Workshop Manual

Audi A8 2003 ➢

Direct petrol injection and ignition system (10-cyl. 5.2 ltr. 4-valve)									
Engine ID	BSM								

Edition 10.2008

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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.

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Contents

24 – Mixture preparation - injection

1 Safety precautions and rules for cleanliness

1.1 Safety precautions

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

> ⚠ WARNING
>
> *Accidents can be caused if the driver is distracted by test equipment while road-testing, or if test equipment is not properly secured.*
>
> *Injuries can also be caused if the passenger's airbag is triggered in a collision.*
>
> - *The use of test equipment while driving causes distraction.*
> - *There is an increased risk of injury if test equipment is not secured.*
>
> ♦ *Test equipment must always be secured on the rear seat with a strap and operated from the rear seat by a second person.*

To avoid any risk of injuries to persons and/or damage to the fuel injection and ignition system, always observe the following safety precautions.

> ⚠ WARNING
>
> *The fuel system is pressurised. The fuel pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening; for procedure see .*
>
> *The connection must be opened immediately after reducing the pressure; wrap a cloth around the connection and allow the residual pressure (approx. 6 bar) to dissipate.*

- ♦ If the battery is not disconnected, the fuse for the fuel pump control unit -J538- must be removed as a precautionary measure before opening the fuel system, because the fuel pump will otherwise be activated by the contact switch on the driver's door.
- ♦ 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.
- ♦ Do not open any fuel line connections while the engine is running.
- ♦ Always switch off the ignition before connecting or disconnecting injection or ignition system wiring or tester cables.
- ♦ If engine is to be operated at cranking speed without it starting (e.g. compression test), unplug connectors from ignition coils and remove fuse for electric fuel pump.
- ♦ Certain tests may lead to a fault being detected by the control unit and stored. The fault memory should therefore be inter-

rogated and (if necessary) erased after completing the tests and any repair work that may be required.

- Always switch off the ignition before cleaning the engine.
- Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.

1.2 Rules for cleanliness and instructions for working on fuel system

Even small amounts of dirt can cause faults in the injection system. When working on the fuel supply/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.
- Plug open lines and connections with suitable protective caps immediately.
- Place parts that have been removed on a clean surface and cover them over. Use only lint-free cloths.
- 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.

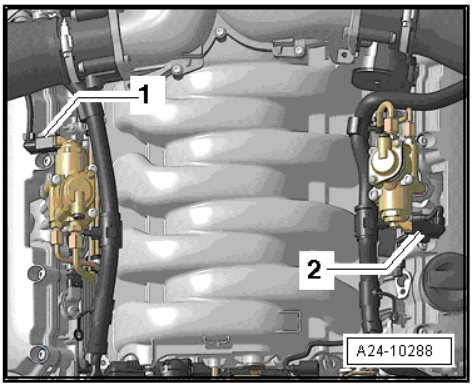
1.3 Important: Required procedure prior to opening high-pressure injection system

Caution

The injection system consists of a high-pressure section (maximum approx. 120 bar) and a low-pressure section (approx. 6 bar).

Prior to opening the high-pressure section (e.g. when removing the high-pressure pump, fuel rail, injectors, fuel pipes, etc.) the fuel pressure in the high-pressure section must be reduced to a residual pressure of approx. 6 bar. The procedure is described below.

Reducing fuel pressure in high-pressure section



– Unplug electrical connector for fuel metering valve -N290- -1- and fuel metering valve 2 -N402- -2-.

– Allow engine to idle for about 10 seconds.

Note

- *Fuel pressure will be reduced to approx. 6 bar when electrical connector is detached from fuel metering valve -N290- and fuel metering valve 2 -N402- while engine is idling.*
- *You can watch the fuel pressure dropping by connecting a fault reader and selecting the engine control unit. Select function "Read measured value block" and display group 140.*
- *The fuel pressure (actual value) is displayed in zone 3.*

– Switch off ignition.

WARNING

The fuel lines are still filled with fuel, however the fuel is no longer under high pressure. Wear safety goggles and protective clothing when opening the fuel system to avoid possible injury and skin contact.

Before opening the high-pressure section, wrap a cloth around the connection.

– The high-pressure system must be opened IMMEDIATELY after reducing the pressure by wrapping a clean cloth around the connection and allowing the residual pressure (approx. 6 bar) to dissipate. Catch the escaping fuel.

– Generate readiness code in engine control unit in "Guided Functions" mode after completing repair work ⇒ Vehicle diagnosis, testing and information system VAS 5051.

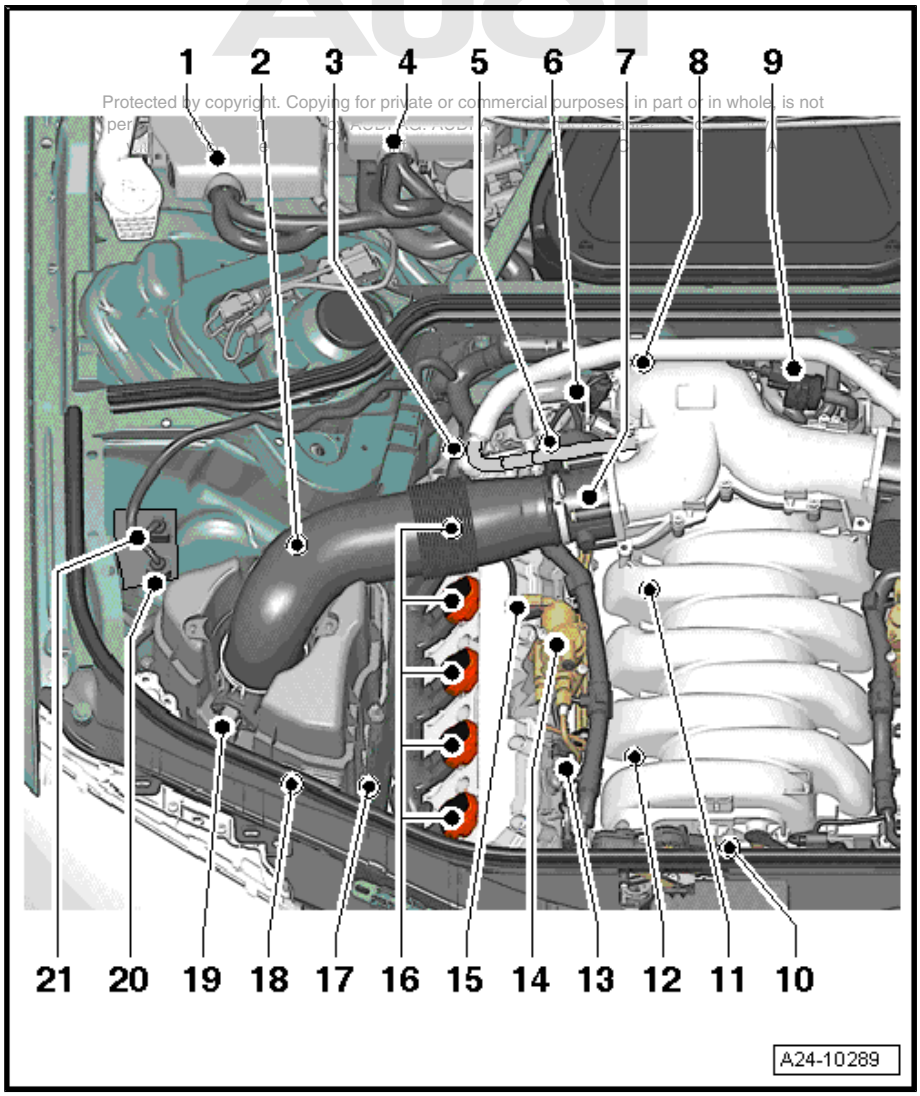
2 Injection system

2.1 Technical data

Engine data	5.2 ltr. / 331 kW engine
Idling speed (not adjustable)	approx. 650 rpm 1)
Fuel pressure after high-pressure pump	18 ... 120 bar
Fuel pressure before high-pressure pump	approx. 6 bar
• 1) Depending on demands placed on engine control unit.	

2.2 Overview of fitting locations

Engine compartment (right-side)



1 - Engine control unit 2 -J624-

- ❑ Fitting location ⇒ page 8
- ❑ Removing and installing ⇒ page 59

2 - Variable intake manifold changeover valve -N335-

- ❑ Fitting location ⇒ page 9

3 - Exhaust camshaft control valve 1 -N318-

4 - Engine control unit -J623-

- ❑ Fitting location ⇒ page 8
- ❑ Removing and installing ⇒ page 56

5 - Camshaft control valve 1 - N205-

6 - Fuel pressure sender for low pressure -G410-

- ❑ Fitting location ⇒ page 10

7 - Throttle valve module - J338-

- ❑ After renewing, perform adaption in “Guided Functions”, option “Adapt throttle valve module”

8 - Coolant temperature sender -G62-

- ❑ Fitting location ⇒ page 10

9 - Activated charcoal filter solenoid valve 1 -N80-

- ❑ ⇒ page 9

10 - Components at front of engine

- ❑ Fitting locations ⇒ page 10
- ❑ Intake manifold flap potentiometer -G336-
- ❑ Variable intake manifold motor -V183-
- ❑ Intake manifold flap motor -V157-
- ❑ Secondary air inlet valve -N112-
- ❑ Intake manifold flap potentiometer 2 -G512-
- ❑ Oil pressure switch -F1-
- ❑ Knock sensor 4 -G199-
- ❑ Knock sensor 3 -G198-
- ❑ Knock sensor 1 -G61-
- ❑ Knock sensor 2 -G66-

11 - Knock sensor 2 -G66-

- ❑ Fitting location ⇒ page 11
- ❑ Electrical connector ⇒ page 10
- ❑ 22 Nm

12 - Knock sensor 1 -G61-

- ❑ Fitting location ⇒ page 11
- ❑ Electrical connector ⇒ page 10
- ❑ 22 Nm

13 - Hall sender -G40-

14 - High-pressure pump

- ❑ With fuel metering valve -N290-

15 - Electrical connector for fuel metering valve -N290-

- ❑ Combined with high-pressure pump in one unit

16 - Ignition coils for cylinder bank 1

- ❑ Ignition coil 1 with output stage -N70-
- ❑ Ignition coil 2 with output stage -N127-
- ❑ Ignition coil 3 with output stage -N291-
- ❑ Ignition coil 4 with output stage -N292-
- ❑ Removing and installing ⇒ page 65

17 - Hall sender 3 -G300-

- ❑ Secured to outside of cylinder head

18 - Secondary air pump motor -V101-

- ❑ Beneath right-side longitudinal member
- ❑ ⇒ page 12

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

- ❑ Removing and installing ⇒ page 18
- ❑ Secured in air cleaner housing

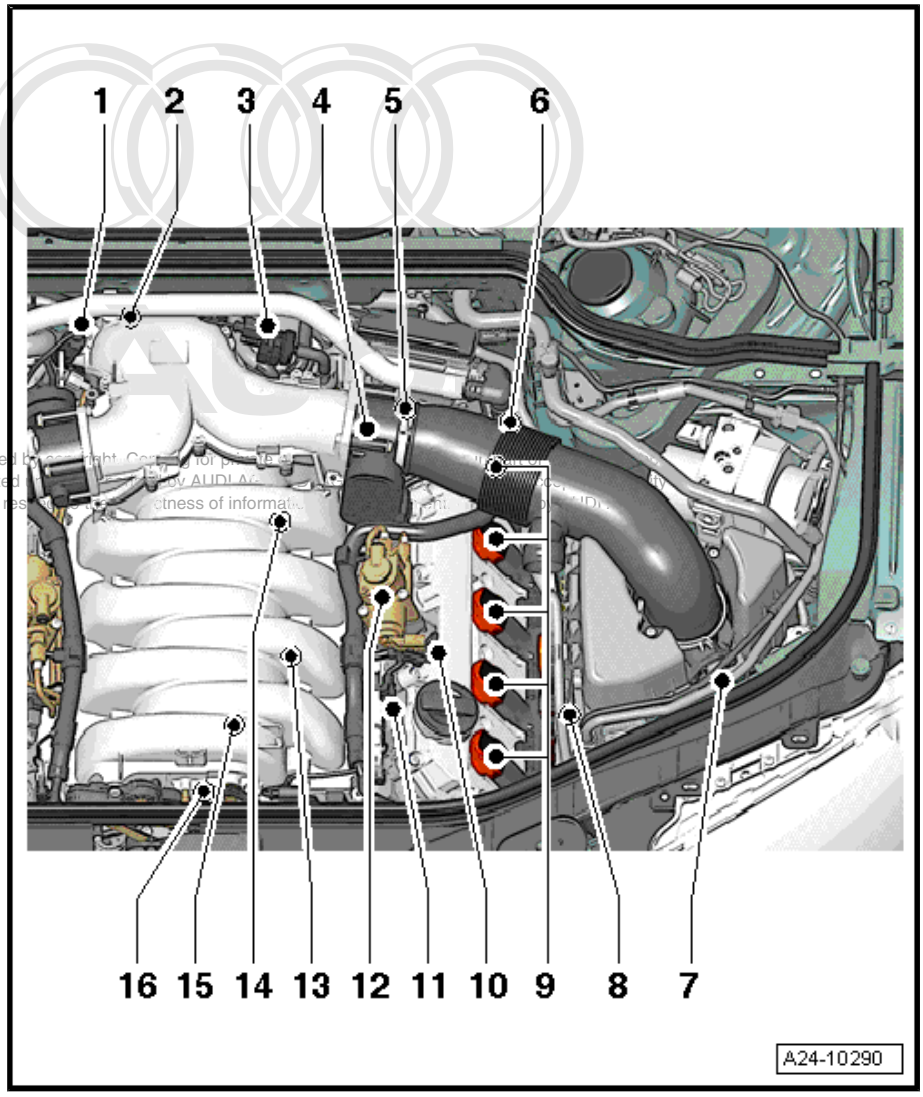
20 - Electrical connector (black) for Lambda probe 2 -G108-

- ❑ Lambda probes - overview ⇒ page 47

21 - Electrical connector (brown) for Lambda probe 4 -G286-

- ❑ Lambda probes - overview ⇒ page 47

Engine compartment (left-side)



1 - Fuel pressure sender for low pressure -G410-

- ❑ Fitting location ⇒ page 10

2 - Coolant temperature sender -G62-

- ❑ Fitting location ⇒ page 10

3 - Activated charcoal filter solenoid valve 1 -N80-

- ❑ ⇒ page 9

4 - Throttle valve module 2 - J544-

- ❑ After renewing, perform adaption in “Guided Functions”, option “Adapt throttle valve module”

5 - Camshaft control valve 2 - N208-

6 - Exhaust camshaft control valve 2 -N319-

7 - Air mass meter 2 -G246-

- ❑ Removing and installing ⇒ page 19
- ❑ Secured in air cleaner housing

8 - Hall sender 4 -G301-

- ❑ Secured to outside of cylinder head

9 - Ignition coils for cylinder bank 2

- ❑ Ignition coil 5 with output stage -N323-
- ❑ Ignition coil 6 with output stage -N324-
- ❑ Ignition coil 7 with output stage -N325-
- ❑ Ignition coil 8 with output stage -N326-
- ❑ Removing and installing ⇒ page 65

10 - Electrical connector for fuel metering valve 2 -N402-

- ❑ Combined with high-pressure pump in one unit

11 - Hall sender 2 -G163-

12 - High-pressure pump

- ❑ With fuel metering valve 2 -N402-

13 - Knock sensor 3 -G198-

- ❑ Fitting location ⇒ page 11
- ❑ Electrical connector ⇒ page 10
- ❑ 22 Nm

14 - Knock sensor 4 -G199-

- ❑ Fitting location ⇒ page 11
- ❑ Electrical connector ⇒ page 10
- ❑ 22 Nm

15 - Fuel pressure sender -G247-

- ❑ Fitting location ⇒ page 11

16 - Components at front of engine

- ❑ ⇒ page 10
- ❑ Intake manifold flap potentiometer -G336-
- ❑ Variable intake manifold motor -V183-
- ❑ Intake manifold flap motor -V157-
- ❑ Secondary air inlet valve -N112-
- ❑ Intake manifold flap potentiometer 2 -G512-
- ❑ Oil pressure switch -F1-
- ❑ Knock sensor 4 -G199-
- ❑ Knock sensor 3 -G198-
- ❑ Knock sensor 1 -G61-
- ❑ Knock sensor 2 -G66-

A - Engine speed sender -G28-

- ❑ Fitting location ⇒ page 10

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

- ❑ In footwell on accelerator pedal (both senders are accommodated in one housing)

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

- ❑ In footwell on brake pedal

D - Clutch pedal switch -F36- and clutch pedal position sender -G476-

- ❑ In footwell on clutch pedal

E - Lambda probe before catalytic converter -G39- with Lambda probe heater -Z19-

- ❑ Exhaust bank I (cylinders 1, 2, 3)
- ❑ Fitting location of electrical connector ⇒ page 48
- ❑ Removing and installing ⇒ page 49

F - Lambda probe 2 before catalytic converter -G108- with Lambda probe 2 heater -Z28-

- ❑ Exhaust bank II (cylinders 4,5)
- ❑ Fitting location of electrical connector ⇒ page 48
- ❑ Removing and installing ⇒ page 51

G - Lambda probe 3 before catalytic converter -G285- with Lambda probe 3 heater -Z62-

- ❑ Exhaust bank III (cylinders 6, 7, 8)
- ❑ Fitting location of electrical connector ⇒ page 48
- ❑ Removing and installing ⇒ page 49

H - Lambda probe 4 before catalytic converter -G286- with Lambda probe 4 heater -Z63-

- ❑ Exhaust bank IV (cylinders 9, 10)
- ❑ Fitting location of electrical connector ⇒ page 48
- ❑ Removing and installing ⇒ page 51

I - Lambda probe after catalytic converter -G130- with Lambda probe 1 heater after catalytic converter -Z29-

- ❑ Exhaust bank I (cylinders 1, 2, 3)
- ❑ Fitting location of electrical connector ⇒ page 48
- ❑ Removing and installing ⇒ page 50

J - Lambda probe 2 after catalytic converter -G131- with Lambda probe 2 heater after catalytic converter -Z30-

- ❑ Exhaust bank II (cylinders 4,5)
- ❑ Fitting location of electrical connector ⇒ page 48
- ❑ Removing and installing ⇒ page 49

K - Lambda probe 3 after catalytic converter -G287- with Lambda probe 3 heater after catalytic converter -Z64-

- ❑ Exhaust bank III (cylinders 6, 7, 8)
- ❑ Fitting location of electrical connector ⇒ page 48
- ❑ Removing and installing ⇒ page 50

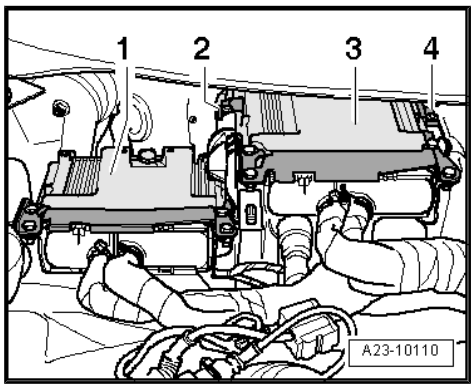
L - Lambda probe 4 after catalytic converter -G288- with Lambda probe 4 heater after catalytic converter -Z65-

- ❑ Exhaust bank IV (cylinders 9, 10)
- ❑ Fitting location of electrical connector ⇒ page 48
- ❑ Removing and installing ⇒ page 49

Fitting location of engine control unit -J623- and engine control unit 2 -J624-

1 - shows engine control unit 2 -J624- (slave)

3 - shows engine control unit -J623- (master)



5-position relay carrier in passenger's footwell

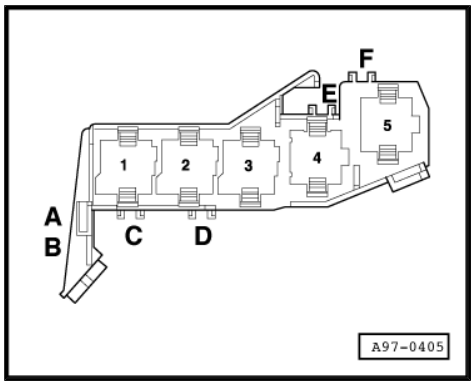
1.2 - Additional coolant pump relay -J496-

2 - Starter motor relay -J53-

3 - Starter motor relay 2 -J695-

4 - Current supply relay for engine components -J757-

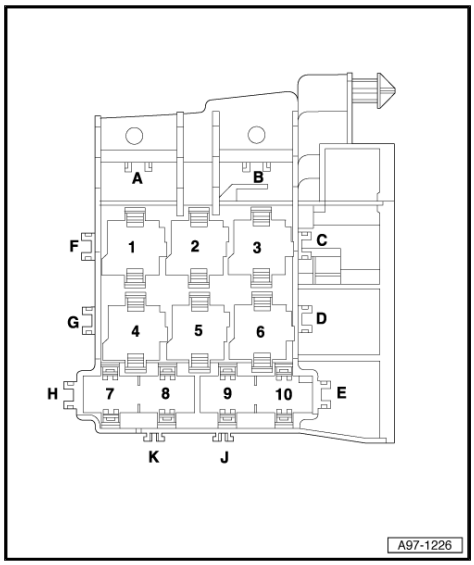
Refer to ⇒ Current flow diagrams, Electrical fault finding and Fitting locations



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

3 - Terminal 15 voltage supply relay -J329-

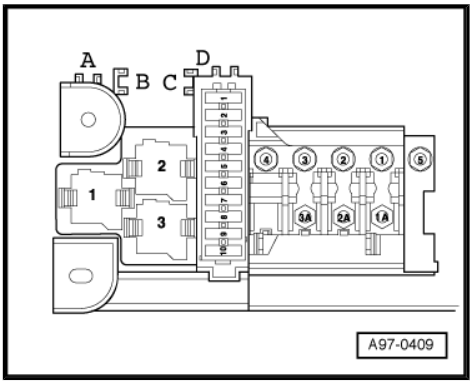
Refer to ⇒ Current flow diagrams, Electrical fault finding and Fitting locations



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

3 - Fuel pump relay -J17-

Refer to ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

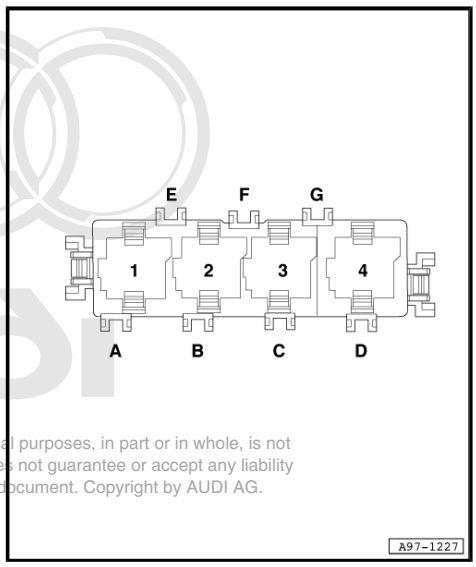


4-position relay carrier in electronics box in plenum chamber

1 - Secondary air pump relay -J299-

2 - Motronic current supply relay -J271-

Refer to ⇒ Current flow diagrams, Electrical fault finding and Fitting locations



Fitting locations

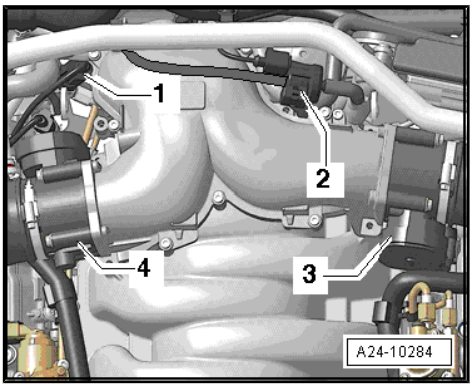
1 - Fuel pressure sender for low pressure -G410-

2 - Activated charcoal filter solenoid valve 1 -N80-

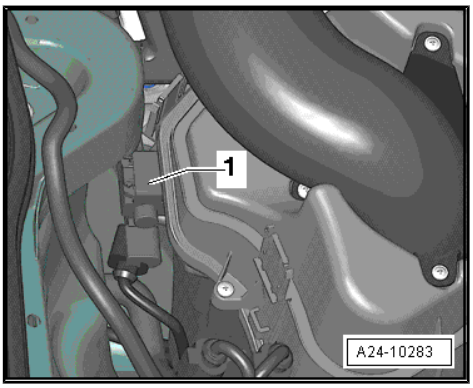
3 - Throttle valve module 2 -J544-

4 - Throttle valve module -J338-

After renewing throttle valve module you must carry out an “adaption”, see “Guided Functions” ⇒ Vehicle diagnosis, testing and information system VAS 5051.



