

Workshop Manual Audi A6 2005 ➤

Injection and ignition system (6-cyl. 3.0 ltr. injection engine)

Engine ID	AVK	BBJ							
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Edition 04.2004



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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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Audi A6 2005 ►

Injection and ignition system (6-cyl. 3.0 ltr. injection engine) - Edition 04.2004



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24 – Mixture preparation - injection

1 Servicing Motronic injection system

1.1 Safety precautions

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

- ◆ Always switch off the ignition before connecting or disconnecting injection or ignition system wiring or tester cables.
- ◆ If you want to crank engine at starting speed without actually starting it (for example, in order to test compression pressure), first unplug connectors from ignition coils and also from injectors.
- ◆ Certain tests may lead to a fault being detected by the control unit and stored. Therefore, interrogate and, if necessary, erase the fault memory after all repairs and tests.
- ◆ 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 opening the system place a cloth around the connection. Then dissipate pressure by carefully unfastening the connection.

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



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.*

1.2 Rules for cleanliness

When working on the fuel supply/injection system, pay careful attention to the following "6 rules":

- ◆ Thoroughly clean all unions and the adjacent 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 opened components if repairs are not to be performed immediately.
- ◆ Only install clean components; replacement parts should only be unpacked immediately prior to installation. Do not use parts that have been previously unpacked and stored away loose (e.g. in toolboxes, etc.).

- ◆ When the system is open: Do not work with compressed air if this can be avoided. Do not move vehicle unless absolutely necessary.
- ◆ Unplugged electrical connectors; keep them clean and dry. Make sure connections are dry when attaching.

1.3 Overview - fitting locations

Components A to F are not shown in the exploded view of components.

A - Accelerator pedal position sender -G79- and accelerator pedal 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
- ❑ ⇒ [page 5](#)

E - Diagnostic connector

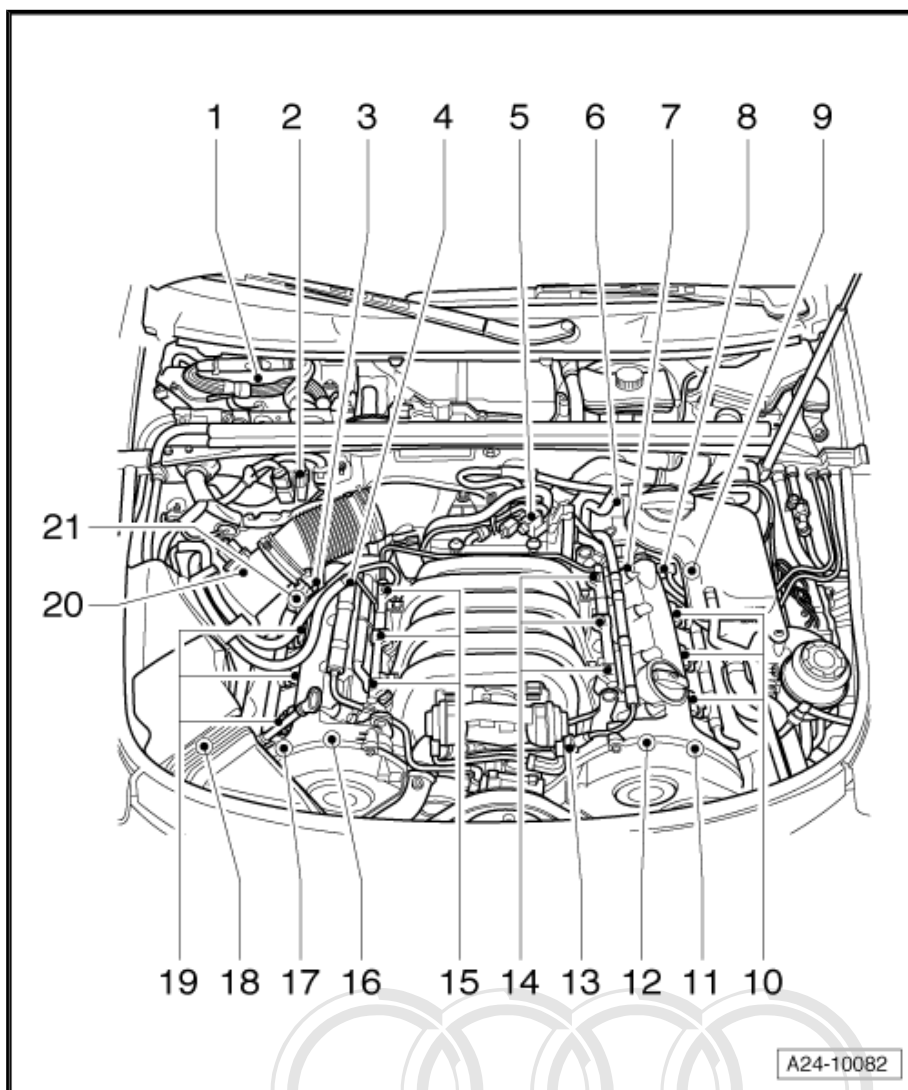
- ❑ In driver's knee restraint

F - Engine speed sender -G28-

- ❑ In gearbox housing above starter ring gear

1 - Motronic control unit -J220-

- ❑ Fitting location: in plenum chamber (right-



A24-10082

side)

2 - Connector console

- ☐ Connector assignment
- ☐ ⇒ [page 5](#)

3 - Hall sender 3 -G300-

- ☐ for exhaust camshaft bank 1

4 - Hall sender -G40-

- ☐ for inlet camshaft bank 1

5 - Retaining plate with secondary air inlet valve -N112-

- ☐ The throttle valve module -J338- is located beneath the retaining plate
- ☐ 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-

6 - Connector console

- ☐ Connector assignment
- ☐ ⇒ [page 6](#)

7 - Hall sender 2 -G163-

- ☐ for inlet camshaft bank 2

8 - Hall sender 4 -G301-

- ☐ for exhaust camshaft bank 2

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

- ☐ Bank 2, probe 1
- ☐ Continuous-action Lambda probe
- ☐ Removing and installing ⇒ [page 26](#)

10 - Ignition coils with output stages, bank 2

- ☐ Cylinder 4 ignition coil 4 with output stage -N292-
- ☐ Cylinder 5 ignition coil 5 with output stage -N323-
- ☐ Cylinder 6 ignition coil 6 with output stage -N324-
- ☐ Removing and installing ⇒ [page 34](#)

11 - Valve 2 for camshaft adjustment, exhaust -N319-

- ☐ Bank 2

12 - Valve 2 for camshaft adjustment -N208-

- ☐ Bank 2

13 - Intake manifold change-over valve -N156-

14 - Injectors, bank 2

- ☐ Cylinder 4 injector, cylinder 4 -N33-
- ☐ Cylinder 5 injector, cylinder 5 -N83-
- ☐ Cylinder 6 injector, cylinder 6 -N84-
- ☐ Checking injection quantity and spray pattern; checking for leaks ⇒ [page 24](#)
- ☐ Removing and installing ⇒ [page 22](#)

15 - Injectors, bank 1

- ☐ Cylinder 1 injector, cylinder 1 -N30-
- ☐ Cylinder 2 injector, cylinder 2 -N31-
- ☐ Cylinder 3 injector, cylinder 3 -N32-
- ☐ Checking injection quantity and spray pattern; checking for leaks ⇒ [page 24](#)
- ☐ Removing and installing ⇒ [page 22](#)

16 - Valve 1 for camshaft adjustment, inlet -N205-

- ☐ Bank 1

17 - Valve 1 for camshaft adjustment, exhaust -N318-

- ☐ Bank 1

18 - Secondary air pump motor -V101-

- ☐ Fitting location ⇒ [page 6](#)

19 - Ignition coils with output stages, bank 1

- ☐ Cylinder 1 ignition coil 1 with output stage -N70-
- ☐ Cylinder 2 ignition coil 2 with output stage -N127-
- ☐ Cylinder 3 ignition coil 3 with output stage -N291-
- ☐ Removing and installing ⇒ [page 34](#)

20 - Air mass meter -G70- with intake air temperature sender -G42-**21 - Lambda probe, before catalytic converter -G39- with Lambda probe heater -Z19-**

- ☐ Bank 1, probe 1
- ☐ Continuous-action Lambda probe
- ☐ Removing and installing ⇒ [page 26](#)

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 detrimental to emissions has occurred. 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.

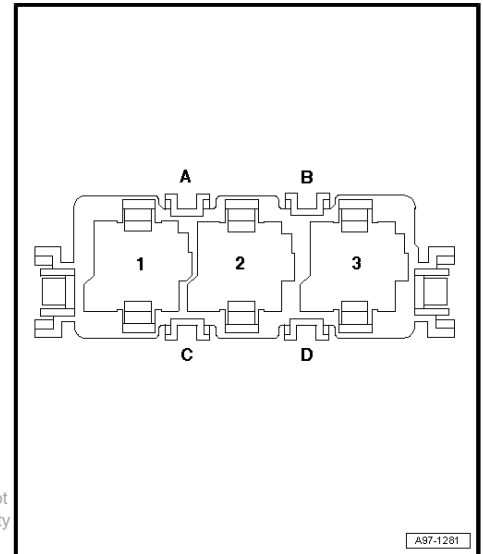
During the test sequence the EPC warning lamp lights up for about 3 seconds. If a fault is detected during this check the warning lamp will remain lit.

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-

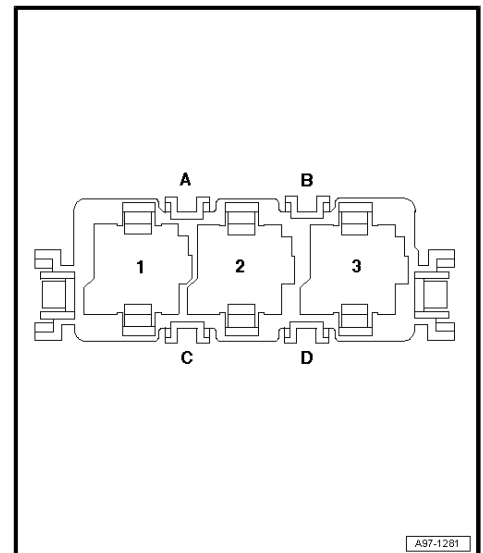
3 - Motronic current supply relay -J271-



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

3 - Secondary air pump relay -J299-

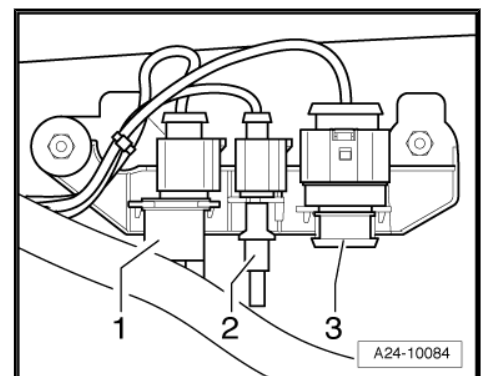


Connector console on bulkhead (right-side)

1 - 6-pin connector for Lambda probe -G39- and Lambda probe heater -Z19- before catalytic converter, bank 1.

