

Workshop Manual Audi A8 2003 ➤

Motronic injection and ignition system (12-cyl.)

Engine ID	BHT	BSB	BTE					
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Edition 03.2012



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

Repair Group

24 - Mixture preparation - injection

28 - Ignition system



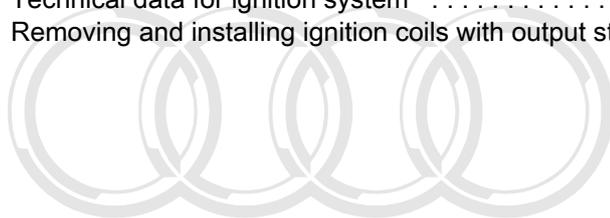
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Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions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

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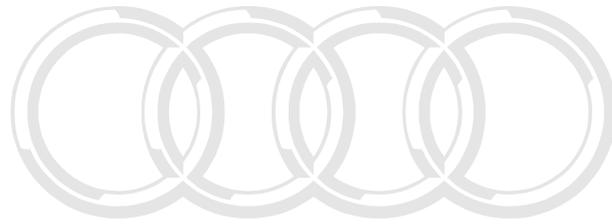
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24 – Mixture preparation - injection

1 Servicing Motronic injection system

1.1 Safety precautions

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



WARNING

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

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.*

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

- ◆ Persons wearing a cardiac pacemaker must at all times maintain a safe distance from high-voltage components such as the ignition system and xenon headlights.
- ◆ 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 event memory should therefore be interrogated and (if necessary) erased after completing the tests and any repair work that may be required.
- ◆ If the event memory has been erased, you must generate the readiness code again.
- ◆ 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.



WARNING

The fuel system is pressurised. Before loosening hose connections or opening the test connection (to measure fuel pressure), place a cloth around the connection. Then release pressure by carefully unscrewing the connection.



1.2 Rules for cleanliness and instructions for working on fuel system

- ◆ Thoroughly clean all unions and surrounding areas before disconnecting.
- ◆ Place parts that have been removed on a clean surface and cover them over. Do not use fluffy cloths.
- ◆ Carefully cover or seal open components if repairs cannot be carried out immediately.
- ◆ Only install clean components; replacement parts should only be unpacked immediately prior to installation. Do not use parts that have been stored loose (e.g. in tool boxes etc.).
- ◆ When the system is open: Do not work with compressed air if this can be avoided. Do not move the vehicle unless absolutely necessary.
- ◆ Unplugged electrical connectors must be kept clean and dry. Make sure connections are dry when attaching.

1.3 Technical data

Engine code letters		BHT 6.0 ltr. 331 kW/ 450 bhp	BSB 6.0 ltr. 331 kW/ 450 bhp
Idling speed ¹⁾ is not adjustable; controlled by the idling speed stabilisation		520 ... 770 rpm	520 ... 770 rpm
Speed governing by closing throttle valve		6200 rpm	6200 rpm
Fuel pressure at idling speed	Vacuum hose connected	approx. 3.5 bar	approx. 3.5 bar
	Vacuum hose disconnected	approx. 4.0 bar	approx. 4.0 bar
Residual pressure after 10 minutes		at least 2.5 bar	at least 2.5 bar
Injectors	Spray pattern	Multi-hole nozzle (same on all injectors)	Multi-hole nozzle (same on all injectors)
	Injection quantity (30 sec.)	121...131 ml	121...131 ml
	Resistance (room temperature around 20 °C) ²⁾	13 ... 16 Ω	13 ... 16 Ω

1) Up-to-date specifications: ⇒ Exhaust emissions test binder

2) When the engine is at operating temperature the resistance of injectors is increased by approx. 4...6 Ω.

1.4 Overview of fitting locations

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

1 - Air mass meter 2 -G246- with intake air temperature sender 2 -G299-

- For cylinder bank 2 (cylinders 7 to 12)
- Removing and installing ⇒ [page 7](#)

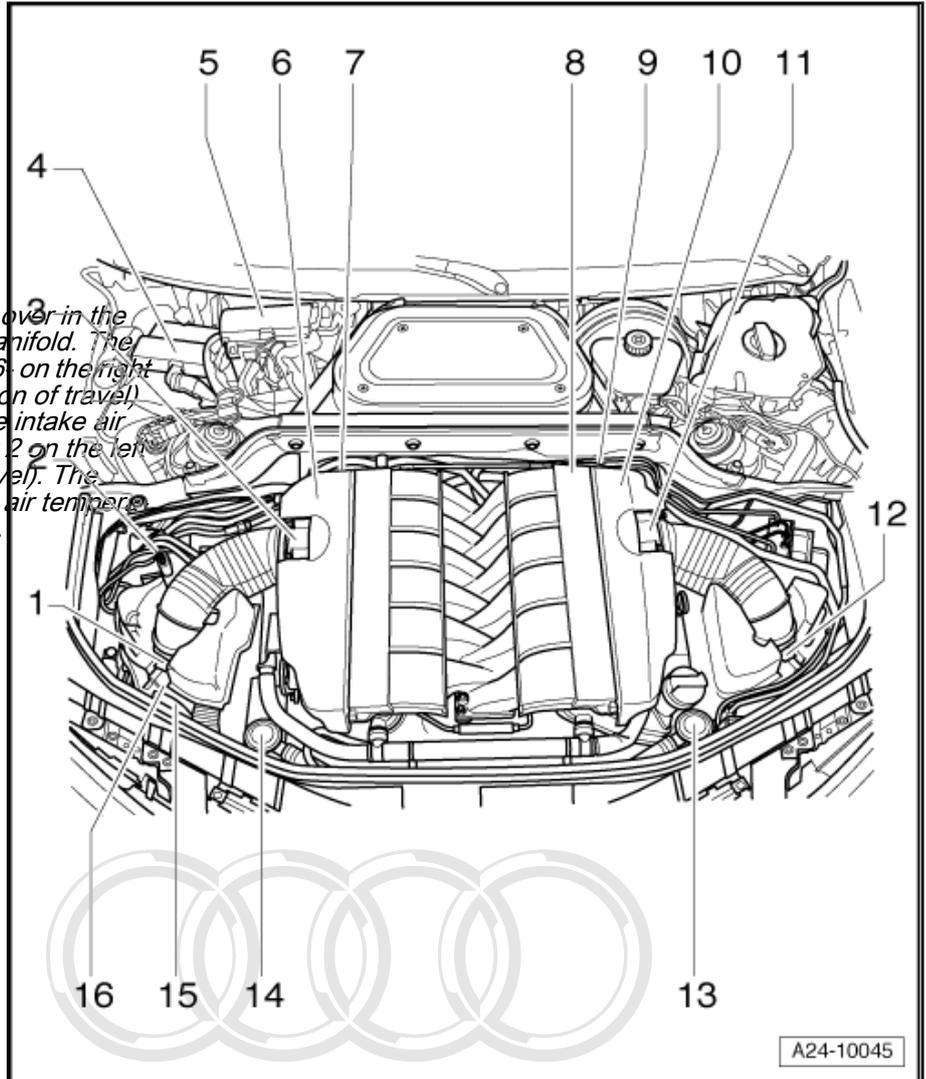
 Note

The intake ports cross over in the middle of the intake manifold. The air mass meter 2 -G246- on the right side (as seen in direction of travel) therefore measures the intake air mass for cylinder bank 2 on the left side (in direction of travel). The same applies to intake air temperature sender 2- (G299).

2 - Electrical connectors for Lambda probes, ⇒ [Item 1 \(page 29\)](#) and following.

3 - Throttle valve module 2 - J544-

- With throttle valve drive 2 -G296- , angle sender -1- for throttle valve drive 2 -G297- and angle sender -2- for throttle valve drive 2 -G298-
- For cylinder bank 2 (cylinders 7 to 12)
- Please also refer to the first sentence of the note shown above.



4 - Engine control unit 2 -J624-

- In electronics box in plenum chamber.
- Mark control unit before removing, to ensure it is not interchanged with engine control unit 1.

5 - Engine control unit -J623-

- In electronics box in plenum chamber.
- Mark control unit before removing, to ensure it is not interchanged with engine control unit 2.

6 - Bank 1 Hall sender 3 -G300-

- For exhaust camshaft
- Cylinder bank 1

7 - Hall sender -G163- ; (bank 2, camshaft position sensor)

- For inlet camshaft
- Cylinder bank 2

8 - Hall sender -G40- ; (bank 1, camshaft position sensor)

- For inlet camshaft
- Cylinder bank 1

9 - Engine speed sender -G28-

10 - Bank 2 Hall sender 4 -G301-

- For exhaust camshaft
- Cylinder bank 2

**11 - Throttle valve module -J338-**

- Including throttle valve drive (electric throttle operation) -G186- , angle sender for throttle valve drive -G187- and angle sender 2 for throttle valve drive -G188-
- For cylinder bank 1 (cylinders 1 to 6)

12 - Air mass meter -G70- with intake air temperature sender -G42-

- For cylinder bank 1 (cylinders 1 to 6)
- Removing and installing ⇒ [page 7](#)

**Note**

The intake ports cross over in the middle of the intake manifold. The air mass meter -G70- on the left side (as seen in direction of travel) therefore measures the intake air mass for cylinder bank 1 on the right side (in direction of travel). The same applies to the intake air temperature sender -G42- .

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13 - Mechanical exhaust gas recirculation valve**14 - Mechanical exhaust gas recirculation valve****15 - Secondary air pump motor 2 -V189-**

- For cylinder bank 2
- In air cleaner housing (bottom section)

16 - Secondary air pump motor -V101-

- For cylinder bank 1
- In air cleaner housing (bottom section)

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

- In footwell on brake pedal

B - Diagnostic connector

- In driver's knee restraint

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

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

D - „MIL“ warning lamp

- In instrument cluster

E - „EPC“ warning lamp

- In instrument cluster

**Note**

In the illustration the intake manifold has been removed.

- 1 - Exhaust camshaft control valve 1 -N318-
- 2 - Camshaft control valve 1 - N205-
- 3 - Map-controlled engine cooling thermostat -F265-
- 4 - Fuel pressure regulator (engine code letters BHT only)
- 5 - Camshaft control valve 2 - N208-
- 6 - Exhaust camshaft control valve 2 -N319-

7 - Ignition coils with output stages, cylinder bank 2

- Ignition coil 7 with output stage -N325-
- Ignition coil 8 with output stage -N326-
- Ignition coil 9 with output stage -N327-
- Ignition coil 10 with output stage -N328-
- Ignition coil 11 with output stage -N329-
- Ignition coil 12 with output stage -N330-

Note

Cylinder numbers are stamped onto cylinder head covers.

8 - Injectors, cylinder bank 2

- Injector, cylinder 7 - N85-
- Injector, cylinder 8 -N86-
- Injector, cylinder 9 -N299-
- Injector, cylinder 10 -N300-
- Injector, cylinder 11 -N301-
- Injector, cylinder 12 -N302-

Note

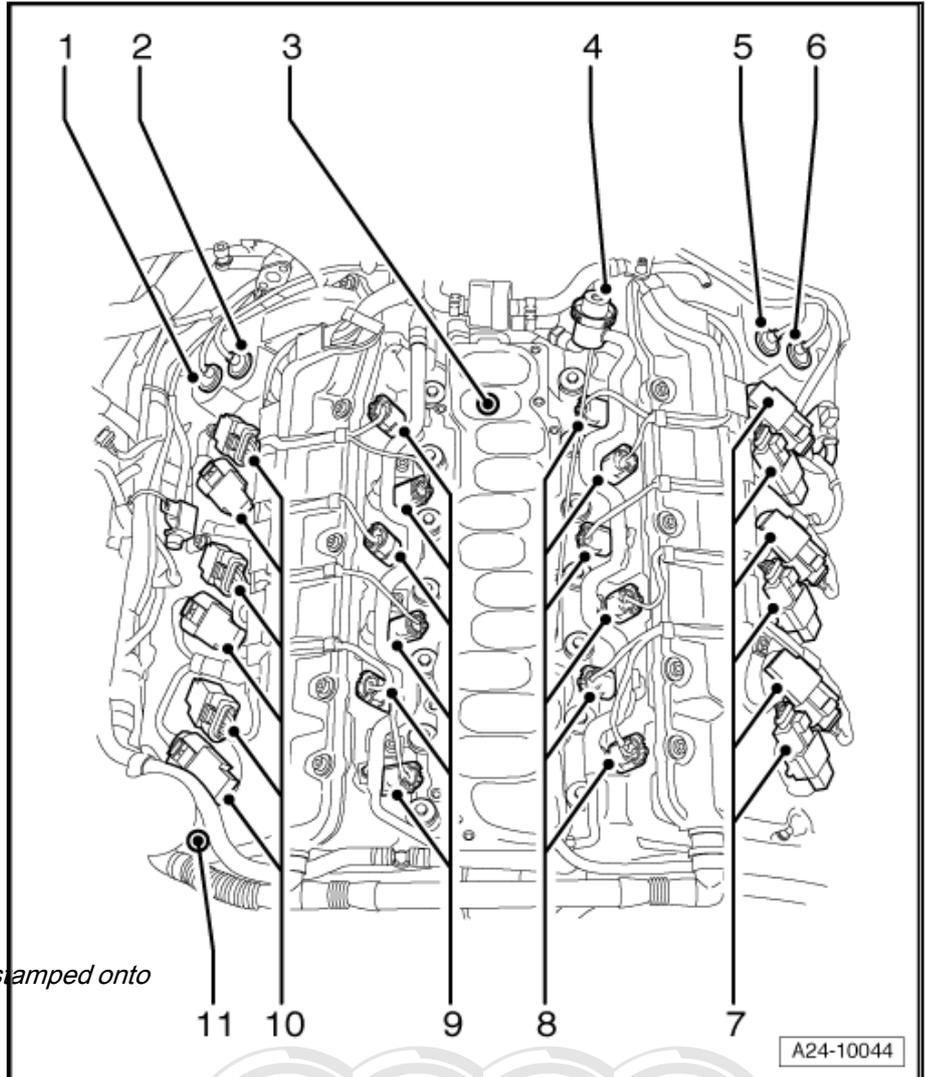
Cylinder numbers are stamped onto cylinder head covers.

9 - Injectors, cylinder bank 1

- Injector, cylinder 1 -N30-
- Injector, cylinder 2 -N31-
- Injector, cylinder 3 -N32-
- Injector, cylinder 4 -N33-
- Injector, cylinder 5 -N83-
- Injector, cylinder 6 -N84-

10 - Ignition coils with output stages, cylinder bank 1

- Ignition coil 1 with output stage -N70-



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- 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-

11 - Electro-hydraulic engine mounting solenoid valve (right-side) -N145-



Note

- ◆ In the following illustration the fitting locations of the knock sensors are only shown in schematic form.
- ◆ The knock sensors are located on the outer sides of the crankcase, not in the „V“ as e.g. on the biturbo engine.
- ◆ The engine is equipped with a total of four knock sensors.
- ◆ The arrow indicates the direction of travel.
- ◆ Continued on next page



I - For cylinder bank 1 (cylinders 1 to 6)

II - For cylinder bank 2 (cylinders 7 to 12)

1 - Knock sensor 1 -G61-

- Knock sensor 1 detects engine knock in cylinders 1, 2 and 3.

