

Workshop Manual Audi A3 2004 ➤

Simos injection and ignition system (4-cylinder)									
Engine ID	BGU	BSE	BSF	CCS A	CMX A				

Edition 09.2010



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List of Workshop Manual Repair Groups

Repair Group

24 - Mixture preparation - injection

28 - Ignition system



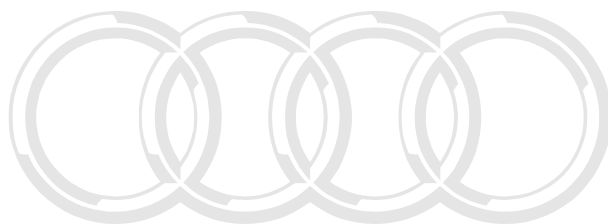
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Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions 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 Safety precautions

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



WARNING

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

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

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

To prevent injuries to persons and/or irreparable 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 the engine at starting speed without actually starting it (e.g. compression test), first unplug the connectors from the ignition coils and the injectors.
- ◆ Certain tests may lead to a fault being detected by the control unit and stored. The event memory should therefore be interrogated and (if necessary) erased after completing the tests and any repair work that may be required.
- ◆ 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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WARNING

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

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 surrounding areas before disconnecting.



- ◆ Place parts that have been removed on a clean surface and cover them over. Do not use fluffy cloths.
- ◆ Carefully cover or seal open components if repairs cannot be carried out immediately.
- ◆ Only install clean components; replacement parts should only be unpacked immediately prior to installation. Do not use parts that have been 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 the vehicle unless absolutely necessary.
- ◆ Unplugged electrical connectors must be kept clean and dry. Make sure connections are dry when attaching.

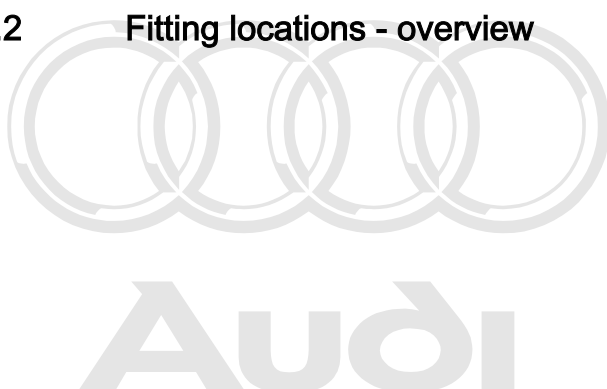
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2 Injection system

2.1 Technical data

Engine data		1.6 ltr. / 75 kW engine
Idling speed		600 ... 800 rpm
Idling speed not adjustable		
Maximum rpm governed by deactivation of injectors		6500 rpm
Fuel pressure at idling speed		approx. 4.0 bar
Residual pressure after 10 minutes		at least 3.0 bar
Injectors	Spray pattern	Same at all injectors
	Injection quantity within approx. 30 seconds	85...105 ml
	Resistance (room temperature)	12...17 Ω (Ohm)

2.2 Fitting locations - overview



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1 - Fuel supply pipe

- ☐ Secure with spring clips
- ☐ Bleeding fuel system
⇒ [page 26](#)

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

- ☐ Fitting location
⇒ [page 7](#)

3 - Lambda probe before catalytic converter -G39-

- ☐ Removing and installing
⇒ [page 29](#)

4 - Intake manifold (top section)

5 - Engine control unit -J361-

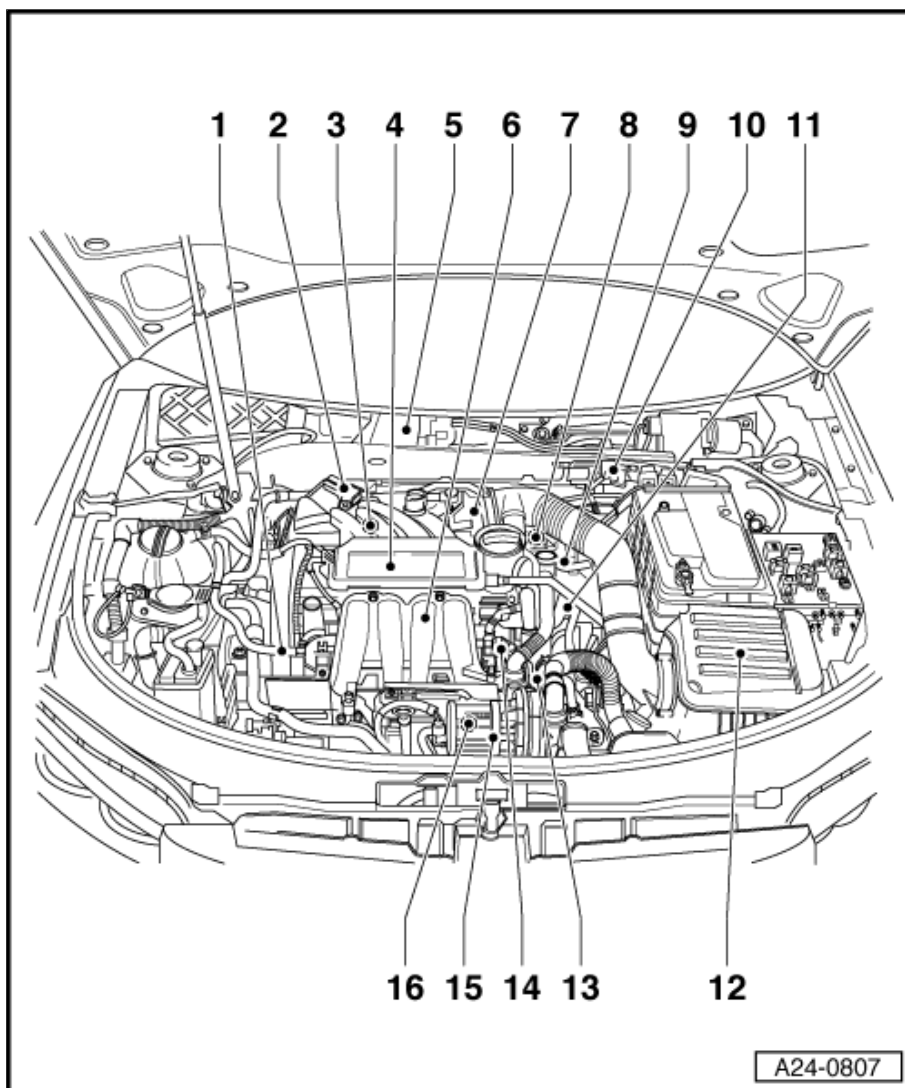
- ☐ Removing and installing
⇒ [page 32](#)

6 - Intake manifold (bottom section)

- ☐ Removing and installing
⇒ [page 15](#)

7 - Throttle valve module - J338-

- ☐ Including throttle valve drive for electric throttle -G186-, throttle valve drive angle sender 1 for electric throttle -G187- and throttle valve drive angle sender 2 for elec-



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tric throttle -G188-

8 - Exhaust gas recirculation valve -N18-

- ☐ Not fitted on engines with code letters BSE and BSF

9 - Coolant temperature sender -G62-

- ☐ If necessary release pressure in cooling system before removing

10 - Connector

- ☐ Lambda probe -G39-
- ☐ Removing and installing ⇒ [page 29](#)

11 - Engine speed sender -G28-

- ☐ Fitting locations ⇒ [page 7](#)

12 - Air cleaner

- ☐ Exploded view ⇒ [page 7](#)
- ☐ Removing and installing ⇒ [page 9](#)

13 - Ignition transformer -N152-

- ☐ Fitting locations ⇒ [page 7](#)

14 - Fuel injectors -N30- ... -N33-

- ☐ Removing and installing ⇒ [page 19](#)

15 - Secondary air pump motor -V101-

- ☐ Not fitted on engines with code letters BSF

16 - Knock sensor 1 -G61-

- ☐ Fitting locations ⇒ [page 7](#)
- ☐ 20 Nm

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

- ☐ Fitting location ⇒ [page 6](#)

B - Brake pedal switch -F47-

- ☐ Fitting location ⇒ [page 6](#)

C - Clutch position sender -G476-

- ☐ Fitting location ⇒ [page 6](#)

D - Activated charcoal filter solenoid valve 1 -N80-

- ☐ Fitting location ⇒ [page 7](#)

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

- ☐ Fitting location ⇒ [page 7](#)

F - Hall sender -G40-

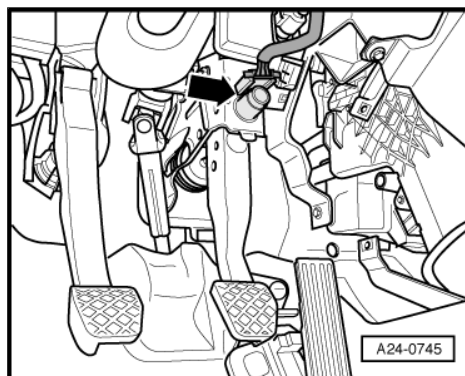
- ☐ Fitting location ⇒ [page 7](#)

G - Lambda probe after catalytic converter -G130-

- ☐ Fitting location: in exhaust manifold
- ☐ Removing and installing ⇒ [page 30](#)
- ☐ 55 Nm

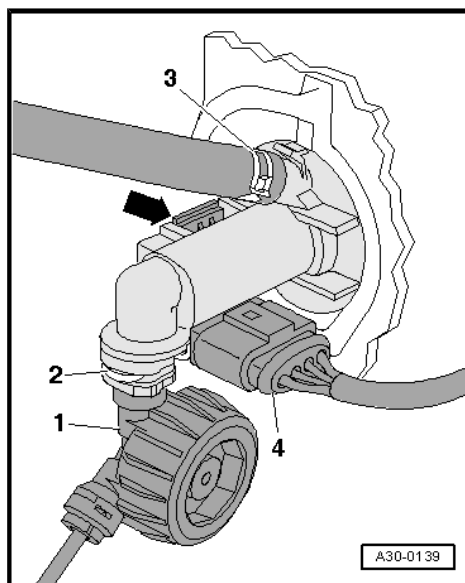
Fitting location: brake light switch -F- , brake pedal switch for cruise control system (diesel direct injection system) -F47- (in driver's footwell)

1 - Brake light switch -F- , brake pedal switch for cruise control system (diesel direct injection system) -F47-



Clutch position sender -G476-

4 - Connector

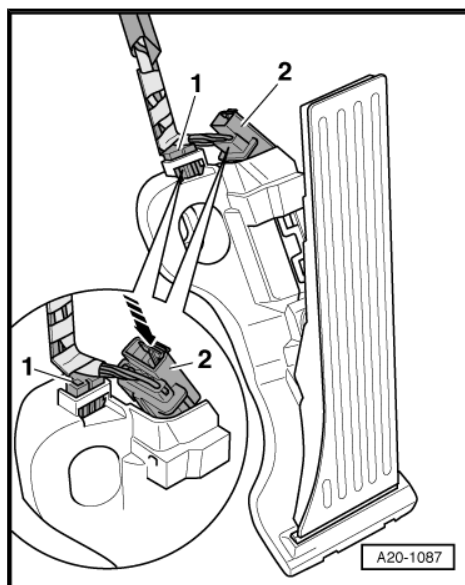


Fitting location: accelerator position sender -G79- and accelerator position sender 2 -G185-



Note

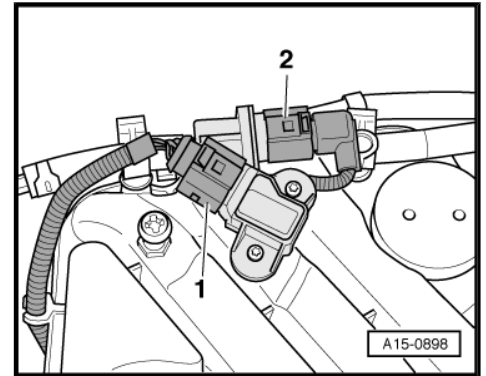
Diagram shows set-up on left-hand drive vehicles.



