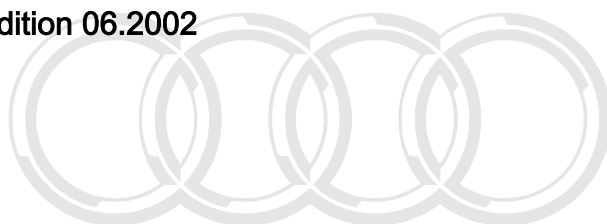


Audi A2 2001 ➤

Motronic Direct Injection and Ignition System (4-Cyl.)

Engine ID	BAD								
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Edition 06.2002



Audi

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

Audi A2 2001 ➤

Motronic Direct Injection and Ignition System (4-Cyl.)

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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Motronic Direct Injection and Ignition System (4-Cyl.) - Edition 06.2002



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24 - Mixture preparation, Injection

1 - Servicing Motronic injection system

1.1 - Servicing Motronic injection system

1.2 - Safety precautions

Pay attention to the following if testers and measuring instruments have to be used in the course of a test drive:

Attention:

- ◆ Always attach testers and measuring instruments to back seat and have them operated from there by a second person.
- ◆ If testers and measuring instruments were to be operated from front passenger's seat, person sitting there could suffer injury in the event of an accident due to triggering of front passenger's airbag.

Observe the following so as to avoid possible injury and/or the destruction of the injection and ignition system:

- ◆ Persons with a cardiac pacemaker should not lean over the engine compartment while the engine is running.
- ◆ Always switch off ignition before disconnecting and connecting injection and ignition system wires (also applies to measuring instrument leads).
- ◆ Certain tests may lead to a fault being detected by the control unit and stored. The fault memory is therefore to be interrogated and if necessary erased on completion of all tests and repair work.
- ◆ Always switch off ignition before washing engine.
- ◆ Always switch off ignition before disconnecting and connecting battery so as not to damage engine control unit.

Attention:

Fuel system operates under high pressure. Always reduce fuel pressure prior to opening fuel system.
Procedure, see => Page 28

1.3 - Rules for cleanliness

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

- ◆ Carefully clean all joints and adjacent areas before disconnecting.
- ◆ Place parts 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:
Do not remove replacement parts from wrapping until immediately prior to installation.
Do not use parts that have been stored loose (e.g. in tool boxes).
- ◆ When system is open:
Do not work with compressed air if at all possible.
Do not move vehicle unless absolutely necessary.
- ◆ Unplugged connectors:
Protect against dirt and damp.
Only connect when dry.



1.4 - Technical data

Engine codes	BAD (1.6 l / 81 kW - FSI engine)
Idling speed 1) Speed cannot be adjusted; regulated by idling speed stabilisation	600 ... 720 rpm
Speed governing By closing throttle valve	6600 rpm
Fuel pressure at idling speed	approx. 70 bar

1) Current values:

=> Exhaust emission test binder

Note:

The abbreviation FSI stands for: Fuel Stratified Injection.

1.5 - Exploded view of fitting locations

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

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

- ♦ In footwell at pedal bracket next to brake pedal

B - Diagnostic connector

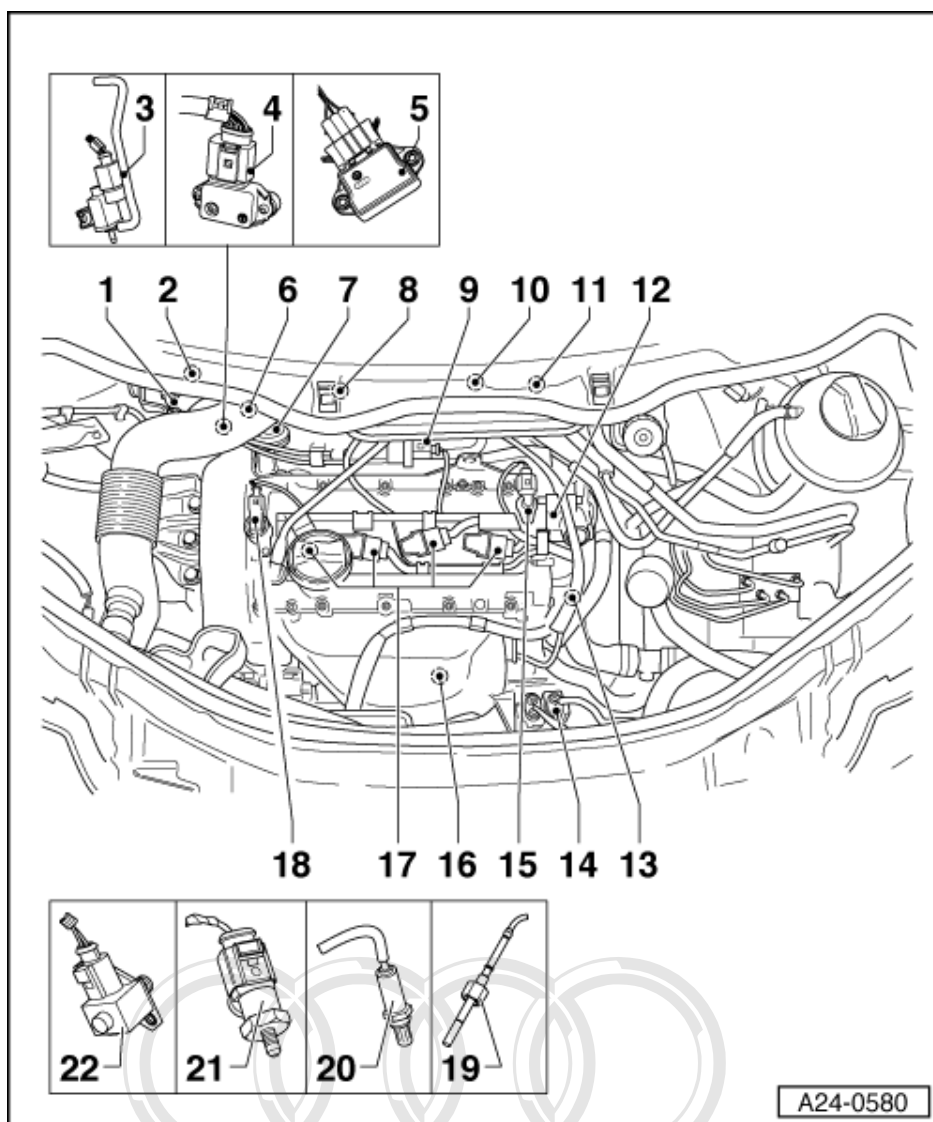
- ♦ In driver's knee restraint

C - Fuel pump relay -J17

- ♦ 6+6-socket relay carrier (left side footwell, relay position 5) =>Fig. 9

D - Motronic current supply relay -J271

- ♦ 3-socket relay carrier (left side footwell, relay position 1) =>Fig. 10



E - Motronic control unit -J220

- ♦ Fitting location =>Fig. 9

F - NOx sender control unit -J583

- ♦ Fitting location =>Fig. 9

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

- ♦ In footwell at accelerator pedal (both senders share same housing)