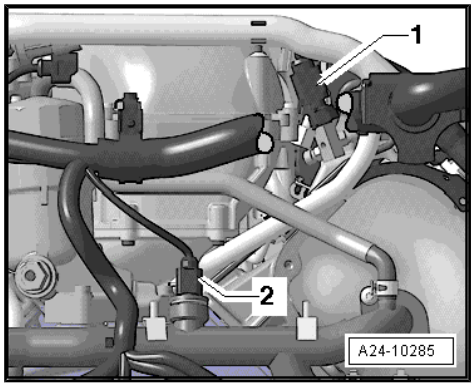
Variable intake manifold changeover valve -N335- -1-



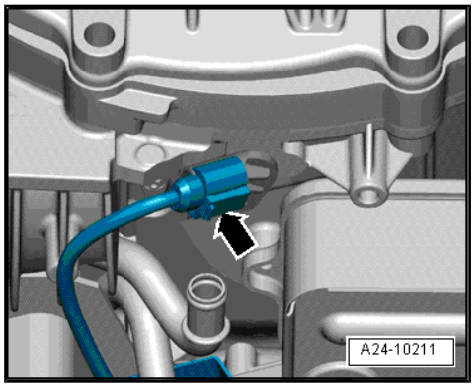
Engine viewed from rear

1 - Fuel pressure sender for low pressure -G410-

2 - Coolant temperature sender -G62-



Engine speed sender -G28- -arrow-



Engine viewed from front

1 - Intake manifold flap potentiometer -G336-

2 - Variable intake manifold motor -V183-

3 - Intake manifold flap motor -V157-

4 - Secondary air inlet valve -N112-

5 - Intake manifold flap potentiometer 2 -G512-

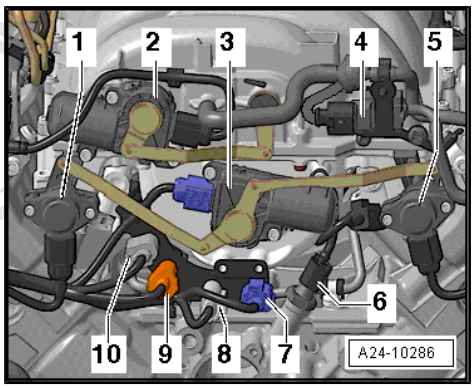
6 - Removing and installing oil pressure switch -F1- ⇒ Rep. Gr. 17

7 - Knock sensor 4 -G199- (blue connector)

8 - Knock sensor 3 -G198- (white connector)

9 - Knock sensor 1 -G61- (orange connector)

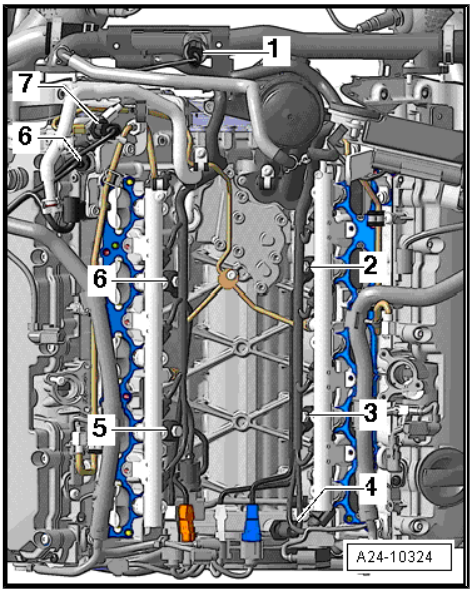
10 - Knock sensor 2 -G66- (grey connector)



Note

To remove the knock sensors you must first remove the intake manifold. Removing and installing intake manifold *⇒ page 22*

Fitting location inside cylinder head



1 - Coolant temperature sender -G62-

2 - Knock sensor 4 -G199-

3 - Knock sensor 3 -G198-

4 - Fuel pressure sender -G247-

5 - Knock sensor 1 -G61-

6 - Knock sensor 2 -G66-

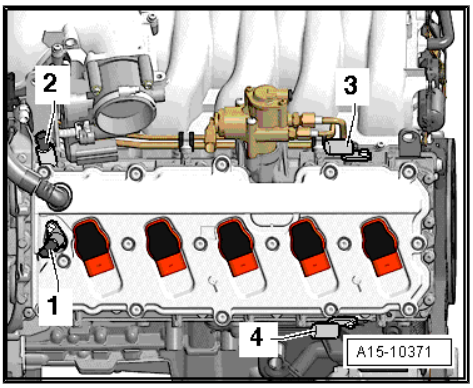
7 - Camshaft control valve 1 -N205-

8 - Fuel pressure sender for low pressure -G410-

Note

To remove the fuel pressure regulator -G247- or the knock sensors you must first remove the intake manifold. Removing and installing intake manifold *⇒ page 22*

Fitting locations on cylinder bank 1 (right-side)



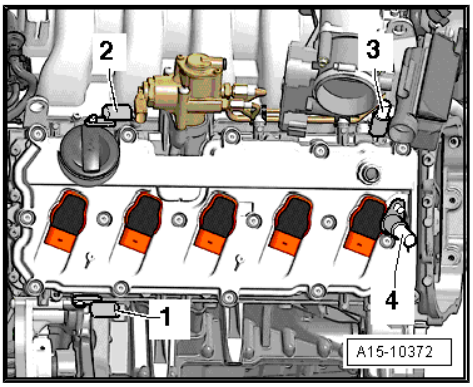
1 - Exhaust camshaft control valve 1 -N318-

2 - Camshaft control valve 1 -N205-

3 - Hall sender -G40-

4 - Hall sender 3 -G300-

Fitting locations on cylinder bank 2 (left-side)



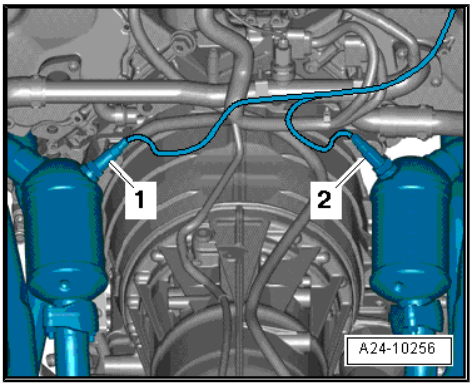
1 - Hall sender 4 -G301-

2 - Hall sender 2 -G163-

3 - Camshaft control valve 2 -N208-

4 - Exhaust camshaft control valve 2 -N319-

Lambda probes before catalytic converter



1 - Lambda probe 4 -G286- with Lambda probe 4 heater -Z63- before catalytic converter

2 - Lambda probe 2 -G108- with Lambda probe 2 heater -Z28- before catalytic converter

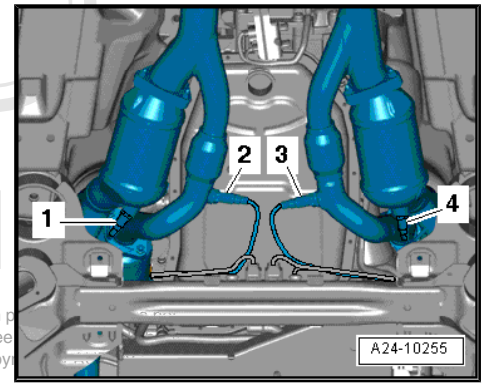
Fitting locations of Lambda probes

1 - Lambda probe 3 -G285-

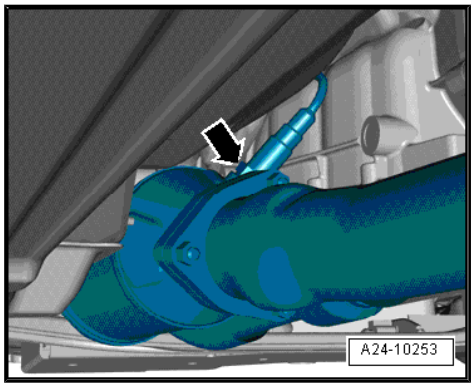
2 - Lambda probe 4 after catalytic converter -G288-

3 - Lambda probe 2 after catalytic converter -G131-

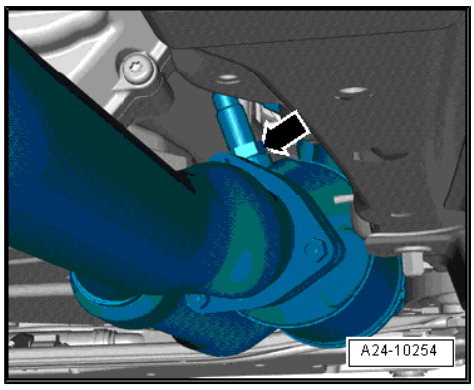
4 - Lambda probe -G39-



Lambda probe 3 after catalytic converter -G287- -arrow-

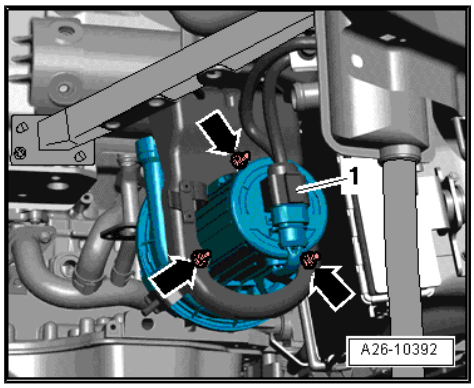


Lambda probe after catalytic converter -G130-



Secondary air pump motor -V101- (below right-side longitudinal member)

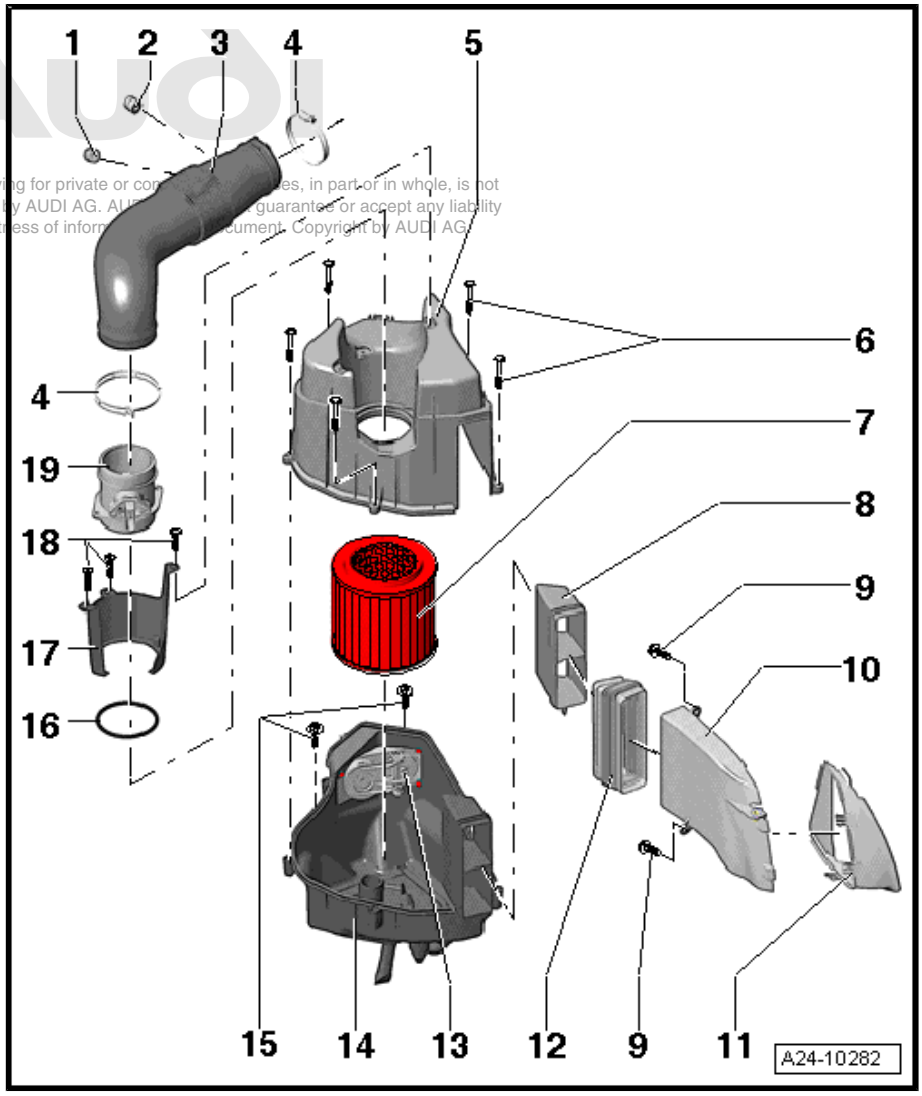
- Removing and installing ⇒ Rep. Gr. 26



2.3 Air cleaner - exploded view

Note

Illustration shows air cleaner on right side.



1 - Vacuum hose

2 - Vacuum hose

3 - Air hose

- ❑ To throttle valve module -J338-

4 - Hose clip

5 - Air cleaner housing (top section)

- ❑ Clean any salt deposits or leaves and dirt out of air cleaner housing (top section)

6 - Bolt

- ❑ 1.5 Nm

7 - Air filter element

- ❑ Always use genuine part for air filter element
- ❑ Maintenance intervals ⇒ Maintenance ; Booklet 404
- ❑ Removing and installing ⇒ page 14
- ❑ Also clean snow screen (if fitted)

8 - Air duct

- ❑ Clean dirt and leaves out of air duct

9 - Bolt

- ❑ 1.5 Nm

10 - Air duct

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

11 - Air duct

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

12 - Air duct

- ❑ Clean dirt and leaves out of air duct

13 - Variable intake manifold changeover valve -N335-

14 - Air cleaner housing (bottom section)

- ❑ Clean any salt deposits or leaves and dirt out of air cleaner housing (bottom section)
- ❑ Check for dirt in water drain and clean as required (this is important)
- ❑ Removing air cleaner housing (bottom section) ⇒ page 14

15 - Bolts

- ❑ 1.5 Nm

16 - O-ring

- ❑ Renew if damaged

17 - Bracket for air mass meter -G70-

18 - Bolts

- ❑ 1.5 Nm

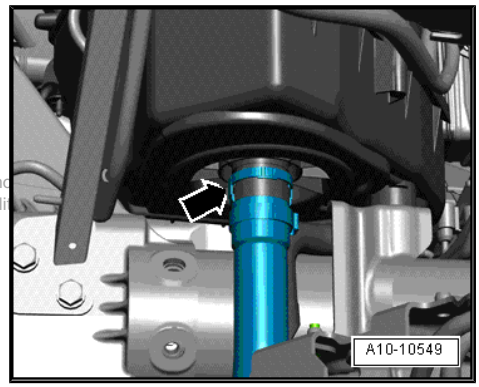
19 - Air mass meter

- ❑ Removing and installing air mass meter -G70- with intake air temperature sender -G42- (cylinder bank 1) ⇒ page 18
- ❑ Removing and installing air mass meter 2 -G246- (cylinder bank 2) ⇒ page 19

Removing air cleaner housing (bottom section)

Remove wheel housing liner (right-side).

Disconnect air hose -arrow- at bottom of air cleaner housing (bottom section).



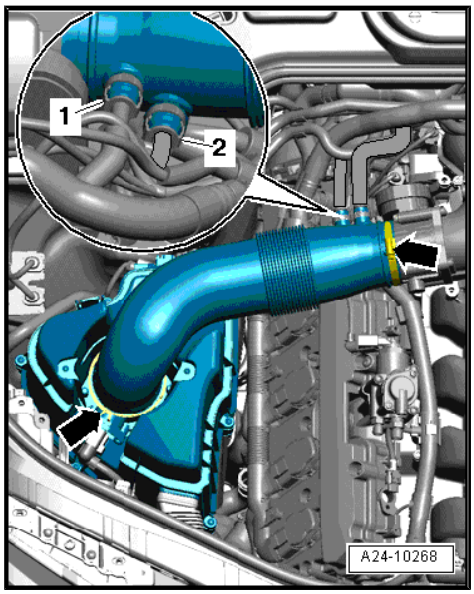
2.4 Removing and installing air filter element (right side) (cylinder bank 1)

Removing

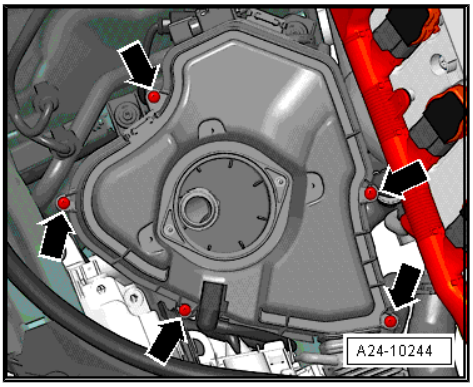
– Release hose clips -arrows- and remove air hose between air mass meter -G70- and throttle valve module -J338- .

– Move air hose to one side, with vacuum hoses -1 and 2- connected.

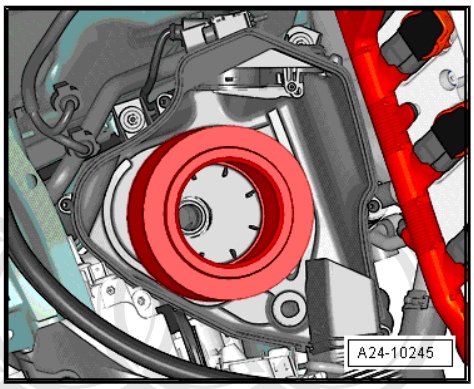
– Unplug electrical connector at air mass meter -G70- .



– Remove bolts -arrows-.
– Detach air cleaner housing (top section).



– Pull out air filter element.



Note

Make sure no dirt gets into the air cleaner housing or air mass meter.

Installing

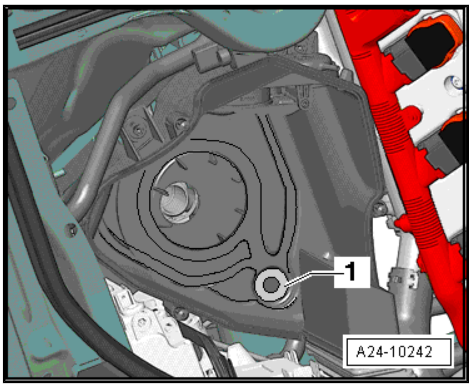
Installation is carried out in the reverse order; note the following:

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

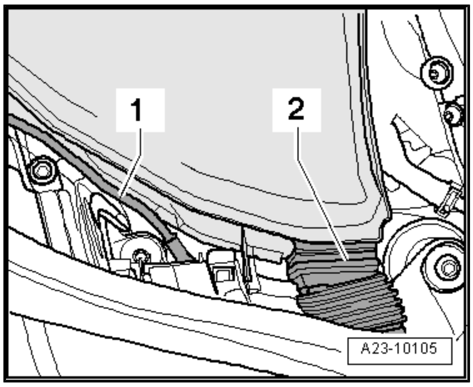
Note

- *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.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- *To prevent malfunctions, cover all critical parts of the engine air intake tract (air mass meter, intake pipes, etc.) with a clean cloth when blowing out the air cleaner housing with compressed air.*
- *Please observe requirements for disposal.*

– Blow out water drain (small hole in bottom section of air cleaner housing -1-) with compressed air.
– Clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); use a vacuum cleaner if necessary.
– Check for salt residue, dirt and leaves in air mass meter and air hose (engine intake side).
– Check for dirt and leaves in air duct going from lock carrier to air cleaner housing.
– When installing the air filter element, check that it is properly centred in the retainer in the air cleaner housing (bottom section).
– Fit the top section of the air cleaner carefully on the bottom section, without using force (make sure sealing lip and air duct -2- are positioned properly to prevent “unmetered air” from being drawn in).



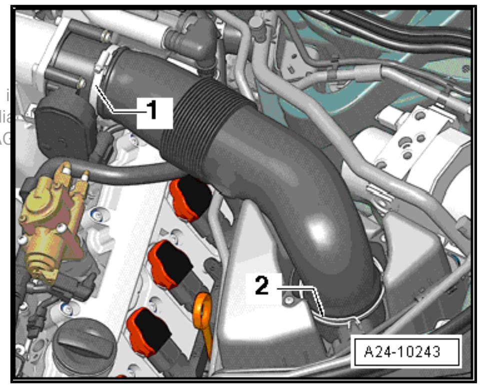
– Make sure that the electrical wiring -1- does not become trapped in the air filter housing when fitting top section of air filter housing.
– Make sure that air intake hose is seated securely between air mass meter -G70- and throttle valve module -J338- .



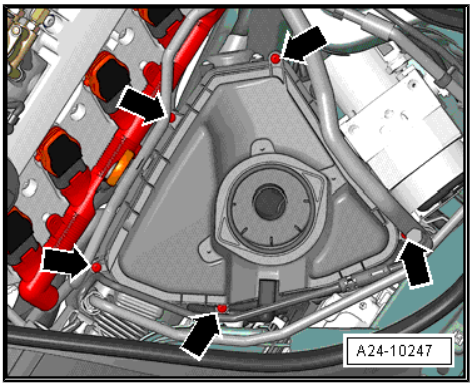
2.5 Removing and installing air filter element (left-side) (cylinder bank 2)

Removing

– Release hose clips -1 and 2- and remove air hose between air mass meter 2 -G246- and throttle valve module 2 -J544- .
– Unplug electrical connector at air mass meter 2 -G246- .



– Remove bolts -arrows-.
– Detach air cleaner housing (top section).
– Pull out air filter element.



Note

Make sure no dirt gets into the air cleaner housing or air mass meter.