2 - Knock sensor 2 -G66-

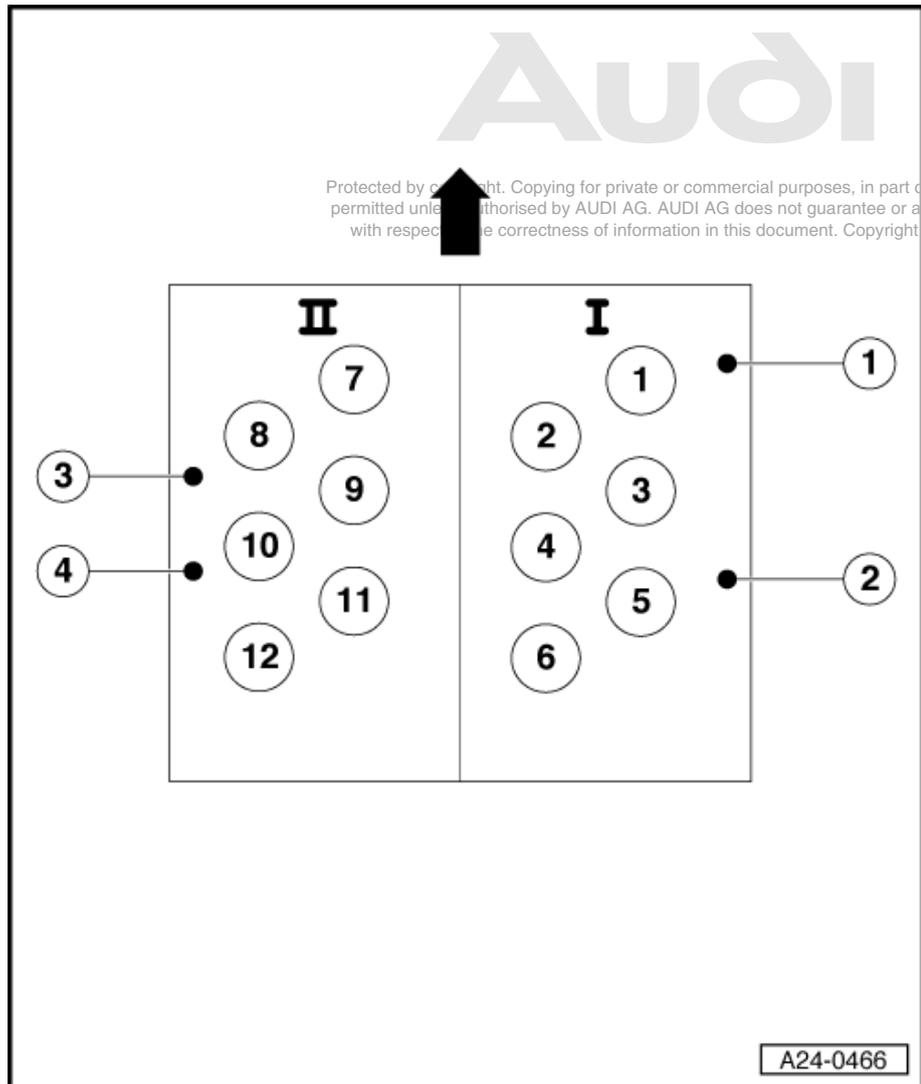
- Knock sensor 2 detects engine knock in cylinders 4, 5 and 6.

3 - Knock sensor 3 -G198-

- Knock sensor 3 detects engine knock in cylinders 7, 8 and 9.

4 - Knock sensor 4 -G199-

- Knock sensor 4 detects engine knock in cylinders 10, 11 and 12.



1.5 Removing and installing air mass meter -G70-



Note

To determine the exact cause of the fault, perform the Guided Fault Finding function before renewing any components that are capable of self-diagnosis. Then send the log to AUDI AG online.

Removing

- Unplug electrical connector at air mass meter -G70- .
- Unscrew both bolts from air mass meter -G70- .
- Open hose clip and 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*
- Check for salt residue, dirt and leaves in air mass meter and air intake hose (engine intake side).
- Check for dirt in air duct leading to air filter element. If necessary, clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); wash out or use a vacuum cleaner as required. Removing and installing air cleaner
- If air cleaner element has been removed, blow out water drain in bottom section of air cleaner with compressed air.

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

1.6 Removing and installing air mass meter 2 -G246-

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Removing

To determine the exact cause of the fault, perform the Guided Fault Finding function before renewing any components that are capable of self-diagnosis. Then send the log to AUDI AG online.

- Unplug electrical connector at air mass meter 2 -G246- .
- Unscrew both bolts from air mass meter 2 -G246- .
- Open hose clip and carefully pull air mass meter 2 -G246- out of guide on air cleaner housing.



Installing

To ensure the proper function of the air mass meter 2 -G246- 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 2 -G246- 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 for salt residue, dirt and leaves in air mass meter and air intake hose (engine intake side).
- Check for dirt in air duct leading to air filter element. If necessary, clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); wash out or use a vacuum cleaner as required. Removing and installing air cleaner
- If air cleaner element has been removed, blow out water drain in bottom section of air cleaner with compressed air.

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

1.7 Removing and installing air cleaner (left-side)

Removing

- Remove bolts from top section of air cleaner housing.
- Detach air cleaner housing (top section) and take out air filter element.
- Cover air mass meter with a clean cloth and clean out bottom and top sections of air cleaner housing.

Installing

To ensure the proper function of the air mass meter it is important to observe the following notes and 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 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*
- Blow out water drain hose in bottom section of air cleaner with compressed air.
- Clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); use a vacuum cleaner if necessary.

- Check for salt residue, dirt and leaves in air mass meter and air intake hose (engine intake side).
- Check for dirt in air duct leading to air filter element.
- When installing the air filter element, check that it is properly centred in the retainer in the air cleaner (bottom section).
- Fit the top section of the air cleaner carefully on the bottom section, without using force. Make sure the top section of the air cleaner is fitted straight on the air filter element. Note position of sealing lip on air filter element (to prevent air leaks).
- Then screw top section of air cleaner back onto bottom section.
- The remaining installation steps are carried out in the reverse sequence.

1.8 Removing and installing air cleaner (right-side)

Removing

- Remove cover for right suspension turret; to do so, detach spreader clips and unscrew threaded fastener.
- Remove bolts from top section of air cleaner housing (right-side).
- Detach top section of air cleaner housing (right-side) and take out air filter element.
- Cover air mass meter with a clean cloth and clean out bottom and top sections of air cleaner housing.

Installing

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



Note

- ◆ *If the air filter element is very dirty or wet, dirt or water could reach the air mass meter and affect the air mass value. This would lead to loss of power, since a smaller injection quantity is calculated.*
- ◆ *Always use genuine part for air filter element.*
- ◆ *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*
- Blow out water drain hose in bottom section of air cleaner with compressed air.
- Clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); use a vacuum cleaner if necessary.
- Check for salt residue, dirt and leaves in air mass meter and air intake hose (engine intake side).
- Check for dirt in air duct leading to air filter element.
- When installing the air filter element, check that it is properly centred in the retainer in the air cleaner (bottom section).
- Fit the top section of the air cleaner carefully on the bottom section, without using force. Make sure the top section of the air cleaner is fitted straight on the air filter element. Note position of sealing lip on air filter element (to prevent air leaks).

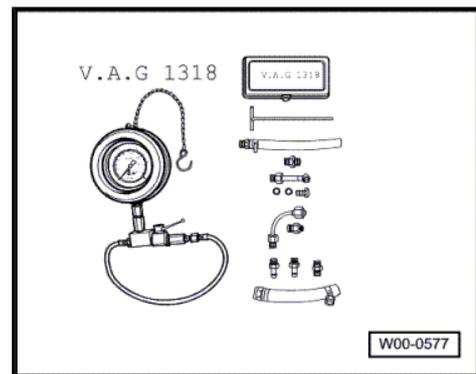


- Then screw top section of air cleaner back onto bottom section.
- The remaining installation steps are carried out in the reverse sequence.

1.9 Checking fuel pressure regulator and residual pressure (engine code letters BHT)

Special tools and workshop equipment required

- ◆ K-Jetronic pressure tester -V.A.G 1318- with adapters - V.A.G 1318/6- and -V.A.G 1318/7-



Test conditions

- Fuel pump relay OK
- Fuel pump OK ⇒ Fuel supply system, petrol engines; Repair group 20
- Fuel filter OK
- Battery voltage at least 11 V.
- Handbrake applied.
- Vehicles with automatic gearbox: selector lever in position „P“ or „N“
- Electrical equipment switched off (radiator fan must not run during the test).
- Air conditioner switched off.
- Ignition off.



Note

Fuel pressure is controlled by the fuel pressure regulator according to the intake manifold pressure. This ensures that the drop in pressure at the injectors remains the same throughout all engine speed and engine load ranges.



WARNING

The fuel system is pressurised. Before loosening hose connections or opening the test connection (to measure fuel pressure), place a cloth around the connection. Then release pressure by carefully unscrewing the connection.

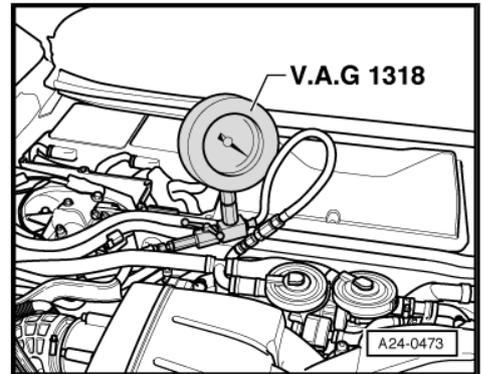
- Briefly open fuel tank filler cap (to release pressure).
- Cover pressurised union with a cloth.

- Open the union and catch escaping fuel with a cloth.

i Note

The union is located behind the cylinder head of cylinder bank 1 (cylinders 1 to 6), under the black plastic cover.

- Connect pressure gauge -V.A.G 1318- with adapters - V.A.G 131- 8/15, 1318/7 between supply line and fuel rail.
- Open cut-off valve on pressure gauge. The lever points in the direction of flow.

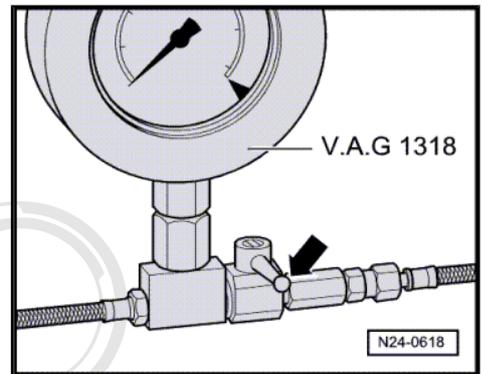


i Note

Cut-off valve on pressure gauge must be open (lever pointing in direction of flow).

- Start the engine and run at idling speed.
- Measure the fuel pressure.

Specification: approx. 3.5 bar



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- Pull vacuum hose -arrow- off fuel pressure regulator.



Note

If fuel flows out at the vacuum connection on the fuel pressure regulator during the following pressure test, fit a new fuel pressure regulator.

The fuel pressure should increase to approx. 4.0 bar.

If the specification is not attained:

- Fit a new pressure regulator as a trial measure and repeat the pressure test.
- If fuel pressure still does not match specification, check fuel pump and supply line for damage (e.g. pinching) and renew if necessary.

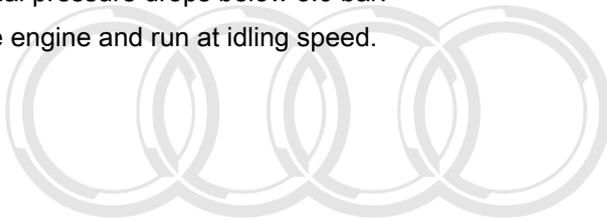
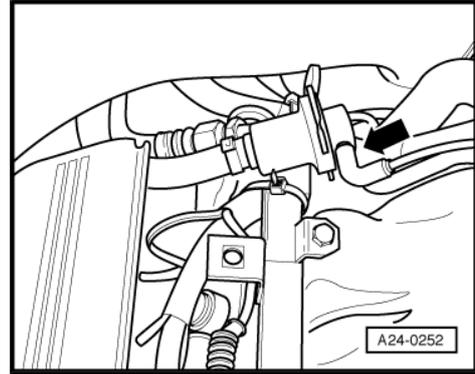
If specification is obtained:

- Reconnect vacuum hose.
- Switch off ignition.
- Observe pressure drop on pressure gauge to check leakage and residual pressure.

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

If the residual pressure drops below 3.0 bar:

- Start the engine and run at idling speed.



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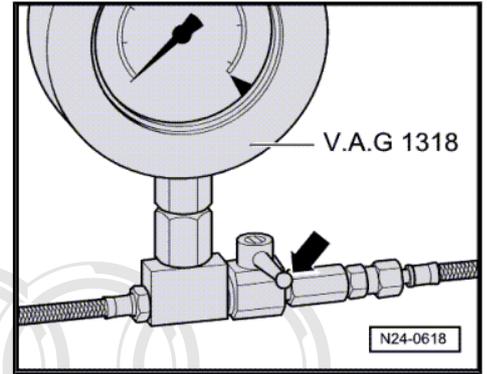
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- Allow pressure to build up, then switch off ignition. At the same time close cut-off valve on pressure gauge -V.A.G 1318- (lever at right angle to direction of flow).
- Observe pressure drop on pressure gauge.

If the pressure drops again, this may be due to the following:

- ◆ Unions on pressure gauge downstream of cut-off valve are leaking
- ◆ Fuel pressure regulator defective
- ◆ Injectors leaking

If the pressure does not drop, this may be due to the following:



 **Note**

Whether or not a pressure drop is indicated on the pressure gauge depends on which direction the cut-off valve on the pressure gauge is pointing in (towards fuel tank or intake manifold).

- ◆ Union between pressure gauge and fuel supply line leaking
- ◆ Leak in supply line at fuel tank
- Non-return valve in fuel pump leaking. ⇒ Fuel supply system, petrol engines; Repair group 20; Fuel supply system

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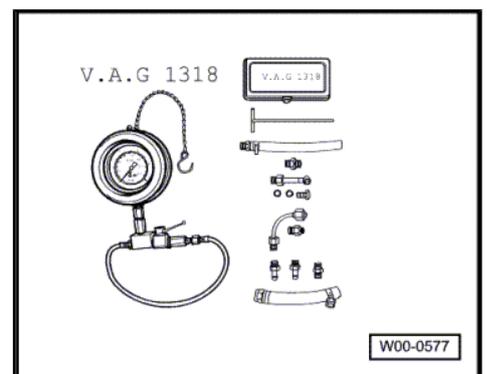
 **Note**

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

1.10 Checking fuel pressure regulator and residual pressure (engine code letters BSB)

Special tools and workshop equipment required

- ◆ K-Jetronic pressure tester -V.A.G 1318-
- ◆ Adapter -V.A.G 1318/26-



Test conditions

- Fuel pump relay OK
- Fuel pump OK ⇒ Fuel supply system, petrol engines; Repair group 20
- Fuel filter OK

- Battery voltage at least 11 V.
- Handbrake applied.
- Vehicles with automatic gearbox: selector lever in position „P“ or „N“
- Electrical equipment switched off (radiator fan must not run during the test).
- Air conditioner switched off.
- Ignition off.

Checking system pressure

- Remove engine cover panel.
- Briefly open fuel tank filler cap (to release pressure).



WARNING

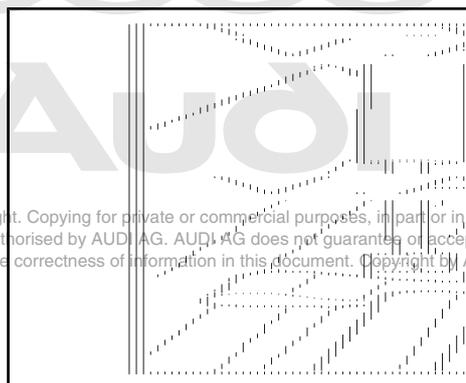
- ◆ *Work on the fuel system must only be performed when the engine is cold.*
- ◆ *The fuel system is pressurised. Before opening the system place a cloth around the connection. Then release pressure by carefully loosening the connection.*

- Open union on fuel supply line ⇒ [page 17](#) and catch escaping fuel with a cloth.

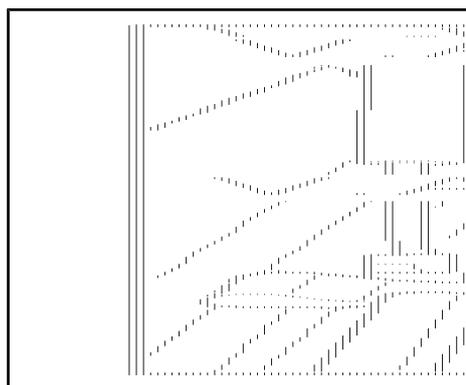
- Connect pressure tester -V.A.G 1318- to fuel supply line.
- Open cut-off valve on pressure gauge. The lever points in the direction of flow.
- Start the engine and run at idling speed.
- Measure the fuel pressure.
- ◆ Specification: approx. 4.0 bar
- Switch off ignition.
- Check leak-tightness and residual pressure by watching the drop in pressure on the pressure gauge.
- ◆ After 10 minutes there should still be a pressure of at least 2.5 bar.

If the residual pressure drops below 2.5 bar:

- Start the engine and run at idling speed.



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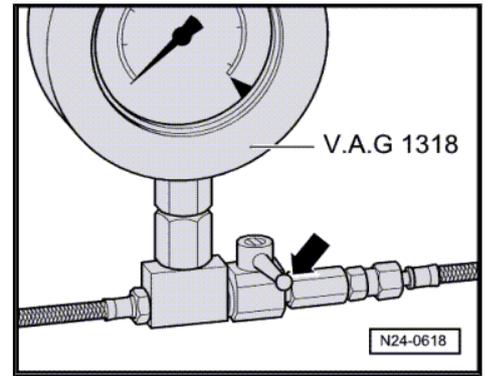
- Allow pressure to build up, then switch off ignition. At the same time close cut-off valve on pressure tester -V.A.G 1318- (lever at right angle to direction of flow -arrow-).
- Observe pressure drop on pressure gauge.