2 - Electrical connector for knock sensor 1 -G61-

3 - 4-pin connector for Lambda probe after catalytic converter -G130- and Lambda probe 1 heater, after catalytic converter -Z29-, bank 1.



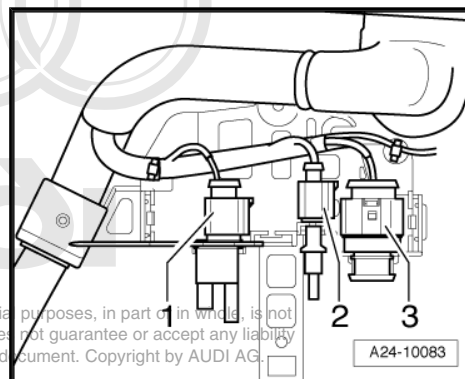
Connector console below coolant expansion tank

1 - 6-pin connector for Lambda probe 2 -G108- and Lambda probe heater -Z28- before catalytic converter, bank 2.

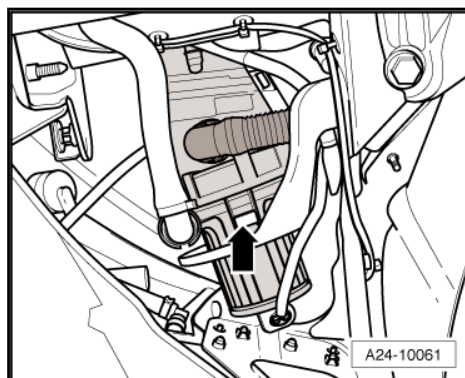
2 - Electrical connector for knock sensor 2 -G66-

3 - 4-pin connector for Lambda probe 2 after catalytic converter - G131- and Lambda probe 2 heater, after catalytic converter - Z30- , bank 2.

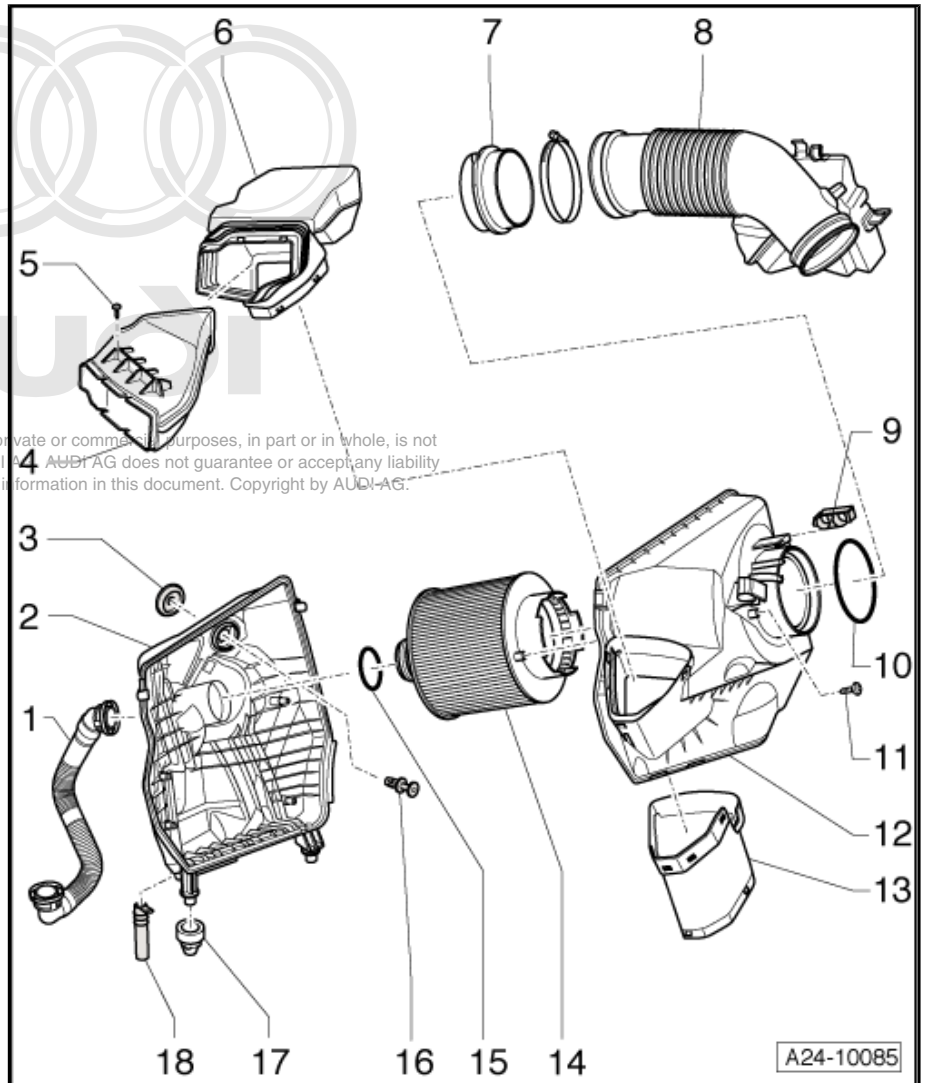
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**Secondary air pump motor -V101-**

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

**1.4 Dismantling and assembling air cleaner**

- 1 - Leading to secondary air pump motor -V101-
- 2 - Air cleaner housing (lower section)
- 3 - Rubber grommet
- 4 - Air duct
- 5 - 1.5 Nm
- 6 - Air duct
 - ☐ To lock carrier
- 7 - Connection
- 8 - Air intake hose leading to throttle valve module -J338-
 - ☐ With resonator
- 9 - Cable bracket
- 10 - O-ring
 - ☐ Renew
- 11 - 1.5 Nm
 - ☐ To secure air filter element
⇒ Item 14 (page 7)
- 12 - Air cleaner housing (upper section)
- 13 - Air duct
 - ☐ Clipped into air cleaner housing (top section)
- 14 - Air filter element
 - ☐ Maintenance intervals
⇒ Maintenance ; Book-let 4F
- 15 - O-ring
 - ☐ Renew
- 16 - Spreader clip
- 17 - Grommet
- 18 - Breather hose



