

Workshop Manual

Audi A4 2008 ➤

Audi A5 Cabriolet 2009 ➤

Audi A5 Coupé 2008 ➤

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

Engine ID	CAM A	CAP A	CAM B	CCW A	CCW B	CGK A	CGK B	CCL A	
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Edition 12.2012



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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 and rules for cleanliness

(ARL003201; Edition 12.2012)

1.1 General note for vehicles with SCR system

The abbreviation SCR stands for Selective Catalytic Reduction.

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



WARNING

Reducing agent can cause skin irritation.

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

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1.2 Adapting learnt value after draining reducing agent or renewing components

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

- ◆ Active tank
- ◆ Pump for reducing agent
- ◆ Injector for reducing agent
- ◆ Reducing agent line
- ◆ Engine control unit
- Perform adaption in “Guided Functions” using a vehicle diagnostic tester .

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

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



WARNING

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

Persons sitting in the front passenger's seat could be injured if the airbag is triggered in an accident.

- *The use of test equipment while driving causes distraction.*
- *There is an increased risk of injury if test equipment is not secured.*
- ◆ *Test equipment must always be secured on the rear seat with a strap and operated from the rear seat by a second person.*

*Press the **DONE** button when you are ready for the test drive.*

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1.4 Safety precautions for vehicles with start/stop system



WARNING

Risk of injury due to automatic engine start on vehicles with start/stop system.

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

1.5 Safety precautions when working on the fuel system

When working on the fuel system note the following warnings:



WARNING

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

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

- ◆ *Wear protective gloves.*

- ◆ *Wear safety goggles.*

Risk of injury - fuel system operates under pressure.

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

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

- ◆ *Wear protective gloves.*

- ◆ *Wear safety goggles.*



Caution

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

The first fuel filling operation is only required on vehicles with engine codes CAMA, CAMB, CCWA, CCWB, CGKA, CGKB and CCLA.

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:

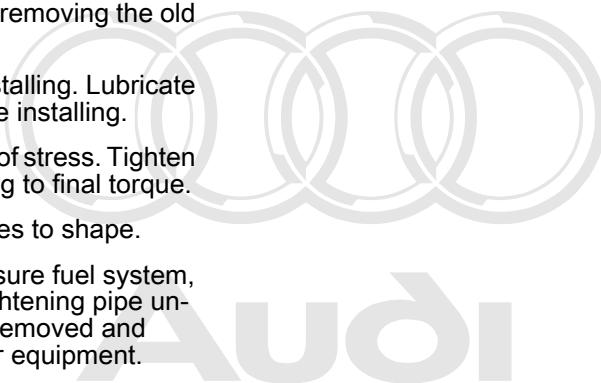


Caution

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

- ◆ ***To prevent the high-pressure fuel pump from running while it is empty and to ensure that the engine starts quickly after parts have been renewed, it is important to observe the following:***
- ◆ ***If components of the fuel system between the tank and the high-pressure fuel pump are removed or renewed, the basic setting must be performed in order to bleed the fuel system.***
- ◆ ***Performing first fuel filling after installing high-pressure pump ⇒ [page 74](#)***

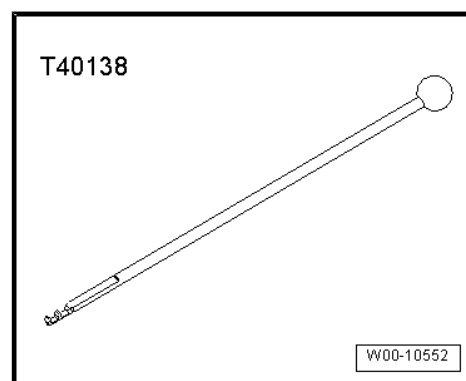
- Clean tools and workbench etc. before working on the injection system.
- Carefully clean connection points and the surrounding area with engine cleaner or brake cleaner and dry thoroughly before opening.
- When removing components, plug all open connections immediately with suitable clean sealing caps.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



- Do not dismantle individual common rail components. If there is a fault, the complete components must be renewed.
- When the engine is running, do not perform any repairs to the common rail system.
- Do not bleed the common rail system by unfastening high-pressure components after the engine has been started.
- All cable ties which are released or cut open when removing must be refitted in the same position when installing.
- When the fuel system is open: Do not work with compressed air if this can be avoided. Do not move the vehicle unless absolutely necessary.
- Also ensure that no diesel fuel comes into contact with the coolant hoses. Should this occur, the hoses must be cleaned immediately. Damaged hoses must be renewed.

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

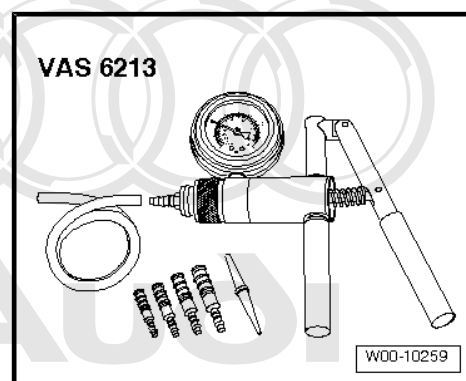
- ◆ Persons wearing a pacemaker should not lean over the engine compartment while the engine is running, as the injectors use high voltage pulses.
- ◆ Do not open any fuel line connections while the engine is running.
- ◆ Always switch off the ignition before connecting or disconnecting injection and glow plug system wiring or tester cables.
- ◆ Always switch off the ignition before cleaning the engine.
- ◆ Certain tests may lead to a fault being detected by the control unit and stored. The event memory should therefore be interrogated and (if necessary) erased after completing the tests and any repair work that may be required.
- ◆ Use release tool -T40138- to unplug connectors that cannot be accessed easily.



1.7 Checking vacuum system

Special tools and workshop equipment required

- ◆ Hand vacuum pump -VAS 6213-



Procedure

- Check all vacuum lines in the complete vacuum system for:
 - ◆ Cracks
 - ◆ Traces of animal bites
 - ◆ Kinked or crushed lines
 - ◆ Lines porous or leaking

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- 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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2 Overview of fitting locations (CAPA, CAMA, CAMB, CCWA, CCWB, CGKA, CGKB)

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
- ☐ If fitted, the bypass flap is located in the air cleaner housing and the air cleaner bypass flap valve -N275- is located on the outside of the air cleaner housing
- ☐ Air cleaner - exploded view ➔ [page 38](#)

2 - Air mass meter -G70-

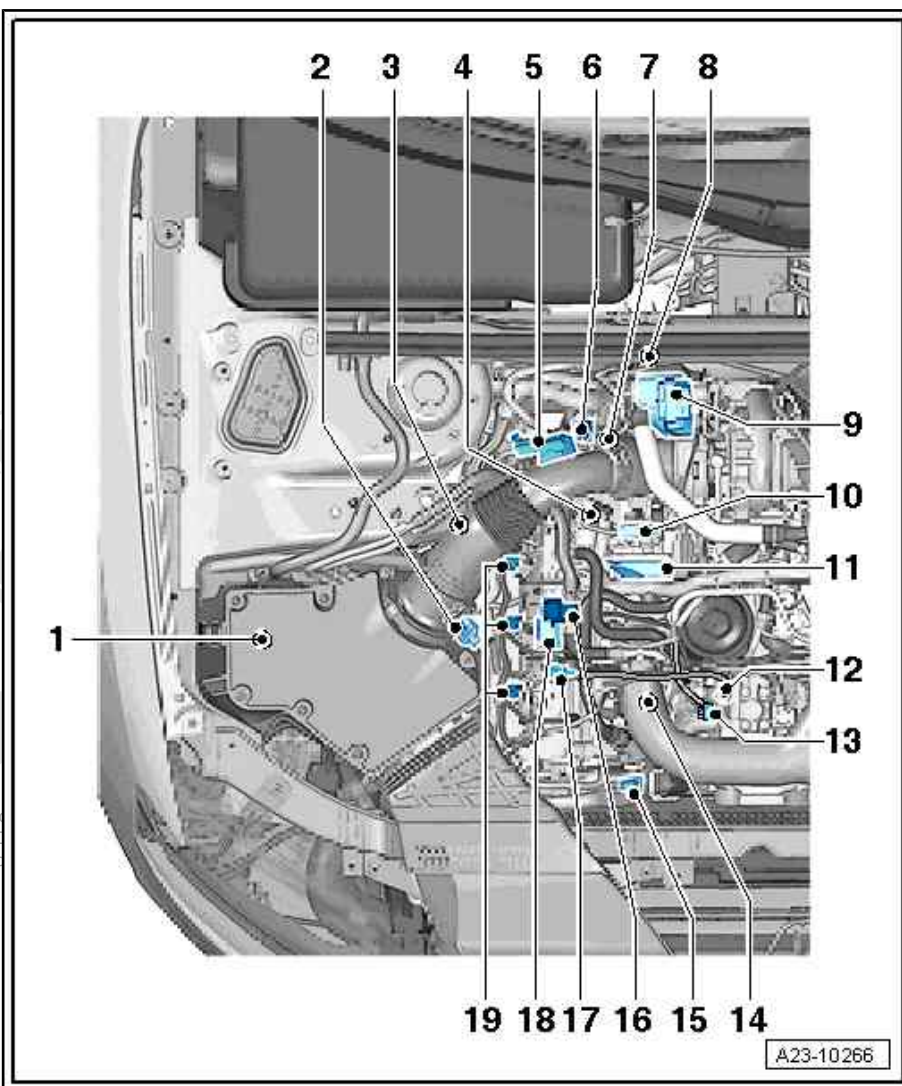
- ☐ Removing and installing ➔ [page 97](#)

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

- ☐ Fitting location ➔ [page 12](#)

4 - Fuel pressure regulating valve -N276-

- ☐ Fitting location ➔ [page 12](#)
- ☐ After renewing high-pressure pump or fuel pressure regulating valve -N276- , learnt values must be re-adapted;





see "Guided Functions"
in vehicle diagnostic tester

- ❑ Removing and installing ⇒ [page 100](#)

5 - Exhaust gas pressure sensor 1 -G450-

- ❑ Fitting location ⇒ [page 15](#)
- ❑ Adaption must be performed after renewing this component
- ❑ Removing and installing ⇒ [page 107](#)

6 - Electrical connector

- ❑ For exhaust gas temperature sender 4 -G648- (engine codes CAMA, CAMB, CCWA, CCWB, CGKA and CGKB)
- ❑ For exhaust gas temperature sender 3 for cylinder bank 1 -G496- (engine code CAPA)
- ❑ Fitting location ⇒ [page 15](#)
- ❑ Removing and installing ⇒ Rep. gr. 26

7 - Coolant temperature sender -G62-

- ❑ Removing and installing ⇒ Rep. gr. 19

8 - Exhaust gas temperature sender 4 -G648- (engine codes CAMA, CAMB, CCWA, CCWB, CGKA and CGKB)

- ❑ Exhaust gas temperature sender 3 for cylinder bank 1 -G496- (engine code CAPA)
- ❑ Fitting location ⇒ [page 15](#)
- ❑ Removing and installing ⇒ Rep. gr. 26

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9 - Control unit for turbocharger 1 -J724-

- ❑ Fitting location ⇒ [page 15](#)

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

- ❑ Only fitted on vehicles with engine codes CAPA, CCWA, CCWB
- ❑ Fitting location ⇒ [page 15](#)
- ❑ Exhaust gas temperature sender 1 -G235- ⇒ [page 15](#)

11 - Intake manifold flap motor -V157-

- ❑ Fitting location ⇒ [page 15](#)
- ❑ Cylinder bank 1
- ❑ Intake manifold - exploded view ⇒ [page 44](#)

12 - Fuel return line connection

13 - Fuel supply line connection

14 - Oil pressure switch

- ❑ Oil pressure switch -F1- (engine codes CAPA, CAMA, CAMB) - fitting location ⇒ [page 13](#)
- ❑ Oil pressure switch for reduced oil pressure -F378- (engine codes CCWA, CCWB, CGKA, CGKB) - fitting location ⇒ [page 13](#)
- ❑ Removing, installing and testing ⇒ Rep. gr. 17

15 - Pump for exhaust gas recirculation cooler -V400-

- ❑ Fitting location ⇒ [page 13](#)

16 - Fuel temperature sender -G81-

- ❑ Fitting location ⇒ [page 12](#)

17 - Radiator outlet coolant temperature sender -G83-

- ❑ Fitting location ⇒ [page 12](#)
- ❑ Removing and installing ⇒ Rep. gr. 19

18 - Pressure retention valve or restrictor in fuel return line

- ☐ Fitting location ➔ [page 12](#)
- ☐ Which component is installed depends on the model year
- ☐ 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
- ☐ The restrictor maintains a residual pressure of approx. 4 bar in the return lines.
- ☐ This residual pressure is required for the control function of the piezo injectors
- ☐ The pressure retention valve/restrictor may only be renewed together with the fuel return lines.
- ☐ Checking pressure retention valve ➔ [page 88](#)
- ☐ Checking restrictor ➔ [page 89](#)

19 - Injectors (piezo injectors)

- ☐ Cylinder bank 1
- ☐ Removing and installing ➔ [page 90](#)

Engine compartment (left-side)

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

1 - Electrical connector

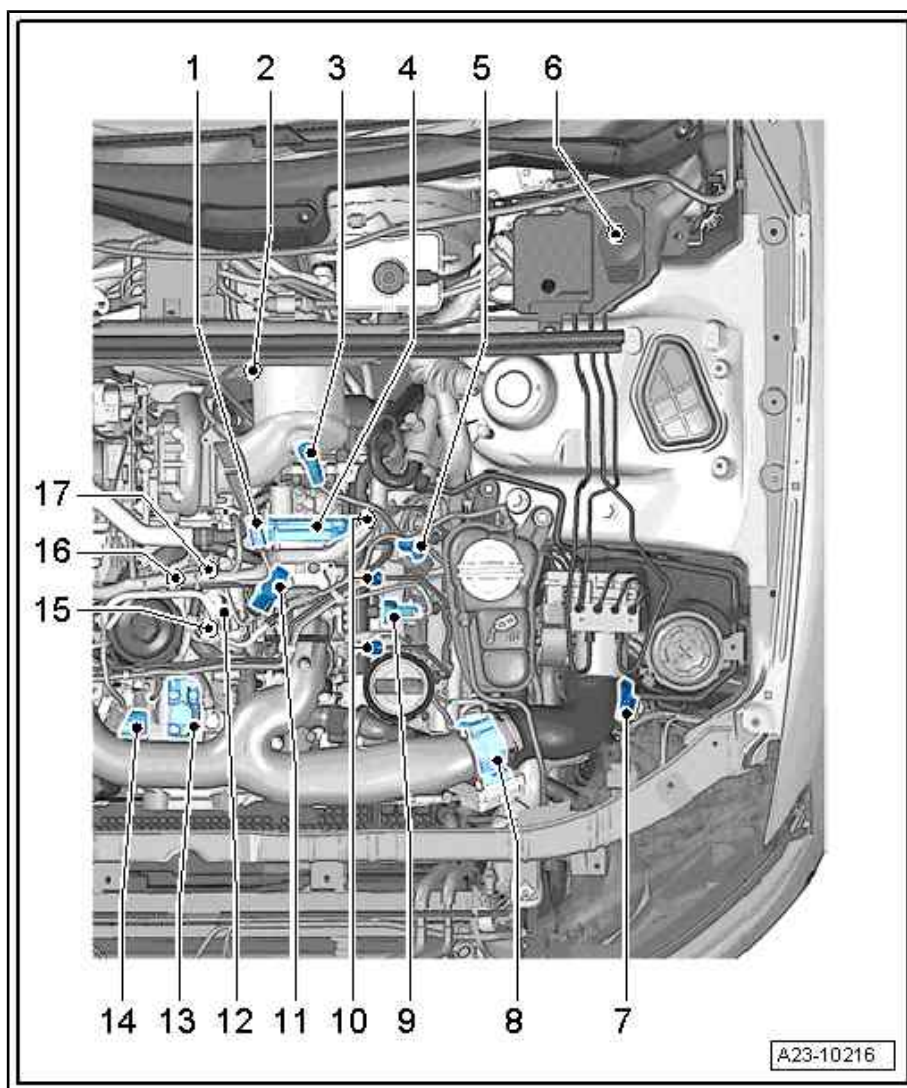
- ☐ For exhaust gas temperature sender 3 - G495- (engine codes CAMA, CAMB, CCWA, CCWB, CGKA and CGKB)
- ☐ For exhaust gas temperature sender 2 - G448- (engine code CAPA)

2 - Exhaust gas temperature sender 3 -G495- (engine codes CAMA, CAMB, CCWA, CCWB, CGKA and CGKB)

- ☐ Exhaust gas temperature sender 2 -G448- (engine code CAPA)
- ☐ Located downstream of starter catalytic converter
- ☐ Removing and installing ➔ Rep. gr. 26
- ☐ 45 Nm

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

- ☐ Fitting location ➔ [page 14](#)
- ☐ Removing and installing





⇒ [page 106](#)

- ☐ 50 Nm

4 - Intake manifold flap 2 motor -V275-

- ☐ Cylinder bank 2
- ☐ Intake manifold - exploded view ⇒ [page 44](#)

5 - Connector for Lambda probe -G39-

- ☐ Fitting location ⇒ [page 14](#)

6 - Engine control unit -J623-

- ☐ Fitting location ⇒ [page 11](#)
- ☐ Removing and installing ⇒ [page 113](#)

7 - Charge pressure sender -G31-

- ☐ With intake air temperature sender -G42-
- ☐ Fitting location ⇒ [page 14](#)
- ☐ Removing and installing ⇒ Rep. gr. 21

8 - Throttle valve module -J338-

- ☐ 9 Nm

9 - Fuel pressure sender -G247-

- ☐ Fitting location ⇒ [page 12](#)
- ☐ Removing and installing ⇒ [page 102](#)

10 - Injectors (piezo injectors)

- ☐ Cylinder bank 2
- ☐ Removing and installing ⇒ [page 90](#)

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

- ☐ Fitting location ⇒ [page 13](#)
- ☐ Overview of exhaust gas recirculation system ⇒ Rep. gr. 26

12 - Exhaust gas recirculation control motor -V338-

13 - High-pressure fuel pump

- ☐ With fuel metering valve -N290-
- ☐ On vehicles with engine codes CAMA, CAMB, CCWA, CCWB, CGKA and CGKB, a first fuel filling operation **MUST** be performed after the high-pressure pump has been renewed (the pump must NOT be allowed to run while it is still empty) ⇒ [page 74](#)
- ☐ After renewing high-pressure pump or fuel pressure regulating valve -N276-, learnt values must be re-adapted; see "Guided Functions" in vehicle diagnostic tester
- ☐ High-pressure pump - exploded view, engine codes CAMA, CAMB, CCWA, CCWB, CGKA, CGKB ⇒ [page 69](#)
- ☐ Removing and installing, engine codes CAMA, CAMB, CCWA, CCWB, CGKA, CGKB ⇒ [page 72](#)
- ☐ High-pressure pump - exploded view, engine code CAPA ⇒ [page 76](#)
- ☐ Removing and installing, engine code CAPA ⇒ [page 77](#)

14 - Fuel metering valve -N290-

- ☐ Do not unscrew
- ☐ Screwed directly into high-pressure fuel pump

15 - Exhaust gas recirculation temperature sensor -G98-

- ☐ Fitting location ⇒ [page 13](#)
- ☐ Removing and installing ⇒ Rep. gr. 26

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

17 - Vacuum unit

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

A - Relay and fuse holder in electronics box in plenum chamber (left-side)

- ☐ Removing and installing engine control unit -J623- with altitude sensor ➤ [page 115](#)
- ☐ Fitting locations ➤ Current flow diagrams, Electrical fault finding and Fitting locations

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

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

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

- ☐ In footwell on brake pedal

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

- ☐ Fitting location ➤ [page 12](#)
- ☐ Removing and installing ➤ Rep. gr. 20

E - Exhaust gas temperature sender 1 -G235-

- ☐ Only fitted on vehicles with engine codes CAPA, CCWA, CCWB
- ☐ On turbocharger
- ☐ 45 Nm
- ☐ Removing and installing ➤ Rep. gr. 26

F - Engine speed sender -G28-

- ☐ Fitting location ➤ [page 15](#)

G - Supplementary fuel pump -V393-

- ☐ Only fitted on vehicles with engine codes CAMA, CAMB, CCWA, CCWB, CGKA, CGKB
- ☐ Fitting location ➤ [page 16](#)
- ☐ Removing and installing ➤ Rep. gr. 20

H - Oil pressure switch -F22-

- ☐ Only fitted on vehicles with engine codes CCWA, CCWB, CGKA, CGKB
- ☐ Fitting location ➤ [page 14](#)
- ☐ Removing and installing ➤ Rep. gr. 17

I - Valve for oil pressure control -N428-

- ☐ Only fitted on vehicles with engine codes CCWA, CCWB, CGKA, CGKB
- ☐ Fitting location ➤ [page 14](#)
- ☐ Removing and installing ➤ Rep. gr. 17

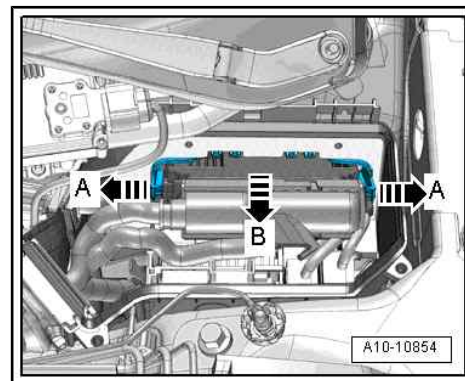
J - Particulate filter

- ☐ Fitted on underbody
- ☐ Combined with a catalytic converter
- ☐ Adaption must be performed after renewing this component
- ☐ Removing and installing ➤ Rep. gr. 26

After renewing exhaust gas pressure sensor 1 -G450- and/or particulate filter, adaption must be performed in order to reset learnt values. The adaption procedure is described in the Guided Fault Finding or Guided Functions; use a vehicle diagnostic tester .

Fitting location of engine control unit -J623-

- ◆ In left electronics box in engine compartment



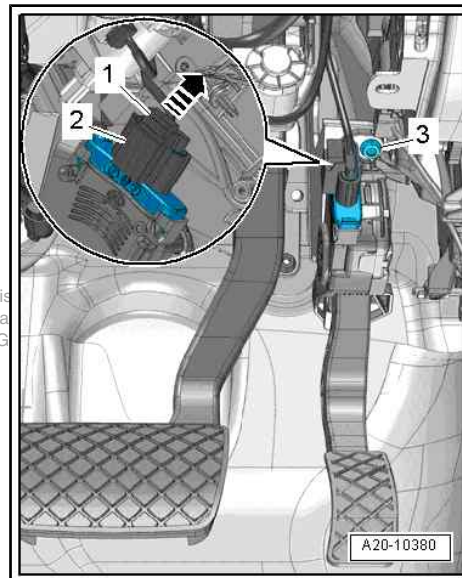
Accelerator position sender -G79- and accelerator position sender 2 -G185-



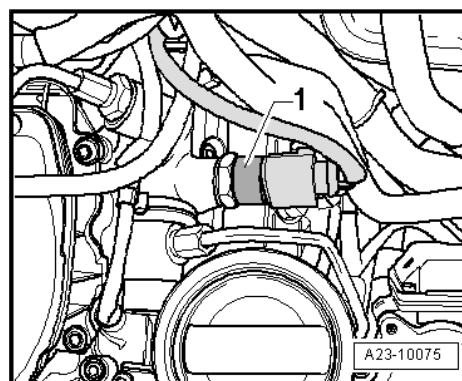
Note

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

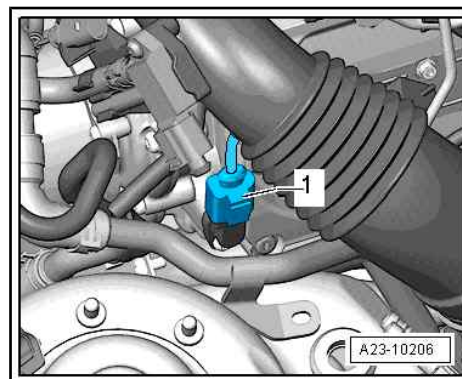
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Fuel pressure sender -G247- -1- on cylinder bank 2

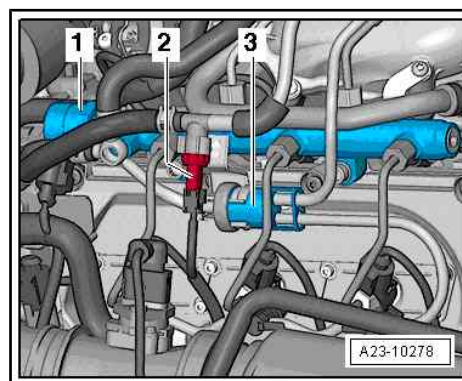


Hall sender -G40- -1- on cylinder bank 1



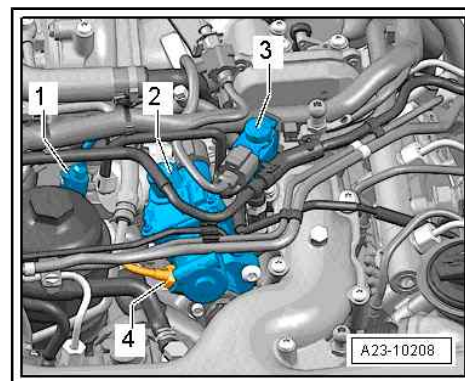
Components on cylinder bank (right-side)

- 1 - Fuel pressure regulating valve -N276-
- 2 - Fuel temperature sender -G81-
- 3 - Pressure retention valve or restrictor in fuel return line

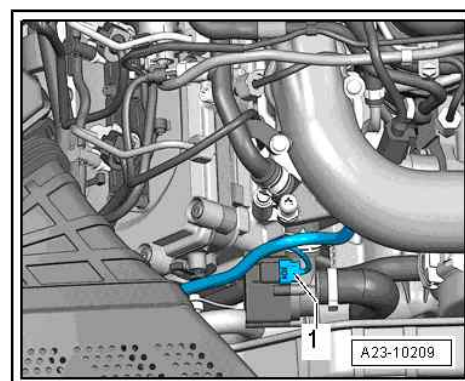


Fitting locations

- 1 - Electrical connector for exhaust gas recirculation temperature sensor -G98-
- 2 - Exhaust gas recirculation control motor -V338-
- 3 - Exhaust gas recirculation cooler change-over valve -N345-
- 4 - Exhaust gas recirculation temperature sensor -G98-

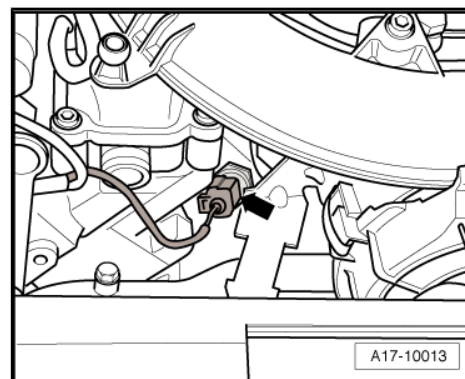


Pump for exhaust gas recirculation cooler -V400- -1-

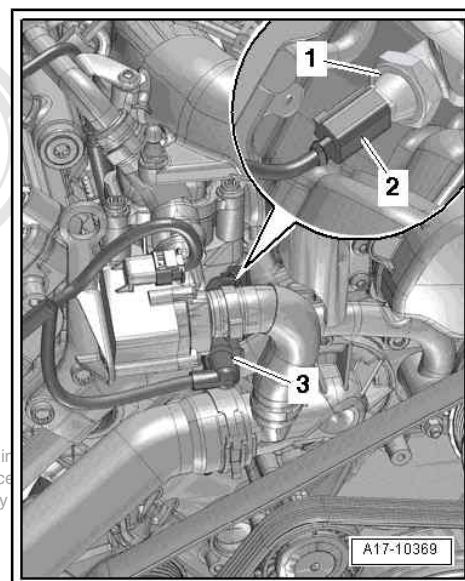


Oil pressure switch -F1- -arrow- (engine codes CAPA, CAMA, CAMB)

- ◆ Removing, installing and testing ⇒ Rep. gr. 17



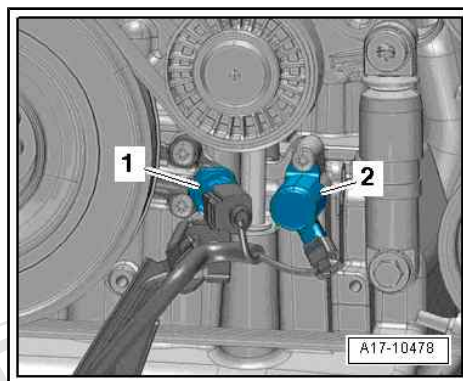
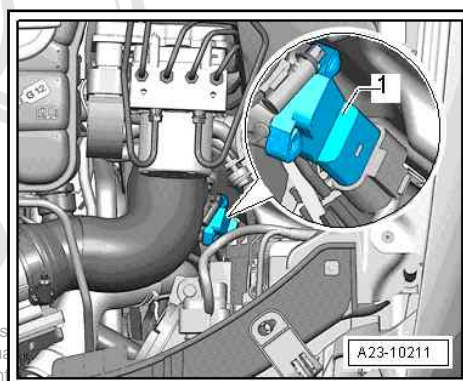
Oil pressure switch for reduced oil pressure -F378- -1- (engine codes CCWA, CCWB, CGKA, CGKB)



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Oil pressure control (engine codes CCWA, CCWB, CGKA, CGKB)

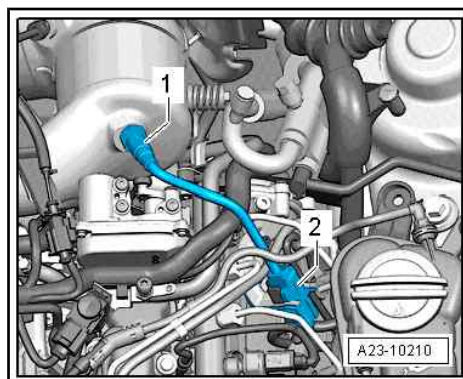
- 1 - Oil pressure switch -F22-
- 2 - Valve for oil pressure control -N428-

**Charge pressure sender -G31- with intake air temperature sender -G42- -1-**

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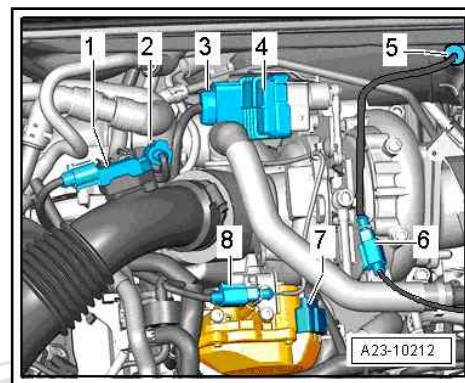
Fitting location of Lambda probe -G39-

- 1 - Lambda probe -G39-
- 2 - Connector for Lambda probe -G39-

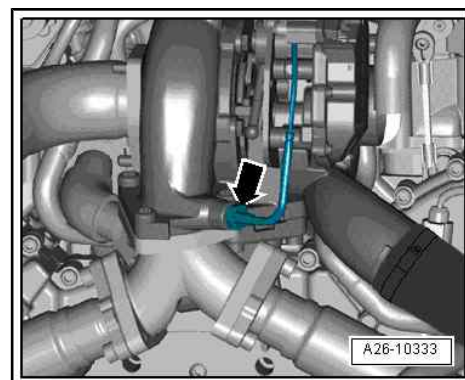


Fitting locations

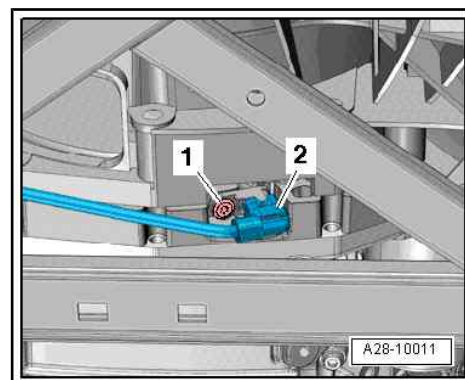
- 1 - Exhaust gas pressure sensor 1 -G450-
- 2 - Electrical connector for exhaust gas temperature sender 3 for cylinder bank 1 -G496- (engine code CAPA)
- 2 - Electrical connector for exhaust gas temperature sender 4 - G648- (engine codes CAMA, CAMB, CCWA, CCWB, CGKA, CGKB)
- 3 - Electrical connector for turbocharger 1 control unit -J724-
- 4 - Control unit for turbocharger 1 -J724-
- 5 - Exhaust gas temperature sender 2 -G448- (engine code CAPA)
- 5 - Exhaust gas temperature sender 3 -G495- (engine codes CAMA, CAMB, CCWA, CCWB, CGKA and CGKB)
- 6 - Electrical connector for exhaust gas temperature sender 2 - G448- (engine code CAPA)
- 6 - Electrical connector for exhaust gas temperature sender 3 - G495- (engine codes CAMA, CAMB, CCWA, CCWB, CGKA, CGKB)
- 7 - Intake manifold flap motor -V157-
- 8 - Electrical connector for exhaust gas temperature sender 1 - G235- (only fitted on 3.0 ltr. engines with codes CAPA, CCWA, CCWB)



Exhaust gas temperature sender 1 -G235- -arrow- (only fitted on 3.0 ltr. engines with codes CAPA, CCWA, CCWB)