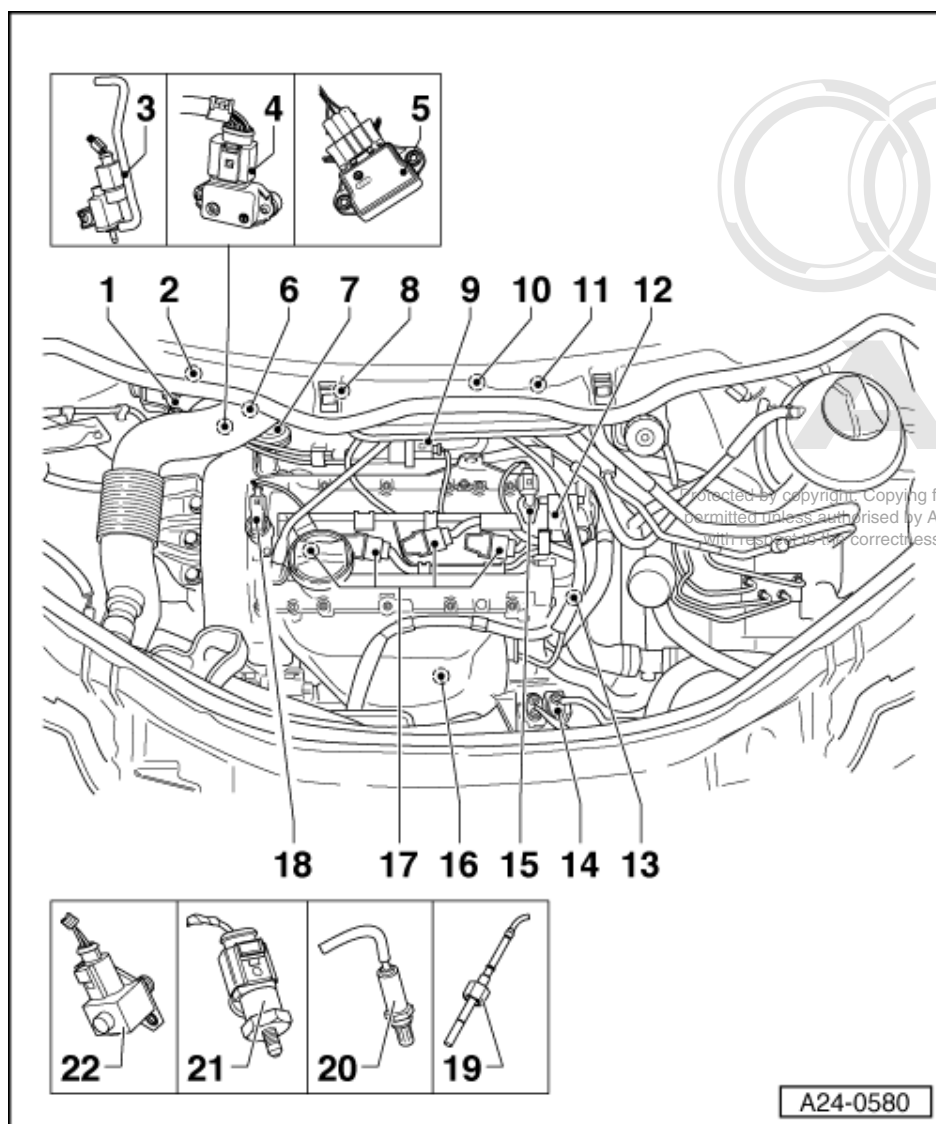
1 Fuel pressure regulator

- ♦ Fitting location =>Fig. 7

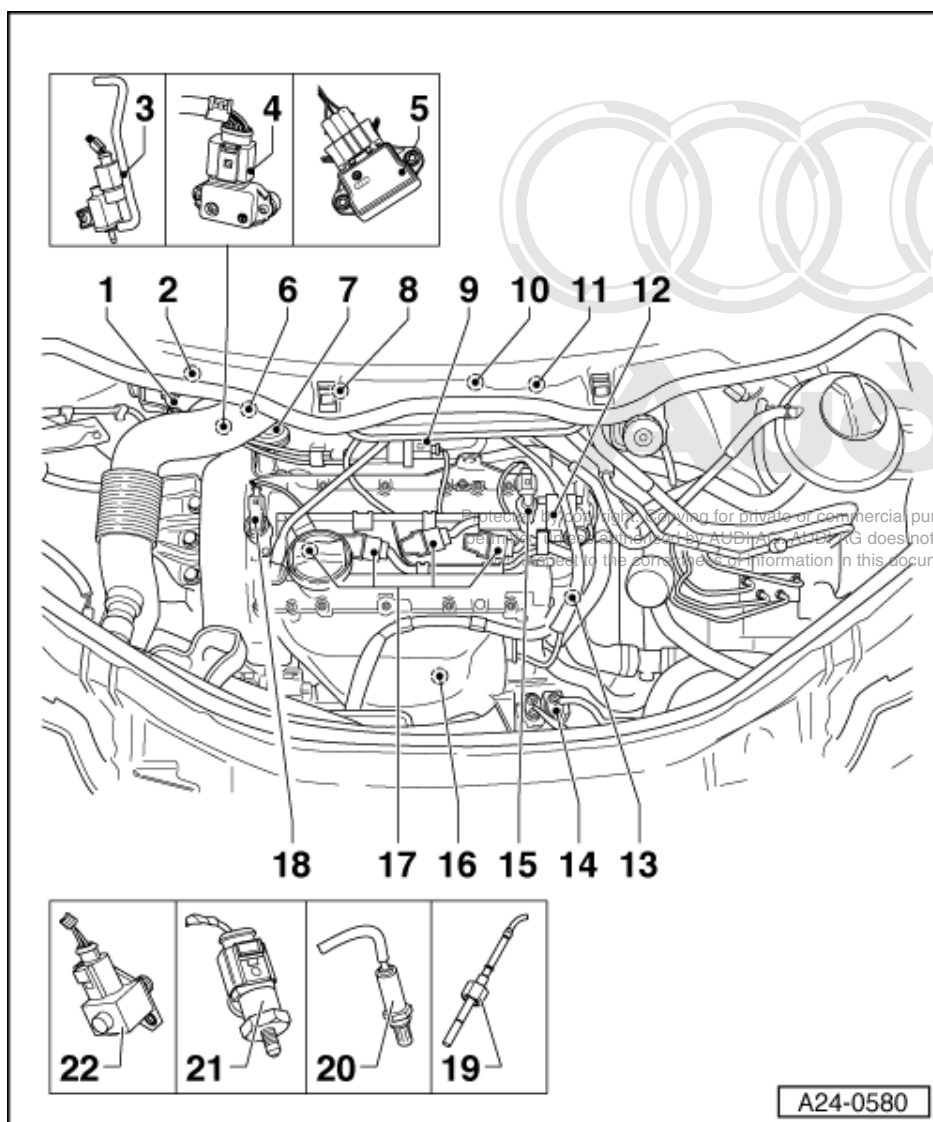
2 Fuel metering valve -N290

- ♦ Fitting location =>Fig. 7

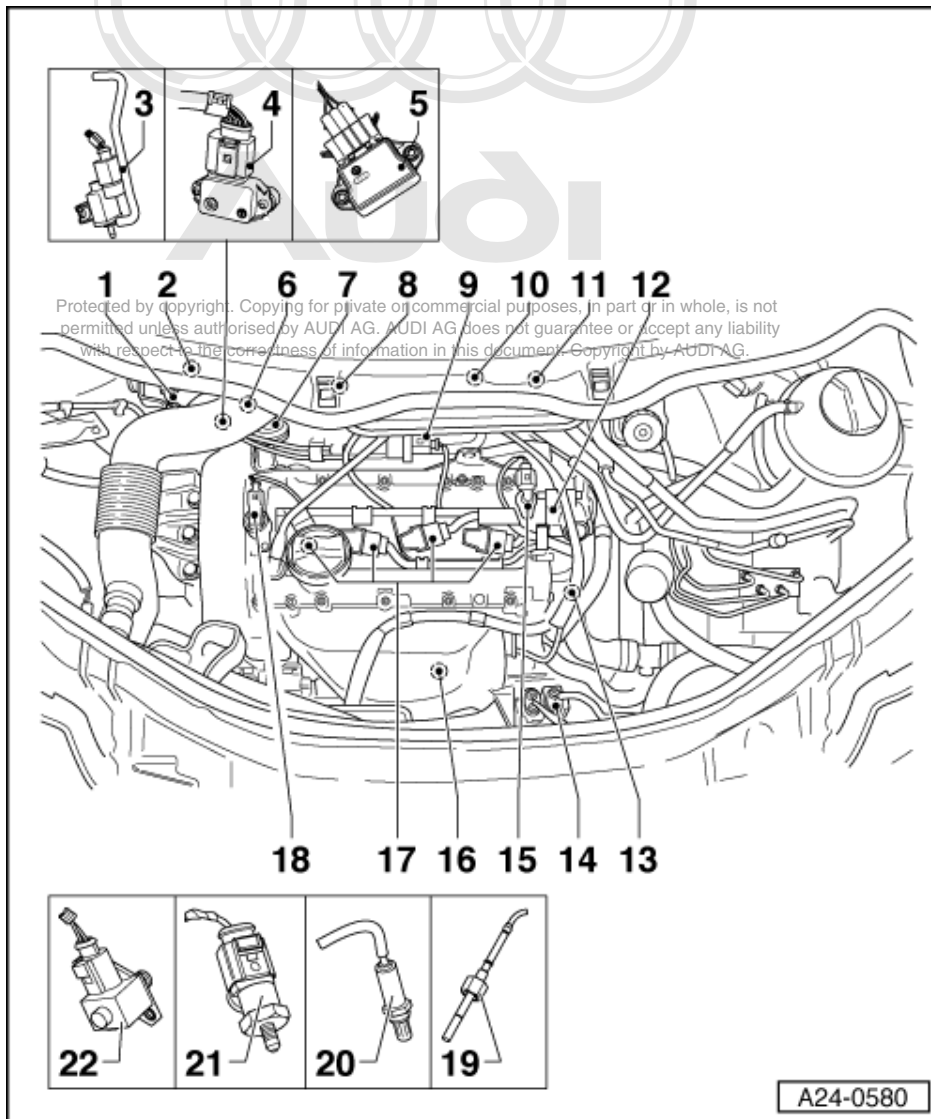
A24-0580



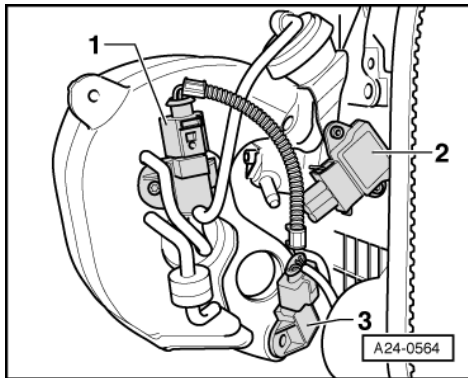
- 3 Intake manifold flap air flow control valve -N316**
 - ♦ Fitting location =>Fig. 7
- 4 Intake manifold pressure sender -G71**
 - ♦ Fitting location =>Fig. 7
- 5 Intake manifold flap potentiometer -G336**
 - ♦ Fitting location =>Fig. 7
- 6 Engine speed sender -G28**
- 7 Vacuum actuator**
- 8 Air-mass meter -G70 with intake-air temperature sender -G42**



- 9 Activated charcoal filter system solenoid valve 1 -N80
 10 Throttle valve control unit -J338
 11 Exhaust-gas recirculation valve -N18 with exhaust-gas recirculation potentiometer -G212
 12 High-pressure fuel pump
 13 Coolant temperature sender -G62
 14 Fan control unit
 15 Hall sender -G40
 16 Lambda probe -G39, -Z19
 ♦ Fitting location =>Fig. 8

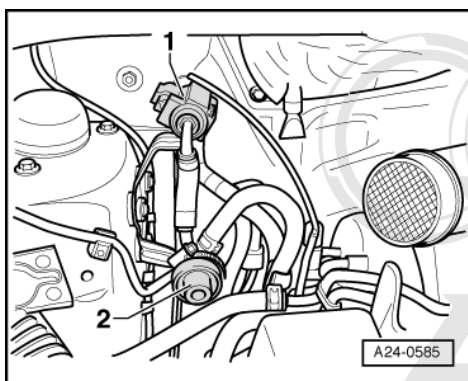


- 17 Ignition coils with output stages**
18 Camshaft adjustment valve 1 -N205
19 Exhaust-gas temperature sender 1 -G235
♦ Fitting location =>Fig. 8
20 NOx sender -G295
♦ Fitting location =>Fig. 8
21 Fuel-pressure sender -G247
♦ Fitting location =>Fig. 9
22 Fuel-pressure regulating valve -N276
♦ Fitting location =>Fig. 9



-> Fig.1

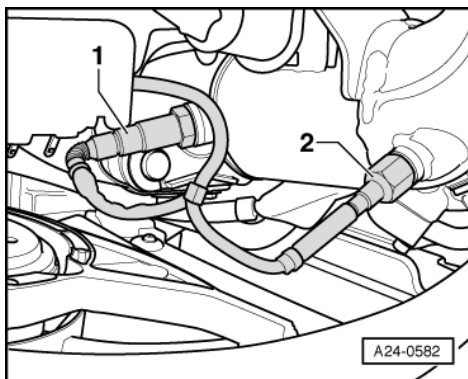
- 1- Intake manifold flap air flow control valve -N316
- 2- Intake manifold flap potentiometer -G336
- 3- Intake manifold pressure sender -G71



-> Fig.2

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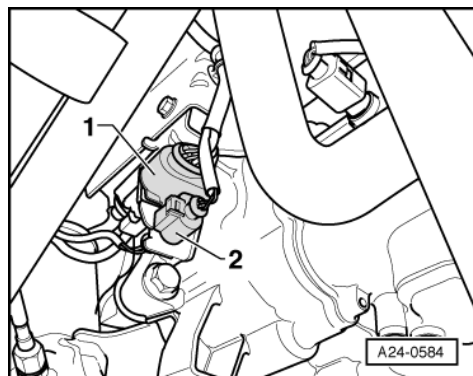
- 1- Fuel metering valve -N290
- 2- Fuel pressure regulator



-> Fig.3

1- Lambda probe -G39, -Z19

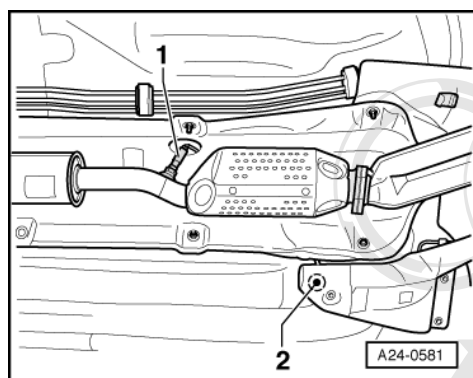
2- Exhaust-gas temperature sender 1 -G235



-> Fig.4

1- Connector coupling for lambda probe

2- Connector coupling for exhaust-gas temperature sender

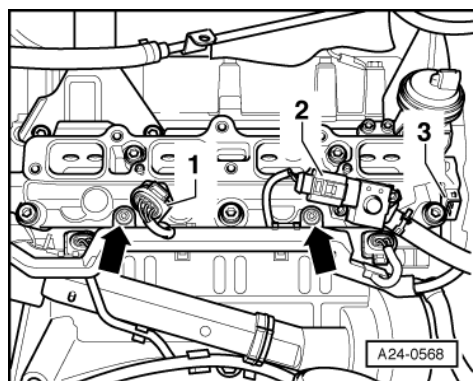


-> Fig.5

1- NOx sender -G295

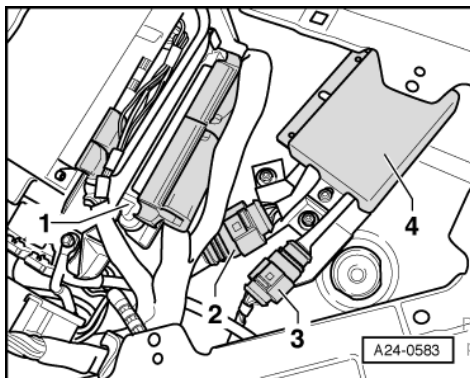
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2- Cable duct into passenger compartment



-> Fig.6 Lower part of intake manifold

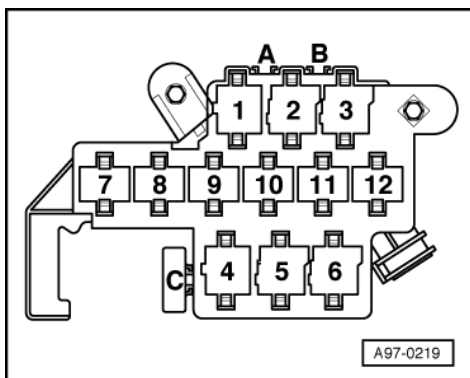
- 1- Fuel-pressure sender -G247
- 2- Fuel-pressure regulating valve -N276



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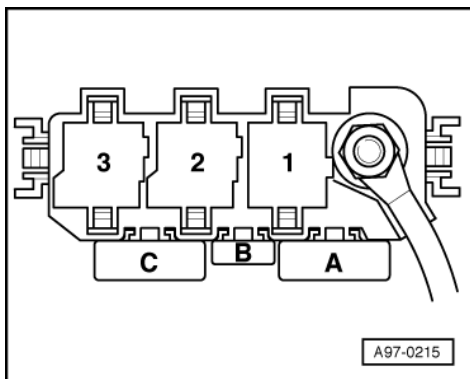
-> Fig.7

- 1- Motronic control unit -J220
- 2- From NOx sender -G295
- 3- To engine control unit
- 4- Control unit for NOx sender -G583



-> Fig.8 6+6-socket relay carrier (in left side footwell)

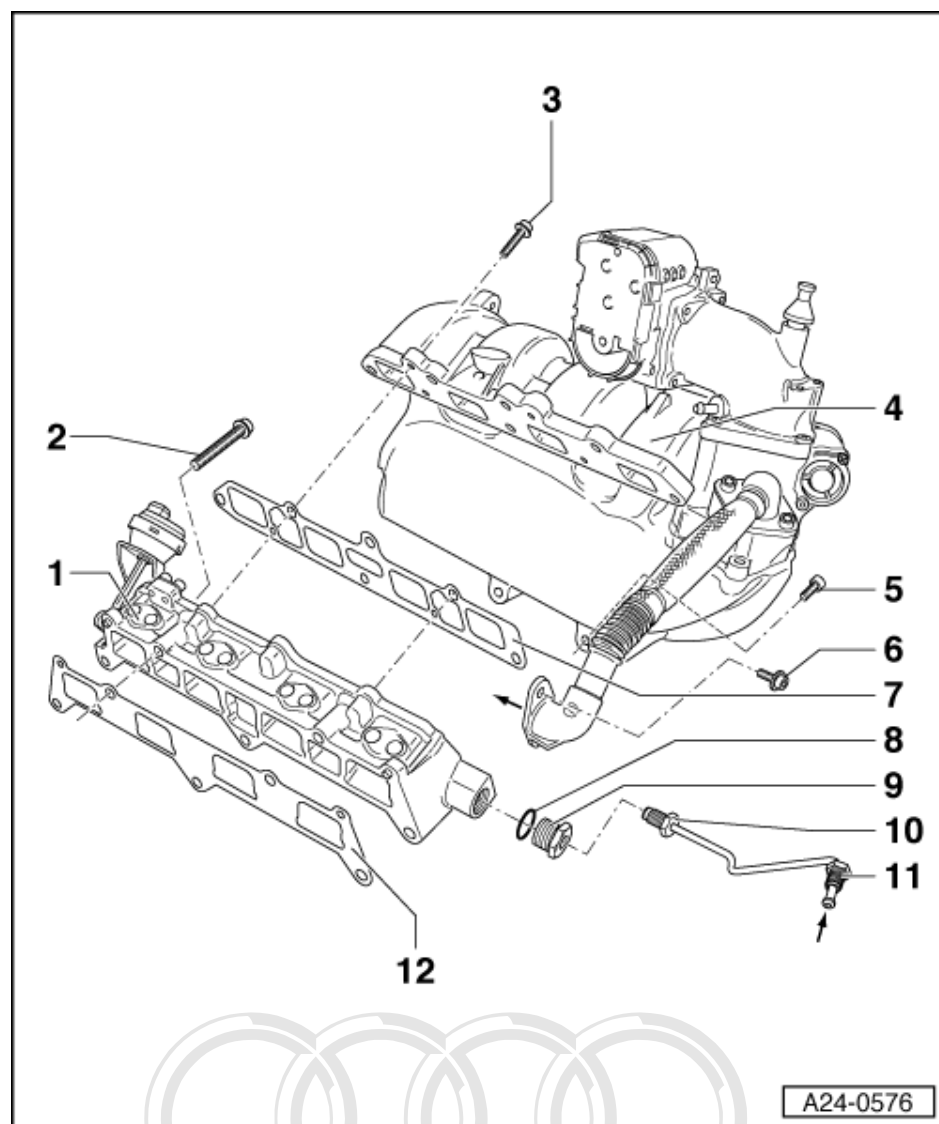
Relay position 5- Fuel pump relay -J17



-> Fig.9 3-socket relay carrier (in left side footwell)