1.5 Intake manifold change-over - exploded view of components

1 - Intake manifold change-over valve -N156-

2 - Y piece

3 - 7 Nm

4 - Vacuum unit with change-over barrel

5 - O-ring

☐ Renew if damaged

6 - Securing plate

7 - Rubber grommet

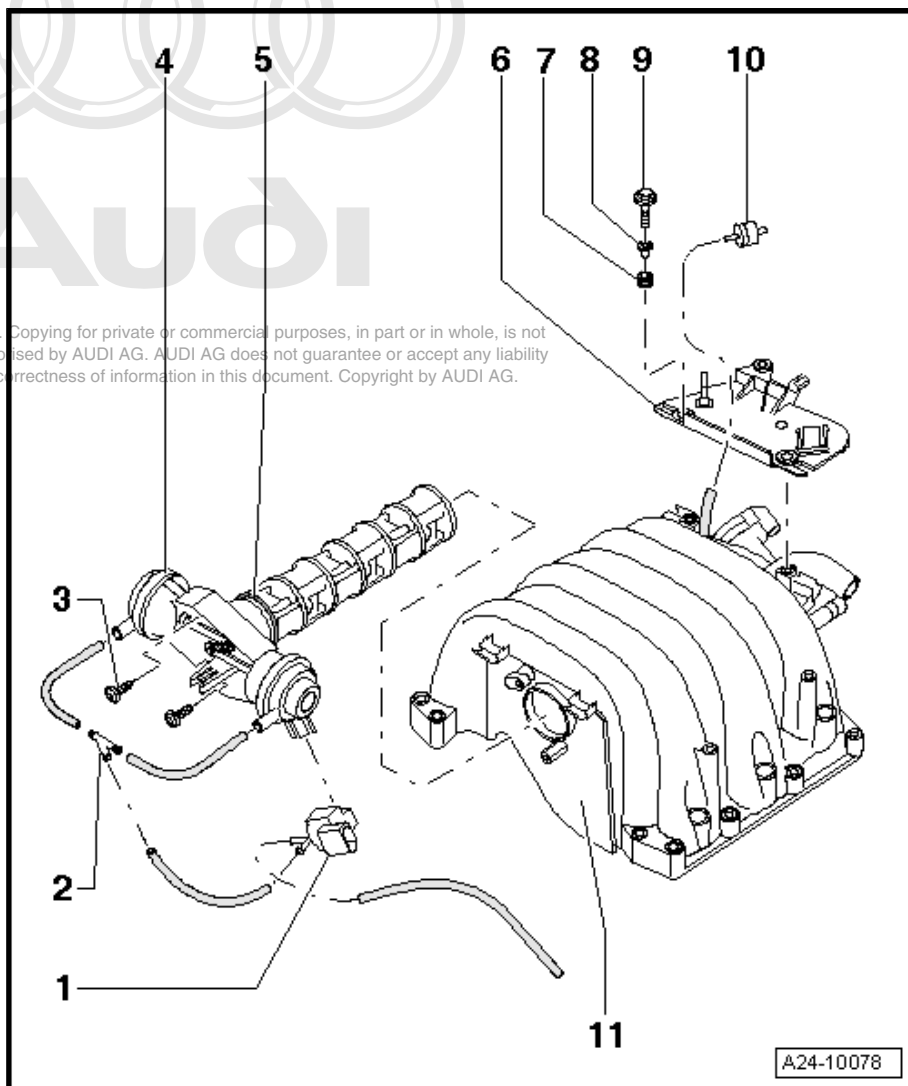
8 - Spacer sleeve

9 - 10 Nm

10 - Non-return valve

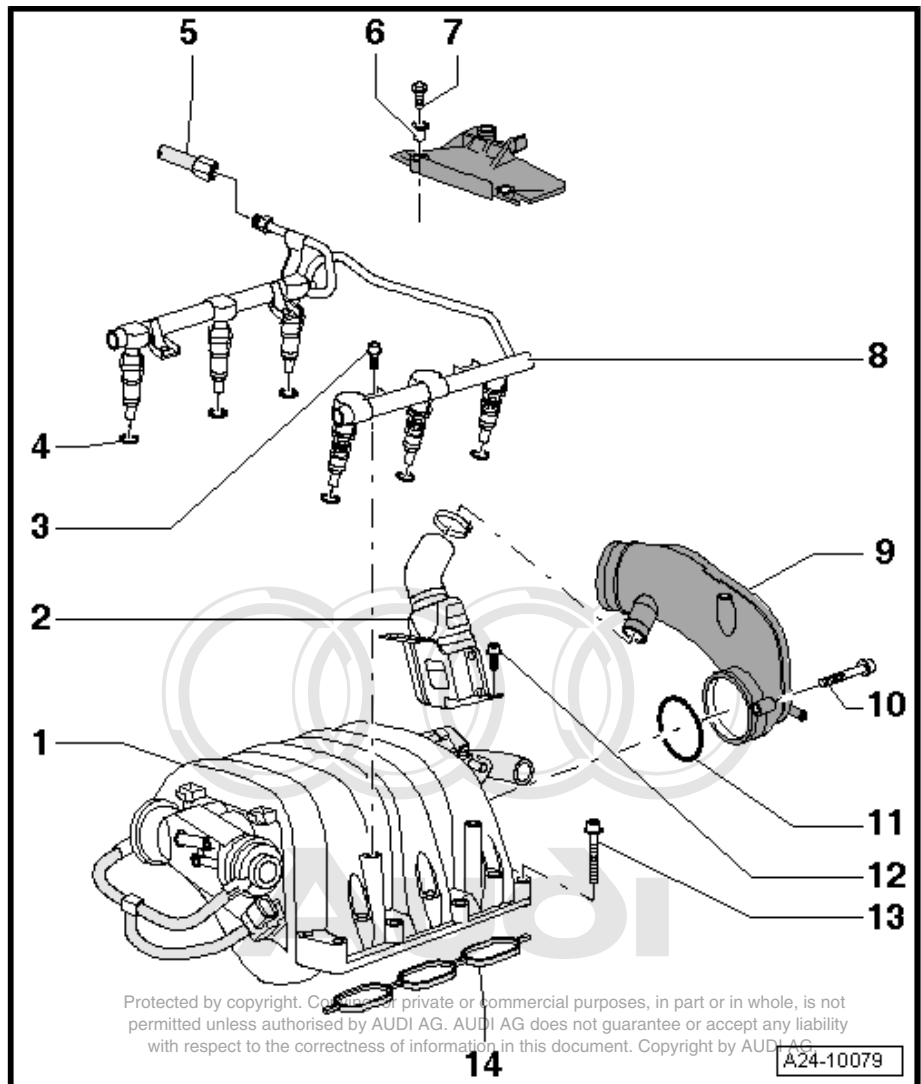
☐ Installation position:
blue end faces Y piece

11 - Intake manifold



1.6 Intake manifold - exploded view of components

- 1 - Intake manifold
 - ☐ Removing and installing
- 2 - Resonator
- 3 - 10 Nm
- 4 - O-rings
- 5 - Fuel supply pipe
 - ☐ Tighten union nut to 25 Nm.
- 6 - Bush
- 7 - 10 Nm
- 8 - Fuel rail
- 9 - Air duct
- 10 - 10 Nm
- 11 - O-ring
 - ☐ Renew
- 12 - 10 Nm
- 13 - 10 Nm
 - ☐ Tighten in stages and in diagonal sequence
- 14 - Intake manifold gasket
 - ☐ Renew



1.7 Removing and installing intake manifold

1.7.1 Removing

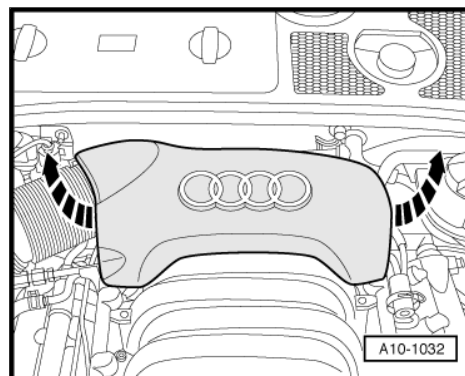


Note

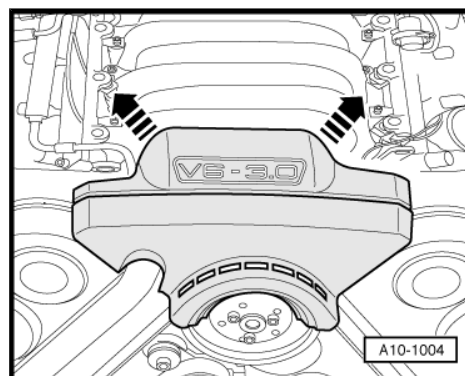
All cable ties which are released or cut open when removing must be fitted in the same position when installing.

- Drain off coolant ⇒ 6-cylinder engine, mechanics; Rep. Gr. 19.
- Pull cover out of retainers.
- Detach electrical connector at air mass meter.
- Detach air intake hose at air cleaner housing.
- Remove air cleaner housing.

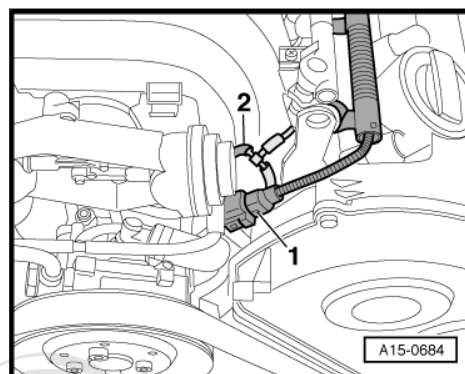
- Pull off rear engine cover -arrows- ...



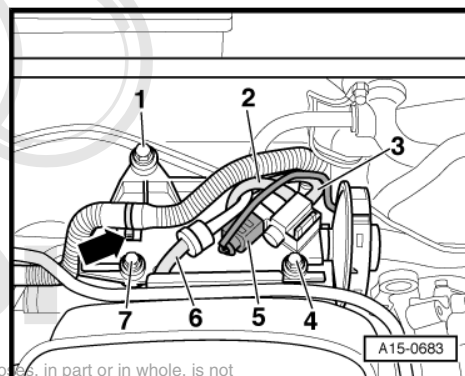
- ... as well as front engine cover -arrows-.



- Detach electrical connector -1-.
- Detach vacuum hose -2- from T piece.



- Detach vacuum hoses.
- Detach vacuum hose -6- from non-return valve.
- Detach electrical connector -5-.
- Move the crankcase breather hose -arrow- clear.
- Unscrew and remove bolts -1-, -4- and -7- on retaining plate for solenoid valves.
- Detach retaining plate for solenoid valves from intake manifold.
- On underside of retaining plate, pull vacuum hose off T piece.



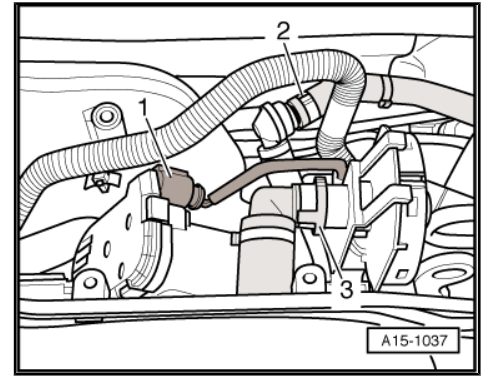
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- Detach electrical connector -1- at throttle valve module - J338- .
- Disconnect vacuum hoses -2- and -3-.
- Unplug electrical connectors at all injectors.
- Pull fuel rail together with injectors off intake manifold (pull off evenly from the top) and place it on a clean cloth in the engine compartment.

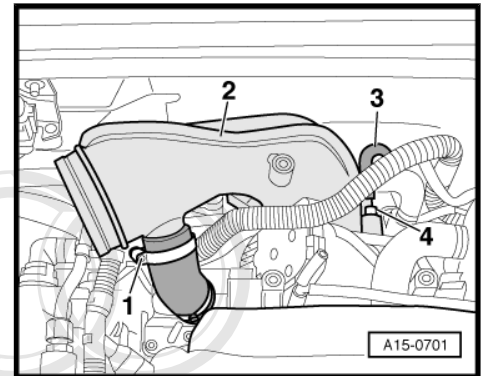


Note

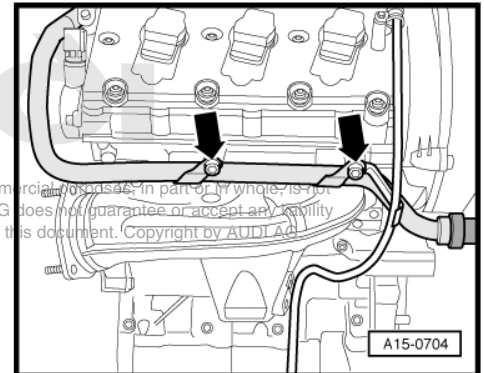
Make sure the removed injectors do not become soiled.



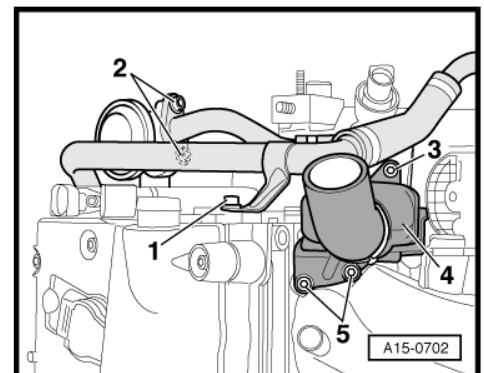
- Pull hose -1- off air duct.
- Unscrew bolt -4- and pull air duct -2- off throttle valve module -J338- .
- If fitted, pull vacuum hose -3- off at lower part of air duct.



- On right side of engine, unscrew and remove bolts -arrows- at secondary air pipe.

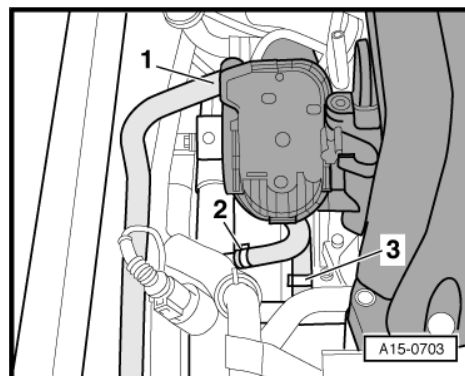


- Unscrew bolts -1- and -2- at secondary air pipes.
- Unscrew bolts -3- and -5- and remove resonator -4-.



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- Detach vacuum hose -1- leading to solenoid valve 1 for activated charcoal filter system -N80- .
- Disconnect coolant hoses.

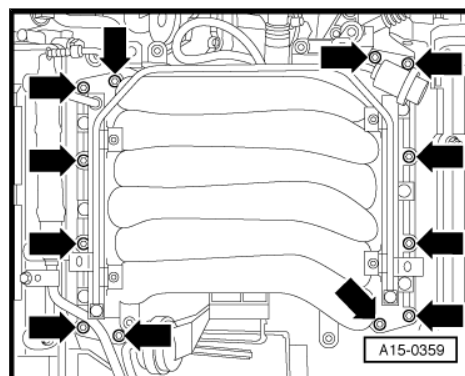


- Unscrew and remove intake manifold -arrows-.



Note

Seal intake ports on cylinder heads with clean cloths.



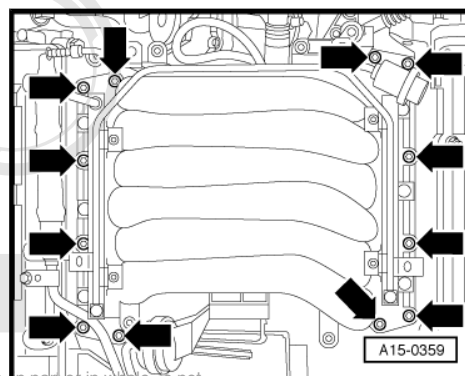
1.7.2 Installing

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



Note

- ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ *Parts catalogue*.
- ◆ Always renew seals and gaskets.
- ◆ Adhere to the instructions for installing the fuel rail ⇒ [page 24](#) .
- Tighten bolts on intake manifold in stages and in diagonal sequence -arrows-.
- Fill up coolant ⇒ 6-cylinder engine, mechanics; Rep. Gr. 19 .



