Workshop Manual

Audi A8 2010 ➤

Direct petrol injection and ignition system (12-cyl. 6.3 ltr. 4-valve)									
Engine ID	CEJA								

Edition 03.2011

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

Repair Group

24 - Mixture preparation - injection

28 - Ignition system

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

Contents

24 – Mixture preparation - injection

1 Safety precautions and rules for cleanliness

Overview

1.1 General notes on self-diagnosis

- The engine control unit has a self-diagnosis capability. Before carrying out repairs and fault finding, the event memory must be interrogated. The vacuum hoses and connections must also be checked (unmetered air).
- A voltage of at least 11.5 V is required for proper operation of the electrical components.
- Entries will be stored in the event memory of the engine control unit if electrical connectors have been unplugged and the engine started.

Additional steps required

– Erase event memory and generate readiness code in engine control units in „Guided Functions“ mode.

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. The procedure is described in Guided Fault Finding. Use ⇒ Vehicle diagnostic tester.*
- *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.*

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. The procedure is described in Guided Fault Finding. Use ⇒ Vehicle diagnostic tester.*

- 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:

- Persons wearing a cardiac pacemaker must at all times maintain a safe distance from high-voltage components such as the ignition system and gas-discharge 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 crank the engine at starting speed without actually starting the engine (e.g. compression test), first unplug the electrical connectors from the injectors and the ignition coils ⇒ page 64 .

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.
- Immediately seal off open lines and connections with clean plugs.
- 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 Procedure before opening high-pressure section of injection system

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.*

The procedure is described in the ⇒ Vehicle diagnostic tester under Guided Functions, „Relieve fuel 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.

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.

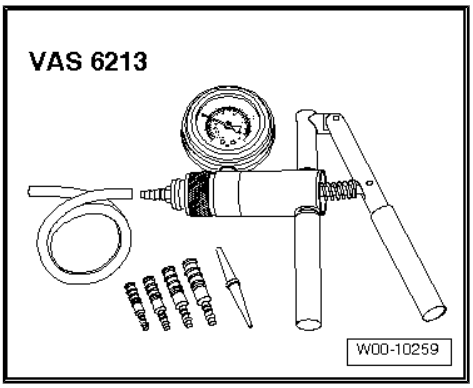
– Road-test vehicle and accelerate with full throttle at least once.

– 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 the vacuum lines leading to the corresponding component and also check the remaining vacuum lines leading to other components.

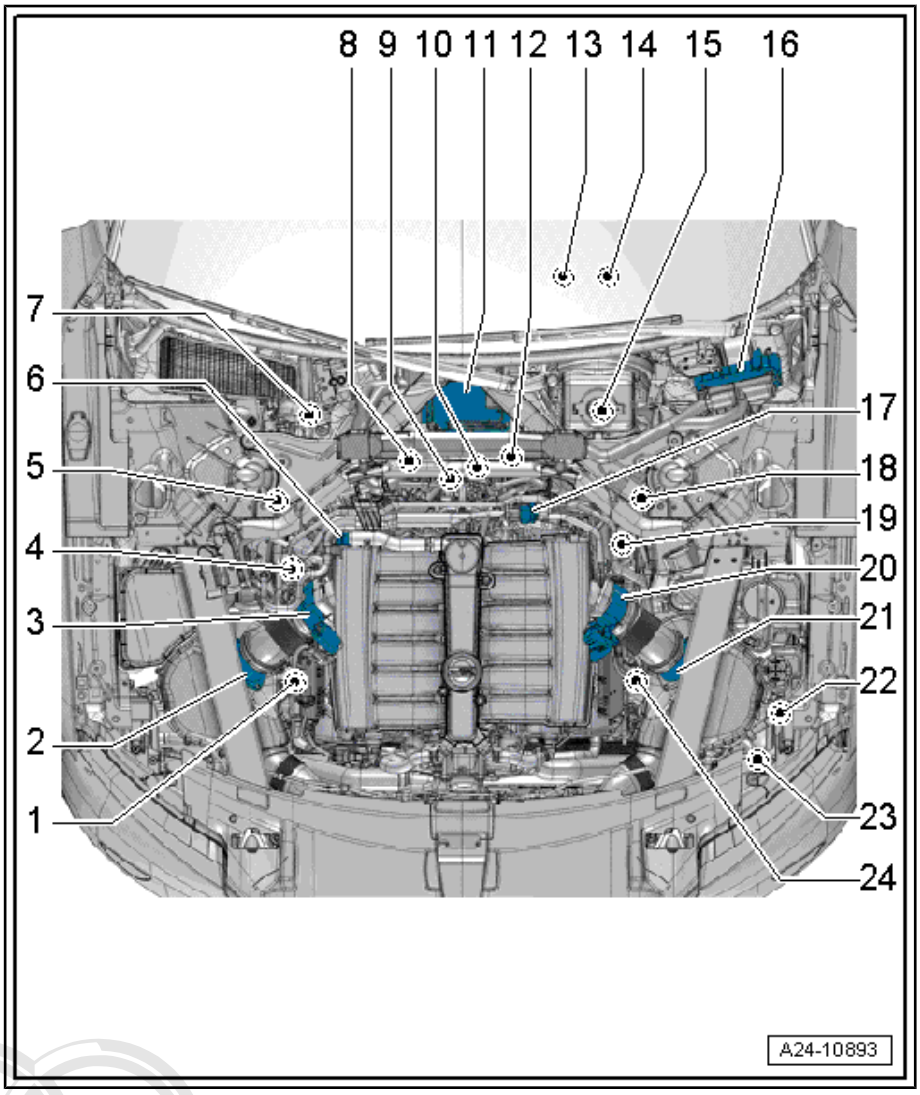
– If it is not possible to build up a vacuum with the hand vacuum pump -VAS 6213- or if the vacuum pressure drops again immediately, check the hand vacuum pump and connecting hoses for leaks.

2 Test data

6.3 ltr. FSI engine	
Idling speed	Cannot be adjusted; regulated by idling speed stabilisation
Fuel pressure before high-pressure pump	6.0 ... 7.0 bar
Fuel pressure after high-pressure pump	15 ... 135 bar

3 Overview of fitting locations

Engine compartment



1 - Lambda probe -G39- (before catalytic converter)

- ❑ With Lambda probe heater -Z19-
- ❑ Exploded view ⇒ page 50

2 - Air mass meter -G70- / intake air temperature sender -G42-

- ❑ Exploded view ⇒ page 16

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-
- ❑ Exploded view ⇒ page 23

4 - Lambda probe after catalytic converter -G130-

- ❑ With Lambda probe 1 heater after catalytic converter -Z29-
- ❑ Exploded view ⇒ page 50

5 - Lambda probe 2 -G108- (before catalytic converter)

- ❑ With Lambda probe heater 2 -Z28-
- ❑ Exploded view ⇒ page 50

6 - Heating element for crankcase breather -N79-

7 - Lambda probe 2 after catalytic converter -G131-

- ❑ With Lambda probe 2 heater after catalytic converter -Z30-
- ❑ Exploded view ⇒ page 50

8 - Secondary air pump motor 2 -V189-

- ❑ Exploded view ⇒ Rep. gr. 26

9 - Sender 2 for secondary air pressure -G610-

- ❑ Exploded view ⇒ Rep. gr. 26

10 - Sender 1 for secondary air pressure -G609-

- ❑ Exploded view ⇒ Rep. gr. 26

11 - Engine control unit 2 -J624-

- ❑ Fitting location ⇒ page 13

12 - Secondary air pump motor -V101-

- ❑ Exploded view ⇒ Rep. gr. 26

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

- ❑ Fitting location ⇒ page 13

14 - Brake light switch -F-

- ❑ Fitting location ⇒ page 13

15 - Lambda probe 4 after catalytic converter -G288-

- ❑ With Lambda probe 4 heater after catalytic converter -Z65-
- ❑ Exploded view ⇒ page 50

16 - Engine control unit -J623-

- ❑ Fitting location ⇒ page 12

17 - Activated charcoal filter solenoid valve 1 -N80-

- ❑ Fitting location ⇒ page 14

18 - Lambda probe 3 after catalytic converter -G287-

- ❑ With Lambda probe 3 heater after catalytic converter -Z64-
- ❑ Exploded view ⇒ page 50

19 - Lambda probe 4 -G286- (before catalytic converter)

- ❑ With Lambda probe heater 4 -Z63-
- ❑ Exploded view ⇒ page 50

20 - 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-
- ❑ Exploded view ⇒ page 23

21 - Air mass meter 2 -G246- / intake air temperature sender 2 -G299-

- ❑ Exploded view ⇒ page 16

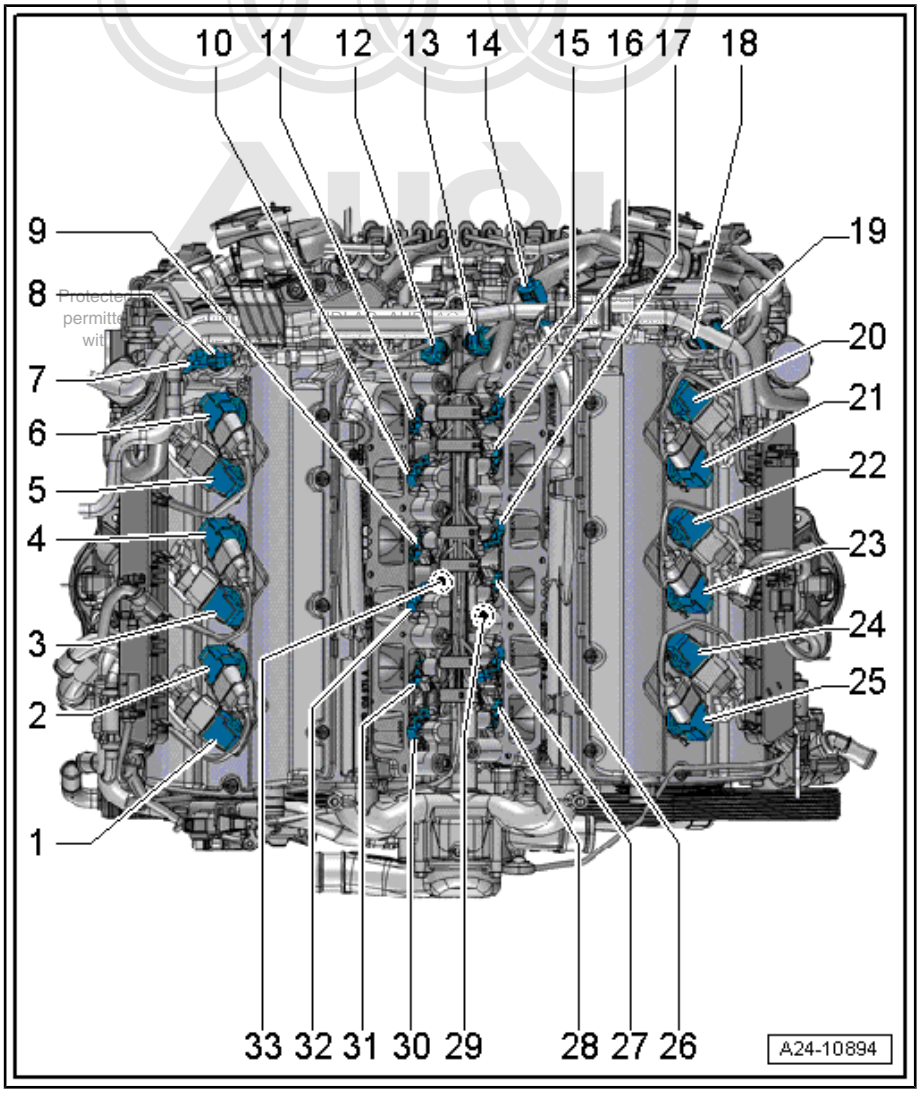
22 - Brake vacuum pump -V192-

23 - Continued coolant circulation pump -V51-

24 - Lambda probe 3 -G285- (before catalytic converter)

- ❑ With Lambda probe heater 3 -Z62-
- ❑ Exploded view ⇒ page 50

Engine (from above)



1 - Ignition coil 1 with output stage -N70-

- ❑ Exploded view ⇒ page 63

2 - Ignition coil 2 with output stage -N127-

- ❑ Exploded view ⇒ page 63

3 - Ignition coil 3 with output stage -N291-

- ❑ Exploded view ⇒ page 63

4 - Ignition coil 4 with output stage -N292-

- ❑ Exploded view ⇒ page 63

5 - Ignition coil 5 with output stage -N323-

- ❑ Exploded view ⇒ page 63

6 - Ignition coil 6 with output stage -N324-

- ❑ Exploded view ⇒ page 63

7 - Exhaust camshaft control valve 1 -N318-

8 - Camshaft control valve 1 -N205-

9 - Injector, cylinder 4 -N33-

- ❑ Exploded view ⇒ page 27

10 - Injector, cylinder 5 -N83-

- ❑ Exploded view ⇒ page 27

11 - Injector, cylinder 6 -N84-

- ❑ Exploded view ⇒ page 27

12 - Fuel pressure sender -G247-

- ❑ Exploded view ⇒ page 27

13 - Fuel pressure sender 2 -G624-

14 - Fuel pressure sender for low pressure -G410-

15 - Injector, cylinder 12 -N302-

- ❑ Exploded view ⇒ page 27

16 - Injector, cylinder 11 -N301-

- ❑ Exploded view ⇒ page 27

17 - Injector, cylinder 10 -N300-

- ❑ Exploded view ⇒ page 27

18 - Camshaft control valve 2 -N208-

19 - Exhaust camshaft control valve 2 -N319-

20 - Ignition coil 12 with output stage -N330-

- ❑ Exploded view ⇒ page 63

21 - Ignition coil 11 with output stage -N329-

- ❑ Exploded view ⇒ page 63

22 - Ignition coil 10 with output stage -N328-

- ❑ Exploded view ⇒ page 63

23 - Ignition coil 9 with output stage -N327-

- ❑ Exploded view ⇒ page 63

24 - Ignition coil 8 with output stage -N326-

- ❑ Exploded view ⇒ page 63

25 - Ignition coil 7 with output stage -N325-

- ❑ Exploded view ⇒ page 63

26 - Injector, cylinder 9 -N299-

- ❑ Exploded view ⇒ page 27

27 - Injector, cylinder 8 -N86-

- ❑ Exploded view ⇒ page 27

28 - Injector, cylinder 7 -N85-

- ❑ Exploded view ⇒ page 27

29 - Knock sensor 2 -G66-

- ❑ Exploded view ⇒ page 63

30 - Injector, cylinder 1 -N30-

- ❑ Exploded view ⇒ page 27

31 - Injector, cylinder 2 -N31-

- ❑ Exploded view ⇒ page 27

32 - Injector, cylinder 3 -N32-

- ❑ Exploded view ⇒ page 27

33 - Knock sensor 3 -G198-

- ❑ Exploded view ⇒ page 63

Engine (shown from front)

1 - Right electrohydraulic engine mounting solenoid valve - N145-

2 - Coolant temperature sender -G62-

3 - Electrical connector

- For knock sensor 3 - G198-
- Orange

4 - Electrical connector

- For knock sensor 2 - G66-
- Grey

5 - Oil pressure switch -F22-

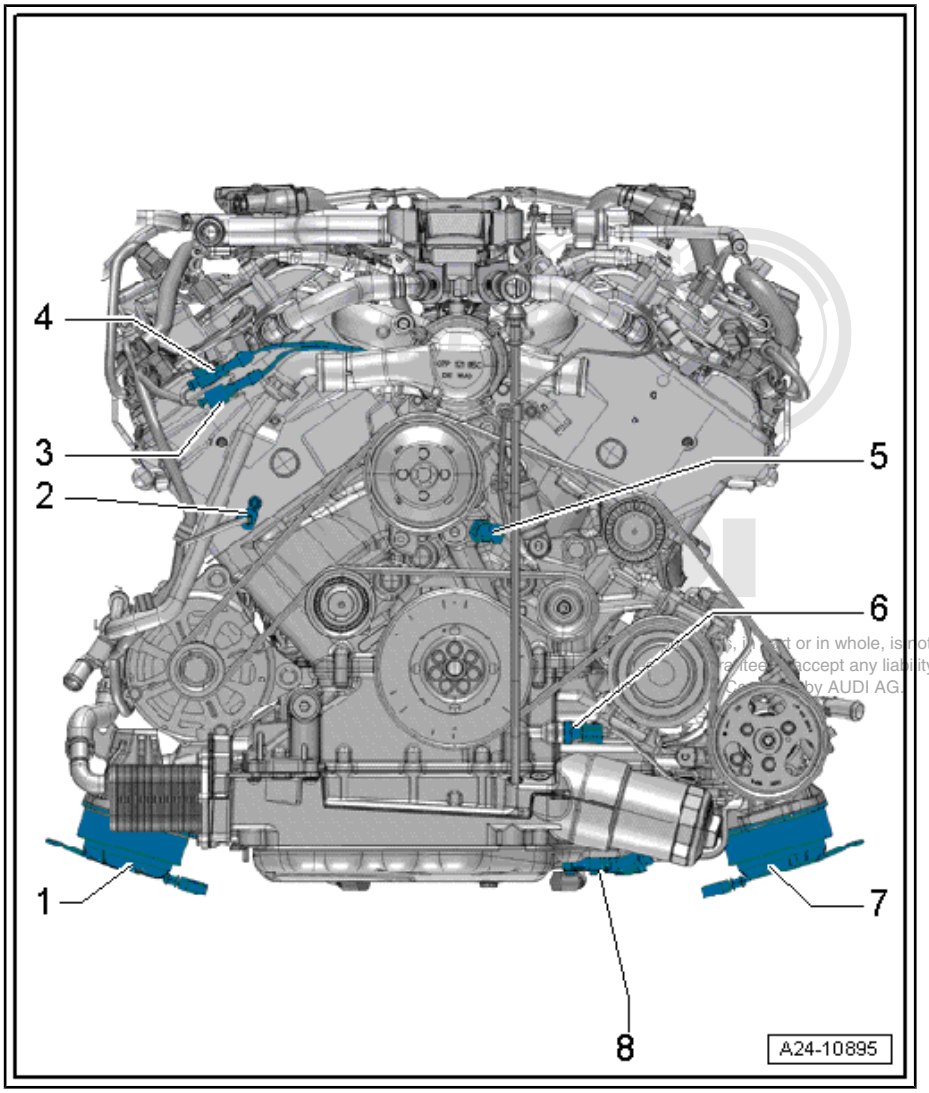
- Removing and installing ⇒ Rep. gr. 17

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

- Removing and installing ⇒ Rep. gr. 17

7 - Left electrohydraulic engine mounting solenoid valve - N144-

8 - Oil level and oil temperature sender -G266-



Engine (shown from rear)

1 - Knock sensor 4 -G199-

- ❑ Exploded view ⇒ page 63

2 - Hall sender 4 -G301-

- ❑ Exploded view ⇒ page 63

3 - Fuel metering valve 2 - N402-

- ❑ Combined with high-pressure pump in one unit
- ❑ Cylinder bank 2
- ❑ ⇒ „6.1 High-pressure pump - exploded view“, page 39

4 - Hall sender 2 -G163-

- ❑ Exploded view ⇒ page 63

5 - Hall sender -G40-

- ❑ Exploded view ⇒ page 63

6 - Fuel metering valve -N290-

- ❑ Combined with high-pressure pump in one unit
- ❑ Cylinder bank 1
- ❑ ⇒ „6.1 High-pressure pump - exploded view“, page 39