Installing

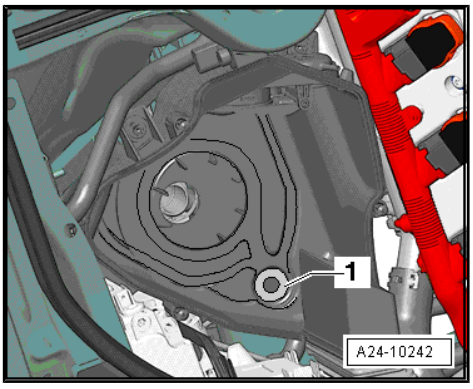
Installation is carried out in the reverse order; note the following:

To ensure the proper function of the air mass meter 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.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- *To prevent malfunctions, cover all critical parts of the engine air intake tract (air mass meter, intake pipes, etc.) with a clean cloth when blowing out the air cleaner housing with compressed air.*
- *Please observe requirements for disposal.*

– Blow out water drain (small hole in bottom section of air cleaner housing -1-) with compressed air.



Note

The illustration shows the bottom section of the air cleaner housing (right-side). Left side is similar.

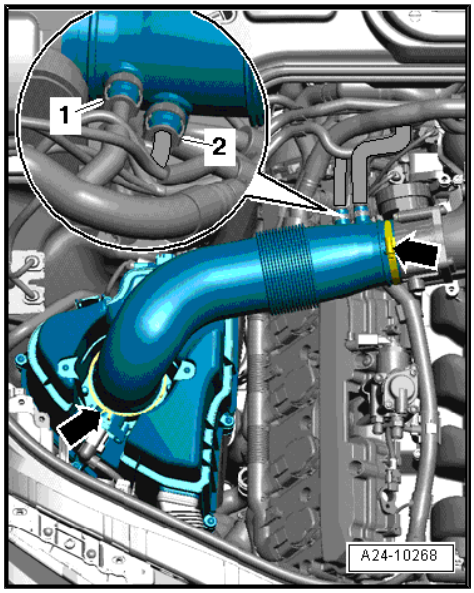
– Clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); use a vacuum cleaner if necessary.
– Check for salt residue, dirt and leaves in air mass meter and air hose (engine intake side).
– Check for dirt and leaves in air duct going from lock carrier to air cleaner housing.
– When installing the air filter element, check that it is properly centred in the retainer in the air cleaner housing (bottom section).
– Fit the top section of the air cleaner carefully on the bottom section, without using force (make sure sealing lip and air duct are positioned properly to prevent “unmetered air” from being drawn in).
– Make sure that air intake hose is seated securely between air mass meter 2 -G246- and throttle valve module 2 -J544- .

2.6 Removing and installing air mass meter -G70- (cylinder bank 1)

Removing

– Release hose clips -arrows- and remove air hose between air mass meter -G70- and throttle valve module -J338- .

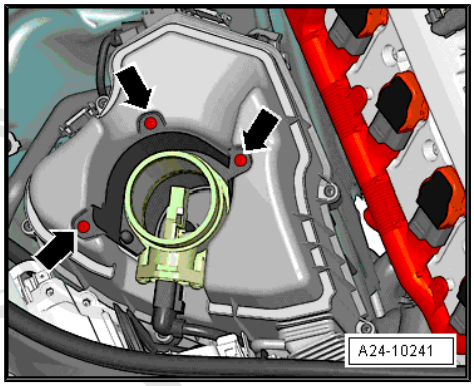
– Move air hose to one side, with vacuum hoses -1 and 2- connected.



– Unscrew the three bolts from air mass meter -G70- -arrows-.

– Then carefully pull air mass meter -G70- out of guide on air cleaner housing (top section).

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



Installing

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

Note

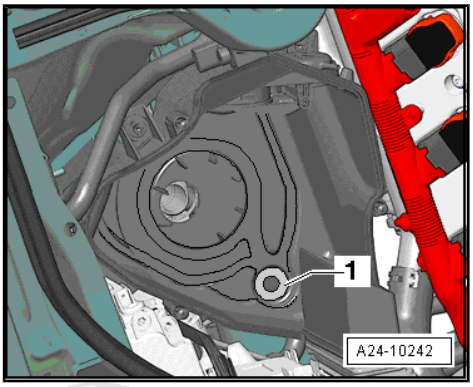
- *If the air filter element is very dirty or wet, dirt or water could reach the air mass meter and affect the air mass value. This would lead to loss of power, since a smaller injection quantity is calculated.*
- *Always use genuine part for air filter element.*
- *Always renew O-ring on air mass meter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

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

– Check for dirt in air duct leading to air filter element. If necessary, clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); wash out or use a vacuum cleaner as required. Removing and installing top section of air cleaner housing ⇒ page 14

– If top section of air cleaner housing has been removed check water drain -1- in bottom section of air cleaner housing for dirt and other obstructions (if necessary clean by blowing it out).
– Make sure that air intake hose is seated securely between air mass meter -G70- and throttle valve module -J338- .

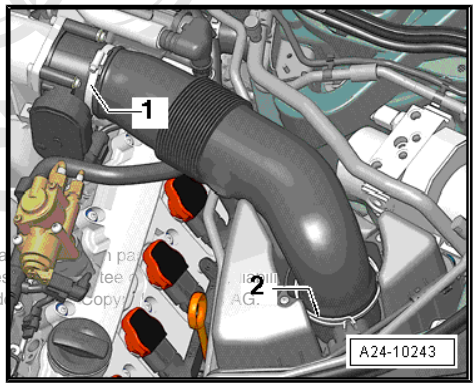
The remaining installation steps are carried out in the reverse sequence.



2.7 Removing and installing air mass meter 2 -G246- (cylinder bank 2)

Removing

– Release hose clips -arrows- and remove air hose between air mass meter 2 -G246- and throttle valve module 2 -J544- .
– Unscrew the three bolts from air mass meter 2 -G246- .
– Then carefully pull air mass meter 2 -G246- out of guide on air cleaner housing (top section).
– Unplug electrical connector at air mass meter 2 -G246- .



Installing

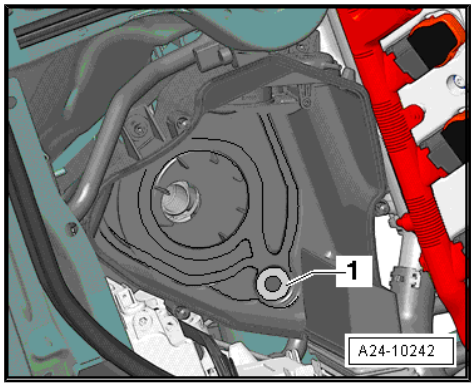
To ensure the proper function of the air mass meter it is important to observe the following notes and instructions.

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.*
- *Always renew O-ring on air mass meter if damaged (air leak).*
- *Use silicone-free lubricant when fitting air hose.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*

– Check for salt residue, dirt and leaves in air mass meter and air intake hose (engine intake side).
– Check for dirt in air duct leading to air filter element. If necessary, clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); wash out or use a vacuum cleaner as required. Removing and installing top section of air cleaner housing

– If top section of air cleaner housing has been removed check water drain -1- in bottom section of air cleaner housing for dirt and other obstructions (if necessary clean by blowing it out).



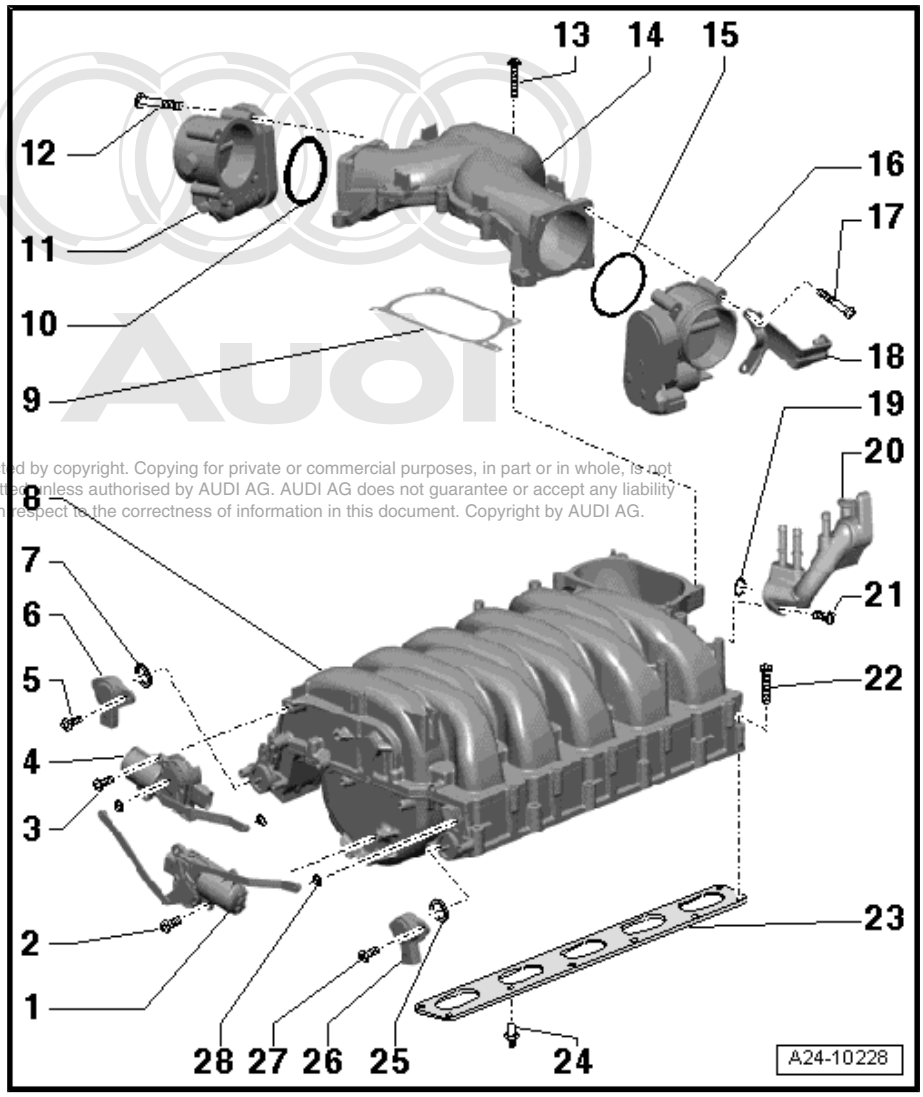
Note

The illustration shows the bottom section of the air cleaner housing (right-side).

– Make sure that air intake hose is seated securely between air mass meter 2 -G246- and throttle valve module 2 -J544- .

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

2.8 Intake manifold - exploded view



1 - Intake manifold flap motor -V157-

2 - Bolt
- ❑ 9 Nm

3 - Bolt
- ❑ 9 Nm

4 - Variable intake manifold motor -V183-

5 - Bolt
- ❑ 2.5 Nm

6 - Intake manifold flap potentiometer -G336-
- ❑ Right cylinder bank
- ❑ After renewing, perform “Adaption” in “Guided Functions”, vehicle diagnostic, testing and information system -VAS 5051B- .

7 - Seal
- ❑ Renew if damaged
- ❑ Open side faces towards intake manifold flap potentiometer -G336-

8 - Intake manifold
- ❑ Removing and installing

9 - Gasket
- ❑ Renew

10 - Seal
- ❑ Renew

11 - Throttle valve module -J338-
- ❑ After renewing, perform “Adaption” in “Guided Functions”, vehicle diagnostic, testing and information system -VAS 5051B- .

12 - Bolt
- ❑ 9 Nm

13 - Bolt

- ❑ 9 Nm

14 - Air duct

15 - Seal

- ❑ Renew

16 - Throttle valve module 2 -J544-

- ❑ After renewing, perform “Adaption” in “Guided Functions”, vehicle diagnostic, testing and information system -VAS 5051B- .

17 - Bolt

- ❑ 9 Nm

18 - Bracket

19 - O-ring

- ❑ Renew

20 - Connecting piece with coolant connection

- ❑ For crankcase breather

21 - Bolt

- ❑ 9 Nm

22 - Bolts

- ❑ Renew
- ❑ Tighten initially to 8 Nm
- ❑ Subsequently tighten to 9 Nm and then tighten 90° further

23 - Intake manifold gasket

- ❑ Renew

24 - Locating pin

- ❑ 2x
- ❑ Check whether fitted

25 - Seal

- ❑ Renew if damaged
- ❑ Open side faces towards intake manifold flap potentiometer 2 -G512-

26 - Intake manifold flap potentiometer 2 -G512-

- ❑ Left cylinder bank
- ❑ After renewing, perform “Adaption” in “Guided Functions”, vehicle diagnostic, testing and information system -VAS 5051B- .

27 - Bolt

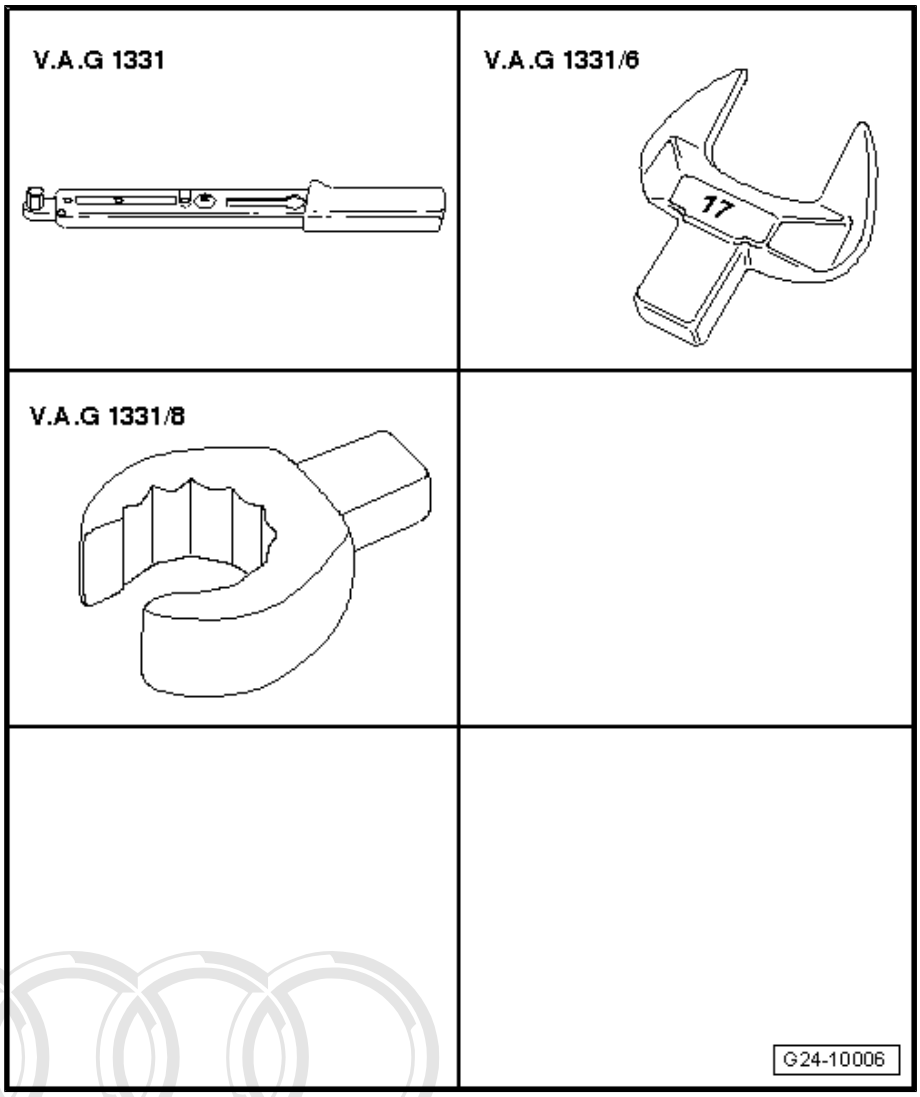
- ❑ 2.5 Nm

28 - Circlip

2.9 Removing and installing intake manifold

Special tools and workshop equipment required

- Torque wrench -V.A.G 1331-
- Tool insert AF 17 -V.A.G 1331/6-
- Socket insert AF 14, flared ring spanner -V.A.G 1331/8-



Removing

WARNING

- *The fuel system operates under high pressure. The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ page 2 .*
- *A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.*

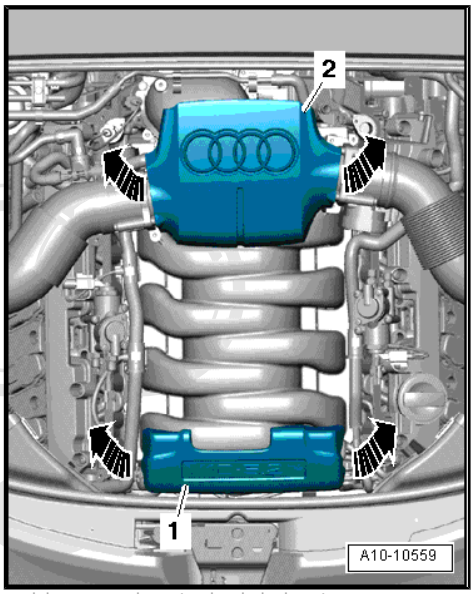
Note

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

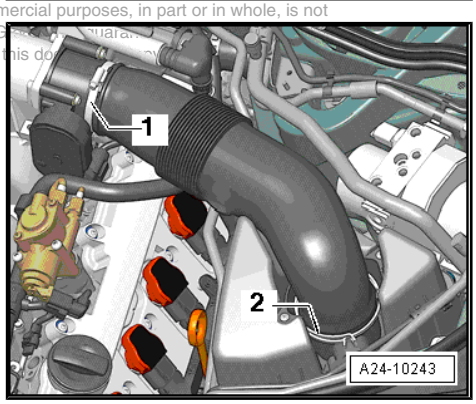
Caution

Observe notes on procedure for disconnecting the battery ⇒ Rep. Gr. 27 .

– Disconnect earth wire at battery with ignition switched off.
– Drain off coolant ⇒ Rep. Gr. 19 .
– Remove radiator ⇒ Rep. Gr. 19 .
– Remove radiator cowl ⇒ Rep. Gr. 19 .
– Pull off engine cover panels at front -1- and at rear -2- -arrows-.



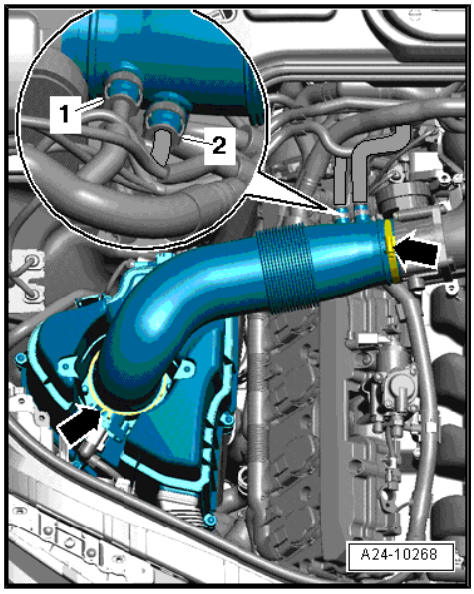
– Remove air hose (left-side) -1 and 2-.
– Disconnect vacuum hoses -1- and -2-.



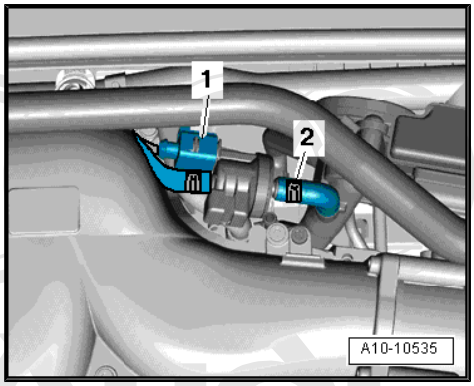
– Remove air hose (right-side) -arrows-.

Caution

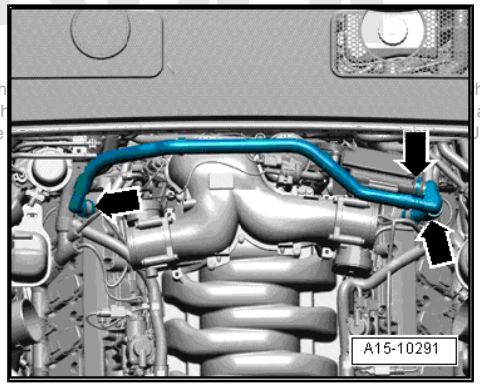
Do not disconnect crankcase breather vacuum hose -1- on USA models. Move air pipe clear instead (vacuum hose remains connected).



– Unplug electrical connector -1- at activated charcoal filter solenoid valve 1 -N80- .
– Detach vacuum hose -2- coming from activated charcoal filter solenoid valve 1 -N80- .
– Detach activated charcoal filter solenoid valve 1 -N80- from bracket and move it clear to the side with hose still attached.



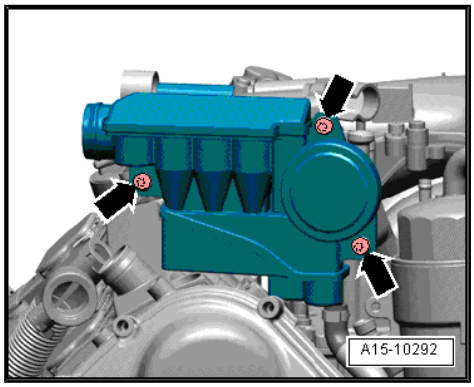
– Remove vacuum hose for crankcase breather system -arrows-.



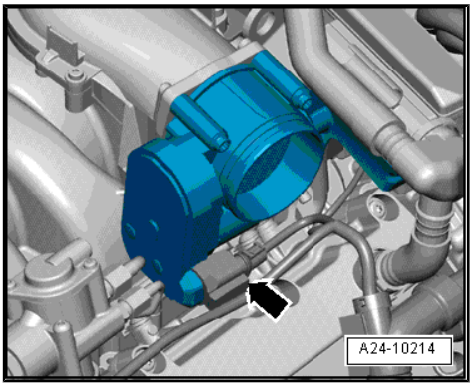
– Remove bolts -arrows-.
– Detach pressure control valve for crankcase breather system towards the rear.

Note

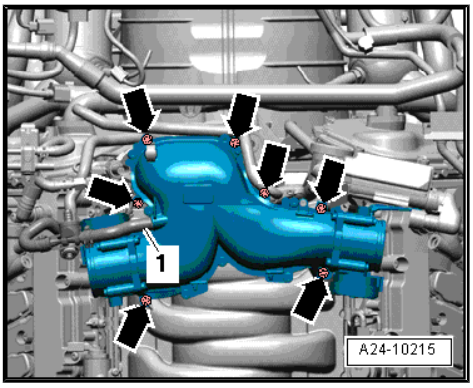
The pressure control valve for the crankcase breather system remains in the engine compartment with the return hose connected.



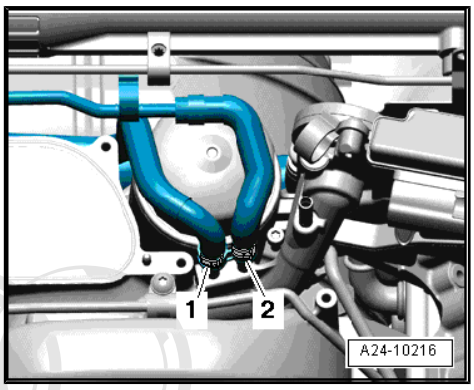
– Unplug electrical connectors -arrow- on left and right of intake manifold at throttle valve module -J338- and throttle valve module 2 -J544- .