Relay position 1- Motronic current supply relay -J271

1.6 - Removing and installing injection system components



1 Lower part of intake manifold

2 Bolt

- ♦ 20 Nm

3 Bolt

- ♦ 20 Nm

4 Intake manifold

- ♦ Removing and installing=>Page 31

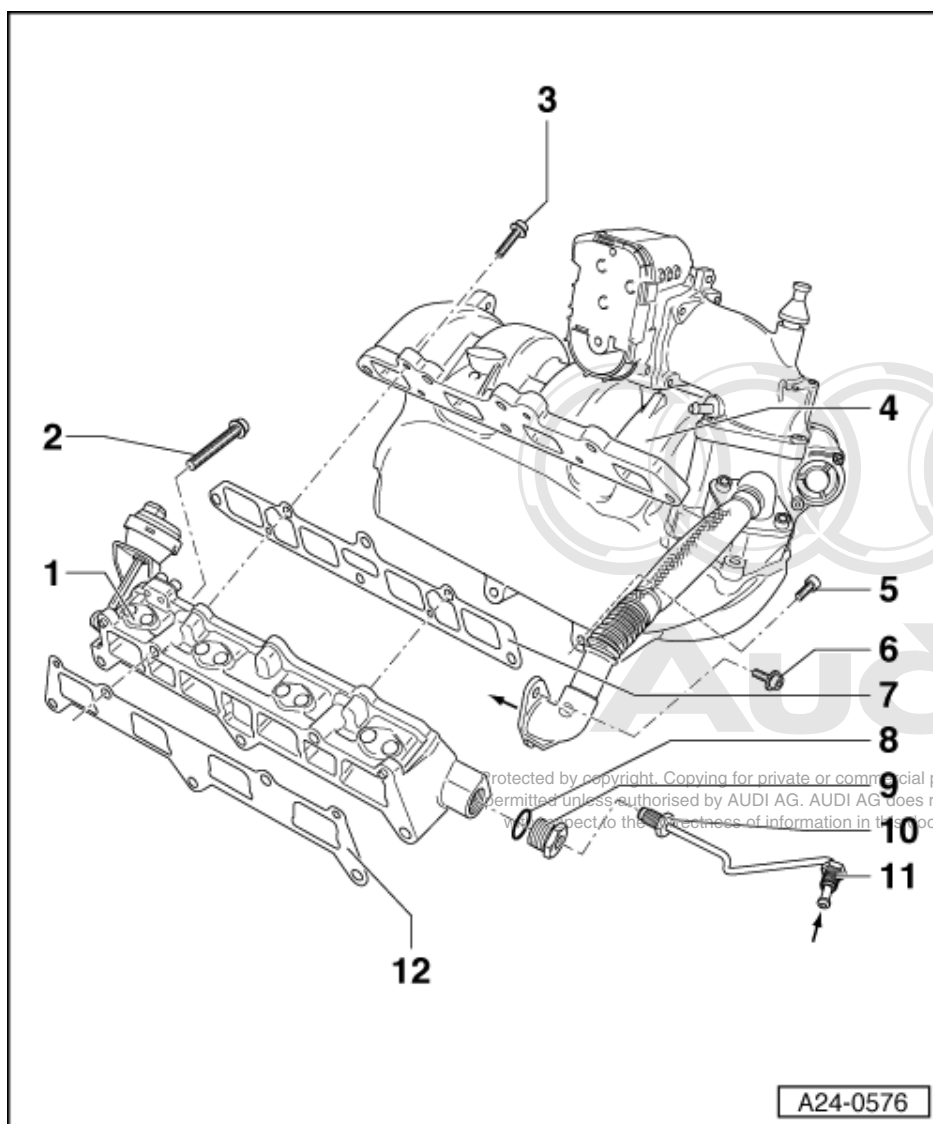
5 Bolt

- ♦ 20 Nm

6 Bolt

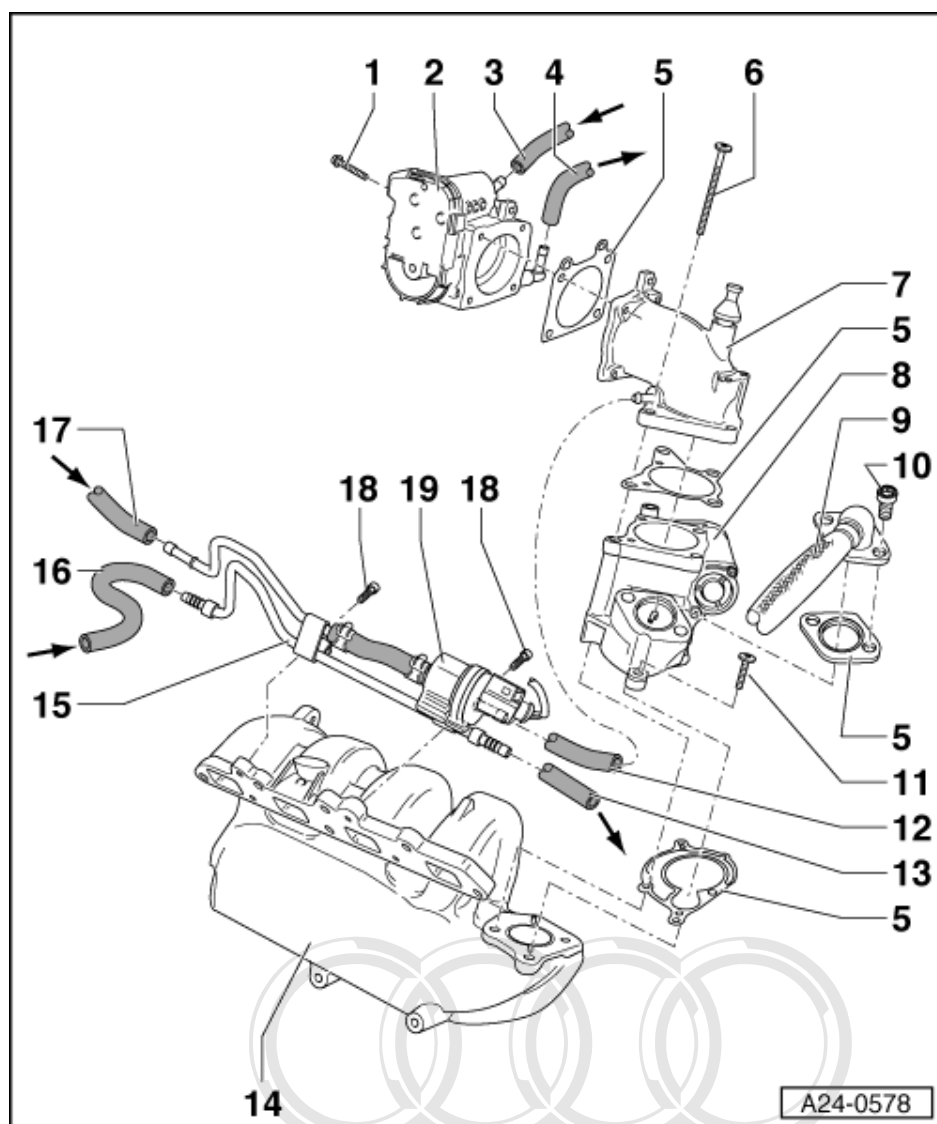
- ♦ 20 Nm

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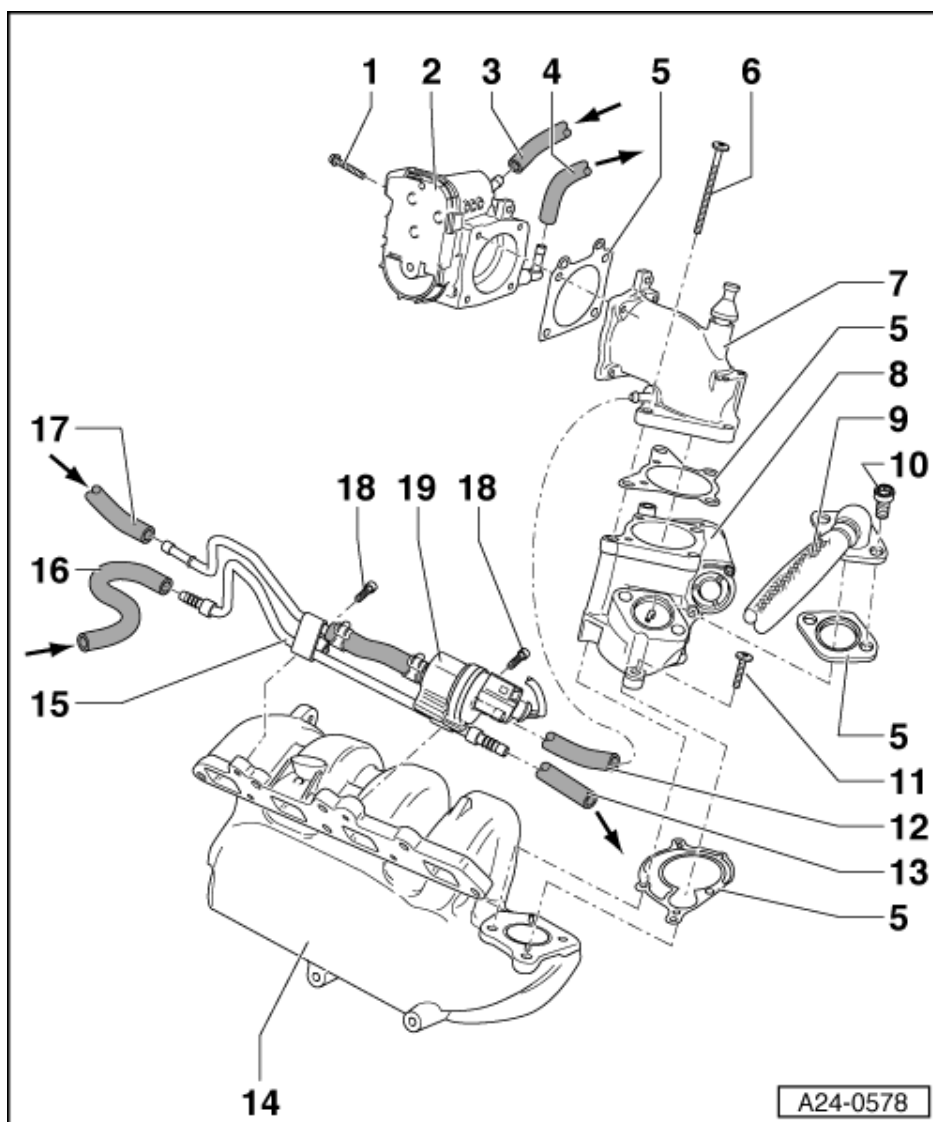


- 7 Gasket**
 - ♦ Replace
- 8 O-ring**
 - ♦ Replace if damaged
- 9 Bolt**
 - ♦ 20 Nm
- 10 High-pressure fuel line**
 - ♦ Connection to fuel rail pipe
- 11 High-pressure fuel line**
 - ♦ Connection to high-pressure fuel pump
- 12 Gasket**
 - ♦ Replace

1.7 - Dismantling and assembling intake manifold (Part 1)



- 1 Bolt
 - ◆ 10 Nm
- 2 Throttle valve control unit -J338
- 3 Coolant supply
- 4 Coolant return
- 5 Gasket
 - ◆ Replace
 - ◆ Pay attention to installation position
- 6 Bolt
 - ◆ 5 Nm
- 7 Intake manifold connection
 - ◆ Between throttle valve control unit and exhaust-gas recirculation valve



8 Exhaust-gas recirculation valve -N18 with exhaust-gas recirculation potentiometer -G212

- ♦ Adaption must be performed on replacement of exhaust-gas recirculation valve
- ♦ Vehicle diagnostic, testing and information system VAS 5051 must be used for this purpose.