7 - Hall sender 3 -G300-

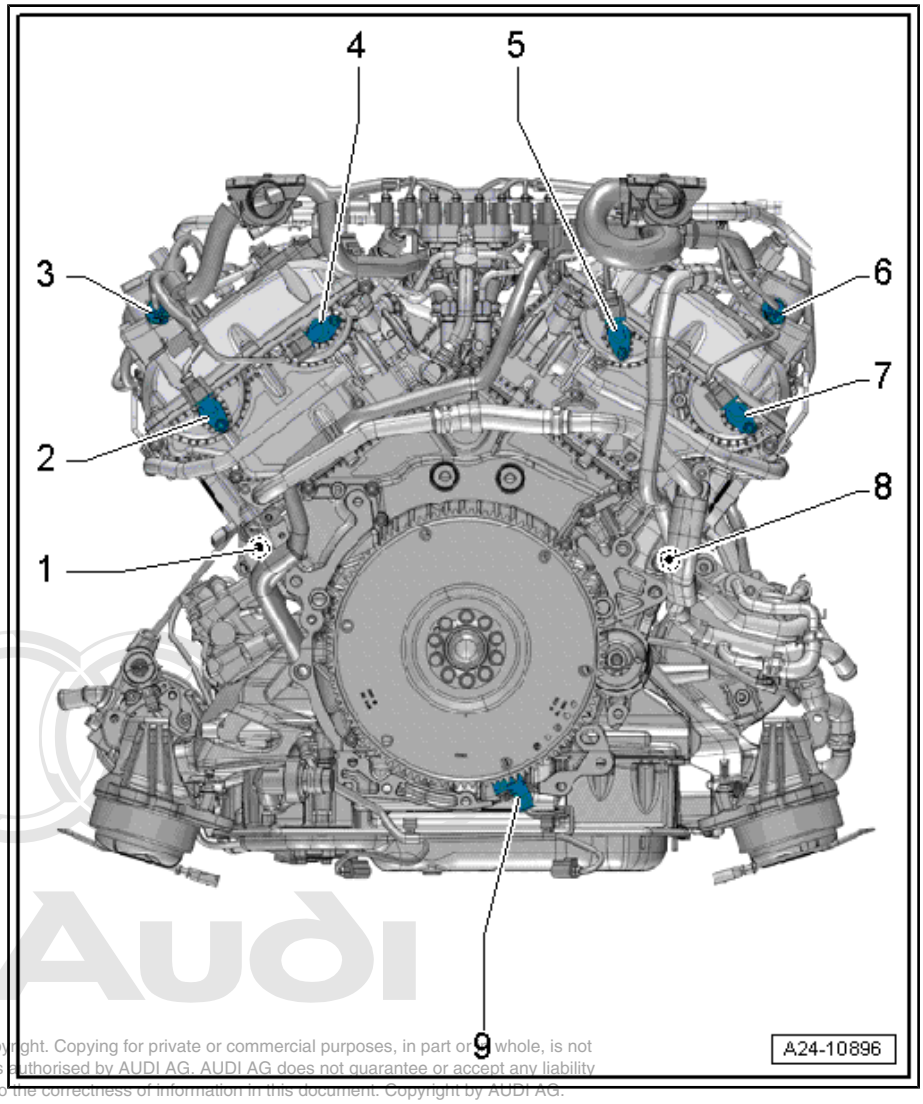
- ❑ Exploded view ⇒ page 63

8 - Knock sensor 1 -G61-

- ❑ Exploded view ⇒ page 63

9 - Engine speed sender -G28-

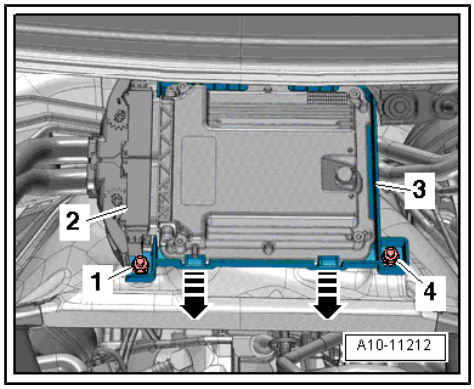
- ❑ Exploded view ⇒ page 63



Fitting location of engine control unit -J623-

♦ In plenum chamber

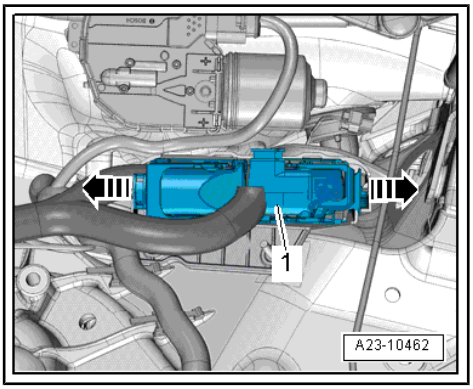
Removing and installing ⇒ page 58



Fitting location of engine control unit 2 -J624-

- In plenum chamber

Removing and installing ⇒ page 58



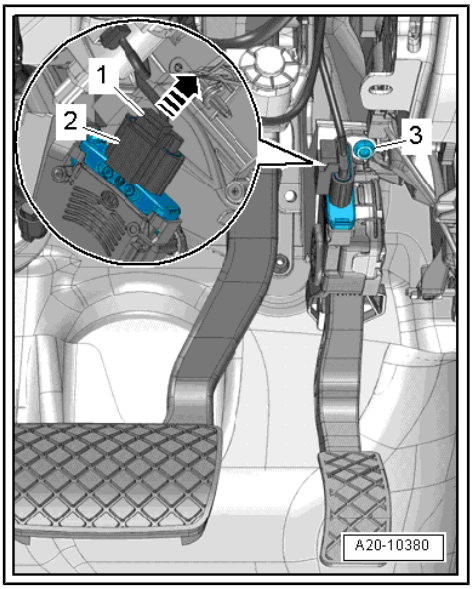
Fitting location of accelerator position sender -G79- / accelerator position sender 2 -G185-

- In accelerator pedal module

Note

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

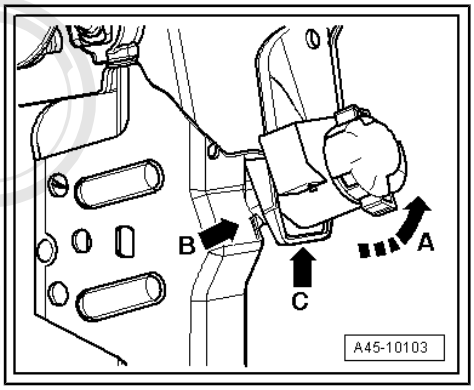
Removing and installing ⇒ Rep. gr. 20



Fitting location of brake light switch -F-

- In footwell on brake pedal

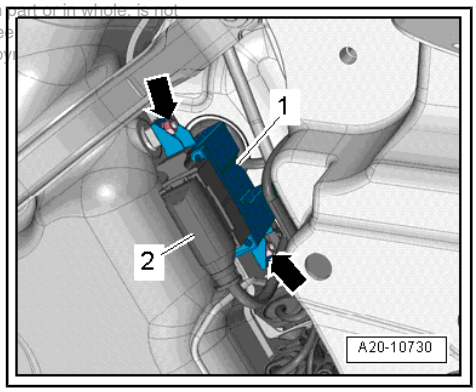
Removing and installing ⇒ Rep. gr. 45



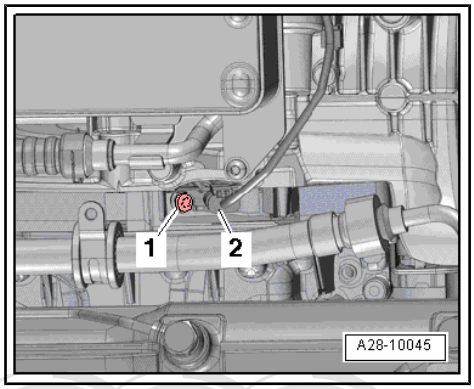
Fitting location of fuel pump control unit -J538- -1-

- At side of fuel tank; accessible after detaching underbody trim (rear right) ⇒ Rep. gr. 66 .

Removing and installing ⇒ Rep. gr. 20



Engine speed sender -G28-



Connectors for Lambda probes

1 - Lambda probe -G39-

2 - Lambda probe 2 -G108-

3 - Lambda probe after catalytic converter -G130-

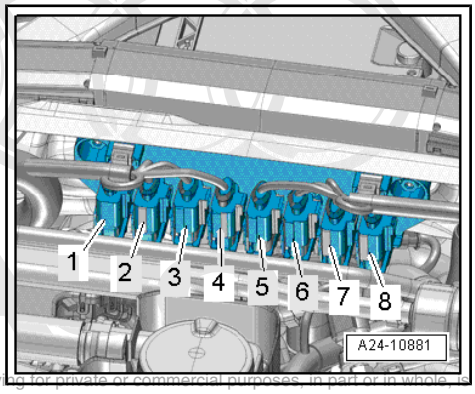
4 - Lambda probe 2 after catalytic converter -G131-

5 - Lambda probe 4 after catalytic converter -G288-

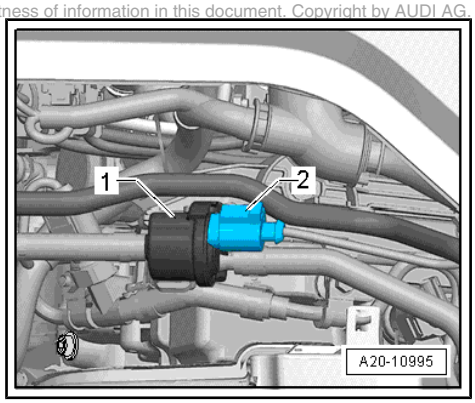
6 - Lambda probe 3 after catalytic converter -G287-

7 - Lambda probe 4 -G286-

8 - Lambda probe 3 -G285-



Activated charcoal filter solenoid valve 1 -N80-



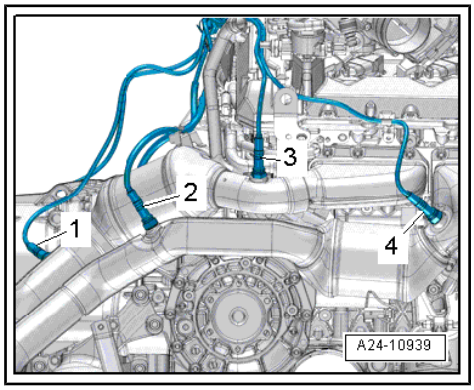
Lambda probes on cylinder bank (right-side)

1 - Lambda probe 2 after catalytic converter -G131-

2 - Lambda probe after catalytic converter -G130-

3 - Lambda probe 2 -G108-

4 - Lambda probe -G39-



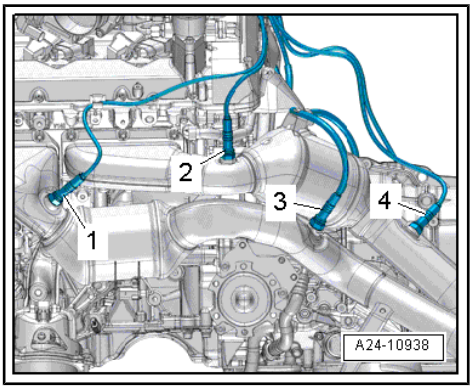
Lambda probes on cylinder bank (left-side)

1 - Lambda probe 3 -G285-

2 - Lambda probe 4 -G286-

3 - Lambda probe 3 after catalytic converter -G287-

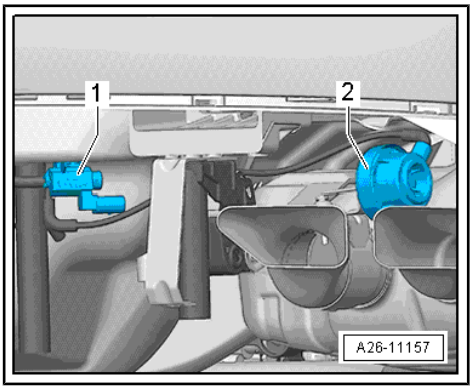
4 - Lambda probe 4 after catalytic converter -G288-



Exhaust flap on exhaust system (rear right)

1 - Exhaust flap 1 valve -N321-

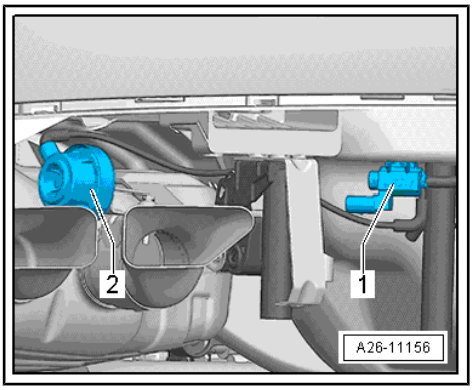
2 - Vacuum unit



Exhaust flap on exhaust system (rear left)

1 - Exhaust flap 2 valve -N322-

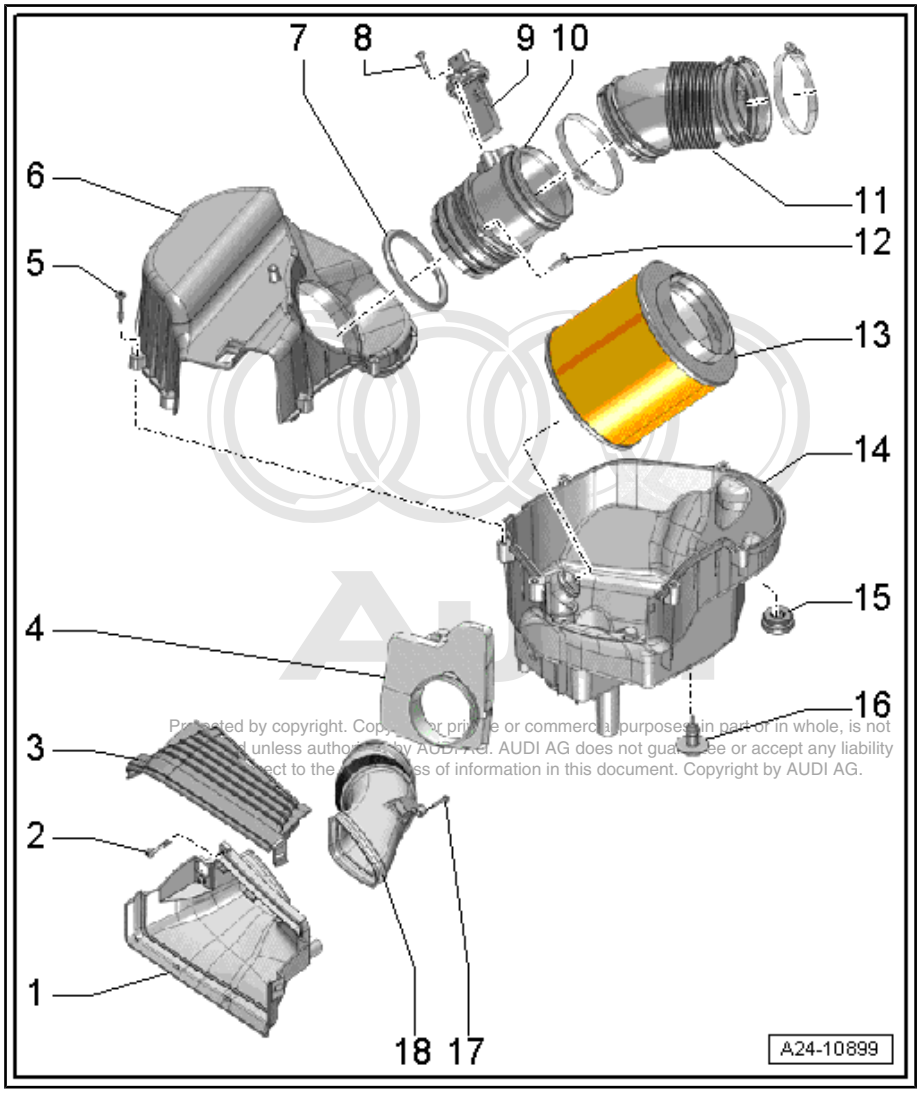
2 - Vacuum unit



4 Air cleaner

Overview

4.1 Air cleaner - exploded view



1 - Air duct

- ❑ Clean out salt deposits, dirt and leaves, etc.

2 - Bolt

- ❑ 1.5 Nm

3 - Cover

- ❑ For air duct

4 - Sealing element

5 - Bolt

- ❑ 2.5 Nm

6 - Air cleaner (top section)

- ❑ Clean out salt deposits, dirt and leaves, etc.
- ❑ Removing and installing ⇒ „4.3 Removing and installing air filter element“, page 18

7 - O-ring

- ❑ Renew if damaged

8 - Bolt

- ❑ 1.5 Nm

9 - Air mass meter/intake air temperature sender

- ❑ Cylinder bank 1 (right-side): air mass meter -G70- / intake air temperature sender -G42-
- ❑ Cylinder bank 2 (left-side): air mass meter 2 -G246- / intake air temperature sender 2 -G299-
- ❑ Removing and installing ⇒ page 21

10 - Housing

11 - Air pipe

12 - Bolt

- ❑ 1.5 Nm

13 - Air filter element

- ❑ Use genuine air filter element ⇒ Electronic parts catalogue
- ❑ Change intervals ⇒ Maintenance tables
- ❑ Removing and installing ⇒ page 18

14 - Air cleaner (bottom section)

- ❑ Clean out salt deposits, dirt and leaves, etc.
- ❑ Removing and installing ⇒ „4.4 Removing and installing air cleaner housing“, page 20

15 - Rubber grommet

16 - Retainer

- ❑ For air cleaner housing

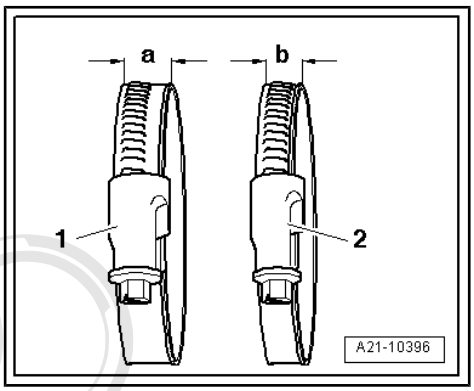
17 - Bolt

- ❑ 2.5 Nm

18 - Air pipe

- ❑ Clean out salt deposits, dirt and leaves, etc.

Installing air hoses with screw-type clips



Note

- ♦ *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- ♦ *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.*

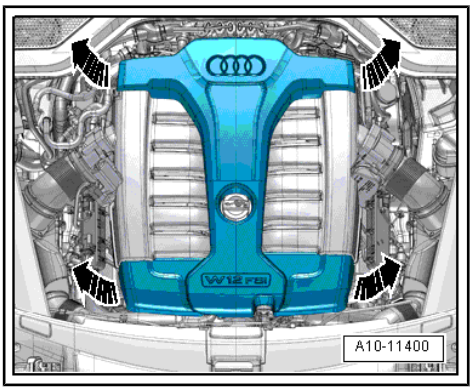
Tightening torque for

1 - Hose clip -a- = 13 mm wide: 5.5 Nm

2 - Hose clip -b- = 9 mm wide: 3.4 Nm

4.2 Removing and installing engine cover panel

Removing



– Carefully pull the engine cover panel off the four fasteners 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.

– First press the engine cover panel with both hands into the ball studs at the rear and then into the ball studs at the front.

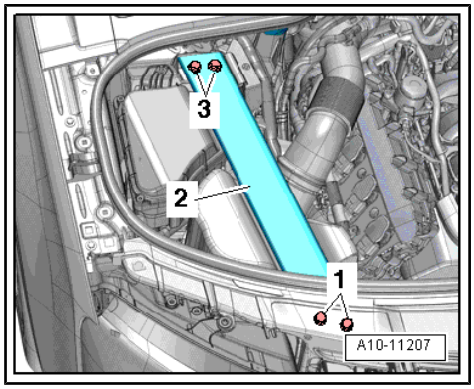
4.3 Removing and installing air filter element

Removing

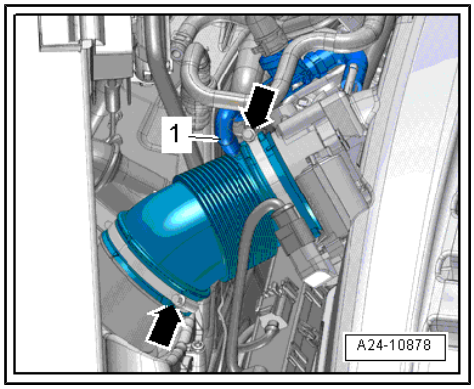
Note

The following description shows the removal and installation of the air cleaner housing (right-side); the procedure for the other side is similar.

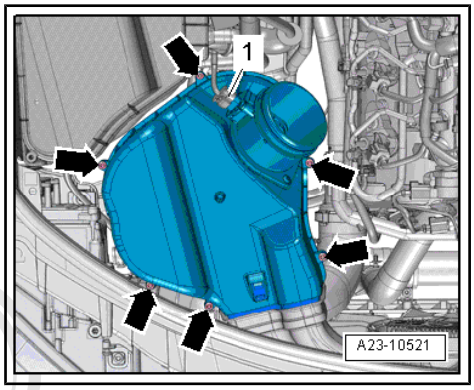
– Remove longitudinal member (top right) -2- ⇒ Rep. gr. 50 .



