

Audi

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Workshop Manual Audi A3 2004 ➤

**Injection and ignition system (6-cyl. 3.2 ltr. 4-valve
injection engine)**

Engine ID	BDB	BMJ	BUB	CBR A					
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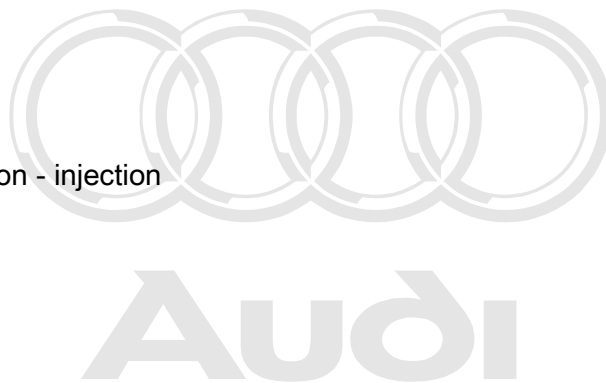
Edition 07.2016

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

(ARL004891; Edition 07.2016)

1.1 Safety precautions

Observe the following to prevent injuries to persons and damage to the injection and ignition system:

- ◆ Always switch off the ignition before connecting or disconnecting electrical wiring for the injection or ignition system or tester cables.
- ◆ Always switch off ignition before washing engine.
- ◆ Faults are stored in engine control unit if electrical connectors have been unplugged.
- With ignition switched off, connect vehicle diagnostic, testing and information system - VAS 5051B- .
- Start “Guided Functions” mode.
- Generate readiness code in engine control unit.



Caution

To prevent irreparable damage to the electronic components when disconnecting the battery:

- ◆ *Observe notes on procedure for disconnecting the battery.*
- ◆ *Always switch off the ignition before disconnecting the battery.*

- Disconnect battery ⇒ Rep. gr. 27 .

When working on the fuel system note the following warnings:



WARNING

The fuel system operates at high pressure - risk of injuries!

- ◆ *Wrap a cloth around the connection before opening the fuel system. Then carefully loosen the connection to relieve the pressure.*

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.

Injuries can also be caused if the passenger's airbag is triggered in a collision.

- *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.

1.2 Rules for cleanliness when working on fuel supply system and injection system

Even small quantities of dirt can lead to defects. For this reason, please observe the following rules when working on the fuel supply system and injection system:

- ◆ Clean connections and surrounding area thoroughly with engine or brake cleaner and dry cleaned area before loosening.
- ◆ Close open lines and connections immediately using clean plugs or protective caps.
- ◆ After removal, place parts on a clean surface and cover them. Use lint-free 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 any parts that have been unpacked previously and stored away loosely (e.g. in a tool box).
- ◆ Do not work with compressed air when the system is open. If possible, do not move vehicle.
- ◆ Protect unplugged electrical connectors against dirt and moisture and make sure connections are dry when attaching.

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2 Servicing Motronic injection system

2.1 Test data

Engine data		3.2 ltr. / 4V / 184 kW engine
Idling speed Cannot be adjusted; regulated by idling speed stabilisation		600 ... 700 rpm ¹⁾
Maximum rpm governed by deactivation of fuel injectors		approx. 6,500 rpm
Fuel pressure at idling speed		approx. 4.0 bar
Residual pressure after 10 minutes		at least 3.0 bar
Injectors	Spray pattern	Two-hole nozzle / same for all injectors
	Injection quantity (30 sec.)	128 ... 140 ml
• ¹⁾ Current values ⇒ Data sheets for exhaust emissions test.		

2.2 Overview of fitting locations



Note

For fitting location of clutch position sender - G476- on vehicles with manual gearbox, refer to ➔ [page 7](#).

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1 - 3-pin connector

- ☐ For knock sensor 1 - G61-

2 - Knock sensor 1 - G61-

- ☐ Fitting location
⇒ [page 10](#)

3 - Activated charcoal filter solenoid valve 1 - N80-

4 - Lambda probe - G39- (before catalytic converter, bank 1) with Lambda probe heater - Z19-

- ☐ Fitting location
⇒ [page 7](#)
- ☐ Removing and installing
⇒ [page 36](#)

5 - Connectors

- ☐ For Lambda probe after catalytic converter - G130- with Lambda probe 1 heater after catalytic converter - Z29- and Lambda probe 2 after catalytic converter - G131- with Lambda probe 2 heater after catalytic converter - Z30-
- ☐ Fitting location
⇒ [page 7](#)

6 - Lambda probe after catalytic converter - G130- with Lambda probe 1 heater after catalytic converter - Z29- (bank 1)

- ☐ Fitting location
⇒ [page 8](#)
- ☐ Removing and installing ⇒ [page 38](#)

7 - Lambda probe 2 - G108- (before catalytic converter, bank 2) with Lambda probe heater 2 - Z28-

- ☐ Fitting location ⇒ [page 7](#)
- ☐ Removing and installing ⇒ [page 36](#)

8 - Lambda probe 2 after catalytic converter - G131- with Lambda probe 2 heater after catalytic converter - Z30- (bank 2)

- ☐ Fitting location ⇒ [page 8](#)
- ☐ Removing and installing ⇒ [page 38](#)

9 - Motronic control unit - J220-

- ☐ Removing and installing ⇒ [page 26](#)

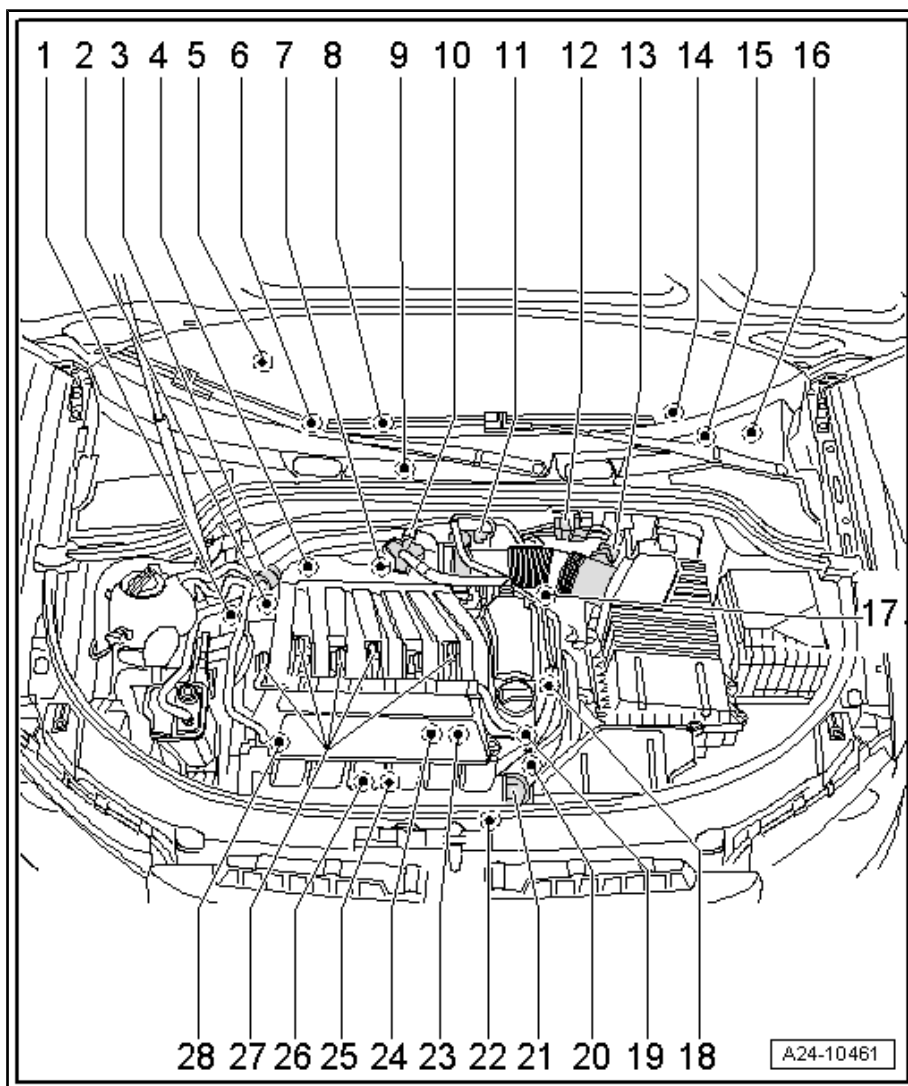
10 - Heating element for crankcase breather - N79-

11 - 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 electric throttle - G188-

12 - Connectors

- ☐ For Lambda probe - G39- (before catalytic converter) with Lambda probe heater - Z19- and Lambda probe 2 - G108- (before catalytic converter) with Lambda probe 2 heater - Z28-
- ☐ Fitting location ⇒ [page 7](#)



13 - Air mass meter - G70-

14 - Instrument cluster

- ☐ With exhaust emissions warning lamp - K83-

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

Fitting location ➔ [page 6](#)

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

- ☐ Fitting location ➔ [page 6](#)

17 - Sender 1 for secondary air pressure - G609-

- ☐ Only for engine code CBRA
- ☐ Fitting location ➔ [page 9](#)

18 - Secondary air pump relay - J299-

Fitting location ➔ [page 8](#)
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19 - Motronic current supply relay - J271-

- ☐ Fitting location ➔ [page 8](#)

20 - Fuel pump relay - J17-

- ☐ Fitting location ➔ [page 8](#)

21 - Hall sender 2 - G163-

- ☐ Fitting location ➔ [page 10](#)

22 - Exhaust camshaft control valve 1 - N318-

- ☐ Brown connector
- ☐ Fitting location ➔ [page 10](#)

23 - Camshaft control valve 1 - N205-

- ☐ Black connector
- ☐ Fitting location ➔ [page 10](#)

24 - Hall sender - G40-

- ☐ Fitting location ➔ [page 10](#)

25 - Coolant temperature sender - G62-

- ☐ Fitting location ➔ [page 10](#)

26 - Engine speed sender - G28-

- ☐ Fitting location ➔ [page 9](#)

27 - Actuator for intake manifold change-over

28 - Secondary air pump motor - V101-

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

- ☐ Fitting location ➔ [page 9](#)

30 - Secondary air inlet valve - N112-

- ☐ For vehicles with vacuum-controlled combination valve for secondary air system
- ☐ Vehicles with engine code CBRA also have secondary air inlet valve 2 - N320-
- ☐ Fitting location ➔ [page 9](#)

31 - Knock sensor 2 - G66-

- ☐ Fitting location ➔ [page 10](#)

32 - 3-pin connector

- ☐ For engine speed sender - G28-
- ☐ Fitting location ➔ [page 9](#)

33 - Ignition coils with output stages

- ☐ Cylinder 1 ignition coil 1 with output stage - N70-

- ☐ Cylinder 2 ignition coil 2 with output stage - N127-
- ☐ Cylinder 3 ignition coil 3 with output stage - N291-
- ☐ Cylinder 4 ignition coil 4 with output stage - N292-
- ☐ Cylinder 5 ignition coil 5 with output stage - N323-
- ☐ Cylinder 6 ignition coil 6 with output stage - N324-

34 - Injectors

- ☐ Cylinder 1 injector for cylinder 1 - N30-
- ☐ Cylinder 2 injector for cylinder 2 - N31-
- ☐ Cylinder 3 injector for cylinder 3 - N32-
- ☐ Cylinder 4 injector for cylinder 4 - N33-
- ☐ Cylinder 5 injector for cylinder 5 - N83-
- ☐ Cylinder 6 injector for cylinder 6 - N84-
- ☐ Checking injection quantity and spray pattern; checking for leaks ⇒ [page 33](#)
- ☐ Removing and installing ⇒ [page 32](#)

Fitting location of accelerator position sender - G79- with accelerator position sender 2 - G185-

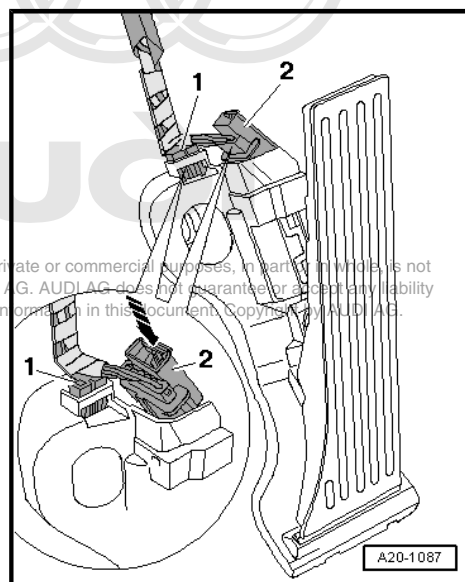
- ◆ To unplug the electrical connector -2- press the release tab and pull off the cable guide -1-.



