Workshop Manual

Audi A5 Coupé 2008 ➤

Direct petrol injection and ignition system (8-cyl. 4.2 ltr. 4-valve)									
Engine ID	CAU A								

Edition 04.2009

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List of Workshop Manual Repair Groups

Repair Group

24 - Mixture preparation - injection

28 - Ignition system

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

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24 – Mixture preparation - injection

1 Safety precautions and rules for cleanliness

1.1 General notes on self-diagnosis

- The engine control unit has a fault memory.
- Before carrying out any repairs or Fault Finding, the fault memory must be interrogated.
- The vacuum hoses and connections must be checked (to prevent unmetered air).
- Fuel hoses in engine compartment must only be secured with spring-type clips. O-type clips or screw-type clips must not be used.
- A voltage of at least 11.5 V is required for proper operation of the electrical components.
- Do not use sealants containing silicone. Particles of silicone drawn into the engine will not be burnt in the engine and will damage the Lambda probe.
- The vehicles are fitted with a crash/fuel shut-off system. This function is designed to reduce the risk of a vehicle fire after a crash by deactivating the fuel pump via the fuel pump relay.
- At the same time, this system also improves the engine's starting performance. When the driver's door is opened, the fuel pump is activated for approx. 2 seconds in order to build up pressure in the fuel system; observe safety precautions ⇒ page 1 .

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1.2 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.

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

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

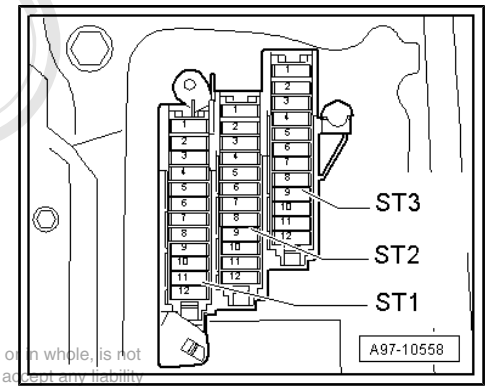
To prevent injuries to persons and/or damage to the fuel injection and ignition system, the following must be noted:

WARNING

- *The fuel system operates under high pressure. The pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening the system ⇒ page 3 .*
- *A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.*

Caution

- *Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.*
- *Observe notes on procedure for disconnecting the battery ⇒ Rep. Gr. 27 .*



- If the battery is not disconnected, the fuse -SC 3 on fuse holder ST2 (brown) in dash panel (driver's side)- for the fuel pump control unit -J538- must be removed as a precaution 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 the engine is to be operated at cranking speed without it starting (e.g. compression test), unplug the connectors from the ignition coils and remove the fuse for the electric fuel pump.
- 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.
- 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.

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1.3 Rules for cleanliness when working on the injection 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 vehicle.

1.4 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).

Before opening the high-pressure section, e.g. before removing different components, the fuel pressure in the high-pressure section must be reduced. The procedure is described below.

Reducing fuel pressure in high-pressure section:

– Connect up the vehicle diagnostic, testing and information system -VAS 5051B- .

– Start engine and run at idling speed.

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

– Then select “Measured values”.

– Select “Fuel pressure” from the list.

– With the engine idling, the fuel pressure displayed will be between 30 and 40 bar.

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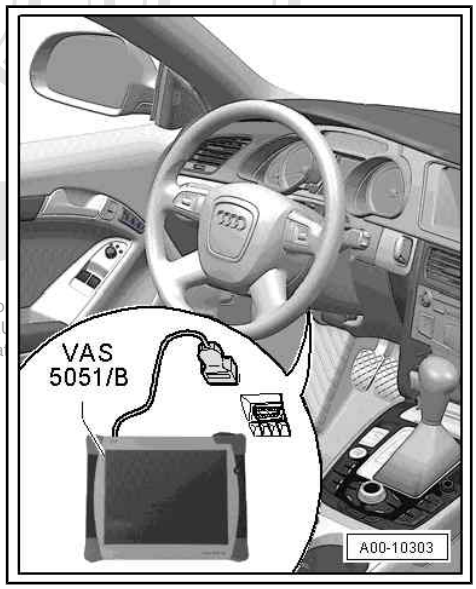
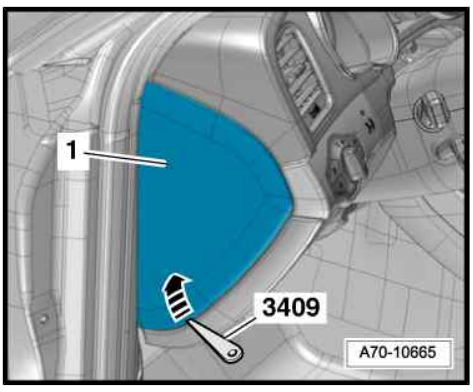


– Pry off cover -1- -arrow- on left side of dash panel using removal wedge -3409- or similar.

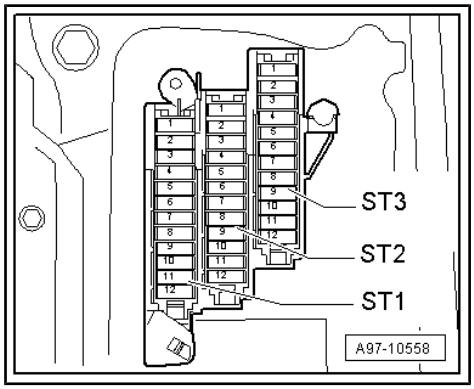


– With engine idling, pull out fuse for fuel pump control unit -J538- in fuse carrier in dash panel (driver's side), see ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

– Observe fuel pressure.

• The fuel pressure will decrease very quickly because the mechanical high-pressure pump is no longer being supplied with fuel by the fuel system pressurisation pump -G6- .

– Switch off ignition as soon as fuel pressure has dropped to approx. 8 bar.



Note

Fuel pressure must not fall below 6 bar, otherwise the engine will stall (this could damage the catalytic converter).

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 fuel pressure; wrap a clean cloth around the connection. Catch the escaping fuel.

The following operations must be performed after completing repair work:

– Refit fuse.

– Erase fault memory and generate readiness code in engine control unit using “Guided Functions” mode of vehicle diagnostic, testing and information system -VAS 5051B- .

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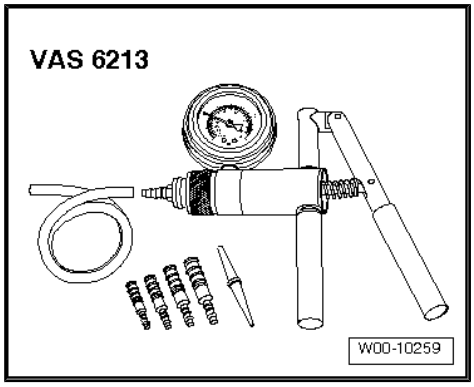
1.5 Checking vacuum system

Special tools and workshop equipment required

♦ Hand vacuum pump -VAS 6213-



Procedure

– Check all vacuum lines in the complete vacuum system for:

♦ Cracks

♦ Traces of animal bites

- ♦ Kinked or crushed lines
- ♦ Lines porous or leaking

– Check vacuum line to solenoid valve and from solenoid valve to corresponding component.

– If a fault is stored in the fault memory, check the vacuum lines leading to the corresponding component and also check the remaining vacuum lines leading to other components.

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

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2 Injection system

2.1 Technical data

Engine data	4.2 ltr. / 4V / 260 kW engine
Idling speed (not adjustable)	approx. 650 rpm 1)
Fuel pressure after high-pressure pump	18 ... 120 bar approx. 25 bar at idling speed
Fuel pressure before high-pressure pump	approx. 6 bar
• 1) Depending on demands placed on engine control unit.	

2.2 Fitting locations - overview

Engine compartment (right-side)

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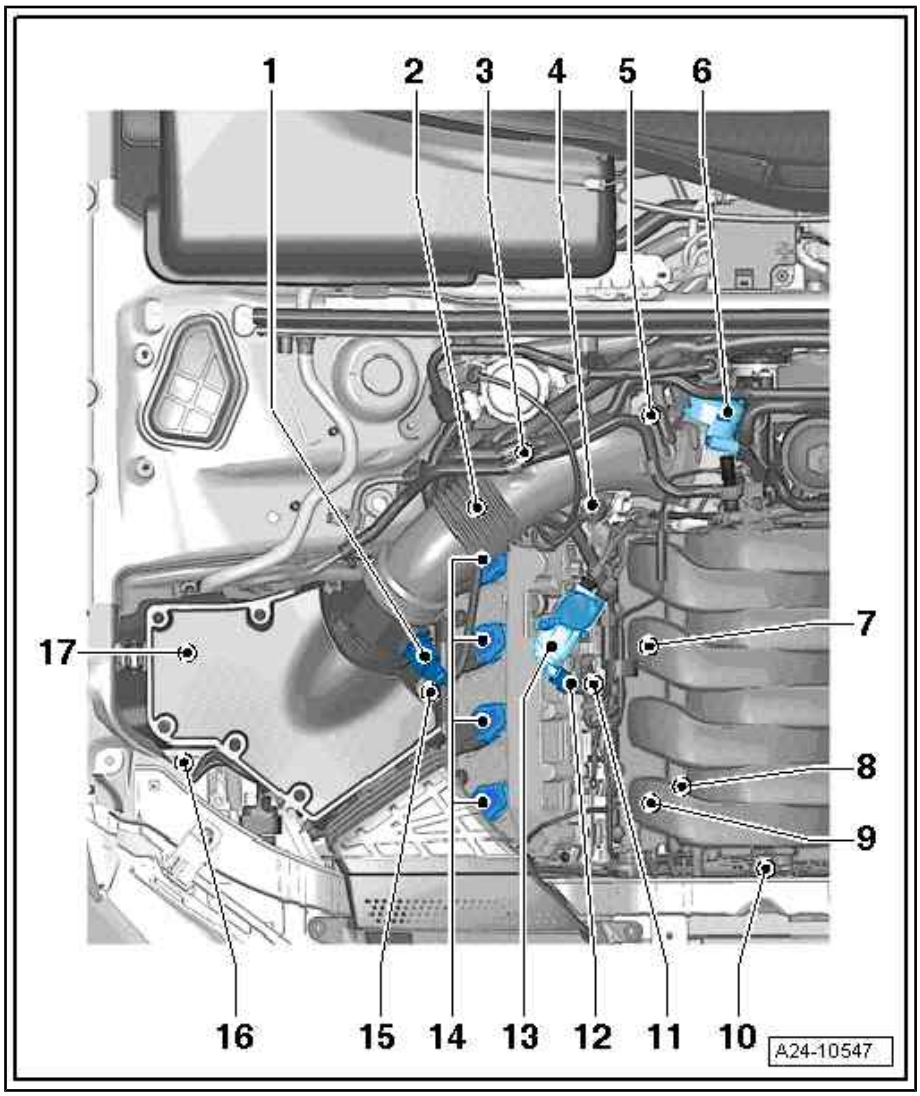

1 - Air mass meter -G70- / intake air temperature sender -G42-

- ❑ Removing and installing ⇒ page 24

2 - Exhaust camshaft control valve 1 -N318-

- ❑ 2.4 Nm

3 - Electrical connectors for

- ❑ Lambda probe before catalytic converter -G39- with Lambda probe heater -Z19-
- ❑ Lambda probe after catalytic converter -G130- with Lambda probe 1 heater after catalytic converter -Z29-
- ❑ Fitting location ⇒ page 12

4 - Camshaft control valve 1 -N205-

- ❑ Fitting location ⇒ page 14
- ❑ 2.4 Nm

5 - Electrical connector for throttle valve module -J338-

6 - Throttle valve module -J338-

- ❑ After renewing throttle valve module -J338- , select “Adapt throttle valve module” in “Gui-

ded Functions" mode

7 - Knock sensor 2 -G66-

- ❑ Fitting location ⇒ page 14
- ❑ Electrical connector ⇒ page 15
- ❑ Removing and installing ⇒ page 81
- ❑ 20 Nm

8 - Fuel pressure sender -G247-

- ❑ Fitting location ⇒ page 14
- ❑ Removing and installing ⇒ page 55
- ❑ 25 Nm
- ❑ Lubricate threads lightly with clean oil

9 - Knock sensor 1 -G61-

- ❑ Fitting location ⇒ page 14
- ❑ Electrical connector ⇒ page 15
- ❑ Removing and installing ⇒ page 81
- ❑ 20 Nm

10 - Components at front of engine

- ❑ Fitting locations ⇒ page 15
- ❑ Intake manifold flap motor -V157-
- ❑ In model year 2009 intake manifold flap motor -V157- is replaced with intake manifold flap valve -N316-
- ❑ Intake manifold flap potentiometer -G336-
- ❑ Variable intake manifold motor -V183-
- ❑ In model year 2009 variable intake manifold motor -V183- is replaced with variable intake manifold change-over valve -N156-
- ❑ Intake manifold flap potentiometer 2 -G512-
- ❑ Electrical connector for knock sensor 4 -G199-
- ❑ Electrical connector for knock sensor 3 -G198-
- ❑ Electrical connector for knock sensor 1 -G61-
- ❑ Electrical connector for knock sensor 2 -G66-
- ❑ Removing, installing and testing oil pressure switch -F1- ⇒ Rep. Gr. 17

11 - Hall sender -G40-

- ❑ Fitting location ⇒ page 14
- ❑ Removing and installing ⇒ page 81
- ❑ 10 Nm

12 - Fuel metering valve -N290-

- ❑ Fitting location ⇒ page 16

13 - High-pressure pump

- ❑ With fuel metering valve -N290-
- ❑ Fitting location ⇒ page 16
- ❑ Removing and installing ⇒ page 63

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14 - 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 79

15 - Hall sender 3 -G300-

- ❑ Secured to outside of cylinder head
- ❑ Fitting location ⇒ page 13
- ❑ Removing and installing ⇒ page 81
- ❑ 10 Nm

16 - Secondary air pump motor -V101-

- ❑ Fitting location ⇒ page 16
- ❑ Removing and installing ⇒ Rep. Gr. 26

17 - Variable intake manifold change-over valve -N335-

- ❑ Fitting location ⇒ page 13

Engine compartment (left-side)

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

1 - Fuel metering valve 2 -N402-

- ❑ Combined with high-pressure pump in one unit
- ❑ Fitting location ⇒ page 16

2 - Fuel pressure sender for low pressure -G410-

- ❑ Fitting location ⇒ page 16

3 - Activated charcoal filter solenoid valve 1 -N80-

- ❑ Fitting location ⇒ page 16
- ❑ Activated charcoal filter solenoid valve 2 -N115- (only on USA vehicles)

4 - Camshaft control valve 2 -N208-

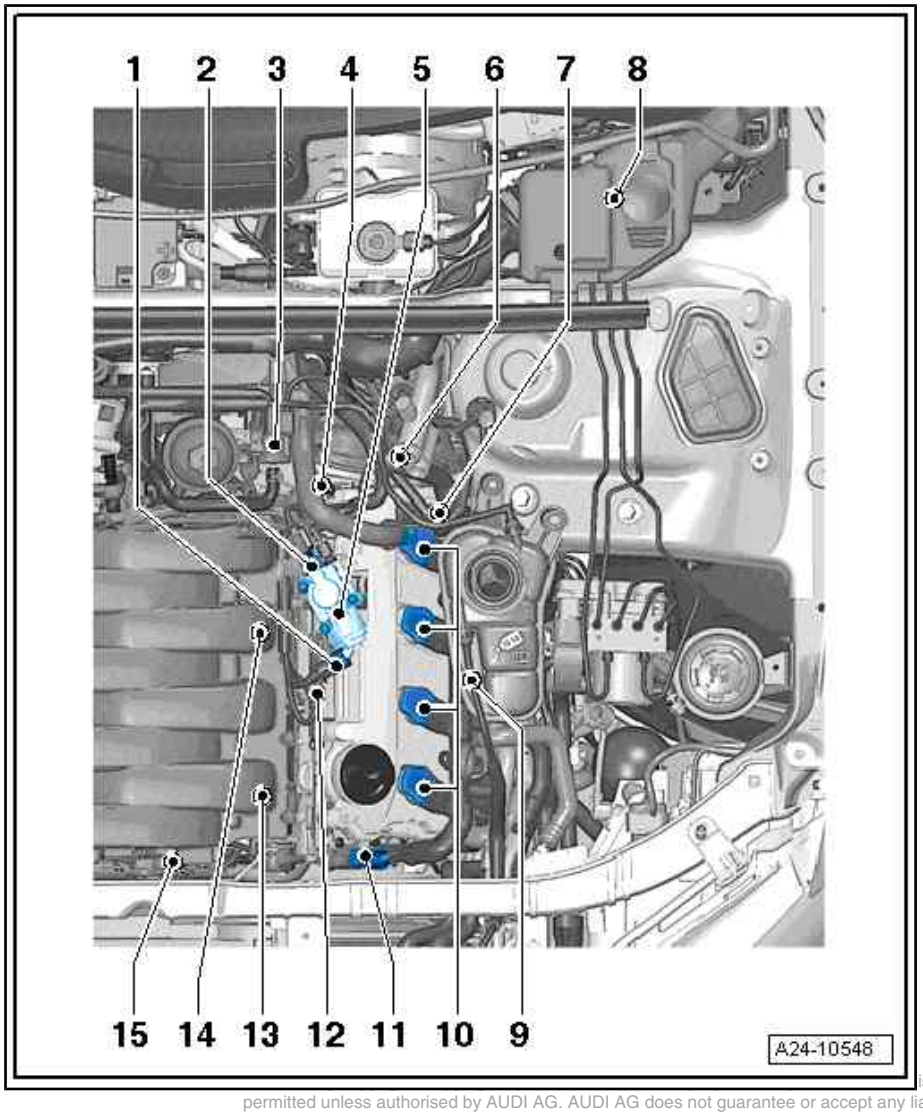
- ❑ Fitting location ⇒ page 14
- ❑ 2.4 Nm

5 - High-pressure pump

- ❑ With fuel metering valve 2 -N402-
- ❑ Fitting location ⇒ page 16

6 - Electrical connectors for

- ❑ Lambda probe 2 before catalytic converter -G108- with Lambda



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probe 2 heater -Z28-

- ❑ Lambda probe 2 after catalytic converter -G131- with Lambda probe 2 heater after catalytic converter -Z30-
- ❑ Fitting location ⇒ page 12

7 - Exhaust camshaft control valve 2 -N319-

- ❑ Fitting location ⇒ page 13
- ❑ 2.4 Nm

8 - Engine control unit -J623-

- ❑ Fitting location ⇒ page 11
- ❑ Removing and installing ⇒ page 73

9 - Hall sender 4 -G301-

- ❑ Fitting location ⇒ page 13
- ❑ Removing and installing ⇒ page 81
- ❑ 10 Nm

10 - 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-
- ❑ Fitting location ⇒ page 13
- ❑ Removing and installing ⇒ page 79

11 - Electrical connectors

- ❑ Knock sensor 3 -G198-
- ❑ Knock sensor 4 -G199-

12 - Hall sender 2 -G163-

- ❑ Fitting location ⇒ page 14
- ❑ Removing and installing ⇒ page 81
- ❑ 10 Nm

13 - Knock sensor 3 -G198-

- ❑ Fitting location ⇒ page 14
- ❑ Removing and installing ⇒ page 81
- ❑ 20 Nm

14 - Knock sensor 4 -G199-

- ❑ Fitting location ⇒ page 14
- ❑ Removing and installing ⇒ page 81
- ❑ 20 Nm

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15 - Components at front of engine

- Electrical connector ⇒ page 15
- Intake manifold flap motor -V157-
- In model year 2009 intake manifold flap motor -V157- is replaced with intake manifold flap valve -N316-
- Intake manifold flap potentiometer -G336-
- Variable intake manifold motor -V183-
- In model year 2009 variable intake manifold motor -V183- is replaced with variable intake manifold change-over valve -N156-
- Intake manifold flap potentiometer 2 -G512-
- Electrical connector for knock sensor 4 -G199-
- Electrical connector for knock sensor 3 -G198-
- Electrical connector for knock sensor 1 -G61-
- Electrical connector for knock sensor 2 -G66-

A - Coolant temperature sender -G62-

- Fitting location ⇒ page 13
- Removing and installing ⇒ Rep. Gr. 19

B - Engine speed sender -G28-

- Fitting location ⇒ page 12
- Removing and installing ⇒ page 82

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

- In footwell on accelerator pedal (both senders are accommodated in one housing)
- Fitting location ⇒ page 12
- Removing and installing ⇒ Rep. Gr. 20

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

- In footwell on brake pedal
- Removing and installing ⇒ Rep. Gr. 45

E - Clutch position sender -G476-

- Clutch position sender -G476- incorporates the components clutch pedal switch for engine start -F194- and clutch pedal switch -F36-
- Only fitted on vehicles with manual gearbox
- In footwell on clutch pedal

F - Fuel pump control unit -J538-

- Fitting location ⇒ page 11

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

- Fitting location of electrical connector ⇒ page 12
- Fitting location of Lambda probe ⇒ page 12
- Removing and installing ⇒ page 68
- Tightening torque: ⇒ page 67

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

- Fitting location of electrical connector ⇒ page 12
- Fitting location of Lambda probe ⇒ page 12
- Removing and installing ⇒ page 68
- Tightening torque: ⇒ page 67

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

- Fitting location of electrical connector ⇒ page 12
- Fitting location of Lambda probe ⇒ page 12
- Removing and installing ⇒ page 68
- Tightening torque: ⇒ page 67

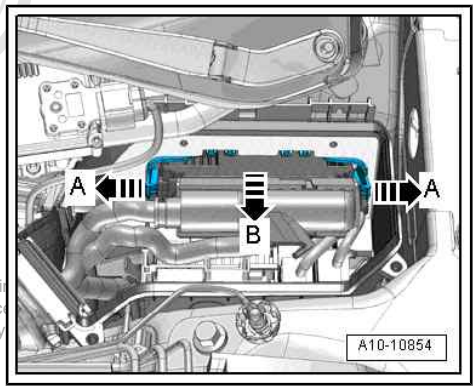
J - Lambda probe 2 after catalytic converter -G131- with Lambda probe 2 heater after catalytic converter -Z30-

- ❑ Fitting location of electrical connector ⇒ page 12
- ❑ Fitting location of Lambda probe ⇒ page 12
- ❑ Removing and installing ⇒ page 68
- ❑ Tightening torque: ⇒ page 67

Fitting location of engine control unit -J623-

- ♦ In left-side electronics box in engine compartment.

Removing and installing ⇒ page 73



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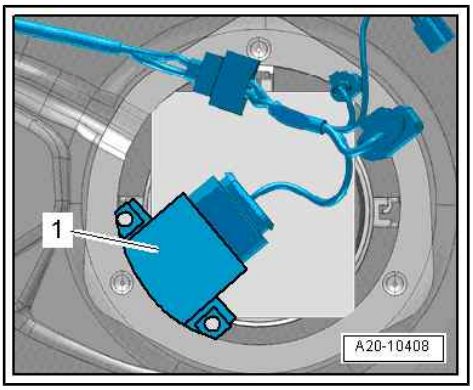
Fuel pump control unit -J538- -1-

Removing and installing ⇒ Rep. Gr. 20



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

A - Current supply relay for engine components -J757-

B - Starter motor relay -J53- (black/purple socket)

B - Starter motor relay 2 -J695- (black/blue socket)

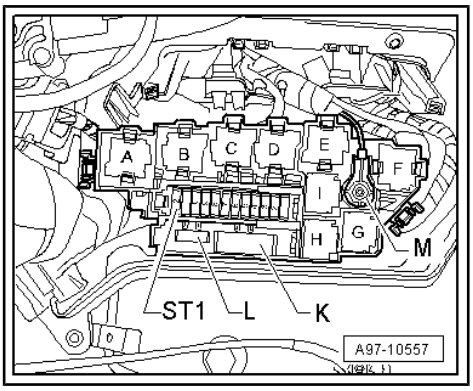
C - Secondary air pump relay -J299-

D - Motronic current supply relay -J271-

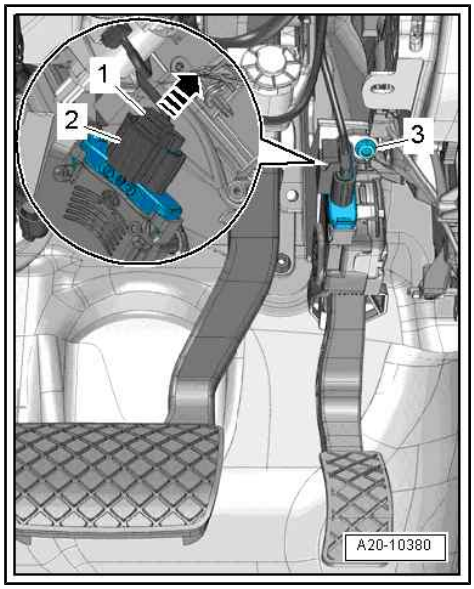
E - Continued coolant circulation relay -J151- (brown/blue socket)

E - Brake servo relay -J569- (brown/purple socket)

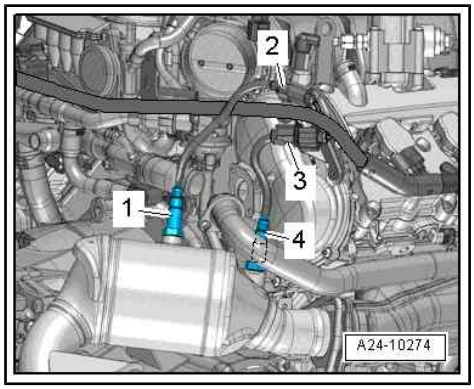
Refer to ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.



