

Workshop Manual

Audi A4 2008 ➤

Audi A5 Cabriolet 2009 ➤

Audi A5 Coupé 2008 ➤

Direct petrol injection and ignition system (8-cyl. 4.2 ltr.
4-valve), RS 4, RS 5

Engine ID	CFS A								
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Edition 07.2013



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List of Workshop Manual Repair Groups

Repair Group

24 - Mixture preparation - injection

28 - Ignition 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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24 – Mixture preparation - injection

1 Safety precautions and rules for cleanliness

(ARL003423; Edition 07.2013)

⇒ [“1.1 General notes on self-diagnosis”, page 1](#)

⇒ [“1.2 Safety precautions when working on the fuel system”, page 2](#)

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⇒ [“1.6 Rules for cleanliness and instructions for working on fuel system”, page 3](#)

⇒ [“1.7 Reducing pressure in high-pressure section of injection system”, page 4](#)

⇒ [“1.8 Checking for leaks in the fuel system”, page 5](#)

⇒ [“1.9 Checking vacuum system”, page 5](#)

1.1 General notes on self-diagnosis

- ◆ The engine control unit has a self-diagnosis capability.
- ◆ Interrogate the event memory before carrying out any repairs or Fault Finding.
- ◆ The vacuum hoses and connections must be checked (to prevent unmetered air).
- ◆ Fuel hoses in engine compartment must only be secured with spring-type clips. O-type clips or screw-type clips must not be used.
- ◆ A voltage of at least 11.5 V is required for proper operation of the electrical components.
- ◆ Do not use sealants containing silicone. Particles of silicone drawn into the engine will not be burnt in the engine and will damage the Lambda probe.
- ◆ The vehicles are fitted with a crash/fuel shut-off system. This function is designed to reduce the risk of a vehicle fire after a crash by deactivating the fuel pump via the engine control unit.

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1.2 Safety precautions when working on the fuel system

When working on the fuel system note the following warnings:



WARNING

There is a risk of injury: avoid skin contact with fuel.

- ◆ *The fuel pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening the system; for the correct procedure see [⇒ page 4](#).*
- ◆ *The connection must be opened IMMEDIATELY after reducing the pressure; wrap a cloth around the connection and allow the residual pressure (approx. 7 bar) to dissipate.*

Escaping fuel can cause a fire risk.

- ◆ *As the fuel pump is activated by the door contact switch when the driver's door is opened, disconnect the voltage supply for the fuel pump if the battery has NOT been disconnected.*
- ◆ *Remove fuse for fuel pump control unit - J538- ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.*

- ◆ Fuel hoses in engine compartment must only be secured with spring-type clips. O-type clips or screw-type clips must not be used.
- ◆ Do not use sealants containing silicone. Particles of silicone drawn into the engine will not be burnt in the engine and will damage the Lambda probes.

1.3 Safety precautions when working on the injection and ignition system

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

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- ◆ Persons wearing a cardiac pacemaker must at all times maintain a safe distance from high-voltage components such as the ignition system and xenon headlights.
- ◆ Always switch off the ignition before connecting or disconnecting electrical wiring for the injection or ignition system or tester cables.
- ◆ For safety reasons, the battery must be disconnected before opening the fuel system to prevent the fuel pump from being activated by the contact switch on the driver's door.
- ◆ Do not open any fuel line connections while the engine is running.
- ◆ Always switch off ignition before washing engine.
- ◆ If you want to turn the engine at cranking speed without actually starting the engine (e.g. compression test), first unplug the electrical connectors from the injectors and the ignition coils [⇒ page 61](#).



Caution

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

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

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

1.4 Safety precautions when working on 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 using testers and measuring instruments during a road test

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



WARNING

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

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

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

1.6 Rules for cleanliness and instructions for working on fuel system

Even small amounts of dirt can cause malfunctions. When working on the fuel supply system and injection system, pay careful attention to the following basic rules:

- ◆ Carefully clean connection points and the surrounding area with engine cleaner or brake cleaner and dry thoroughly before opening.



- ◆ Seal off open pipes/lines and connections immediately with clean plugs, e.g. from engine bung set - VAS 6122- .
- ◆ Place parts that have been removed on a clean surface and cover them over. Do not use fluffy cloths.
- ◆ Carefully cover or seal open components if repairs cannot be carried out immediately.
- ◆ Only install clean components; replacement parts should only be unpacked immediately prior to installation. Do not use parts that have been previously unpacked and stored away loose (e.g. in toolboxes, etc.).
- ◆ When the system is open: Do not work with compressed air. Do not move the vehicle unless absolutely necessary.
- ◆ Protect unplugged electrical connectors against dirt and moisture and make sure connections are dry when attaching.

1.7 Reducing pressure in high-pressure section of injection system

Special tools and workshop equipment required

- ◆ Vehicle diagnostic tester



WARNING

The fuel system operates at extremely high pressure. This can cause injury.

- ◆ *The injection system consists of a high-pressure section (maximum approx. 140 bar) and a low-pressure section (4 ... 7 bar).*
- ◆ *Prior to opening the high-pressure section (e.g. when removing the high-pressure pump, fuel rail, injectors, fuel pipes or fuel pressure sender - G247-), the pressure in the high-pressure section must be reduced to a specified level. The procedure is described below.*

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Procedure

- Connect ⇒ Vehicle diagnostic tester, select function "Reducing fuel pressure in fuel rail" in "Guided Functions" and follow on-screen instructions.
- Fuel pressure will drop to a specified value.
- Switch off ignition.

The fuel rail is still filled with fuel, however it is no longer under high pressure.



WARNING

There is a risk of injury: avoid skin contact with fuel.

- ◆ *Wear safety goggles and protective clothing when opening the fuel system.*
- ◆ *Before opening the high-pressure section of the fuel system, place a clean cloth around the connection to catch escaping fuel.*

- The high-pressure system must be opened »immediately« after reducing the fuel pressure; wrap a clean cloth around the connection. Catch the escaping fuel.

 Note

- ◆ *The pressure will increase again due to the effect of residual heat if the high-pressure system is not opened immediately.*
- ◆ *The ignition must not be switched on again from this point on as this would increase the pressure again.*

Additional steps required

- Erase event memory and generate readiness code in engine control unit in “Guided Functions” mode.

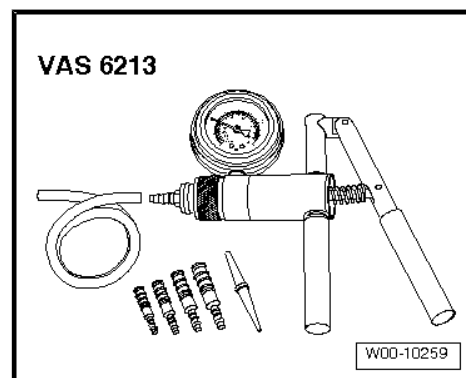
1.8 Checking for leaks in the fuel system

- Allow engine to run for several minutes at moderate rpm.
- Switch off ignition.
- Check complete fuel system for leaks.
- If leaks are found although the connections have been tightened to the correct torque, the relevant component must be renewed.
- Road-test vehicle and accelerate with full throttle at least once.
- Then inspect high-pressure section again for leaks.

1.9 Checking vacuum system

Special tools and workshop equipment required

- ◆ Hand vacuum pump - VAS 6213-



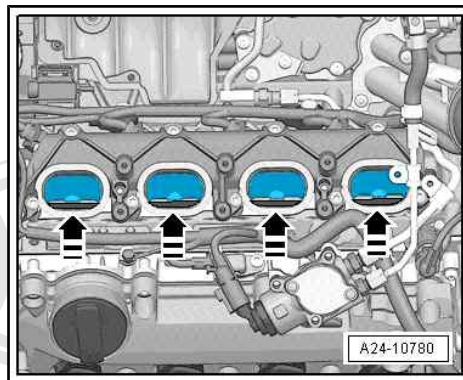
Procedure

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



Vacuum units

- After renewing vacuum units, check vacuum system for leaks.
- If there are still leaks, remove intake manifold (bottom section) and trace leaks.
- Also check that intake manifold flaps -arrows- function correctly and are not obstructed by guide plates in cylinder head.



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2 Injection system

⇒ [“2.1 Technical data”, page 7](#)

⇒ [“2.2 Overview of fitting locations - injection system”, page 7](#)

⇒ [“2.3 Exploded view - vacuum system”, page 14](#)

2.1 Technical data

Engine data		4.2 ltr. FSI engine
Idling speed is not adjustable (controlled by idling speed stabilisation).		620 ... 720 rpm
Maximum rpm governed by deactivation of fuel injectors		8500 rpm
Fuel pressure	Initial fuel pressure up to high-pressure pump (generated by electric fuel pump in fuel tank)	5.0 ... 6.5 bar
	Pressure in high-pressure fuel circuit (generated by mechanical single-plunger pump) at a coolant temperature of approx. 85°C.	25 ... 135 bar (depending on operating conditions)

2.2 Overview of fitting locations - injection system

Part 1

1 - Secondary air pump motor - V101-

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

2 - Continued coolant circulation pump - V51-

- ☐ Fitting location
⇒ [page 13](#)
- ☐ Removing and installing
⇒ Rep. gr. 19

3 - Throttle valve module - J338-

- ☐ Including throttle valve drive for electric throttle - G186- , throttle valve drive angle sender 1 for electric throttle - G187- and throttle valve drive angle sender 2 for electric throttle - G188-
- ☐ Removing and installing
⇒ [page 21](#)
- ☐ After renewing, perform Adaption in Guided Functions ⇒ Vehicle diagnostic tester

4 - Lambda probe - G39-

- ☐ (Before catalytic converter) with Lambda probe heater - Z19-
- ☐ Exploded view
⇒ [page 49](#)

5 - Lambda probe after catalytic converter - G130-

- ☐ With Lambda probe 1 heater after catalytic converter - Z29-
- ☐ Exploded view ⇒ [page 49](#)

6 - Accelerator pedal module

- ☐ With accelerator position sender - G79- / accelerator position sender 2 - G185-
- ☐ Fitting location ⇒ [page 13](#)
- ☐ Removing and installing ⇒ Rep. gr. 20

7 - Engine control unit - J623-

- ☐ Fitting location ⇒ [page 12](#)
- ☐ Removing and installing ⇒ [page 53](#)

8 - Lambda probe 2 after catalytic converter - G131-

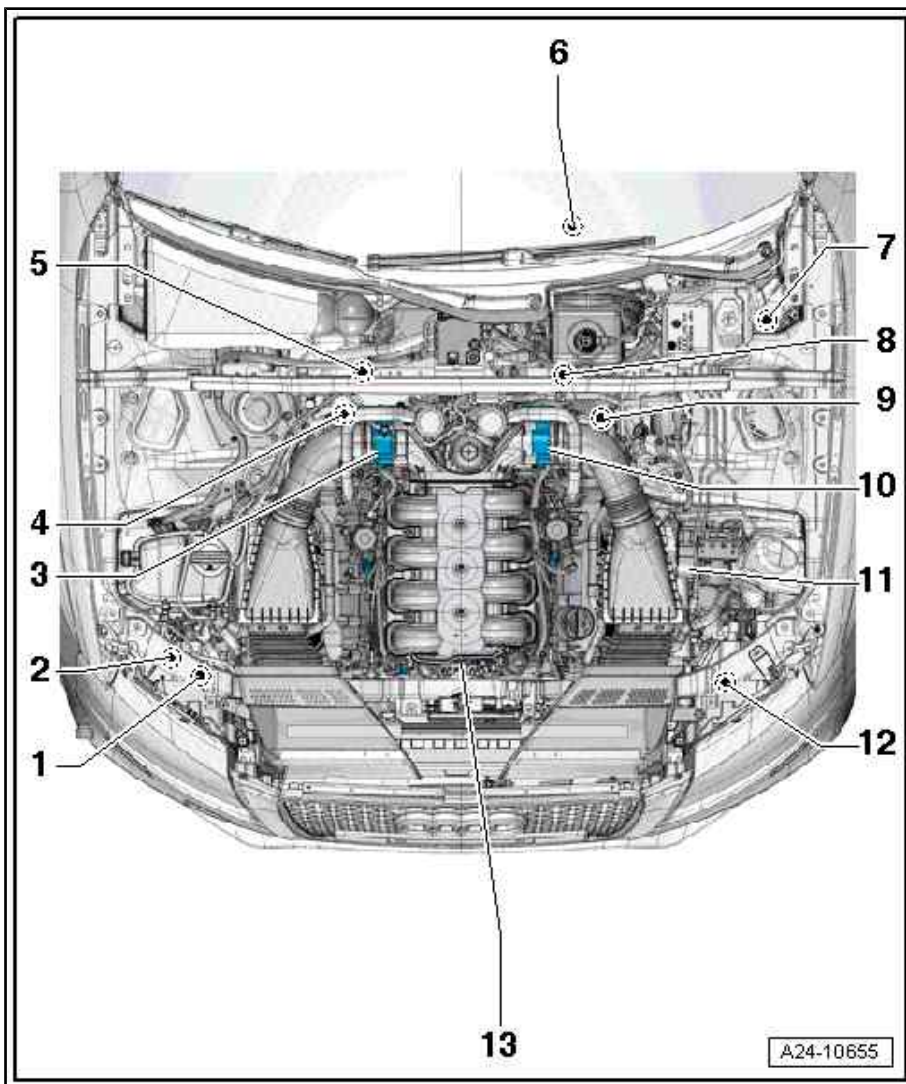
- ☐ With Lambda probe 2 heater after catalytic converter - Z30-
- ☐ Exploded view ⇒ [page 49](#)

9 - Lambda probe 2 - G108-

- ☐ (Before catalytic converter) with Lambda probe heater 2 - Z28-
- ☐ Exploded view ⇒ [page 49](#)

10 - Throttle valve module 2 - J544-

- ☐ With throttle valve drive 2 - G296- , angle sender 1 for throttle valve drive 2 - G297- and angle sender 2 for throttle valve drive 2 - G298-



- ☐ Removing and installing ➔ [page 21](#)
- ☐ After renewing, perform **Adaption** in **Guided Functions** ➔ Vehicle diagnostic tester

11 - Brake vacuum pump - V192-

12 - Secondary air pump motor 2 - V189-

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

13 - Intake air temperature sender - G42- / intake manifold pressure sender - G71-

- ☐ Fitting location ➔ [page 14](#)

1 - Injector, cylinder 1 - N30-

- ☐ Exploded view
➔ [page 24](#)

2 - Ignition coil 1 with output stage - N70-

- ☐ Removing and installing
➔ [page 61](#)

3 - Injector, cylinder 2 - N31-

4 - Ignition coil 2 with output stage - N127-

5 - Injector, cylinder 3 - N32-

6 - Ignition coil 3 with output stage - N291-

7 - Injector, cylinder 4 - N33-

8 - Ignition coil 4 with output stage - N292-

9 - Exhaust camshaft control valve 1 - N318-

10 - Camshaft control valve 1 - N205-

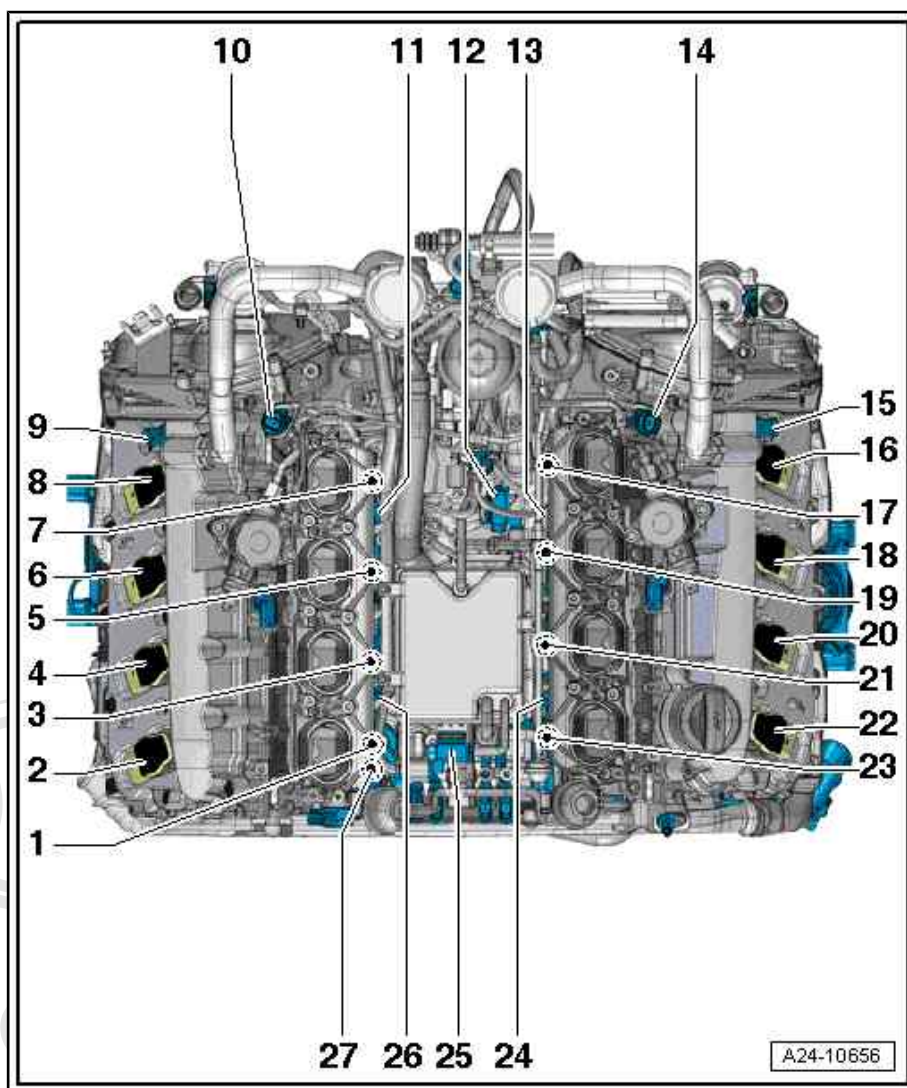
11 - Knock sensor 2 - G66-

- ☐ Removing and installing
➔ [page 62](#)

12 - Secondary air inlet valve - N112-

13 - Knock sensor 4 - G199-

- ☐ Removing and installing
➔ [page 62](#)



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14 - Camshaft control valve 2 - N208-

15 - Exhaust camshaft control valve 2 - N319-

16 - Ignition coil 8 with output stage - N326-

17 - Injector, cylinder 8 - N86-

18 - Ignition coil 7 with output stage - N325-

19 - Injector, cylinder 7 - N85-

20 - Ignition coil 6 with output stage - N324-

21 - Injector, cylinder 6 - N84-

22 - Ignition coil 5 with output stage - N323-

23 - Injector, cylinder 5 - N83-

24 - Knock sensor 3 - G198-

- ☐ Removing and installing ⇒ [page 62](#)

25 - Intake air temperature sender - G42- / intake manifold pressure sender - G71-

- ☐ Fitting location ⇒ [page 14](#)

26 - Knock sensor 1 - G61-

- ☐ Removing and installing ⇒ [page 62](#)

27 - Fuel pressure sender - G247-

- ☐ Fitting location ⇒ [page 27](#)
- ☐ Removing and installing ⇒ [page 44](#)



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1 - Coolant temperature sender - G62-

- ☐ Removing and installing
⇒ Rep. gr. 19

2 - Intake manifold flap potentiometer 2 - G512-

3 - Intake manifold flap potentiometer - G336-

4 - Oil pressure switch - F22-

- ☐ Removing and installing
⇒ Rep. gr. 17

5 - Oil temperature sender - G8-

- ☐ Removing and installing
⇒ Rep. gr. 17

6 - Activated charcoal filter solenoid valve 1 - N80-

7 - Fuel metering valve 2 - N402-

8 - Hall sender 2 - G163-

- ☐ Removing and installing
⇒ [page 63](#)

9 - Hall sender 4 - G301-

- ☐ Removing and installing
⇒ [page 64](#)