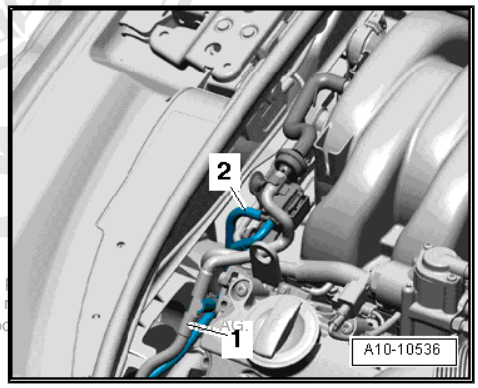
– Detach vacuum hose -1- from intake manifold.
– Unscrew bolts -arrows- and remove air duct.



– Detach coolant hoses -1- and -2- from intake connecting pipe.



– Pull bonnet seal off lock carrier and wing panels.
– Disconnect vacuum hoses -1- and -2-.
– Move vacuum hoses clear.



– Unplug electrical connectors for:

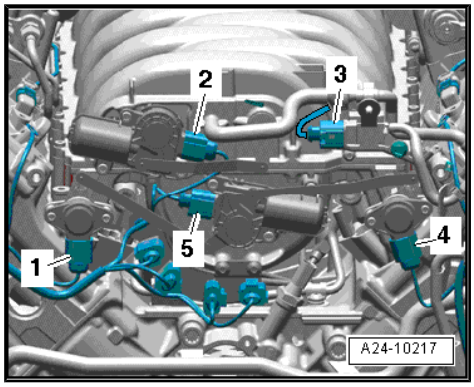
1 - Intake manifold flap potentiometer -G336-

2 - Variable intake manifold motor -V183- (black connector)

3 - Secondary air inlet valve -N112-

4 - Intake manifold flap potentiometer 2 -G512-

5 - Intake manifold flap motor -V157- (blue connector)



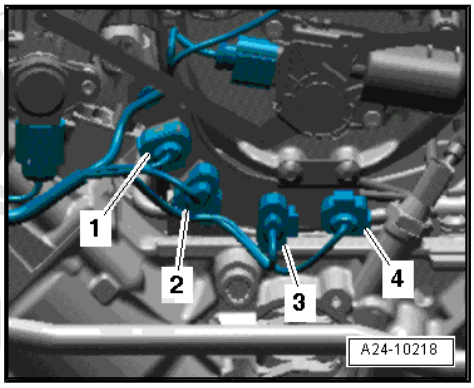
– Unplug electrical connectors for:

1 - Knock sensor 2 -G66- (grey connector)

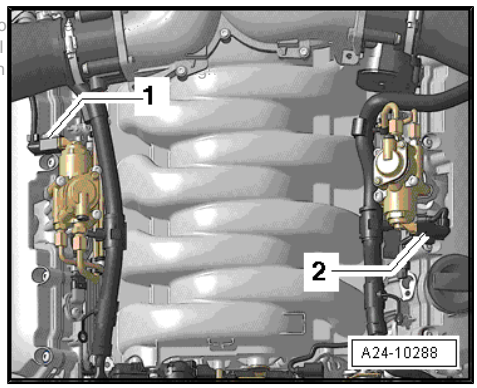
2 - Knock sensor 1 -G61- (orange connector)

3 - Knock sensor 3 -G198- (white connector)

4 - Knock sensor 4 -G199- (blue connector)

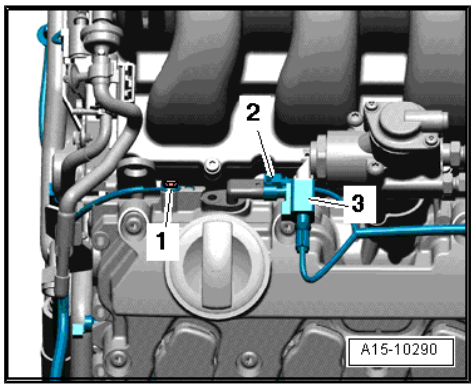


– Unplug electrical connectors for fuel metering valve -N290- -1- and fuel metering valve 2 -N402- -2-.



– Unplug electrical connectors (left and right) -2- at Hall sender -G40- and Hall sender 2 -G163- on cylinder head.

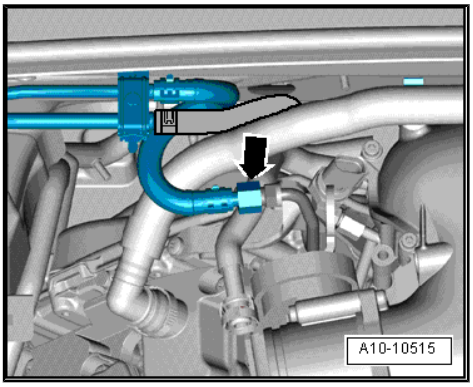
– Unbolt earth cable (left and right) -1- at cylinder head.



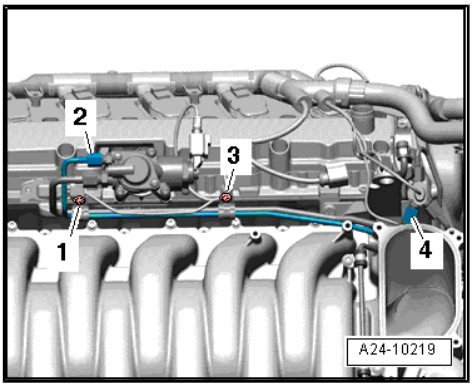
– Disconnect fuel supply pipe -arrow-.

WARNING

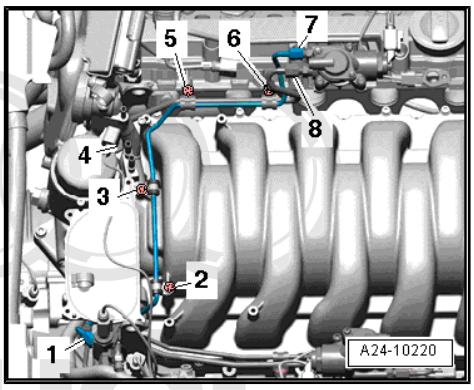
The fuel system is pressurised. Before opening the system place a clean cloth around the connection. Then release pressure by carefully loosening the connection.



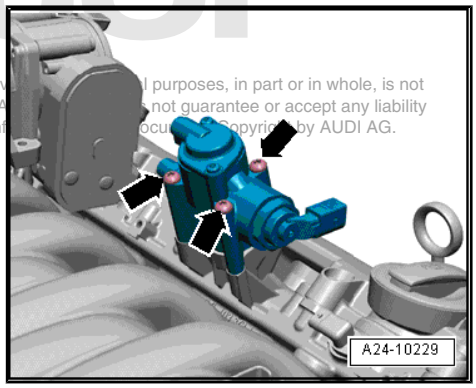
– Loosen bolts -1 ... 4- and detach fuel supply pipe leading to high-pressure pump (right-side).



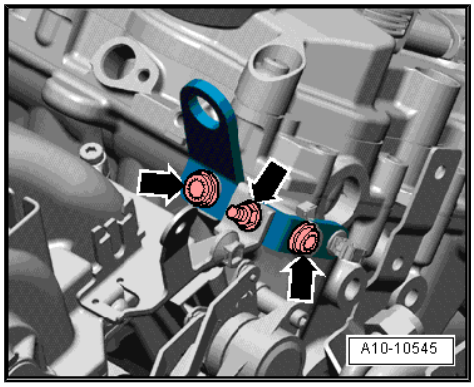
– Loosen bolts -1 ... 8- and detach fuel supply pipe and high-pressure pipe leading to high-pressure pump (left-side).



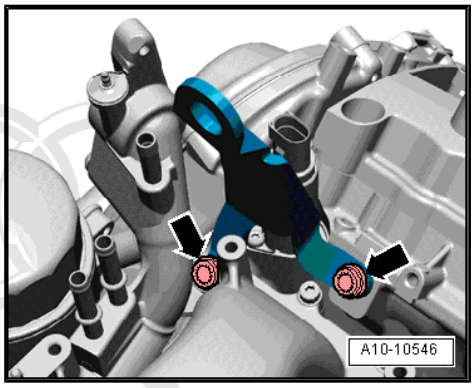
– Unscrew bolts on left and right -arrows- and detach both high-pressure pumps.



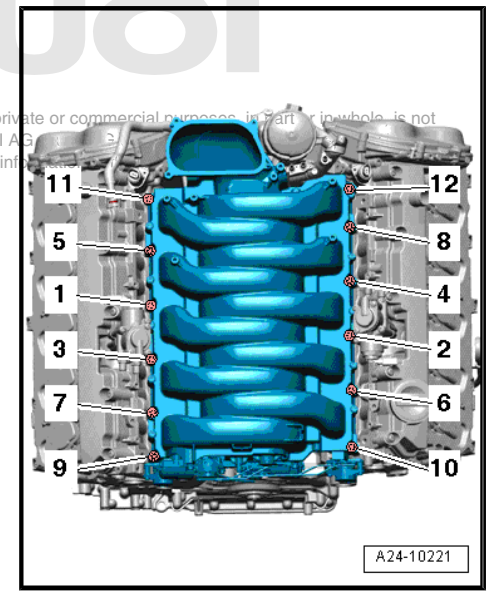
– Unscrew the bolts and the nut -arrows- and remove engine lifting eye (front left).



– Unscrew bolts -arrows- and remove engine lifting eye (rear left).



– Remove intake manifold bolts in the sequence -12 ... 1-.
– Remove intake manifold from engine compartment.



Note

Seal intake ports on cylinder heads with clean cloths.

Installing

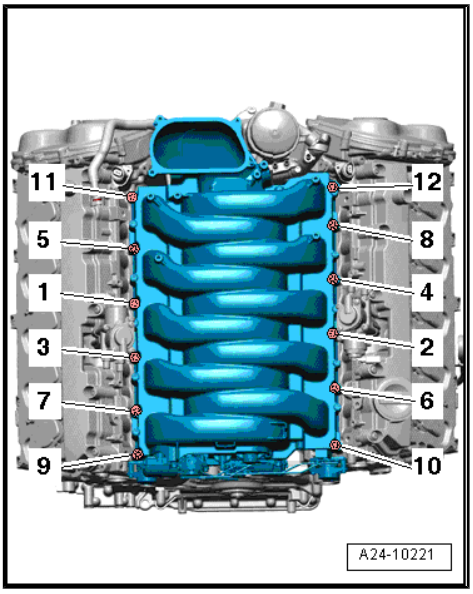
Installation is carried out in the reverse order; note the following:

Note

- *Renew gaskets, seals and O-rings.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- *Fit all cable ties in the original positions when installing.*

– Renew intake manifold gaskets (note locating pins).
– Observe locating pins when fitting intake manifold.
• Tightening torque: refer to intake manifold - exploded view ⇒ page 20

– Tighten bolts for intake manifold in 2 stages.



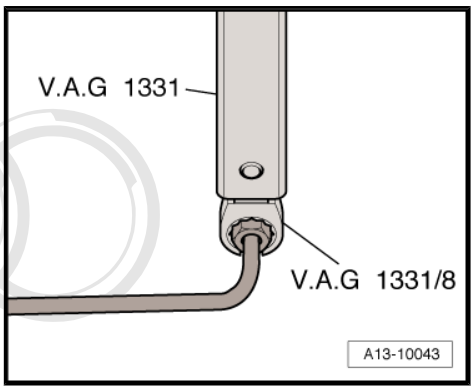
Note

- *The connections of the high-pressure pipes must not be damaged.*
- *Do not attempt to bend high-pressure pipes to a different shape.*

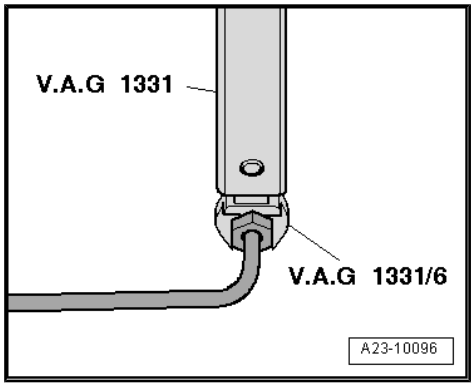
– Tighten union nuts on high-pressure pipes hand-tight initially.

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

– To tighten union nut (14 mm) for high-pressure pipes, use torque wrench -V.A.G 1331- with socket insert AF 14, flared ring spanner -V.A.G 1331/8- .



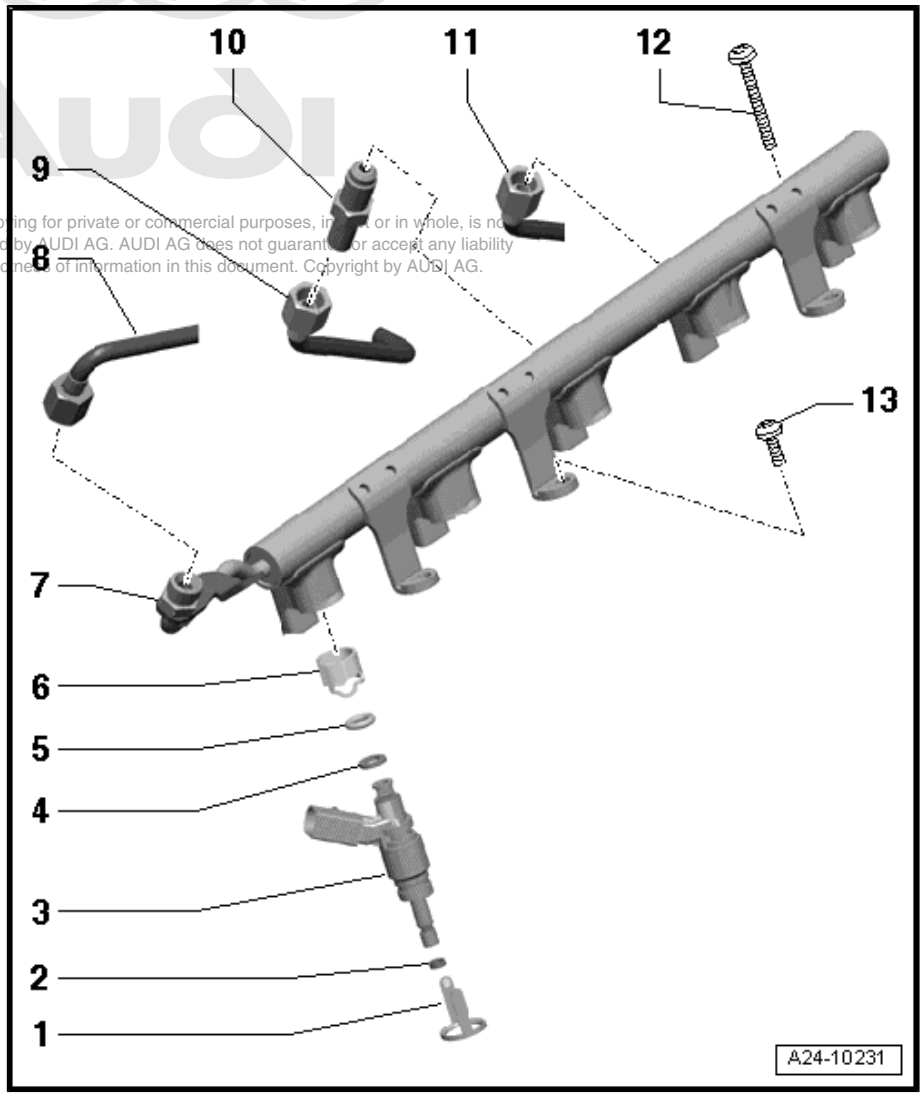
– To tighten union nut (17 mm) for high-pressure pipes, use torque wrench -V.A.G 1331- with tool insert AF 17 -V.A.G 1331/6- .
– Do not install mounting brackets until high-pressure pipes have been finally secured.
– Install high-pressure pumps (right and left) ⇒ page 34 .
– Install radiator cowl ⇒ Rep. Gr. 19 .
– Install radiator ⇒ Rep. Gr. 19 .
– Fill system with coolant ⇒ Rep. Gr. 19 .
– Observe notes on procedures required after connecting battery ⇒ Rep. Gr. 27 .



Tightening torques

Component		Nm
Engine lifting eye to cylinder head		22
High-pressure pipes to:	Fuel rail	25
	High-pressure pump	25
Pipe/wiring retainer to intake manifold		9
Cap on oil filter housing		25
Fuel supply line to fuel rail		25
Air duct to intake manifold		9

2.10 Injectors and fuel rail - exploded view



1 - Radial compensation element

- ❑ Renew if damaged
- ❑ Clip onto support ring ⇒ Item 6 (page 31)

2 - Combustion chamber ring seal

- ❑ Do not apply grease to ring seal or use any other lubricants
- ❑ Renewing ⇒ “2.13 Removing and installing injectors”, page 37

3 - Injector

- ❑ Removing and installing ⇒ page 37

4 - Spacer ring

- ❑ Renew if damaged

5 - O-ring

- ❑ Renew
- ❑ Lubricate lightly with clean engine oil

6 - Support ring

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

7 - Fuel rail

8 - High-pressure pipe

> **WARNING**
>
> *The fuel system operates under high pressure. The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ page 2 .*
>
> *A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.*

- ❑ Connections must not be damaged
- ❑ Do not alter shape
- ❑ Tighten to 25 Nm

9 - High-pressure pipe

> **WARNING**
> *The fuel system operates under high pressure. The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ page 2 .*
>
> *A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.*

- ❑ Connections must not be damaged
- ❑ Do not alter shape
- ❑ Tighten to 25 Nm

10 - Pressure relief valve, 120 bar

- ❑ For high-pressure pipe
- ❑ Tighten to 25 Nm

11 - High-pressure pipe

> **WARNING**
> *The fuel system operates under high pressure. The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ page 2 .*
>
> *A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.*

- ❑ Connections must not be damaged
- ❑ Do not alter shape
- ❑ Tighten to 25 Nm

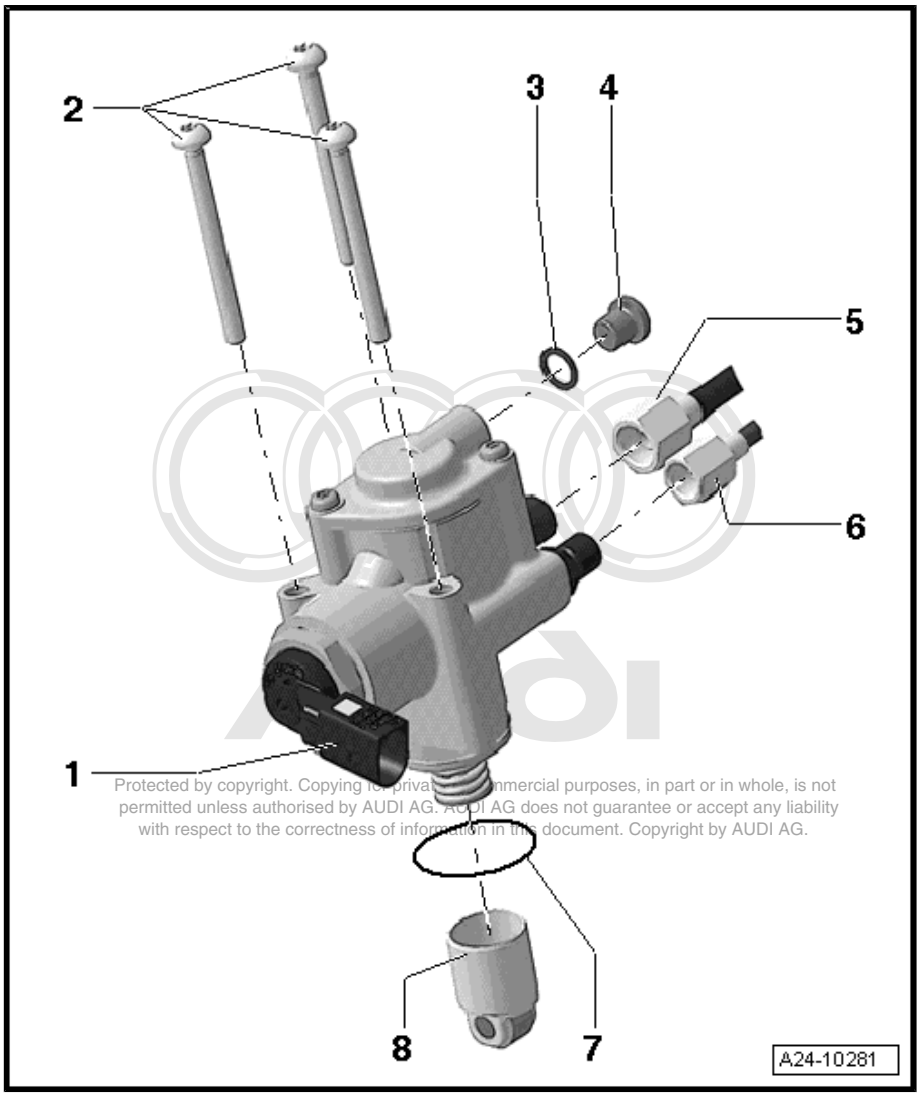
12 - Bolts

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

13 - Bolts

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

2.11 High-pressure pump - exploded view



1 - High-pressure pump

- ❑ Removing and installing ⇒ page 34

2 - Bolt

- ❑ 9 Nm

3 - Seal

- ❑ Renew

4 - Screw plug

- ❑ 10 Nm

5 - High-pressure pipe

> **WARNING**
>
> *The fuel system operates under high pressure. The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ page 2 .*
>
> *A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.*

- ❑ Connections must not be damaged
- ❑ Do not alter shape
- ❑ 25 Nm

6 - High-pressure pipe (fuel supply pipe)

> **WARNING**
>
> *The fuel system operates under high pressure. The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ page 2 .*
>
> *A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.*

- ❑ Connections must not be damaged
- ❑ Do not alter shape
- ❑ 25 Nm

7 - O-ring

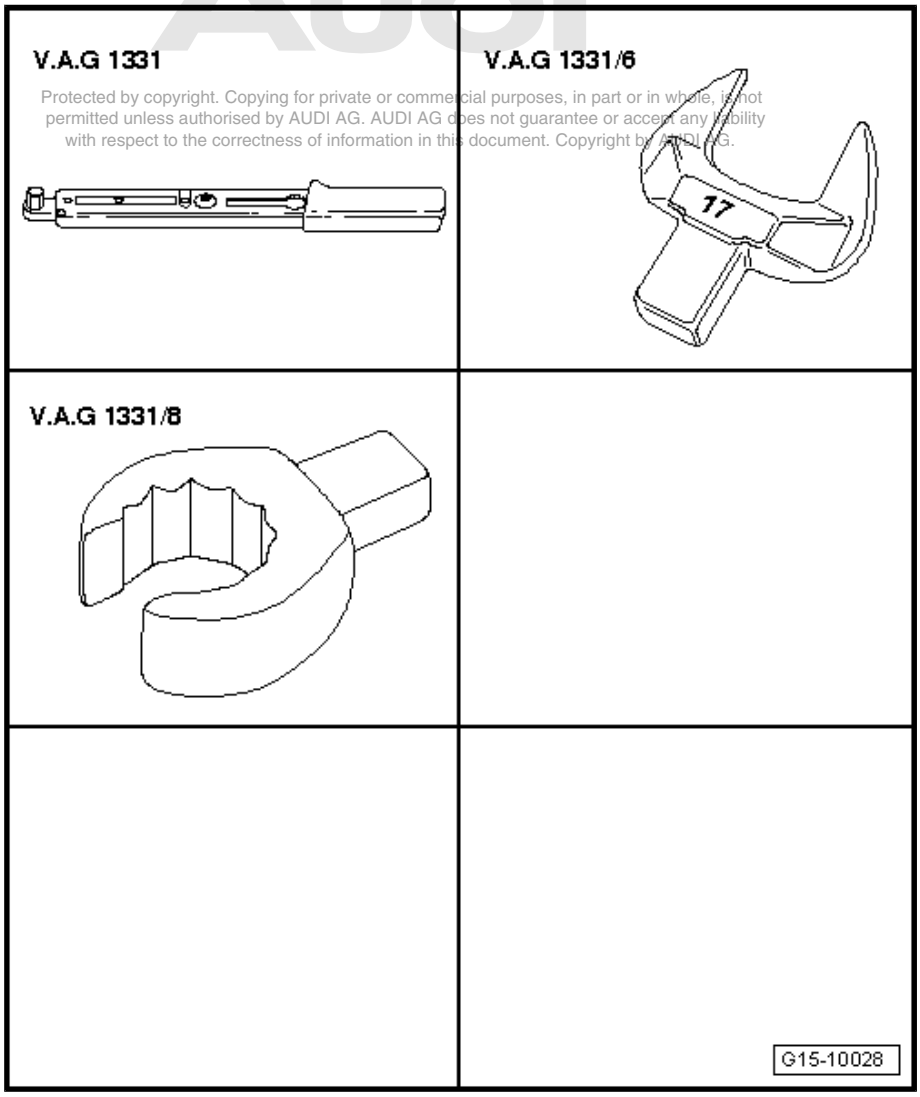
- ❑ Renew

8 - Roller tappet

2.12 Removing and installing high-pressure pumps

Special tools and workshop equipment required

- Torque wrench -V.A.G 1331-
- Tool insert AF 17 -V.A.G 1331/6-
- Socket insert AF 14, flared ring spanner -V.A.G 1331/8-



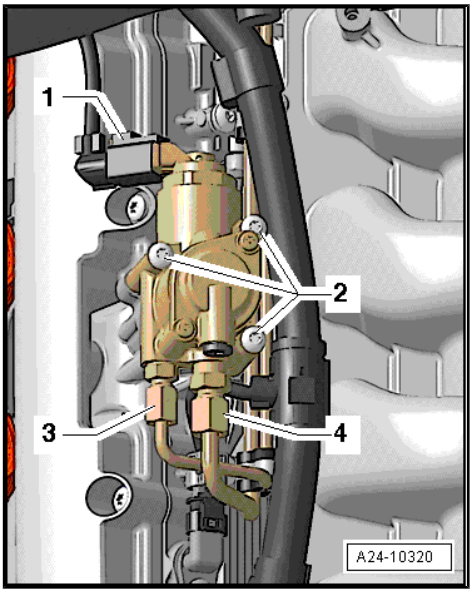
Removing

WARNING

- *The fuel system operates under high pressure. The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ page 2 .*
- *A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.*
- *Observe notes on procedure for disconnecting the battery ⇒ Rep. Gr. 27 .*

– In each case, unplug electrical connector -1- from high-pressure pump.

