

Workshop Manual Audi A6 2005 ➤

Simos injection and ignition system (6-cyl. 2.4 ltr.)

Engine ID

BDW

Edition 07.2009

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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](#).

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:



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.*

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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.

1.3 Rules for cleanliness when working on the injection system

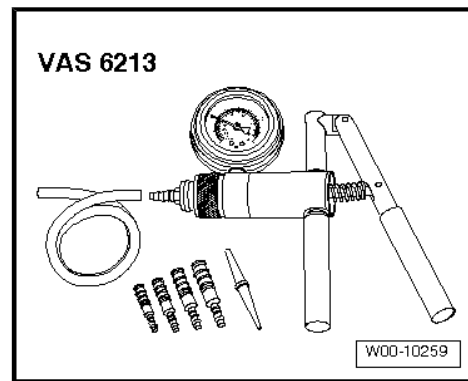
Even small amounts of dirt can cause faults in the injection system. When working on the fuel supply/injection system, pay careful attention to the following basic rules:

- ◆ 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. Do not use fluffy 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 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 other 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.

2 Injection system

2.1 Overview of fitting locations

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

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

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

B - Brake light switch -F-

- ☐ In footwell on pedal bracket near brake pedal

C - Clutch pedal switch -F36-

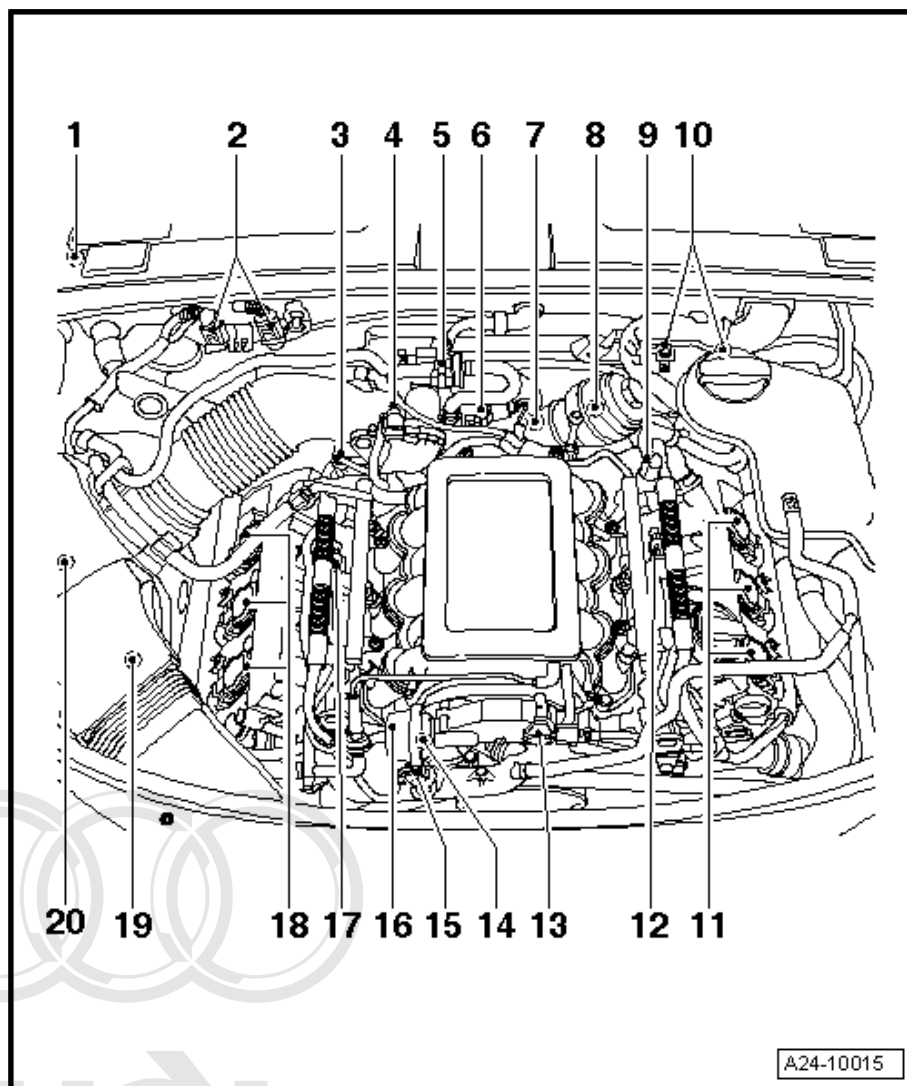
- ☐ In footwell on pedal bracket near clutch pedal

D - Fuel pump relay -J17-

- ☐ In 3-position relay carrier in plenum chamber (left-side), relay position 2
- ☐ ⇒ [Fig. "Fitting locations on 3-position relay carrier in plenum chamber \(left-side\)", page 7](#)

E - Motronic current supply relay -J271-

- ☐ In 3-position relay carrier in plenum chamber (left-side), relay position 3
- ☐ ⇒ [Fig. "Fitting locations on 3-position relay carrier in plenum chamber"](#)



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[\(left-side\) “ , page 7](#)

F - Secondary air pump relay -J299-

- ☐ In 3-position relay carrier in electronics box in plenum chamber (right-side), relay position 3
- ☐ [⇒ Fig. “ Fitting locations on 3-position relay carrier in electronics box in plenum chamber \(right-side\) “ , page 7](#)

G - Diagnostic connector

- ☐ In driver's knee restraint

H - Engine speed sender -G28-

- ☐ In gearbox housing above starter ring gear

1 - Simos control unit -J361-

- ☐ Fitting location: in plenum chamber (right-side)

2 - Connector console on bulkhead (right-side)

- ☐ Connector assignment
- ☐ [⇒ Fig. “ Connector console on bulkhead \(right-side\) “ , page 7](#)

3 - Camshaft control valve 1 -N205-

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4 - Throttle valve module -J338-

- ☐ Including throttle valve drive (electric power control) -G186- , throttle valve drive angle sender -1- (electric power control) -G187- and throttle valve drive angle sender -2- (electric power control) -G188-

5 - Activated charcoal filter solenoid valve 1 -N80-

6 - Intake manifold pressure sender -G71- with intake air temperature sender -G42-

7 - Oil pressure switch -F1-

8 - 3-pin connector

- ☐ For knock sensor 1 -G61-
- ☐ For knock sensor 2 -G66-

9 - Camshaft control valve 2 -N208-

10 - Connector console below coolant expansion tank

- ☐ Connector assignment
- ☐ [⇒ Fig. “ Connector console below coolant expansion tank “ , page 8](#)

11 - Ignition coils with output stages

- ☐ Cylinder bank 2
- ☐ Use puller -T10094- to remove.

12 - Hall sender 2 -G163-

- ☐ Cylinder bank 2

13 - Intake manifold position sender (potentiometer) -G513-

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

15 - Coolant temperature sender -G62-

16 - Vacuum unit for intake manifold change-over

17 - Hall sender -G40-

- ☐ Cylinder bank 1

18 - Ignition coils with output stages

- ☐ Cylinder bank 1
- ☐ Use puller -T10094- to remove.

19 - Secondary air pump motor -V101-

- ☐ At bottom front (as seen in direction of travel)
- ☐ [⇒ Fig. “ Secondary air pump motor -V101- “ , page 8](#)



20 - Secondary air inlet valve -N112-

- ❑ Behind air cleaner housing

MIL exhaust emissions warning lamp

- ◆ Exhaust emissions warning lamp will come on if engine control unit detects faults which are relevant for exhaust emissions.
- ◆ Fitting location of exhaust emissions warning lamp (CHECK): in dash panel insert



Note

The exhaust emissions warning lamp will either flash or light up constantly. Fault memory has to be interrogated in any case.

Emissions warning lamp is flashing:

- ◆ A fault has occurred which, under the current driving conditions, will cause damage to the catalytic converter. In this case the vehicle may only be driven with reduced power (until MIL goes out or lights up constantly). The fault must be rectified as soon as possible.

Emissions warning lamp lights up constantly:

- ◆ A fault has occurred causing deterioration of emission levels. Interrogate fault memory for engine control unit / automatic gearbox.
- ◆ Fault memory must be interrogated and emissions warning lamp must be checked in the event of engine running problems or a customer complaint, even if exhaust emissions warning lamp does not light up. There could be faults stored in the memory which do not activate the emissions warning lamp immediately.

EPC warning lamp

- ◆ "EPC" stands for Electronic Power Control and refers to the electronic throttle control system.
- ◆ Fitting location of EPC warning lamp: in dash panel insert

The engine control unit switches the EPC warning lamp on when the ignition is switched on.

After the engine has been started, the engine control unit checks all components for faults relevant to the electronic throttle control system.

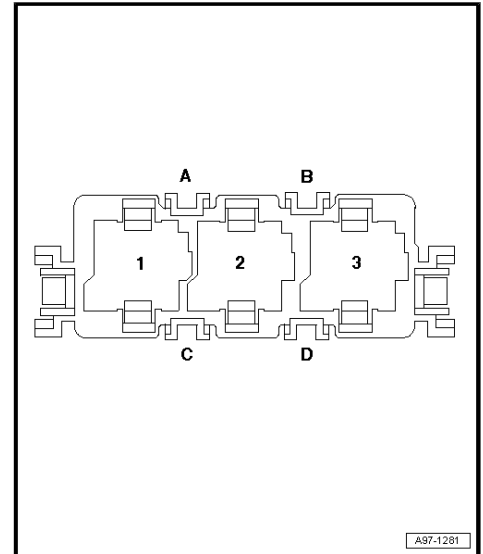
During the test sequence the EPC warning lamp lights up for about 3 seconds. If a fault is detected during this check the warning lamp will remain lit.

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If a fault is detected in the electronic power control system while the engine is running, the engine control unit switches on the EPC lamp. At the same time an entry is stored in the fault memory of the engine control unit.