10 - Servotronic solenoid valve - N119-

- ☐ Only on vehicles with hydraulic power steering

11 - Left electrohydraulic engine mounting solenoid valve - N144-

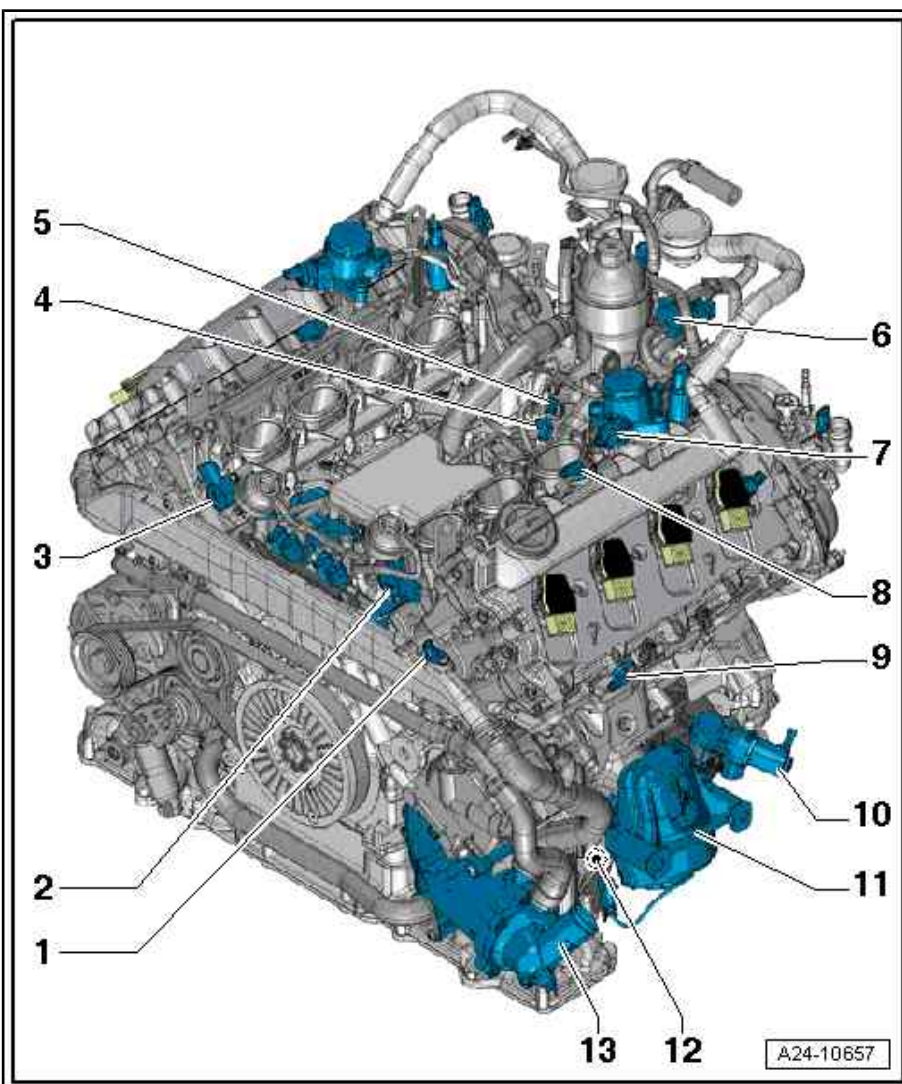
- ☐ On engine mounting (left-side)

12 - Valve for oil pressure control - N428-

- ☐ Fitting location ⇒ [page 14](#)
- ☐ Removing and installing ⇒ Rep. gr. 17

13 - Map-controlled engine cooling system thermostat - F265-

- ☐ Removing and installing ⇒ Rep. gr. 19



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

- ❑ Removing and installing
⇒ Rep. gr. 17

2 - Fuel pressure sender for low pressure - G410-
3 - Sender 2 for secondary air pressure - G610-

- ❑ Removing and installing
⇒ Rep. gr. 26

4 - Fuel metering valve - N290-

- ❑ at high-pressure pump
(right-side)

5 - Hall sender - G40-

- ❑ Removing and installing
⇒ [page 63](#)

6 - Hall sender 3 - G300-

- ❑ Removing and installing
⇒ [page 64](#)

7 - Right electrohydraulic engine mounting solenoid valve - N145-

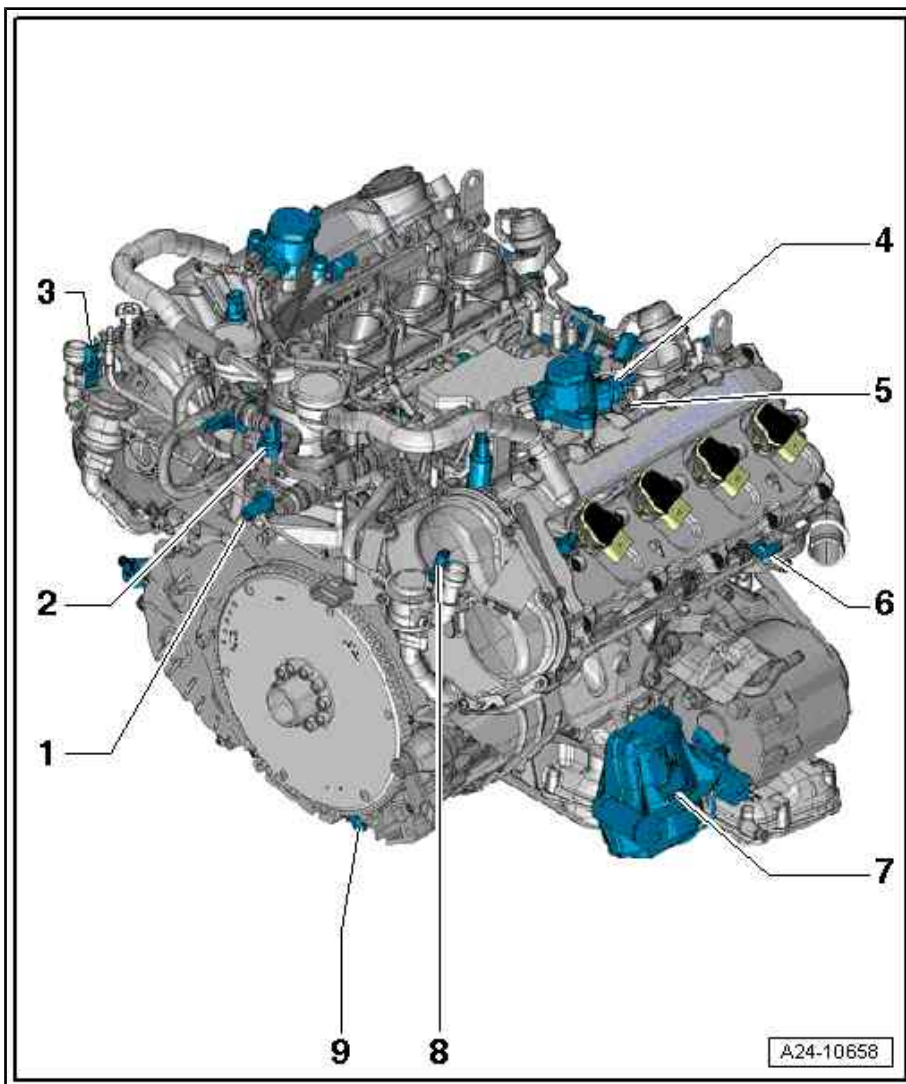
- ❑ On engine mounting
(right-side)

8 - Sender 1 for secondary air pressure - G609-

- ❑ Removing and installing
⇒ Rep. gr. 26

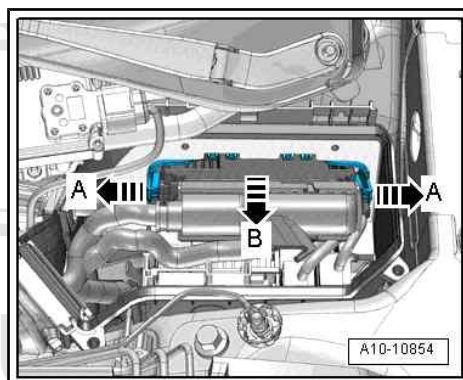
9 - Engine speed sender - G28-

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


Fitting location of engine control unit - J623-

- ◆ In electronics box in engine compartment (left-side)

Removing and installing ⇒ [page 53](#)



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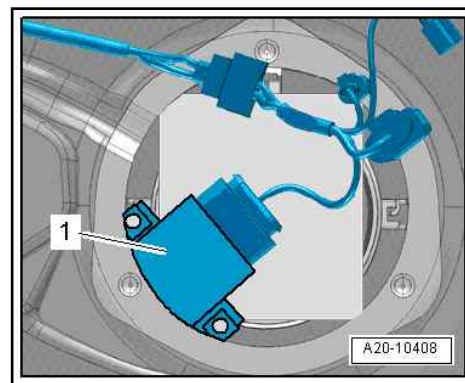
Fitting location of fuel pump control unit - J538-

- ◆ Beneath rear seat bench

Removing and installing ⇒ Rep. gr. 20



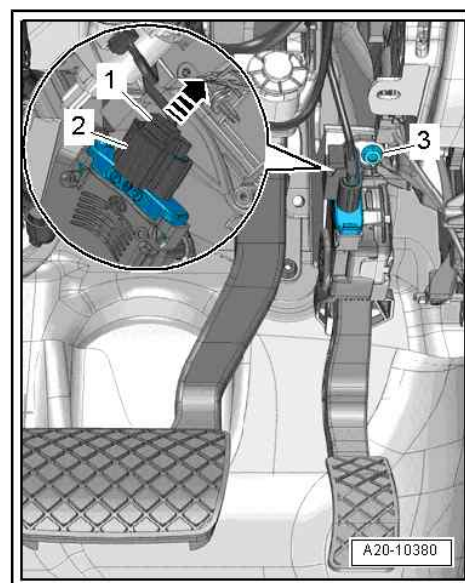
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Fitting location of accelerator pedal module with accelerator position sender - G79- / accelerator position sender 2 - G185-

- ◆ On pedal bracket

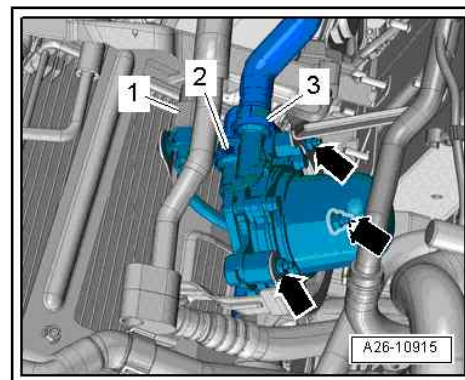
Removing and installing ⇒ Rep. gr. 20



Fitting location of secondary air pump motor -V101- / -V189-

- ◆ Behind wheel housing liner (front)
- ◆ Illustration shows secondary air pump motor 2 - V189- (left-side).
- ◆ Fitting location on right side: symmetrically reversed

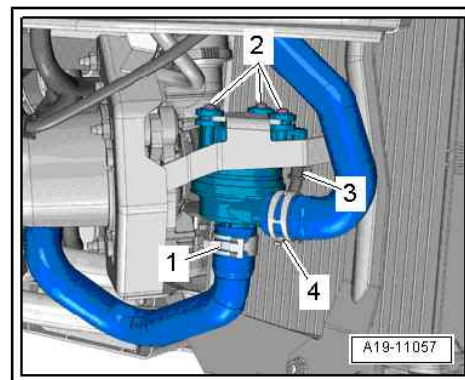
Removing and installing ⇒ Rep. gr. 26



Fitting location of continued coolant circulation pump - V51-

- ◆ Behind wheel housing liner (front right)

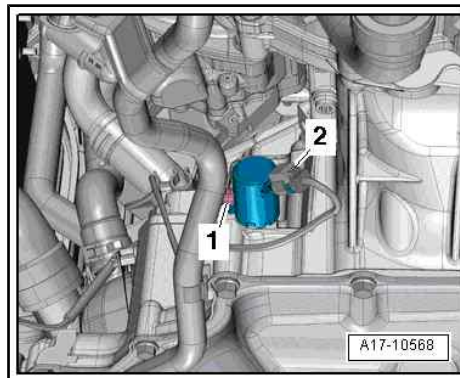
Removing and installing ⇒ Rep. gr. 19



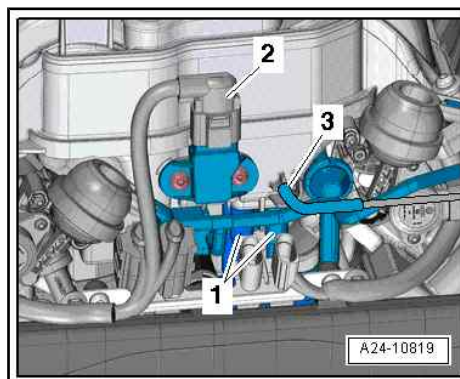
Fitting location of valve for oil pressure control - N428-

◆ On left of sump (top section)

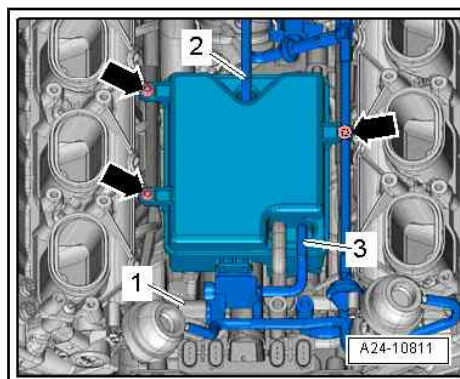
Removing and installing ⇒ Rep. gr. 17



Intake air temperature sender - G42- / intake manifold pressure sender - G71- -2-



Intake manifold flap valve - N316- -1-



2.3 Exploded view - vacuum system



Note

Checking vacuum system ⇒ [page 5](#)

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1 - Vacuum reservoir

- ☐ Beneath intake manifold

2 - Secondary air inlet valve - N112-

3 - Combination valve for secondary air system (right-side)

4 - Vacuum reservoir

- ☐ In plenum chamber

5 - Grommet

- ☐ As leadthrough for vacuum line

6 - Combination valve for secondary air system (left-side)

7 - Vacuum unit

- ☐ For intake manifold flaps (left-side)

8 - Vacuum line

- ☐ With non-return valves
- ☐ To vacuum reservoir in plenum chamber

9 - Vacuum line

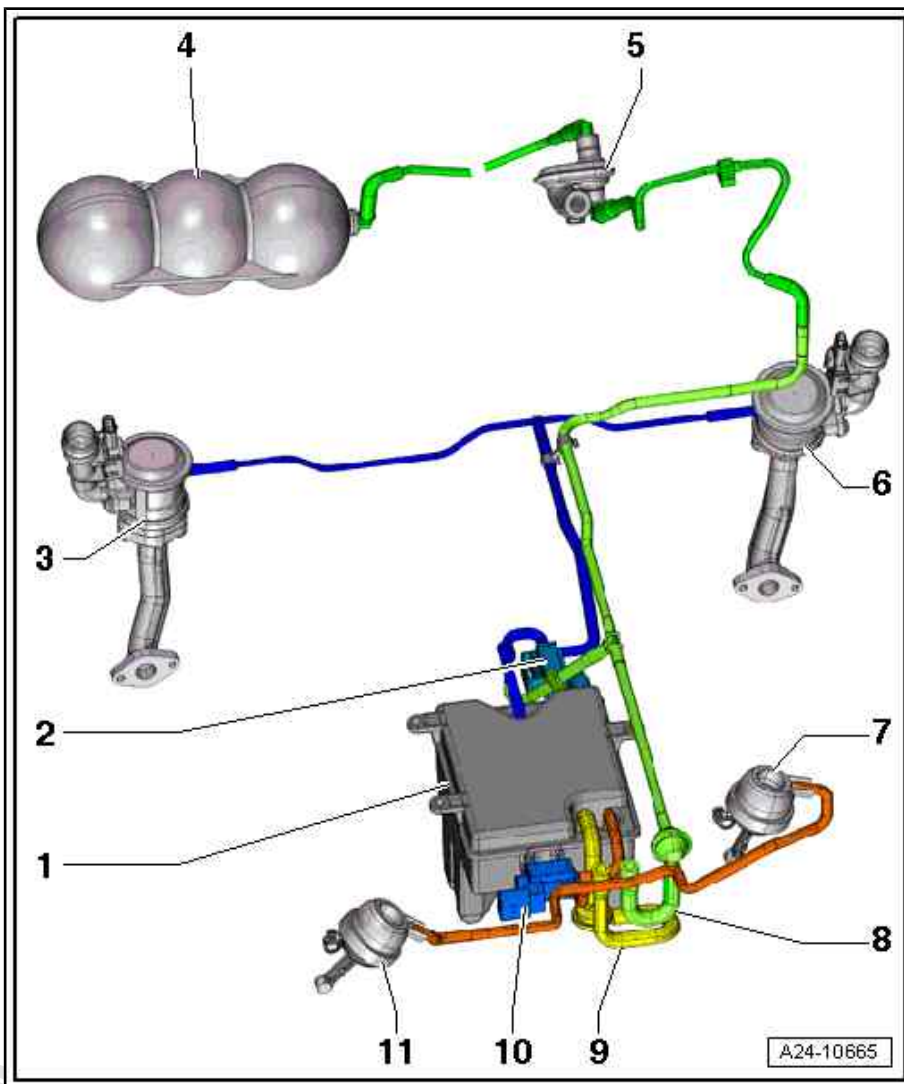
- ☐ With non-return valves
- ☐ To vacuum reservoir

10 - Intake manifold flap valve - N316-

- ☐ Fitting location
⇒ [page 14](#)

11 - Vacuum unit

- ☐ For intake manifold flaps (right-side)



3 Air cleaner

⇒ ["3.1 Exploded view - air cleaner housing", page 16](#)

⇒ ["3.2 Removing and installing engine cover panel", page 17](#)

⇒ ["3.3 Removing and installing air filter element", page 18](#)

⇒ ["3.4 Removing and installing air cleaner housing", page 19](#)

3.1 Exploded view - air cleaner housing

1 - Air duct

2 - Threaded pin

□ 9 Nm

3 - Nut

□ 9 Nm

4 - Rubber grommets

□ Inserted in bracket for air cleaner

5 - Bracket

□ For air cleaner

6 - Bolt

□ 2.5 Nm

7 - Heat shield

8 - Speed nut

9 - Bolt

□ 3.5 Nm

10 - Air cleaner (top section)

□ Clean out salt deposits, dirt and leaves, etc.

11 - Air hose

□ Clean out salt deposits, dirt and leaves, etc.

12 - Hose clip

□ Spray rust remover onto worm thread before installing

□ 3.5 Nm

13 - Air filter element

□ Use genuine air filter element ⇒ Electronic parts catalogue

□ Removing and installing ⇒ [page 18](#)

□ Maintenance intervals ⇒ Maintenance tables

14 - Bolt

□ 9 Nm

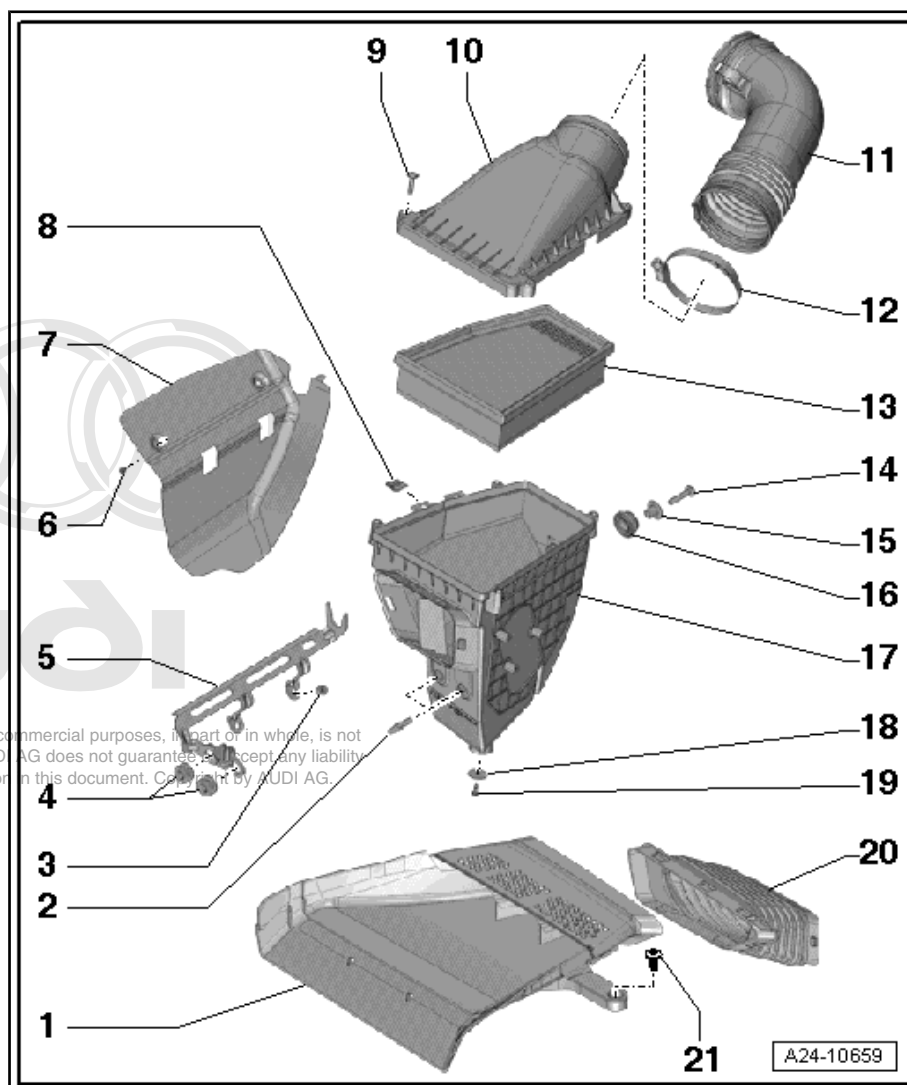
15 - Spacer sleeve

16 - Rubber grommet

17 - Air cleaner (bottom section)

□ Clean out salt deposits, dirt and leaves, etc.