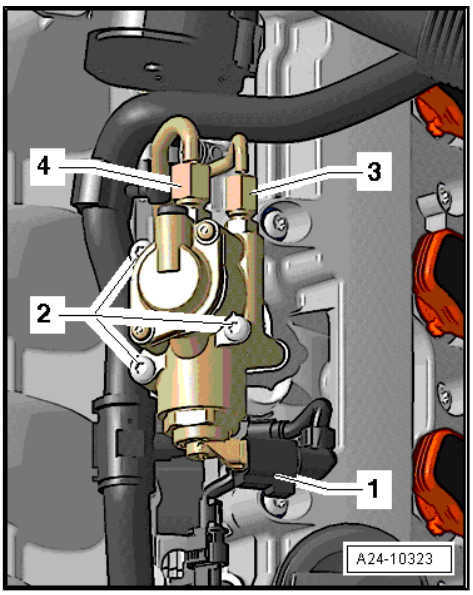
High-pressure pump (right-side)



High-pressure pump (left-side)

– Unfasten union nuts -3- and -4-.

– Remove bolts -2-.



Note

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

– Carefully pull out high-pressure pump.

– Pull roller tappet out of cylinder head.

Installing

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

For correct torque settings refer to exploded view of components ⇒ page 33 .

Note

Always renew O-ring.

– Fit roller tappet in cylinder head.

– Only lift high-pressure pipes slightly to fit the high-pressure pump.

– Insert high-pressure pump with new O-ring in cylinder head and tighten.

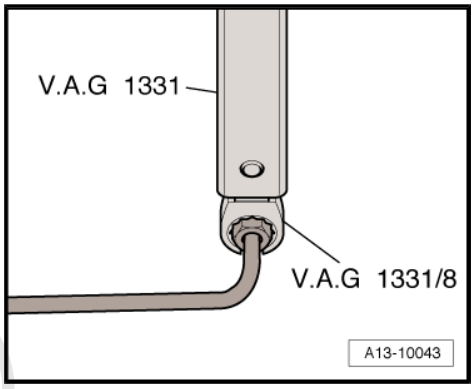
Note

- *The connections of the high-pressure pipes must not be damaged.*
- *Do not attempt to bend high-pressure pipes to a different shape.*

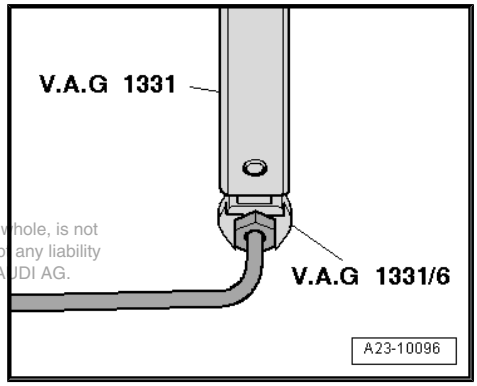
– Tighten union nuts on high-pressure pipes hand-tight initially.

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

– To tighten union nut (14 mm) for high-pressure pipe, use torque wrench -V.A.G 1331- with socket insert, 14 mm (open ring spanner) -V.A.G 1331/8- .



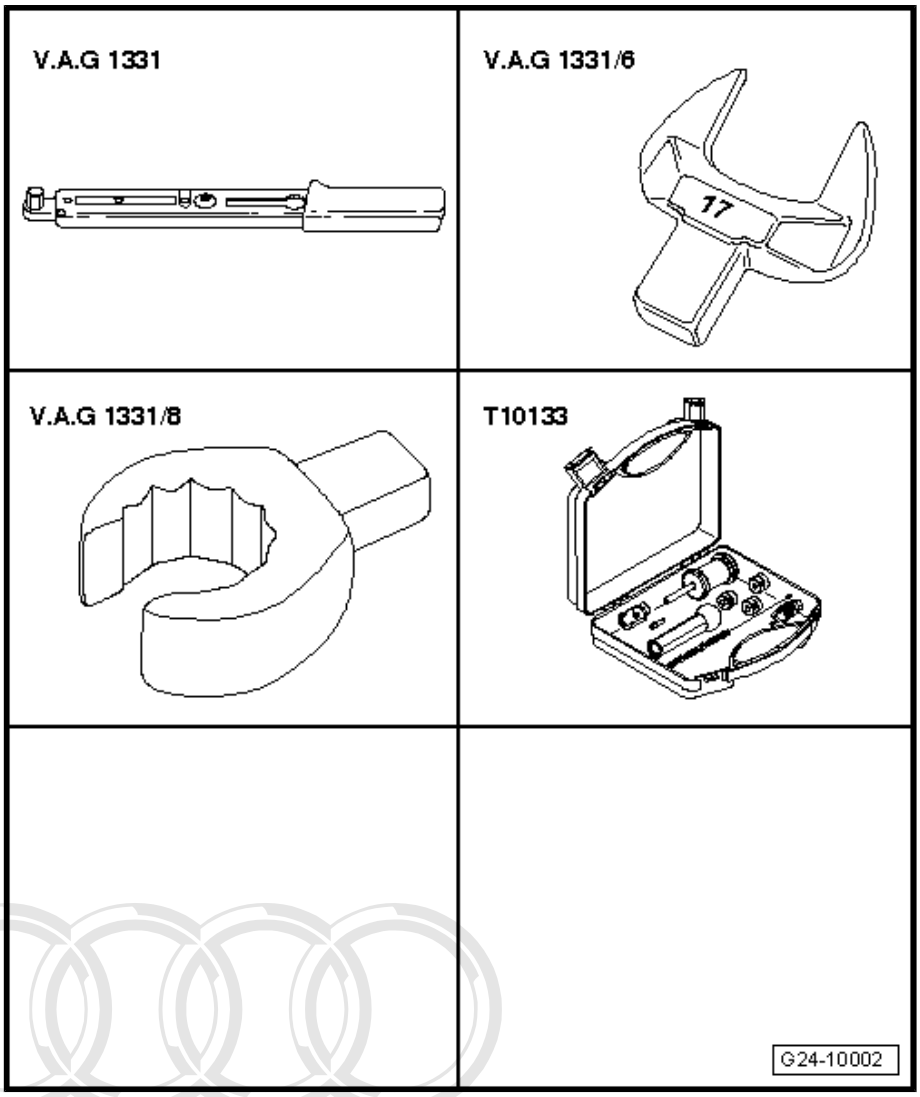
– To tighten union nut (17 mm) for high-pressure pipe, use torque wrench -V.A.G 1331- with tool insert AF 17 -V.A.G 1331/6- .



2.13 Removing and installing injectors

Special tools and workshop equipment required

- Torque wrench -V.A.G 1331-
- Tool insert AF 17 -V.A.G 1331/6-
- Socket insert AF 14, flared ring spanner -V.A.G 1331/8-
- Tool set -T10133- with -T10133/10-



Removing

WARNING

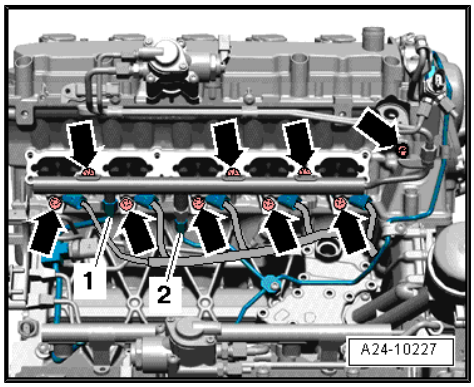
- *The fuel system operates under high pressure. The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ page 2 .*
- *A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.*
- *Observe notes on procedure for disconnecting the battery ⇒ Rep. Gr. 27 .*

– Remove intake manifold ⇒ page 22 .

Note

Seal off the injector openings in the cylinder heads with clean cloths.

– Unplug electrical connectors at injectors.
– Unscrew high-pressure pipe -1- at connection on fuel rail.
– Unscrew high-pressure pipe -2- at connection on fuel rail. To do so, counterhold at hexagon flats with an open-end spanner and slacken union nut.
– Remove bolts -arrows-.



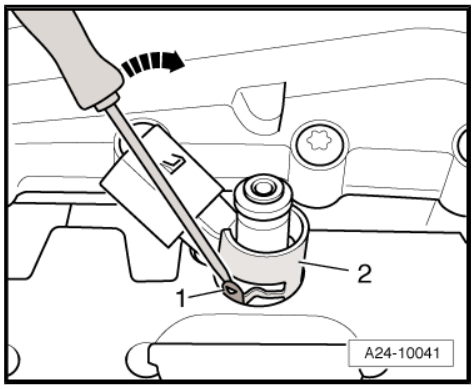
Note

- *Illustration shows left-side cylinder head.*
- *Do not attempt to bend high-pressure pipes to a different shape.*

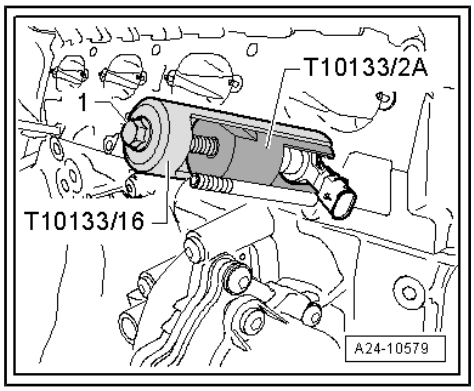
– Pull off fuel rail together with injectors.

If injectors cannot be pulled out of cylinder head by hand, proceed as follows:

– Use a screwdriver to bend retainer tabs -1- of radial compensation element to side -arrow- and pull support ring -2- off injector.
– Remove O-ring from injector.



– Guide puller -T10133/2A- into groove on injector.
– Then attach removal tool -T10133/16- and pull out injector by turning bolt -1-.

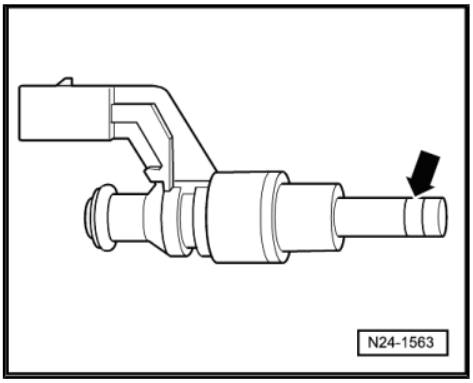


Note

- *When inserting the puller, there is a risk of destroying the radial compensation element due to the retainer tabs breaking.*
- *The combustion chamber ring seal must always be renewed prior to reinstalling the high-pressure injector.*

Renewing combustion chamber ring seal (teflon ring seal)

– Carefully remove old teflon ring -arrow- using suitable tools (e.g. cut open ring using razor blade, or prise open ring with small screwdriver and then pull off forwards). It is important to ensure that the groove and the continuous ridge in the bottom of the groove are not damaged.



Note

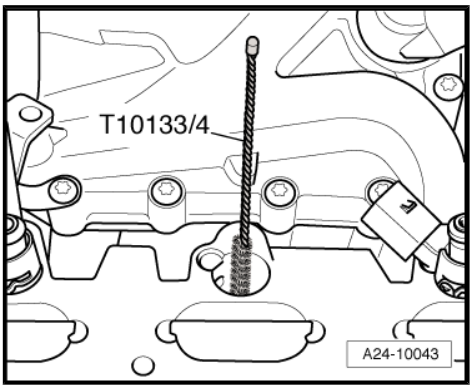
The injector must be renewed if the groove is damaged.

Installing

Note

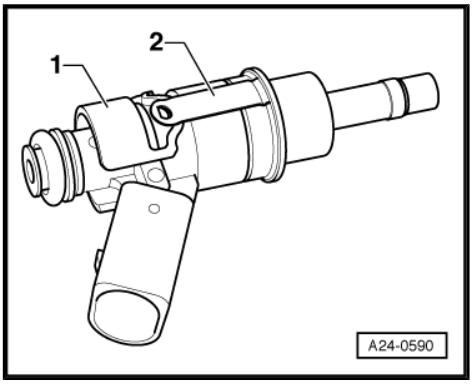
- *Renew combustion chamber ring seal and O-ring.*
- *Renew spacer ring if damaged.*
- *Lightly lubricate O-rings for injectors with clean engine oil.*
- *The injector pipes must be re-installed on the same cylinders.*

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

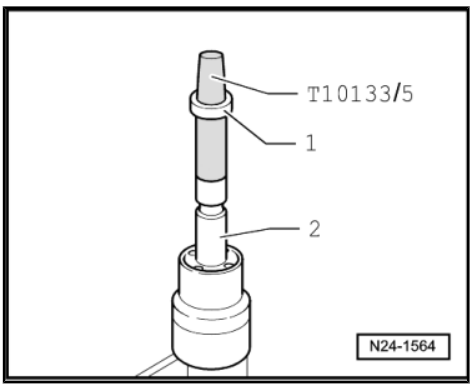


– Clip radial compensation element -1- into support ring -2-.

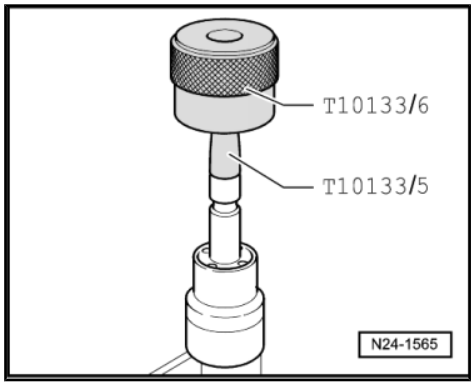
– When re-installing an injector, clean any combustion residue off groove for combustion chamber ring seal and injector stem with a clean cloth.



– Fit assembly cone -T10133/5- with new combustion-chamber ring seal -1- onto injector -2-.



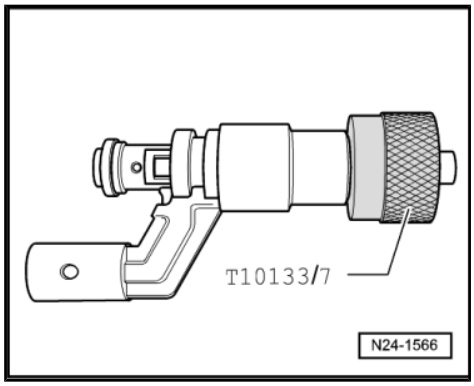
– Push combustion-chamber ring seal onto assembly cone -T10133/5- as far as it will go using assembly sleeve -T10133/6- .
– Turn assembly sleeve -T10133/6- upside down and push combustion-chamber ring seal into groove.



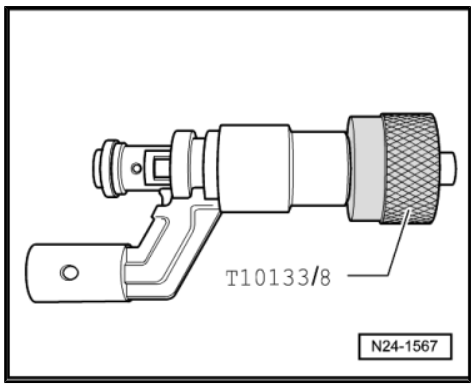
Note

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

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



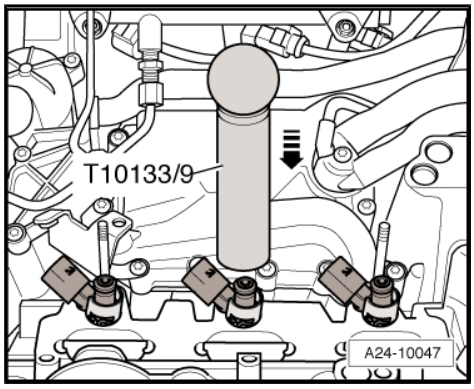
– Push calibration sleeve -T10133/8- onto injector as far as it will go and simultaneously turn it slightly (approx. 180°).
– Pull calibration sleeve -T10133/8- off again by turning it in the opposite direction.
– Lubricate new O-ring lightly with clean engine oil before installing.



Note

The combustion chamber ring seal must not be lubricated.

– Use assembly tool -T10133/9- to push injector as far as it will go into hole in cylinder head.



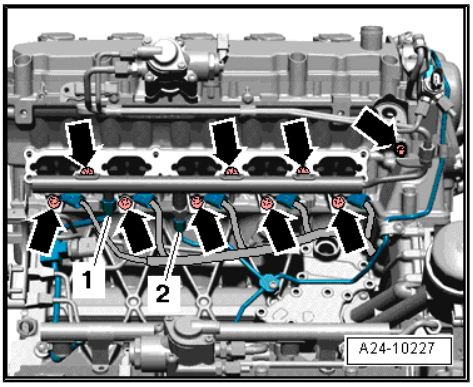
Note

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

– Make sure injector is in correct installation position in cylinder head:

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

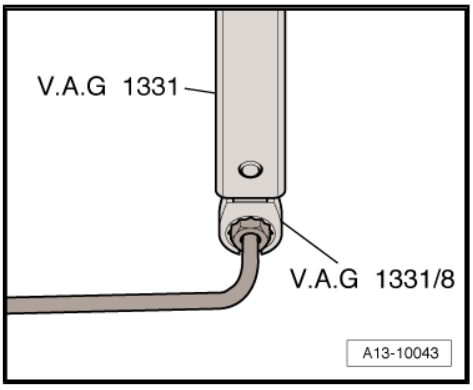
– Press fuel rail evenly onto injectors.
– Tighten bolts -arrows- in stages and in diagonal sequence.



Note

- *The connections of the high-pressure pipes must not be damaged.*
- *Do not attempt to bend high-pressure pipes to a different shape.*

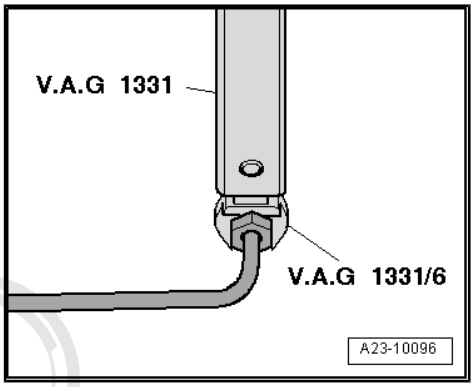
– Tighten union nuts on high-pressure pipes hand-tight initially.
– Ensure that high-pressure pipes are not under tension.
– To tighten union nut (14 mm) for high-pressure pipe, use torque wrench -V.A.G 1331- with socket insert, 14 mm (open ring spanner) -V.A.G 1331/8- .



– To tighten union nut (17 mm) for high-pressure pipe, use torque wrench -V.A.G 1331- with tool insert AF 17 -V.A.G 1331/6- .
– Do not install mounting brackets until high-pressure pipes have been finally secured.

Perform further installation in reverse order, paying attention to the following:

– Install intake manifold ⇒ page 22 .



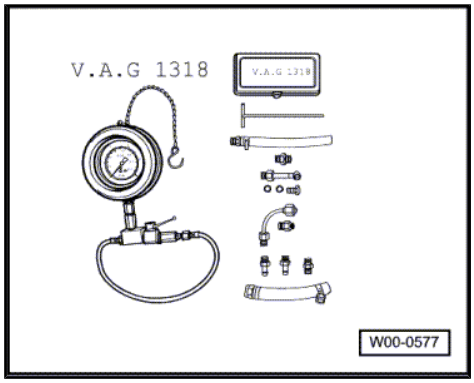
Tightening torques

Component	Nm
Fuel rail to cylinder head	9
High-pressure pipes to fuel rail	25
Engine lifting eye to cylinder head	22

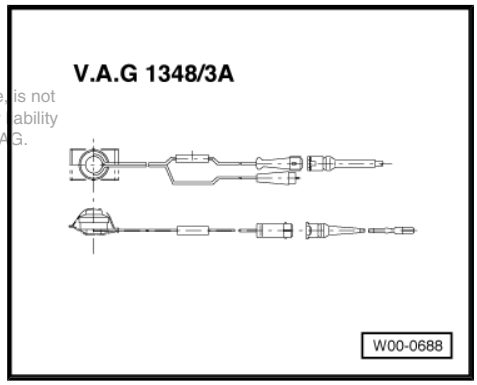
2.14 Checking fuel pressure and residual pressure (up to high-pressure pump)

Special tools and workshop equipment required

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



- Adapter set -V.A.G 1318/10-12-
- Remote control -V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3-



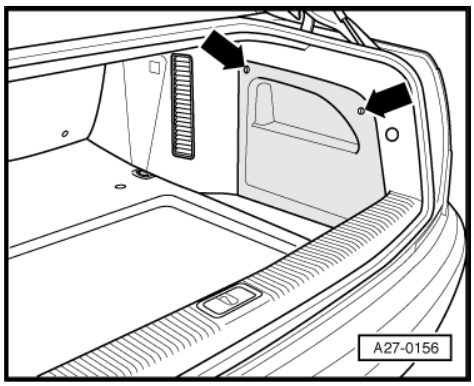
- Fuel-resistant measuring container

Test condition

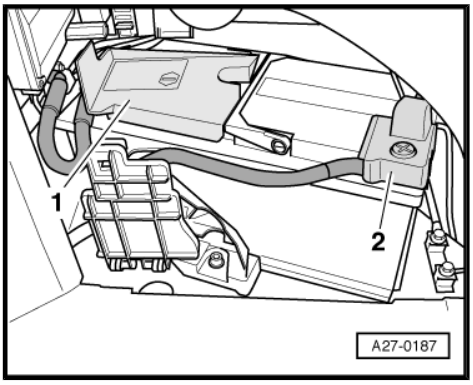
- Battery voltage at least 12.5 Volts.
- Fuel pump control unit -J538- OK; check in “Guided Fault Finding” using vehicle diagnostic, testing and information system -VAS 5051B- .
- Fuel filter OK
- Fuel tank at least $^1/_4$ full.
- Ignition off.

