

Audi A8 1994 ➤

Motronic Fuel Injection and Ignition System (12-cyl.)

Engine ID	AZC								
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Edition 05.2001



Audi

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List of Workshop Manual Repair GroupsList of Workshop Manual
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Audi A8 1994 ➤

Motronic Fuel Injection and Ignition System (12-cyl.)

Repair Group

01 - Self-diagnosis

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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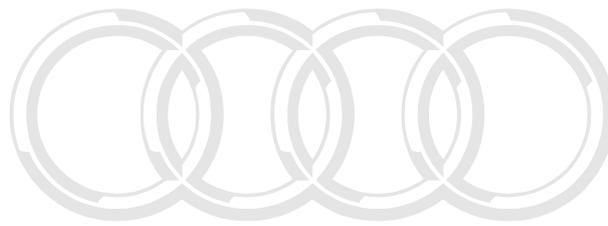
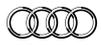


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01 - Self-diagnosis

1 - Self-diagnosis of Motronic system

1.1 - Self-diagnosis of Motronic system

1.2 - To aid understanding, please read this important information

The 12-cylinder engine referred to in this Workshop Manual, in practice consists of two VR-6 engines, as is familiar from VW. The twelve cylinders work together on a single crankshaft.

The control of the injection and ignition system for the engine is carried out by two engine control units - put simply, one engine control unit for each bank of cylinders (6 cylinders in each case).

"Engine control unit 1" operates cylinders 1 to 6; "engine control unit 2" operates cylinders 7 to 12.

Both engine control units are identical (same part number), however engine control unit 1 takes on a lead function (master) compared with engine control unit 2 (slave). Both engine control units "communicate" via CAN-data bus.

The two engine control units each have their own fault memory, which must also always be read out in both control units (engine control unit 1: address word 01; engine control unit 2: address word 11).

Diagnosis of the components occurs in the relevant control unit, to which the components are connected.
Example: The injector for cylinder 8 -N86 is connected to engine control unit 2. This means that it is monitored by engine control unit 2 with respect to fault memory, and not by engine control unit 1.

Another example: If it is necessary to adapt the throttle valve control part -J338 to the engine control unit, then this must take place in engine control unit 1, because -J338 is connected to engine control unit 1.

It is possible to find out from the current flow diagram where each component is connected.

1.3 - Technical data of self-diagnosis

Features

Data transfer between the control unit and the vehicle diagnostic, testing and information system VAS 5051 occurs in the "self-diagnosis" mode.

The engine control units are equipped with a fault memory so that the fault can be traced quickly in the event of an electronic/electrical component failure or an open circuit.

The possibilities offered by self-diagnosis can only be utilised in full with the vehicle diagnostic, testing and information system VAS 5051.

The fault memory is a non-volatile memory and thus independent of the power supply.

Important:

- ◆ If the engine control unit detects faults which result in a deterioration of exhaust emissions, these faults will be indicated by illumination of exhaust gas warning lamp (MIL) in dash panel insert.
Explanations on this lamp => Page 2 .

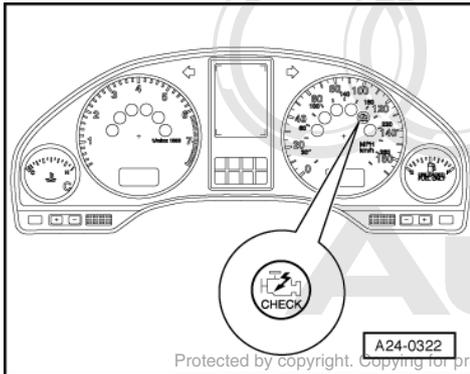


- ♦ Faults related to the electronic throttle are additionally indicated by the warning lamp for the electronic throttle control ("EPC warning lamp") which is situated in the dash panel insert.

Explanations on this lamp => Page 3 .

1.4 - Meaning of exhaust warning lamp -K83 MIL (Malfunction Indicator Lamp)

If exhaust-related faults are recognised by the engine control unit these are indicated by switching on the exhaust warning lamp.



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-> -> Fitting location of exhaust gas warning lamp

Note:

When switched on, the exhaust gas warning lamp may flash or illuminate constantly. In any case the fault memory must be interrogated => Page 7 .

Flashing of exhaust warning lamp

- ♦ A fault is present which under these driving conditions will cause damage to the catalytic converter. In this case continue driving with reduced power only (until MIL goes out or illuminates continuously) and eliminate the fault as quickly as possible!

Continuous light of exhaust warning lamp

- ♦ A fault is present which causes deterioration of the exhaust emission. Interrogate fault memory for engine control unit or automatic gearbox.
- ♦ If there is a performance problem or a customer complaint and the exhaust warning lamp does not illuminate interrogate fault memory after function test of exhaust warning lamp as faults may have been stored which do not switch on the exhaust warning lamp immediately.

Functional check:

- Switch on ignition

The exhaust warning lamp must illuminate.

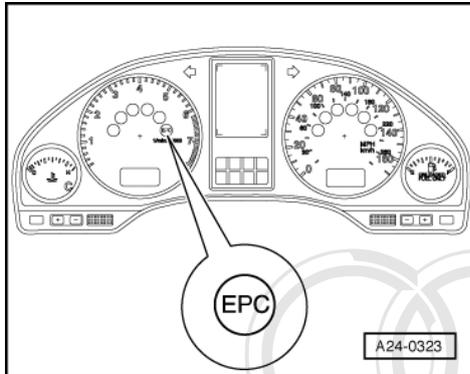
- If exhaust warning lamp does not illuminate interrogate fault memory => Page 7 .

Note:

The exhaust warning lamp extinguishes approximately 2 seconds after the engine is started.

1.5 - Meaning of the EPC warning lamp -K132 (fault warning lamp for electronic throttle)

"EPC" is an abbreviation for Electronic Power Control and refers to the electronic throttle control system.



-> Fitting location of the EPC warning lamp

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

After the engine has been started the engine control unit tests all parts for faults relating to the electronic throttle system.

During the test sequence the EPC warning lamp illuminates for about 3 seconds. If this check reveals a fault, the warning light remains illuminated.

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If a fault is detected in the electronic throttle system while the engine is running, the engine control unit switches on the EPC warning lamp. At the same time there is an entry into the fault memory of the engine control unit (these faults are marked in the fault table).