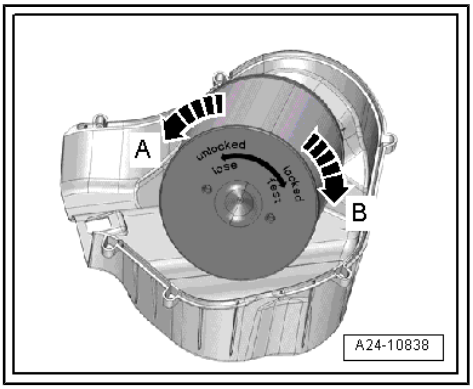
– Detach vacuum hose -1-.
– Release hose clips -arrows- and remove air pipe.



– Unplug electrical connector -1- from air mass meter -G70- .
– Unscrew bolts -arrows- and detach air cleaner (top section).



– Turn air filter element in anti-clockwise direction -arrow A- and detach it.



Installing

- Tightening torques
  ⇒ „4.1 Air cleaner - exploded view“, page 16

To ensure that the air mass meter -G70- functions properly, it is important to observe the following notes and instructions.

Note

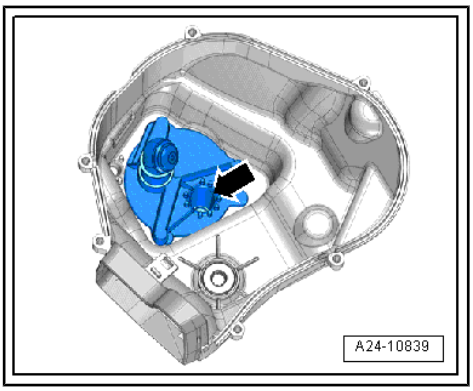
- *If the air filter element is very dirty or wet, dirt or water could reach the air mass meter and affect the air mass value. This would lead to loss of power, since a smaller injection quantity is calculated.*
- *Always use genuine part for air filter element.*
- *The air cleaner housing MUST be clean.*
- *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- *Use a silicone-free lubricant when installing the air hoses.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *To prevent malfunctions, cover critical parts of the engine air intake (air mass meter, air pipes, etc.) with a clean cloth when blowing out the air cleaner housing with compressed air.*
- *Observe environmental requirements for disposal.*

– Clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections) using a vacuum cleaner.

– Blow out water drain -arrow- with compressed air.

– Check for salt residue, dirt and leaves in air mass meter and air pipe (engine intake side).

– Check for dirt and leaves in air duct going from lock carrier to air cleaner housing.

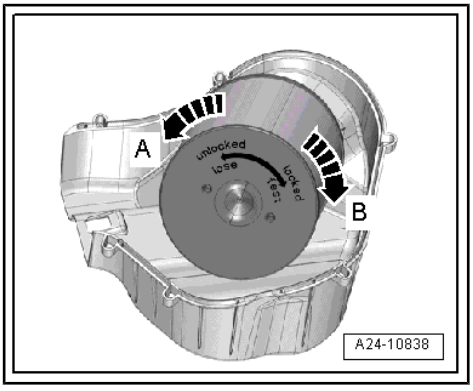


– Turn air filter element in clockwise direction -arrow B- so that it engages.

– Carefully fit top section of air cleaner onto bottom section, without using any force; check that air filter element is properly centred in retainer in air cleaner (bottom section).

– Make sure that air pipe is securely fitted on air cleaner (top section).

– Install air hoses with screw-type clips ⇒ page 17 .



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

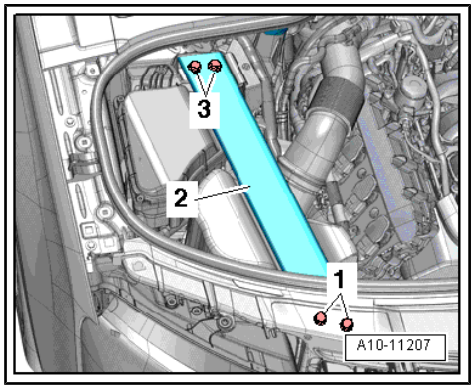
– Install longitudinal member (top right) ⇒ Rep. gr. 50 .

4.4 Removing and installing air cleaner housing

Removing

– Remove engine cover panel ⇒ page 17 .

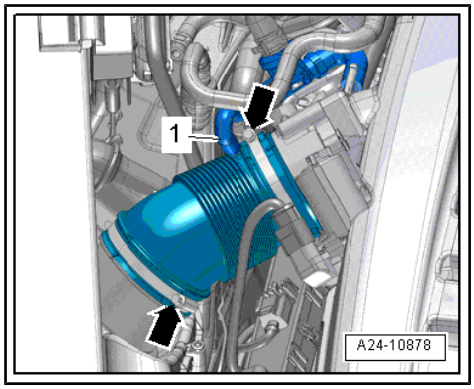
– Remove longitudinal member (top right) -2- ⇒ Rep. gr. 50 .



Air cleaner housing on left side:

– Detach vacuum hose -1-.

– Release hose clips -arrows- and remove air pipe.

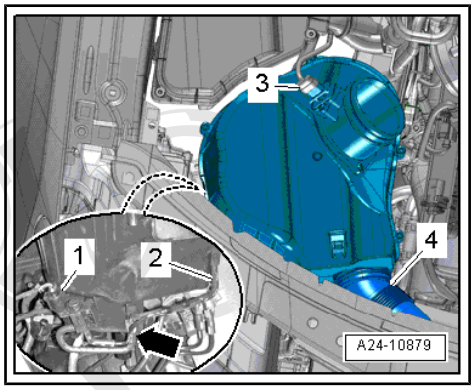


– Unplug electrical connector -3- from air mass meter -G70- .

– Detach air hose -4- and lift off air cleaner housing.

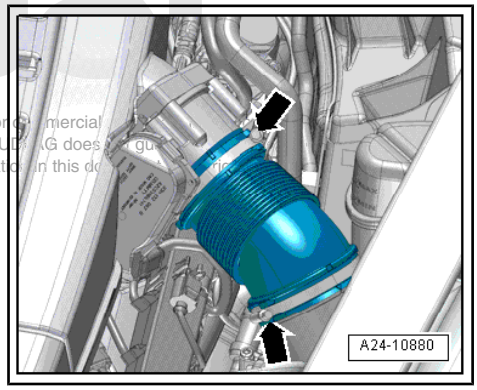
– Disconnect vacuum hose -2- and move clear -arrow-.

– Release fasteners and detach change-over valve -1- from air cleaner housing.



Air cleaner housing on right side:

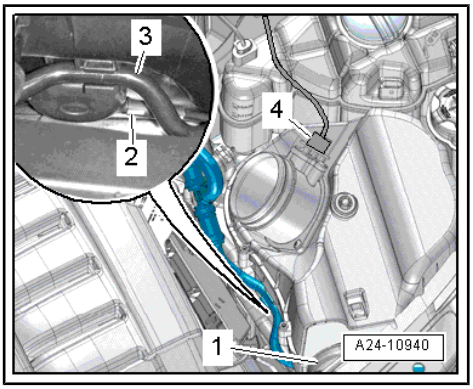
– Release hose clips -arrows- and remove air pipe.



– Disconnect vacuum hose -2- and move clear vacuum line -3-.

– Unplug electrical connector -4- from air mass meter 2 -G246- .

– Detach air hose -1- and lift off air cleaner housing.



Installing

- Tightening torques
⇒ „4.1 Air cleaner - exploded view“, page 16

Note

- *The air cleaner housing MUST be clean.*
- *To prevent malfunctions, cover critical parts of the engine air intake (air mass meter, air pipes, etc.) with a clean cloth when blowing out the air cleaner housing with compressed air.*
- *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- *Use a silicone-free lubricant when installing the air hoses.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

– Check for salt residue, dirt and leaves in air pipe (engine intake side).

– Check for dirt and leaves in air duct going from lock carrier to air cleaner housing.

– Install air hoses with screw-type clips ⇒ page 17 .

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

– Install longitudinal member (top right) ⇒ Rep. gr. 50 .

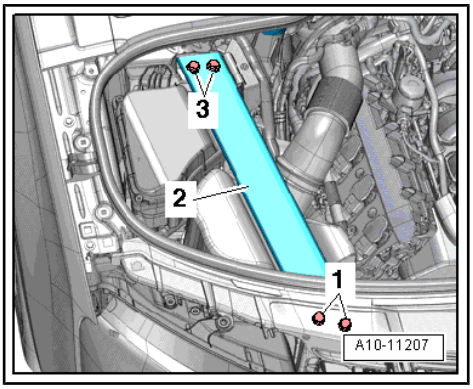
4.5 Removing and installing air mass meter -G70- / -G246-

Note

The following description shows the removal and installation of the air mass meter -G70- on cylinder bank 1 (right-side); the procedure for the other side is similar.

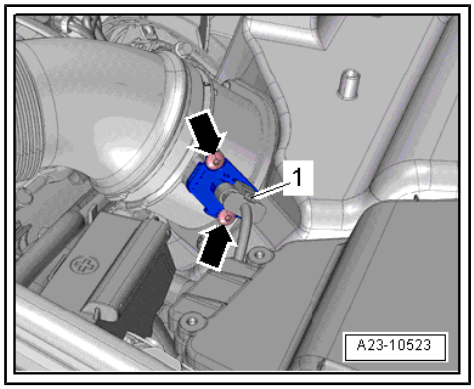
Removing

– Remove longitudinal member (top right) -2- ⇒ Rep. gr. 50 .



– Unplug electrical connector -1-.

– Unscrew bolts -arrows- and detach air mass meter -G70- .



Installing

- Tightening torques
  ⇒ „4.1 Air cleaner - exploded view“, page 16

To ensure that the air mass meter functions properly, 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 and affect the air mass value. This would lead to loss of power, since a smaller injection quantity is calculated.

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

– Install longitudinal member (top right) ⇒ Rep. gr. 50 .

5 Intake manifold, fuel rail and injectors

Overview

5.1 Intake manifold - exploded view

Note

Illustration shows intake manifold (left-side).

1 - Intake manifold
- ❑ Removing and installing ⇒ page 24

2 - Gaskets
- ❑ For intake manifold
- ❑ Renew

3 - Bolt
- ❑ Tighten mountings from centre outwards
- ❑ 9 Nm

4 - Housing
- ❑ For oil filler neck and pressure control valve of crankcase breather system

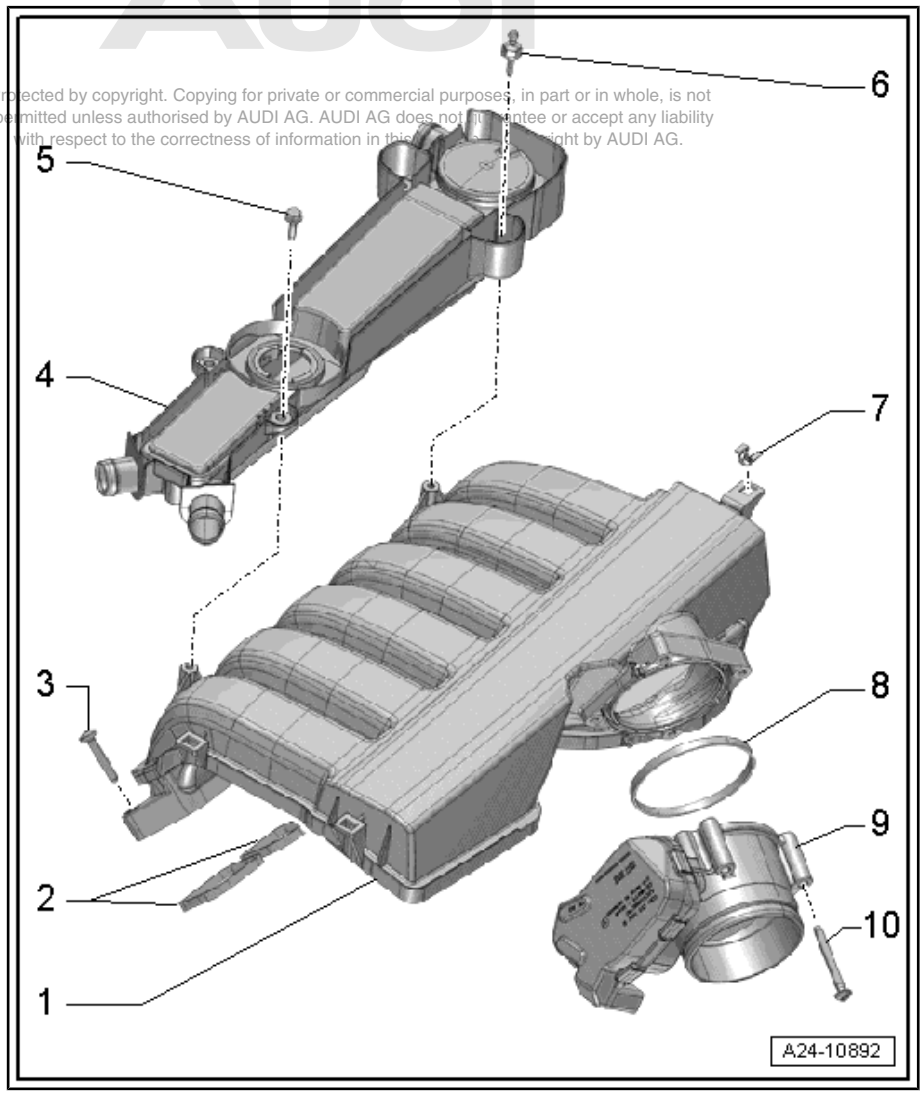
5 - Bolt
- ❑ Tightening torque ⇒ Rep. gr. 17

6 - Ball stud
- ❑ For engine cover
- ❑ Tightening torque ⇒ Rep. gr. 17

7 - Clip

8 - Seal
- ❑ Renew

9 - Throttle valve module
- ❑ Right-side: throttle valve module -J338-
- ❑ Left-side: throttle valve module 2 -J544-



- ❑ Removing and installing ⇒ page 25
- ❑ „Adaption“ must be performed after this component has been renewed; use a ⇒ Vehicle diagnostic tester

10 - Bolt

- ❑ Renew
- ❑ 7 Nm

5.2 Removing and installing intake manifolds

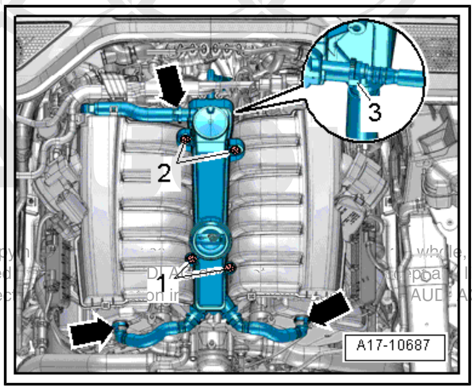
Removing

– Remove engine cover panel ⇒ page 17 .

– Remove bolts -1- and ball studs -2-.

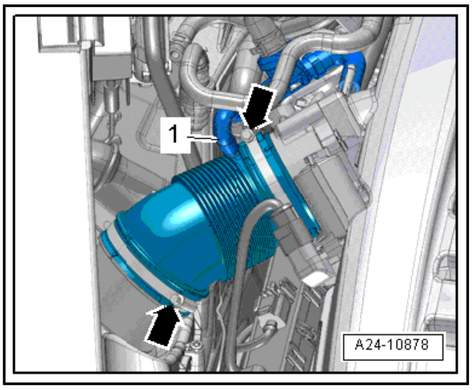
– Press release tabs and disconnect crankcase breather hoses -arrows-.

– Press release tabs and detach housing for oil filler neck to disconnect hose -3-.

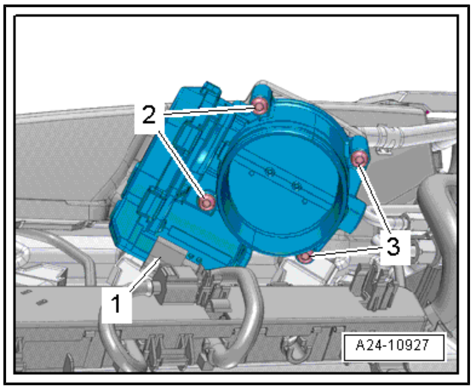


– Release hose clip and detach vacuum hose -1-.

– Release hose clips -arrows- and remove air pipes (left and right).



– Unplug electrical connectors (left and right) -1- for throttle valve modules -J338- / -J544- .



Note

Disregard -items 2, 3-.

– Release hose clip -2- and detach vacuum hoses (left and right).

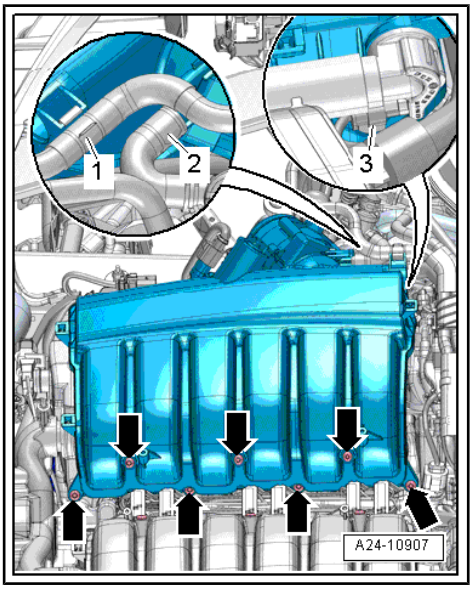
Intake manifold (right-side):

– Move clear fuel hose -1- and unplug electrical connector -3- for heater element for crankcase breather -N79- .

Continuation for both sides:

– Slacken bolts -arrows-, working from outside inwards and remove.

– Detach intake manifold.



Caution

Risk of irreparable damage to engine.

- *Block off the intake ports 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 torques
⇒ „5.1 Intake manifold - exploded view“, page 23

Note

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

– Make sure seals and/or gaskets in intake manifold are positioned correctly.

– Install air hoses with screw-type clips ⇒ page 17 .

– Make sure that hoses and electrical wires are not trapped.

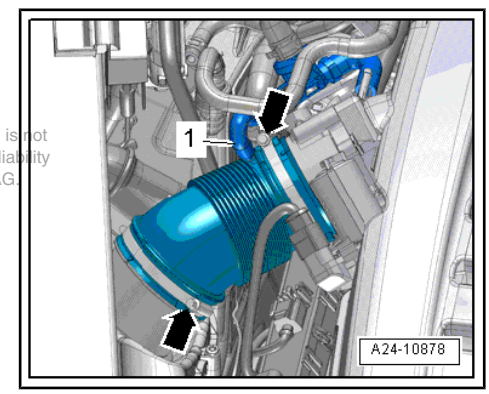
5.3 Removing and installing throttle valve module -J338- / -J544-

Removing

– Remove engine cover panel ⇒ page 17 .

Throttle valve module -J338- :

– Release hose clip and detach vacuum hose -1-.

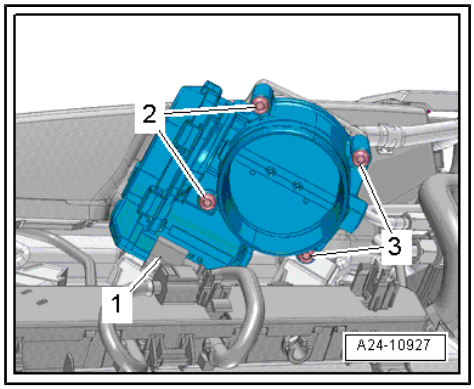


Continuation for both sides:

– Release hose clips -arrows- and remove relevant air pipe.

– Unplug electrical connector -1-.

– Remove bolts -2 and 3- and detach throttle valve module - J338- / -J544- .