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1.7.3 Tightening torques

Component		Nm
Intake manifold to cylinder head		10
Resonator to coolant pipe / to cylinder head		10
Secondary air pipe	M 6	10

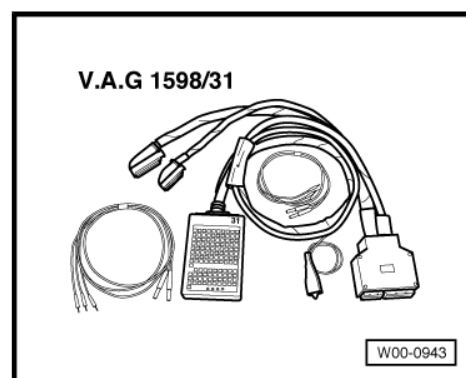
Component		Nm
to cylinder head	M 8	23
Secondary air pipe to combination valve for secondary air		10
Air duct to intake manifold		10
Retaining plate for solenoid valves to intake manifold / air duct		10

1.8 Wiring and component check with adapter lead, 121-pin -V.A.G 1598/31- (test box)



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.
- ◆ To connect the testers to test box -V.A.G 1598/31-, always use the adapter leads from adapter set -V.A.G 1594 C-.

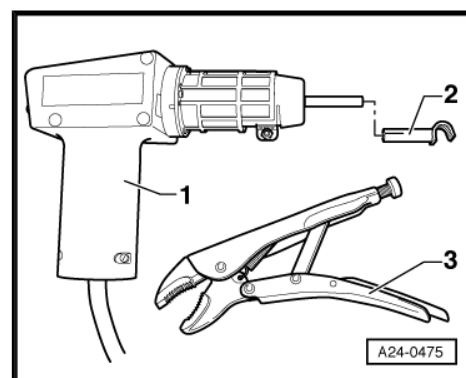


WARNING

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

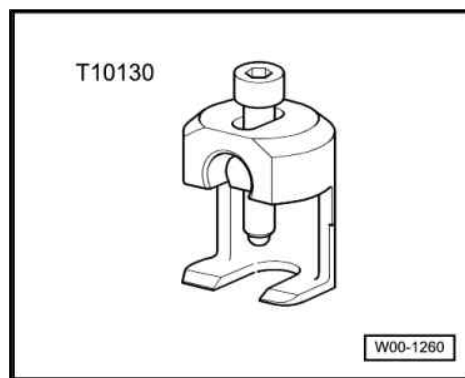
Special tools and workshop equipment required

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



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◆ Puller -T10130-

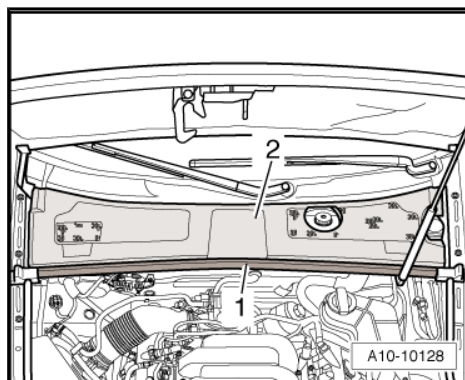


WARNING

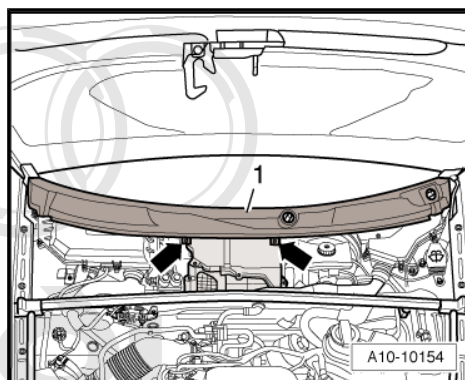
Heating the thread of the locking plate also heats up the shear bolts and parts of the metal housing. Take care to avoid burns. It is also important to ensure that only the thread is heated and none of the surrounding components if at all possible. These should be covered if necessary.

1.8.1 Procedure

- Switch off ignition.
- 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.
- Detach wiper arms from wiper shafts using puller -T10130- .



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



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



WARNING

The pump valve unit for 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 control unit is secured by means of shear bolts to a locking plate and a metal casing.

The threads of the two shear bolts -1- which are not screwed into the engine control unit are secured with locking fluid. To unscrew these bolts, the threads must therefore be heated with the hot-air blower.

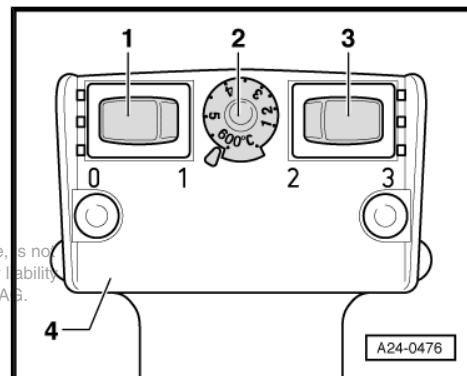
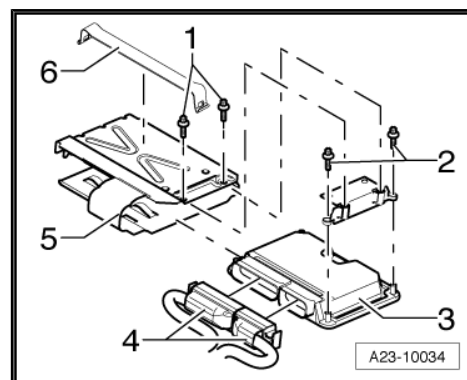
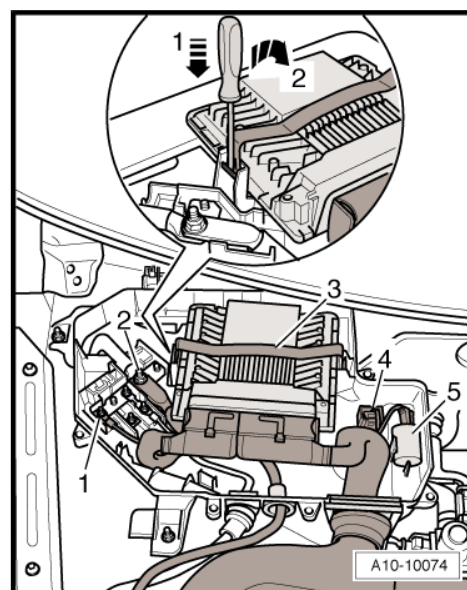
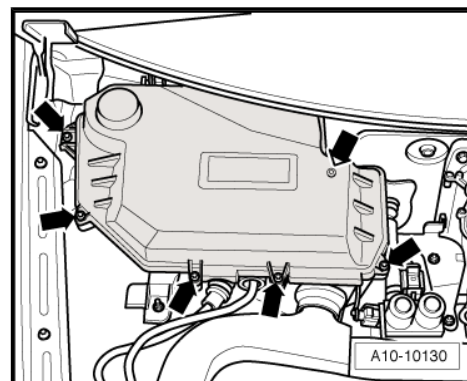
The threads of the two shear bolts -2- which are screwed into the engine control unit are not secured with locking fluid. Do not apply heat to the threads in the control unit housing; this is not necessary and would cause overheating of the control unit.

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

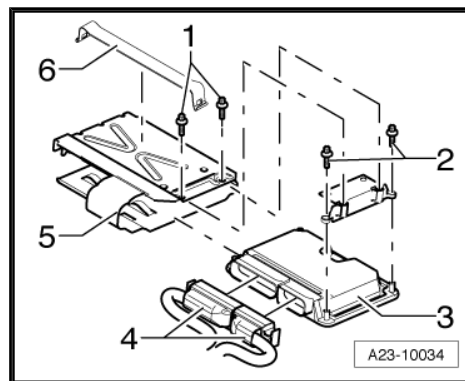


WARNING

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 -1- for approx. 25 to 30 seconds.
- Unscrew shear bolts using vice-grip pliers.
- The two shear bolts screwed into the control unit do not need to be heated. They can be removed without heating.
- Detach metal locking plate from control unit connectors.
- Release connectors on engine control unit and unplug connectors.
- Connect adapter cable, 121-pin -V.A.G 1598/31- 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.



1.8.2 Installing Motronic control unit -J220-

Installation is performed in the reverse sequence.

- Make sure you fit protective housing back on engine control unit.
- Always use new shear bolts.
- Clean threaded holes for new shear bolts to remove any residue from locking fluid. Cleaning can be performed using a thread tap.
- Interrogate and, if necessary, erase fault memory. ⇒ Vehicle diagnostic, testing and information system VAS 5051

1.9 Renewing Motronic control unit -J220-



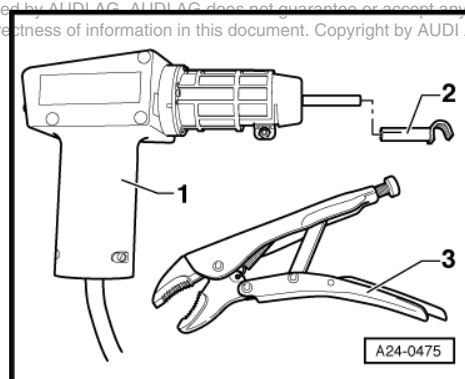
Note

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

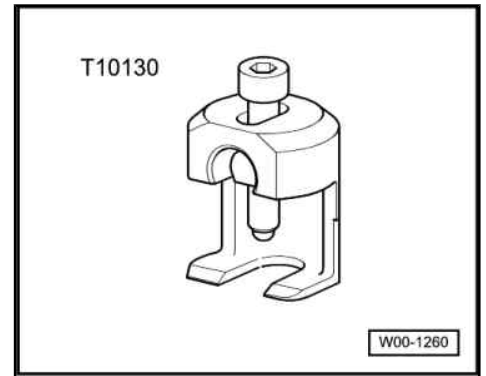
Special tools and workshop equipment required

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

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◆ Puller -T10130-

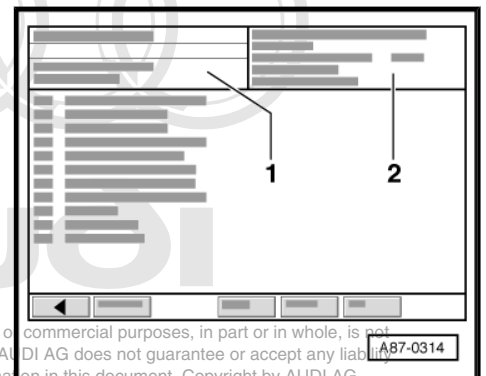


1.9.1 Removing Motronic control unit -J220-

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

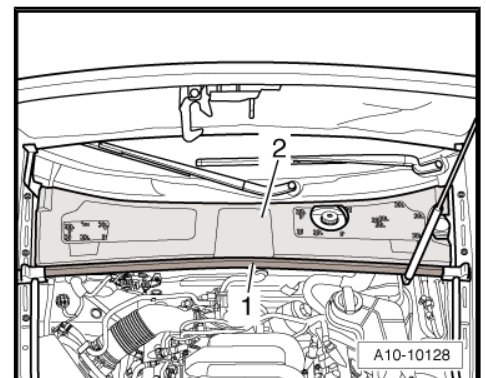
The display on vehicle diagnostic, testing and information system -VAS 5051 A- will show the control unit identification and the coding -2-.