□ Removing and installing ⇒ ["3.4 Removing and installing air cleaner housing", page 19](#)



18 - Grommet

- ☐ For water drain

19 - Water drain

- ☐ Clean

20 - Air duct

21 - Bolt

- ☐ 2 Nm

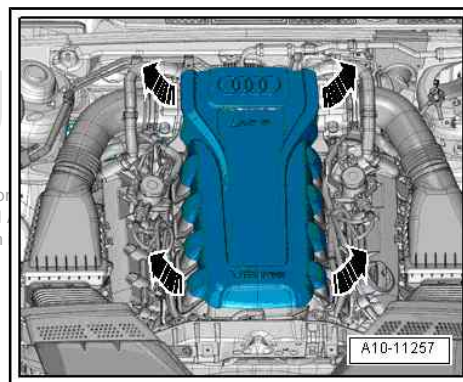
3.2 Removing and installing engine cover panel

Removing

- Carefully pull engine cover panel out of retaining clips one after the other -arrows- (do not jerk 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.
- Press engine cover panel with both hands first into retaining clips at rear and then into retaining clips at front.



3.3 Removing and installing air filter element

Removing

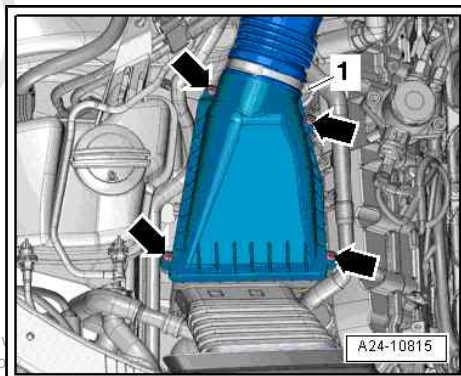
- Loosen hose clip -1-.
- Unscrew bolts -arrows- and detach air cleaner (top section).
- Take out air filter element.

Installing

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

- Tightening torques
⇒ ["3.1 Exploded view - air cleaner housing", page 16](#)

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Note

- ◆ *Always use genuine part for air filter element.*
- ◆ *Hose connections and hoses in intake system must be free of oil and grease before assembly. Do not use any lubricants containing silicone when assembling.*
- ◆ *The air cleaner housing MUST be clean.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *To ensure that the air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*
- ◆ *To prevent malfunctions, cover all critical parts of the engine air intake tract (intake pipes, etc.) with a clean cloth when blowing out the air cleaner housing with compressed air.*
- ◆ *Observe environmental requirements for disposal.*
- Blow out water drain ⇒ [Item 19 \(page 17\)](#) with compressed air.
- Clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections) using a vacuum cleaner.
- Check for salt residue, dirt and leaves in air hose (engine intake side).
- Check for dirt and leaves in air duct going from lock carrier to air cleaner housing.
- When installing the air filter element, check that it is properly centred in the retainer in the bottom section of the air cleaner housing.
- Carefully fit top section of air cleaner onto bottom section, without using any force. Make sure that air cleaner (top section) is fitted straight on air filter element (note position of sealing lip on air filter element).

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

3.4 Removing and installing air cleaner housing

Removing

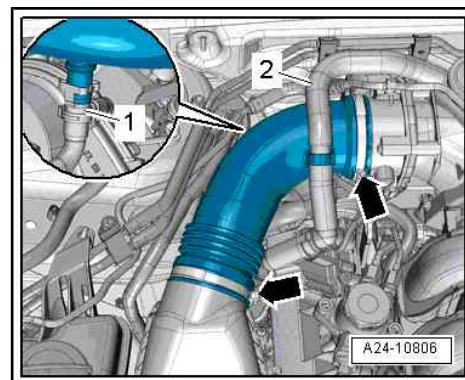
- Move crankcase breather hose -2- clear at air pipe.

Crankcase breather with separate hose:

- Disconnect crankcase breather hose -1- from air pipe by pressing release tabs.
- Release hose clips -arrows- and remove air pipe.

Crankcase breather with permanently connected hose:

- Remove air pipe; to do so, loosen hose clips -arrows- and move air pipe clear to one side (hose -1- remains connected).



All vehicles (continued):

- Remove bolts -3-.
- Pull air cleaner housing -2- at rear upwards off bracket -arrow- and detach towards rear.



Note

Disregard items marked -1 and 4-.

Installing

- Tightening torques
⇒ ["3.1 Exploded view - air cleaner housing", page 16](#)

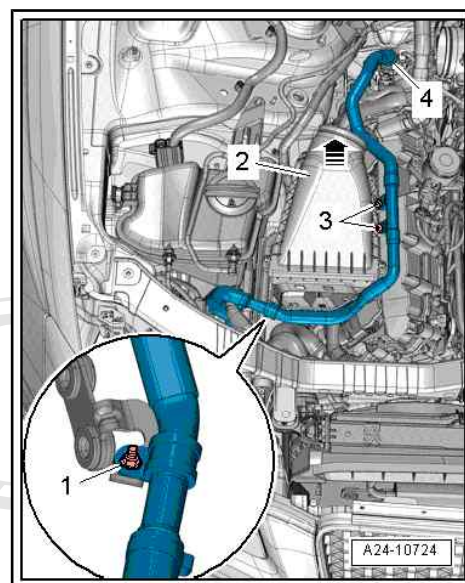


Note

- ◆ *Hose connections and hoses in intake system must be free of oil and grease before assembly. Do not use any lubricants containing silicone when assembling.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *To ensure that the air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

- Check for salt residue, dirt and leaves in air hose (engine intake side).
- Check for dirt and leaves in air duct going from lock carrier to air cleaner housing.

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



4 Intake manifold

⇒ ["4.1 Exploded view - intake manifold \(top section\)", page 20](#)

⇒ ["4.2 Removing and installing throttle valve module J338 / J544", page 21](#)

⇒ ["4.3 Removing and installing intake manifold \(top section\)", page 22](#)

⇒ ["4.4 Exploded view - intake manifold \(bottom section\), fuel rail and injectors", page 24](#)

⇒ ["4.5 Removing and installing intake manifold \(bottom section\) with fuel rail", page 27](#)

4.1 Exploded view - intake manifold (top section)

1 - O-ring

- ☐ Renew

2 - Intake air temperature sender - G42- / intake manifold pressure sender - G71-

3 - Bolt

- ☐ 5 Nm

4 - Damper element

5 - Bolt

- ☐ Tightening torque and sequence ⇒ [page 21](#)

6 - Retaining clip

- ☐ For engine cover
- ☐ 4x
- ☐ Clips should make contact at front at inner stop on intake manifold

7 - Intake manifold (top section)

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

8 - Seal

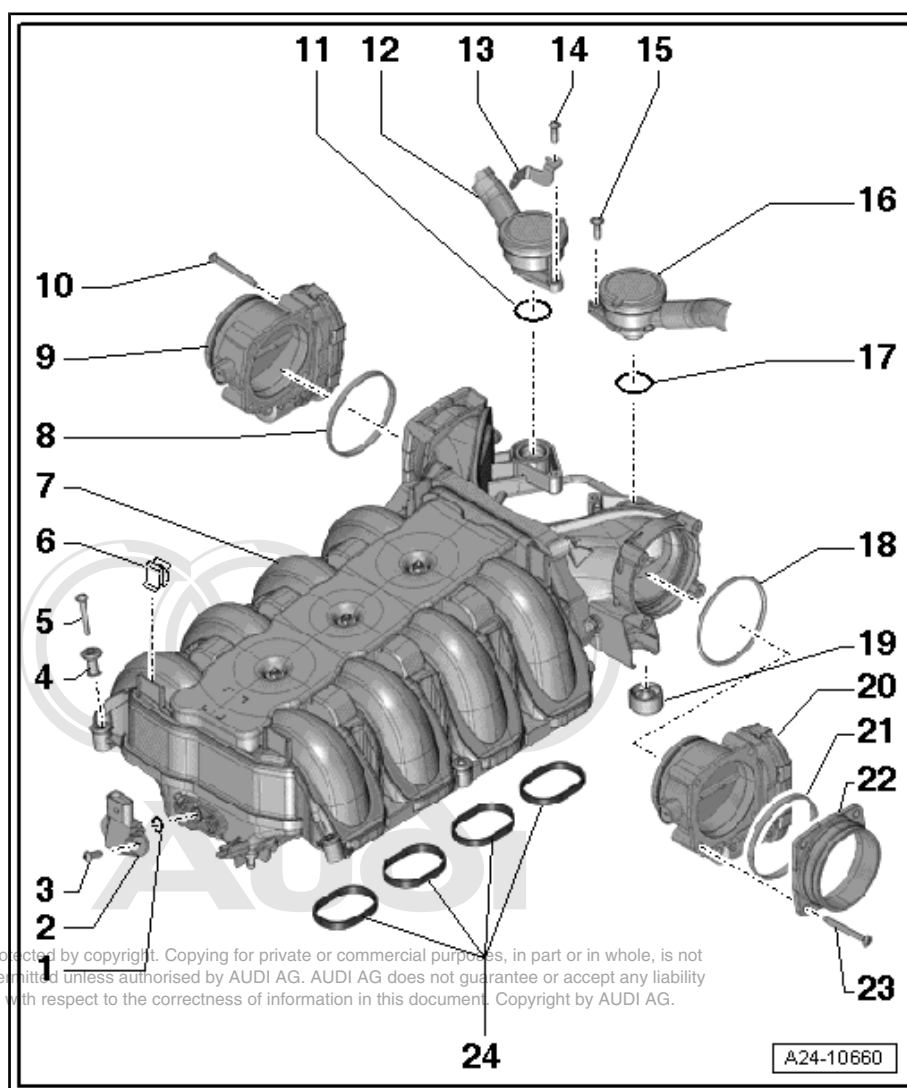
- ☐ Renew

9 - Throttle valve module - J338-

- ☐ Cylinder bank 1 (right-side)
- ☐ Removing and installing ⇒ [page 21](#)
- ☐ After renewing, perform Adaption in Guided Functions ⇒ Vehicle diagnostic tester

10 - Bolt

- ☐ Thread-forming
- ☐ Allow bolt to engage in existing thread on intake manifold
- ☐ 9 Nm



11 - O-ring

- ☐ Renew

12 - Pressure control valve

- ☐ For crankcase breather

13 - Bracket

14 - Bolt

- ☐ 4.5 Nm

15 - Bolt

- ☐ 4.5 Nm

16 - Pressure control valve

- ☐ For crankcase breather

17 - O-ring

- ☐ Renew

18 - O-ring

- ☐ Renew

19 - Buffer

- ☐ For intake manifold (top section)

20 - Throttle valve module 2 - J544-

- ☐ Cylinder bank 2 (right-side)
- ☐ Removing and installing ⇒ [page 21](#)
- ☐ After renewing, perform **Adaption** in **Guided Functions** ⇒ Vehicle diagnostic tester

21 - Seal

- ☐ Renew

22 - Connection

23 - Bolt

- ☐ Thread-forming
- ☐ Allow bolt to engage in existing thread on intake manifold
- ☐ 9 Nm

24 - Seals

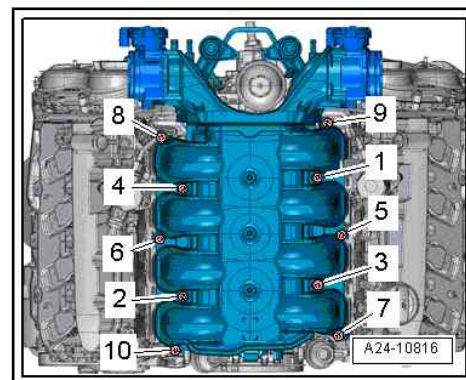
- ☐ Renew

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Intake manifold (top section) - tightening torque and sequence

– Tighten bolts in 2 stages in the sequence shown:

Stage	Bolts	Tightening torque
1.	-1 ... 10-	8 Nm
2.	-1 ... 10-	11 Nm



4.2 Removing and installing throttle valve module -J338- / -J544-

Removing

– Pull off engine cover panel ⇒ [page 17](#) .

Removing

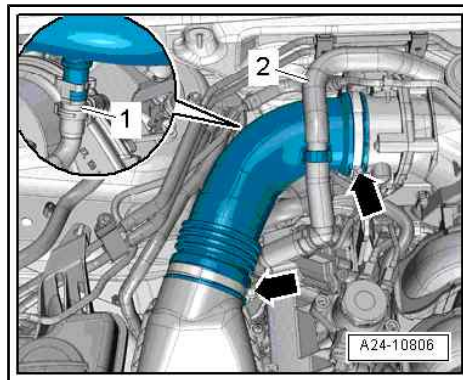
- Move crankcase breather hose -2- clear at air pipe.

Crankcase breather with separate hose:

- Disconnect crankcase breather hose -1- from air pipe by pressing release tabs.
- Release hose clips -arrows- and remove air pipe.

Crankcase breather with permanently connected hose:

- Remove air pipe; to do so, loosen hose clips -arrows- and move air pipe clear to one side (hose -1- remains connected).



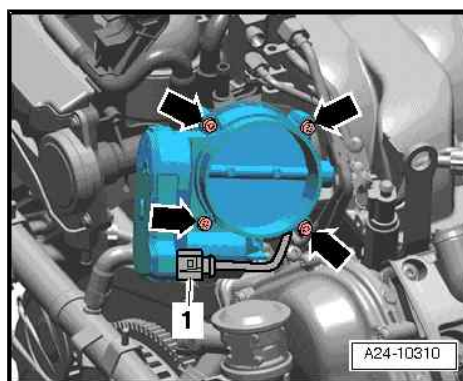
All vehicles (continued):

- Unplug electrical connector -1-.
- Remove bolts -arrows- and detach throttle valve module.

Installing

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

- Tightening torques
⇒ **"4.1 Exploded view - intake manifold (top section)", page 20**



Note

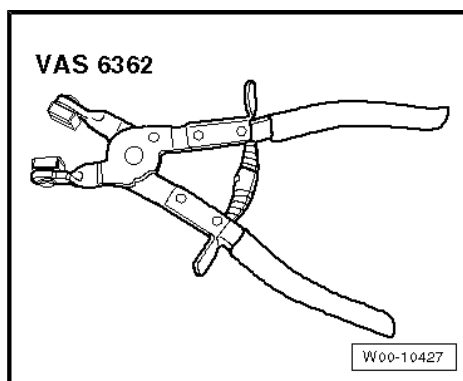
Renew seal.

- Install engine cover panel ⇒ **page 17**.

4.3 Removing and installing intake manifold (top section)

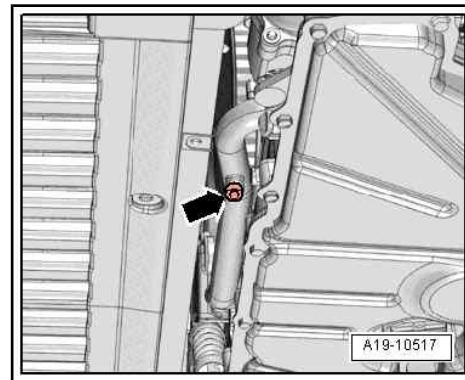
Special tools and workshop equipment required

- ♦ Hose clip pliers - VAS 6362-



Removing

- Drain coolant from coolant pipe (front) -arrow- ➔ Rep. gr. 19 .
- Pull off engine cover panel ➔ [page 17](#) .

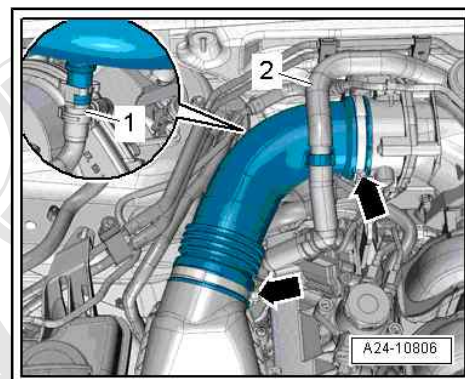


Removing

- Move crankcase breather hose -2- clear at air pipe.

Crankcase breather with separate hose:

- Disconnect crankcase breather hose -1- from air pipe by pressing release tabs.
- Release hose clips -arrows- and remove air pipe.

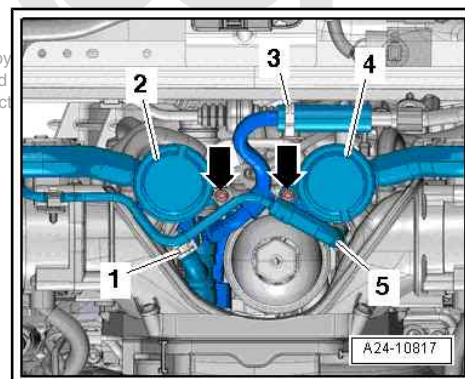


Crankcase breather with permanently connected hose:

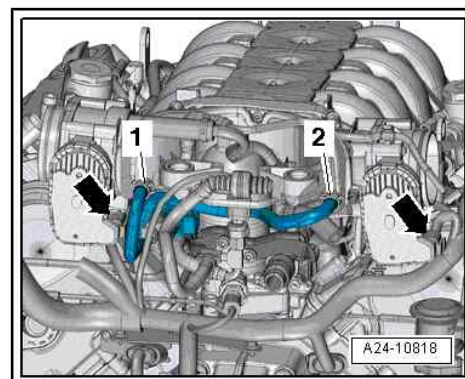
- Remove air pipe; to do so, loosen hose clips -arrows- and move air pipe clear to one side (hose -1- remains connected).

All vehicles (continued):

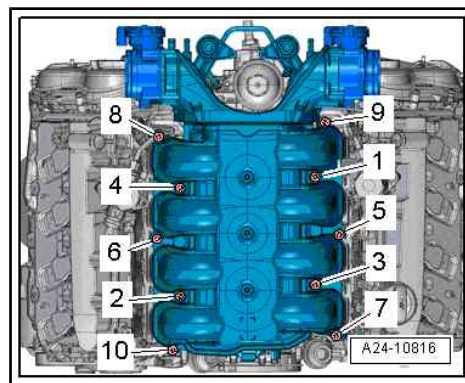
- Unscrew bolts -arrows- and move pressure control valves -2- and -4- for crankcase breather system clear to one side.
- Release hose clips -1, 3 and 5- and disconnect coolant hoses and vacuum hose.



- Unplug electrical connectors -arrows- at throttle valve modules.
- Release hose clips -1- and -2- and detach hoses coming from activated charcoal filter.



- Slacken and remove bolts in the sequence: -10 ... 1-.



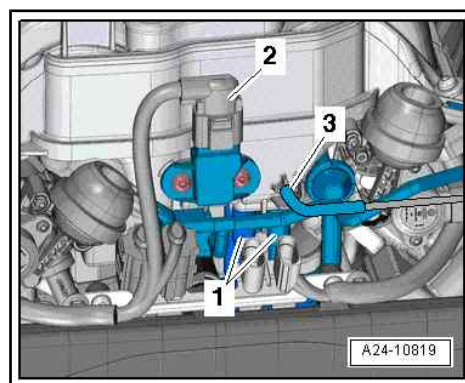
- Unplug electrical connector -2-.
- Disconnect vacuum hose -3-.
- Detach intake manifold (top section) and disconnect vacuum hoses -1-.



Caution

Risk of irreparable damage to engine.

- ◆ *Block off the intake ports in the cylinder heads with clean cloths to prevent small items from dropping into the ports.*



Installing

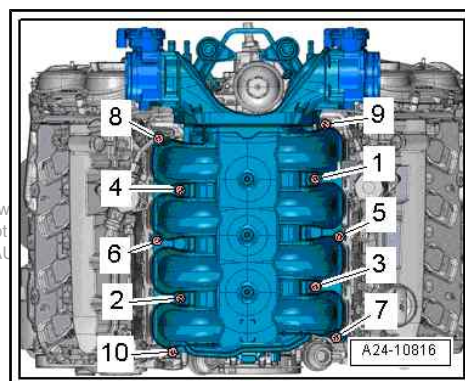
Installation is carried out in the reverse order; note the following:

- Tightening torques
⇒ [Fig. "Intake manifold \(top section\) - tightening torque and sequence"](#), [page 21](#)



Note

- ◆ *Renew gaskets and O-rings.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ [Electronic parts catalogue](#) .*
- Tighten bolts for intake manifold (top section) ⇒ [page 21](#) .
- Fill up with coolant ⇒ [Rep. gr. 19](#) .