Functional check on warning lamp

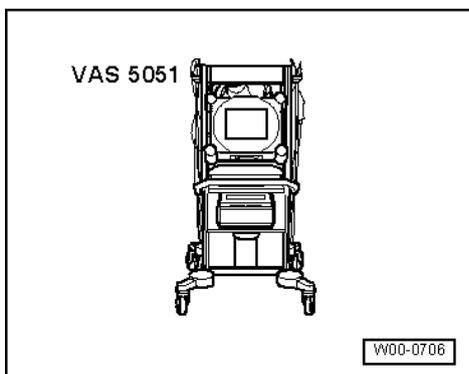
- Start the engine.

Specified value: If no faults relating to the electronic throttle system are stored in the fault memory the EPC warning lamp should illuminate for about 3 seconds after the engine is started.

If the EPC warning lamp does not illuminate:

- Interrogate fault memory of engine control unit => Page 7 .

1.6 - Connecting vehicle diagnostic, testing and information system VAS 5051 and selecting control units for engine electronics or their functions





Special tools, workshop equipment, test equipment and auxiliary items required

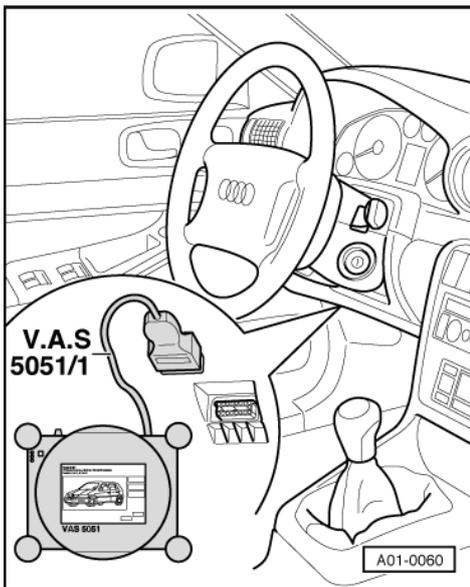
- ♦ VAS 5051 vehicle diagnostic, testing and information system

Test conditions

- Fuses for engine electronics OK

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

- Battery voltage must be at least 11.5 V.
- Fuel pump relay OK.
- Switch off air conditioner.
- For vehicles with automatic gearbox, the selector lever must be in the "P" or "N" position.



Procedure

- -> Connect up vehicle diagnostic, testing and information system VAS 5051 with diagnostic wire VAS 5051/1.

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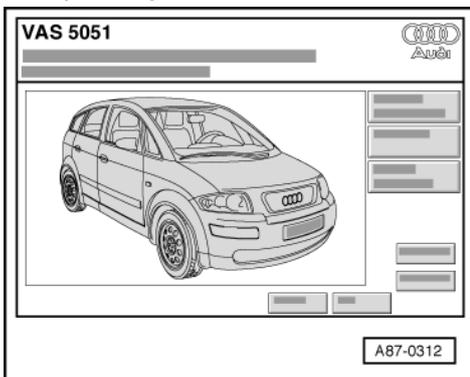
Important

- ♦ **When driving the vehicle for measurement and test purposes, always secure the vehicle diagnostic, testing and information system VAS 5051 on the rear seat only and operate it from this position.**
- ♦ **Observe the safety precautions => Page 92**

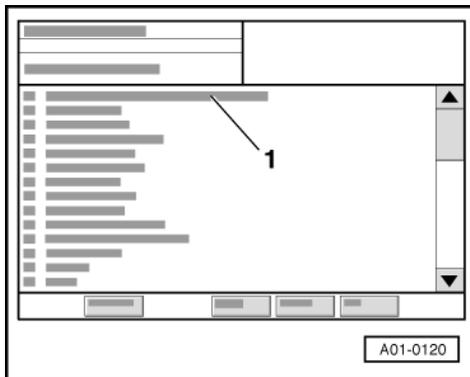
Note:

If a fault message appears in the display:

=> Operating instructions for vehicle diagnostic, testing and information system VAS 5051



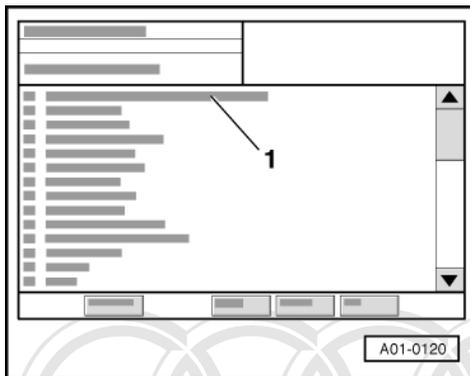
- > Display on VAS 5051:
- Press the "vehicle self-diagnosis" key.



-> Display on VAS 5051:

Note:

By entering "00 - interrogate fault memory - whole system" under -1-, the automatic test sequence is carried out, i.e. the fault memory for all the systems in the vehicle that are capable of self-diagnosis is interrogated.



-> Display on VAS 5051:

Depending on required function => "diagnosis functions" table, Page 7 :

- Switch the ignition on.
- or
- Start the engine.

Select engine control unit 1:

- Select the following on the display:
"01 - Engine electronics" off.

or

Select engine control unit 2

- Select the following on the display:
"11 - engine electronics 2".

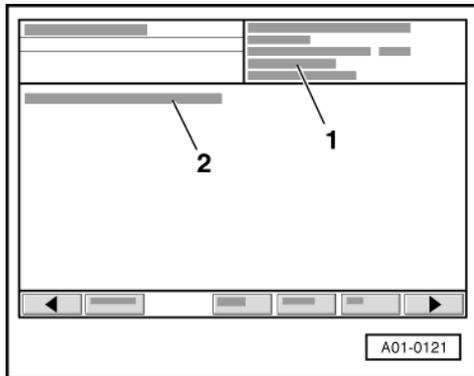
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Note:

The procedure following selection of engine control unit 1 "01 - engine electronics" is shown below.

- Wait until the next display appears.