Installing

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

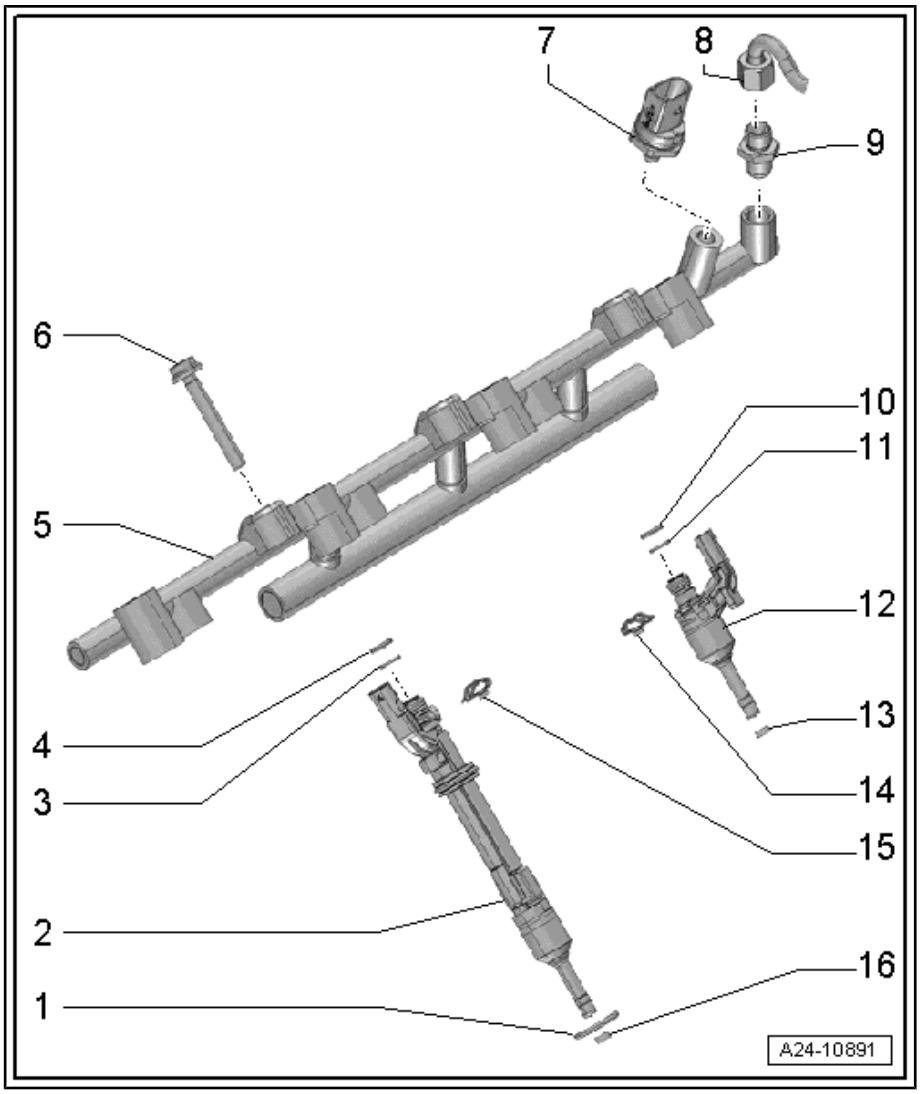
- Tightening torques
⇒ „5.1 Intake manifold - exploded view“, page 23

Note

- *Renew seals and/or gaskets.*
- *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *To secure the air hoses at their connections, spray rust remover onto the worm thread of the used hose clips before installing.*

„Adaption“ must be performed after this component has been renewed; use a ⇒ Vehicle diagnostic tester.

5.4 Fuel rail and injectors - exploded view



1 - O-ring
- ❑ Renew
- ❑ Lubricate lightly with clean engine oil

2 - Injector
- ❑ Long version
- ❑ Removing and installing ⇒ page 29

3 - Support ring
- ❑ Renew
- ❑ Make sure it is correctly seated

4 - O-ring
- ❑ Renew
- ❑ Lubricate lightly with clean engine oil

5 - Fuel rail
- ❑ Removing and installing ⇒ „5.5 Removing and installing injectors“, page 29
- ❑ Spring elements for injectors must be renewed before installation

6 - Bolt
- ❑ Renew
- ❑ 30 Nm + 90°
- ❑ Tighten mountings from centre outwards

7 - Fuel pressure sender
- ❑ Right-side fuel pressure sender -G247-
- ❑ Left-side fuel pressure sender 2 -G624-
- ❑ Removing and installing ⇒ page 35
- ❑ Lubricate sealing surface and threads lightly with clean engine oil
- ❑ 27 Nm

8 - High-pressure pipe

> **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.*
>
> *The procedure is described in the ⇒ Vehicle diagnostic tester under Guided Functions, „Relieve fuel high pressure“.*

- ❑ Before loosening, disconnect earth cable at battery with ignition switched off ⇒ Electrical system; Rep. gr. 27 .
- ❑ Reducing fuel pressure in high-pressure section of injection system ⇒ page 4
- ❑ Removing and installing ⇒ page 45
- ❑ Do not alter shape
- ❑ Check for damage before re-installing
- ❑ To loosen and tighten high-pressure pipe, counterhold at pipe connection -item 9-
- ❑ Lubricate threads of union nuts with fuel
- ❑ 27 Nm

9 - Connection

- ❑ 40 Nm

10 - O-ring

- ❑ Renew
- ❑ Lubricate lightly with clean engine oil

11 - Support ring

- ❑ Renew
- ❑ Make sure it is correctly seated

12 - Injector

- ❑ Short version
- ❑ Removing and installing ⇒ page 29

13 - Combustion chamber ring seal

- ❑ Renewing after injector has been removed ⇒ „5.5 Removing and installing injectors“, page 29
- ❑ Do not apply grease or use any other lubricants

14 - Spring element

- ❑ Make sure it is correctly seated
- ❑ Always renew if fuel rail is removed

15 - Spring element

- ❑ Make sure it is correctly seated
- ❑ Always renew if fuel rail is removed

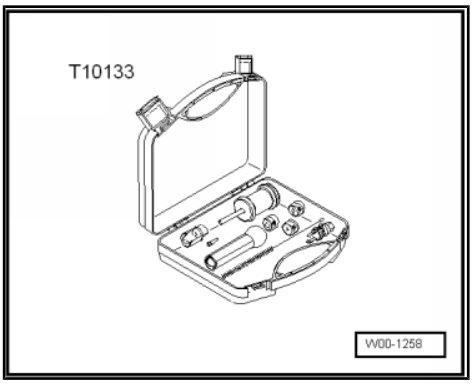
16 - Combustion chamber ring seal

- ❑ Renewing after injector has been removed ⇒ „5.5 Removing and installing injectors“, page 29
- ❑ Do not apply grease or use any other lubricants

5.5 Removing and installing injectors

Special tools and workshop equipment required

- Tool set for FSI engines -T10133-



Removing

WARNING

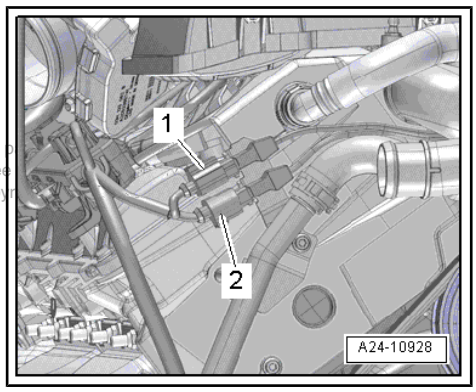
The fuel system operates at extremely high pressure. This can cause injury.

- *The fuel pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening the system.*
- *The procedure is described in the ⇒ Vehicle diagnostic tester under Guided Functions, „Relieve fuel high pressure“.*

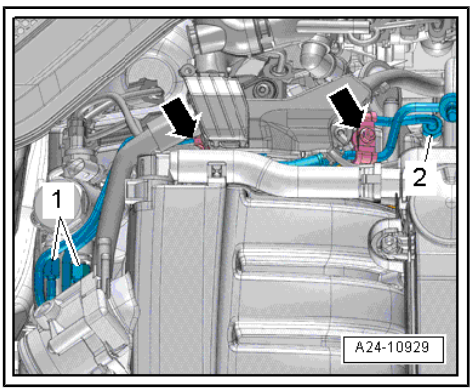
– Reduce fuel pressure in high-pressure section of injection system ⇒ page 4 .

– Remove intake manifolds ⇒ page 24 .

– Detach electrical connectors -1 and 2- from bracket.



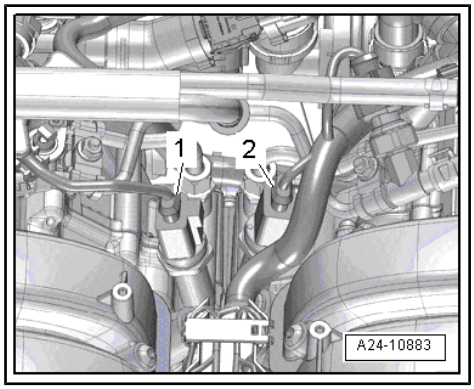
– Remove nuts -arrows- on both sides and union nut -2-.



Note

Disregard -item 1-.

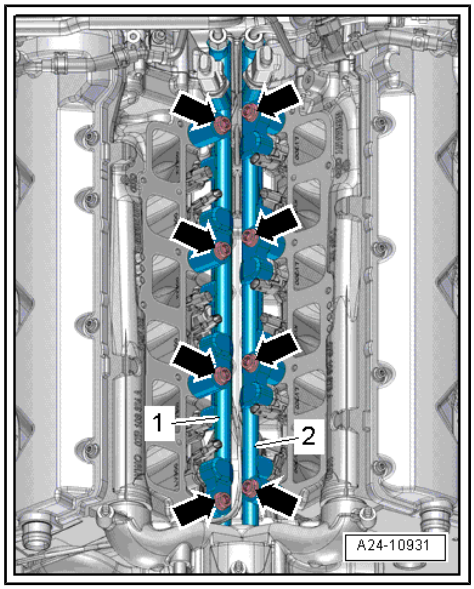
– Unplug electrical connector -1- for fuel pressure sender - G247- or connector -2- for fuel pressure sender 2 -G624- .
– Unplug electrical connectors at injectors that are to be removed.



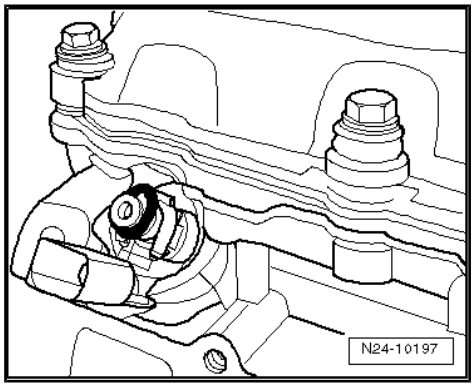
– Unscrew bolts -arrows- for fuel rail that is to be removed.
– Pull out fuel rail -1 or 2-, as required.

Note

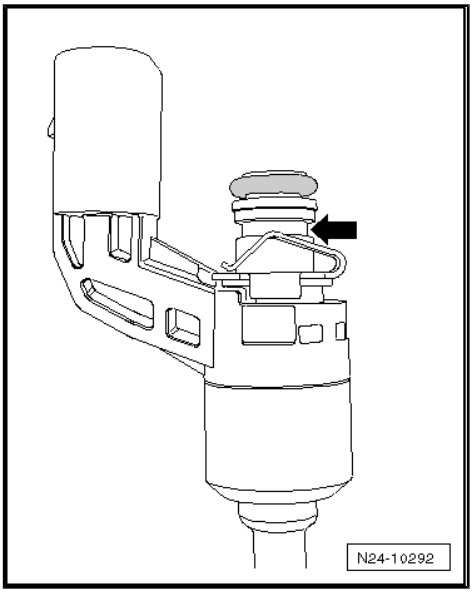
When detaching fuel rails, make sure injectors remain in cylinder head.



– Press O-ring by hand upwards (as illustrated) and remove from injector.
– Screw striker -T10133/3- onto puller -T10133/15- .

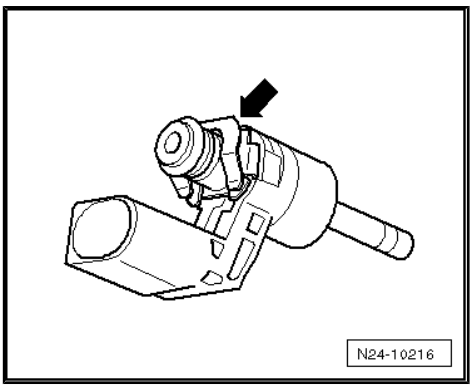


– Then guide puller -T10133/15- into groove -arrow- on injector.

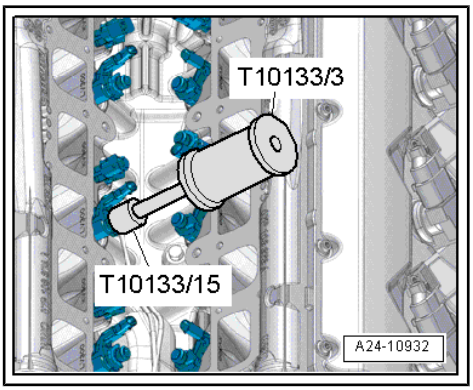


Note

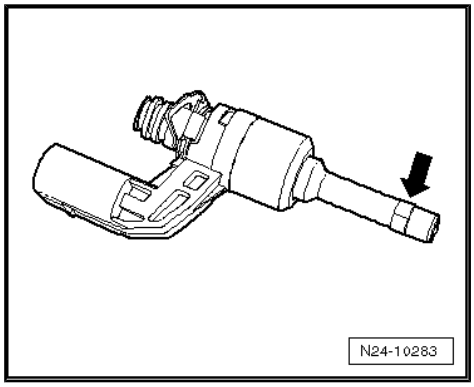
The spring element -arrow- must not be removed before the injectors are pulled out.



– Pull out injector by knocking carefully.



– Carefully remove old combustion chamber ring seal -arrow-. To do so, cut open combustion chamber ring seal using knife or prise open with small screwdriver and then pull off forwards.



Note

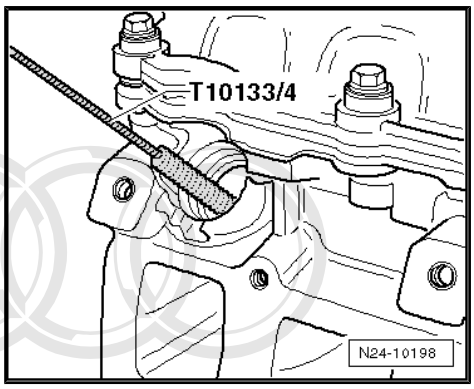
Take care not to damage groove on injector. The injector must be renewed if the groove is damaged.

Installing

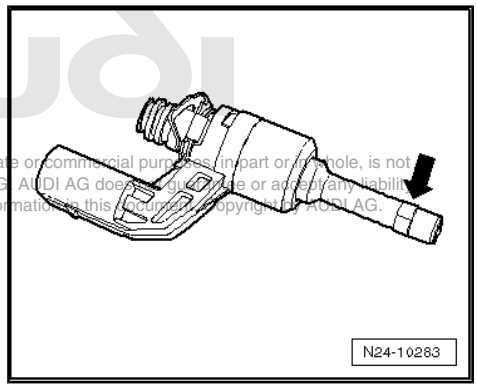
Note

- *Renew combustion chamber ring seal, support ring, spring element and O-ring.*
- *Lubricate O-rings of injectors lightly with clean engine oil.*
- *The injectors must be re-installed on the same cylinders.*

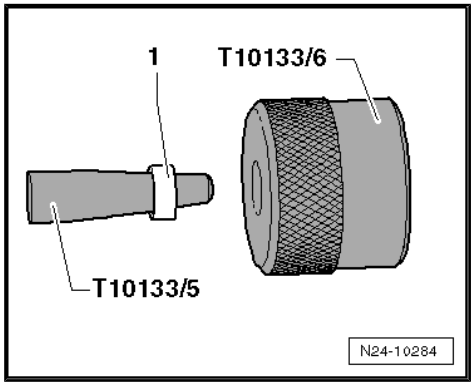
– Clean bore in cylinder head with nylon brush -T10133/4- .



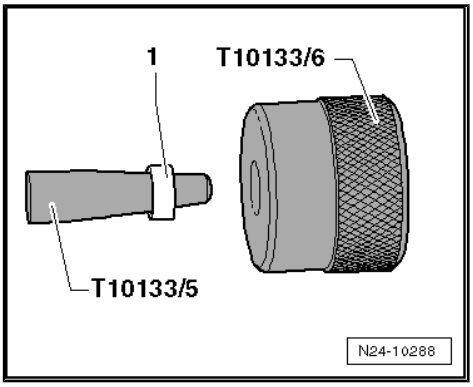
– Remove old seal and clean ring groove where seal was located -arrow-. Remove any carbon deposits with a brass wire brush.



– Fit new seal -1- onto assembly cone -T10133/5- . Push seal lightly onto assembly cone -T10133/5- as far as possible using assembly sleeve -T10133/6- (knurled side faces towards seal -1-).



– Turn round assembly sleeve -T10133/6- (knurled side no longer faces towards seal) and push seal -1- up to end of assembly cone -T10133/5- .



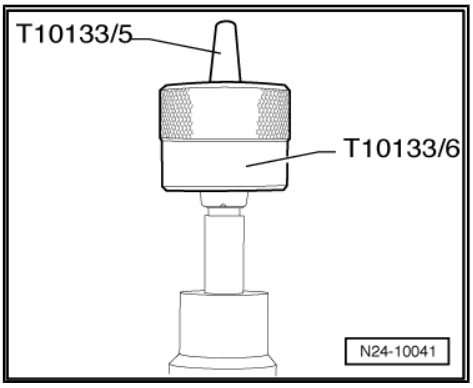
– Now fit assembly cone -T10133/5- with seal from the front onto injector. Push seal further onto injector using assembly sleeve -T10133/6- .

The seal is not yet in its groove.

– Remove assembly sleeve -T10133/6- and assembly cone -T10133/5- .

– Slide seal by hand into ring groove.

– Fit spacer sleeve -T10133/11- onto body of injector.



Note

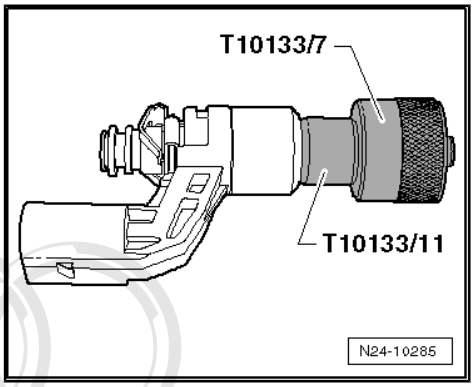
The combustion chamber ring seal is widened when it is pushed onto the injector. After pushing it on, it therefore has to be compressed again. This is done in two stages, as described below.

– Now push calibration sleeve -T10133/7- over seal until it makes contact with spacer sleeve -T10133/11- .

– Pull calibration sleeve -T10133/7- off again.

– Now push calibration sleeve -T10133/8- over seal until it makes contact with spacer sleeve -T10133/11- .

– Pull calibration sleeve -T10133/8- off again.

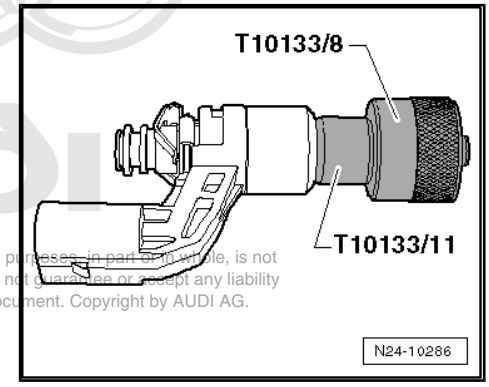


The teflon ring seal is now installed in the correct position.

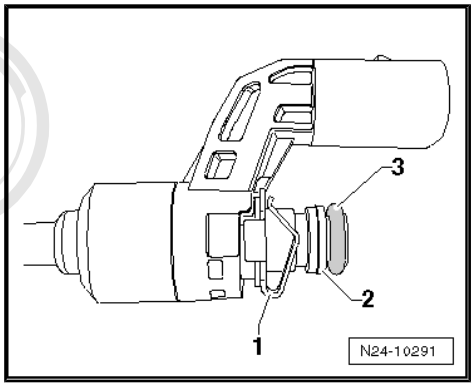
Renewing support ring:

– Remove O-ring -3-.

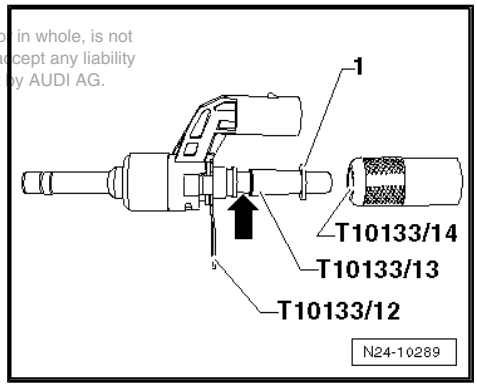
– Cut open support ring -2- with small side-cutting pliers and remove support ring.



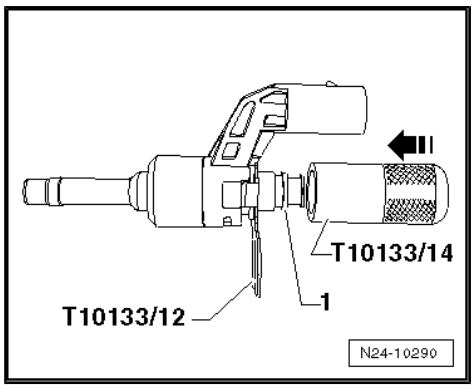
– Detach spring element -1- from injector and fit locking plate -T10133/12- in place of spring element.
– Fit a new support ring -1- onto assembly cone -T10133/13- and fit onto injector (as illustrated).