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



Fitting location of Lambda probes on cylinder bank 1 (right-side)



1 - Lambda probe after catalytic converter -G130-

2 - Electrical connector for Lambda probe after catalytic converter -G130-

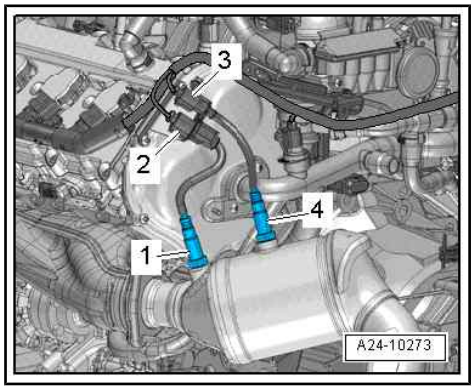
3 - Electrical connector for Lambda probe -G39-

4 - Lambda probe -G39-

Removing and installing ⇒ page 68

- Tightening torque ⇒ page 67 .

Fitting location of Lambda probes on cylinder bank 2 (left-side)



1 - Lambda probe 2 -G108-

2 - Electrical connector for Lambda probe 2 -G108-

3 - Electrical connector for Lambda probe 2 after catalytic converter -G131-

4 - Lambda probe 2 after catalytic converter -G131-

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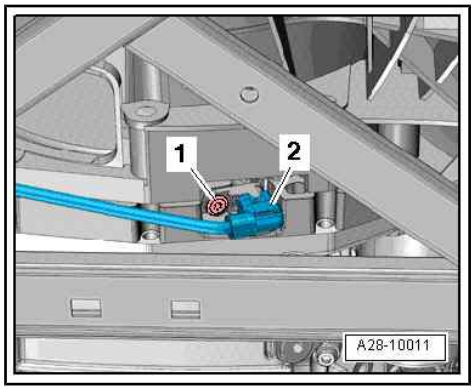
Removing and installing ⇒ page 70

- Tightening torque ⇒ page 67 .

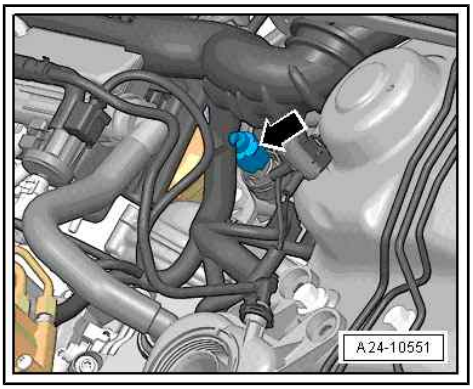
Fitting location of engine speed sender -G28- -arrow-

Engine speed sender -G28- is bolted to the gearbox from below.

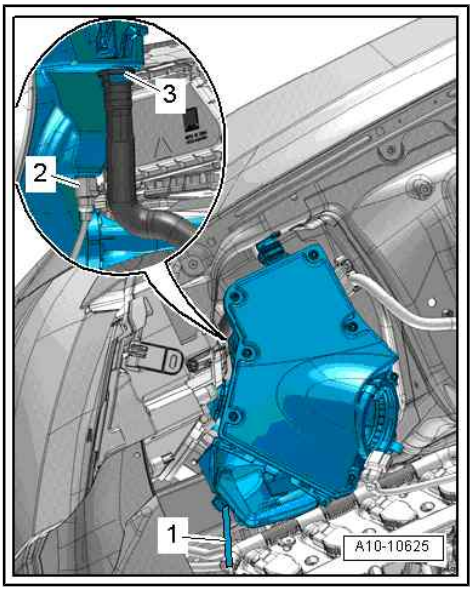


Fitting location of coolant temperature sender -G62- -arrow-

Removing and installing ⇒ Rep. Gr. 19

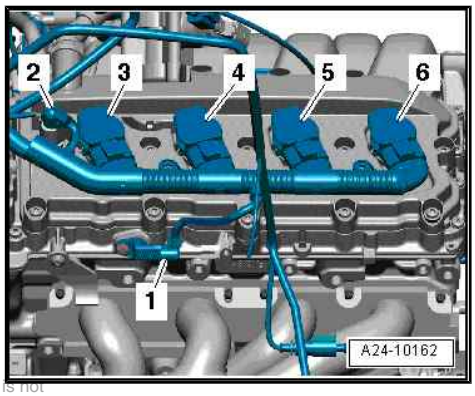


Variable intake manifold change-over valve -N335- -2-



Fitting locations on cylinder bank 1 (right-side)

1 - Hall sender 3 -G300-
2 - Exhaust camshaft control valve 1 -N318-
3 - Ignition coil 4 with output stage -N292-
4 - Ignition coil 3 with output stage -N291-
5 - Ignition coil 2 with output stage -N127-
6 - Ignition coil 1 with output stage -N70-



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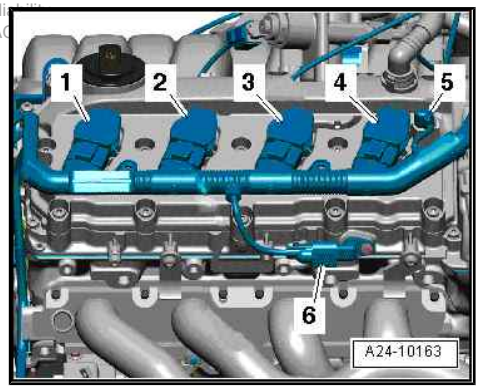
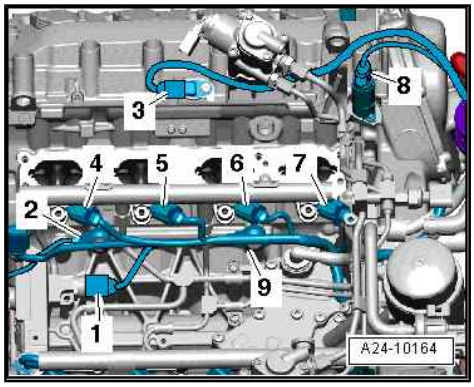
Fitting locations on cylinder bank 2 (left-side)

1 - Ignition coil 5 with output stage -N323-
2 - Ignition coil 6 with output stage -N324-
3 - Ignition coil 7 with output stage -N325-
4 - Ignition coil 8 with output stage -N326-
5 - Exhaust camshaft control valve 2 -N319-
6 - Hall sender 4 -G301-



Fitting locations: components on inside of right cylinder head



1 - Fuel pressure sender -G247-

2 - Knock sensor 1 -G61-

3 - Hall sender -G40-

4 - Injector, cylinder 1 -N30-

5 - Injector, cylinder 2 -N31-

6 - Injector, cylinder 3 -N32-

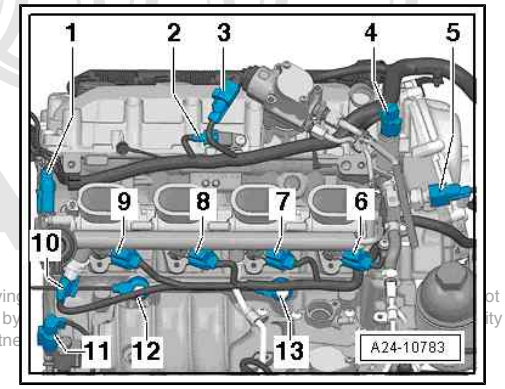
7 - Injector, cylinder 4 -N33-

8 - Camshaft control valve 1 -N205-

9 - Knock sensor 2 -G66-

For fitting locations of components on inside of cylinder head, right-side (gradual introduction in model year 2009), see next illustration.

Fitting locations on inside of cylinder head, right-side (gradual introduction in model year 2009)



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1 - Intake manifold flap potentiometer -G336-

2 - Hall sender -G40-

3 - Fuel metering valve -N290-

4 - Camshaft control valve 1 -N205-

5 - Fuel pressure sender for low pressure -G410-

6 - Injector, cylinder 1 -N30-

7 - Injector, cylinder 2 -N31-

8 - Injector, cylinder 3 -N32-

9 - Injector, cylinder 4 -N33-

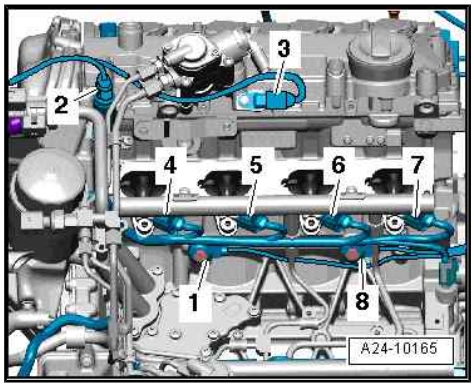
10 - Fuel pressure sender -G247-

11 - Intake manifold flap valve -N316-

12 - Knock sensor 1 -G61-

13 - Knock sensor 2 -G66-

Fitting locations: components on inside of left cylinder head



1 - Knock sensor 4 -G199-

2 - Camshaft control valve 2 -N208-

3 - Hall sender 2 -G163-

4 - Injector, cylinder 8 -N86-

5 - Injector, cylinder 7 -N85-

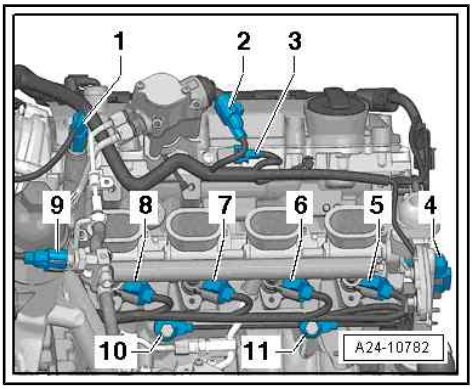
6 - Injector, cylinder 6 -N84-

7 - Injector, cylinder 5 -N83-

8 - Knock sensor 3 -G198-

For fitting locations of components on inside of cylinder head, left-side (gradual introduction in model year 2009), see next illustration.

Fitting locations on inside of cylinder head, left-side (gradual introduction in model year 2009)



1 - Camshaft control valve 2 -N208-

2 - Fuel metering valve 2 -N402- (screwed into high-pressure pump)

3 - Hall sender 2 -G163-

4 - Intake manifold flap potentiometer 2 -G512-

5 - Injector, cylinder 5 -N83-

6 - Injector, cylinder 6 -N84-

7 - Injector, cylinder 7 -N85-

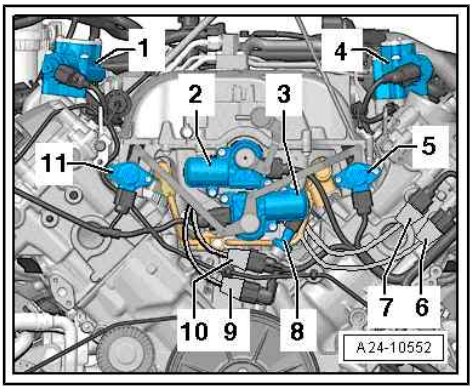
8 - Injector, cylinder 8 -N86-

9 - Fuel pressure sender for low pressure -G410-

10 - Knock sensor 4 -G199-

11 - Knock sensor 3 -G198-

Fitting location: at front of engine



1 - High-pressure pump on right side (cylinder bank 1)

2 - Variable intake manifold motor -V183-

3 - Intake manifold flap motor -V157-

4 - High-pressure pump on left side (cylinder bank 2)

5 - Intake manifold flap potentiometer 2 -G512-

6 - Electrical connector for knock sensor 4 -G199-

7 - Electrical connector for knock sensor 3 -G198-

8 - Oil pressure switch -F1-

9 - Electrical connector for knock sensor 2 -G66-

10 - Electrical connector for knock sensor 1 -G61-

11 - Intake manifold flap potentiometer -G336-

In model year 2009, -items 2 and 3- are replaced with vacuum-controlled valves.

- Variable intake manifold motor -V183- is replaced with variable intake manifold change-over valve -N156- .
- Intake manifold flap motor -V157- is replaced with intake manifold flap valve -N316- .

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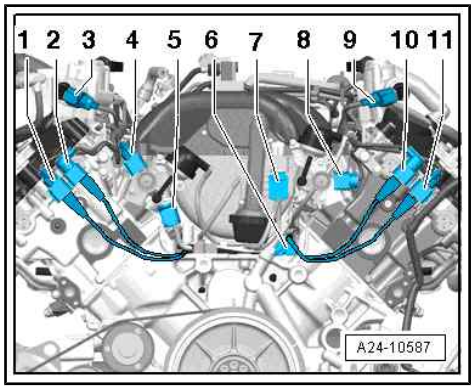
Fitting locations at front of engine (gradual introduction of modification in model year 2009)



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

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

3 - Fuel metering valve -N290-

4 - Intake manifold flap potentiometer -G336-

5 - Fuel pressure sender -G247-

6 - Intake manifold flap valve -N316- (CVTS tumble flaps)

7 - Variable intake manifold change-over valve -N156-

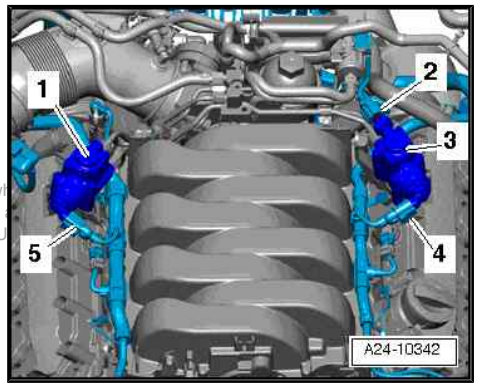
8 - Intake manifold flap potentiometer 2 -G512-

9 - Fuel metering valve -N290-

10 - Knock sensor 4 -G199- (black connector)

11 - Knock sensor 3 -G198- (brown connector)

Fitting locations of high-pressure pumps



1 - High-pressure pump on right side (cylinder bank 1)

2 - Fuel pressure sender for low pressure -G410-

3 - High-pressure pump on left side (cylinder bank 2)

4 - Fuel metering valve 2 -N402-

5 - Fuel metering valve -N290-

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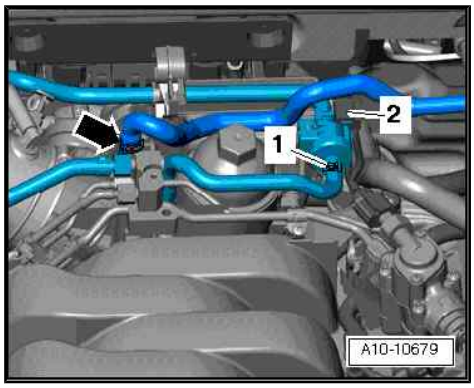
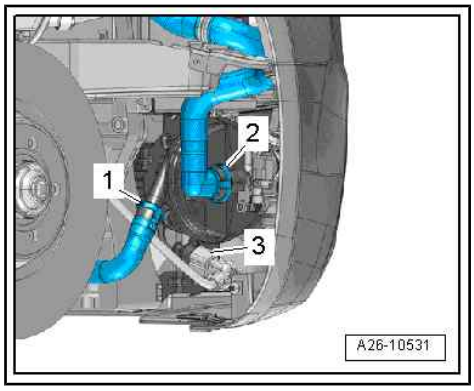
Activated charcoal filter solenoid valve 1 -N80- -2-



Secondary air pump motor -V101-



2.3 Air cleaner - exploded view

1 - Hose clip

2 - Air hose

- ❑ To throttle valve module -J338-
- ❑ When installing, pay attention to marking. Arrow on air hose should point towards bolt of throttle valve module -J338-

3 - Hose clip

4 - Air mass meter

- ❑ Removing and installing air mass meter -G70- with intake air temperature sender -G42- ⇒ page 24

5 - O-ring

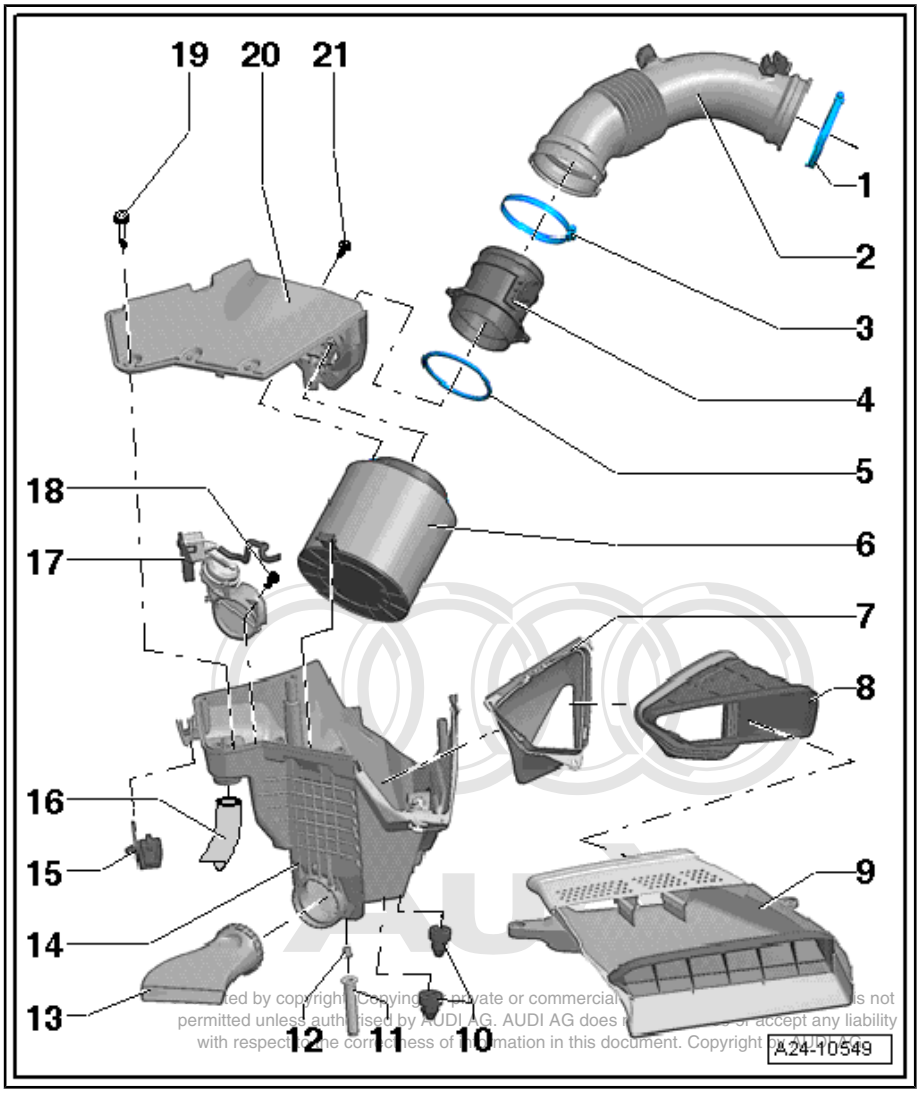
- ❑ Renew if damaged

6 - Air filter element

- ❑ Always use genuine part for air filter element.
- ❑ Maintenance intervals ⇒ Maintenance ; Booklet 811
- ❑ Removing and installing ⇒ page 19
- ❑ Also clean snow screen (if fitted)

7 - Air duct

- ❑ Clipped into air cleaner



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(top section)

- ❑ Make sure it is engaged correctly (to prevent unmetered air)
- ❑ Clean dirt and leaves out of air duct

8 - Air duct

- ❑ Clean dirt and leaves out of air duct

9 - Air duct

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

10 - Rubber grommet

11 - Water drain hose

- ❑ Important: Clean any leaves and dirt out of water drain hose

12 - Guide for water drain hose

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

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

14 - Air cleaner (bottom section)

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

15 - Retainer for air cleaner (bottom section)

16 - Intake hose for secondary air pump

17 - Variable intake manifold change-over valve -N335-

- ❑ With flap for variable intake manifold change-over

18 - Bolt

- ❑ For variable intake manifold change-over valve -N335-

19 - Bolt

20 - Air cleaner (top section)

- ❑ Clean any salt residue, leaves and dirt out of air cleaner (top section)
- ❑ Make sure it is engaged correctly (to prevent unmetered air)

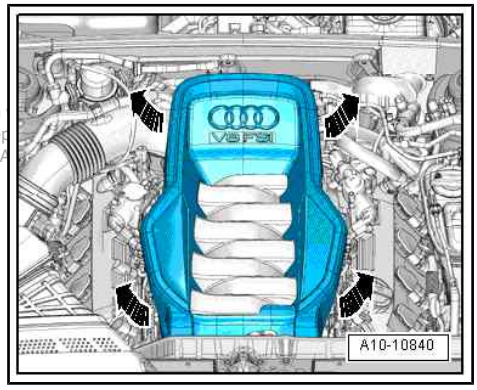
21 - Bolt

- ❑ For securing air filter element

2.4 Removing and installing engine cover panel

Removing

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



Installing

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– To avoid damage, do not strike the engine cover panel with your fist or with any kind of tool.

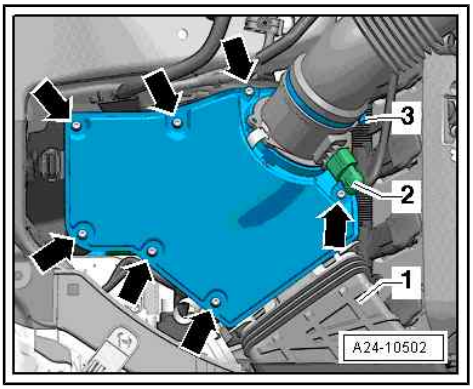
– Press engine cover panel with both hands into the rubber grommets at the rear and then into the grommets at the front.

2.5 Removing and installing air filter element

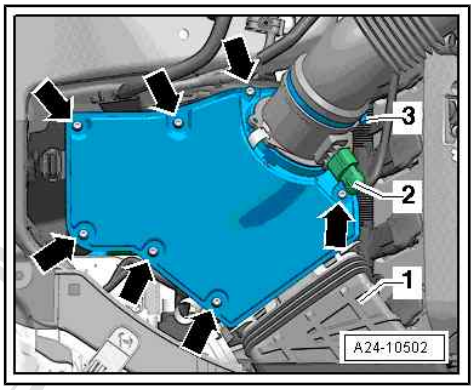
Removing

– Unplug electrical connector -2- at air mass meter -G70- .

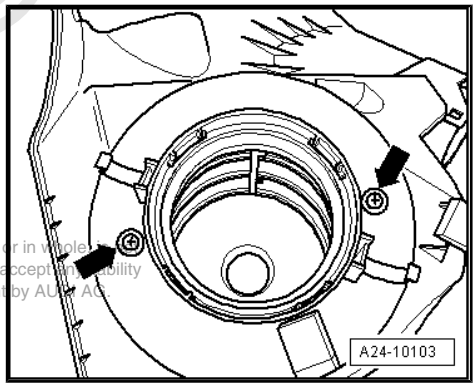
– Release hose clip -3- and detach air hose from air mass meter -G70- .



– Remove bolts -arrows- from air cleaner (top section) and lift out air cleaner (top section).



– Remove 2 securing bolts -arrows- from air filter element.



Installing

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

Note

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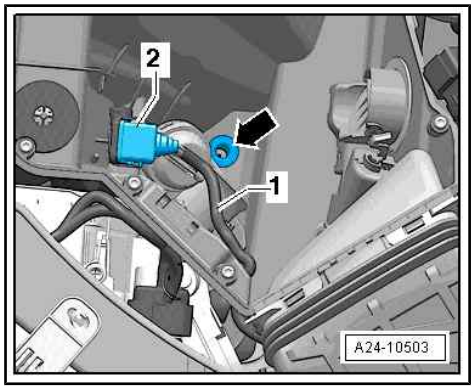
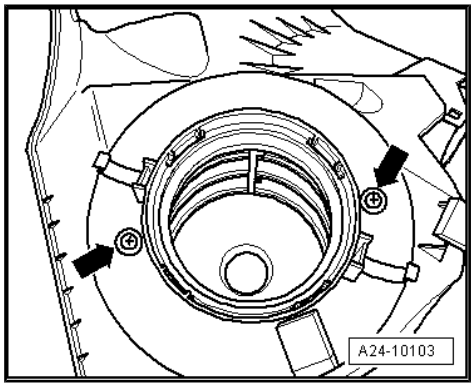
- *If the air filter element is very dirty or wet, dirt or water could reach the air mass meter -G70- and affect the air mass value. This would lead to loss of power, since a smaller injection quantity is calculated.*
- *Always use genuine part for air filter element.*
- *Use a silicone-free lubricant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

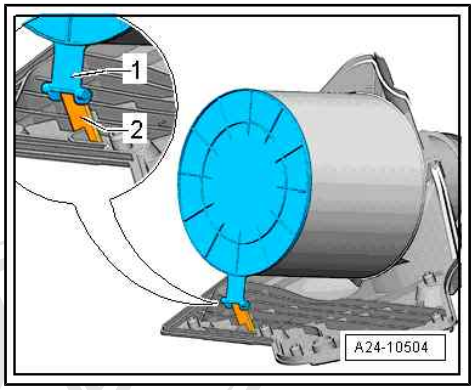
– Check water drain hose -arrow- in air cleaner (bottom section) for dirt and other obstructions (clean if necessary).
– Clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); use a vacuum cleaner if necessary.
– Check for salt residue, dirt and leaves in air mass meter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



– Screw air cleaner (top section) onto new air filter element.



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



Note

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

– Then screw top section of air cleaner back onto bottom section.
– Make sure that air hose is seated securely at air mass meter -G70- (note marking between air hose and air mass meter -G70-).
– Re-connect electrical connector at air mass meter -G70- .
– The remaining installation steps are carried out in the reverse sequence.

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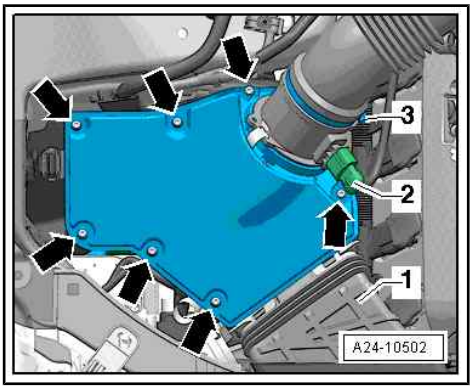
2.6 Removing air cleaner (bottom section)

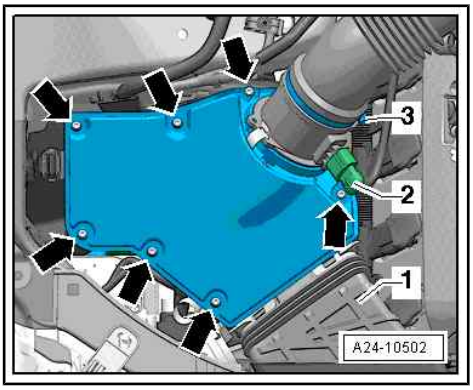
Removing

– Remove cover above radiator grille (4 bolts).
– Completely remove air duct -1-.