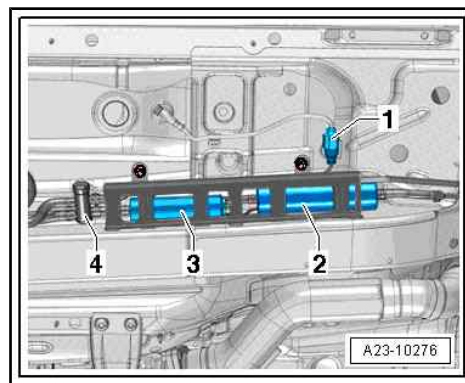
Engine speed sender -G28- -2-





Supplementary fuel pump -V393- -3- (engine codes CAMA, CAMB, CCWA, CCWB, CGKA, CGKB)

- 1 - Electrical connector for supplementary fuel pump -V393-
- 2 - Fuel filter
- 3 - Supplementary fuel pump -V393-
- 4 - Preheating valve



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3 Overview of fitting locations (CCLA)

Engine compartment (right-side)

1 - Hall sender -G40-

- ☐ Fitting location
 ⇒ [page 23](#)

2 - Pressure differential sender -G505-

- ☐ Fitting location
 ⇒ [page 25](#)

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- ☐ Adaption must be performed after renewing this component

- ☐ Removing and installing
 ⇒ [page 111](#)

3 - Fuel pressure regulating valve -N276-

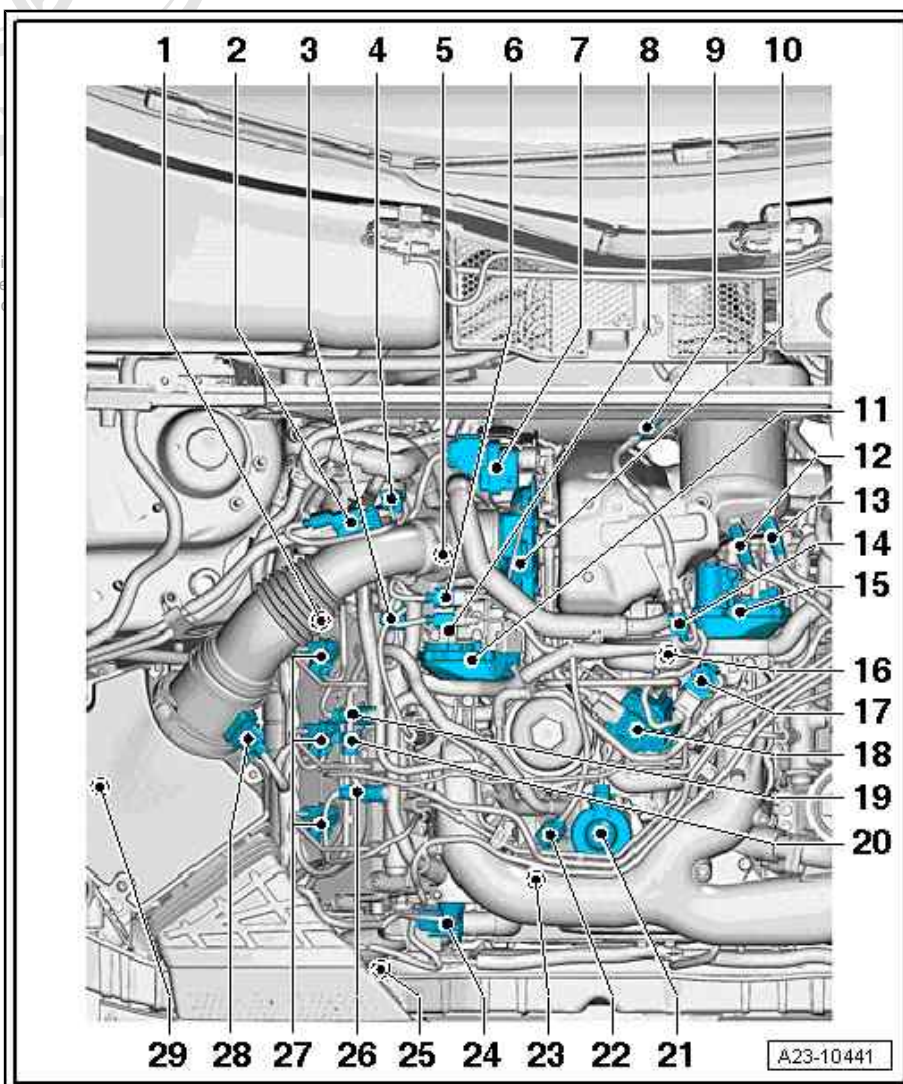
- ☐ Fitting location
 ⇒ [page 23](#)
- ☐ After renewing high-pressure pump or fuel pressure regulating valve -N276-, learnt values must be re-adapted; see "Guided Functions" in vehicle diagnostic tester
- ☐ Removing and installing
 ⇒ [page 100](#)

4 - Electrical connector

For exhaust gas temperature sender 4 -G648-

5 - Coolant temperature sender -G62-

- ☐ Removing and installing





⇒ Rep. gr. 19

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

- ☐ Fitting location ⇒ [page 24](#)

7 - Control unit for turbocharger 1 -J724-

- ☐ Fitting location ⇒ [page 25](#)

8 - Electrical connector for exhaust gas recirculation temperature sensor -G98-

- ☐ Fitting location ⇒ [page 25](#)

9 - Exhaust gas temperature sender 3 -G495-

- ☐ Fitting location ⇒ [page 25](#)

10 - Turbocharger

- ☐ Removing and installing ⇒ Rep. gr. 26

11 - Intake manifold flap motor -V157-

- ☐ Fitting location ⇒ [page 25](#)
- ☐ Cylinder bank 1
- ☐ Intake manifold - exploded view ⇒ [page 44](#)

12 - NOx sender -G295-

- ☐ Fitting location ⇒ [page 25](#)

13 - Lambda probe -G39-

- ☐ Fitting location ⇒ [page 25](#)

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

15 - Intake manifold flap 2 motor -V275-

16 - Exhaust gas recirculation temperature sensor -G98-

- ☐ Fitting location ⇒ [page 24](#)
- ☐ Removing and installing ⇒ Rep. gr. 26

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

- ☐ Fitting location ⇒ [page 24](#)

18 - Exhaust gas recirculation control motor -V338-

- ☐ Fitting location ⇒ [page 24](#)

19 - Fuel temperature sender -G81-

- ☐ Fitting location ⇒ [page 23](#)

20 - Pressure retention valve or restrictor in fuel return line

- ☐ Fitting location ⇒ [page 23](#)
- ☐ Which component is installed depends on the model year
- ☐ 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
- ☐ The restrictor maintains a residual pressure of approx. 4 bar in the return lines.
- ☐ This residual pressure is required for the control function of the piezo injectors
- ☐ The pressure retention valve/restrictor may only be renewed together with the fuel return lines.
- ☐ Checking pressure retention valve ⇒ [page 88](#)
- ☐ Checking restrictor ⇒ [page 89](#)

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21 - High-pressure fuel pump

- ☐ With fuel metering valve -N290-
- ☐ After renewing high-pressure pump, first fuel filling operation MUST be performed (it is important not to allow pump to run while it is still empty) ⇒ [page 74](#)
- ☐ After renewing high-pressure pump or fuel pressure regulating valve -N276- , learnt values must be re-adapted; see "Guided Functions" in vehicle diagnostic tester
- ☐ High-pressure pump - exploded view ⇒ [page 69](#)
- ☐ Removing and installing ⇒ [page 72](#)

22 - Fuel metering valve -N290-

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

- ☐ Fitting location ⇒ [page 24](#)
- ☐ Removing, installing and testing ⇒ Rep. gr. 17

24 - Pump for exhaust gas recirculation cooler -V400-

- ☐ Fitting location ⇒ [page 24](#)

25 - Control unit for NOx sender -J583-

- ☐ Fitting location ⇒ [page 24](#)

26 - Radiator outlet coolant temperature sender -G83-

- ☐ Fitting location ⇒ [page 23](#)

27 - Injectors (piezo injectors)

- ☐ Cylinder bank 1
- ☐ Removing and installing ⇒ [page 90](#)

28 - Air mass meter -G70-

- ☐ Removing and installing ⇒ [page 97](#)
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29 - 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 cleaner bypass flap valve -N275- is located on the outside of the air cleaner housing
- ☐ Air cleaner - exploded view ⇒ [page 38](#)

Engine compartment (left-side)

Components A to K are not shown in the illustration.

1 - Exhaust gas temperature sender 3 -G495-

- ☐ Fitting location
⇒ [page 25](#)

2 - NOx sender -G295-

- ☐ Fitting location
⇒ [page 25](#)

3 - Lambda probe -G39-

- ☐ Fitting location
⇒ [page 25](#)

4 - Engine control unit -J623-

- ☐ Fitting location
⇒ [page 22](#)
- ☐ Removing and installing
⇒ [page 113](#)

5 - Charge pressure sender - G31-

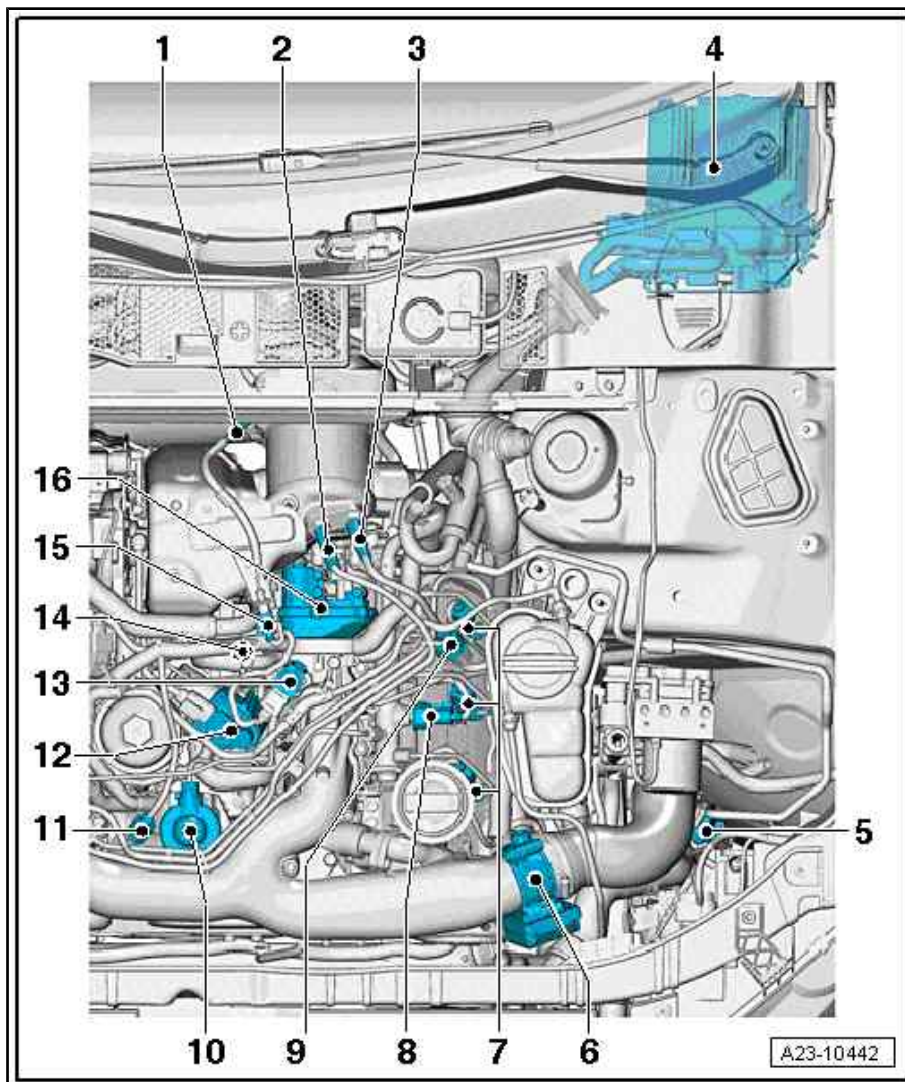
- ☐ With intake air temperature sender -G42-
- ☐ Fitting location
⇒ [page 25](#)
- ☐ Removing and installing
⇒ Rep. gr. 21

6 - Throttle valve module - J338-

- ☐ 9 Nm

7 - Injectors (piezo injectors)

- ☐ Cylinder bank 2
- ☐ Removing and installing



⇒ [page 90](#)

8 - Fuel pressure sender -G247-

- ☐ Fitting location ⇒ [page 23](#)
- ☐ Removing and installing ⇒ [page 102](#)

9 - Connector for Lambda probe -G39-

- ☐ Fitting location ⇒ [page 25](#)

10 - High-pressure fuel pump

- ☐ With fuel metering valve -N290-
- ☐ After renewing high-pressure pump, first fuel filling operation MUST be performed (it is important not to allow pump to run while it is still empty) ⇒ [page 74](#)
- ☐ After renewing high-pressure pump or fuel pressure regulating valve -N276- , learnt values must be re-adapted; see "Guided Functions" in vehicle diagnostic tester
- ☐ High-pressure pump - exploded view ⇒ [page 69](#)
- ☐ Removing and installing ⇒ [page 72](#)

11 - Fuel metering valve -N290-

12 - Exhaust gas recirculation control motor -V338-

- ☐ Fitting location ⇒ [page 24](#)

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

- ☐ Fitting location ⇒ [page 24](#)

14 - Exhaust gas recirculation temperature sensor -G98-

- ☐ Fitting location ⇒ [page 24](#)
- ☐ Removing and installing ⇒ Rep. gr. 26

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

16 - Intake manifold flap 2 motor -V275-

A - Relay and fuse holder in electronics box in plenum chamber (left-side)

- ☐ Removing and installing engine control unit -J623- with altitude sensor ⇒ [page 115](#)
- ☐ Fitting locations ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

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

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

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

- ☐ In footwell on brake pedal

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

- ☐ Fitting location ⇒ [page 22](#)
- ☐ Removing and installing ⇒ Rep. gr. 20

E - Exhaust gas temperature sender 1 -G235-

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

F - Engine speed sender -G28-

- ☐ Fitting location ⇒ [page 26](#)

G - Supplementary fuel pump -V393-

- ☐ Fitting location ⇒ [page 26](#)
- ☐ Removing and installing ⇒ Rep. gr. 20

H - Oil pressure switch -F22-

- ☐ Fitting location ⇒ [page 25](#)
- ☐ Removing and installing ⇒ Rep. gr. 17

I - Valve for oil pressure control -N428-

- ☐ Fitting location ⇒ [page 25](#)
- ☐ Removing and installing ⇒ Rep. gr. 17

J - Glow plugs

- ☐ Glow plug 1 -Q10-
- ☐ Glow plug 2 -Q11- with cylinder 2 combustion chamber pressure sender -G678-
- ☐ Glow plug 3 -Q12-
- ☐ Glow plug 4 -Q13-
- ☐ Glow plug 5 -Q14- with cylinder 5 combustion chamber pressure sender -G681-
- ☐ Glow plug 6 -Q15-
- ☐ Removing and installing ⇒ [page 121](#)

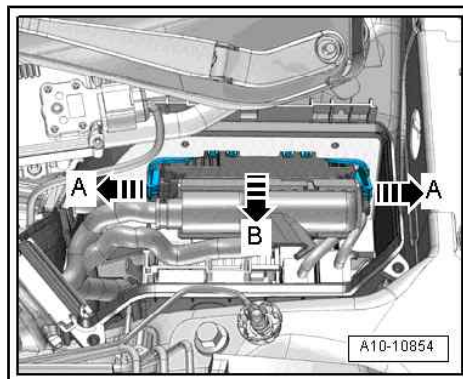
K - Particulate filter

- ☐ Fitted on underbody
- ☐ Combined with a catalytic converter
- ☐ Adaption must be performed after renewing this component
- ☐ Removing and installing ⇒ Rep. gr. 26

After renewing exhaust gas pressure sensor 1 -G450- and/or particulate filter, adaption must be performed in order to reset learnt values. The adaption procedure is described in the Guided Fault Finding or Guided Functions; use a vehicle diagnostic tester .

Fitting location of engine control unit -J623-

- ◆ In left electronics box in engine compartment

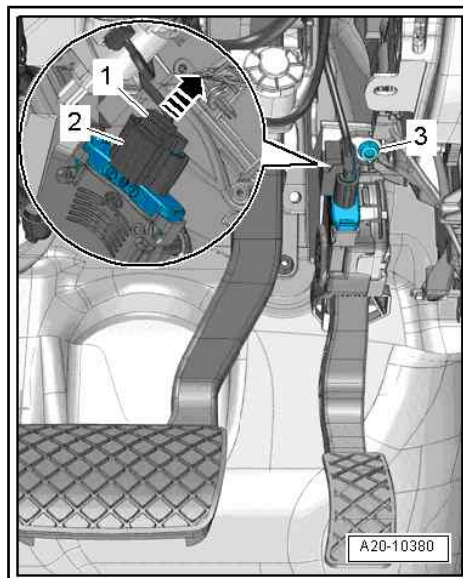


Accelerator position sender -G79- and accelerator position sender 2 -G185-

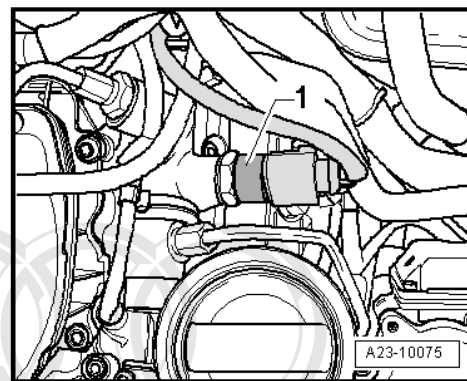


Note

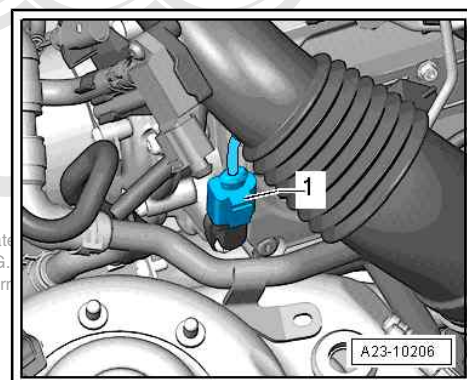
The accelerator position sender -G79- and accelerator position sender 2 -G185- are integrated in the accelerator pedal module and cannot be renewed individually.



Fuel pressure sender -G247- -1- on cylinder bank 2 (left-side)

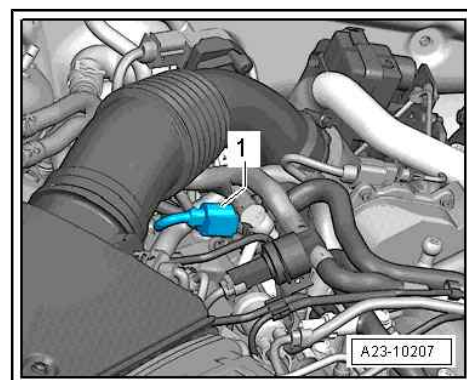


Hall sender -G40- -1- on cylinder bank 1 (right-side)



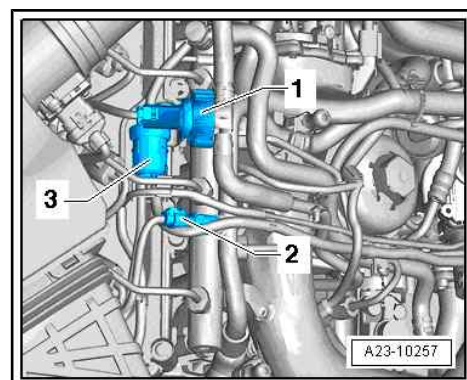
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Fuel pressure regulating valve -N276- -1-



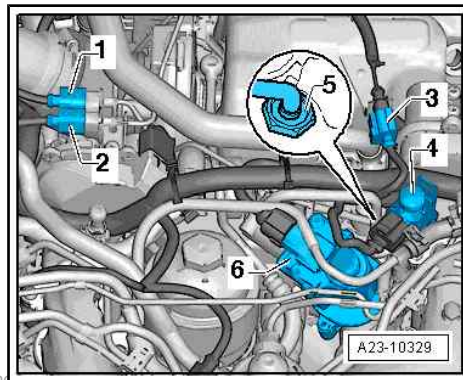
Components on cylinder bank 1 (right-side)

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

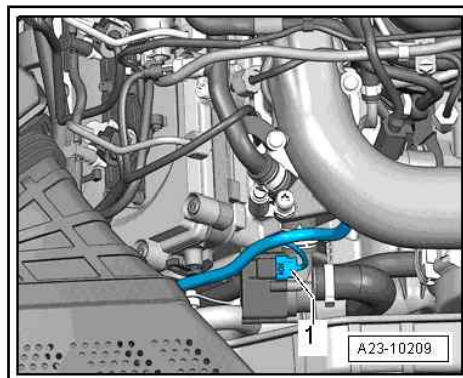


Fitting locations

- 1 - Electrical connector for exhaust gas recirculation temperature sensor -G98-
- 2 - Electrical connector for exhaust gas temperature sender 1 - G235-
- 3 - Electrical connector for exhaust gas temperature sender 3 - G495-
- 4 - Exhaust gas recirculation cooler change-over valve -N345-
- 5 - Exhaust gas recirculation temperature sensor -G98-
- 6 - Exhaust gas recirculation control motor -V338-

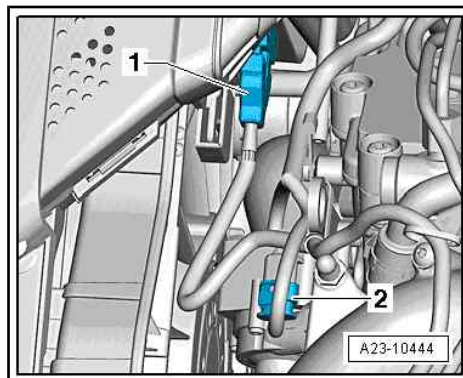


Pump for exhaust gas recirculation cooler -V400- -1-

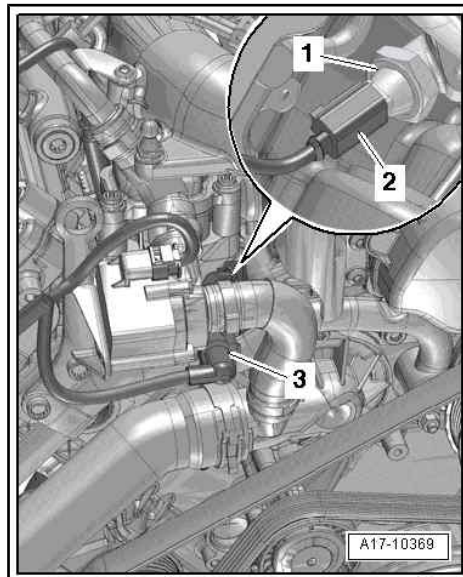


Fitting locations (front right)

- 1 - Control unit for NOx sender -J583-
- 2 - Pump for exhaust gas recirculation cooler -V400-

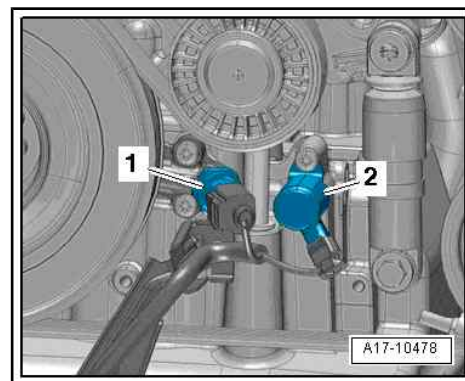


Oil pressure switch for reduced oil pressure -F378- -1-

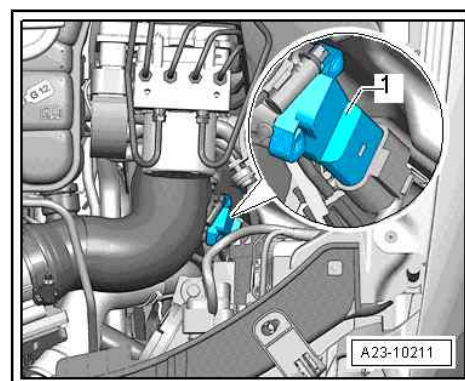


Oil pressure control

- 1 - Oil pressure switch -F22-
- 2 - Valve for oil pressure control -N428-

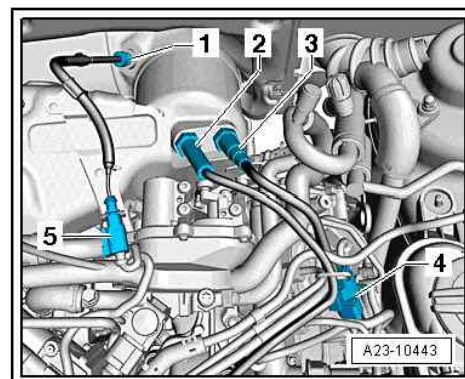


Charge pressure sender -G31- with intake air temperature sender -G42- -1-



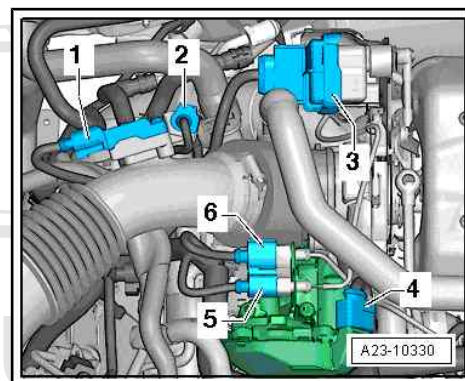
Fitting locations

- 1 - Exhaust gas temperature sender 3 -G495-
- 2 - NOx sender -G295-
- 3 - Lambda probe -G39-
- 4 - Connector for Lambda probe -G39-
- 5 - Electrical connector for exhaust gas temperature sender 3 - G495-



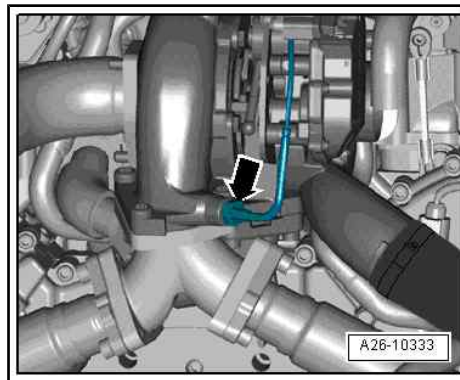
Fitting locations

- 1 - Pressure differential sender -G505-
- 2 - Electrical connector for exhaust gas temperature sender 4 - G648-
- 3 - Control unit for turbocharger 1 -J724-
- 4 - Intake manifold flap motor -V157-
- 5 - Electrical connector for exhaust gas temperature sender 1 - G235-
- 6 - Electrical connector for exhaust gas recirculation temperature sensor -G98-

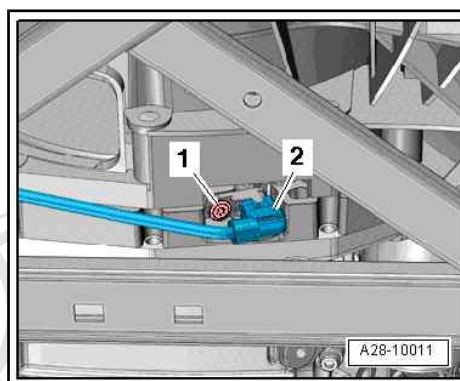


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Exhaust gas temperature sender 1 -G235- -arrow-



Engine speed sender -G28- -2-



Supplementary fuel pump -V393- -3-

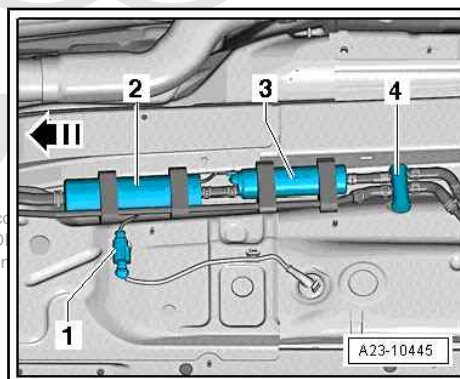
- 1 - Electrical connector for supplementary fuel pump -V393-
- 2 - Fuel filter
- 3 - Supplementary fuel pump -V393-
- 4 - Preheating valve

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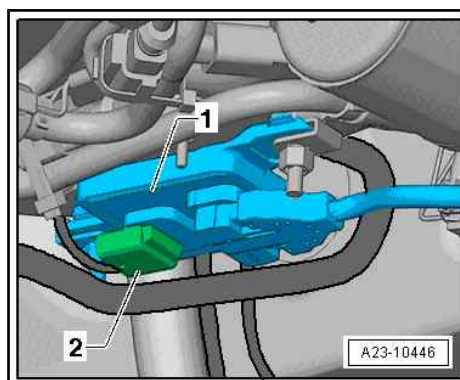
Note

-Arrow- points in direction of travel.



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

Underneath cover for active tank, in front of rear left wheel



4 Fuel system - overview



WARNING

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

The first fuel filling operation is only required on vehicles with engine codes CAMA, CAMB, CCWA, CCWB, CGKA, CGKB and CCLA.