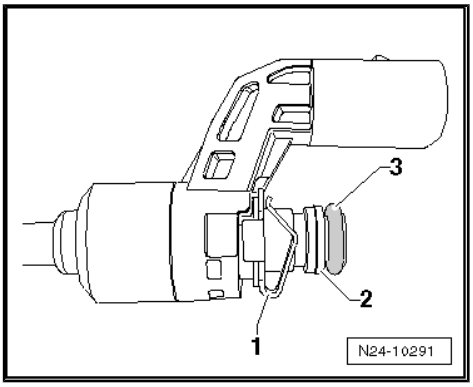
– Using calibration sleeve -T10133/14- (knurled side faces towards injector), push support ring -1- into first groove -arrow- on injector.
– Then turn round calibration sleeve -T10133/14- (knurled side now faces away from injector). Push calibration sleeve over support ring -1- in direction of -arrow- until it makes contact with locking plate -T10133/12- .
– Pull calibration sleeve -T10133/14- off again.



Support ring now has its correct installation depth.



– Then fit a new spring element -1- in place of locking plate - T10133/12- and fit a new O-ring -3- against support ring -2-.



Note

Do not apply grease to combustion chamber ring seal or use any other lubricants.

– To make it easier to install injector in fuel rail, lubricate new O-ring lightly with clean engine oil before installing it.

– 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.

Note

It should be possible to insert injector easily. If necessary wait until the combustion chamber ring seal has contracted sufficiently.

• Electrical connector of injector must engage in recess in cylinder head.

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

• Tightening torques
⇒ „5.4 Fuel rail and injectors - exploded view“, page 27

– Install intake manifolds ⇒ page 24 .

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

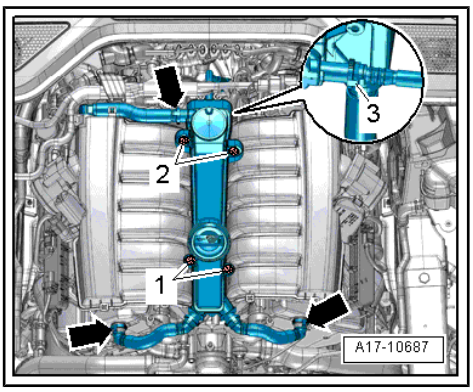
Removing

– Remove engine cover panel ⇒ page 17 .

– Remove bolts -1- and ball studs -2-.

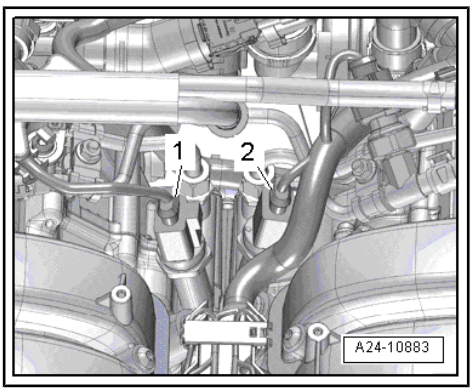
– Press release tabs and disconnect crankcase breather hoses -arrows-.

– Press release tabs and detach housing for oil filler neck to disconnect hose -3-.



– Unplug electrical connector -1- for fuel pressure sender -G247- and connector -2- for fuel pressure sender 2 -G624- .

– Unscrew relevant fuel pressure sender.



Installing

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

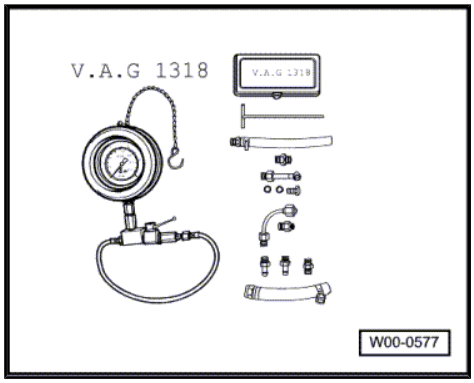
• Tightening torque
⇒ „5.4 Fuel rail and injectors - exploded view“, page 27

– Install oil filler neck ⇒ Rep. gr. 17 .

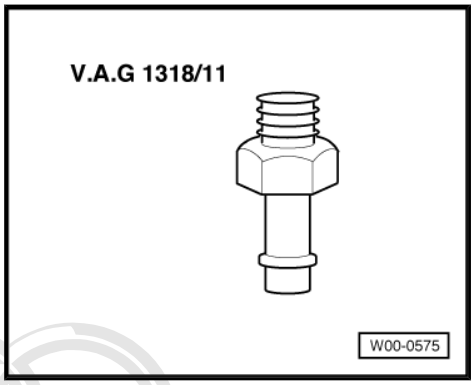
5.7 Checking fuel pressure and residual pressure (up to high-pressure pump)

Special tools and workshop equipment required

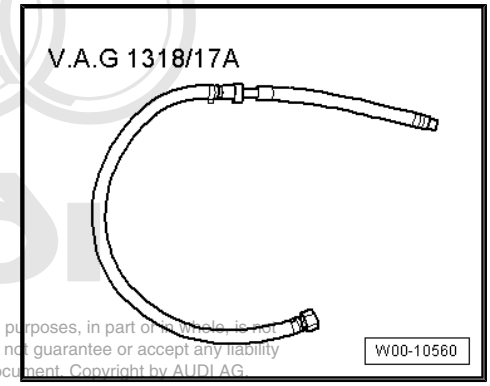
- K-Jetronic pressure tester -V.A.G 1318-



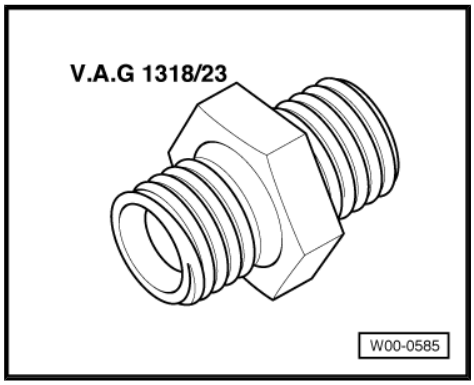
- Adapter -V.A.G 1318/11-



- Adapter set -V.A.G 1318/17A-



- Connector -V.A.G 1318/23-



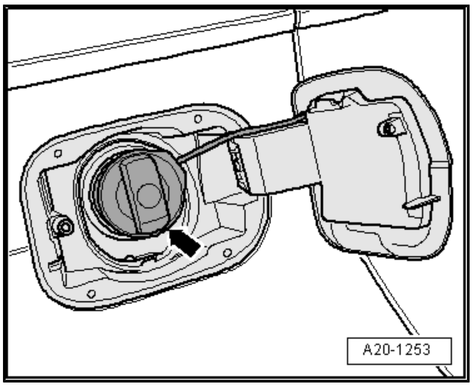
- ⇒ Vehicle diagnostic tester
- Fuel-resistant measuring container

♦ Protective gloves

Checking fuel pressure

- Battery voltage at least 12.5 V.
- Fuel filter OK.
- Fuel tank at least $^{1}/_{4}$ full.
- Fuel pump control unit -J538- OK.
- Ignition off.

– Remove filler cap -arrow- for fuel filler neck.



WARNING

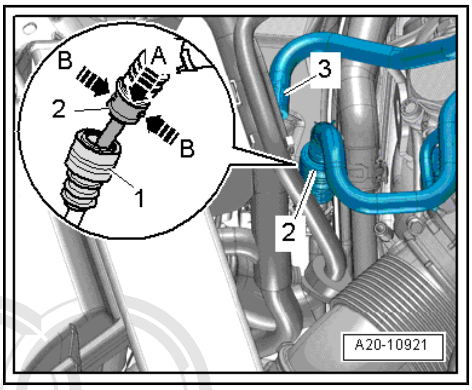
The fuel system operates at extremely high pressure. This can cause injury.

- ♦ *The fuel pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening the system.*
- ♦ *The procedure is described in the ⇒ Vehicle diagnostic tester under Guided Functions, „Relieve fuel high pressure“.*

– Push back protective sleeve -1- and disconnect fuel line.

– First press hose connector -2- downwards -arrow A-, then press release tabs -arrow B-.

– Pull off hose connector, keeping release tabs depressed.



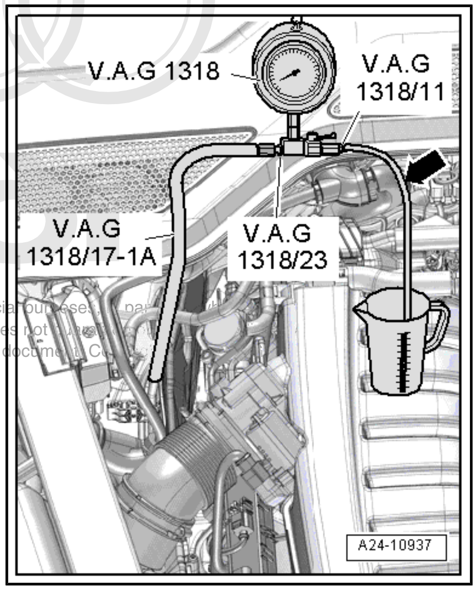
Note

Disregard -item 3-.

– 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.

– Attach test hose -arrow- and hold end of hose in measuring container.



Note

Fuel system must be bled before pressure can be checked.

– Connect ⇒ Vehicle diagnostic tester.

– Select „Engine electronics“ in vehicle self-diagnosis.

– Then select „Final control diagnosis“.

– Select „Fuel pump electronics“ from list and press „start“.

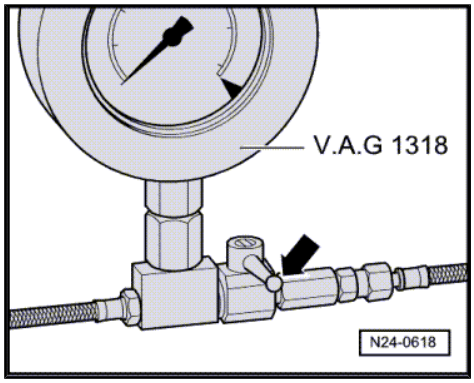
– When fuel starts coming out of test hose, close cut-off valve on pressure tester.

• Lever is at right angle to direction of flow -arrow-.

– Read off fuel pressure on K-Jetronic pressure tester -V.A.G 1318- .

• Specification: 5 to 8 bar

– End this function when fuel pressure stops rising on K-Jetronic pressure tester -V.A.G 1318- .



If specification is not obtained:

– Check delivery rate of fuel pump ⇒ Rep. gr. 20 .

Checking residual pressure

– Check system for leaks and check residual pressure by watching drop in pressure on K-Jetronic pressure tester -V.A.G 1318- .

• After 10 minutes pressure should still be at least 3 bar.

If the residual pressure drops below 3.0 bar:

♦ Check union between pressure gauge and fuel line for leaks.

♦ Test pressure gauge for leaks.

♦ Check fuel lines and their connections for leaks.

♦ Check delivery rate of fuel pump ⇒ Rep. gr. 20 .

♦ Renew fuel filter with integrated fuel pressure regulator ⇒ Rep. gr. 20 .

♦ Non-return valve of fuel pump is defective ⇒ Rep. gr. 20 .

Assembling

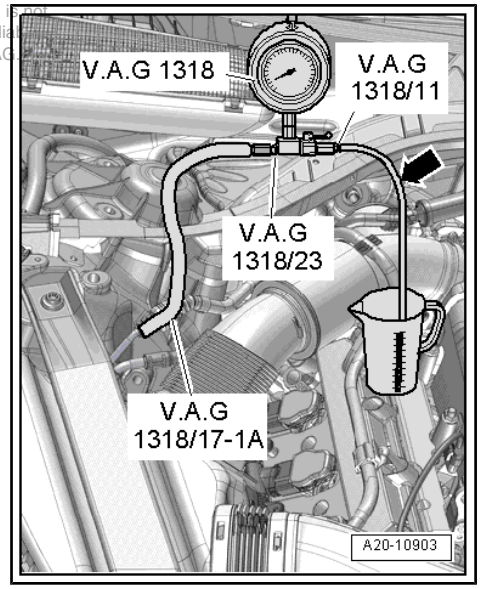
Installation is carried out in the reverse order; note the following:

Note

Before removing pressure gauge, release fuel pressure by opening cut-off valve. Hold a container under the connection.

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

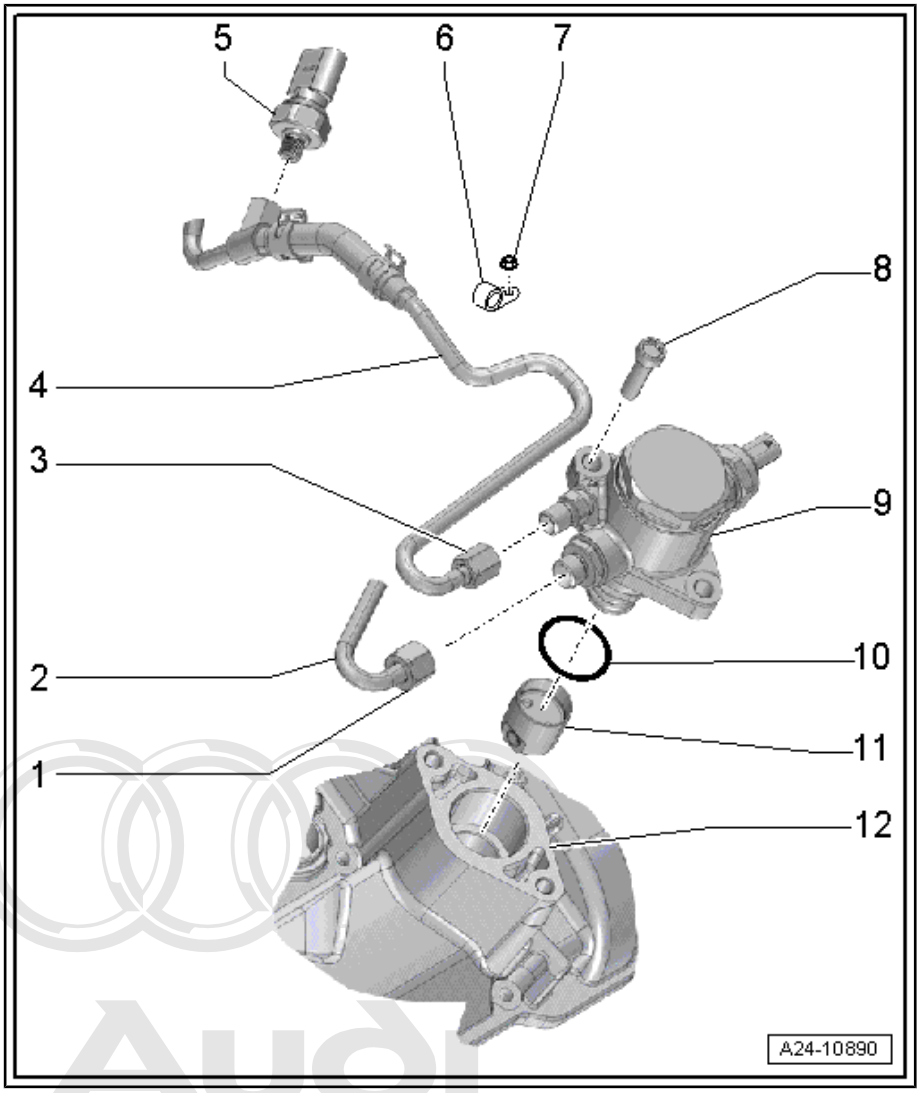
– Check fuel system for leaks ⇒ page 5 .



6 High-pressure pump

Overview

6.1 High-pressure pump - exploded view



1 - Union nut

- ❑ Connections must not be damaged
- ❑ 27 Nm

2 - High-pressure pipe

> **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.*
>
> *The procedure is described in the ⇒ Vehicle diagnostic tester under Guided Functions, „Relieve fuel high pressure“.*

- ❑ Before loosening, disconnect earth cable at battery with ignition switched off ⇒ Electrical system; Rep. gr. 27 .
- ❑ Reducing fuel pressure in high-pressure section of injection system ⇒ page 4
- ❑ Removing and installing ⇒ page 45
- ❑ Do not alter shape
- ❑ Counterhold at connection on high-pressure pump when loosening union nut
- ❑ Tighten connection on high-pressure pump to 40 Nm
- ❑ Do not alter shape

3 - Union nut

- ❑ Connections must not be damaged

- ❑ Lubricate thread lightly with fuel
- ❑ 22 Nm

4 - Fuel supply line

5 - Fuel pressure sender for low pressure -G410-

- ❑ Removing and installing ⇒ page 49
- ❑ 15 Nm

6 - Retaining clamp

7 - Nut

- ❑ 9 Nm

8 - Bolt

- ❑ 20 Nm

9 - High-pressure pump

- ❑ Right side (cylinder bank 1) with fuel metering valve -N290-
- ❑ Left side (cylinder bank 2) with fuel metering valve 2 -N402-
- ❑ Removing and installing high-pressure pump (right-side) ⇒ page 40
- ❑ Removing and installing high-pressure pump (left-side) ⇒ page 42

10 - O-ring

- ❑ Renew
- ❑ Lubricate lightly with clean engine oil before installing

11 - Roller tappet

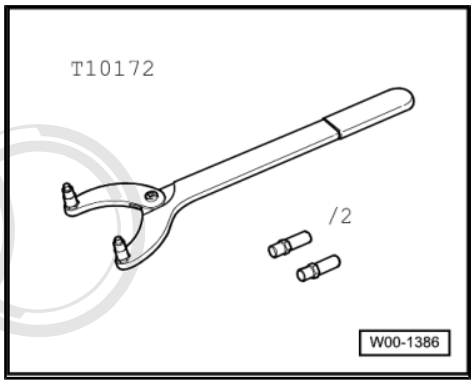
- ❑ Can only be installed in one position
- ❑ Lubricate lightly with clean engine oil before installing

12 - Cylinder head cover

6.2 Removing and installing high-pressure pump (right-side) on cylinder bank 1

Special tools and workshop equipment required

- ♦ Counterhold tool -T10172- with pins -T10172/1-



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.*
- *The procedure is described in the ⇒ Vehicle diagnostic tester under Guided Functions, „Relieve fuel high pressure“.*

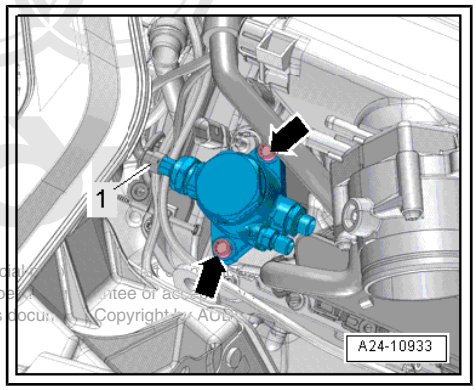
– Reduce fuel pressure in high-pressure section of injection system ⇒ page 4 .

– Remove high-pressure pipe (right-side) ⇒ page 45 .

– Unplug electrical connector -1-.

– Remove bolts -arrows-.

– Carefully pull out high-pressure pump. It is possible that the roller tappet may remain lodged inside.



Note

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

Installing

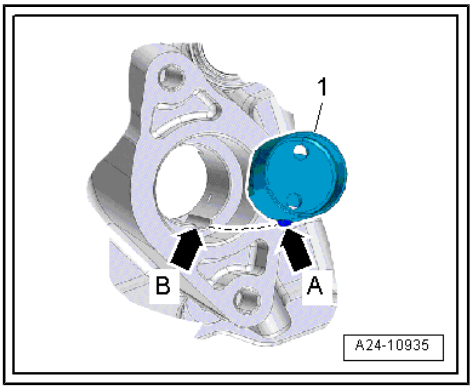
Installation is carried out in the reverse order; note the following:

Note

- *Fit new O-ring.*
- *The connections of the high-pressure pipe must not be damaged.*
- *Do not attempt to bend high-pressure pipe to a different shape.*

– Check roller tappet -1- for damage and renew if necessary.

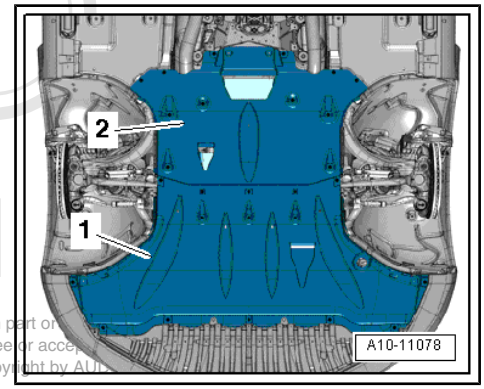
– Lightly lubricate roller tappet with oil and insert it so that lug -arrow A- slides into guide notch -arrow B-.