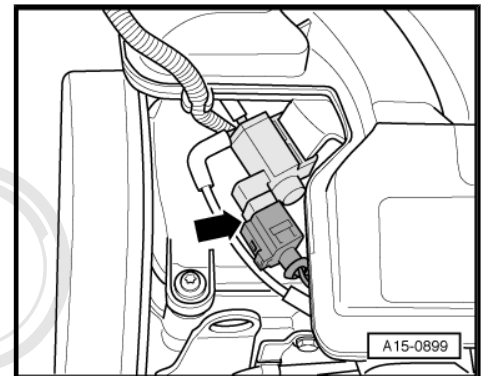
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Components on intake manifold

- 1 - Intake manifold pressure sender -G71- with intake air temperature sender -G42-
- 2 - Activated charcoal filter solenoid valve 1 -N80-



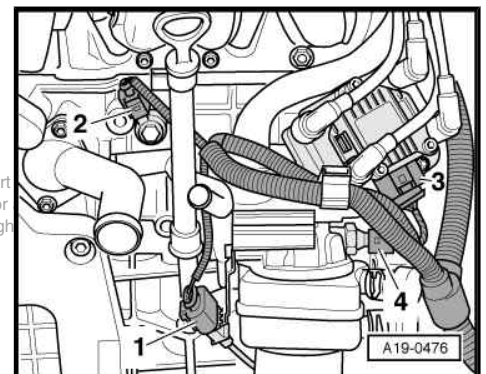
Variable intake manifold change-over valve -N156-



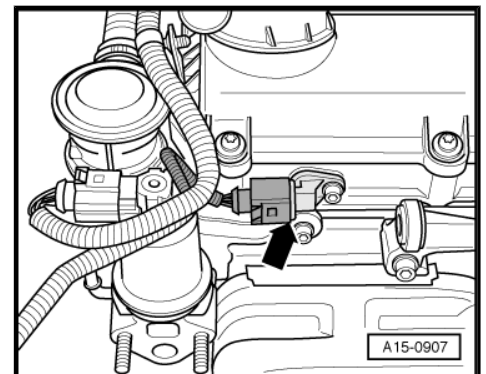
Components

- 1 - Electrical connector for engine speed sender -G28-
- 2 - Knock sensor 1 -G61-
- 3 - Ignition transformer -N152-
- 4 - Oil pressure switch -F1-

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Hall sender -G40- -arrow-



2.3 Air cleaner - exploded view

1 - Panel bolt
2 - Air duct

- ☐ Clean any leaves and dirt out of air duct

3 - Air funnel
4 - Panel bolt
5 - Spring-type clip
6 - Air pipe

- ☐ Check air intake for dirt and leaves

7 - Connection for crankcase breather
8 - Spring-type clip
9 - Air duct

- ☐ Check air intake for dirt and leaves

10 - Panel bolt
11 - Panel bolt
12 - Air cleaner housing

- ☐ Clean any salt residue, leaves and dirt out of air cleaner housing
- ☐ Clean dirt out of water drain in bottom section of air cleaner (this is important)

13 - Filter element

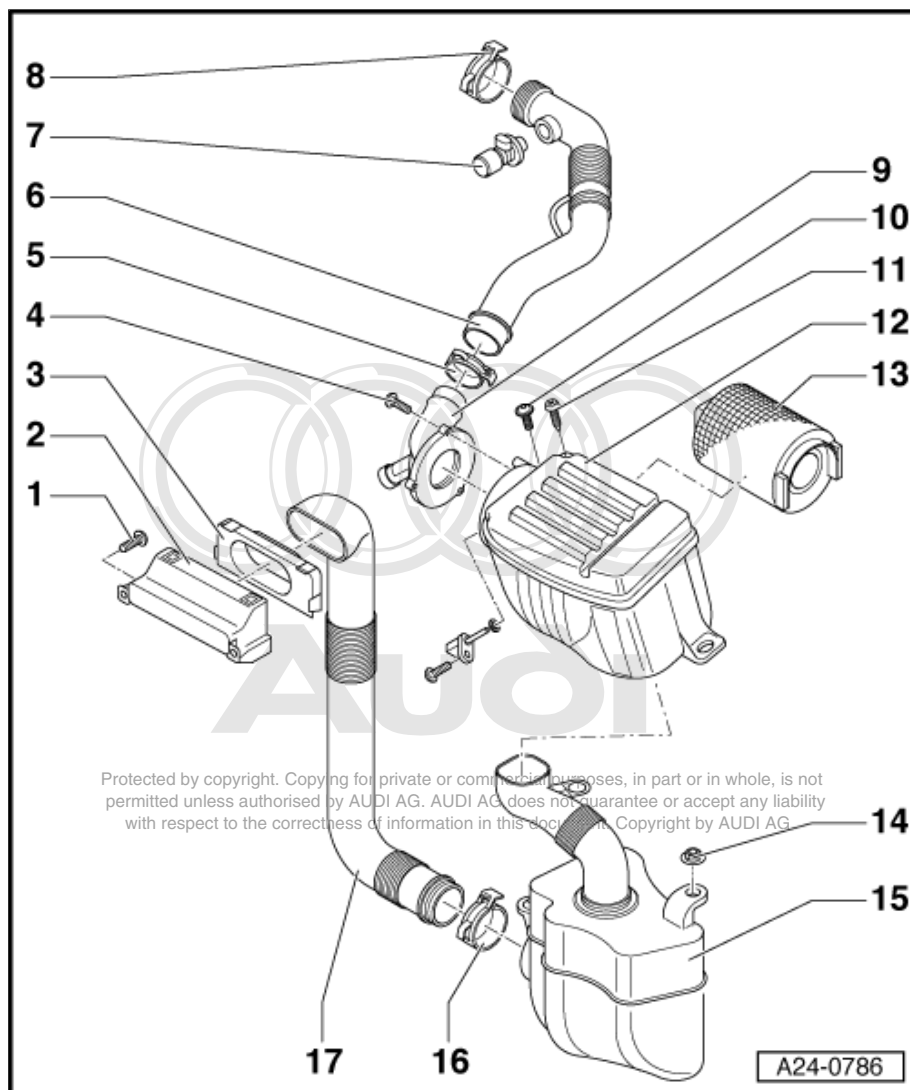
- ☐ Always use genuine part for air filter element
- ☐ Removing and installing
⇒ [page 9](#)
- ☐ Observe change intervals ⇒ Maintenance ; Booklet 808

14 - Hexagon flange nut
15 - Intake air duct

- ☐ Check air intake for dirt and leaves

16 - Spring-type clip
17 - Air pipe

- ☐ Check air intake for dirt and leaves



2.4 Removing and installing air filter element

Removing air filter element

- Unscrew the 4 bolts -arrows- and remove air cleaner cover.
- Unscrew retaining clip and remove.
- Take out old air filter element.

Installing air filter element

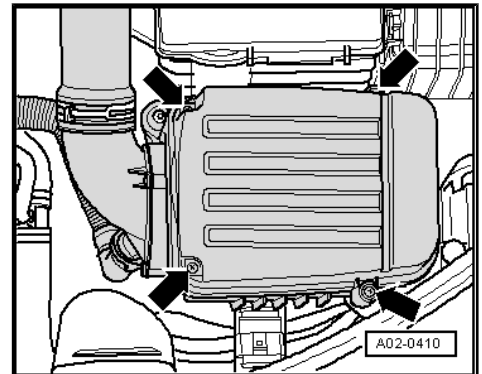
To ensure the proper function of the air mass meter -G70- it is important to observe the following notes and instructions.



Note

- ◆ *If the air filter element is very dirty or wet, dirt or water could reach the air mass meter -G70- and affect the air mass value. This would lead to loss of power, since a smaller injection quantity is calculated.*
- ◆ *Always use genuine part for air filter element.*
- ◆ *Hose connections and hoses for charge air system must be free of oil and grease before assembly. Do not use any lubricants containing silicone when assembling.*
- ◆ *Both sections of the air cleaner housing MUST be clean.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue*
- ◆ *To prevent malfunctions, cover all critical parts of the engine air intake tract (air mass meter, intake pipes, etc.) with a clean cloth when blowing out the air cleaner housing with compressed air.*
- ◆ *Please observe requirements for disposal.*
- Clean water drain (small hole) in bottom section of air cleaner (this is important).
- 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 and leaves in air duct going from lock carrier to air cleaner housing.
- 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).
- Ensure secure fit of intake hose at air mass meter -G70- .

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



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2.5 Intake manifold - exploded view

1 - Fuel supply pipe
2 - Fuel rail

- ☐ With injectors

3 - Support

- ☐ For intake manifold

4 - Bolt

- ☐ 23 Nm

5 - Bolt

- ☐ 10 Nm

6 - Rubber mounting
7 - Intake manifold (top section)

- ☐ Removing and installing
⇒ [page 11](#)

8 - Seal

- ☐ Renew

9 - Pipe for exhaust gas recirculation

- ☐ Only for engine code BGU

10 - Bolt

- ☐ 10 Nm
- ☐ Only for engine code BGU

11 - Gasket

- ☐ Renew

12 - Bolt

- ☐ 10 Nm

13 - Throttle valve connection
14 - Spreader clip
15 - Seal

- ☐ Renew if damaged

16 - Bolt

- ☐ 3 Nm

17 - Bottom section of intake manifold

- ☐ Removing and installing ⇒ [page 15](#)