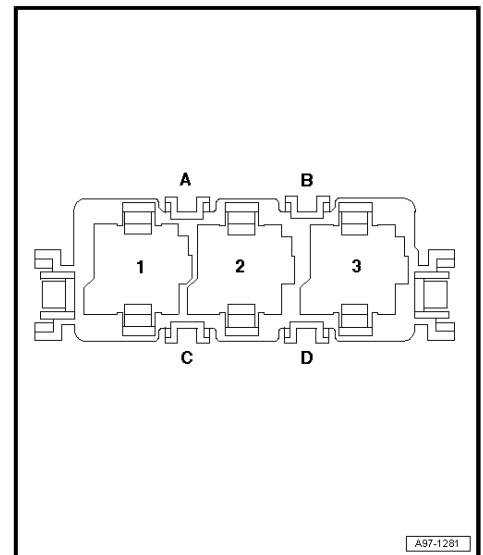
Fitting locations on 3-position relay carrier in plenum chamber (left-side)

- 2 - Fuel pump relay -J17-
- 3 - Motronic current supply relay -J271-



Fitting locations on 3-position relay carrier in electronics box in plenum chamber (right-side)

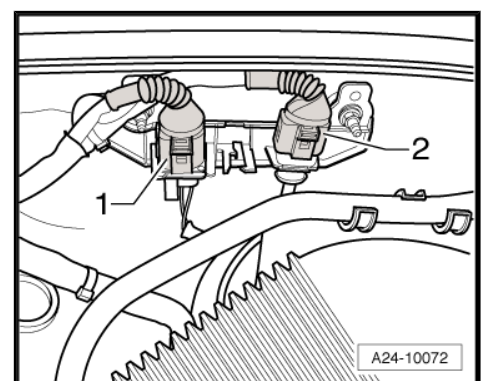
- 3 - Secondary air pump relay -J299-



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Connector console on bulkhead (right-side)

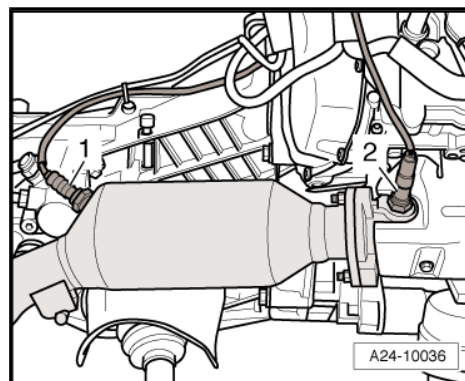
- 1 - 6-pin electrical connector for Lambda probe -G39- and Lambda probe heater -Z19- before catalytic converter (bank 1)
- 2 - 4-pin electrical connector for Lambda probe after catalytic converter -G130- and Lambda probe 1 heater after catalytic converter -Z29- (bank 1)



Lambda probes, cylinder bank 1 (right-side)

1 - Lambda probe after catalytic converter -G130- and Lambda probe heater 1 after catalytic converter -Z29-

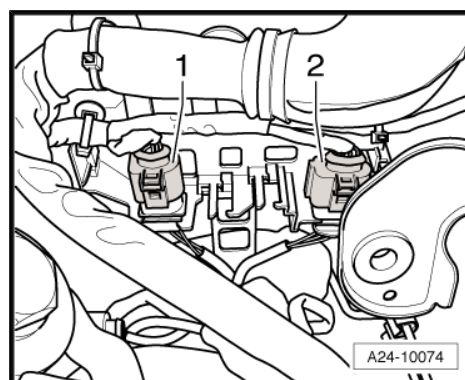
2 - Lambda probe -G39- and Lambda probe heater -Z19-



Connector console below coolant expansion tank

1 - 6-pin electrical connector for Lambda probe 2 -G108- and Lambda probe heater 2 -Z28- before catalytic converter (bank 2)

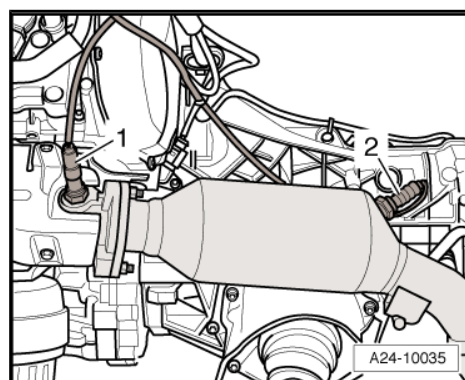
2 - 4-pin electrical connector for Lambda probe 2 after catalytic converter -G131- and Lambda probe 2 heater after catalytic converter -Z30- (bank 2)



Lambda probes, cylinder bank 2 (left-side)

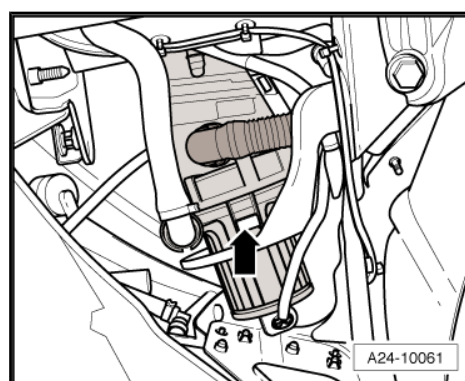
1 - Lambda probe 2 -G108- and Lambda probe heater 2 -Z28-

2 - Lambda probe 2 after catalytic converter -G131- and Lambda probe heater 2 after catalytic converter -Z30-



Secondary air pump motor -V101-

◆ At bottom right (as seen in direction of travel)



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2.2 Air cleaner - exploded view

1 - Connecting hose between air cleaner and secondary air pump motor -V101-

2 - Air cleaner housing (bottom section)

- ☐ Clean any salt deposits or leaves and dirt out of air cleaner housing (bottom section)
- ☐ Check for dirt in water drain (inspect valve)

3 - Rubber grommet

4 - Air duct

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

5 - 1.5 Nm

6 - Air duct

- ☐ Clean dirt and leaves out of air duct

7 - Connection

8 - Air intake hose leading to throttle valve module -J338-

- ☐ With resonator

9 - Cable guide

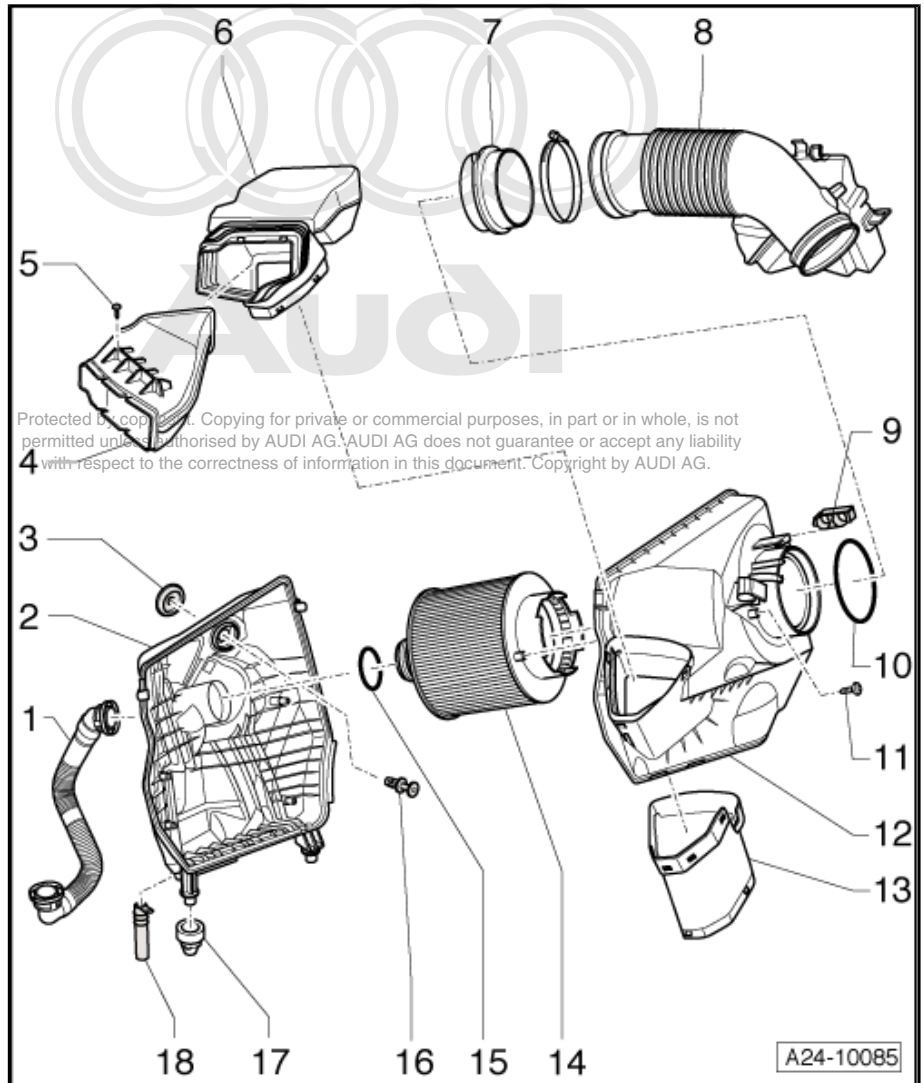
10 - O-ring

- ☐ Renew

11 - 1.5 Nm

- ☐ Secures air filter element

⇒ [Item 14 \(page 9\)](#)



12 - Air cleaner housing (top section)

- ☐ Clean any leaves and dirt out of air cleaner housing (top section)

13 - Air duct

- ☐ Clipped into air cleaner housing (top section)

14 - Air filter element

- ☐ Always use genuine part for air filter element
- ☐ Removing and installing ⇒ [page 10](#)
- ☐ Maintenance intervals ⇒ Maintenance ; Booklet 405
- ☐ Also clean snow screen (if fitted)

15 - O-ring

- ☐ Renew

16 - Spreader clip

17 - Grommet

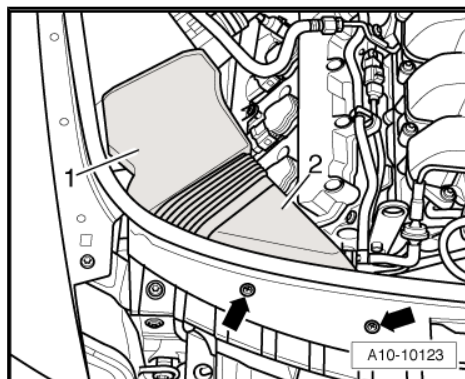
18 - Water drain

- ☐ Check for dirt and clean as required (inspect valve)
- ☐ Water drain must function properly

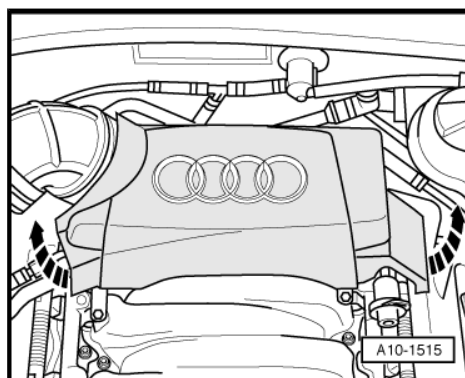
2.3 Removing and installing air cleaner

Removing

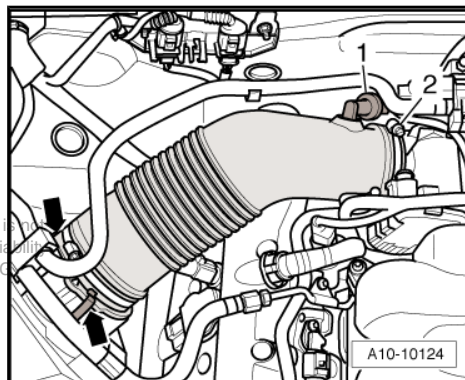
- Remove bolts -arrow-.
- Remove air ducts -1- and -2-.



- Detach engine cover panel (rear) -arrows-.
- Unclip fuel hose and vacuum hose from air cleaner housing (top section).
- Pull non-return valve -1- off air intake hose.

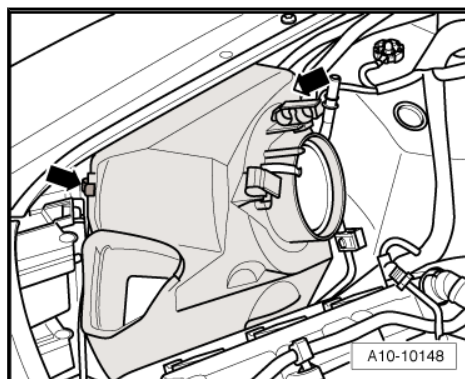


- Remove air intake hose. To do so, release hose clip -2- and clamps -arrows-.



- Loosen clamps -arrows- and detach top section of air cleaner housing.