-> Display on VAS 5051:

- 1 - Control unit identification of the engine control unit (in this example engine control unit 1) =>Page 6
- 2 - Control unit identification of the immobiliser => Page 6

In addition, the following note appears: "Read out MSG 2 (11)"

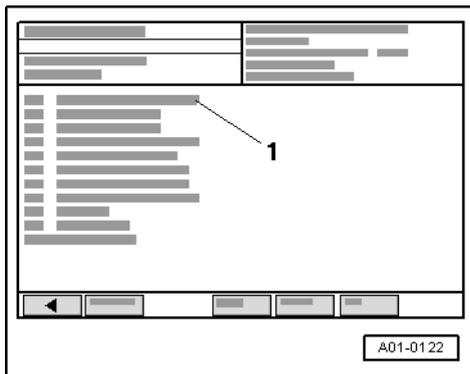
This means that you are currently in engine control unit 1. However, you should also read out the fault memory in engine control unit 2 (MSG 2; address word 11).

Control unit identification engine control unit 1 (example)	
01 - Engine electronics	Vehicle system
4D0906018..	Part-No.; assignment => Parts List
6.0L1)W12/4V2)G3)XXXX4)	1) Engine capacity 2) W-engine, 12 cylinder / 4 valve 3) - G = cruise control system activated 4) No display = no cruise control system or cruise control system not activated Control unit data status (software type)
Code 11753	Code of control unit (check => Page 51)
Dealership No. 12345	Workshop Code of VAS 5051 with which encoding was last performed

Control unit identification immobiliser (example)	
WAUZZZ4DZ1N006441 1) AUZ7Z0Y1574198 2)	1) 17-digit vehicle identification no. 2) (Chassis number) 14-digit ident no. for immobiliser

Note:

The control unit identification of engine control unit 2 is identical to that of engine control unit 1, with two differences. One difference is that "11 - engine electronics II" is displayed as the vehicle system, and the other is that the note "read out MSG 2 (11)" no longer appears under the control unit identification for the immobiliser, because engine control unit 2 (MSG 2) has already been selected.



- Press the ▶ key.

-> Display on VAS 5051:

1 - Selecting the diagnostic functions:

Diagnostic functions	Ignition on, engine stopped	Engine idling	Vehicle running
02 Interrogating fault memory	no	yes	yes
03 Final control diagnosis	yes	no	no
04 Basic setting	yes	yes	yes
05 Erase fault memory	yes	yes	yes
06 End of output	yes	yes	yes
07 Encoding control unit	yes	no	no
08 Reading measured value block	yes	yes	yes
09 Reading individual measured value	no	no	no
10 Adaption	no	no	no
11 Log-in procedure	no	no	no

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2 - Interrogating and erasing fault memory

2.1 - Interrogating and erasing fault memory

When interrogating the fault memory, both engine control units must always be interrogated and erased one after the other.

- Connect the vehicle diagnostic, testing and information system VAS 5051 and select engine control unit 1 with "address word" 01, and then engine control unit 2 with "address word" 11 => Page 3 .
For this purpose, the engine must be running at idle speed.

Note:

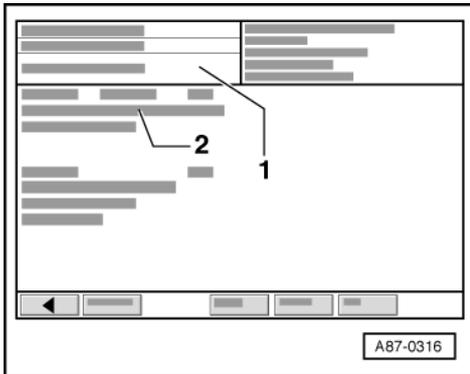
If the engine will not start, turn it for at least 5 seconds with the starter and then always leave the ignition on.





-> Display on VAS 5051:

- Under -1- select the diagnostic function "02 - interrogate fault memory".

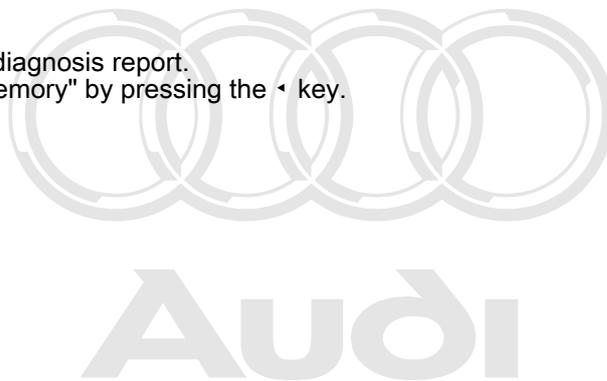
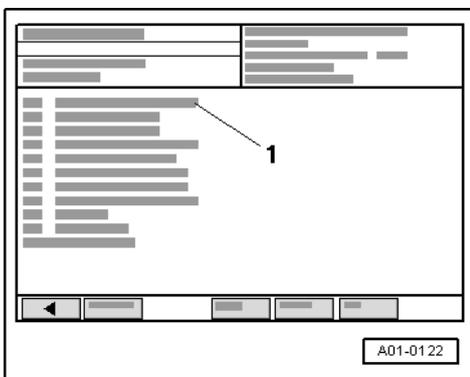


-> Display on VAS 5051:

- 1 - Contents of the fault memory:
 - 0 faults recognised
 - or
 - X faults recognised
- 2 - Fault
 - fault code
 - fault location
 - type of fault

A - if faults were recognised:

- Print out the screen contents or the self-diagnosis report.
- Exit the function "02 - interrogate fault memory" by pressing the ◀ key.



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-> Display on VAS 5051:

- Rectify the fault(s) as specified in fault table => Page 11 .
- Select diagnostic function "02 - interrogate fault memory" again and erase the fault memory => Page 9 .
- Select diagnostic function "06 - end output"=> Page 10 .

B - if no fault was recognised:

- Select diagnostic function "06 - end output"=> Page 10 .

Important tips:

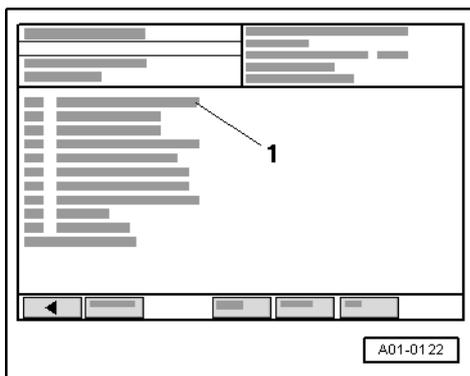
- ◆ If no fault is stored in the fault memory the fault memory should not be erased unnecessarily as the readiness code is reset.

- ◆ If the fault memory is erased the readiness code must be produced again => Page 59 .

2.2 - Erasing fault memory

Note:

If it is not possible to erase fault memory, interrogate it once again and remedy faults.