Checking fuel pressure

– Remove luggage compartment side trim cover (right-side) -arrows-.



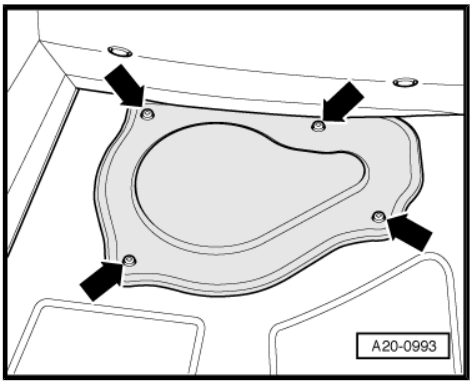
– Remove cover -2- over battery.



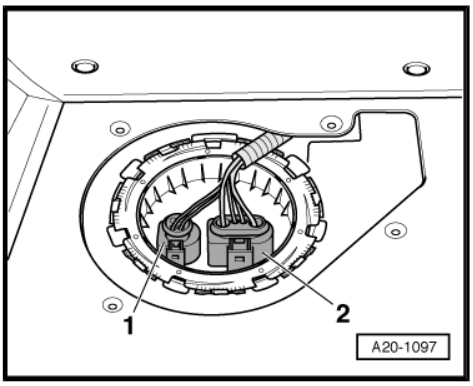
Note

Disregard -item 1-.

– Remove luggage compartment floor lining.
– Detach cover for flange (left-side) -arrows-.



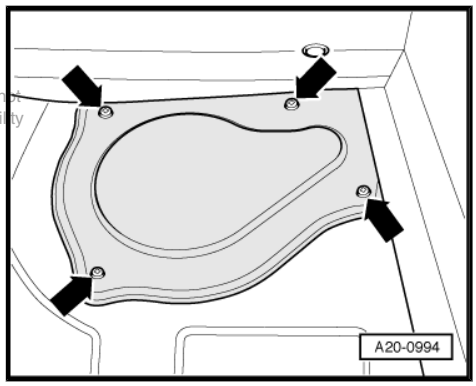
– Unplug electrical connector -2- on flange (left-side).



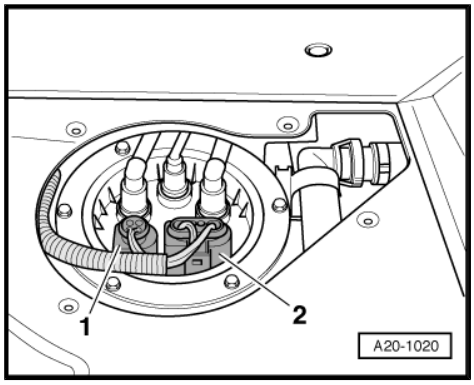
Note

Disregard -item 1-.

– Unscrew cover for flange (right-side) -arrows-.



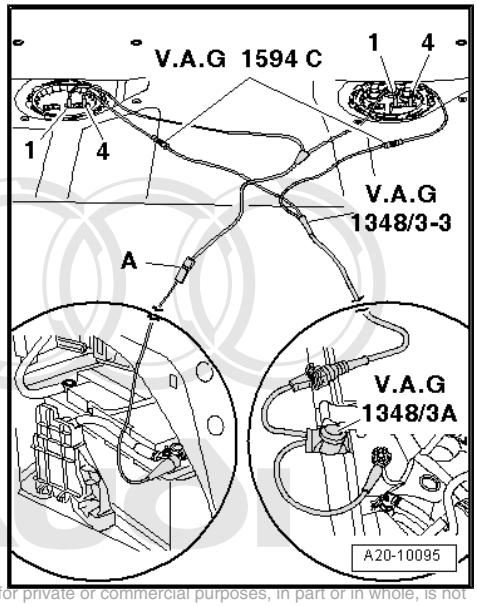
– Unplug electrical connector -2- on flange (right-side).



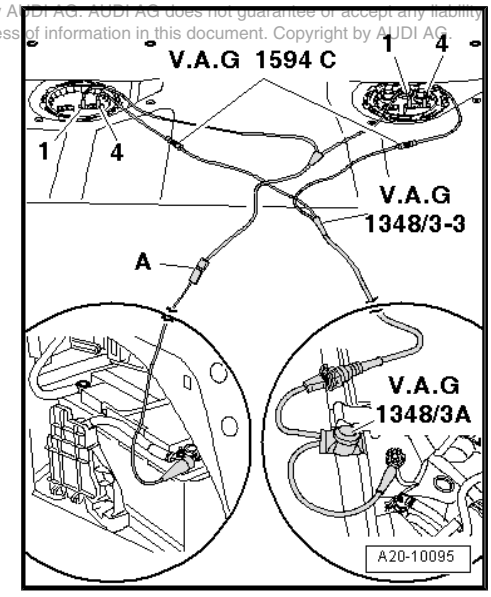
Note

Disregard -item 1-.

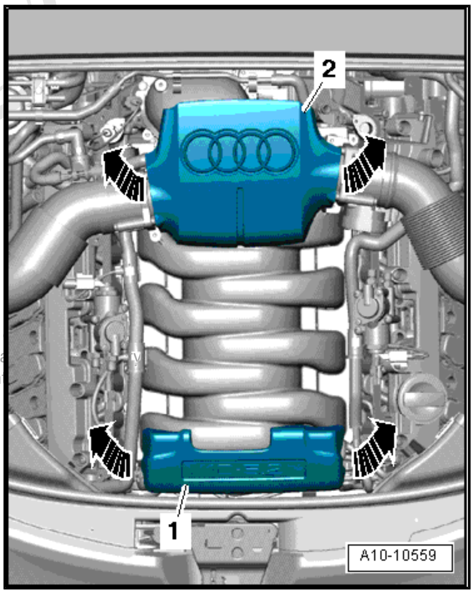
– Connect remote control -V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3- to contact -4- (earth) of fuel delivery unit (left-side) and fuel delivery unit (right-side) using test leads from auxiliary measuring set -V.A.G 1594C- .
– Move switch of remote control -V.A.G 1348/3A- for V.A.G 1348 to front of engine compartment.
– Connect crocodile clamp to earth point in engine compartment.



– Connect contact -1- (positive) of fuel delivery unit (left-side) and fuel delivery unit (right-side) to vehicle battery “+” via an improvised auxiliary lead. For safety reasons an in-line fuse -A- (10 A) must be connected into the lead.
– Remove filler cap from fuel filler neck.



– Pull off engine cover panel (rear) -2- -arrows-.

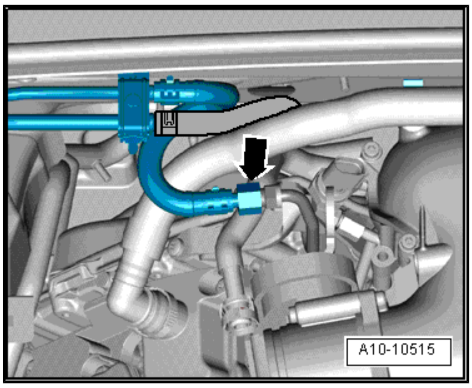


Note

Disregard -item 1-.

> **WARNING**
>
> ***Fuel system is pressurised (low pressure). Wear safety goggles and protective clothing to avoid possible injury and skin contact. Before opening the system place a clean cloth around the connection. Then release pressure by carefully loosening the connection.***

– Disconnect fuel supply pipe -arrow- at fuel rail.



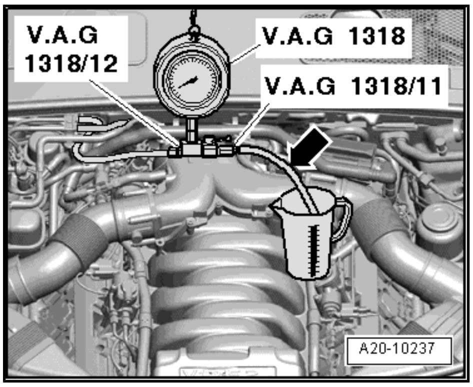
> **Caution**
>
> *Observe rules for cleanliness when working on the injection system.*

– Connect K-Jetronic pressure tester -V.A.G 1318- with adapters -V.A.G 1318/11- and -V.A.G 1318/12- to fuel pipe.

– Fit auxiliary hose -arrow- onto pressure tester and hold it in a container.

– Open cut-off valve on pressure tester. Cut-off valve must point in direction of flow.

– Bleed fuel system by pressing remote control button briefly.

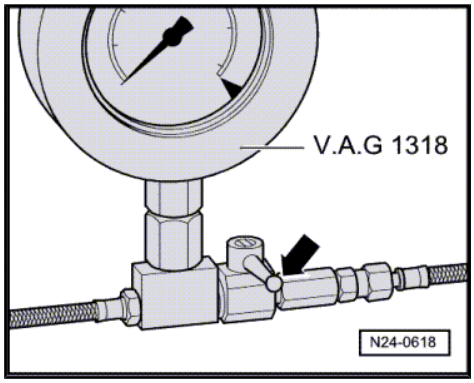


– Close cut-off valve on pressure tester. Cut-off valve is at right angle to direction of flow.
– Press button on remote control until pressure tester shows no further increase in pressure.

• Specification: approx. 6 bar (5 ... 7 bar)

If specification is not obtained:

– Check delivery rate of fuel pumps ⇒ Rep. Gr. 20 .



Checking residual pressure

– Check leak-tightness and residual pressure by watching the drop in pressure on the K-Jetronic pressure tester -V.A.G 1318- .

• After 10 minutes pressure should still be at least 3.75 bar.

If the residual pressure drops below 3.75 bar:

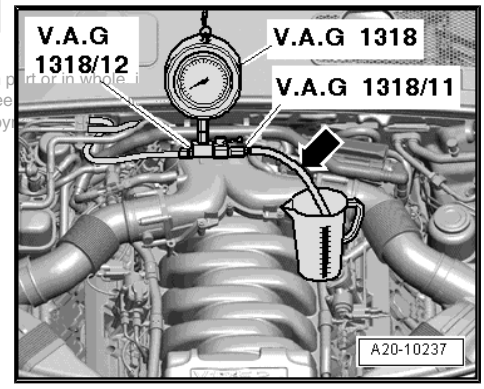
♦ Check union between K-Jetronic pressure tester -V.A.G 1318- and fuel line for leaks.
♦ Check pressure tester for leaks.
♦ Check fuel lines and their connections for leaks.
♦ Renew fuel filter with integral fuel pressure regulator ⇒ Rep. Gr. 20 . Then repeat the test.
♦ If necessary, renew fuel pump -G23- (right-side) ⇒ Rep. Gr. 20 .

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

– Switch off ignition.

Note

Before removing the pressure tester, release the fuel pressure by opening the cut-off valve. Hold hose in a container.



– Re-install fuel supply line (make sure that all parts are clean).

Tightening torque

Component	Nm
Fuel supply pipe	25

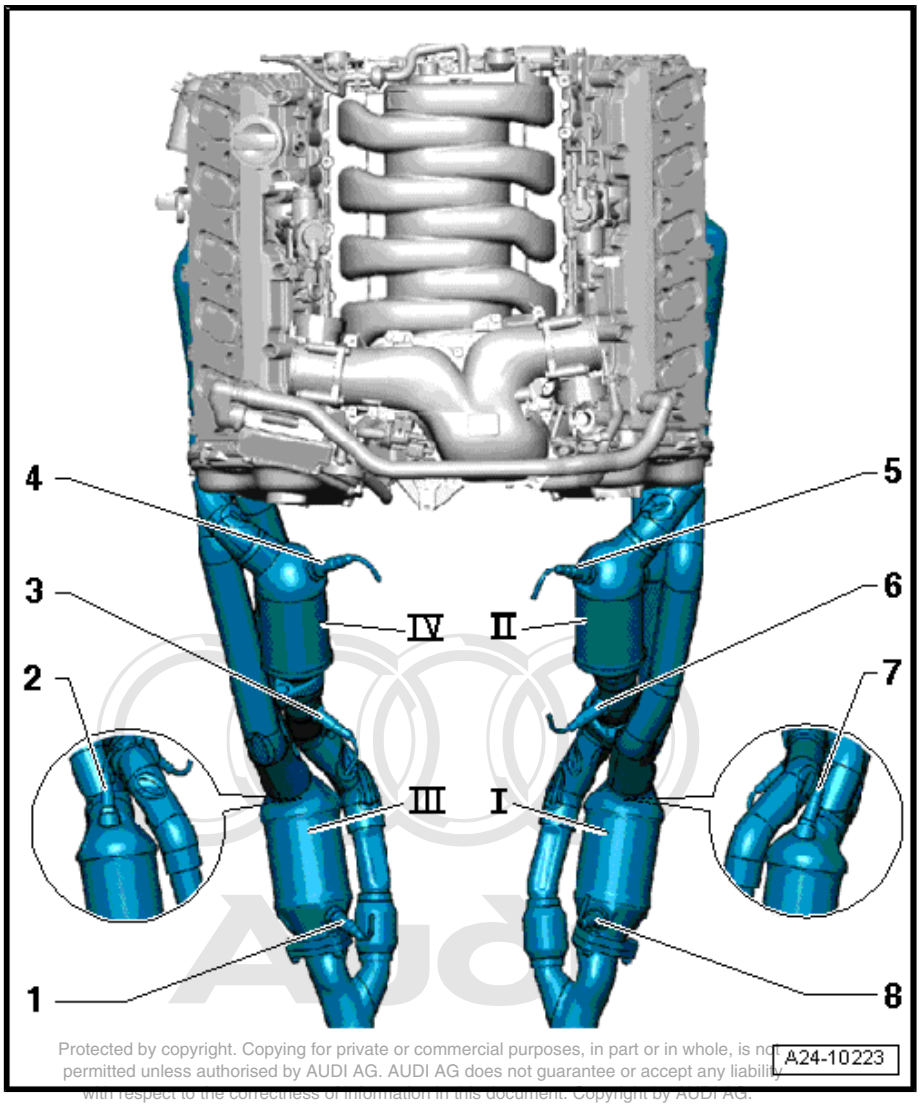
2.15 Lambda probes - overview

I - Starter catalytic converter for cylinders 1, 2, 3 (exhaust bank I)

II - Starter catalytic converter for cylinders 4, 5 (exhaust bank II)

III - Starter catalytic converter for cylinders 6, 7, 8 (exhaust bank III)

IV - Starter catalytic converter for cylinders 9, 10 (exhaust bank IV)



1 - Lambda probe 3 after catalytic converter -G287- with Lambda probe 3 heater after catalytic converter -Z64-

- ❑ Exhaust bank III (cylinders 6, 7, 8)
- ❑ Fitting location of electrical connector ⇒ page 48
- ❑ Removing and installing ⇒ page 50
- ❑ 55 Nm

2 - Lambda probe 3 before catalytic converter -G285- with Lambda probe 3 heater -Z62-

- ❑ Exhaust bank III (cylinders 6, 7, 8)
- ❑ Fitting location of electrical connector ⇒ page 48
- ❑ Removing and installing ⇒ page 49
- ❑ 55 Nm

3 - Lambda probe 4 after catalytic converter -G288- with Lambda probe 4 heater after catalytic converter -Z65-

- ❑ Exhaust bank IV (cylinders 9, 10)
- ❑ Fitting location of electrical connector ⇒ page 48
- ❑ Removing and installing ⇒ page 49
- ❑ 55 Nm

4 - Lambda probe 4 before catalytic converter -G286- with Lambda probe 4 heater -Z63-

- ❑ Exhaust bank IV (cylinders 9, 10)
- ❑ Fitting location of electrical connector ⇒ page 48
- ❑ Removing and installing ⇒ page 51
- ❑ 55 Nm

5 - Lambda probe 2 before catalytic converter -G108- with Lambda probe 2 heater -Z28-

- ❑ Exhaust bank II (cylinders 4,5)
- ❑ Fitting location of electrical connector ⇒ page 48
- ❑ Removing and installing ⇒ page 51
- ❑ 55 Nm

6 - Lambda probe 2 after catalytic converter -G131- with Lambda probe 2 heater after catalytic converter -Z30-

- ❑ Exhaust bank II (cylinders 4,5)
- ❑ Fitting location of electrical connector ⇒ page 48
- ❑ Removing and installing ⇒ page 49
- ❑ 55 Nm

7 - Lambda probe before catalytic converter -G39- with Lambda probe heater -Z19-

- ❑ Exhaust bank I (cylinders 1, 2, 3)
- ❑ Fitting location of electrical connector ⇒ page 48
- ❑ Removing and installing ⇒ page 49
- ❑ 55 Nm

8 - Lambda probe after catalytic converter -G130- with Lambda probe 1 heater after catalytic converter -Z29-

- ❑ Exhaust bank I (cylinders 1, 2, 3)
- ❑ Fitting location of electrical connector ⇒ page 48
- ❑ Removing and installing ⇒ page 50
- ❑ 55 Nm

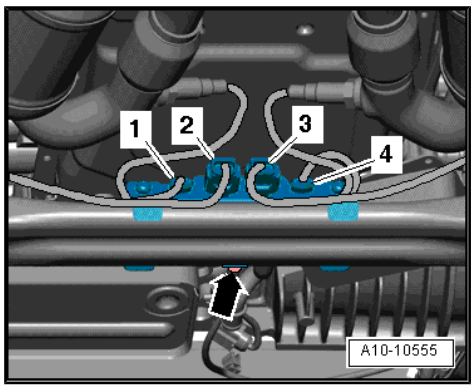
Fitting location of electrical connectors for Lambda probes -G288- , -G285- , -G39- and -G131-

1 - Connector (brown) for Lambda probe 4, after catalytic converter -G288-

2 - Connector (brown) for Lambda probe 3, before catalytic converter -G285-

3 - Connector (black) for Lambda probe (before catalytic converter) -G39-

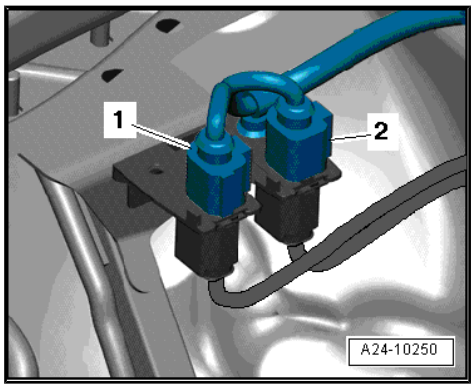
4 - Connector (black) for Lambda probe 2, after catalytic converter -G131-



Fitting location of electrical connectors for Lambda probes -G286- and -G108-

1 - Connector (black) for Lambda probe 2 -G108- with Lambda probe 2 heater -Z28- before catalytic converter

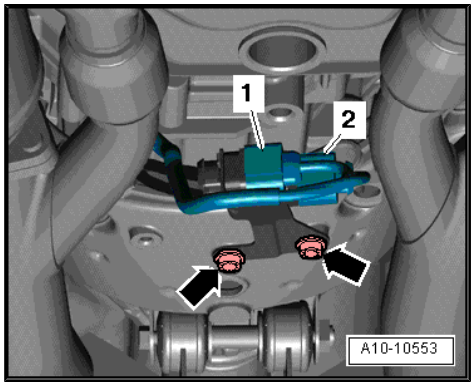
2 - Connector (brown) for Lambda probe 4 -G286- with Lambda probe 4 heater -Z63- before catalytic converter



Fitting location of electrical connectors for Lambda probes -G287- and -G130-

1 - Connector (brown) for Lambda probe 3, after catalytic converter -G287-

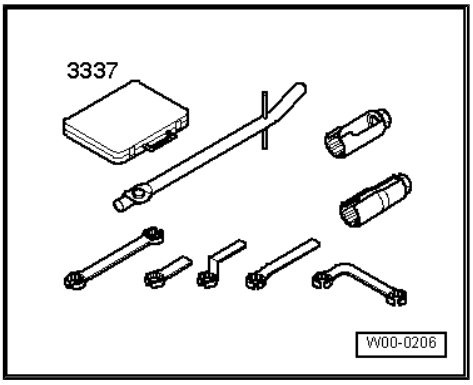
2 - Connector (black) for Lambda probe, after catalytic converter -G130-



2.16 Removing and installing Lambda probes -G39- , -G131- , -G285- and -G288-

Special tools and workshop equipment required

- Lambda probe open ring spanner set -3337-

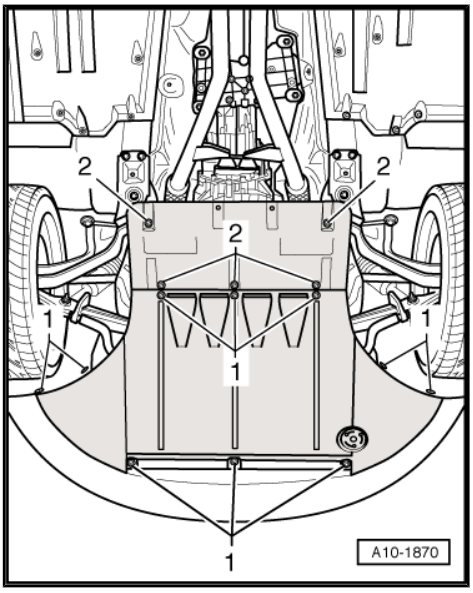


Removing

Note

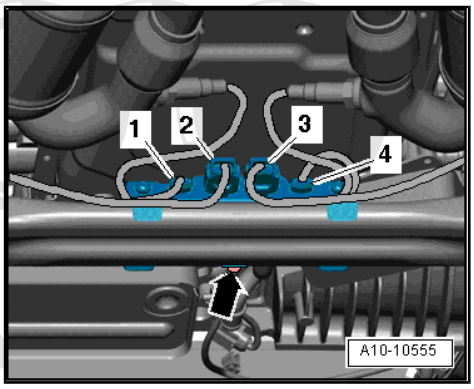
All cable ties which are released or cut open when removing must be fitted in the same position when installing.

– Open quick-release fasteners -2- and remove rear noise insulation.



– Unscrew bracket from subframe -arrow-.

– Remove relevant electrical connector for Lambda probe from bracket on gearbox.