Renewing air filter element

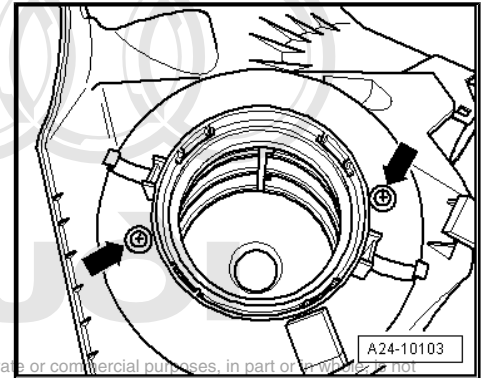


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- Remove 2 securing bolts -arrows- from air filter element.

Removing air cleaner housing (bottom section)

- Detach hose -1- for secondary air.
- Pull pin out of fastener -3-.



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- Remove air cleaner housing (bottom section) and unplug electrical connector -2- on reverse side from variable intake manifold change-over valve -N335-.

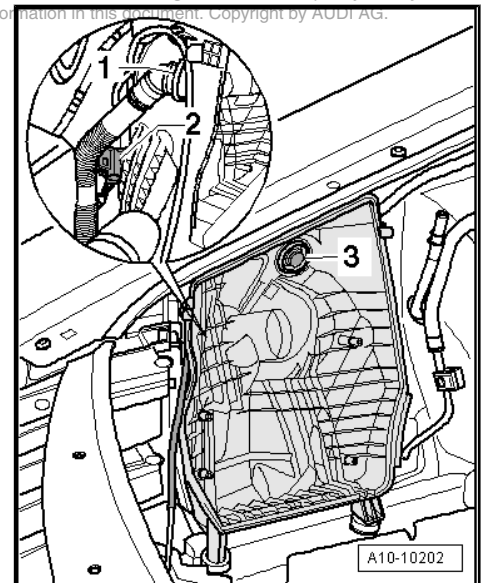
Installing

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



- Check water drain hose 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 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.

2.4 Intake manifold - exploded view

1 - 2.5 Nm

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

3 - 2.5 Nm

4 - Actuator for intake manifold change-over

- ☐ Installation position of toothed segments for intake manifold change-over ⇒ [page 13](#)
- ☐ Replacement part is supplied together with ⇒ [Item 28 \(page 13\)](#)

5 - Seal

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

6 - Ball stud, 2.5 Nm

7 - O-ring

- ☐ Renew
- ☐ When installing lubricate lightly with clean engine oil

8 - Injector

9 - O-ring

- ☐ Renew
- ☐ When installing lubricate lightly with clean engine oil

10 - Retaining clip

- ☐ Ensure it is positioned correctly on injector and fuel rail

11 - Fuel pipe

- ☐ Tighten to 22 Nm

12 - Fuel rail

13 - 5 Nm

14 - 5 Nm

15 - Bracket for wiring harness

16 - Throttle valve module -J338-

17 - Seal

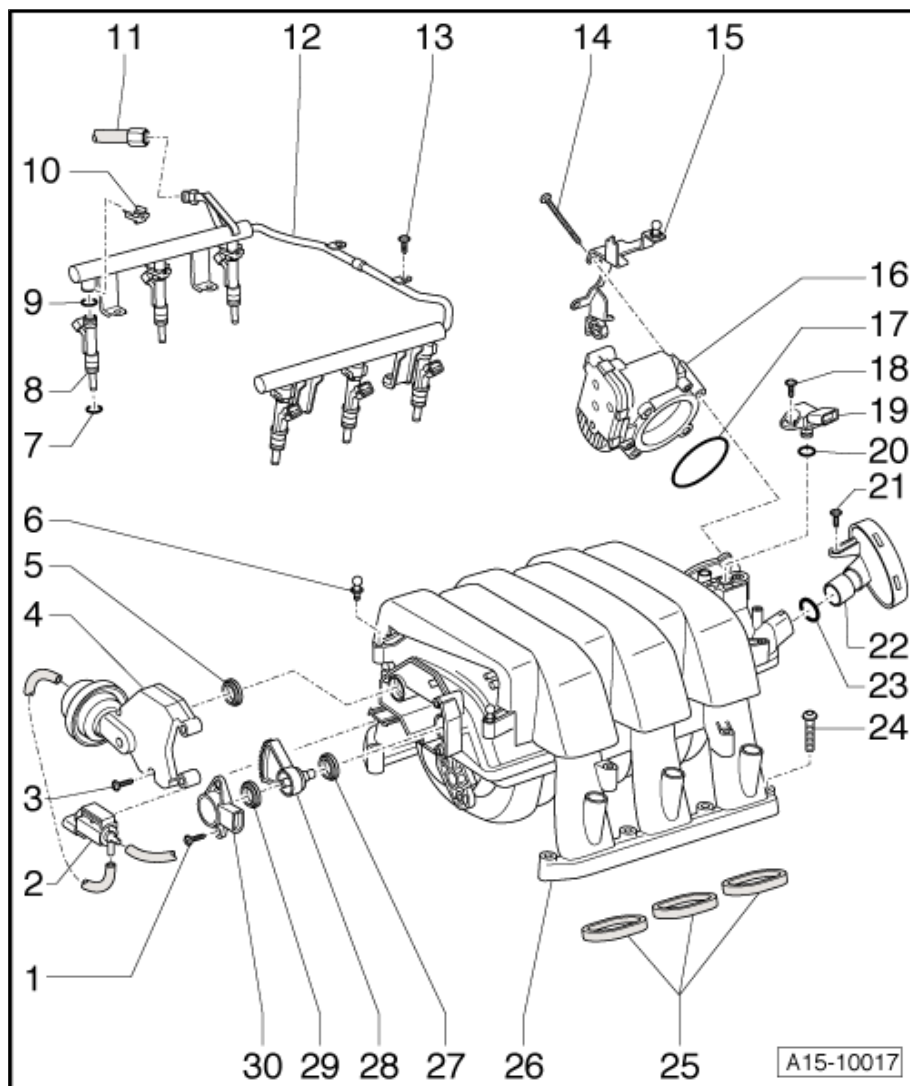
- ☐ Renew

18 - 2.5 Nm

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

20 - O-ring

- ☐ Renew



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21 - 2.5 Nm

22 - Pressure control valve for crankcase breather system

23 - O-ring

- ☐ Renew

24 - 8 Nm

25 - Gaskets

- ☐ Renew

26 - Intake manifold

- ☐ Removing and installing ⇒ [page 13](#)

27 - Seal

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

28 - Lever with toothed segment

- ☐ For intake manifold change-over
- ☐ Installation position of toothed segments ⇒ [page 13](#)
- ☐ Replacement part is supplied together with ⇒ [Item 4 \(page 12\)](#)

29 - Seal

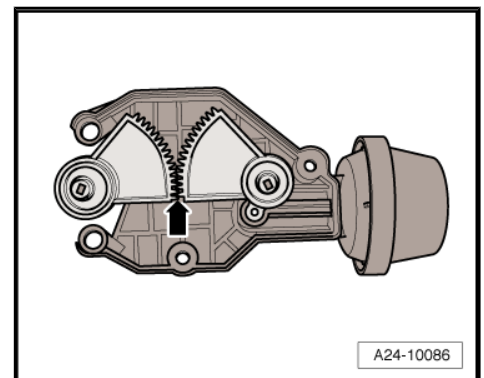
- ☐ Renew if damaged
- ☐ When renewing lever out with screwdriver
- ☐ Press in by hand

30 - Potentiometer for intake manifold -G513-

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Installation position of toothed segments for intake manifold change-over

- The lower edges of the toothed segments must be flush -arrow-.



2.5 Removing and installing intake manifold

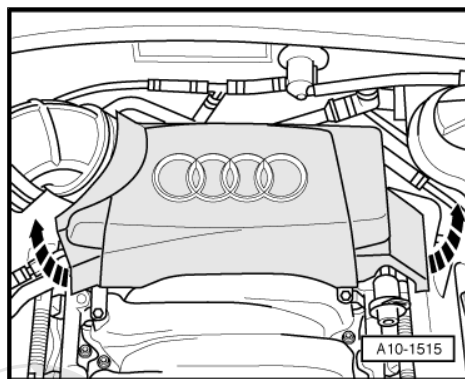
Removing



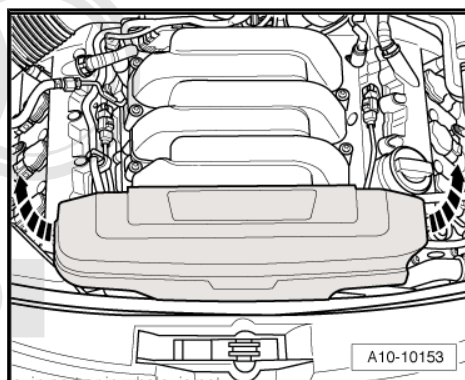
Note

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

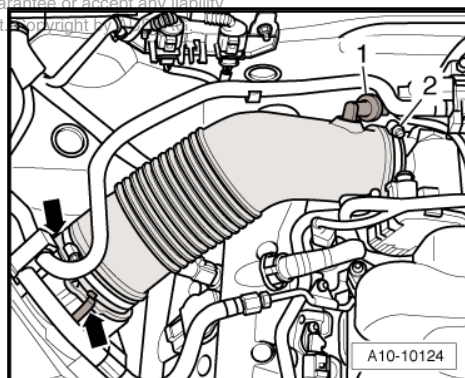
- Pull off engine cover panel (rear) -arrows-.



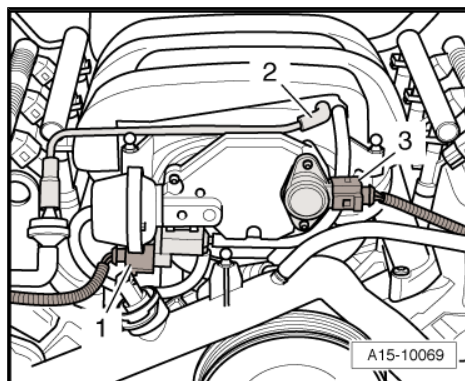
- Pull off engine cover panel (front) -arrows-.
- Pull non-return valve -1- off air intake hose.



- Remove air intake hose. To do so, release hose clip -2- and clamps -arrows-.
- Detach vacuum hose -2-.



- Unplug electrical connectors.
- 1 - Variable intake manifold change-over valve -N156-
- 3 - Potentiometer for intake manifold -G513-
- Detach vacuum hose -arrow- at solenoid valve 1 for activated charcoal filter system -N80- .



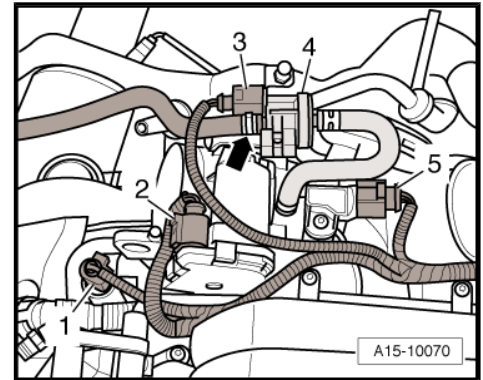
- Unplug the electrical connectors and move wiring harness clear.