Note

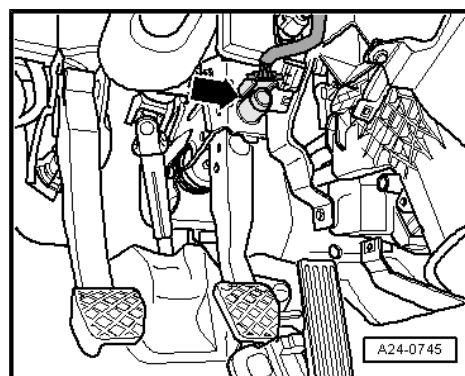
Illustration shows arrangement on LHD vehicles

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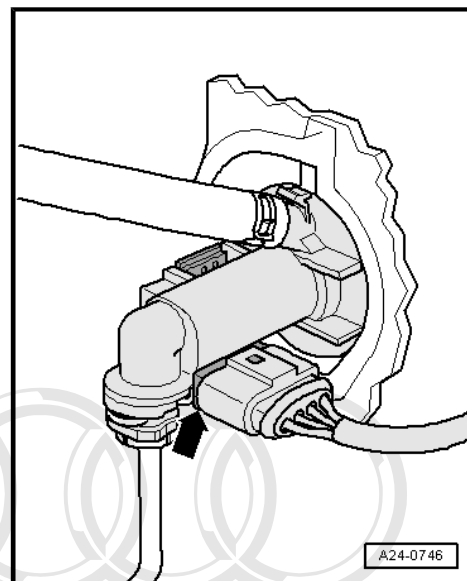
Fitting location of brake light switch - F- and brake pedal switch - F63-

- ◆ On pedal bracket
- ◆ Removing and installing ⇒ Rep. gr. 46



Fitting location of clutch position sender - G476-

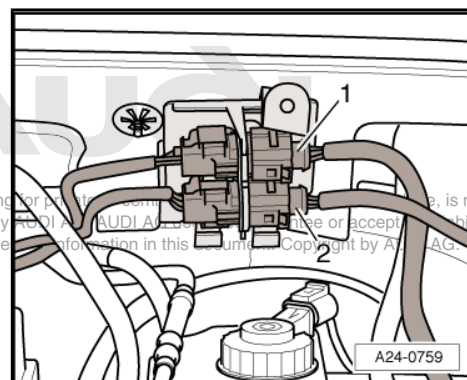
- ◆ On clutch master cylinder
- ◆ Removing and installing ⇒ Rep. gr. 30



Fitting location of connectors for Lambda probes before catalytic converter

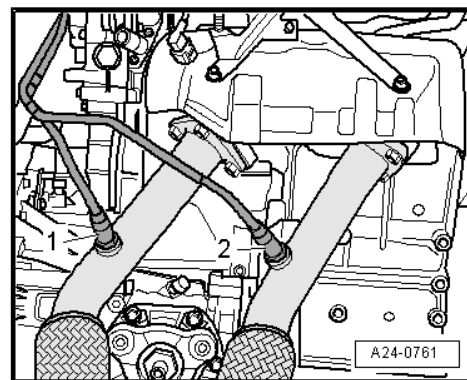
- 1 - Lambda probe 2 before catalytic converter - G108- with Lambda probe 2 heater - Z28-
- 2 - Lambda probe - G39- (before catalytic converter) with Lambda probe heater - Z19-

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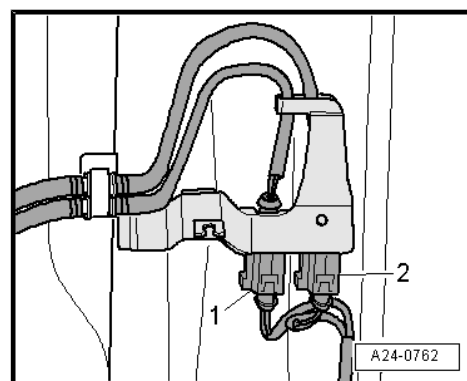
Fitting location of Lambda probes before catalytic converter

- ◆ In front exhaust pipe
- 1 - Lambda probe 2 - G108- (before catalytic converter, bank 2) with Lambda probe heater 2 - Z28-
 - 2 - Lambda probe - G39- (before catalytic converter, bank 1) with Lambda probe heater - Z19-



Fitting location of connectors for Lambda probes after catalytic converter

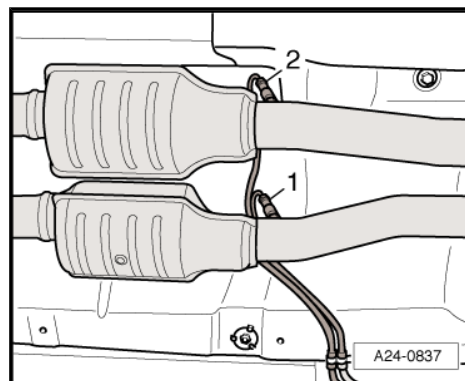
- ◆ On underbody (right-side) beneath underbody cover.
- 1 - Lambda probe after catalytic converter - G130- with Lambda probe 1 heater after catalytic converter - Z29- (bank 1)
 - 2 - Lambda probe 2 after catalytic converter - G131- with Lambda probe 2 heater after catalytic converter - Z30- (bank 2)



Fitting location of Lambda probes after catalytic converter

◆ In catalytic converters.

- 1 - Lambda probe after catalytic converter - G130- with Lambda probe 1 heater after catalytic converter - Z29- (bank 1)
- 2 - Lambda probe 2 after catalytic converter - G131- with Lambda probe 2 heater after catalytic converter - Z30- (bank 2)

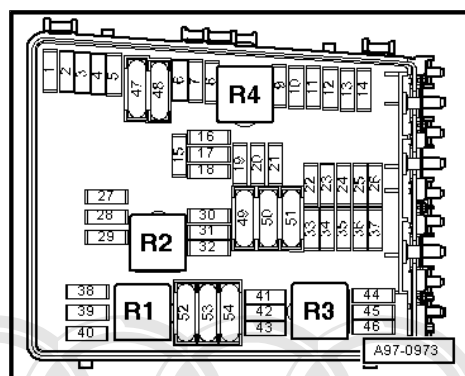


Fitting location of fuel pump relay - J17- and Motronic current supply relay - J271-

◆ In electronics box in engine compartment.

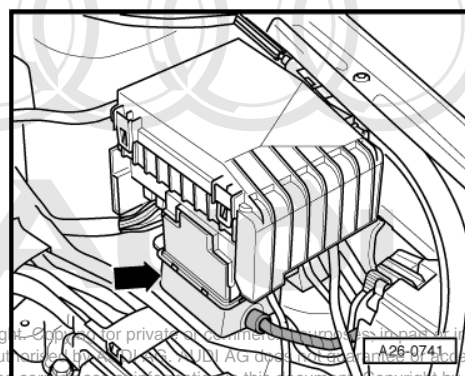
R3 - Fuel pump relay - J17-

R4 - Motronic current supply relay - J271-



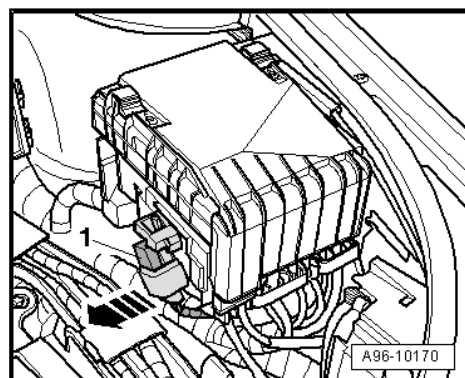
Fitting location of secondary air pump relay - J299- (old version of relay carrier)

◆ On 6-position relay carrier -arrow- beneath electronics box in engine compartment; position 5.



Fitting location of secondary air pump relay - J299- (new version of relay carrier)

- ◆ On relay carrier below electronics box in engine compartment.
- To remove, pull out relay carrier below electronics box -arrow- and pull secondary air pump relay - J299- -item 1- out of socket in relay carrier.



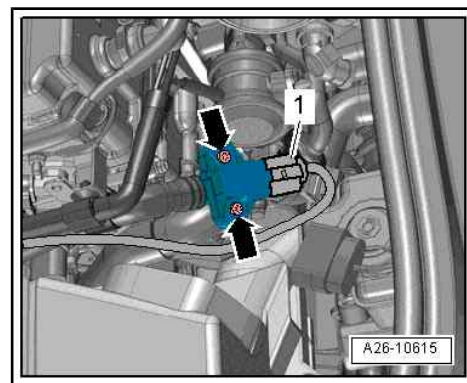
Fitting location of sender 1 for secondary air pressure - G609- (engine code CBRA)

- ◆ Near throttle valve module - J338-
- 1 - Sender 1 for secondary air pressure - G609-
- ◆ Removing and installing ⇒ Rep. gr. 26



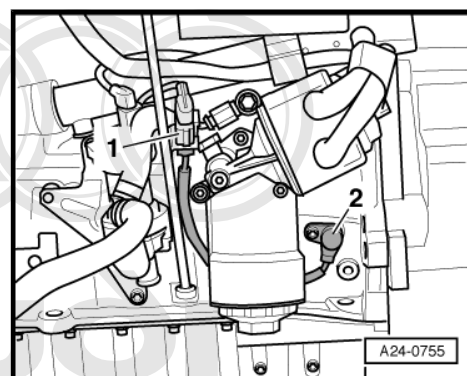
Note

Disregard -arrows-.



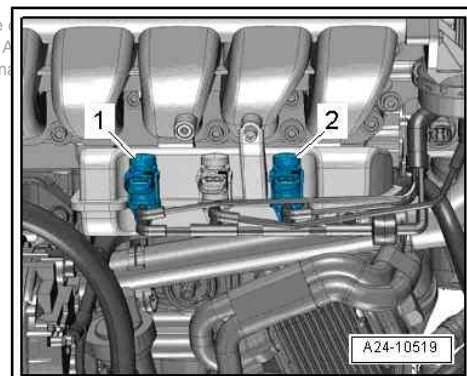
Fitting location of engine speed sender - G28- with 3-pin connector

- ◆ At front of engine
- 1 - 3-pin connector
- 2 - Engine speed sender - G28-



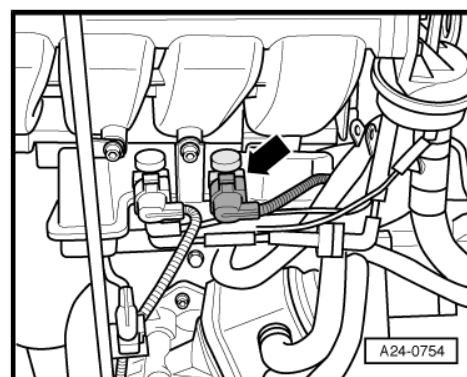
Fitting location of secondary air inlet valve(s)

- 1 - Secondary air inlet valve - N112-
- 2 - Secondary air inlet valve 2 - N320- (engine code CBRA only)



Fitting location of intake manifold change-over valve - N156-

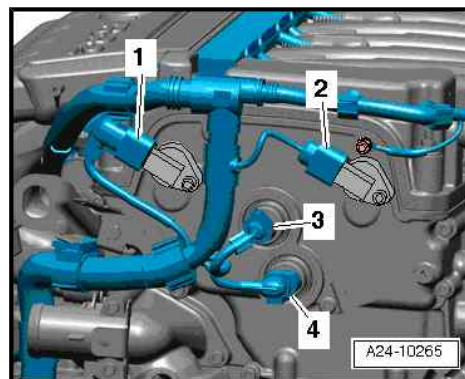
- ◆ At vacuum reservoir (at front of engine)



Fitting location of Hall sender and camshaft control valves

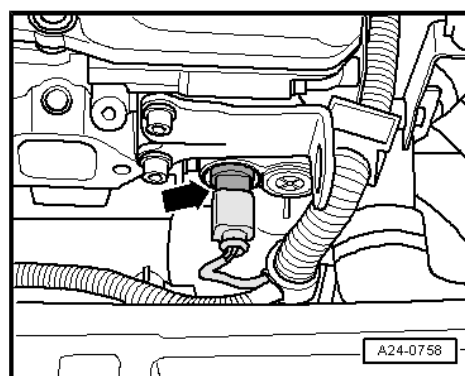
◆ On left side of cylinder head

- 1 - Hall sender - G40-
- 2 - Hall sender 2 - G163-
- 3 - Camshaft control valve 1 - N205-
- 4 - Exhaust camshaft control valve 1 - N318-



Fitting location of coolant temperature sender - G62-

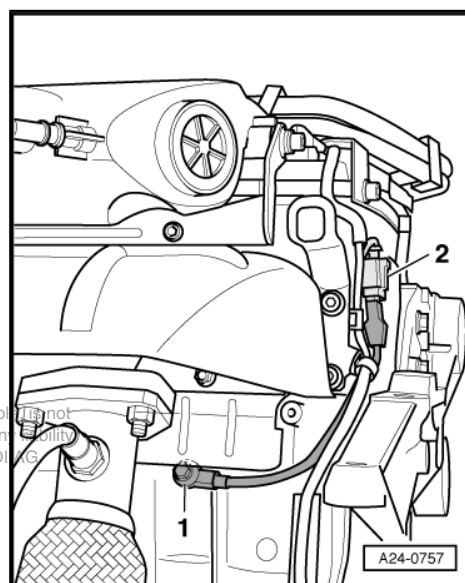
◆ At front left on cylinder head



Fitting location of knock sensor 1 - G61-

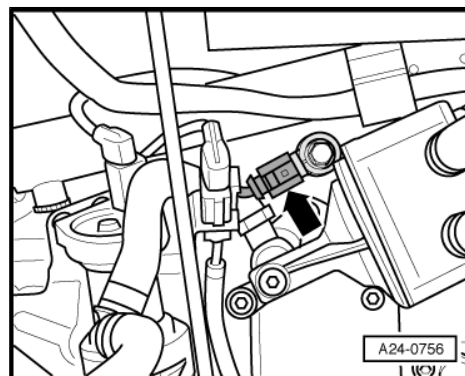
◆ At rear right on cylinder block.

- 1 - Knock sensor 1 - G61-
- 2 - 3-pin connector



Fitting location of knock sensor 2 - G66-

◆ At front on cylinder block



2.3 Air cleaner - exploded view

1 - Lower part of air duct

2 - Air duct

3 - Air duct cover

4 - Rubber grommet

5 - 10 Nm

6 - 5 Nm

7 - 3 Nm

8 - Air hose

9 - Air mass meter - G70-

❑ Removing and installing

⇒ [page 14](#)

10 - Seal

❑ Renew if damaged

11 - Air cleaner housing (top section)

❑ Removing and installing

⇒ ["2.4 Removing and installing air filter element", page 12](#)

12 - Air filter element

❑ Removing and installing

⇒ [page 12](#)

❑ Observe change intervals ⇒ Maintenance ; Booklet 808

13 - Air cleaner housing (bottom section)

❑ Removing and installing

⇒ [page 13](#)