9 Connecting pipe for exhaust-gas recirculation

10 Bolt

- ♦ 16 Nm

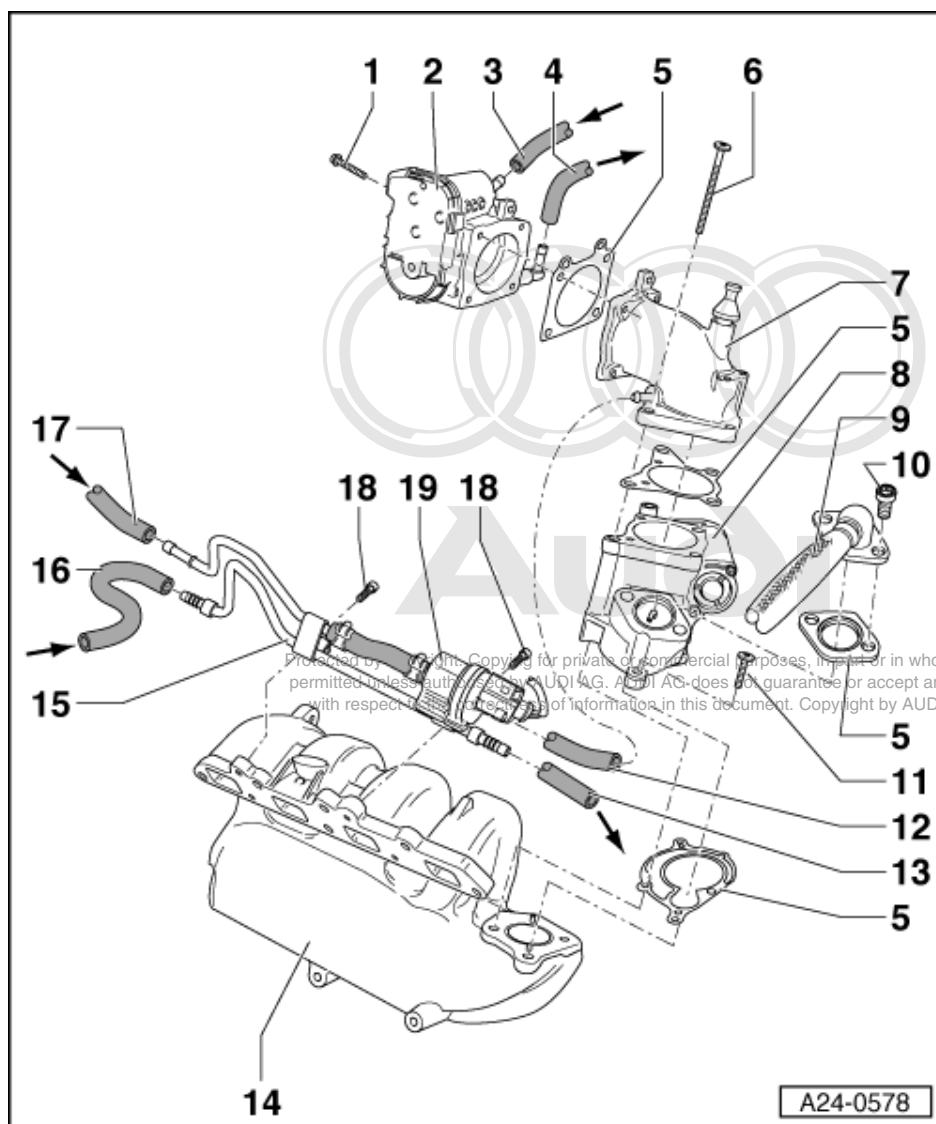
11 Bolt

- ♦ 10 Nm

12 Connecting hose

- ♦ To intake manifold connection

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13 Fuel line

- ♦ To high-pressure fuel pump

14 Intake manifold
15 Fuel pipe
16 Fuel line

- ♦ From T-piece

17 Breather hose

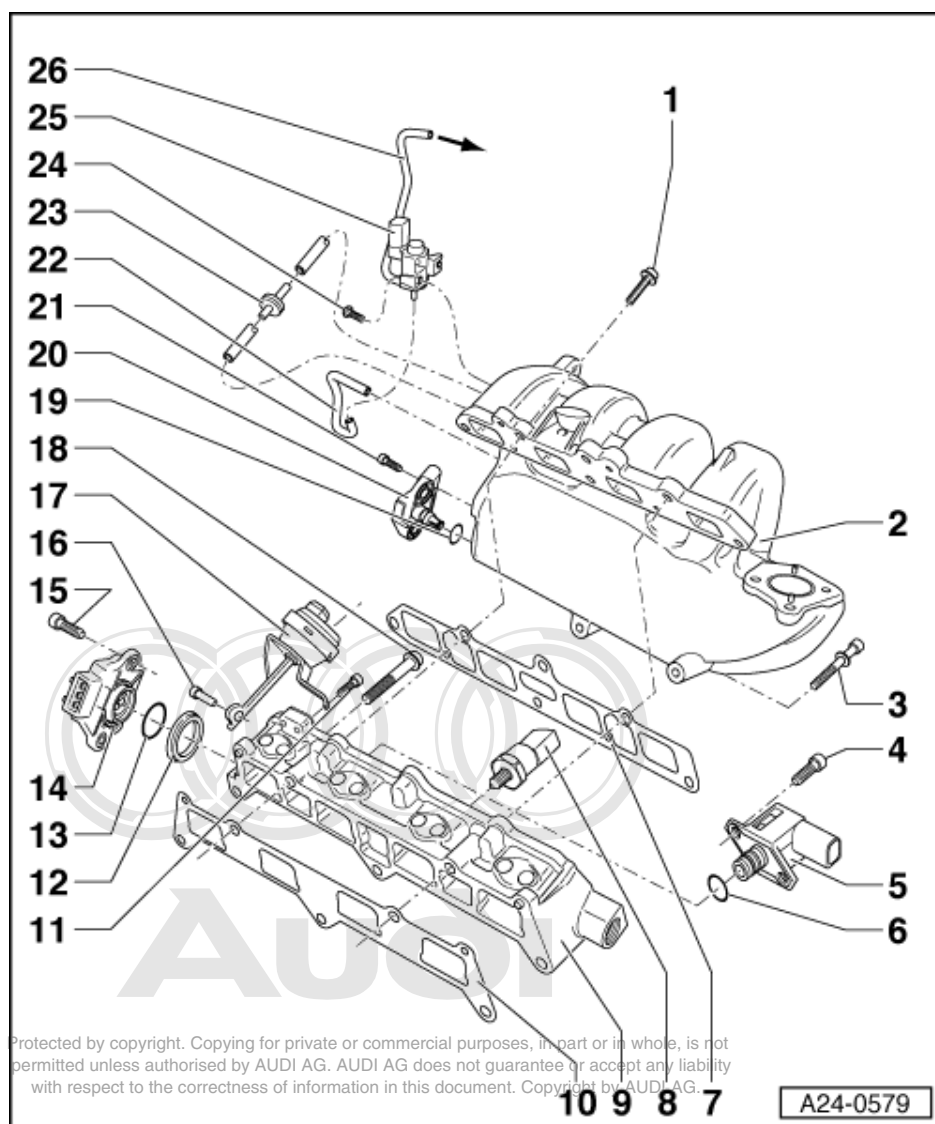
- ♦ From activated charcoal filter

18 Bolt

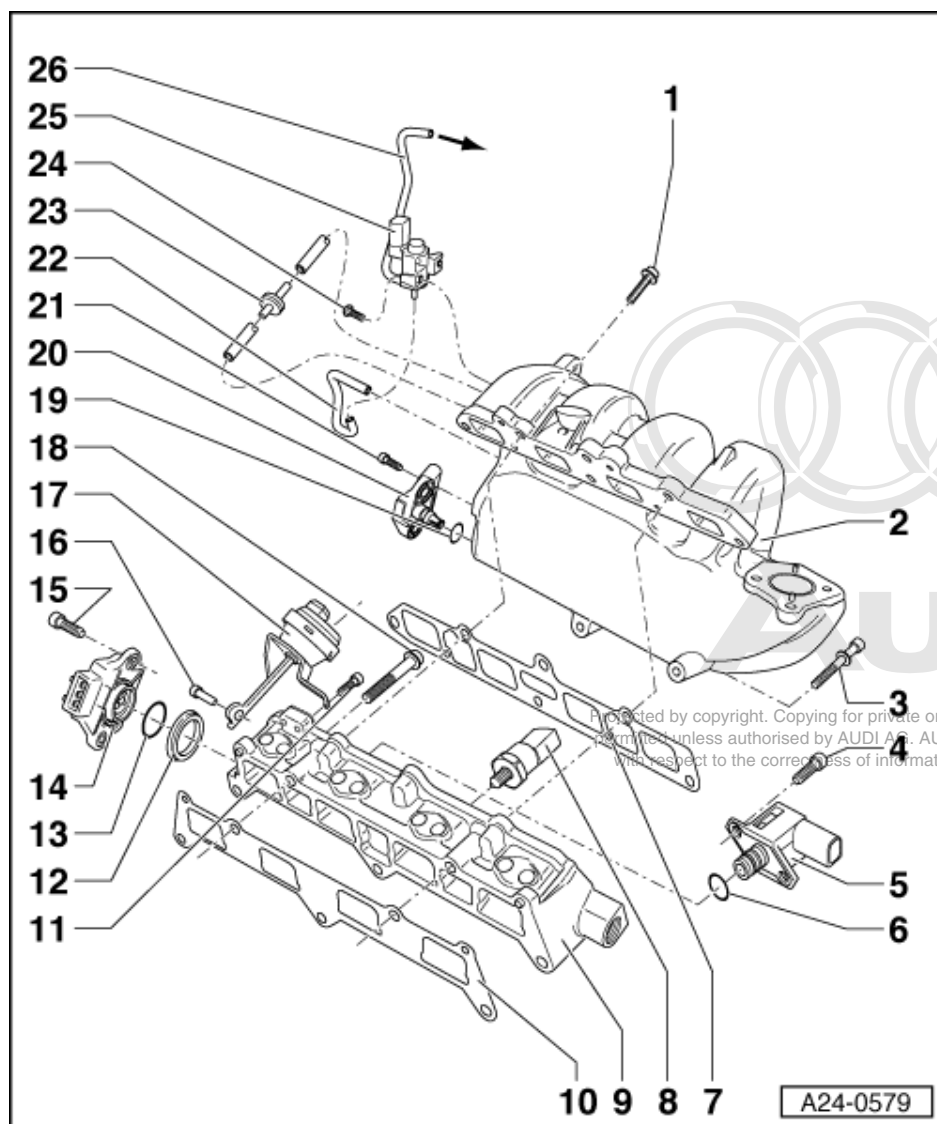
- ♦ 15 Nm

19 Activated charcoal filter system solenoid valve 1 -N80

1.8 - Dismantling and assembling intake manifold (Part 2)



- 1 Bolt
 - ♦ 20 Nm
- 2 Intake manifold
- 3 Bolt
 - ♦ 20 Nm
- 4 Bolt
 - ♦ 10 Nm
- 5 Fuel-pressure regulating valve -N276
 - ♦ Fitting location =>Fig. 9
- 6 O-ring
 - ♦ Replace if damaged



7 Gasket

- ◆ Replace
- ◆ Pay attention to installation position

8 Fuel-pressure sender -G247

- ◆ Fitting location =>Fig. 9

9 Lower part of intake manifold

10 Gasket

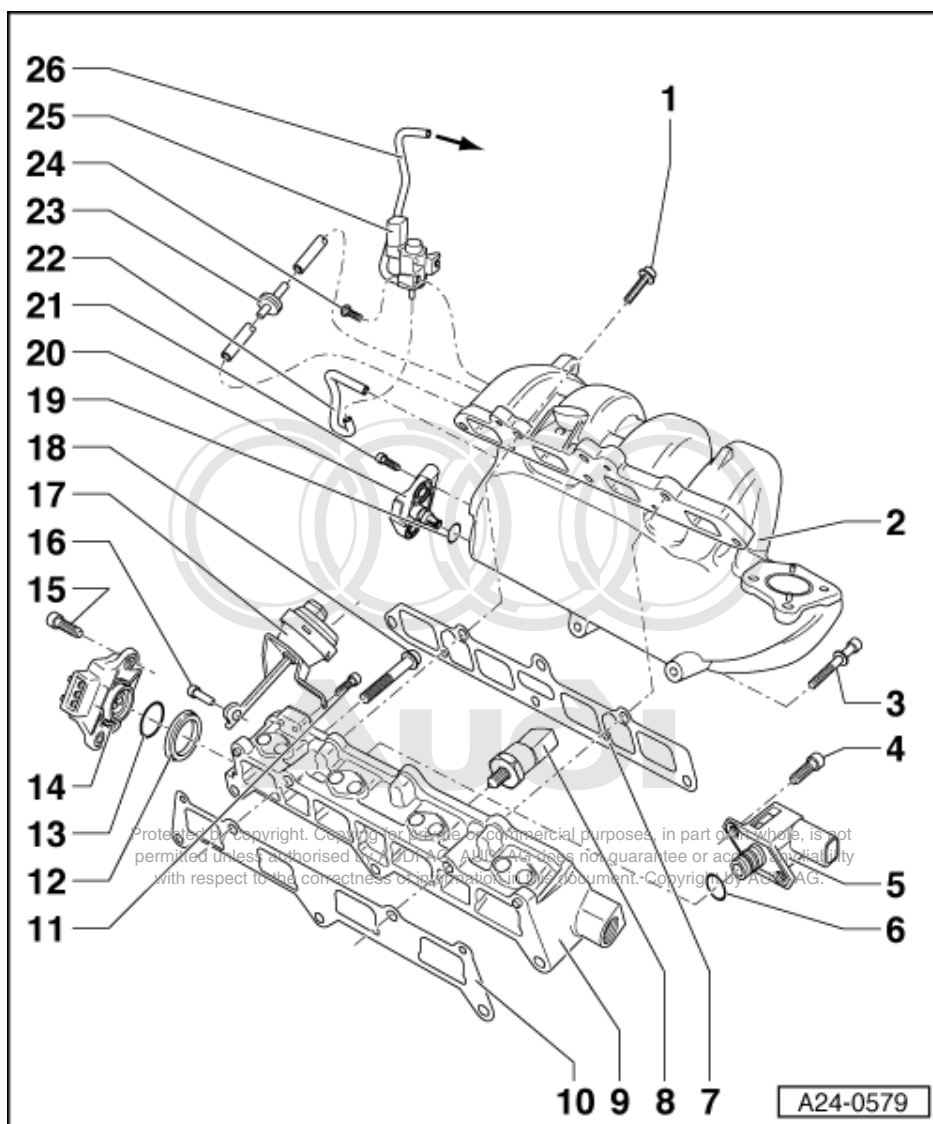
- ◆ Replace
- ◆ Pay attention to installation position