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4.4 Exploded view - intake manifold (bottom section), fuel rail and injectors

1 - Seals

- ☐ Renew

2 - Intake manifold (bottom section)

- ☐ Removing and installing
⇒ [page 27](#)

3 - Seal

- ☐ Renew if damaged
- ☐ When renewing lever out with screwdriver
- ☐ Press in by hand

4 - Bolt

- ☐ 2.5 Nm

5 - Intake manifold flap potentiometer

- ☐ Cylinder bank 1 (right-side): intake manifold flap potentiometer - G336-
- ☐ Cylinder bank 2 (left-side): intake manifold flap potentiometer 2 - G512-
- ☐ Before removing, remove intake manifold (top section)
- ☐ Adaption must be performed after this component has been renewed; use a ⇒ Vehicle diagnostic tester

6 - Bolt

- ☐ 2.5 Nm

7 - Vacuum unit

- ☐ For intake manifold flaps
- ☐ After renewing, check vacuum system for leaks ⇒ [page 5](#)

8 - Screw plug

- ☐ 25 Nm

9 - Fuel rail

- ☐ Removing and installing ⇒ ["6.1 Removing and installing injectors", page 38](#) ⇒ [page 27](#)

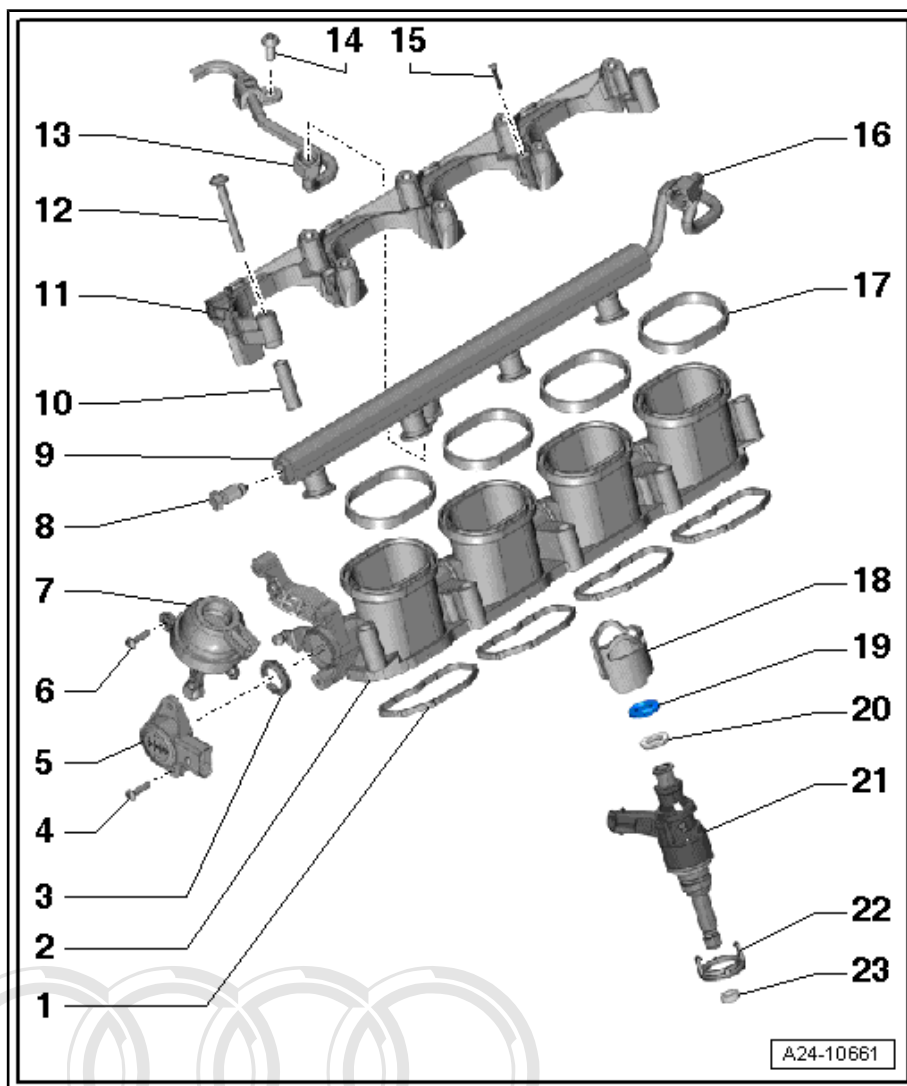
10 - Sleeve

11 - Retaining clip

- ☐ For fuel rail

12 - Bolt

- ☐ Tightening torque and sequence ⇒ [page 27](#)



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13 - High-pressure pipe

**WARNING**

The fuel system operates at extremely high pressure. This can cause injury.

The pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening the system.

- ☐ Reducing fuel pressure in high-pressure section of injection system ⇒ [page 4](#)
- ☐ Connections must not be damaged
- ☐ Do not alter shape
- ☐ Removing and installing ⇒ [“5.3 Removing and installing high-pressure pipe”, page 34](#)
- ☐ Lubricate thread lightly with engine oil
- ☐ 25 Nm

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14 - Bolt

- ☐ 9 Nm

15 - Bolt

- ☐ 2.5 Nm

16 - Union nut

- ☐ Lubricate thread lightly with engine oil
- ☐ 25 Nm

17 - Seals

- ☐ Renew

18 - Support ring

- ☐ Renew
- ☐ Via this support ring, the fuel rail exerts the clamping force that holds the injector in the cylinder head

19 - O-ring

- ☐ Renew
- ☐ Lubricate lightly with clean engine oil

20 - Spacer ring

- ☐ Renew if damaged

21 - Injector

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

22 - Sealing element

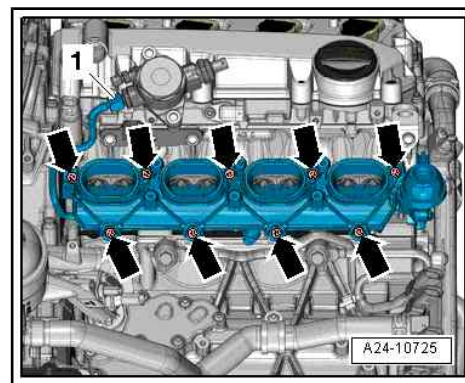
- ☐ Renew

23 - Combustion chamber ring seal

- ☐ Renew
- ☐ Do not apply grease or use any other lubricants

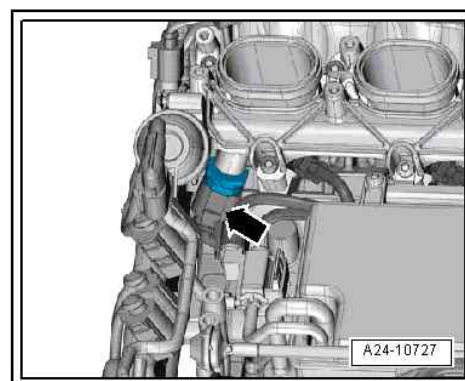
Intake manifold (bottom section) - tightening torque and sequence

- Tighten bolts -arrows- in stages and in diagonal sequence; final torque 9 Nm.



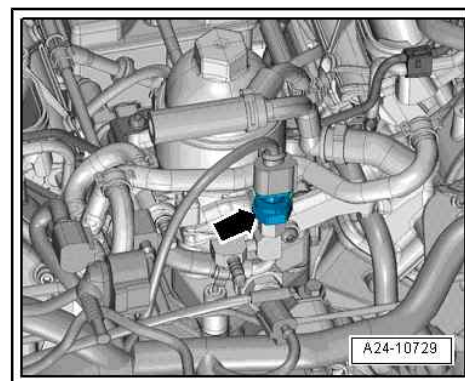
Fuel pressure sender -G247- / -G624-

- ◆ At front of fuel rail
- ◆ Cylinder bank 1 (right-side): fuel pressure sender - G247- -arrow-
- ◆ Cylinder bank 2 (left-side): fuel pressure sender 2 - G624-
- ◆ Removing and installing ⇒ [page 44](#)
- ◆ 25 Nm



Fuel pressure sender for low pressure - G410-

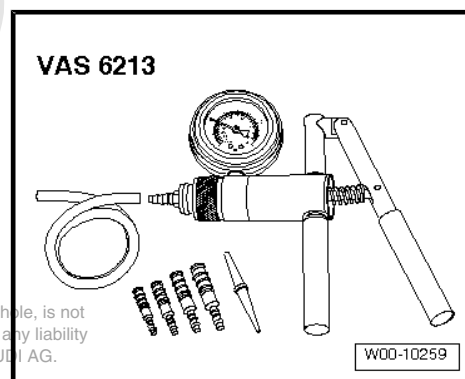
- ◆ Behind oil filter housing -arrow-
- ◆ 15 Nm



4.5 Removing and installing intake manifold (bottom section) with fuel rail

Special tools and workshop equipment required

- ◆ Hand vacuum pump - VAS 6213-



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Removing

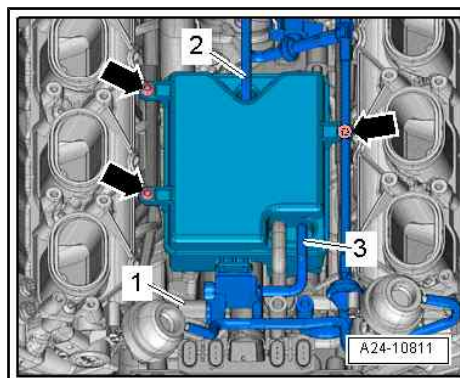


WARNING

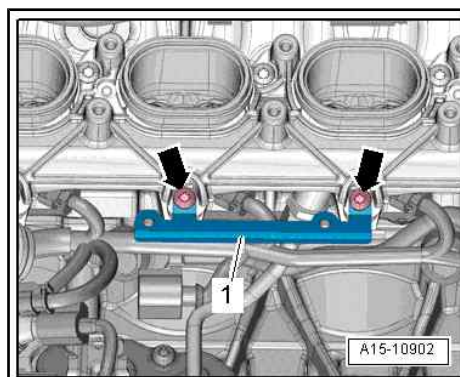
The fuel system operates at extremely high pressure. This can cause injury.

- ◆ *The fuel pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening the system.*

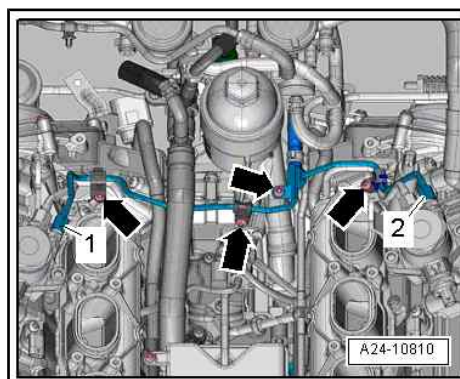
- Reduce fuel pressure in high-pressure section of injection system ➔ [page 4](#) .
- Remove intake manifold (top section) ➔ [page 22](#) .
- Disconnect vacuum hose -2- and -3- and take change-over valve -1- out of bracket.
- Remove bolts -arrows- and detach vacuum reservoir.



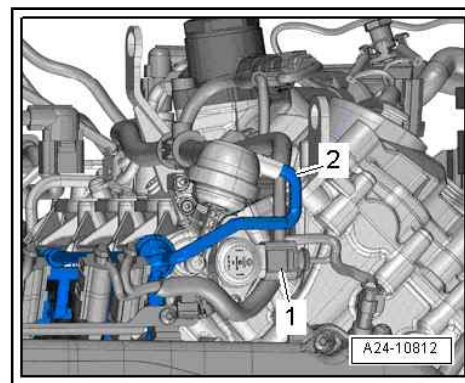
- Unscrew bolts -arrows- and detach bracket -1- for vacuum reservoir.



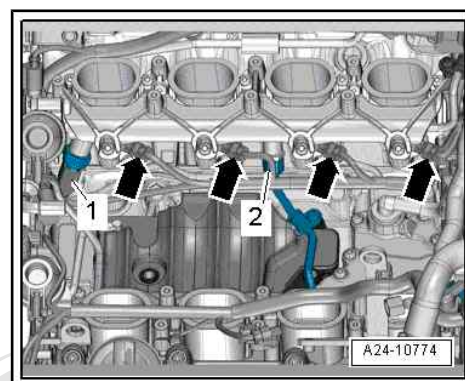
- Remove bolts -arrows- and union nuts -1, 2- and move fuel supply line to one side.



- Unplug electrical connector -1- and disconnect vacuum hose -2-.



- Unplug electrical connectors -arrows- at injectors.
- Cylinder head (right-side): Unplug electrical connector -1- at fuel rail.
- Unscrew high-pressure pipe -2- from connection on fuel rail. To do so, counterhold at hexagon flats with an open-end spanner and loosen union nut.



Note

Do not attempt to bend high-pressure pipe to a different shape.

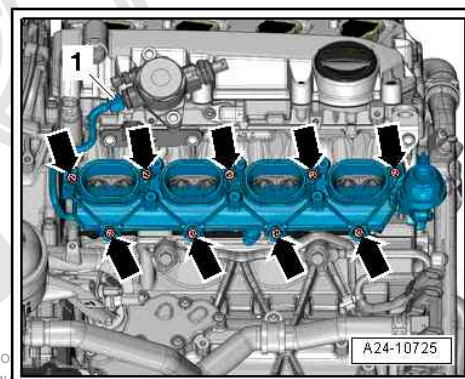
- Remove union nut -1-.
- Loosen bolts -arrows- in diagonal sequence and remove.
- Pull off intake manifold (bottom section) with fuel rail.



Caution

Risk of irreparable damage to engine.

- ◆ ***Block off the intake manifolds (bottom section) with clean cloths to prevent small objects from dropping into the engine through the intake ports in the cylinder heads.***



Installing

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

- Tightening torque
⇒ [Fig. "Intake manifold \(bottom section\) - tightening torque and sequence", page 27](#)



Note

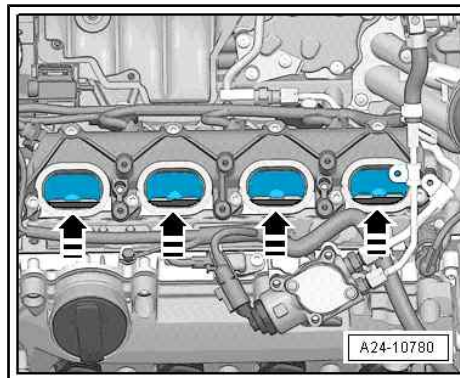
- ◆ *If an injector has been pulled out of the cylinder head, the teflon ring seal must be renewed.*
- ◆ *Renew gaskets and O-rings.*
- ◆ *Lubricate O-rings of injectors lightly with clean engine oil.*



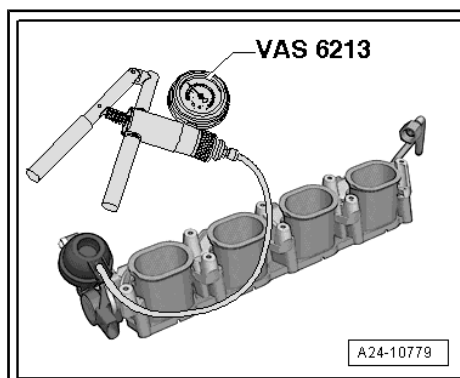
Caution

Risk of damage to intake manifold flaps.

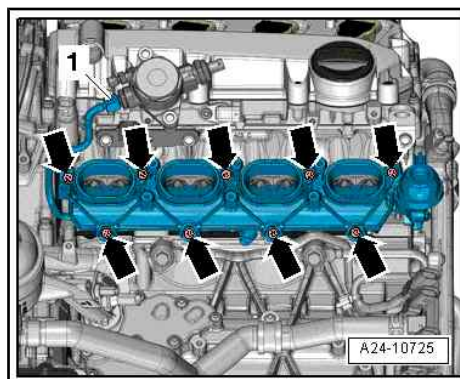
- ◆ **If the intake manifold flaps are closed, they can catch on the guide plates in the cylinder head -arrows- when the intake manifold (bottom section) is installed.**



- Connect hand vacuum pump - VAS 6213- to vacuum unit for actuating intake manifold flaps, as shown in illustration.
- Operate hand vacuum pump to produce a vacuum.
- This will cause the intake manifold flaps to open.
- Install intake manifold (bottom section) and press fuel rail evenly onto injectors.



- Tighten bolts for intake manifold (bottom section) ⇒ [page 27](#) .
- Disconnect vacuum hose of hand vacuum pump - VAS 6213- from vacuum unit for actuating intake manifold flaps.
- Install high-pressure pipe
⇒ ["5.3 Removing and installing high-pressure pipe", page 34](#) .
- Install intake manifold (top section)
⇒ ["4.3 Removing and installing intake manifold \(top section\)", page 22](#) .



Note

After installation, check vacuum system for leaks ⇒ [page 5](#) .

5 High-pressure pump

⇒ [“5.1 Exploded view - high-pressure pump”, page 31](#)

⇒ [“5.2 Removing and installing high-pressure pump”, page 32](#)

⇒ [“5.3 Removing and installing high-pressure pipe”, page 34](#)

5.1 Exploded view - high-pressure pump

1 - High-pressure pipe



WARNING

*Risk of injury - fuel system operates under high pressure.
The fuel pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening the system.*

- ☐ Reducing fuel pressure in high-pressure section of injection system
⇒ [page 4](#)
- ☐ Tighten connecting piece to 40 Nm (always make sure that connecting piece is tightened to specified torque before installing fuel line)
- ☐ Connections must not be damaged
- ☐ Do not alter shape
- ☐ Lubricate thread lightly with engine oil
- ☐ Removing and installing
⇒ [“5.3 Removing and installing high-pressure pipe”, page 34](#)

2 - Union nut

- ☐ Connections must not be damaged
- ☐ Lubricate thread lightly with engine oil
- ☐ 25 Nm

3 - High-pressure pump

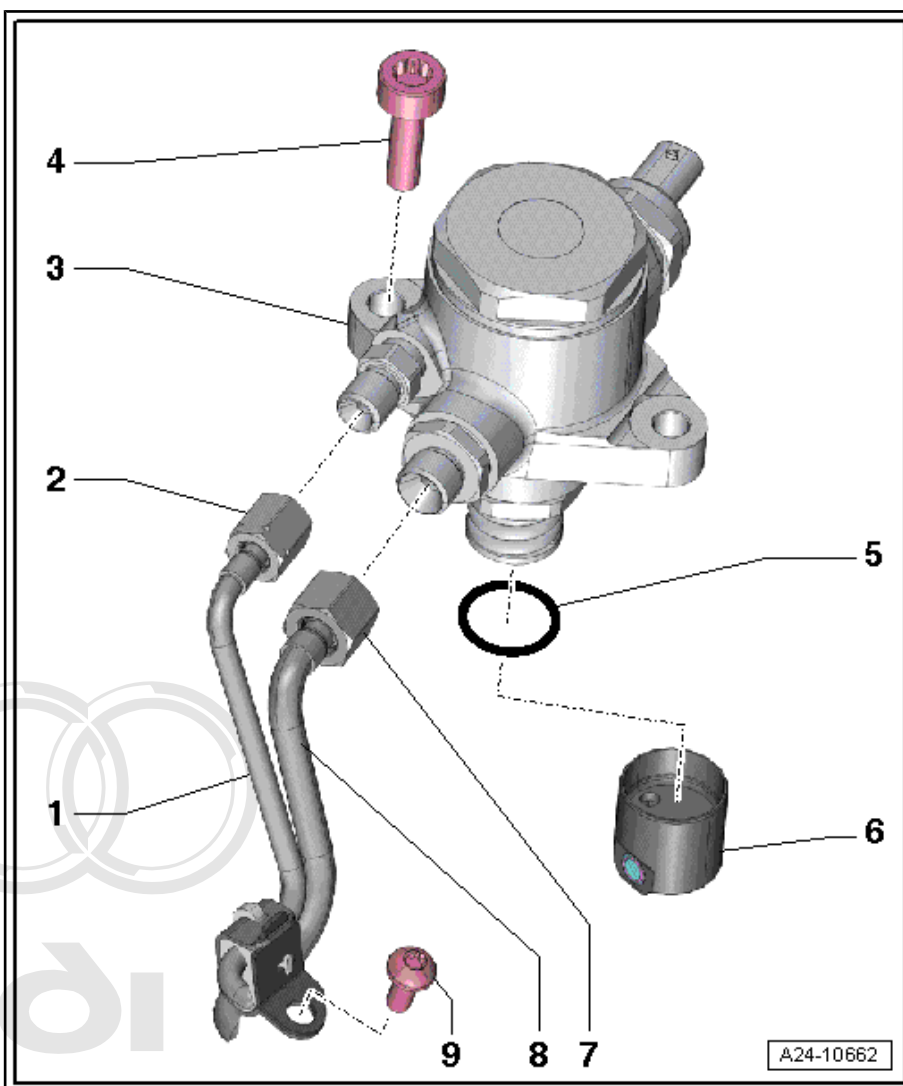
- ☐ Cylinder bank 1 (right-side): with fuel metering valve - N290-
- ☐ Cylinder bank 2 (left-side): with fuel metering valve 2 - N402-
- ☐ Removing and installing ⇒ [page 32](#)

4 - Bolt

- ☐ 22 Nm

5 - O-ring

- ☐ Renew



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6 - Roller tappet

7 - Union nut

- ☐ Connections must not be damaged
- ☐ Lubricate thread lightly with engine oil
- ☐ 25 Nm

8 - High-pressure pipe

⚠ WARNING

Risk of injury - fuel system operates under high pressure.