14 - 10 Nm

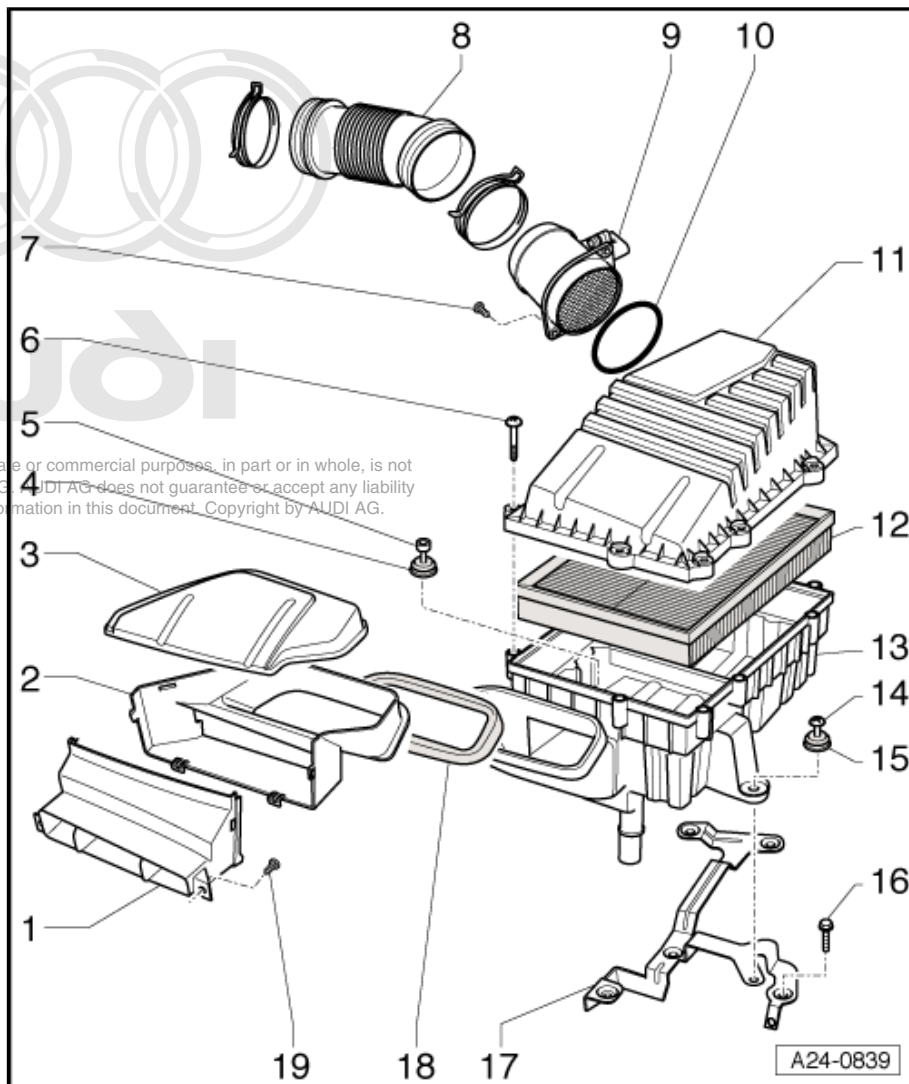
15 - Rubber grommet

16 - 10 Nm

17 - Bracket for air cleaner housing

18 - Gasket

19 - 2 Nm



2.4 Removing and installing air filter element

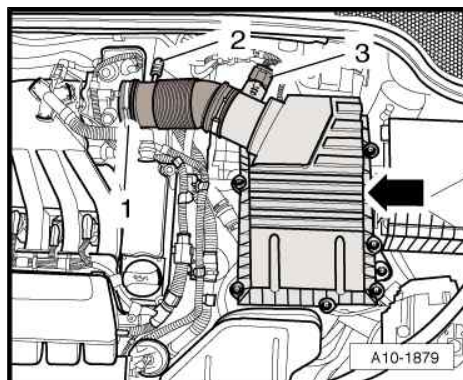
Removing

- If fitted, disconnect vacuum hose -2- from air hose.
- Disconnect air hose -1- from throttle valve module - J338- .
- Unplug electrical connector for air mass meter - G70- -item 3-.
- Remove air cleaner (top section) -arrow-.
- Take out air filter element.

Installing

Installation is performed in reverse sequence; note the following:

To ensure the correct function of the air mass meter it is important to observe the following notes and adhere to the procedures described below.



Note

- ◆ *If the air filter element is very dirty or wet, dirt particles or water can reach the air mass meter and falsify the detected air mass values. This will cause a loss of power, as the calculated injection quantities will be too low.*
- ◆ *Always use genuine air filter elements (same as original equipment).*
- ◆ *The air cleaner housing must always be clean.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*
- ◆ *When cleaning the air cleaner housing with compressed air, cover the critical components of the engine intake system such as the air mass meter and intake pipes etc. with a clean cloth to avoid malfunctioning.*
- ◆ *Please observe requirements for disposal.*

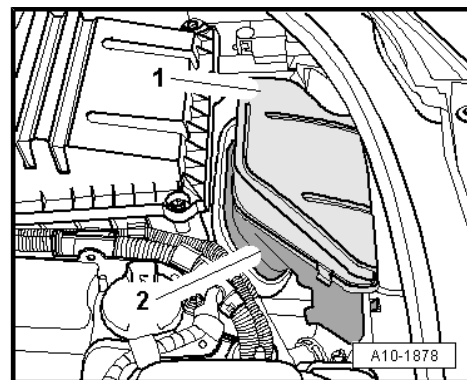
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- Blow out water drain (small hole in bottom section of air cleaner housing) with compressed air.
- Clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); use a vacuum cleaner if necessary.
- Check for salt residue, dirt and leaves in air mass meter and air hose (engine intake side).
- Check air duct leading from lock carrier to air cleaner housing for dirt and leaves.
- When installing the air filter element, make sure it is positioned centrally on the mounting in the bottom section of the air cleaner housing.
- Carefully fit the top section of the air cleaner housing on the bottom section without applying any significant force. Make sure the top section of the air cleaner housing is fitted straight on the air filter element (note position of sealing lip on air filter element).
- Make sure that the air hose is seated correctly at the air mass meter.

2.5 Removing and installing air cleaner housing

Removing

- Remove air filter element ⇒ [page 12](#) .
- Pull cover -1- off air duct (release clips on sides).
- Unclip air duct -2-.



- Unscrew air cleaner housing (lower section) -arrows-.

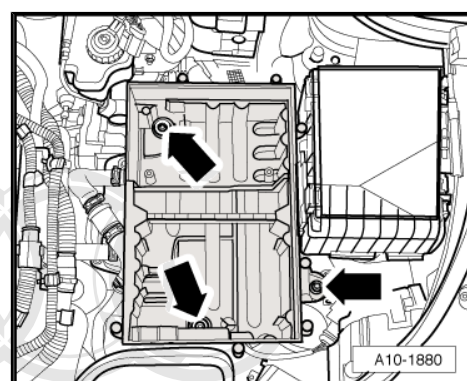
Installing

Installation is performed in reverse sequence; note the following:



Note

- ◆ *The air cleaner housing must always be clean.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*
- ◆ *When cleaning the air cleaner housing with compressed air, cover the critical components of the engine intake system such as the air mass meter and intake pipes etc. with a clean cloth to avoid malfunctioning.*



- Blow out water drain (small hole in bottom section of air cleaner housing) with compressed air.
- Clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); use a vacuum cleaner if necessary.
- Check for salt residue, dirt and leaves in air mass meter and air hose (engine intake side).
- Check air duct leading from lock carrier to air cleaner housing for dirt and leaves.
- Carefully fit the top section of the air cleaner housing on the bottom section without applying any significant force. Make sure the top section of the air cleaner housing is fitted straight on the air filter element (note position of sealing lip on air filter element).

2.6 Removing and installing air mass meter - G70-

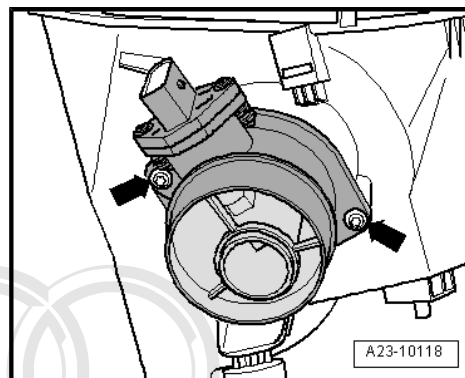
Removing

- Detach air hose at air mass meter - G70- .
- Remove bolts -arrows-.
- Then carefully pull air mass meter - G70- out of guide on air cleaner housing (top section).

Installing

Installation is performed in reverse sequence; note the following:

To ensure the correct function of the air mass meter it is important to observe the following notes and adhere to the procedures described below.



Note

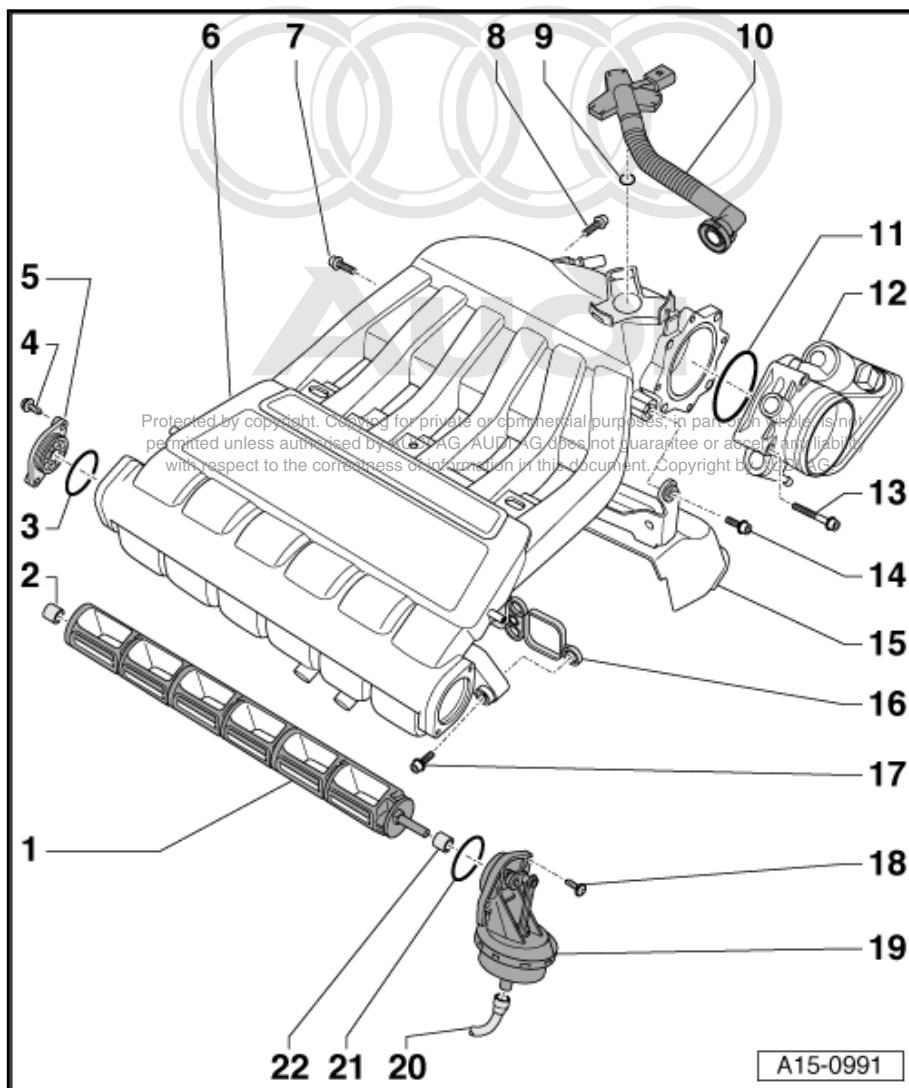
- ◆ *Renew O-ring.*
- ◆ *If the air filter element is very dirty or wet, dirt particles or water can reach the air mass meter and falsify the detected air mass values. This will cause a loss of power, as the calculated injection quantities will be too low.*
- ◆ *Always use genuine air filter elements (same as original equipment).*
- ◆ *Use silicone-free lubricant when fitting air hose.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*
- Check for salt residue, dirt and leaves in air mass meter and air hose (engine intake side).
- Check for dirt in air duct leading to air filter element. Clean salt residue, dirt and leaves out of top and bottom sections of air cleaner housing (wash out or vacuum out if necessary).
- Fit top section of air cleaner housing
⇒ ["2.4 Removing and installing air filter element", page 12](#) .

Tightening torque

Component	Nm
Air mass meter to air cleaner housing (top section)	1.5

2.7 Intake manifold - exploded view

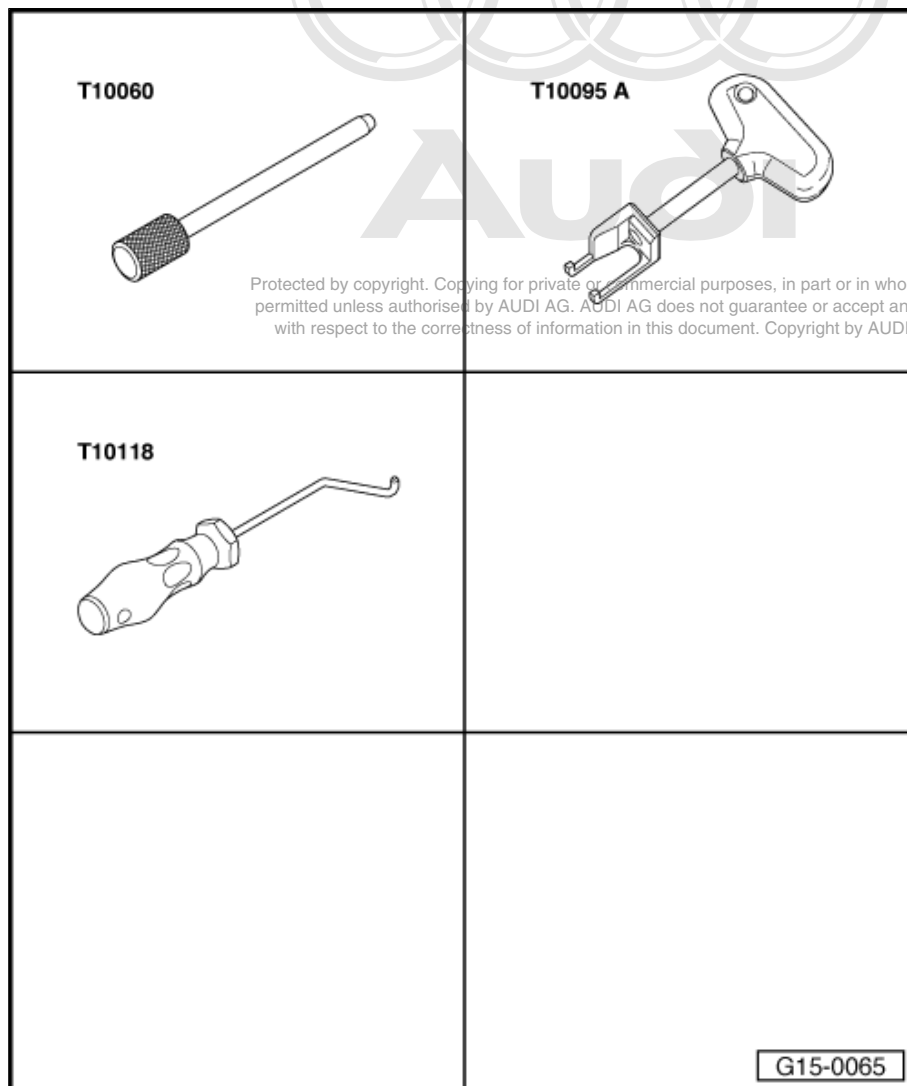
- 1 - Change-over barrel
- 2 - Bearing bush
- 3 - O-ring
 - ☐ Renew
- 4 - Panel bolt
- 5 - Bearing cap
- 6 - Intake manifold
- 7 - 20 Nm
- 8 - 20 Nm
- 9 - Seal
- 10 - Connection for crankcase breather
 - ☐ With heater element for crankcase breather - N79-
- 11 - O-ring
- 12 - Throttle valve module - J338-
- 13 - 10 Nm
- 14 - 20 Nm
- 15 - Heat shield for exhaust manifold
 - ☐ With support for intake manifold
- 16 - Gasket
 - ☐ Renew
 - ☐ Insert into intake manifold
- 17 - 13 Nm
- 18 - Panel bolt
- 19 - Vacuum unit
- 20 - Vacuum connection
 - ☐ To intake manifold change-over valve - N156-
- 21 - O-ring
 - ☐ Renew
- 22 - Bearing bush



2.8 Removing and installing intake manifold

Special tools and workshop equipment required

- ◆ Locking pin - T10060-
- ◆ Puller - T10095 A-
- ◆ Assembly tool - T10118-



Removing



Note

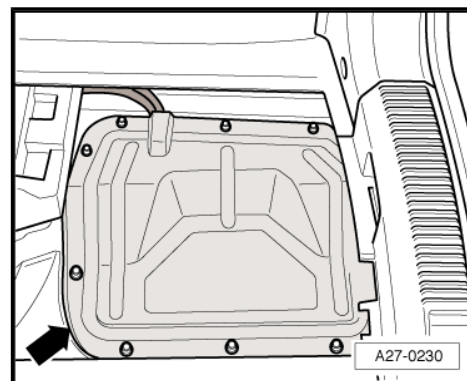
All cable ties which are released or cut open when removing must be refitted in the same position when installing.