1 - Camshaft control valve 1 -N205-

2 - Throttle valve module -J338-

3 - Activated charcoal filter system solenoid valve 1 -N80-

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



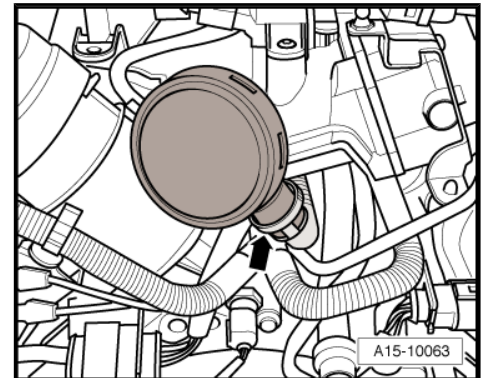
- Pull crankcase breather hose off pressure control valve -arrow-.



Note

Shown from rear with engine removed for illustration purposes.

- Unplug electrical connectors -1- and -3- at all injectors.
- Remove bolts -arrows-.

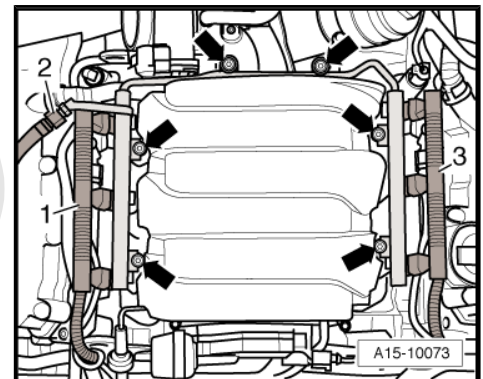


- Pull fuel rail together with injectors off intake manifold (pull off evenly from the top) and place it on a clean cloth in the engine compartment. Fuel line -2- remains attached.



Note

Make sure the removed injectors do not become soiled.



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- Unscrew bolts -arrows- and remove intake manifold.


Note

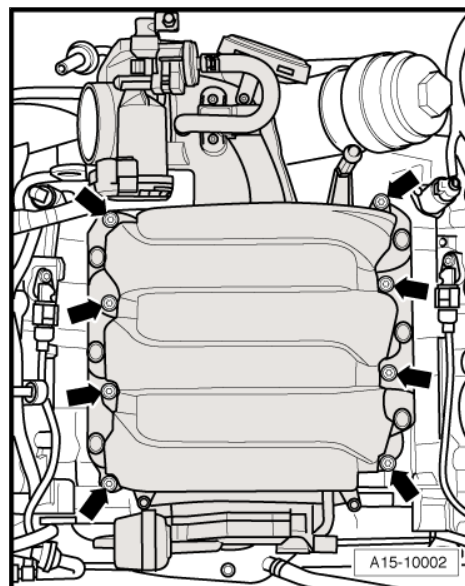
Seal intake ports on cylinder heads with clean cloths.

Installing

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


Note

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


Tightening torque

Component	Nm
Intake manifold to cylinder head	8 ¹⁾
Fuel rail to intake manifold	5

1) Tighten in stages and in diagonal sequence

2.6 Checking fuel pressure regulator and residual pressure

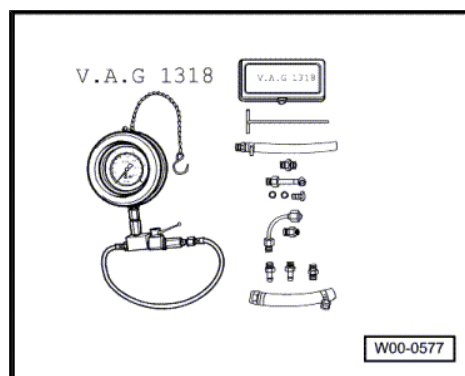

Note

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The fuel pressure regulator is located in the fuel filter below the fuel tank.

Special tools and workshop equipment required

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


Test conditions

- Fuel pump relay OK
- Fuel pump OK
- Fuel filter OK
- Battery voltage at least 11 V
- Vehicles with automatic gearbox: selector lever in position P or N



Note

Fuel pressure is controlled by the fuel pressure regulator according to the intake manifold pressure.



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 the fuel tank filler cap (to release pressure).
- Remove engine cover.
- Cover pressurised union (fuel supply) with a cloth.
- Open the union -arrow- and catch escaping fuel with a cloth.
- Connect K-Jetronic tester -V.A.G 1318- with adapters -V.A.G 1318/6- and 1318/7 between supply pipe and fuel rail.



Note

Cut-off valve on K-Jetronic tester -V.A.G 1318- must be installed on the side leading to fuel tank (fuel supply line).

- Open cut-off valve on pressure tester. Lever must point in direction of flow.
- Start the engine and run at idling speed.
- Measure the fuel pressure.

Specification: approx. 4 bar

- Switch off ignition.

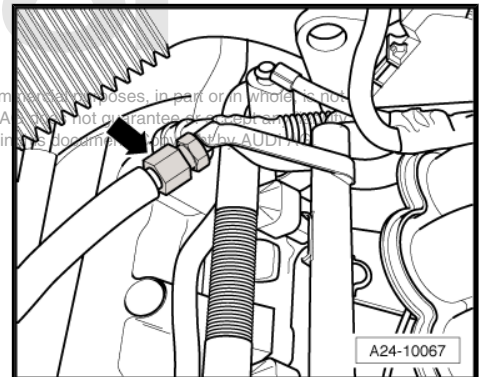
Checking leakage and residual pressure

- Check leak-tightness and residual pressure by watching the drop in pressure on the pressure gauge.

After 10 minutes pressure should still be at least 2.5 bar.

If the residual pressure drops below 2.5 bar:

- Start the engine and run at idling speed.



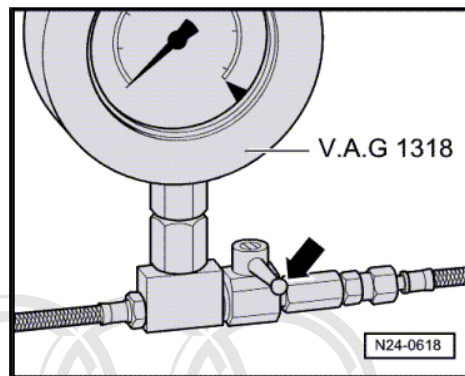
- Allow pressure to build up, then switch off ignition. At the same time close cut-off valve on pressure gauge -V.A.G 1318- (lever at right angle to direction of flow).
- Observe pressure drop on pressure gauge.

If the pressure drops again:

- ◆ Union between pressure gauge and fuel supply pipe leaking
- ◆ Test pressure gauge for leaks.
- ◆ Check pipe connections, O-rings on fuel rail and injectors for leaks.

If the pressure does not drop:

- ◆ Replace fuel filter ⇒ Fuel supply system, petrol engines; Repair group 20
- ◆ Check non-return valve of fuel pump ⇒ Fuel supply system, petrol engine; Repair group 20 .



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

Removing fuel rail

- Remove engine cover.
- Unplug electrical connectors from injectors.

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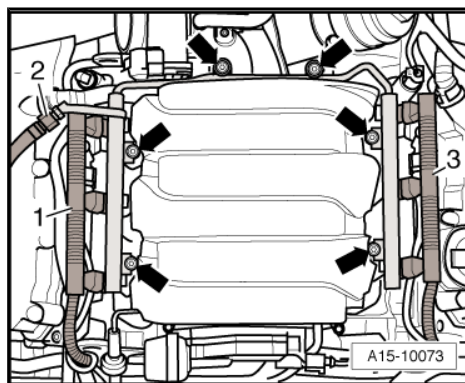
WARNING

The fuel system is pressurised. Before opening the fuel supply line place a cloth around the connection. Then release pressure by carefully unscrewing the connection.

- Briefly open the fuel tank filler cap (to release pressure).
- Cover pressurised union (fuel supply) -1- with a cloth.
- Open the union -1- and catch escaping fuel with a cloth.
- Unbolt fuel rail from intake manifold -arrows- and lift it off intake manifold together with injectors.

Checking injectors for leaks

- Remove fuel rail (with injectors fitted) from intake manifold ⇒ [page 13](#) . The fuel connection must remain connected.



- Place the injector which is to be tested into measuring glass of injection rate tester -V.A.G 1602- .
- Connect test box -V.A.G 1598/42- to wiring harness for engine control unit. Do not connect engine control unit → [page 21](#) .
- Bridge contacts 1 and 65 on the test box using test leads from auxiliary measuring set -V.A.G 1594 C- . (This creates an earth connection to one side of the fuel pump relay coil.)
- Switch on ignition.



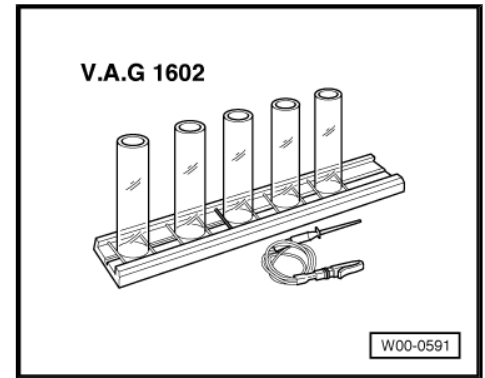
Note

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.

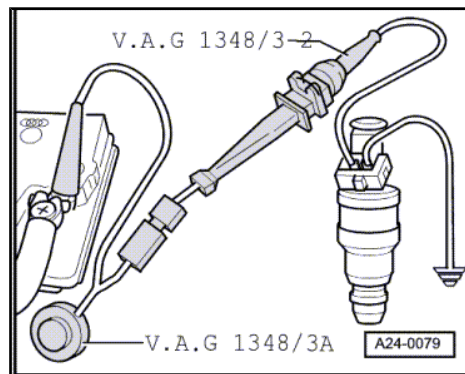
Checking injection quantity

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



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- Connect one of the injector contacts to engine earth using test lead and crocodile clip from auxiliary measuring set -V.A.G 1594 C- .
- Connect second injector contact to positive using remote control -V.A.G 1348/3 A- , adapter lead -V.A.G 1348/3 - 2- and auxiliary lead.
- Use leads from adapter set -V.A.G 1594 C- to bridge contacts 1 and 65 at test box.
- Switch on ignition.
- ◆ The fuel pump should run.
- Activate remote control -V.A.G 1348/3 A- for 30 seconds.
- Perform measurements on all injectors.
- Once all four injectors have been actuated, place measuring glasses on a level surface.



Specification: 95..115 ml for each injector

If none of the injectors delivers the specified quantity:

- Check fuel pressure ⇒ [page 16](#) .

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.
- Bolt fuel rail to intake manifold (tightening torque 5 Nm)

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2.8 Bleeding fuel system

- Start engine and let it run at moderate speed for several minutes and then switch off.



Note

To begin with, the engine may not run smoothly due to air in fuel system.

- Start engine and let it run at moderate speed for several minutes and then switch off.
- Check fuel system for leaks.
- Interrogate fault memory and erase, if necessary.



WARNING

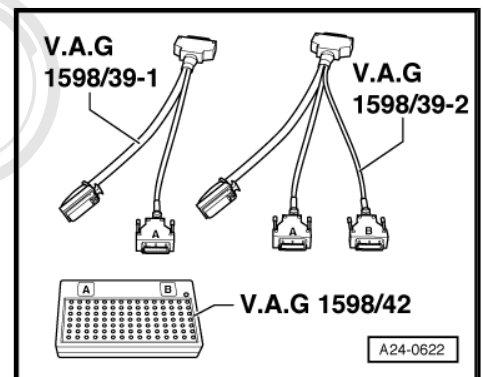
- ◆ *Test equipment must always be secured on the rear seat and operated from that position by a second person.*
- ◆ *If test and measuring instruments are operated from front passenger's seat and the vehicle is involved in an accident, the person sitting in this seat could be seriously injured when the airbag is triggered.*

- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then inspect fuel system for leaks again.
- After road test interrogate the fault memory again.