The fuel pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening the system.

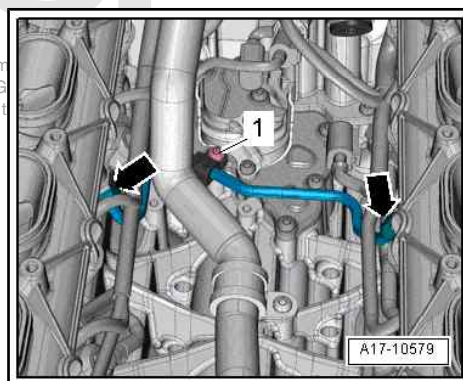
- ☐ Reducing fuel pressure in high-pressure section of injection system ⇒ [page 4](#)
- ☐ Tighten connecting piece to 40 Nm (always make sure that connecting piece is tightened to specified torque before installing fuel line)
- ☐ Connections must not be damaged
- ☐ Do not alter shape
- ☐ Lubricate thread lightly with engine oil
- ☐ Removing and installing ⇒ ["5.3 Removing and installing high-pressure pipe", page 34](#)

9 - Bolt

- ☐ 9 Nm

High-pressure pipe - tightening torques

- Tighten each union nut by hand until it makes contact, making sure that high-pressure pipe is not under tension.
- Tighten union nuts -arrows- to 25 Nm; to do so, counterhold at hexagon flats of threaded connection on fuel rail with an open-end spanner.
- Do not tighten bolt -1- for retainer until high-pressure pipe has been tightened; tightening torque ⇒ Rep. gr. 17 ; Spray nozzle valve - exploded view .



5.2 Removing and installing high-pressure pump

Special tools and workshop equipment required

- ◆ Adapter -T40257-
- ◆ Wrench -T40263-

Removing



WARNING

The fuel system operates at extremely high pressure. This can cause injury.

- ◆ *The fuel pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening the system.*

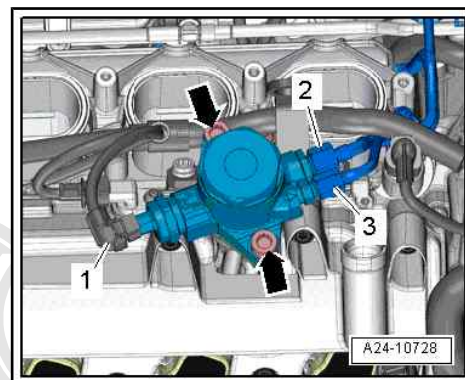
- Reduce fuel pressure in high-pressure section of injection system ➔ [page 4](#) .
- Pull off engine cover panel ➔ [page 17](#) .
- Unplug electrical connector -1- for fuel metering valve.
- Detach high-pressure pipes at connections on high-pressure pump. To do so, counterhold at hexagon flats with an open-end spanner and loosen union nuts -2- and -3-.
- Unscrew bolts -arrows- and detach high-pressure pump.



Note

Do not attempt to bend high-pressure pipe to a different shape.

- Pull roller tappet out of cylinder head.



Installing

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

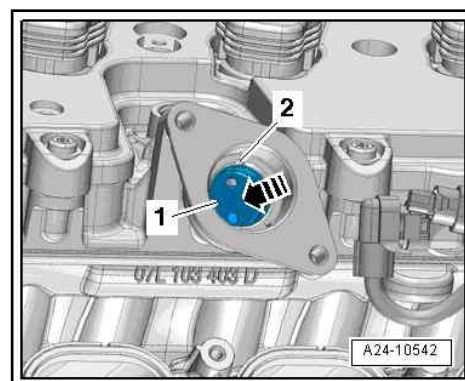
- Tightening torques
➔ ["5.1 Exploded view - high-pressure pump", page 31](#)



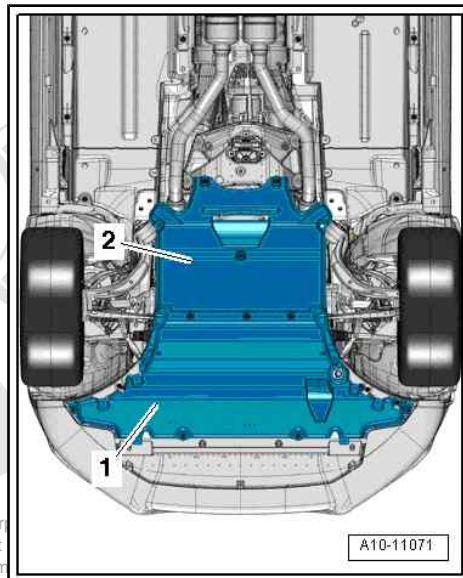
Note

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- ◆ *Renew O-ring for high-pressure pump.*
- ◆ *The connections of the high-pressure pipes must not be damaged.*
- Check roller tappet -1- for damage and renew if necessary.
- Lightly lubricate roller tappet with oil and fit in cylinder head so that guide -2- is in correct position -arrow-.



- Remove front noise insulation -1- ➔ Rep. gr. 66 .



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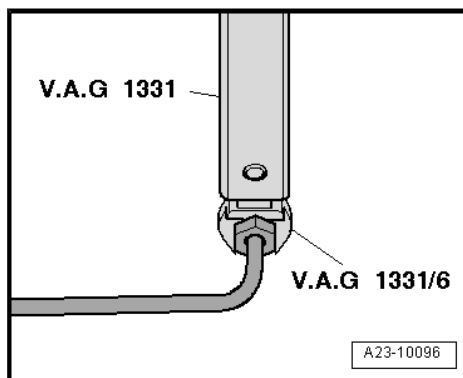
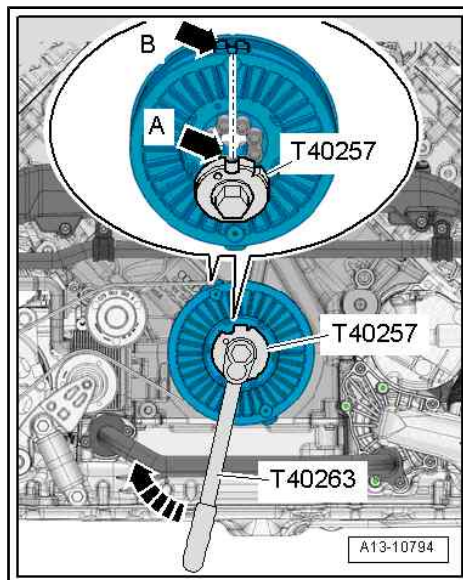
- Fit adapter -T40257- onto wrench -T40263- .
- Position adapter on bolts of vibration damper.
- The semi-circular recess -arrow A- on the adapter -T40257- must point to the semi-circular recess -arrow B- on the vibration damper.



Note

Disregard notch on adapter -T40257- .

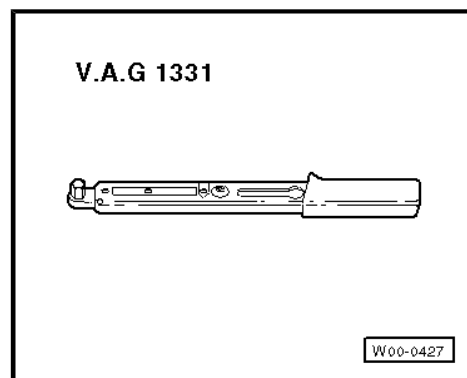
- Rotate crankshaft in direction of engine rotation -arrow- and at the same time press roller tappet into cylinder head until it reaches its lowest point.
- Fit high-pressure pump and press downwards in guide as far as stop.
- Tighten bolts by hand in several stages until they make contact.
- Tighten bolts alternately to specified torque.
- Lubricate threads of both union nuts lightly with engine oil.
- First tighten union nut by hand until it makes contact, making sure that high-pressure pipe is not under tension.
- Tighten union nut with torque wrench - V.A.G 1331- and open end spanner insert (AF 17) - V.A.G 1331/6- ; to do so, counterhold at hexagon flats of threaded connection on high-pressure pump with an open-end spanner.
- Install engine cover panel ➔ [page 17](#) .



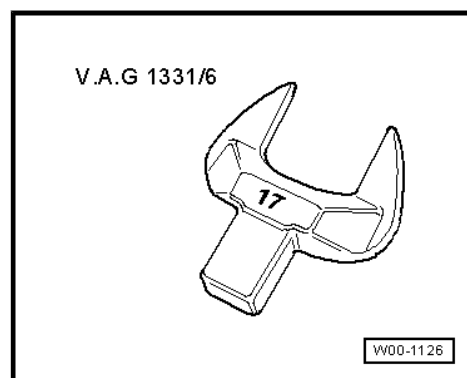
5.3 Removing and installing high-pressure pipe

Special tools and workshop equipment required

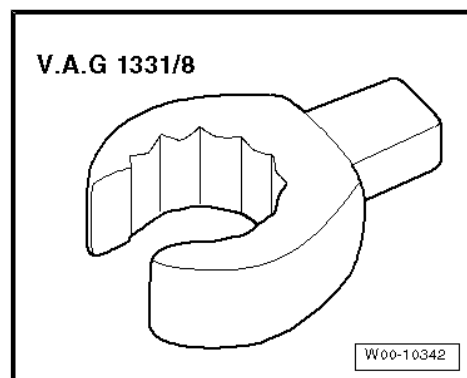
- ◆ Torque wrench - V.A.G 1331-



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



- ◆ Socket insert AF 14, flared ring spanner - V.A.G 1331/8-



Removing



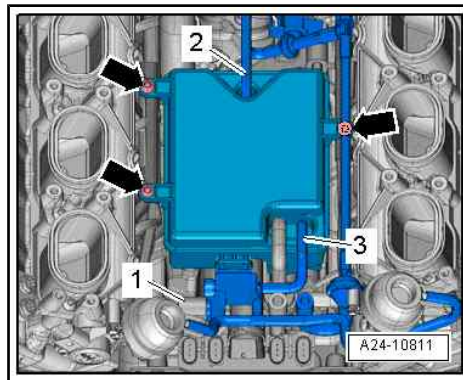
WARNING

The fuel system operates at extremely high pressure. This can cause injury.

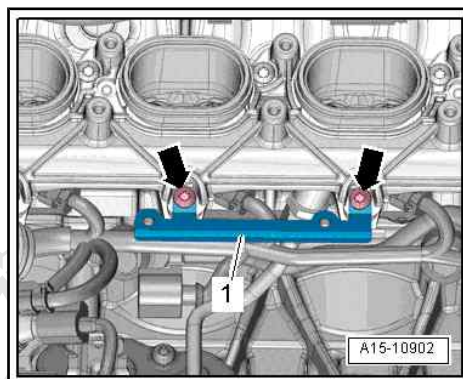
- ◆ *The fuel pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening the system.*

- Reduce fuel pressure in high-pressure section of injection system ➔ [page 4](#) .
- Remove intake manifold (top section) ➔ [page 22](#) .

- Disconnect vacuum hose -2- and -3- and take change-over valve -1- out of bracket.
- Remove bolts -arrows- and detach vacuum reservoir.



- Unscrew bolts (left and right) -arrows- and detach bracket -1- for vacuum reservoir.



- Remove bolt -1-.
- Detach high-pressure pipes (left and right) from connections -arrows- on fuel rail. To do so, counterhold at hexagon flats with an open-end spanner and loosen union nut.
- Detach high-pressure pipe.



Note

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Do not attempt to bend high-pressure pipe to a different shape.

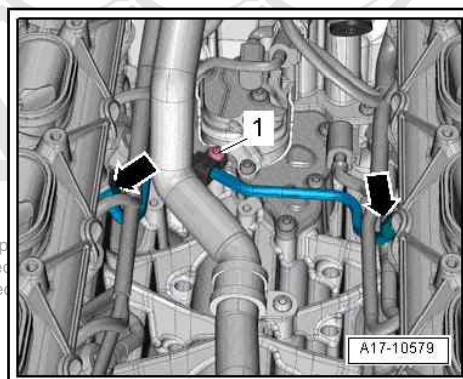
Installing

- Tightening torque
⇒ [Fig. "High-pressure pipe - tightening torques", page 32](#)

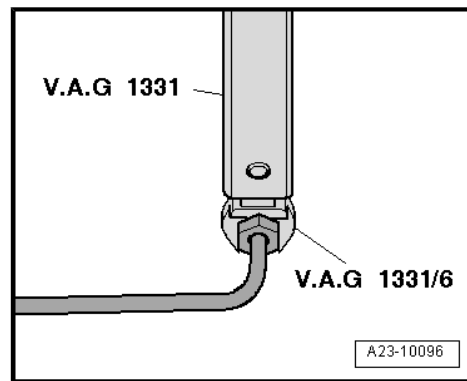


Note

- ♦ *The connections of the high-pressure pipe must not be damaged.*
- ♦ *Do not attempt to bend high-pressure pipe to a different shape.*
- Lubricate threads of both union nuts lightly with engine oil.



- Tighten union nuts using torque wrench - V.A.G 1331- and open end spanner insert (AF 17) - V.A.G 1331/6- ➔ [page 32](#) .
- Install intake manifold (top section) ➔ [page 22](#) .



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6 Injectors

⇒ ["6.1 Removing and installing injectors", page 38](#)

⇒ ["6.2 Cleaning injectors", page 42](#)

6.1 Removing and installing injectors

Special tools and workshop equipment required

- ◆ Tool set for FSI engines - T10133-



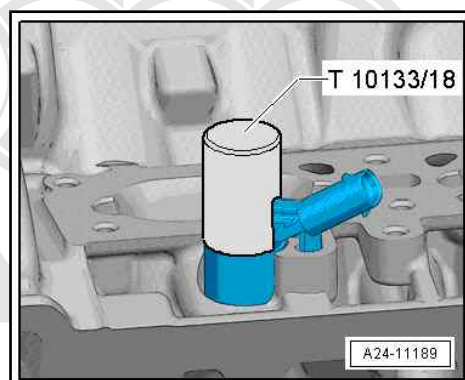
Removing



Note

Injectors must only be installed when the engine is cold.

- Remove corresponding intake manifold (bottom section)
⇒ [page 27](#) .
- Cover open inlet ports with a clean cloth.
- Unplug electrical connector at injector that is to be removed.
- Slide stop sleeve -T10133/18- over injector.



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- Carefully knock against stop sleeve several times to loosen injector.

 Note

- ◆ Use a torque wrench to pull out injector.
- ◆ Adjust torque wrench to 5 Nm.



- Guide puller T10133/2A- into groove on injector.
- Then apply puller T10133/16A .

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- Pull out injector by turning bolt with torque wrench -1-.
- If injector does not come loose after limit torque of 5 Nm is reached, remove puller and repeat procedure using stop sleeve to loosen injector.

 Note

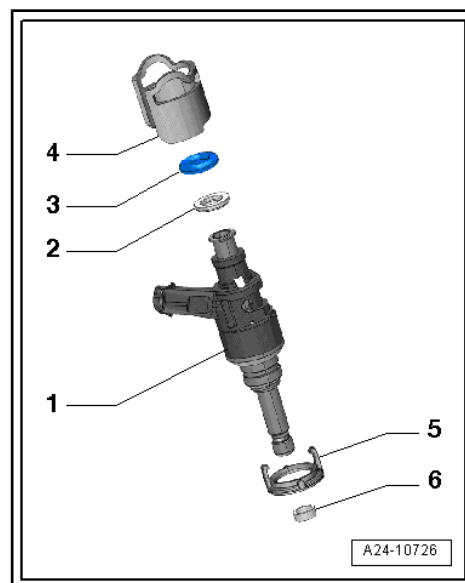
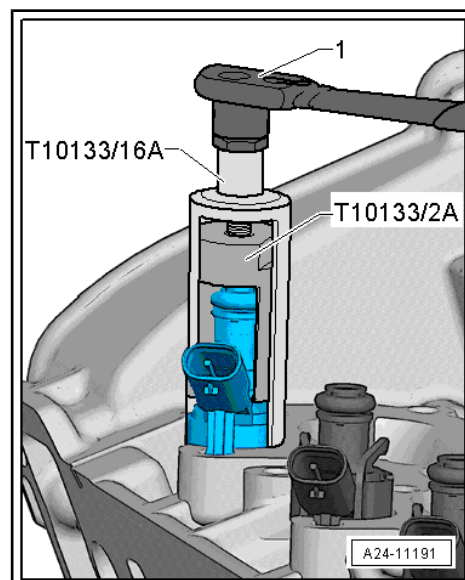
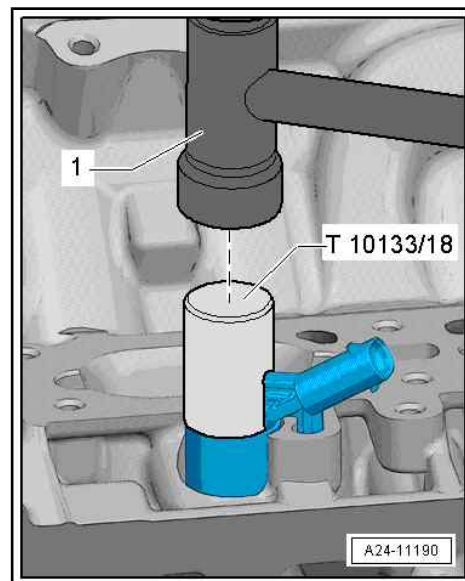
- ◆ Observe correct torque to avoid irreparable damage to injector.
- ◆ The combustion chamber ring seal must always be renewed prior to reinstalling the injector
⇒ "6.1.1 Renewing combustion chamber ring seal (teflon ring seal)", page 40 .

Dismantling injector

- Pull support ring -4-, O-ring -3- and spacer ring -2- off injector -1-.
- Unclip sealing element -5-.
- Carefully remove old combustion chamber ring seal -6-. To do so, cut open combustion chamber ring seal using knife or prise open with small screwdriver and then pull off.

 Note

The injector must be renewed if the groove is damaged.

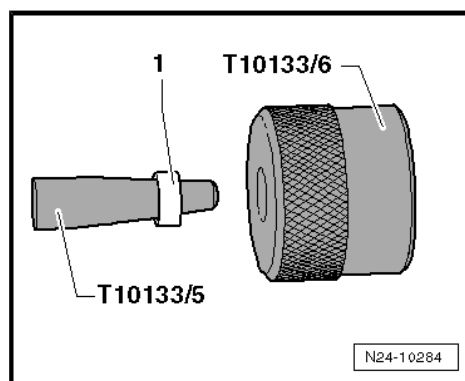
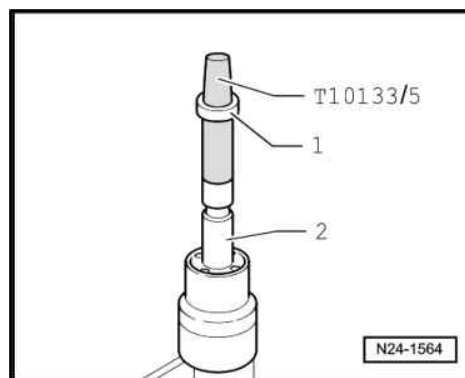
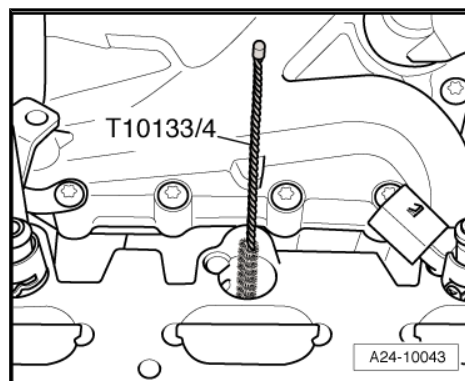


6.1.1 Renewing combustion chamber ring seal (teflon ring seal)

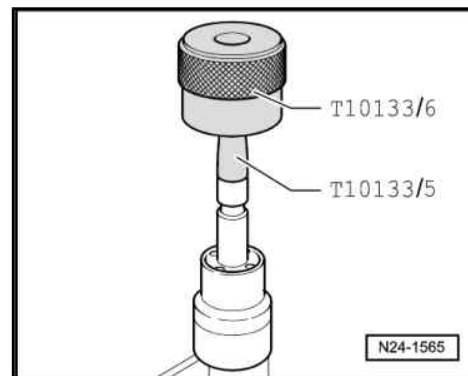


Note

- ◆ *Renew combustion chamber ring seal and O-ring.*
- ◆ *Renew spacer ring if damaged.*
- Before installing injectors, thoroughly clean apertures for injectors in cylinder head using supplied nylon brush T10133/4.
- Before new combustion chamber ring seal is fitted, any combustion residue must be removed from ring groove and injector stem using a clean cloth.
- Fit assembly cone -T10133/5- with new combustion chamber ring seal -1- onto injector -2-.
- Using assembly sleeve -T10133/6-, push combustion chamber ring seal onto assembly cone -T10133/5- as far as it will go.