11 Bolt

- ◆ 10 Nm

12 Sealing ring

- ◆ Replace if damaged



13 O-ring

- ♦ Replace if damaged

14 Intake manifold flap potentiometer -G336

- ♦ Fitting location =>Fig. 7

15 Bolt

- ♦ 1.5 Nm

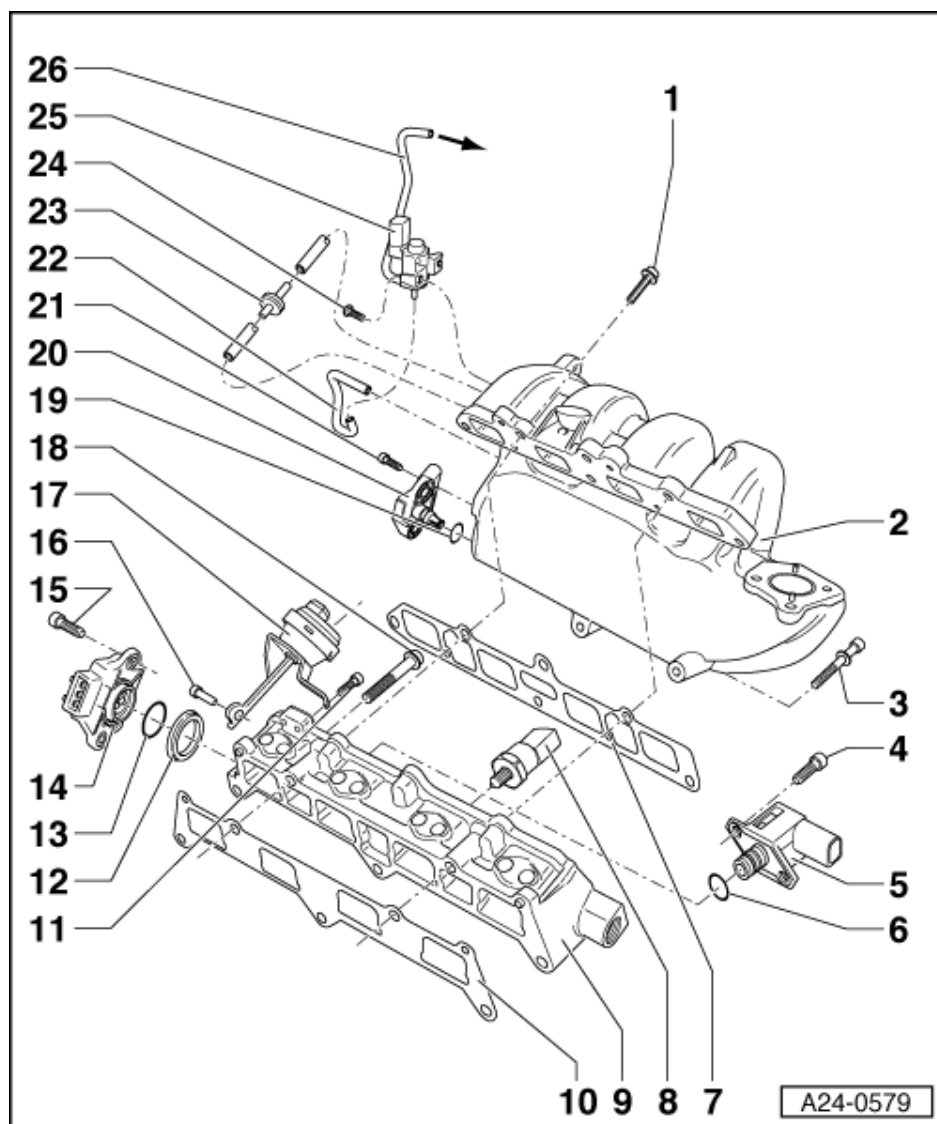
16 Plastic wedge

- ♦ Replace

17 Vacuum actuator

18 Bolt

- ♦ 20 Nm



19 O-ring

- ◆ Replace if damaged

**20 Intake manifold pressure sender
-G71**

- ◆ Fitting location =>Fig. 7

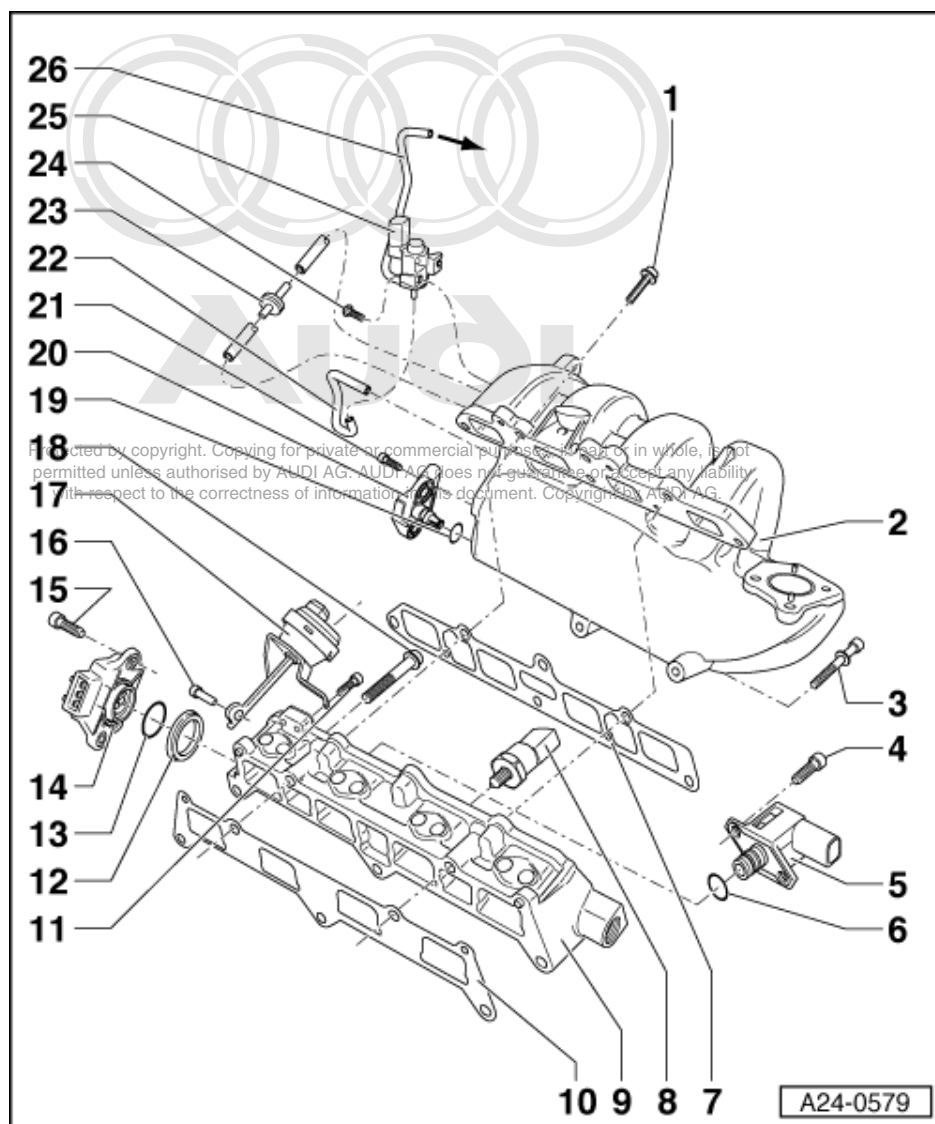
21 Bolt

- ◆ 4.5 Nm

22 Vacuum hose

- ◆ Between intake manifold flap air flow control valve and intake manifold

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23 Non-return valve

- ♦ Black side must face downwards

24 Bolt

- ♦ 3.5 Nm

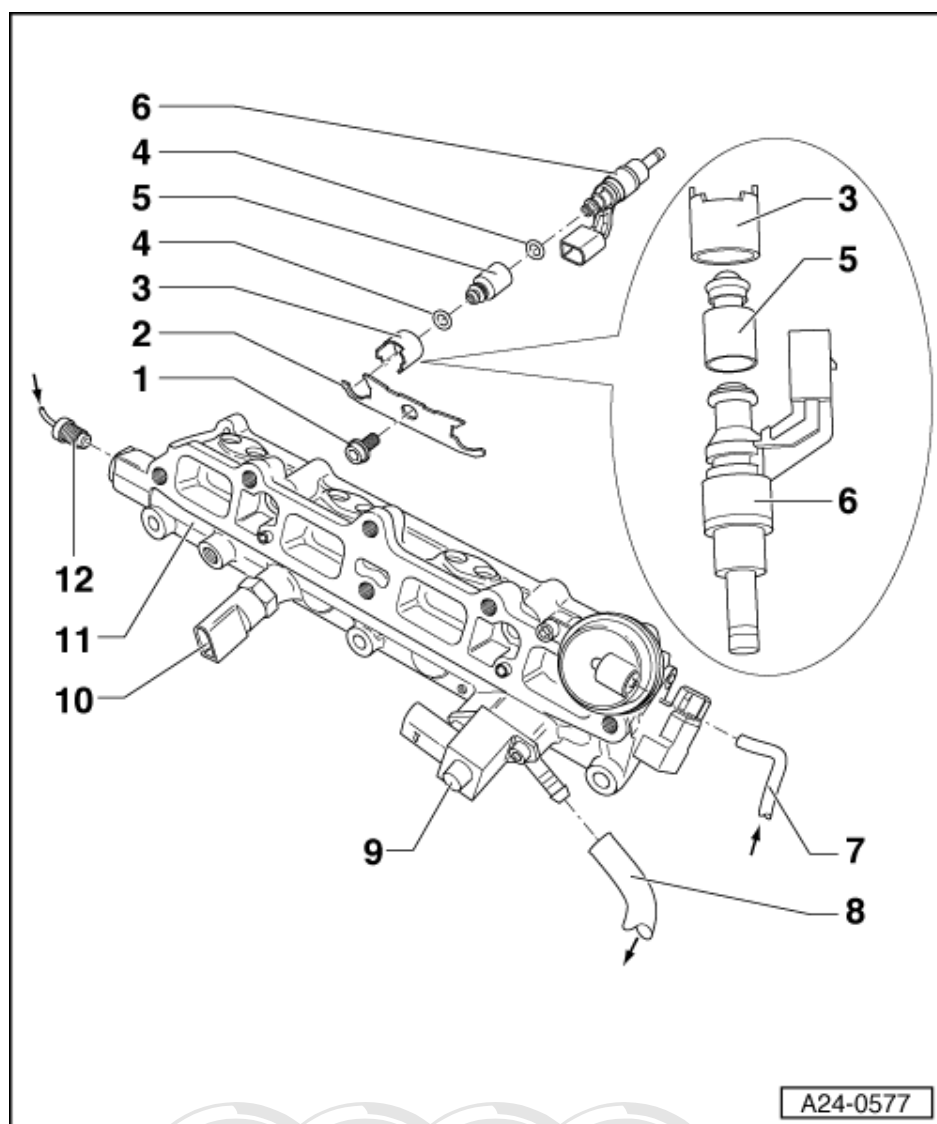
25 Intake manifold flap air flow control valve -N316

- ♦ Fitting location =>Fig. 7

26 Vacuum hose

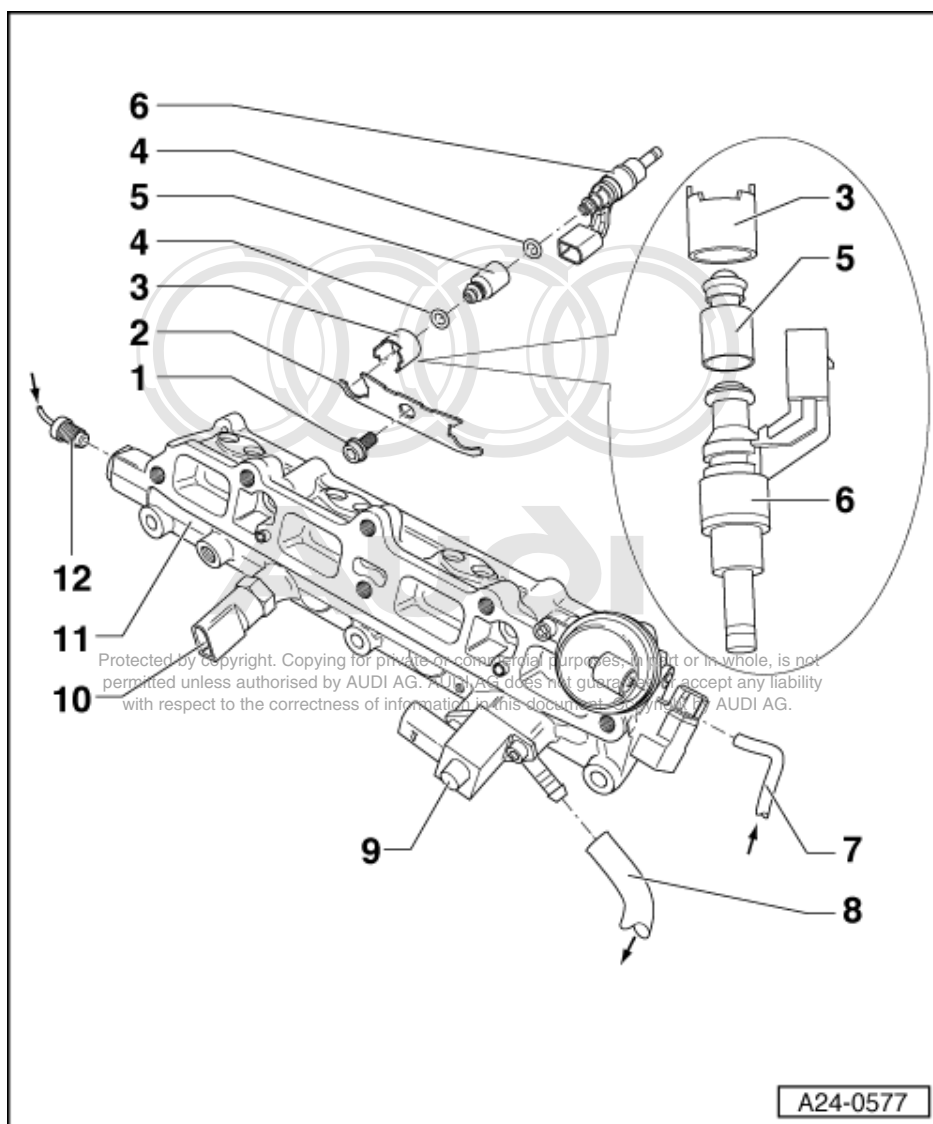
- ♦ Between intake manifold flap air flow control valve and vacuum actuator

1.9 - Fuel rail pipe with high-pressure injectors

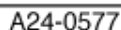


- 1 Bolt**
 - ◆ 20 Nm
- 2 Injector holder**
 - ◆ Pay attention to installation position
 - ◆ Replace if damaged
- 3 Support piece**
 - ◆ Make sure that it is correctly fitted to injector and injector holder
- 4 O-ring**
 - ◆ Replace
 - ◆ Apply thin coating of clean engine oil prior to installation

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- 5 Spacer sleeve
- 6 High-pressure injector -N30...-N33
- 7 Vacuum hose
 - ◆ Between vacuum unit and intake manifold flap air flow control valve -N316
- 8 Fuel return line
 - ◆ Blue marking
 - ◆ Secure with spring clip
 - ◆ Ensure firm attachment
- 9 Fuel-pressure regulating valve -N276
 - ◆ Fitting location =>Fig. 9



- ◆ Fitting location => Fig. 9

- ♦ Adaption of intake manifold

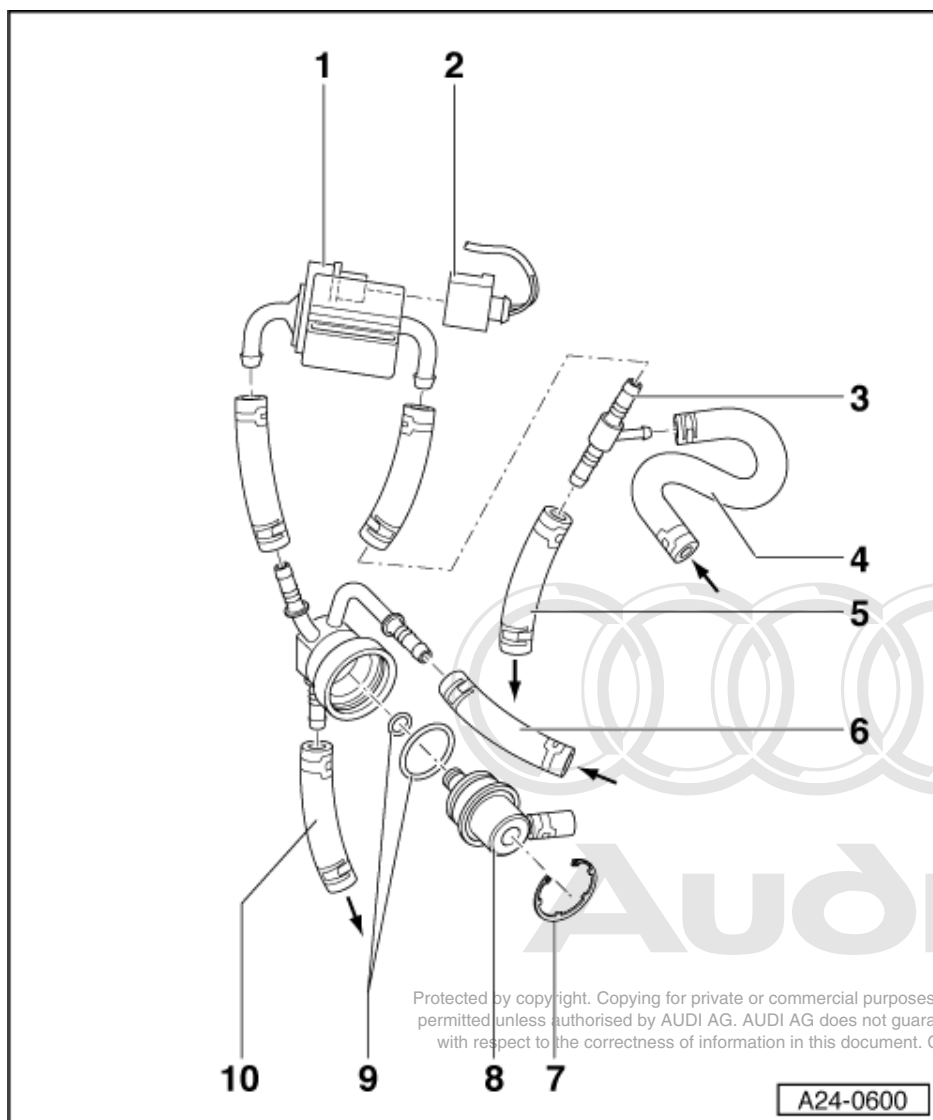
- ◆ Adaption of intake manifold flaps must be performed on replacement of lower part of intake manifold (Self-diagnosis, Basic setting, Measured value block 142)
- ◆ Vehicle diagnostic, testing and information system VAS 5051 must be used for this purpose.