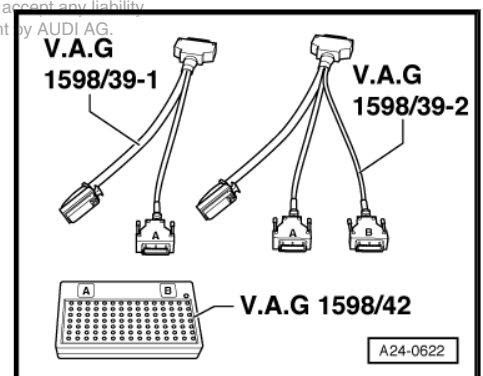
2.9 Checking wiring and components with test box -V.A.G 1598/42- (154-pin)

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-



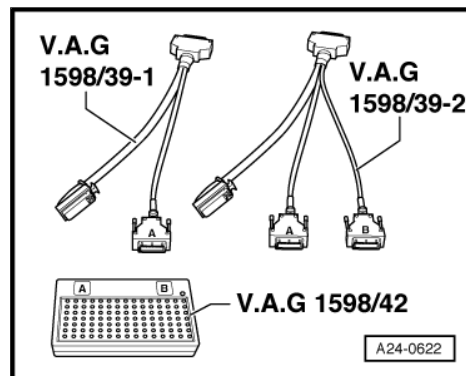
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Note

- ◆ 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.
- ◆ To carry out tests on the 60-pin wiring harness connector, the adapter cable -V.A.G 1598/39-1- is connected to connector "A" on the test box. For components connected to 60-pin wiring harness connector ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- ◆ To carry out tests on the 94-pin wiring harness connector, the adapter cable -V.A.G 1598/39-2- must be connected to connectors "A" and "B" on the test box. For components connected to 94-pin wiring harness connector ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- ◆ The test box -V.A.G 1598/42- is designed so it can be connected both to the wiring harness for the engine control unit and to the engine control unit itself at the same time.
- ◆ The advantage of this is that the electronic engine control system remains fully functional when the test box is connected (for example, for measuring signals when the engine is running).
- ◆ The relevant test procedure will state whether it is necessary to also connect the engine control unit to the test box.



WARNING

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

- Remove engine control unit ⇒ [page 23](#) .
- Connect test box -V.A.G 1598/42- with -V.A.G 1598/39-1- or -V.A.G 1598/39-2- to connector on wiring harness. 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.
- Clean threaded holes for new shear bolts to remove any residue from locking fluid. This can be done using a thread tap.
- Always use new shear bolts.
- Interrogate fault memory and erase if necessary. If fault memory has been erased, generate readiness code in engine control unit using "Guided Functions" mode of vehicle diagnostic, testing and information system -VAS 5051B- .

 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 fault(s) registered in the memories must be rectified until all fault entries can be erased.

2.10 Renewing Simos control unit -J361-

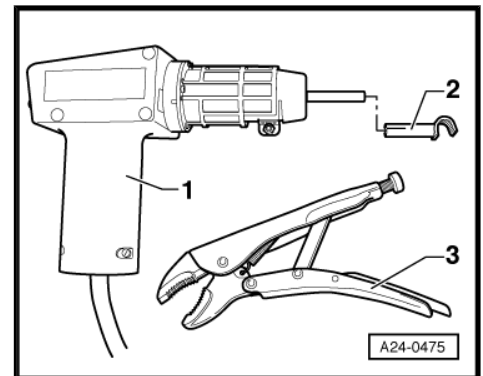
 Note

When the engine control unit is disconnected, the learnt values are erased but the contents of the fault memory remain intact.

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Special tools and workshop equipment required

- ◆ Hot air blower (220 V/ 50 Hz) -VAS 1978/14- -item 1- with nozzle attachment -2- from wiring harness repair set -VAS 1978-
- ◆ Small, commercially available vice grip pliers -3-



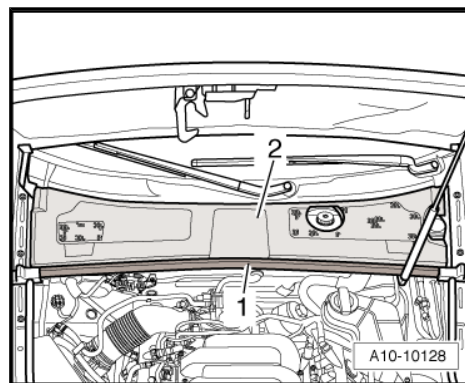
WARNING

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.

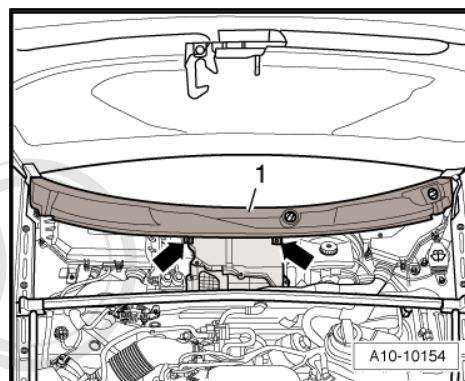
Removing Simos control unit -J361-

- Connect vehicle diagnostic, testing and information system - VAS 5051B- and select vehicle system "01 - Engine electronics" from list. When doing this, the ignition must be switched on.
- Always start by displaying the control unit identification and printing it out.
- Switch off ignition and remove ignition key.
- Pull off rubber seal -1- on plenum chamber cover.

- Detach plenum chamber cover -2-.
- Use screwdriver to pry off cover caps on wiper arms and unscrew hexagon nuts.
- Pull wiper arms off wiper shafts.



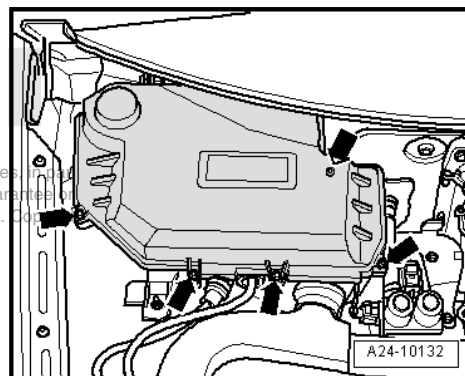
- Unscrew bolts (left and right) -arrows- from cowl panel -1-.



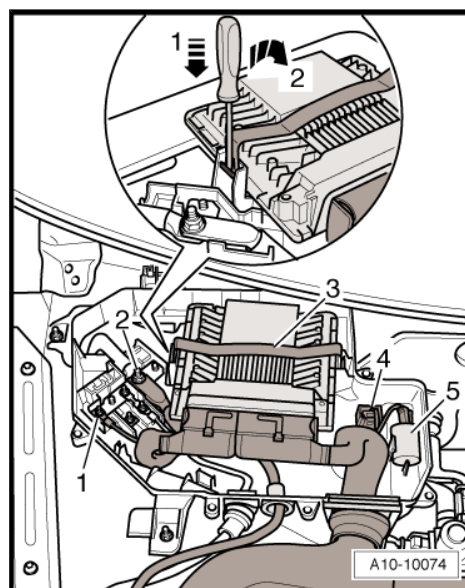
- Unscrew bolts -arrows- and take off cover for electronics box.


WARNING

The pump valve unit for the heating system (left in front of electronics box) gets very hot - risk of burns!

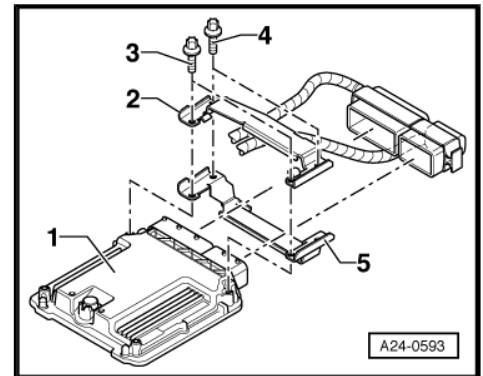


- Carefully lever out the retaining strap -3- using a screwdriver -arrows 1 and 2- and remove the engine control unit from the electronics box.

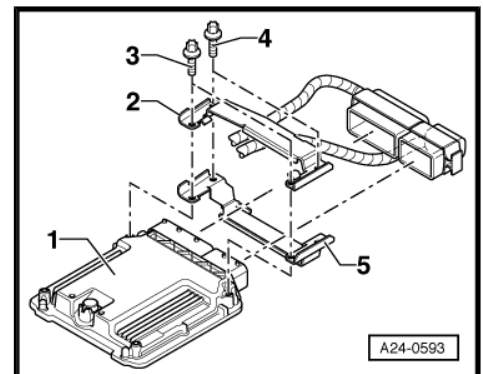


To help prevent unauthorised access to the connectors on the engine control unit, the engine control unit -1- is bolted to a metal casing -5- by means of shear bolts -3 and 4- and a locking plate -2-.

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



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

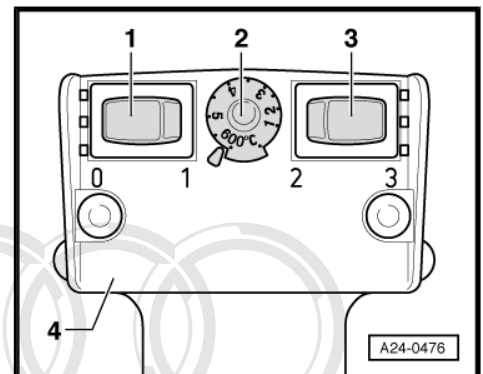


- Select settings on hot air blower as shown in illustration, i.e. set temperature potentiometer -2- to maximum heat output and two-stage air flow switch -3- to position 3.



WARNING

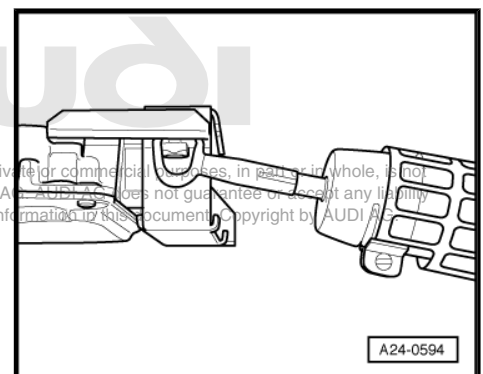
Heating the thread of the locking plate also heats up the shear bolts and parts of the metal housing. Take care to avoid burns. It is also important to ensure that only the thread is heated and none of the surrounding components if at all possible. These should be covered if necessary.



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

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

- Unscrew shear bolts using vice-grip pliers (see arrow in illustration).



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- The two shear bolts screwed into the control unit do not need to be heated. They can be removed without heating.
- Detach protective housing from control unit connectors.
- Release connectors on engine control unit and unplug connectors.
- Remove old Simos control unit -J361- and install new Simos control unit -J361- .