– Unplug electrical connector -2- at air mass meter -G70- .
– Release hose clip -3- and detach air hose from air mass meter -G70- .



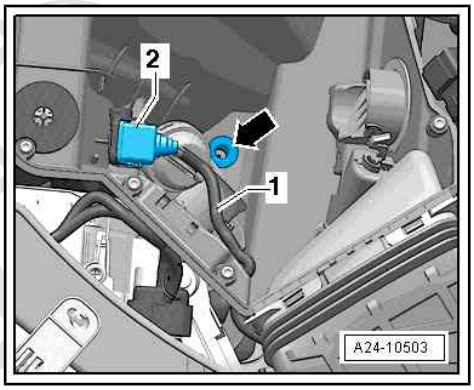
– Remove bolts -arrows- from air cleaner (top section) and lift out air cleaner (top section).



– Disconnect vacuum hose -1- at variable intake manifold change-over valve -N335- -2-.
– Release retainer for bottom section of air cleaner (press in rubber on left and right side and pull upwards).

Note

Do not use lubricant when installing retainer.



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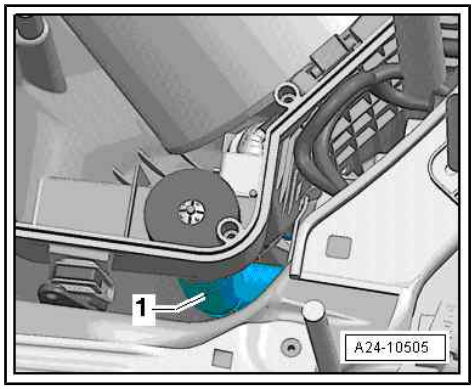
– Disconnect air hose -1- leading to secondary air pump.

– Disconnect electrical connector at variable intake manifold change-over valve -N335- .

– Carefully take out air cleaner (bottom section).



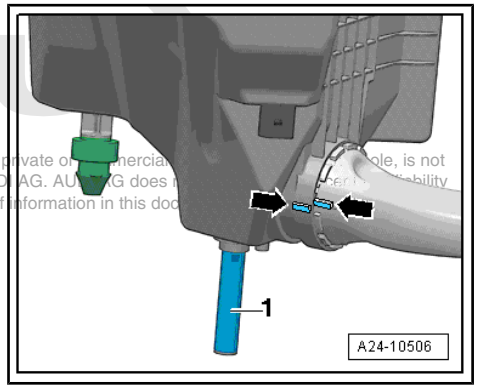
Installing

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

Note

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

– If warm air intake hose is fitted (for countries with cold climates only), make sure that air intake connection has engaged properly -arrows- (pay attention to markings).



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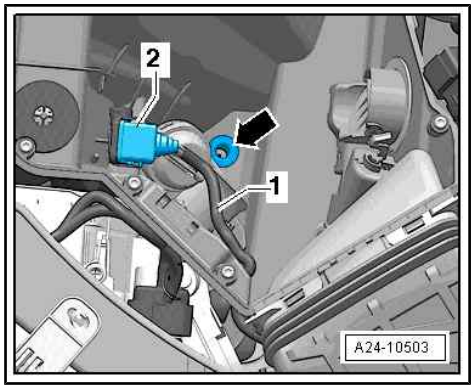
– Check water drain hose -arrow- in air cleaner (bottom section) for dirt and other obstructions (clean if necessary).

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

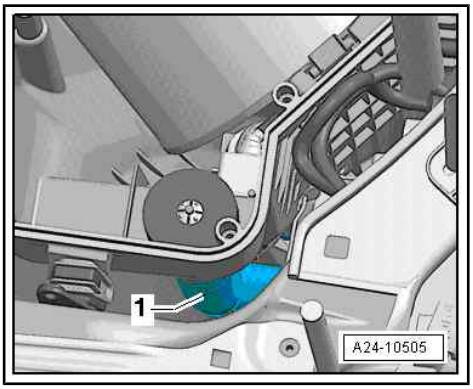
– Check for salt residue, dirt and leaves in air mass meter and air intake hose (engine intake side).

– Check for dirt in air duct leading to air filter element.

– Re-attach electrical connector at variable intake manifold change-over valve -N335- .



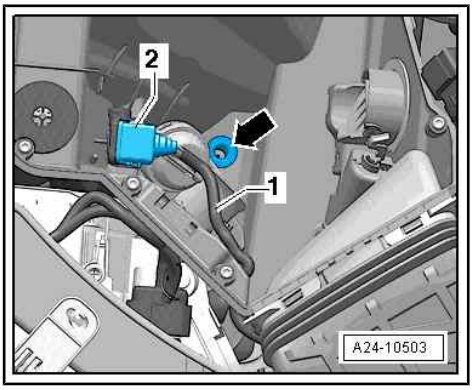
– Re-attach air hose -1- (make sure connection has engaged properly).
– Re-install air cleaner (bottom section).



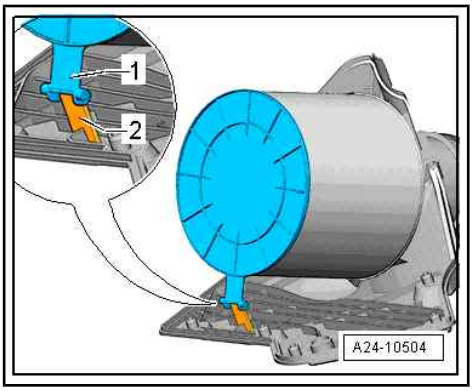
Note

The water drain hose must be routed straight downwards without kinks.

– Slide vacuum hose -1- back onto connection of variable intake manifold change-over valve -N335- .



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



Note

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

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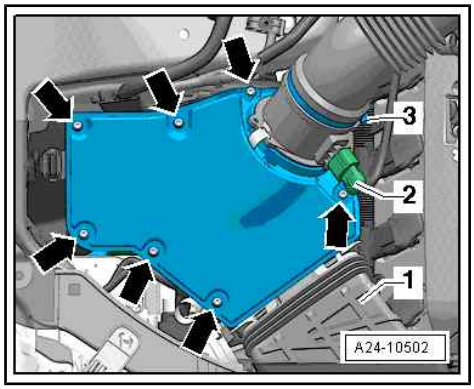
– Then screw top section of air cleaner back onto bottom section.
– Make sure that air hose is seated securely at air mass meter -G70- (note marking between air hose and air mass meter -G70- “arrows”).
– Re-connect electrical connector at air mass meter -G70- .
– The remaining installation steps are carried out in the reverse sequence.

2.7 Removing and installing air mass meter -G70-

Removing



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

Installing

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

Note

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

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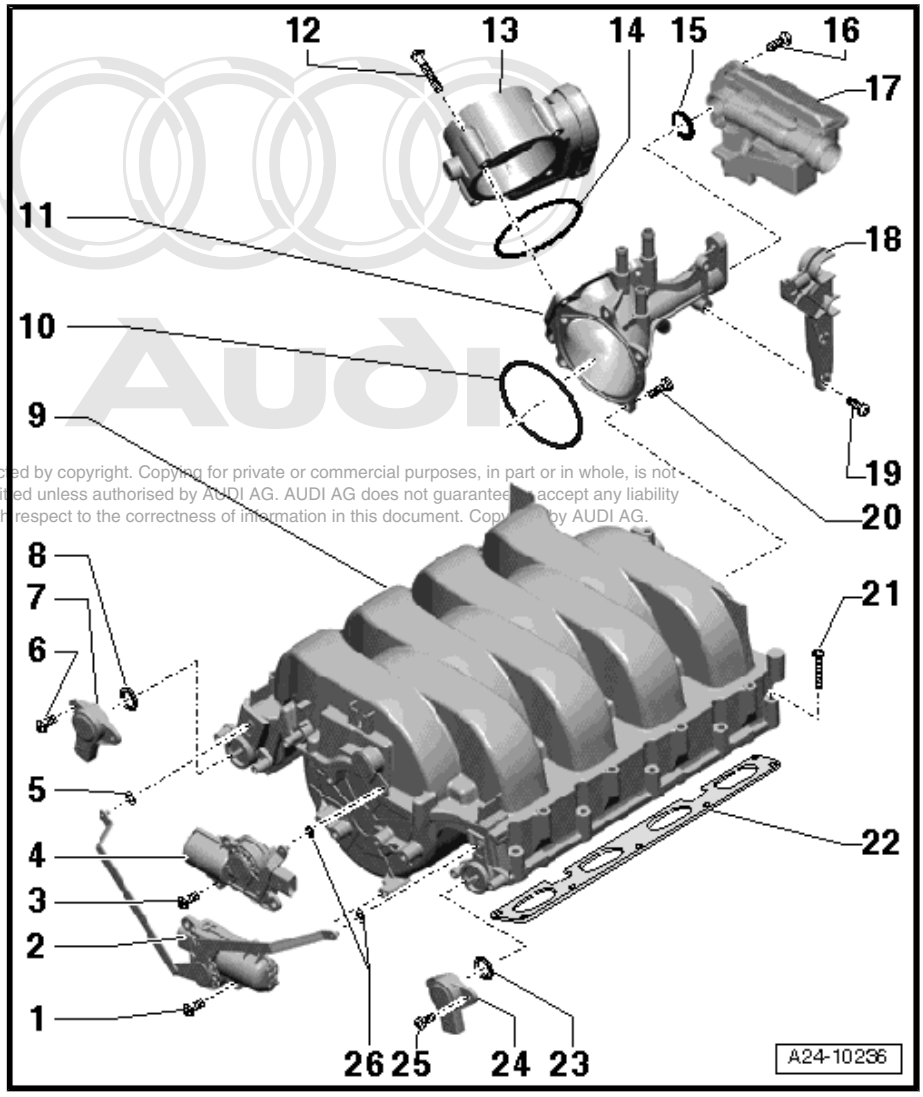
– Check for salt residue, dirt and leaves in air mass meter -G70- and air intake hose (engine intake side).
– Check for dirt in air duct leading to air filter element. If necessary, clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); wash out or use a vacuum cleaner as required. Removing and installing air cleaner ⇒ page 19 .
– If air filter element has been removed, clean water drain hose in air cleaner (bottom section).
– Align O-ring in slot on air cleaner housing and carefully push air mass meter -G70- into air cleaner housing.

Note

Renew O-ring if damaged.

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

2.8 Intake manifold (magnesium) - exploded view



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1 - Bolt

- ❑ 9 Nm

2 - Intake manifold flap motor -V157-

- ❑ In model year 2009 intake manifold flap motor -V157- is replaced with intake manifold flap valve -N316-

3 - Bolt

- ❑ 9 Nm

4 - Variable intake manifold motor -V183-

- ❑ In model year 2009 variable intake manifold motor -V183- is replaced with variable intake manifold changeover valve -N156-

5 - Circlip

6 - Bolt

- ❑ 2.5 Nm

7 - Intake manifold flap potentiometer -G336-

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

8 - Seal

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

9 - Intake manifold

- ❑ Removing and installing ⇒ page 26

10 - O-ring

- ❑ Renew

11 - Intake connecting pipe

- ❑ With crankcase breather connection

12 - Bolt

- ❑ 9 Nm

13 - Throttle valve module -J338-

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

14 - O-ring

- ❑ Renew

15 - O-ring

- ❑ Renew

16 - Bolt

- ❑ 9 Nm

17 - Pressure control valve for crankcase breather system

18 - Bracket

- ❑ For vacuum hose

19 - Bolt

- ❑ 9 Nm

20 - Bolt

- ❑ 9 Nm

21 - Bolt

- ❑ For tightening torque and tightening sequence, refer to ⇒ page 26

22 - Gaskets for intake manifold

- ❑ Renew

23 - Seal

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

24 - Intake manifold flap potentiometer 2 -G512-

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

25 - Bolt

- ❑ 2.5 Nm

26 - Circlips

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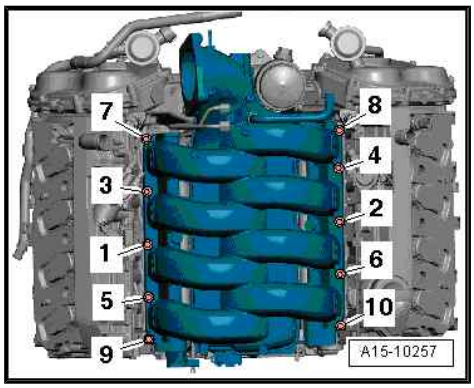
Tightening sequence for intake manifold

– Tighten bolts for intake manifold in the sequence -1 to 10-.

♦ Tighten initially to 8 Nm

♦ Subsequently tighten to 9 Nm and then tighten 90° further.



2.8.1 Removing and installing intake manifold

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 3 .*
- *A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.*

Note

Fit all cable ties in the original positions when installing.

Caution

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

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

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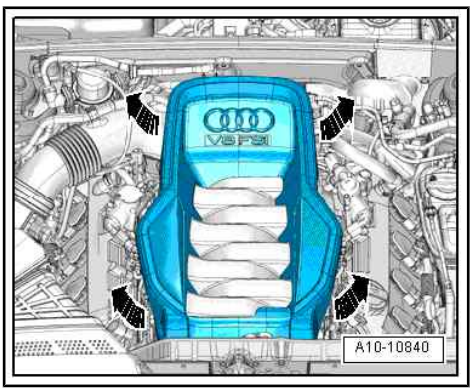
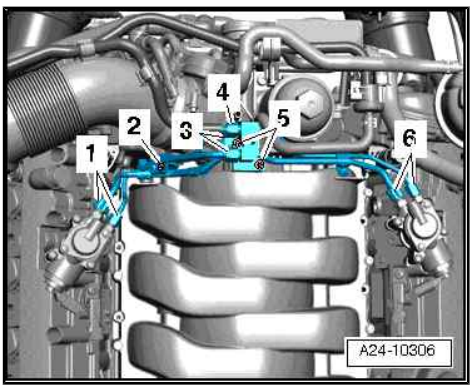
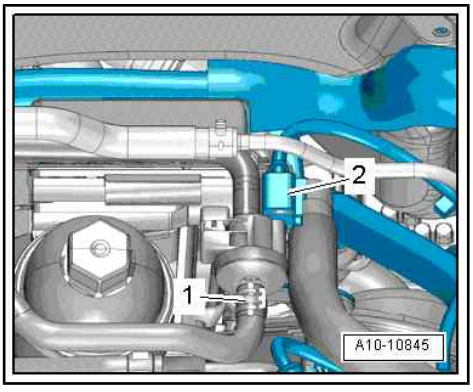
– Disconnect battery ⇒ Rep. Gr. 27 .
– Remove engine cover panel -arrows-.



– Disconnect fuel lines -1, 3, 4, 6-.
– Remove bolts -2- and -5- and detach fuel rail with high-pressure pipes.
– Move fuel line and vacuum line going to activated charcoal filter clear at air intake hose.



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



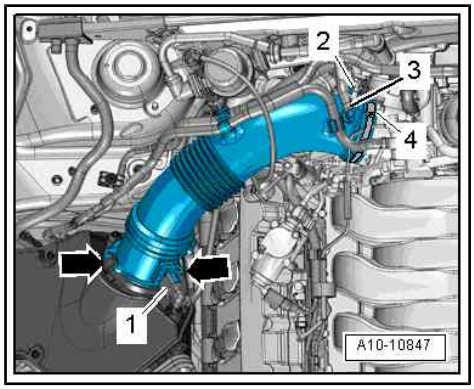
– Unplug electrical connector -1- from air mass meter -G70- .

– Detach vacuum line -3- going to air pipe.

Rest-of-world vehicles:

– Disconnect crankcase breather hose -2- from air hose by pressing release tabs.

– Remove air hose and air mass meter -G70- . To do so, release hose clip -4- and clamps -arrows-.



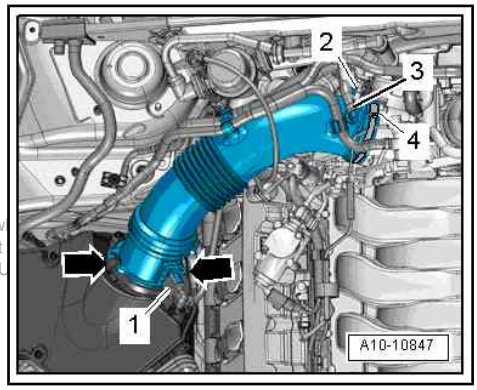
USA models:

Caution

Risk of violating emission legislation applying to USA models.

- ***Do NOT open hose connection -2-.***

– Move air intake hose clear to one side (crankcase breather hose -2- remains connected). To do so, release hose clips -4- and clamps -arrows-.



All vehicles (continued):

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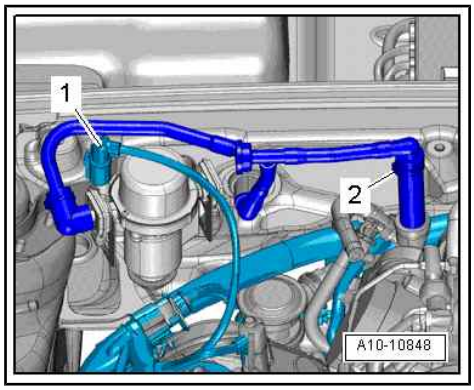
– Disconnect vacuum hose -2-.

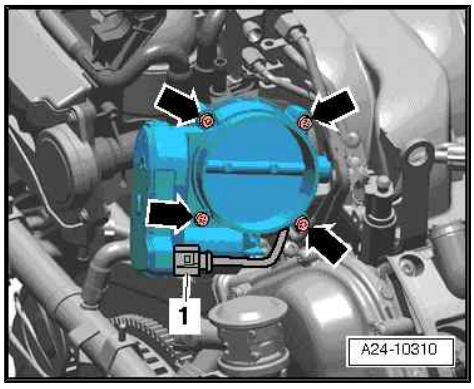


Note

Disregard -item 1-.

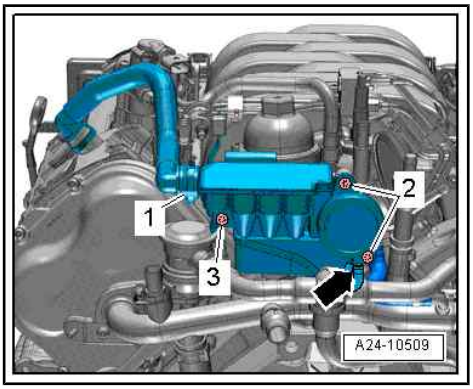
– Unplug electrical connector -1- at throttle valve module - J338- .

– Remove bolts -arrows- and detach throttle valve module - J338- .



– Slacken bolt -3- a few turns.

– Unscrew bolts -2- and remove pressure control valve for crankcase breather system from throttle valve housing.



Note

- *Disregard items marked -1- and -arrow-.*
- *For illustration purposes, the installation position is shown from the rear and with the engine removed.*

WARNING

Hot steam or hot coolant can escape when coolant expansion tank is opened; cover filler cap with cloth and open carefully.

– Open filler cap on coolant expansion tank.

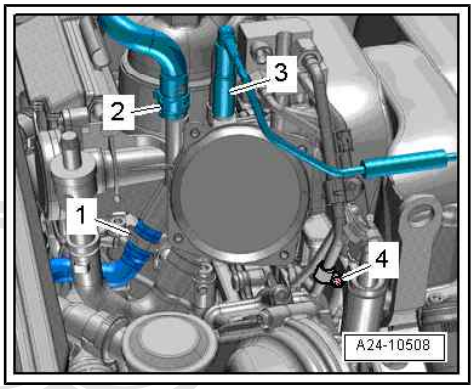
– Clamp off coolant hose -1- with hose clamp up to 25 mm -3094- and detach.

– Detach coolant hose -2-.

– Detach vacuum hose -3- and move clear to side.

– Remove bolt -4- at retaining clip for high-pressure lines.

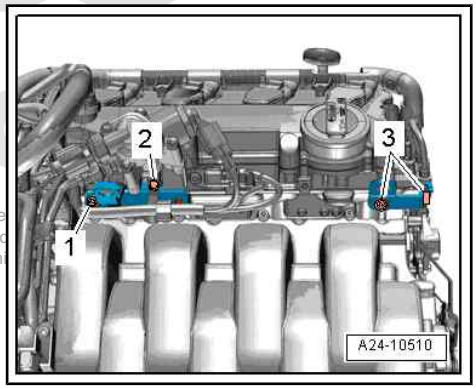
– Remove bolts -1- and detach engine lifting eye (rear left).



– Remove bolt -2- on bracket for wiring harness.

– Remove bolts -3- and move engine lifting eye (front left) with electrical connectors to one side.

– Push wiring harness to the left.



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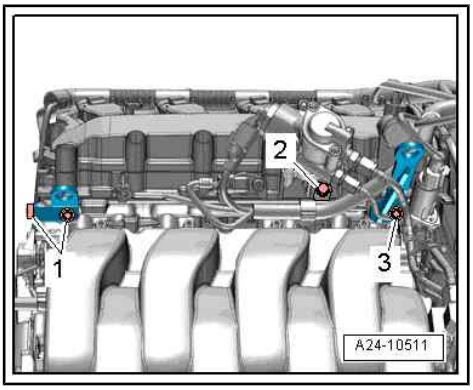
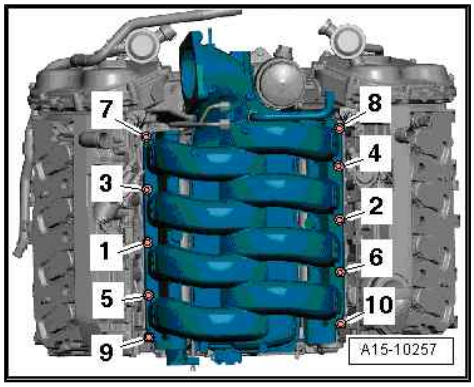
– Remove bolt -3- and remove engine lifting eye (rear right).

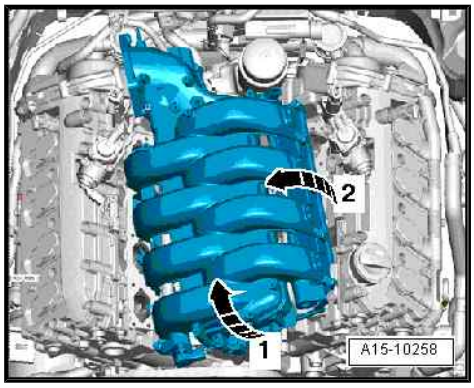
– Remove bolt -2- on bracket for wiring harness.



– Remove bolts for intake manifold in the sequence -10 ... 1-.
– To prevent scratches, mask off intake manifold in vicinity of high-pressure pipes with adhesive tape.



– First lift up intake manifold at the front -arrow 1-.



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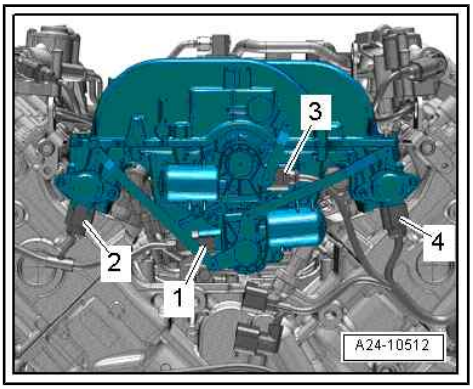
– Now unplug electrical connectors.

1 - Intake manifold flap motor -V157- (brown connector)

2 - Intake manifold flap potentiometer -G336-

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

4 - Intake manifold flap potentiometer 2 -G512-



Note

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

– Then pivot out intake manifold below high-pressure fuel pipes towards right side of vehicle -arrow 2-.

– Lift intake manifold out of engine compartment.

Caution

Risk of damage to engine.

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

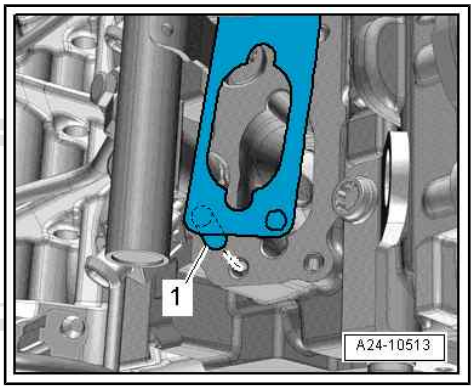
Installing

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

Note

- *Renew gaskets and O-rings.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- *The connections of the high-pressure pipes must not be damaged.*

– Note locating feature -1- when fitting gaskets for intake manifold.



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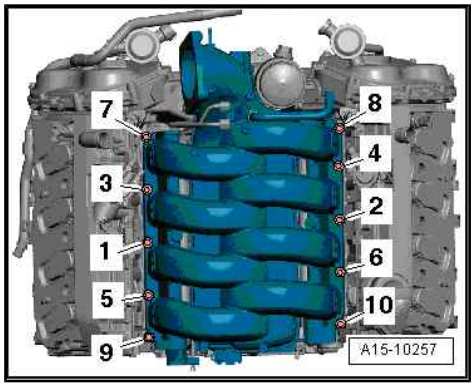
– Tighten bolts for intake manifold ⇒ page 26 .
– Install high-pressure pipes ⇒ page 65 .