Caution

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

- ◆ *If components of the fuel system between the fuel tank and the high-pressure pump are removed or renewed, the fuel system must be bled ➔ [page 37](#).*
- ◆ *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.*

Performing first fuel filling after installing high-pressure pump ➔ [page 74](#)

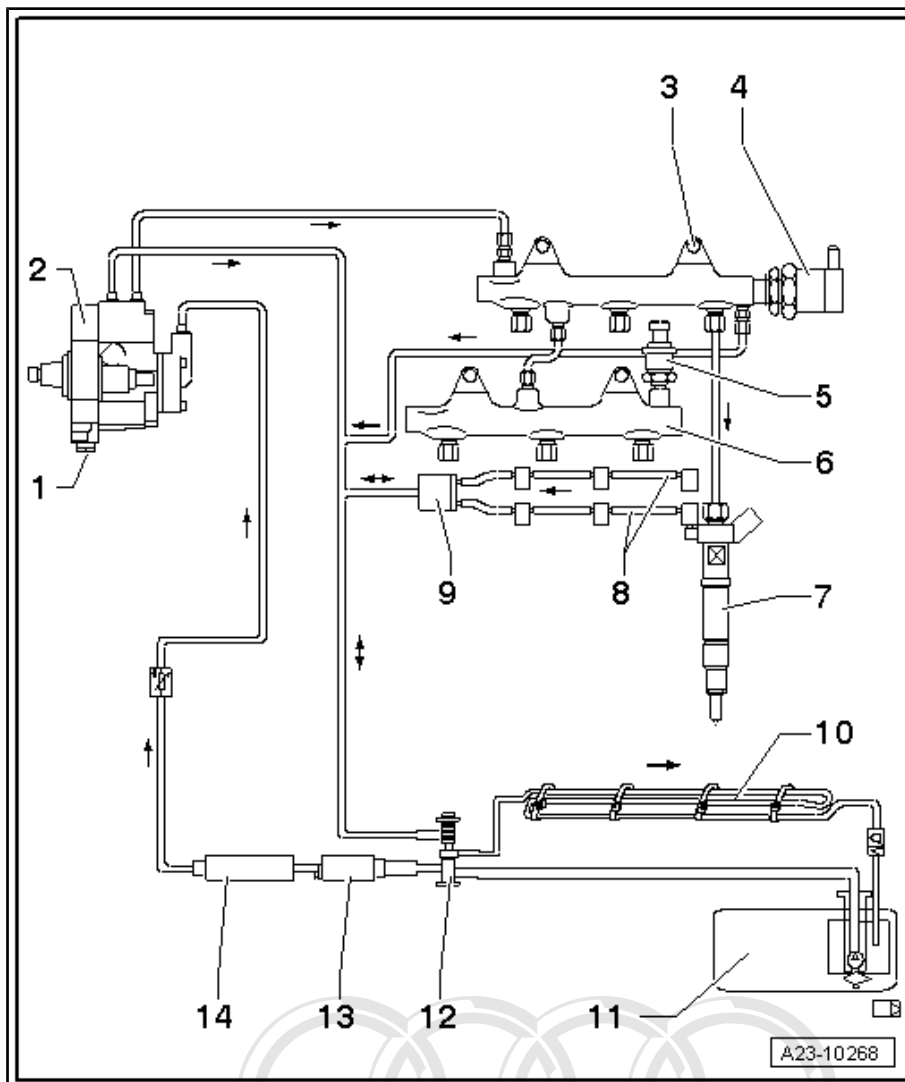
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1 - Fuel metering valve -N290-

- ❑ Do not unscrew

2 - High-pressure fuel pump

- ❑ With fuel metering valve -N290-
- ❑ On vehicles with engine codes CAMA, CAMB, CCWA, CCWB, CGKA, CGKB and CCLA, a first fuel filling operation **MUST** be performed after the high-pressure pump has been renewed (the pump must **NOT** be allowed to run while it is still empty)
⇒ [page 74](#)
- ❑ On vehicles with engine codes CAMA, CAMB, CCWA, CCWB, CGKA, CGKB, and CCLA, the learnt values must be re-adapted after renewing the high-pressure pump or the fuel pressure regulating valve - N276- ; see "Guided Functions" in vehicle diagnostic tester
- ❑ High-pressure pump - exploded view, engine codes CAMA, CAMB, CCWA, CCWB, CGKA, CGKB, CCLA
⇒ [page 69](#)
- ❑ Removing and installing, engine codes CA-



MA, CAMB, CCWA,
CCWB, CGKA, CGKB, CCLA ⇒ [page 72](#)

- ☐ High-pressure pump - exploded view, engine code CAPA ⇒ [page 76](#)
- ☐ Removing and installing, engine code CAPA ⇒ [page 77](#)

3 - Fuel rail

- ☐ Cylinder bank 1

4 - Fuel pressure regulating valve -N276-

- ☐ On cylinder bank 1
- ☐ Cannot be re-installed
- ☐ On vehicles with engine codes CAMA, CAMB, CCWA, CCWB, CGKA, CGKB, and CCLA, the learnt values must be re-adapted after renewing the high-pressure pump or the fuel pressure regulating valve -N276- ; see "Guided Functions" in vehicle diagnostic tester
- ☐ Removing and installing ⇒ [page 100](#)

5 - Fuel pressure sender -G247-

- ☐ 30 Nm
- ☐ On cylinder bank 2
- ☐ Removing and installing ⇒ [page 102](#)

6 - Fuel rail

- ☐ For cylinder bank 2

7 - Injectors

- ☐ Injectors 1 ... 6
- ☐ Removing and installing ⇒ [page 90](#)

8 - Fuel return lines

- ☐ The fuel return lines must not be dismantled; if necessary they must be renewed as a complete 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 or restrictor

- ☐ Which component is installed depends on the model year
- ☐ Maintains a residual pressure in fuel return hoses
- ☐ Cannot be renewed separately; if defective, renew fuel return hoses
- ☐ Checking pressure retention valve ⇒ [page 88](#)
- ☐ Checking restrictor ⇒ [page 89](#)

10 - Fuel cooler

- ☐ Fitted on underbody

11 - Fuel tank

- ☐ With fuel system pressurisation pump -G6-

12 - Preheating valve

13 - Supplementary fuel pump -V393-

- ☐ Only fitted on vehicles with engine codes CAMA, CAMB, CCWA, CCWB, CGKA, CGKB, CCLA

14 - Fuel filter

- ☐ Fuel filter - exploded view ⇒ Rep. gr. 20
- ☐ Renewing fuel filter ⇒ Rep. gr. 20

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5 Exploded view - fuel system (CAMA, CAMB, CCWA, CCWB, CGKA, CGKB, CCLA)



WARNING

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



Caution

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

- ◆ *If components of the fuel system between the fuel tank and the high-pressure pump are removed or renewed, the fuel system must be bled ➔ [page 37](#).*
- ◆ *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.*

Performing first fuel filling after installing high-pressure pump ➔ [page 74](#)



Note

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



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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

4 - Fuel temperature sender - G81-

5 - Bolt

6 - Bracket

7 - Fuel pressure regulating valve -N276-

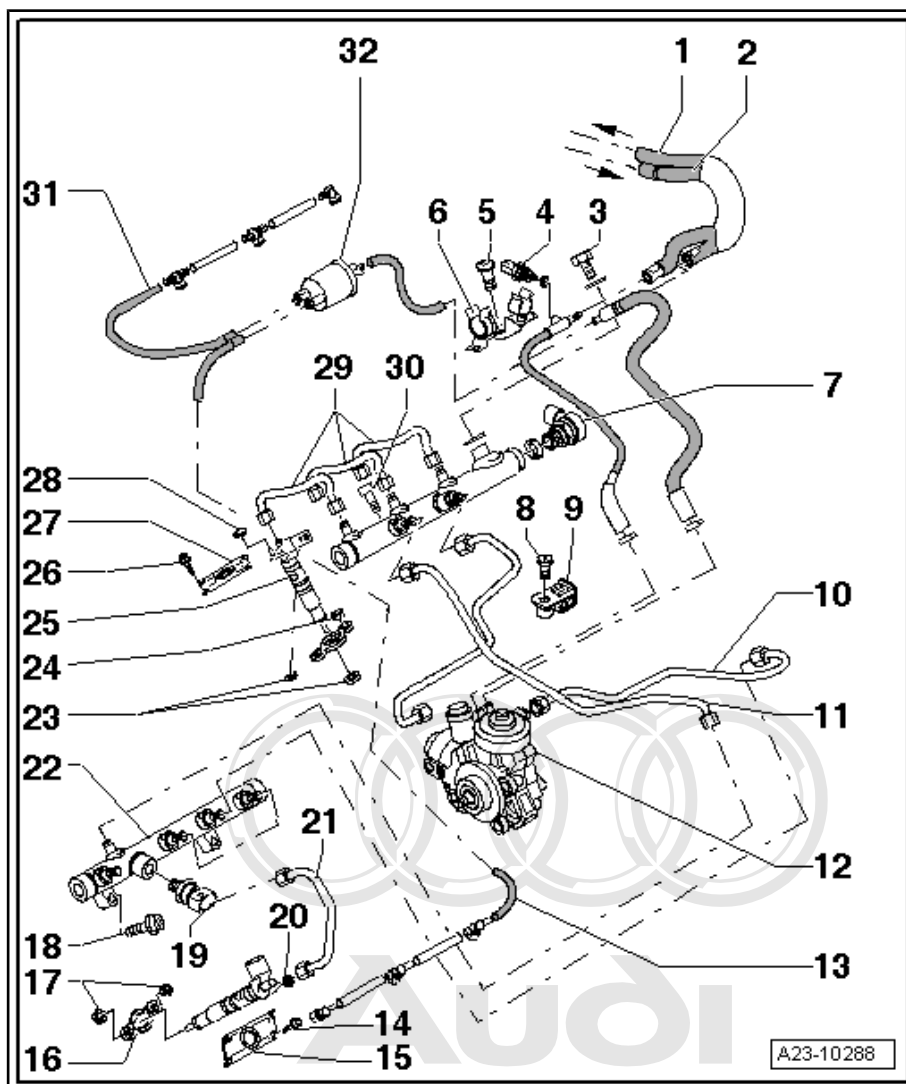
- ☐ Located on cylinder bank 1
- ☐ Cannot be re-installed
- ☐ After renewing high-pressure pump or fuel pressure regulating valve -N276-, learnt values must be re-adapted; see "Guided Functions" in vehicle diagnostic tester
- ☐ Removing and installing
 ➔ [page 100](#)

8 - Bolt

9 - Bracket

10 - High-pressure fuel pipe

- ☐ Between high-pressure



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pump and fuel rail

11 - High-pressure fuel pipe

- ☐ Between fuel rail on cylinder bank 1 and fuel rail 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 74](#)
- ☐ After renewing high-pressure pump or fuel pressure regulating valve -N276- , learnt values must be re-adapted; see "Guided Functions" in ⇒ Vehicle diagnostic tester
- ☐ ⇒ ["12.1 Exploded view - high-pressure pump", page 69](#)
- ☐ Removing and installing ⇒ [page 72](#)

13 - Fuel return lines

- ☐ The fuel return lines must not be dismantled; if necessary they must be renewed as a complete 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.

14 - Bolt

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

15 - Cover for injector

16 - Clamping piece

- ☐ If they are to be re-installed, the injectors and clamping pieces must always be re-fitted on the same cylinder.
- ☐ When an injector is renewed, the corresponding clamping piece must be renewed at the same time.

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-

- ☐ 30 Nm
- ☐ Located on cylinder bank 2
- ☐ Removing and installing ⇒ [page 102](#)

20 - Seal

- ☐ Renew

21 - High-pressure fuel pipes

- ☐ For cylinder bank 2
- ☐ 25 Nm

22 - Fuel rail

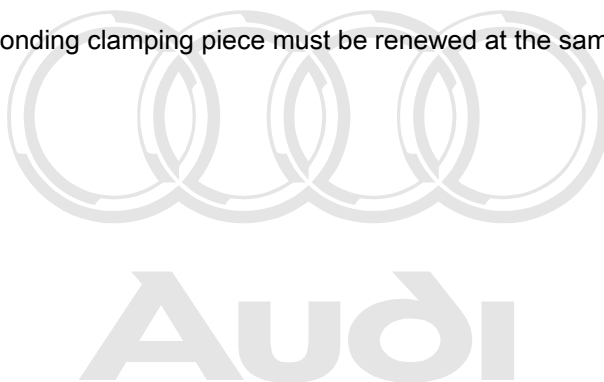
- ☐ For cylinder bank 2

23 - Seals

- ☐ Renew

24 - Hexagon flange nut

- ☐ For clamping piece
- ☐ 10 Nm



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25 - Injector

- ☐ Mark allocation for re-installation; pay attention to marking when installing
- ☐ Removing and installing ⇒ [page 90](#)

26 - Bolt

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

27 - Cover for injector

28 - Seal

- ☐ Renew

29 - High-pressure 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 as a complete 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

32 - Pressure retention valve or restrictor

- ☐ Which component is installed depends on the model year
- ☐ Maintains a residual pressure in fuel return hoses
- ☐ Cannot be renewed separately; if defective, renew fuel return hoses
- ☐ Checking pressure retention valve ⇒ [page 88](#)
- ☐ Checking restrictor ⇒ [page 89](#)



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6 Exploded view - fuel system (CAPA)



WARNING

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

1 - Fuel supply line

- ☐ From fuel filter

2 - Fuel return line

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

3 - Banjo bolt for fuel return line

4 - Hose clip

5 - Fuel temperature sender - G81-

6 - Hose clip

7 - Fuel pressure regulating valve -N276-

- ☐ Located on cylinder bank 1
- ☐ Cannot be re-installed
- ☐ Removing and installing ➔ [page 100](#)

8 - Banjo bolt for fuel return line

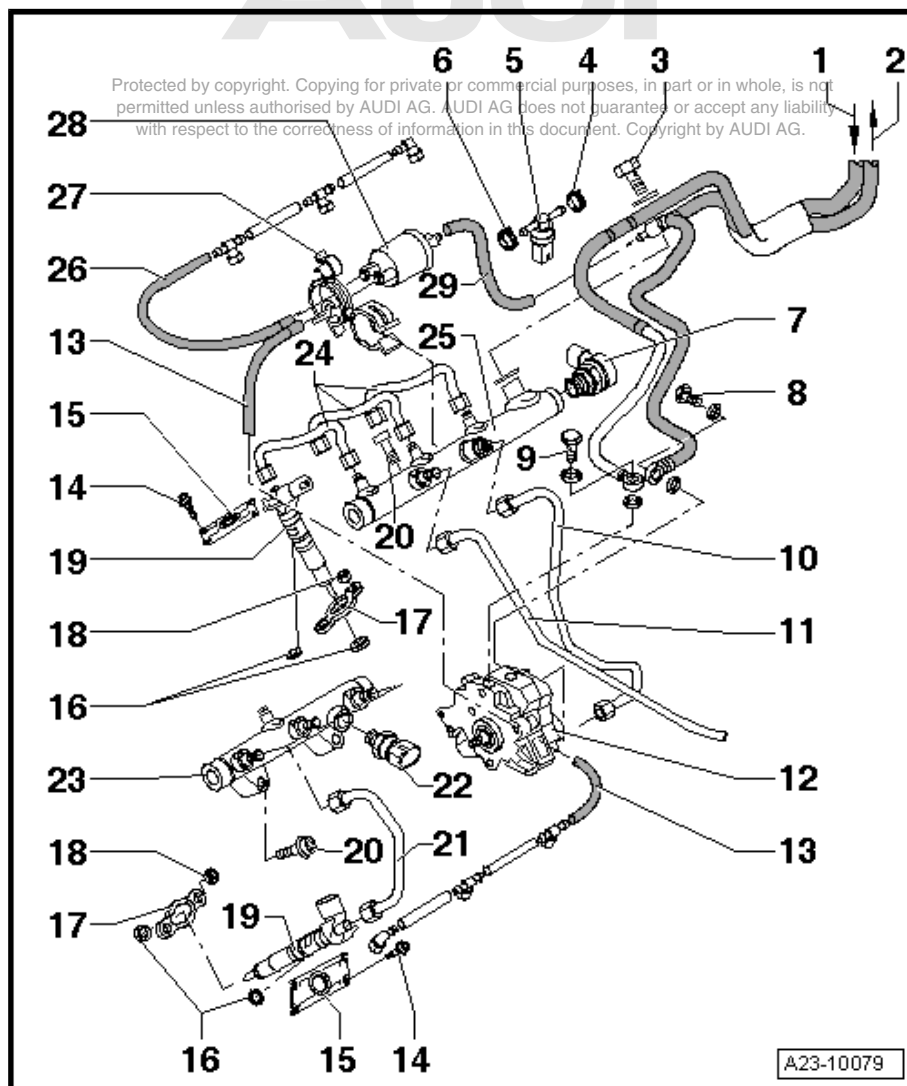
- ☐ 25 Nm

9 - Banjo bolt for fuel supply line

- ☐ 25 Nm

10 - High-pressure fuel pipe

- ☐ Between high-pressure pump and fuel rail on



cylinder bank 1

11 - High-pressure fuel pipe

- ☐ Between fuel rail on cylinder bank 1 and fuel rail 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 they are to be re-installed, the injectors, high-pressure fuel pipes and clamping pieces must always be re-fitted in their original positions (i.e. on the same cylinder)

12 - High-pressure fuel pump

- ☐ With fuel metering valve -N290-
- ☐ High-pressure pump - exploded view ⇒ [page 76](#)
- ☐ Removing and installing ⇒ [page 77](#)

13 - Fuel return line

- ☐ The fuel return lines must not be dismantled; if necessary they must be renewed as a complete 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

14 - Bolt

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

15 - Cover for injector

16 - Seal

17 - Clamping piece

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- ☐ If they are to be re-installed, the injectors and clamping pieces must always be re-fitted on the same cylinder.
- ☐ When an injector is renewed, the corresponding clamping piece must be renewed at the same time.

18 - Hexagon flange nut

- ☐ For clamping piece
- ☐ 10 Nm

19 - Injector

- ☐ Removing and installing ⇒ [page 90](#)

20 - Bolt

- ☐ 22 Nm

21 - High-pressure pipes

- ☐ For cylinder bank 2
- ☐ 25 Nm

22 - Fuel pressure sender -G247-

- ☐ 30 Nm
- ☐ Located on cylinder bank 2
- ☐ Removing and installing ⇒ [page 102](#)

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 line

- ☐ The fuel return lines must not be dismantled; if necessary they must be renewed as a complete 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

27 - Retainer

- ☐ For fuel return line

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 piezo injectors
- ☐ The pressure retention valve may only be renewed together with the fuel return lines
- ☐ After replacement, engine must be run at idling speed for approx. 2 minutes to bleed fuel system
- ☐ Checking pressure retention valve ➔ [page 88](#)

29 - Fuel return line

- ☐ Common return line to fuel tank



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7 Bleeding fuel system (CAMA, CAMB, CCWA, CCWB, CGKA, CGKB, CCLA)

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).

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

- There must be sufficient fuel in the tank.
- Connect a vehicle diagnostic tester .
- Switch on ignition.
- Select “Engine electronics” in vehicle self-diagnosis.
- Then select “Basic setting”.
- Select “Checking fuel system pressurisation pump” from the list.
- Press “start” button.
- The fuel pumps start running.
- The fuel pump must run for approx. 3 minutes to ensure that the fuel system is filled sufficiently with fuel.



Note

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

- Start engine after filling fuel system.
- Run engine at moderate speed for several minutes and then switch off.
- Check fuel system for leaks.
- Erase 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 high-pressure section of the fuel system again for leaks.



Note

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

- Interrogate event memory.

8 Air cleaner

8.1 Exploded view - air cleaner

1 - Hose clip

2 - Air hose

- ☐ To throttle valve module -J338-
- ☐ When installing, pay attention to marking
⇒ [page 39](#)

3 - Hose clip

4 - Air mass meter

- ☐ Removing and installing air mass meter -G70- with intake air temperature sender -G42-
⇒ [page 97](#)

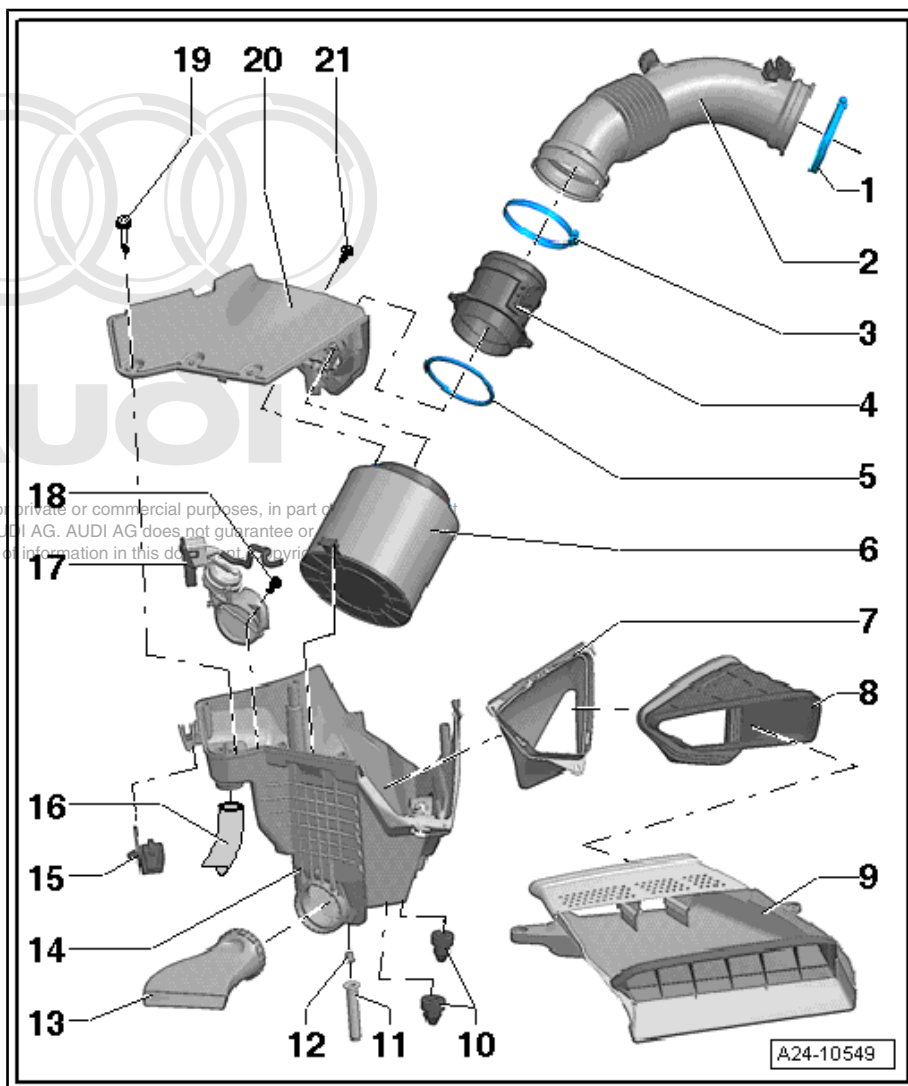
- ☐ 5 Nm

5 - O-ring

- ☐ Renew if damaged

6 - Air filter element

- ☐ Always use genuine part for air filter element
- ☐ For maintenance intervals refer to ⇒ Maintenance ; Booklet 811 (for A5 Coupé); ⇒ Maintenance ; Booklet 812 (for A4); or ⇒ Maintenance ; Booklet 818 (for A5 Cabriolet)
- ☐ Removing and installing
⇒ [page 40](#)
- ☐ Also clean snow screen



(if fitted)

7 - Air duct

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

8 - Air duct

- ☐ Clean dirt and leaves out of air duct

9 - Air duct

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

10 - Rubber grommet

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11 - Water drain hose

- ☐ Clean any leaves and dirt out of water drain hose (important)

12 - Guide for water drain hose

13 - Hot air intake (countries with cold climates only)

- ☐ Slide hot air intake into air cleaner as far as stop; then turn clockwise until it engages noticeably

14 - Air cleaner (bottom section)

- ☐ Clean any salt residue, leaves and dirt out of air cleaner (bottom section)
- ☐ Check for dirt in water drain and clean as required (important)

15 - Retainer for air cleaner (bottom section)

16 - Intake hose for secondary air pump

- ☐ Installed on petrol engines only

17 - Air filter bypass flap valve -N275-

- ☐ With flap for variable intake manifold change-over

18 - Bolt

- ☐ For air filter bypass flap valve -N275-

19 - Bolt

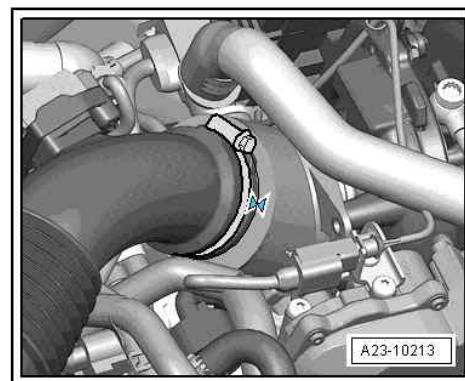
20 - Air cleaner (top section)

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

21 - Bolt

- ☐ For securing air filter element

Pay attention to arrows when installing intake hose.



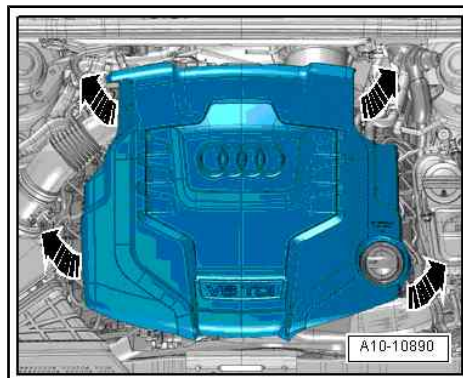
8.2 Removing and installing engine cover panel

Removing

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

Installing

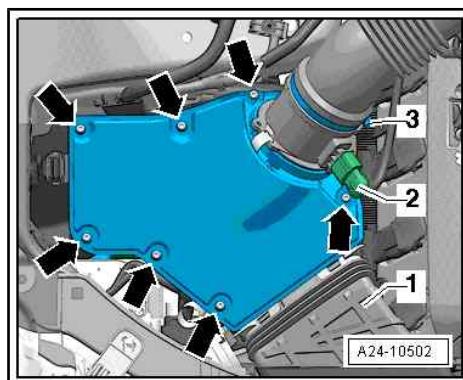
- To avoid damage, do not strike the engine cover panel with your fist or with any kind of tool.
- Position engine cover panel on engine (note locations of oil filler neck and oil dipstick).
- Press engine cover panel with both hands into the rubber grommets at the rear and then into the grommets at the front.



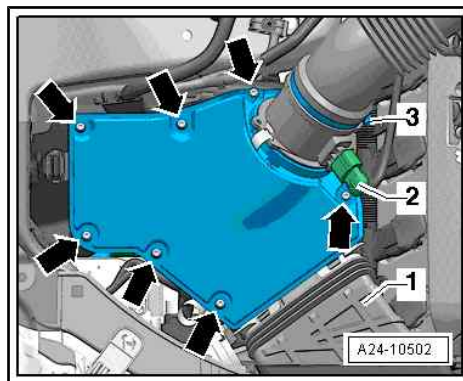
8.3 Removing and installing air filter element

Removing

- Remove air duct -1-.
- Unplug electrical connector -2- at air mass meter -G70- .



- Release hose clip -3- and detach air hose from air mass meter -G70- .
- Remove bolts -arrows- from air cleaner (top section) and lift out air cleaner (top section).



- Remove 2 securing bolts -arrows- from air filter element.
- Take out air filter element.

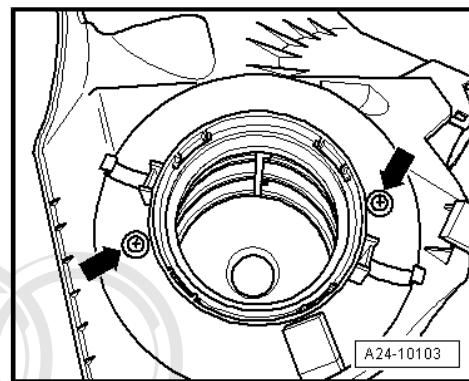
Installing

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

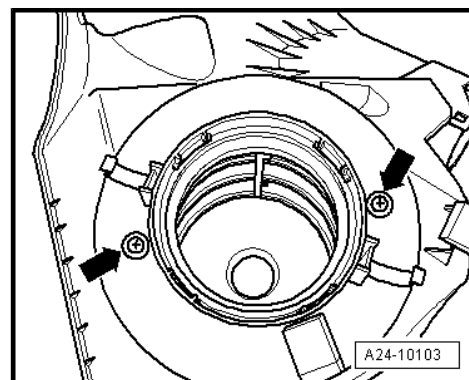
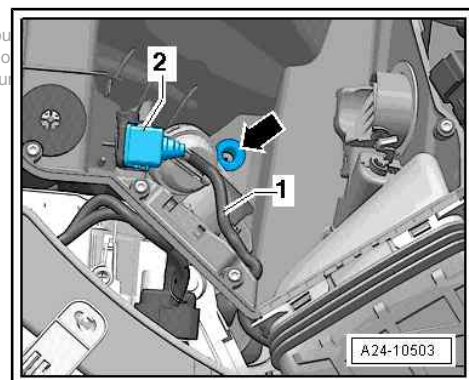


Note

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



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



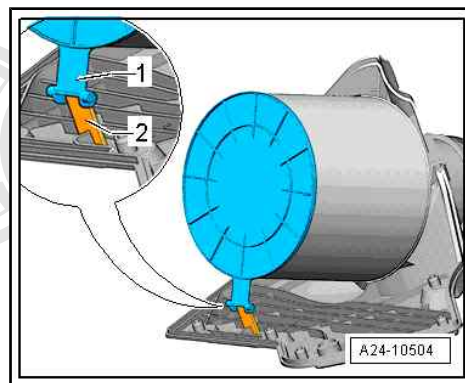
- Lug on air filter element -1- must make contact with lug on air cleaner housing -2-.
- Fit the top section of the air cleaner carefully on the bottom section, without using force.



Note

Before tightening bolts, make sure that top section of air cleaner is inserted into groove on bottom section of air cleaner (to prevent air leaks).

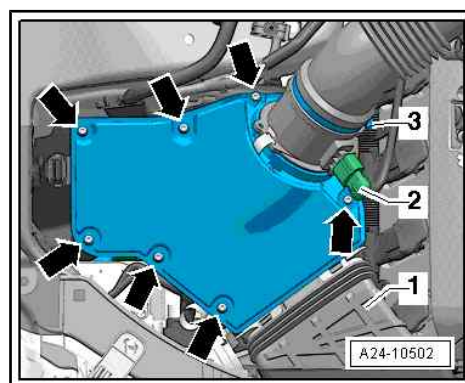
- Then screw top section of air cleaner back onto bottom section.
- Ensure secure fit of air hose at air mass meter -G70-.
- Re-connect electrical connector at air mass meter -G70-.
- The remaining installation steps are carried out in the reverse sequence.



8.4 Removing air cleaner (bottom section)

Removing

- Remove cover above radiator grille (4 bolts).
- Remove air duct -1-.
- Unplug electrical connector -2- at air mass meter -G70- .
- Release hose clip -3- and detach air hose from air mass meter -G70- .



- Detach vacuum hose -1-.
- Release retainer for bottom section of air cleaner (press in rubber on left and right side and pull upwards).
- Unplug electrical connector at air filter bypass flap valve - N275- -2-.
- Carefully take out air cleaner (bottom section).

Installing

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



Note

- ◆ *If the air filter element is very dirty or wet, dirt or water could reach the air mass meter -G70- and affect the air mass value. This would lead to loss of power, since a smaller injection quantity is calculated.*
- ◆ *Always use genuine part for air filter element.*
- ◆ *Use a silicone-free lubricant when installing the intake hose.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue*
- ◆ *Do not use lubricant when installing retainer.*

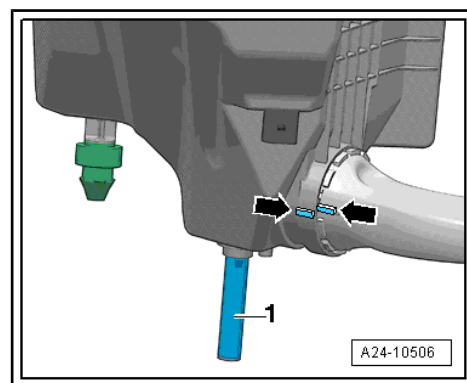
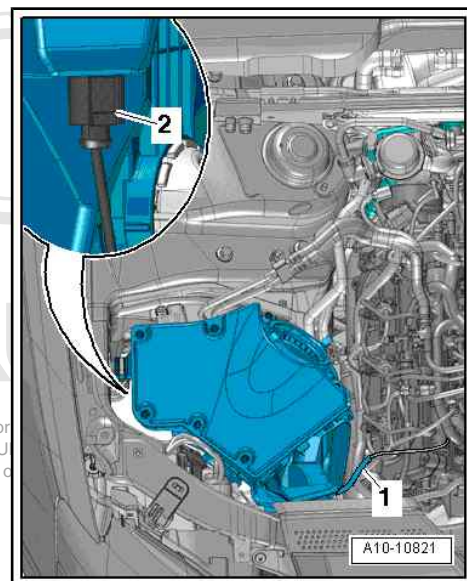
- If hot air intake is fitted (for countries with cold climates only), make sure that air intake connection has engaged properly -arrows- (pay attention to markings).
- Check water drain hose -1- in air cleaner (bottom section) for dirt and other obstructions (clean if necessary).
- Check for salt residue, dirt and leaves in air mass meter and air intake hose (engine intake side).
- Check for dirt in air duct leading to air filter element.
- Plug in electrical connector at air filter bypass flap valve -N275- again.
- Re-install air cleaner (bottom section).



Note

The water drain hose must be routed straight downwards and must not be kinked.

- Slide vacuum hose for air filter bypass flap valve -N275- back on.



9 Intake manifold

9.1 Exploded view - intake manifold



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 45](#)

9 - Seal

- ☐ Renew

10 - Screw plug

- ☐ 10 Nm

11 - Bolt

- ☐ 9 Nm

12 - Mounting pin for engine cover panel

- ☐ 5 Nm

13 - Bolt

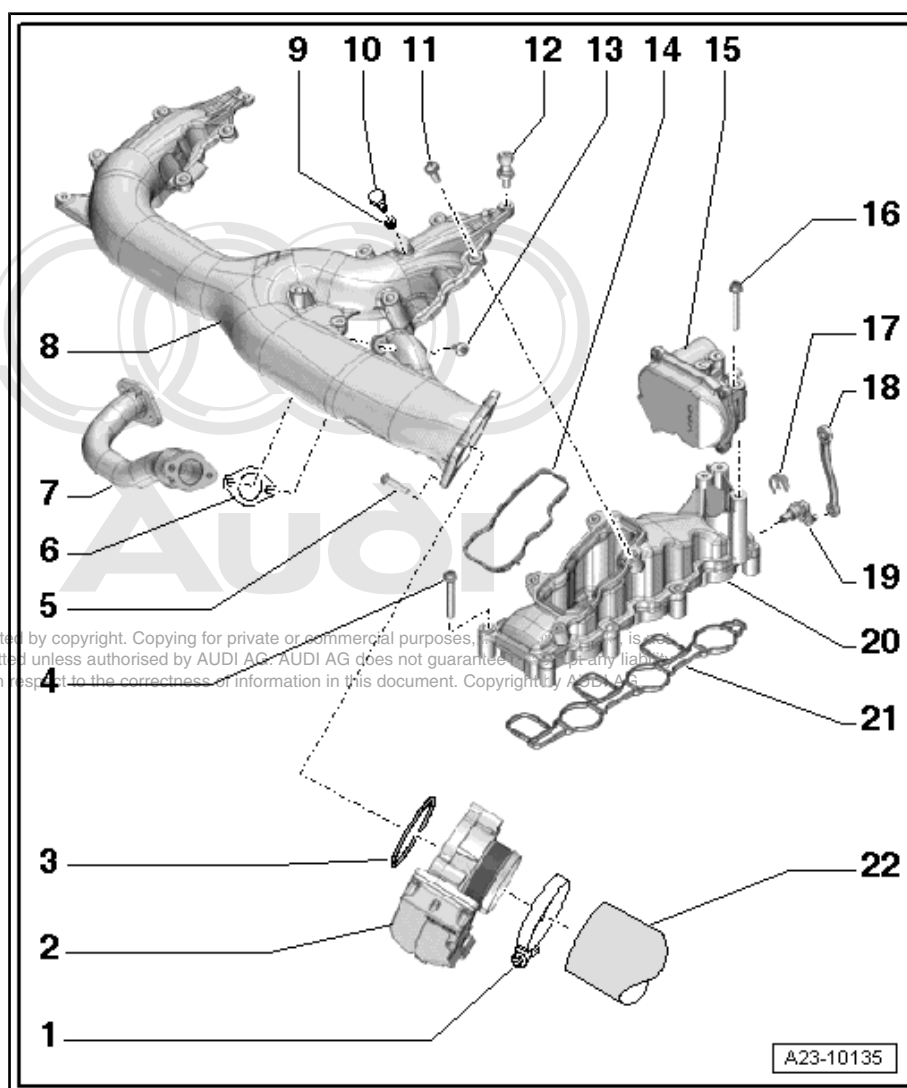
- ☐ 9 Nm

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 - Coupling

20 - Intake manifold (bottom section)

21 - Gasket

- ☐ Check for damage and renew if necessary

22 - Air hose

- ☐ Must be free of oil and grease when installing

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9.2 Removing and installing intake manifold (top section)

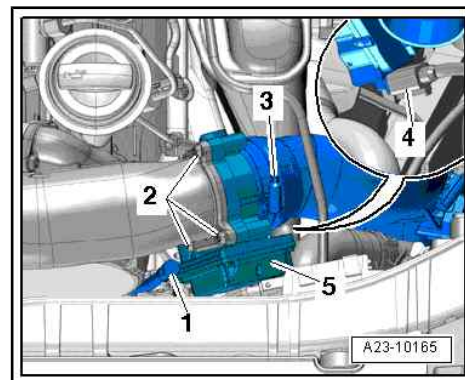
Removing



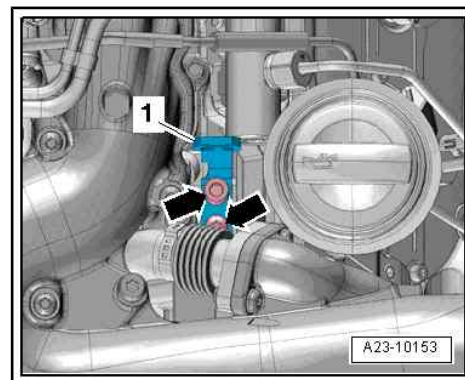
WARNING

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

- Remove engine cover panel ➔ [page 40](#).
- 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 -arrows- and remove engine lifting eye (front left) -1-.