Preconditions:

- Fault memory interrogated => Page 7 .
- All faults rectified.

After fault memory has been successfully interrogated:

-> Display on VAS 5051:

- Under -1- select the diagnostic function "05 - erase fault memory".



-> Display on VAS 5051:

- 1 - - No display (before erasing)
- or
- Fault memory erased

Note:

If the following note appears in display zone -1-: "Fault memory has not yet been interrogated", the procedure has not been followed precisely. The fault memory can only be erased once the fault memory has been interrogated.

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2 - Note:

Should the function be carried out?

Note: Data will be erased!

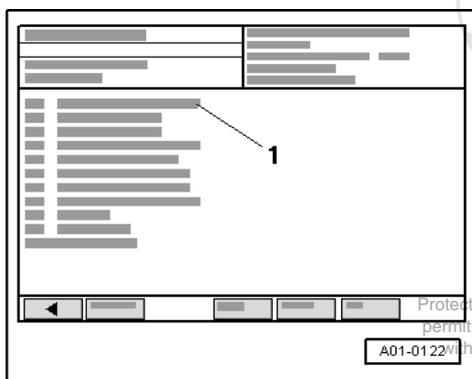
- Press the "OK"-key in display -2-.
- Exit function "05 - Erase fault memory" by pressing the ◀ key.
- Interrogate fault memory for both control units again after carrying out the repairs.

Note:

This erases faults that have been stored whilst the fault was being rectified, for example, faults that have arisen as a result of connectors being detached.

- If the fault memory is erased the readiness code must be produced again => Page 59 .

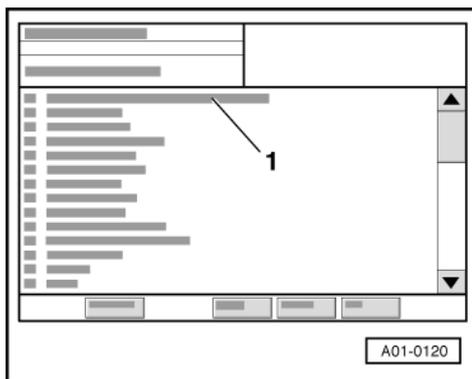
2.3 - End of output



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-> Display on VAS 5051:

- Under -1- select the diagnostic function "06 - End output".



-> Display on VAS 5051:

- After this display appears, switch off ignition and detach diagnostic connector.

3 - Fault table (16397 to 17547)

3.1 - Fault table (16397 to 17547)

Notes:

- ◆ The fault table lists all the faults which can be recognised by both engine control units. Recognised faults always refer to the engine control unit in which the faults were recognised. If, for example, the fault "control unit defective" appears in engine control unit 1, then engine control unit 1 must be replaced, and not engine control unit 2. The control unit identification (display on VAS 5051) shows which engine control unit has been selected.
- ◆ If faults occur in the monitored sensors and components, these are stored in the fault memory together with an indication of type of fault.
- ◆ Do not immediately renew components indicated as faulty by the VAS 5051 but First check the wiring and connectors of these components against the current flow diagram. Also check the earth connections against current flow diagram. This is particularly relevant for faults recorded as "sporadic".
- ◆ Faults relevant to "electronic throttle" are additionally indicated by a warning lamp ("EPC warning lamp") located in the dash panel.
- ◆ Faults which cause deterioration of the exhaust emissions are displayed via an exhaust warning lamp (MIL) which is also located in the dash panel insert. Some faults cause the exhaust gas warning lamp to switch on immediately after detection. There are also faults where the exhaust warning lamp is only switched on when the fault is recognised again after engine has been restarted.
- ◆ If the connector is unplugged from engine control unit or if the battery is disconnected, all the stored values in the control unit will be erased. However, the contents of the fault memory are retained. If the engine is then started, it may run rough for a short period.
In addition, the following adaption procedures must be performed=>Page 206 .
- ◆ The fault table is sorted according to the 5-digit fault code on the left.
- ◆ If a stored fault does not appear within the next 40 engine starts, the fault code will be automatically erased.
- ◆ Sporadic faults are marked "SP" (sporadic fault) on the VAS 5051 display.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0013	16397	Bank 1, exhaust camshaft timing control Malfunction 1)	Check camshaft timing control => 12-cylinder Engine, Mechanical Components; Repair group 15; Checking camshaft timing control
P0023	16407	Bank 2, exhaust camshaft timing control Malfunction 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0102	16486	Air mass meter -G70 Signal too small 1)	Check air mass meter =>Page 143
P0103	16487	Air mass meter -G70 Signal too great 1)	
P0112	16496	Intake air temperature sender -G42 Signal too small 1)	Check the intake air temperature sender =>Page 243
P0113	16497	Intake air temperature sender -G42 Signal too great 1)	
P0116	16500	Coolant temperature sender -G62 Implausible signal 1)	Check coolant temperature sender =>Page 248
P0117	16501	Coolant temperature sender -G62 Signal too small 1)	



P0118	16502	Coolant temperature sender -G62 Signal too great 1)	
-------	-------	--	--

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0130	16514	Bank 1, probe 1 Electrical fault in circuit 1)	Check lambda probe heating for lambda probe =>Page 177
P0131	16515	Bank 1, probe 1 Voltage too low 1)	Check lambda probe signal wiring and actuation => Pages 188
P0132	16516	Bank 1, probe 1 Voltage too high 1)	
P0133	16517	Bank 1, probe 1 Signal too slow 1)	
P0134	16518	Bank 1, probe 1 No activity 1)	Check lambda probe heating =>Page 177

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0136	16520	Bank 1, probe 2 Electrical fault in circuit 1)	Check the wiring connections to the engine control unit => Pages 193
P0137	16521	Bank 1, probe 2 Voltage too low 1)	Check lambda probe signal wiring and actuation => Pages 193
P0138	16522	Bank 1, probe 2 Voltage too high 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0139	16523	Bank 1, probe 2 Signal too slow	Up to engine control unit data status (software status) 0003 (see control unit identification) => Page 197
P0140	16524	Bank 1, probe 2 No activity 1)	Check lambda probe heating => Page 177 ; if the heater is OK, replace the lambda probe