18 - Bolt

- ☐ 20 Nm

19 - Nut

- ☐ 20 Nm

20 - Seal

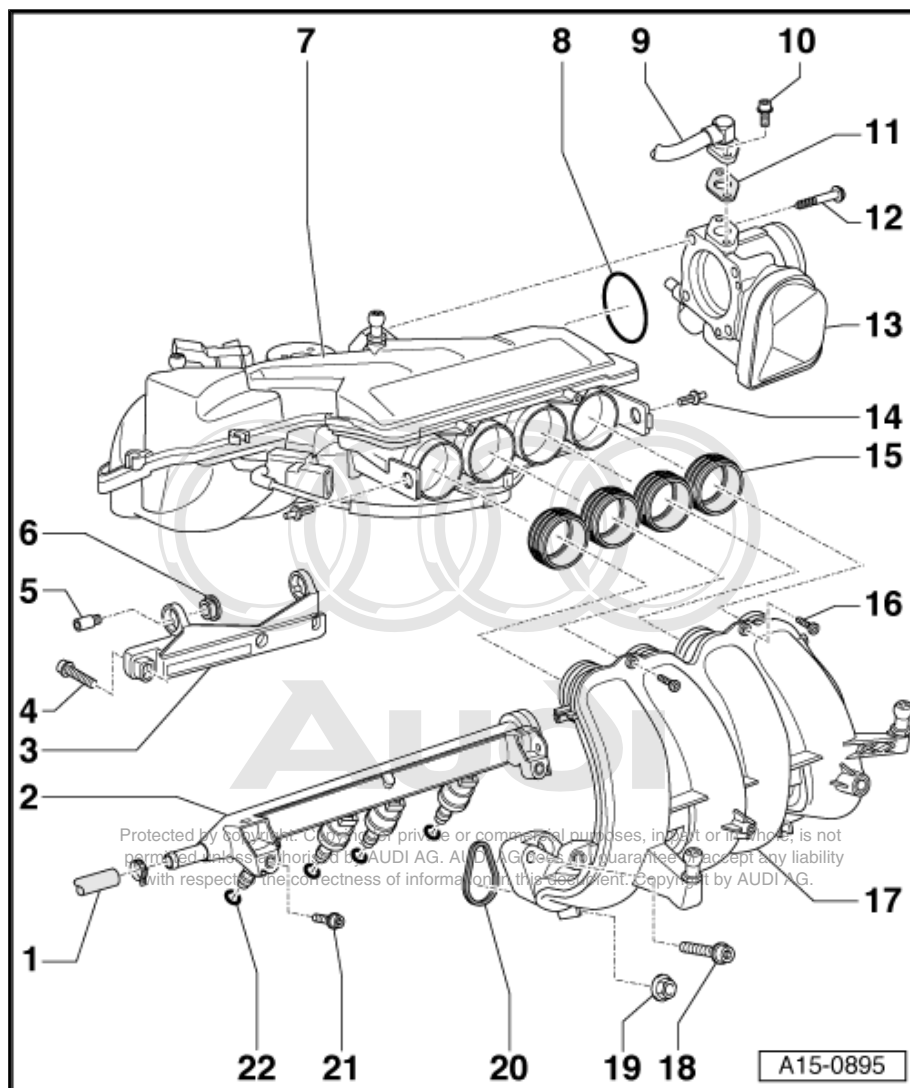
- ☐ Renew

21 - Bolt

- ☐ 10 Nm

22 - O-ring

- ☐ For injectors
- ☐ Renew

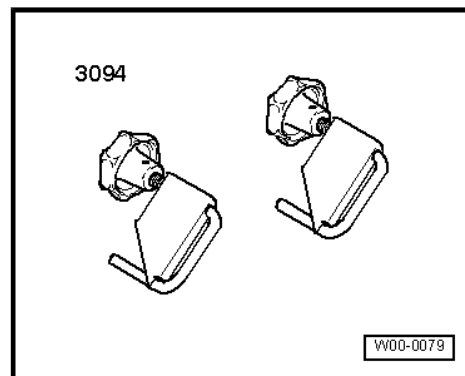


- ❑ Lubricate lightly with clean engine oil

2.6 Removing and installing intake manifold (top and bottom sections)

Special tools and workshop equipment required

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



Removing

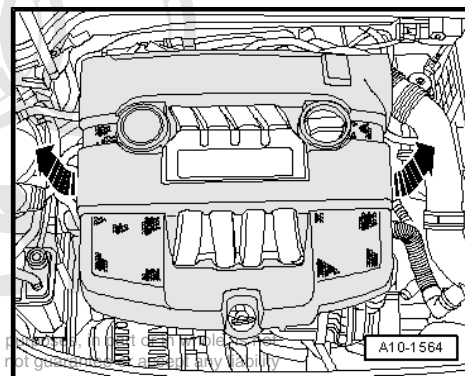
- Take off engine cover panel -arrows-.



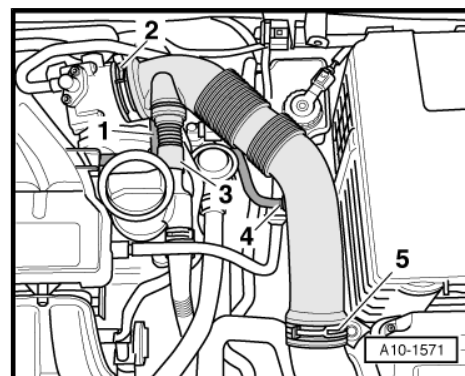
Note

The top and bottom sections of the intake manifold are removed and installed together as one unit.

- Detach hoses -1-, -3- and -4-.



- Release spring-type hose clips -2- and -5- and remove air hose.



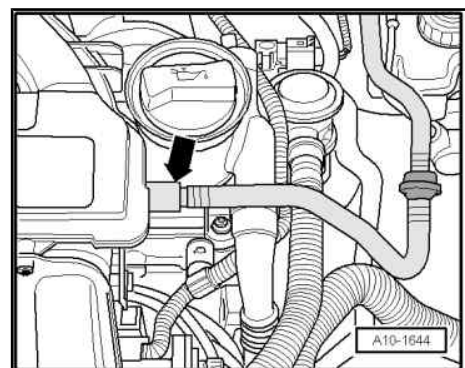
- Detach vacuum hose -arrow- going to brake servo at intake manifold.



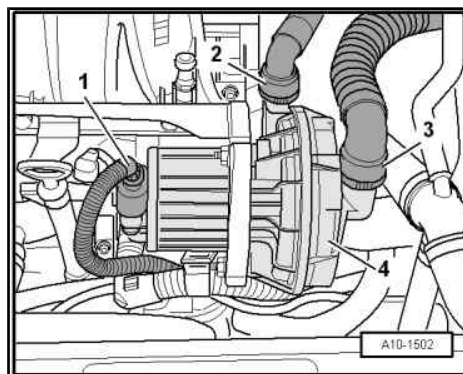
Note

Engines with engine code BSF are not fitted with a secondary air pump motor -V101-.

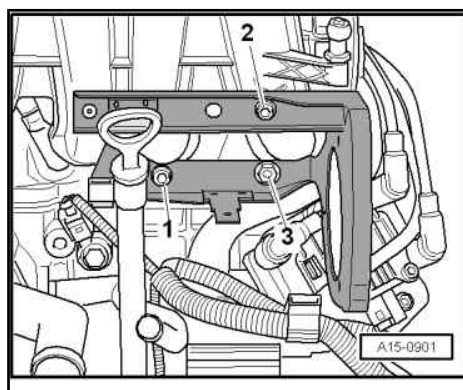
- Unplug electrical connector -1- at secondary air pump motor.
- Disconnect hoses -2- and -3- at secondary air pump.



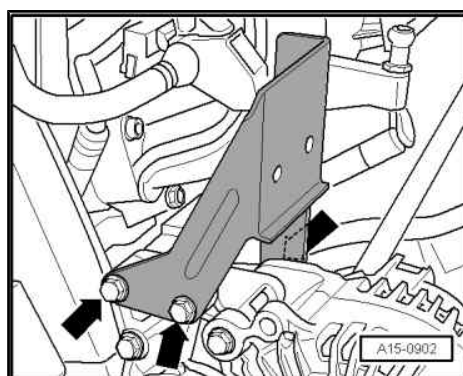
- Detach secondary air pump -4- from bracket.



- Unscrew bolts -1- and -2- and nut -3- on secondary air pump bracket.
- Remove bracket for secondary air pump.



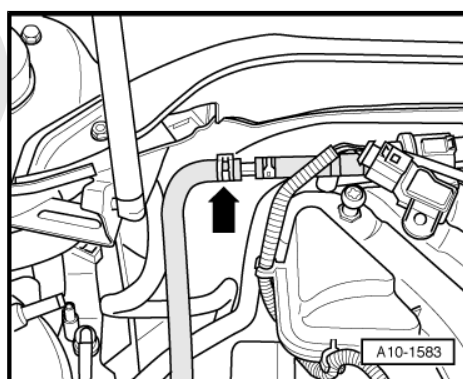
- Remove deflector plate -arrows-.



- Disconnect vacuum hose going to activated charcoal filter at the position marked with an -arrow-.


WARNING

The fuel system is pressurised. Wrap a cloth around the connection before opening the system. Then release pressure by carefully loosening the connection.



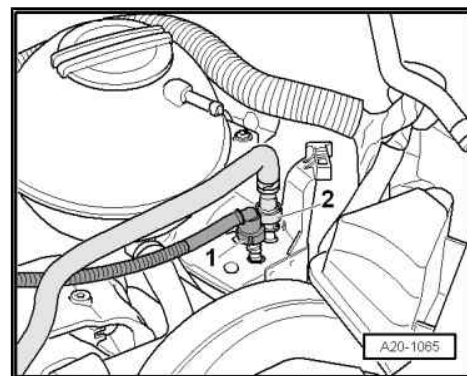
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- Disconnect fuel supply pipe -2- (lift release tab).



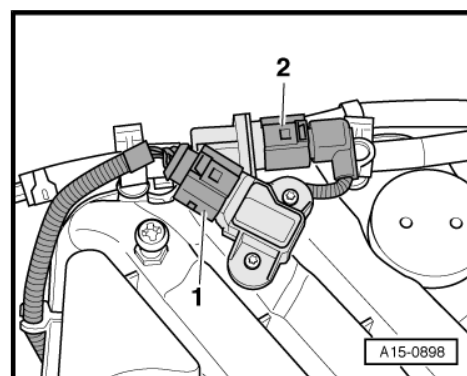
Note

Disregard -item 1-.



- Unplug electrical connectors:

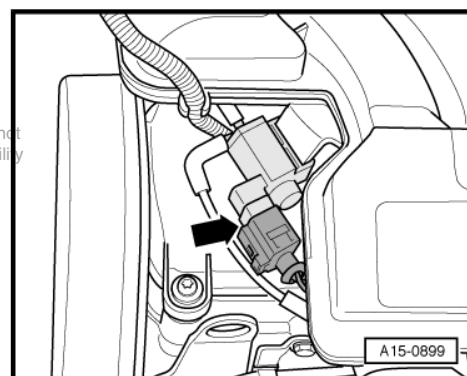
- 1 - Intake air temperature sender -G42-
- 2 - Activated charcoal filter solenoid valve 1 -N80-



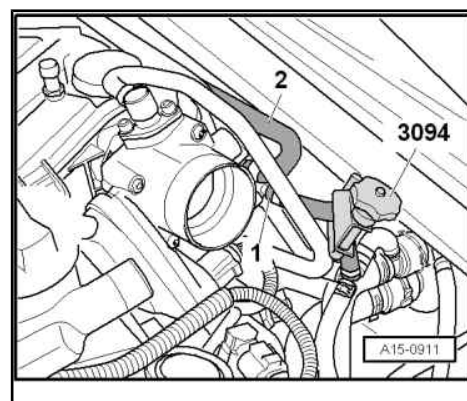
- Detach connector -arrow- at intake manifold changeover valve -N156- .

- Clamp off coolant hose leading to heat exchanger for heater using hose clamp up to 25 mm -3094-

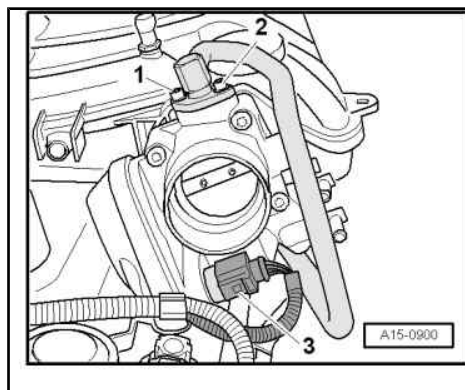
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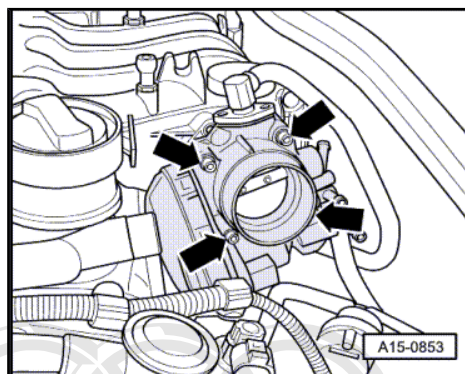
- Disconnect coolant hoses -1- and -2- at throttle valve housing.
- Move coolant hose from expansion tank clear of intake manifold.
- Unplug electrical connector -3- at throttle valve module - J338- .



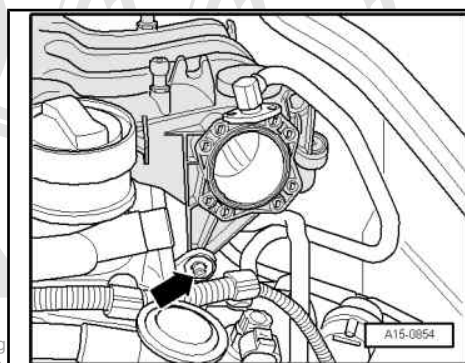
- Remove bolts -1- and -2- (only engine code BGU).