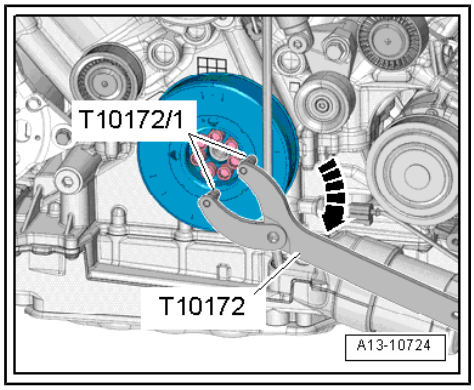
Note

The roller tappet must be positioned at the lowest point when installing the high-pressure pump.

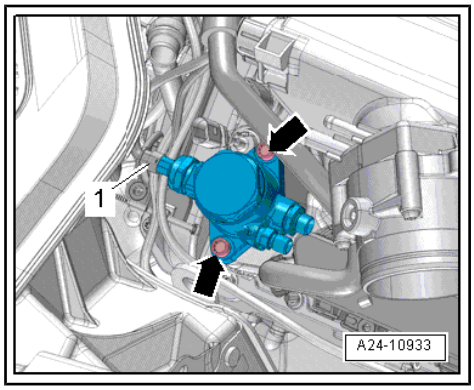
– Remove front noise insulation -1- ⇒ Rep. gr. 66 .



– Rotate crankshaft in direction of engine rotation -arrow- using counterhold tool -T10172- with pins -T10172/1- , and at the same time press roller tappet into cylinder head until it reaches its lowest point.
– Insert high-pressure pump into housing.
– Press high-pressure pump down by hand as far as possible onto stop.



– Hand-tighten the bolts -arrows- as far as the flange.
– Then initially tighten securing bolts alternately to 5 Nm (do not tilt high-pressure pump).



Note

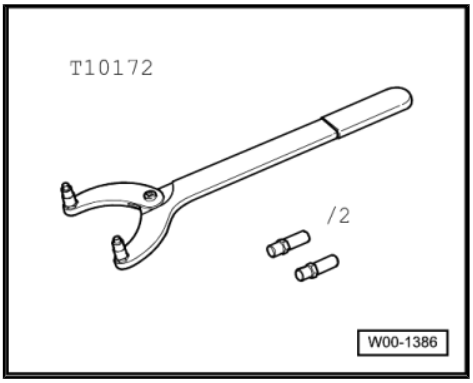
The pump can be damaged if it is tightened too much on one side (keep it straight).

- Final tightening torque for securing bolts ⇒ „6.1 High-pressure pump - exploded view“, page 39
– Install high-pressure pipe ⇒ page 45 .
– Check fuel system for leaks ⇒ page 5 .
– Install front noise insulation ⇒ Rep. gr. 66 .

6.3 Removing and installing high-pressure pump (left-side) on cylinder bank 2

Special tools and workshop equipment required

- Counterhold tool -T10172- with pins -T10172/1-



Removing

– Remove engine cover panel ⇒ page 17 .

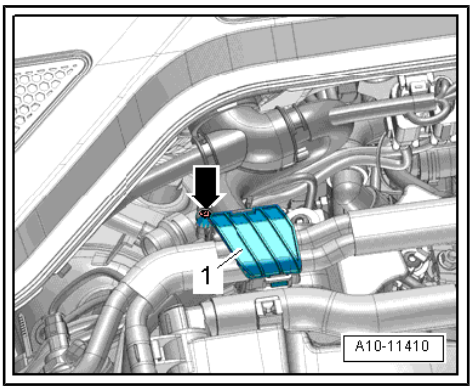
WARNING

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.*
- *The procedure is described in the ⇒ Vehicle diagnostic tester under Guided Functions, „Relieve fuel high pressure“.*

– Reduce fuel pressure in high-pressure section of injection system ⇒ page 4 .

– Remove bolt -arrow- and detach bracket -1-.



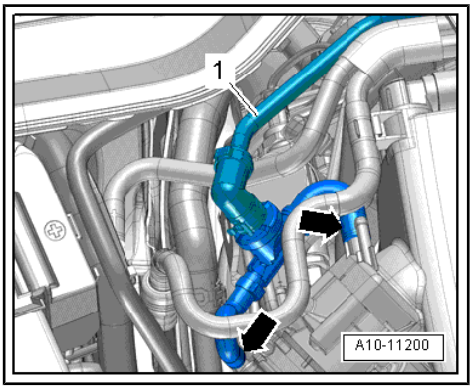
– Release hose clips -arrows- and detach hoses.

– Move clear vacuum pipe -1- and swivel to left side.

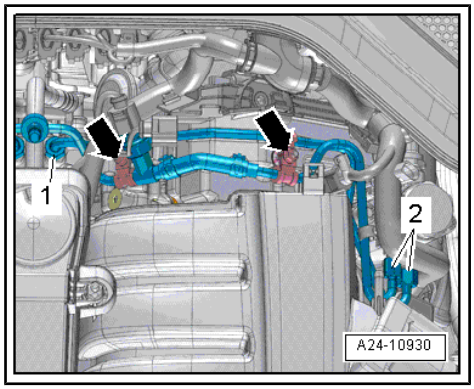
Caution

Risk of damage caused by particles of dirt.

- *Observe ⇒ „1.6 Rules for cleanliness and instructions for working on fuel system“, page 4 .*



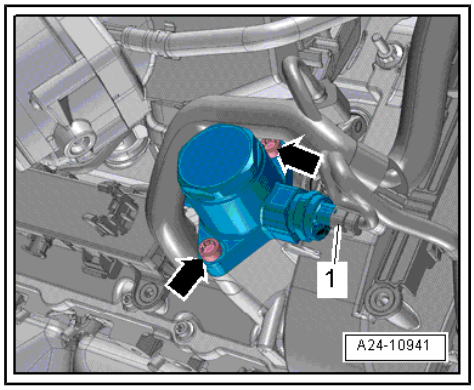
– Remove nuts -arrows- and union nuts -2-.
– Remove bolts -arrows-.



Note

Disregard -item 1-.

– Unplug electrical connector -1-.
– Remove bolts -arrows-.
– Carefully pull out high-pressure pump. It is possible that the roller tappet may remain lodged inside.



Note

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

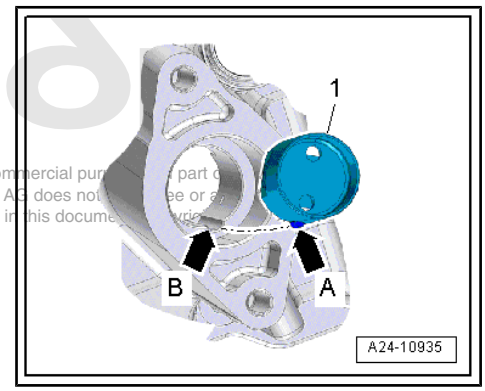
Installing

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

Note

- *Fit new O-ring.*
- *The connections of the high-pressure pipe must not be damaged.*
- *Do not attempt to bend high-pressure pipe to a different shape.*

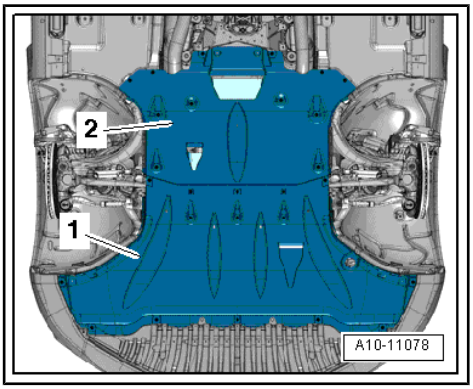
– Check roller tappet -1- for damage and renew if necessary.
– Lightly lubricate roller tappet with oil and insert it so that lug -arrow A- slides into guide notch -arrow B-.



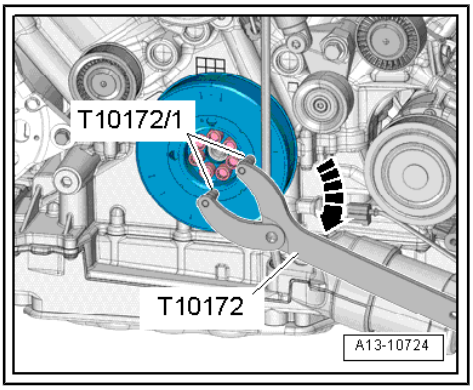
Note

The roller tappet must be positioned at the lowest point when installing the high-pressure pump.

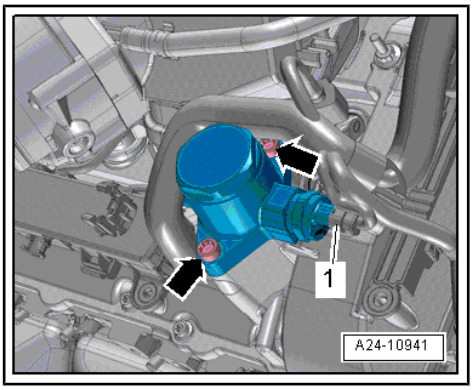
– Remove front noise insulation -1- ⇒ Rep. gr. 66 .



– Rotate crankshaft in direction of engine rotation -arrow- using counterhold tool -T10172- with pins -T10172/1- , and at the same time press roller tappet into cylinder head until it reaches its lowest point.
– Insert high-pressure pump into housing.
– Press high-pressure pump down by hand as far as possible onto stop.



– Hand-tighten the bolts -arrows- as far as the flange.
– Then initially tighten securing bolts alternately to 5 Nm (do not tilt high-pressure pump).



Note

The pump can be damaged if it is tightened too much on one side (keep it straight).

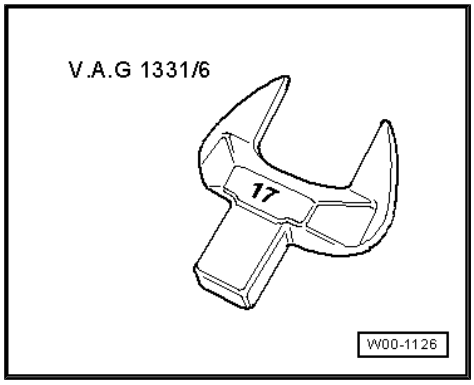
- Final tightening torque for securing bolts
⇒ „6.1 High-pressure pump - exploded view“, page 39

– Install high-pressure pipe ⇒ page 45 .
– Check fuel system for leaks ⇒ page 5 .
– Install front noise insulation ⇒ Rep. gr. 66 .

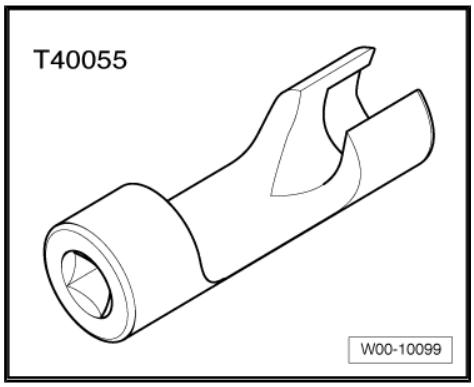
6.4 Removing and installing high-pressure pipes

Special tools and workshop equipment required

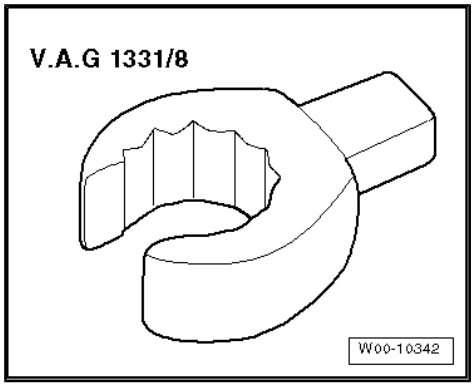
- Open-end spanner insert, 17 mm -V.A.G 1331/6- or crow-foot ring spanner, 17 mm (commercially available)



- Socket -T40055-



- Flared ring spanner tool insert, 14 mm -V.A.G 1331/8- or crow-foot ring spanner, 14 mm (commercially available)



Removing

– Remove engine cover panel ⇒ page 17 .

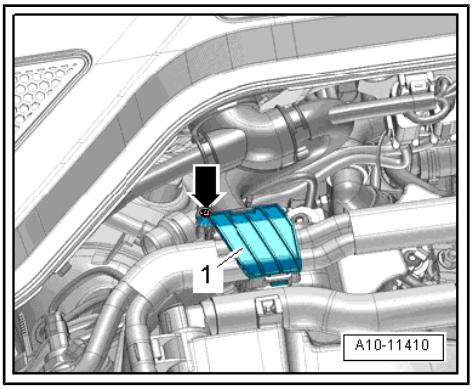
WARNING

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

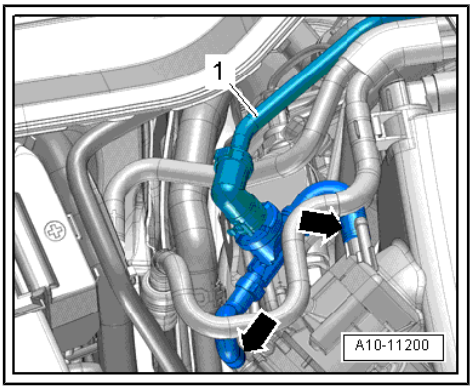
- *The fuel pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening the system.*
- *The procedure is described in the ⇒ Vehicle diagnostic tester under Guided Functions, „Relieve fuel high pressure“.*

– Reduce fuel pressure in high-pressure section of injection system ⇒ page 4 .

– Remove bolt -arrow- and detach bracket -1-.



– Release hose clips -arrows- and detach hoses.
– Move clear vacuum pipe -1- and swivel to left side.



Caution

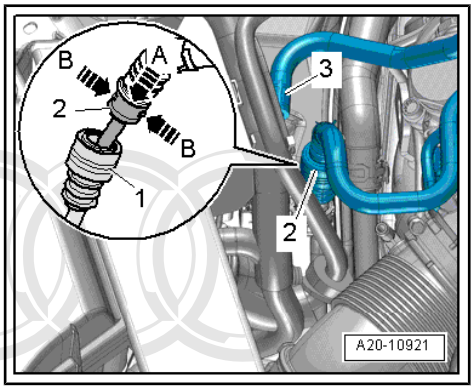
Risk of damage caused by particles of dirt.

- *Observe*
  ⇒ „1.6 Rules for cleanliness and instructions for working on fuel system“, page 4 .

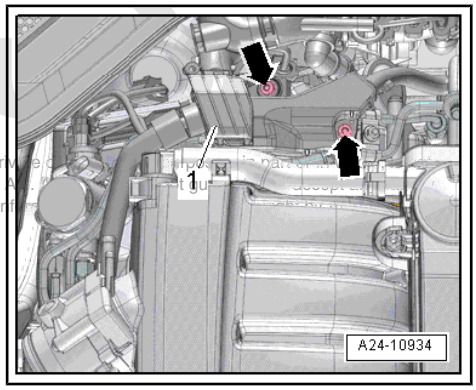
High-pressure pipe (right-side):

– Remove throttle valve module -J338- ⇒ page 25 .
– Push down protective sleeve -1- and disconnect fuel line.

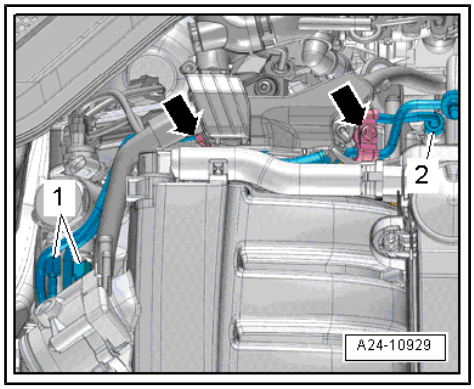
– First press hose connector -2- downwards -arrow A-, then press release tabs -arrow B-.
– Pull off hose connector, keeping release tabs depressed.
– Release hose clip -3- and detach hose for activated charcoal filter.
– Move clear hoses and push to left side.



– Remove bolts -arrows- and push bracket -1- slightly to one side.

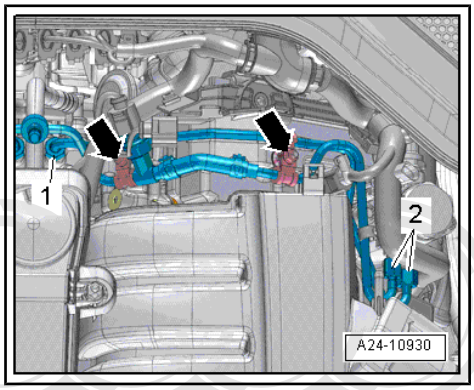


– Remove nuts -arrows-.
– Remove union nuts -1 and 2- and detach high-pressure pipe (right-side).



High-pressure pipe (left-side):

– Remove nuts -arrows-.
– Remove union nuts -1 and 2- and detach high-pressure pipe (left-side).



Installing

- Tightening torques
⇒ „6.1 High-pressure pump - exploded view“, page 39

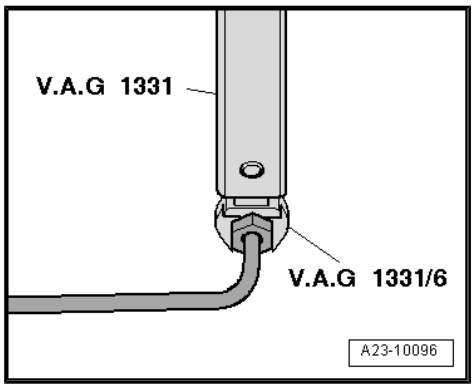
Note

♦ *The connections of the high-pressure pipe must not be damaged.*

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

– 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, 17 mm -V.A.G 1331/8- or crow-foot ring spanner, 17 mm; to do so, counterhold at hexagon flats of threaded connection on fuel rail with an open-end spanner.

– Tighten union nut with torque wrench -V.A.G 1331- and flared ring spanner tool insert, 14 mm -V.A.G 1331/8- or crow-foot ring spanner, 14 mm; to do so, counterhold at hexagon flats of threaded connection on fuel rail with an open-end spanner.
– Do not tighten bolt for retainer until high-pressure pipe has been tightened.
– Install throttle valve module -J338- ⇒ page 25 .



6.5 Removing and installing fuel pressure sender for low pressure -G410-

Removing

Caution

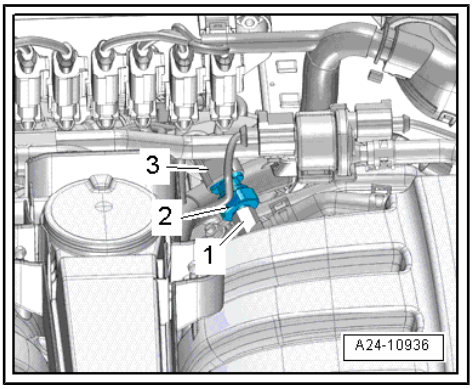
Risk of damage caused by particles of dirt.

- *Observe*
  ⇒ „1.6 Rules for cleanliness and instructions for working on fuel system“, page 4 .

– Remove engine cover panel ⇒ page 17 .

– Unplug electrical connector -3-.

– Unscrew fuel pressure sender for low pressure -G410- -item 2-; to do so, counterhold at fuel supply line -1-.