Vehicles with engine codes CAMA, CAMB, CCWA, CCWB, CGKA, CGKB, CCLA:

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


Note

Disregard -items 2 and 3-.

Vehicles with engine code CAPA:

- Unscrew union nuts -1- and -3-.
- Move high-pressure pipes clear and detach.


Note

Disregard item -2-.

All vehicles (continued):

- Unscrew mounting pins for engine cover panel -1- and -2-.
- Remove bolts -arrows- and detach intake manifold (top section).

Installing

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

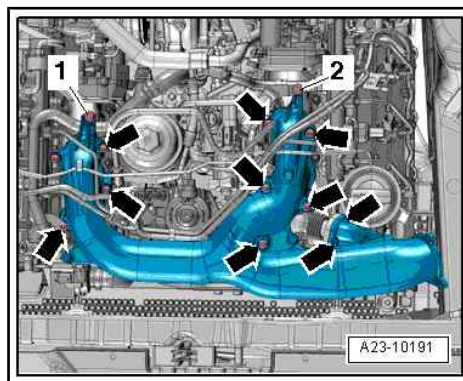
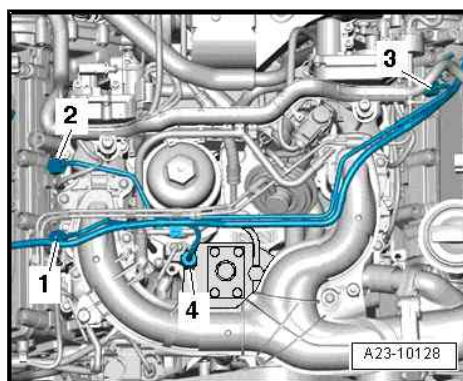
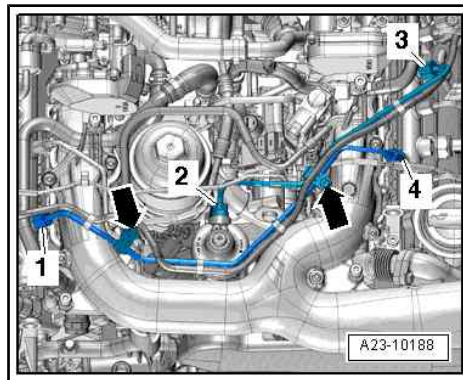
- Tightening torques: refer to exploded view of intake manifold ➔ [page 44](#)


Note

- ◆ *Renew seals and gaskets.*
- ◆ *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ➔ Parts catalogue.*
- ◆ *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

Vehicles with engine codes CAMA, CAMB, CCWA, CCWB, CGKA, CGKB, CCLA:

- Install high-pressure pipe ➔ [page 97](#) .



9.3 Removing and installing intake manifold (bottom section, left-side)

Removing



WARNING

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

Vehicles with engine codes CAMA, CAMB, CCWA, CCWB, CGKA, CGKB, CCLA:

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

Vehicles with engine code CAPA:

- Unscrew union nuts -1- and -3-.
- Move high-pressure pipes clear and detach.

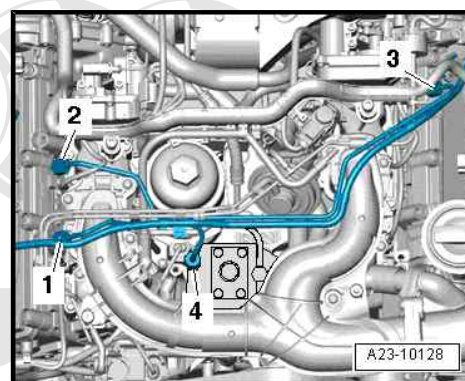
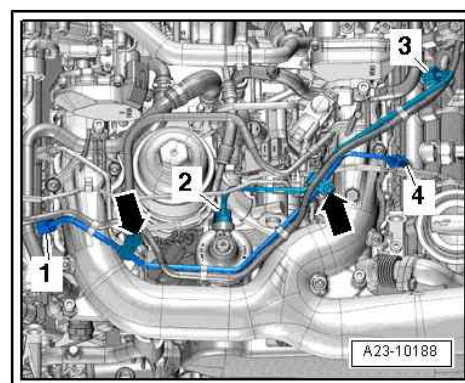


Note

Disregard item -2-.

All vehicles (continued):

- Remove intake manifold (top section) ➔ [page 45](#).



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

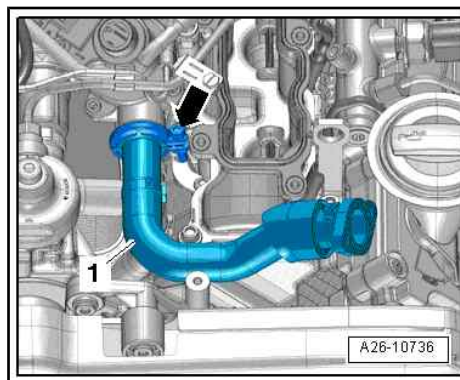
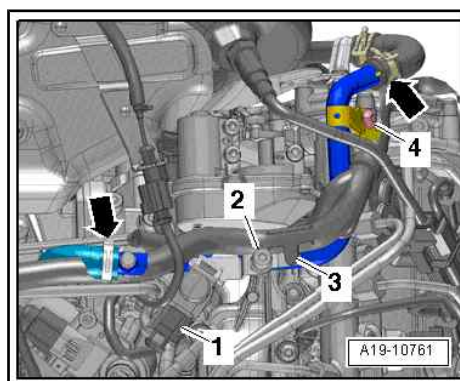
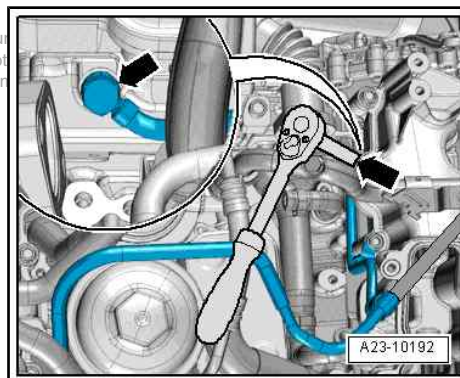
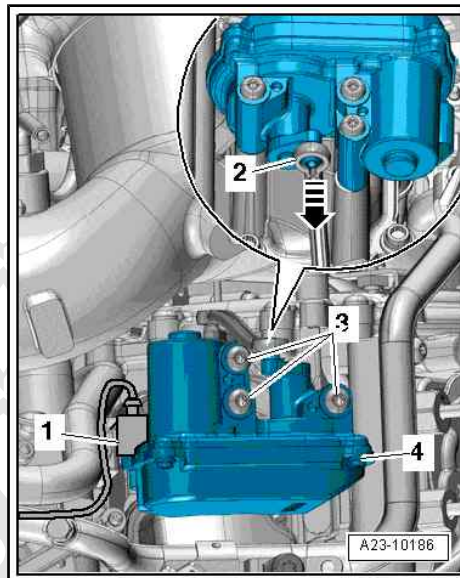
Vehicles with engine codes CAPA, CAMA, CAMB:

- Use jointed wrench to unscrew banjo bolt -arrow- securing coolant bleeder line.

Vehicles with engine codes CCWA, CCWB, CGKA, CGKB, CCLA:

- Remove bolt -4-.

- Release clamp -arrow- and detach exhaust gas recirculation pipe -1-.

All vehicles (continued):


- Remove bolts -arrows-.
- Press coolant bleeder line to one side and detach bottom section of intake manifold (left-side) to the front.



Note

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

Installing

- Tightening torques: refer to exploded view of intake manifold ➔ [page 44](#) .

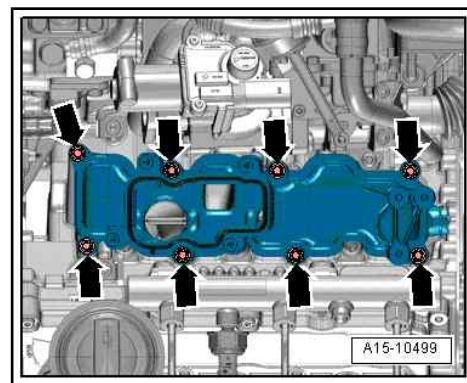
Installation is carried out in the reverse order; note the following:



Note

Renew seals and gaskets.

- Before installing intake manifold (bottom section), screw in banjo bolt for coolant bleeder pipe 2 to 3 turns with new seals (only for vehicles with engine codes CAPA, CAMA, CAMB).
- Tighten banjo bolt for coolant bleeder line to 15.5 Nm.
- Install intake manifold (top section) ➔ [page 45](#) .
- Install high-pressure pipes ➔ [page 97](#) .



9.4 Removing and installing intake manifold (bottom section, right-side)

Removing



WARNING

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

- Remove engine cover panel ➔ [page 40](#) .

Vehicles with engine codes CAMA, CAMB, CCWA, CCWB, CGKA, CGKB, CCLA:

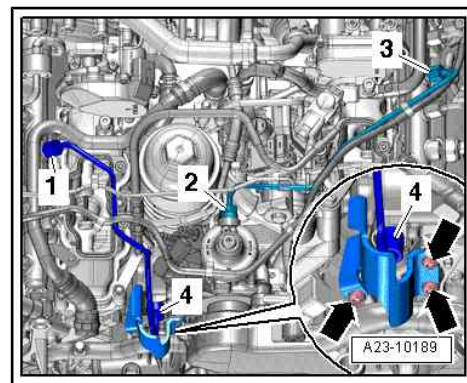
- Unscrew bolts -arrows- and remove protective plate for high-pressure pipe.
- Remove union nuts -1- and -4- and detach high-pressure pipe.



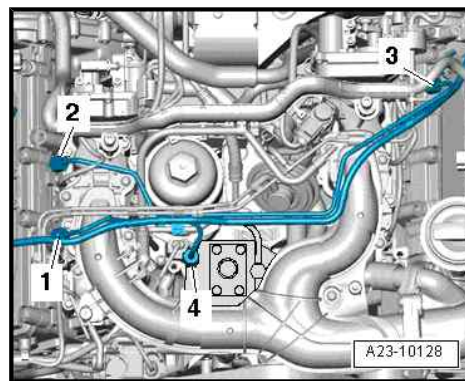
Note

Disregard -items 2 and 3-.

Vehicles with engine code CAPA:



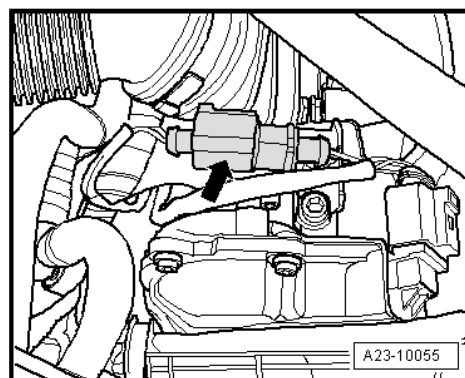
- Unscrew union nuts -1 ... 4- and detach high-pressure pipes.



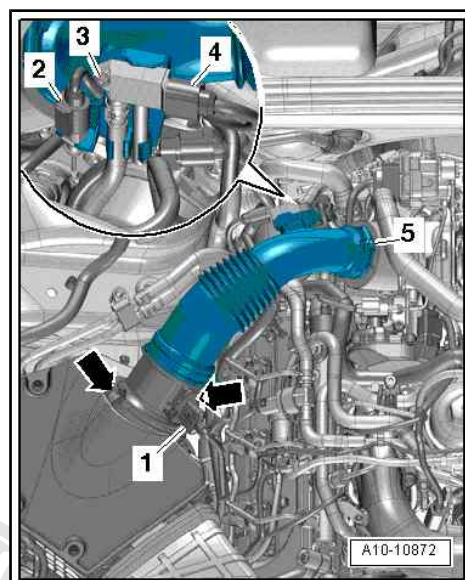
- Take electrical connector -arrow- for exhaust gas temperature sender 2 -G448- out of bracket and unplug.

All vehicles (continued):

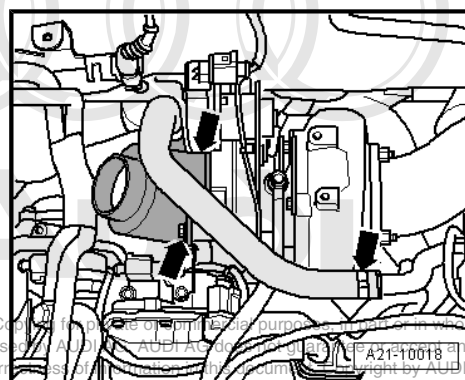
- Remove intake manifold (top section) ➔ [page 45](#) .



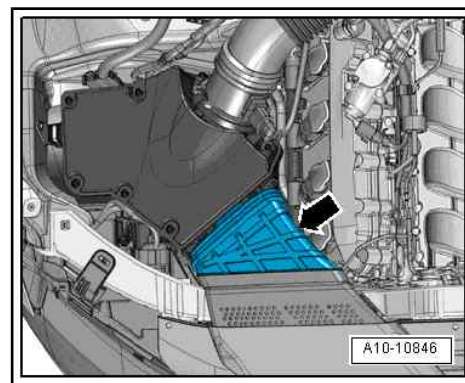
- Unplug electrical connector -1- from air mass meter -G70- .
- Unscrew bolt -3- and move clear exhaust gas pressure sensor 1 -G450- -item 4- at air pipe.
- Move clear electrical connector -2- for exhaust gas temperature sender 3 for cylinder bank 1 -G496- at air pipe.
- Remove air hose and air mass meter -G70- . To do so, release hose clip -5- and clamps -arrows-.



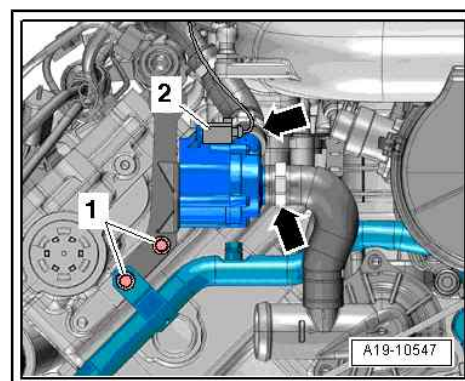
- Unscrew bolts -left arrows-, detach air hose -right arrow- and remove air intake connection with air hose.



- Remove air duct -arrow-.



- Unplug electrical connector -2-.
- Remove bolts -1-.



- Pull electrical connectors -1 and 2- out of bracket.

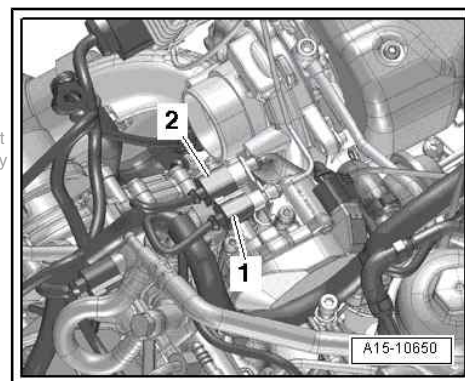


Note

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Connector -2- is not fitted in this location on vehicles with engine code CAPA.

- Unplug electrical connector -3- at intake manifold flap motor -V157-.



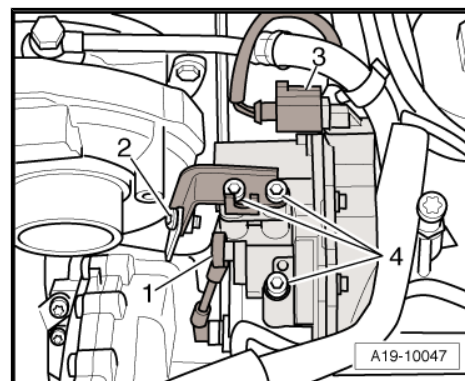
- Carefully press connecting rod -1- off intake manifold flap motor -V157- (observe note).



Note

- ◆ Proceed carefully when pressing connecting rod off ball stud (risk of breaking).
- ◆ Bolt -2- is not fitted.

- 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 intake manifold (bottom section, right-side).



Note

- ◆ *Disregard -item 1-.*
- ◆ *Block off intake ports in cylinder head with a clean rag.*

Installing

- Tightening torques: refer to intake manifold - exploded view
⇒ [page 44](#)

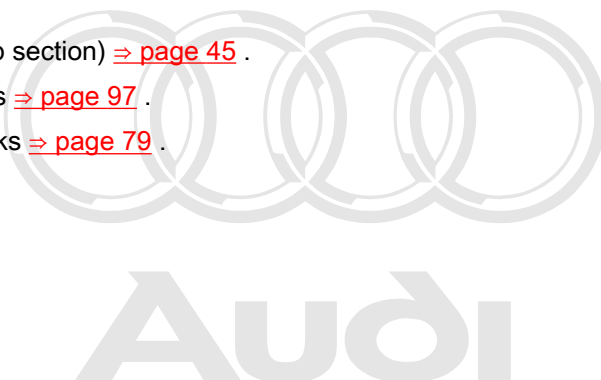
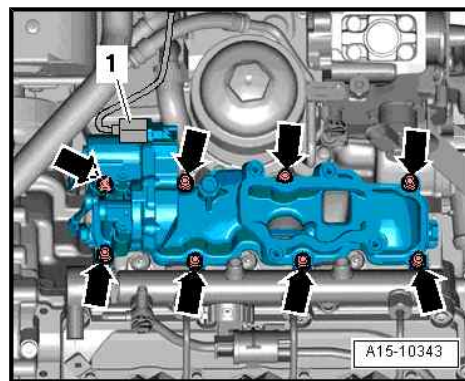
Installation is carried out in the reverse order; note the following:



Note

Renew seals and/or gaskets.

- Install intake manifold (top section) ⇒ [page 45](#) .
- Install high-pressure pipes ⇒ [page 97](#) .
- Check fuel system for leaks ⇒ [page 79](#) .



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10 Toothed belt (CAMA, CAMB, CCWA, CCWB, CGKA, CGKB, CCLA)

10.1 Exploded view - toothed belt for high-pressure pump

1 - Toothed belt cover (front)

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

2 - Nut

- ☐ 70 Nm

3 - Bolt

- ☐ 23 Nm

4 - Toothed belt sprocket for high-pressure pump

- ☐ Remove using puller - T40064- ➔ [page 54](#)

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

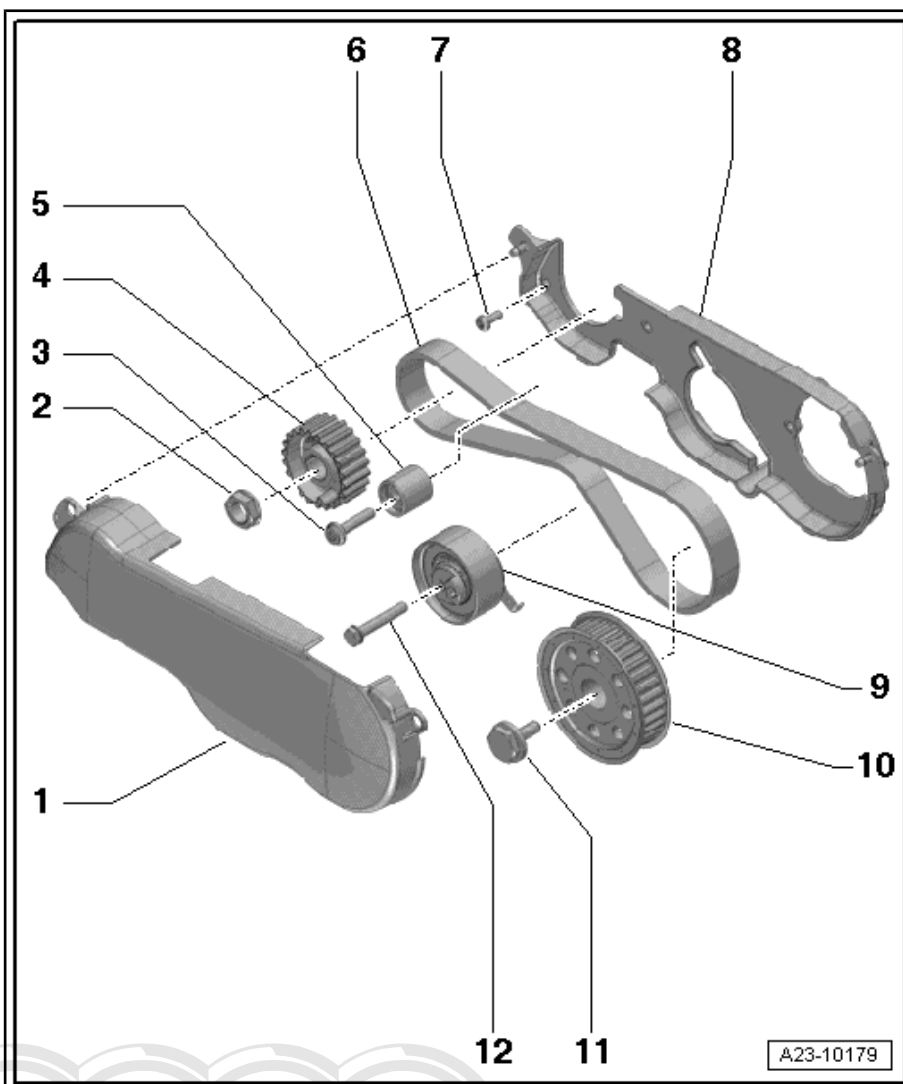


Caution

Prerequisites for fitting toothed belt:

TDC of crankshaft
 ➔ [page 54](#) and **TDC of camshaft** ➔ [page 54](#)
 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 54](#) .



- ☐ Removing and installing ➔ [page 55](#)

7 - Bolt

- ☐ 9 Nm

8 - Toothed belt cover (rear)

9 - Toothed belt tensioning roller

10 - Toothed belt drive sprocket

- ☐ Remove using puller - T10320- ➔ [page 55](#)

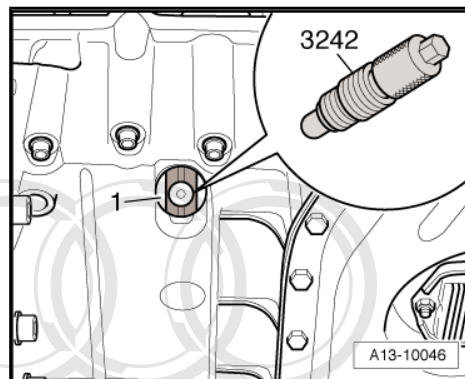
11 - Bolt

- ☐ 75 Nm
- ☐ Use counterhold tool -3036- when loosening and tightening ➔ [page 55](#)

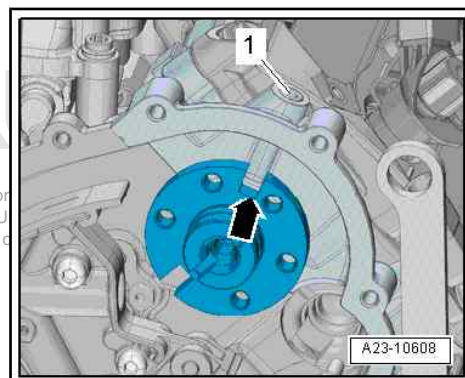
12 - Bolt

- ☐ 23 Nm

TDC of crankshaft -1-

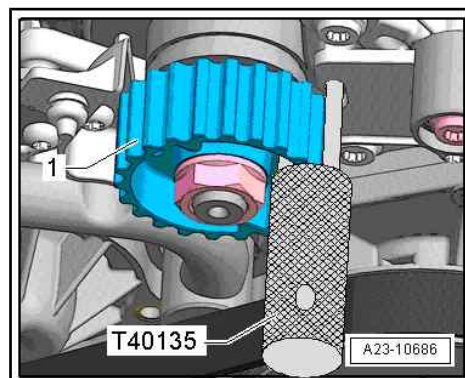


TDC of camshaft -arrow-



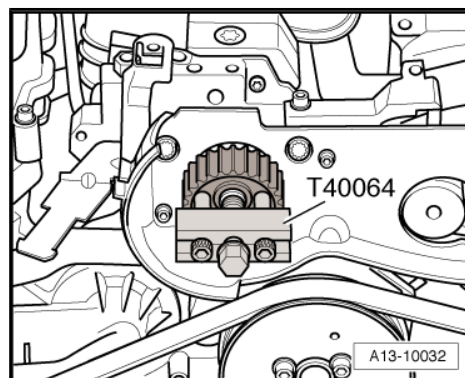
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Locking tool -T40135- for toothed belt sprocket for high-pressure pump



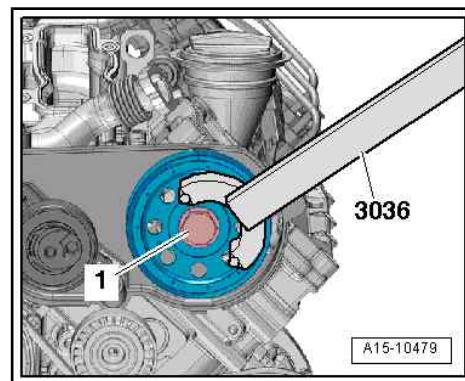
Pulling off toothed belt sprocket for high-pressure pump

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



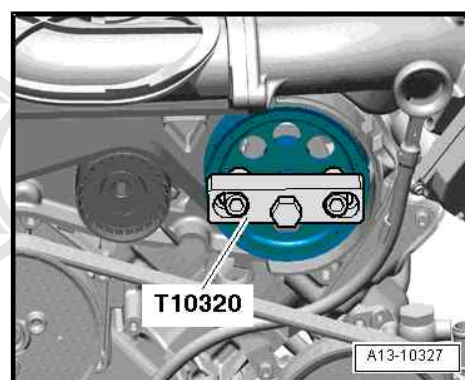
Loosening and tightening central bolt for toothed belt drive sprocket

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



Removing toothed belt drive sprocket

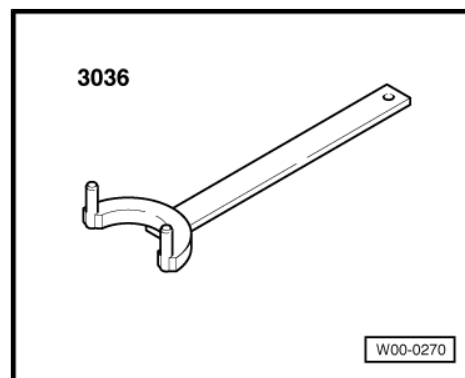
- Use puller -T10320- to pull off toothed belt drive sprocket.



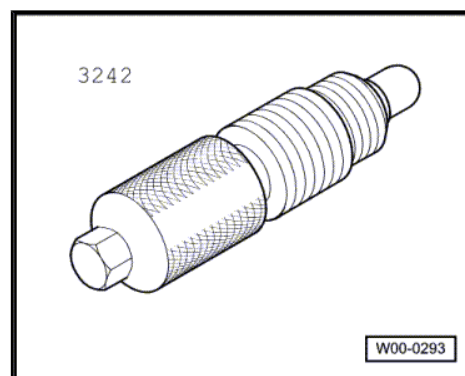
10.2 Removing and installing toothed belt for high-pressure pump

Special tools and workshop equipment required

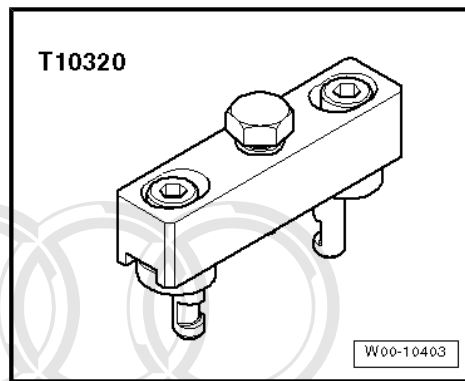
- ◆ Counterhold tool -3036-



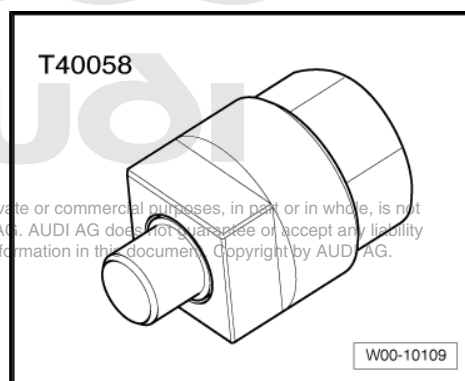
- ◆ Locking pin -3242-



◆ Puller -T10320-

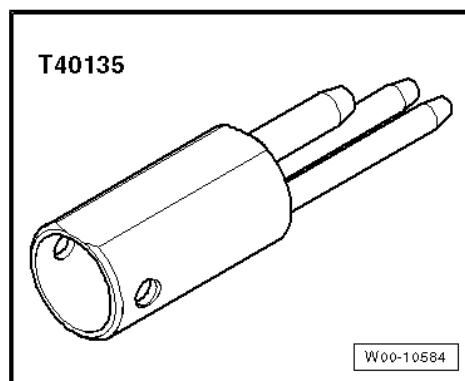


◆ Adapter -T40058-



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



Removing

- Remove intake manifold (top section) ➤ [page 45](#) .
- Pivot toothed belt cover forwards -arrows- and disengage retaining pegs on bottom side of toothed belt cover.



Note

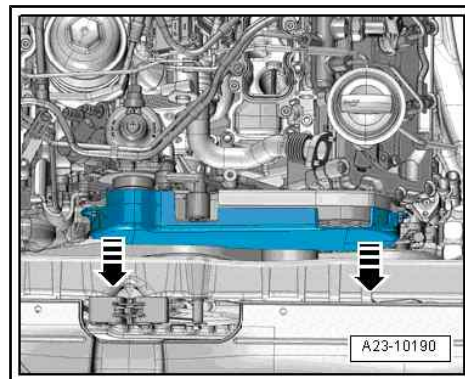
For illustration purposes, the toothed belt cover is shown with the top section of the intake manifold removed.



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.

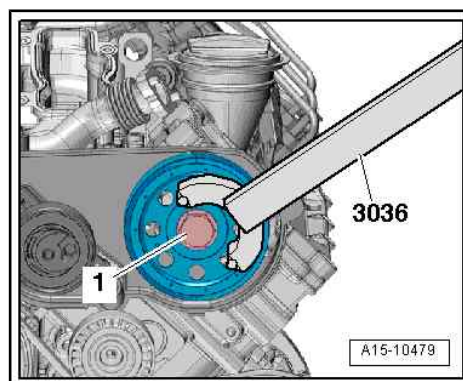
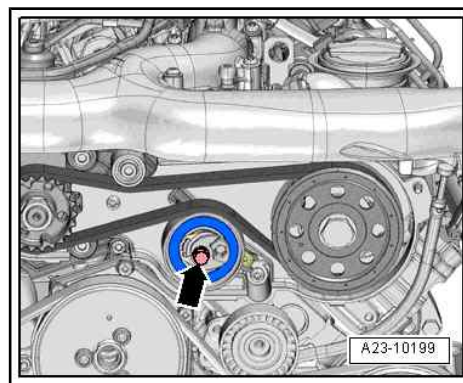


- Loosen bolt -arrow- for toothed belt tensioning roller approx. 2 turn.



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

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



Note

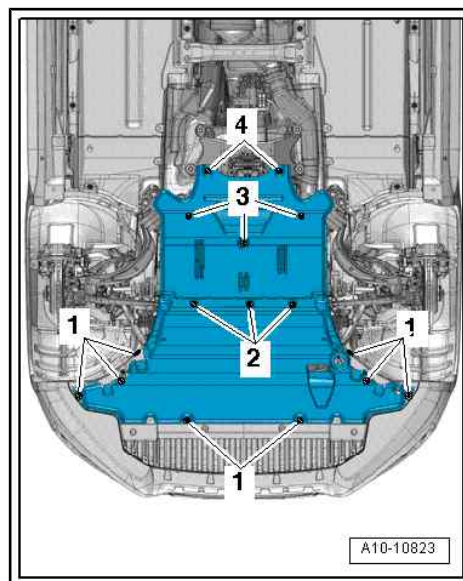
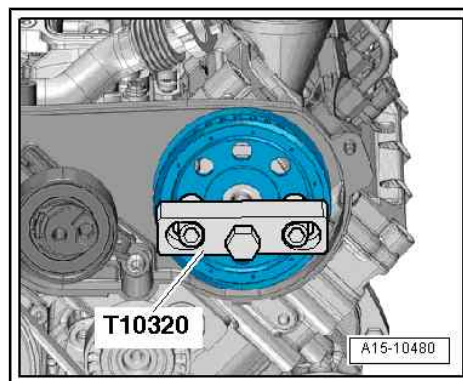
Leave toothed belt drive sprocket on camshaft.

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

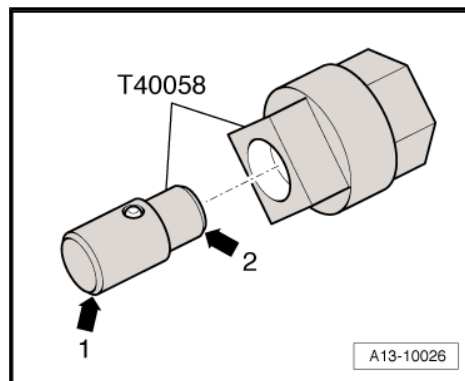
Installing

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

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



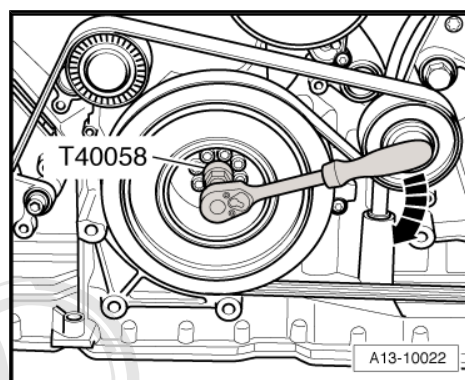
- Insert guide pin of adapter -T40058- as follows:
- The larger-diameter section -arrow 1- faces towards the engine.
- The smaller-diameter section -arrow 2- faces the adapter.