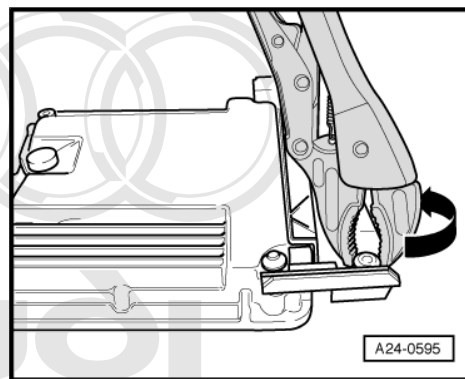
Installing Simos control unit -J361-

Installation is performed in the reverse sequence.

- After installation, the protective housing 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.

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".



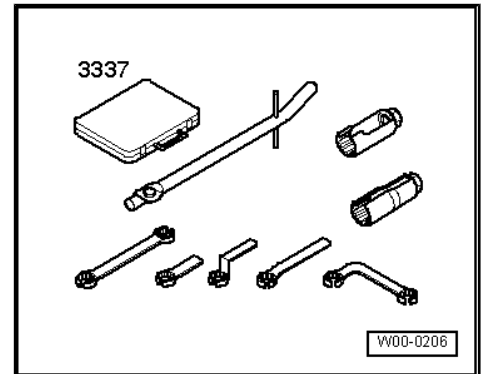
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3 Removing and installing Lambda probes

3.1 Removing and installing Lambda probe -G39- before catalytic converter - bank 1 (right-side)

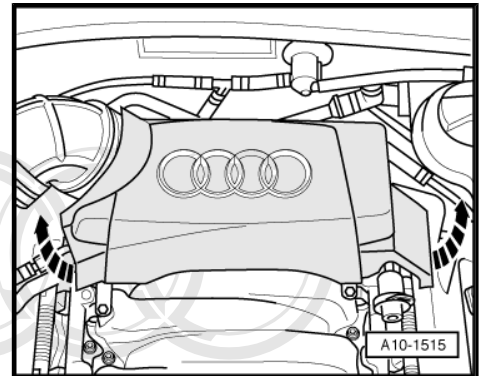
Special tools and workshop equipment required

- ◆ Lambda probe open ring spanner set -3337-

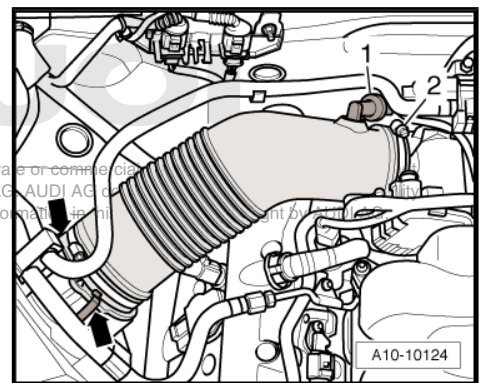


Removing

- Pull off engine cover panel (rear) -arrows-.
- Pull non-return valve -1- off air intake hose.

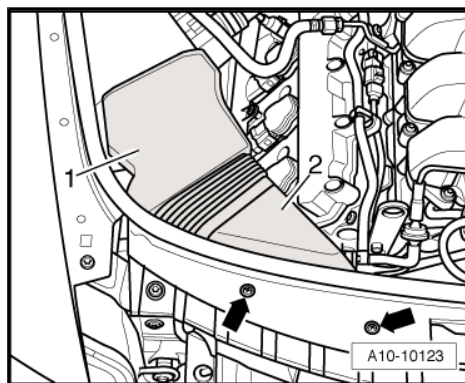


- Remove air intake hose. To do so, release hose clip -2- and clamps -arrows-.
- Remove bolts -arrows-.

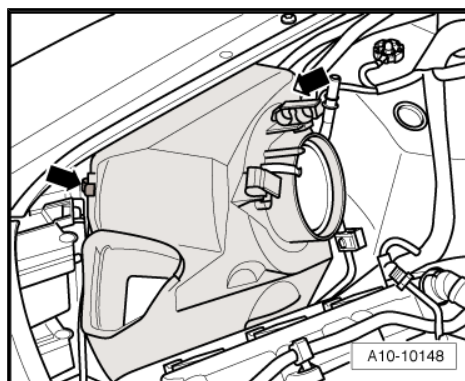


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- Remove air ducts -1- and -2-.



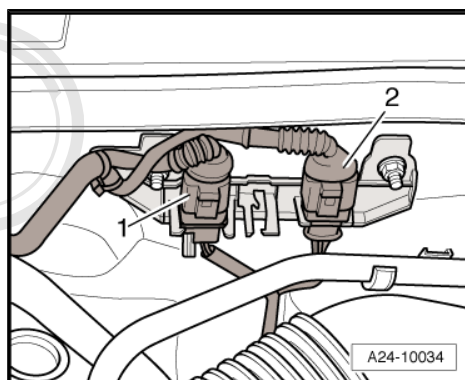
- Loosen clamps -arrows- and detach top section of air cleaner housing.



- Unplug electrical connector -1- for Lambda probe -G39- and move wiring clear.

**Note**

-Item 2- is the connector for Lambda probe after catalytic converter -G130- .



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

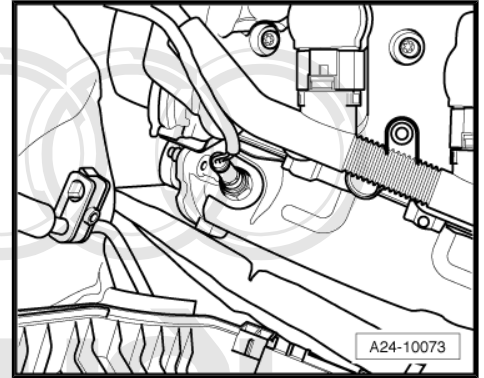
Installing

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

Note

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

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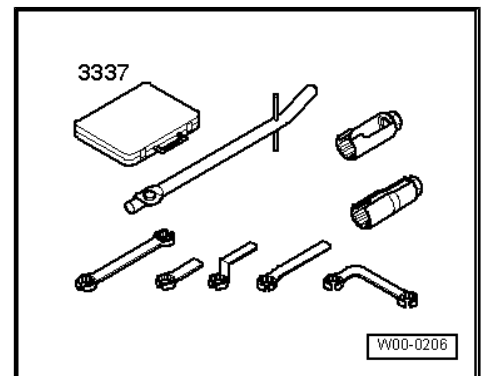
Tightening torque

Component	Nm
Lambda probe	55

3.2 Removing and installing Lambda probe 2 -G108- before catalytic converter - bank 2 (left-side)

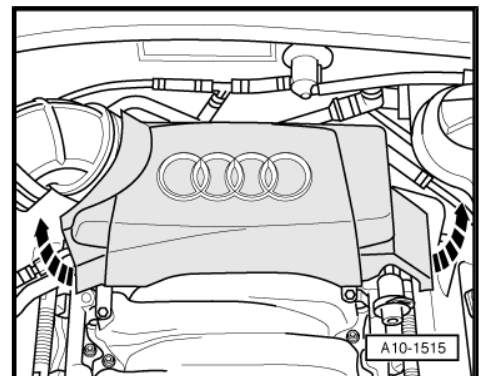
Special tools and workshop equipment required

- ◆ Lambda probe open ring spanner set -3337-

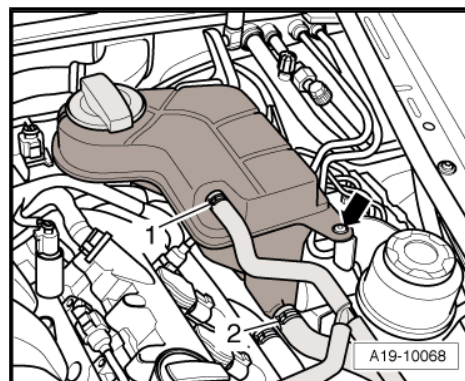


Removing

- Pull off engine cover panel (rear) -arrows-.
- Unbolt coolant expansion tank -arrow-.



- Unplug electrical connector for coolant shortage indicator switch -F66- at bottom of expansion tank and move expansion tank to one side with coolant hoses -1- and -2- attached.

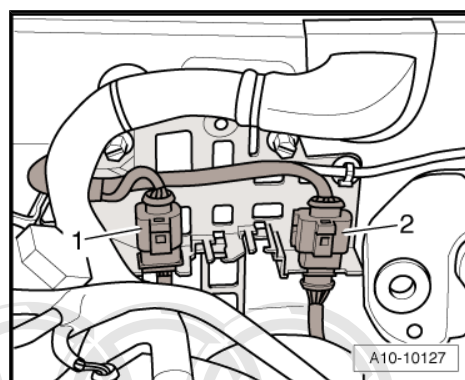


- Unplug electrical connector -1- for Lambda probe 2 -G108- and move wiring clear.



Note

-Item 2- is the connector for Lambda probe 2 after catalytic converter -G131- .



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

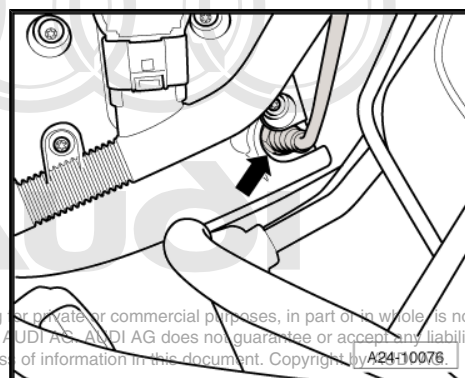
Installing

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



Note

- ◆ *The thread on the Lambda probe is coated with assembly paste. The paste must not get into the slots on the probe body.*
- ◆ *In the case of a used Lambda probe grease **only the thread** with high-temperature paste. The paste must not get into the slots on the probe body. High-temperature paste ⇒ Parts catalogue*
- ◆ *When installing, the Lambda probe wires must always be re-attached at the same locations to prevent them from coming into contact with the exhaust pipe.*



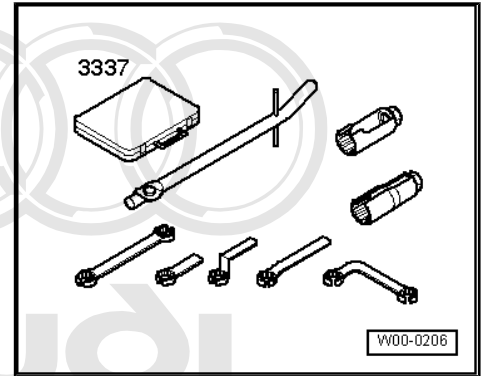
Tightening torque

Component	Nm
Lambda probe	55

3.3 Removing and installing Lambda probe after catalytic converter -G130- - bank 1 (right-side)

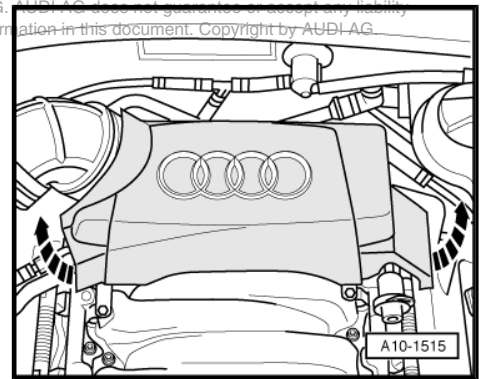
Special tools and workshop equipment required

- ◆ Lambda probe open ring spanner set -3337-

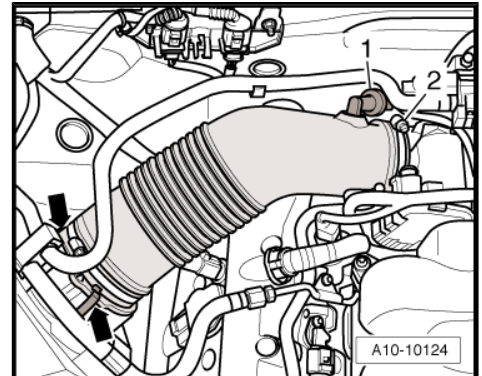


Removing

- Pull off engine cover panel (rear) -arrows-.
- Pull non-return valve -1- off air intake hose.