2.8.2 Injectors with fuel rail - exploded view

1 - Radial compensation element
- ❑ Renew if damaged
- ❑ Clip onto support ring ⇒ Item 6 (page 32)

2 - Combustion chamber ring seal
- ❑ Do not apply grease to ring seal or use any other lubricants
- ❑ Renewing ⇒ “2.8.3 Removing and installing injectors”, page 34

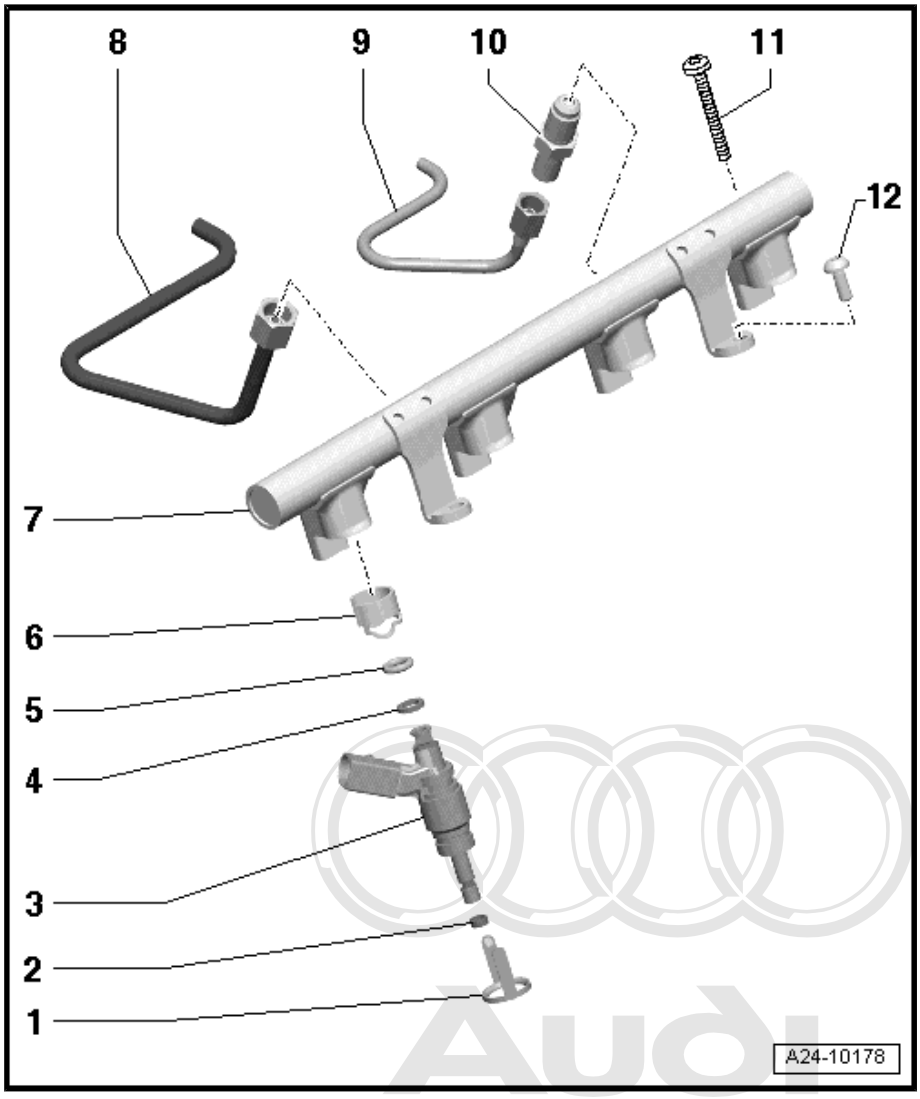
3 - Injector
- ❑ Removing and installing ⇒ page 34

4 - Spacer ring
- ❑ Renewing ⇒ “2.8.3 Removing and installing injectors”, page 34
- ❑ Via this support ring, the fuel rail exerts the clamping force that holds the injector in the cylinder head

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
- ❑ Removing and installing ⇒ “2.8.3 Removing and installing injectors”, page 34



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8 - High-pressure pipe

> **WARNING**
>
> *The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ page 3 .*
>
> *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

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9 - High-pressure pipe

> **WARNING**
>
> *The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ page 3 .*
>
> *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
- ❑ Installing high-pressure pipes ⇒ page 65

10 - Pressure relief valve, 140 bar

- ❑ For high-pressure pipe
- ❑ 25 Nm

11 - Bolt

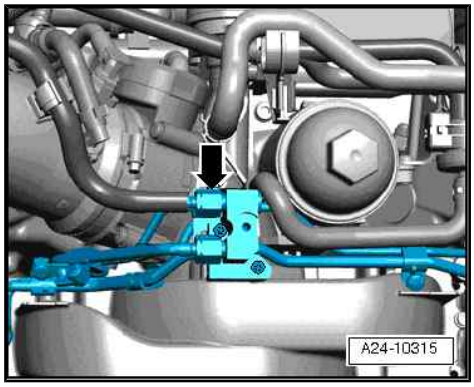
- ❑ 9 Nm
- ❑ Tighten in stages and in diagonal sequence

12 - Bolt

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

Tightening torque for fuel supply pipe

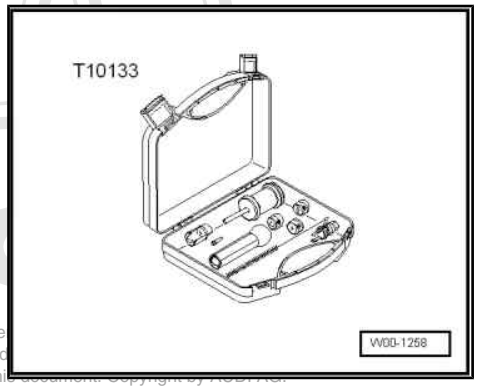
- Tightening torque: 25 Nm



2.8.3 Removing and installing injectors

Special tools and workshop equipment required

- Tool set for FSI engines -T10133-



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Note

Special tool T10133/2 (puller) has been modified and now has the designation puller T10133/2 A . If you have not yet received the new tool you can make the modification yourself.

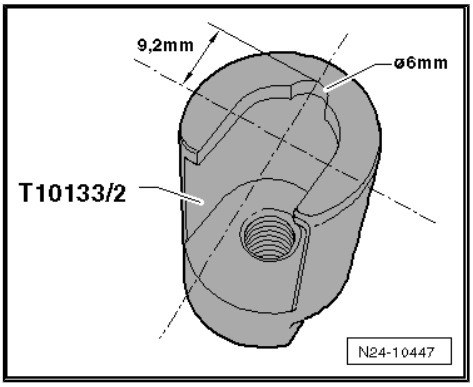
Modifying special tool T10133/2 (puller) to make it equivalent to puller T10133/2 A

Special tools and workshop equipment required

- Round file, approx. 6 mm

– File out a semi-circular recess as shown in the illustration. The recess allows the tool to be pushed further onto the injector so the contact surface is increased.

– For identification purposes, mark the modified tool with the letter “A” after the tool number.



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 3 .*
- *A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.*

– Remove intake manifold ⇒ page 26 .

Note

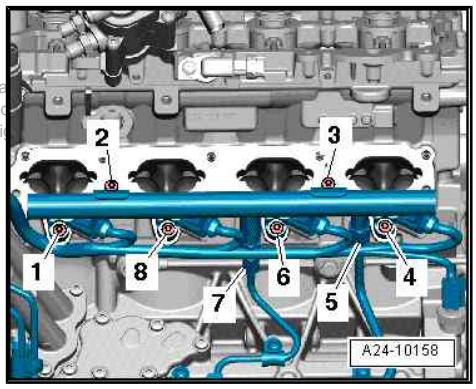
Seal off the injector openings in the cylinder heads with clean cloths.

– Unplug electrical connectors at injectors.

– Unscrew high-pressure pipe -5- at connection on fuel rail.

– Unscrew high-pressure pipe -7- at connection on fuel rail. To do so, counterhold at hexagon flats with an open-end spanner and slacken union nut.

– Remove bolts -1, 2, 3, 4, 6 and 8-.



Note

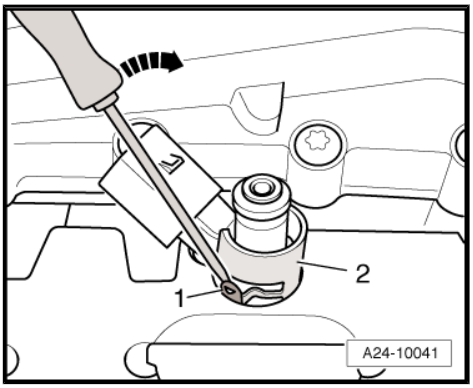
Do not attempt to bend high-pressure pipes to a different shape.

– 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.



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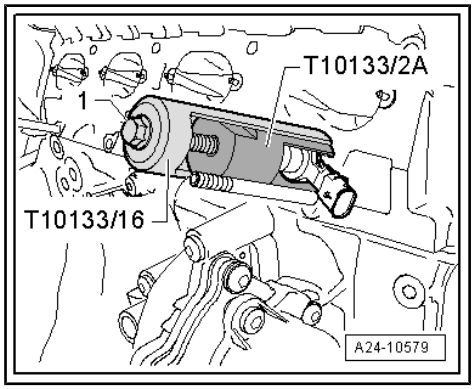
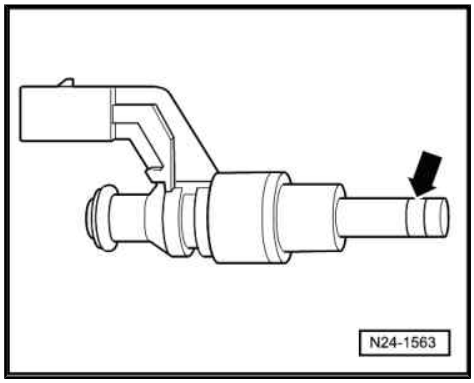
– Guide puller -T10133/2A- into groove on injector.
– Then attach removal tool -T10133/16- and pull out injector by turning bolt -1-.



Note

When inserting the puller, there is a risk of destroying the radial compensation element due to the retainer tabs breaking.

– 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.

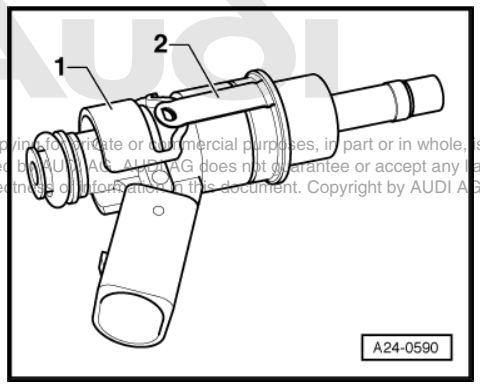
– Before new teflon ring is fitted, any combustion residue must be removed from ring groove and injector stem using a clean cloth.

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.*

– 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.



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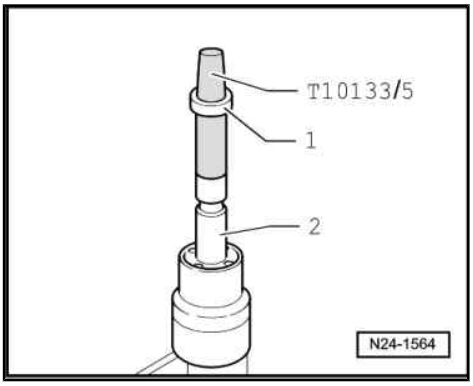
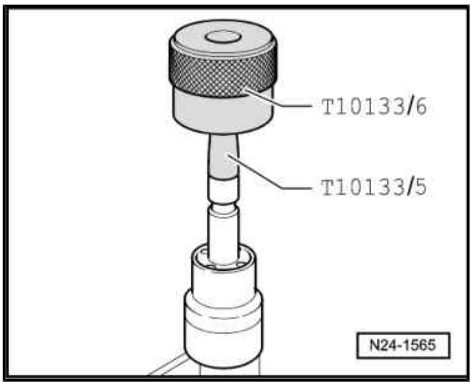
– Fit assembly cone -T10133/5- with new combustion chamber ring seal -1- onto injector -2-.



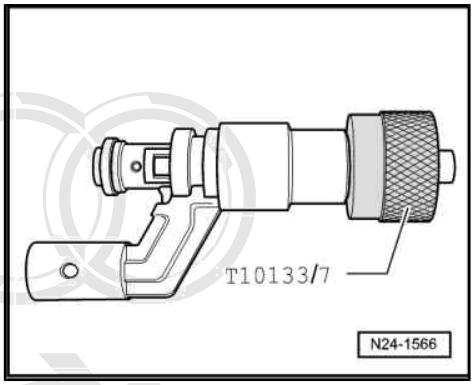
– Push combustion chamber ring seal onto assembly cone -T10133/5- as far as it will go using assembly sleeve -T10133/6- .
– Turn assembly sleeve -T10133/6- upside down and push combustion chamber ring seal into sealing ring groove.



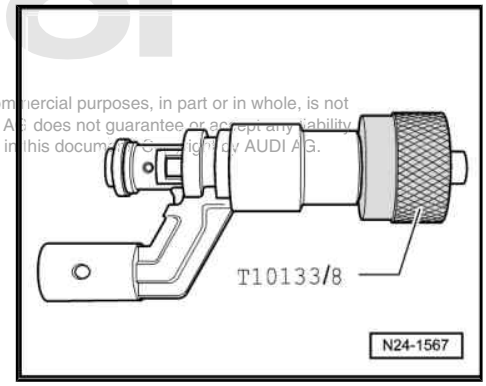
Note

The combustion chamber ring seal is widened when it is pushed onto the injector. After pushing on the combustion chamber ring seal, 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.



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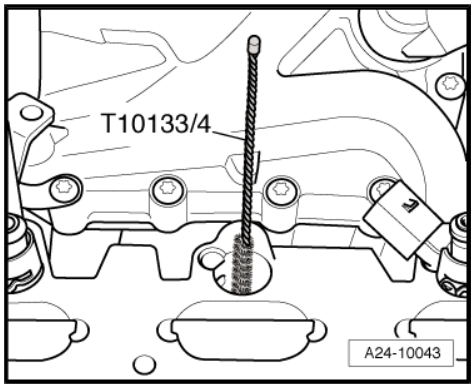
Note

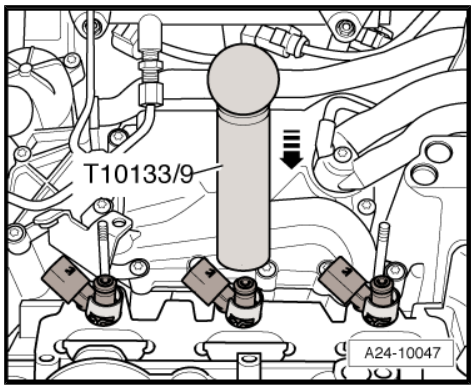
- *The combustion chamber ring seal must not be lubricated.*
- *Do not apply grease, oil or any other lubricant to combustion-chamber ring seal.*

Installing injectors:

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



– Use assembly tool -T10133/9- to push injector into hole in cylinder head.



Note

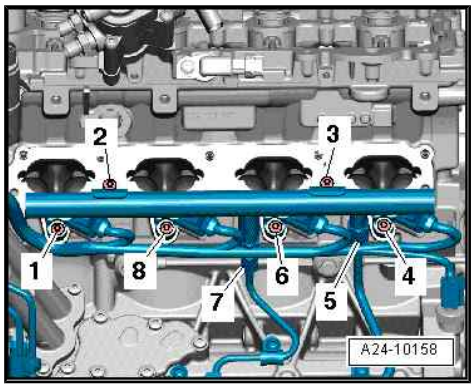
It should be possible to insert the injector easily. If necessary wait until the combustion chamber ring seal has contracted sufficiently.

– 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 -1, 2, 3, 4, 6 and 8- in diagonal sequence and in stages.



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

• Tightening torques: refer to exploded view of injectors with fuel rail ⇒ page 32 .

Note

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

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

– Install intake manifold ⇒ page 26 .

– Install high-pressure pipes ⇒ page 65 .

2.9 Intake manifold (plastic - gradual introduction in model year 2009) - exploded view

From model year 2009 onwards, a plastic intake manifold is installed (a combination is possible in model year 2009).

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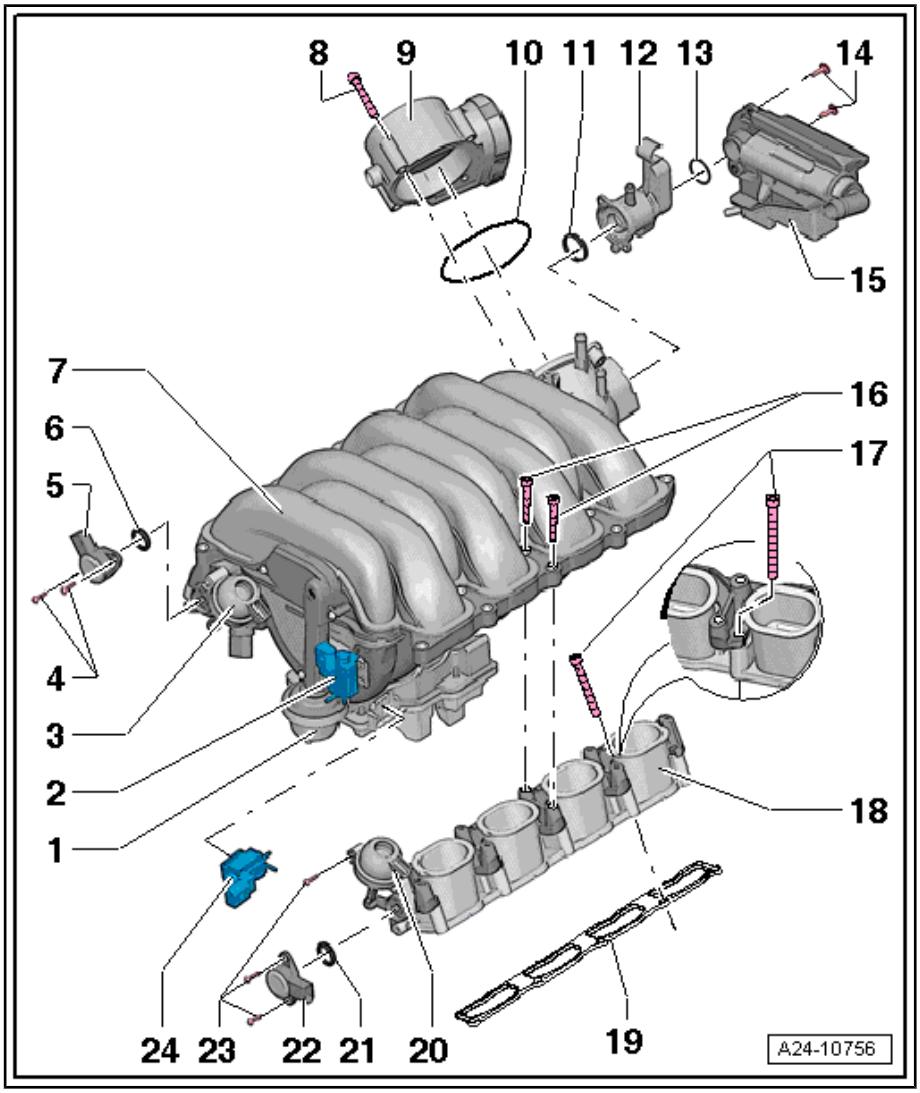

1 - Vacuum unit for intake manifold change-over

2 - Variable intake manifold change-over valve -N156-

3 - Vacuum unit for intake manifold flaps (cylinder bank 1)

- ❑ For CVTS tumble flaps (cylinder bank 1)

4 - Bolt

- ❑ 2.5 Nm

5 - Intake manifold flap potentiometer -G336-

- ❑ Cylinder bank 1
- ❑ After renewing, perform “Adaption” in “Guided Functions”, vehicle diagnostic, testing and information system -VAS 5051B- .

6 - Seal

- ❑ Renew if damaged
- ❑ Open side faces towards potentiometer

7 - Intake manifold

- ❑ Removing and installing ⇒ page 41

8 - Bolt

- ❑ 9 Nm

9 - Throttle valve module -J338-

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

10 - O-ring

- ❑ Renew

11 - O-ring

- ❑ Renew

12 - Adapter for crankcase breather system

- ❑ Tighten to 2.5 Nm

13 - O-ring

- ❑ Renew

14 - Bolt

- ❑ 9 Nm

15 - Pressure control valve for crankcase breather system

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16 - Bolts for intake manifold

- ❑ For tightening torque and tightening sequence, refer to ⇒ page 40

17 - Bolts for intake manifold (bottom section)

- ❑ For tightening torque and tightening sequence, refer to ⇒ page 40

18 - Intake manifold (bottom section)

19 - Gaskets for intake manifold

- ❑ Renew

20 - Vacuum unit for intake manifold flaps (cylinder bank 2)

- ❑ For CVTS tumble flaps (cylinder bank 2)

21 - Seal

- ❑ Renew if damaged
- ❑ Open side faces towards potentiometer

22 - Intake manifold flap potentiometer 2 -G512-

- ❑ Cylinder bank 2
- ❑ After renewing, perform “Adaption” in “Guided Functions”, vehicle diagnostic, testing and information system -VAS 5051B- .

23 - Bolt

- ❑ 2.5 Nm

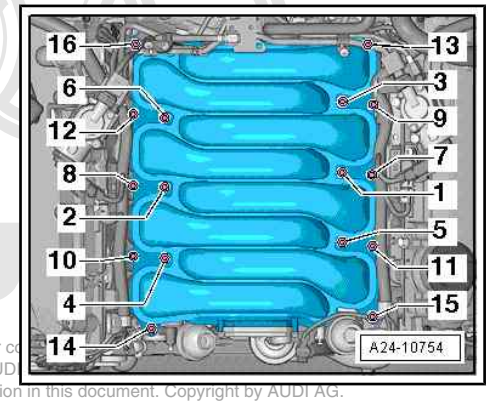
24 - Intake manifold flap valve -N316-

Tightening torque and tightening sequence for intake manifold

– Tighten bolts for intake manifold in the sequence -1 to 16-.

♦ Tighten initially to 8 Nm in specified sequence

♦ Subsequently tighten to 11 Nm in specified sequence



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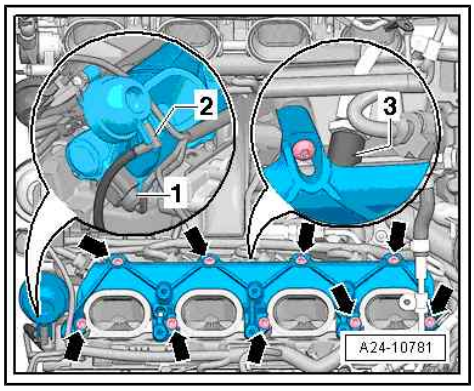
Intake manifold (bottom section) - tightening torque

– Tighten bolts -arrows- for intake manifold (bottom section) in diagonal sequence and in stages.

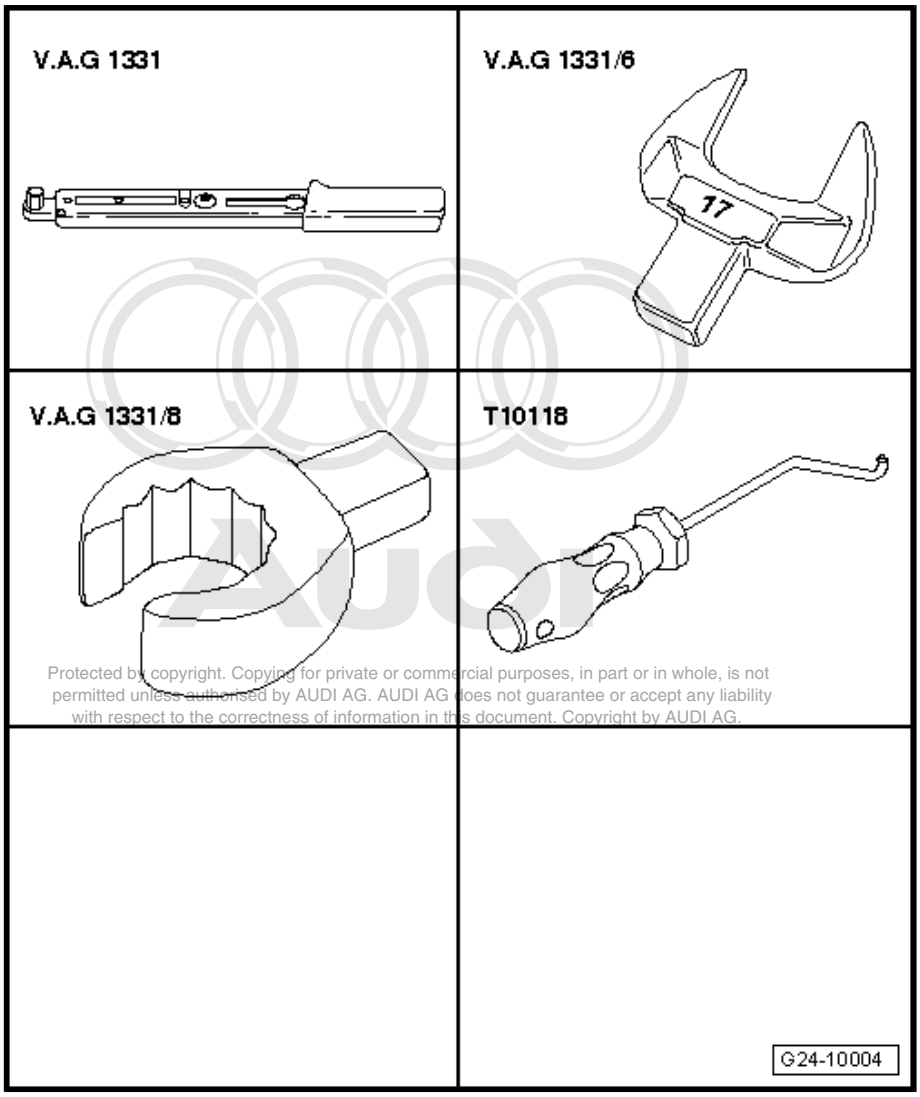
• 10 Nm



2.9.1 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-
- Assembly tool -T10118-



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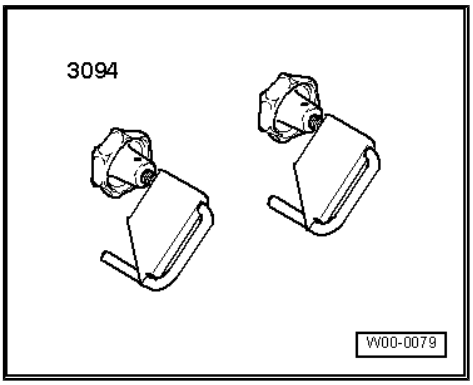
- Hose clamps for hoses up to 25 mm -3094-



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 3 .*
- *A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.*

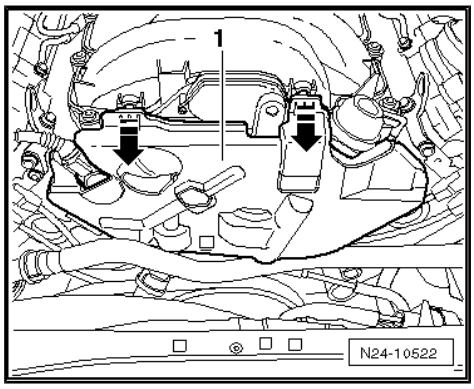
Note

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

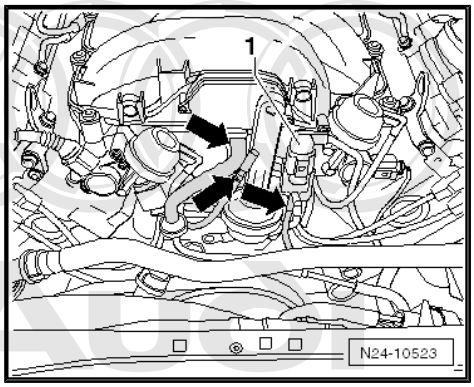
– Disconnect earth wire at battery with ignition switched off.