If the pressure now does not drop:

- Check pressure gauge for leaks.
- Check pipe connections and injectors for leaks.

If the pressure drops again:

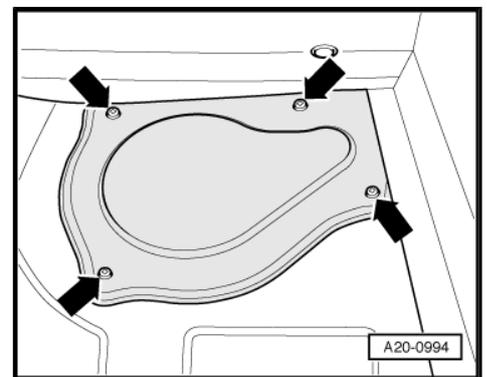
- Check pressure regulator in fuel filter.
- ◆ Check fuel pressure regulator.



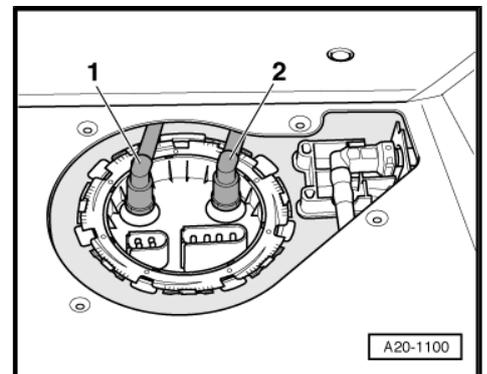
Checking fuel pressure regulator

- Detach trim in luggage compartment.

- Unscrew cover for flange on fuel tank -arrows-.



- Disconnect fuel return line -1- (press release tab).

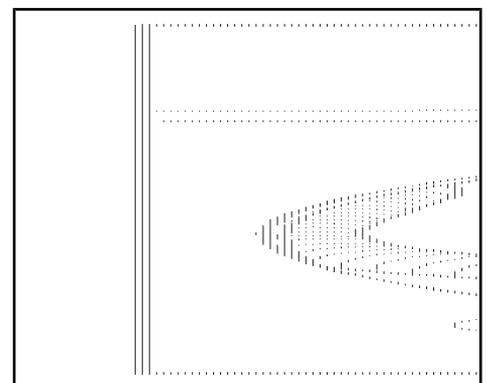


- Connect adapter hose -2- (adapter -V.A.G 1318/26-) to return line -1-.
- Clamp off adapter hose using hose clamp 3094.

Note

Do not attach hose clamp 3094 directly to fuel pipe - Danger of damage.

- Start the engine and run at idling speed.





- Allow pressure to build up, then switch off ignition. At the same time close cut-off valve on pressure tester -V.A.G 1318- (lever at right angle to direction of flow -arrow-).

- Observe pressure drop on pressure gauge.

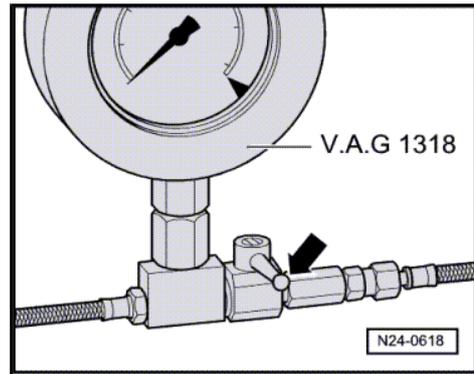
If pressure drops again, non-return valve of fuel pump is leaking.

- Renew fuel pump.

If the pressure now does not drop:

- Renew fuel filter with integral fuel pressure regulator.

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

**Note**

- ◆ Before removing the pressure gauge, release the fuel pressure by opening the cut-off valve. Hold a container under the connection.
- ◆ Vehicles with engine code letters BSB: after working on the fuel lines or fuel filter, the engine must only be started when it is cold to avoid damaging the catalytic converter.
- ◆ When the engine is first started it can take up to 15 seconds before it fires.

Additional steps required

After completing the repair, perform the following steps in the sequence listed.

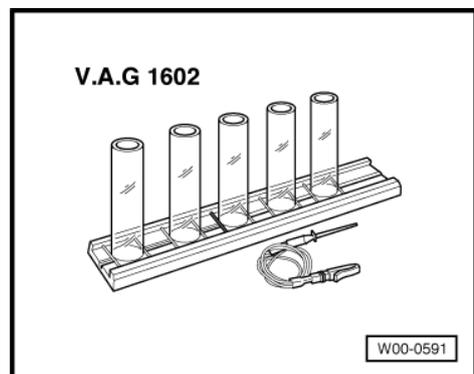
- 1 - Interrogate fault memory ⇒ „Mode 3: Interrogate fault memory“, page .
 - 2 - Erase fault memory if necessary ⇒ „Mode 4: Reset/erase diagnostic data“, page.
 - 3 - Generate readiness code.
- Terminate diagnosis and switch off ignition.

1.11 Checking injection quantity and spray pattern of injectors; checking for leaks

Special tools and workshop equipment required

- ◆ Injection rate tester -V.A.G 1602-

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**Test condition**

- Fuel pressure OK
- In order to reach the injectors, first remove the intake manifold.
⇒ [page 21](#)

- Unplug electrical connectors on injectors by pressing release tab down and then inwards -arrow-.

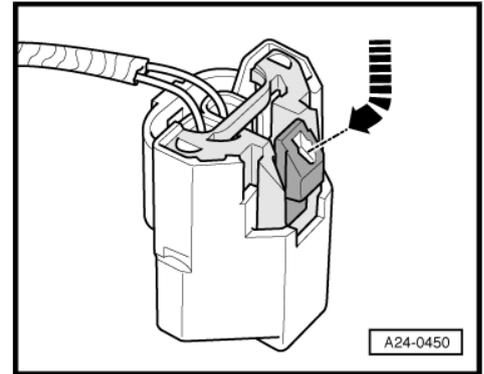
 **Note**

- ◆ *When the connector is released, the release tab will remain in the released (lower) position. When the connector is plugged in again, the release tab will engage upwards again.*
- ◆ *Vehicles with engine code letters BSB not fitted with fuel return line -2-*

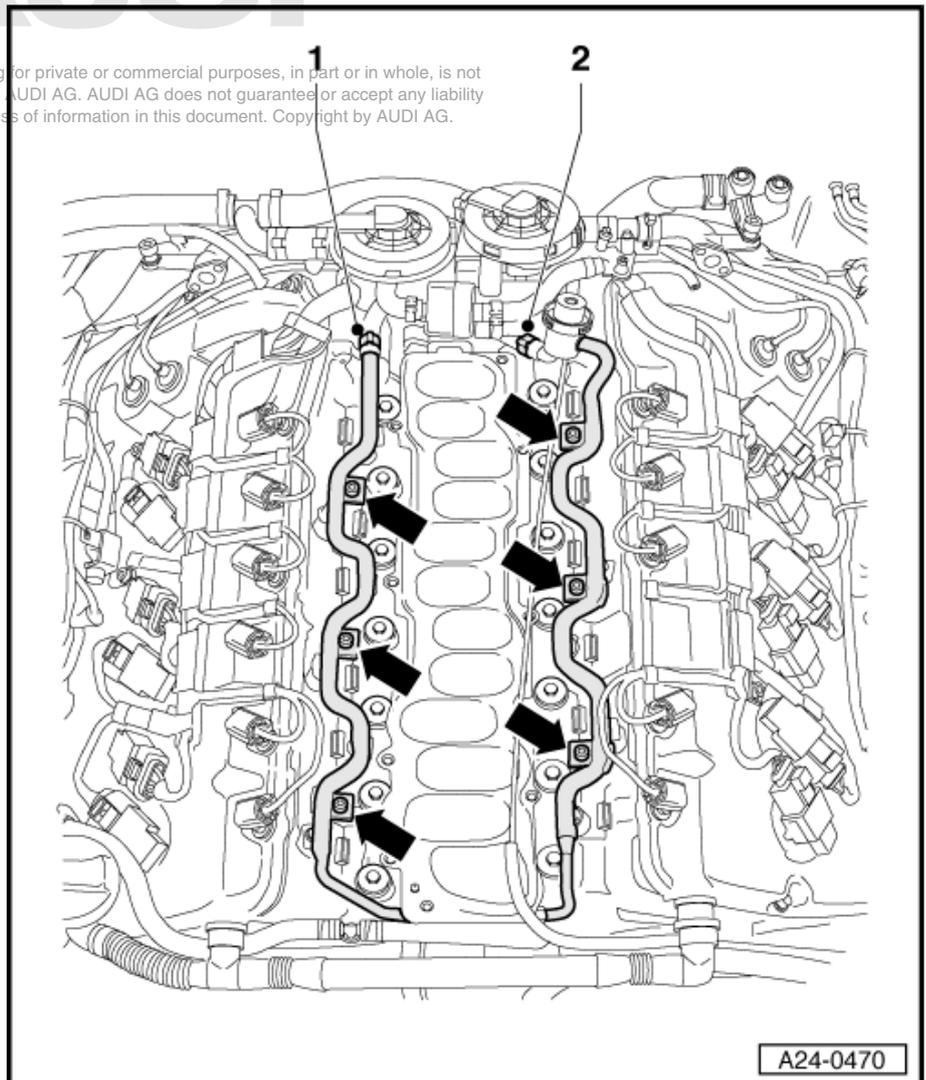
- Disconnect fuel supply line -1- and fuel return line -2- from fuel rail. Use a clean cloth to catch escaping fuel.

 **Note**

Vehicles with engine code letters BSB not fitted with fuel return line -2-



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- Disconnect vacuum hose from fuel pressure regulator.
- Remove securing bolts from fuel rail -arrows- (tightening torque: 10 Nm).
- Pull fuel rail (on gearbox side) off intake manifold together with injectors (pull off evenly from the top) and place it on a clean cloth in the engine compartment.
- Re-connect fuel supply line -1- and fuel return line -2- to fuel rail.

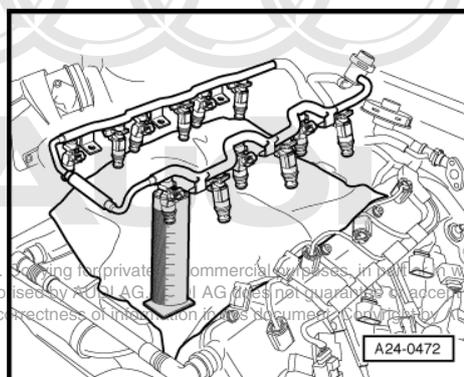


Note

Vehicles with engine code letters BSB not fitted with fuel return line -2-

1.11.1 Checking injectors for leaks

- Place the injector which is to be tested into measuring glass of injection quantity tester -V.A.G 1602- .
- Connect test box -V.A.G 1598/31- to wiring harness for engine control unit 1. Do not connect engine control unit ⇒ [page 41](#) .
- Bridge contacts 1 and 65 on the test box using test leads from adapter set -V.A.G 1594 A- . (This creates an earth connection to one side of the fuel pump relay coil.)
- Switch on ignition.



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Note

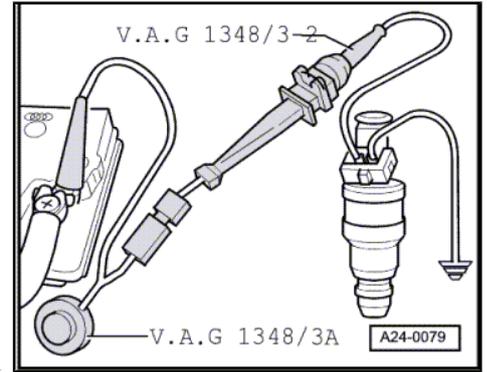
Once the ignition has been switched on the fuel pump runs continuously, even if the engine is not running. This is because the fuel pump relay receives a positive voltage supply via the central electrics when the ignition is switched on. The earth connection for the fuel pump relay is set up via the test lead bridge connection in the test box.

- Check injectors for leaks (visual check). When the fuel pump is running, no more than 1 to 2 drops a minute should escape from any one of the injectors.
- If the fuel loss is greater, switch off the fuel pump (turn off ignition) and renew the faulty injector.

1.11.2 Checking injection quantity

- Place the injector which is to be tested into measuring glass of injection quantity tester -V.A.G 1602- .

- Connect one of the injector contacts to engine earth using test lead and crocodile clip from -V.A.G 1594 A- .
- Connect second injector contact to positive using remote control -V.A.G 1348/3A- , adapter lead -V.A.G 1348/3-2- and auxiliary lead.
- Switch on ignition.
- ◆ The fuel pump should run.
- Activate remote control -V.A.G 1348/3A- for 30 seconds.
- Perform measurements on all injectors.
- Once four injectors have been actuated, place measuring glasses on a level surface.



Specification for each injector:

- ◆ 121...131 ml

If none of the injectors delivers the specified quantity:

- Check fuel pressure ⇒ [page 10](#) .

If only one injector fails to deliver the specified quantity:

- Renew the defective injector.

 **Note**

When checking the injection quantity, also check the spray pattern. The spray pattern should be the same for all injectors.

Installation of the fuel rail together with injectors is performed in the reverse sequence. The following points should be noted when installing:

- Renew the O-rings at all opened connections. (When renewing the front O-ring, ensure that the plastic cap is never removed from the injector head. The O-ring must be pulled off over the plastic cap).
- Lubricate the O-rings with clean engine oil.
- Make sure retaining clips are properly connected.
- Make sure injectors are installed in correct position.

1.12 Dismantling and assembling fuel rail with injectors



Note

- ◆ Depending on the version, the fuel rail may differ from the one shown in this illustration.
- ◆ Vehicles with engine code letters BSB not fitted with fuel pressure regulator, items -2- -3- -4- -5-

1 - Fuel rail

2 - To intake manifold

3 - Retaining clip

4 - O-ring

- Renew

5 - Fuel pressure regulator

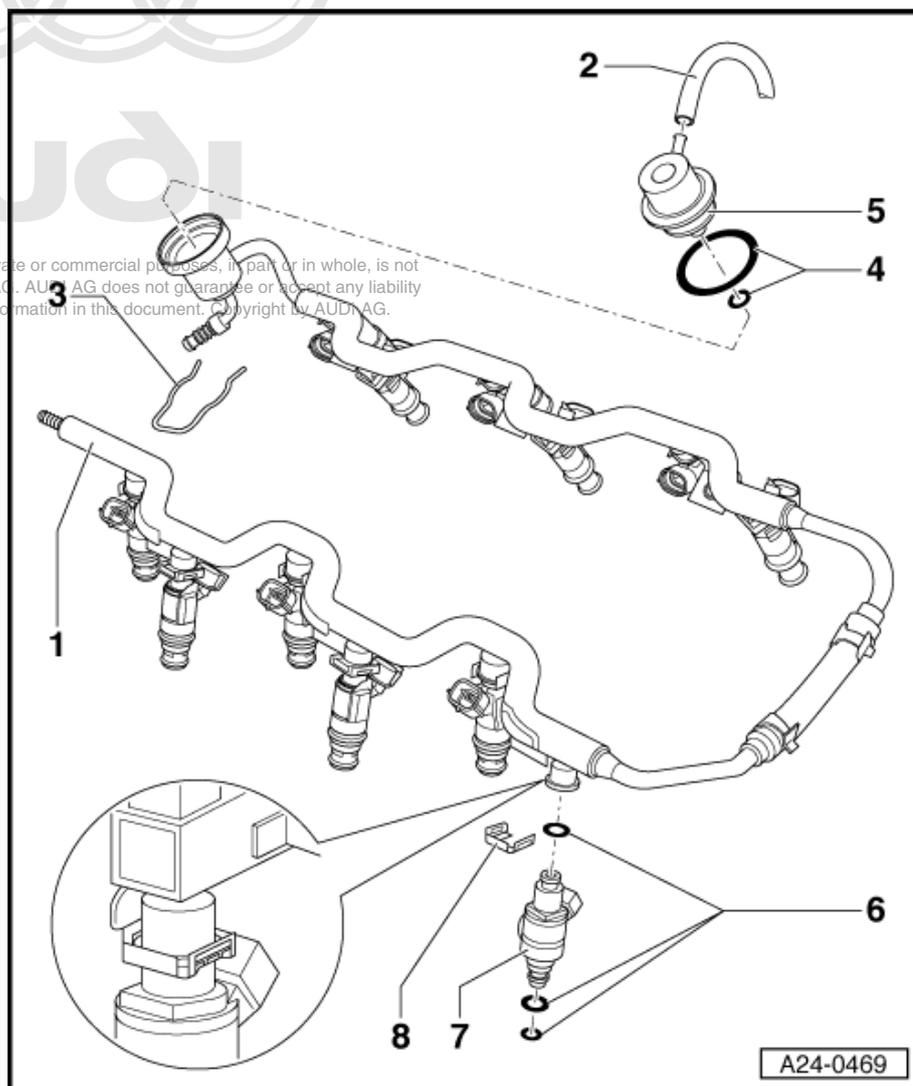
6 - O-ring

- Renew

7 - Injector

8 - Retaining clip

- Ensure it is positioned correctly on injector and fuel rail



1.13 Intake manifold - exploded view

1 - Bottom section of intake manifold

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

2 - 9 Nm

3 - Gasket

- Renew

4 - Fuel rail

- Removing and installing

5 - 9 Nm

6 - Seal

- Renew

7 - 22 Nm

8 - Side section of intake manifold

- Removing and installing left section of intake manifold ⇒ [page 22](#)
- Removing and installing right section of intake manifold ⇒ [page 23](#)