- Between fuel rail pipe and high-pressure fuel pump

- ◆ Between fuel rail pipe and high-pressure fuel pump

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1.10 - Removing and installing fuel pressure regulator and fuel metering valve



1 Fuel metering valve -N290

2 Connector

- ♦ Black, 2-pin

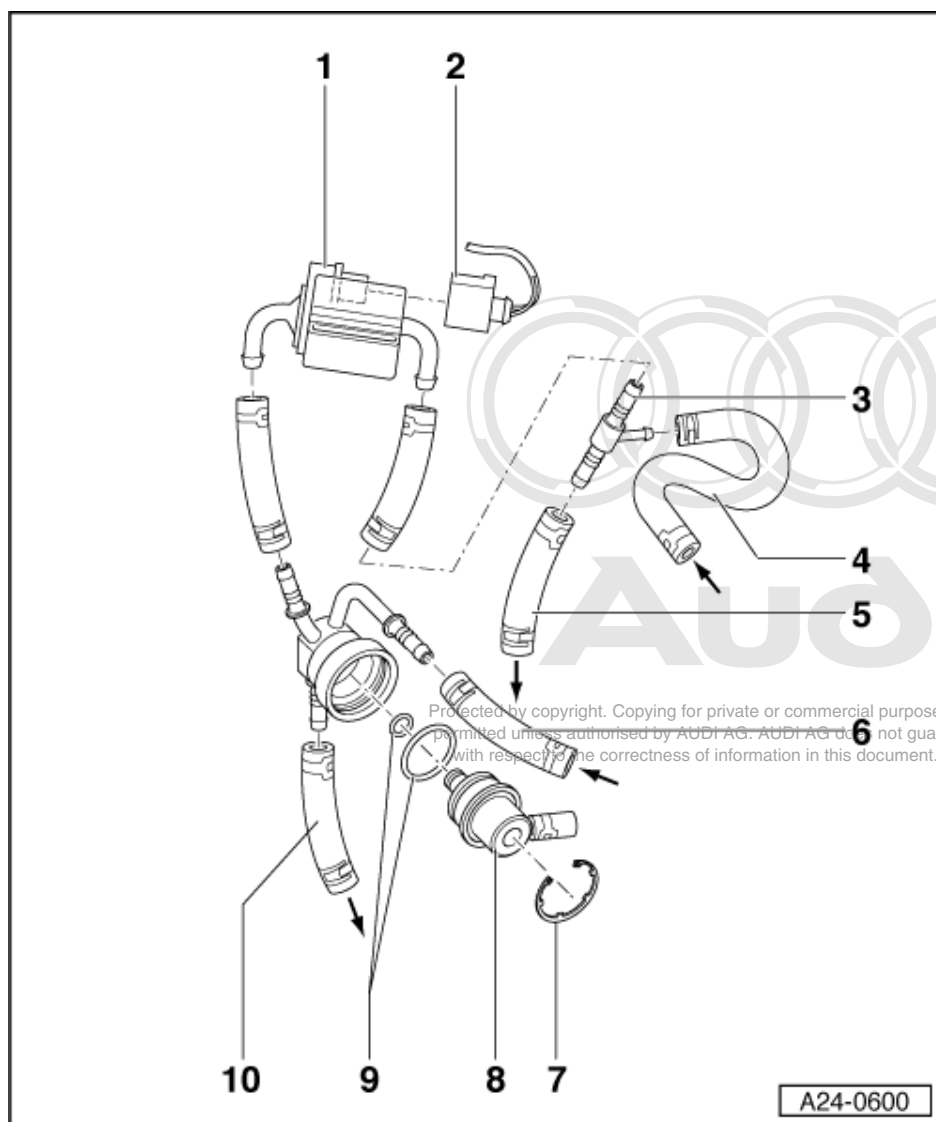
3 T-piece

4 Fuel supply line

- ♦ From fuel tank
- ♦ Secure with spring clips
- ♦ Ensure firm attachment

5 Fuel supply line

- ♦ To metal fuel line
- ♦ Secure with spring clips
- ♦ Ensure firm attachment



6 Fuel return line

- ◆ From fuel-pressure regulating valve -N276
- ◆ Secure with spring clips
- ◆ Ensure firm attachment
- ◆ Blue marking

7 Circlip

8 Fuel pressure regulator

9 O-ring

- ◆ Replace if damaged

10 Fuel return line

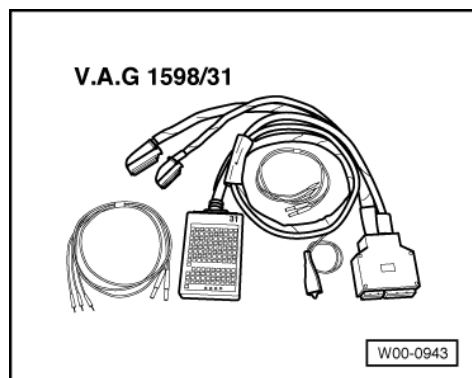
- ◆ To fuel tank
- ◆ Blue marking
- ◆ Secure with spring clips
- ◆ Ensure firm attachment

1.11 - Wiring and component check using test box V.A.G 1598/31

Notes:

- ◆ Use portable multimeter V.A.G 1526 or multimeter V.A.G 1715 and diode test lamp V.A.G 1527 for testing.
- ◆ Always use auxiliary leads from adapter set V.A.G 1594 for connection of testers to test box V.A.G 1598/31.

- ♦ Unplugging connectors from engine control unit erases learned values, however content of fault memory is retained.
- ♦ The test box V.A.G 1598/31 is designed for simultaneous connection to the engine control unit wiring harness and the actual engine control unit.
- ♦ This has the advantage that the electronic engine management system remains fully operational with the test box connected (e.g. measurement of signals with engine running).
- ♦ Whether or not the engine control unit is additionally to be connected to the test box is indicated in the appropriate test sequences.



Attention:

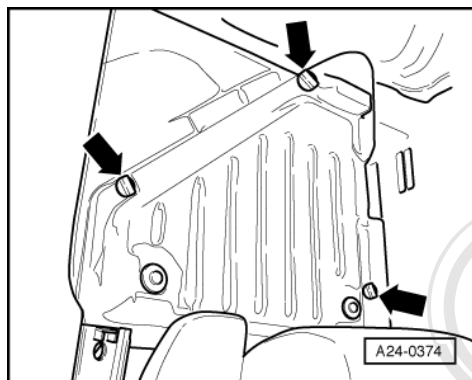
So as not to destroy electronic components, select required measuring range before connecting test leads and observe test conditions.

Special tools and workshop equipment required

- ♦ V.A.G 1598/31

Connecting test box V.A.G 1598/31

Important: Switch off ignition.

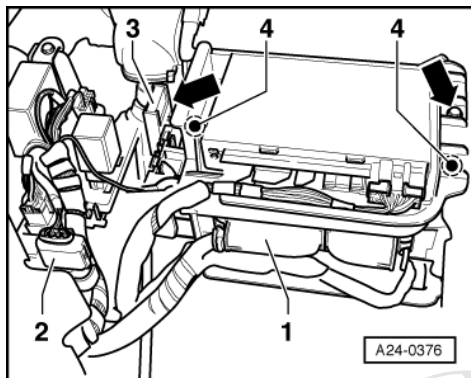


- Lift up floor mat in left side footwell.

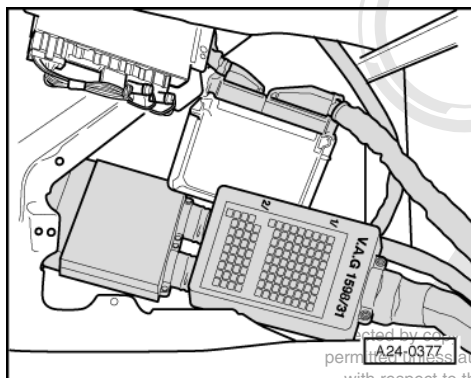
=> General Body Repairs; Repair Group 70; Removing and installing floor mats Removing and installing floor mats

- -> Slacken bolts -arrow- on cover.
- Detach cover.

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- -> Unlock connectors from engine control unit -1- and detach it.



- -> Connect test box V.A.G 1598/31 to wiring harness connector. Earth clip must be connected to earth.
- Perform testing as described in appropriate repair operations.

Vehicle diagnostic, testing and information system VAS 5051 must be used for this purpose.

After reconnecting the engine control unit carry out the following steps:

- Interrogate and if necessary erase fault memory.

1.12 - Replacing Motronic control unit -J220

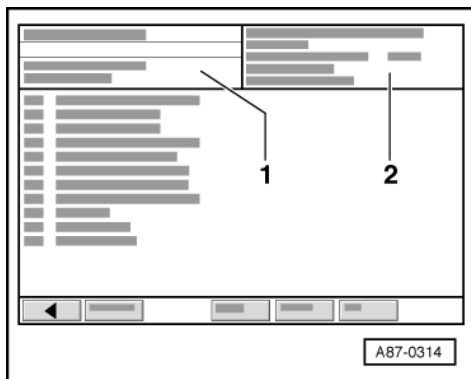
Note:

Unplugging connectors from engine control unit erases learned values, however content of fault memory is retained.

Special tools and workshop equipment required

- ♦ VAS 5051 with VAS 5051/1

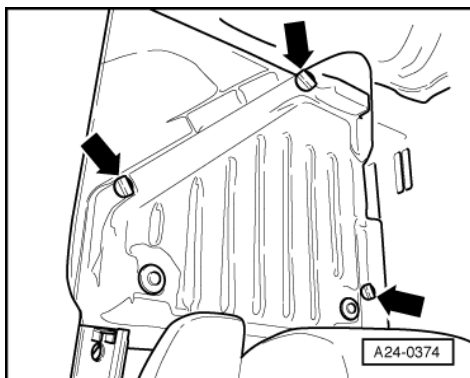
Removing engine control unit



- Connect up vehicle diagnostic, testing and information system VAS 5051 and select vehicle system "01 - Engine electronics" from list. Ignition must be on.

-> Control unit identification and code -2- appear on display of vehicle diagnostic, testing and information system VAS 5051.

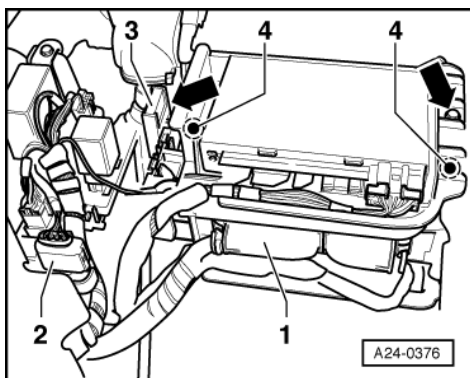
- Always start by displaying control unit identification and printing it out.
- Switch off ignition.
- Lift up floor mat in left side footwell.



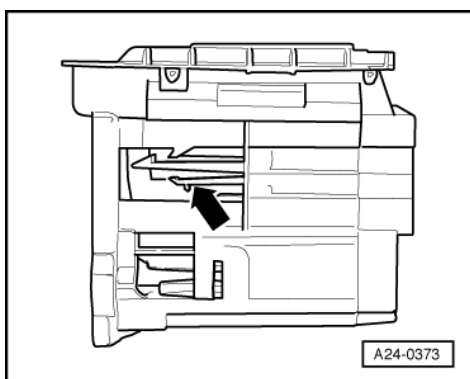
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=> General Body Repairs, Interior; Repair Group 70; Removing and installing floor mats Removing and installing floor mats

- -> Slacken bolts -arrow- on cover.
- Detach cover.



- Remove fuse box -3-
- -> Unscrew bolts -arrow- and carefully withdraw control unit holder.
- Carefully withdraw engine control unit -1-, pressing retainers -4- in direction of arrow -see next illustration-.



- -> Engine control unit retainers



- Unlock connectors from engine control unit and detach them.

Installing engine control unit

Install in reverse order, paying attention to the following:

The following steps must be performed after connecting new engine control unit:

- Activate engine control unit in "Assisted fault-finding" under diagnosis item "Replacing engine control unit".

Vehicle diagnostic, testing and information system VAS 5051 must be used for this purpose.

1.13 - Important - Procedure to be followed prior to opening high-pressure injection system

The injection system consists of a high-pressure part (maximum 110 bar approx.) and a low-pressure part (approx. 3 bar).

Prior to opening the high-pressure part - e.g. when removing the high-pressure pump, fuel rail, injectors, intake manifold flap air flow control valve or any other component, or a fuel line located in the high-pressure zone of the injection system - the fuel pressure in the high-pressure part must be reduced to a residual pressure of approx. 6 bar. The appropriate procedure is described below.

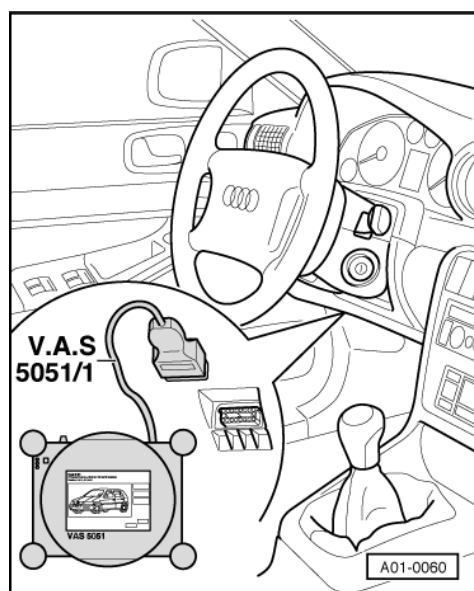
Locate the fuse for the electric fuel pump using the current flow diagram.