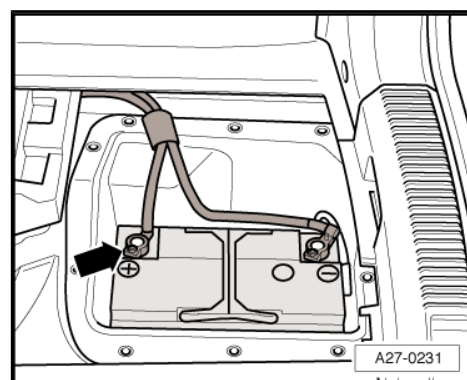
Caution

Observe notes on procedure for disconnecting the battery ⇒ Rep. gr. 27.

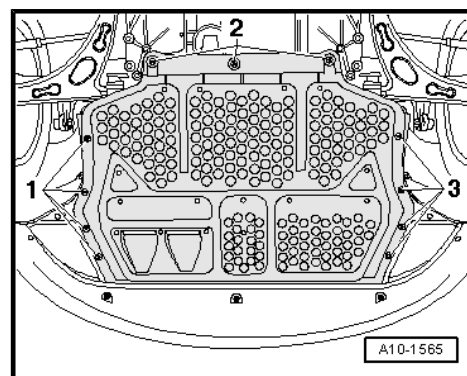
- Remove the moulded insert for tools from beneath the luggage compartment floor cover.
- Remove cover -arrow- for battery compartment.
- Detach moulded insert above battery.



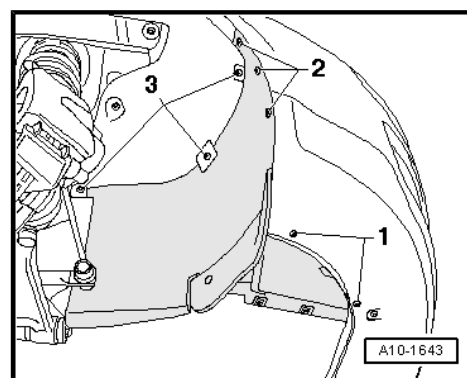
- With ignition switched off, disconnect earth wire -arrow- at battery.



- Remove centre noise insulation -fasteners 1 ... 3-.

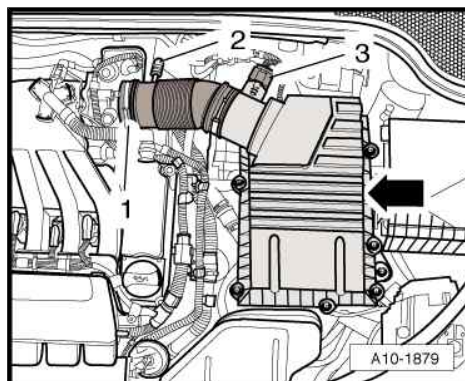


- Remove noise insulation (right-side) -fasteners 1 ... 3-.

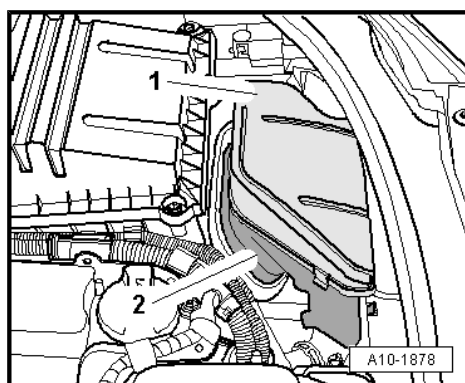


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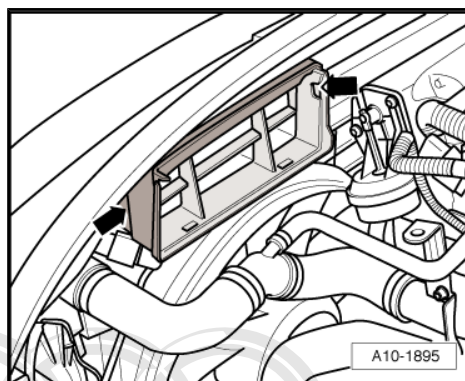
- Detach vacuum hose -2- from air intake hose.
- Disconnect air hose -1- from throttle valve module - J338- .
- Unplug electrical connector for air mass meter - G70-
-item 3-.
- Remove air cleaner (top section) -arrow-.
- Take out filter element.



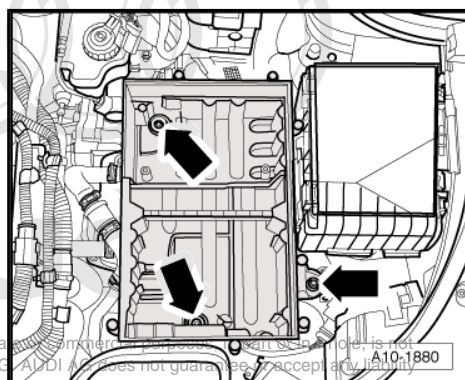
- Pull cover -1- off air duct.
- Unclip air duct -2-.



- Unscrew air duct (lower section) -arrows-.

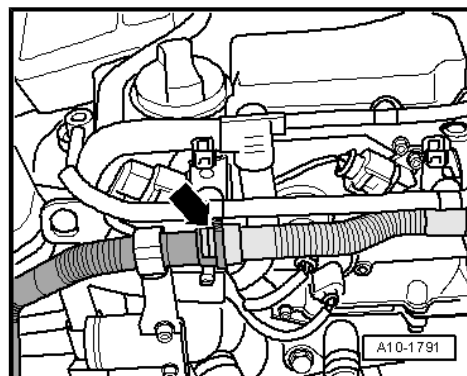


- Unscrew air cleaner housing (lower section) -arrows-.

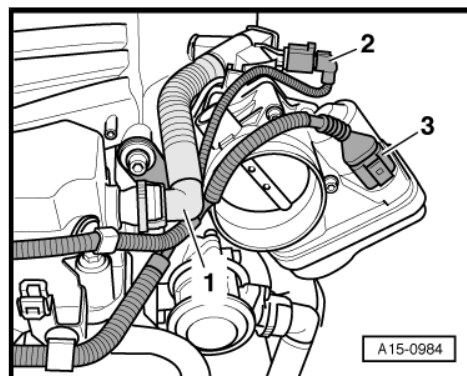


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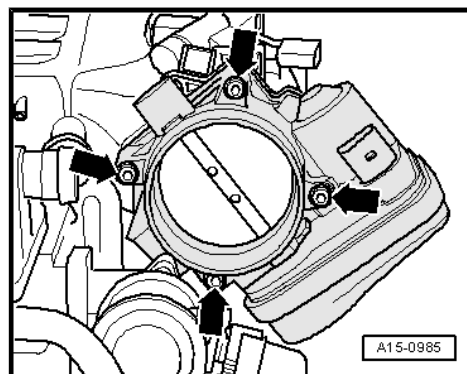
- Disconnect secondary air hose at the position marked with an -arrow-.
- Move air hose to secondary air pump clear.



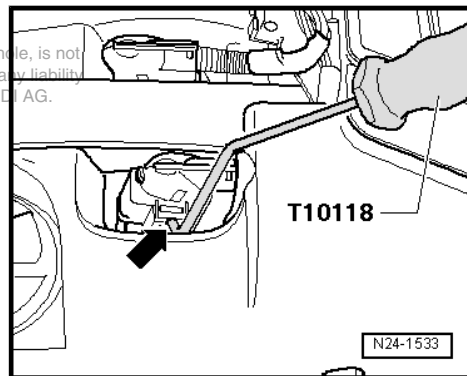
- Unplug electrical connectors -2- and -3-.
- Remove crankcase breather hose -1-.



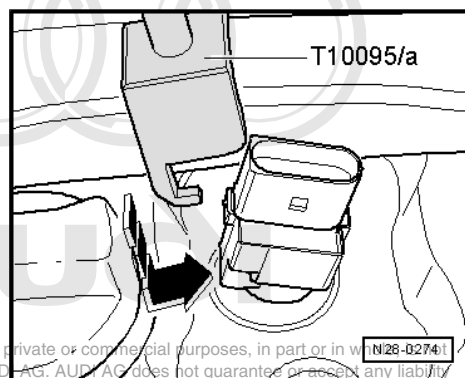
- Unbolt throttle valve module - J338- from intake manifold -arrows- and move clear to one side.



- Unplug electrical connectors at ignition coils; to do so, apply assembly tool - T10118- to release tab -arrow- and carefully pull off electrical connector.



- Attach puller - T10095 A- to ignition coils as shown in illustration -arrow- and remove ignition coils one at a time.
- Remove retainer for ignition cable harness and move to one side.

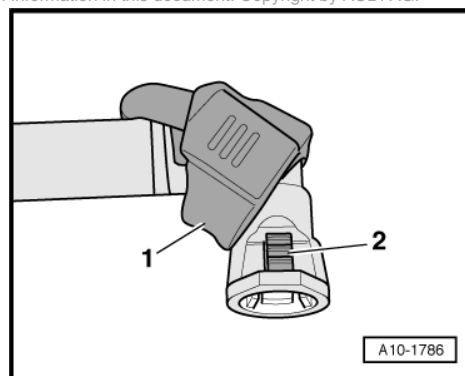


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Note

Some versions have plug-in vacuum connections on the intake manifold as illustrated. To disconnect, push back rubber cap -1- and slide back retaining tab -2-.



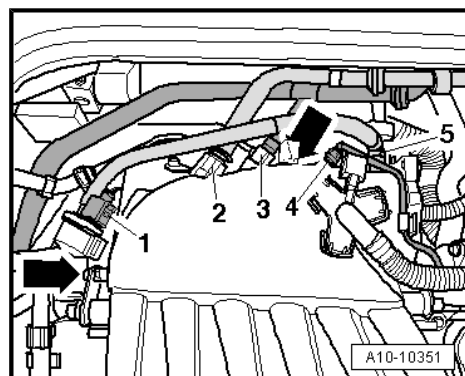
- Disconnect vacuum hoses -2 ... 5- at rear of intake manifold.



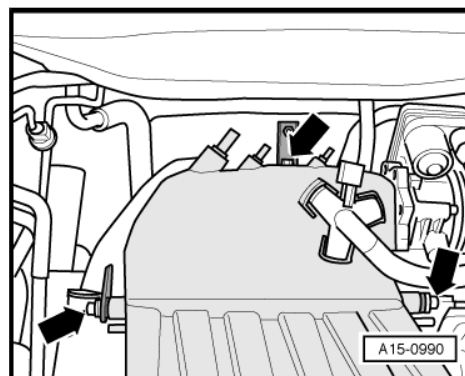
Note

Disregard -item 1-.

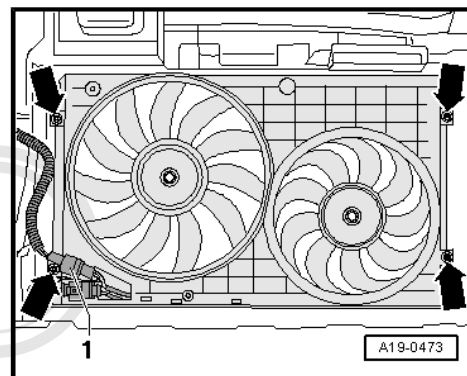
- Unbolt hose bracket from intake manifold -arrows- and move clear to rear, with hoses attached.



- Remove rear securing bolts -arrows- for intake manifold.



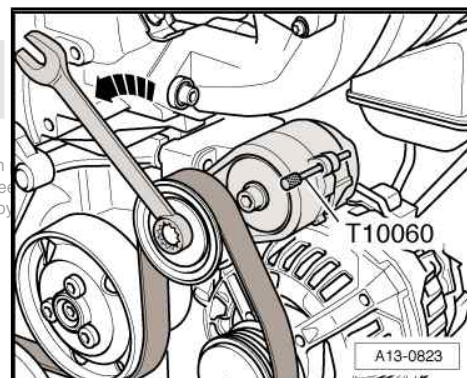
- Unscrew upper securing bolts -upper arrows- for radiator cowl.
- Pull out oil dipstick.



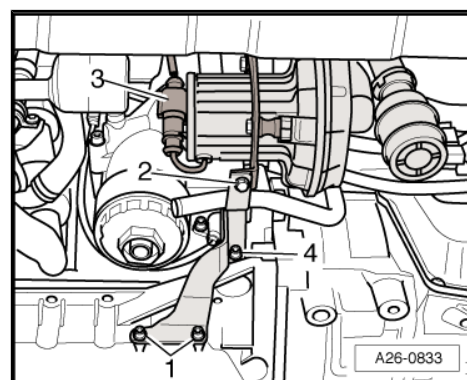
Note

Before removing, mark direction of rotation of poly V-belt with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

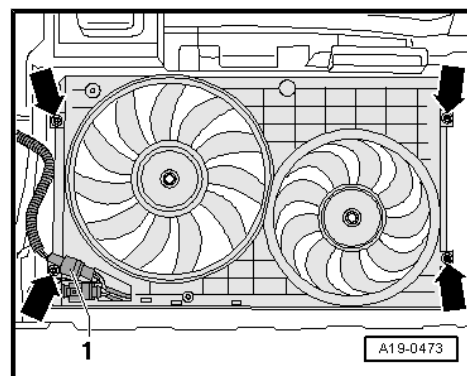
- To slacken poly V-belt turn tensioning element in direction of arrow.
- Lock tensioning element in position with locking pin - T10060- or with an Allen key.
- Remove poly V-belt.