- Always start by displaying the control unit identification and printing it out.
- Switch off ignition.
- Pull off rubber seal -1- on plenum chamber cover.

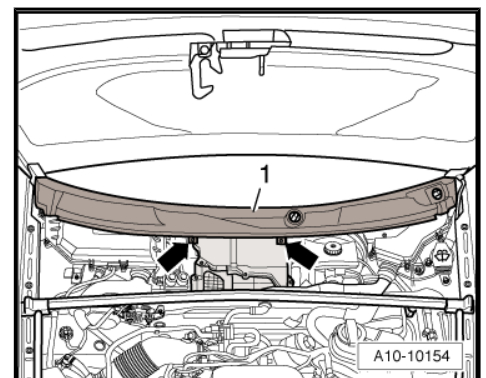


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- Detach plenum chamber cover -2-.
- Use screwdriver to pry off cover caps on wiper arms and unscrew hexagon nuts.
- Detach wiper arms from wiper shafts using puller -T10130- .



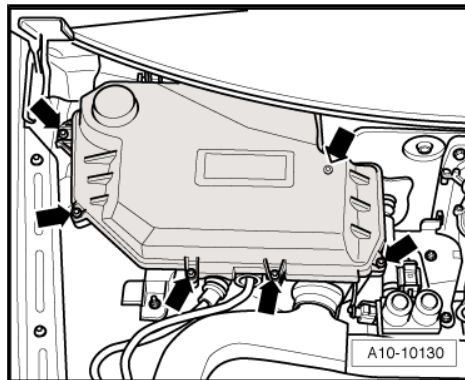
- Unscrew bolts (left and right) -arrows- from cowl panel -1-.



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


WARNING

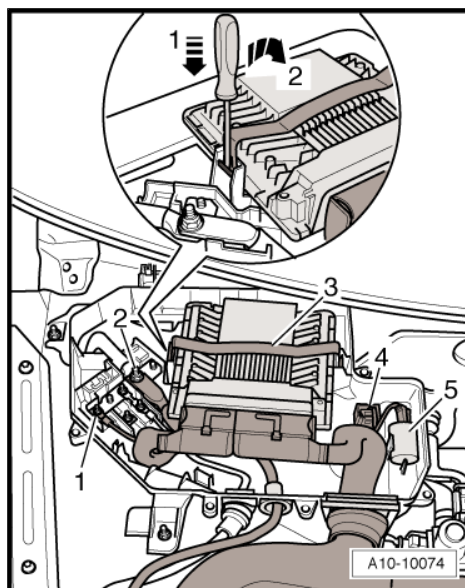
The pump valve unit for heating system (left in front of electronics box) gets very hot - risk of burns!



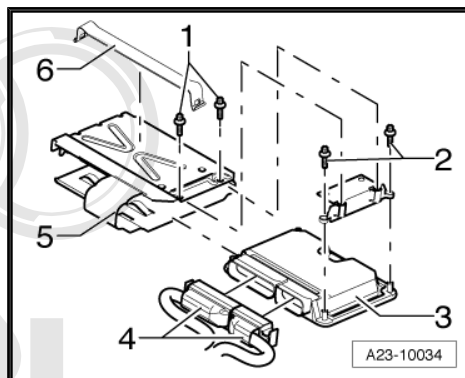
- Carefully lever out the retaining strap -3- using a screwdriver -arrows 1 and 2- and remove the engine control unit from the electronics box.

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

The threads of the two shear bolts -1- which are not screwed into the engine control unit are secured with locking fluid. To unscrew these bolts, the threads must therefore be heated with the hot-air blower.



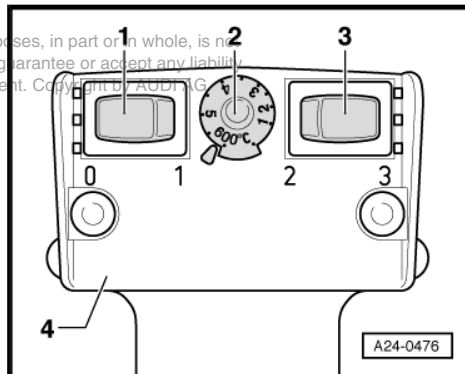
The threads of the two shear bolts -2- which are screwed into the engine control unit are not secured with locking fluid. Do not apply heat to the threads in the control unit housing; this is not necessary and would cause overheating of the control unit.



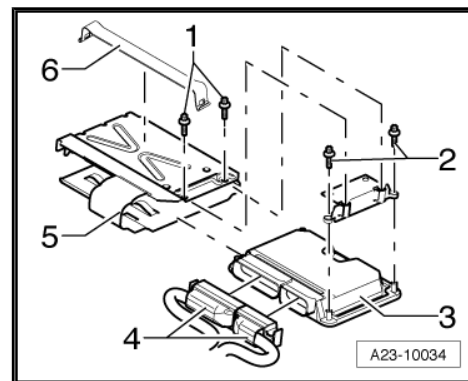
- Select settings on hot air blower as shown in illustration, i.e. set temperature potentiometer -2- to max. heat output and two-stage air flow switch -3- to position 3.


WARNING

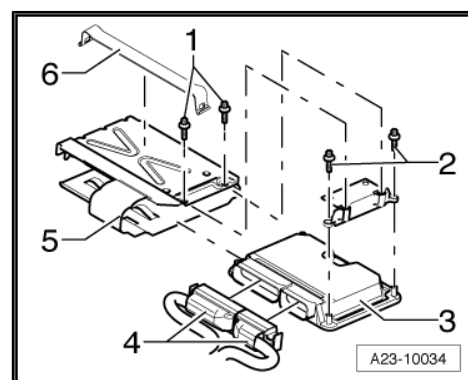
Heating the thread of the locking plate also heats up the shear bolts and parts of the metal housing. Take care to avoid burns. It is also important to ensure that only the thread is heated and none of the surrounding components if at all possible. These should be covered if necessary.



- Apply heat to the threads of the shear bolts -1- for approx. 25 to 30 seconds.
- Unscrew shear bolts using vice-grip pliers.
- The two shear bolts screwed into the control unit do not need to be heated. They can be removed without heating.
- Detach metal locking plate from control unit connectors.



- Release connectors -4- on engine control unit and unplug connectors.
- Remove old Motronic control unit -J220- and install new Motronic control unit -J220-.



1.9.2 Installing Motronic control unit -J220-

Installation is performed in the reverse sequence.

- Make sure you fit protective housing back on engine control unit.
- Always use new shear bolts.
- Clean threaded holes for new shear bolts to remove any residue from locking fluid. Cleaning can be performed using a thread tap.

The procedure required after connecting the new engine control unit is described in the Guided fault-finding or Guided functions.

- Enter correct vehicle identification in Guided fault-finding.
- Press "Go to" button.
- Press "Function/component selection".
- Select "Drive train".
- Select "Engine code letters".
- "01 - Systems with self-diagnosis capability"
- "Motronic injection and ignition system"
- Select "Functions, engine".
- Select "Renewing engine control unit".

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1.10 Checking system pressure, fuel pressure regulator and residual pressure



Note

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

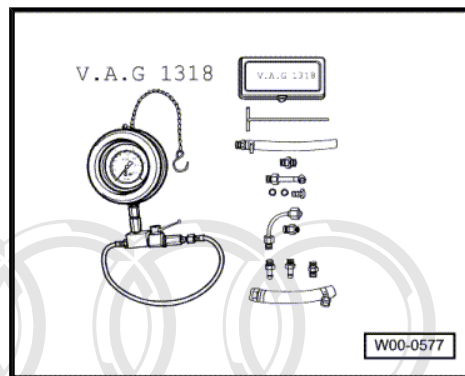
1.10.1 Special tools and workshop equipment required

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



Note

- ◆ Fuel pump relay OK.
- ◆ Fuel pump OK; checking: ⇒ Fuel supply system, petrol engines; Repair group 20.
- ◆ Fuel filter OK
- ◆ Battery voltage at least 12.7 V
- ◆ Vehicles with automatic gearbox: selector lever in position P or N



1.10.2 Checking system pressure

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

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WARNING

The fuel system is pressurised. Before opening the system place a cloth around the connection. Then dissipate pressure by carefully unfastening the connection.

- Open union for fuel supply ⇒ [Item 5 \(page 22\)](#) and catch escaping fuel with a cloth.
- Connect K-Jetronic tester -V.A.G 1318- with adapters 1318/6 and 1318/7 to fuel supply pipe.



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 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:

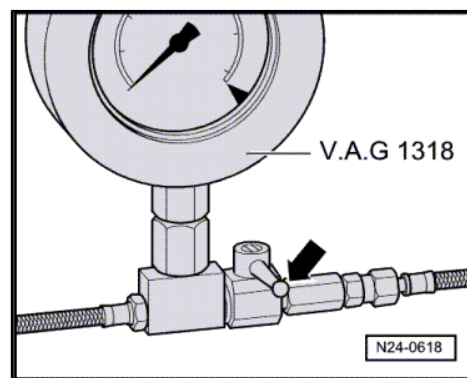
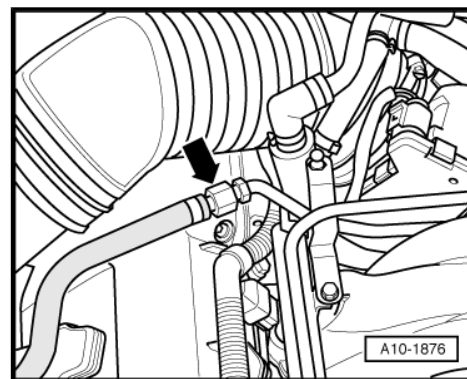
- Start the engine and run at idling speed.
- Allow pressure to build up, then switch off ignition. At the same time close cut-off valve on pressure gauge -V.A.G 1318- (lever at right angles to direction of flow -arrow-).
- Observe pressure drop on pressure gauge.

If the pressure drops again:

- Check pressure gauge for leaks.
- Check pipe connections, O-rings on fuel rail and injectors for leaks.

If the pressure now 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 .