– Pull off engine cover panel.

– Pull cover -1- towards front and lift off.



– Unplug electrical connector -1- and detach vacuum lines -arrows-.



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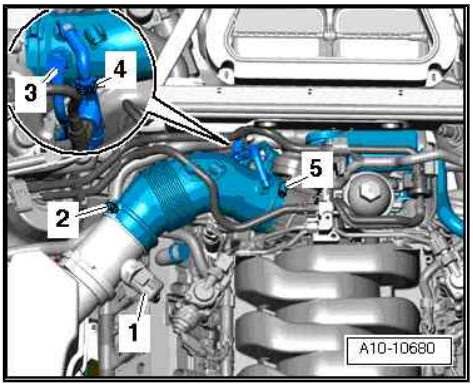
– Detach vacuum line -4- at air intake hose.



Note

Disregard -item 1-.

Rest-of-world vehicles:

– Disconnect hose -3- for crankcase breather system from air hose by pressing release tabs.

– Release hose clips -2- and -5- and remove air intake hose.

USA models:

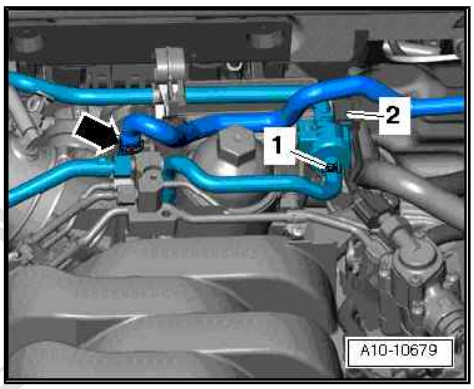
– Release hose clips -2- and -5- and move air intake hose clear to one side (crankcase breather hose -3- remains connected).

Caution

Do not open hose connection -3- on USA models.

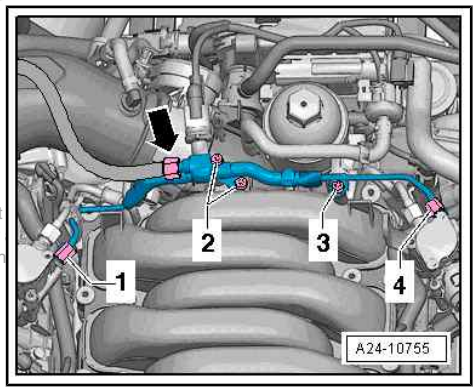
– Unplug electrical connector -2- at activated charcoal filter solenoid valve 1 -N80- and detach vacuum hose -1-.

– Detach activated charcoal filter solenoid valve 1 -N80- from bracket and move it clear to the side with hose still attached.



– Disconnect fuel lines -1 and 4- at high-pressure pumps.

– Remove bolts -2 and 3-.



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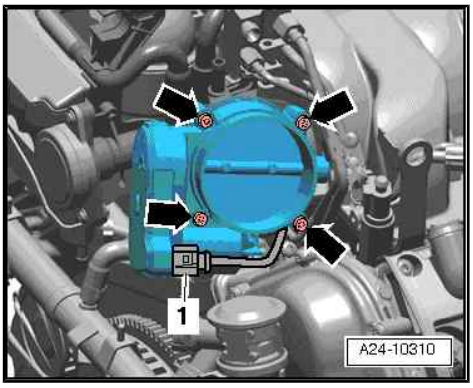
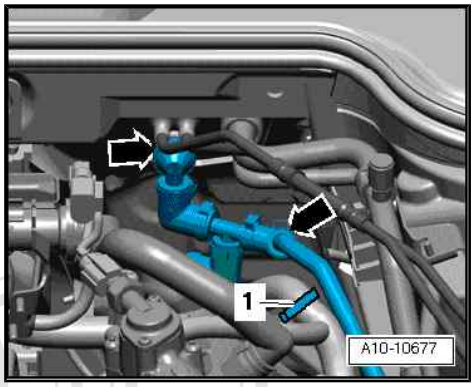
– Unplug electrical connector -1- at throttle valve module - J338- .

– Unscrew bolts -arrows- and remove throttle valve module - J338- .



– Detach vacuum lines -arrows- going to brake servo.
– Move vacuum lines clear to one side.



Note

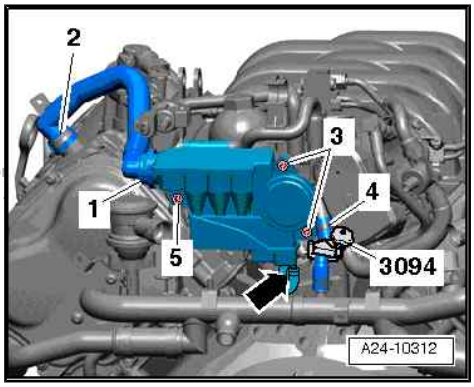
Disregard -item 1-.

WARNING

Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

– Open filler cap on coolant expansion tank.

– Detach crankcase breather hose at the points marked with -item 1- and -item 2- (press release tabs).
– Clamp off coolant hose -4- using hose clamp (up to 25 mm) -3094- and detach coolant hose from intake manifold connection.
– Slacken bolt -5- a few turns.
– Unscrew bolts -3- and carefully remove pressure control valve for crankcase breather system from intake manifold connection.



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Note

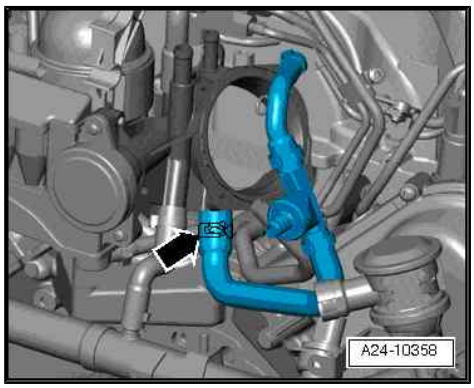
- *Disregard -arrow-.*
- *Shown from rear with engine removed for illustration purposes.*

Note

Lay a cloth under the intake manifold connection to catch escaping coolant.

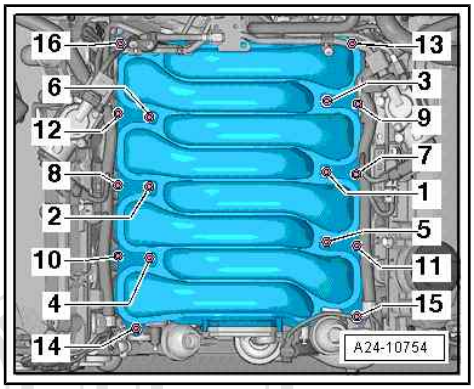
– Detach coolant hose -arrow- and move clear to one side.

– Detach vacuum hose -arrow- going to intake manifold connection.



– Remove bolts for intake manifold in the sequence -16 to 1-.

– Remove intake manifold from engine compartment.



Note

Seal intake ducts in cylinder heads with clean cloths.

Installing

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.*

– Check seals in intake manifold for damage and make sure they are positioned correctly.

– Make sure that hoses and wires are not trapped.

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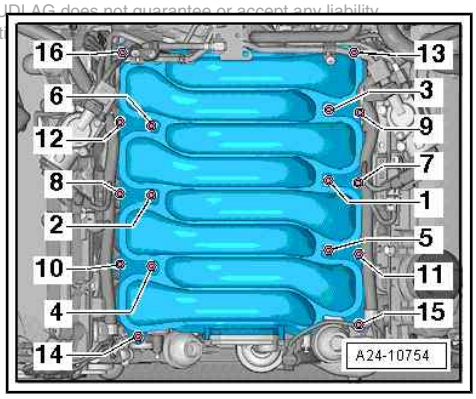
– Tighten bolts for intake manifold in the sequence -1 to 16-.



- Tightening torques: refer to exploded view of intake manifold ⇒ page 40
- Tightening torques: refer to exploded view of fuel rail with injectors ⇒ page 47 .

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

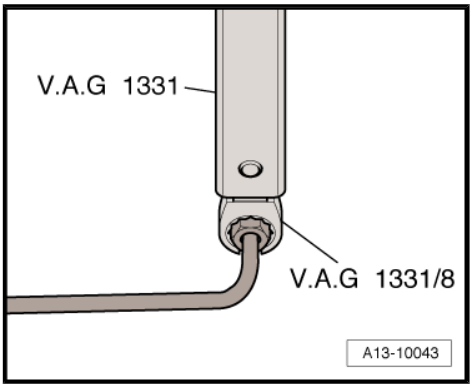
Note

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

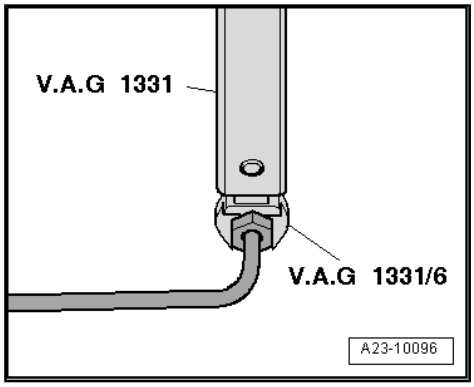
– Tighten union nuts on high-pressure pipes hand-tight initially.

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

– To tighten union nuts (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 nuts (17 mm) for high-pressure pipes, use torque wrench -V.A.G 1331- with tool insert (17 mm) -V.A.G 1331/6- .
- Do not install mounting brackets until high-pressure pipes have been finally secured.
- Observe notes on procedures required after connecting battery ⇒ Rep. Gr. 27 .
- If necessary, fill up with coolant ⇒ Rep. Gr. 19 .



2.9.2 Intake manifold (bottom section) with fuel rail - exploded view

1 - Bracket
- ❑ For flange and fuel rail

2 - Seal
- ❑ Renew

3 - Sleeve

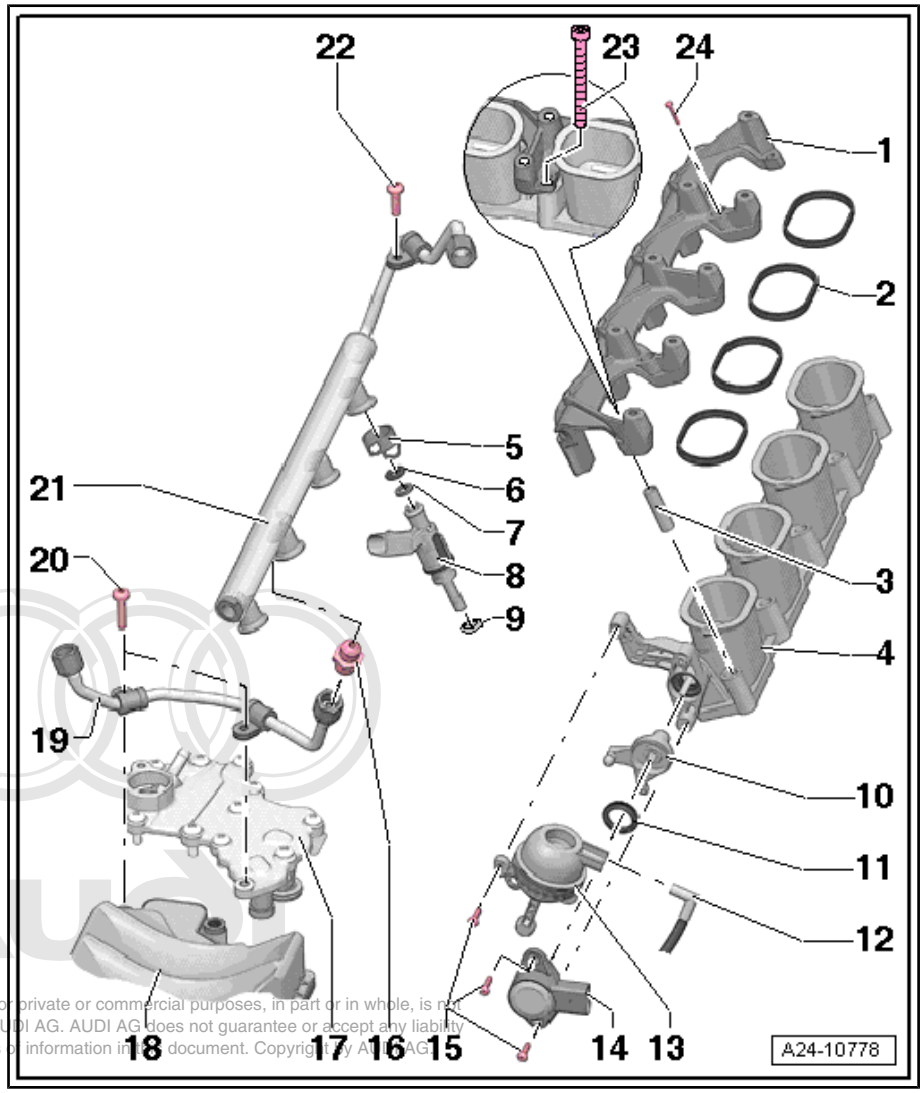
4 - Intake manifold (bottom section)
- ❑ When installing intake manifold (bottom section), intake manifold flaps must be in output position (intake channel fully open)
- ❑ Removing and installing ⇒ page 48
- ❑ 10 Nm

5 - Support ring
- ❑ Renew if damaged
- ❑ When installing, make sure it is seated correctly

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

7 - Spacer ring
- ❑ Renew if damaged

8 - Injector
- ❑ Removing and installing ⇒ page 51



9 - Combustion chamber ring seal
- ❑ Do not apply grease to ring seal or use any other lubricants
- ❑ Renew

10 - Operating lever
- ❑ For vacuum unit

11 - Seal
- ❑ Renew if damaged

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- ❑ When renewing lever out with screwdriver
- ❑ Press in by hand

12 - Vacuum hose

- ❑ From intake manifold flap valve -N316-

13 - Vacuum unit for actuating intake manifold flaps

14 - Intake manifold flap potentiometer 2 -G512-

15 - Bolts

- ❑ 2.5 Nm

16 - Threaded connection

- ❑ 40 Nm

17 - Cover

- ❑ For spray nozzle valve and oil retention valve
- ❑ Removing and installing ⇒ Rep. Gr. 17

18 - Vacuum reservoir

19 - High-pressure fuel pipe

20 - Bolts

- ❑ 9 Nm

21 - Fuel rail

- ❑ Removing and installing ⇒ page 48

22 - Bolts

- ❑ 9 Nm

23 - Bolts

- ❑ 9 Nm

24 - Bolts

- ❑ 0.3 Nm

2.9.3 Injectors and fuel rail - exploded view

Note

The illustration shows the fuel rail (right-side) for cylinder bank 1.

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1 - Bolts
- ❑ 0.3 Nm

2 - Bracket
- ❑ For flange and fuel rail

3 - Support ring
- ❑ Renew if damaged
- ❑ Clip onto support ring ⇒ Item 8 (page 48)

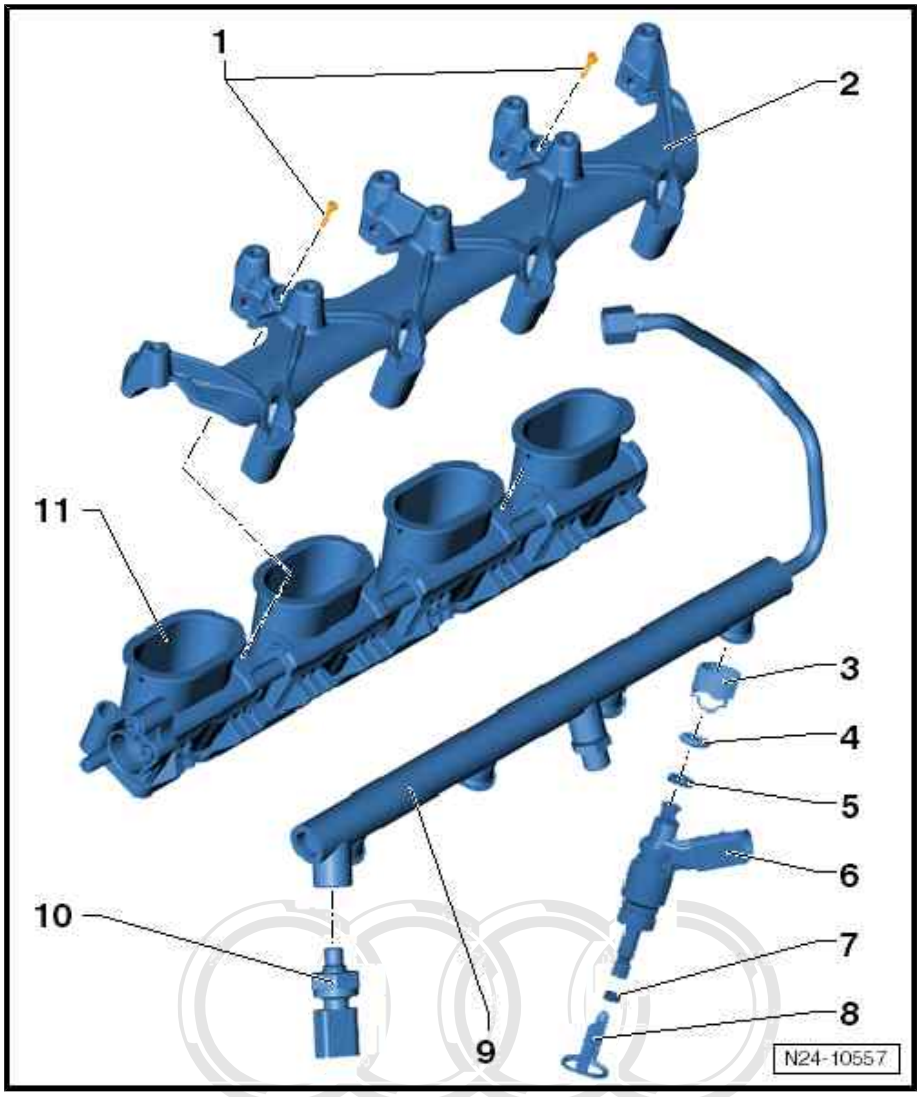
4 - O-ring
- ❑ Renew
- ❑ Lubricate lightly with clean engine oil

5 - Spacer ring
- ❑ Renew if damaged

6 - Injector
- ❑ Removing and installing ⇒ page 51

7 - Combustion chamber ring seal
- ❑ Do not apply grease to ring seal or use any other lubricants
- ❑ Renew

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



9 - Fuel rail
- ❑ Removing and installing ⇒ page 48

10 - Fuel pressure sender -G247-
- ❑ Lubricate taper seal with oil
- ❑ 25 Nm

11 - Intake manifold (bottom section)
- ❑ Removing and installing ⇒ page 48
- ❑ 10 Nm

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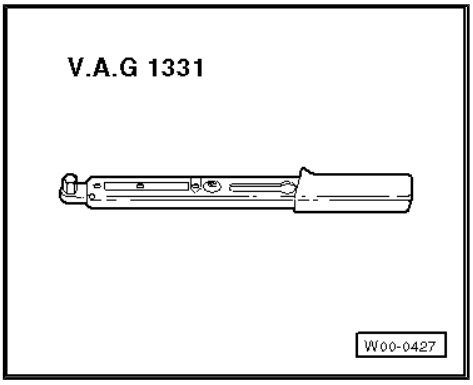
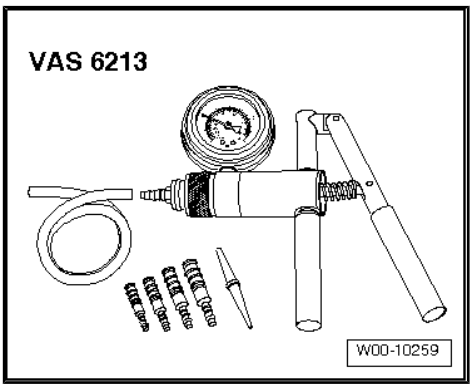
2.9.4 Removing and installing intake manifold (bottom section) with fuel rail

Special tools and workshop equipment required

- Torque wrench -V.A.G 1331-



- Tool inserts -V.A.G 1331/2- , 17 mm
- Hand vacuum pump -VAS 6213-



Removing

Note

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

WARNING

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

- ***The fuel pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening the system ⇒ page 3 .***

– Reduce fuel pressure in high-pressure section of injection system ⇒ page 3 .

– Detach vacuum hose from vacuum unit for intake manifold flaps.

– Unscrew union nut for high-pressure fuel pipe at high-pressure pump (counterhold threaded connection).

– Unplug electrical connector -1- at intake manifold flap potentiometer and pull off vacuum hose -2-.

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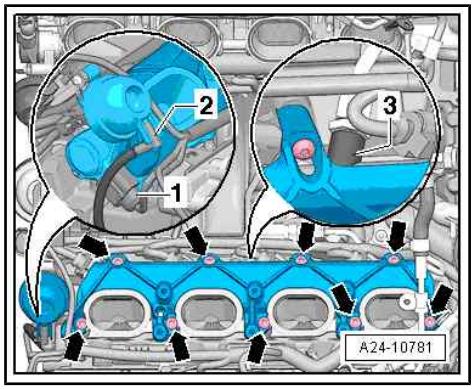
– Unscrew union nut -3- (counterhold threaded connection).
– Remove bolts -arrows- and detach intake manifold (bottom section) with fuel rail.



Caution

Risk of damage to engine.

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

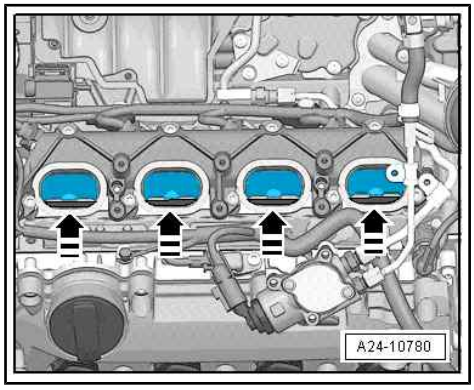
Installing

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

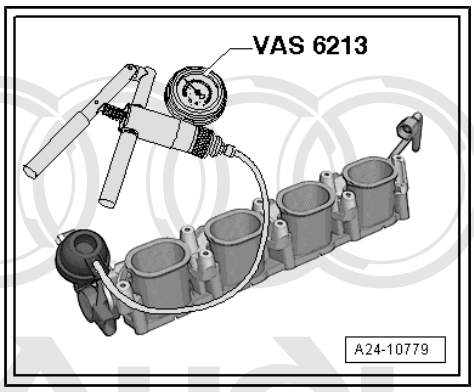
Note

- *Renew gaskets and O-rings.*
- *Lubricate O-rings of injectors lightly with clean engine oil.*

When installing intake manifold (bottom section) move intake manifold flaps in direction of -arrow-.



– To do so, connect hand vacuum pump -VAS 6213- to connection for vacuum unit for intake manifold flaps.
– Use hand vacuum pump to generate vacuum.
• This will cause the intake manifold flaps to open.



Note

If the intake manifold flaps are not opened, they can catch on the guide plates in the cylinder head when the intake manifold (bottom section) is installed.

– Then press intake manifold (bottom section) evenly onto injectors.
– Tighten bolts for intake manifold (bottom section) in diagonal sequence to specified torque.
• Tightening torque: refer to intake manifold - exploded view ⇒ page 38
– Detach hand vacuum pump from connection for vacuum unit for intake manifold flaps.
– Tighten union nut for high-pressure fuel pipe at high-pressure pump (counterhold threaded connection).

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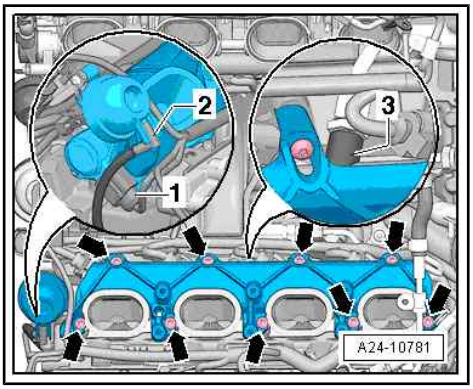
– Tighten union nut -3- (counterhold threaded connection).

• Tightening torque: refer to exploded view of high-pressure pump ⇒ page 60 .