- Move coolant hose at bottom of radiator cowl clear.
- Unplug electrical connector -3- at secondary air pump motor - V101- .
- Move wire clear.
- Unscrew bracket -2- for coolant pipe.
- Remove bolts -1-.
- Loosen bolt -4- and remove secondary air pump with bracket.



- Detach electrical connectors -1- for radiator fans at bottom of radiator cowl.
- Unscrew lower securing bolts -lower arrows- for radiator cowl.
- Remove the radiator cowl with both fans from below.



- Unplug electrical connector -1- for magnetic clutch at air conditioner compressor and move electrical wiring clear.


WARNING

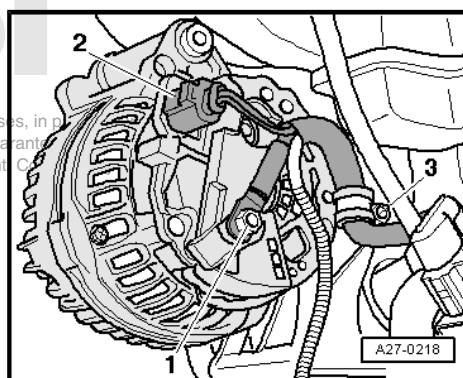
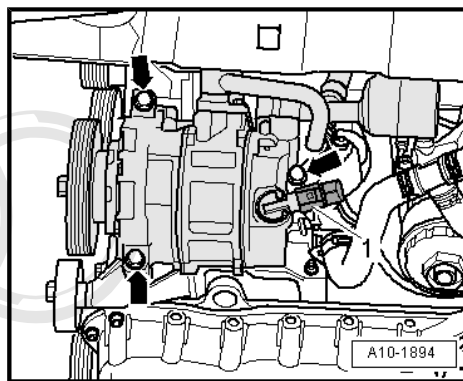
The air conditioner refrigerant circuit must not be opened.

- Unscrew bolts -arrow- for air conditioner compressor.
- Tie up air conditioner compressor together with refrigerant hoses at front of longitudinal member (refrigerant hoses remain connected).
- Unscrew wire -1- at alternator.
- Unplug electrical connector -2-.


Note

Disregard -item 3-.

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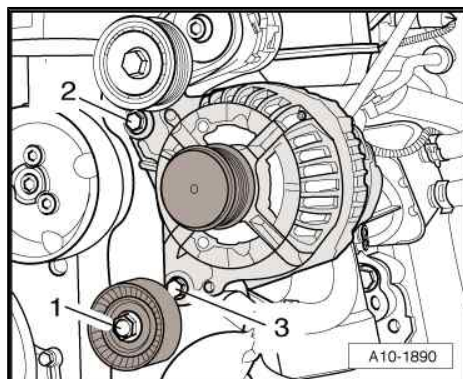


- Remove the upper idler roller -1-.
- Unscrew securing bolts -2- and -3- for alternator.

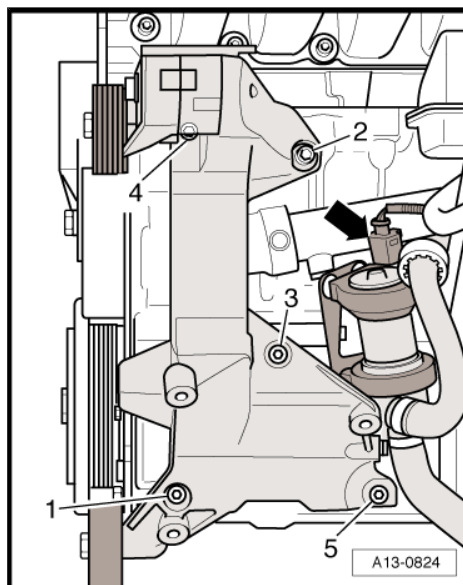

Note

The alternator can only be removed from bracket with upper securing bolt still inserted.

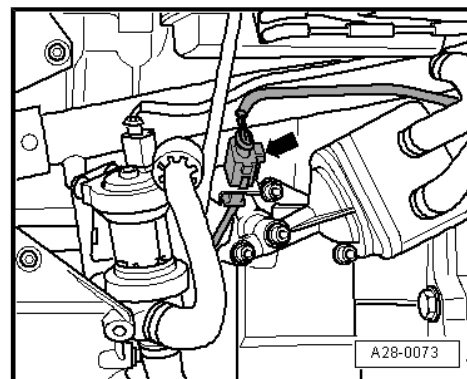
- Remove alternator from bracket for ancillary units (electrical wires remain connected).
- Take out alternator to the bottom left.
- Unplug electrical connector -arrow- at continued coolant circulation pump - V51- .
- Remove bolts -1 ... 5- and detach bracket for ancillaries.
- Pull continued coolant circulation pump - V51- downwards out of rubber retainers on bracket (with coolant hoses attached). If necessary, spray rubber retainers with silicone-free lubricant.


Note

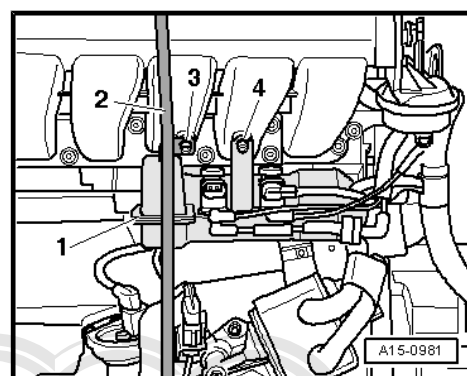
The coolant pump with attached coolant hoses can be left in place on the engine.



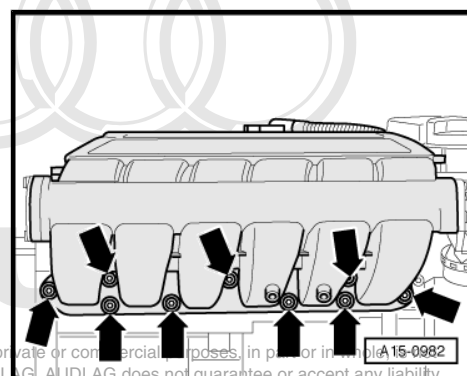
- Unhook connector -arrow- for engine speed sender - G28- from bracket on guide tube for oil dipstick.



- Unscrew bolt -3- and pull out guide tube for oil dipstick -2-.
- Unscrew bolt -4- and detach vacuum reservoir -1- from manifold.
- Move vacuum reservoir to side (hoses remain attached).



- Unscrew bolts -arrows- at front of intake manifold.



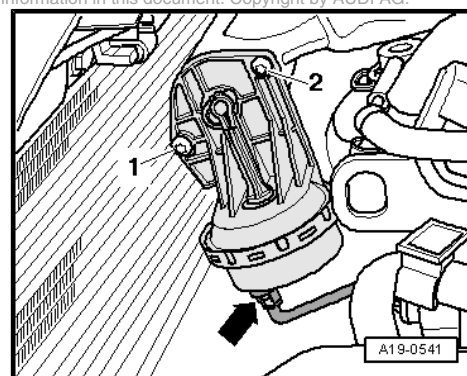
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- Disconnect vacuum hose -arrow- at actuator for intake manifold change-over.



Note

Disregard items marked -1- and -2-.



- Protect the intake manifold from damage with a clean cloth -1-.
- Pivot intake manifold forwards -arrow 1- and then pull slightly to the left -arrow 2-.



Note

Cover or plug the intake ports in the cylinder head with a clean cloth or foam plastic to prevent small items from dropping in.

- Unbolt bracket for fuel line (right-side) at cylinder head cover.
- Move electrical wiring harness -1- on cylinder head cover clear to one side.
- Remove bolts -arrows-.
- Remove fuel rail -2- with fuel injectors from cylinder head and move clear to one side (fuel line remains attached).
- Swing intake manifold back to its fitting position and remove.

Installing

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



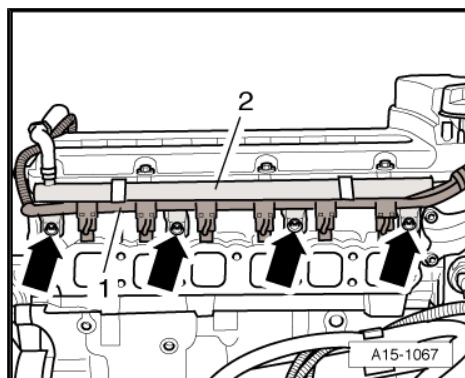
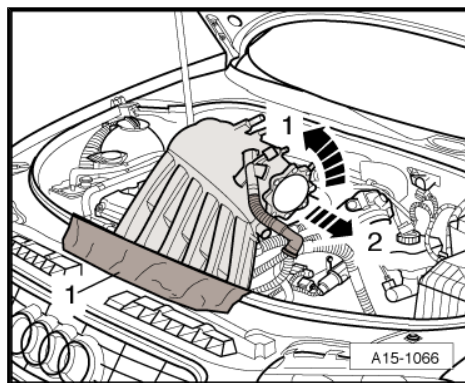
Note

- ◆ *Renew seals.*
- ◆ *To simplify assembly, detach wiring harness -1- to injectors from fuel rail.*

- Install bracket for ancillaries ⇒ Rep. gr. 13 .
- Install alternator ⇒ Rep. gr. 27 .
- Install air conditioner compressor ⇒ Rep. gr. 87 .
- Install radiator cowl ⇒ Rep. gr. 19 .
- Install secondary air pump ⇒ Rep. gr. 26 .
- Install poly V-belt ⇒ Rep. gr. 13 .
- Connect earth strap to battery ⇒ Rep. gr. 27 .

Tightening torques

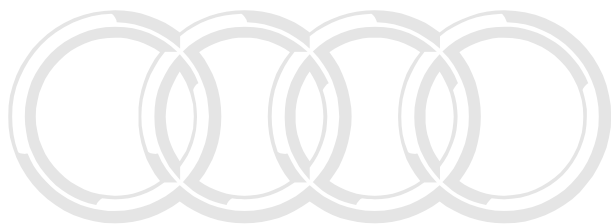
Component	Nm
Intake manifold to cylinder head	13
Intake manifold support to intake manifold	20
Throttle valve module - J338- to intake manifold	10
Vacuum reservoir to intake manifold	5
Guide tube for oil dipstick to intake manifold	5



2.9 Wiring and component check on engine control unit with adapter cable - V.A.G 1598/31- (test box)

Special tools and workshop equipment required

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



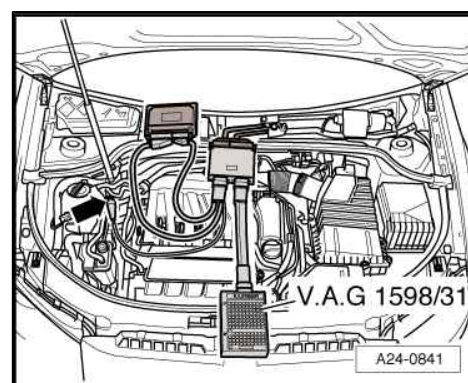
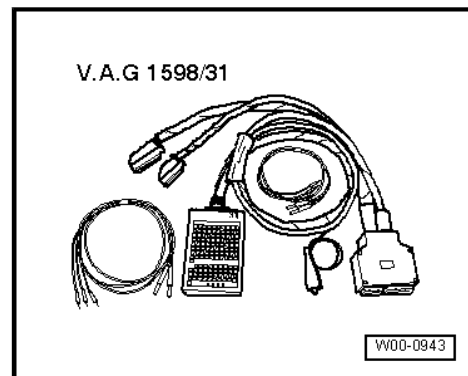
Note

◆ *The adapter cable - V.A.G 1598/31- (test box) is designed in such a way that 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 instructions for performing the individual tests indicate whether or not the engine control unit itself also needs to be connected to the test box.*
- ◆ *Always use auxiliary measuring set - V.A.G 1527 B- to connect test equipment (e.g. voltage tester - V.A.G 1526 C- , hand-held multimeter - V.A.G 1594 C- etc.).*

Procedure

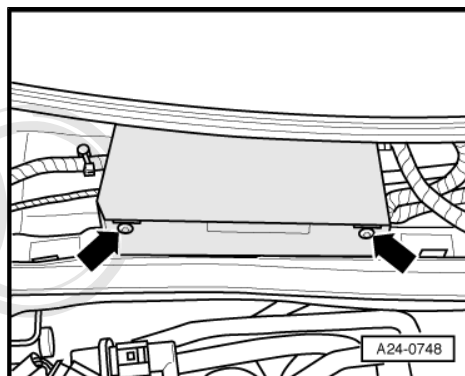
- Remove engine control unit ⇒ [page 26](#) .
- Connect adapter cable - V.A.G 1598/31- (test box) to multi-pin connectors on wiring harness.
- Connect earth clip of test box to earth -arrow-.
- The instructions for performing the individual tests indicate whether or not the engine control unit itself also needs to be connected to the test box.
- Carry out test as described in relevant repair procedures.
- After completing test, re-install engine control unit ⇒ [page 26](#) .



2.10 Removing and installing engine control unit

The multi-pin connectors of the engine control unit are enclosed in a protective housing, which is secured by a locking device and shear bolts -arrows-. To make it more difficult to unscrew the shear bolts, the threads have additionally been coated with locking fluid.

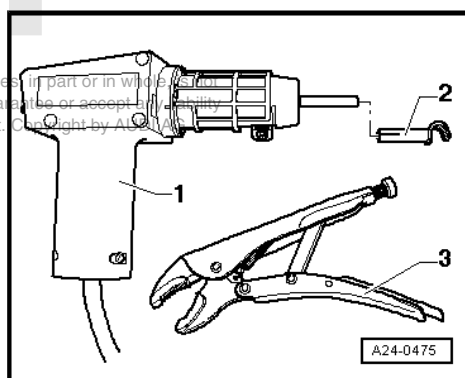
The protective housing has to be removed before multi-pin connectors can be unplugged from engine control unit (e.g. to connect test box or renew engine control unit).