Caution

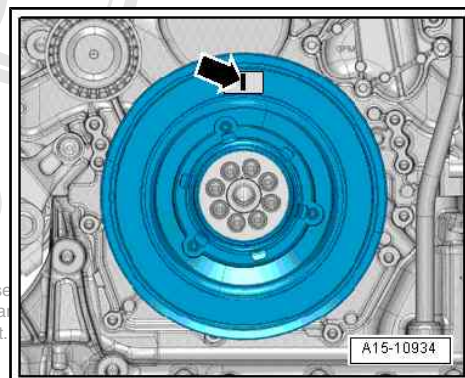
Irreparable damage can be caused if the camshaft timing chain slips.

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



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

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



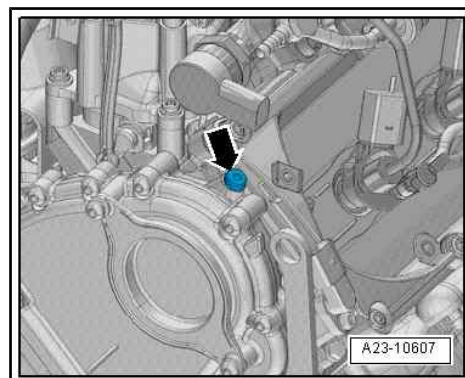
- Remove sealing plug -arrow- at rear of cylinder head (right-side).



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.



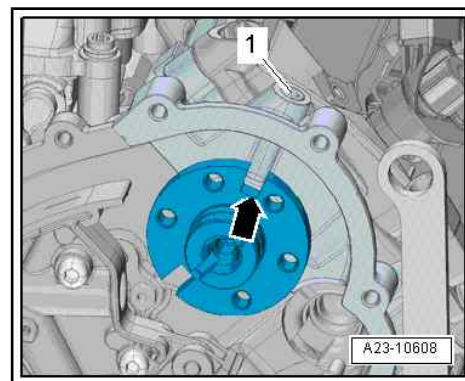
- To do so, shine a small torch into bore for sealing plug.



Note

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

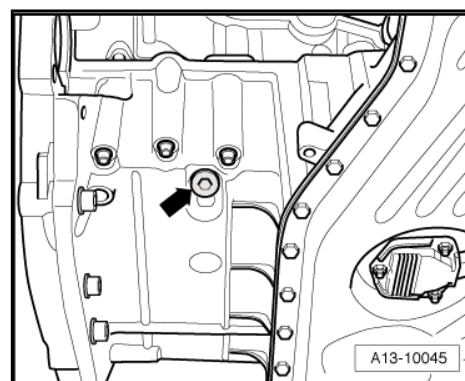
- If groove is not positioned under bore, turn crankshaft 360 further in direction of engine rotation.



Note

Place a cloth underneath sump (top section) to catch any escaping engine oil.

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

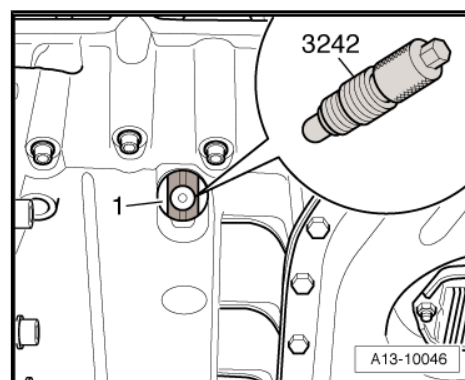


WARNING

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

- ◆ **Do NOT turn crankshaft -1-.**

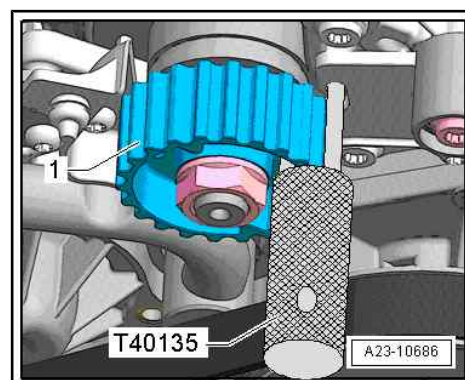
- Screw locking pin -3242- into hole (20 Nm); if necessary, turn crankshaft backwards and forwards slightly to fully centralise locking pin.

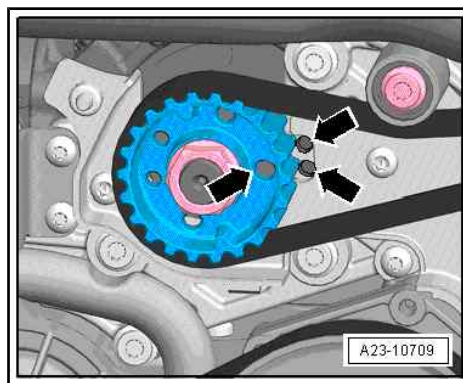


Note

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

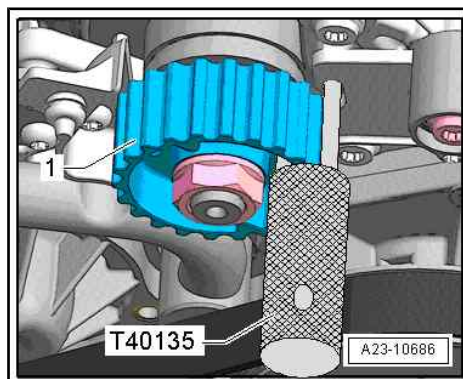
- Lock toothed belt sprocket for high-pressure pump in position using locking tool -T40135- .





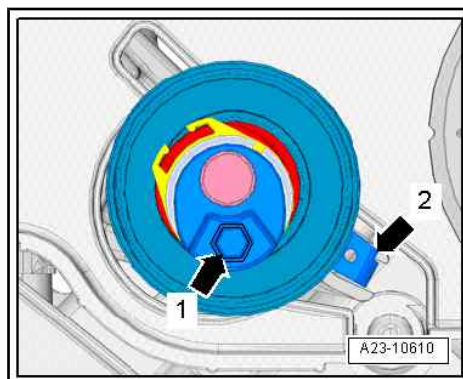
Note

- ◆ 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.

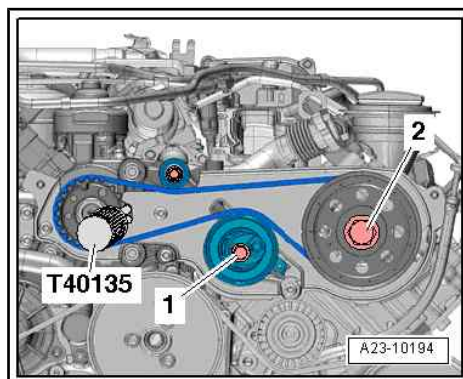


- Check installation position of toothed belt tensioning roller:
 - Retaining lug -arrow 2- must engage in slot on bracket for high-pressure pump.
 - Tensioning roller must be slack and hexagon socket -arrow 1- must face downwards.
- Fit toothed belt.

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- 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.

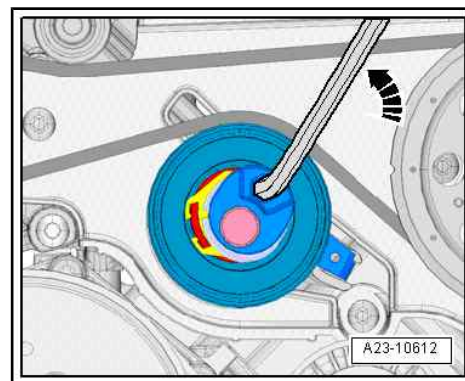


- Tension toothed belt tensioning roller slightly by turning in direction of -arrow- using hexagon key until hexagon socket is in "1 o'clock" position.

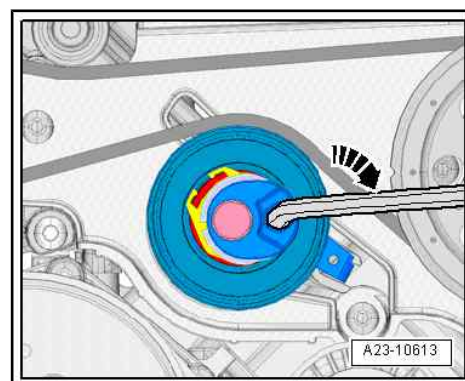


Caution

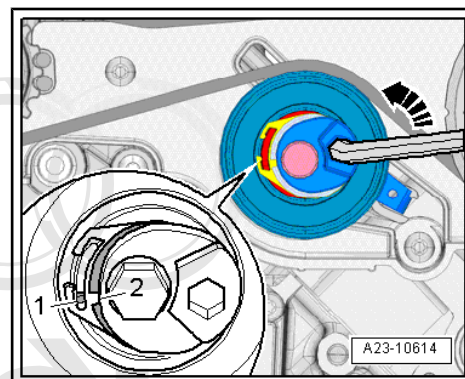
Do NOT turn tensioning roller up to or beyond "12 o'clock" position.



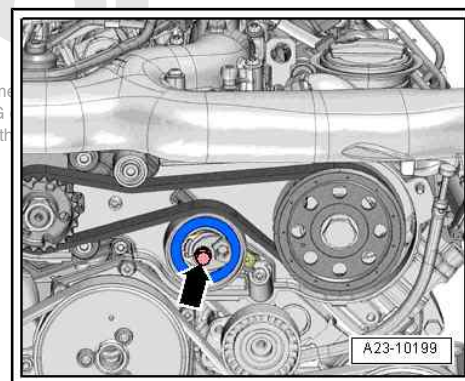
- Now release toothed belt tensioning roller -arrow- to such an extent that hexagon socket moves into "3 o'clock" position.



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

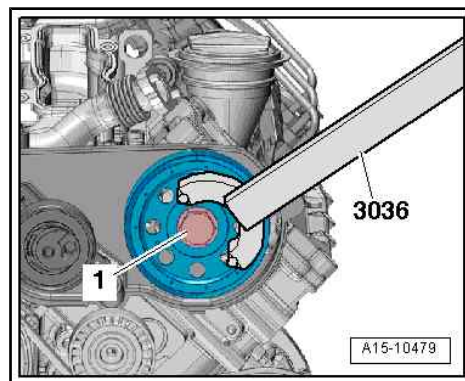


- Hold toothed belt tensioning roller in this position and tighten bolt -arrow- ➔ [Item 12 \(page 54\)](#) .

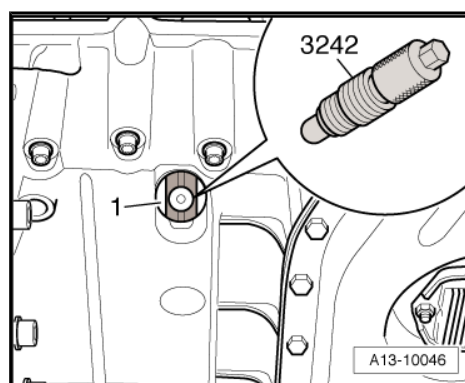


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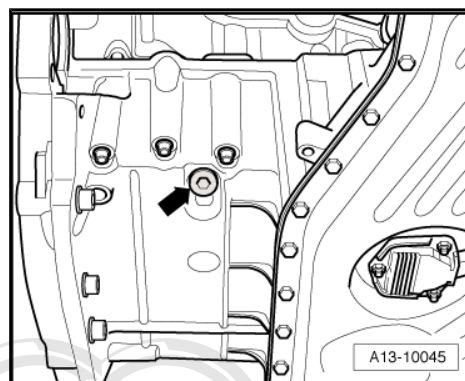
- Tighten bolt -1- for toothed belt drive sprocket using counter-hold tool -3036- ➔ [Item 11 \(page 54\)](#) .



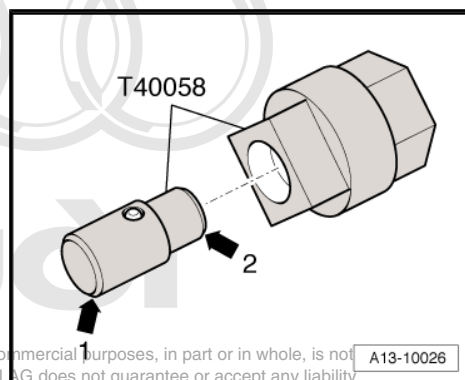
- Remove locking pin -3242- .



- 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.



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Caution

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

– Turn crankshaft 1 rotation using adapter -T40058- .

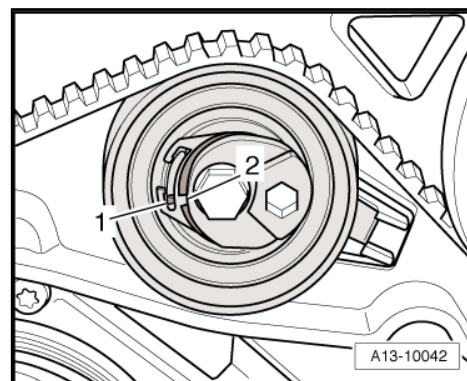
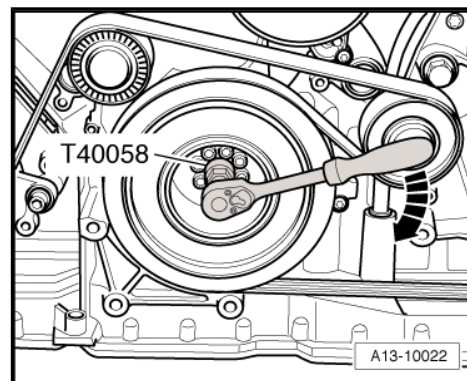
– Check toothed belt tension:

- 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 45](#) .



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11 Toothed belt (CAPA)

11.1 Exploded view - toothed belt for high-pressure pump

1 - Toothed belt cover (front)

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

2 - Nut

- ☐ 70 Nm

3 - Damper weight

4 - Bolt

- ☐ 23 Nm

5 - Toothed belt sprocket for high-pressure pump

- ☐ Remove using puller - T40064-

6 - Toothed belt tensioning roller

7 - Bolt

- ☐ 9 Nm

8 - Toothed belt cover (rear)

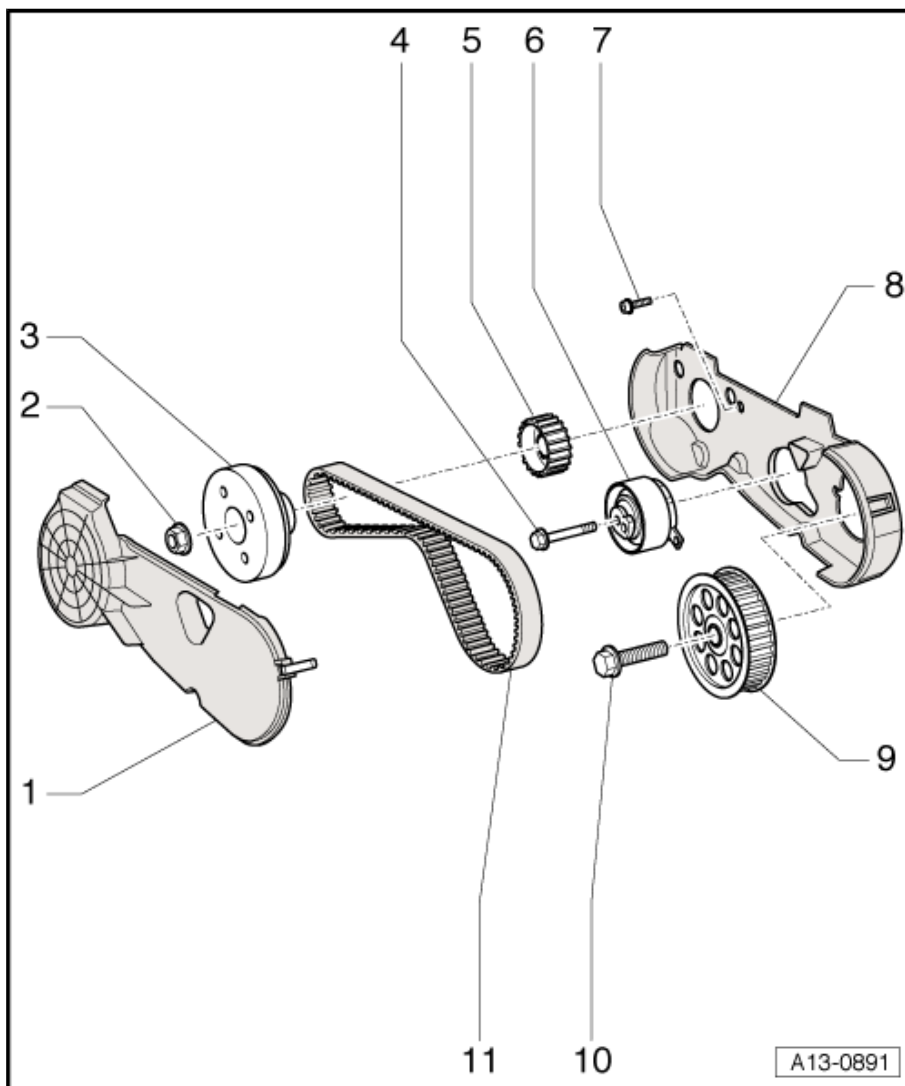
9 - Toothed belt drive sprocket

10 - Bolt

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

11 - Toothed belt for high-pressure pump

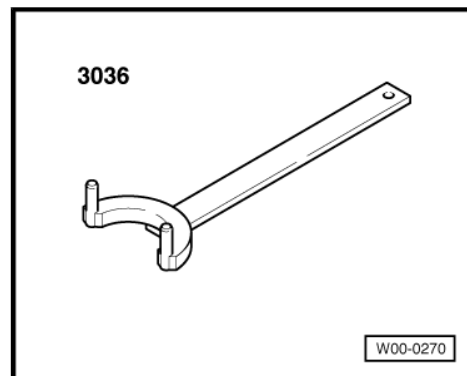
- ☐ Before removing, mark direction of rotation with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage
- ☐ Check for wear
- ☐ Removing and installing ➤ [page 64](#)



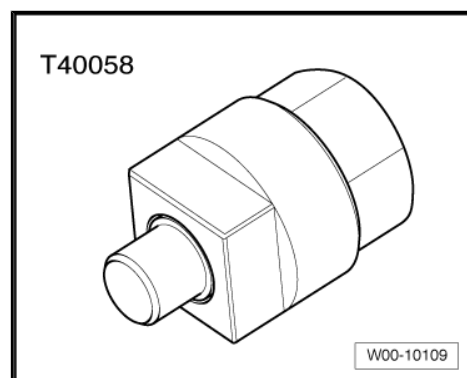
11.2 Removing and installing toothed belt for high-pressure pump

Special tools and workshop equipment required

◆ Counterhold tool -3036-



◆ Adapter -T40058-



Removing

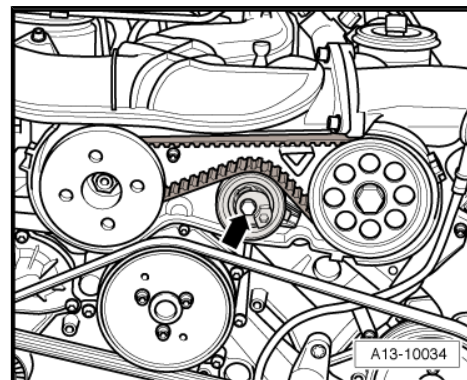
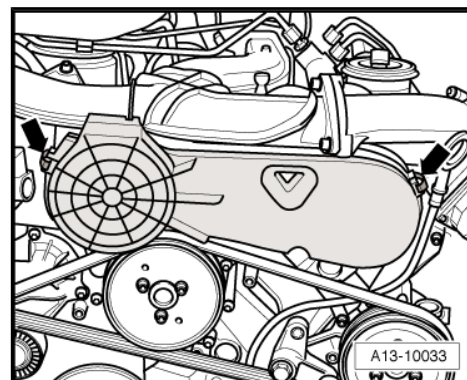
- Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted without the express written consent of Audi AG. Audi AG does not assume any liability with respect to the correctness of information in this document. Copyright by AUDI AG.
- Remove intake manifold (top section) ➤ [page 45](#).
 - Release hose clips -arrows-.
 - Pivot toothed belt cover forward and disengage retaining pegs on bottom side of toothed belt cover.
 - Remove toothed belt cover.



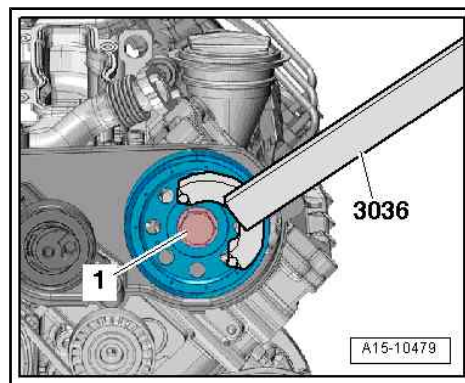
Note

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.

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



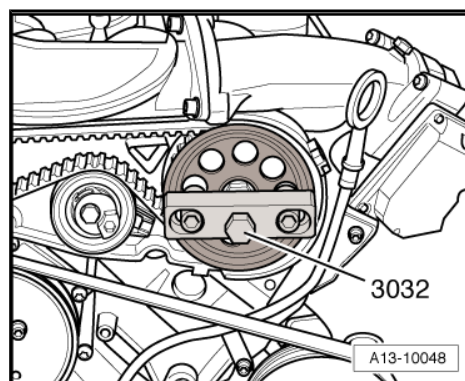
- Loosen central bolt -1- for toothed belt drive sprocket approx. 2 turns using counterhold tool -3036- .



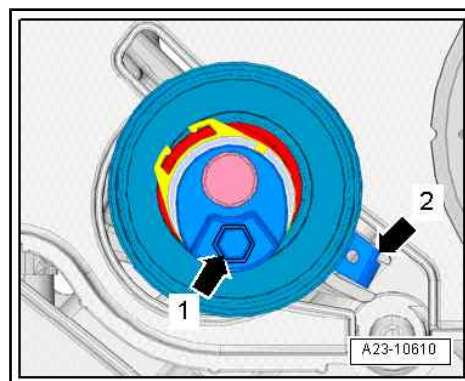
- Use puller -3032- to pull off toothed belt drive sprocket.
- Take off drive sprocket together with toothed belt.

Installing

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

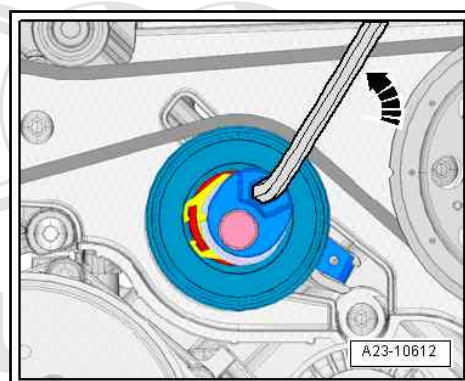


- Check installation position of toothed belt tensioning roller:
 - Retaining lug -arrow 2- must engage in slot on bracket for high-pressure pump.
 - Tensioning roller must be slack and hexagon socket -arrow 1- must face downwards.
- Fit toothed belt together with toothed belt drive sprocket.
- Install toothed belt tensioning roller; to do so, screw in bolt for toothed belt tensioning roller without applying force until eccentric adjuster of toothed belt tensioning roller can just still be turned without axial movement.
- Screw in bolt for toothed belt drive sprocket until toothed belt drive sprocket can just still be turned without axial movement.
- Tension toothed belt tensioning roller slightly by turning in direction of -arrow- using hexagon key until hexagon socket is in "1 o'clock" position.



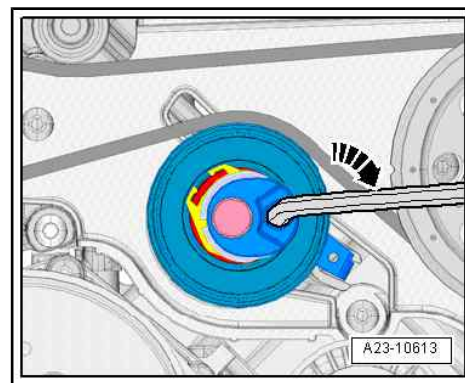
Caution

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

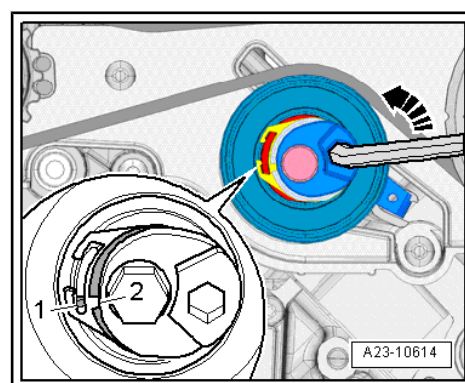


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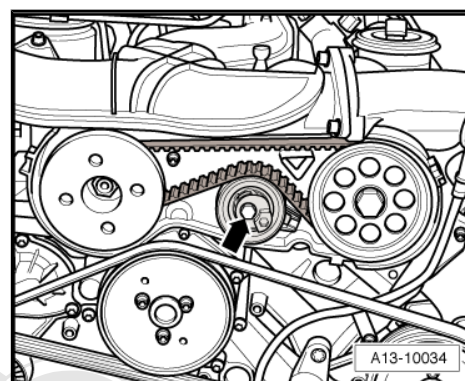
- Now release toothed belt tensioning roller -arrow- to such an extent that hexagon socket moves into "3 o'clock" position.



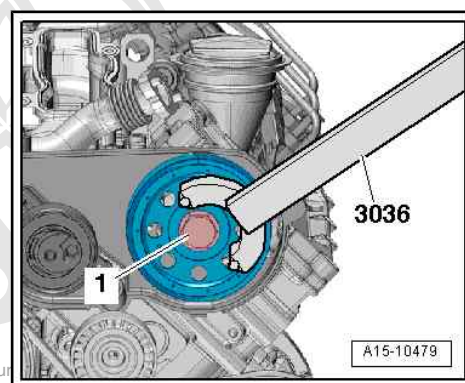
- Tension toothed belt tensioning roller slightly from "3 o'clock" position -arrow- until lug -1- and notch -2- are exactly in line.



- Hold toothed belt tensioning roller in this position and tighten bolt -arrow- ➔ [Item 4 \(page 64\)](#) .

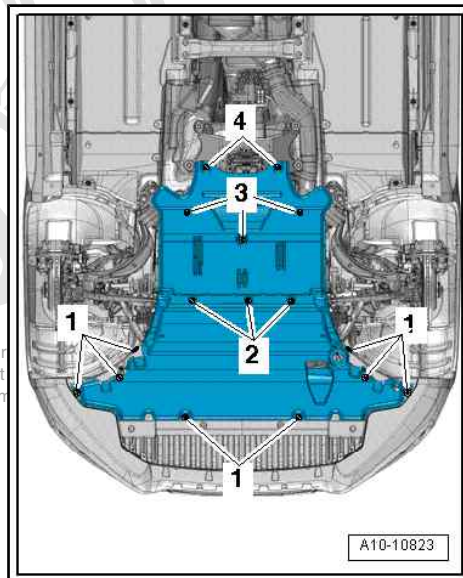


- Tighten bolt -1- for toothed belt drive sprocket using counter-hold tool -3036- ➔ [Item 10 \(page 64\)](#) .

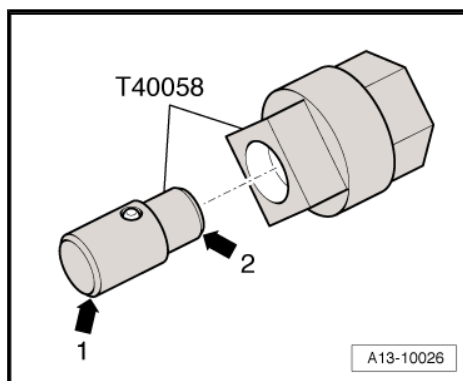


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- Release fasteners -1 ... 4- and remove noise insulation panels.



- 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.



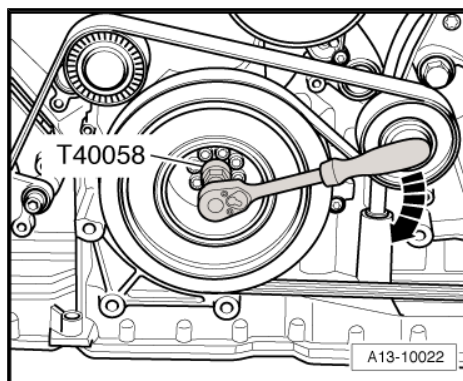
- Turn crankshaft 1 rotation using adapter -T40058- .



Caution

Irreparable damage can be caused if the camshaft timing chains slip.

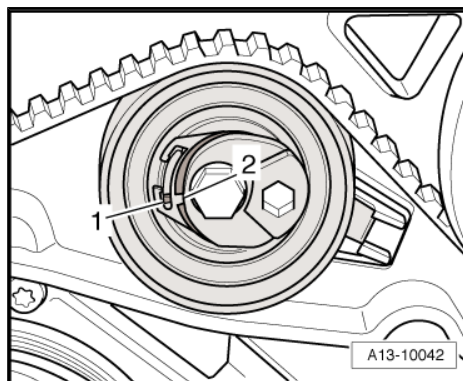
- ◆ *Turn crankshaft only in direction of engine rotation -arrow-.*



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

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

- Install intake manifold (top section) ➔ [page 45](#) .



12 High-pressure pump (CAMA, CAMB, CCWA, CCWB, CGKA, CGKB, CCLA)

12.1 Exploded view - high-pressure pump



Caution

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

- ◆ *If components of the fuel system between the fuel tank and the high-pressure pump are removed or renewed, the first fuel filling operation must be performed.*
- ◆ *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.*

*Performing first fuel filling after installing high-pressure pump
⇒ [page 74](#)*

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

- ☐ Tightening torque
⇒ [page 97](#)

6 - High-pressure pump

Caution

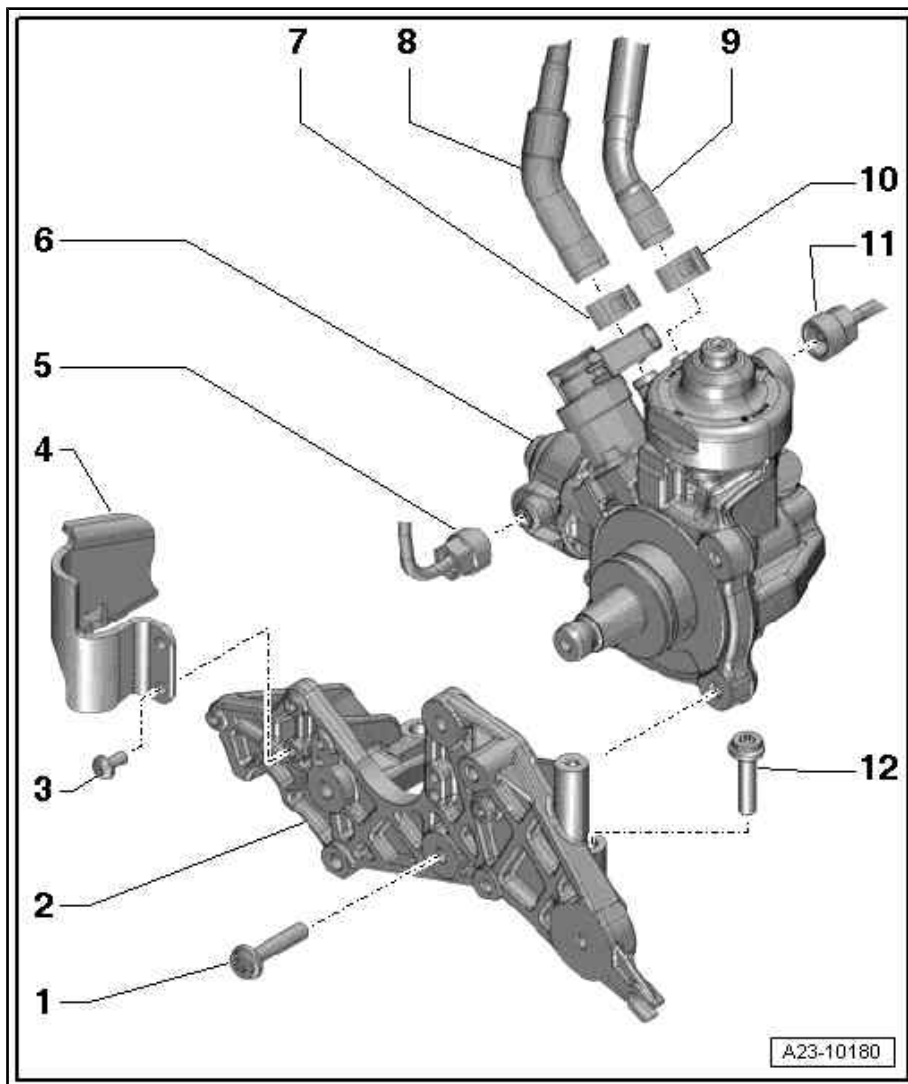
Prerequisites for fitting toothed belt:

TDC of crankshaft
⇒ [page 71](#) and **TDC of camshaft**
⇒ [page 71](#)
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 54](#)

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 74](#)

Observe rules for cleanliness when working on the injection system
⇒ [page 3](#).