1.11 Dismantling and assembling fuel rail with injectors

1 - Retaining clip

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

2 - O-ring

- ☐ Removing and installing
⇒ [page 22](#)
- ☐ Renew
- ☐ Lubricate with clean engine oil

3 - Injector

- ☐ Removing and installing
⇒ [page 22](#)

4 - O-ring

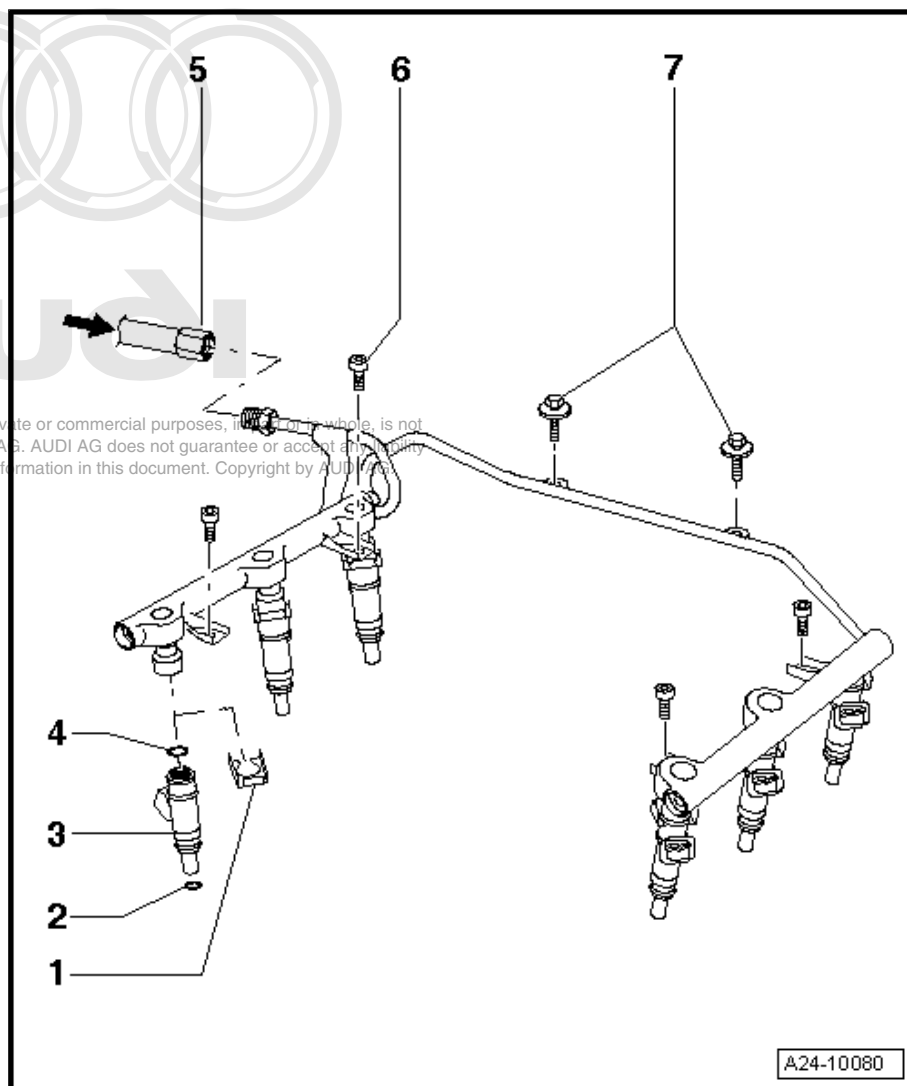
- ☐ Removing and installing
⇒ [page 22](#)
- ☐ Renew
- ☐ Lubricate with clean engine oil

5 - Fuel supply pipe

- ☐ Tighten union nut to 25 Nm.

6 - Hexagon socket head bolt - 10 Nm

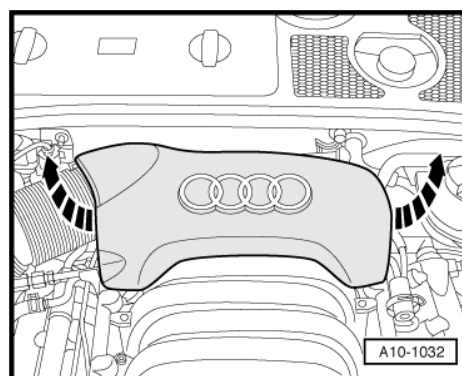
7 - Bolt -10 Nm-



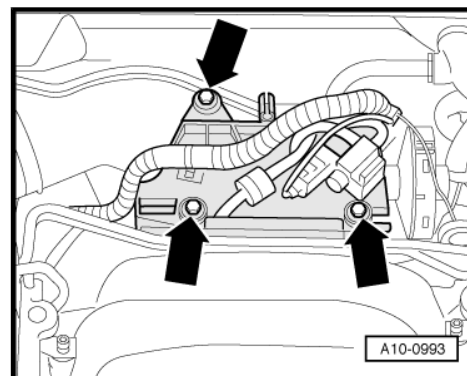
1.12 Removing and installing fuel rail and injectors

1.12.1 Removing

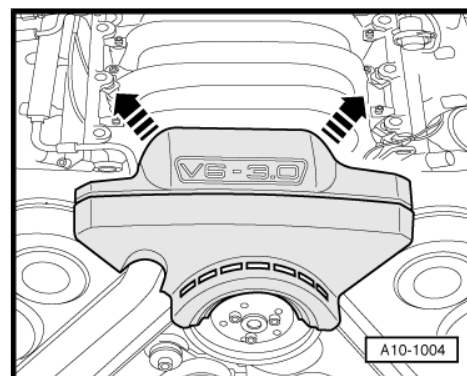
- Pull off engine cover (rear) -arrows-.



- Unscrew bolts for solenoid valve retaining plate -arrows-.



- Pull off engine cover (front) -arrows-.

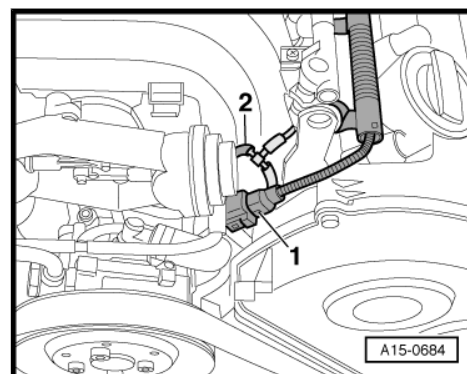


- Unplug electrical connector at intake manifold change-over valve -N156- -Item 1-.



Note

Ignore item marked -2-.



- Unplug all electrical connectors at all injectors; to do so, release connectors on underside -arrow-.



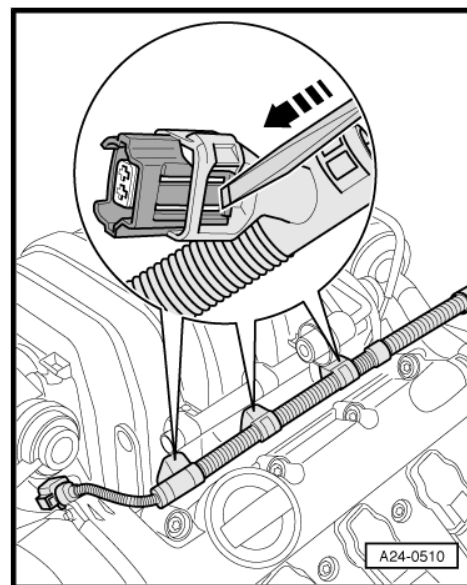
Note

The fuel supply pipe must be detached before renewing fuel rail.

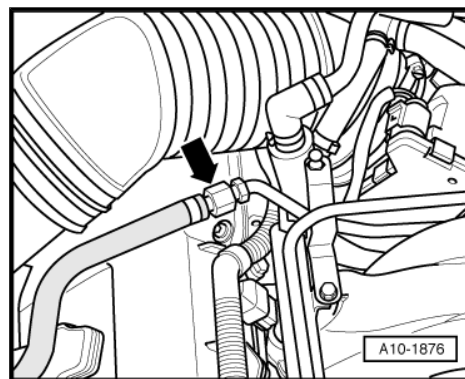


WARNING

The fuel system is pressurised. Before opening the system place a cloth around the connection. Then dissipate pressure by carefully unfastening the connection.



- Detach fuel supply pipe at fuel rail.
- Pull fuel rail together with injectors off intake manifold evenly and set it aside on a clean cloth in rear of engine compartment.
- To take off the injectors first pull off the retaining clips.



1.12.2 Installing

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

- Renew the O-rings at all opened connections. (When renewing the front O-ring, ensure that the plastic cap is not 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 injectors are installed in correct position.
- Make sure retaining clips are properly connected.
- Position fuel rail with secured injectors on intake manifold and press evenly into place.

1.12.3 Tightening torque

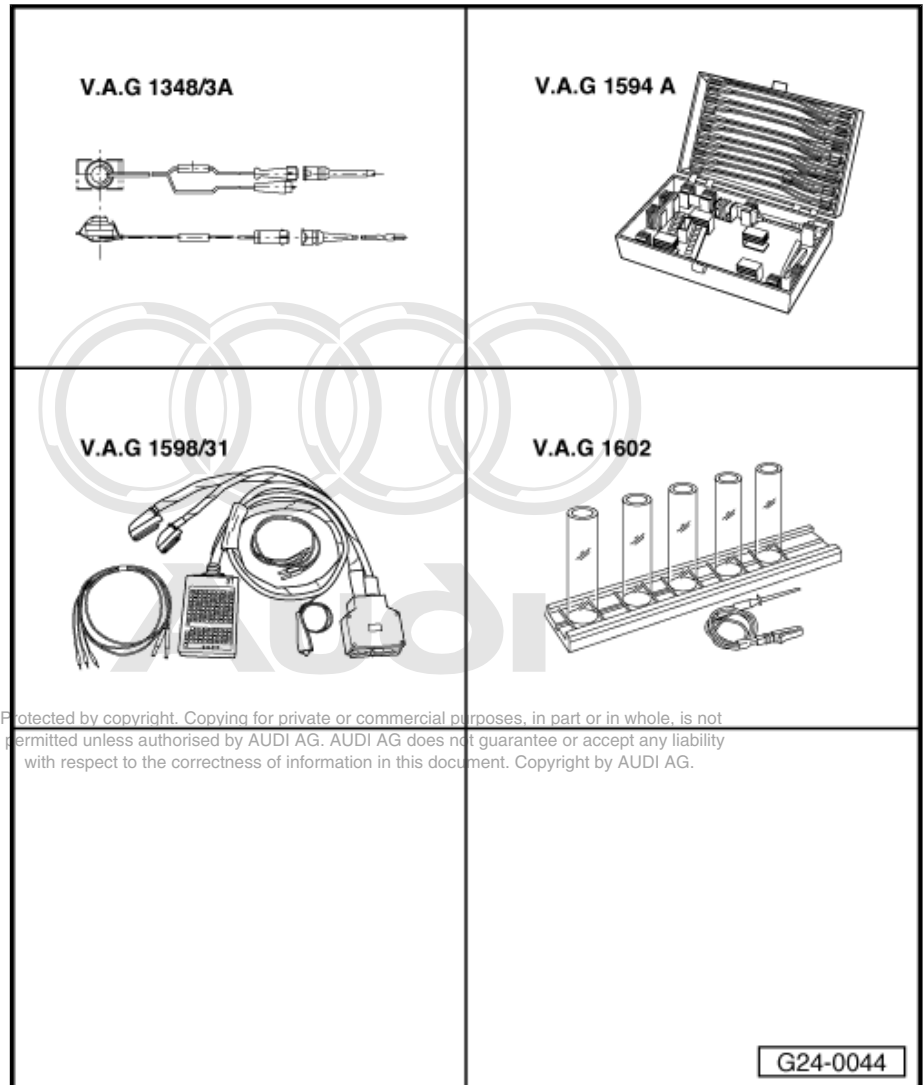
Component	Nm
Fuel rail to intake manifold	10

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

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Special tools and workshop equipment required

- ◆ Remote control -
V.A.G 1348/3 A- with
adapter cable -
V.A.G 1348/3-2-
- ◆ Adapter set -V.A.G 1594 A-
- ◆ Injection rate tester -
V.A.G 1602-
- ◆ Test box -V.A.G 1598/31-



1.13.1 Test requirement

- Fuel pressure OK; testing ⇒ [page 20](#) .