Special tools and workshop equipment required

- ◆ Hot air blower (from wiring harness repair set - VAS 1978-)

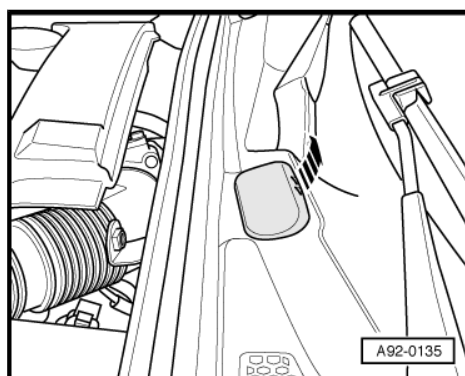
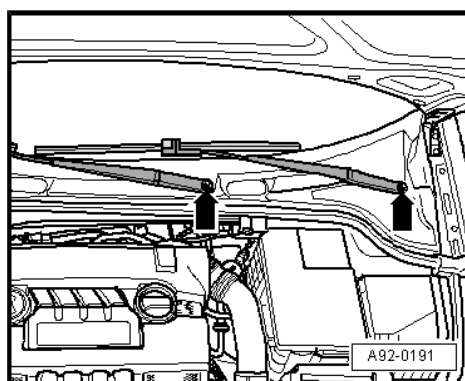
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- ◆ Nozzle for hot air blower from the wiring harness repair set - VAS 1978-
- ◆ Vice-grip pliers (commercially available)

Removing

- Switch off ignition and remove ignition key.
- Prise cover caps off wiper arms using a screwdriver.
- Loosen hexagon nuts -arrows- several turns.
- Release wiper arms from wiper shafts by tilting them slightly. Unscrew and remove hexagon nuts and then detach wiper arms.
- Unclip washer jets -arrow-.
- Push washer jet through assembly opening back into plenum chamber, leaving hoses connected.

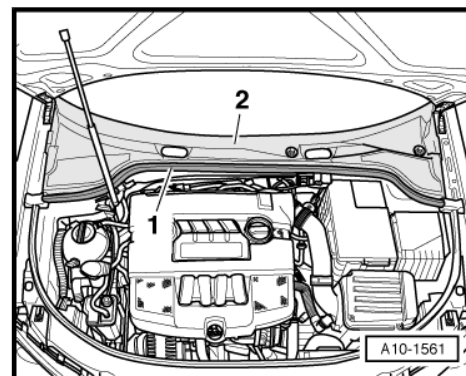


- Detach rubber seal -1- from plenum chamber cover.
- Detach plenum chamber cover -2-.



Caution

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

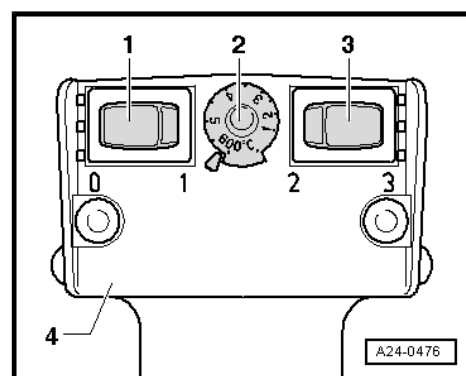


- Select settings on hot-air blower as shown in illustration, i.e. set temperature potentiometer -2- to maximum heat output and two-stage air flow switch -3- to position "3".



Note

- ◆ Then use hot air blower to heat threaded holes in protective housing into which shear bolts have been screwed. This reduces the inhibiting action of the locking fluid on the 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.

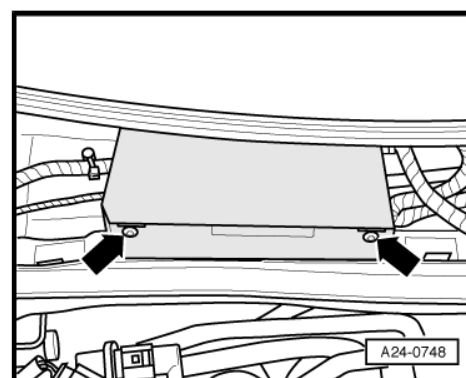


WARNING

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 thread is heated and none of the nearby components. These should be covered if necessary.

- Carry out the following operations on the two shear bolts -arrows-, one after the other.
- Place the nozzle of the hot air blower close to the shear bolt on the protective housing.
- Switch on the hot air blower and heat the bolt for approximately 20 ... 25 seconds.
- Then grasp the bolt head with the vice-grip pliers and unscrew the shear bolt.
- Take off the protective housing.

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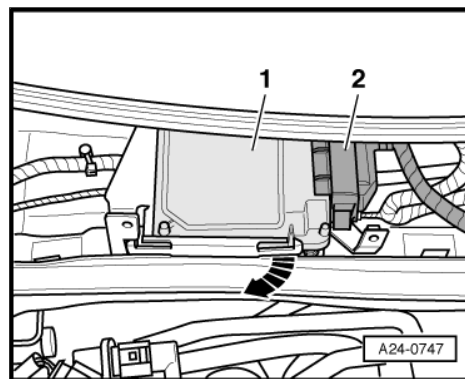


- Release and unplug front multi-pin connector -2- on engine control unit.
- Release retaining clip -arrow-.
- Pull engine control unit -1- out of bracket.
- Release and unplug rear multi-pin connector on engine control unit.



Note

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



Installing

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

- Reinstall the engine control unit into the protective housing.
- Clean threaded holes for shear bolts to remove any residue from locking fluid. This can be done using a thread tap.
- Use new shear bolts.

After installing a new engine control unit, the following operations must be performed:

- Activate engine control unit in “Guided Fault Finding” mode under diagnosis option “Replace engine control unit” ⇒ Vehicle diagnostic tester.

2.11 Checking system pressure, fuel pressure regulator and residual pressure

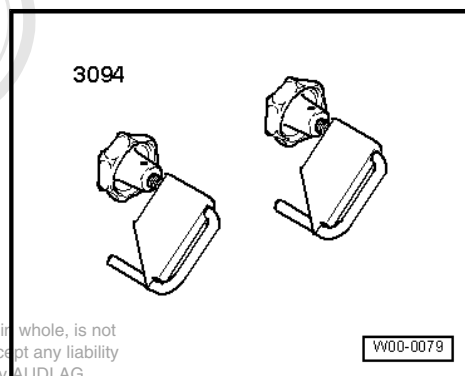


Note

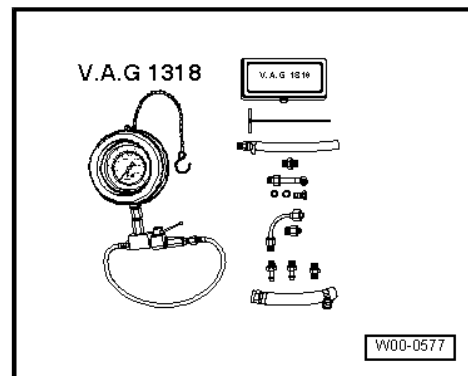
The fuel pressure regulator is integrated in the fuel filter and cannot be renewed on its own.

Special tools and workshop equipment required

- ◆ Hose clamps up to Ø 25 mm - 3094-



- ◆ K-Jetronic tester - V.A.G 1318- with adapters - V.A.G 1318/11- , -V.A.G 1318/17- and -V.A.G 1318/23-



Test conditions

- Fuel pump relay OK.
- Fuel pump OK; checking ⇒ Rep. gr. 20 .
- Fuel filter OK.
- Battery voltage at least 12.5 V

Test sequence

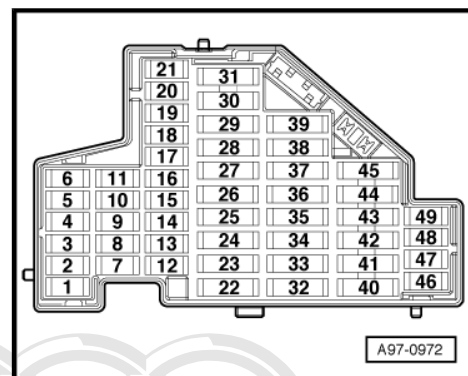
Measuring fuel pressure:

- Remove cover from fuse holder in dash panel (left-side) and pull out fuse SC27.



WARNING

The fuel system is pressurised. Before opening the system place a clean cloth around the connection. Then carefully loosen the connection to relieve the pressure.

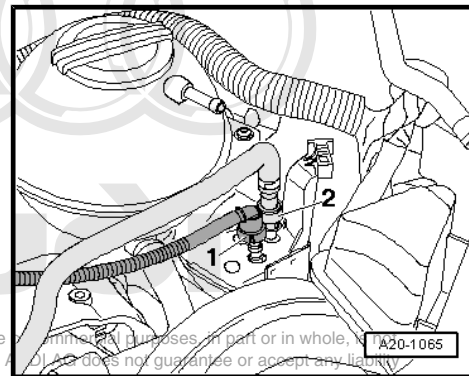


- Disconnect fuel supply line -2- at right rear of engine compartment by pulling release tab.



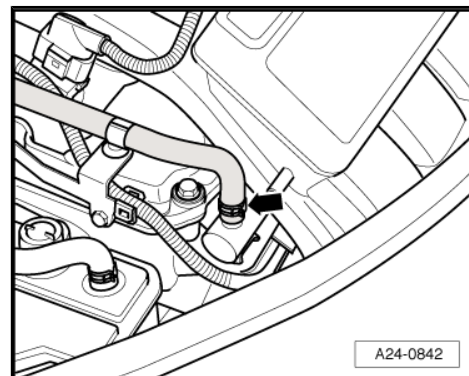
Note

Disregard -item 1-.



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- Disconnect fuel supply line -arrow- at fuel rail.



- Fit a fuel-resistant auxiliary hose -1- to fuel rail.



Note

Use hose clips -arrows- to secure the auxiliary hose.

- Connect the K-Jetronic tester - V.A.G 1318- with adapters - V.A.G 1318/11- , -V.A.G 1318/17- and -V.A.G 1318/23- .
- Open cut-off valve on pressure tester.
- Lever points in direction of flow.
- Start engine and run at idling speed.
- Measure the fuel pressure.
- Specification: approx. 4.0 bar
- Switch off ignition.

If specification is not obtained:

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

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Checking leakage and residual pressure:

- Check leak-tightness and residual pressure by watching the drop in pressure on the pressure gauge.
- After 10 minutes pressure should still be at least 3.0 bar.

If the residual pressure drops below 3.0 bar:

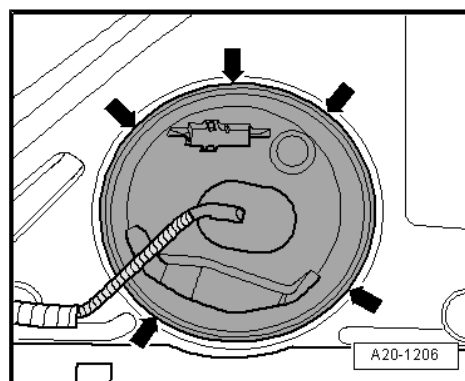
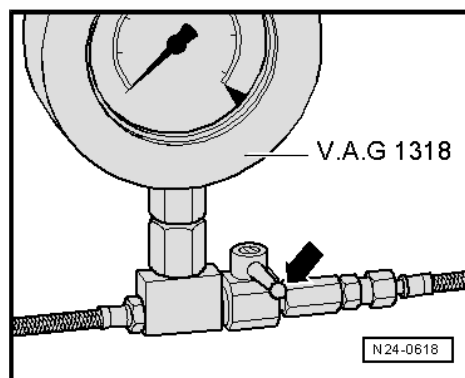
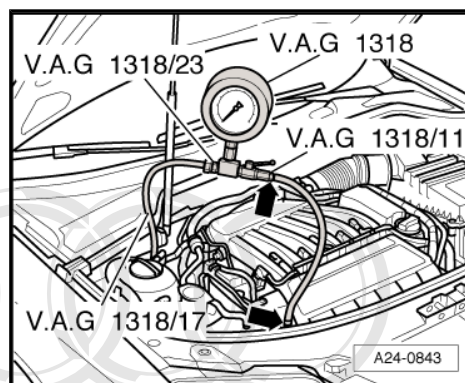
- Start engine and run at idling speed.
- Allow pressure to build up, then switch off ignition. At the same time close cut-off valve of K-Jetronic tester - V.A.G 1318- .
- Lever is at right angle to direction of flow -arrow-.
- Observe pressure drop on pressure gauge.

If the pressure drops again:

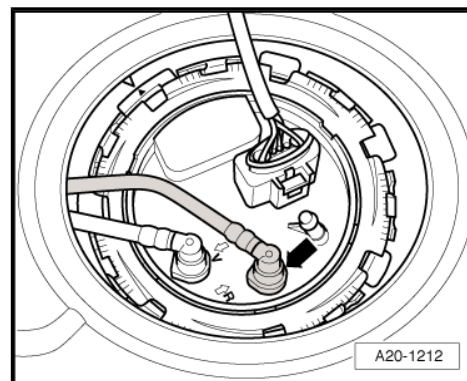
- Check pipe connections, O-rings on fuel rail and injectors for leaks.
- Check pressure gauge for leaks.

If the pressure now does not drop:

- Open cut-off valve on pressure gauge (lever points in direction of flow).
- Remove rear seat bench ⇒ Rep. gr. 72 .
- Unclip the retaining tabs -arrows- for the flange cover (right-side).



- Disconnect fuel return line -arrow- by pressing release tab.



- Connect adapter hose - 1318/17-1- to fuel return line.
- Clamp off adapter hose using hose clamp - 3094- .



Note

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

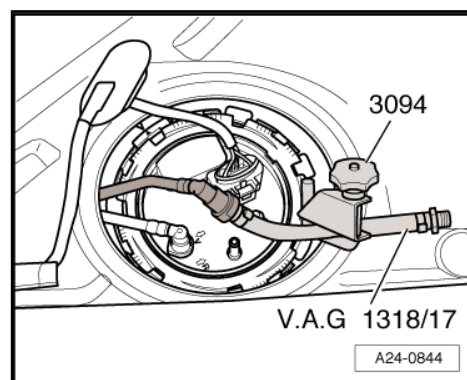
- Cover the return line connection with a cloth.
- Start the engine and briefly run at idling speed.
- Allow pressure to build up, then switch off ignition.
- Observe pressure drop on pressure gauge.

If pressure does not drop, non-return valve of fuel pump is defective.

- Renew fuel pump ⇒ Rep. gr. 20 .

If the pressure drops again:

- Renew fuel filter with integral fuel pressure regulator ⇒ Rep. gr. 20 .



Note

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

- Assembly is carried out in the reverse order; note the following:
- Re-insert fuse SC27 in fuse holder in dash panel (left-side).
- Install rear seat bench ⇒ Rep. gr. 72 .

2.12 Dismantling and assembling fuel rail with injectors

1 - Fuel rail

2 - Fuel hose


WARNING

Before detaching fuel hose, pull out fuse SC27 from fuse holder in dash panel (left-side).