9 - Gasket

- Renew

10 - 7 Nm + 180° (1/2 turn) further

- Renew
- Starting from the centre, tighten in stages and in diagonal sequence

11 - Intake manifold (top section)

- Removing and installing ⇒ [page 24](#)

12 - Vacuum hose

- To fuel pressure regulator

13 - Vacuum hose

- To activated charcoal filter system solenoid valve 2 -N333-

14 - Vacuum hose

- To vacuum booster for brake servo

15 - 9 Nm

16 - Throttle valve module

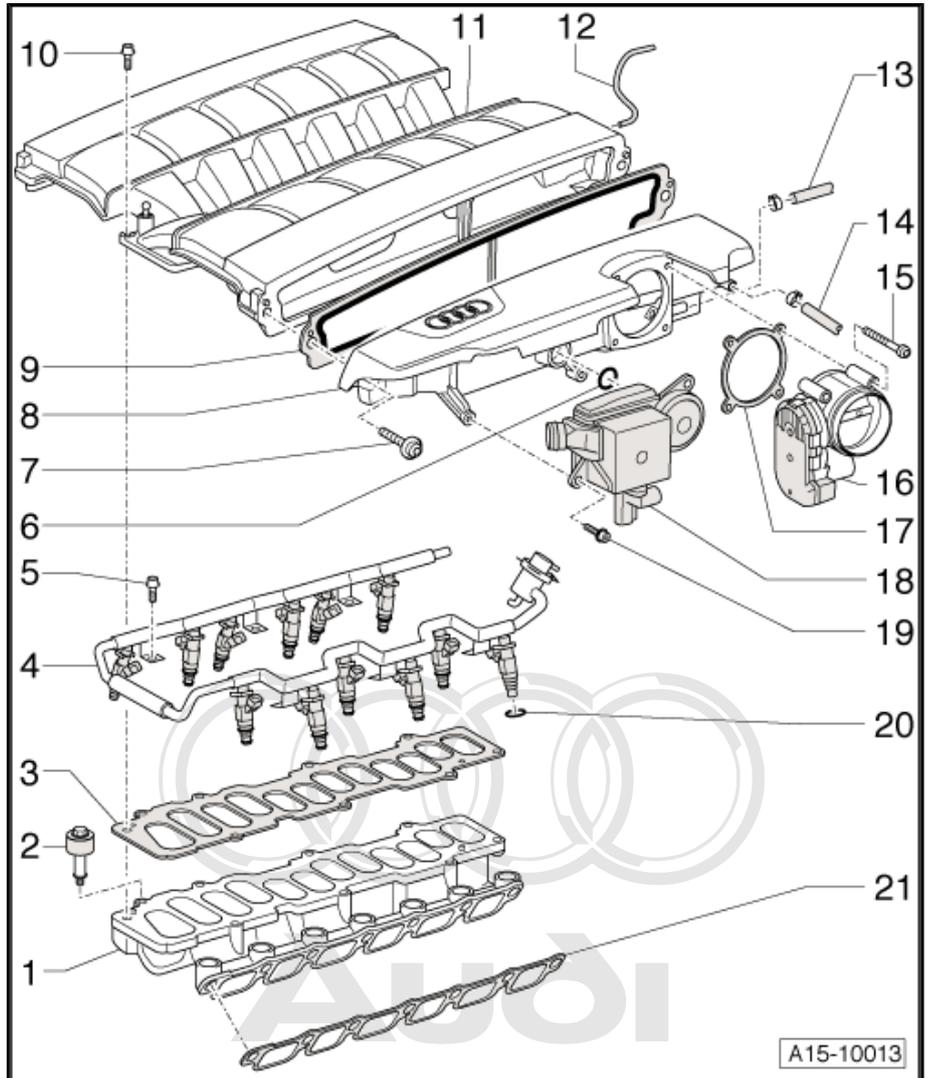
- Cylinder bank 1 (right-side): throttle valve module -J338-
- Cylinder bank 2 (left-side) throttle valve module 2 -J544-

17 - Gasket

- Renew

18 - Pressure control valve for crankcase breather system

- With oil separator



A15-10013

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19 - 9 Nm

20 - O-ring

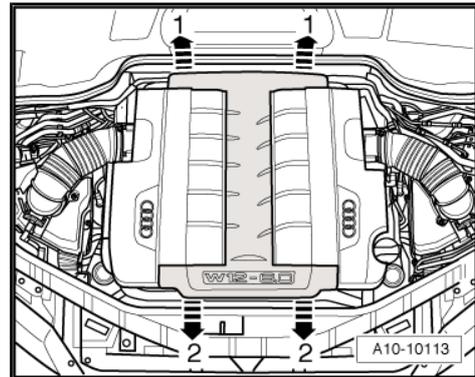
- Renew
- Lubricate with fuel when installing
- Do not use silicon-based lubricant

21 - Gasket

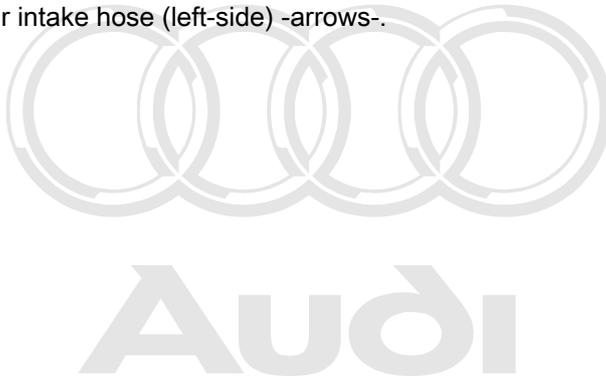
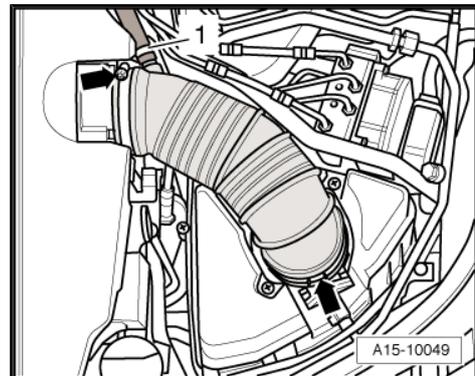
- Renew
- Press into cylinder head

1.14 Removing and installing left section of intake manifold

- Carefully lift off engine cover panel first at rear and then in middle -arrows 1-.
- Then pull engine cover panel forwards off intake manifold -arrows 2-.

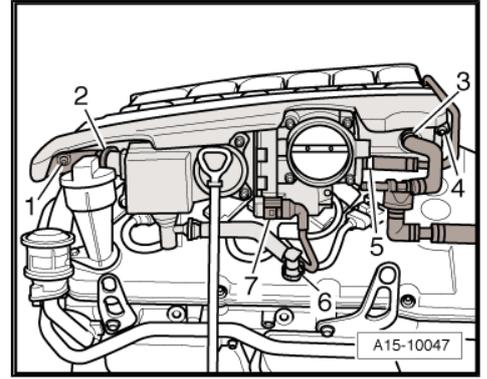


- Pull hose -1- off air intake hose.
- Remove air intake hose (left-side) -arrows-.



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- Detach electrical connector -7- at throttle valve module 2 - J544- .
- Disconnect vacuum hoses -3- and -5-.
- Disconnect hoses for crankcase breather system -2- and -6-.
- Remove bolts -1- and -4-.
- Remove left section of intake manifold.



Installing

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



Note

- ◆ *Renew gaskets, seals and O-rings.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) → Parts catalogue.*

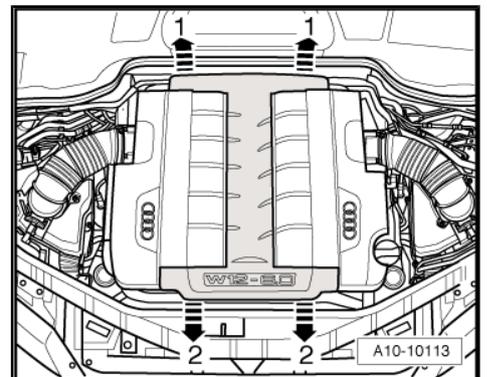
Tightening torque

Component	Nm
Side section of intake manifold to side section of intake manifold	22

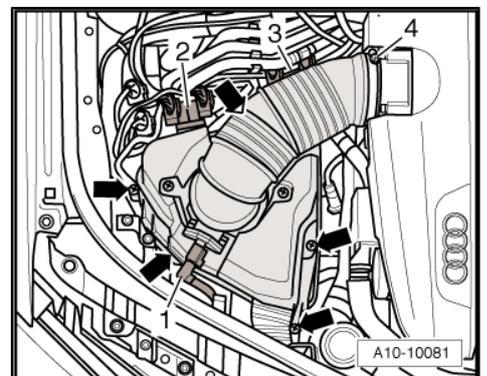
1.15 Removing and installing right section of intake manifold

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- Carefully lift off engine cover panel first at rear and then in middle -arrows 1-.
- Then pull engine cover panel forwards off intake manifold -arrows 2-.



- Detach electrical connector -1- for air mass meter -G70- .
- Detach air intake hose -4- from intake manifold.
- Unhook bracket for connectors -2- and -3- at top section of air cleaner housing.
- Remove bolts -arrows-.
- Detach top section of air cleaner housing (right-side).

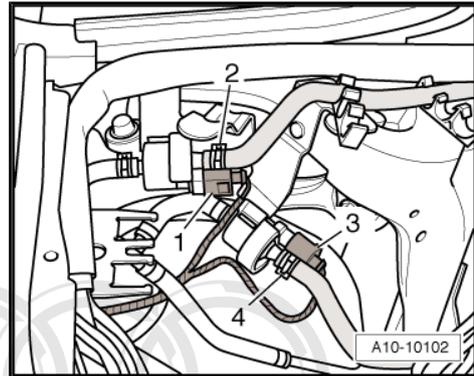




- Detach vacuum hose -4- at solenoid valve 1 for activated charcoal filter system -N80- .

**Note**

Disregard items marked -1 ... 3-.



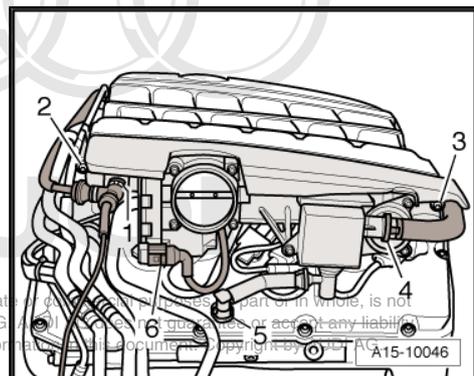
- Unplug electrical connector -6- at throttle valve module - J338- .
- Unplug vacuum hose -1-.
- Disconnect hoses for crankcase breather system -4- and -5-.
- Remove bolts -2- and -3-.
- Remove right section of intake manifold.

Installing

Installation is carried out in the reverse order, **note the following:**

**Note**

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

**Tightening torque**

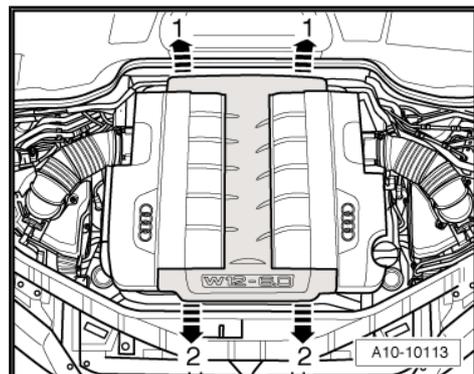
Component	Nm
Side section of intake manifold to side section of intake manifold	22

1.16 Removing and installing intake manifold (top section)

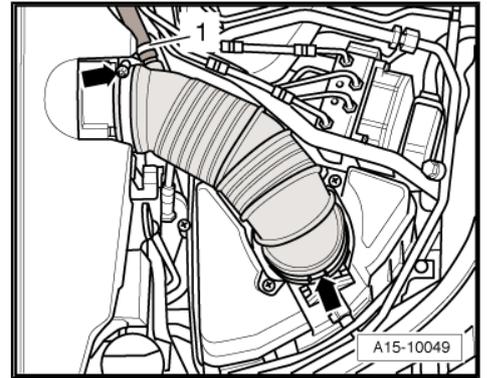
**Note**

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

- Carefully lift off engine cover panel first at rear and then in middle -arrows 1-.
- Then pull engine cover panel forwards off intake manifold -arrows 2-.



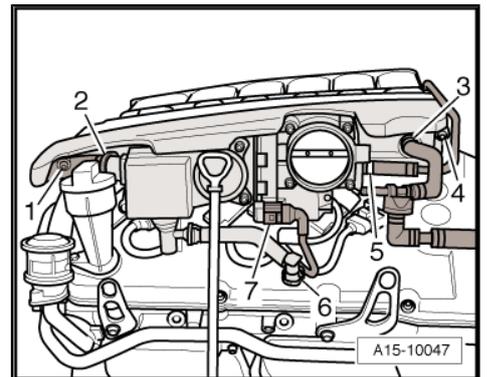
- Pull hose -1- off air intake hose.
- Remove air intake hose (left-side) -arrows-.



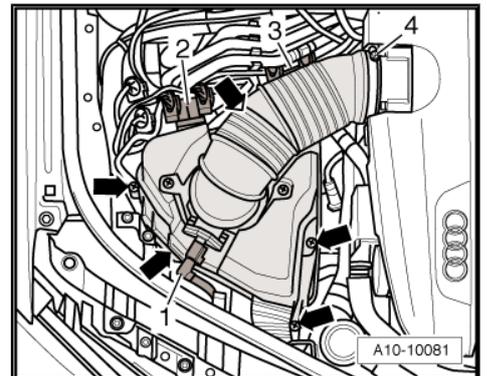
- Detach electrical connector -7- at throttle valve module 2 - J544- .
- Disconnect vacuum hoses -3- and -5-.
- Disconnect hoses for crankcase breather system -2- and -6-.

 **Note**

Ignore items marked -1- and -4-.



- Detach electrical connector -1- for air mass meter -G70- .
- Detach air intake hose -4- from intake manifold.
- Unhook bracket for connectors -2- and -3- at top section of air cleaner housing.
- Remove bolts -arrows-.
- Detach top section of air cleaner housing (right-side).

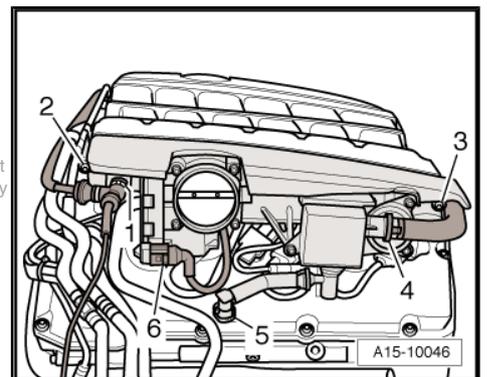


- Unplug electrical connector -6- at throttle valve module - J338- .
- Unplug vacuum hose -1-.
- Disconnect crankcase breather hoses -4- and -5-.

 **Note**

Disregard items -2- and -3-.

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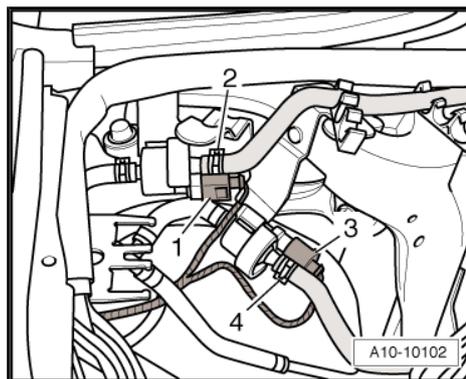


- Detach vacuum hose -4- at solenoid valve 1 for activated charcoal filter system -N80- .



Note

Disregard items marked -1 ... 3-.