=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

- Unplug connector from activated charcoal filter system solenoid valve 1 -N80 (ACF valve); see Exploded view of fitting locations => Page 2 .
- Start engine and let it idle.

Note:

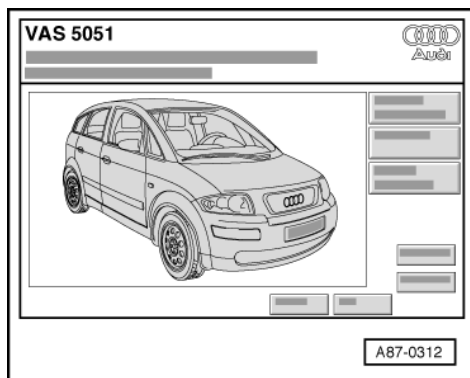
The engine control unit is selected below using the V.A.S 5051 and the display group 140 then selected under the function "Read measured value block".



- -> Use diagnostic wire VAS 5051/1 to connect up vehicle diagnostic, testing and information system VAS 5051.



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-> Readout on VAS 5051:

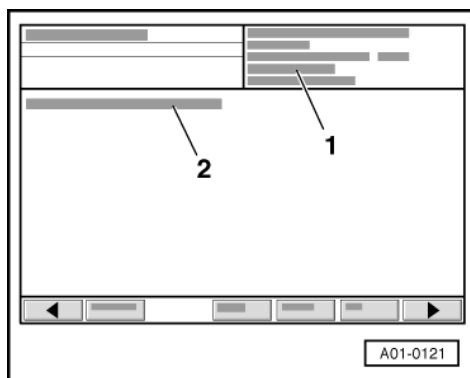
- Touch "Vehicle self-diagnosis" key.



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-> Readout on VAS 5051:

- From list -1- select vehicle system "01 - Engine electronics".
- Wait until next readout appears.



-> Readout on VAS 5051:

- 1 - Engine control unit identification.

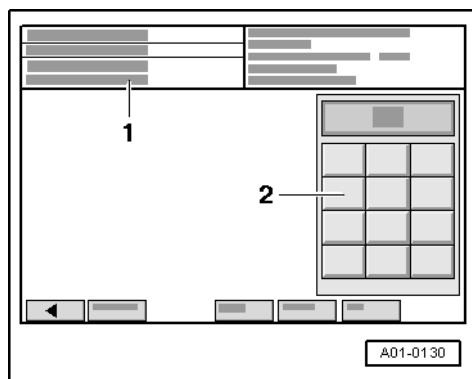


- Touch ▶ key.

-> Readout on VAS 5051:

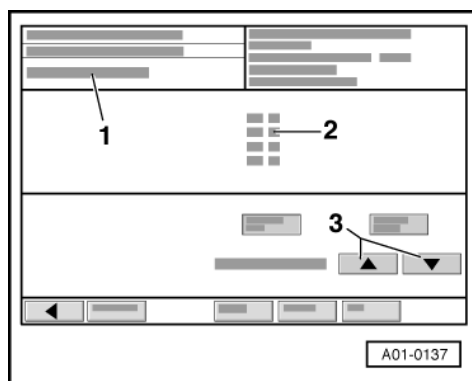
1 - List of diagnosis functions:

- From list -1- select diagnostic function "08 - Read measured value block".



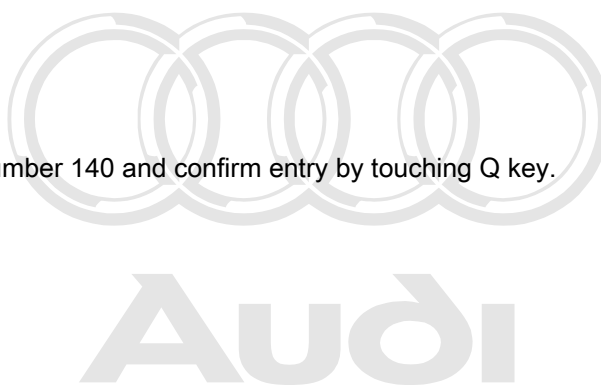
-> Readout on VAS 5051:

- Use keypad -2- to enter display group number 140 and confirm entry by touching Q key.



-> Readout on VAS 5051:

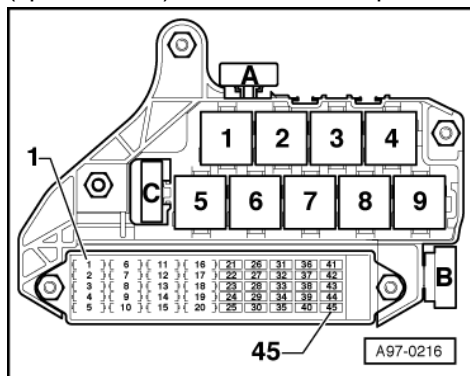
1 - Display group X
2 - Display zone 1
Display zone 2
Display zone 3



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Display zone 4

Watch the readout in display zone 3. When the engine is idling, a value from 60 to 70 bar is shown in display zone 3. The readout shows the current pressure (actual pressure) in the fuel rail which is being generated by the high-pressure pump. In display zone 2, the predefined pressure is displayed by the engine control unit (specification). The values for specification and actual value should be identical.



- -> Now remove fuse for electric fuel pump and continue to watch readout in display zone 3. Allow engine to continue idling.

Note:

The readout must not fall below 5 bar, otherwise the engine will stall (this could damage the catalytic converter).

The readout in display zone 3 decreases (process takes between 2 and 3 minutes) because the mechanical high-pressure pump is no longer being supplied with fuel from the fuel tank by the electric fuel pump.

- Switch off ignition when readout reaches approx. 6 bar.

The fuel rail is still full of fuel; the fuel is, however, no longer under high pressure.

Components or lines can now be opened. A clean cloth must be wrapped around the joints. Any discharged fuel must be collected.

- Interrogate and, if necessary, erase fault memory of engine control unit on completion of repair work.
- If fault memory has been erased, you must generate readiness code again.

1.14 - Removing and installing intake manifold

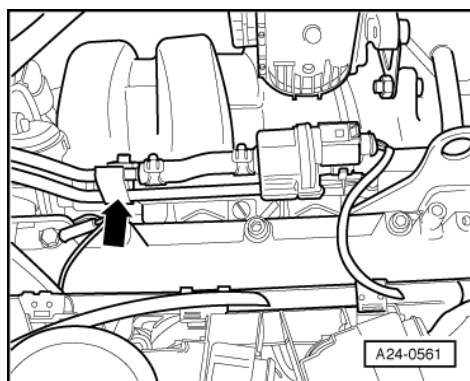
Attention:

Fuel system operates under high pressure. Always reduce fuel pressure prior to opening fuel system. Procedure, see => Page 28

- Remove fresh-air intake duct.

=> Heater and Air Conditioner; Repair Group 80; Checking, removing and installing fresh-air intake duct (in engine compartment) Checking, removing and installing fresh-air intake duct (in engine compartment)

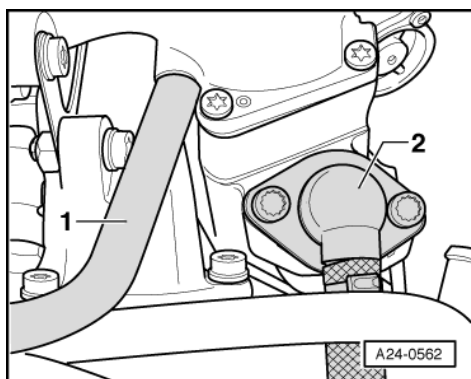
- Remove air duct between air cleaner and air-mass meter using special tool V.A.G 1921 (hose-clamp pliers).



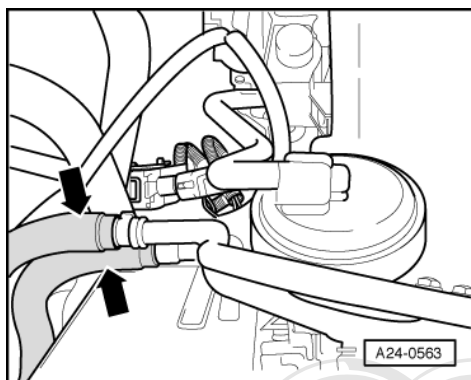
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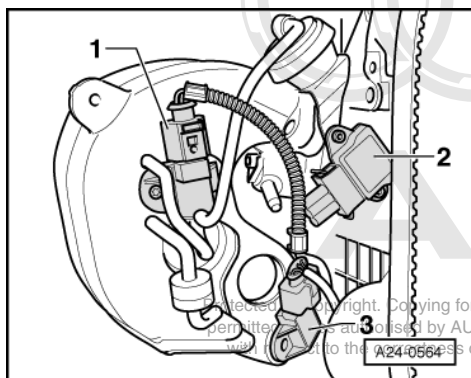
- Unplug connectors from throttle valve control unit, air-mass meter, potentiometer for exhaust-gas recirculation valve and activated charcoal filter system solenoid valve 1.
- -> Unscrew and remove the two bolts on fuel lines -arrow- together with activated charcoal filter system solenoid valve 1 from intake manifold.



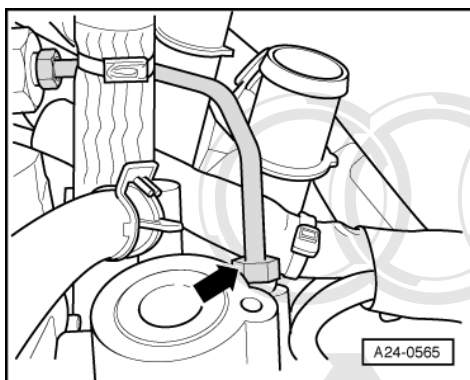
- -> Disconnect hose from intake connection -1-.
- Unbolt exhaust-gas recirculation hose -2-.



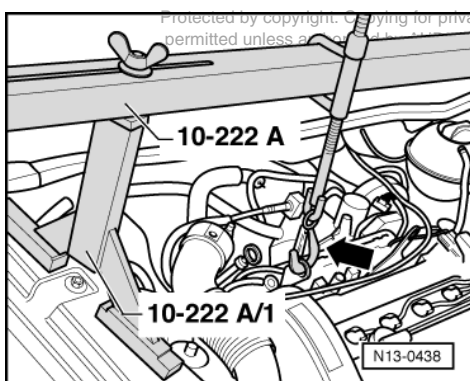
- -> Disconnect the two hoses -arrows- from fuel lines.
- Disconnect hose from vacuum actuator.



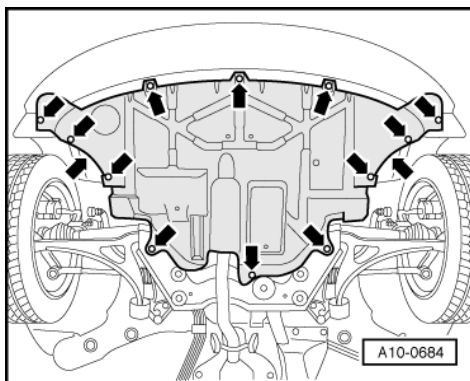
- -> Unplug connector from intake manifold flap air flow control valve -1-, intake manifold flap potentiometer -2- and from intake manifold pressure sender -3-.



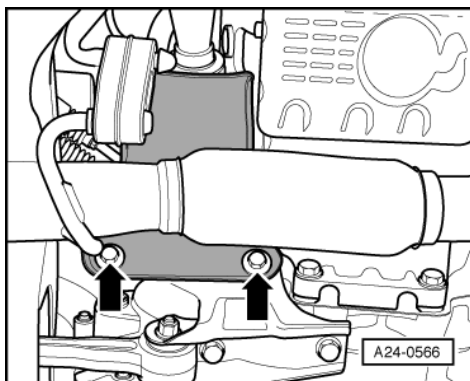
- -> Unbolt high-pressure fuel line from high-pressure fuel pump -arrow- and from fuel rail pipe (lower part of intake manifold).
- Unscrew all hexagon socket bolts from intake manifold.



- -> Attach support bar 10-222 A using adapters 10-222 A/1.

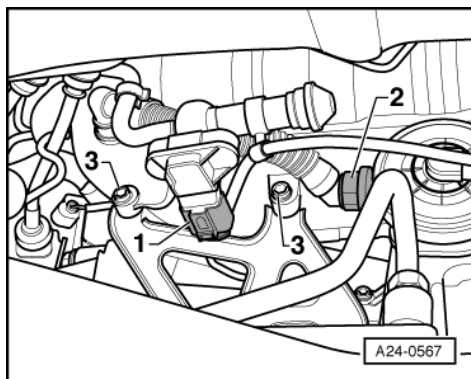


- -> Remove noise insulation -arrows-.



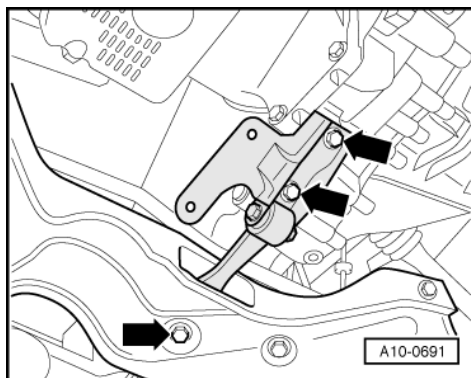


- -> Unbolt heat shield -arrows-.

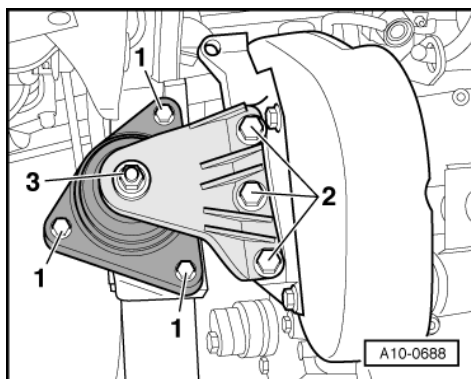


- -> Unplug connector from brake servo pressure sensor -1-.
- Disconnect hose from crankcase heater -2-.
- Unscrew the two bolts -3-.

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- -> Unscrew pendulum support -arrows-.



- -> Unscrew the three bolts -2- from engine mount.