3 - Hexagon socket head bolt, 10 Nm

4 - O-ring

- ☐ Removing and installing
⇒ [page 32](#)
- ☐ Renew
- ☐ Lubricate lightly with clean engine oil

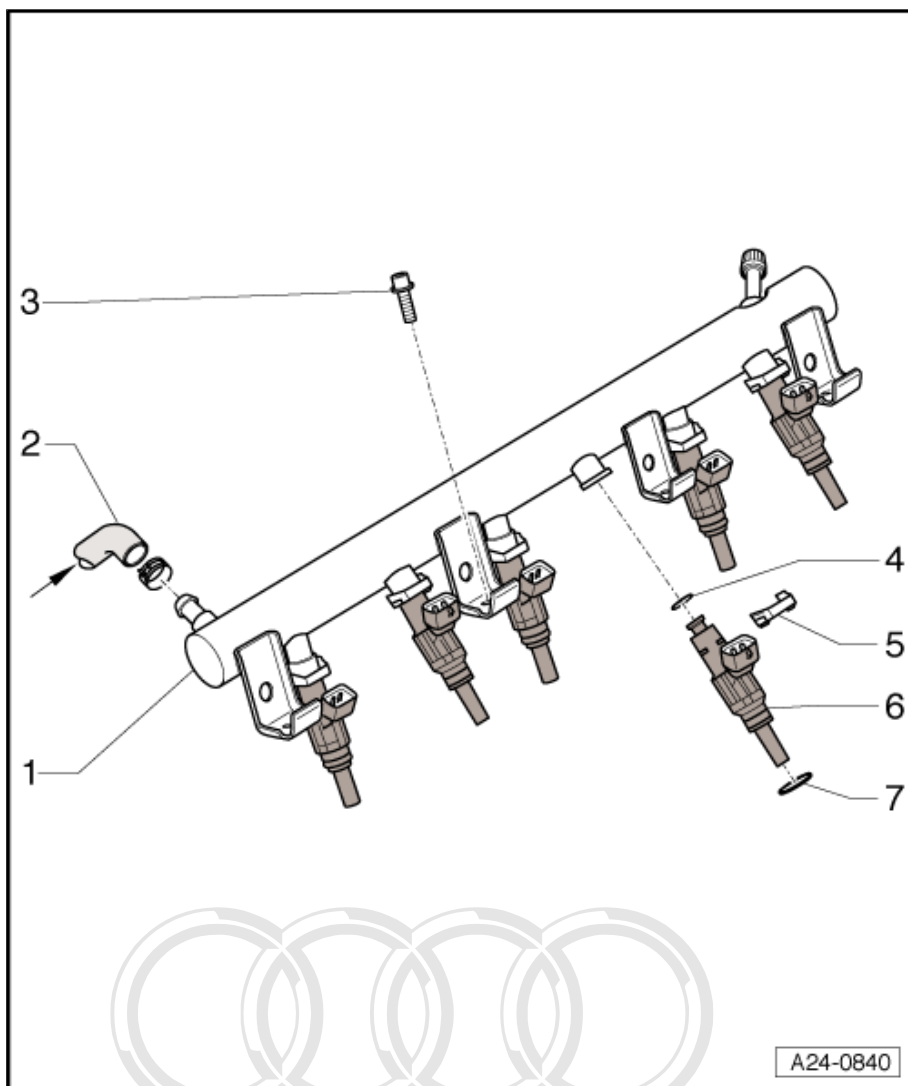
5 - Retaining clip

- ☐ After installing injector, make sure the retaining clip is seated correctly.

6 - Injector

7 - O-ring

- ☐ Removing and installing
⇒ [page 32](#)
- ☐ Renew
- ☐ Lubricate lightly with clean engine oil



2.13 Removing and installing injectors

Removing


WARNING

The fuel system is pressurised. Put cloth around connection before opening the system. Then carefully loosen the connection to relieve the pressure.

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- Disconnect fuel pipe -2- by lifting release tab.



Note

Disregard -item 1-.

- Remove intake manifold and fuel rail ⇒ [page 16](#) .
- Pull off retaining clip and detach appropriate injector.

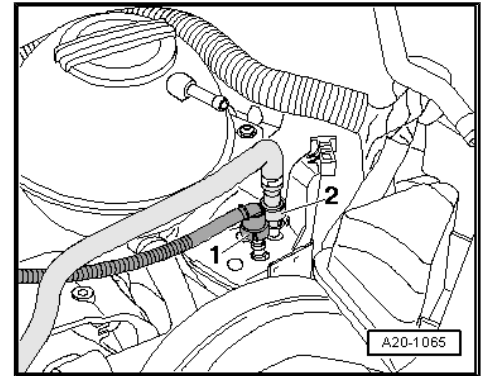
Installing

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

- Renew the O-rings at all opened connections. (When renewing the front O-ring, ensure that the plastic cap is not removed from the injector head. The O-ring must be pulled off over the plastic cap).
- Lubricate the O-rings with clean engine oil.
- Make sure injectors are installed in correct position.
- Make sure retaining clips are properly connected.
- Position fuel rail together with injectors (properly secured) against intake manifold and press into place evenly.

Tightening torque

Component	Nm
Fuel rail to intake manifold	10

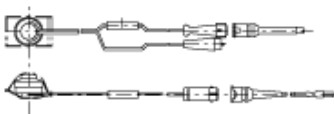
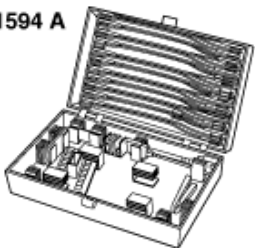
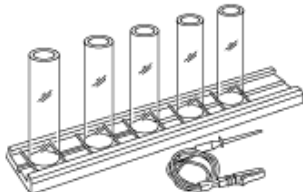


2.14 Checking injection quantity and spray pattern of injectors; checking for leaks

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Special tools and workshop equipment required

- ◆ Remote control -
V.A.G 1348/3 A- with
adapter cable -
V.A.G 1348/3-2-
- ◆ Auxiliary measuring set -
V.A.G 1594 C- or -
V.A.G 1594 A-
- ◆ Adapter cable -
V.A.G 1598/31- (test box)
- ◆ Injection rate tester -
V.A.G 1602-

V.A.G 1348/3A 	V.A.G 1594 A 
V.A.G 1598/31 	V.A.G 1602 
	G24-0044

Test condition

- Fuel pressure OK; testing ⇒ [page 28](#) .

Test sequence

- Remove intake manifold ⇒ [page 16](#) .
- Remove fuel rail together with injectors ⇒ [page 31](#) . Fuel hose remains connected.

Checking for leaks

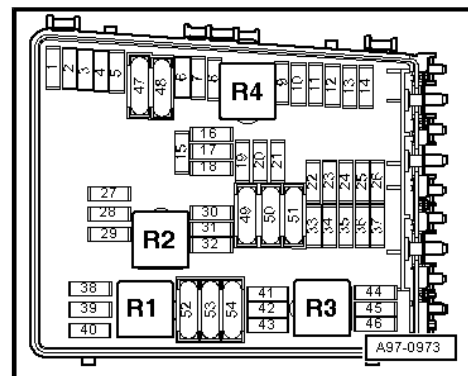
- Open lid of electronics box in engine compartment and remove fuse SB33.
- Connect remote control - V.A.G 1348/3 A- with adapter cable - V.A.G 1348/3-2- to fuse contact for fuel pump and to the positive (+) battery terminal.
- Connect battery earth cable.
- Press button on remote control - V.A.G 1348/3 A- .
- The fuel pump should run.
- Visually check the fuel injectors for leaks.
- When the fuel pump is running, no more than 1 to 2 drops a minute should escape from any one of the injectors.

If the fuel loss is greater:

- Renew defective fuel injector ⇒ [page 32](#) .
- Re-insert fuse SB33 in electronics box in engine compartment.

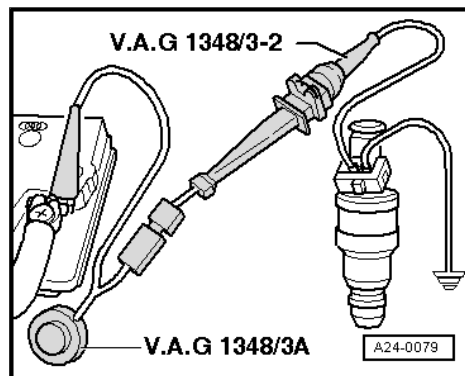
Checking injection quantity

- Connect adapter cable - V.A.G 1598/31- (test box) to wiring harness for engine control unit ⇒ [page 24](#) . The engine control unit is not connected.
- Use leads from adapter set - V.A.G 1594 C- to bridge contacts 1 and 65 at test box.
- Unplug electrical connectors for injectors.
- Place a fuel injector in a measuring glass for injection rate tester - V.A.G 1602- .



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- Connect one of the contacts of the fuel injector to engine earth (-) using test lead and crocodile clip from adapter set - V.A.G 1594 C- .
- Connect second contact of fuel injector to remote control - V.A.G 1348/3 A- using adapter cable - V.A.G 1348/3-2- .
- Connect crocodile clip to positive (+) battery terminal.
- Use leads from adapter set - V.A.G 1594 C- to bridge contacts 1 and 65 at test box.
- If necessary, connect battery earth cable.
- Switch on ignition.
- The fuel pump should run.
- Press button on remote control - V.A.G 1348/3 A- for 30 seconds.
- Carry out test for all fuel injectors using a new test glass each time.


Note

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

- Once all 6 injectors have been actuated, place measuring glasses on a level surface.
- Specification: 128 ... 140 ml for each injector.

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

- Switch off fuel pump (switch off ignition) and renew defective injector ⇒ [page 32](#) .

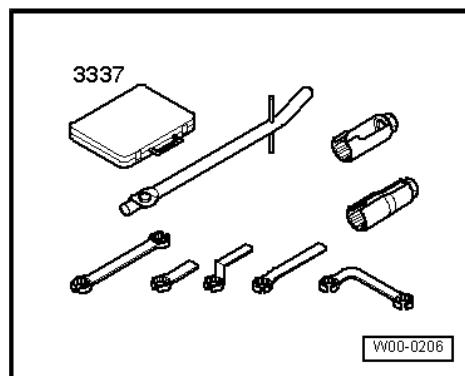
If the measured values for all the injectors are outside the specification:

- Check fuel pressure ⇒ [page 28](#) .
- Install injectors together with fuel rail ⇒ [page 33](#) .
- Install intake manifold ⇒ [page 16](#) .

2.15 Removing and installing Lambda probes (before catalytic converter)

Special tools and workshop equipment required

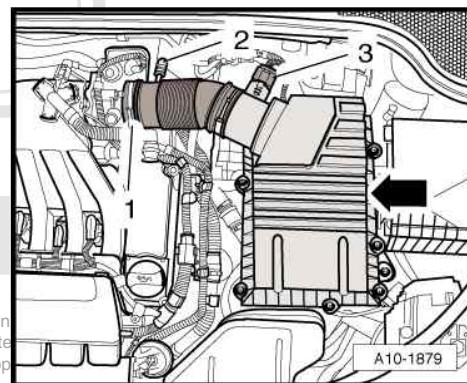
- ◆ Lambda probe open ring spanner set - 3337-



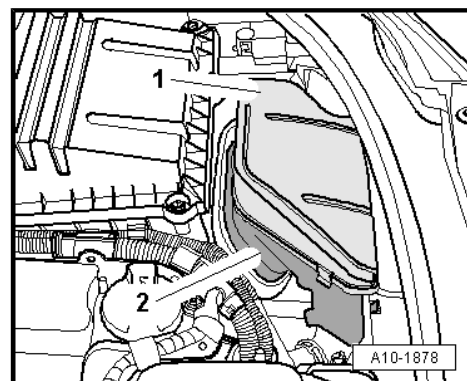
Removing

- Detach vacuum hose -2- from air intake hose.
- Detach air hose -1- at throttle valve module - J338- .
- Unplug electrical connector for air mass meter - G70- -item 3-.
- Remove air cleaner (top section) -arrow-.
- Take out filter element.

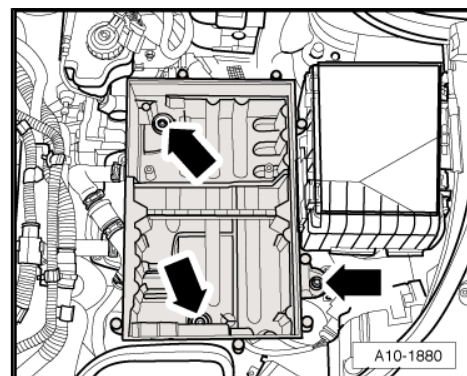
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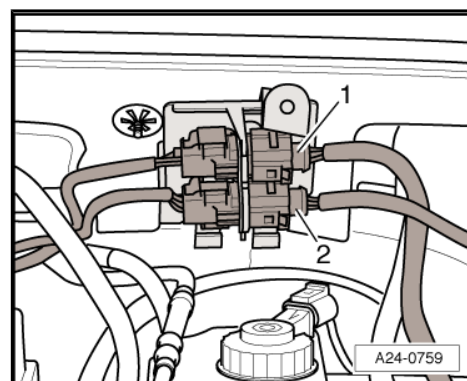
- Pull cover -1- off air duct.
- Unclip air duct -2-.



- Unscrew air cleaner housing (lower section) -arrows-.



- Unplug electrical connector -1- for Lambda probe 2 - G108- (before catalytic converter, bank 2) / electrical connector -2- for Lambda probe - G39- (before catalytic converter, bank 1).
- Move electrical wiring to Lambda probes clear.



- Unscrew Lambda probe 2 - G108- -item 1- (before catalytic converter, bank 2) / Lambda probe - G39- -item 2- (before catalytic converter, bank 1).