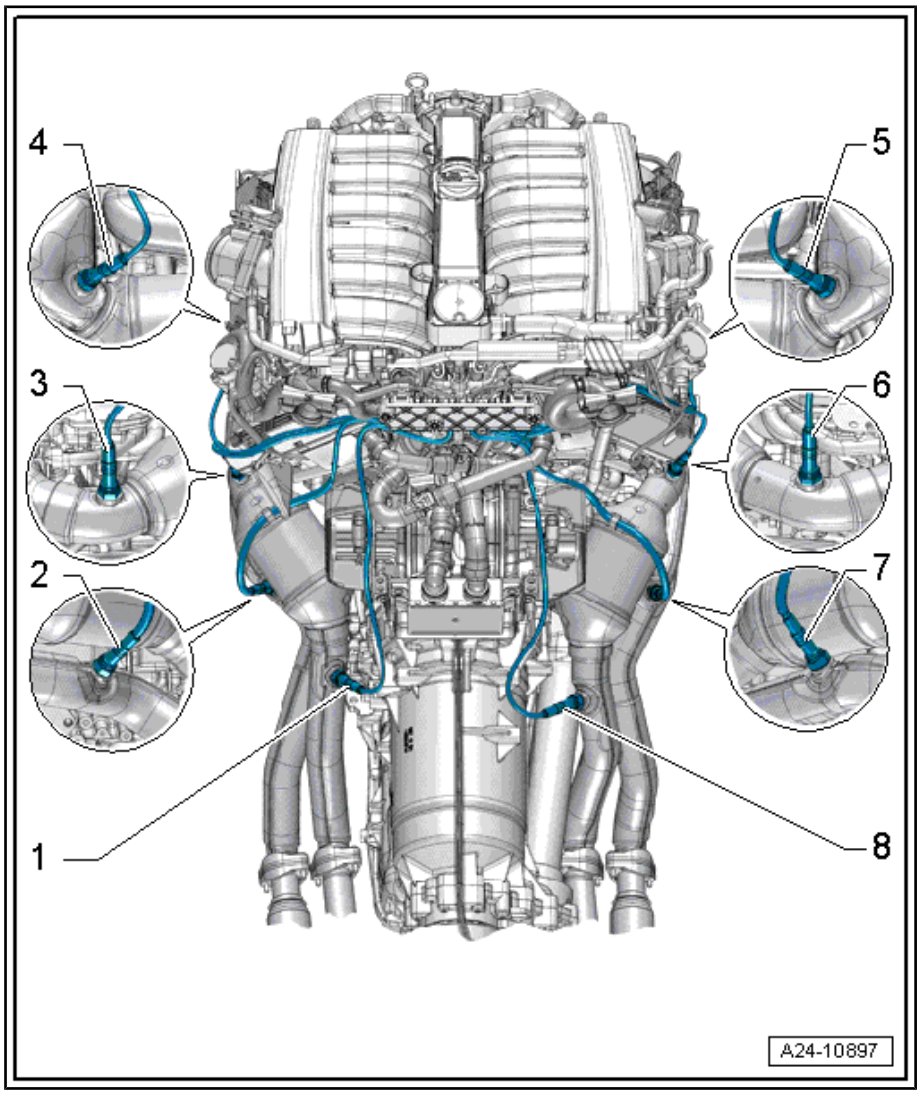
Installing

- Tightening torque
  ⇒ „6.1 High-pressure pump - exploded view“, page 39 .

– Check fuel system for leaks ⇒ page 5 .

7 Lambda probes

7.1 Lambda probes - overview



1 - Lambda probe 4 after catalytic converter -G288-

- ❑ With Lambda probe 4 heater after catalytic converter -Z65-
- ❑ Removing and installing ⇒ page 54

2 - Lambda probe 3 after catalytic converter -G287-

- ❑ With Lambda probe 3 heater after catalytic converter -Z64-
- ❑ Removing and installing ⇒ page 54

3 - Lambda probe 4 -G286- (before catalytic converter)

- ❑ With Lambda probe heater 4 -Z63-
- ❑ Removing and installing ⇒ page 52

4 - Lambda probe 3 -G285- (before catalytic converter)

- ❑ With Lambda probe heater 3 -Z62-
- ❑ Removing and installing ⇒ page 52

5 - Lambda probe -G39- (before catalytic converter)

- ❑ With Lambda probe heater -Z19-
- ❑ Removing and installing ⇒ page 51

6 - Lambda probe 2 -G108- (before catalytic converter)

- ❑ With Lambda probe heater 2 -Z28-
- ❑ Removing and installing ⇒ page 51

7 - Lambda probe after catalytic converter -G130-

- ❑ With Lambda probe 1 heater after catalytic converter -Z29-
- ❑ Removing and installing ⇒ page 54

8 - Lambda probe 2 after catalytic converter -G131-

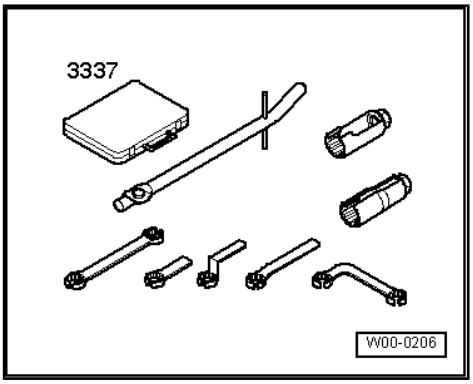
- ❑ With Lambda probe 2 heater after catalytic converter -Z30-

❑ Removing and installing ⇒ page 54

7.2 Removing and installing Lambda probe -G39- / -G108- (before catalytic converter)

Special tools and workshop equipment required

♦ Lambda probe open ring spanner set -3337-



Removing

Note

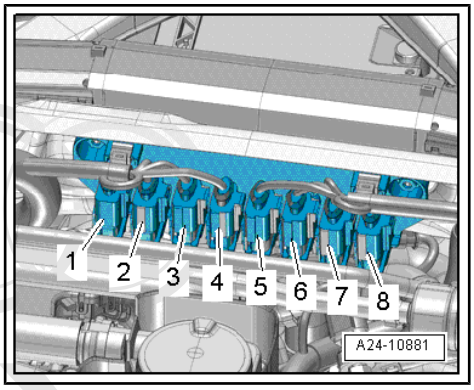
All cable ties which are released or cut open when removing must be fitted in the same position when installing.

– Remove air cleaner housing (right-side) ⇒ page 20 .

– Detach electrical connectors from bracket, unplug and move electrical wires clear:

1 - Lambda probe -G39-

2 - Lambda probe 2 -G108-

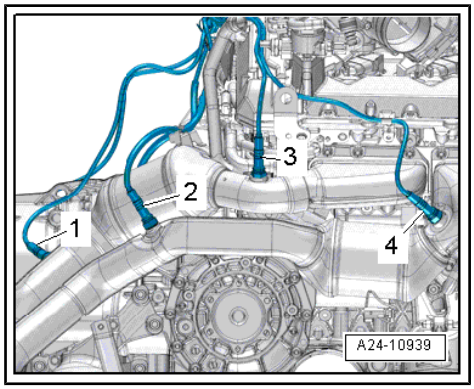


Note

Disregard -items 3 to 8-.

– Unscrew Lambda probe -G39- -4- using tool from Lambda probe open ring spanner set -3337- .

– Unscrew Lambda probe 2 -G108- -3- using tool from Lambda probe open ring spanner set -3337- .



Note

- *Disregard -items 1 and 2-.*
- *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
⇒ „7.1 Lambda probes - overview“, page 50

Note

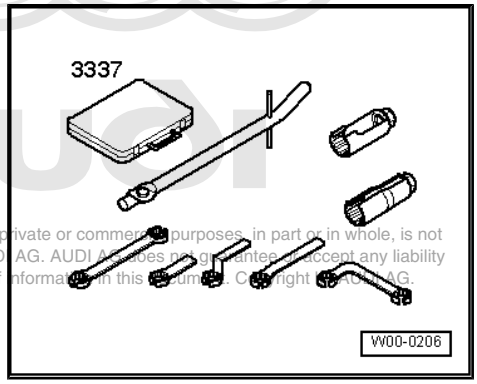
- *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*
- *In the case of a used Lambda probe grease only the thread with high-temperature paste. The paste must not get into the slots on the Lambda probe body. High-temperature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

– Install air cleaner housing (right-side) ⇒ page 20 .

7.3 Removing and installing Lambda probe -G285- / -G286- (before catalytic converter)

Special tools and workshop equipment required

- Lambda probe open ring spanner set -3337-



Removing

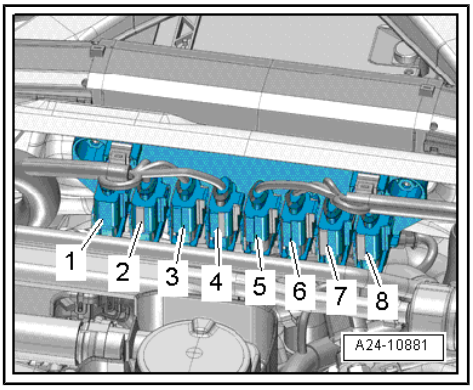
Note

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

– Detach electrical connectors from bracket, unplug and move electrical wires clear:

7 - For Lambda probe 4 -G286-

8 - For Lambda probe 3 -G285-



Note

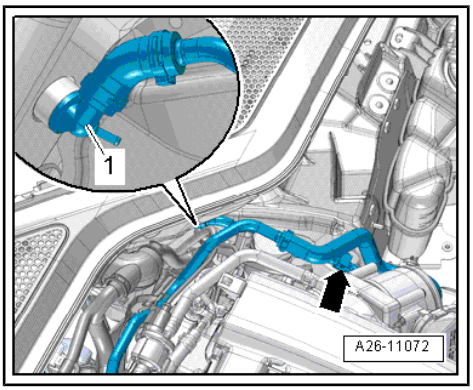
Disregard items marked -1 ... 6-.

Lambda probe 3 -G285- :

– Remove air cleaner housing (right-side) ⇒ page 20 .

Lambda probe 4 -G286- :

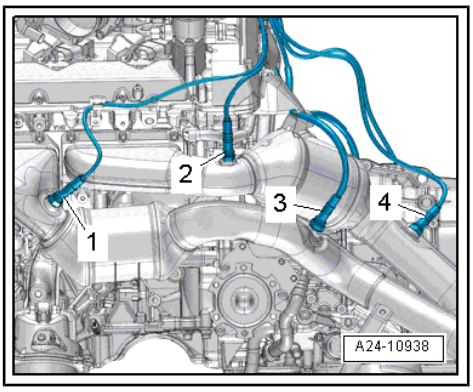
– Detach vacuum hose -1- at plenum chamber partition panel, move clear at clip -arrow- and push to one side.



Continuation for both Lambda probes:

– Unscrew Lambda probe 3 -G285- -1- using tool from Lambda probe open ring spanner set -3337- .

– Unscrew Lambda probe 4 -G286- -2- using tool from Lambda probe open ring spanner set -3337- .



Note

- *Disregard -items 3 and 4-.*
- *For illustration purposes, the installation position is shown with the engine removed.*

Installing

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

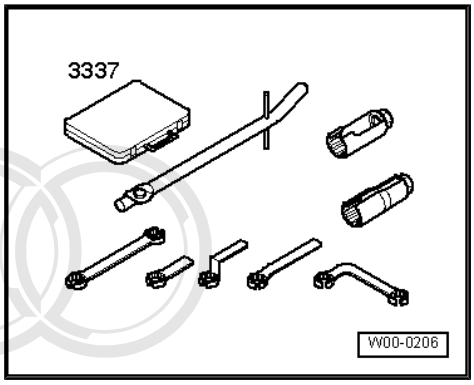
- Tightening torques
  ⇒ „7.1 Lambda probes - overview“, page 50

– Install air cleaner housing (right-side) ⇒ page 20 .

7.4 Removing and installing Lambda probe after catalytic converter -G130- / -G131- / -G287- / -G288-

Special tools and workshop equipment required

- Lambda probe open ring spanner set -3337-

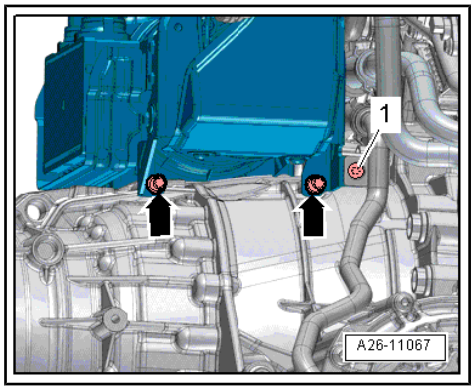


Removing

Note

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

– Remove secondary air pumps -V101- / -V189- ⇒ Rep. gr. 26 .
– Remove bolt -1- for coolant pipe on gearbox (rear right).
– Remove bolts -arrows- on both sides and detach brackets for secondary air pumps.



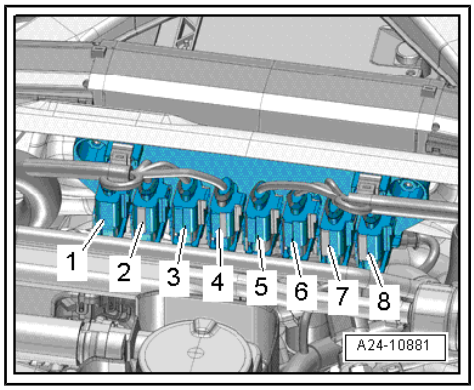
– Detach electrical connectors from bracket, unplug and move electrical wires clear:

3 - For Lambda probe after catalytic converter -G130-

4 - For Lambda probe 2 -G131- (after catalytic converter)

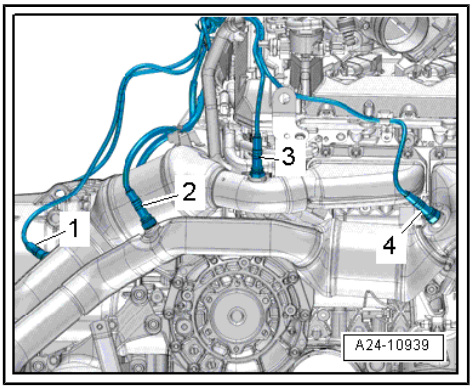
5 - For Lambda probe 4 -G288- (after catalytic converter)

6 - For Lambda probe 3 -G287- (after catalytic converter)



– Unscrew Lambda probe after catalytic converter -G130- -2- using tool from Lambda probe open ring spanner set -3337- .

– Unscrew Lambda probe 2 after catalytic converter -G131- -1- using tool from Lambda probe open ring spanner set -3337- .

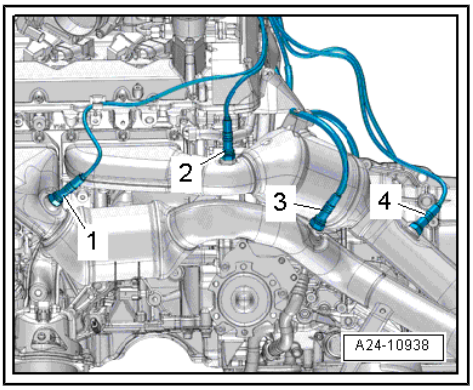


Note

- *Disregard -items 3 and 4-.*
- *For illustration purposes, the installation position is shown with the engine removed.*

– Unscrew Lambda probe 3 after catalytic converter -G287- -3- using tool from Lambda probe open ring spanner set -3337- .

– Unscrew Lambda probe 4 after catalytic converter -G288- -4- using tool from Lambda probe open ring spanner set -3337- .



– Unscrew Lambda probe 4 after catalytic converter -G288- -item 4- with ring spanner -3337/1- .

Note

- *Disregard -items 1 and 2-.*
- *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
  ⇒ „7.1 Lambda probes - overview“, page 50

Note

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

– Install secondary air pumps -V101- / -V189- ⇒ Rep. gr. 26 .

8 Engine control unit

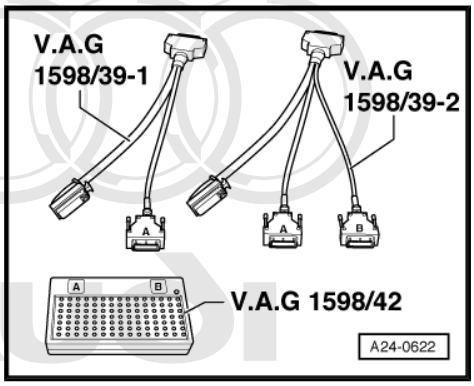
Overview

- ⇒ „8.1 Wiring and component check with test box V.A.G 1598/42 “, page 56
- ⇒ „8.2 Removing and installing engine control unit J623 (master) / J624 (slave)“, page 58

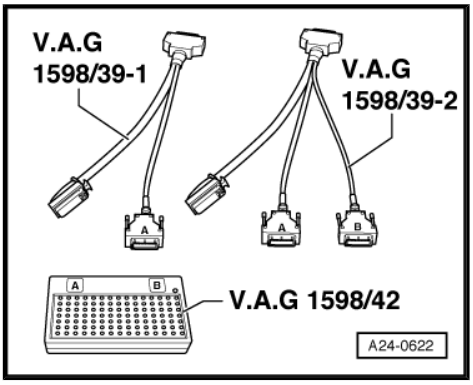
8.1 Wiring and component check with test box -V.A.G 1598/42-

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-



- ⇒ Vehicle diagnostic tester



Note

- *The test box -V.A.G 1598/42- has 105 sockets. It can be connected to the engine control unit via 2 different adapter cables.*
- *The engine control unit is connected to the vehicle's wiring harness via two connectors, one of which has 60 pins, the other has 94 pins.*
- *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).*
- *Always use auxiliary measuring set -V.A.G 1527B- to connect test equipment (e.g. voltage tester -V.A.G 1526E-, hand-held multimeter -V.A.G 1594C- etc.).*

The engine control unit has to be removed before connectors can be unplugged from engine control unit ⇒ page 58 .

Caution

Electronic components are susceptible to damage.

- ***Select the appropriate measuring range before connecting the test leads and observe test requirements.***

– Remove engine control unit ⇒ page 58 .
– Connect test box -V.A.G 1598/42- to wiring harness connector. The earth clip on the test box must be connected to the negative battery terminal. The instructions for performing the individual tests indicate whether or not the engine control unit itself also needs to be connected to the test box.
– Carry out test as described in appropriate repair procedures.

Installing engine control unit

Installation is performed in the reverse sequence.

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

Note

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

8.2 Removing and installing engine control unit -J623- (master) / -J624- (slave)

- Electronic engine control for the 12-cylinder engine is handled by two engine control units.
- The two engine control units communicate via a separate CAN bus.
- Engine control unit -J623- (master control unit) informs engine control unit 2 -J624- (slave control unit) which functions it has to perform.

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 remove ignition key.

– Remove wiper arms ⇒ Electrical system; Rep. gr. 92.

Caution

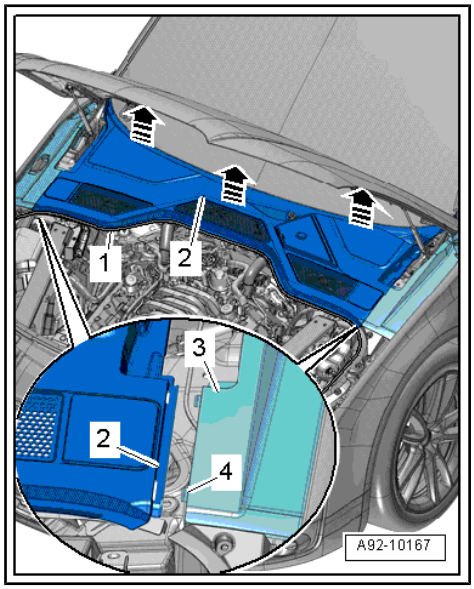
Risk of damage to plenum chamber cover.

- ***Apply a small amount of soap solution to transition between windscreen and plenum chamber cover.***

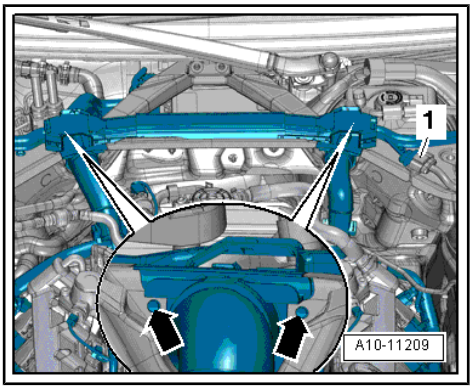
– Detach seal -1- from plenum chamber cover.

– Starting at edge of windscreen, carefully pull plenum chamber cover -2- vertically upwards off retainer at windscreen -arrows-.

– Disengage plenum chamber cover at outer plenum chamber covers -3-; lift plenum chamber cover at centre and disengage from guides -4- at side.

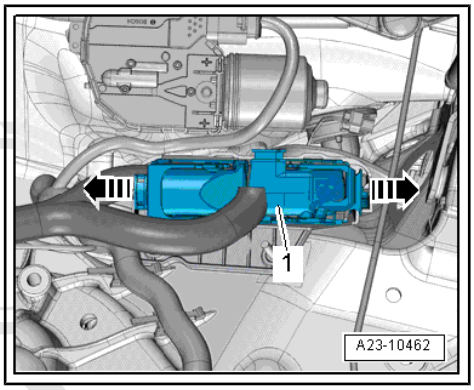


– Move clear wiring harness at plenum chamber cover on bulkhead on both sides (release catches -arrows-).