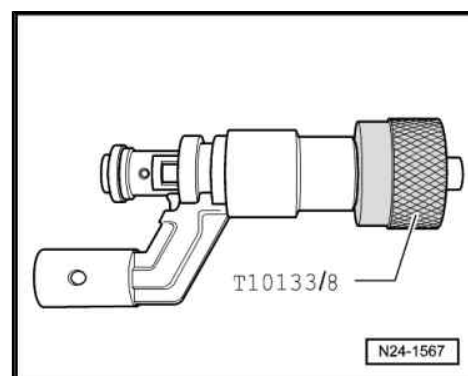
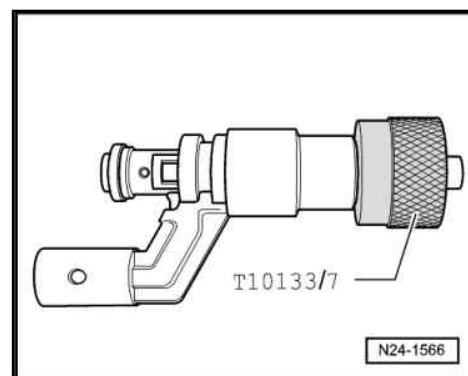
- Turn round assembly sleeve -T10133/6- and slide combustion chamber ring seal into groove.



Note

The combustion chamber ring seal is widened when it is pushed onto the injector. After pushing it on, it therefore has to be compressed again. This is done in two stages, as described below.

- Push calibration sleeve -T10133/7- onto injector as far as it will go and simultaneously turn it slightly (approx. 180°).
- Pull calibration sleeve -T10133/7- off again by turning it in the opposite direction.
- Push calibration sleeve -T10133/8- onto injector as far as it will go and simultaneously turn it slightly (approx. 180°).
- Pull calibration sleeve -T10133/8- off again by turning it in the opposite direction.

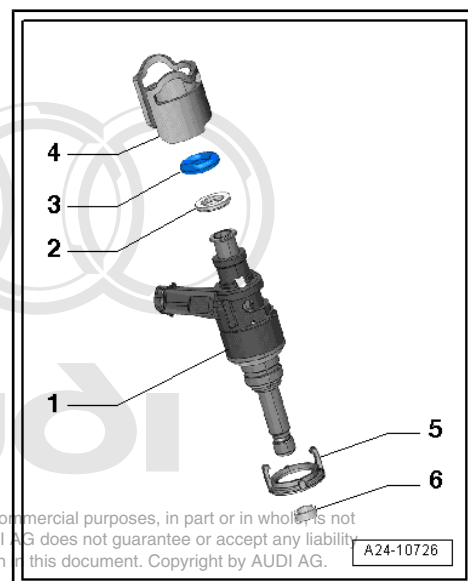


- Before installing new injector -1-, lubricate new O-ring -3- lightly with clean engine oil.



Note

- ◆ *The combustion chamber ring seal -6- must not be lubricated.*
- ◆ *Make sure there is no cleaning fluid or oil in the cylinder head bores when installing the injectors.*
- Push injector by hand as far as it will go into aperture in cylinder head (do not use oil or grease). Ensure that the injector is properly seated in the cylinder head.

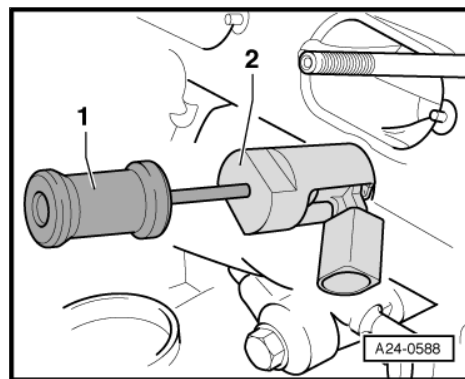


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Note

- ◆ *It should be possible to insert injector easily. If necessary wait until the combustion chamber ring seal has contracted sufficiently.*
- ◆ *Note correct installation position and ensure that injectors are properly seated in cylinder head.*
- ◆ *If the injector cannot be pushed in by hand, use puller - T10133/2A- -2- with striker - T10133/3- to insert the injector.*
- Electrical connector of injector must engage in recess in cylinder head.



Remaining installation steps are carried out in reverse sequence; note the following:

- Install intake manifold (bottom section) ➔ [page 27](#).

6.2 Cleaning injectors

Special tools and workshop equipment required

- ◆ Ultrasonic cleaning unit - VAS 6418-
- ◆ Mounting plate for injection modules - VAS 6418/1-
- ◆ Cleaning fluid - VAS 6418/2-

Cleaning

- Remove injectors
➔ ["6.1 Removing and installing injectors", page 38](#).



Note

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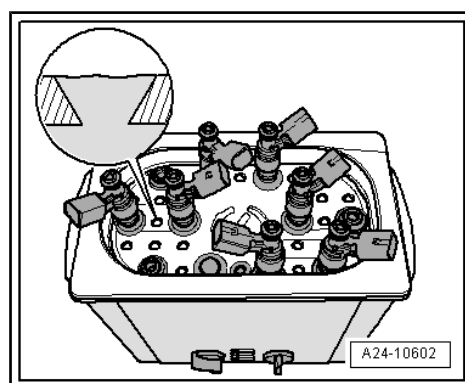
Observe safety precautions and operating instructions for ultrasonic unit.

- Ultrasonic unit must be filled with cleaning fluid.



Note

Ultrasonic unit must be filled with cleaning fluid up to top edge of apertures (see detail in illustration).

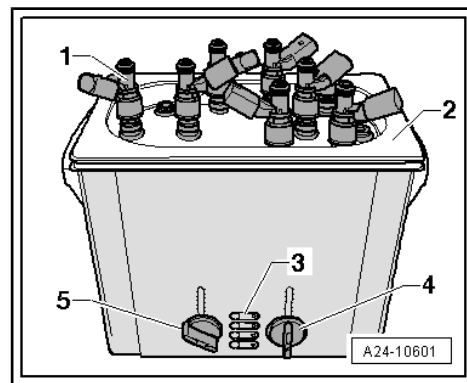


- Insert injectors -1- all the way into mounting plate for injection modules - VAS 6418/1- -2-.
- Set rotary knob -4- to a temperature of 50°C.
- Select a cleaning time of 30 minutes with rotary knob -5-.
- Switch on ultrasonic unit with button -3-.



Note

The time set starts to elapse as soon as a cleaning temperature of 50°C has been reached.



- After cleaning, renew combustion chamber ring seal (teflon ring seal) for each injector
⇒ ["6.1.1 Renewing combustion chamber ring seal \(teflon ring seal\)", page 40](#) .
- Then re-install injectors
⇒ ["6.1 Removing and installing injectors", page 38](#) .



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7 Senders and sensors

⇒ **“7.1 Removing and installing fuel pressure sender G247 / G624”**, **page 44**

⇒ **“7.2 Checking fuel pressure and residual pressure (up to high-pressure pump)”**, **page 44**

7.1 Removing and installing fuel pressure sender -G247- / -G624-

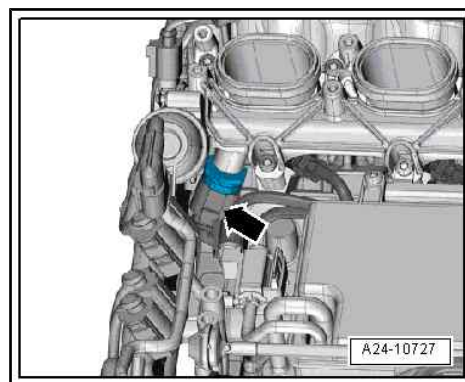
Removing

- Remove intake manifold (top section) ⇒ **page 22** .
- Unplug electrical connector -arrow-.
- Unscrew fuel pressure sender.

Installing

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

- Tightening torque
⇒ **Fig. ““Fuel pressure sender -G247- / -G624- ””**, **page 27**
- Install intake manifold (top section) ⇒ **page 22** .



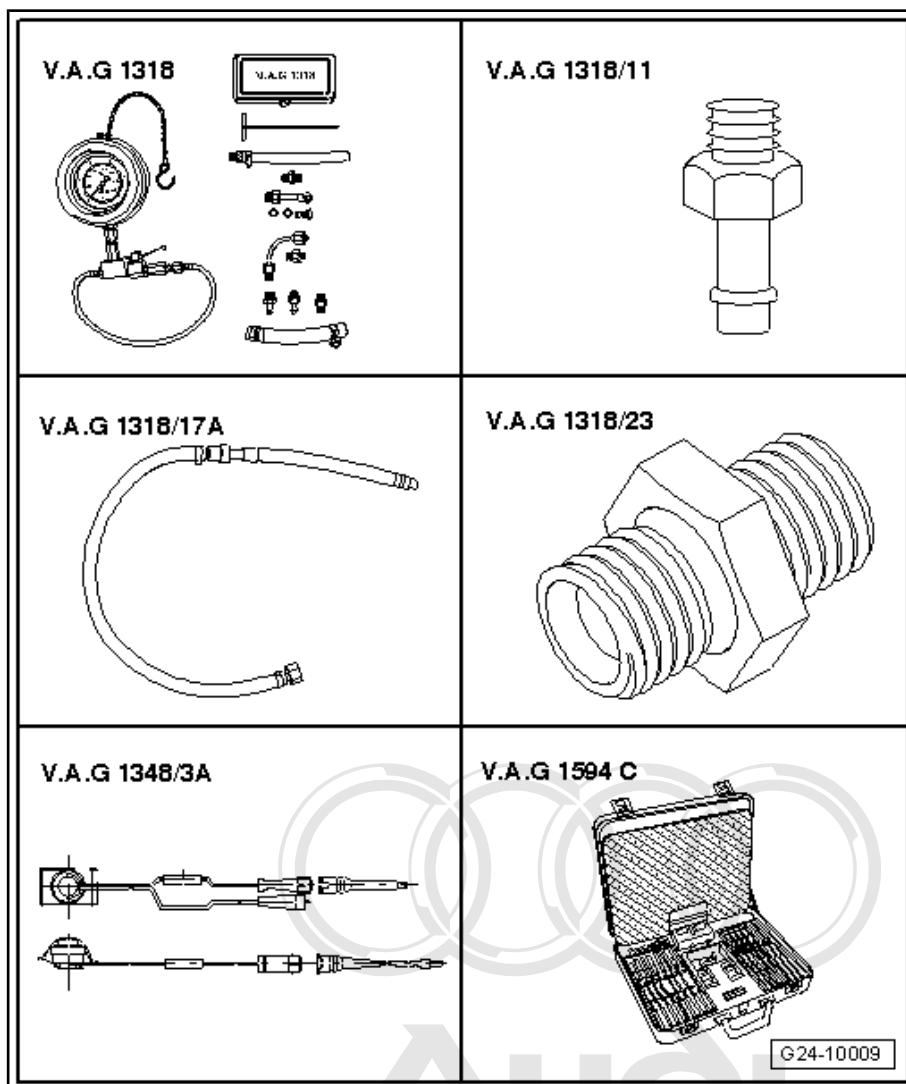
7.2 Checking fuel pressure and residual pressure (up to high-pressure pump)



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Special tools and workshop equipment required

- ◆ K-Jetronic pressure tester - V.A.G 1318-
- ◆ Adapter - V.A.G 1318/11-
- ◆ Adapter set - V.A.G 1318/17A-
- ◆ Connector - V.A.G 1318/23-
- ◆ Remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3-
- ◆ Auxiliary measuring set - V.A.G 1594C-
- ◆ Fuel-resistant measuring container



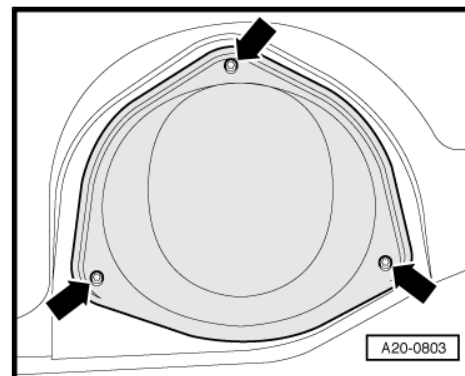
Test conditions

- Battery voltage at least 12.5 Volt.
- Fuel filter OK.
- Fuel tank at least $\frac{1}{4}$ full.
- Fuel pump control unit - J538- OK; checking in Guided Fault Finding ⇒ Vehicle diagnostic tester.

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Preparations

- Ignition off.
- Remove rear seat bench ⇒ Rep. gr. 72 .
- Unscrew cover for flange -arrows-.

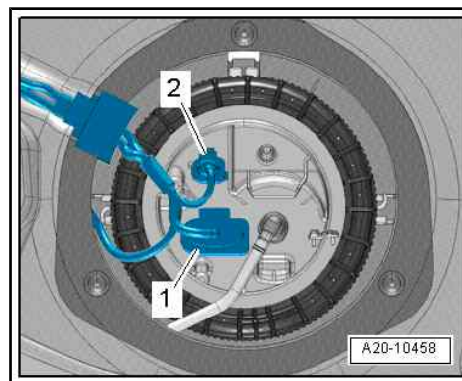


- Unplug electrical connector -1- on flange.

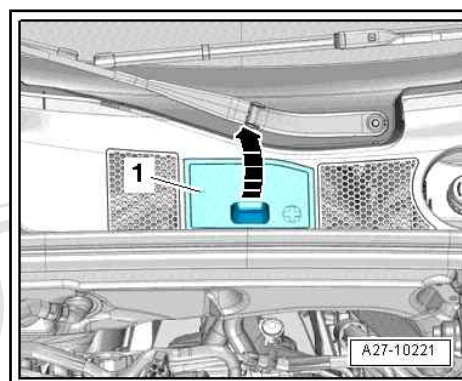


Note

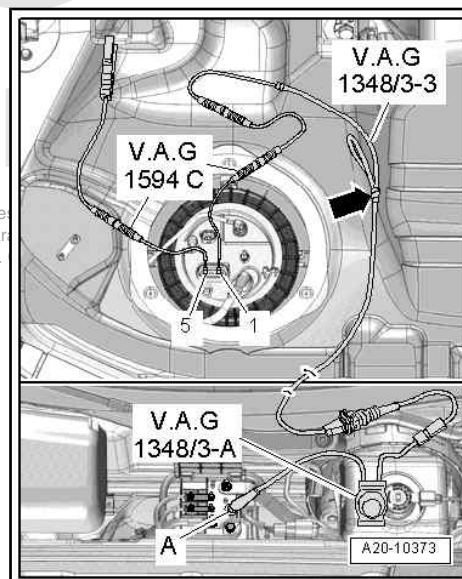
Disregard -item 2-.



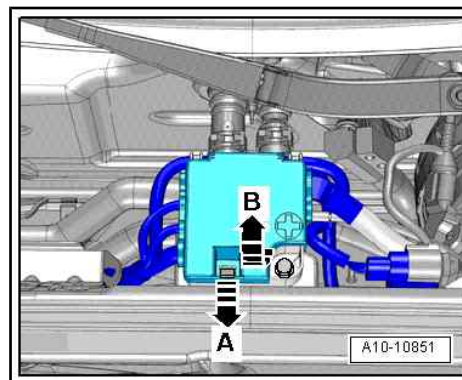
- Lift cover -1- by its handle -arrow-.



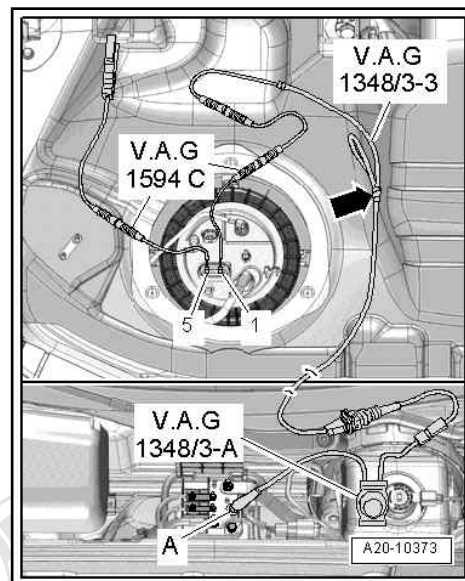
- Connect remote control - V.A.G 1348/3A- for V.A.G 1348 to contact -1- using adapter cable -V.A.G 1348/3-3- and test lead from auxiliary measuring set - V.A.G 1594C- .
- Tape off 2nd connector contact of adapter cable -V.A.G 1348/3-3- with insulating tape -arrow- to prevent short circuits.
- Connect contact -5- to vehicle body (earth) using a test lead from auxiliary measuring set - V.A.G 1594C- .
- Move switch of remote control - V.A.G 1348/3A- for V.A.G 1348 to front of engine compartment.



- Release retainer -arrow A- and open cover -arrow B-.



- Connect crocodile clip to jump start socket - U6- -item A- in terminal 30 wiring junction 2 - TV22- located in plenum chamber.
- Remove filler cap from fuel filler neck.



- Pull off engine cover panel ➔ [page 17](#) .

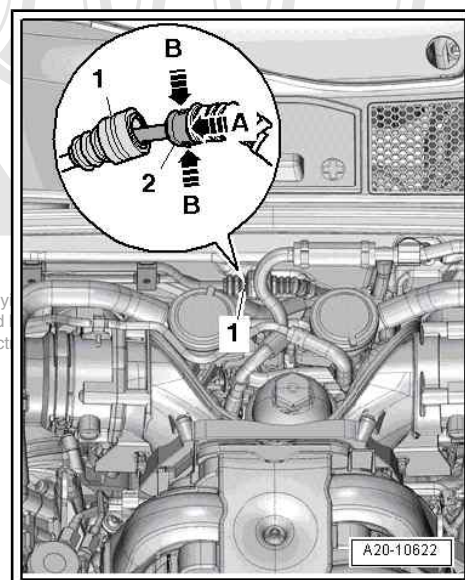


WARNING

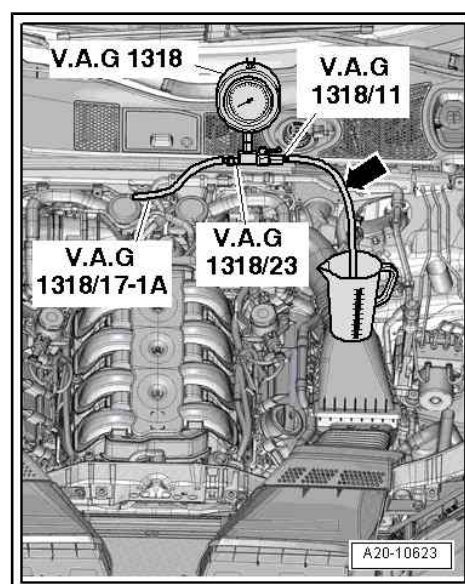
Risk of injury - fuel system operates under high pressure.

- ◆ *To reduce the pressure in the fuel system, wrap a clean cloth around the connection and carefully loosen the connection.*

- Push down protective sleeve -1- and disconnect fuel supply line.
- First press hose connector -2- downwards -arrow A-, then press release tabs -arrow B-.
- Pull off hose connector, keeping release tabs depressed.



- Screw connector - V.A.G 1318/23- and adapter -V.A.G 1318/17-1A- onto K-Jetronic pressure tester - V.A.G 1318- .
- Fit -V.A.G 1318/17-1A- onto disconnected fuel line.
- Connect adapter -V.A.G 1318/11- to -V.A.G 1318- .
- Attach test hose -arrow- and hold end of hose in measuring container.
- Open cut-off valve on pressure tester.
- Lever points in direction of flow.
- Bleed fuel system by pressing remote control briefly.



Checking fuel pressure

- Close cut-off valve on pressure tester.
- Lever is at right angle to direction of flow -arrow-.
- Press and hold remote control switch until K-Jetronic pressure tester - V.A.G 1318- shows no further increase in pressure.
- Specification: approx. 5.5 bar (4.5 ... 8.0 bar)
- If specification is not attained, check delivery rate of fuel pump
⇒ Rep. gr. 20 .

Checking residual pressure

- Check system for leaks and check residual pressure by watching the drop in pressure on the K-Jetronic pressure tester - V.A.G 1318- .
- After 10 minutes pressure should still be at least 3.0 bar.

If the residual pressure drops below 3 bar:

- ◆ Check union between K-Jetronic pressure tester - V.A.G 1318- and fuel supply line for leaks.
- ◆ Check K-Jetronic pressure tester - V.A.G 1318- for leaks.
- ◆ Check fuel lines and their connections for leaks.
- ◆ Check fuel filter with integral fuel pressure regulator ⇒ Rep. gr. 20 .
- ◆ If fuel filter is OK, renew fuel pump ⇒ Rep. gr. 20 .

