using a screwdriver -arrows 1 and 2- and remove the engine control unit from the electronics box.



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To help prevent unauthorised access to the connectors on the engine control unit, the engine control unit -1- is bolted to a metal casing -2- by means of shear bolts -3 and 4- and a locking plate -5-.

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



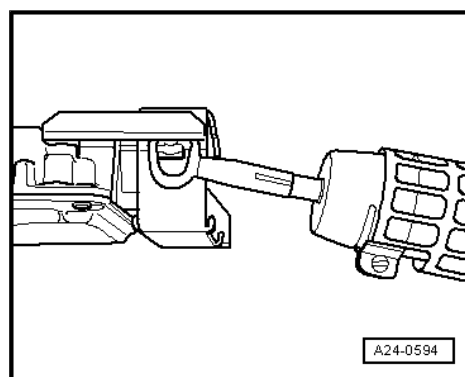
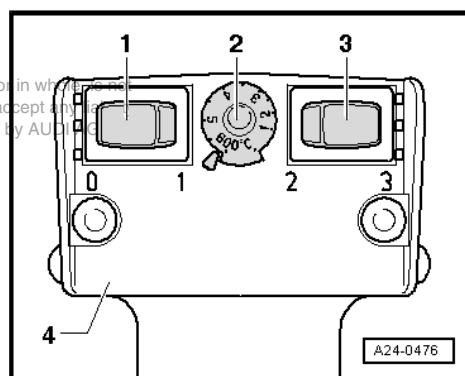
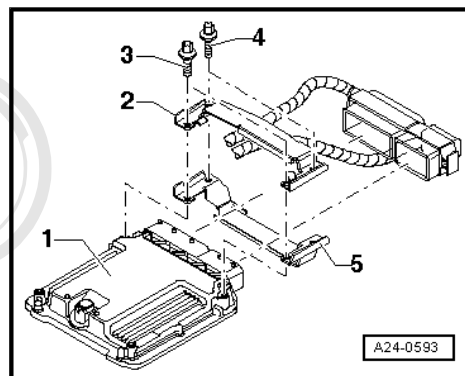
WARNING

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.

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

- Unscrew shear bolts using mole grips (see arrow in illustration).

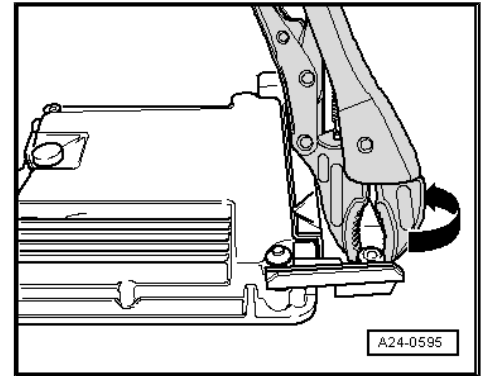


- The two shear bolts screwed into the engine control unit do not need to be heated. They should be removed without being heated.
- Detach protective housing from control unit connectors.
- Release connectors on engine control unit and unplug connectors.
- Take out old engine control unit and install new one.

Installing

Installation is performed in the reverse sequence.

- Make sure you fit protective housing back on engine control unit.
- Clean threaded holes for new shear bolts to remove any residue from locking fluid. This can be done using a thread tap.
- Always use new shear bolts.
- After the engine control unit - J623- has been renewed, the "Injector delivery calibration" and the "Injector voltage calibration" must also be re-adapted in the engine control unit (these functions influence engine power and exhaust emissions).
- On vehicles with particulate filter the current mileage (km) reading must be stored in the engine control unit - J623- via an adaption procedure.



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

Use ⇒ Vehicle diagnostic tester.



Note

Please note the information regarding engine software and glow plugs at the beginning of this section.

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

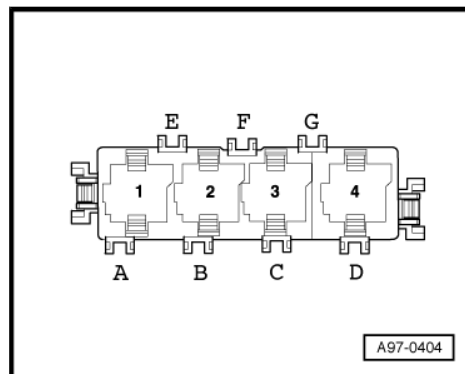
The glow plug system is activated via the automatic glow period control unit - J179-. The automatic glow period control unit - J179- is capable of self-diagnosis. A fault is stored in the engine control unit if a fault occurs in the glow plug system.