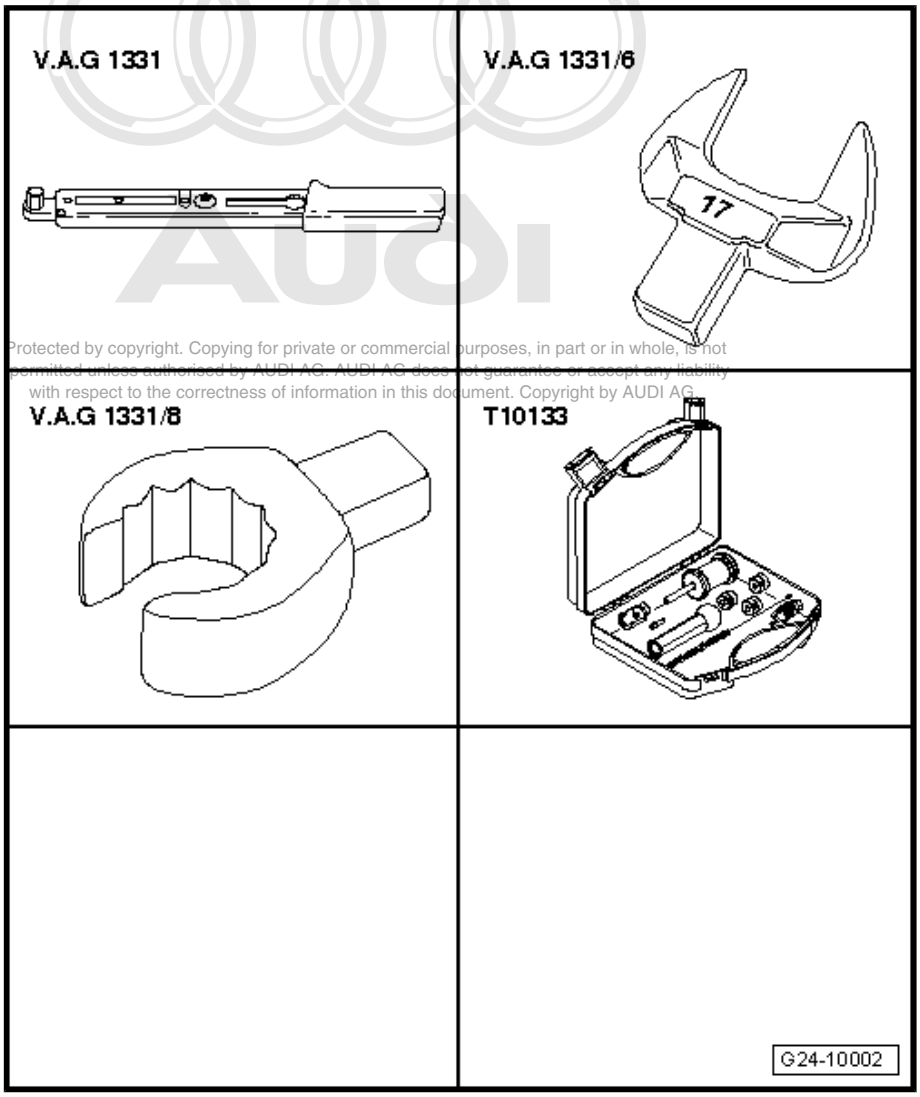
– Ensure that high-pressure pipe is not under tension.



2.9.5 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 for FSI engines - T10133-



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Removing

Note

The following description is for removing and installing the injectors on the left side (cylinder bank 2).

WARNING

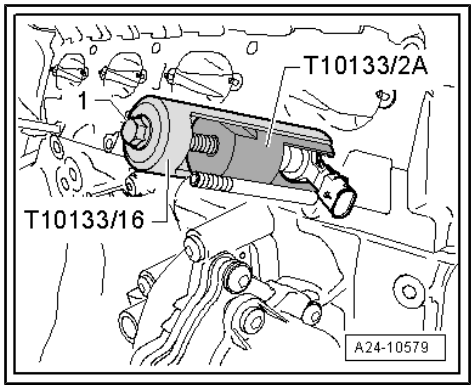
- *The fuel system operates under high pressure. The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ page 3 .*
- *A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.*

– Remove intake manifold ⇒ page 41 .

– Remove intake manifold (bottom section) on relevant side ⇒ page 48 .

– Guide puller -T10133/2A- into groove on injector.

– Then attach removal tool -T10133/16- and pull out injector by turning bolt -1-.

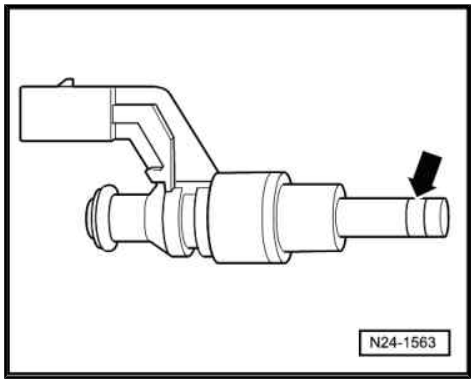


Note

When inserting the puller, there is a risk of destroying the radial compensation element due to the retainer tabs breaking.

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

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



Installing

Note

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

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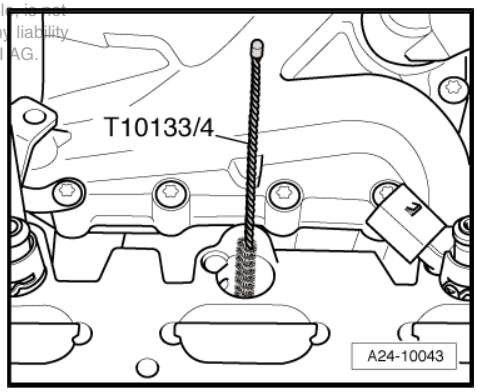
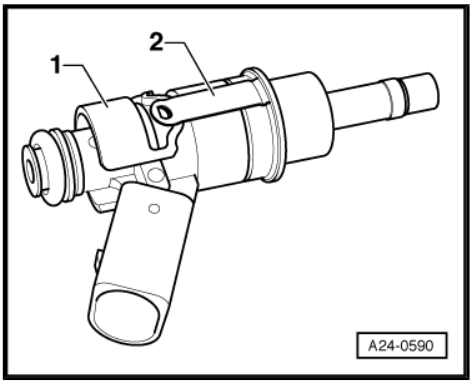
– Clean bore in cylinder head with nylon cylinder brush - T10133/4- .

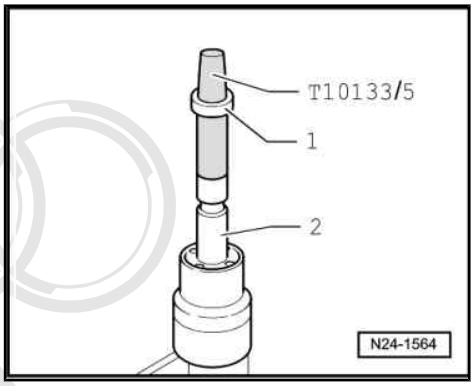


– Clip radial compensation element -1- into support ring -2-.

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

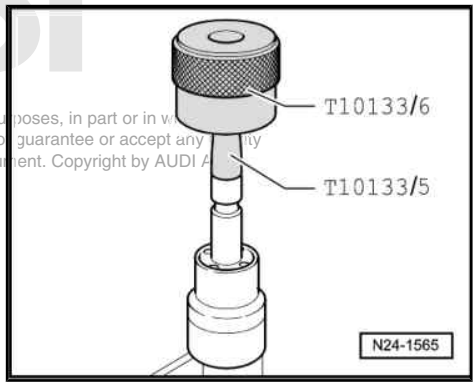


– Fit assembly cone -T10133/5- with new combustion chamber ring seal -1- onto injector -2-.



– 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 sealing ring groove.



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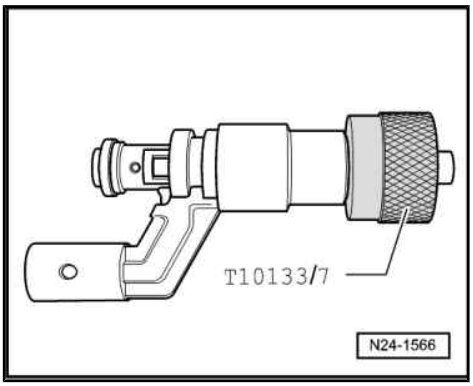
Note

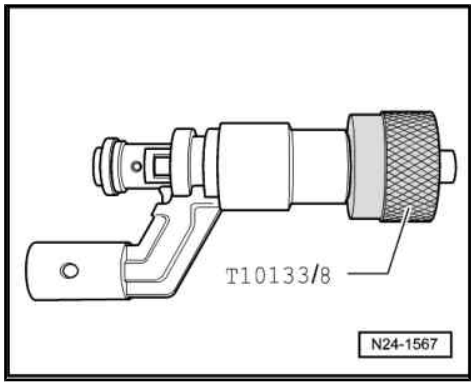
The combustion chamber ring seal is widened when it is pushed onto the injector. After pushing it on, it therefore has to be compressed again. This is done in two stages, as described below.

– 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.



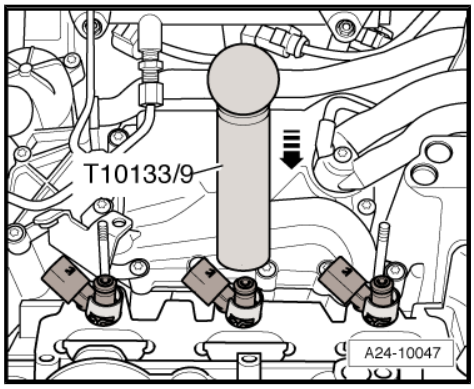
– Push calibration sleeve -T10133/8- onto injector as far as it will go and simultaneously turn it slightly (approx. 180°).
– Pull calibration sleeve -T10133/8- off again by turning it in the opposite direction.



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.
• Coat O-rings of injectors with clean engine oil to facilitate insertion into fuel rail.
• Renew all seals.

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

• Tightening torque: Intake manifold - exploded view ⇒ page 38

Note

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

– Do not install mounting brackets until high-pressure pipes have been finally secured.
– Install relevant bottom section of intake manifold ⇒ page 48 .
– Install intake manifold ⇒ page 41 .

2.9.6 Connection diagram for vacuum hoses at intake manifold (plastic)

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1 - Vacuum hose with non-return valve

2 - Vacuum unit for intake manifold flap

- ❑ For cylinder bank 1
- ❑ Check with hand vacuum pump -VAS 6213-

3 - Vacuum unit for intake manifold flap 2

- ❑ For cylinder bank 2
- ❑ Check with hand vacuum pump -VAS 6213-

4 - Variable intake manifold change-over valve -N156-

5 - Vacuum unit for intake manifold change-over

- ❑ Check with hand vacuum pump -VAS 6213-

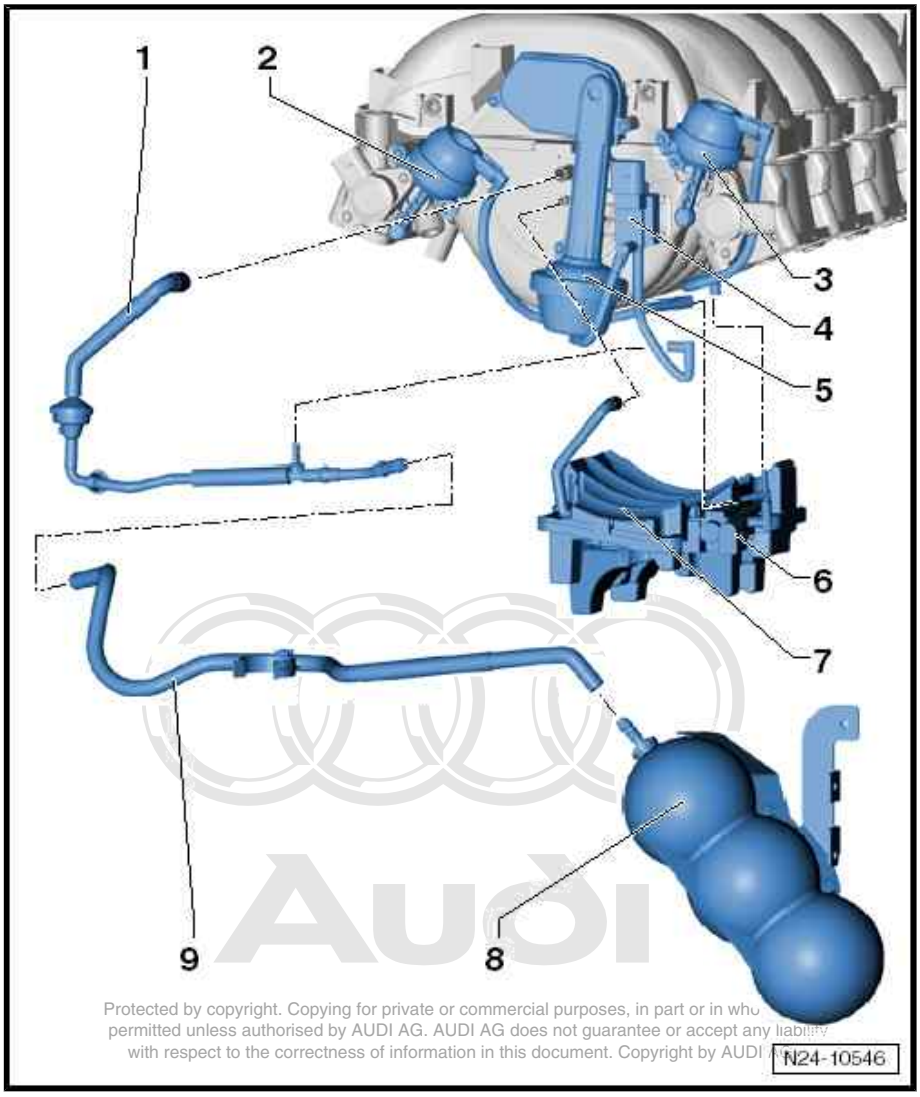
6 - Intake manifold flap valve -N316-

- ❑ Take out intake manifold for removal and installation

7 - Vacuum reservoir

- ❑ Fitting location: beneath intake manifold
- ❑ Take out intake manifold for removal and installation

8 - Vacuum reservoir



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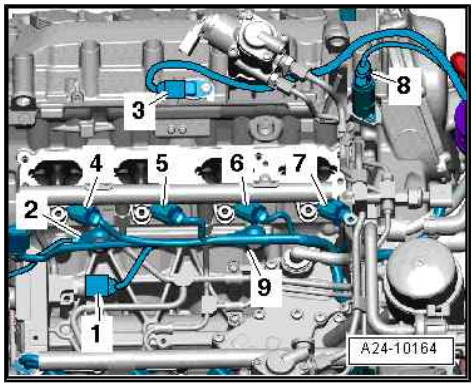
2.10 Removing and installing fuel pressure sender -G247-

Removing

– Remove intake manifold.

– Loosen union nut securing high-pressure pipe to fuel rail.

– Unscrew bolt from fuel pressure sender -G247- -1-.



Note

Fitting location may differ on vehicles from model year 2009 onwards.

– Detach fuel pressure sender -G247- with high-pressure pipe.

Note

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

Installing

– Tighten fuel pressure sender -G247- .

• Tightening torques: refer to overview of fitting locations ⇒ page 6 .

Note

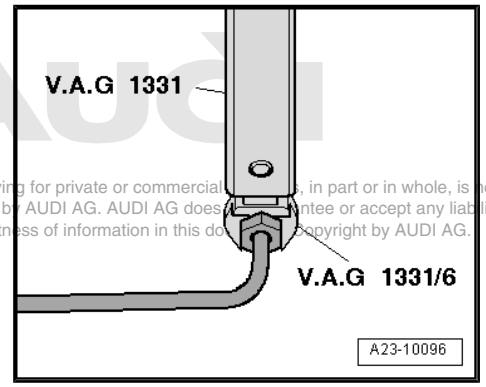
♦ *The connections -arrows- of the high-pressure pipe must not be damaged.*

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

– Tighten union nut on high-pressure pipe hand-tight initially.

– Ensure that high-pressure pipe is not under tension.

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



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

– Install intake manifold.

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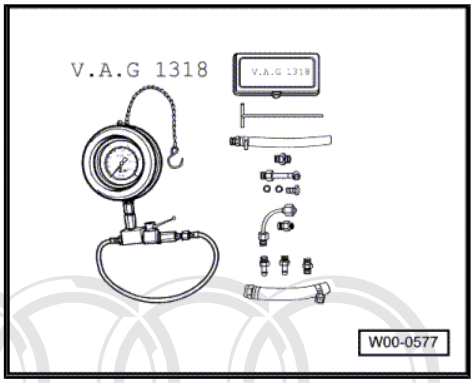
2.11 Checking fuel pressure and residual pressure (up to high-pressure pump)

Special tools and workshop equipment required

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



- Adapter set -V.A.G 1318/10-12-
- Auxiliary measuring set -V.A.G 1594C-
- Remote control -V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3-

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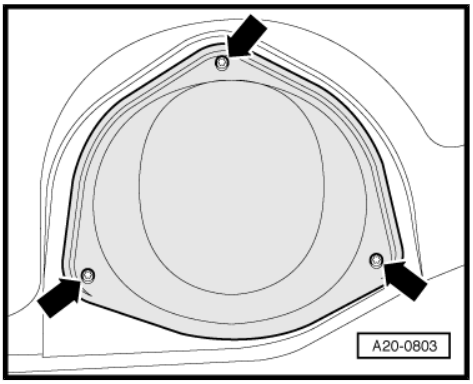
- Fuel-resistant measuring container
- Protective gloves

Checking fuel pressure:

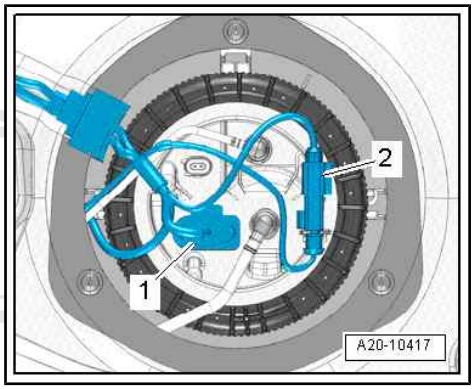
- Battery voltage at least 12.5 V
- Fuel filter OK
- Fuel tank at least $^1/_4$ full.
- Fuel pump control unit -J538- OK
- Ignition off.

– Remove rear seat bench ⇒ Rep. Gr. 72 .

– Unscrew cover for flange -arrows-.



– Unplug electrical connector -1- at flange.



Note

Disregard -item 2-.

– Connect remote control -V.A.G 1348/3A- for V.A.G 1348 to contact -1- using adapter cable -V.A.G 1348/3-3- and test lead from auxiliary measuring set -V.A.G 1594C- .

– Tape off 2nd connector contact of adapter cable -V.A.G 1348/3-3- with insulating tape -arrow- to prevent short circuits.

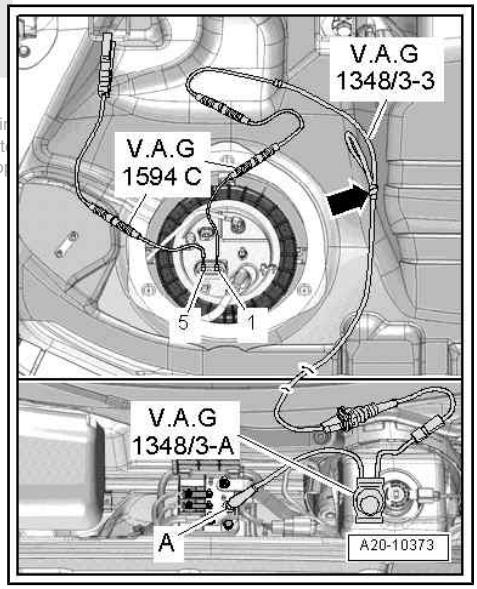
– Connect contact -5- to the body (earth) using a test lead from auxiliary measuring set -V.A.G 1594C- .

– Move control switch of remote control -V.A.G 1348/3A- for V.A.G 1348 to front into engine compartment.

– Connect remote control -V.A.G 1348/3A- for V.A.G 1348 to connection -A- of distribution box in plenum chamber (battery positive). For safety reasons an in-line fuse (10 A) must be connected into the lead.

– Remove filler cap from fuel filler neck.

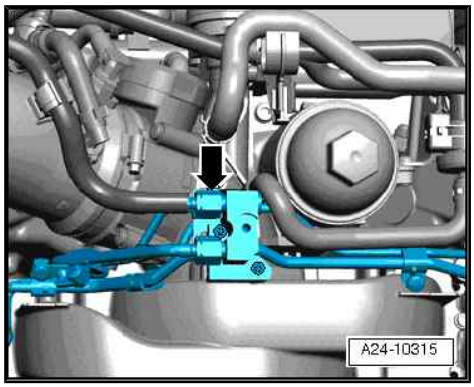
– Pull off engine cover panel.



WARNING

- *The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ page 3 .*
- *A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.*

Disconnecting fuel supply pipe -arrow- from connecting piece (engines with magnesium intake manifolds)



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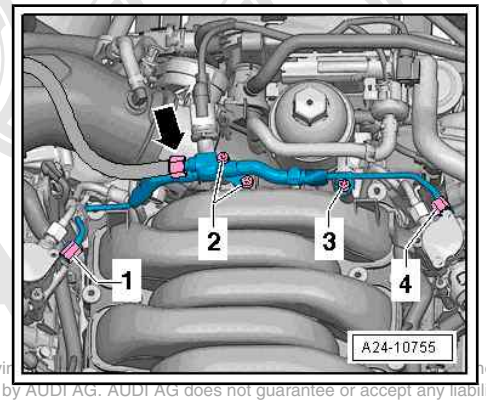
Disconnecting fuel supply pipe -arrow- from connecting piece (engines with plastic intake manifolds)



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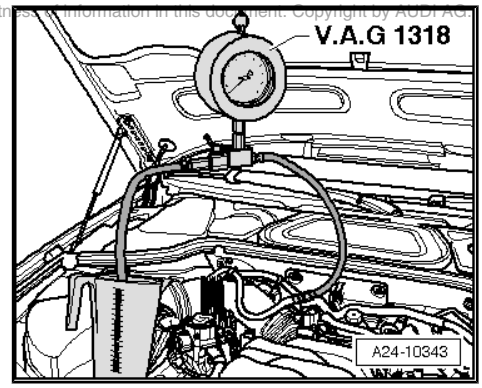
– Connect K-Jetronic pressure tester -V.A.G 1318- with adapter from adapter set -V.A.G 1318/10-12- to fuel line.
– Fit test hose -arrow- onto pressure tester and hold end of hose into a container to catch escaping fuel.
– Open cut-off valve on pressure tester.
• Lever points in direction of flow.
– Bleed fuel system by pressing remote control switch briefly.



– Close cut-off valve on pressure gauge.

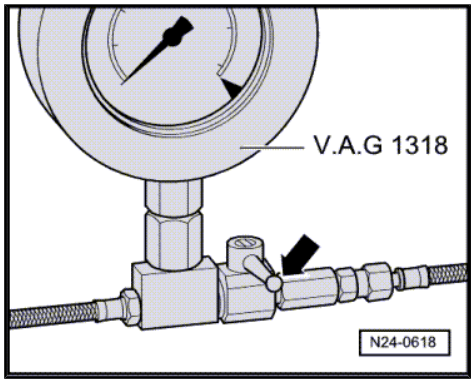
• Lever is at right angle to direction of flow -arrow-.

– Press control switch on remote control until pressure gauge shows no further increase in pressure.

• Specification: approx. 5.5 bar (4.5 ... 6.5 bar)

If specification is not obtained:

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



Checking residual pressure:

– Check for leaks and check residual pressure by watching drop in pressure on pressure tester.

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

If the residual pressure drops below 3 bar:

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

♦ Test pressure gauge for leaks.

♦ Check fuel lines and their connections for leaks.

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

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

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

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

– Switch off ignition.

Note

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

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

Tightening torque

Component	Nm
Fuel supply pipe	25

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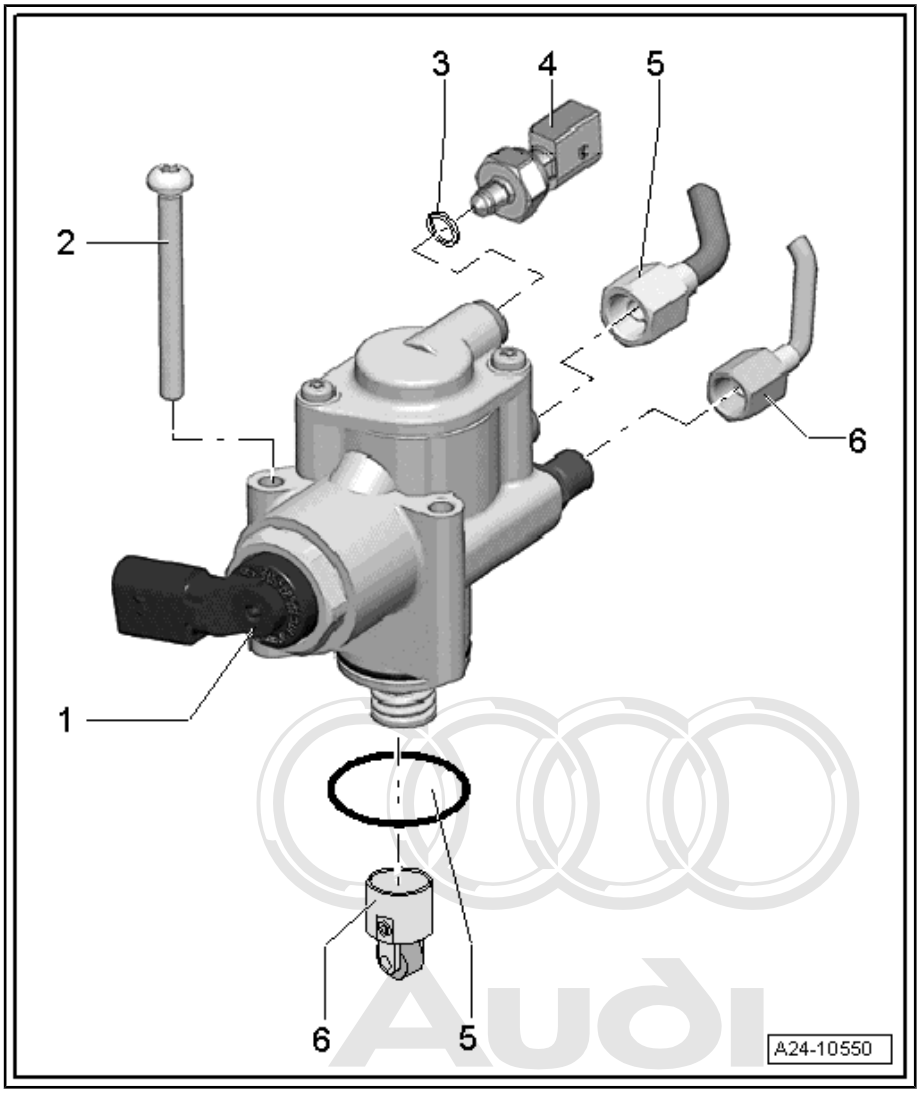
2.12 High-pressure pump - exploded view



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1 - High-pressure pump

- ❑ Fuel metering valve - N290- is installed in high-pressure pump on right-side (cylinder bank 1).
- ❑ Fuel metering valve 2 - N402- is installed in high-pressure pump on left-side (cylinder bank 2).
- ❑ Fuel pressure sender for low pressure -G410- is installed in high-pressure pump on left-side (cylinder bank 2).
- ❑ Removing and installing ⇒ page 63

2 - Bolt

- ❑ 9 Nm

3 - Seal

- ❑ Renew

4 - Fuel pressure sender for low pressure -G410-

- ❑ 10 Nm
- ❑ Only fitted in high-pressure pump on left side (cylinder bank 2)

5 - High-pressure pipe

WARNING

The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ page 3 .