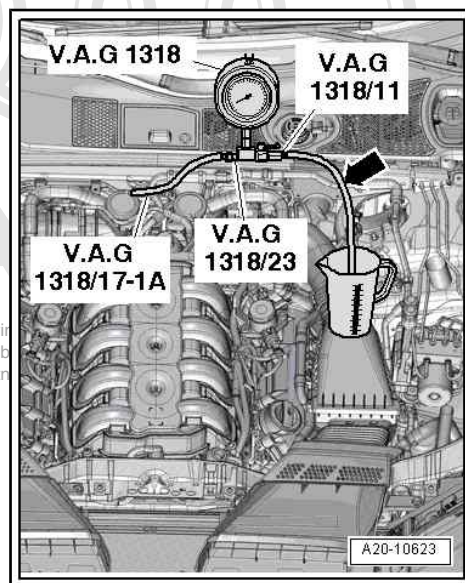
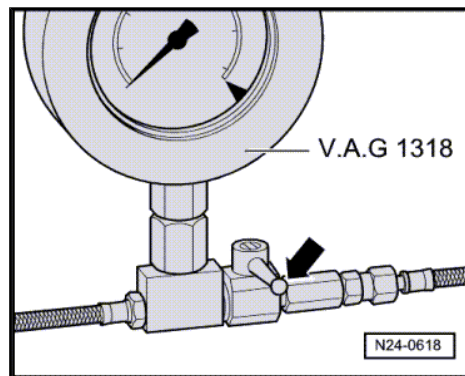
Installation is carried out in the reverse order; note the following:



Note

Before removing the pressure tester, release the fuel pressure by opening the cut-off valve. Hold end of test hose into measuring container -arrow-.

- Re-attach fuel supply line (make sure that all parts are clean and that there are no leaks).



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8 Lambda probes

⇒ ["8.1 Overview - Lambda probes", page 49](#)

⇒ ["8.2 Removing and installing Lambda probes", page 49](#)

8.1 Overview - Lambda probes



Note

- ◆ New Lambda probes are coated with an assembly paste.
- ◆ In the case of a used Lambda probe, coat only the thread with high-temperature paste; refer to ⇒ [Electronic parts catalogue for high-temperature paste](#).
- ◆ The assembly paste / high-temperature paste must not make contact with the slots on the Lambda probe body.

1 - Lambda probe 2 after catalytic converter - G131-

- ☐ With Lambda probe 2 heater after catalytic converter - Z30-
- ☐ Removing and installing
⇒ [page 49](#)
- ☐ 55 Nm

2 - Lambda probe 2 - G108-

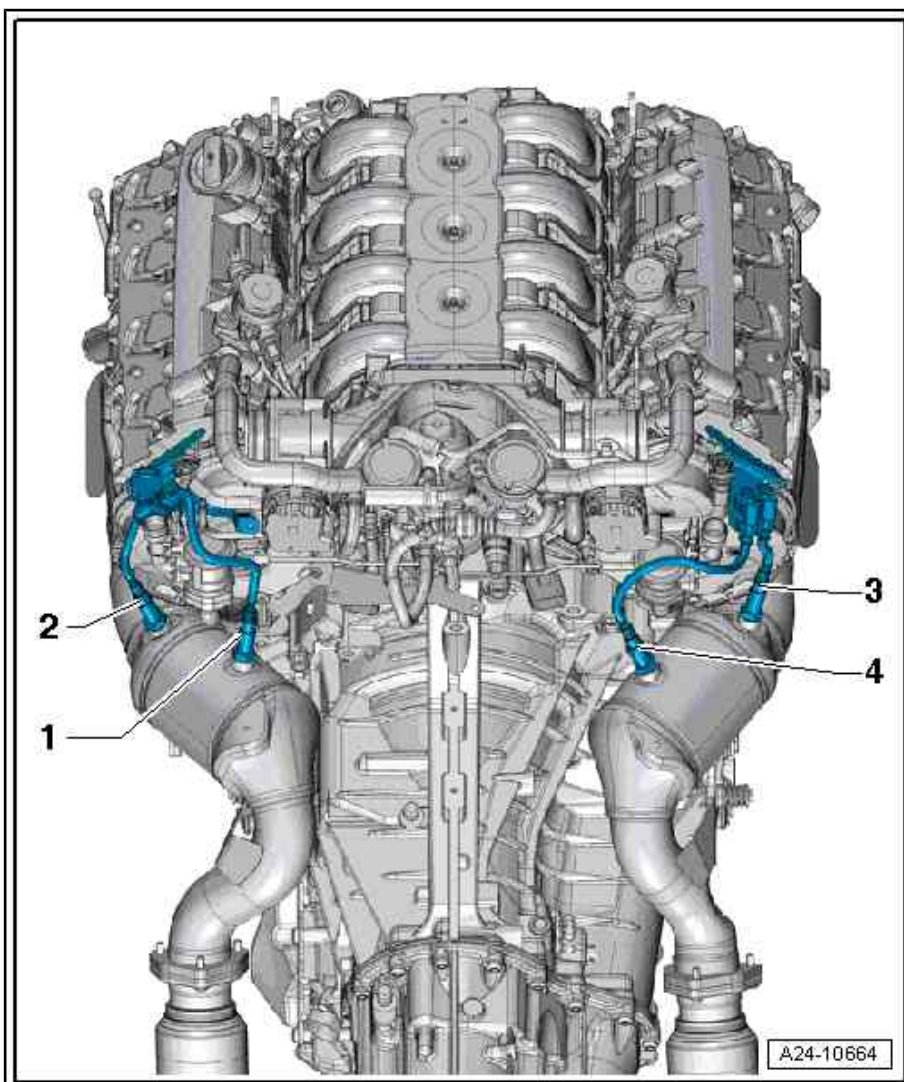
- ☐ With Lambda probe heater 2 - Z28-
- ☐ Removing and installing
⇒ [page 49](#)
- ☐ 55 Nm

3 - Lambda probe - G39-

- ☐ With Lambda probe heater - Z19-
- ☐ Removing and installing
⇒ [page 49](#)
- ☐ 55 Nm

4 - Lambda probe after catalytic converter - G130-

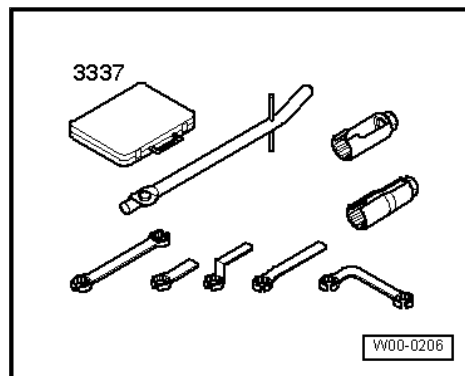
- ☐ With Lambda probe 1 heater after catalytic converter - Z29-
- ☐ Removing and installing
⇒ [page 49](#)
- ☐ 55 Nm



8.2 Removing and installing Lambda probes

Special tools and workshop equipment required

◆ Lambda probe open ring spanner set - 3337-



Removing

- Pull off engine cover panel ➔ [page 17](#) .

Lambda probe - G39- / Lambda probe 2 - G108- before catalytic converter:



Note

The preparations are described for cylinder bank 1 (left-side).

- Move crankcase breather hose -2- clear at air pipe.

Crankcase breather with separate hose:

- Disconnect crankcase breather hose -1- from air pipe by pressing release tabs.
- Release hose clips -arrows- and remove air pipe.

Crankcase breather with permanently connected hose:

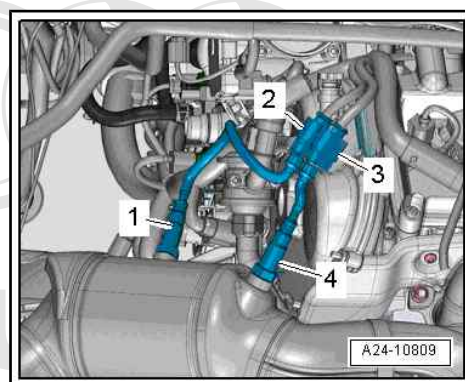
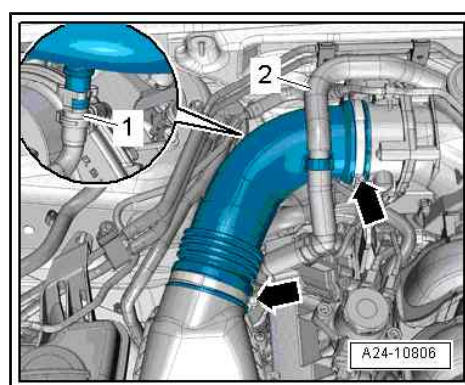
- Remove air pipe; to do so, loosen hose clips -arrows- and move air pipe clear to one side (hose -1- remains connected).
- To remove Lambda probe 2 - G108- , remove throttle valve module 2 - J544- as well ➔ [page 21](#) .

Lambda probe after catalytic converter - G130- / Lambda probe 2 after catalytic converter - G131- :

- Remove corresponding throttle valve module ➔ [page 21](#) .

Continued for cylinder bank 1 (right-side):

- Detach electrical connectors from bracket and unplug.
- 2 - For Lambda probe after catalytic converter - G130-
- 3 - For Lambda probe - G39-
- Unscrew Lambda probe using a tool from Lambda probe open ring spanner set - 3337- :
- 1 - Lambda probe after catalytic converter - G130-
- 4 - Lambda probe - G39-



Note

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

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Continued for cylinder bank 2 (left-side):

- Detach electrical connectors from bracket and unplug.
- 2 - For Lambda probe 2 - G108-
- 3 - For Lambda probe 2 - G131- (after catalytic converter)
- Unscrew Lambda probe using ring spanner -3337/7- :
- 1 - Lambda probe 2 - G108-
- 4 - Lambda probe 2 after catalytic converter - G131-



Note

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

Installing

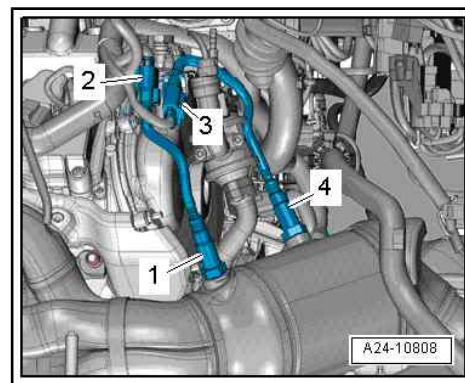
Installation is carried out in the reverse order; note the following:

- Tightening torques
⇒ ["8.1 Overview - Lambda probes", page 49](#)



Note

- ◆ *New Lambda probes are coated with an assembly paste.*
- ◆ *In the case of a used Lambda probe, coat only the 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.*
- ◆ *When installing, the Lambda probe wire must always be reattached at the same locations to prevent it from coming into contact with the exhaust pipe.*



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9 Engine control unit

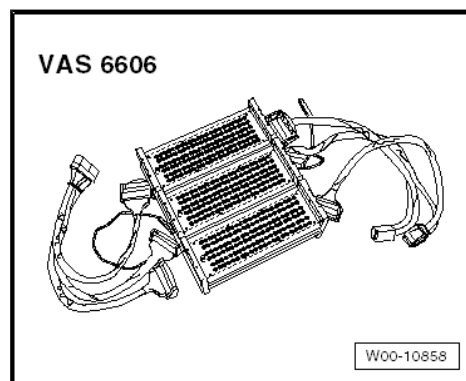
⇒ ["9.1 Wiring and component check with isolator boxes VAS 6606"](#), [page 52](#)

⇒ ["9.2 Removing and installing engine control unit J623"](#), [page 53](#)

9.1 Wiring and component check with isolator boxes -VAS 6606-

Special tools and workshop equipment required

- ◆ Isolator box, 198-pin - VAS 6606/1-1-
- ◆ Isolator box, 198-pin - VAS 6606/1-2-
- ◆ Isolator box, 198-pin - VAS 6606/1-3-
- ◆ Sheets -VAS 6606/1-1-
- ◆ Sheets -VAS 6606/2-1-
- ◆ Sheets -VAS 6606/3-1-
- ◆ Set of cables -VAS 6606/7-1- and -VAS 6606/7-2-



Note

- ◆ *Always make sure that the cables are properly connected.*
- ◆ *Do not use damaged or worn tools and accessories.*
- ◆ *Observe operating instructions.*
- Connect both cable sets -VAS 6606/7-1- and -VAS 6606/7-2- to the three isolator boxes -VAS 6606- .
- Use the following sheets:
 - ◆ -VAS 6606/1-1- for isolator box, 198-pin - VAS 6606/1-1-
 - ◆ -VAS 6606/2-1- for isolator box, 198-pin - VAS 6606/1-2-
 - ◆ -VAS 6606/3-1- for isolator box, 198-pin - VAS 6606/1-3-



Note

Make sure that all plug-in bridges are inserted completely in all isolator boxes.

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- Connect earth strap to an isolator box and to an earth point on the vehicle.
- Remove engine control unit ⇒ [page 53](#) .

- Connect engine control unit to cable set -VAS 6606/7-1- .
- Connect vehicle wiring harness to cable set -VAS 6606/7-2- .

The connection on the engine control unit consists of a large and a small connector.

The large connector has 105 pins and is assigned to the sheets for the isolator box marked "A 1 to A 105".

The small connector has 91 pins and is assigned to the sheets for the isolator box marked "B 1 to B 91".

When a push-in bridge is pulled out, the corresponding wiring connection is disconnected.



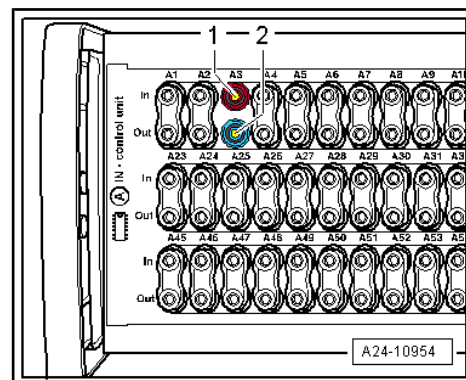
Note

- ◆ The "In" contact -1- (red socket) leads to the engine control unit.
- ◆ The "Out" contact -2- (blue socket) leads to the wiring harness.
- Carry out test as described in appropriate repair procedures.

Installing engine control unit

Installation is performed in the reverse sequence.

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



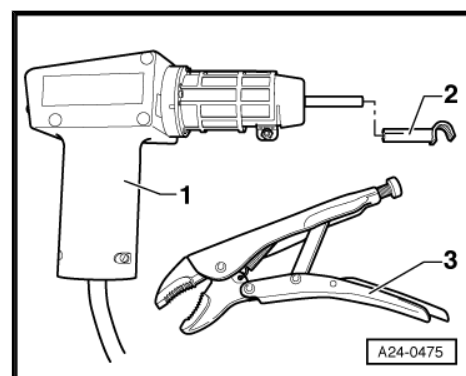
Note

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

9.2 Removing and installing 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-

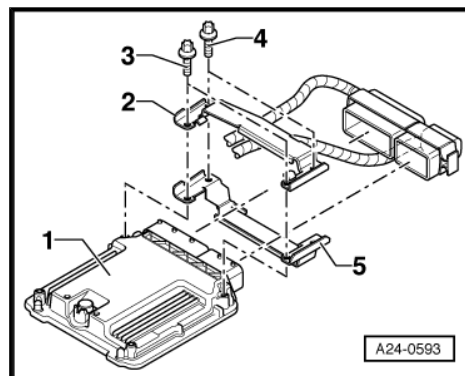


- ◆ Small, commercially available mole grips -3-



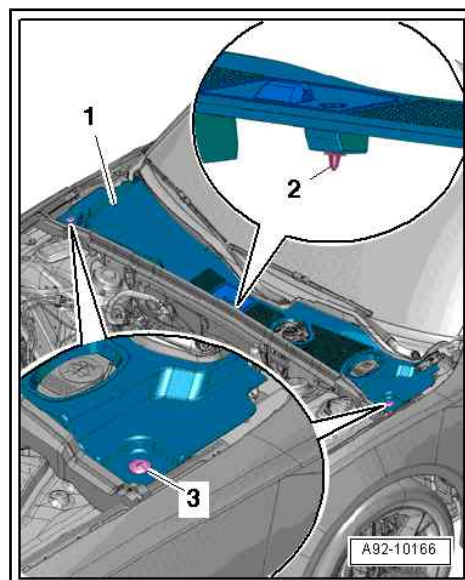
Note

- ◆ The engine control unit -1- is bolted to the protective housing -5-. To make it more difficult to unscrew the shear bolts -4- for locking plate -2-, their threads have been coated with locking fluid.
- ◆ The protective housing has to be removed before the connectors can be unplugged from the engine control unit (e.g. to connect the test box or renew the engine control unit).

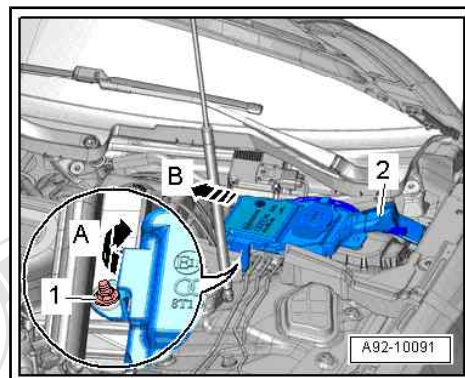


Removing

- When renewing engine control unit, select diagnosis object “Replace engine control unit” in “Guided Functions” mode of ➔ Vehicle diagnostic tester.
- Switch off ignition and take out ignition key.
- Remove bolts -3-.
- Unclip retaining clips -2- from mounting and detach plenum chamber cover -1-.



- Remove nut -1- and swivel filler neck for washer fluid reservoir slightly upwards -arrow A-.
- Pull filler neck -2- with filler pipe out of washer fluid reservoir and through opening in body -arrow B-.

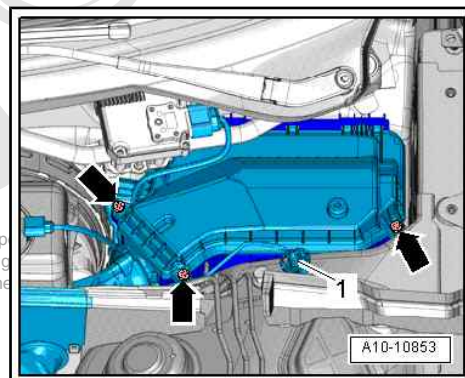


- Remove bolts -arrows- and detach cover for electronics box in engine compartment.



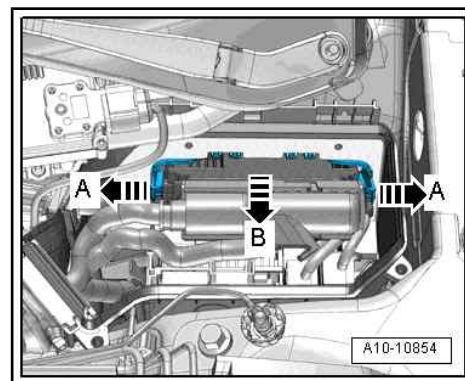
Note

Disregard -item 1-.



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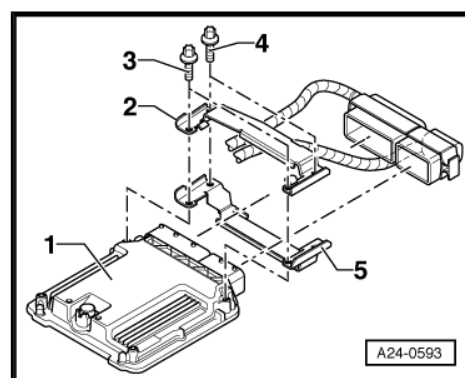
- Release catches -arrows A- and take out engine control unit -arrow B-.



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

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.



Caution

Wiring, connectors, insulation and control units can be burnt and damaged.

- ◆ *Keep exactly to the following procedure. Observe operating instructions for hot air blower.*

- Select settings on hot air blower -4- as shown in illustration:
2 - Temperature potentiometer to maximum heat output
3 - Two-stage air flow switch to position "3"

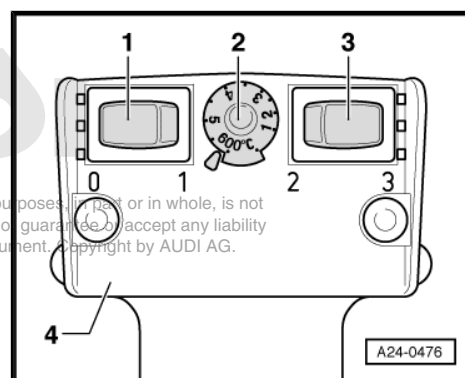


WARNING

Risk of burns.