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0150	16534	Bank 2, probe 1 Electrical fault in circuit 1)	Check the wiring connections to the engine control unit =>Page 175
P0151	16535	Bank 2, probe 1 Voltage too low 1)	Check lambda probe signal wiring and actuation
P0152	16536	Bank 2, probe 1 Voltage too high 1)	=> Pages 188

P0153	16537	Bank 2, probe 1 Signal too slow 1)	
P0154	16538	Bank 2, probe 1 No activity 1)	Check lambda probe heating for lambda probe => Page 177 ; if the heater is OK, replace the lambda probe

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0156	16540	Bank 2, probe 2 Electrical fault in circuit 1)	Check the wiring connections to the engine control unit => Pages 193
P0157	16541	Bank 2, probe 2 Voltage too low 1)	Check lambda probe signal wiring and actuation => Pages 193
P0158	16542	Bank 2, probe 2 Voltage too high 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0159	16543	Bank 2, probe 2 Signal too slow	Up to engine control unit data status (software status) 0003 (see control unit identification => Page 197
P0160	16544	Bank 2, probe 2 No activity 1)	Check lambda probe heating for lambda probe => Page 177 ; if the heater is OK, replace the lambda probe

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0197	16581	Oil temperature sender -G8 Signal too small	Check sender for (engine) oil temperature => 12-cylinder Engine, Mechanical Components; Repair group 17
P0198	16582	Oil temperature sender -G8 Signal too high	
P0209	16593	Injector, cylinder 9 -N299 Electrical fault in circuit 1)	Check injectors =>Page 133
P0210	16594	Injector, cylinder 10 -N300 Electrical fault in circuit 1)	
P0211	16595	Injector, cylinder 11 -N301 Electrical fault in circuit 1)	
P0212	16596	Injector, cylinder 12 -N302 Electrical fault in circuit 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

2) With this fault, engine control unit switches on EPC warning lamp in dash panel insert immediately after recognising the fault. Meaning of EPC warning lamp => 3.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		



Fault code		Fault readout	Fault remedy
P0285	16669	Injector, cylinder 9 -N299 Short to earth 1)	Check injectors =>Page 133
P0286	16670	Injector, cylinder 9 -N299 Short to positive 1)	
P0288	16672	Injector, cylinder 10 -N300 Short to earth 1)	
P0289	16673	Injector, cylinder 10 -N300 Short to positive 1)	
P0291	16675	Injector, cylinder 11 -N301 Short to earth 1)	
P0292	16676	Injector, cylinder 11 -N301 Short to positive 1)	
P0294	16678	Injector, cylinder 12 -N302 Short to earth 1)	
P0295	16679	Injector, cylinder 12 -N302 Short to positive 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0300	16684	Misfire detected 1)	- Check misfire detection => Page 239 - Refuel the vehicle - Check crankcase breather
P0301	16685	Cyl. 1 misfire detected 1)	
P0302	16686	Cyl. 2 misfire detected 1)	
P0303	16687	Cyl. 3 misfire detected 1)	
P0304	16688	Cyl. 4 misfire detected 1)	
P0305	16689	Cyl. 5 misfire detected 1)	
P0306	16690	Cyl. 6 misfire detected 1)	
P0307	16691	Cyl. 7 misfire detected 1)	
P0308	16692	Cyl. 8 misfire detected 1)	

Note:

For faults which may result from lack of fuel, (e.g. misfiring), the fault "P1250, Fuel level too low" is also displayed. This means that misfiring was not detected as a result of a technical defect, but simply due to insufficient fuel in the tank.

1) Depending on the fault recognition the exhaust warning lamp (MIL) is switched on immediately in the dash panel insert or after double confirmation of the fault. Meaning of MIL warning lamp => 2

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0309	16693	Cyl. 9 misfire detected 1)	- Check misfire detection =>Page 239 - Refuel the vehicle - Check crankcase breather
P0310	16694	Cyl. 10 misfire detected 1)	
P0311	16695	Cyl. 11 misfire detected 1)	
P0312	16696	Cyl. 12 misfire detected 1)	

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Note:

For faults which may result from lack of fuel, (e.g. misfiring), the fault "P1250, Fuel level too low" is also displayed. This means that misfiring was not detected as a result of a technical defect, but simply due to insufficient fuel in the tank.

1) Depending on the fault recognition the exhaust warning lamp (MIL) is switched on immediately in the dash panel insert or after double confirmation of the fault. Meaning of MIL warning lamp => 2

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0321	16705	Engine speed sender -G28 Implausible signal 1)	Check engine speed sender =>Page 250
P0322	16706	Engine speed sender -G28 No signal 1)	
P0327	16711	Knock sensor 1 -G61 Signal too small	Check knock sensor =>Page 252
P0328	16712	Knock sensor 1 -G61 Signal too great	
P0332	16716	Knock sensor 2 -G66 Signal too small	
P0333	16717	Knock sensor 2 -G66 Signal too great	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0340	16724	Camshaft position sensor Fault 1)	Check Hall sender =>Page 255
P0341	16725	Camshaft sensor =>sender -G40 Implausible signal 1)	
P0346	16730	Camshaft pos sensor =>sender -G163 Implausible signal 1)	
P0366	16750	Camshaft pos sensor =>sender -G300 Implausible signal 1)	
P0391	16775	Camshaft pos sensor =>sender -G301 Implausible signal 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0421	16805	Primary catalytic converter bank 1, Inefficient 1)	Produce readiness code => Page 56 , if the same fault is displayed again replace the primary catalytic converter bank 1. => Mechanical Components; Repair group 26; Removing and installing parts of the exhaust gas system; Removing and installing catalytic converter Removing and installing parts of the exhaust gas system; Removing and installing catalytic converter



P0431	16815	Primary catalytic converter bank 2, Inefficient 1)	Produce readiness code => Page 56 , if the same fault is displayed again replace the primary catalytic converter bank 2. => Mechanical Components; Repair group 26; Removing and installing parts of the exhaust gas system; Removing and installing catalytic converter Removing and installing parts of the exhaust gas system; Removing and installing catalytic converter
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1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Important note:

The primary catalytic converter bank 1 is the primary catalytic converter for cylinders 1, 2 and 3.

The primary catalytic converter bank 2 is the primary catalytic converter for cylinders 4, 5 and 6.