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 .

- ❑ Before loosening, first disconnect earth wire at battery with ignition switched off
- ❑ Connections must not be damaged
- ❑ Do not alter shape
- ❑ 25 Nm

6 - Fuel supply pipe

WARNING

The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ page 3 .

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 .

- ❑ Before loosening, first disconnect earth wire at battery with ignition switched off
- ❑ Connections must not be damaged
- ❑ Do not alter shape
- ❑ 25 Nm

7 - O-ring

- ❑ Renew

8 - Roller tappet

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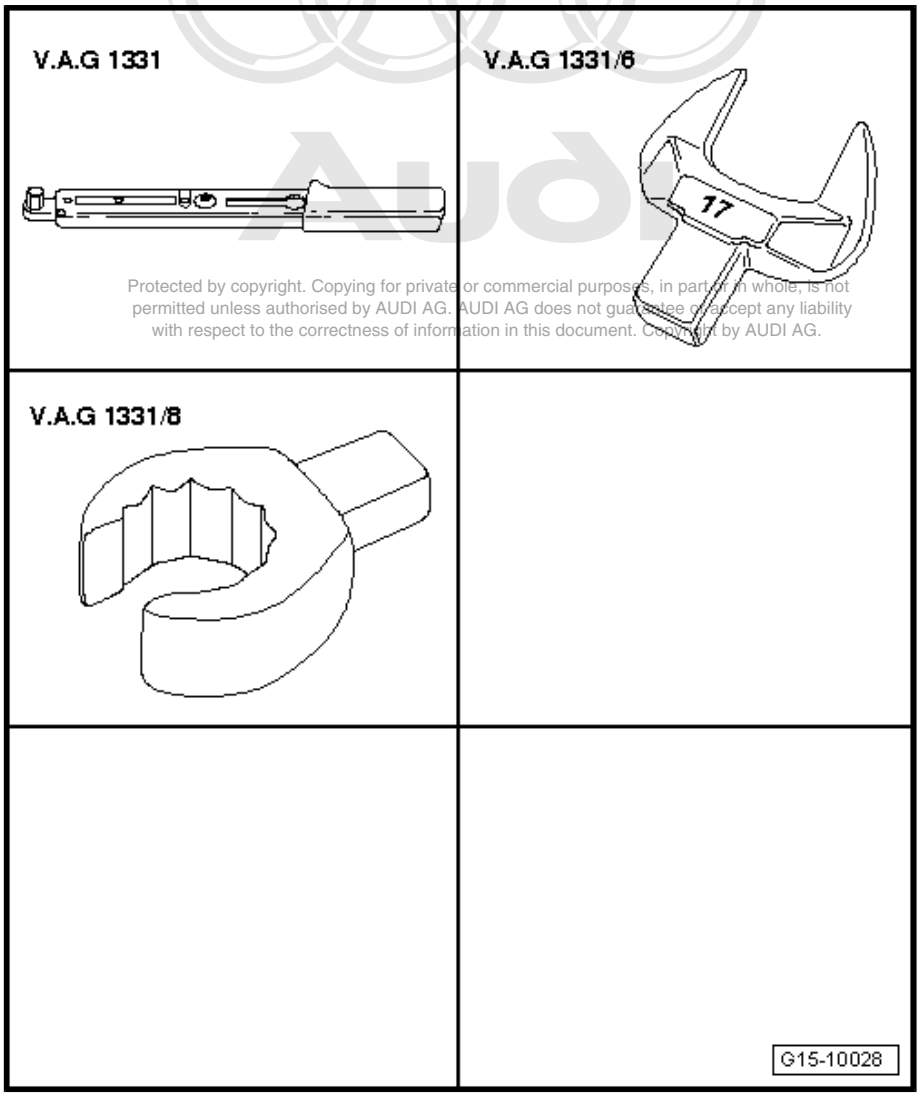
2.13 Removing and installing high-pressure pump

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-



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Removing

Note

The following description is for removing and installing the high-pressure pump on the left side.

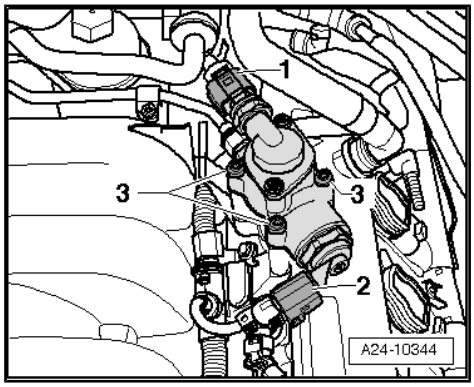
WARNING

- *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 3 .*
- *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 .*

– Disconnect earth wire at battery with ignition switched off.

– Pull off engine cover ⇒ page 18 .

– Unplug electrical connectors for fuel pressure sender for low pressure -G410- -1- and fuel metering valve 2 -N402- -2-.



Note

The fuel pressure sender for low pressure -G410- is installed only in the high-pressure pump on the left-side (cylinder bank 2).

– Detach both union nuts for fuel lines.

– Remove bolts -3-.

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:

Note

Renew O-ring.

– Fit roller tappet in cylinder head.

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Note

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

– Turn crankshaft until roller tappet is positioned at lowest point.

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

– Fit high-pressure pump in cylinder head and secure in position.

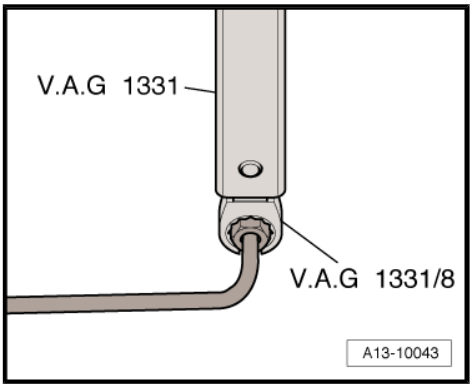
Note

- *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.

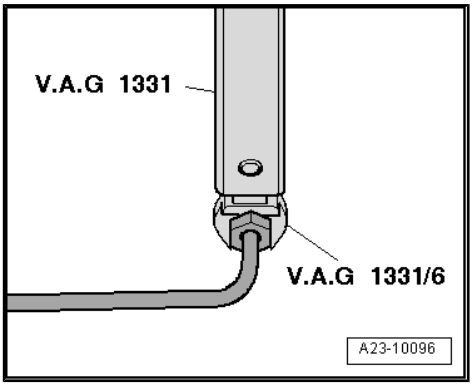
– To tighten union nuts (14 mm) for high-pressure pipes, use torque wrench -V.A.G 1331- with socket insert AF 14, flared ring spanner -V.A.G 1331/8- .



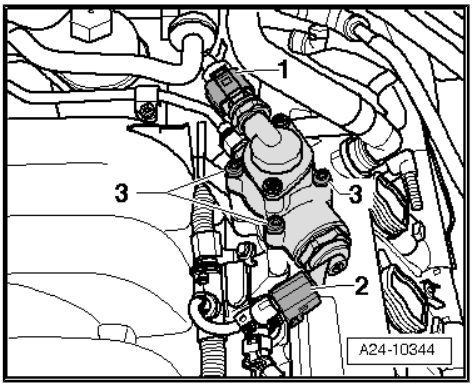
– To tighten union nuts (17 mm) for high-pressure pipes, use torque wrench -V.A.G 1331- with tool insert (17 mm) -V.A.G 1331/6- .

• Tightening torques: refer to exploded view of high pressure pump ⇒ page 60 .

– Observe notes on procedures required after connecting battery ⇒ Rep. Gr. 27 .



– Reattach electrical connectors for fuel pressure sender for low pressure -G410- -1- and fuel metering valve 2 -N402- -2-.



Note

Check fuel system for leaks.

2.14 Installing high-pressure pipes

Special tools and workshop equipment required

- Torque wrench -V.A.G 1331-

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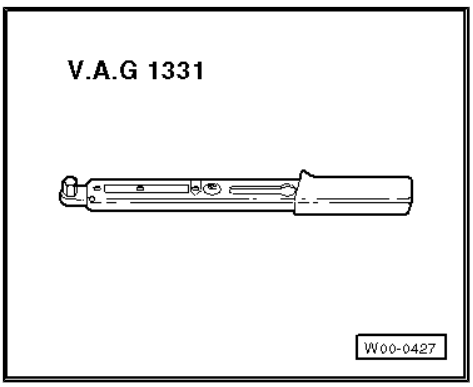
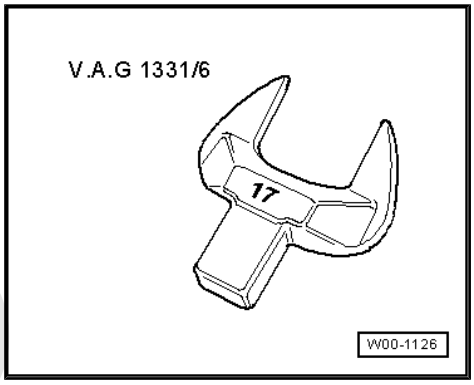
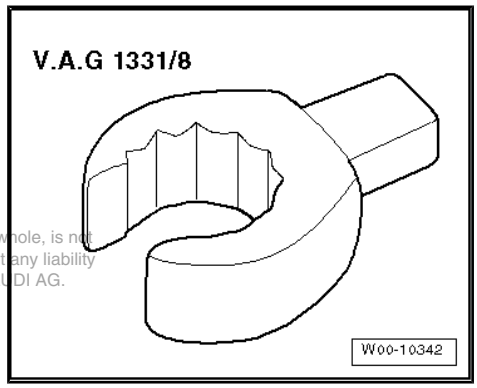


- Tool insert AF 17 -V.A.G 1331/6-



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



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Procedure

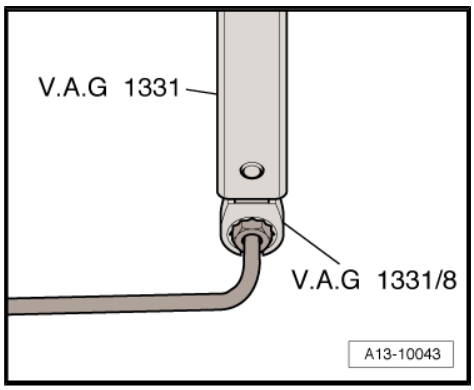
Note

- *Do not bend fuel pipes to a different shape.*
- *The connections of the high-pressure pipes must not be damaged.*
- *Do NOT bend open retaining clamps for fuel pipe.*
- *If one of the retaining clamps has been bent open or the fuel pipe has to be renewed, the retaining clamps must also be renewed.*

– Lubricate threads of union nuts with fuel.

– Hand-tighten union nuts on high-pressure pipes (ensure that pipes are not under tension).

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

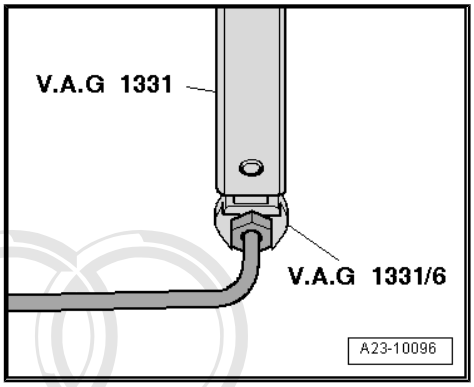


– To tighten union nut (17 mm) on high-pressure pipes, use torque wrench -V.A.G 1331- with tool insert AF 17 -V.A.G 1331/6- .

• Tightening torque 25 Nm

– Do not fasten retaining clips until high-pressure pipes have been tightened.

– Check fuel system for leaks.



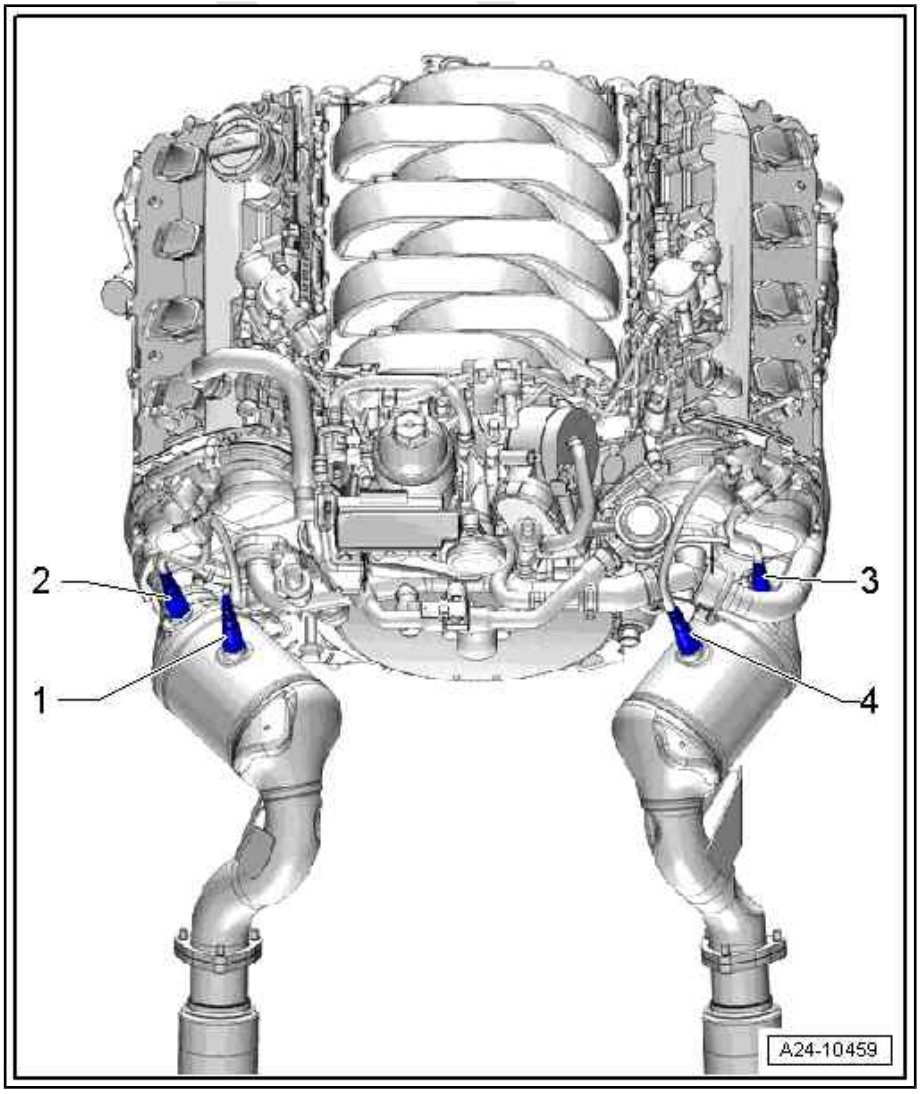
2.15 Lambda probes - overview

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

- ❑ 50 Nm
- ❑ New Lambda probes are coated with an assembly paste
- ❑ In the case of a used Lambda probe, coat only thread with high-temperature paste; refer to ⇒ Parts catalogue for high-temperature paste
- ❑ The assembly paste / high-temperature paste must not make contact with the slots on the Lambda probe body
- ❑ Removing and installing ⇒ page 70

2 - Lambda probe 2 -G108- with Lambda probe heater 2 -Z28-

- ❑ 50 Nm
- ❑ New Lambda probes are coated with an assembly paste
- ❑ In the case of a used Lambda probe, coat only thread with high-temperature paste; refer to ⇒ Parts catalogue for high-temperature paste
- ❑ The assembly paste / high-temperature paste must not make contact with the slots on the Lambda probe body
- ❑ Removing and installing ⇒ page 70



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

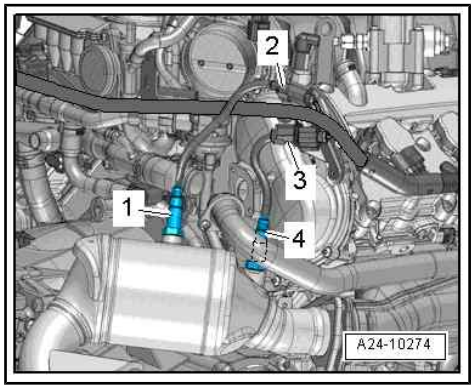
- ❑ 50 Nm
- ❑ New Lambda probes are coated with an assembly paste
- ❑ In the case of a used Lambda probe, coat only thread with high-temperature paste; refer to ⇒ Parts catalogue for high-temperature paste

- ❑ The assembly paste / high-temperature paste must not make contact with the slots on the Lambda probe body
- ❑ Removing and installing ⇒ page 68

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

- ❑ 50 Nm
- ❑ New Lambda probes are coated with an assembly paste
- ❑ In the case of a used Lambda probe, coat only thread with high-temperature paste; refer to ⇒ Parts catalogue for high-temperature paste
- ❑ The assembly paste / high-temperature paste must not make contact with the slots on the Lambda probe body
- ❑ Removing and installing ⇒ page 68

Fitting location of Lambda probes on cylinder bank 1 (right-side)



1 - Lambda probe after catalytic converter -G130-

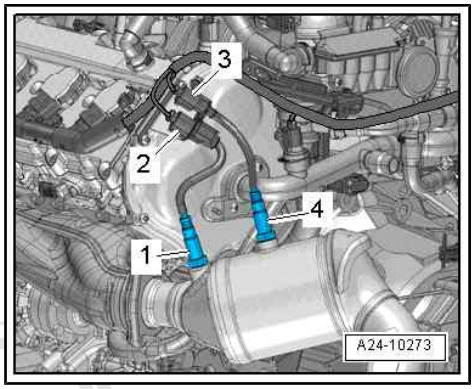
2 - Electrical connector for Lambda probe after catalytic converter -G130-

3 - Electrical connector for Lambda probe -G39-

4 - Lambda probe -G39-

Removing and installing ⇒ page 68

Fitting location of Lambda probes on cylinder bank 2 (left-side)



1 - Lambda probe 2 -G108-

2 - Electrical connector for Lambda probe 2 -G108-

3 - Electrical connector for Lambda probe 2 after catalytic converter -G131-

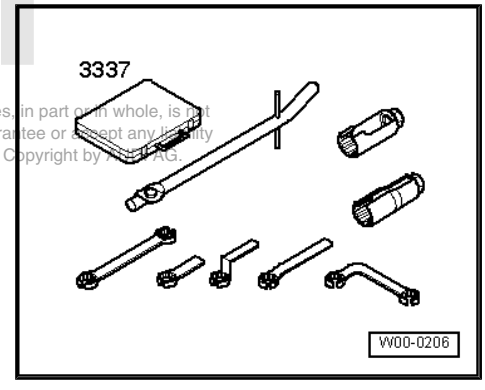
4 - Lambda probe 2 after catalytic converter -G131-

Removing and installing ⇒ page 70

2.16 Removing and installing Lambda probe before catalytic converter -G39- and Lambda probe after catalytic converter -G130- (cylinder bank 1)

Special tools and workshop equipment required

- ♦ Lambda probe open ring spanner set -3337-



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Removing

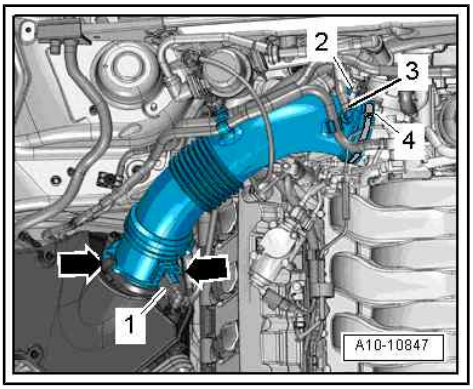
Note

Fit all cable ties in the original positions when installing.

– Remove engine cover panel.

– Unplug electrical connector -1- from air mass meter -G70- .

– Detach vacuum line -3- going to air pipe.



Rest-of-world vehicles:

– Disconnect crankcase breather hose -2- from air hose by pressing release tabs.

– Remove air hose and air mass meter -G70- . To do so, release hose clip -4- and clamps -arrows-.

USA models:

Caution

Risk of violating emission legislation applying to USA models.

- ***Do NOT open hose connection -2-.***

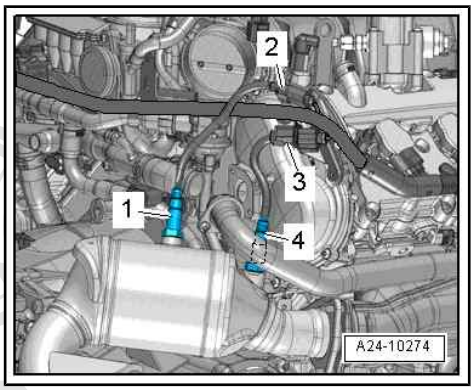
– Move air intake hose clear to one side (crankcase breather hose -2- remains connected). To do so, release hose clips -4- and clamps -arrows-.

All vehicles (continued):

– Take corresponding electrical connector out of bracket and unplug it.

2 - For Lambda probe after catalytic converter -G130-

3 - For Lambda probe -G39-

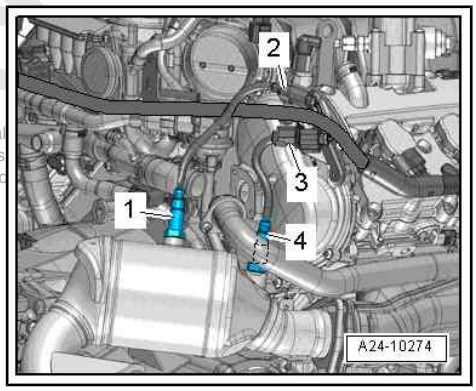


Note

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

Removing Lambda probe -G39-

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



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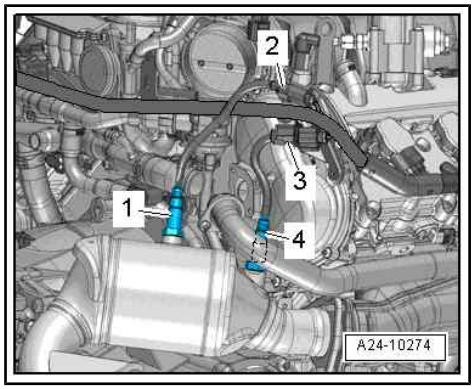
Removing Lambda probe after catalytic converter -G130-



– Unscrew Lambda probe after catalytic converter -G130- -1- using tool from Lambda probe open ring spanner set -3337- .

Installing

- Tightening torque: refer to Lambda probes - overview ⇒ page 67 .

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

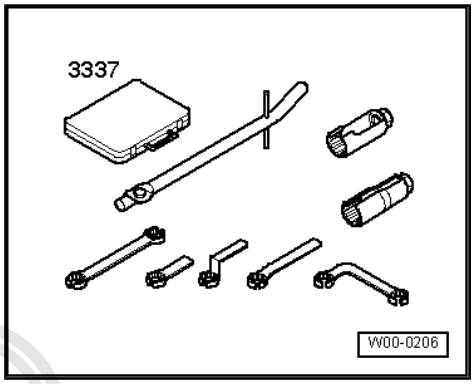
Note

- *New Lambda probes are coated with an 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.*
- *Fit all cable ties in the original positions when installing.*

2.17 Removing and installing Lambda probe 2 before catalytic converter -G108- and Lambda probe after catalytic converter -G131- (cylinder bank 2)

Special tools and workshop equipment required

- Lambda probe open ring spanner set -3337-



Removing

Note

Fit all cable ties in the original positions when installing.

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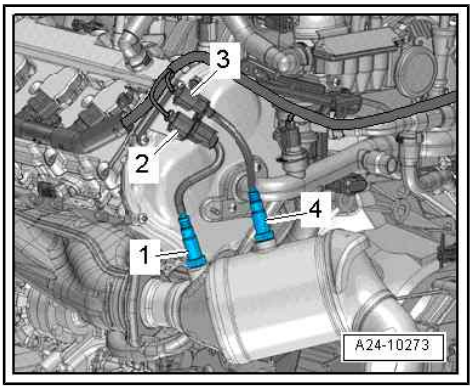
– Take corresponding electrical connector out of bracket and unplug it.