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- ☐ 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 71](#)
- ☐ Removing and installing ⇒ [page 72](#)

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

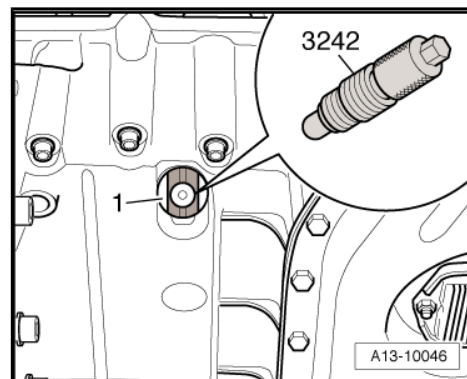
11 - Union nut for high-pressure pipe

- Tightening torque ➔ [page 97](#)

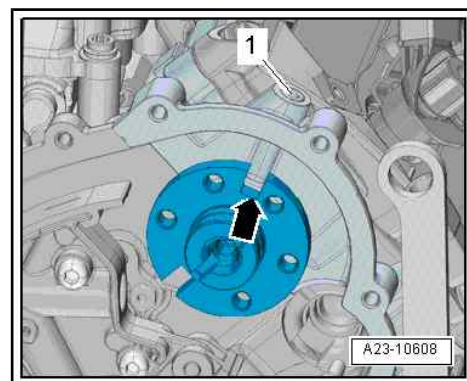
12 - Bolt

- 23 Nm

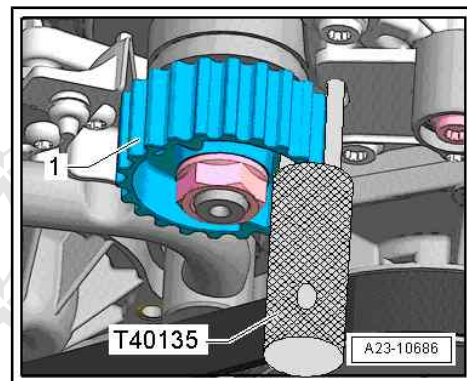
TDC of crankshaft -1-



TDC of camshaft -arrow-

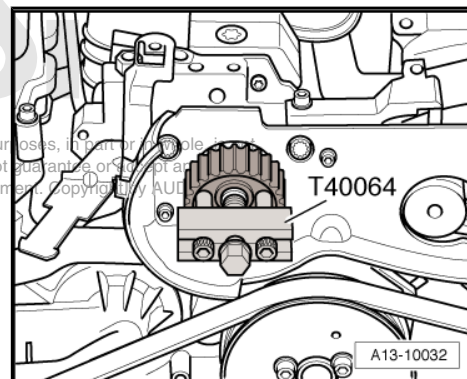


Locking tool -T40135- for toothed belt sprocket for high-pressure pump



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



12.2 Removing and installing high-pressure pump

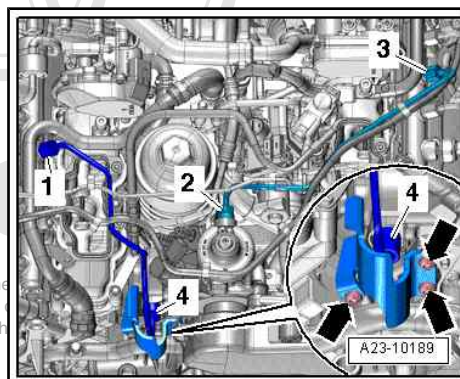


Caution

- ◆ *Observe rules for cleanliness when working on the injection system ➔ [page 3](#) .*
- ◆ *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 74](#) .*

Removing

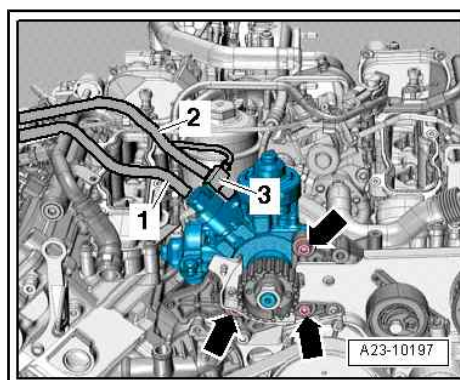
- Remove intake manifold (top section) ➔ [page 45](#) .
- Remove toothed belt for high-pressure pump ➔ [page 55](#) .
- Unscrew bolts -arrows- and remove protective plate for high-pressure pipe.
- Unscrew union nuts -1 ... 4- and move high-pressure pipes clear.

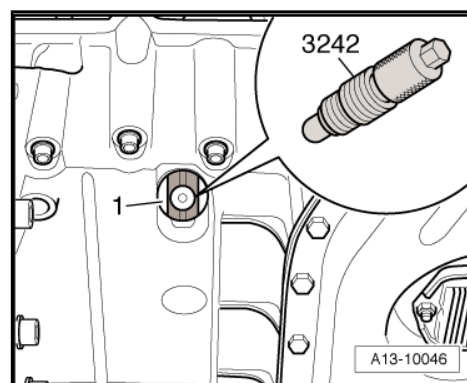
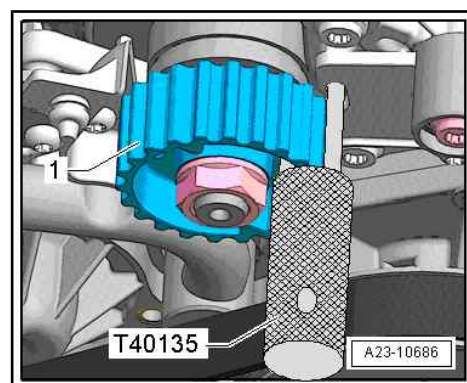
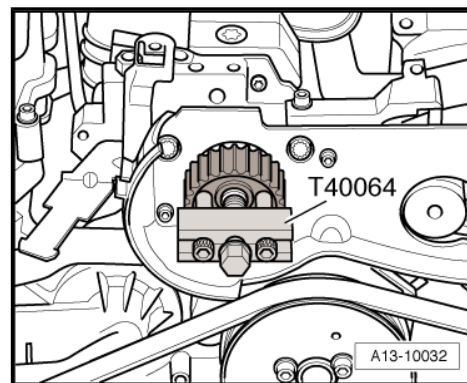


- Unplug electrical connector -3-.
- Remove fuel supply hose -1- and fuel return hose -2-.
- Unscrew bolts -arrows- and detach high-pressure pump.

Installing

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



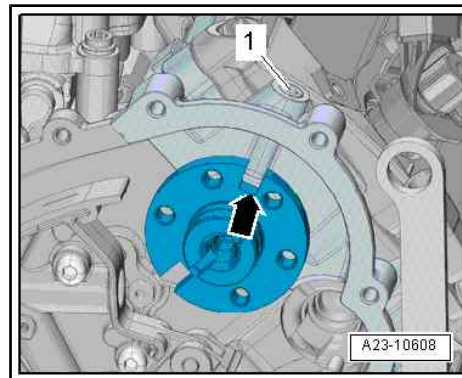


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Note

- ◆ *Renew seals and gaskets.*
- ◆ *Fuel return lines must not be kinked, damaged or clogged.*
- ◆ *If toothed belt sprocket for high-pressure pump has to be renewed, use puller -T40064- to remove it.*
- ◆ *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 ➔ [page 69](#)
- Tightening torque for nut for toothed belt sprocket: 70 Nm
- Install toothed belt for high-pressure pump ➔ [page 55](#) .
- Install high-pressure pipes ➔ [page 97](#) .
- Install intake manifold (top section) ➔ [page 45](#) .



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 74](#)*
- ◆ *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.

12.3 Performing first fuel filling after installing high-pressure pump (CAMA, CAMB, CCWA, CCWB, CGKA, CGKB, CCLA)

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).

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

Prerequisite for testing:

- Check fuel gauge in instrument cluster; fuel gauge needle must indicate that fuel is above reserve level.

- Connect a vehicle diagnostic tester .
- Switch on ignition.
- Select “Engine electronics” in vehicle self-diagnosis.
- Then select “Basic setting”.
- Select “Checking fuel system pressurisation pump” from the list.
- Press “start” button.
- The fuel pumps start running.
- The fuel pumps must run for approx. 3 minute to ensure that the high-pressure pump is filled with sufficient fuel.



Note

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

- Start engine after filling fuel system.
- Run engine at moderate speed (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 inspect high-pressure section of fuel system again for leaks.



Note

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

- Interrogate event memory.

13 High-pressure pump (CAPA)

13.1 Exploded view - high-pressure pump

1 - Damper weight

2 - Nut

□ 70 Nm

3 - Toothed belt sprocket for high-pressure pump

4 - Bolt

□ 23 Nm

5 - High-pressure pump

□ Removing and installing
⇒ [page 77](#)

6 - Seals

□ Renew

7 - Banjo bolt

□ 25 Nm

8 - Fuel supply hose

9 - Union nut for high-pressure pipe

□ Tightening torque
⇒ [page 97](#)

10 - Banjo bolt

□ 25 Nm

11 - Seal

□ Renew

12 - Fuel return hose

□ Fuel return line must not be kinked, damaged or clogged

13 - Seal

□ Renew

14 - Bolt

□ 23 Nm

15 - Bolt

□ 23 Nm

16 - Bracket for high-pressure pump

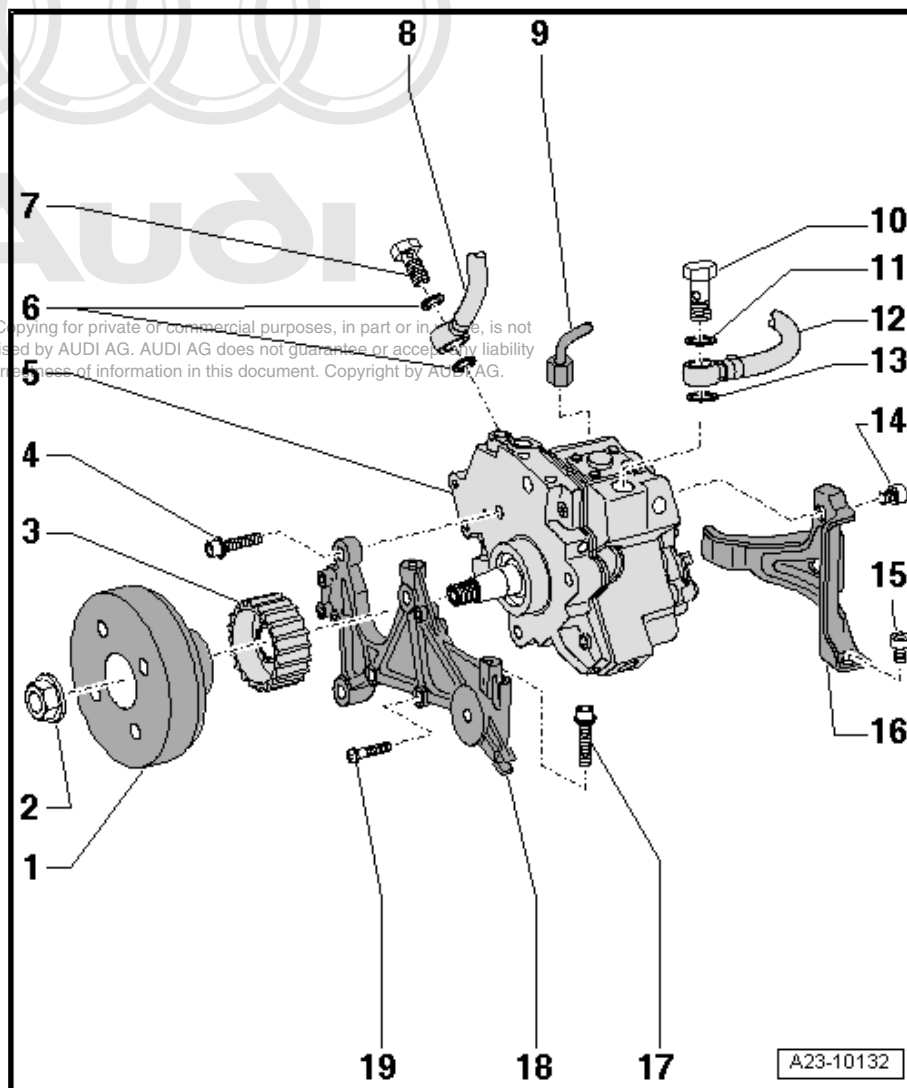
17 - Bolt

□ 23 Nm

18 - Front bracket for high-pressure pump

19 - Bolt

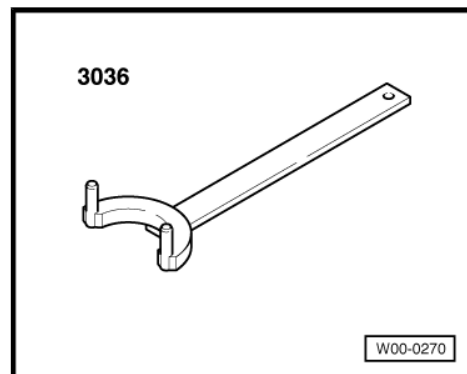
□ 9 Nm



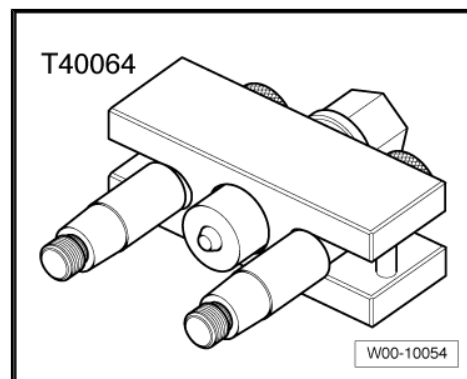
13.2 Removing and installing high-pressure pump

Special tools and workshop equipment required

- ◆ Counterhold tool -3036-



- ◆ Puller -T40064-

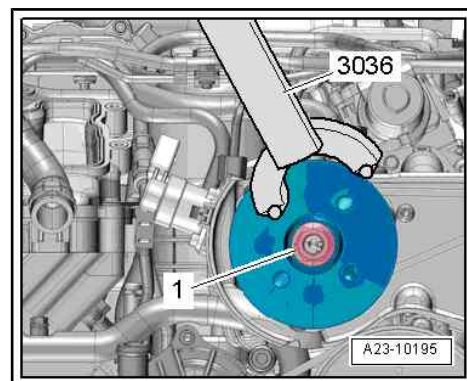


WARNING

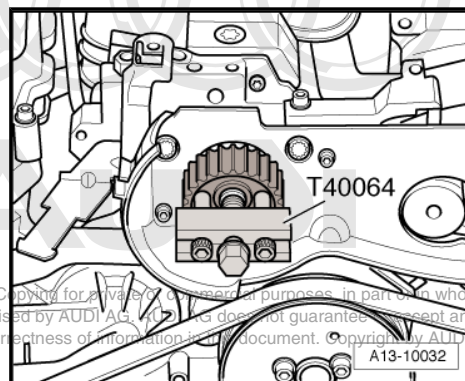
- ◆ **Always read rules for cleanliness and instructions for working on fuel system ➔ page 3**
- ◆ **Follow these instructions and rules for cleanliness before starting work and while working on the fuel system.**

Removing

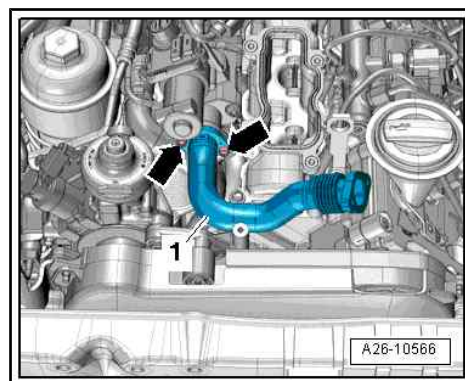
- Remove intake manifold (top section) ➔ page 45 .
- Remove toothed belt for high-pressure pump ➔ page 64 .
- Unscrew nut -1- for high-pressure pump shaft using counterhold tool -3036- .
- Remove damper weight.



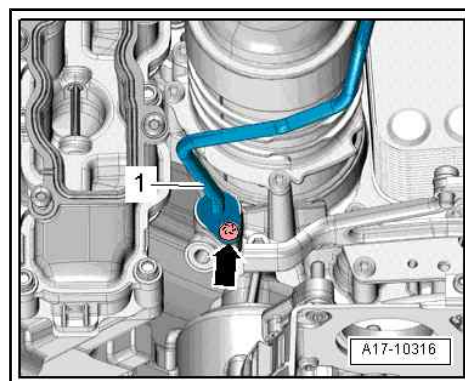
- Remove toothed belt sprocket for high-pressure pump using puller -T40064- .



- Unscrew bolts -arrows- and remove connecting pipe -1- for exhaust gas recirculation.



- Unscrew bolt -arrow-, pull off oil supply line for turbocharger and move to one side.

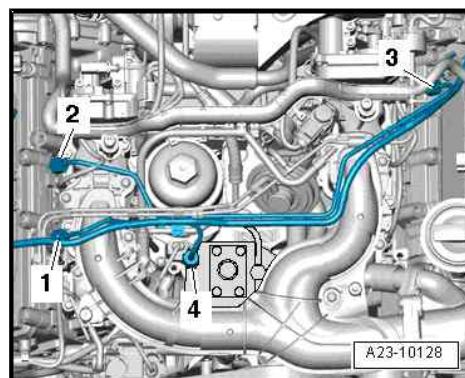


- Remove union nuts -2- and -4-, move high-pressure pipe clear and remove.



Note

Disregard -items 1 and 3-.

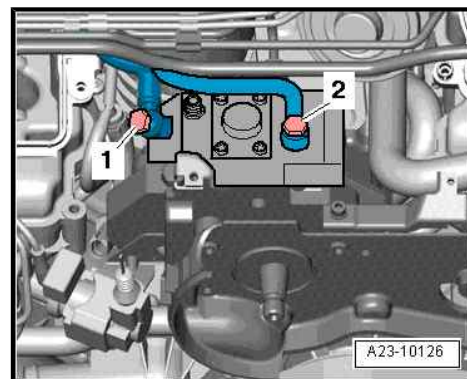


- Unscrew banjo bolt -2- for fuel supply hose and banjo bolt -1- for fuel return hose and move fuel hoses to one side.



Caution

Observe rules for cleanliness when working on the injection system ➔ [page 3](#).



- Remove bolts -1, 2, 4- and -arrows-.
- Unplug electrical connector -3-.
- Carefully pull toothed belt cover forward and lift out high-pressure pump.

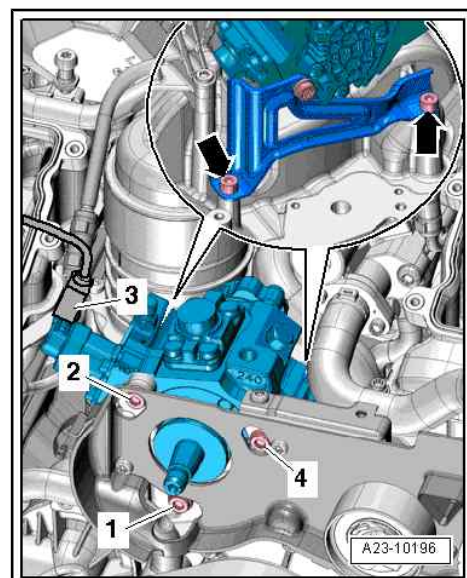
Installing

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

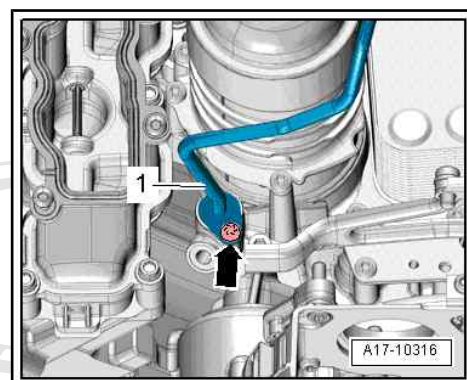


Note

- ◆ *Renew seals and gaskets.*
- ◆ *Fuel return line must not be kinked, damaged or clogged.*
- Tightening torques ➔ [page 76](#)



- Secure oil supply line for turbocharger -arrow- ➔ Rep. gr. 21 .
- Install toothed belt for high-pressure pump ➔ [page 64](#) .
- Install high-pressure pipes ➔ [page 97](#) .
- Install intake manifold (top section) ➔ [page 45](#) .
- Bleed fuel system and check for leaks ➔ [page 79](#) .



13.3 Bleeding fuel system and checking for leaks

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

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

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

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Note

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



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14 Injectors

14.1 Checking injectors

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

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- Checking adaption of “Injector delivery calibration values” and “Injector voltage calibration values” ➔ [page 81](#)
- Checking return flow rate of injectors with engine running ➔ [page 82](#)
- Checking return flow rate of injectors at starter cranking speed ➔ [page 84](#)
- Checking for injectors sticking open ➔ [page 86](#)

14.2 Performing adaption of correction values for injectors

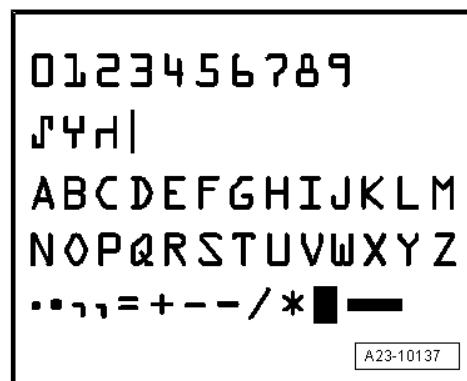
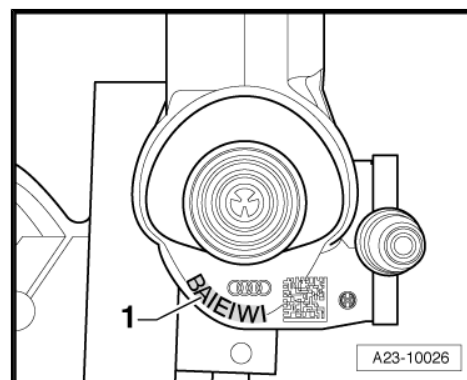
- ◆ The “Injector delivery calibration” and “Injector voltage calibration” serve to correct the injection rates for each cylinder of a common rail system individually across the entire operating range.
- ◆ The 7-digit adaption value -1- (example) is marked separately on each injector. It may consist of letters and/or numbers (AS-CII code).
- ◆ Reference table for reading out letters and/or numbers on each injector

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

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

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

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



14.3 Checking return flow rate of injectors with engine running

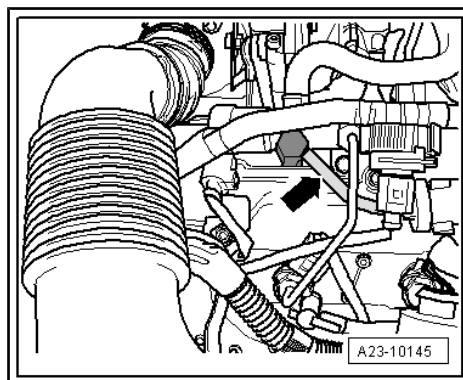
Checking return flow rate of all injectors



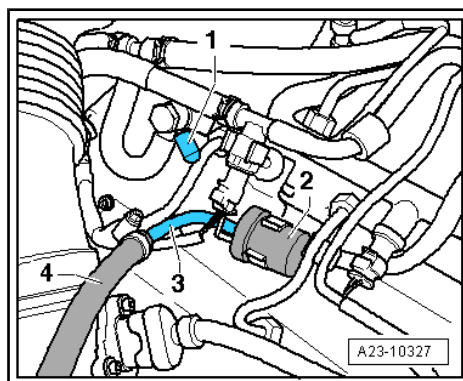
WARNING

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

- Remove engine cover panel ➔ [page 40](#).
- Disconnect hose connection downstream of pressure retention valve (restrictor) -arrow- at banjo bolt connection.



- Seal off the open return connection with a 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. two minutes:
 - Specification for 2 minutes: less than 250 ml



Note

1000 ml = 1 litre

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

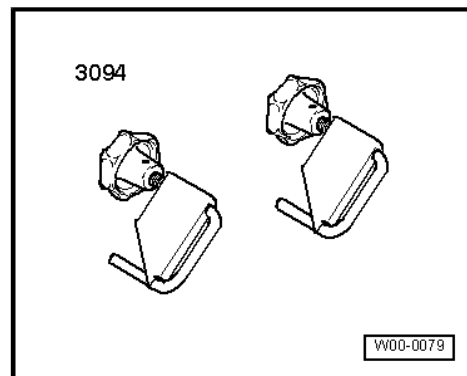
Checking return flow rate of individual injectors

Special tools and workshop equipment required



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

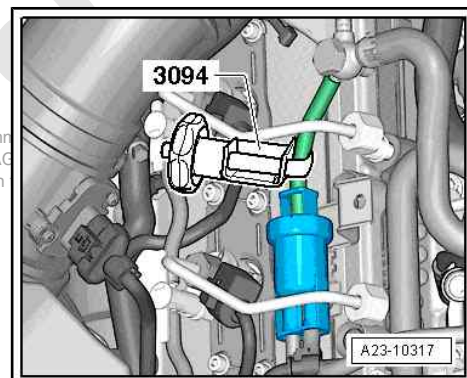


- ◆ Return flow meter -VAS 6684-
- ◆ Fuel-resistant measuring container

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

- Clean all return line connections with engine cleaner or brake cleaner and dry.
- Clamp off fuel return line downstream of pressure retention valve (restrictor) using hose clamp up to 25 mm -3094- .

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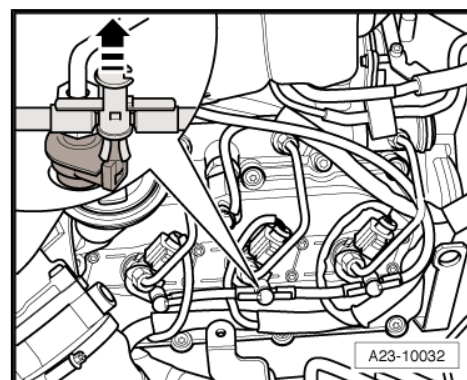


- Pull return line connections off injectors; to do so, press both tabs down and at the same time pull centre piece up to release connection -arrow-.



Note

- ◆ Illustration shows cylinder bank 2.
- ◆ On cylinder bank 2 the coolant expansion tank must be detached; coolant hoses remain connected.
- ◆ No dirt must be allowed to get into the disconnected return lines or the open connections on the injectors.



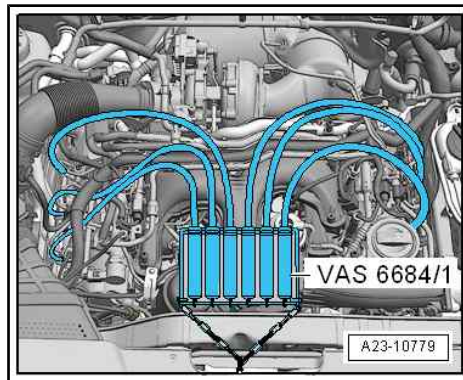
- Connect hoses of return flow meter -VAS 6684- to all return line connections of the six injectors.
- Start engine and let it idle for several minutes.



Caution

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

Running the engine at higher speeds with the return lines disconnected will cause damage to the injectors.



- When the engine is warm and running at idling speed, the return flow rates at each of the 6 return lines must not differ by more than a small amount.
- If one injector has a significantly higher return flow rate than the others it must be renewed ➔ [page 90](#) .

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

- Push the return line connections carefully over the new seals and onto the injectors. The catch should engage audibly. Then press release pin down carefully.
- 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.
- Check fuel system for leaks ➔ [page 79](#) .

14.4 Checking return flow rate of injectors at starter cranking speed

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If it is not possible to start engine, check return flow rate of injectors at starter cranking speed.

Special tools and workshop equipment required

- ◆ Return flow meter -VAS 6684-



WARNING

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

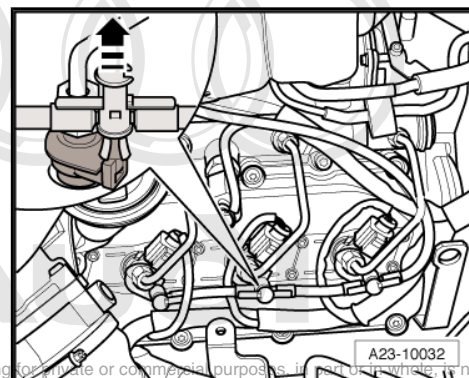
Each injector normally has a relatively low return flow rate. If the return flow rate at one injector is relatively high compared to the other injectors, that injector is probably defective.

- Remove engine cover panel ➔ [page 40](#) .

- Clean all return line connections with engine cleaner or brake cleaner and dry.
- Pull return line connections off injectors; to do so, press both tabs down and at the same time pull centre piece up to release connection -arrow-.

 Note

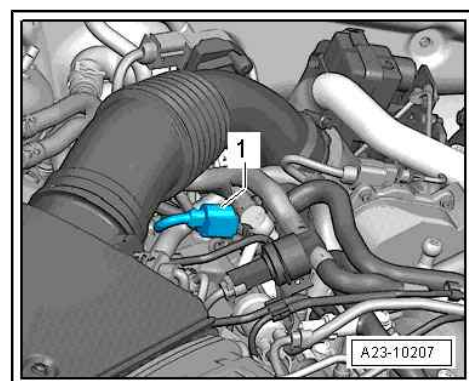
- ◆ *Illustration shows cylinder bank 2.*
- ◆ *On cylinder bank 2 the coolant expansion tank must be detached; coolant hoses remain connected.*
- ◆ *No dirt must be allowed to get into the disconnected return lines or the open connections on the injectors.*



- Detach electrical connector -1- from fuel pressure regulating valve -N276- .

 Note

This prevents fuel from being injected when starter is operated.



- Connect hoses of return flow meter -VAS 6684- to all return line connections of the six injectors.
- Operate starter three times. (Wait approx. 20 seconds each time after operating starter to prevent it from overheating.)
- ◆ Specification of return flow rate: 0 ml
- If fuel comes out of one injector, that injector must be renewed.
- Re-attach electrical connector on fuel pressure regulating valve -N276- .

Installing fuel return lines

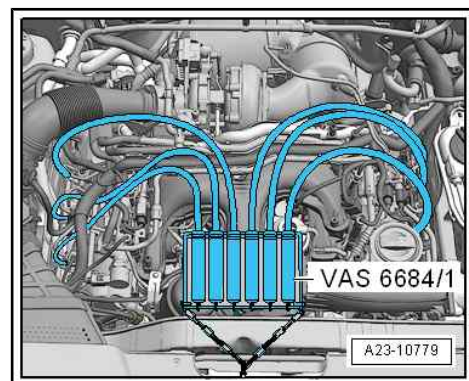
- Check O-ring for fuel return line connection for damage and deformation.

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

 Note

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

- Push the return line connections carefully over the new seals and onto the injectors. The catch should engage audibly. Then press release pin down carefully.
- Erase entry in event memory using a diagnostic tester.
- Check fuel system for leaks ➔ [page 79](#) .

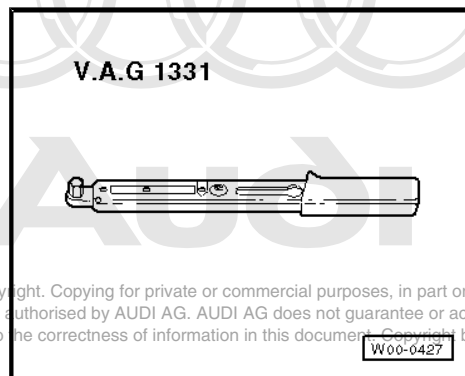


14.5 Checking for injectors sticking open

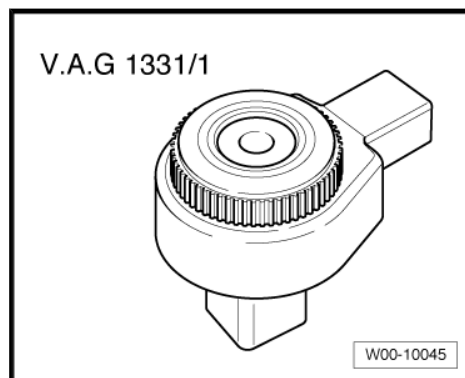
If one of the injectors is sticking open, this means that the injector needle is not closing fully and fuel escapes into the cylinder.

Special tools and workshop equipment required

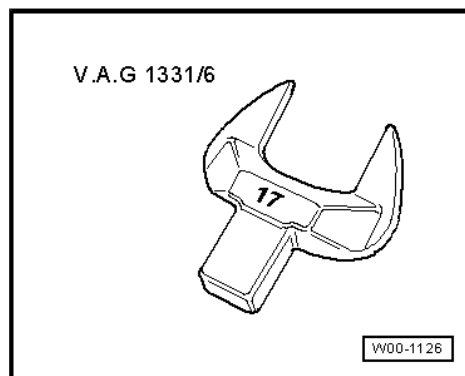
- ◆ Torque wrench -V.A.G 1331-



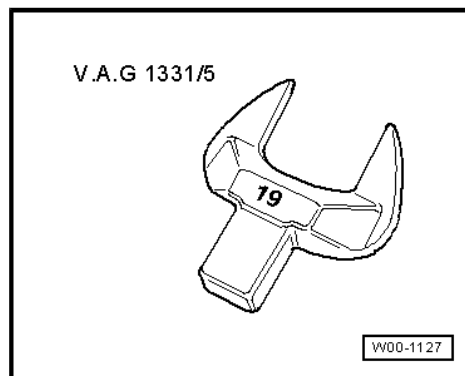
- ◆ Ratchet -V.A.G 1331/1-



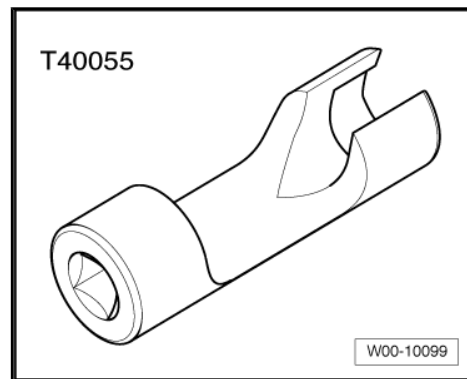
- ◆ Open end spanner insert, AF 17 -V.A.G 1331/6-



- ◆ Tool insert, AF 19 -V.A.G 1331/5- (engine code CAPA)



◆ Socket -T40055-



◆ Plug -T40162 A- (for engine code CAPA only)

◆ Plug -T40040- or plug -T40204-



WARNING

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

- Erase event memory of engine control unit.
- Remove engine cover panel ➔ [page 40](#) .
- Clean all connections (with commercial cleaning solution or similar) before removing.