1.13.2 Preparation for test

- Remove fuel rail (together with injectors) from intake manifold
⇒ [page 22](#) . Fuel hoses remain connected.
- Connect test box -V.A.G 1598/31- to wiring harness for engine control unit. The engine control unit is not connected.
- Use leads from adapter set -V.A.G 1594 A- to bridge contacts 1 and 65 at test box.

1.13.3 Checking for leaks

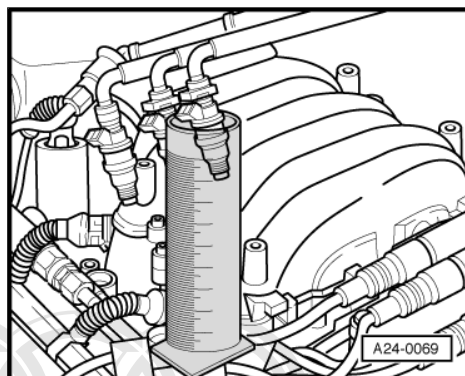
- Switch on ignition.
- The fuel pump should run.
- Visually check the fuel injectors for leaks.
- When the fuel pump is running, no more than 1 to 2 drops a minute should escape from any one of the injectors.

If the fuel loss is greater:

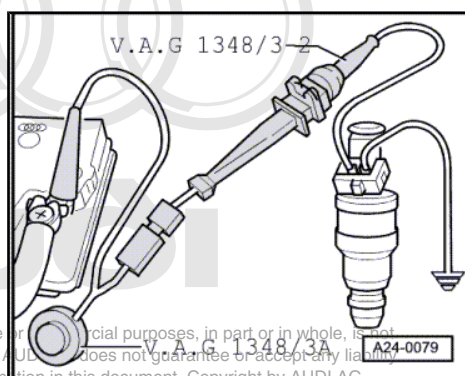
- Renew defective fuel injector ⇒ [page 22](#) .

1.13.4 Checking injection quantity

- Place a fuel injector in a measuring glass for injection rate tester -V.A.G 1602- .



- Connect one of the contacts of fuel injector to engine earth using test lead and crocodile clamp from adapter set -V.A.G 1594 A- .
- Connect second contact of fuel injector to the remote control -V.A.G 1348/3 A- with adapter cable -V.A.G 1348/3-2- .
- Connect crocodile clamp to positive (+) battery terminal.
- Switch on ignition.
- The fuel pump should run.
- Press the remote control -V.A.G 1348/3 A- for 30 seconds.
- Carry out test for all fuel injectors using a new test glass each time.



Note

Also check the spray pattern when testing the injection rate. The spray pattern should be the same for all injectors.

- Once all 6 injectors have been actuated, place measuring glasses on a level surface.
- Specification: 90 ... 125 ml for each injector
- Switch off fuel pump (switch off ignition).

If the measured values for one or more of the fuel injectors do not meet the specification:

- Renew defective fuel injector ⇒ [page 22](#) .

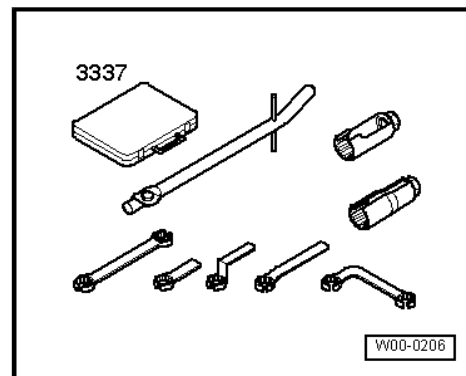
If the measured values for all the injectors are outside the specification:

- Check fuel pressure ⇒ [page 20](#) .
- Install injectors together with fuel rail ⇒ [page 24](#) .

1.14 Removing and installing Lambda probe before catalytic converter - bank 1 (right)

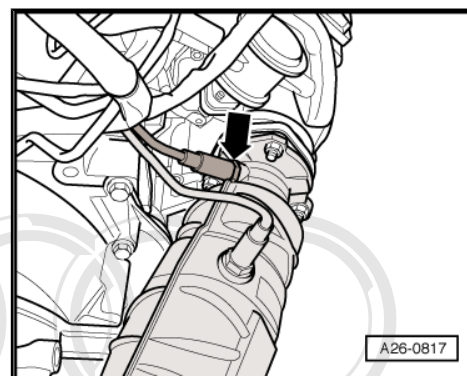
Special tools and workshop equipment required

- ◆ Lambda probe open ring spanner set -3337-



1.14.1 Removing

- Remove front exhaust pipe (right-side) ⇒ 6-cylinder engine, mechanics; Rep. Gr. 26 .
- Unscrew Lambda probe using socket -3337/7- .



1.14.2 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.*
- ◆ *When installing, the Lambda probe wires must always be re-attached at the same locations to prevent probe wires from coming into contact with exhaust pipe.*
- Install front exhaust pipe (right-side) ⇒ 6-cylinder engine, mechanics; Rep. Gr. 26 .

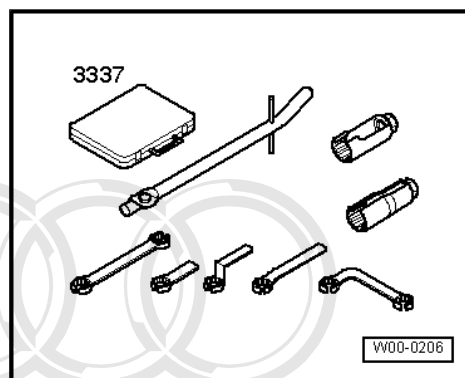
1.14.3 Tightening torque

Component	Nm
Lambda probe in front exhaust pipe	55

1.15 Removing and installing Lambda probe before catalytic converter - bank 2 (left)

Special tools and workshop equipment required

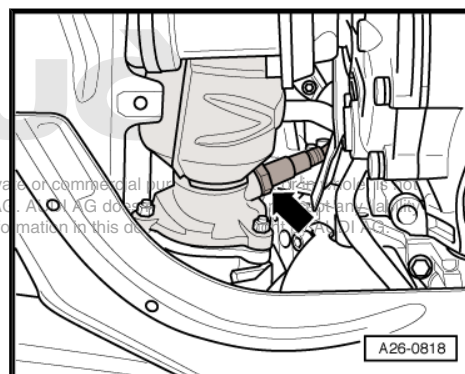
- ◆ Lambda probe open ring spanner set -3337-



1.15.1 Removing

- Remove front exhaust pipe (left-side) ⇒ 6-cylinder engine, mechanics; Rep. Gr. 26 .
- Unscrew Lambda probe using socket -3337/7- .

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1.15.2 Installing

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

- Install front exhaust pipe (left-side) ⇒ 6-cylinder engine, mechanics; Rep. Gr. 26 .



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.*
- ◆ *When installing, the Lambda probe wire must always be reattached at the same locations to prevent probe wire from coming into contact with exhaust pipe.*

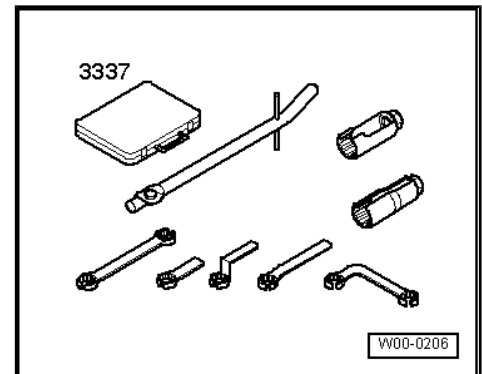
1.15.3 Tightening torques

Component		Nm
Lambda probe in front exhaust pipe		55
Drive shaft heat shield to gearbox		23
Air duct to intake manifold		10
Retaining plate to	Intake manifold	10
	Air duct	10

1.16 Removing and installing Lambda probe after catalytic converter - bank 1 (right)

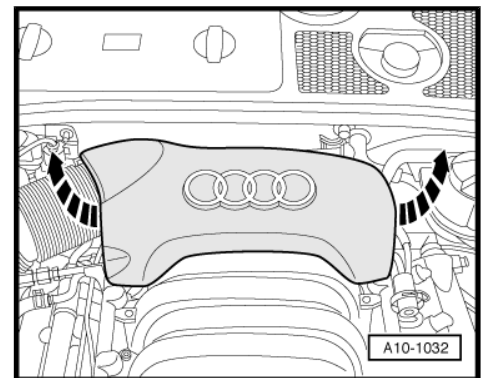
Special tools and workshop equipment required

- ◆ Lambda probe open ring spanner set -3337-

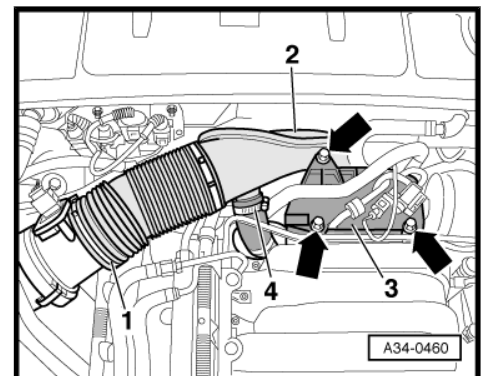


1.16.1 Removing

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



- Unscrew bolts for solenoid valve retaining plate -3- (-arrows-).
- Detach air intake hose -1- at air mass meter.
- Pull hose -4- off air duct -2-.



- Unscrew bolt -arrow- and disconnect air duct -2- from throttle valve module -J338-.
- If fitted, pull hose -1- off at air duct.

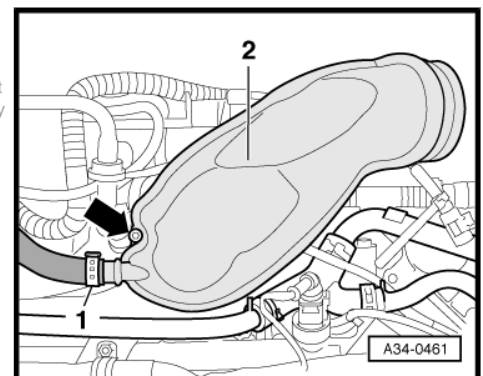
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Note

For illustration purposes, the air duct is shown from rear and with engine removed.