- Remove air intake hose. To do so, release hose clip -2- and clamps -arrows-.

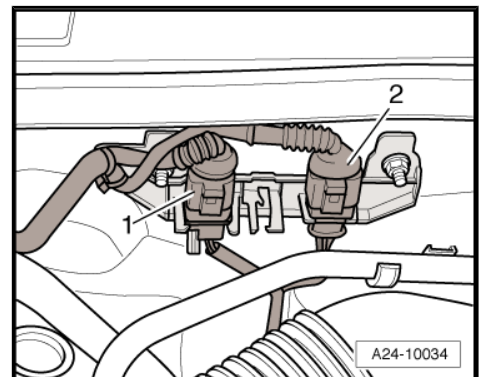


- Unplug electrical connector -2- for Lambda probe after catalytic converter -G130- and move wiring clear.



Note

-Item 1- is the connector for Lambda probe -G39- .



- Unscrew Lambda probe -1- using tool from Lambda probe open ring spanner set -3337- from above (between engine and bulkhead).



Note

Shown in illustration with engine removed.

Installing

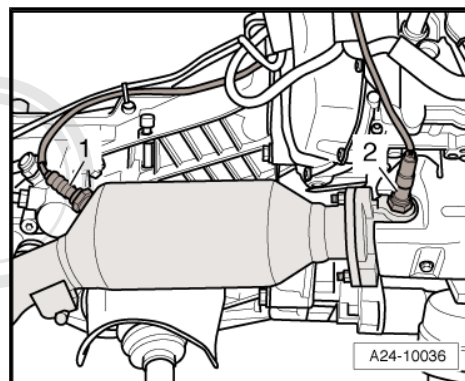
Installation is carried out in the reverse order; note the following:



Note

- ◆ **Renew O-ring.**
- ◆ **The thread on the Lambda probe is coated with assembly paste. The paste must not get into the slots on the probe body.**
- ◆ **In the case of a used Lambda probe grease only the thread with high-temperature paste. The paste must not get into the slots on the probe body. High-temperature paste ⇒ Parts catalogue**
- ◆ **When installing, all cable ties and the clip at the gearbox must always be reattached at the same locations to prevent probe wire from coming into contact with exhaust pipe.**

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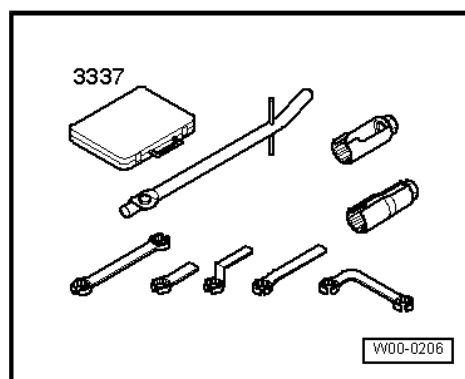
Tightening torques

Component	Nm
Lambda probe	55
Air duct to intake manifold	10

3.4 Removing and installing Lambda probe 2 after catalytic converter -G131- - bank 2 (left-side)

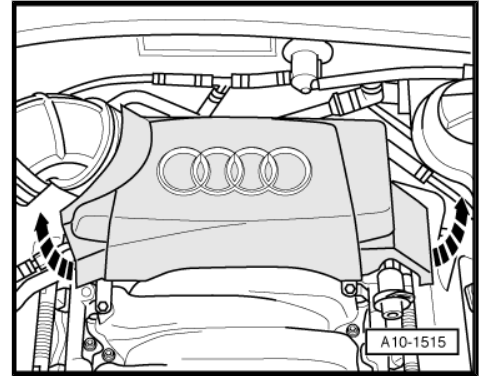
Special tools and workshop equipment required

- ◆ Lambda probe open ring spanner set -3337-

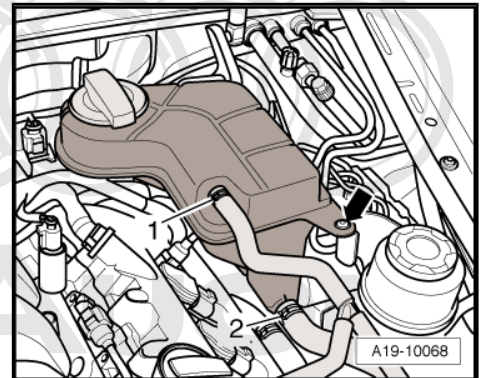


Removing

- Pull off engine cover panel (rear) -arrows-.
- Unbolt coolant expansion tank -arrow-.



- Unplug electrical connector for coolant shortage indicator switch -F66- at bottom of expansion tank and move expansion tank to one side with coolant hoses -1- and -2- attached.



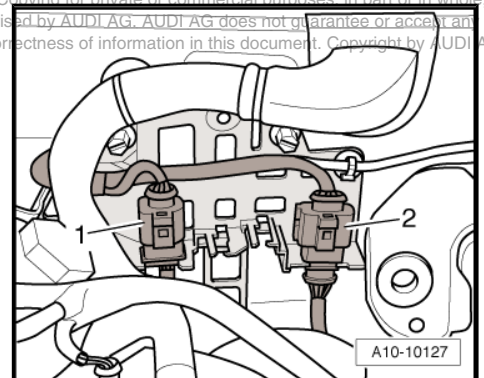
- Unplug electrical connector -2- for Lambda probe 2 after catalytic converter -G131- and move wiring clear.

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Note

-Item 1- is the connector for Lambda probe 2 -G108-.



- Unscrew Lambda probe -2- using tool from Lambda probe open ring spanner set -3337- from above (between engine and bulkhead).


Note

Shown in illustration with engine removed.

Installing

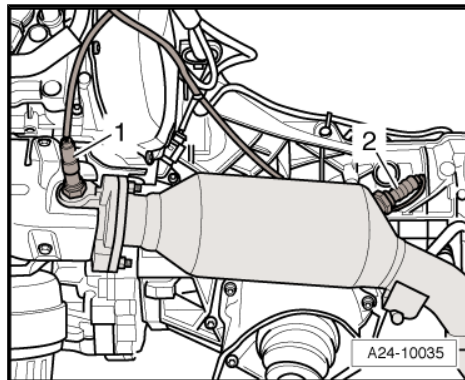
Installation is carried out in the reverse order; note the following:


Note

- ◆ *Renew O-ring.*
- ◆ *The thread on the Lambda probe is coated with assembly paste. The paste must not get into the slots on the probe body.*
- ◆ *In the case of a used Lambda probe grease only the thread with high-temperature paste. The paste must not get into the slots on the probe body. High-temperature paste ⇒ Parts catalogue*
- ◆ *When installing, all cable ties and the clip at the gearbox must always be reattached at the same locations to prevent probe wire from coming into contact with exhaust pipe.*

Tightening torque

Component	Nm
Lambda probe	55



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28 – Ignition system

1 General notes and safety precautions

1.1 General notes on ignition system

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

1.2 Safety precautions

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

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



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



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2 Servicing ignition system

2.1 Technical data

Engine data	2.4 ltr / 125 kW engine
Idling speed	650 ... 750 rpm ²⁾
Ignition timing Not adjustable (determined by control unit)	
Ignition system	Multi-coil system with 6 ignition coils (output stages integrated) connected directly to spark plugs via spark plug connectors
Removing and installing spark plugs ⇒ Maintenance ; Booklet 405	Tightening torque 30 Nm
Firing order	1-5-3-6-2-4

2) Not adjustable

2.2 Ignition system - exploded view

1 - Knock sensor 1 -G61-

- ☐ Contacts gold-plated

2 - Ignition coil with output stage

- ☐ 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 38](#)
- ☐ Use puller -T40039- for removal

3 - Spark plug

- ☐ 30 Nm
- ☐ For removing and installing refer to ⇒ Maintenance ; Booklet 405

4 - Bolt

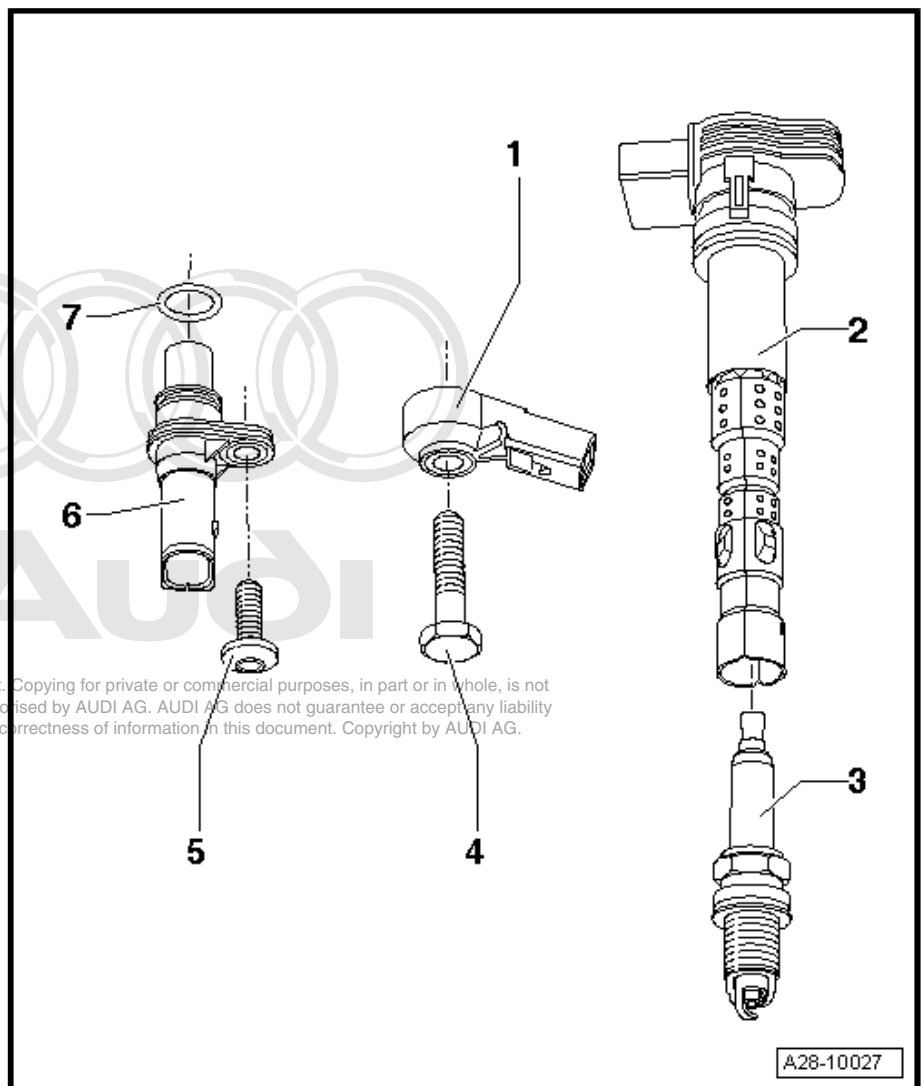
- ☐ 20 Nm
- ☐ Tightening torque influences functions of knock sensor