- Remove throttle valve housing -arrows-.



- Remove the two bolts arrow on the rear intake manifold mounting (one on the left, one on the right) -arrow-.



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- Unscrew bolts -1 ... 4-, -7- and -8- and detach intake manifold.

 Note

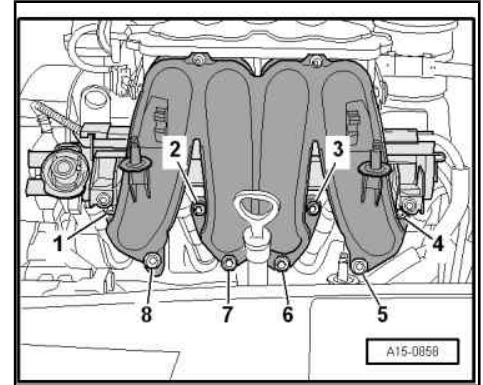
Block off intake ports in cylinder head with clean cloths.

Installing

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

 Note

- ◆ *Renew gaskets and seals.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- Fill cooling system ⇒ Rep. gr. 19 .
- Bleed fuel system ⇒ [page 26](#) .
- ◆ Tightening torques: intake manifold - exploded view
 ⇒ [page 9](#) .



2.7 Removing and installing intake manifold (bottom section)

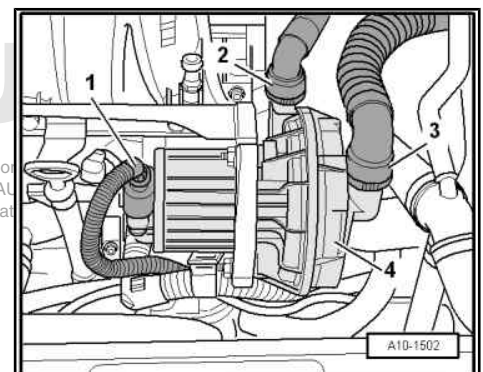
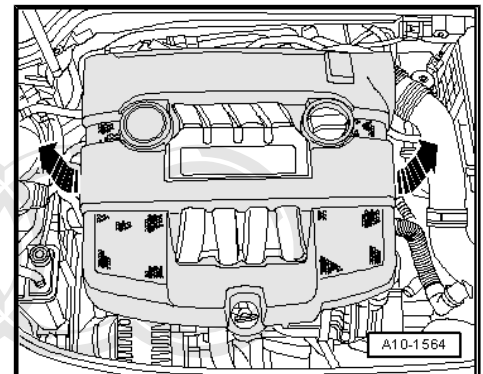
Removing

- Take off engine cover panel -arrows-.

 Note

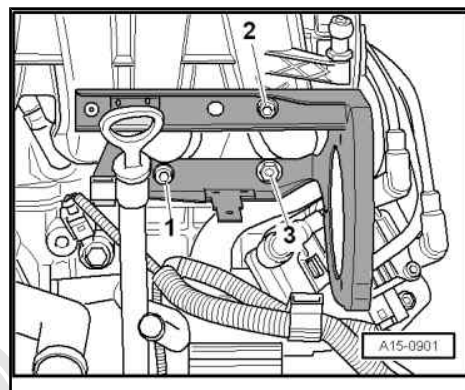
Engines with engine code BSF are not fitted with a secondary air pump motor -V101- .

- Unplug electrical connector -1-.
- Disconnect hoses -2- and -3- at secondary air pump.
- Detach secondary air pump -4- from bracket.

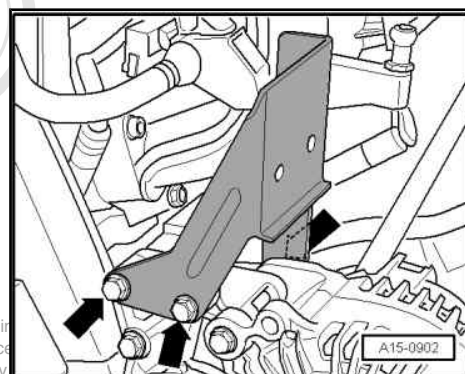


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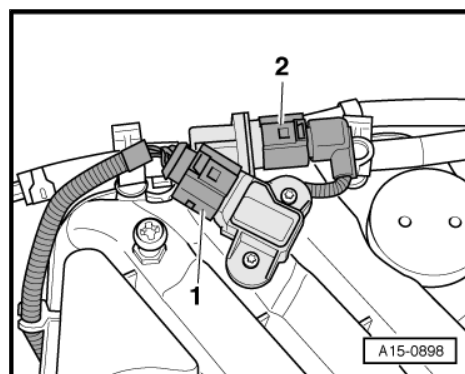
- Unscrew bolts -1- and -2- and nut -3- on secondary air pump bracket.
- Remove bracket for secondary air pump.



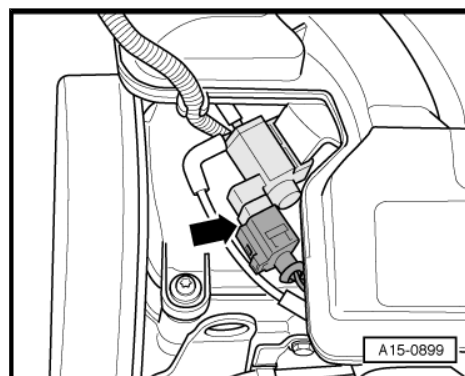
- Remove deflector plate -arrows-.



- Unplug electrical connectors:
- 1 - Intake air temperature sender -G42-
- 2 - Activated charcoal filter solenoid valve 1 -N80-



- Detach connector -arrow- at intake manifold changeover valve -N156- .


WARNING

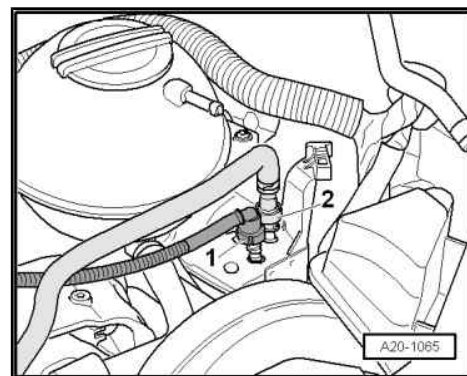
The fuel system is pressurised. Wrap a cloth around the connection before opening the system. Then release pressure by carefully loosening the connection.

- Disconnect fuel supply pipe -2- (lift release tab).

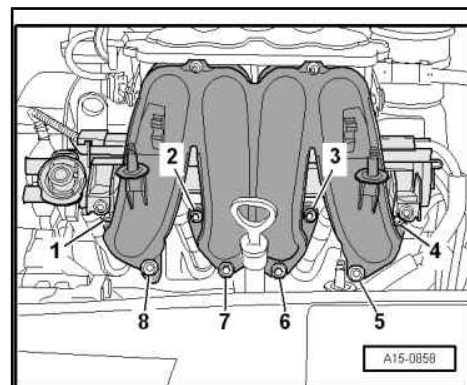


Note

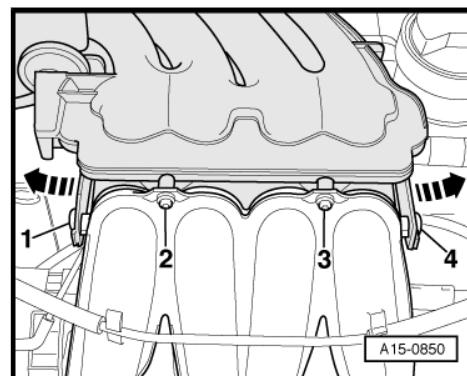
Disregard -item 1-.



- Unscrew bolts -1, 2, 3, 4, 7 and 8- and detach intake manifold (bottom section).



- Remove bolts -2- and -3-.
- Lever off the clips -1- and -4-.
- Press retainers slightly aside to release -arrows- and detach bottom section of intake manifold from top section.
- Unclip cable duct at bottom section of intake manifold and unplug electrical connectors for injectors.



Note

Block off intake ports in cylinder head with clean cloths.

Installing

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



Note

Renew gaskets and seals.

- Bleed fuel system ⇒ [page 26](#) .
- ♦ Tightening torques: intake manifold - exploded view ⇒ [page 9](#) .

2.8

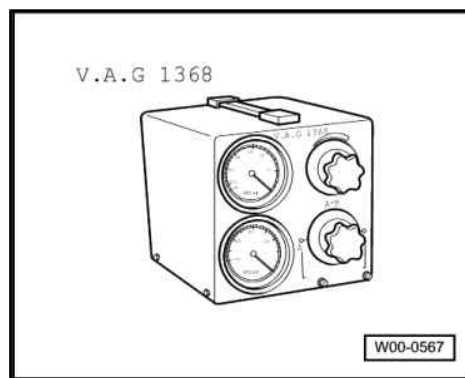
Checking intake manifold change-over function

Special tools and workshop equipment required

- ♦ Hand vacuum pump -VAS 6213-

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◆ Vacuum tester -V.A.G 1368-



There must be no entry in the event memory relating to the variable intake manifold changeover valve -N156- .

Perform the following checks if the variable intake manifold change-over valve -N156- is OK.

- Check proper connection of vacuum lines.
- Check vacuum hoses for porosity.
- Check vacuum system for leaks.
- Check vacuum unit in top section of intake manifold for leaks.

Checking vacuum unit for leaks

- Detach vacuum hose going to vacuum unit for intake manifold change-over -arrow- at variable intake manifold change-over valve -N156- -1-.



Note

The vacuum unit for intake manifold change-over is integrated in the intake manifold and is not visible from the outside.

- Connect hand vacuum pump -VAS 6213- to »connection B« on vacuum tester -V.A.G 1368-.

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- Connect vacuum hose going to vacuum unit to »connection A« on vacuum tester -V.A.G 1368- .

- Select »position A/B« on vacuum tester -V.A.G 1368- .

- Operate the hand vacuum pump -VAS 6213- several times. Generate a vacuum of max. 500 millibar.

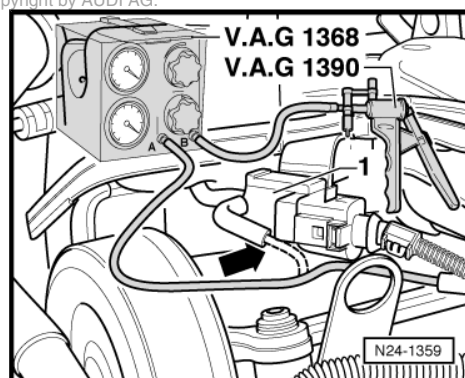
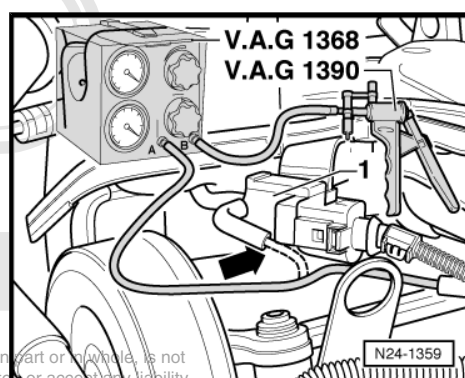
- ◆ Specification: The generated vacuum must be maintained.

If the vacuum reading drops:

- Renew top section of intake manifold.

If the vacuum reading does not drop:

- Check whether change-over mechanism in intake manifold is moving freely; renew intake manifold if necessary.