- Detach electrical connector for Lambda probes from bracket and unplug.
- Move wire clear.

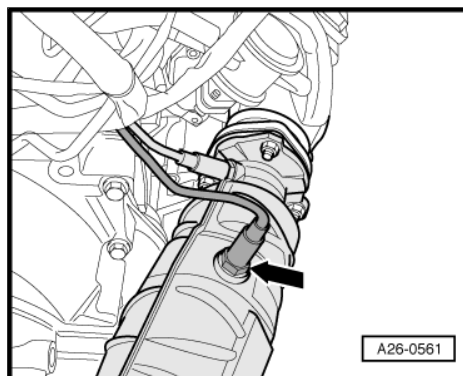


- Unscrew Lambda probe using socket -3337/- .



Note

Shown from rear with engine removed for illustration purposes.



1.16.2 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.
- ◆ When installing, the Lambda probe wire must always be reattached at the same locations to prevent probe wire from coming into contact with exhaust pipe.

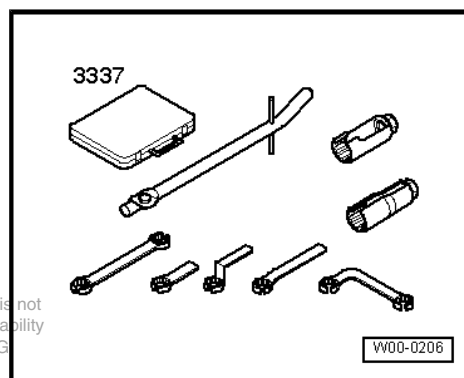
1.16.3 Tightening torques

Component		Nm
Lambda probe in front exhaust pipe		55
Air duct to intake manifold		10
Retaining plate to	Intake manifold	10
	Air duct	10

1.17 Removing and installing Lambda probe after catalytic converter - bank 2 (left)

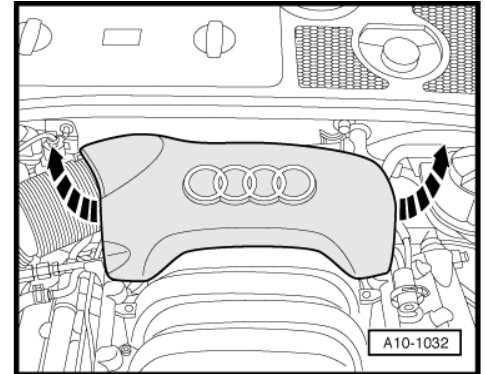
Special tools and workshop equipment required

- ◆ Lambda probe open ring spanner set -3337-



1.17.1 Removing

- Pull off engine cover (rear) -arrows-.
- Detach electrical connector for Lambda probe from bracket on left of bulkhead and unplug.
- Move wire clear.

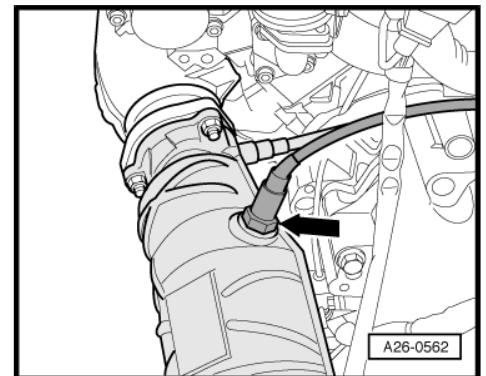


- Unscrew Lambda probe using socket -3337/7- .



Note

Shown from rear with engine removed for illustration purposes.



1.17.2 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.*
- ◆ *When installing, the Lambda probe wire must always be reattached at the same locations to prevent probe wire from coming into contact with exhaust pipe.*

1.17.3 Tightening torque

Component	Nm
Lambda probe in front exhaust pipe	55

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28 – Ignition system

1 General notes on ignition system

- ◆ Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.
- ◆ A voltage of at least 12.7 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.

2 Safety measures

Note the following to avoid injuries or damage to the fuel injection system or ignition system:

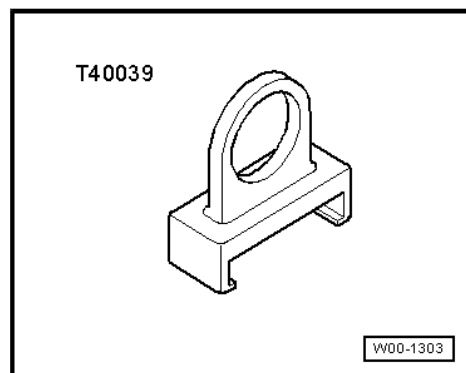
- ◆ Do not touch or detach the ignition wires when the engine is running or while starting the engine.
- ◆ The ignition must be switched off before disconnecting or connecting ignition system wiring, high-voltage wires and test leads.
- ◆ If you want to crank engine at starting speed without actually starting it (for example, in order to test compression pressure), first unplug connectors from ignition coils and also from injectors.
- ◆ Certain tests may lead to a fault being detected by the control unit and stored. Therefore, interrogate and, if necessary, erase the fault memory after all repairs and tests.
- ◆ Always switch off the ignition before cleaning the engine.

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3 Removing and installing ignition coils

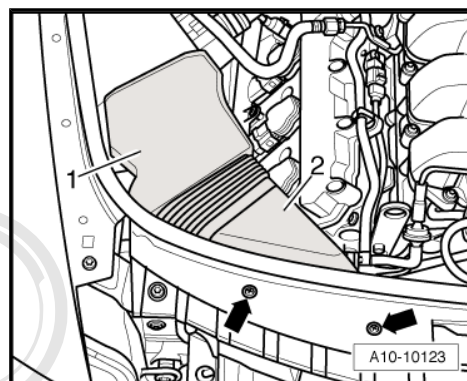
Special tools and workshop equipment required

- ◆ Puller -T40039-



Removing (cylinder 1):

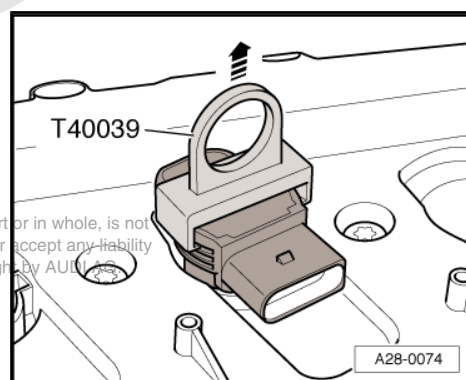
- Unscrew bolts -arrows- and remove air ducts -1- and -2-.
- Unscrew bolts at cable guide and unplug electrical connectors at ignition coils.



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

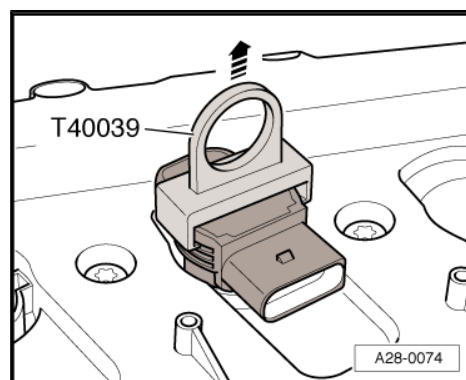
Removing (cylinder 2):

- Unscrew bolts at cable guide and unplug electrical connectors at ignition coils.



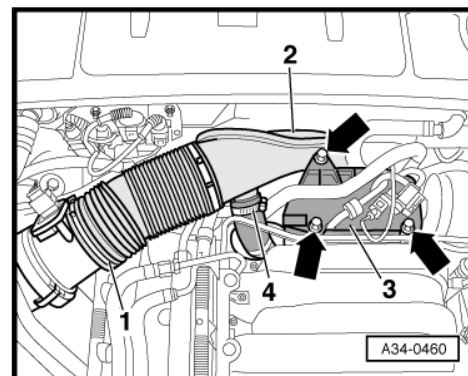
- Pull ignition coil (cylinder 2) out with puller -T40039- .

Removing (cylinder 3):



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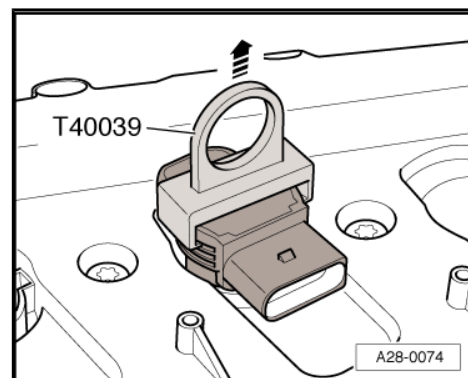
- Remove air intake hose -1- with air mass meter -G70- .
- Unscrew bolts at cable guide and unplug electrical connectors at ignition coils.



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

Removing (cylinders 4 and 5):

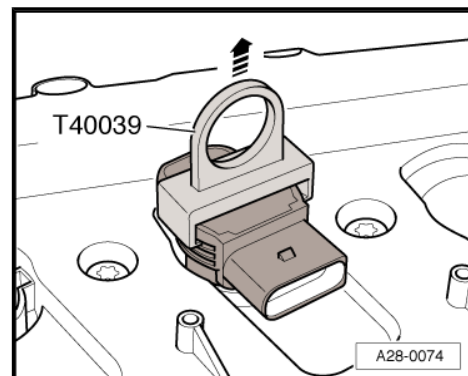
- Unscrew bolts at cable guide and unplug electrical connectors at ignition coils.



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

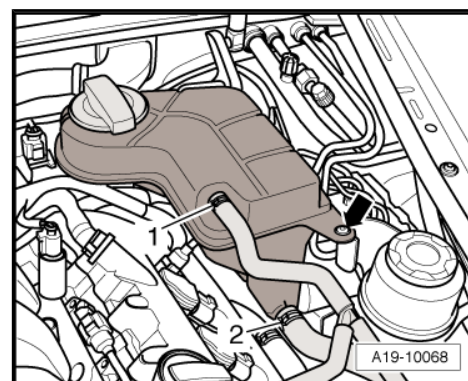
Removing (cylinder 6):

- 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 at cable guide and unplug electrical connectors at ignition coils.

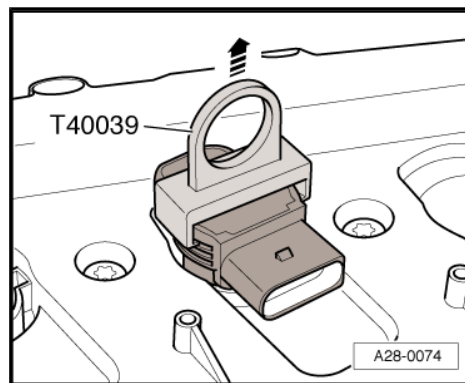




- Pull ignition coil (cylinder 6) out with puller -T40039- .

Installing ignition coils

Install in reverse order.



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