Please also refer to the fitting locations overview

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0441	16825	Fuel tank breather system Throughput faulty 1)	Check solenoid valves for activated charcoal filter, carry out final control diagnosis in both control units => Page 46
P0501	16885	Vehicle speed signal Implausible signal 1)	Interrogate dash panel insert => Electrical System; Repair group 01; Self-diagnosis of dash panel; Interrogating fault memory
P0506	16890	Idling speed regulation Engine speed below specification	Perform adaption of the throttle valve control parts =>Page 206
P0507	16891	Idling speed regulation Engine speed above specification	Check system for unmetered air

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0560	16944	Voltage supply Implausible signal	Check supply voltage to engine control unit
P0562	16946	Voltage supply Voltage too low	
P0563	16947	Voltage supply Voltage too high	
P0568	16952	CCS switch -E45 Implausible signal	Check the power supply for the switch according to the current flow diagram, and the wiring connections to the engine control unit
P0571	16955	Brake light switch -F Implausible signal	Check brake light switch and brake pedal switch => Page 223
P0601	16985	Control unit defective 1)	Replace engine control unit =>Page 120
P0604	16988	Control unit defective 1)	
P0605	16989	Control unit defective 1)	
P0606	16990	Control unit defective 1)	

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1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0685	17069	Main relay => -J271 Open circuit 1)	Check power supply relay for Motronic system -J271 =>Page 141
P0686	17070	Main relay => -J271 Short to earth 1)	
P0687	17071	Main relay => -J271 Short to positive 1)	
P1010	17418	Injector, cylinder 9 -N299 Open circuit 1)	Check injectors =>Page 133
P1011	17419	Injector, cylinder 10 -N300 Open circuit 1)	
P1012	17420	Injector, cylinder 11 -N301 Open circuit 1)	
P1013	17421	Injector, cylinder 12 -N302 Open circuit 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1055	17463	Bank 1, exhaust camshaft timing control Short to positive 1)	Check camshaft timing control => Mechanical Components; Repair group 15; Checking camshaft timing control; Checking function of camshaft timing control Checking camshaft timing control; Checking function of camshaft timing control
P1056	17464	Bank 1, exhaust camshaft timing control Short to earth 1)	
P1057	17465	Bank 1, exhaust camshaft timing control Open circuit 1)	
P1058	17466	Bank 2, exhaust camshaft timing control Short to positive 1)	
P1059	17467	Bank 2, exhaust camshaft timing control Short to earth 1)	
P1060	17468	Bank 2, exhaust camshaft timing control Open circuit 1)	
P1073	17481	Air mass meter 2 -G246 Signal too small 1)	Check air mass meter =>Page 143
P1074	17482	Air mass meter 2 -G246 Signal too great 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

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Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1075	17483	Lambda control exhaust bank 3 System too lean	Check lambda control for cylinders 7 to 12 => Page 184
P1076	17484	Lambda control exhaust bank 3 System too rich	



Fault code		Fault readout	Fault remedy
P1077	17485	Lambda control exhaust bank 4 System too lean	
P1078	17486	Lambda control exhaust bank 4 System too rich	
P1079	17487	Lambda control exhaust bank 3 Implausible control value	
P1080	17488	Lambda control exhaust bank 4 Implausible control value	

Note:

In each case, 3 cylinders are controlled independently from each other with respect to the lambda control:

Cylinders 1, 2 and 3 (exhaust bank 1); cylinders 4, 5 and 6 (exhaust bank 2); cylinders 7, 8 and 9 (exhaust bank 3); cylinders 10, 11 and 12 (exhaust bank 4).

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1081	17489	Exhaust bank 3, mixture adaption range 1 Lean limit not reached 1)	Check lambda control and learned values for cylinders 7 to 12 =>Page 184 .
P1082	17490	Exhaust bank 3, mixture adaption range 2 Lean limit not reached 1)	
P1083	17491	Exhaust bank 3, mixture adaption range 1 Rich limit exceeded 1)	
P1084	17492	Exhaust bank 3, mixture adaption range 2 Rich limit exceeded 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Note:

In each case, 3 cylinders are controlled independently from each other with respect to the lambda control:

Cylinders 1, 2 and 3 (exhaust bank 1); cylinders 4, 5 and 6 (exhaust bank 2); cylinders 7, 8 and 9 (exhaust bank 3); cylinders 10, 11 and 12 (exhaust bank 4).

"Range 1" means when idling; "Range 2" means in part throttle range

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1085	17493	Exhaust bank 4, mixture adaption range 1 Lean limit not reached 1)	Check lambda control and learned values for cylinders 7 to 12 =>Page 184 .
P1086	17494	Exhaust bank 4, mixture adaption range 2 Lean limit not reached 1)	
P1087	17495	Exhaust bank 4, mixture adaption range 1 Rich limit exceeded 1)	
P1088	17496	Exhaust bank 4, mixture adaption range 2 Rich limit exceeded 1)	

Fault code		Fault readout	Fault remedy
P1089	17497	Bank 2, mixture adaption range 1 Lean limit not reached 1)	Check lambda control and learned values for cylinders 1 to 6 =>Page 170 .
P1091	17499	Bank 2, mixture adaption range 1 Rich limit exceeded 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => **2**

Note:

In each case, 3 cylinders are controlled independently from each other with respect to the lambda control:

Cylinders 1, 2 and 3 (exhaust bank 1); cylinders 4, 5 and 6 (exhaust bank 2); cylinders 7, 8 and 9 (exhaust bank 3); cylinders 10, 11 and 12 (exhaust bank 4).

"Range 1" means when idling; "Range 2" means in part throttle range

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1102	17510	Bank 1, lambda probe 1, heating circuit Short to positive 1)	Check lambda probe heating =>Page 177
P1103	17511	Bank 1, lambda probe 1, heating circuit Too inefficient 1)	
P1105	17513	Bank 1, probe 2, heating circuit Short to positive 1)	
P1107	17515	Bank 2, lambda probe 1, heating circuit Short to positive 1)	
P1108	17516	Bank 2, lambda probe 1, heating circuit Too inefficient 1)	
P1110	17518	Bank 2, probe 2, heating circuit Short to positive 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => **2**

Note:

In each case, 3 cylinders are controlled independently from each other with respect to the lambda control:

Cylinders 1, 2 and 3 (exhaust bank 1); cylinders 4, 5 and 6 (exhaust bank 2); cylinders 7, 8 and 9 (exhaust bank 3); cylinders 10, 11 and 12 (exhaust bank 4).