2.9 Fuel rail with injectors - exploded view

1 - Fuel rail

2 - Fuel supply pipe

- ☐ From fuel filter ⇒ Rep. gr. 20
- ☐ Secure with spring-type clips

3 - O-ring

- ☐ Removing and installing ⇒ [page 19](#)
- ☐ Renew
- ☐ Lubricate lightly with clean engine oil

4 - Retaining clip

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

5 - Injector, cylinder 1 -N30- ... -N33-

- ☐ Removing and installing ⇒ [page 19](#)

6 - O-ring

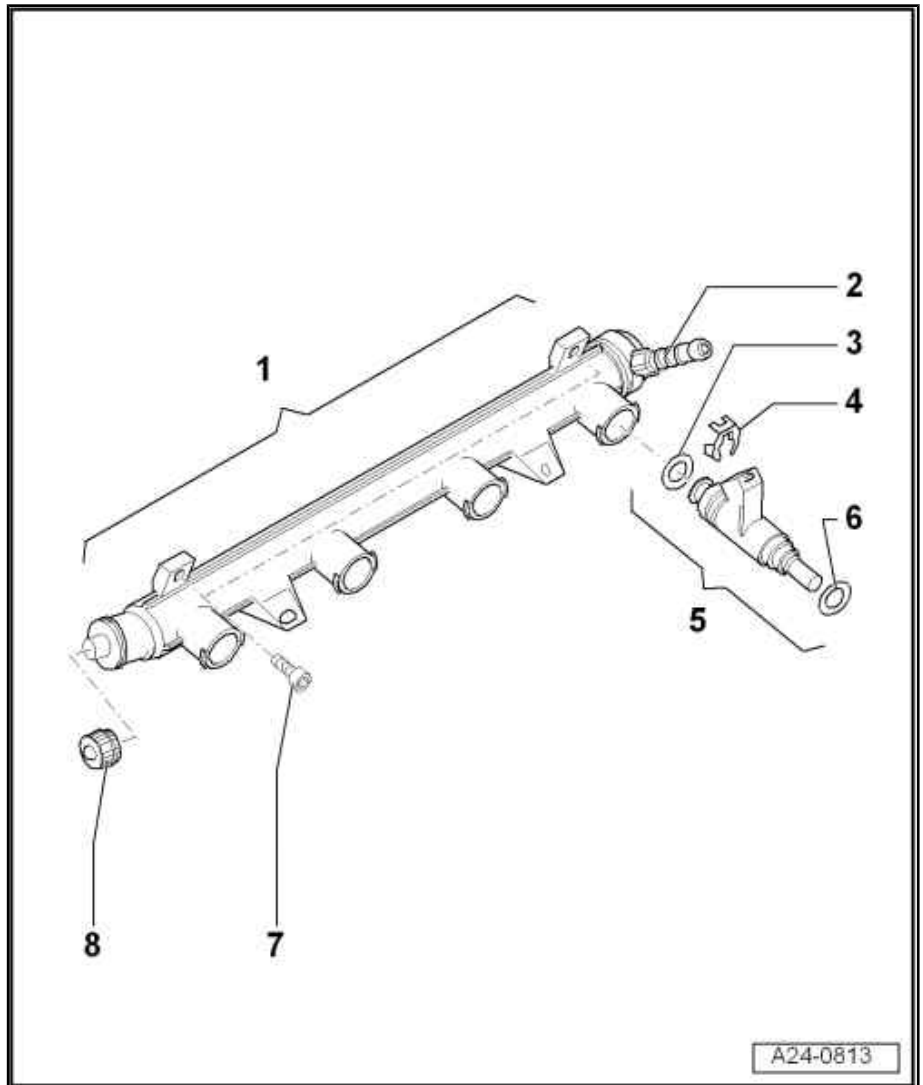
- ☐ Removing and installing ⇒ [page 19](#)
- ☐ Renew
- ☐ Lubricate lightly with clean engine oil

7 - Hexagon socket-head bolt

- ☐ 10 Nm

8 - Protective cap

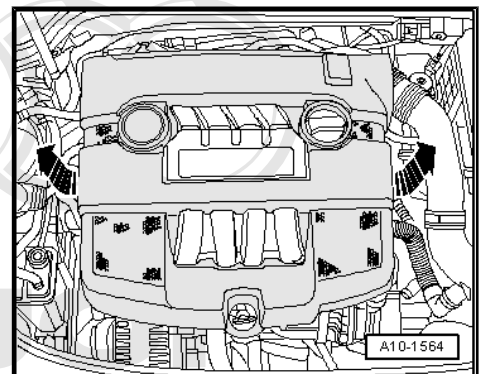
- ☐ Removing and installing ⇒ [page 19](#)



2.10 Removing and installing injectors

Removing

- Remove engine cover panel.



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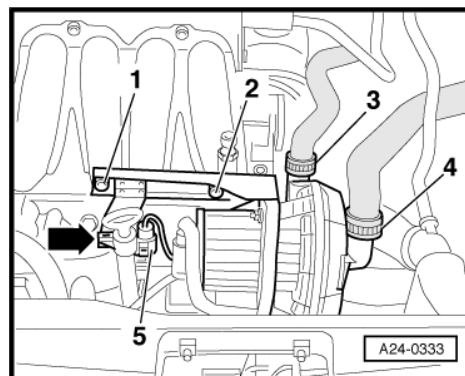
- Disconnect hoses -3- and -4- from secondary air pump.
- Unplug connector -5- for engine speed sender.



Note

Secondary air pump motor -V101- is not fitted on engines with code letters BSE and BSF.

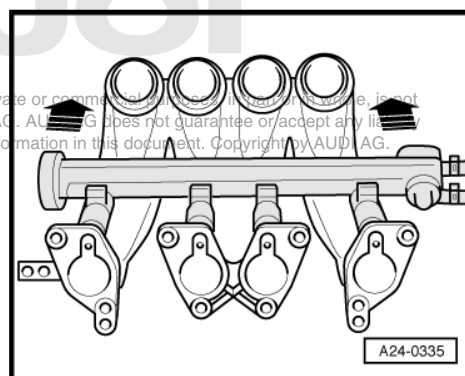
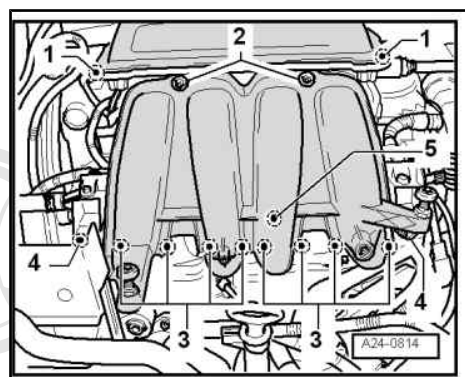
- Detach secondary air pump bracket by unscrewing 2 bolts at top -1- and -2- and a nut and bolt at bottom (not shown in illustration).
- Disengage secondary air pump bracket from dipstick guide -arrow- and lay secondary air pump aside.



WARNING

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

- Unplug all electrical connectors as necessary.
- Unscrew securing bolts -2- connecting top and bottom sections of intake manifold.
- Use screwdriver to prise off expanding clips -1-.
- Unscrew bolts -3- between bottom section of intake manifold and cylinder head.
- Unscrew bolts -4- from fuel rail.
- Carefully press the two lugs apart and pull off bottom section of intake manifold from the front.
- Unplug electrical connectors at all injectors.
- Detach cable duct.
- Pull fuel rail including injectors evenly off bottom section of intake manifold -arrows- and place it on a clean cloth in the engine compartment.



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- Detach retaining clip -arrow- and remove injector.



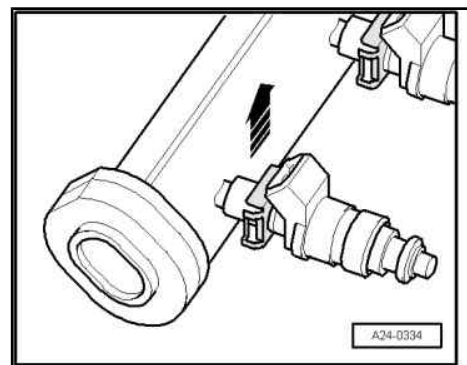
Note

The fuel hoses must be detached before renewing the fuel rail.

Installing

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

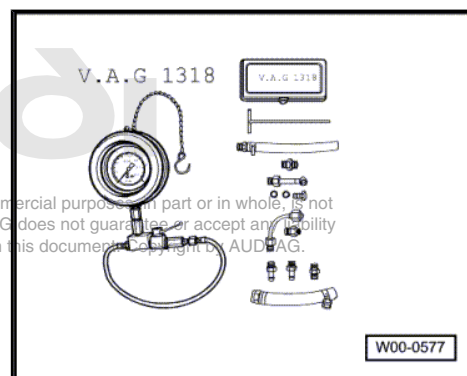
- Renew the O-rings at all opened connections. (When renewing the front O-ring, ensure that the plastic cap is never removed from the injector head. The O-ring must be pulled off over the plastic cap).
- Lubricate the O-rings with clean engine oil.
- Make sure injectors are installed in correct position.
- Make sure retaining clips are properly connected.
- Position fuel rail together with injectors (properly secured) against intake manifold and press into place evenly.
- ♦ Tightening torques: intake manifold - exploded view
⇒ [page 9](#).



2.11 Checking fuel pressure regulator and residual pressure

Special tools and workshop equipment required

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



- ♦ Adapter set -V.A.G 1318/17-
- ♦ Hose clamps for hoses up to 25 mm -3094-

The specification for the check is dependent upon the working pressure of the fuel pump.

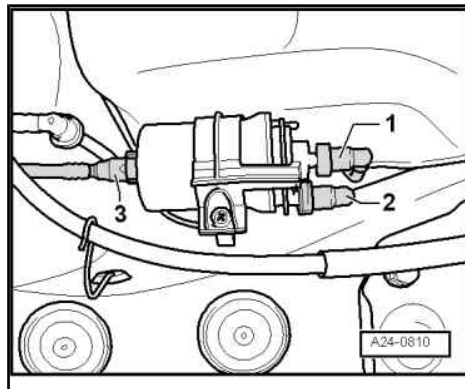
- ♦ Specification: approx. 4.0 bar

The fuel pressure regulator is located in the fuel filter.

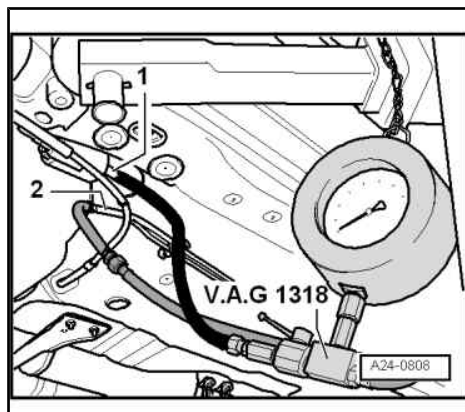
- Pull off supply hose -3- and collect escaping fuel with a cloth.


WARNING

Fuel system is pressurised. Before opening the system place a cloth around the connection. Then release pressure by carefully loosening the connection.



- Connect K-Jetronic pressure tester -V.A.G 1318- to fuel supply hose -1- and fuel supply pipe.



- Open cut-off valve on K-Jetronic pressure tester -V.A.G 1318- . Lever must point in direction of flow.

- Allow engine to idle.
- Measure the fuel pressure.
- ◆ Specification: approx. 4.0 bar
- Switch off ignition.

If specification is not obtained:

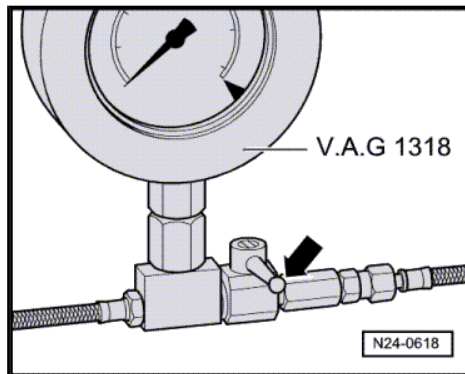
- Check delivery rate of fuel pump ⇒ Rep. gr. 20 .