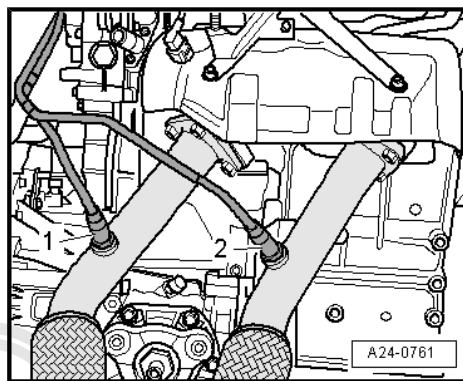
Installing

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



Note

- ◆ *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*
- ◆ *If reinstalling the old Lambda probes, coat the threads with high-temperature paste ⇒ Parts catalogue . The paste must not get into the slots on the probe body.*
- ◆ *When installing, the Lambda probe wire must always be reattached at the same locations to prevent it from coming into contact with the exhaust pipe.*
- ◆ *Secure the heat insulation sleeves in the original position when installing.*



Tightening torques

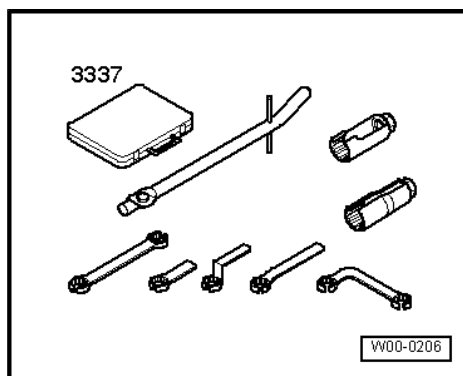
Component	Nm
Lambda probe (before catalytic converter) in front exhaust pipe	55
Body brace to body / bracket	20

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2.16 Removing and installing Lambda probes (after catalytic converter)

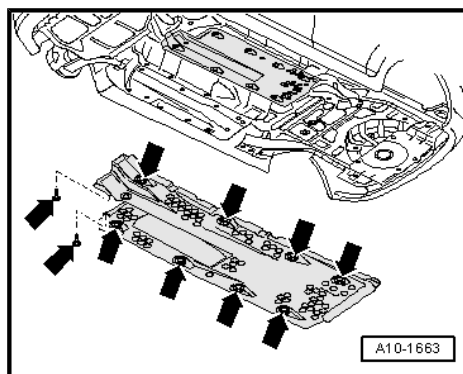
Special tools and workshop equipment required

- ◆ Lambda probe open ring spanner set - 3337-

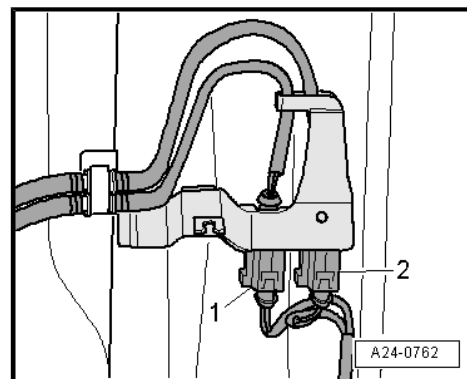


Removing

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



- Unplug electrical connector -1- to Lambda probe after catalytic converter - G130- (bank 1) / electrical connector -2- to Lambda probe 2 after catalytic converter - G131- (bank 2) on underbody (right-side).
- Remove appropriate plug connector from bracket and move electrical wiring to appropriate Lambda probe clear.



- Unscrew Lambda probe after catalytic converter - G130- -item 1- (bank 2) / Lambda probe 2 after catalytic converter - G131- -item 2- (bank 2).

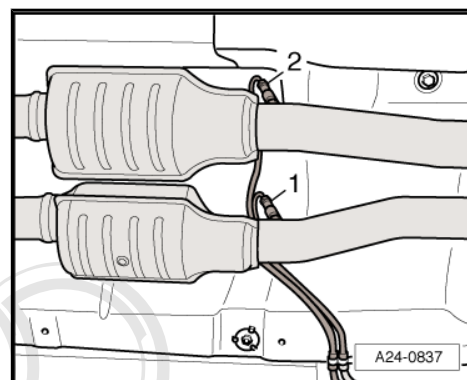
Installing

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



Note

- ◆ *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*
- ◆ *If reinstalling the old Lambda probes, coat the threads with high-temperature paste ⇒ Parts catalogue . The paste must not get into the slots on the probe body.*
- ◆ *When installing, the Lambda probe wire must always be reattached at the same locations to prevent it from coming into contact with the exhaust pipe.*



Tightening torque

Component	Nm
Lambda probe (after catalytic converter) in catalytic converter	55

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28 – Ignition system

1 General notes and safety precautions

1.1 General notes on ignition system

- ◆ A voltage of at least 12.5 V is required for proper operation of electrical components.
- ◆ If the engine starts, runs for a short period and then cuts out after completing fault finding, repairs or component tests, this may be due to the immobiliser disabling the engine control unit. The fault memory must then be interrogated and, if necessary, the control unit must be adapted.

1.2 Safety precautions

Observe the following to prevent injuries to persons and damage to the injection and ignition system:

- ◆ Always switch off the ignition before connecting or disconnecting electrical wiring for the injection or ignition system or tester cables.
- ◆ Always switch off ignition before washing engine.
- ◆ Faults are stored in engine control unit if electrical connectors have been unplugged:
 - With ignition switched off, connect vehicle diagnostic, testing and information system - VAS 5051B- .
 - Start “Guided Functions” mode.
 - Generate readiness code in engine control unit.



Caution

To prevent irreparable damage to the electronic components when disconnecting the battery:

- ◆ *Observe notes on procedure for disconnecting the battery.*

- Disconnect battery ⇒ Rep. gr. 27 .

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.

Injuries can also be caused if the passenger's airbag is triggered in a collision.

- *The use of test equipment while driving causes distraction.*
- *There is an increased risk of injury if test equipment is not secured.*

Test equipment must always be secured on the rear seat with a strap and operated from the rear seat by a second person.



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2 Servicing ignition system

2.1 Test data

Test data	3.2 ltr. / 4V / 184 kW engine
Idling speed Cannot be adjusted; regulated by idling speed stabilisation	600 ... 700 rpm ¹⁾
Maximum rpm governed by deactivation of fuel injectors	approx. 6,500 rpm
Ignition timing Not adjustable (determined by control unit)	
Ignition system	Multi-coil system with 6 ignition coils (output stages integrated) connected directly to spark plugs via spark plug connectors
Designation of spark plugs	⇒ Data sheets for exhaust emissions test
• ¹⁾ Current values ⇒ Data sheets for exhaust emissions test.	

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2.2 Exploded view - Ignition system

1 - Ignition coils with output stages

- ☐ Cylinder 1 ignition coil 1 with output stage - N70-
- ☐ Cylinder 2 ignition coil 2 with output stage - N127-
- ☐ Cylinder 3 ignition coil 3 with output stage - N291-
- ☐ Cylinder 4 ignition coil 4 with output stage - N292-
- ☐ Cylinder 5 ignition coil 5 with output stage - N323-
- ☐ Cylinder 6 ignition coil 6 with output stage - N324-
- ☐ Removing and installing ⇒ [page 44](#)

2 - 4-pin connector

- ☐ For ignition coils with output stage

3 - Bracket

- ☐ For connector for knock sensor 1 - G61-

4 - Bolt, 10 Nm

5 - 3-pin connector

- ☐ Black
- ☐ With gold-plated contacts

6 - Knock sensor 1 - G61-

7 - Bolt, 20 Nm

- ☐ To ensure correct operation of the knock sensor, it is important to adhere to the specified tightening torque.

8 - Camshaft adjuster

- ☐ Exhaust side
- ☐ With sender wheel for Hall sender 2 - G163-
- ☐ Adjusting valve timing after re-installation ⇒ Rep. gr. 13

9 - Cover (upper) for camshaft timing chain

- ☐ Removing and installing ⇒ Rep. gr. 13

10 - Seal

- ☐ Renew

11 - Hall sender 2 - G163-

- ☐ For exhaust camshaft

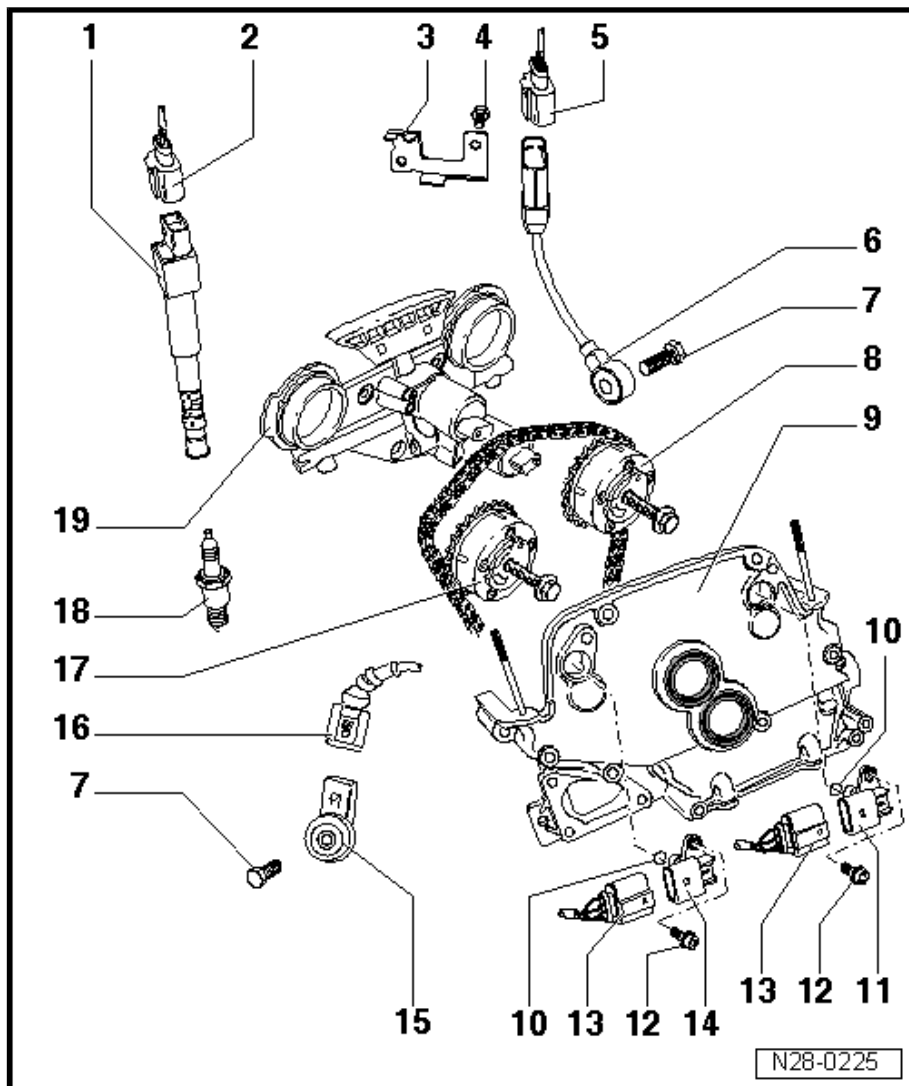
12 - Bolt, 10 Nm

13 - 3-pin connector

- ☐ Black
- ☐ With gold-plated contacts

14 - Hall sender - G40-

- ☐ For inlet camshaft



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15 - Knock sensor 2 - G66-**16 - 2-pin connector**

- ☐ Black
- ☐ With gold-plated contacts

17 - Camshaft adjuster

- ☐ Inlet side
- ☐ With sender wheel for Hall sender - G40-
- ☐ Adjusting valve timing after re-installation ⇒ Rep. gr. 13

18 - Spark plug

- ☐ Current values ⇒ Data sheets for exhaust emissions test
- ☐ Removing and installing ⇒ Maintenance ; Booklet 808

19 - Valve timing housing

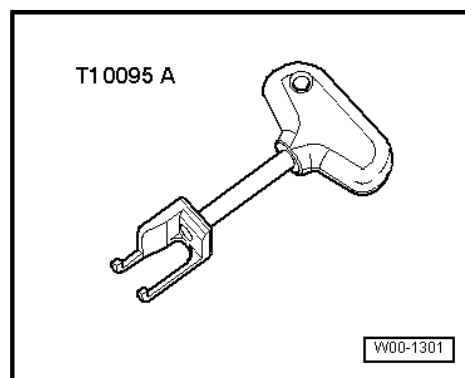
- ☐ For variable valve timing
- ☐ Removing and installing ⇒ Rep. gr. 13

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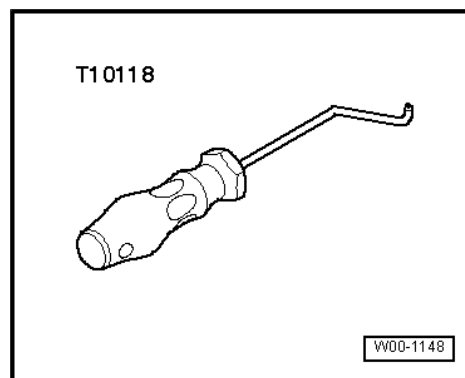
2.3 Removing and installing ignition coils

Special tools and workshop equipment required

- ◆ Puller - T10095 A-

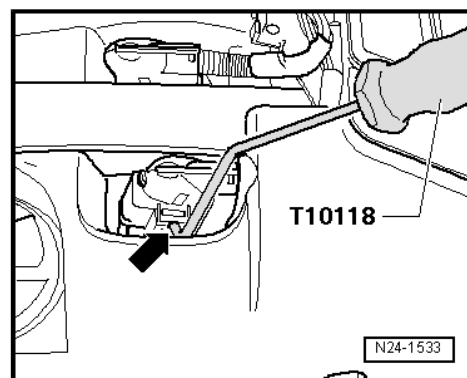


- ◆ Assembly tool - T10118-

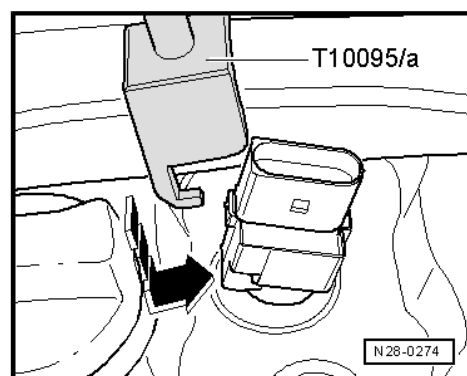


Removing

- Unplug electrical connectors at ignition coils; to do so, apply assembly tool - T10118- to release tab -arrow- and carefully pull off electrical connector.



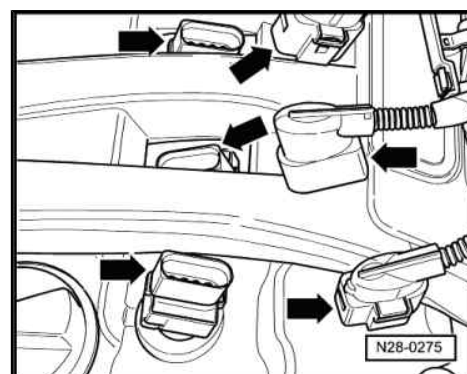
- Attach puller - T10095 A- to ignition coils as shown in illustration -arrow- and remove ignition coils one at a time.



Installing

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

- Insert the ignition coils into the holes so that the flat edges align with one another -arrows-.



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