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1111	17519	Lambda control (bank 1) System too lean	Check lambda probe learned values and lambda control =>Page 173
P1112	17520	Lambda control (bank 1) System too rich	

**Note:**

In each case, 3 cylinders are controlled independently from each other with respect to the lambda control:

Cylinders 1, 2 and 3 (exhaust bank 1); cylinders 4, 5 and 6 (exhaust bank 2); cylinders 7, 8 and 9 (exhaust bank 3); cylinders 10, 11 and 12 (exhaust bank 4).

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1113	17521	Bank 1, probe 1 Internal resistance too high 1)	Check lambda probe heating for lambda probe => Page 177
P1114	17522	Bank 1, probe 2, Internal resistance too high 1)	Check lambda probe signal wiring and actuation => Pages 193
P1115	17523	Bank 1, lambda probe 1, heating circuit Short to earth 1)	Check lambda probe heating for lambda probe => Page 177
P1116	17524	Bank 1, lambda probe 1, heating circuit Open circuit 1)	Also check the lambda probe heating for the post catalytic converter probes
P1117	17525	Bank 1, probe 2, heating circuit Short to earth 1)	
P1118	17526	Bank 1, probe 2, heating circuit Open circuit 1)	

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1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => **2**

Note:

In each case, 3 cylinders are controlled independently from each other with respect to the lambda control:

Cylinders 1, 2 and 3 (exhaust bank 1); cylinders 4, 5 and 6 (exhaust bank 2); cylinders 7, 8 and 9 (exhaust bank 3); cylinders 10, 11 and 12 (exhaust bank 4).

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1119	17527	Bank 2, lambda probe 1, heating circuit Short to earth 1)	Check lambda probe heating
P1120	17528	Bank 2, lambda probe 1, heating circuit Open circuit 1)	=> Pages 181
P1121	17529	Bank 2, probe 2, heating circuit Short to earth 1)	Check the lambda probe heating for the post catalytic con- verter probes
P1122	17530	Bank 2, probe 2, heating circuit Open circuit 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => **2**

Note:

In each case, 3 cylinders are controlled independently from each other with respect to the lambda control:

Cylinders 1, 2 and 3 (exhaust bank 1); cylinders 4, 5 and 6 (exhaust bank 2); cylinders 7, 8 and 9 (exhaust bank 3); cylinders 10, 11 and 12 (exhaust bank 4).

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1127	17535	Bank 1, mixture adaption (mult.) System too rich 1)	Perform road test (fuel in oil) Check fuel system pressure =>Page 127 Check air mass meter =>Page 143 Check lambda control => Page 184 Check injectors =>Page 133
P1128	17536	Bank 1, mixture adaption (mult.) System too lean 1)	
P1129	17537	Bank 2, mixture adaption (mult.) System too rich 1)	
P1130	17538	Bank 2, mixture adaption (mult.) System too lean 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => **2**

Note:

mult. = multiplicative means that the fault occurs throughout the entire speed range and load range.

Note:

In each case, 3 cylinders are controlled independently from each other with respect to the lambda control:

Cylinders 1, 2 and 3 (exhaust bank 1); cylinders 4, 5 and 6 (exhaust bank 2); cylinders 7, 8 and 9 (exhaust bank 3); cylinders 10, 11 and 12 (exhaust bank 4).

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1131	17539	Bank 2, probe 1 Internal resistance too high 1)	Check lambda probe heating for lambda probe => Page 175

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => **2**

Note:

In each case, 3 cylinders are controlled independently from each other with respect to the lambda control:

Cylinders 1, 2 and 3 (exhaust bank 1); cylinders 4, 5 and 6 (exhaust bank 2); cylinders 7, 8 and 9 (exhaust bank 3); cylinders 10, 11 and 12 (exhaust bank 4).

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1136	17544	Bank 1, mixture adaption (add.) System too lean 1)	Perform road test (fuel in engine oil) Check fuel system pressure =>Page 127
P1137	17545	Bank 1, mixture adaption (add.) System too rich 1)	
P1138	17546	Bank 2, mixture adaption (add.) System too lean 1)	Testing air mass meter =>Page 143
P1139	17547	Bank 2, mixture adaption (add.) System too rich 1)	Check lambda probe upstream of catalytic converter => Page 198

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => **2**

**Note:**

add. = additive means that fault only has effect during idling.

Note:

In each case, 3 cylinders are controlled independently from each other with respect to the lambda control:

Cylinders 1, 2 and 3 (exhaust bank 1); cylinders 4, 5 and 6 (exhaust bank 2); cylinders 7, 8 and 9 (exhaust bank 3); cylinders 10, 11 and 12 (exhaust bank 4).

4 - Fault table (17548 to 17967)**4.1 - Fault table (17548 to 17967)**

Important: Observe the notes on Page **11**

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1140	17548	Bank 2, probe 2 Internal resistance too high 1)	Check lambda probe heating for lambda probe => Page 193
P1141	17549	Load recognition Implausible value 1)	Check whether the correct throttle valve control part was installed (see part number) Testing air mass meter =>Page 143
P1143	17551	Load recognition Limit exceeded	Replace engine control unit =>Page 120

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => **2**

Note:

In each case, 3 cylinders are controlled independently from each other with respect to the lambda control:

Cylinders 1, 2 and 3 (exhaust bank 1); cylinders 4, 5 and 6 (exhaust bank 2); cylinders 7, 8 and 9 (exhaust bank 3); cylinders 10, 11 and 12 (exhaust bank 4).

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Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1147	17555	Lambda control, bank 2 System too lean	Checking lambda probe learned values and lambda control => Pages 184
P1148	17556	Lambda control, bank 2 System too rich	

Note:

In each case, 3 cylinders are controlled independently from each other with respect to the lambda control:

Cylinders 1, 2 and 3 (exhaust bank 1); cylinders 4, 5 and 6 (exhaust bank 2); cylinders 7, 8 and 9 (exhaust bank 3); cylinders 10, 11 and 12 (exhaust bank 4).

Fault code		Fault readout	Fault remedy
SAE	V.A.G		

P1149	17557	Lambda control, bank 1 Implausible control value	Check lambda probe learned values and control => Page 184 Check fuel system pressure =>Page 127 Check unmetered air
P1150	17558	Lambda control, bank 2 Implausible control value	
P1151	17559	Bank 1, mixture adaption range 1 Lean limit not reached 1)	
P1165	17573	Bank 1, mixture adaption range 1 Rich limit exceeded 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => **2**

Note:

In each case, 3 cylinders are controlled independently from each other with respect to the lambda control:

Cylinders 1, 2 and 3 (exhaust bank 1); cylinders 4, 5 and 6 (exhaust bank 2); cylinders 7, 8 and 9 (exhaust bank 3); cylinders 10, 11 and 12 (exhaust bank 4).