1 - Connector (brown) for Lambda probe 4, after catalytic converter -G288-

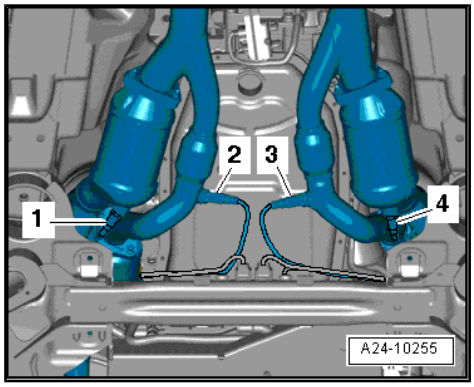
2 - Connector (brown) for Lambda probe 3, before catalytic converter -G285-

3 - Connector (black) for Lambda probe (before catalytic converter) -G39-

4 - Connector (black) for Lambda probe 2, after catalytic converter -G131-

– Unplug relevant electrical connector and move wiring clear.

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



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

2 - Lambda probe 4 after catalytic converter -G288-

3 - Lambda probe 2 after catalytic converter -G131-

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

Installing

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

Note

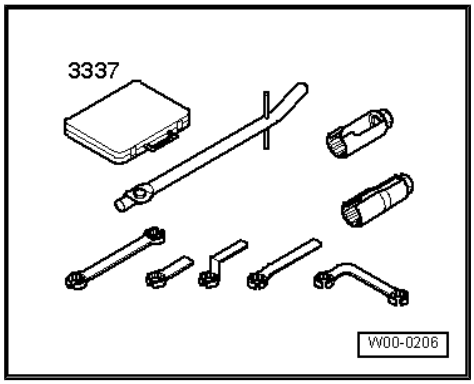
- *Threads of new Lambda probes are already coated with assembly paste, the paste must not get into the slots on the probe body.*
- *In the case of a used Lambda probe grease only the thread with high-temperature paste. The paste must not get into the slots on the probe body. High-temperature paste ⇒ 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.*

Tightening torques: refer to Lambda probes - overview
⇒ page 47

2.17 Removing and installing Lambda probes -G130- and -G287-

Special tools and workshop equipment required

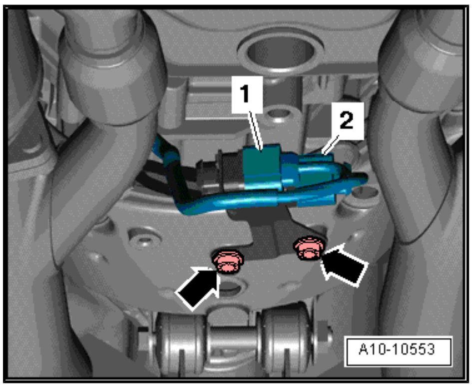
- Lambda probe open ring spanner set -3337-



Removing

Note

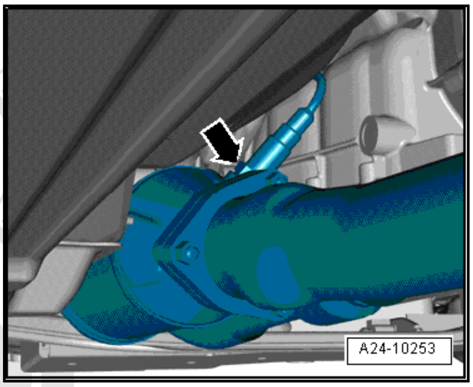
All cable ties which are released or cut open when removing must be fitted in the same position when installing.



– Detach electrical connectors from bracket and unplug connectors:

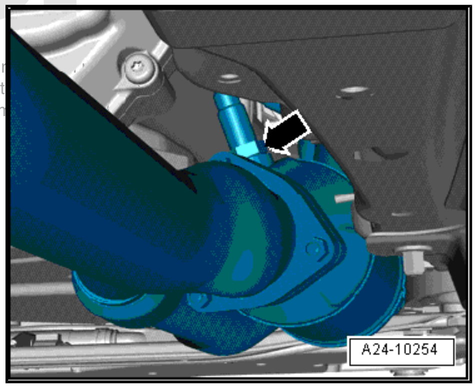
1 - Connector (brown) for Lambda probe 3, after catalytic converter -G287-

2 - Connector (black) for Lambda probe, after catalytic converter -G130-



Exhaust pipes (left-side):

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



Exhaust pipes (right-side):

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

Installing

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

Note

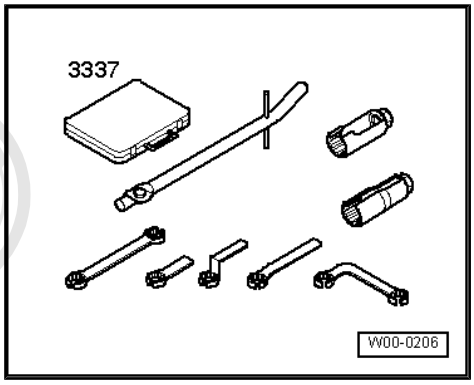
- *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*
- *In the case of a used Lambda probe grease only the thread with high-temperature paste. The paste must not get into the slots on the probe body. High-temperature paste ⇒ 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.*

Tightening torques: refer to Lambda probes - overview ⇒ page 47

2.18 Removing and installing Lambda probes -G108- and -G286-

Special tools and workshop equipment required

♦ Lambda probe open ring spanner set -3337-



Removing

Note

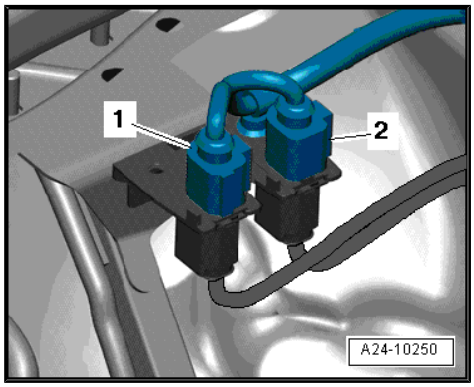
All cable ties which are released or cut open when removing must be fitted in the same position when installing.

– Remove intake manifold ⇒ page 22 .

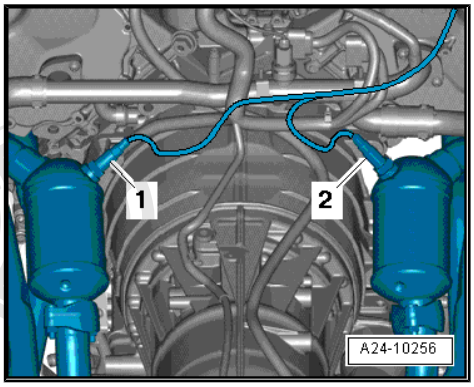
– Detach electrical connectors from bracket and unplug connectors:

1 - Connector (black) for Lambda probe 2 -G108- with Lambda probe 2 heater -Z28- before catalytic converter

2 - Connector (brown) for Lambda probe 4 -G286- with Lambda probe 4 heater -Z63- before catalytic converter



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



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

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

Installing

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

Note

- *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*
- *In the case of a used Lambda probe grease only the thread with high-temperature paste. The paste must not get into the slots on the 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.*

Tightening torques: refer to Lambda probes - overview
⇒ page 47

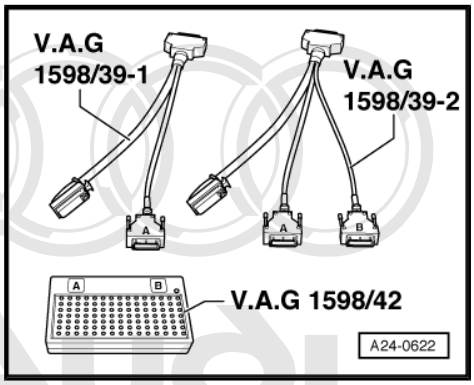
– Install intake manifold ⇒ page 22 .

3 Engine control units

3.1 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-



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 leads.*
- *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 lead -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 lead -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 1594 C- to connect test equipment (e.g. voltage tester -V.A.G 1527 B- , hand-held multimeter -V.A.G 1526 C- etc.).*

The engine control unit has to be removed before multi-pin connectors can be unplugged from engine control unit ⇒ page 56 .

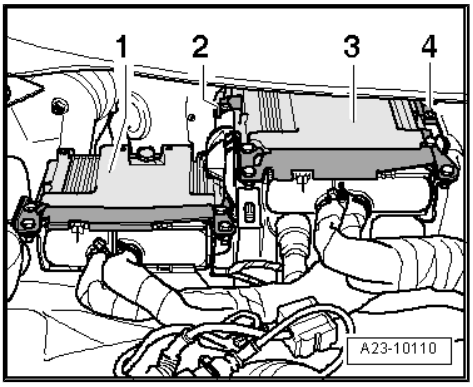
Caution

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

– Switch off ignition.

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

Note



- *The two engine control units are identical from the outside. However, if both control units are removed, they must be marked before removal so they are not interchanged on re-installation.*
- *Master engine control unit 1: mark "M" (for example)*
- *Slave engine control unit 2: mark "S" (for example)*
- *Item -3- is engine control unit -J623- (master control unit).*
- *Item -1- is engine control unit 2 -J624- (slave control unit).*

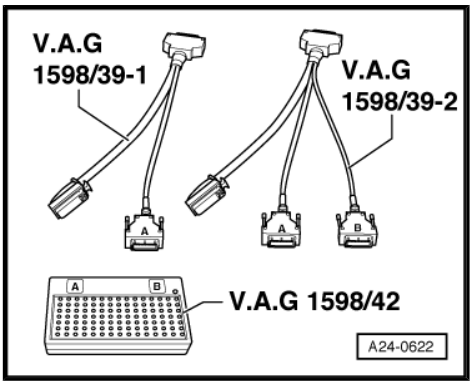
– Carefully pull cowl panel grille off retainer at windscreen (only pull off as far as necessary).

To help prevent unauthorised access to the connectors on the engine control units, the control units are secured by means of shear bolts to a locking plate and a metal casing.

- Removing and installing engine control unit -J623- ⇒ page 56
- Removing and installing engine control unit 2 -J624- ⇒ page 59

– Connect the test box -V.A.G 1598/42- to wiring harness with adapter lead -V.A.G 1598/39-1- or adapter lead -V.A.G 1598/39-2- . Connect earth clip of test box to negative terminal of battery. The instructions for performing the individual tests indicate whether or not the engine control unit itself also needs to be connected to the test box.

– Carry out test as described in relevant repair procedure.



Installing engine control unit

Installation is performed in the reverse sequence.

– After installation, the locking plate must be re-fitted on the control unit.

– Clean threaded holes for shear bolts to remove any residue from locking fluid. This can be done using a thread tap.

– Always use new shear bolts.

Note

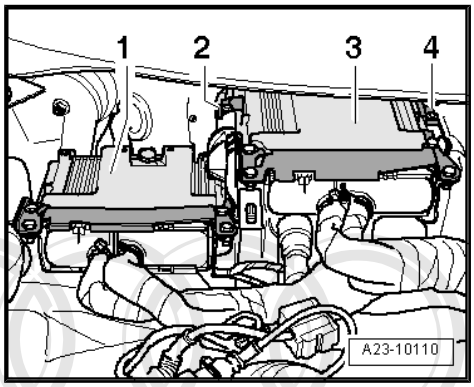
After completion of the Guided Fault Finding routine, the tester will attempt to erase the fault memories of all control units. If this is not successful, the remaining faults registered in the memories must be rectified until all faults can be erased.

3.2 Removing and installing engine control unit -J623- (master)

In the case of the V10, two engine control units are responsible for engine management.

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.



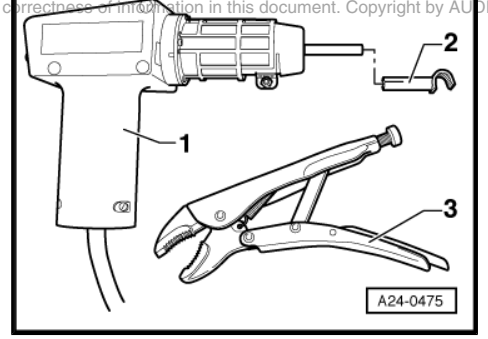
Note

- *The two engine control units are identical from the outside. However, if both control units are removed, they must be marked before removal so they are not interchanged on re-installation.*
- *Mark engine control unit -J623- (master) with an "M" (for example).*
- *Mark engine control unit 2 -J624- (slave) with an "S" (for example)*
- *Item -3- is engine control unit -J623- (master control unit).*
- *Item -1- is engine control unit 2 -J624- (slave control unit).*

– When renewing engine control unit, select diagnosis object "Renew engine control unit" in "Guided Functions" ⇒ Vehicle diagnosis, testing and information system VAS 5051.

Special tools and workshop equipment required

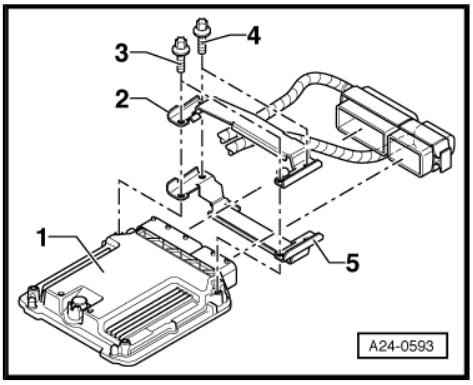
- Hot air blower 220 V/ 50 Hz -VAS 1978/14- -item 1- with nozzle attachment -2- from wiring harness repair set -VAS 1978A-



- Small, commercially available vice grip pliers -3- (mole grip)

Note

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



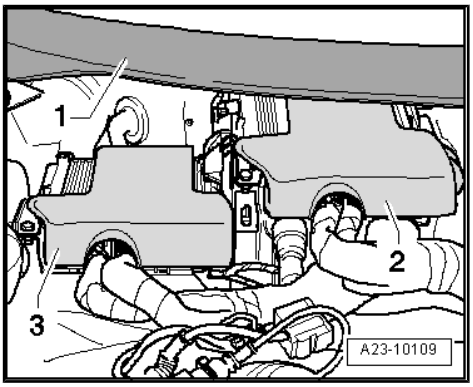
Removing

– Switch off ignition and remove ignition key.

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

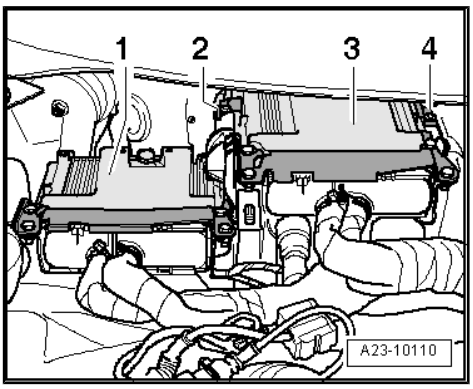
– Carefully pull cowl panel grille -1- off retainer at windscreen (only pull off as far as necessary).

– Detach cover -2- above engine control unit -J623- .

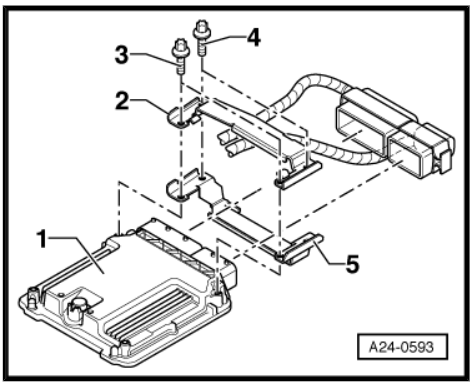


– Remove engine control unit -J623- -3- (unscrew bolts -2 and 4-).

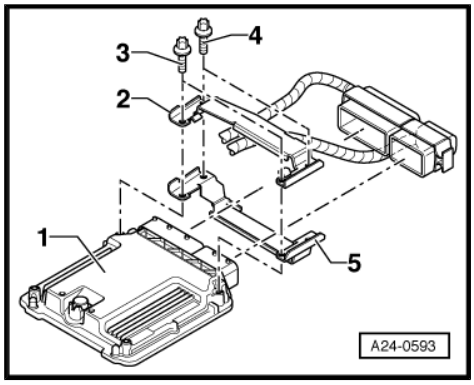
To help prevent unauthorised access to the connectors on the engine control unit, the control unit is secured by means of shear bolts to a locking plate and a metal casing.



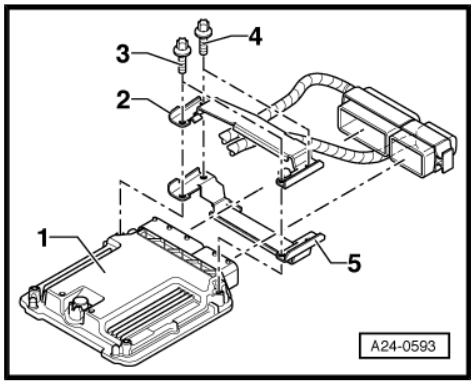
Remove engine control unit -J623- .



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



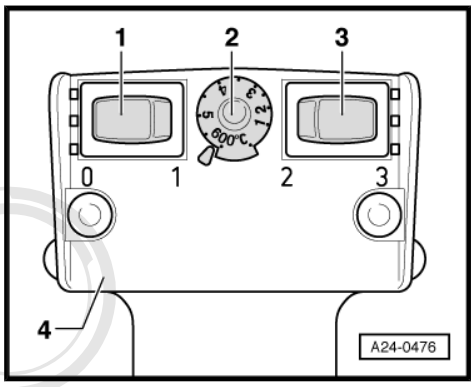
The threads of the two shear bolts -3- which are screwed into the engine control unit are not secured with locking fluid. Do not apply heat to the threads in the control unit housing; this is not necessary and would cause overheating of the control unit.



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

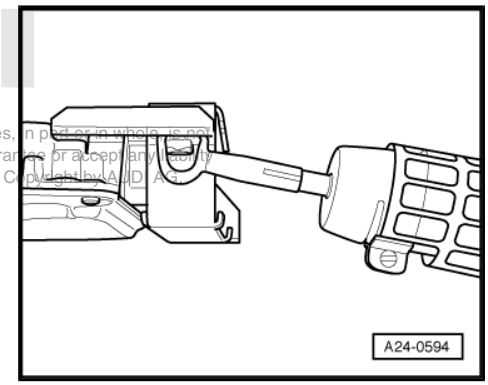
WARNING

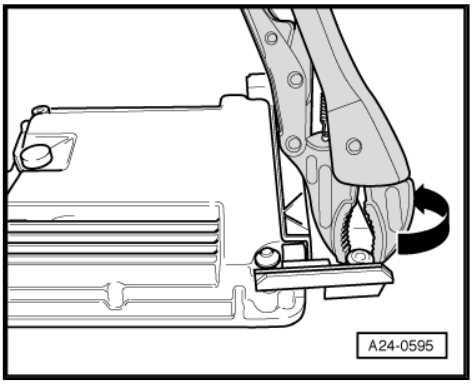
Heating the thread of the locking plate also heats up the shear bolts and parts of the metal housing. Take care to avoid burns. It is also important to ensure that only the thread is heated and none of the surrounding components if at all possible. These should be covered if necessary.



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

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





– Unscrew shear bolts using vice-grip pliers (see arrow in illustration).
– The two shear bolts screwed into the engine control unit do not need to be heated. They can be removed without heating.
– Detach metal locking plate from connectors.
– Unscrew two bolts securing retainers for engine control unit -J623- .
– Release connectors on engine control unit -J623- and unplug connectors.
– Take out old engine control unit -J623- and install new engine control unit -J623- .

Installing

Installation is performed in the reverse sequence.

– After installation, the locking plate must be re-fitted on the engine control unit -J623- .
– Clean threaded holes for shear bolts to remove any residue from locking fluid. This can be done using a thread tap.
– Always use new shear bolts.
– Carefully clip cowl panel grille into retainer at windscreen.

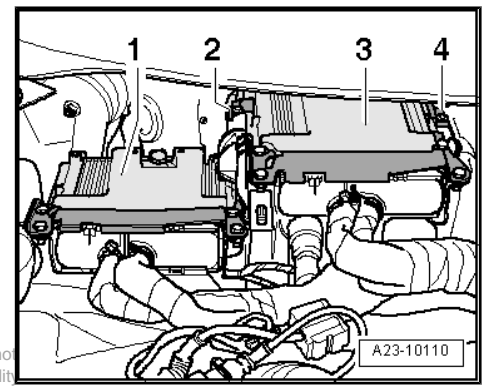
The procedure required after connecting the new engine control unit is described in the Guided Fault Finding or Guided functions.

3.3 Removing and installing engine control unit 2 -J624- (slave)

In the case of the V10, two engine control units are responsible for engine management.

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.



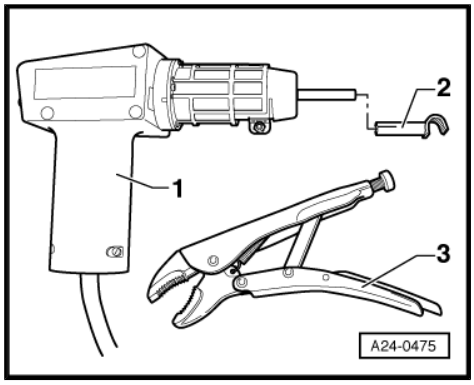
Note

- *The two engine control units are identical from the outside. However, if both control units are removed, they must be marked before removal so they are not interchanged on re-installation.*
- *Mark engine control unit -J623- (master) with an “M” (for example).*
- *Mark engine control unit 2 -J624- (slave) with an “S” (for example).*
- *Item -3- is engine control unit -J623- (master control unit).*
- *Item -1- is engine control unit 2 -J624- (slave control unit).*

– When renewing engine control unit, select diagnosis object “Renew engine control unit” in “Guided Functions” ⇒ Vehicle diagnosis, testing and information system VAS 5051.

Special tools and workshop equipment required

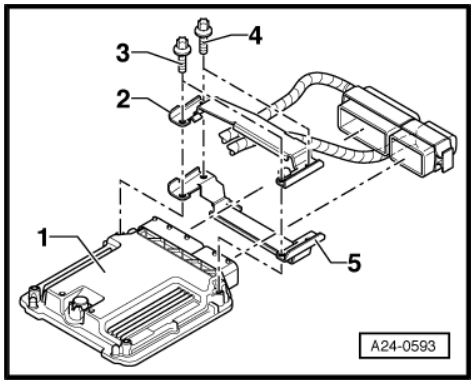
- Hot air blower 220 V/ 50 Hz -VAS 1978/14- -item 1- with nozzle attachment -2- from wiring harness repair set -VAS 1978A-



- Small, commercially available vice grip pliers -3- (mole grip)

Note

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



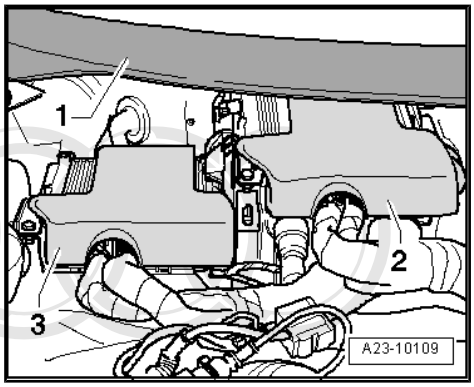
Removing

– Switch off ignition and remove ignition key.