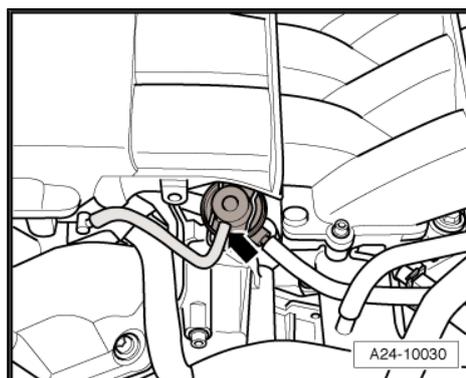


- Engine code letters BHT only: detach vacuum hose -arrow- from fuel pressure regulator.



Note

Shown from rear in illustration.

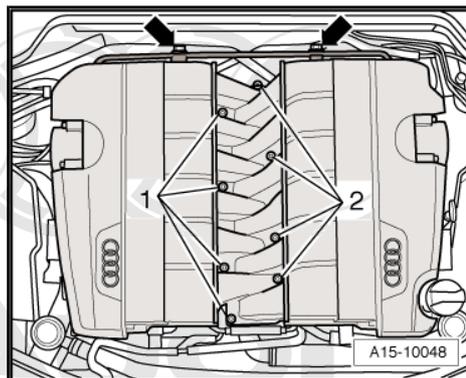


- Remove bolts -arrows-.
- Unscrew bolts -1- and -2- and detach top section of intake manifold.



Note

Seal intake ports on cylinder heads with clean cloths.



Installing

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



Note

- ◆ *Reinstall all cable ties in the same locations when assembling.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) => Parts catalogue.*
- ◆ *Renew gaskets, seals and O-rings.*

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Tightening torques

Component	Nm
Intake manifold (top section) to intake manifold (bottom section)	7 + 180° 3) 4) 5)
Pipe to top section of intake manifold	10
Side section of intake manifold to top section of intake manifold	22

3) Renew bolts.

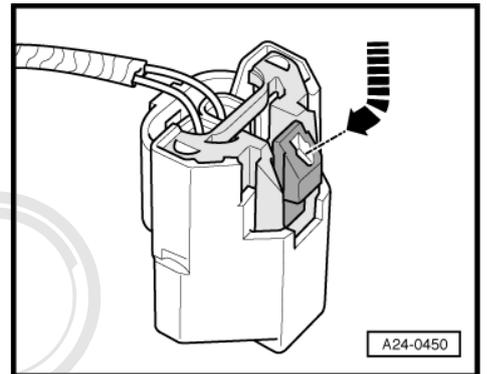
4) 180° = one half turn.

5) Note different bolt lengths

1.17 Removing and installing intake manifold (bottom section)

Note

- ◆ Depending on the version, the fuel rail may differ slightly from the one shown in this illustration.
- ◆ All cable ties which are released or cut open when removing must be refitted in the same position when installing.
- Remove intake manifold (top section) ⇒ [page 24](#) .
- Unplug electrical connectors on injectors by pressing release tab down and then inwards -arrow-.



- Unscrew bolts for fuel rail -1-.
- Unbolt bottom section of intake manifold -2-.
- Remove bottom section of intake manifold together with fuel rail upwards; the fuel hoses remain connected.

Note

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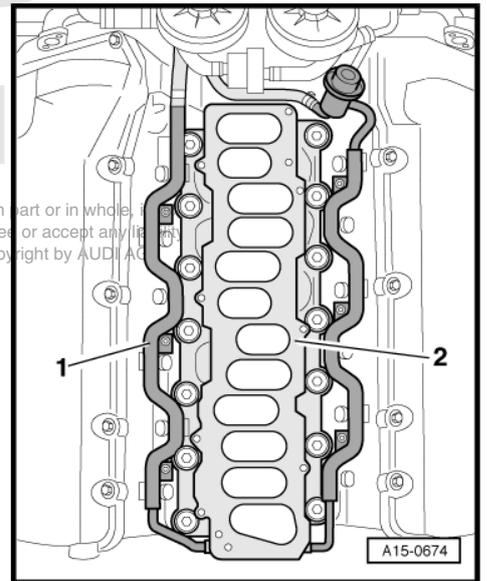
Seal intake ports on cylinder heads with clean cloths.

Installing

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

Note

- ◆ Reinstall all cable ties in the same locations when assembling.
- ◆ Renew gaskets, seals and O-rings.
- Press lugs of gasket for bottom section of intake manifold into holes on cylinder heads.
- Install bottom section of intake manifold together with fuel rail.
- Install intake manifold (top section) ⇒ [page 24](#) .



Tightening torques

Component	Nm
Bottom section of intake manifold to cylinder heads	9
Fuel rail to cylinder heads	9

1.18 Lambda probes - overview



Note

- ◆ The following illustration shows the Lambda probes, the exhaust manifolds and the starter catalytic converters.
- ◆ The engine is equipped with a total of eight Lambda probes.
- ◆ To keep the illustration simple, the crankcase and cylinders (numbers 1 to 12) are only shown in schematic form.
- ◆ The Lambda probes, exhaust manifolds and starter catalytic converters are, however, shown as they are installed in the vehicle.
- ◆ The arrow indicates the direction of travel.

I - Starter catalytic converter for cylinders 1, 2, 3; also referred to as -exhaust bank 1-

II - Starter catalytic converter for cylinders 4, 5, 6; also referred to as -exhaust bank 2-

III - Starter catalytic converter for cylinders 7, 8, 9; also referred to as -exhaust bank 3-

IV - Starter catalytic converter for cylinders 10, 11, 12; also referred to as -exhaust bank 4-

1.1 - Lambda probe -G39- with Lambda probe heating; before catalytic converter

- Exhaust bank 1 (cylinders 1, 2, 3)

1.2 - Lambda probe after catalytic converter -G130- with Lambda probe heating

- Exhaust bank 1 (cylinders 1, 2, 3)

2.1 - Lambda probe 2 -G108- with Lambda probe heating; before catalytic converter

- Exhaust bank 2 (cylinders 4, 5, 6)

2.2 - Lambda probe 2 after catalytic converter -G131- , with Lambda probe heating

- Exhaust bank 2 (cylinders 4, 5, 6)

3.1 - Lambda probe 3 -G285- with Lambda probe heating; before catalytic converter

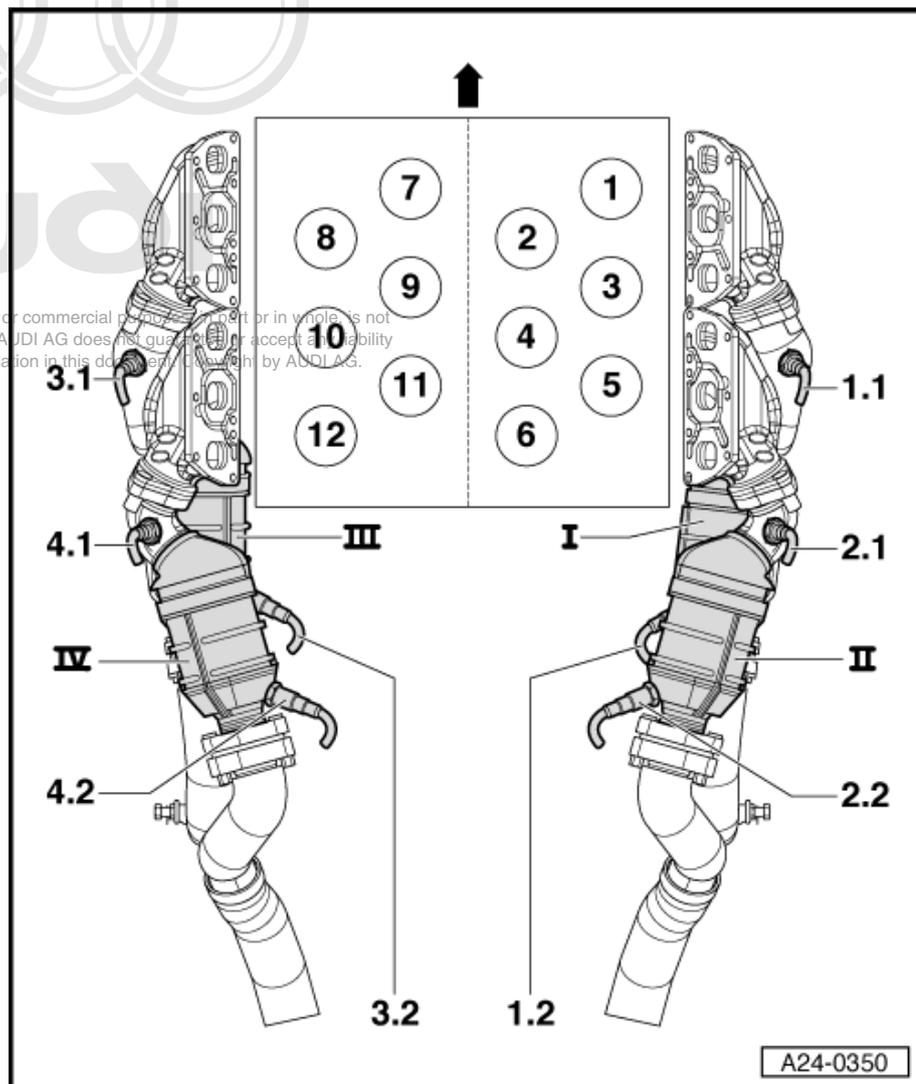
- Exhaust bank 3 (cylinders 7, 8, 9)

3.2 - Lambda probe 3 after catalytic converter -G287- , with Lambda probe heating

- Exhaust bank 3 (cylinders 7, 8, 9)

4.1 - Lambda probe 4 -G286- with Lambda probe heating; before catalytic converter

- Exhaust bank 4 (cylinders 10, 11, 12)



4.2 - Lambda probe 4 after catalytic converter -G288- , with Lambda probe heating; after catalytic converter

- Exhaust bank 4 (cylinders 10, 11, 12)

Fitting locations of Lambda probe connectors

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

- Exhaust bank 3 (cylinders 7, 8, 9)
- 6-pin, black

2 - Connector for Lambda probe 4 -G286- (before catalytic converter)

- Exhaust bank 4 (cylinders 10, 11, 12)
- 6-pin, brown

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

- Exhaust bank 3 (cylinders 7, 8, 9)
- 4-pin, green

4 - Connector for Lambda probe -G130- (after catalytic converter).

- Exhaust bank 1 (cylinders 1, 2, 3)
- 4-pin, black

5 - Connector for Lambda probe 2 -G131- (after catalytic converter).

- Exhaust bank 2 (cylinders 4, 5, 6)
- 4-pin, brown

6 - Connector for Lambda probe 4 -G288- (after catalytic converter)

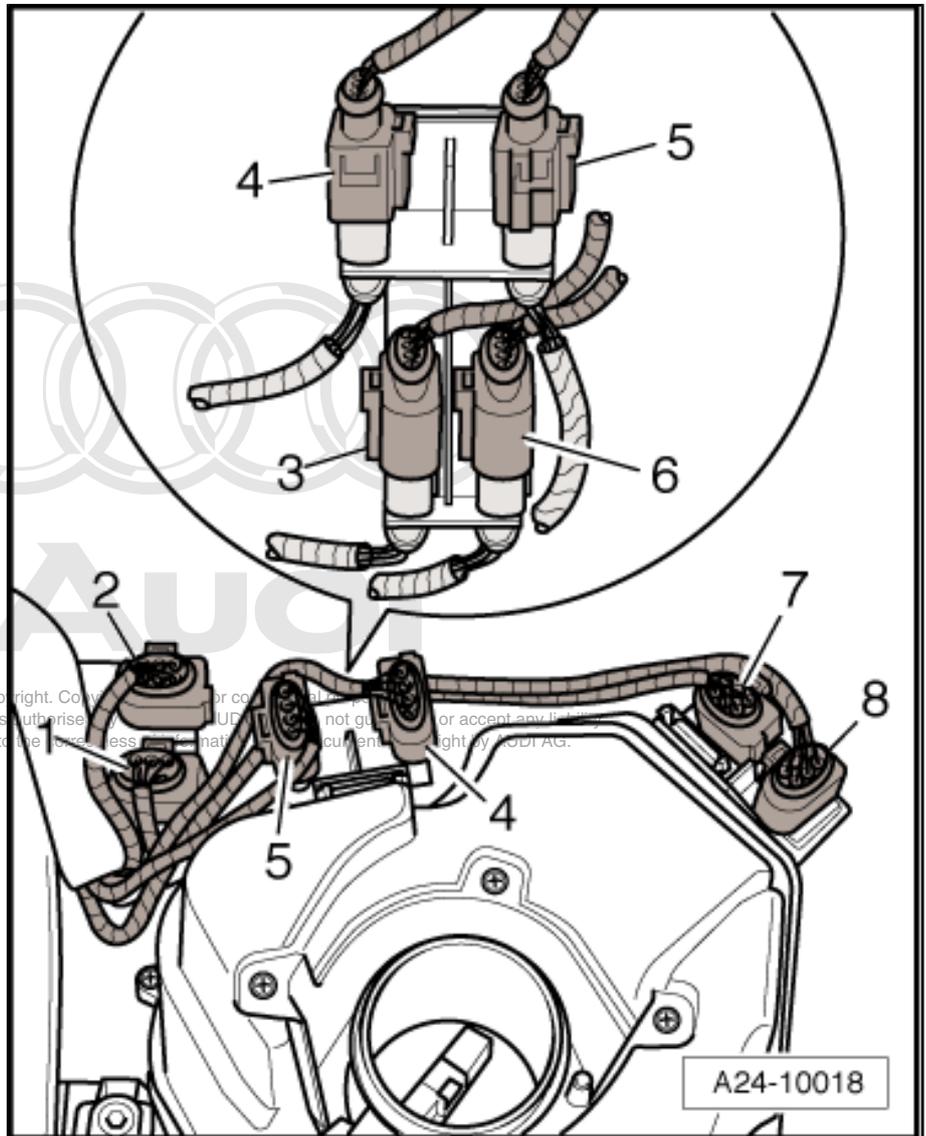
- Exhaust bank 4 (cylinders 10, 11, 12)
- 4-pin, grey

7 - Connector for Lambda probe 2 -G108- (before catalytic converter)

- Exhaust bank 2 (cylinders 4, 5, 6)
- 6-pin, brown

8 - Connector for Lambda probe -G39- (before catalytic converter)

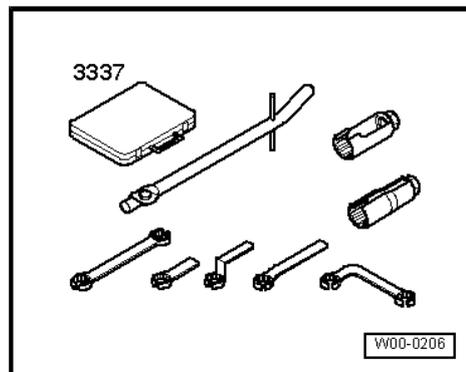
- Exhaust bank 1 (cylinders 1, 2, 3)
- 6-pin, black



1.19 Removing and installing Lambda probe -G39- (before catalytic converter at front right)

Special tools and workshop equipment required

- ◆ Lambda probe open ring spanner set -3337-



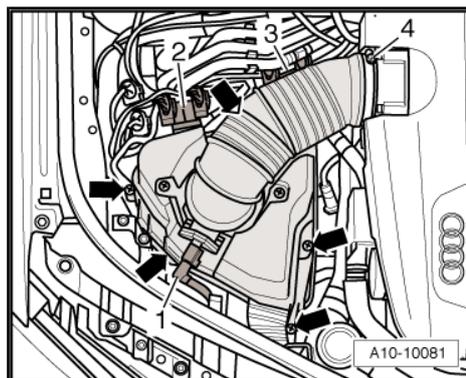
Removing



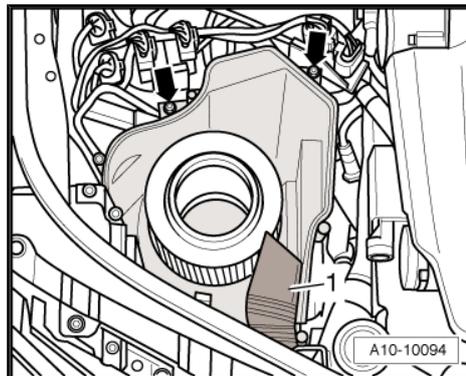
Note

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

- Detach electrical connector -1- for air mass meter -G70- .
- Detach air intake hose -4- from intake manifold.
- Unhook bracket for connectors -2- and -3- at top section of air cleaner housing.
- Remove bolts -arrows-.
- Detach top section of air cleaner housing (right-side).



- Remove air duct -1-.
- Remove bolts -arrows-.
- Remove bottom section of air cleaner housing (right-side).