- ◆ *Parts of the metal locking plate will become very hot as a result of heating the shear bolts. Try to ensure that only the thread is heated and none of the nearby components. These should be covered if necessary.*

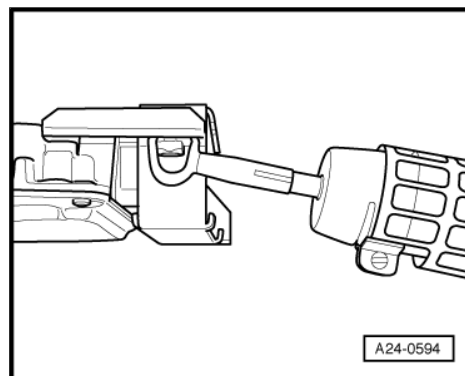
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Apply heat to the threads of the shear bolts on the connector side as shown in the illustration.

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

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



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

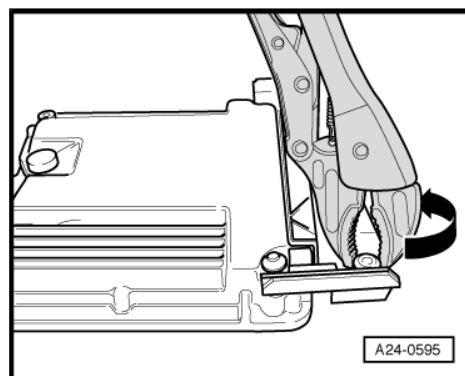
Installing

Installation is performed in the reverse sequence.

- After installation, the protective housing must be re-fitted on the engine control unit - J623- .
- Clean threaded holes for shear bolts to remove any residue from locking fluid. This can be done using a thread tap.
- Use new shear bolts.
- Install cover for electronics box in engine compartment ⇒ Electrical system; Rep. gr. 97 .
- Install filler neck for washer fluid reservoir ⇒ Electrical system; Rep. gr. 92 .

After installing a new engine control unit, the following operation must be performed:

- Activate engine control unit using ⇒ Vehicle diagnostic tester in "Guided Functions" mode, "Replace engine control unit".



28 – Ignition system

1 General notes and safety precautions

⇒ [“1.1 General notes on ignition system”, page 57](#)

⇒ [“1.2 Safety precautions”, page 57](#)

1.1 General notes on ignition system

- ◆ The engine control unit has a self-diagnosis capability. Before carrying out repairs and fault finding, the event memory must be interrogated.
- ◆ A voltage of at least 11.5 V is required for proper operation of the electrical components.
- ◆ 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.
- ◆ If the engine starts, runs for a short period and then cuts out after completing fault finding, repairs or component tests, this may be due to the immobilizer disabling the engine control unit. The event memory must then be interrogated and, if necessary, the control unit must be adapted.

1.2 Safety precautions

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



WARNING

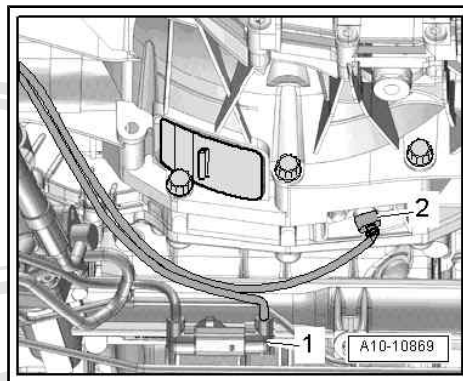
Accidents can be caused if the driver is distracted by test equipment while road-testing, or if test equipment is not properly secured.

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.*

To prevent injuries to persons and/or irreparable damage to the fuel injection and ignition system, the following must be noted:

- ◆ Do not touch or disconnect ignition coils when the engine is running or being turned at cranking speed.
- ◆ The ignition must be switched off before disconnecting or connecting ignition system wiring, high-voltage wires and test leads.
- ◆ Always switch off the ignition before cleaning the engine.
- ◆ Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.
- ◆ If you want to turn the engine at cranking speed without actually starting it (e.g. compression test), first unplug connector -2- at engine speed sender - G28- .



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2 Ignition system

⇒ [“2.1 Test data”, page 59](#)

⇒ [“2.2 Exploded view - ignition system”, page 59](#)

⇒ [“2.3 Removing and installing ignition coils”, page 61](#)

⇒ [“2.4 Removing and installing knock sensors G61 / G66 / G198 / G199”, page 62](#)

⇒ [“2.5 Removing and installing Hall senders G40 / G163”, page 63](#)

⇒ [“2.6 Removing and installing Hall senders G300 / G301”, page 64](#)

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2.1 Test data

Engine data		4.2 ltr. FSI engine
Idling speed		Cannot be adjusted; regulated by idling speed stabilisation
Ignition timing		Not adjustable (determined by control unit)
Ignition system		Multi-coil system with 8 ignition coils (output stages integrated) connected directly to spark plugs via spark plug connectors
Spark plugs	Designations	⇒ Electronic parts catalogue
	Tightening torque	⇒ Maintenance ; Booklet 811
Firing order		1-5-4-8-6-3-7-2

2.2 Exploded view - ignition system

1 - Knock sensor

- ☐ Cylinder bank 1 (right-side): knock sensor 1 - G61- , knock sensor 3 - G198-
- ☐ Cylinder bank 2 (left-side): knock sensor 2 - G66- , knock sensor 4 - G199-
- ☐ Removing and installing ➔ [page 62](#)

2 - Bolt

- ☐ 20 Nm

3 - O-ring

- ☐ Renew

4 - Hall sender

- ☐ Cylinder bank 1 (right-side)
- ☐ Inlet side: Hall sender - G40-
- ☐ Removing and installing Hall sender (inlet side) ➔ [page 63](#)
- ☐ Exhaust side: Hall sender 3 - G300-
- ☐ Removing and installing Hall sender (exhaust side) ➔ [page 64](#)

5 - Bolt

- ☐ 9 Nm

6 - Spark plug

- ☐ Change interval ➔ Maintenance tables
- ☐ Tightening torque ➔ Maintenance ; Booklet 811 , ➔ Maintenance ; Booklet 812 or ➔ Maintenance ; Booklet 818

7 - Ignition coil

- ☐ Removing and installing ➔ [page 61](#)

8 - Bolt

- ☐ 5 Nm

9 - Electrical wiring harness

10 - Engine speed sender - G28-

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

11 - Bolt

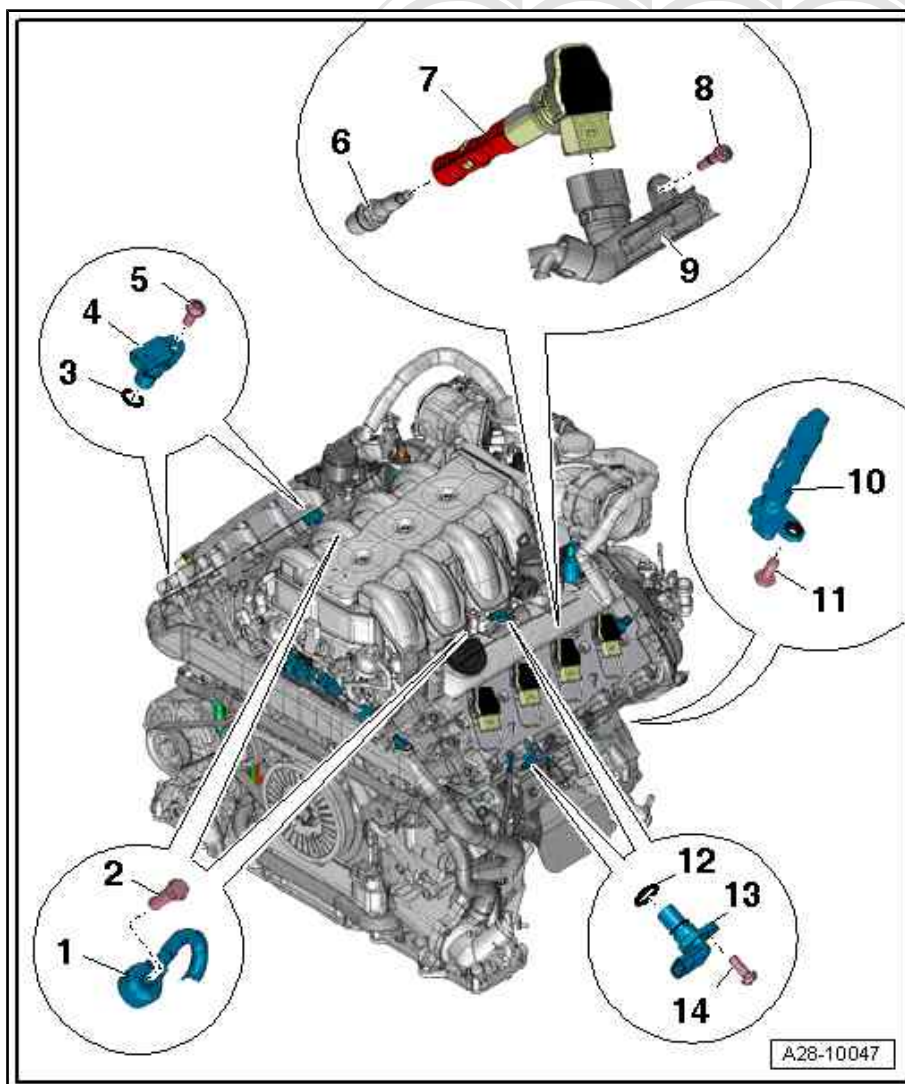
- ☐ 9 Nm

12 - O-ring

- ☐ Renew

13 - Hall sender

- ☐ Cylinder bank 2 (left-side)
- ☐ Inlet side: Hall sender 2 - G163-
- ☐ Removing and installing Hall sender (inlet side) ➔ [page 63](#)
- ☐ Exhaust side: Hall sender 4 - G301-
- ☐ Removing and installing Hall sender (exhaust side) ➔ [page 64](#)



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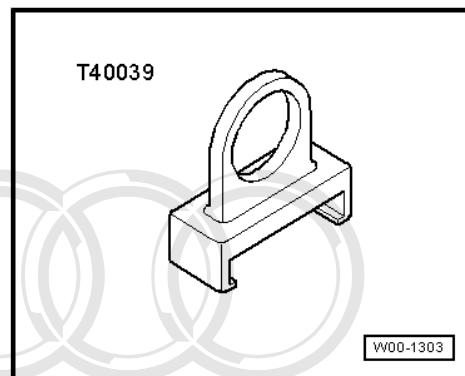
14 - Bolt

□ 9 Nm

2.3 Removing and installing ignition coils

Special tools and workshop equipment required

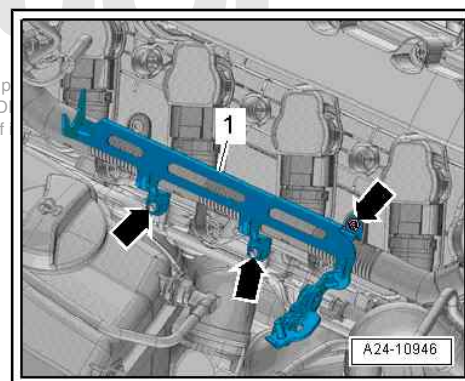
◆ Puller - T40039-



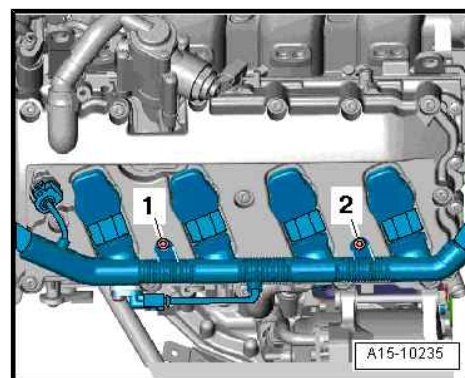
Removing

- Pull off engine cover panel ➔ [page 17](#) .
- Remove corresponding air cleaner housing ➔ [page 19](#) .
- Unscrew nuts and bolts -arrows- and remove corresponding bracket -1- for air cleaner housing.

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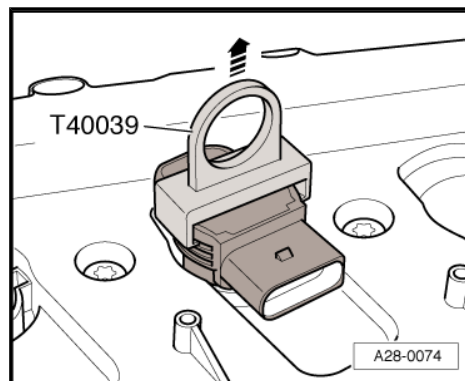
- Remove bolts -1- and -2-.



- Pull ignition coils out of spark plug holes approx. 30 mm using puller - T40039- .
- Release electrical connectors and detach from ignition coils simultaneously.
- Pull out ignition coils.

Installing

- Tightening torques
⇒ ["2.2 Exploded view - ignition system", page 59](#)
- Fit all ignition coils loosely into spark plug holes.
- Align ignition coils with connectors and attach all connectors onto ignition coils simultaneously.
- Press ignition coils onto spark plugs by hand evenly (do not use tool).



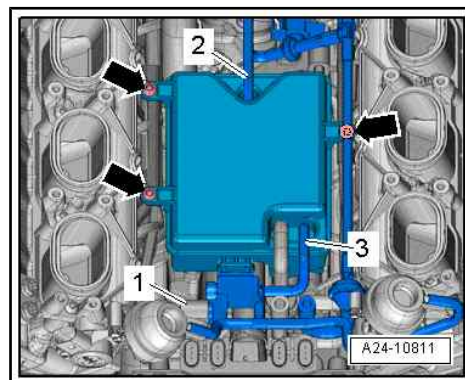
2.4 Removing and installing knock sensors -G61- / -G66- / -G198- / -G199-

Removing knock sensors -G61- / -G198- (front):

- Remove intake manifold (top section) ⇒ [page 22](#) .
- Disconnect vacuum hose -2- and -3- and take change-over valve -1- out of bracket.
- Remove bolts -arrows- and detach vacuum reservoir.

Removing knock sensors -G66- / -G199- (centre of engine):

- Remove high-pressure pipe
⇒ ["5.3 Removing and installing high-pressure pipe", page 34](#) .



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All knock sensors (continued):

- Take corresponding electrical connector out of bracket (right-side) and unplug:

5 - Blue connector for knock sensor 3 - G198-

6 - Orange connector for knock sensor 4 - G199-

7 - Grey connector for knock sensor 2 - G66-

8 - Black connector for knock sensor 1 - G61-

- Remove corresponding bolt and detach knock sensor:

1 - Knock sensor 1 - G61-

2 - Knock sensor 2 - G66-

3 - Knock sensor 4 - G199-

4 - Knock sensor 3 - G198-

Installing

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

- Tightening torques
⇒ ["2.2 Exploded view - ignition system", page 59](#)



Note

Fit all cable ties in the original positions when installing.

- Install high-pressure pipe
⇒ ["5.3 Removing and installing high-pressure pipe", page 34](#) .
- Install intake manifold (top section) ⇒ [page 22](#) .

2.5 Removing and installing Hall senders - G40- / -G163-

Removing

- Unplug electrical connector -1-.
- Unscrew bolt -arrow- and remove Hall sender.

Installing

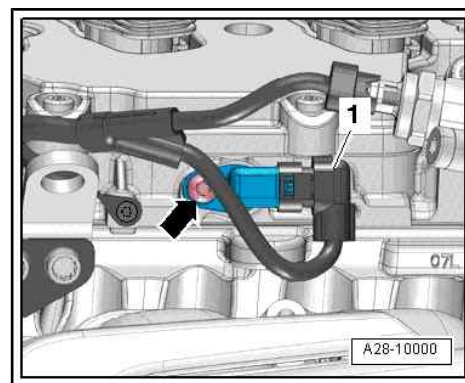
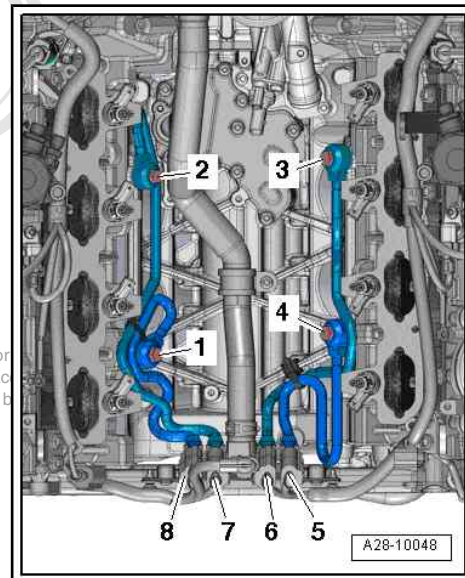
- Tightening torques
⇒ ["2.2 Exploded view - ignition system", page 59](#)

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



Note

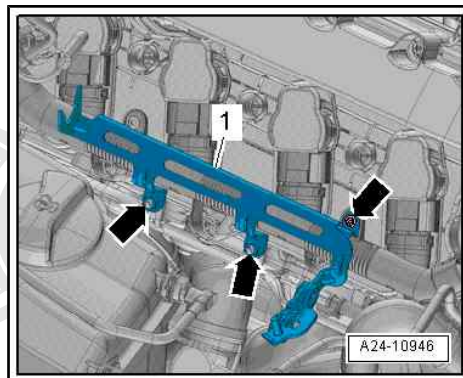
Fit new O-rings.



2.6 Removing and installing Hall senders - G300- / -G301-

Removing

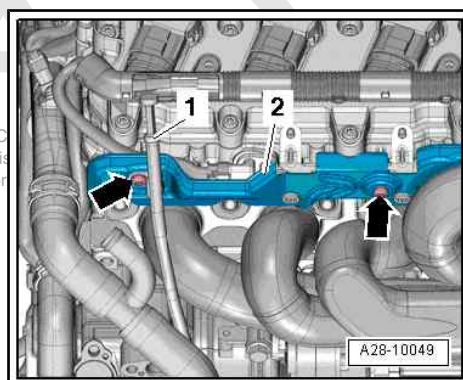
- Remove corresponding air cleaner housing ⇒ [page 19](#) .
- Unscrew nuts and bolts -arrows- and remove corresponding bracket -1- for air cleaner housing.



Hall sender 4 - G301-

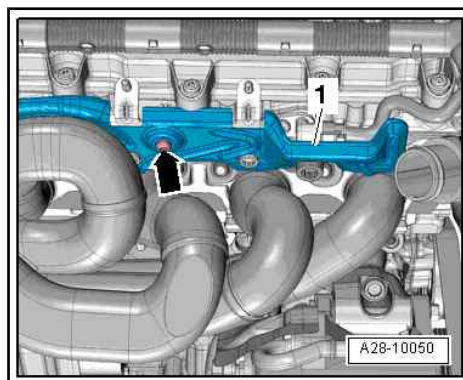
- Remove bolts -arrows- and pull out guide tube for oil dipstick.
- Carefully bend heat shield -2- slightly to the side.

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Hall sender 3 - G300-

- Remove bolts -arrows-.
- Carefully bend heat shield -1- slightly to the side.



- Unplug electrical connector -2-.
- Unscrew bolt -1- and detach Hall sender.

Installing

- Tightening torques
⇒ ["2.2 Exploded view - ignition system", page 59](#)

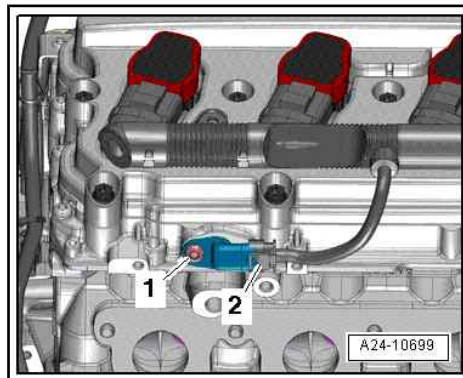
Installation is carried out in the reverse order; note the following:

- Install dipstick guide tube ⇒ Rep. gr. 13 .



Note

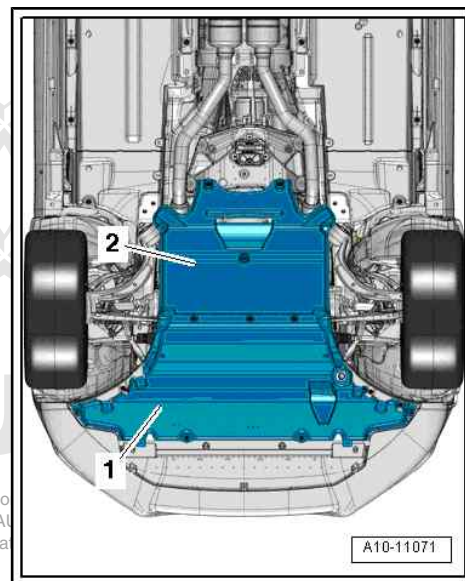
Fit new O-rings.



2.7 Removing and installing engine speed sender - G28-

Removing

- Remove rear noise insulation panel -2- ⇒ Rep. gr. 66 .



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

Installing

- Tightening torque
⇒ ["2.2 Exploded view - ignition system", page 59](#)

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

- Install noise insulation ⇒ Rep. gr. 66 .