Note

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

Start with cylinder No. 1.

- Unscrew union nut at fuel rail for cylinder 1 using appropriate tool insert, and also loosen union nut on injector slightly using socket -T40055-. Seal off open connection on injector pipe.
- Seal off open fuel rail connection using corresponding plug.
- The electrical connector of the relevant injector must remain connected.
- Erase all entries in the event memory.
- Perform test drive.



Note

- ◆ *The entry "positive control deviation" should no longer be indicated when the defective injector has been located.*
- ◆ *Other fault messages may possibly be stored in the memory. These result from previous steps and can be disregarded.*

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- Interrogate event memory after road-testing vehicle. If a fault relating to “positive control deviation” is still being indicated, repeat the above steps for all fuel rail connections until the fault is no longer indicated after the road test.

Observe all instructions for connecting injector pipes.

- Lubricate threads of union nuts with fuel.
- Hand-tighten union nuts on high-pressure pipes. Make sure that connections are not under tension.
- Tightening high-pressure pipes ⇒ [page 97](#)
- Check fuel system for leaks ⇒ [page 79](#) .

14.6 Checking pressure retention valve in fuel return line

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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

Special tools and workshop equipment required

- ♦ Tester for fuel return system -6330-



WARNING

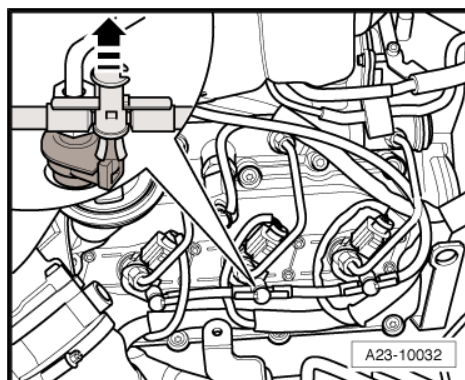
- ♦ *Always read rules for cleanliness and instructions for working on fuel system ⇒ [page 3](#) .*
- ♦ *Follow these instructions and rules for cleanliness before starting work and while working on the fuel system.*

- Remove engine cover panel ⇒ [page 40](#) .
- Clean return line connection on cylinder 1 (with commercial cleaning solution or similar) before removing.
- Dry return line connection on cylinder 1.
- Cover return line connection on cylinder 1 with a cloth.
- Pull return line connection off cylinder 1; to do so, press both tabs down and at the same time pull centre piece up to release connection -arrow-.



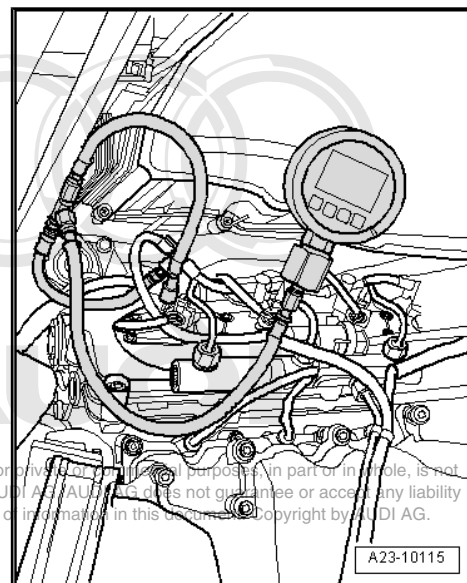
Note

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



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

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



14.7 Checking restrictor in fuel return line

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

Special tools and workshop equipment required

- ◆ Tester for fuel return system -VAS 6330-



WARNING

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

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

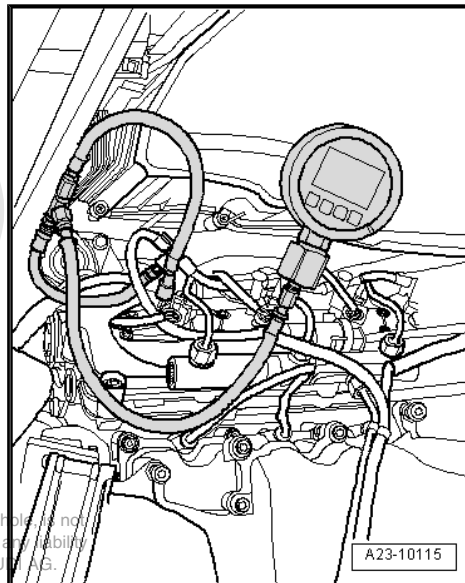


Note

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

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

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

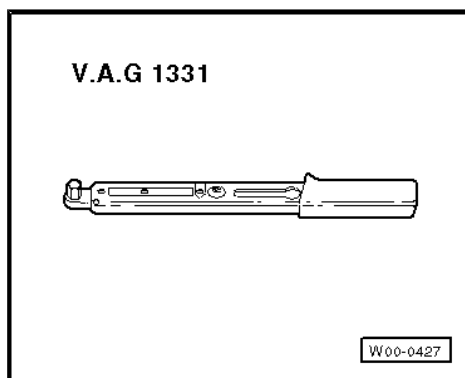


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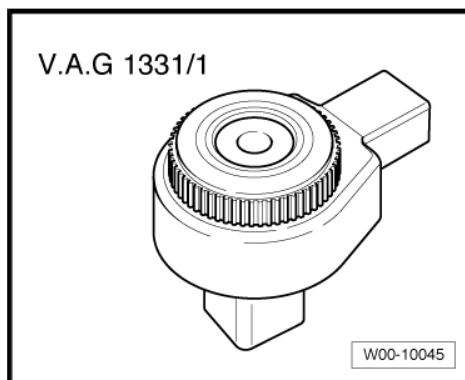
14.8 Removing and installing injectors

Special tools and workshop equipment required

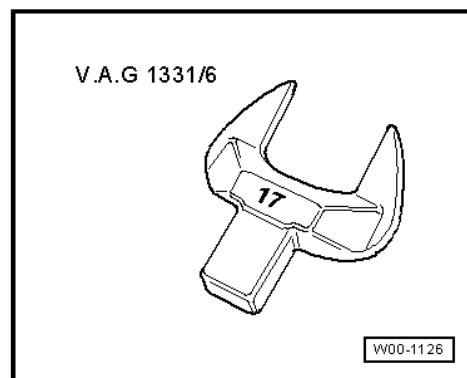
- ◆ Cleaning kit -VAS 6811-
- ◆ Torque wrench -V.A.G 1331-



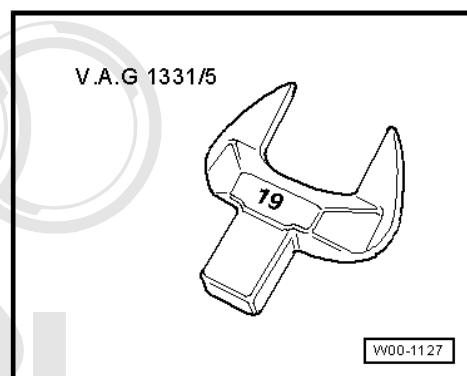
- ◆ Ratchet -V.A.G 1331/1-



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

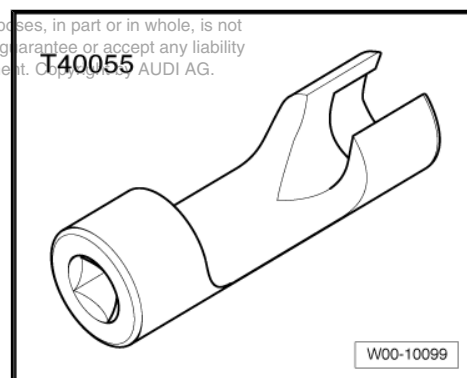


- ◆ Tool insert, AF 19 -V.A.G 1331/5- (engine code CAPA only)



- ◆ Socket -T40055-

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Removing



WARNING

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



Note

- ◆ *The following description shows the removal and installation of the injectors on cylinder bank 2 (left-side).*
- ◆ *Step required only for cylinder bank 1: Remove top section of air cleaner with air mass meter ➔ [page 40](#).*
- ◆ *On cylinder bank 2 the coolant expansion tank must be detached; coolant hoses remain connected.*

- Remove engine cover panel ➤ [page 40](#) .



Caution

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

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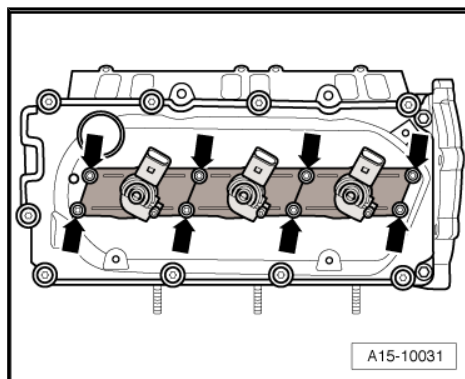
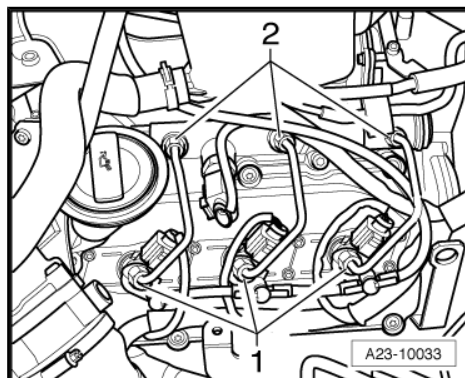
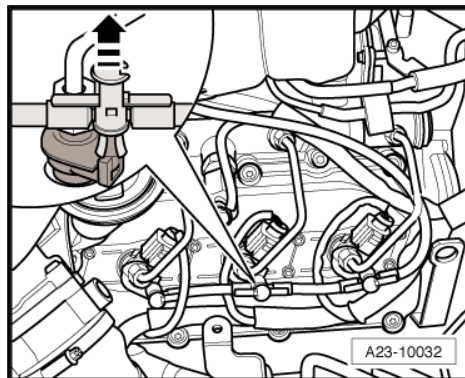
- Pull return line connections off injectors; to do so, press both tabs down and at the same time pull centre piece up to release connection -arrow-.



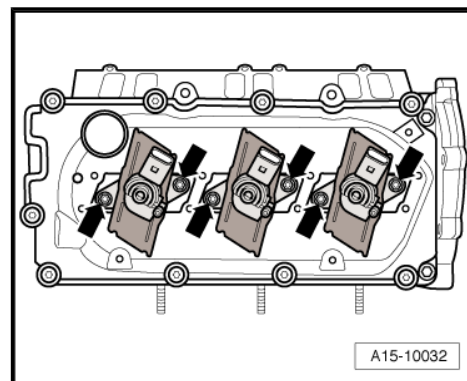
Note

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

- Detach electrical connectors at injectors which are to be removed.
- Loosen union nuts for high-pressure pipes -1- at injectors using socket -T40055- .
- Loosen union nuts for high-pressure pipes at fuel rail using appropriate socket.
- Remove union nuts, carefully take out high-pressure pipes and put them down on a clean cloth.
- Unbolt covers for injectors -arrows-.
- Pull covers upwards and turn them $\frac{1}{4}$ turn (90°).



- Unbolt clamping pieces for injectors -arrows-.



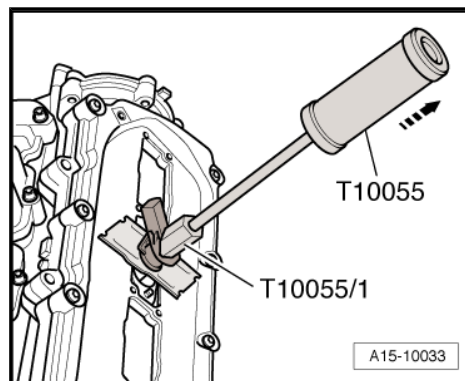
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- Pull out injectors using puller -T10055- with adapter - T10055/1- .
- After removal, lay injectors on a clean cloth.

Installing new injectors

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

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



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.*

Installing used injectors

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

- ◆ Clamping piece
- ◆ Copper seal
- ◆ O-ring for injector bore
- ◆ O-ring for fuel return line connection
- Spray tip of injector nozzle with rust-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.
- Use a plastic bush to fit the new copper seal.



Note

Lubricate all O-rings with engine oil or assembly oil 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 using the cleaning kit -VAS 6811- or a cloth soaked in engine oil.***

- Install injectors.
- ◆ Tightening torques
⇒ ***“5 Exploded view - fuel system (CAMA, CAME, CCWA, CCWB, CGKA, CGKB, CCLA)”***, page 30
- Hand-tighten union nuts on high-pressure pipes. Make sure that connections are not under tension.
- Tighten high-pressure pipes ⇒ ***page 97***.
- Press return line connections carefully over seals and onto injectors (check seal for damage before connecting return line). 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 81***.

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

Bleeding fuel system and checking for leaks



Note

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

- Run engine at idling speed for several minutes and then switch off.
- Switch off ignition.
- Check the complete fuel system including all 6 return line connections for leaks.

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



Note

The return lines can only be renewed as a complete unit.

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



Note

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

- Tightening torques: refer to exploded view of fuel system
⇒ [page 30](#) .



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15 Senders and sensors

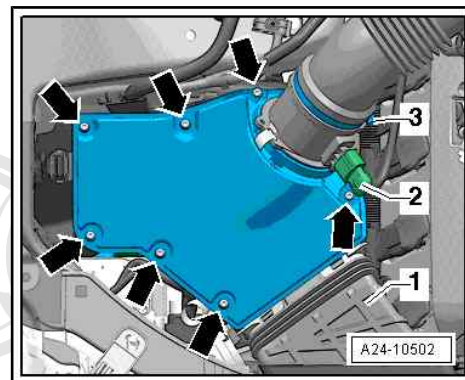
15.1 Removing and installing air mass meter -G70-

Removing

- Unplug electrical connector at air mass meter -G70- -2-.
- Open hose clip -3- at air hose and disconnect air hose from air mass meter -G70- .
- Open both clamps at air mass meter -G70- .
- Carefully pull air mass meter -G70- out of guide on air cleaner housing.

Installing

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



Note

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

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- Check for salt residue, dirt and leaves in air mass meter -G70- and air intake hose (engine intake side).
- Check for dirt in air duct leading to air filter element. If necessary, clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); wash out or use a vacuum cleaner as required. Removing and installing air cleaner ⇒ [page 40](#)
- If air filter element has been removed, clean water drain hose in air cleaner (bottom section).
- Align O-ring in slot on air cleaner housing and carefully push air mass meter -G70- into air cleaner housing.

Note

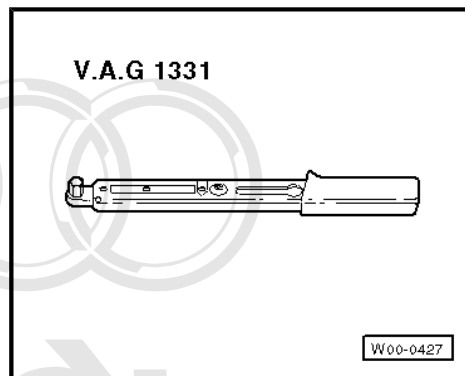
Renew O-ring if damaged.

- Engage the two clamps.
- Fit air hose and tighten hose clamp.
- Plug electrical connector back onto air mass meter -G70- .

15.2 Installing high-pressure pipes

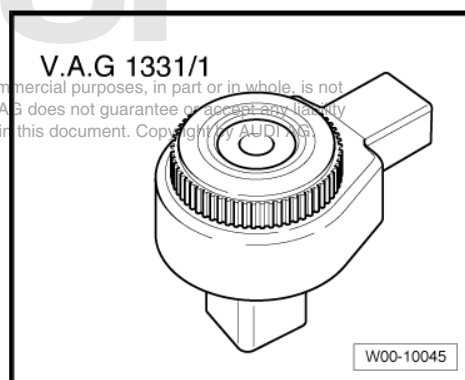
Special tools and workshop equipment required

◆ Torque wrench -V.A.G 1331-

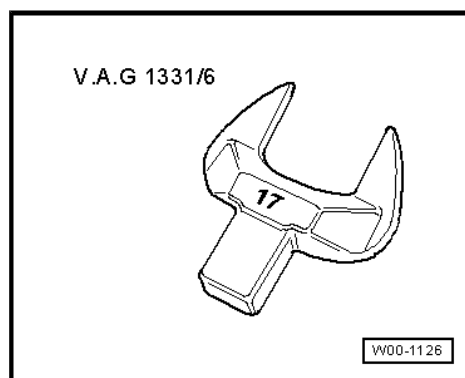


◆ Ratchet -V.A.G 1331/1-

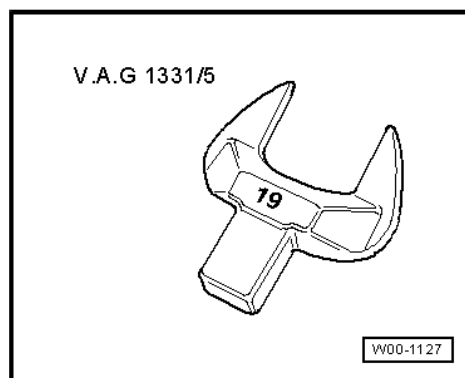
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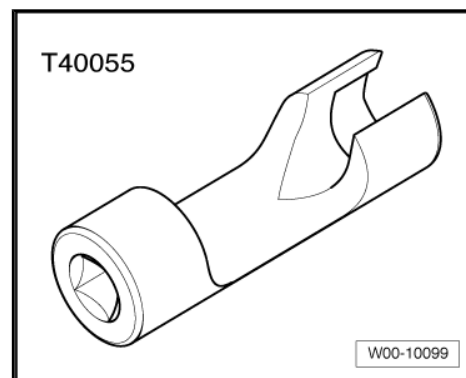
◆ Open end spanner insert, AF 17 -V.A.G 1331/6-



◆ Tool insert, AF 19 -V.A.G 1331/5- (engine code CAPA only)



◆ Socket -T40055-



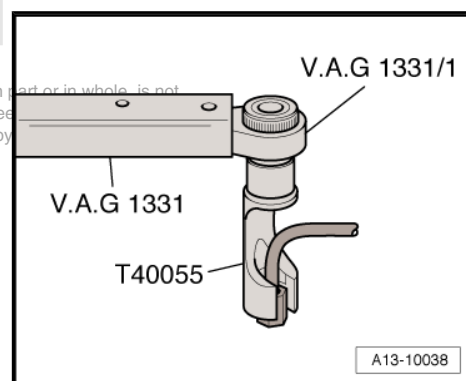
Procedure



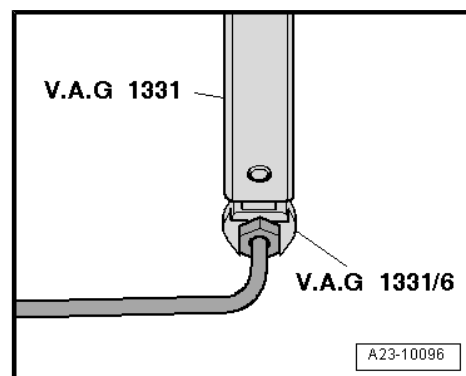
Note

- ◆ *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.*
- Lubricate threads of union nuts with fuel.
- Hand-tighten union nuts on high-pressure pipes (ensure that pipes are not under tension).
- Tightening torque: 25 Nm
- To tighten unions of high-pressure pipes, use torque wrench -V.A.G 1331- with ratchet -V.A.G 1331/1- and socket, 17 mm -T40055- .

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- To tighten unions of high-pressure pipes, use torque wrench -V.A.G 1331- with tool insert, AF 17 -V.A.G 1331/6- / tool insert, AF 19 -V.A.G 1331/5- .
- Check fuel system for leaks ➔ [page 79](#) .



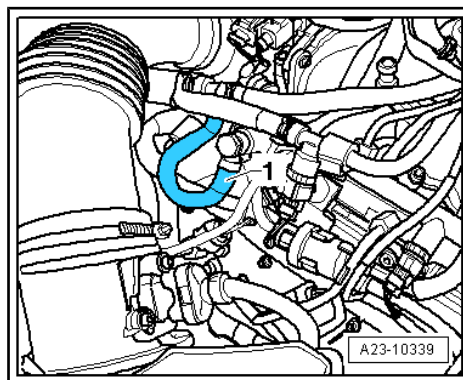
15.3 Checking fuel pressure regulating valve -N276-



WARNING

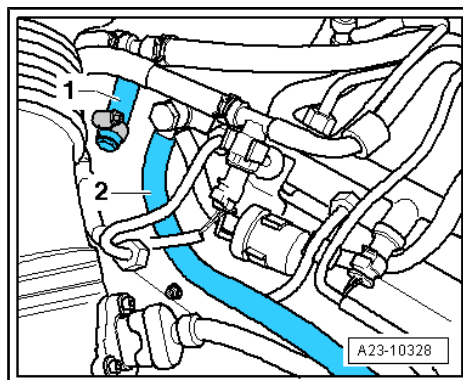
- ◆ Always read rules for cleanliness and instructions for working on fuel system ➔ [page 3](#).
- ◆ Follow these instructions and rules for cleanliness before starting work and while working on the fuel system.

- Remove engine cover panel ➔ [page 40](#).
- Detach fuel return line -1-.



- Seal off open return line connection with a plug -1-.
- Attach a suitable hose -2- to open return line connection.
- Hold end of this hose -2- in a suitable container to measure return flow rate.
- Perform check at starting speed.
- Specification: return flow rate = 0 ml at starting speed

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



15.4 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)



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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 (restrictor) 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.

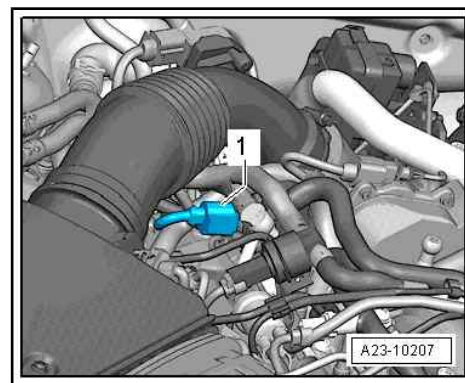
Removing



WARNING

◆ **Always read rules for cleanliness and instructions for working on fuel system ➔ page 3.**

◆ **Follow these instructions and rules for cleanliness before starting work and while working on the fuel system.**



- Remove engine cover panel ➔ [page 40](#) .
- Remove intake hose between air mass meter -G70- and turbocharger.
- Before removal, clean area around thread for fuel pressure regulating valve using 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).
- Open cable tie securing wiring harness located above fuel pressure regulating valve -N276- .
- 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 and the deformable sealing lip 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.
- Use suitable torque wrench with an open-end spanner insert (30 mm) to tighten union nut.

Tightening torque: 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 for fuel return lines with new seals to 25 Nm.
- Remove intake hose between air mass meter -G70- and turbocharger.
- The remaining installation steps are carried out in the reverse sequence.
- After installation, run engine at moderate speed for several minutes and then switch off.
- Check fuel system for leaks.
- Interrogate event memory.

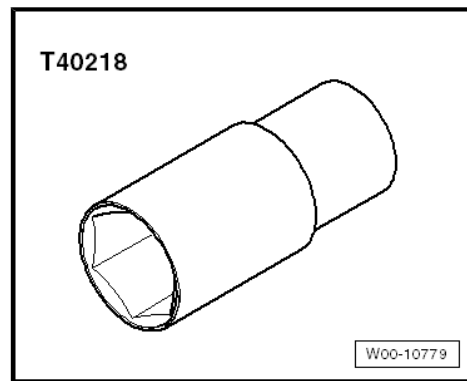
After renewing high-pressure pump and/or fuel pressure regulating valve -N276- , adaption must be performed.

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

15.5 Removing and installing fuel pressure sender -G247-

Special tools and workshop equipment required

- ◆ Socket, 27 mm -T40218-



- ◆ Torque wrench



Note

- ◆ *The fuel pressure sender -G247- continuously measures the fuel pressure in the high-pressure system. It transmits a corresponding voltage signal to the engine control unit -J623-.*
- ◆ *Should the fuel pressure sender fail, the engine control unit will control the fuel pressure via a mapped open-loop backup function. Maximum engine speed in this mode is restricted.*
- ◆ *The fuel pressure sender -G247- has a deformable sealing lip.*

Removing



WARNING

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

- Remove engine cover panel ➔ [page 40](#).
- 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-.
- Unplug electrical connector at fuel pressure sender -G247-.
- Unscrew fuel pressure sender -G247- using socket, 27 mm -T40218-.



Note

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



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

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

Installing



Note

- ◆ *If the deformable sealing lip and the thread of the fuel pressure sender -G247- are not damaged, the sender can be re-used once.*
 - ◆ *Check that the deformable sealing lip and the thread on the new fuel pressure sender -G247- are not damaged.*
 - ◆ *Check sealing surface at opening in fuel rail.*
 - ◆ *The beginning of the thread and the deformable sealing lip of the fuel pressure sender -G247- must be coated with diesel fuel.*
- Screw in fuel pressure sender -G247- by hand.
 - Then tighten fuel pressure sender -G247- to specified torque.
 - Tightening torques: refer to exploded view of fuel system
⇒ [page 30](#).

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



Note

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

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

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

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



Note

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

- After road test, interrogate event memory again.

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16 Lambda probe and exhaust gas temperature control (CAMA, CAMB, CCWA, CCWB, CGKA, CGKB, CAPA)

16.1 Exploded view - Lambda probe and exhaust gas temperature control

1 - Particulate filter

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

- ☐ New Lambda probes are coated with an assembly paste
- ☐ In the case of a used Lambda probe, coat only thread with high-temperature paste; refer to ➔ Parts catalogue for high-temperature paste
- ☐ The assembly paste / high-temperature paste must not make contact with the slots on the Lambda probe body
- ☐ Removing and installing ➔ [page 106](#)
- ☐ 50 Nm

3 - Exhaust gas temperature sender 1 -G235-

- ☐ Only fitted on vehicles with engine codes CAPA, CCWA, CCWB
- ☐ Removing and installing ➔ Rep. gr. 26
- ☐ 45 Nm

4 - Turbocharger

5 - Exhaust gas temperature sender

- ☐ Exhaust gas temperature sender 3 -G495- (engine codes CAMA, CAMB, CCWA, CCWB, CGKA and CGKB)

- ☐ Exhaust gas temperature sender 2 -G448- (engine code CAPA)
- ☐ Removing and installing ➔ Rep. gr. 26
- ☐ 45 Nm

6 - Exhaust gas pressure sensor 1 -G450-

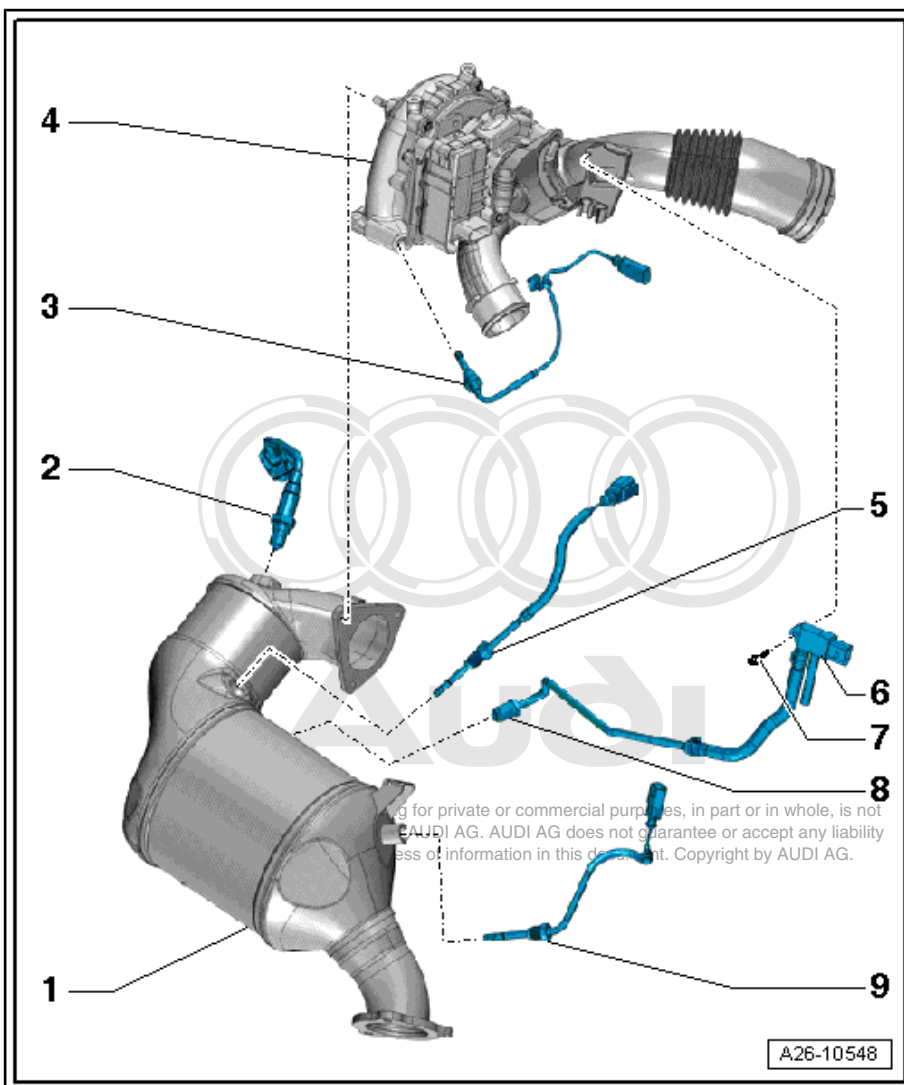
- ☐ Removing and installing ➔ [page 107](#)

7 - Bolt

- ☐ 4.5 Nm

8 - Control pipe for exhaust gas pressure sensor 1 -G450-

- ☐ Pressure pipe to particulate filter: 45 Nm



- ☐ Secure to pressure sensor with hose clip
- ☐ Do not attempt to bend pressure pipe to a different shape
- ☐ Install free of stress

9 - Exhaust gas temperature sender

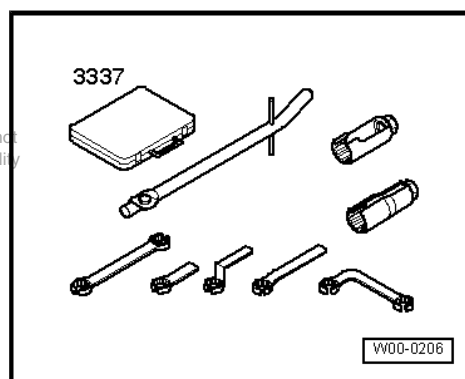
- ☐ Exhaust gas temperature sender 4 -G648- (engine codes CAMA, CAMB, CCWA, CCWB, CGKA and CGKB)
- ☐ Exhaust gas temperature sender 3 for cylinder bank 1 -G496- (engine code CAPA)
- ☐ Removing and installing ⇒ Rep. gr. 26
- ☐ 45 Nm

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

Special tools and workshop equipment required

- ◆ Lambda probe open ring spanner set -3337-

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Removing

- Remove engine cover panel ⇒ [page 40](#) .
- Unplug electrical connector -2- for Lambda probe -G39- .
- Unscrew Lambda probe -G39- -1- using tool from Lambda probe open ring spanner set -3337- .

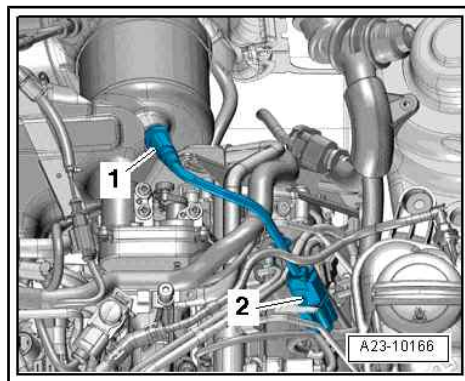
Installing

When installing, note the following:



Note

- ◆ *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*
- ◆ *In the case of a used Lambda probe grease only the thread with high-temperature paste. The paste must not get into the slots on the Lambda probe body. For high-temperature paste refer to ⇒ Parts catalogue .*
- ◆ *When installing, the Lambda probe wiring must always be re-attached at the same locations to prevent it from coming into contact with the exhaust pipe.*
- Tightening torque: refer to Lambda probe - overview
⇒ [page 105](#)



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

The exhaust gas pressure sensor 1 -G450- is connected to a take-off point upstream of the particulate filter via a pipe.

The second measuring line is approx. 7 cm in length and free to atmosphere (relative pressure sensor concept).

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

Removing

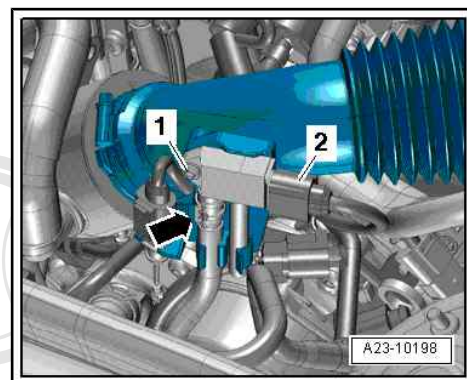
- Remove engine cover panel ➔ [page 40](#) .
- Before disconnecting, spray hoses coming from exhaust gas pressure sensor 1 -G450- with suitable release agent.
- Carefully pull hoses off connections (take care to keep the hoses straight; the connections can easily break off exhaust gas pressure sensor 1 -G450-).