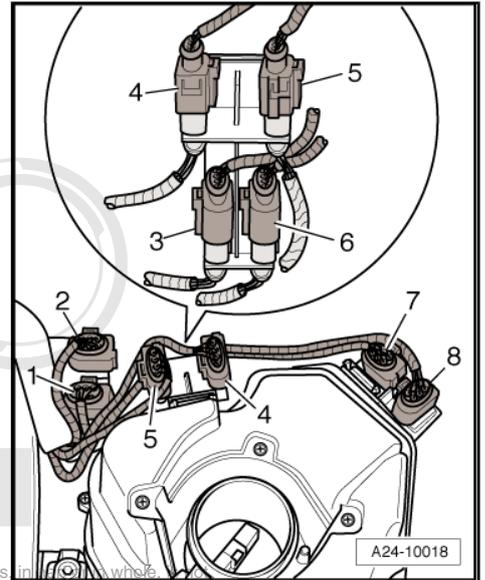


- Unplug electrical connector -8- for Lambda probe -G39- .

i Note

Ignore other items.

- Move electrical wiring to Lambda probe clear.



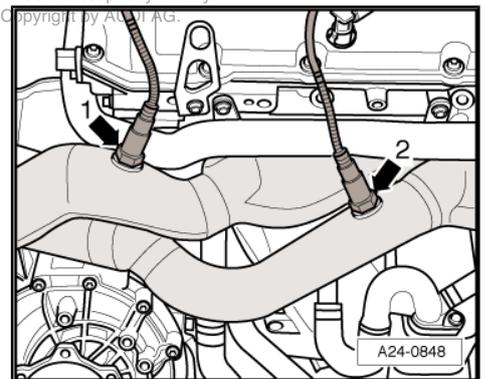
- Unscrew Lambda probe -G39- using Lambda probe open ring spanner set -3337- .

Installing

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

i Note

- ◆ *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*
- ◆ *If reinstalling the old Lambda probes, coat the threads with high-temperature paste => Parts catalogue . The paste must not get into the slots on the probe body.*
- ◆ *Fit all cable ties in the original positions when installing.*
- ◆ *When installing, the Lambda probe wires must always be re-attached at the same locations to prevent them from coming into contact with the exhaust pipe.*
- ◆ Tightening torque: 55 Nm

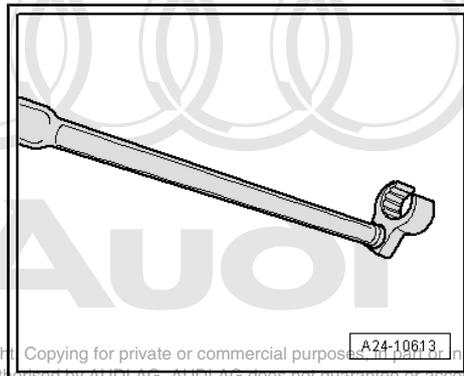


1.20 Removing and installing Lambda probe 2 -G108- (before catalytic converter at rear right)

Special tools and workshop equipment required



- ◆ Extension with open socket, 22 mm (secure socket to extension additionally with adhesive tape).



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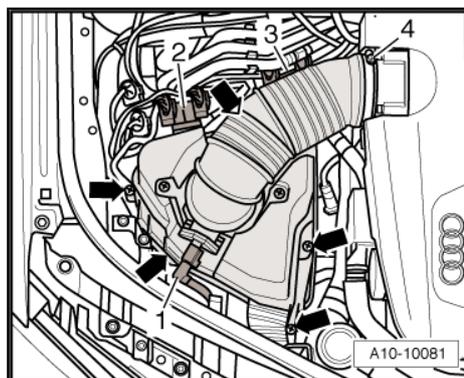
Removing



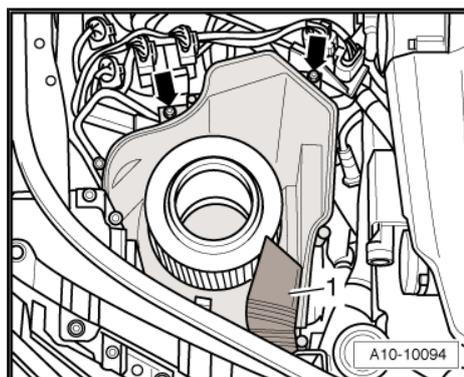
Note

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

- Detach electrical connector -1- for air mass meter -G70- .
- Detach air intake hose -4- from intake manifold.
- Unhook bracket for connectors -2- and -3- at top section of air cleaner housing.
- Remove bolts -arrows-.
- Detach top section of air cleaner housing (right-side).



- Remove air duct -1-.
- Remove bolts -arrows-.
- Remove bottom section of air cleaner housing (right-side).

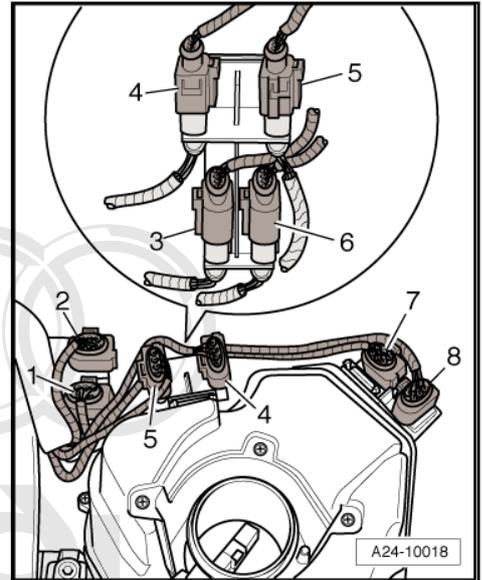


- Unplug electrical connector -7- for Lambda probe 2 -G108- .

i Note

Ignore other items.

- Move electrical wiring to Lambda probe clear.



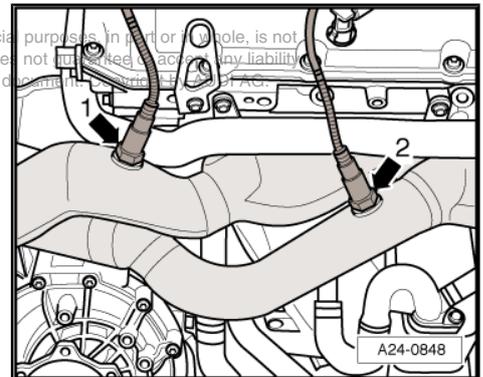
- Unscrew Lambda probe 2 -G108- -arrow 1- using socket with extension.

Installing

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

i Note

- ◆ *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*
- ◆ *If reinstalling the old Lambda probes, coat the threads with high-temperature paste => Parts catalogue . The paste must not get into the slots on the probe body.*
- ◆ *Fit all cable ties in the original positions when installing.*
- ◆ *When installing, the Lambda probe wires must always be re-attached at the same locations to prevent them from coming into contact with the exhaust pipe.*
- ◆ Tightening torque: 55 Nm

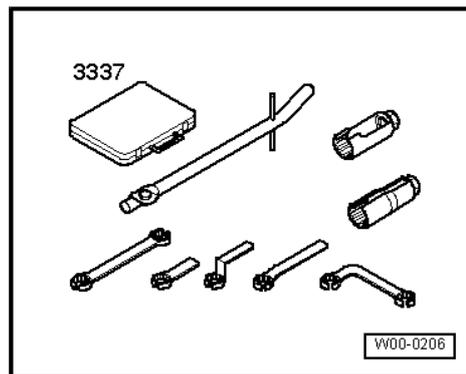


1.21 Removing and installing Lambda probe 3 -G285- (before catalytic converter at front left)

Special tools and workshop equipment required



◆ Lambda probe open ring spanner set -3337-



Removing



Note

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

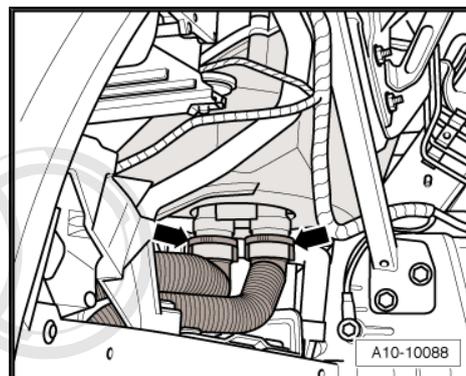
- Activate jacking mode => Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .
- Remove front left wheel.



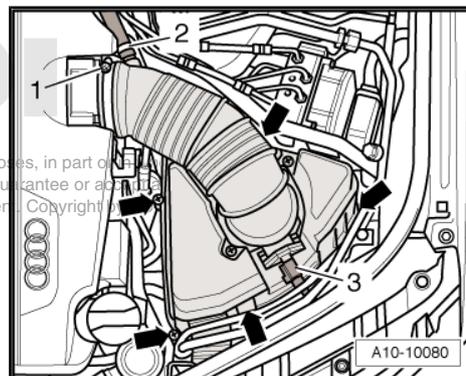
Note

Secure brake disc with wheel bolts.

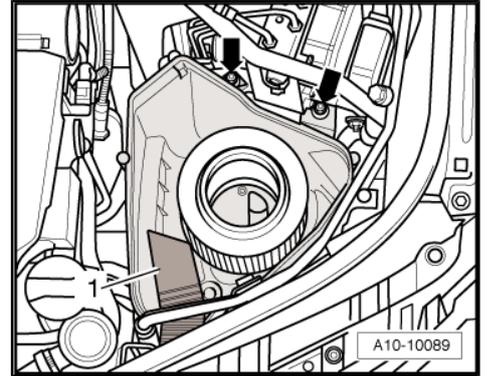
- Remove front section of wheel housing liner (front left) => General body repairs, exterior; Rep. gr. 66 .
- Press release tabs to detach the two air intake hoses (bottom) -arrows- at bottom section of air cleaner housing (left-side).



- Detach electrical connector -3- for air mass meter 2 -G246- .
- Detach hose -2- from air intake hose.
- Detach air intake hose -1- from intake manifold.
- Remove bolts -arrows-.
- Detach top section of air cleaner housing (left side).



- Remove air duct -1-.
- Remove bolts -arrows-.
- Remove bottom section of air cleaner housing (left-side).

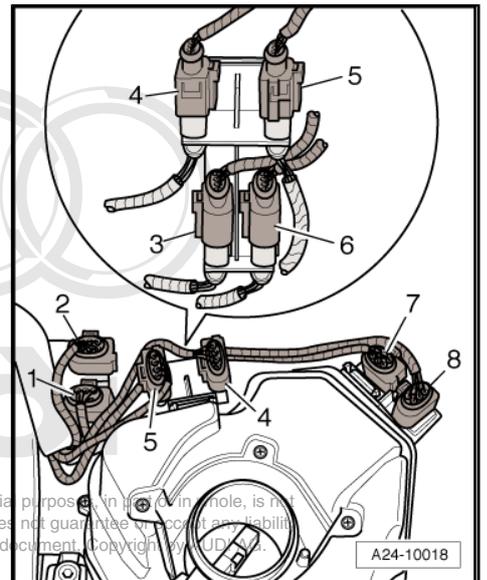


- Unplug electrical connector -1- for Lambda probe 3 -G285- .

i Note

Ignore other items.

- Move electrical wiring to Lambda probe clear.



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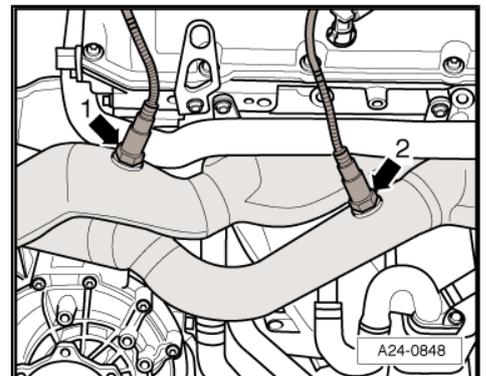
- Unscrew Lambda probe 3 -G285- -arrow 2- using Lambda probe open ring spanner set -3337- .

Installing

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

i Note

- ◆ *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*
- ◆ *If reinstalling the old Lambda probes, coat the threads with high-temperature paste ⇒ Parts catalogue . The paste must not get into the slots on the probe body.*
- ◆ *Fit all cable ties in the original positions when installing.*
- ◆ *When installing, the Lambda probe wires must always be re-attached at the same locations to prevent them from coming into contact with the exhaust pipe.*

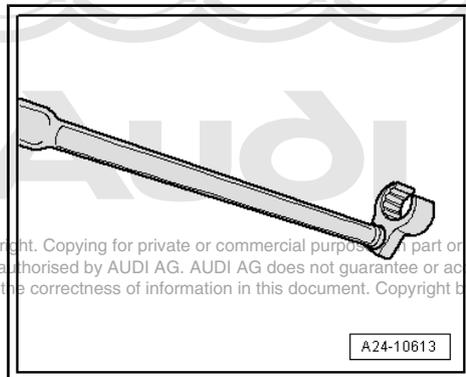


- Install front section of wheel housing liner (front left) ⇒ General body repairs, exterior; Rep. gr. 66 .
- Deactivate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .

1.22 Removing and installing Lambda probe 4 -G286- (before catalytic converter at rear left)

Special tools and workshop equipment required

- ◆ Open socket, 22 mm, and extension (secure socket to extension additionally with adhesive tape).



Removing



Note

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

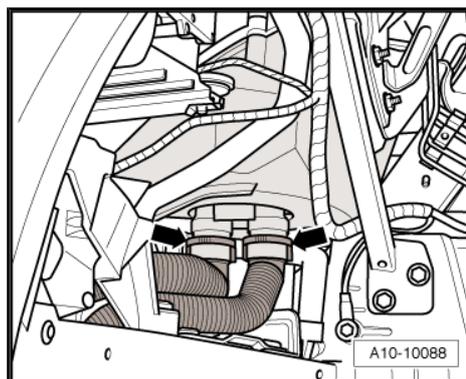
- Activate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .
- Remove front left wheel.



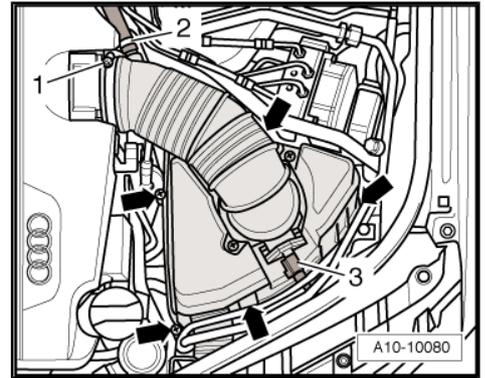
Note

Secure brake disc with wheel bolts.

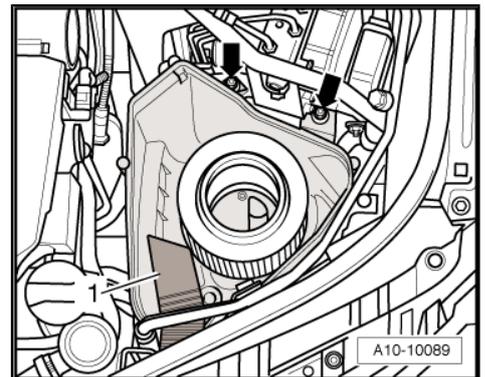
- Remove front section of wheel housing liner (front left) ⇒ General body repairs, exterior; Rep. gr. 66 .
- Press release tabs to detach the two air intake hoses (bottom) -arrows- at bottom section of air cleaner housing (left-side).



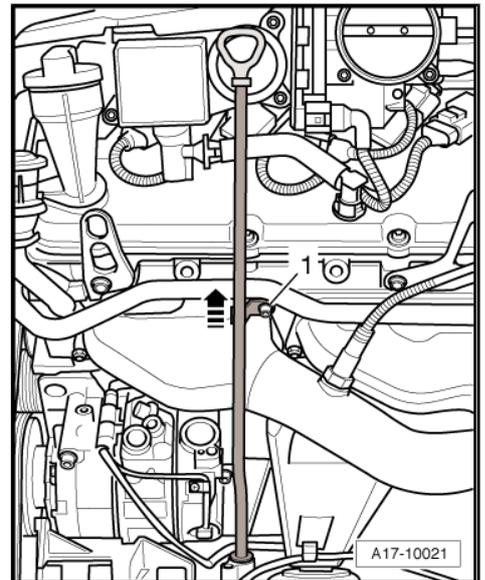
- Detach electrical connector -3- for air mass meter 2 -G246- .
- Detach hose -2- from air intake hose.
- Detach air intake hose -1- from intake manifold.
- Remove bolts -arrows-.
- Detach top section of air cleaner housing (left-side).



- Remove air duct -1-.
- Remove bolts -arrows-.
- Remove bottom section of air cleaner housing (left-side).