5 - Bolt

- ☐ 10 Nm

6 - Hall sender -G40-

- ☐ Contacts gold-plated



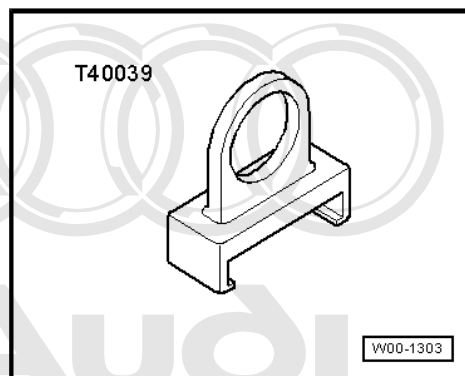
7 - O-ring

- ☐ Renew O-Ring if damaged

2.3 Removing and installing ignition coils

Special tools and workshop equipment required

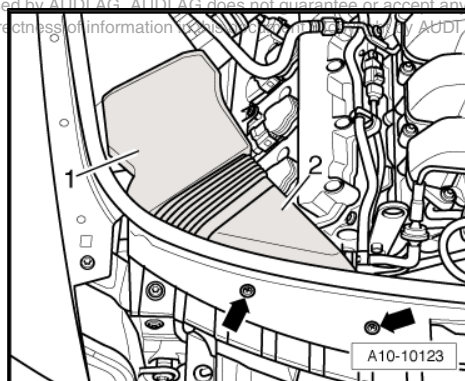
- ◆ Puller -T40039-



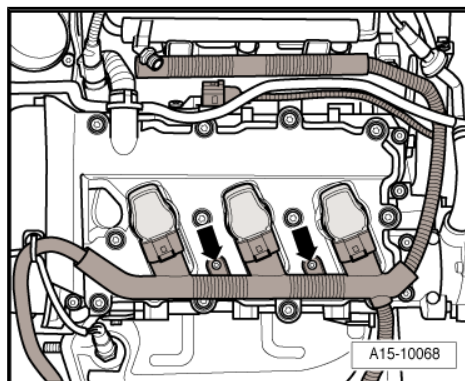
Removing (cylinder 1):

- Unscrew bolts -arrows- and remove air ducts -1- and -2-

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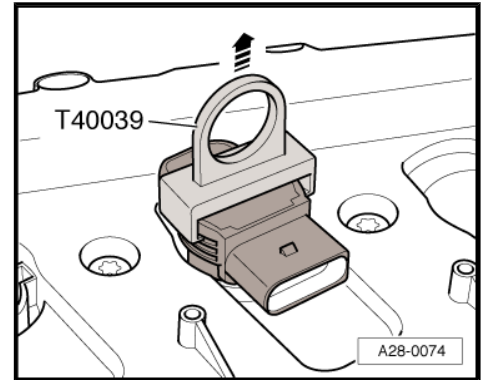


- Unscrew bolts -arrows- and unplug electrical connectors at ignition coils.

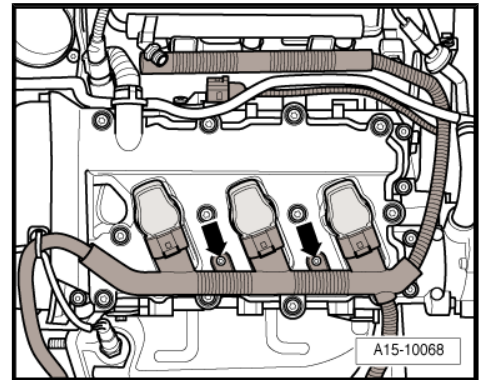


- Pull ignition coil (cylinder 1) out with puller -T40039- .

Removing (cylinder 2):



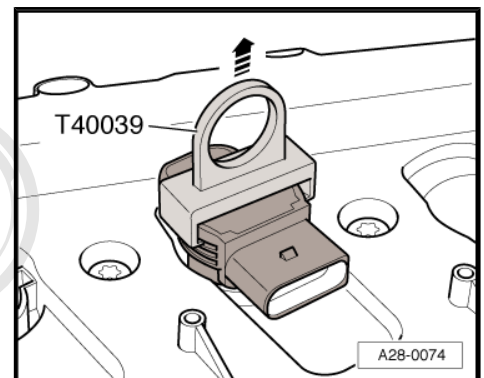
- Unscrew bolts -arrows- and unplug electrical connectors at ignition coils.



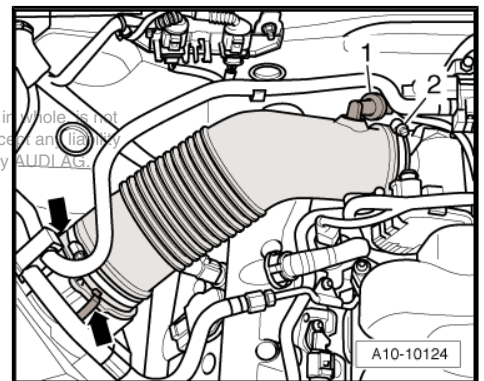
- Pull ignition coil (cylinder 2) out with puller -T40039- .

Removing (cylinder 3):

- Pull non-return valve -1- off air intake hose.

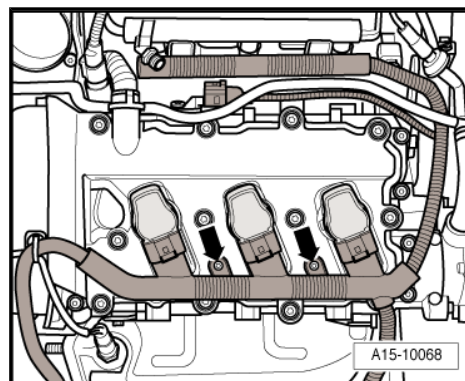


- Remove air intake hose. To do so, release hose clip -2- and clamps -arrows-.



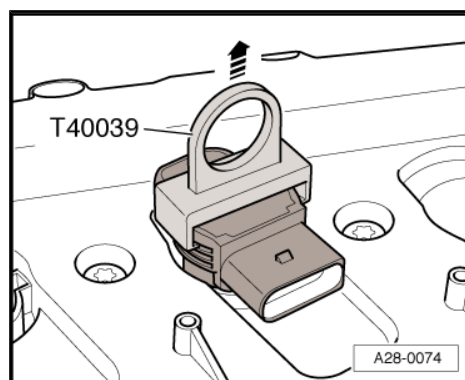
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- Unscrew bolts -arrows- and unplug electrical connectors at ignition coils.

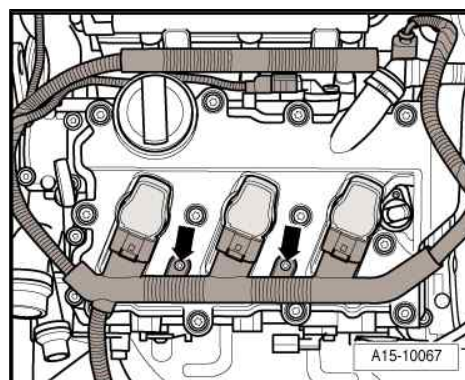


- Pull ignition coil (cylinder 3) out with puller -T40039- .

Removing (cylinders 4 and 5):



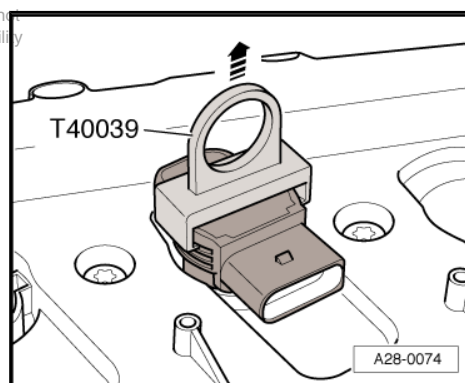
- Unscrew bolts -arrows- and unplug electrical connectors at ignition coils.



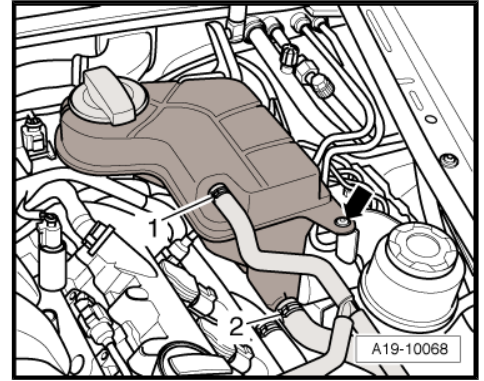
- Pull ignition coils (cylinders 4 and 5) out with puller -T40039- .

Removing (cylinder 6):

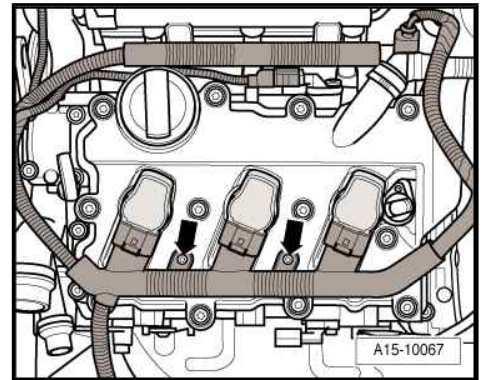
- Unbolt coolant expansion tank -arrow-.



- Unplug electrical connector for coolant shortage indicator switch -F66- at bottom of expansion tank and move expansion tank to one side with coolant hoses -1- and -2- attached.



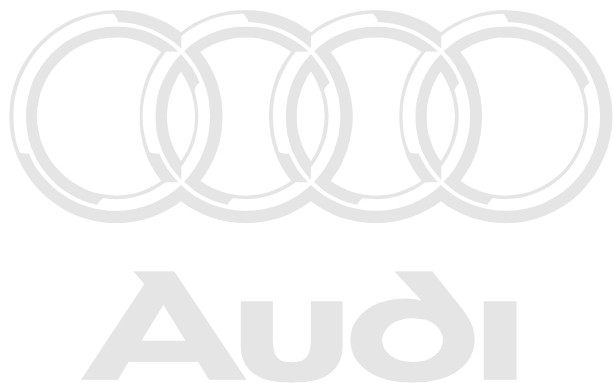
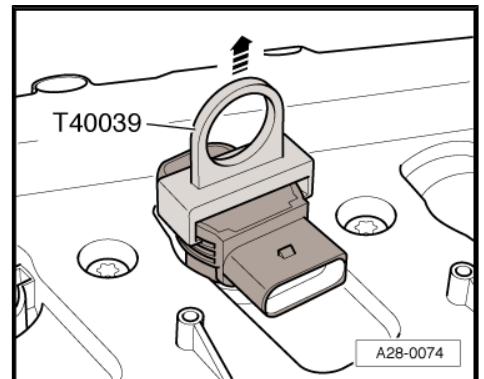
- Unscrew bolts -arrows- and unplug electrical connectors at ignition coils.



- Pull ignition coil (cylinder 6) out with puller -T40039- .

Installing ignition coils

Install in reverse order.



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