If specification is obtained:

- Check for leaks and check residual pressure by observing pressure drop on gauge.
- ◆ Specification: After 10 minutes there should still be a pressure of at least 3.0 bar.

Only perform following check if residual pressure drops below 3 bar:

- Allow engine to idle.



- Allow pressure to build up, then switch off ignition. At the same time, close cut-off valve of K-Jetronic pressure tester -V.A.G 1318- (so that lever is perpendicular to direction of flow -arrow-).

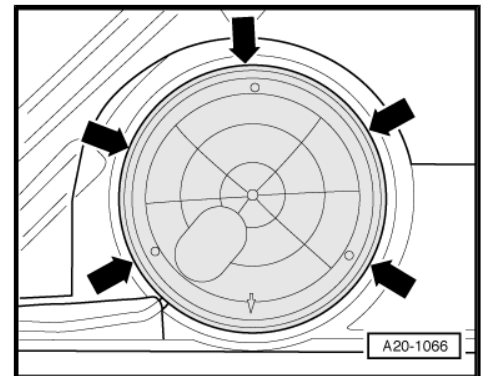
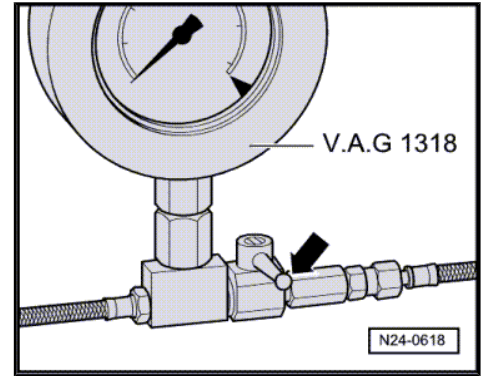
- Observe pressure on pressure gauge.

If the pressure drops again:

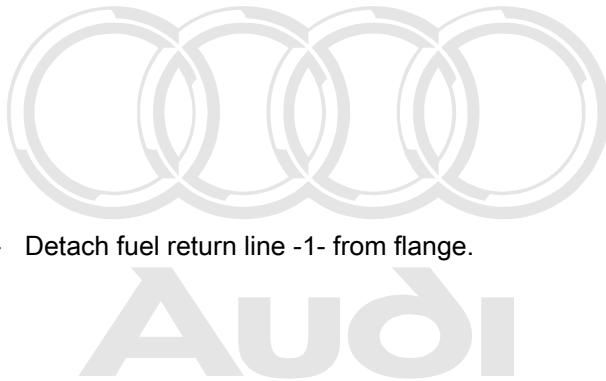
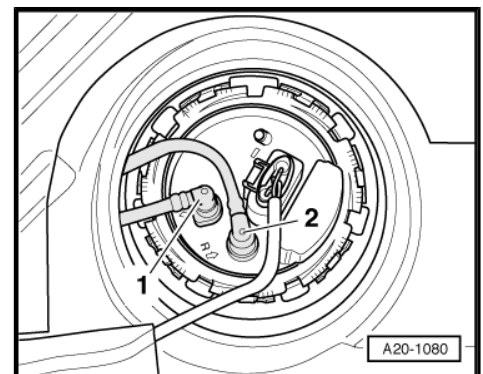
- Check pipe connections, O-rings on fuel rail and injectors for leaks.

If the pressure does not drop:

- Open cut-off valve on K-Jetronic pressure tester -V.A.G 1318- (lever is in direction of flow).
- Fold back lining under rear set.
- Detach cover for fuel delivery unit.



- Detach fuel return line -1- from flange.



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- Connect adapter set -V.A.G 1318/17- to return pipe.
- Clamp off adapter hose using hose clamp up to 25 mm -3094- .
- Cover the return pipe connection with a clean cloth.


Note

Do not attach hose clamp up to 25 mm -3094- directly to fuel pipe - risk of damage.

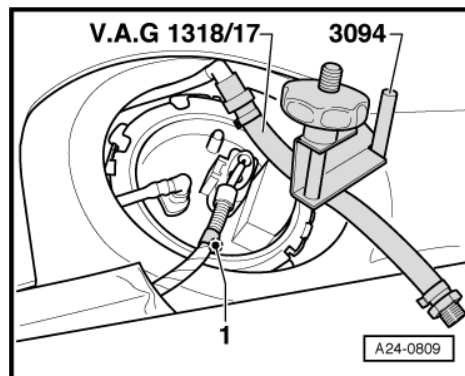
- Start the engine and run at idling speed.
- Allow pressure to build up, then switch off ignition.
- Observe pressure on pressure gauge.

If the pressure now does not drop:

- Check fuel pump non-return valve ⇒ Rep. gr. 20 .

If the pressure drops again:

- Renew fuel filter ⇒ Rep. gr. 20 .

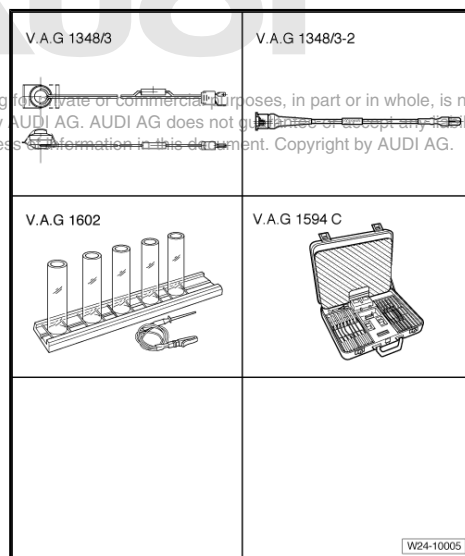

Note

- ◆ *Open cut-off valve to dissipate fuel pressure before removing K-Jetronic pressure tester -V.A.G 1318- .*
- ◆ *Assemble the fuel supply system in reverse order.*

2.12 Checking for leaks, checking injection quantity and spray pattern of injectors

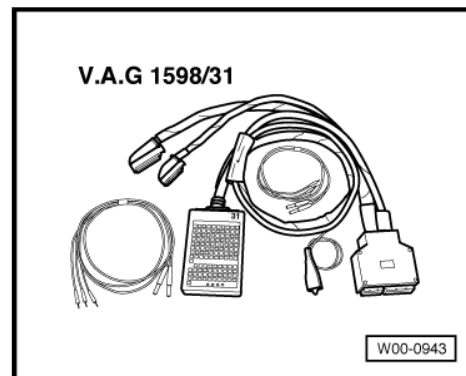
Special tools and workshop equipment required

- ◆ Remote control for V.A.G 1348 -V.A.G 1348/3A-
- ◆ Auxiliary measuring set -V.A.G 1594C-
- ◆ Injection rate tester -V.A.G 1602-



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- ◆ Adapter cable, 121-pin -V.A.G 1598/31- (test box)



Checking for leaks



Note

Fuel pressure OK; checking ⇒ [page 21](#) .

- Remove fuel rail with injectors installed from intake manifold. Fuel hoses remain connected ⇒ [page 19](#) .
- Connect test box -V.A.G 1598/31- to wiring harness for engine control unit. Do not connect engine control unit ⇒ [page 32](#) .
- Bridge contacts 1 and 80 on the test box using test leads from auxiliary measuring set -V.A.G 1594C-. (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.

- 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, switch off the fuel pump (turn off ignition) and renew the faulty injector ⇒ [page 19](#) .

Checking injection quantity

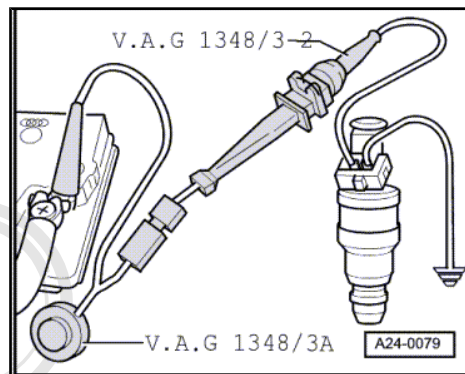


Note

Make sure contacts 1 and 80 on test box remain bridged. (This creates an earth connection to one side of the fuel pump relay coil.)

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

- Connect one of the injector contacts to engine earth using test lead and crocodile clip from auxiliary measuring set -V.A.G 1594C- .
- Connect second injector contact to positive using remote control for V.A.G 1348 -V.A.G 1348/3A- , adapter lead - V.A.G 1348/3-2- and test lead.
- Switch on ignition.
- ◆ The fuel pump should run.
- Operate remote control for V.A.G 1348 -V.A.G 1348/3A- for 30 seconds.
- Perform measurements on all injectors.
- Once all four injectors have been actuated, place measuring glasses on a level surface.
- ◆ Specification: 85...105 ml for each injector
- When checking the injection quantity, also check the spray pattern. The spray pattern should be the same for all injectors.
- If the measured value for one or more of the injectors is outside the tolerance range, switch off the fuel pump (switch off ignition) and renew the defective injector.
- Install injectors together with fuel rail ⇒ [page 19](#) .



2.13 Bleeding fuel system without return pipe

Special tools and workshop equipment required

- ◆ Adapter for K-Jetronic pressure tester -V.A.G 1318/20-
- ◆ Adapter for K-Jetronic pressure tester -V.A.G 1318/20-1-
- ◆ Diesel extractor -VAS 5226-
- ◆ Vehicle diagnostic tester



Note

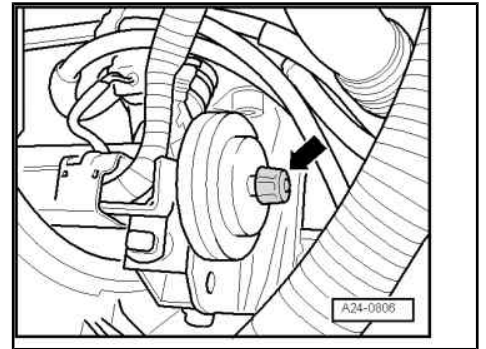
In order to prevent damage to the catalytic converter, the fuel system without return pipe must be bled after working on the fuel pipes or the fuel filter. Do not start the engine until the fuel system has been bled.



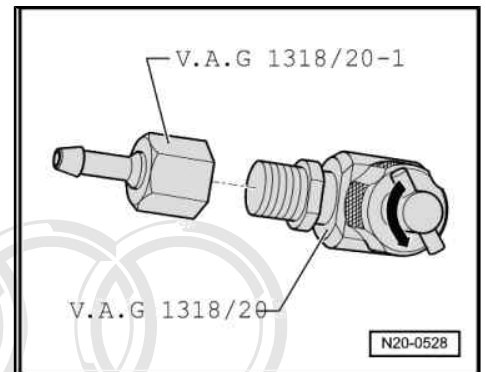
WARNING

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

- Carefully unscrew cap -arrow- on bleeder valve.
- Turn valve (on T-piece) anti-clockwise until it is fully open.

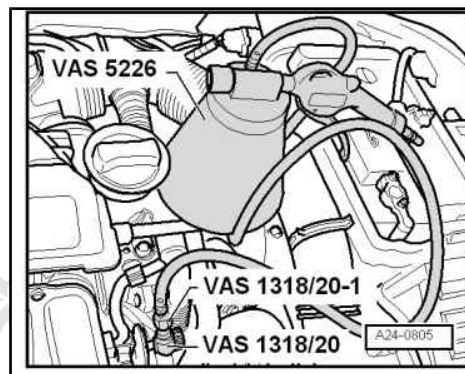


- Screw adapter -V.A.G 1318/20-1- onto adapter for K-Jetronic pressure tester -V.A.G 1318/20- .