- Remove bolt -1-.
- Pull the guide tube for oil dipstick out upwards -arrow-.



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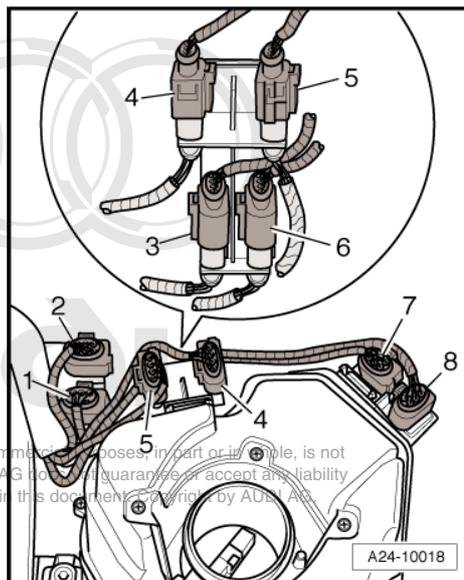
- Unplug electrical connector -2- for Lambda probe 4 -G286- .



Note

Ignore other items.

- Move electrical wiring to Lambda probe clear.



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- Unscrew Lambda probe 4 -G286- -arrow 1- using open socket with extension.

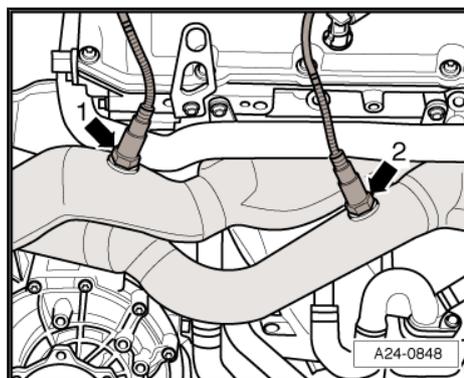
Installing

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



Note

- ◆ Renew O-ring.
- ◆ Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.
- ◆ If reinstalling the old Lambda probes, coat the threads with high-temperature paste ⇒ Parts catalogue . The paste must not get into the slots on the probe body.
- ◆ Fit all cable ties in the original positions when installing.
- ◆ When installing, the Lambda probe wires must always be re-attached at the same locations to prevent them from coming into contact with the exhaust pipe.



- Install front section of wheel housing liner (front left) ⇒ General body repairs, exterior; Rep. gr. 66 .
- Deactivate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .

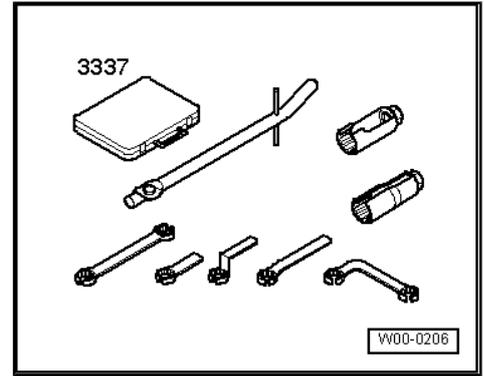
Tightening torques

Component	Nm
Lambda probe in exhaust manifold with catalytic converter	55
Guide tube for dipstick to cylinder head	10

1.23 Removing and installing Lambda probes after catalytic converter -G130-, -G131-, -G287- and -G288-

Special tools and workshop equipment required

◆ Lambda probe open ring spanner set -3337-



Removing

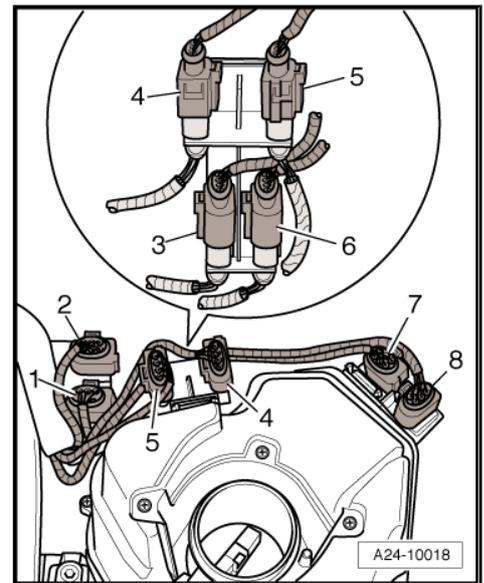
- Remove engine ⇒ 12-cylinder engine, mechanics; Rep. gr. 10 .



Note

Engine/gearbox assembly remains on scissor-type assembly platform -VAS 6131- .

- Unplug the following electrical connectors for Lambda probes:
- 3 - Lambda probe 3 after catalytic converter -G287-
- 4 - Lambda probe after catalytic converter -G130-
- 5 - Lambda probe 2 after catalytic converter -G131-
- 6 - Lambda probe 4 after catalytic converter -G288-

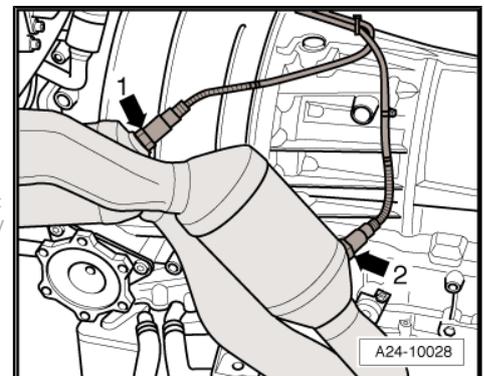


- Now unscrew the Lambda probe after catalytic converter on the left side of the vehicle.

Ar- Lambda probe 3 after catalytic converter -G287-
 row 1 -

Ar- Lambda probe 4 after catalytic converter -G288-
 row 2 -

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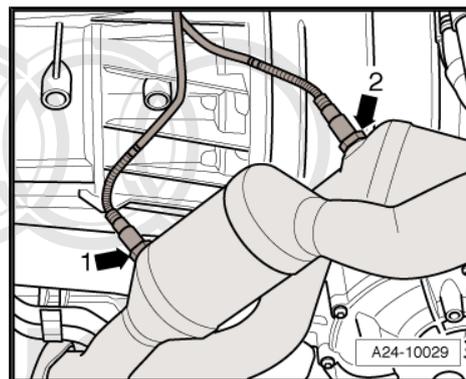




- Now unscrew the Lambda probe after catalytic converter on the right side of the vehicle.

Ar- Lambda probe 2 after catalytic converter -G131-
row
1 -

Ar- Lambda probe after catalytic converter -G130-
row
2 -



Installing

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



Note

- ◆ *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*
- ◆ *If reinstalling the old Lambda probes, coat the threads with high-temperature paste ⇒ Parts catalogue . The paste must not get into the slots on the probe body.*
- ◆ *Fit all cable ties in the original positions when installing.*
- ◆ *When installing, the Lambda probe wires must always be re-attached at the same locations to prevent them from coming into contact with the exhaust pipe.*

- Install engine ⇒ 12-cylinder engine, mechanics; Rep. gr. 10 .

Tightening torque

Component	Nm
Lambda probe in exhaust manifold with catalytic converter	55

2 Engine control unit

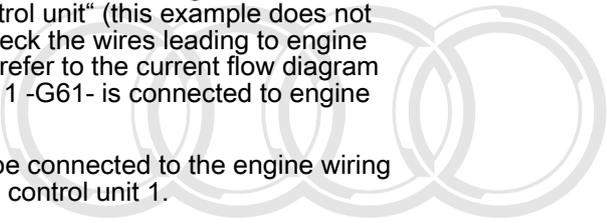
2.1 Wiring and component check with test box -V.A.G 1598/31-

Refer to the current flow diagram.

If it is not specifically mentioned in a particular component check whether you should connect the test box to the wiring harness for engine control unit 1 or engine control unit 2, please refer to the current flow diagram.

Example: You are instructed to check the wiring from knock sensor 1 -G61- „to the engine control unit“ (this example does not specify whether you should check the wires leading to engine control unit 1 or 2). When you refer to the current flow diagram you will see that knock sensor 1 -G61- is connected to engine control unit 1.

The test box therefore has to be connected to the engine wiring harness which leads to engine control unit 1.

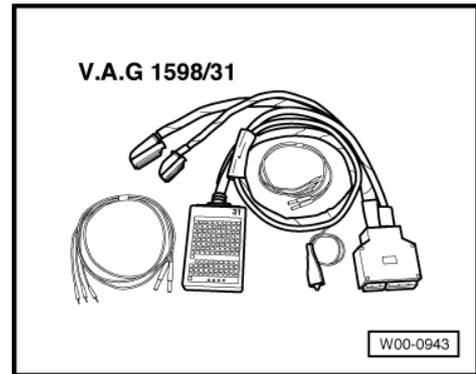


Audi

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**Note**

- ◆ *Test box -V.A.G 1598/31- is designed so that it can be connected 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.*
- ◆ *The checks should be carried out using hand-held multimeter -V.A.G 1526- or multimeter -V.A.G 1715- together with diode test lamp -V.A.G 1527-.*
- ◆ *To connect the testers to test box -V.A.G 1598/31-, always use the adapter leads from adapter set -V.A.G 1594-.*

**WARNING**

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

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

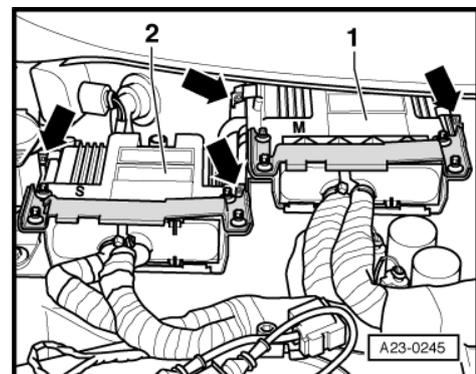
**Note**

- ◆ *The two engine control units are identical from the outside. However, if both control units are removed, they must be marked before removal so they are not interchanged on re-installation.*
- ◆ *Master engine control unit 1: mark „M“ (for example)*
- ◆ *Slave engine control unit 2: mark „S“ (for example)*

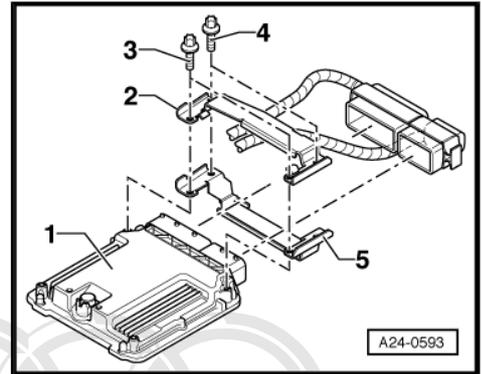
Item -1- shows the master engine control unit 1.

Item -2- shows the slave engine control unit 2.

The removal procedure is the same for both engine control units.



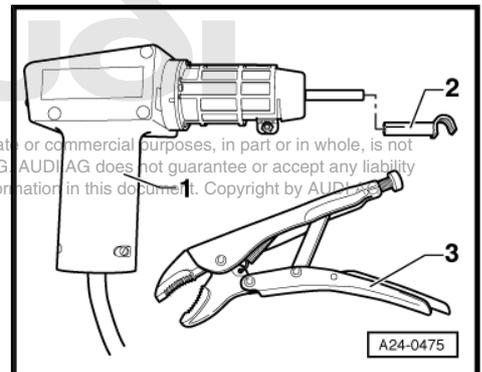
To help prevent unauthorised access to the connectors on the engine control units, the control unit -1- is bolted to a metal casing -5- by means of shear bolts -3- and -4- and a locking plate -2-.



Special tools and workshop equipment required

- ◆ Hot air blower -1- from the wiring harness repair set - VAS 1978-
- ◆ Nozzle attachment -2- (also included in wiring repair set - VAS 1978-)
- ◆ Small, commercially available vice grip pliers (mole grip) -3-

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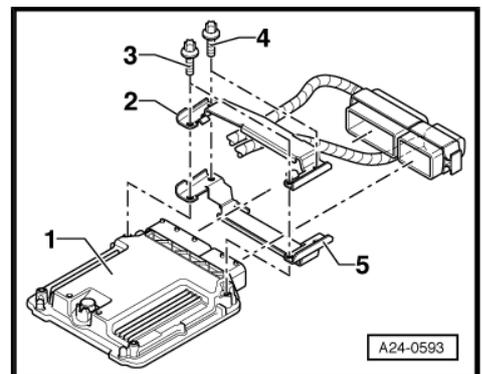


WARNING

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.

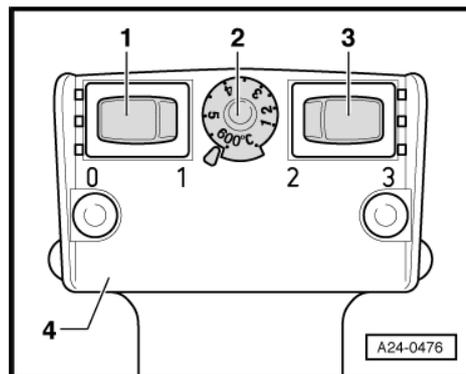
The threads of the two shear bolts which are not screwed into the engine control unit (-Item 4-) are secured with locking fluid. To unscrew these two bolts, the threads must therefore be heated with the hot air blower.

The threads of the two shear bolts which are screwed into the engine control unit (-Item 3-) 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.





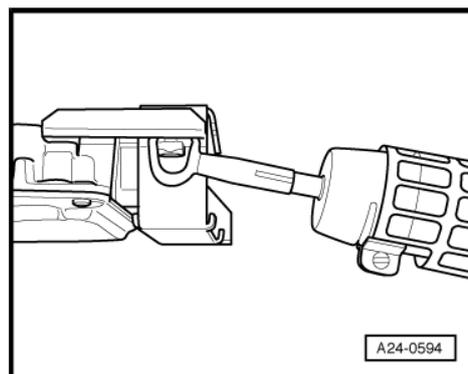
- Select settings on hot air blower as shown in illustration, i.e. set temperature potentiometer -2- to maximum heat output and two-stage air flow switch -3- to position 3.



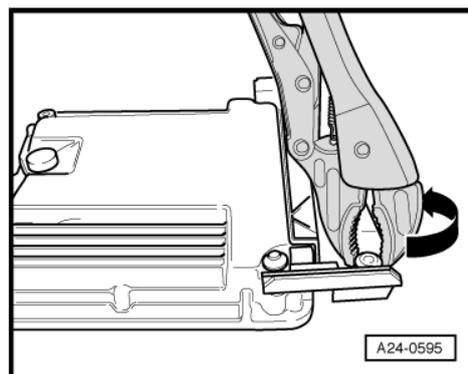
- Apply heat to the threads of the shear bolts on the connector side as shown in the illustration for approx. 25 to 30 seconds.

**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.



- Unscrew shear bolts using mole grips (see arrow in illustration).
- The two shear bolts screwed into the control unit do not need to be heated. They should be removed without being heated.
- Detach metal locking plate from control unit connectors.
- Release connectors on engine control unit and unplug connectors.
- Connect test adapter -V.A.G 1598/42- to wiring harness connector. The earth clip on the test box must be connected to the negative battery terminal. The instructions for performing the individual tests indicate whether or not the engine control unit itself also needs to be connected to the test box.
- Carry out test as described in appropriate repair procedures.

**Installing engine control unit**

Installation is performed in the reverse sequence. After installation, the protective housing must be re-fitted on the control unit. Use new shear bolts.

**Note**

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

The procedure to follow after connecting the new engine control unit is described in Guided Fault Finding.

2.2 Renewing engine control unit -J623- (master control unit)

Two engine control units are responsible for engine management.

The two engine control units communicate via a separate CAN bus.

Engine control unit -J623- (master control unit) informs engine control unit 2 -J624- (slave control unit) which functions it has to perform.

The two engine control units are identical from the outside. However, if both control units are removed, they must be marked before removal so they are not interchanged on re-installation.

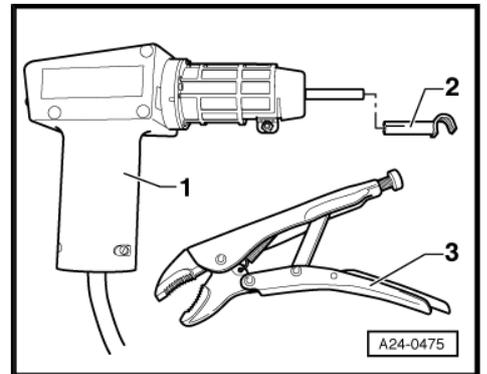
Master engine control unit 1: mark „M“ (for example)

Slave engine control unit 2: mark „S“ (for example)

Special tools and workshop equipment required

- ◆ Hot air blower -1- from the wiring harness repair set - VAS 1978-
- ◆ Nozzle attachment -2- (also included in wiring repair set - VAS 1978-)
- ◆ Small, commercially available vice grip pliers (mole grip) -3-

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Removing

- Connect vehicle diagnostic, testing and information system - VAS 5051- and select vehicle system „01 - Engine electronics“. When doing this, the ignition must be switched on.