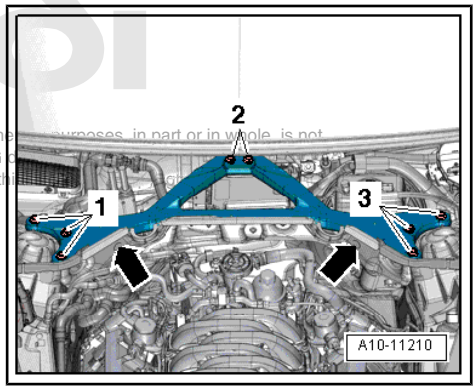
Engine control unit 2 -J624- :

– Release catches -arrows-, detach engine control unit 2 -J624- and move clear electrical wiring harness.

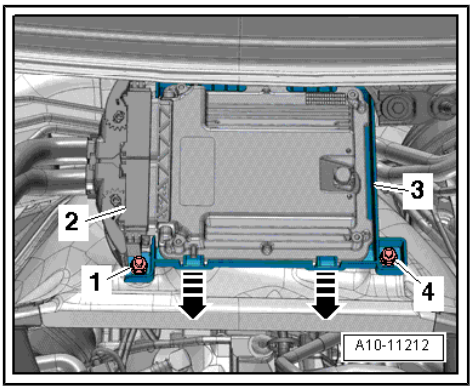


Engine control unit -J623- :

– Remove bolts -1, 2, 3- and -arrows- and detach body brace.



– Release clips -arrows- and take out engine control unit -J623- -2-.



Note

Disregard -items 1, 3, 4-.

– Release connectors on engine control unit -J623- and unplug connectors.

Installing

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

– Install body brace ⇒ Rep. gr. 40 .

– Install plenum chamber cover ⇒ Rep. gr. 50 .

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

28 – Ignition system

1 General notes and safety precautions

Overview

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. The vacuum hoses and connections must also be checked (unmetered air).
- A voltage of at least 11.5 V is required for proper operation of the electrical components.
- Entries will be stored in the event memory of the engine control unit if electrical connectors have been unplugged and the engine started.
- 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 of the engine control unit must then be interrogated and, if necessary, the control unit must be adapted.

1.2 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:

- Persons wearing a cardiac pacemaker must at all times maintain a safe distance from high-voltage components such as the ignition system and gas-discharge 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 crank the engine at starting speed without actually starting the engine (e.g. compression test), first unplug the electrical connectors from the injectors and the ignition coils ⇒ page 64 .
- Also remove fuse for fuel pump control unit -J538- ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

- Entries will be stored in the event memory of the engine control unit if electrical connectors have been unplugged and the engine started.

> ⚠ 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 .

1.3 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).*

1.4 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.*

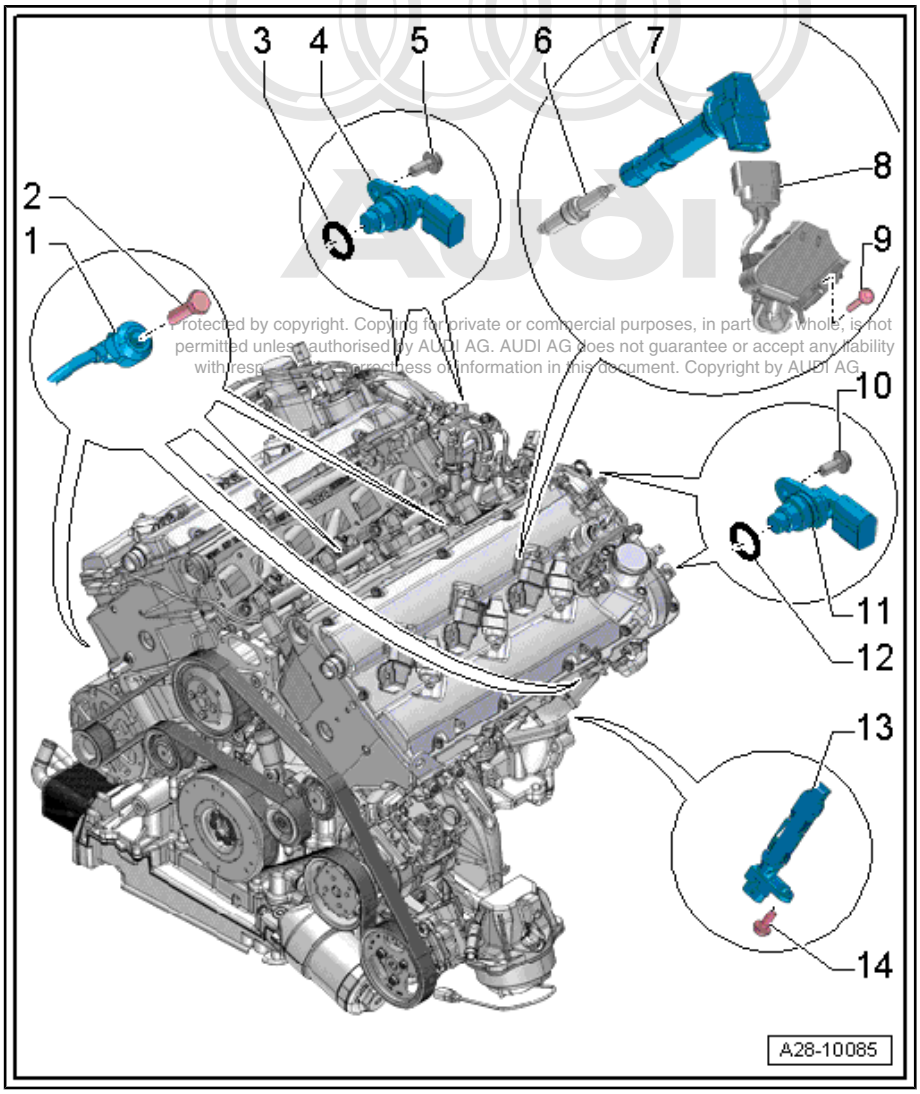
2 Servicing ignition system

Overview

2.1 Test data

Test data		6.3 ltr. / 4-valve 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 12 ignition coils (output stages integrated) connected directly to spark plugs via spark plug connectors
Spark plugs	Designations	⇒ Data sheets for exhaust emissions test
	Tightening torque	⇒ Maintenance ; Booklet 410
Firing order		1-12-5-8-3-10-6-7-2-11-4-9

2.2 Ignition system - exploded view



1 - Knock sensor

- ❑ Cylinder bank 1 (right-side): knock sensor 1 -G61- and knock sensor 2 -G66-
- ❑ Cylinder bank 2 (left-side): knock sensor 3 -G198- and knock sensor 4 -G199-
- ❑ Removing and installing ⇒ page 64

2 - Bolt

- ❑ 20 Nm

3 - O-ring

- ❑ Renew

4 - Hall sender

- ❑ Inlet side: Hall sender -G40-
- ❑ Exhaust side: Hall sender 2 -G163-
- ❑ Removing and installing ⇒ page 66

5 - Bolt

- ❑ 9 Nm

6 - Spark plug

- ❑ Change interval ⇒ Maintenance tables
- ❑ Tightening torque ⇒ Maintenance ; Booklet 410

7 - Ignition coil

- ❑ Removing and installing ⇒ page 64

8 - Electrical connector

9 - Bolt

- ❑ 5 Nm

10 - Bolt

- ❑ 9 Nm

11 - Hall sender

- ❑ Inlet side: Hall sender 3 -G300-
- ❑ Exhaust side: Hall sender 4 -G301-
- ❑ Removing and installing ⇒ page 66

12 - O-ring

- ❑ Renew

13 - Engine speed sender -G28-

- ❑ Removing and installing ⇒ page 68

14 - Bolt

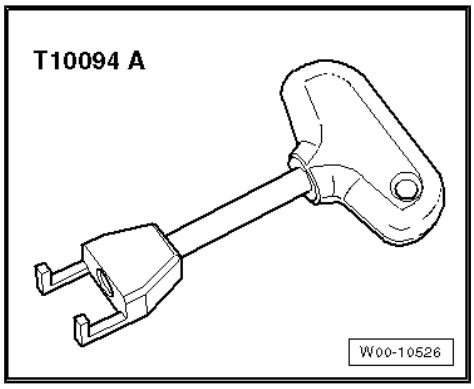
- ❑ Renew

❑ 4 Nm + 45°

2.3 Removing and installing ignition coils

Special tools and workshop equipment required

◆ Puller -T10094 A-

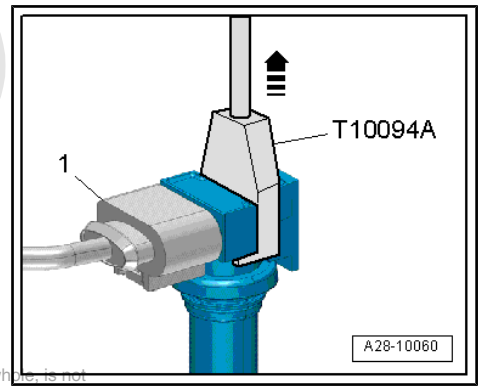


Removing

– Remove relevant intake manifold ⇒ page 24 .

– Unplug electrical connector -1- at ignition coil.

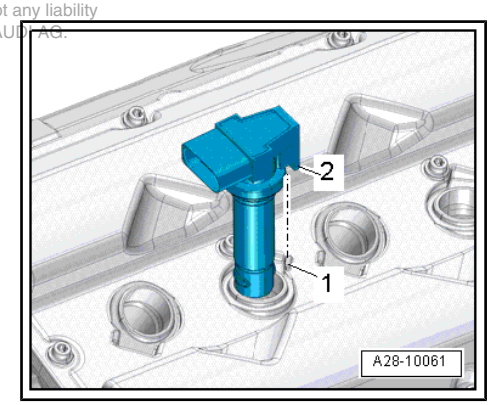
– Remove ignition coils using puller -T10094 A- -arrow-.



Installing

– Align ignition coils -2- with recesses -1- in cylinder head cover, as shown in illustration.

– Press ignition coils onto spark plugs by hand (do NOT use tool).



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

– Install intake manifold ⇒ page 24 .

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

Removing

Fitting locations
⇒ „2.2 Ignition system - exploded view“, page 63

Note

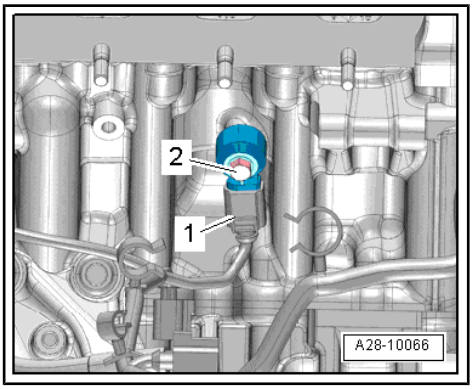
Fit all cable ties and heat insulation sleeves in the original positions when installing.

Knock sensor 1 -G61- :

– Remove alternator ⇒ Electrical system; Rep. gr. 27 .

– Unplug electrical connector -1-.

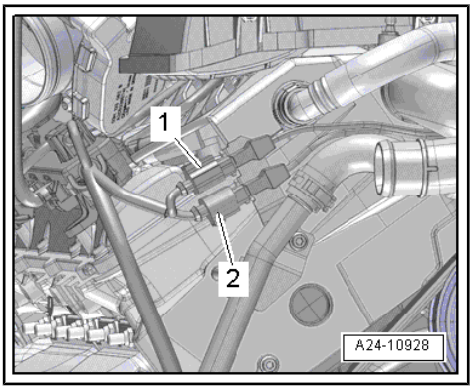
– Unscrew bolt -2- and remove knock sensor 1 -G61- .



Knock sensor 2 -G66- / knock sensor 3 -G198- :

– Unplug electrical connectors -1 and 2-.

– Remove fuel rails (left and right)
⇒ „5.5 Removing and installing injectors“, page 29 .

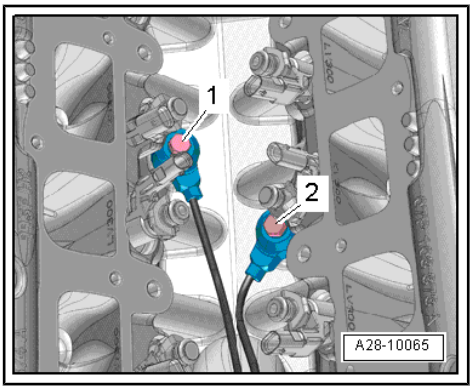


– Unscrew bolt and remove relevant knock sensor:

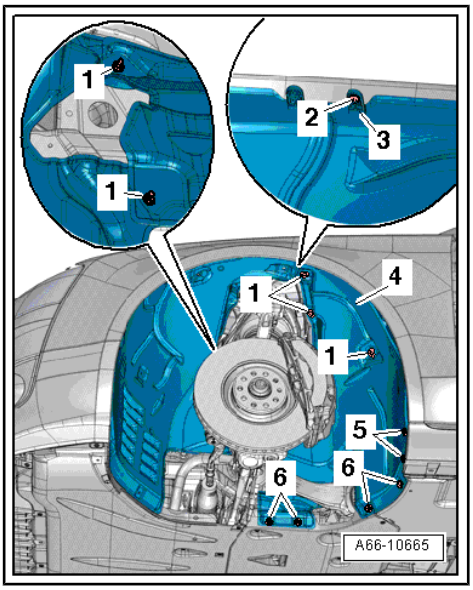
1 - Knock sensor 2 -G66-

2 - Knock sensor 3 -G198-

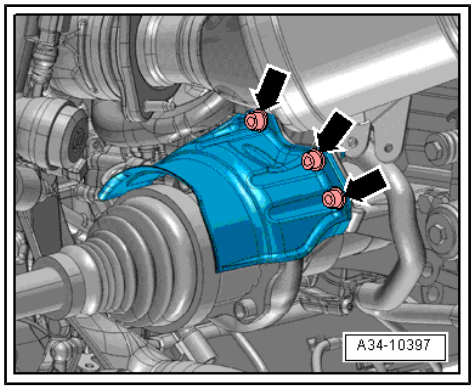
Knock sensor 4 -G199- :



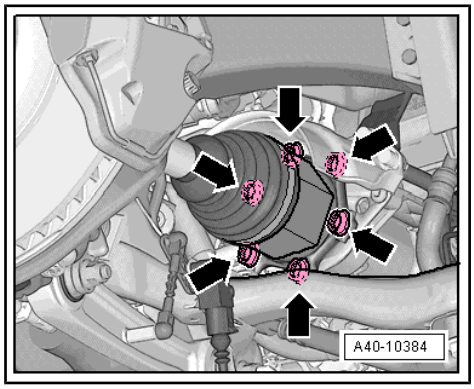
– Remove complete front wheel housing liner (left-side) ⇒ Rep. gr. 66 .



– Remove bolts -arrows- and detach heat shield for drive shaft (left-side).



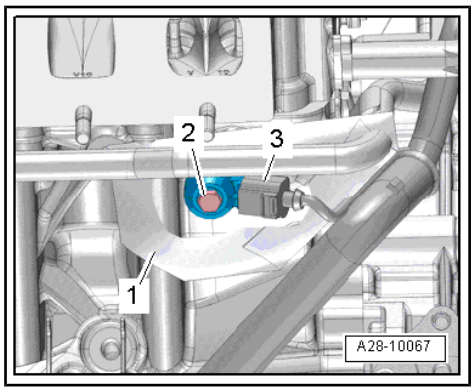
– Detach drive shaft (left-side) from flange shaft -arrows-.



– Cut through cable tie and and remove heat insulation sleeve -1-.

– Unplug electrical connector -3-.

– Unscrew bolt -2- and remove knock sensor 4 -G199-.



Installing

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

- Tightening torques
  ⇒ „2.2 Ignition system - exploded view“, page 63

Note

The tightening torque influences the function of the knock sensor.

2.5 Removing and installing Hall senders - G40- / -G163- / -G301- / -G300-

Removing

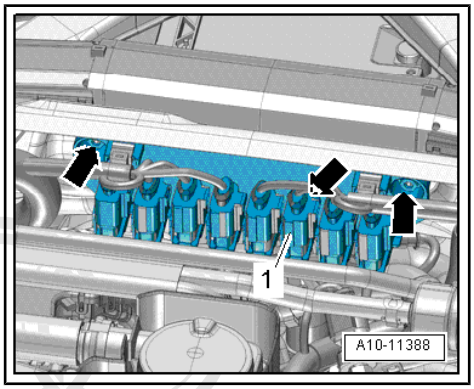
Note

Fit all cable ties and heat insulation sleeves in the original positions when installing.

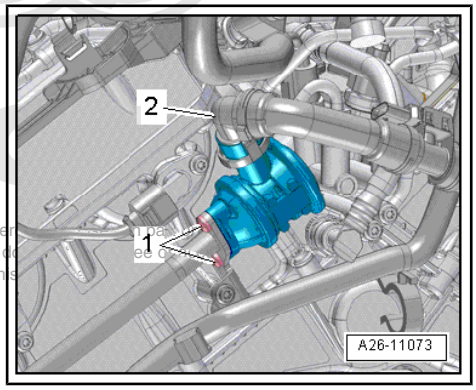
Hall sender -G40- / -G163- :

– Detach all electrical connectors from bracket.

– Remove nuts -arrows- and detach bracket for electrical connectors from plenum chamber partition panel.



– Press release tabs and disconnect relevant secondary air hose -2-.

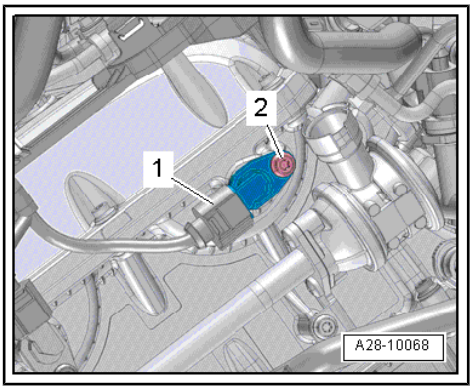


Note

Disregard -item 1-.

– Unplug electrical connector -1-.

– Unscrew bolt -2- and detach relevant Hall sender.



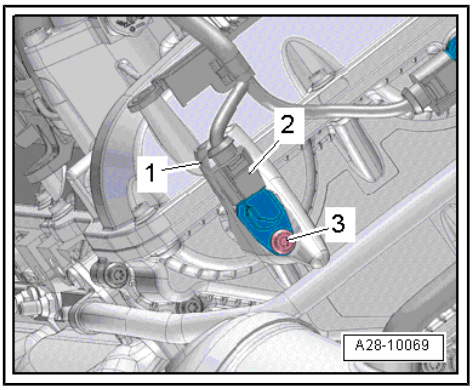
Hall sender -G300- / -G301- :

– Remove plenum chamber partition panel ⇒ Rep. gr. 50 .

– Cut through cable tie and and remove heat insulation sleeve -1-.

– Unplug electrical connector -2-.

– Unscrew bolt -3- and detach relevant Hall sender.



Installing

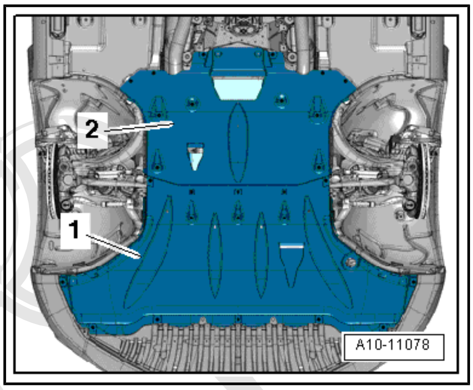
Installation is carried out in the reverse order; note the following:

- Tightening torques
⇒ „2.2 Ignition system - exploded view“, page 63

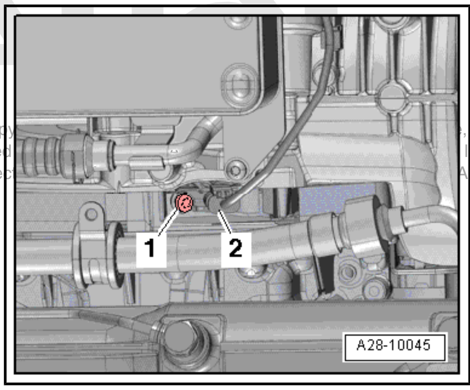
– Install plenum chamber partition panel ⇒ Rep. gr. 50 .

2.6 Removing and installing engine speed sender -G28-

Removing



– Remove noise insulation panels -1- and -2- ⇒ Rep. gr. 66 .



– Unplug electrical connector -2-.

– Unscrew bolt -1- and remove engine speed sender -G28- .

Installing

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

- Tightening torque
  ⇒ „2.2 Ignition system - exploded view“, page 63

– Install noise insulation panels ⇒ Rep. gr. 66 .