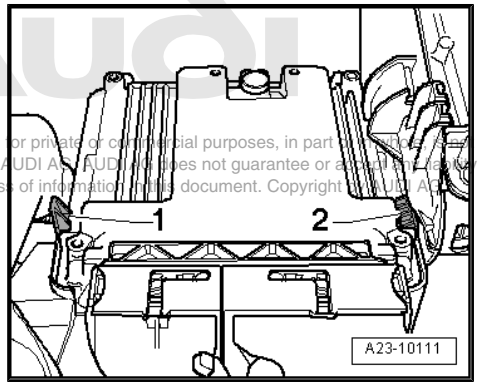
– Remove cover from plenum chamber (right-side).

– Carefully pull cowl panel grille -1- off retainer at windscreen (only pull off as far as necessary).

– Detach cover -3- above engine control unit 2 -J624- .

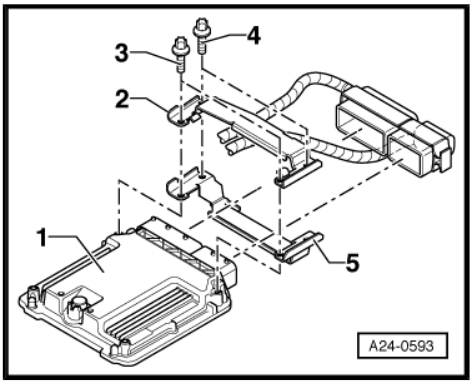


– Remove engine control unit 2 -J624- -1-. Release retaining clip -1- and detach engine control unit 2 -J624- from guide -2-.

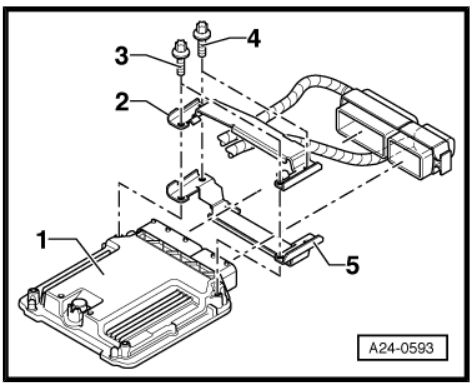


To help prevent unauthorised access to the connectors on the engine control unit, the control unit is secured by means of shear bolts to a locking plate and a metal casing.

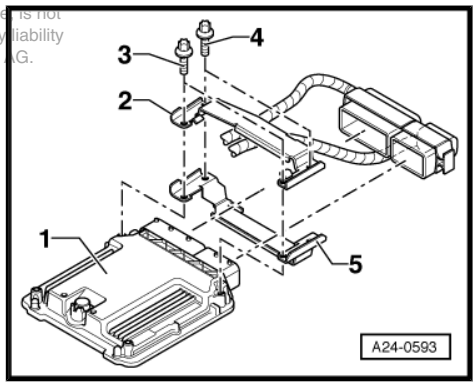
Remove engine control unit 2 -J624- .



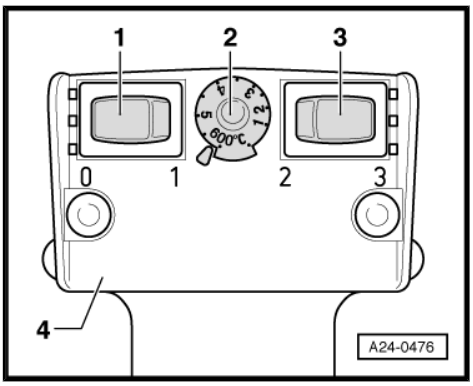
The threads of the two shear bolts -4- which are not screwed into the engine control unit are secured with locking fluid. To unscrew these two bolts, the threads must therefore be heated with the hot air blower.



The threads of the two shear bolts -3- which are screwed into the engine control unit are not secured with locking fluid. Do not apply heat to the threads in the control unit housing; this is not necessary and would cause overheating of the control unit.



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

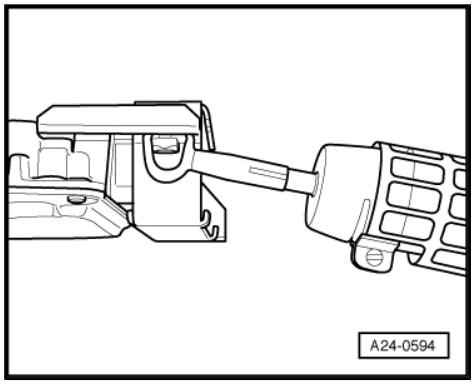


WARNING

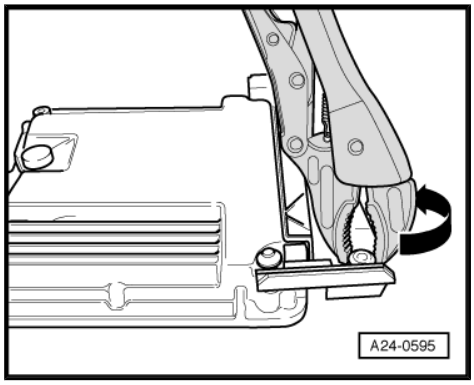
Heating the thread of the locking plate also heats up the shear bolts and parts of the metal housing. Take care to avoid burns. It is also important to ensure that only the thread is heated and none of the surrounding components if at all possible. These should be covered if necessary.

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

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



- Unscrew shear bolts using vice-grip pliers (see arrow in illustration).
- The two shear bolts screwed into the engine control unit do not need to be heated. They can be removed without heating.
- Detach metal locking plate from connectors.
- Unscrew two bolts securing retainers for engine control unit 2 -J624- .
- Release connectors on engine control unit 2 -J624- and unplug connectors.
- Take out old engine control unit 2 -J624- and install new engine control unit -J623- .



Installing

Installation is performed in the reverse sequence.

- After installation, the locking plate must be re-fitted on the engine control unit 2 -J624- .
- Clean threaded holes for shear bolts to remove any residue from locking fluid. This can be done using a thread tap.
- Always use new shear bolts.
- Carefully clip cowl panel grille into retainer at windscreen.

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

28 – Ignition system

1 General notes and safety precautions

1.1 General notes on ignition system

- The engine control unit has a self-diagnosis capability.
- A voltage of at least 11.5 V is required for proper operation of the electrical components.
- Certain tests may lead to a fault being detected by the control unit and stored. The fault memory should therefore be interrogated and (if necessary) erased after completing the tests and any repair work that may be required.
- If the engine starts, runs for a short period and then cuts out after completing fault finding, repairs or component tests, this may be due to the immobiliser disabling the engine control unit. The fault memory must then be interrogated and, if necessary, the control unit must be adapted.

1.2 Safety precautions

WARNING

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

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

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

To avoid any risk of injuries to persons and/or damage to the fuel injection and ignition system, always observe the following safety precautions.

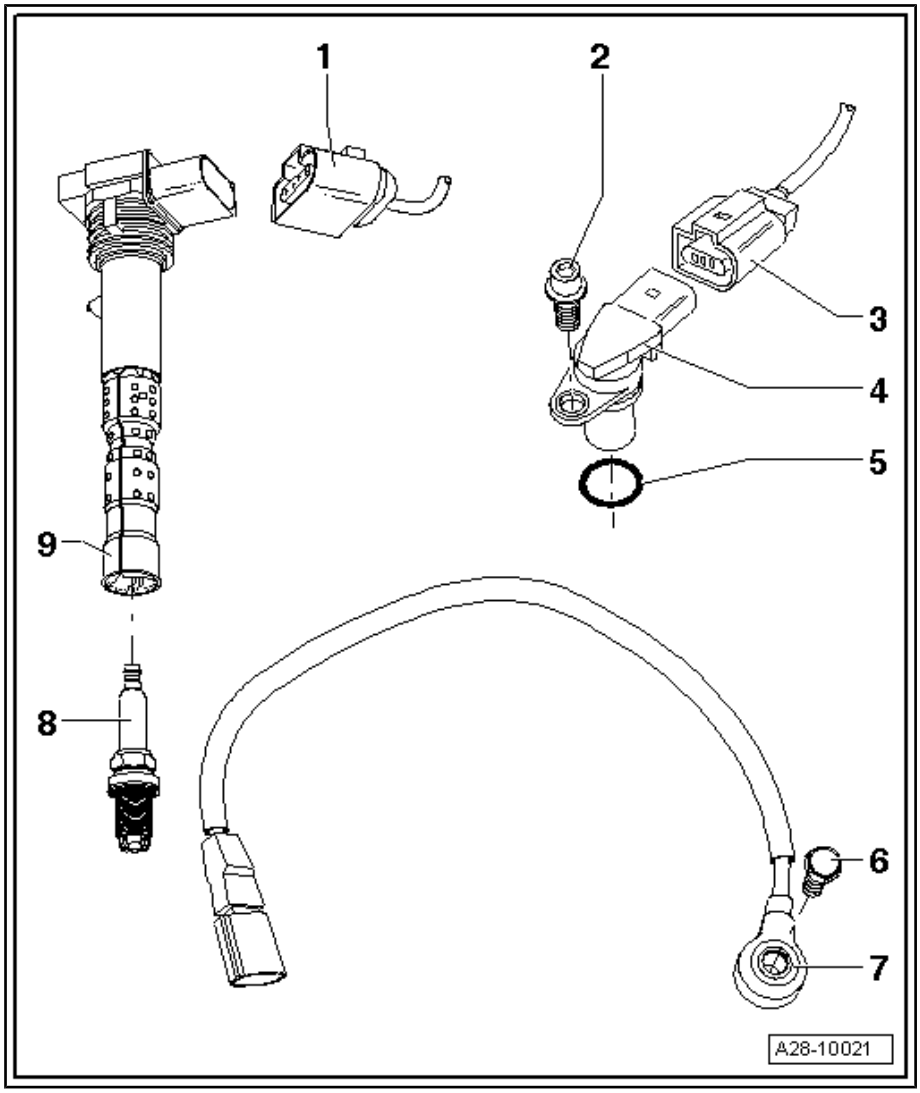
- Do not touch or disconnect ignition wiring when the engine is running or being turned at starter speed.
- The ignition must be switched off before disconnecting or connecting ignition system wiring, high-voltage wires and test leads.
- If you want to crank the engine at starting speed without actually starting it (e.g. compression test), first unplug the connectors from the ignition coils and the injectors. After completing the work, interrogate and erase the fault memory.
- Always switch off the ignition before cleaning the engine.
- Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.

2 Servicing ignition system

2.1 Test data

Engine data		5.2 ltr. / 4V / 331 kW engine
Ignition timing		Not adjustable (determined by control unit)
Ignition system		Multi-coil system with 10 ignition coils (output stages integrated) connected directly to spark plugs via spark plug connectors
Spark plugs	Designations	⇒ Data sheets for exhaust emission test
	Tightening torque	⇒ Maintenance ; Booklet 404

2.2 Ignition system - exploded view



1 - Connector for ignition coil
- ❑ 4-pin

2 - Bolt
- ❑ 10 Nm

3 - 3-pin connector

4 - Hall sender
- ❑ Hall sender -G40- (cylinder bank 1)
- ❑ Hall sender 3 -G300- (cylinder bank 1)
- ❑ Hall sender 2 -G163- (cylinder bank 2)
- ❑ Hall sender 4 -G301- (cylinder bank 2)

5 - O-ring
- ❑ Renew if damaged
- ❑ Lubricate lightly with clean engine oil

6 - Bolt
- ❑ 20 Nm
- ❑ Tightening torque influences the function of the knock sensor

7 - Knock sensors
- ❑ Contact surfaces between knock sensor and cylinder block must be free of corrosion, oil and grease.
- ❑ Knock sensor 1 -G61- (cylinder bank 1)
- ❑ Knock sensor 2 -G66- (cylinder bank 1)
- ❑ Knock sensor 3 -G198- (cylinder bank 2)
- ❑ Knock sensor 4 -G199- (cylinder bank 2)
- ❑ Removing and installing ⇒ page 68

8 - Spark plug

- ❑ Remove and install with spark plug socket and extension -3122 B- ⇒ Maintenance ; Booklet 404
- ❑ 30 Nm

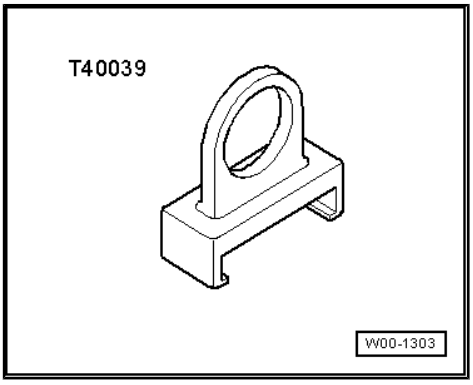
9 - Ignition coil

- ❑ Ignition coil 1 with output stage -N70-
- ❑ Ignition coil 2 with output stage -N127-
- ❑ Ignition coil 3 with output stage -N291-
- ❑ Ignition coil 4 with output stage -N292-
- ❑ Ignition coil 5 with output stage -N323-
- ❑ Ignition coil 6 with output stage -N324-
- ❑ Ignition coil 7 with output stage -N325-
- ❑ Ignition coil 8 with output stage -N326-
- ❑ Removing and installing ⇒ page 65
- ❑ Use puller -T40039- for removal

2.3 Removing and installing ignition coils with output stages

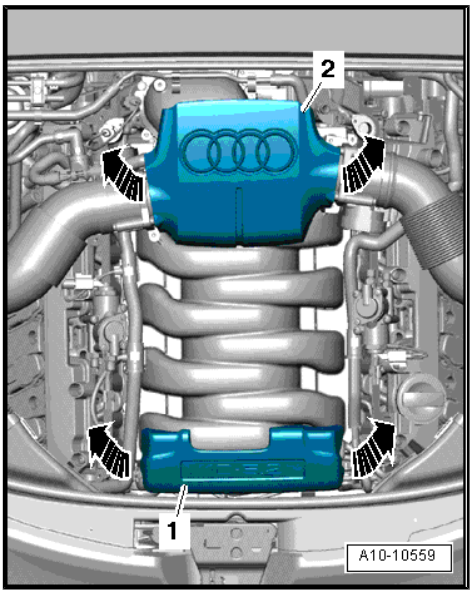
Special tools and workshop equipment required

- ♦ Puller -T40039-

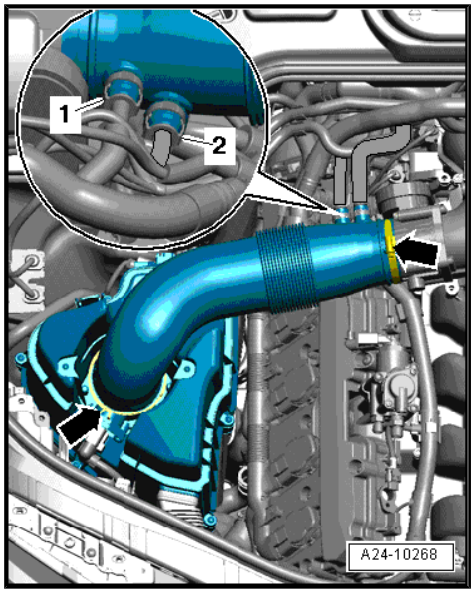


– Pull off rear engine cover panel -2-.

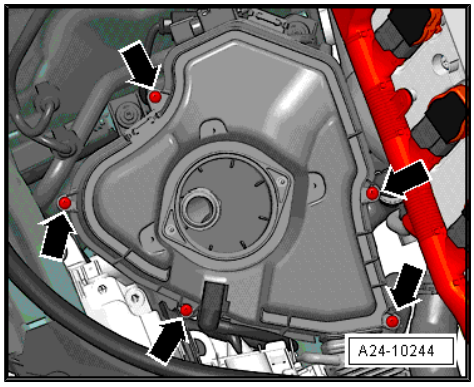
Removing cylinder bank 1 (right-side):



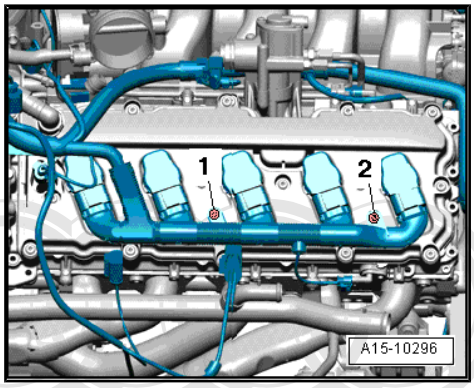
– Release hose clips -arrows- and remove air hose between air mass meter -G70- and throttle valve module -J338- .
– Move air hose to one side, with vacuum hoses -1 and 2- connected.
– Unplug electrical connector at air mass meter -G70- .



– Remove bolts -arrows-.
– Detach air cleaner housing (top section).

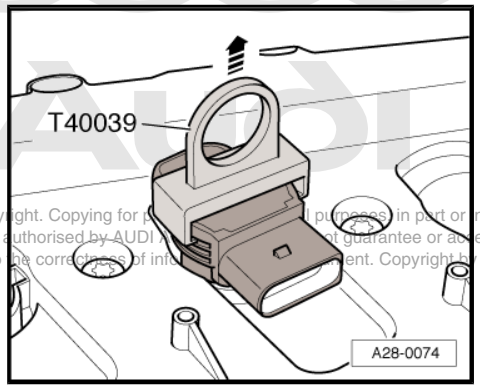


– Remove bolts -1- and -2-.

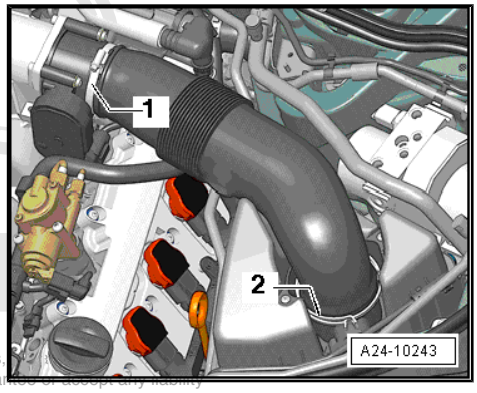


– Pull ignition coils approx. 30 mm out of spark plug holes using puller -T40039- .
– Release electrical connectors and pull all connectors off ignition coils at the same time.

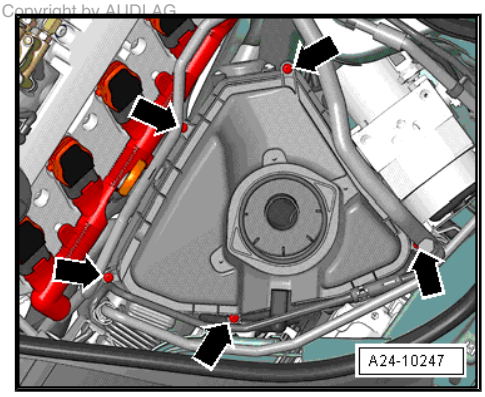
Removing cylinder bank 2 (left-side):



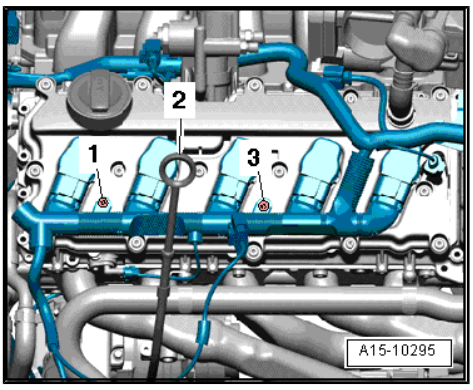
– Release hose clips -arrows- and remove air hose between air mass meter 2 -G246- and throttle valve module 2 -J544- .
– Unplug electrical connector at air mass meter 2 -G246- .



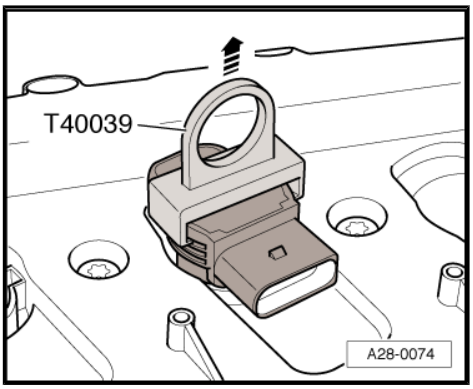
– Remove bolts -arrows-.
– Detach air cleaner housing (top section).



– Remove bolts -1- and -3-.



– Pull ignition coils approx. 30 mm out of spark plug holes using puller -T40039- .
– Release electrical connectors and pull all connectors off ignition coils at the same time.



Installing ignition coils

– Fit all ignition coils loosely into spark plug holes.
– Align the ignition coils with the connectors and attach all connectors onto ignition coils simultaneously.
– Press ignition coils onto spark plugs by hand evenly (do NOT use tool).

Tightening torque

Component	Nm
Electrical wiring guide for ignition coils to cylinder head cover	5

2.4 Removing and installing knock sensors

WARNING

- *The fuel system operates under high pressure. The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ page 2 .*
- *A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.*

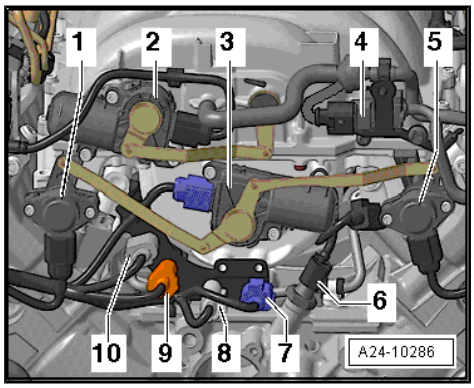
Fitting location of electrical connectors at front of engine

7 - Knock sensor 4 -G199- (blue connector)

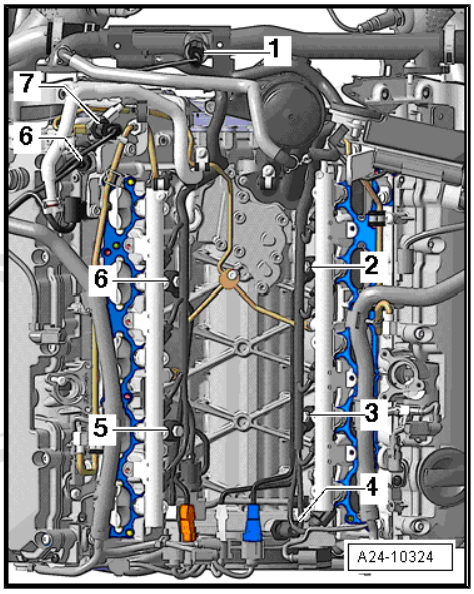
8 - Knock sensor 3 -G198- (white connector)

9 - Knock sensor 1 -G61- (orange connector)

10 - Knock sensor 2 -G66- (grey connector)



Fitting location of knock sensors inside cylinder head



1 - Coolant temperature sender -G62-

2 - Knock sensor 4 -G199-

3 - Knock sensor 3 -G198-

4 - Fuel pressure sender -G247-

5 - Knock sensor 1 -G61-

6 - Knock sensor 2 -G66-

7 - Camshaft control valve 1 -N205-

8 - Fuel pressure sender for low pressure -G410-

– Remove intake manifold ⇒ page 22 .

Note

Seal off the intake ports in the cylinder heads with clean cloths.

– Then remove relevant knock sensor.

Installing

– Secure relevant knock sensor (removed before) at fitting location.

- Tightening torque: refer to exploded view of ignition system ⇒ page 64 .

Note

The tightening torque influences the function of the knock sensor.

– Install intake manifold ⇒ page 22 .