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- Screw adapter for K-Jetronic pressure tester -V.A.G 1318/20- hand-tight onto bleeder valve.
- Connect hose from diesel extractor -VAS 5226- as illustrated.
- Screw the valve (on T-piece) into bleed valve clockwise as far as it will go.
- Check adapter and hose connections for leaks.
- Connect vehicle diagnostic tester and select engine electronics.
- Switch on ignition.
- Then select final control diagnosis.



Note

- ◆ *Final control diagnosis can only be performed when engine is not running and ignition is switched on.*
- ◆ *Final control diagnosis is terminated if next step is not selected after an actuation time of 1 minute, if engine is started or if an engine speed pulse is detected.*
- ◆ *Before restarting the final control diagnosis the engine must be started and the ignition must be switched off and on again.*

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- In the final control diagnosis select fuel pump relay.



WARNING

As soon as bubble-free fuel flows into diesel extractor -VAS 5226-, switch the ignition off immediately. This indicates that fuel system has been bled.



WARNING

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

- Turn valve (on T-piece) anti-clockwise until it is fully open again.
- Clamp off hose from diesel extractor -VAS 5226- (for example using hose clamp up to 25 mm -3094-) and detach hose from adapter -V.A.G 1318/20-1- .
- Unscrew adapter for K-Jetronic pressure tester -V.A.G 1318/20- from bleeder valve.



Note

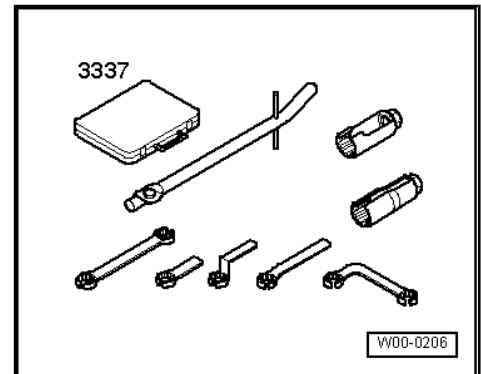
After completing bleeding process the protective cap has to be screwed onto the bleeder connection.

2.14 Removing and installing Lambda probe -G39- and Lambda probe heater -Z19- before catalytic converter

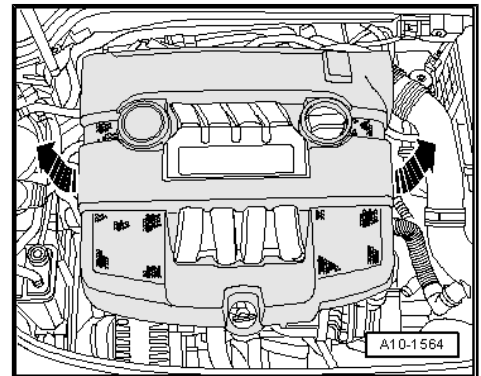
Removing

Special tools and workshop equipment required

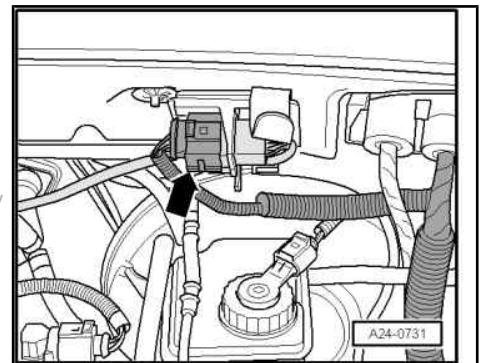
- ◆ Lambda probe open ring spanner set -3337-



- Take off engine cover panel -arrows-.



- Take electrical connector -arrow- for Lambda probe -G39- out of bracket and unplug it.



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- Release wire clamp -1-.
- Unscrew Lambda probe -arrow- using tool from Lambda probe open ring spanner set -3337- .



Note

Illustration shows engine removed.

Installing

When installing, note the following:



Note

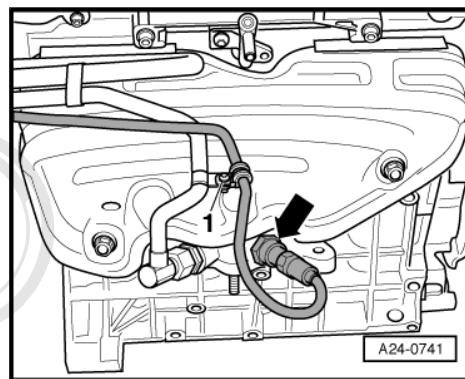
- ◆ *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*

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- ◆ *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 Lambda 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.*

- ◆ *Tightening torque: 55 Nm.*

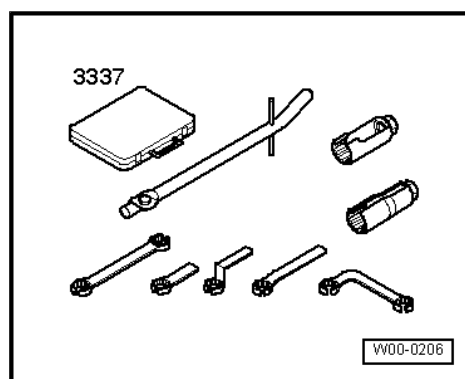


2.15 Removing and installing Lambda probe after catalytic converter -G130- and Lambda probe 1 heater after catalytic converter -Z29-

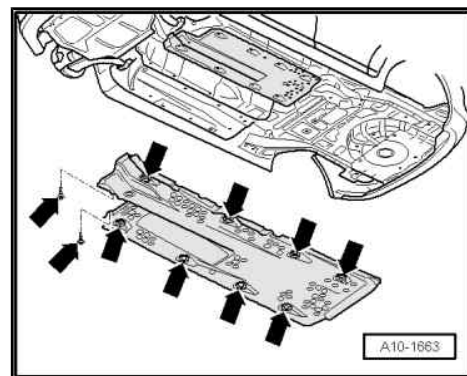
Removing

Special tools and workshop equipment required

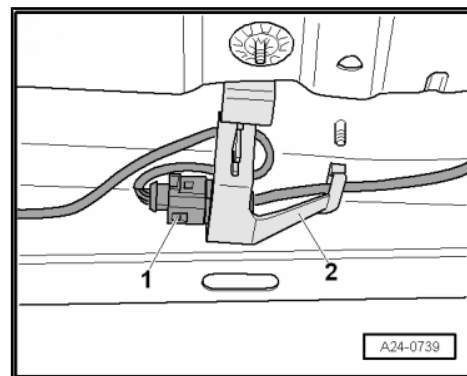
- ◆ Lambda probe open ring spanner set -3337-



- Remove underbody cover (right-side) -arrows-.



- Unplug electrical connector -1-.
- Detach connector from bracket -2- and expose wire leading to Lambda probe after catalytic converter -G130- .



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

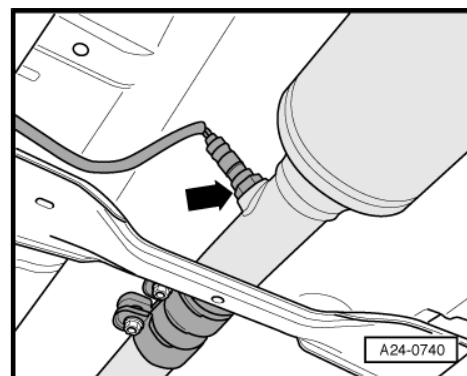
Installing

When installing, 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 Lambda 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.*
- ◆ *Tightening torque: 55 Nm.*



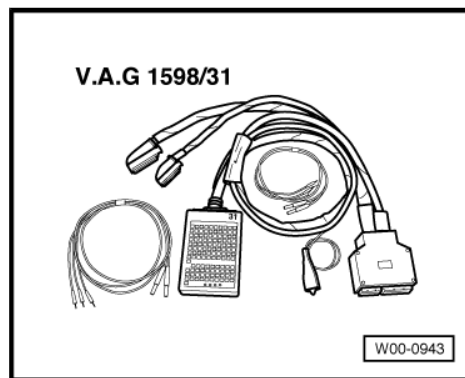
3 Engine control unit

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



Note

- ◆ *The adapter cable, 121-pin -V.A.G 1598/31- is designed so it can be connected both to the wiring harness for the engine control unit and to the engine control unit itself at the same time.*
- ◆ *The advantage of this is that the electronic engine control system remains fully functional when the test box is connected (for example, for measuring signals when the engine is running).*
- ◆ *The relevant test procedure will state whether it is necessary to also connect the engine control unit to the test box.*
- ◆ *Always use auxiliary measuring set -V.A.G 1527B- to connect test equipment (e.g. voltage tester -V.A.G 1526C- , hand-held multimeter -V.A.G 1594C- etc.).*



WARNING

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

- Remove engine control unit ⇒ [page 32](#) .
- 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.

Installing engine control unit

Installation is performed in the reverse sequence; the engine control unit must be installed with the protective housing. New shear bolts must be used.

Perform the following after reconnecting engine control unit:

- Interrogate event memory.

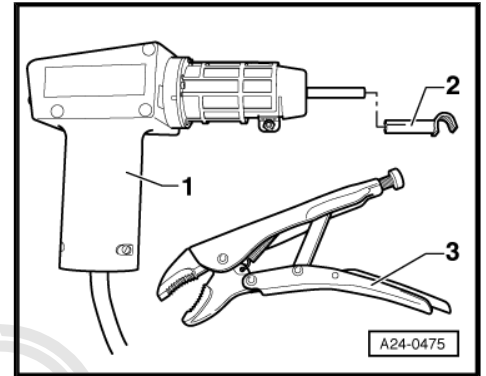
3.2 Renewing engine control unit

Removing

Special tools and workshop equipment required

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- ◆ Hot air blower -VAS 1978/14A- -item 1- with shrink element for hot air blower -VAS 1978/15A- -2- from wiring harness repair set -VAS 1978B-



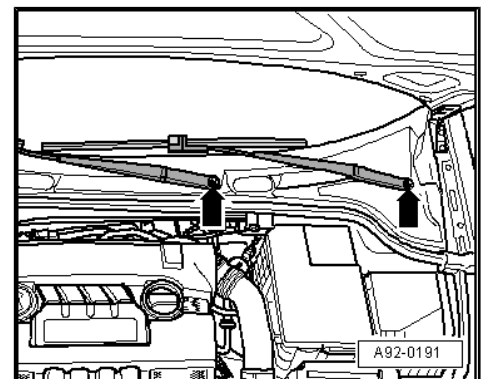
- ◆ Small mole grips -3-



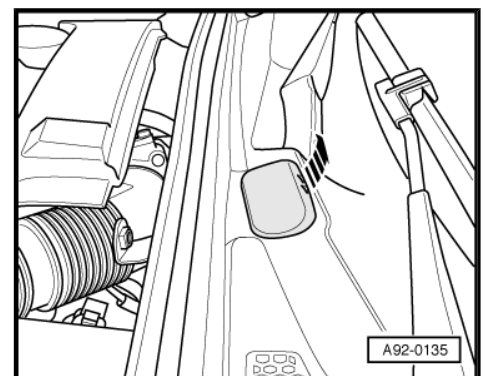
Note

When the connectors are unplugged from the engine control unit, the learnt values are erased, but the contents of the event memory remain intact.

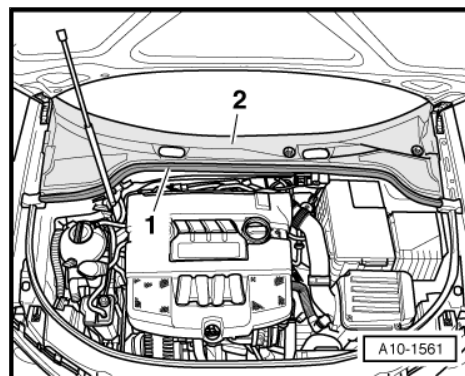
- When renewing engine control unit, select diagnosis object „Replace engine control unit“ in „Guided Functions“ mode of vehicle diagnostic tester.
- Switch off ignition.
- Lever off caps on windscreen wiper arms with a screwdriver.
- Loosen hexagon nuts -arrows- several turns.
- Loosen wiper arms from wiper shafts by tilting them slightly.
- Completely remove hexagon nuts and detach wiper arms from wiper shafts.