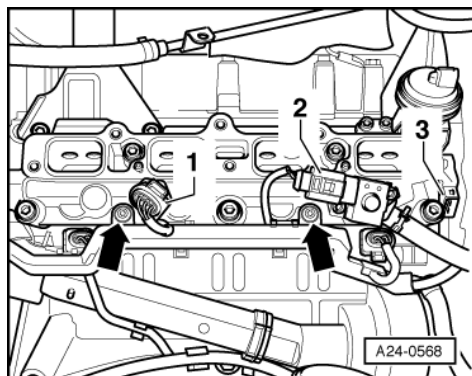
Note:

The central bolt -3- must not be slackened.

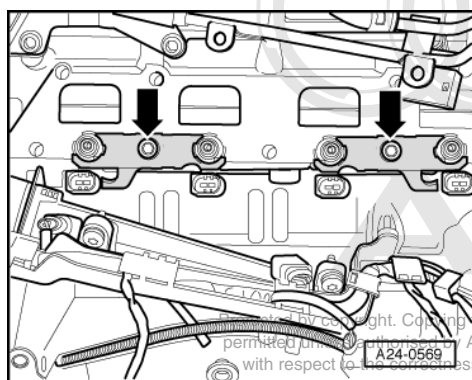
- Lower engine slightly to remove intake manifold.

Removing and installing high-pressure injectors

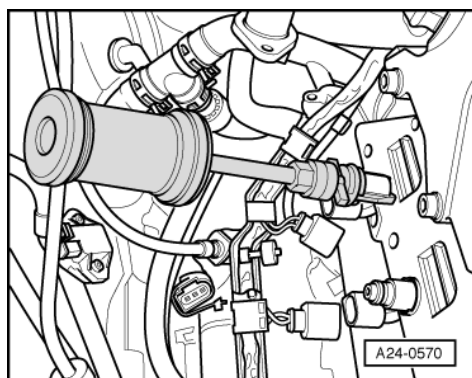
Notes:



- ♦ To improve clarity, the engine is viewed from the rear.
- ♦ To replace the injectors, you will need the tool box containing the special tool T10133.
- -> Unscrew the two bolts -arrows-.
- Unplug connectors from fuel-pressure sender -1-, from fuel-pressure regulating valve -2-, from intake manifold flap potentiometer -3- and from the four injectors.



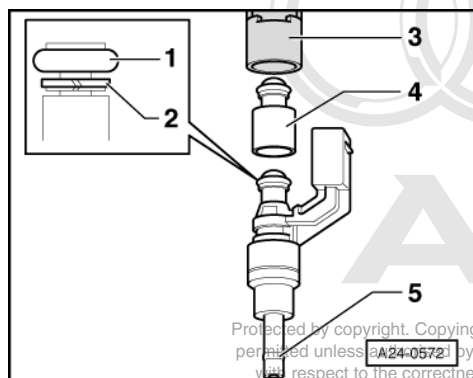
- Unscrew and remove hexagon socket bolts from lower part of intake manifold and carefully pull off lower part of intake manifold (keeping intake manifold parallel).
- -> Unbolt injector holder -arrows- and remove support piece from injector.



- -> Attach extractor T10133/1 with striker T10133/3 to injector and carefully knock out injector.



Replacing O-ring and Teflon ring on high-pressure injector



- -1- Always replace O-ring
- -2- Only replace support ring if damaged
- -3- Retainer
- -4- Always replace O-ring spacer sleeve
- -5- Always replace Teflon ring

Replacing O-rings

The O-rings from the spacer sleeves and from the high-pressure injector must always be replaced.

- Use clean engine oil to facilitate assembly.

Replacing support ring

The support ring only has to be replaced if it has been damaged.

- Rotate and pull support ring over collar (do not widen diameter).

Note:

Pay attention to correct installation position. The flat side without shoulder must face the O-ring.

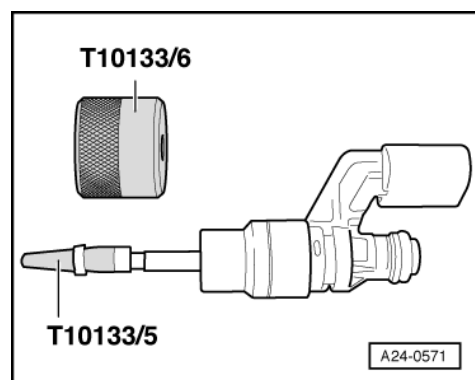
Replacing Teflon ring

The Teflon ring used as a combustion chamber seal must always be replaced if the high-pressure injector is reused.

- Carefully remove old Teflon ring using a suitable tool, taking care not to damage groove or continuous ridge in groove land.

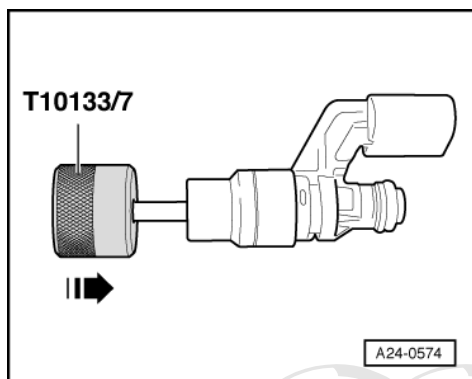
Note:

The groove must not be damaged, otherwise the high-pressure injector must be replaced.



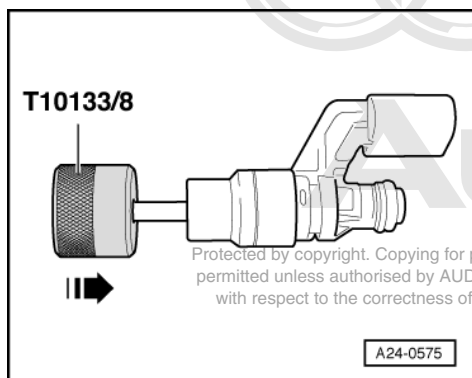
- Sealing ring groove must be cleaned with a clean cloth and any residue must be removed using a brush prior to fitting new Teflon ring.
- Use assembly drift (special tool T10133/5) and assembly sleeve T10133/6 to fit new Teflon ring.
- -> Slide Teflon ring over assembly drift and use assembly sleeve to push Teflon ring into groove of high-pressure injector (do not use any lubrication).

Step 1 of Teflon ring calibration (adaption) is performed using the special tool T 10133/7.

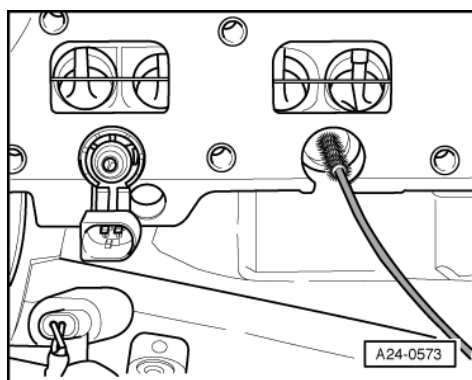


- -> Rotate special tool (approx. 180°) while simultaneously sliding it over injector as far as it will go, applying moderate force. Then pull back to original position, once again rotating by 180°.

Step 2 of Teflon ring calibration (adaption) is performed using the special tool T 10133/8.



- -> Rotate special tool (approx. 180°) while simultaneously sliding it over injector as far as it will go, applying moderate force. Then pull back to original position, once again rotating by 180°.



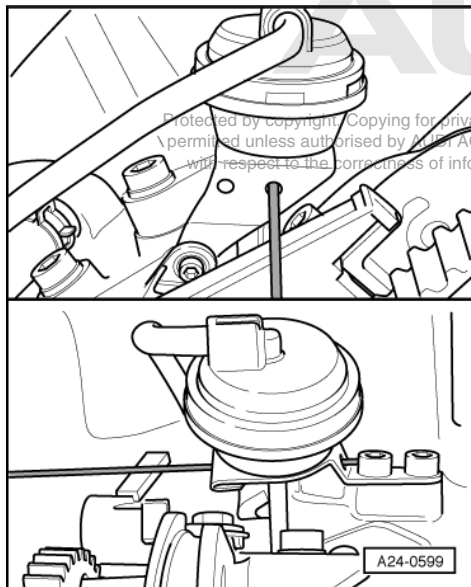
- -> Use a nylon brush (special tool T10133/4) to clean high-pressure injector holes in cylinder head (example: cylinder 3).



Installing high-pressure injection units and lower part of intake manifold / upper part of intake manifold

Install in reverse order

Important: The following points must always be observed.



- High-pressure fuel line must always be replaced.
- Replace all gaskets.
- -> Prior to installing lower part of intake manifold, insert a suitable tool through opening of holder and linkage of vacuum actuator to lift intake manifold flaps (otherwise intake manifold flaps cannot be adjusted). Remove tool again when lower part of intake manifold has been installed.
- Adaption of intake manifold flaps must be performed on replacement of lower part of intake manifold (Self-diagnosis, Basic setting, Measured value block 142). Vehicle diagnostic, testing and information system VAS 5051 must be used for this purpose.
- Coat O-rings of high-pressure injection units with clean oil so that they can be inserted into lower part of intake manifold more easily

Torques, see exploded views:

- Removing and installing injection system components=>Page 10
- Dismantling and assembling intake manifold => Page 12
- Dismantling and assembling fuel rail with high-pressure injection units => Page 20

1.15 - Removing and installing high-pressure fuel pump

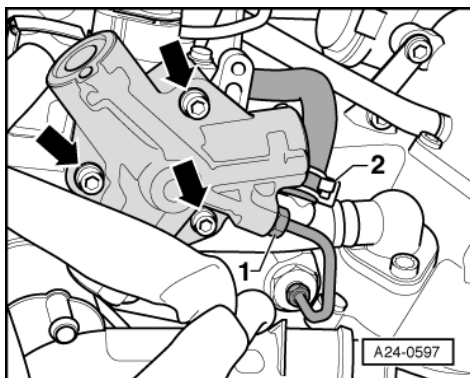
Notes:

- ♦ The high-pressure fuel pump should only be removed and installed when the engine is cold.
- ♦ When assembling the high-pressure fuel pump, it is essential to ensure that no dirt enters the fuel system.
- ♦ Use a rag to catch any discharged fuel.

Attention:

Fuel system operates under high pressure. Always reduce fuel pressure prior to opening fuel system.
Procedure, see => Page 28

Removing high-pressure fuel pump after reducing fuel pressure

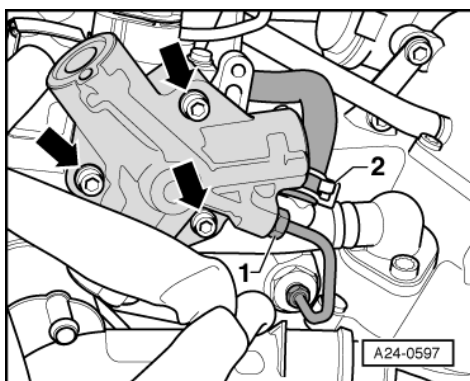


- -> Disconnect fuel supply line -2- from high-pressure fuel pump.
- Disconnect high-pressure fuel line -1- from high-pressure fuel pump and fuel rail pipe.
- Unscrew the three bolts -arrows-. If necessary, undo cable ties on wiring harness.
- Rotate high-pressure fuel pump anticlockwise until the high-pressure line -2- can be pulled out of the high-pressure fuel pump.
- Pull high-pressure fuel pump out of camshaft housing.

Installing high-pressure fuel pump

Notes:

- ◆ The O-ring of the high-pressure fuel pump must always be replaced.
- ◆ The high-pressure fuel line must always be replaced.
- When installing high-pressure fuel pump in camshaft housing, pay attention to pin which must be inserted into high-pressure fuel pump.
- Hand-tighten new high-pressure line on fuel rail pipe.

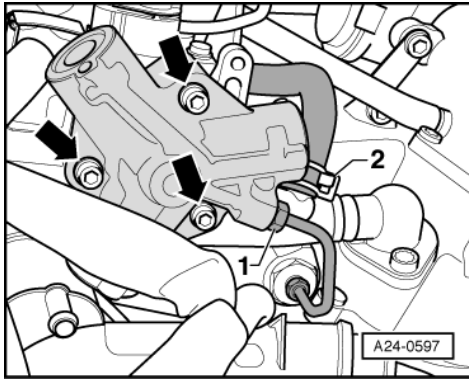


- Rotate high-pressure fuel pump anticlockwise slightly and then clockwise again while carefully inserting new high-pressure line into high-pressure fuel pump.
- -> Screw union bolt -1- approx. 2 turns onto high-pressure fuel pump.
- Securely bolt down high-pressure fuel pump using the three bolts -arrows-.

Torque: 10 Nm

- Securely tighten high-pressure line.

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Torque: 15 Nm

- -> Reconnect fuel supply line -2- to high-pressure fuel pump. Make sure that hose clamp is securely fitted.
- With engine idling, check high-pressure fuel pump and fuel lines for leaks.



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28 - Ignition system

1 - Checking ignition system

1.1 - Checking ignition system

1.2 - General notes on ignition system

- ◆ The engine control unit features self-diagnosis.
- ◆ A voltage of at least 11.5 V is required for proper operation of electrical components.
- ◆ Certain tests may lead to a fault being detected by the control unit and stored. The fault memory is therefore to be interrogated and if necessary erased on completion of all tests and repair work.
- ◆ If engine only starts briefly and then cuts out again after component fault-finding, repair or testing, this may be due to disabling of the engine control unit by the immobilizer. If this is the case, fault memory must be interrogated and control unit adapted if necessary.

1.3 - Safety precautions

Observe the following so as to avoid possible injury and/or the destruction of the injection and ignition system:

- ◆ Never touch/disconnect ignition cables with engine running or at cranking speed.
- ◆ Always switch off ignition before disconnecting and connecting battery so as not to damage engine control unit.
- ◆ Always switch off ignition before disconnecting and connecting injection and ignition system wires (also applies to measuring instrument leads).
- ◆ If engine is to be operated at cranking speed without it starting (e.g. compression test), unplug connectors from output stages for ignition coils and from injectors. Interrogate and erase fault memory on completion of work.
- ◆ Always switch off ignition before washing engine.

1.4 - Ignition system technical data

Engine codes	AQF (4.2 l / 228 kW) / AUW (4.2 l / 228 kW) ARU (4.2 l / 175 kW) / AVN (4.2 l / 175 kW) AQG (3.7 l / 191 kW) / AKC (3.7 l / 191 kW) AQH (4.2 l / 265 kW) / AVP (4.2 l / 265 kW)
Ignition point is determined in control unit Ignition point cannot be adjusted	
Ignition system	Single-coil ignition system with 8 ignition coils (ignition coil and output stage combined in one component) connected directly to spark plugs by way of spark-plug connectors
Spark plugs Spare part number and manufacturer identification	See Spare Parts List
Tightening torque	30 Nm
Firing order	1-5-4-8-6-3-7-2