Note

The short measuring line can also be pulled off with the exhaust gas pressure sensor 1 -G450- removed.

- Detach electrical connector -2- from exhaust gas pressure sensor 1 -G450- .
- Unscrew bolt -1- and remove exhaust gas pressure sensor 1 -G450- .



Installing

- When installing, note the following:
 - Tightening torque
➔ ["16.1 Exploded view - Lambda probe and exhaust gas temperature control", page 105](#) .



Note

- ◆ *Before installing, blow out hose for exhaust gas pressure sensor 1 -G450- to particulate filter 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.*
- ◆ *If pressure pipe has been released from particulate filter, tighten to 45 Nm.*

After renewing exhaust gas pressure sensor 1 -G450- and/or particulate filter, adaption must be performed in order to reset learnt values. The adaption procedure is described in the Guided Fault Finding or Guided Functions; use a vehicle diagnostic tester .

17 Lambda probe and exhaust gas temperature control (CCLA)

17.1 Exploded view - Lambda probe and exhaust gas temperature control

1 - Nut

- ☐ 3.5 Nm

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

- ☐ Removing and installing ➔ [page 111](#)
- ☐ Tightening torque for NOx sender 2 -G687- : 50 Nm

3 - Rear silencer

4 - SCR catalytic converter

- ☐ The abbreviation SCR stands for Selective Catalytic Reduction.

5 - Exhaust pipe

6 - Particulate filter

- ☐ Removing and installing ➔ Rep. gr. 26

7 - Exhaust gas temperature sender 3 -G495-

- ☐ Removing and installing ➔ Rep. gr. 26
- ☐ Coat thread with high-temperature paste; refer to ➔ Parts catalogue
- ☐ 45 Nm

8 - Lambda probe -G39- with Lambda probe heater -Z19-

- ☐ New Lambda probes are coated with an assembly paste
- ☐ In the case of a used Lambda probe, coat only thread with high-temperature paste; refer to ➔ Parts catalogue for high-temperature paste
- ☐ The assembly paste / high-temperature paste must not make contact with the slots on the Lambda probe body
- ☐ Removing and installing ➔ [page 109](#)
- ☐ 50 Nm

9 - Control unit for NOx sender -J583- with NOx sender -G295-

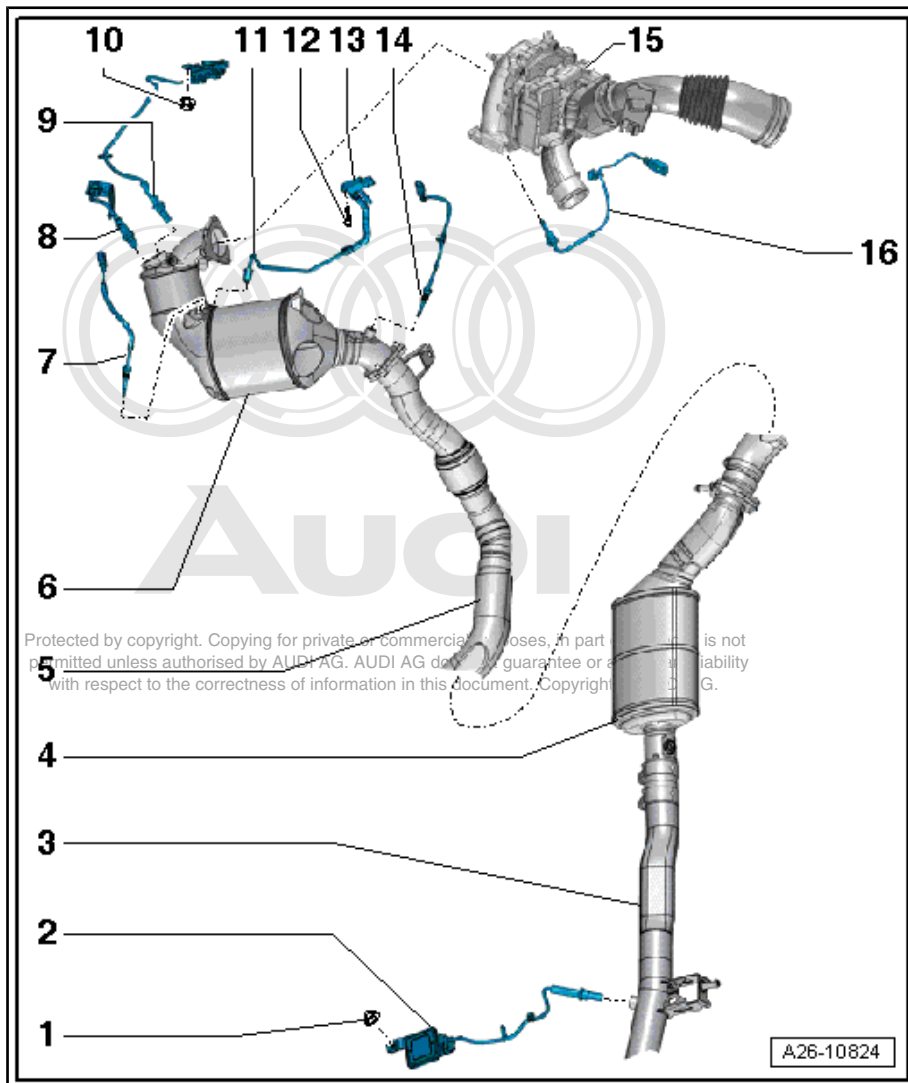
- ☐ Removing and installing ➔ [page 110](#)
- ☐ Tightening torque for NOx sender -G295- : 50 Nm

10 - Nut

- ☐ 3.5 Nm

11 - Control pipe for pressure differential sender -G505-

- ☐ Tighten to 45 Nm at exhaust
- ☐ Secure to pressure sensor with hose clip



- ☐ Do not attempt to bend pressure pipe to a different shape
- ☐ Install free of stress

12 - Bolt

- ☐ 4.5 Nm

13 - Pressure differential sender -G505-

- ☐ Removing and installing ⇒ [page 111](#)
- ☐ Adaption must be performed after renewing this component

14 - Exhaust gas temperature sender 4 -G648-

- ☐ Removing and installing ⇒ Rep. gr. 26
- ☐ Coat thread with high-temperature paste; refer to ⇒ Parts catalogue
- ☐ 45 Nm

15 - Turbocharger

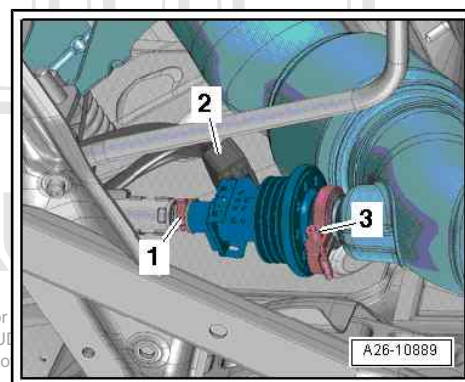
- ☐ Removing and installing ⇒ Rep. gr. 21

16 - Exhaust gas temperature sender 1 -G235-

- ☐ Removing and installing ⇒ Rep. gr. 26
- ☐ Coat thread with high-temperature paste; refer to ⇒ Parts catalogue
- ☐ 45 Nm

Injector for reducing agent -N474-

Removing and installing injector for reducing agent -N474- ⇒
Rep. gr. 26

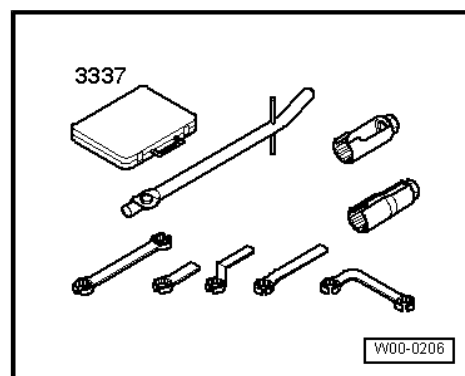


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17.2 Removing and installing Lambda probe -G39- with Lambda probe heater -Z19-

Special tools and workshop equipment required

- ◆ Lambda probe open ring spanner set -3337-



Removing

- Remove engine cover panel ⇒ [page 40](#) .
- Unplug electrical connector -2- for Lambda probe -G39- .

- Unscrew Lambda probe -G39- -3- using tool from Lambda probe open ring spanner set -3337- .

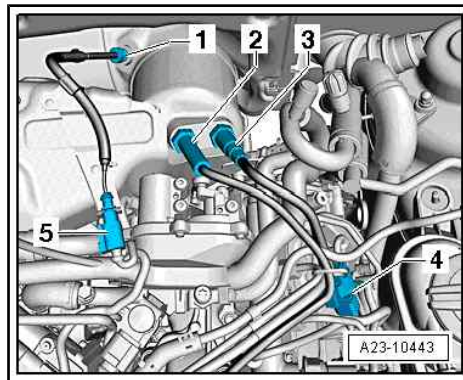
Installing

When installing, note the following:



Note

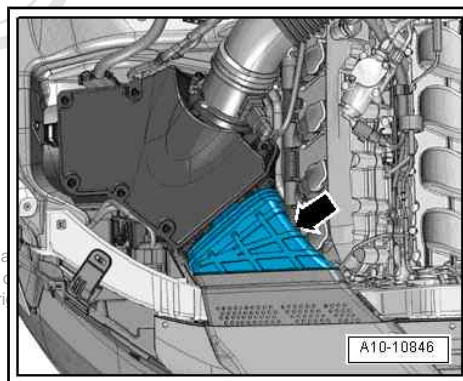
- ◆ *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*
- ◆ *In the case of a used Lambda probe grease only the thread with high-temperature paste. The paste must not get into the slots on the Lambda probe body. For high-temperature paste refer to ➔ Parts catalogue .*
- ◆ *When installing, the Lambda probe wiring must always be re-attached at the same locations to prevent it from coming into contact with the exhaust pipe.*
- Tightening torque: Lambda probe and exhaust gas temperature control - exploded view ➔ [page 108](#) .



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

Removing

- Remove engine cover panel ➔ [page 40](#) .
- Remove air duct -arrow-.

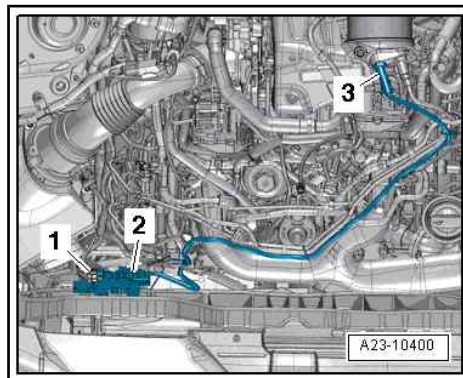


- Unplug electrical connector -2-.
- Unscrew nuts -1- and detach control unit for NOx sender -J583- .
- Move clear electrical wiring harness and unscrew NOx sender -G295- -3-.

Installing

Install in reverse order.

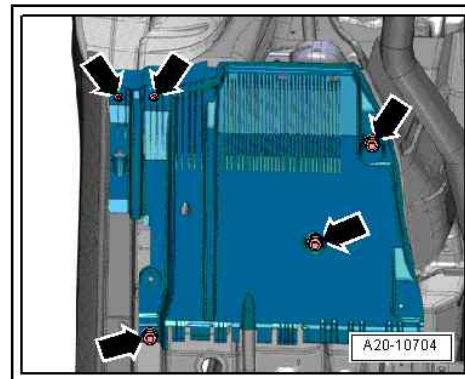
- Tightening torque: Lambda probe and exhaust gas temperature control - exploded view ➔ [page 108](#) .



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

Removing

- Remove bolt and nuts -arrows- and detach cover for active tank.



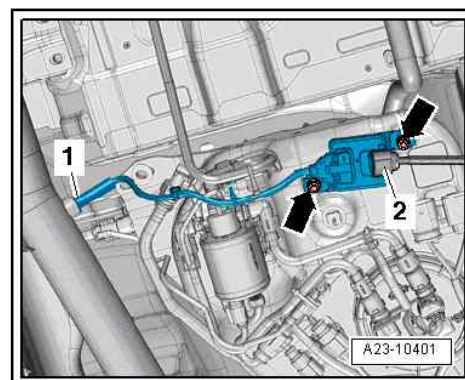
- Unplug electrical connector -2-.
- Unscrew nuts -arrows- for control unit for NOx sender 2 -J881-.
- Unscrew and detach NOx sender 2 -G687- -1-.

Installing

- Tightening torque: Lambda probe and exhaust gas temperature control - exploded view ➔ [page 108](#).

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

- Install cover for active tank ➔ Rep. gr. 26.



17.5 Removing and installing pressure differential sender -G505-

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

The second measuring line is approx. 7 cm in length and free to atmosphere (relative pressure sensor concept).

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

Removing

- The pressure differential sender -G505- -3- is mounted at the end face.

- Before disconnecting, spray the hoses for the pressure differential sender -G505- with suitable release agent.
- Carefully disconnect the hoses from their connections (take care to keep the hoses straight: the connections on pressure differential sender -G505- can break off easily).



Note

The short measuring line can also be pulled off with the exhaust gas pressure sensor 1 -G450- removed.

- Unplug electrical connector -2- at pressure differential sender -G505- .
- Unscrew bolt -1- and take out pressure differential sender - G505- .

Installing

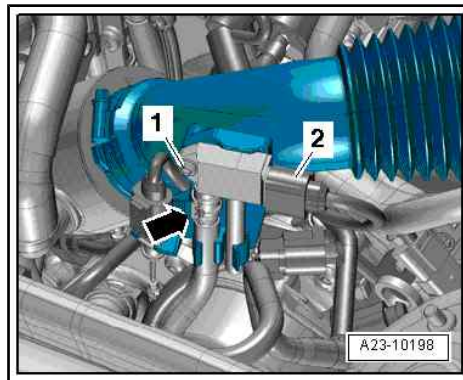
- When installing, note the following:



Note

- ◆ *Before installing, blow out hose for pressure differential sender -G505- towards particulate filter with compressed air (hose can become obstructed or may ice up due to condensation).*
- ◆ *Make sure that hoses are securely fitted and seal properly.*
- ◆ *If pressure pipes have been detached from particulate filter, tighten connections to specified torque.*
- Tightening torque: Lambda probe and exhaust gas temperature control - exploded view ➔ [page 108](#) .

After renewing exhaust gas pressure sensor 1 -G450- and/or particulate filter, adaption must be performed in order to reset learnt values. The adaption procedure is described in the Guided Fault Finding or Guided Functions; use a vehicle diagnostic tester .



Audi

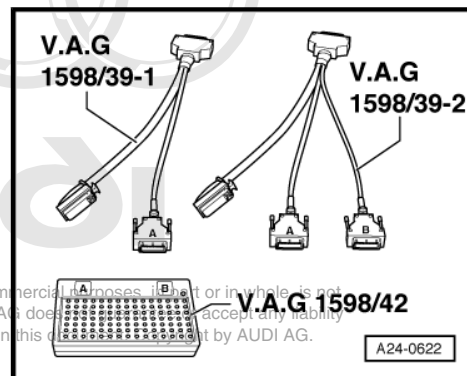
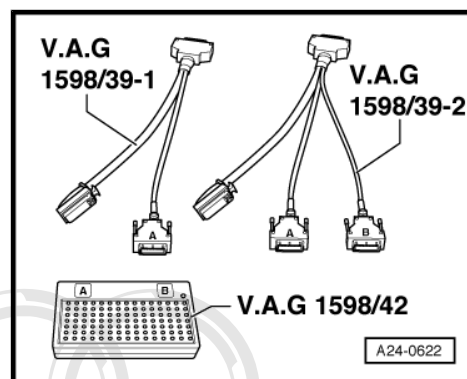
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18 Engine control unit

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

Special tools and workshop equipment required

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

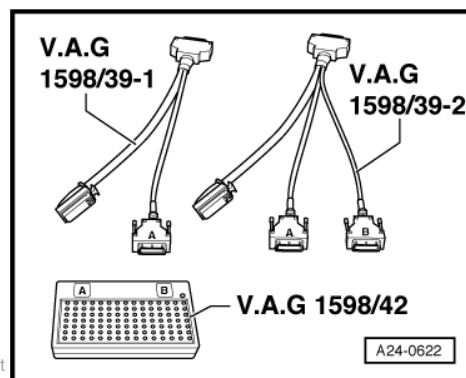


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Note

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



WARNING

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

- Remove engine control unit ➔ [page 115](#) .



Note

Not every engine control unit is bolted to locking plates. Whether locking plates are fitted depends on the engine/gearbox combination.

- Connect test box -V.A.G 1598/42- with adapter -V.A.G 1598/39-1- or -V.A.G 1598/39-2- to connector on wiring harness. The earth clip on the test box must be connected to the negative battery terminal. The instructions for performing the individual tests indicate whether or not the engine control unit itself also needs to be connected to the test box.
- Carry out test as described in appropriate repair procedures.

Installing engine control unit

Installation is performed in the reverse sequence.

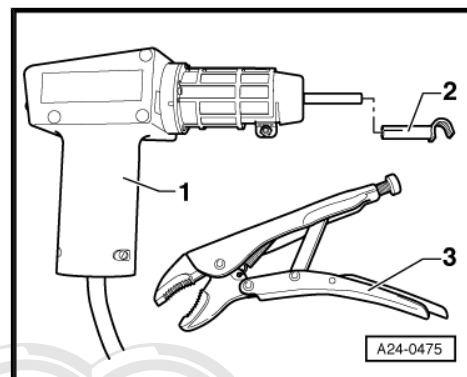
- After installation, the locking plates must be re-fitted on the control unit (if locking plates were fitted previously).

- Clean threaded holes for shear bolts to remove any residue from locking fluid. This can be done using a thread tap.
- Always use new shear bolts.
- Interrogate event memory and erase if necessary.

18.2 Renewing engine control unit -J623-

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-



Removing

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

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

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

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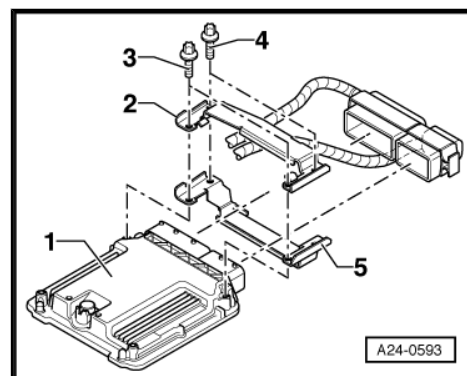
Note

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.

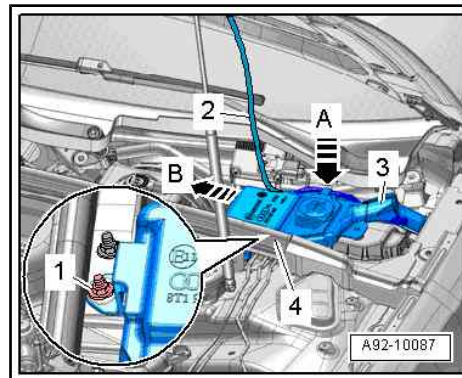


Note

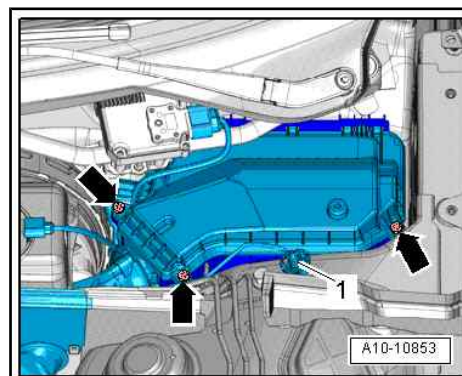
- ◆ *Not every engine control unit is bolted to locking plates. Whether locking plates are fitted depends on the engine/gear-box combination.*
- ◆ *The engine control unit -1- is bolted to the locking plates -2 and 5-. To make it more difficult to unscrew the shear bolts -4-, the threads have additionally been coated with locking fluid.*



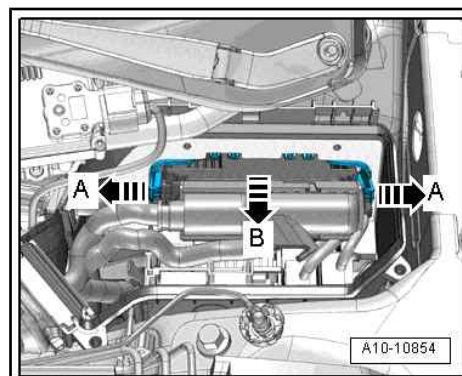
- Slightly pull off rubber seal in front of nut -1- on plenum chamber cover.
- Remove nut -1-.
- Unhook wiring harness -2- from retainers -A-.
- Pull filler neck -3- with filler pipe out of washer fluid reservoir and through opening in body.



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

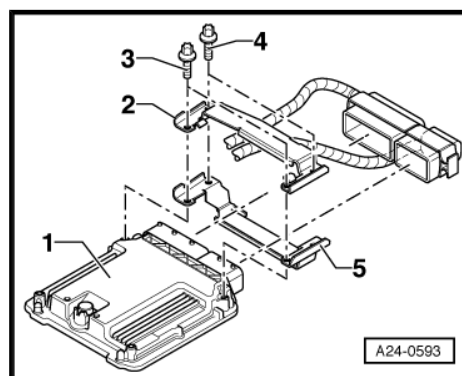


- Release retainers -arrows A- and pull out engine control unit -J623- -arrow B-.

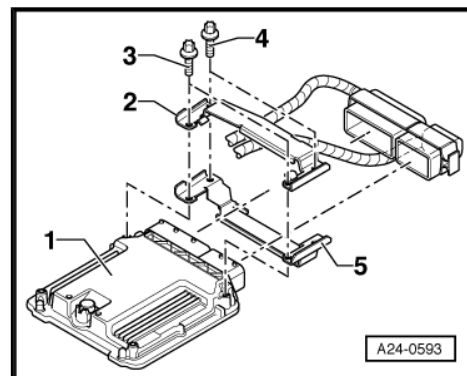


To help prevent unauthorised access to the connectors on the engine control unit, the engine control unit -1- is bolted onto locking plates -2 and 5- with shear bolts -3 and 4-.

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.

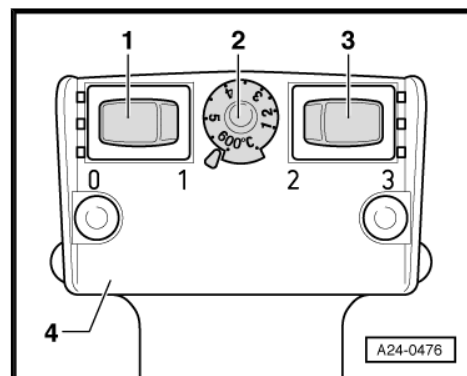


- Select settings on hot air blower as shown in illustration, i.e. set temperature potentiometer -2- to maximum heat output and two-stage air flow switch -3- to position 3.



WARNING

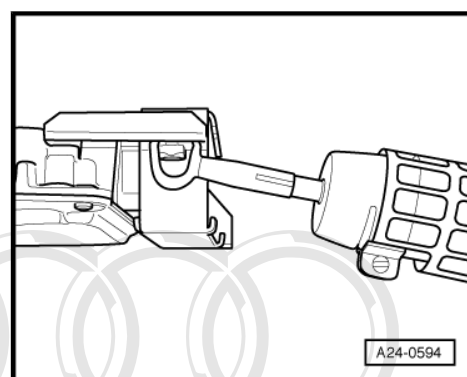
Heating the thread of the locking plate also heats up the shear bolts and parts of the metal housing. Take care to avoid burns. It is also important to ensure that only the thread is heated and none of the surrounding components if at all possible. These should be covered if necessary.



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).





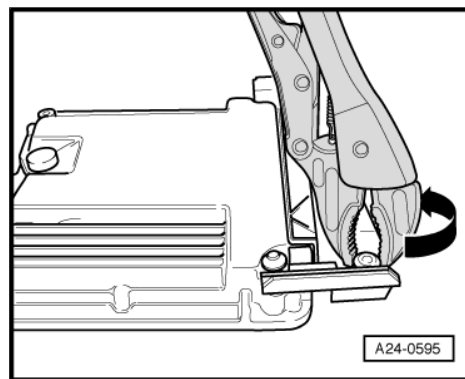
- The two shear bolts screwed into the engine control unit do not need to be heated. They should be removed without being heated.
- Detach locking plate from control unit connectors.
- Release connectors on engine control unit and unplug connectors.
- Take out old engine control unit -J623- and install new engine control unit -J623- .

Installing

Installation is performed in the reverse sequence.

- It is important that the locking plates be re-fitted on the control unit (if locking plates were fitted previously).
- Clean threaded holes for shear bolts to remove any residue from locking fluid. This can be done using a thread tap.
- Always use new shear bolts.
- Tightening torque for bolts securing lid of electronics box: 3.5 Nm.
- 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 .



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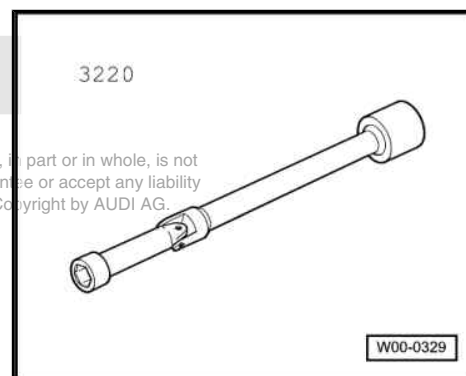
28 – Glow plug system

1 Removing and installing glow plugs (CAMA, CAPA, CAMB, CCWA, CCWB, CGKA, CGKB)

Special tools and workshop equipment required

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

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Removing

- Switch off ignition.
- Remove engine cover panel ➔ [page 40](#) .



Note

For cylinders No. 3 and 6 the respective intake manifold flap motor must be detached. Do not detach the connecting rod. The wiring harness must also be detached (unscrew the respective retaining stud for the engine cover panel).

- Detach glow plug connectors from glow plugs.
- Clean glow plug openings in cylinder head; make sure no dirt gets into cylinder.



Note

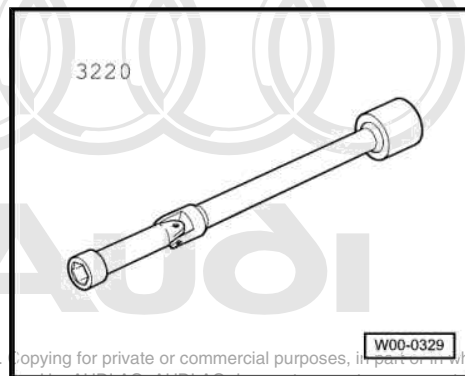
- ◆ *Cleaning procedure:*
- ◆ *Use a vacuum cleaner to remove coarse dirt.*
- ◆ *Spray brake cleaner or suitable cleaning agent into glow plug openings, let it work in briefly, and blow out with compressed air.*
- ◆ *Then clean the glow plug openings using a cloth moistened with oil.*



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

Installing

- To tighten the glow plugs use special tool U/J extension and socket, 10 mm -3220- with a suitable torque wrench.
- Then tighten glow plugs to specified torque.
- Tightening torque: 17 Nm
- Attach glow plug connectors correctly and make sure they are securely fitted.
- Install any ancillary units that were previously detached.

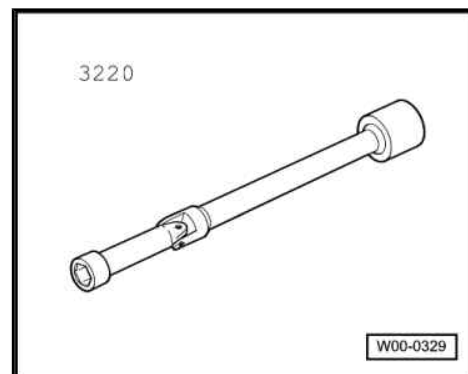


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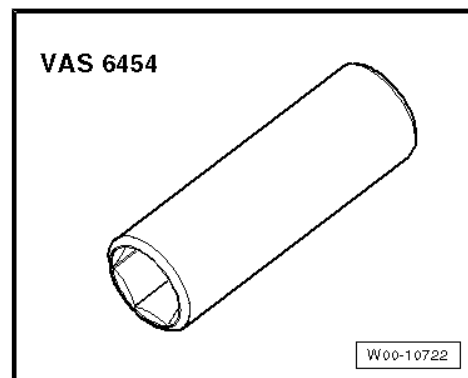
2 Removing and installing glow plugs (CCLA)

Special tools and workshop equipment required

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



- ◆ Socket insert AF 12 for glow plugs 4-cyl.TDI CR diesel -VAS 6454- (for glow plugs for cylinders 2 and 5)



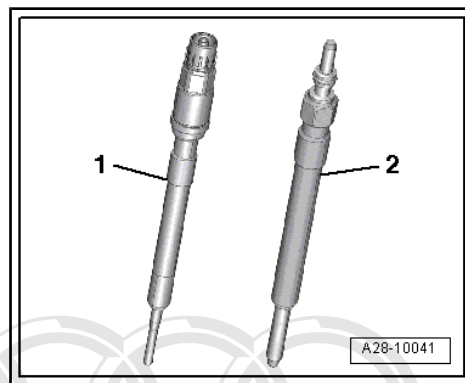
Removing

- Switch off ignition.
- Remove engine cover panel ➔ [page 40](#) .



Note

- ◆ For cylinders No. 3 and 6 the respective intake manifold flap motor must be detached. Do not detach the connecting rod. The wiring harness must also be detached (unscrew the respective retaining stud for the engine cover panel).
- ◆ On cylinders 3 and 5, a combustion chamber pressure sender is integrated in the glow plugs.
- ◆ Designation: glow plug 2 -Q11- with cylinder 2 combustion chamber pressure sender -G678-
- ◆ Designation: glow plug 5 -Q14- with cylinder 5 combustion chamber pressure sender -G681-



Glow plug versions

- 1 - Glow plug with combustion chamber pressure sender (only installed on cylinders 2 and 5)
- 2 - Glow plug without combustion chamber pressure sender
- Detach glow plug connectors from glow plugs.
- Clean glow plug openings in cylinder head; make sure no dirt gets into cylinder.

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Note

- ◆ *Cleaning procedure:*
- ◆ *Use a vacuum cleaner to remove coarse dirt.*
- ◆ *Spray brake cleaner or suitable cleaning agent into glow plug openings, let it work in briefly, and blow out with compressed air.*
- ◆ *Then clean the glow plug openings using a cloth moistened with oil.*
- To loosen glow plugs 1, 3, 4 and 6, use U/J extension and socket, 10 mm -3220- .
- To loosen glow plugs 2 and 5, use socket insert AF 12 for glow plugs 4-cyl.TDI CR diesel -VAS 6454- .

Installing

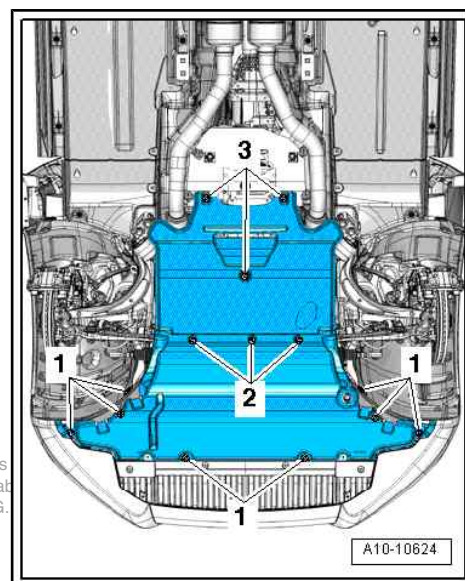
- Fit glow plugs carefully by hand or using a suitable hose. Keep the glow plugs straight while screwing them back in.
- To tighten glow plugs, use U/J extension and socket, 10 mm -3220- / socket insert AF 12 for glow plugs 4-cyl.TDI CR diesel -VAS 6454- and a suitable torque wrench.
- Tightening torque: 17 Nm
- Attach glow plug connectors correctly and make sure connectors are securely fitted.
- Install any ancillary units that were previously detached.
- Tightening torque for intake manifold flap motor: refer to exploded view of intake manifold ➔ [page 44](#) .

3 Removing and installing engine speed sender -G28-

Removing

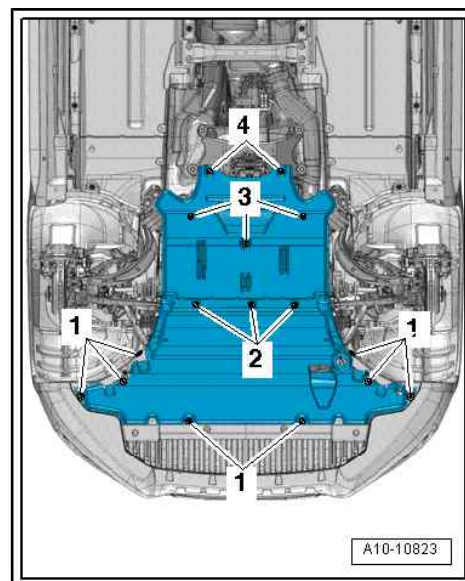
Vehicles with manual gearbox:

- Release fasteners -1, 2, 3- and remove noise insulation panels.



Vehicles with multitronic gearbox:

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



All vehicles (continued):

- Unplug electrical connector -2-.
- Unscrew bolt -1- and detach engine speed sender -G28- downwards.

Installing

- Tightening torque: 9 Nm

Install in reverse order.