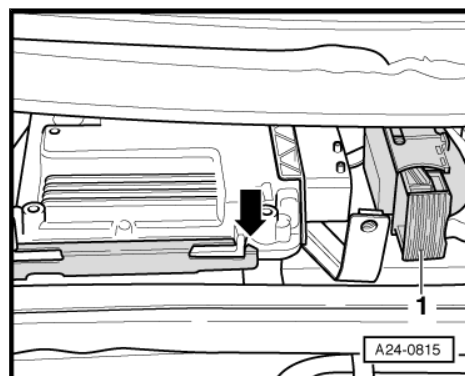
- Unclip washer jets -arrow-.
- Push washer jets through assembly opening back into plenum chamber, leaving water hoses connected.



- Pull rubber seal -1- off plenum chamber cover.
- Detach plenum chamber cover -2-.



Bracket for engine control unit: version 1



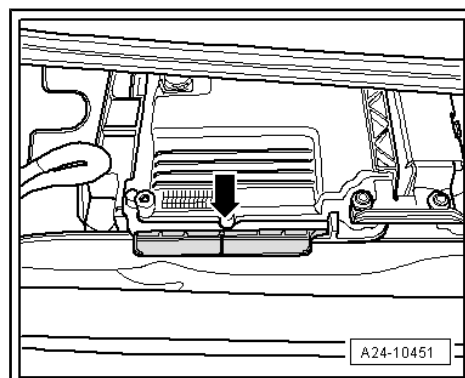
Bracket for engine control unit: version 2

- Release clip »arrow« and remove engine control unit. You can then unplug connectors from engine control unit.

The following steps are only required if the engine control unit is installed as in version 1 in the illustration.

Run wiper shafts to service position.

- First close bonnet.
- Switch ignition on and then off again. Within 10 seconds, press wiper switch down once to brief wipe position.

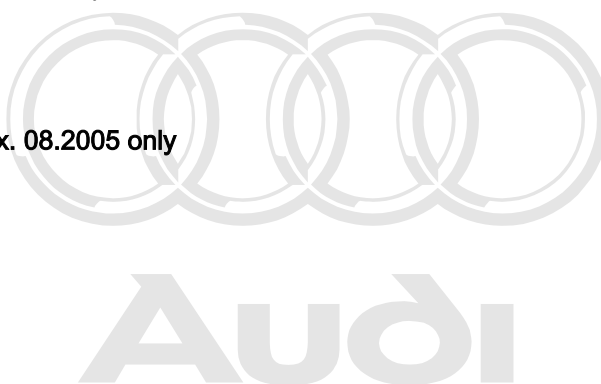


Note

The wiper shafts will now run to the service position.

- Then open bonnet again.
- Remove ignition key.

Work steps for vehicles up to approx. 08.2005 only



To make it more difficult to access the connectors on the engine control unit, the control unit is covered by a protective housing -1- and secured with shear bolts -2-.

To make it more difficult to unscrew the shear bolts, their threads have been coated with locking fluid.

Engine control unit must be separated from protective housing before connectors can be unplugged from engine control unit (e.g. when connecting test box or replacing engine control unit). This procedure is described in the following.

Procedure:



WARNING

The following procedure must be followed exactly to prevent any damage (scorching) to wiring, connectors, insulation and control units. Observe operating instructions for hot air blower.

- 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.



Note

- ◆ Then use hot air blower to heat shear bolts. This step reduces inhibiting action of locking fluid on shear bolt threads and makes it easier to unscrew these bolts.
- ◆ Cover up all painted parts to avoid any damage caused by hot air blower or vice-grip pliers.



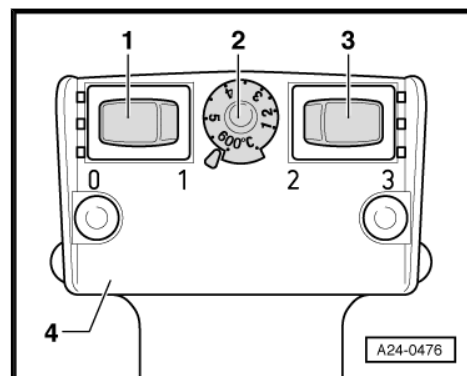
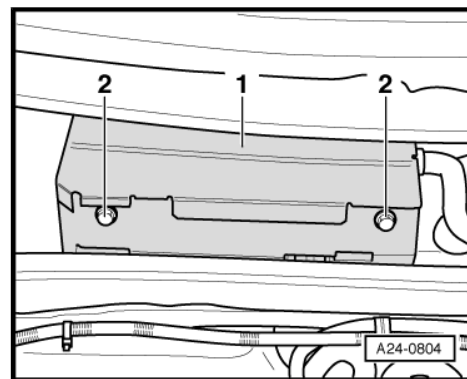
WARNING

Parts of the protective housing will become very hot as a result of heating the shear bolts. Take care to avoid burns. Try to ensure that only the shear bolt is heated and none of the nearby components. These should be covered if necessary.

- Place the hot air blower nozzle close to the shear bolt on the protective housing.
- Switch on the hot air blower and heat the bolt for approximately 20 to 25 seconds.
- Then grasp the bolt head with the vice-grip pliers and unscrew the shear bolt.

The procedure for the second shear bolt is exactly the same.

Engine control unit can now be separated from protective housing.



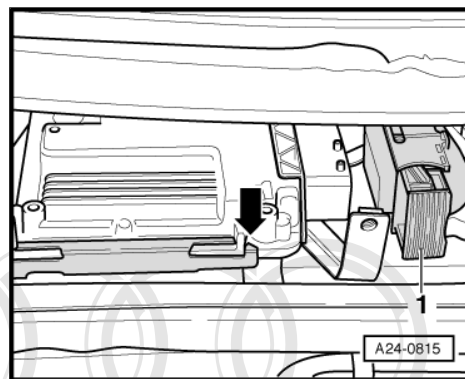
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- Release front connector -1- from engine control unit and unplug connector.
- Pull engine control unit out of retainer -arrow- (wiper shafts in service position).
- Release rear connector on engine control unit and unplug connector.

Installing engine control unit on vehicles with protective housing

Installation is performed in the reverse sequence.

- Make sure you fit protective housing back on engine 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.
- Return wiper arms to normal position.
- First close bonnet.
- Switch on ignition and press wiper switch down once to brief wipe position. The wipers will then return to the normal position.



The following step must be performed after installing the new engine control unit:

- Activate engine control unit via a vehicle diagnostic tester in „Guided Functions“ mode, „Replace engine control unit“.

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

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

2 Servicing ignition system

2.1 Technical data for ignition system

Engine data	1.6 ltr. engine
Idling speed is not adjustable	600 ... 800 rpm
Maximum rpm governed by deactivation of fuel injectors	approx. 6,500 rpm
Ignition timing is determined by the control unit. Ignition timing cannot be adjusted.	
Ignition system	Dual-spark system with two ignition coils
Spark plug connectors	Resistance approx. 5 kΩ
Firing order	1-3-4-2

2.2 Ignition system - exploded view

1 - Ignition cable

- ☐ 4...8 kΩ
- ☐ With suppressor connector and spark plug connector
- ☐ Check for continuity
- ☐ Detach spark plug connector using assembly tool -T10029- or puller -T10112-.

2 - Ignition transformer -N152-

- ☐ Marked for ignition cables: A = cylinder 1, B = cylinder 2, C = cylinder 3, D = cylinder 4

3 - Bolt

- ☐ 10 Nm

4 - Connector

- ☐ 4-pin
- ☐ For ignition transformer -N152-

5 - Spark plug

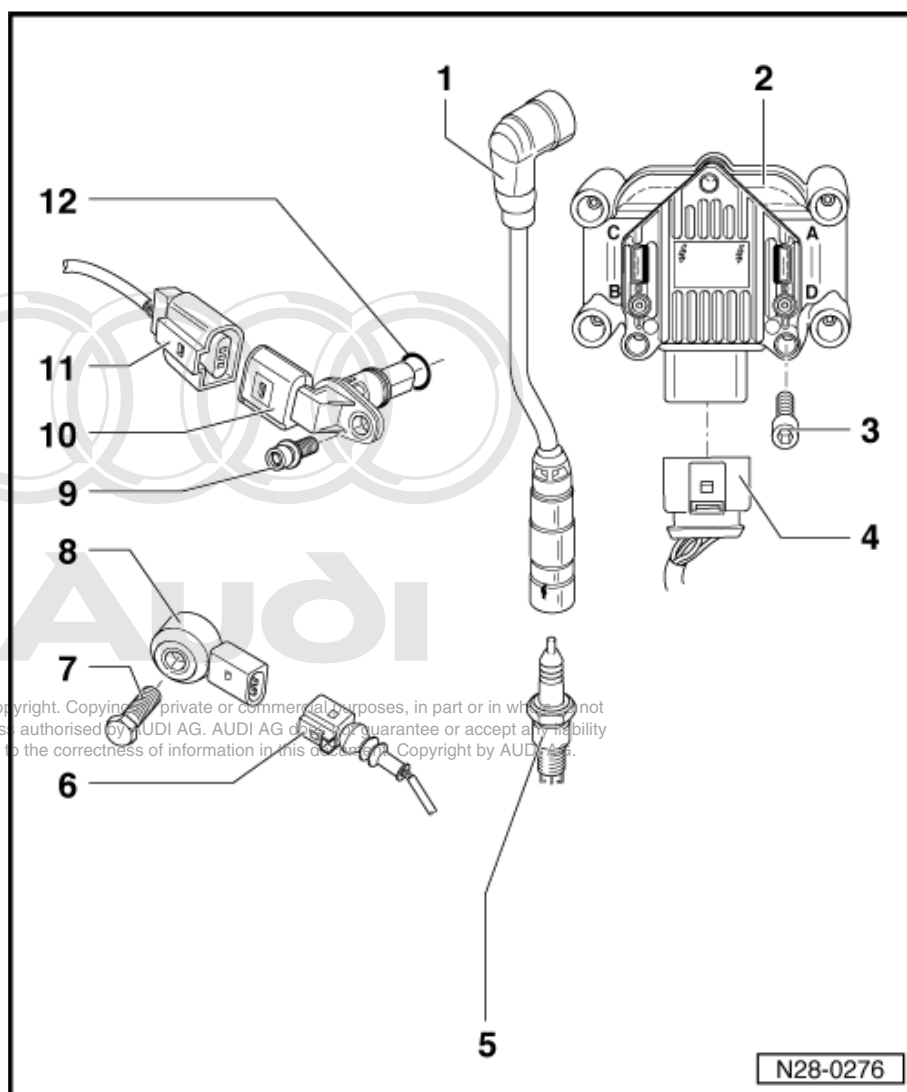
- ☐ Remove and install with spark plug socket and extension -3122 B- ⇒ Maintenance ; Booklet 808

6 - 2-pin connector

- ☐ For knock sensor 1 - G61-
- ☐ Contacts gold-plated

7 - Bolt

- ☐ 20 Nm
- ☐ Tightening torque influences the function of the knock sensor



8 - Knock sensor 1 -G61-

- ☐ Contacts gold-plated

9 - Bolt

- ☐ 10 Nm

10 - Hall sender -G40-

- ☐ Contacts gold-plated

11 - Connector

- ☐ For Hall sender -G40-
- ☐ Contacts gold-plated

12 - O-ring



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