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.



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

- ◆ *Metal glow plugs are always fitted in the 2.7 ltr. common rail engine.*
- ◆ *Two different types of glow plugs are fitted in the 3.0 ltr. common rail engine (engine code letters BMK and BNG): Bosch ceramic glow plugs or Beru metal glow plugs.*
- ◆ *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.*

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The following safety precautions are only required on 3.0 ltr. common rail engines with engine code letters BMK and BNG up to and including model year 2005.



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.

Identifying the different types of glow plugs for the 3.0 ltr. common rail 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-.

Removing ceramic glow plugs (Bosch)



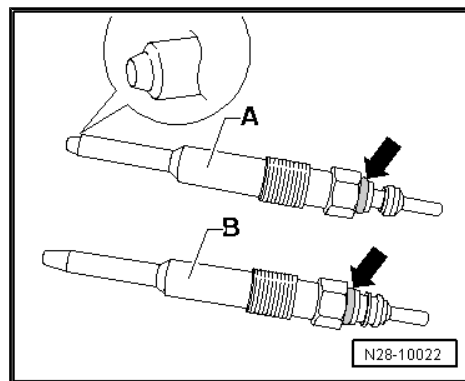
Caution

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.



Note

- ◆ *Wait for 60 seconds each time after performing final control diagnosis of 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.*
- 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.*



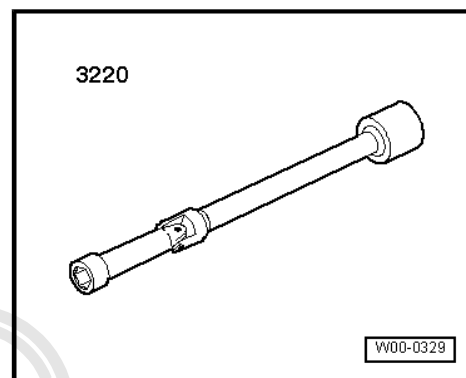
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- When loosening and tightening ceramic glow plugs, use special tool U/J extension and socket, 10 mm - 3220- and a suitable torque wrench.
- Unplug the connector from the glow plug to be removed.
- When loosening a ceramic glow plug, do not exceed 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 ceramic glow plug carefully by hand or using a suitable hose. 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. Detach 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.

Additionally check ceramic glow plugs via self-diagnosis.

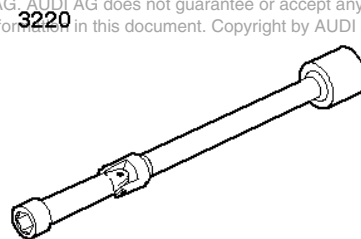
- Erase event memory of engine control unit. Do not start engine at this stage.
- Perform final control diagnosis (automatic glow period control unit - J179-).
- Interrogate event memory again. Do not start engine at this stage.
- The engine must not be started if the event memory has registered a fault relating to the ceramic glow plugs. Check that electrical connectors have engaged properly.

Removing metal glow plugs:

Special tools and workshop equipment required

- ◆ Torque wrench - V.A.G 1331-
- ◆ Articulated wrench, 10 mm - 3220-

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VW00-0329



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.



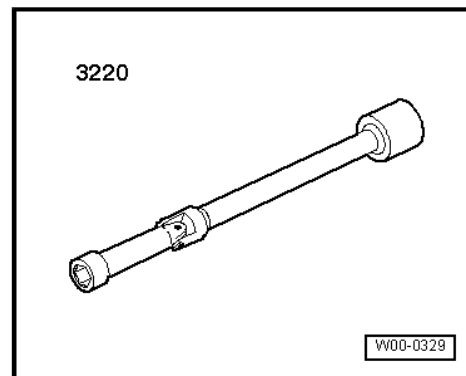
Note

- ◆ *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.*

- To slacken the glow plugs use special tool U/J extension and socket, 10 mm - 3220- .
- Then unscrew glow plugs carefully by hand or using a suitable hose. Keep the glow plugs straight while unscrewing.

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.
- Then tighten glow plugs to specified torque.
- 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.



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