The display on vehicle diagnostic, testing and information system -VAS 5051- will show the control unit ID and code -2-.

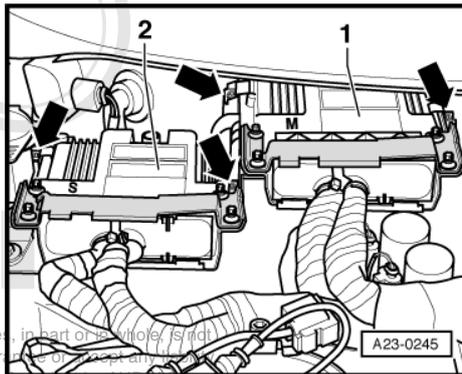
- Always start by displaying the control unit identification and printing it out.
- Remove cover from plenum chamber (right-side).

Item -1- shows engine control unit -J623- .





Item -2- shows engine control unit 2 -J624- .



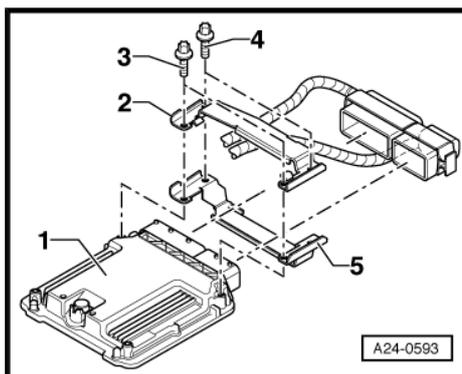
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To help prevent unauthorised access to the connectors on the engine control units, the engine control unit -1- is bolted to a metal casing -5- by means of shear bolts -3- and -4- and a locking plate -2-.



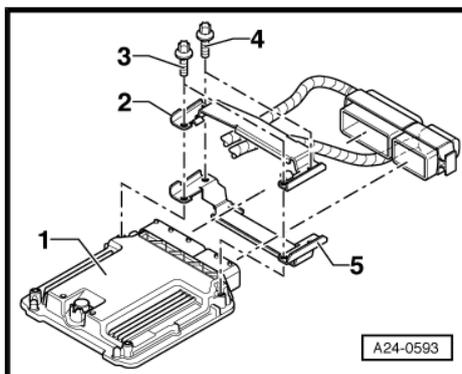
WARNING

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.

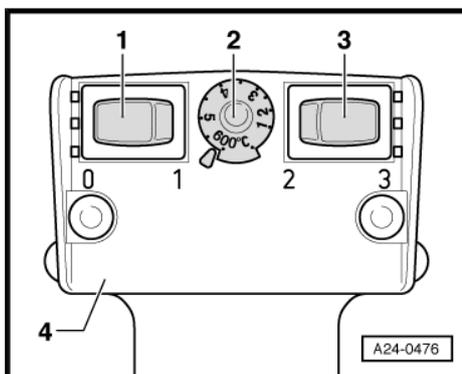


The threads of the two shear bolts which are not screwed into the engine control unit (-Item 4-) are secured with locking fluid. To unscrew these two bolts, the threads must therefore be heated with the hot air blower.

The threads of the two shear bolts which are screwed into the engine control unit (-Item 3-) 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.



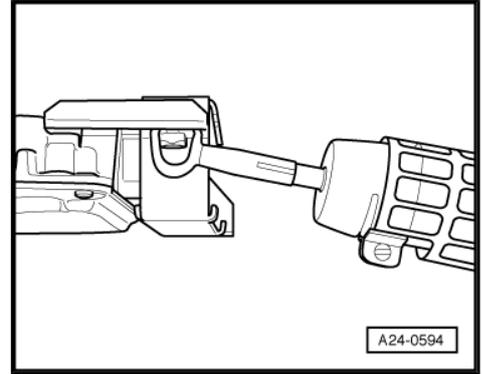
- Select settings on hot air blower as shown in illustration, i.e. set temperature potentiometer -2- to maximum heat output and two-stage air flow switch -3- to position 3.



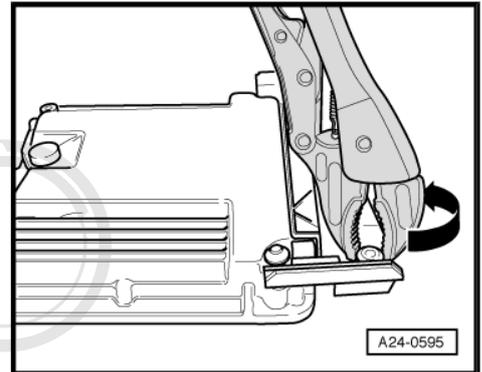
- Apply heat to the threads of the shear bolts on the connector side as shown in the illustration for approx. 25 to 30 seconds.

 **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.



- Unscrew shear bolts using mole grips (see arrow in illustration).
- The two shear bolts screwed into the control unit do not need to be heated. They should be removed without being heated.
- Detach metal locking plate from control unit connectors.
- Remove the two bolts securing engine control unit -J623- (master control unit) and pull control unit forwards.
- Release connectors on engine control unit -J623- and unplug connectors.
- Take out old engine control unit -J623- and install new engine control unit.



Removing

 **Note**

- ◆ *Installation is performed in the reverse sequence. After installation, the locking plate must be re-fitted on the control unit. Use new shear bolts.*
- ◆ *After renewing the engine control unit you must also adapt the injector delivery calibration values for the new engine control unit (injector delivery calibration values influence engine power output and exhaust emissions).*

The procedure to follow after connecting the new engine control unit is described in Guided Fault Finding.

2.3 Renewing engine control unit 2 -J624- (slave control unit)

Two engine control units are responsible for engine management.

The two engine control units communicate via a separate CAN bus.

Engine control unit -J623- (master control unit) informs engine control unit 2 -J624- (slave control unit) which functions it has to perform.

The two engine control units are identical from the outside. However, if both control units are removed, they must be marked before removal so they are not interchanged on re-installation.

Master engine control unit 1: mark „M“ (for example)

Slave engine control unit 2: mark „S“ (for example)



Removing

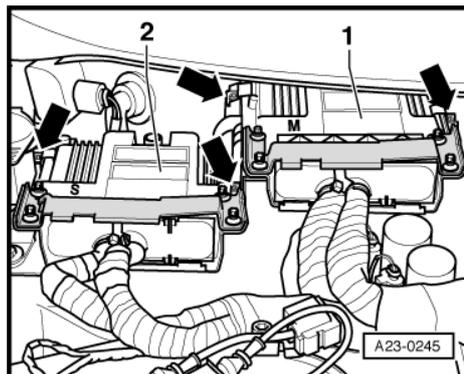
- Connect vehicle diagnostic, testing and information system - VAS 5051- and select vehicle system „11 - Engine electronics 2“. When doing this, the ignition must be switched on.

The display on vehicle diagnostic, testing and information system -VAS 5051- will show the control unit ID and code.

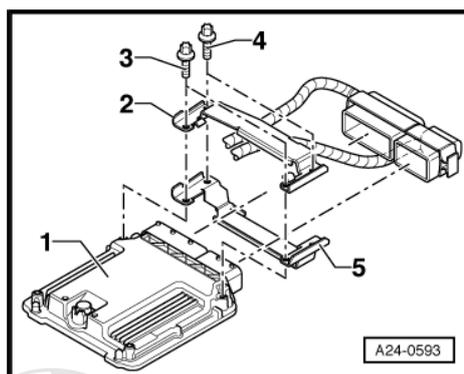
- Always start by displaying the control unit identification and printing it out.
- Remove cover from plenum chamber (right-side).

Item -1- shows engine control unit -J623- .

Item -2- shows engine control unit 2 -J624- .

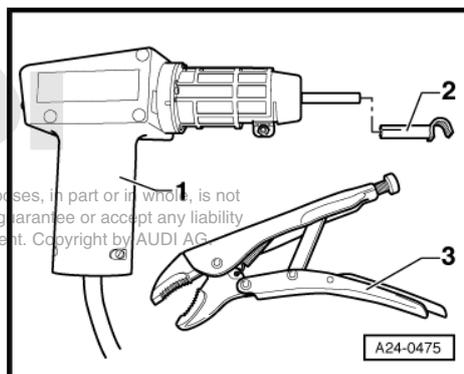


To help prevent unauthorised access to the connectors on the engine control units, the engine control unit -1- is bolted to a metal casing -5- by means of shear bolts -3- and -4- and a locking plate -2-.



Special tools and workshop equipment required

- ◆ Hot air blower -1- from the wiring harness repair set - VAS 1978-
- ◆ Nozzle attachment -2- (also included in wiring repair set - VAS 1978-)
- ◆ Small, commercially available vice grip pliers (mole grip) -3-



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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.

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

The threads of the two shear bolts which are screwed into the engine control unit (-Item 3-) 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.



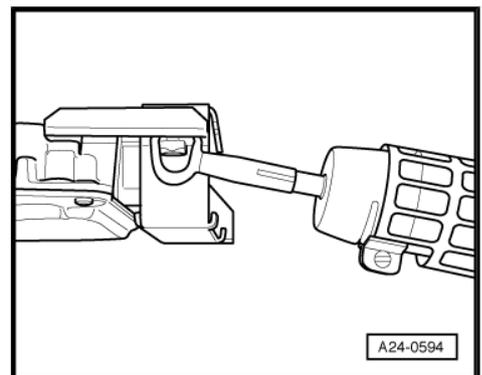
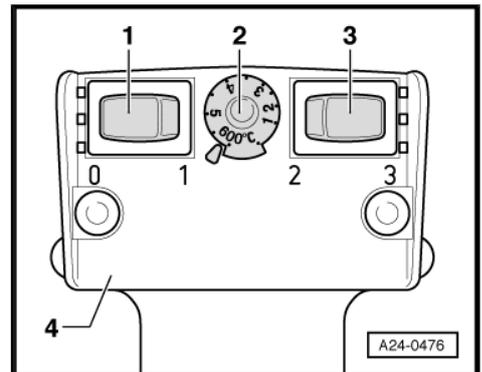
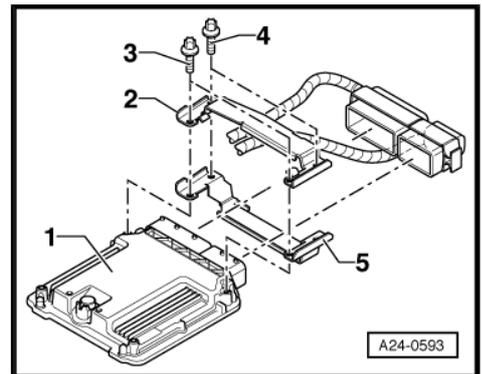
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- Apply heat to the threads of the shear bolts on the connector side as shown in the illustration for approx. 25 to 30 seconds.



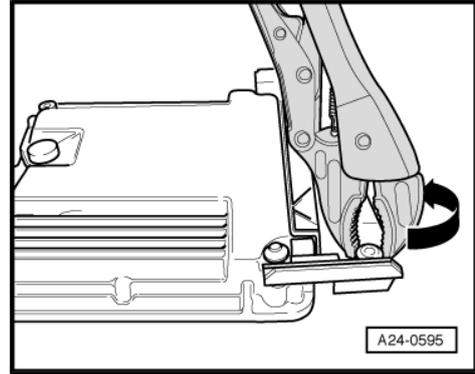
WARNING

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.





- Unscrew shear bolts using mole grips (see arrow in illustration).
- The two shear bolts screwed into the control unit do not need to be heated. They should be removed without being heated.
- Detach metal locking plate from control unit connectors.
- Remove the two bolts securing engine control unit 2 -J624- (slave control unit) and pull control unit forwards.
- Release connectors on engine control unit 2 -J624- and unplug connectors.
- Take out old engine control unit 2 -J624- and install new engine control unit.



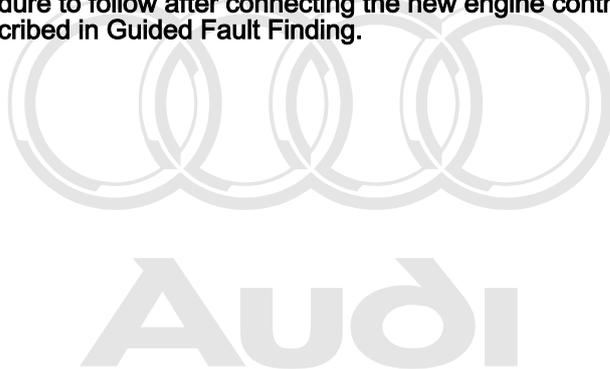
Installing



Note

Installation is performed in the reverse sequence. After installation, the protective housing must be re-fitted on the control unit. Use new shear bolts.

The procedure to follow after connecting the new engine control unit is described in Guided Fault Finding.



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28 – Ignition system

1 Checking ignition system

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 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 off after completing fault finding, repairs or component tests, this may be due to the immobiliser blocking the engine control unit. The fault memory must then be interrogated and, if necessary, the control unit must be adapted.

1.2 Safety precautions

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

- ◆ Do not touch or disconnect ignition wiring when the engine is running or being turned at starter speed.
- ◆ Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.
- ◆ The ignition must be switched off before connecting or disconnecting injection or ignition system wiring or tester cables.
- ◆ To operate the engine at starting speed without actually starting it (for example, in order to test compression), unplug the connectors from the output stages for the ignition coils and remove fuse for injectors. After completing the work, interrogate and erase the fault memory.
- ◆ Always switch off the ignition before cleaning the engine.

1.3 Technical data for ignition system

Engine code letters	BHT (6.0 ltr. / 4-valve, 331 kW)	BSB (6.0 ltr. / 4-valve, 331 kW)
Ignition timing is determined by the control units. Ignition timing cannot be adjusted.		
Ignition system	Multi-coil ignition system with 12 ignition coils (ignition coil and output stage combined in one component) connected directly to spark plugs by way of spark-plug connectors. The side sections of the intake manifold have to be removed to gain access to the ignition coils (spark plugs).	Multi-coil ignition system with 12 ignition coils (ignition coil and output stage combined in one component) connected directly to spark plugs by way of spark-plug connectors. The side sections of the intake manifold have to be removed to gain access to the ignition coils (spark plugs).
Spark plugs Part number and manufacturer details	See Parts catalogue	See Parts catalogue

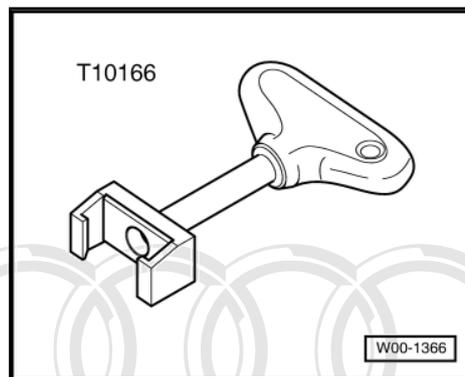


Engine code letters	BHT (6.0 ltr. / 4-valve, 331 kW)	BSB (6.0 ltr. / 4-valve, 331 kW)
Tightening torque	30 Nm	30 Nm
Firing order	1-12-5-8-3-10-6-7-2-11-4-9	1-12-5-8-3-10-6-7-2-11-4-9

1.4 Removing and installing ignition coils with output stages

Special tools and workshop equipment required

- ◆ Puller -T10166-



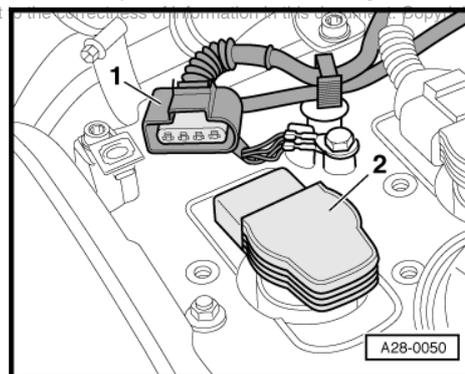
Note

To remove one or more ignition coils, you must always remove the top section of the intake manifold completely first.

Removing

- Remove intake manifold (top section) ⇒ [page 24](#) .
- Unplug electrical connectors -1- at ignition coils -2- which are to be removed.

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- Disconnect the ignition coils from the spark plugs using puller -T10166- .

Installing

- Fit all ignition coils loosely into spark plug holes.
- Press ignition coils onto spark plugs by hand evenly (do NOT use tool).
- Plug in all electrical connectors at ignition coils.
- Install intake manifold (top section) ⇒ [page 24](#) .