2 - For Lambda probe 2 -G108-

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

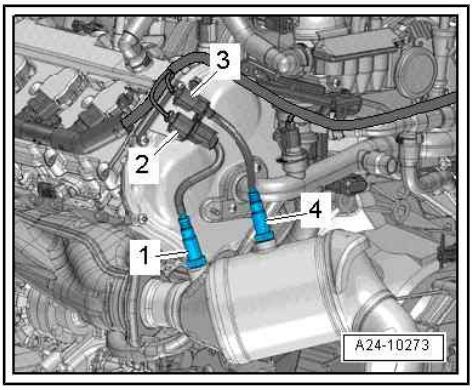


Note

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

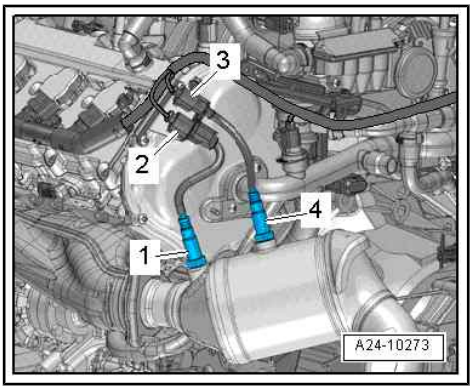
Removing Lambda probe 2 -G108-

– Unscrew Lambda probe 2 -G108- -1- using tool from Lambda probe open ring spanner set -3337- .



Removing Lambda probe 2 after catalytic converter -G131-

– Unscrew Lambda probe 2 after catalytic converter -G131- -4- using tool from Lambda probe open ring spanner set -3337- .



Installing

- Tightening torque: refer to Lambda probes - overview ⇒ page 67 .

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

Note

- *New Lambda probes are coated with an 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.*

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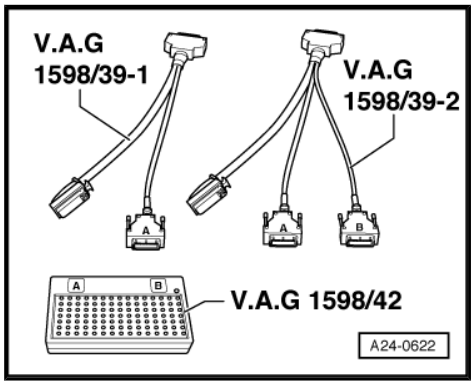
3 Engine control unit

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 has 105 sockets. The connecting cable can be disconnected from the test box. This means that only the cable (and not the test box) has to be purchased for future engine control units with different types of connectors.*
- *The smaller of the two connectors on the engine control unit has the contacts 1 to 60. The larger of the two connectors has the contacts 1 to 94.*
- *If you want to check a wiring connection to the engine control unit, first refer to the current flow diagram to find out which connector on the engine control unit the wiring connection leads to. If the wire goes to the 60-pin connector, connect the smaller of the two connectors -V.A.G 1598/39-1- to input "A" of test box -V.A.G 1598/42- .*
- *If a wiring connection leads to the 94-pin connector (according to current flow diagram), connect the larger of the two connectors -V.A.G 1598/39-2- as follows: The connector marked "A" must be attached to input "A" on the test box -V.A.G 1598/42- and the connector marked "B" must be attached to input "B" on the test box -V.A.G 1598/42- .*
- *The test box -V.A.G 1598/42- is designed so it can be connected both to the wiring harness for the engine control unit and to the engine control unit itself at the same time.*
- *The advantage of this is that the electronic engine control system remains fully functional when the test box is connected (for example, for measuring signals when the engine is running).*
- *The relevant test procedure will state whether it is necessary to also connect the engine control unit to the test box.*
- *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.).*

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WARNING

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

– Remove engine control unit -J623- ⇒ page 73 .

– Connect test box -V.A.G 1598/42- to wiring harness connector. The earth clip on the test box must be connected to the negative battery terminal. The instructions for performing the individual tests indicate whether or not the engine control unit -J623- itself also needs to be connected to the test box.

– Carry out test as described in appropriate repair procedures.

Installing engine control unit:

Installation is performed in the reverse sequence.

– After installation, the locking 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.

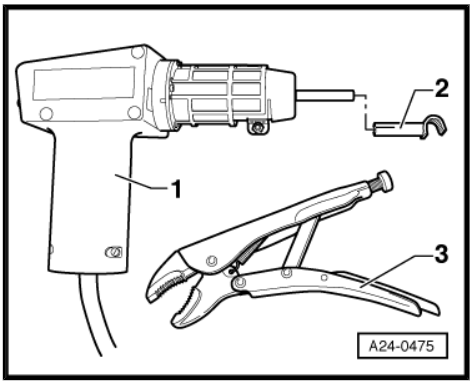
Note

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 fault entries can be erased.

3.2 Removing and installing engine control unit -J623-

Special tools and workshop equipment required

- Hot air blower -1- from the wiring harness repair set -VAS 1978A-
- Nozzle attachment -2- from the wiring harness repair set -VAS 1978A-
- Small, commercially available vice grip pliers -3-



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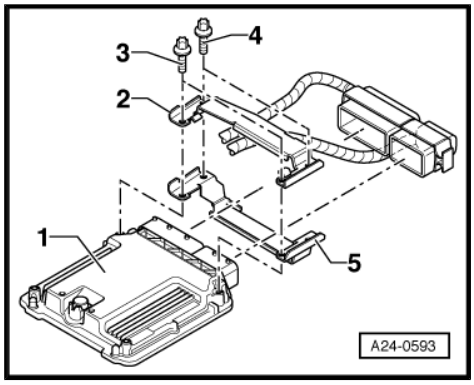


Note

- *Not every engine control unit is bolted to a protective housing. On vehicles with automatic gearbox, there is no protective housing installed.*
- *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 metal housing has to be removed before the connectors can be unplugged from the engine control unit (e.g. to connect the test box or renew the engine control unit).*

Removing

– When renewing engine control unit, select “Guided Functions” and then select diagnosis object “Replace engine control unit” on vehicle diagnostic, testing and information system -VAS 5051B- .

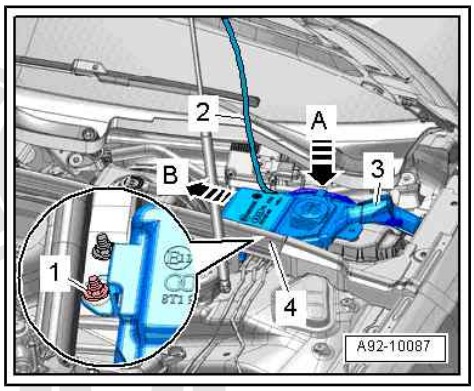
– Switch off ignition and remove ignition key.

– Slightly pull off rubber seal in front of nut -1- on plenum chamber cover.

– Unhook wiring harness -2- from retainers -A-.

– Remove nut -1-.

– Pull filler neck -3- with filler pipe out of washer fluid reservoir and through opening in body.



– Unscrew bolts -arrows- and take off cover for electronics box.

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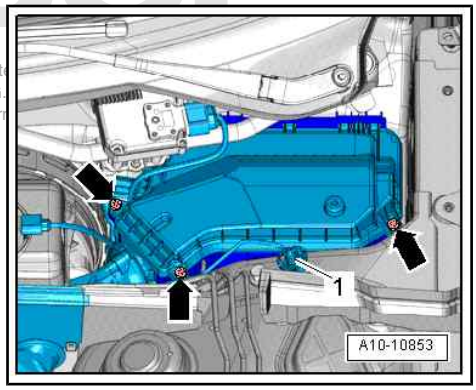
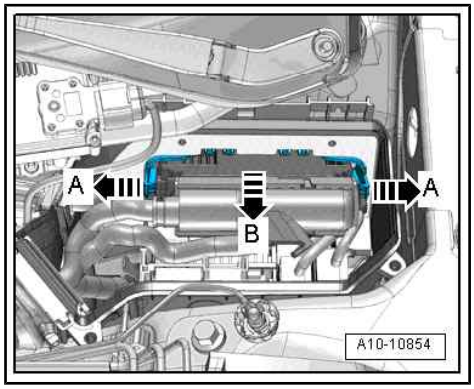
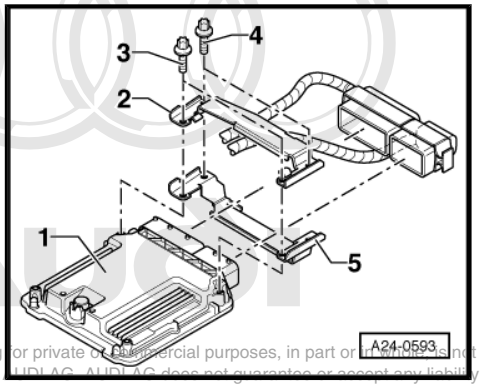


– Release retainers -arrows A- and pull out engine control unit -J623- -arrow B-.



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



Note

Not every engine control unit is bolted to a protective housing. On vehicles with automatic gearbox, there is no protective housing installed.

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.

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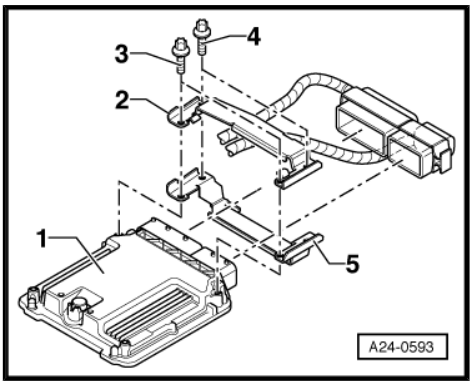
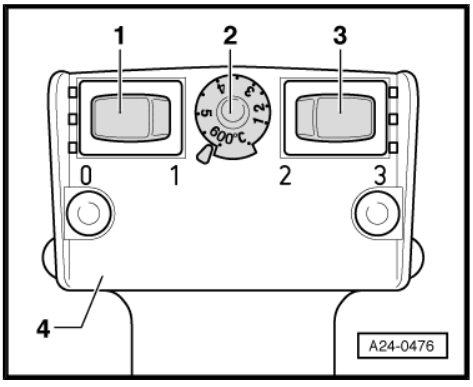
The threads of the two shear bolts -3- which are screwed into the engine control unit are not secured with locking fluid. Do not apply heat to the threads in the control unit housing; this is not necessary and would cause overheating of the control unit.



– 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.



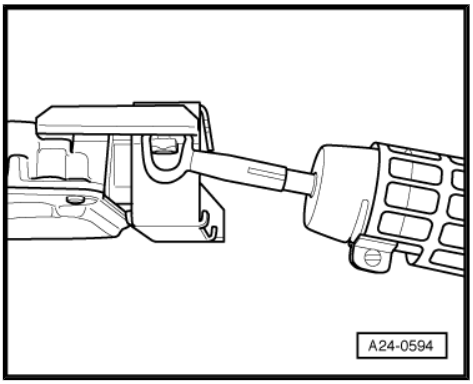
WARNING

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.

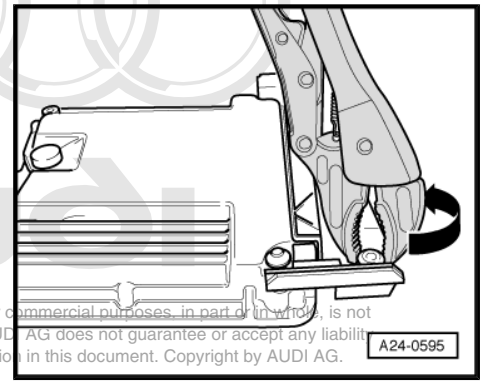
Grinding or drilling is not permitted.

– Apply heat to the threads of the shear bolts on the connector side for approx. 25 to 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.
– Detach metal locking plate from control unit connectors.
– Release connectors on engine control unit and unplug connectors.
– Take out old engine control unit -J623- and install new engine control unit -J623- .



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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.
• Tightening torque for bolts securing cover of electronics box: 3.5 Nm.

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

– Activate engine control unit via vehicle diagnostic, testing and information system -VAS 5051B- in “Guided Functions” mode, “Replace engine control unit”.

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.

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1.2 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.*
>
> *Persons sitting in the front passenger's seat could be injured if the airbag is triggered in an accident.*
>
> - *The use of test equipment while driving causes distraction.*
> - *There is an increased risk of injury if test equipment is not secured.*
> - *Test equipment must always be secured on the rear seat with a strap and operated from the rear seat by a second person.*

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

- 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		4.2 ltr. / 4V / 260 kW engine
Idling speed (not adjustable)		
Ignition timing		Not adjustable (determined by control unit)
Ignition system		Multi-coil system with 8 ignition coils (output stages integrated) connected directly to spark plugs via spark plug connectors
Spark plugs	Designations	⇒ Data sheets for exhaust emission test
	Removing and installing	⇒ Maintenance ; Booklet 811 .
Firing order		1-5-4-8-6-3-7-2

2.2 Ignition system - exploded view

1 - Connector for ignition coil
- ❑ 4-pin

2 - Bolt
- ❑ 10 Nm

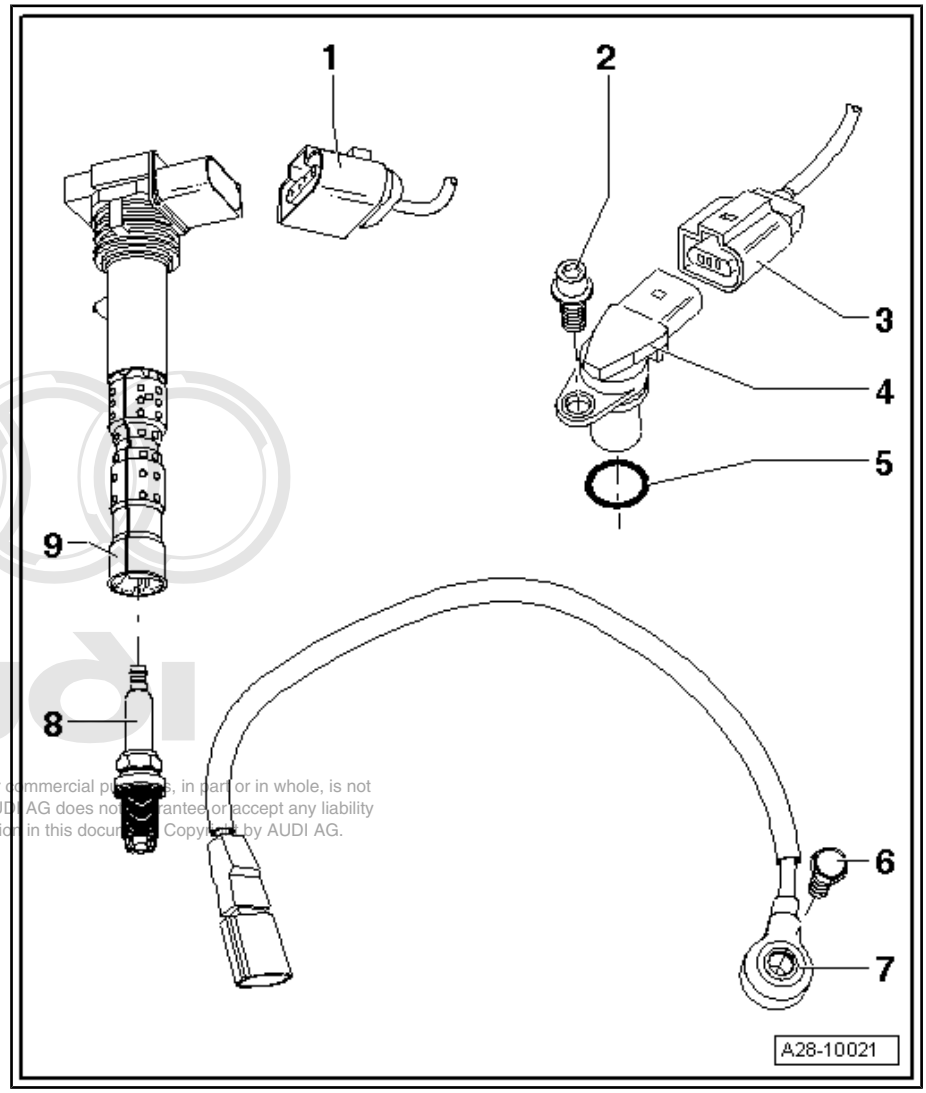
3 - 3-pin connector

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 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-



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(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 81

8 - Spark plug

- ❑ Remove and install with spark plug socket and extension -3122 B- ⇒ Maintenance ; Booklet 811
- ❑ 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 79
- ❑ Use puller -T40039- for removal

2.3 Removing and installing ignition coils

Special tools and workshop equipment required

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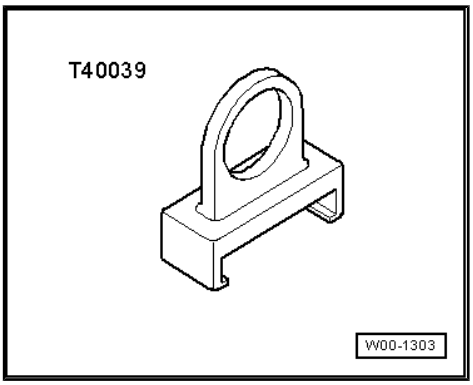
- ◆ Puller -T40039-

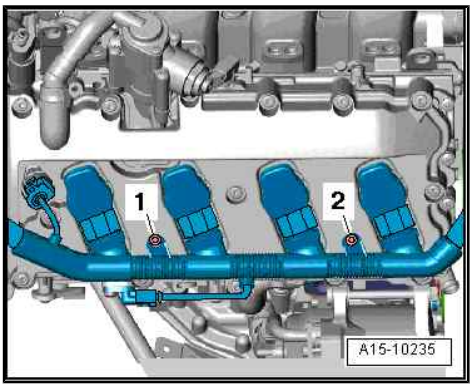


Removing ignition coils on cylinder bank 1:

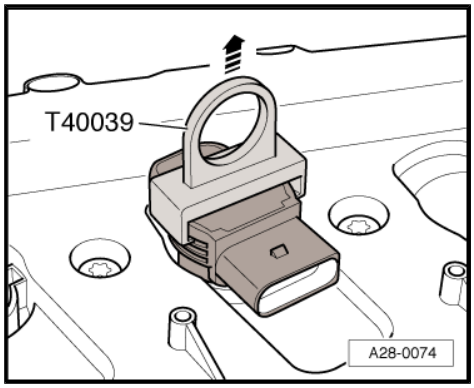
– Remove air cleaner (bottom section) ⇒ page 20 .

– Remove bolts -1- and -2-.

– Pull ignition coils approx. 30 mm out of spark plug holes using puller -T40039- .

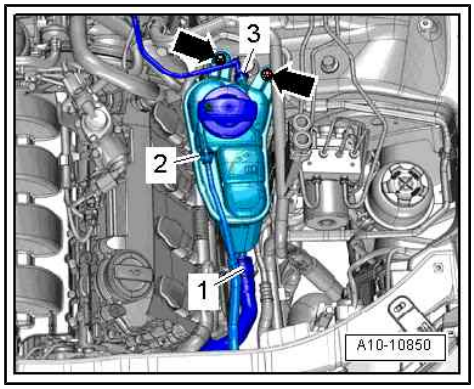


– Release electrical connectors and pull all connectors off ignition coils at the same time.



Removing ignition coils on cylinder bank 2:

– Unbolt coolant expansion tank -arrow- and unplug electrical connector for coolant shortage indicator switch -F66- at bottom of coolant expansion tank.



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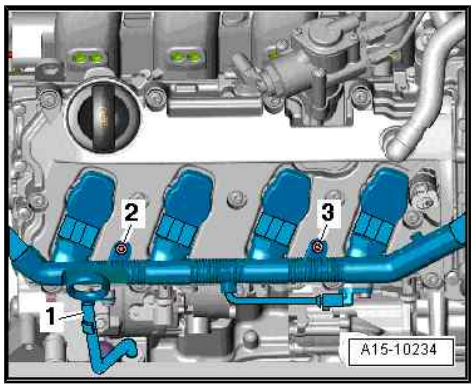
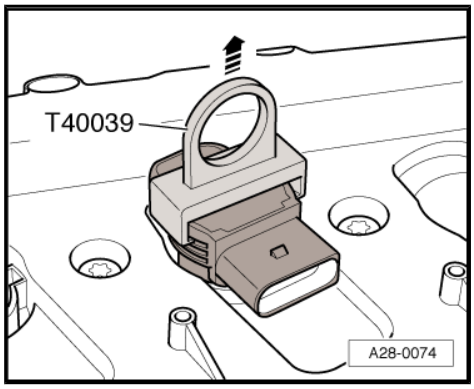
– Lay aside coolant expansion tank with coolant hoses -1 and 3- connected.

– Remove bolts -2- 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

– Fit all ignition coils loosely into spark plug holes.

– Align the ignition coils with the connectors and attach all connectors onto ignition coils simultaneously.

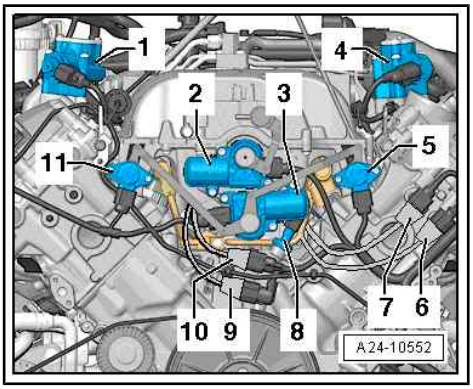
– Press ignition coils onto spark plugs by hand evenly (do NOT use tool).

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

Tightening torque

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

2.4 Removing and installing knock sensors



Electrical connectors

6 - Knock sensor 3 -G198-

7 - Knock sensor 4 -G199-

9 - Knock sensor 2 -G66-

10 - Knock sensor 1 -G61-

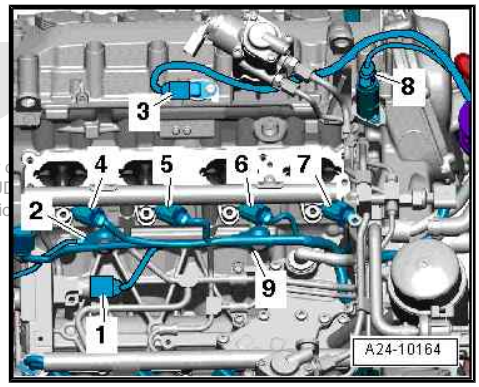
Removing

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 3 .*
- *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 26 .

Remove appropriate knock sensor on cylinder bank (right-side).



2 - Knock sensor 1 -G61-

9 - Knock sensor 2 -G66-

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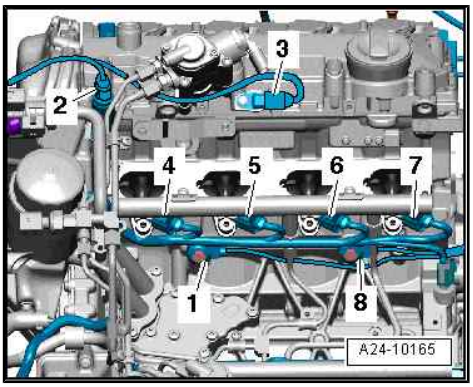
Remove appropriate knock sensor on cylinder bank (left-side).



8 - Knock sensor 3 -G198-

1 - Knock sensor 4 -G199-

Installing

– Re-install whichever knock sensor was removed.

Note

The tightening torque influences the function of the knock sensor.

Tightening torques for knock sensors: refer to exploded view of ignition system ⇒ page 78 .

– Install intake manifold ⇒ page 26 .

2.5 Removing and installing Hall sender

For fitting locations of the four Hall senders, refer to overview of fitting locations ⇒ page 6 .

– Unplug electrical connector from corresponding Hall sender.

Note

- *The following Hall senders are installed in cylinder bank 1 (right-side): Hall sender -G40- and Hall sender 3 -G300-*
- *The following Hall senders are installed in cylinder bank 2 (left-side): Hall sender 2 -G163- and Hall sender 4 -G301-*

– To remove Hall sender 3 -G300- on cylinder bank 1 you must first remove the air cleaner housing.

– To remove Hall sender 4 -G301- on cylinder bank 2 you must first remove the coolant expansion tank.

Installing

Note

Renew O-ring if damaged.

– Lubricate O-ring with engine oil and carefully press in Hall sender by hand.

– Secure Hall sender and plug back connector.

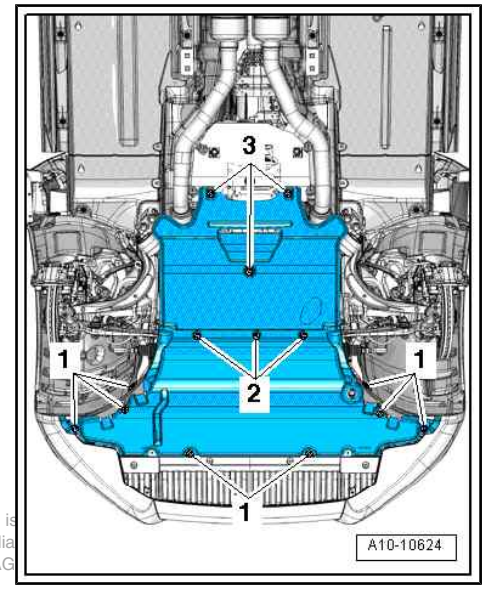
• Tightening torques for Hall senders: refer to exploded view of ignition system ⇒ page 78 .

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

2.6 Removing and installing engine speed sender -G28-

Removing

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



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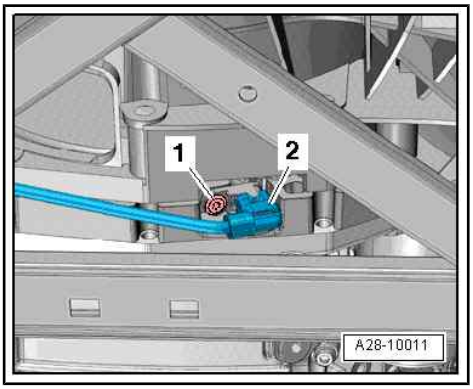
– Unplug electrical connector -2-.
– Unscrew bolt -1- and remove engine speed sender -G28- .



Installing

Install in reverse order.

Tightening torque

Component	Nm
Engine speed sender -G28-	9

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