"Range 1" means when idling; "Range 2" means in part throttle range

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1171	17579	Angle sender 2 for throttle valve actuator -G188 Implausible signal 1) 2)	Check angle sender for throttle valve actuator =>Page 209
P1172	17580	Angle sender 2 for throttle valve actuator -G188 Signal too small 1)2)	
P1173	17581	Angle sender 2 for throttle valve actuator -G188 Signal too great 1) 2)	
P1176	17584	Bank 1, lambda correction downstream of catalytic converter Control limit reached	Please replace appropriate primary catalytic converter lambda probe.
P1177	17585	Bank 2, lambda correction downstream of catalytic converter Control limit reached	

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1) **With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => **2****

2) With this fault, engine control unit switches on EPC warning lamp in dash panel insert immediately after recognising the fault. Meaning of EPC warning lamp => **3**.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1196	17604	Bank 1, probe 1 Electrical fault in heating circuit 1)	Check lambda probe heating for lambda probe => Page 177
P1197	17605	Bank 2, probe 1, Electrical fault in heating circuit 1)	
P1198	17606	Bank 1, probe 2, Electrical fault in heating circuit 1)	



P1199	17607	Bank 2, probe 2 Electrical fault in heating circuit 1)	Also check the probe heating for the post catalytic converter probes
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1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Note:

In each case, 3 cylinders are controlled independently from each other with respect to the lambda control:

Cylinders 1, 2 and 3 (exhaust bank 1); cylinders 4, 5 and 6 (exhaust bank 2); cylinders 7, 8 and 9 (exhaust bank 3); cylinders 10, 11 and 12 (exhaust bank 4).

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1201	17609	Injector, cylinder 1 -N30 Electrical fault in circuit 1)	Check injectors =>Page 133
P1202	17610	Injector, cylinder 2 -N31 Electrical fault in circuit 1)	
P1203	17611	Injector, cylinder 3 -N32 Electrical fault in circuit 1)	
P1204	17612	Injector, cylinder 4 -N33 Electrical fault in circuit 1)	
P1205	17613	Injector, cylinder 5 -N83 Electrical fault in circuit 1)	
P1206	17614	Injector, cylinder 6 -N84 Electrical fault in circuit 1)	
P1207	17615	Injector, cylinder 7 -N85 Electrical fault in circuit 1)	
P1208	17616	Injector, cylinder 8 -N86 Electrical fault in circuit 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1213	17621	Injector, cylinder 1 -N30 Short to positive 1)	Check injectors =>Page 133
P1214	17622	Injector, cylinder 2 -N31 Short to positive 1)	
P1215	17623	Injector, cylinder 3 -N32 Short to positive 1)	
P1216	17624	Injector, cylinder 4 -N33 Short to positive 1)	
P1217	17625	Injector, cylinder 5 -N83 Short to positive 1)	
P1218	17626	Injector, cylinder 6 -N84 Short to positive 1)	
P1219	17627	Injector, cylinder 7 -N85 Short to positive 1)	

P1220	17628	Injector, cylinder 8 -N86 Short to positive 1)	
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1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1225	17633	Injector, cylinder 1 -N30 Short to earth 1)	Check injectors =>Page 133
P1226	17634	Injector, cylinder 2 -N31 Short to earth 1)	
P1227	17635	Injector, cylinder 3 -N32 Short to earth 1)	
P1228	17636	Injector, cylinder 4 -N33 Short to earth 1)	
P1229	17637	Injector, cylinder 5 -N83 Short to earth 1)	
P1230	17638	Injector, cylinder 6 -N84 Short to earth 1)	
P1231	17639	Injector, cylinder 7 -N85 Short to earth 1)	
P1232	17640	Injector, cylinder 8 -N86 Short to earth 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1237	17645	Injector, cylinder 1 -N30 Open circuit 1)	Check injectors =>Page 133
P1238	17646	Injector, cylinder 2 -N31 Open circuit 1)	
P1239	17647	Injector, cylinder 3 -N32 Open circuit 1)	
P1240	17648	Injector, cylinder 4 -N33 Open circuit 1)	
P1241	17649	Injector, cylinder 5 -N83 Open circuit 1)	
P1242	17650	Injector, cylinder 6 -N84 Open circuit 1)	
P1243	17651	Injector, cylinder 7 -N85 Open circuit 1)	
P1244	17652	Injector, cylinder 8 -N86 Open circuit 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Fault code		Fault readout	Fault remedy
SAE	V.A.G		



P1250	17658	Fuel level too low	- Resulting fault, see note Refuel vehicle, erase fault memory Interrogate fault memory of dash panel insert => Electrical System; Repair group 01; Dash panel insert self-diagnosis Dash panel insert self-diagnosis
P1292	17700	Thermostat for map-controlled engine cooling system -F265 Open circuit	Check thermostat for map-controlled engine cooling system -F265 => Mechanical Components; Repair group 19
P1293	17701	Thermostat for map-controlled engine cooling system -F265 Short to positive	
P1294	17702	Thermostat for map-controlled engine cooling system -F265 Short to earth	
P1296	17704	Fault in cooling system	

Note:

The information "Fuel level too low" is stored only in conjunction with misfiring or faults concerning lambda control if too little fuel is or was in the tank. The fault is stored in the control unit as static fault and is not set as a sporadic fault even if the vehicle is refuelled in the meantime e.g. by the customer.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1301	17709	Knock control, cylinder 9 Control limit reached	Check knock control =>Page 252
P1302	17710	Knock control, cylinder 10 Control limit reached	
P1303	17711	Knock control, cylinder 11 Control limit reached	
P1304	17712	Knock control, cylinder 12 Control limit reached	
P1305	17713	Ignition actuation cyl. 9 Open circuit 1)	Check output stages =>Page 237
P1306	17714	Ignition actuation cyl. 9 Short to positive 1)	
P1307	17715	Ignition actuation cyl. 9 Short to earth 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

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Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1308	17716	Ignition actuation cyl. 10 Open circuit 1)	Check output stages =>Page 237
P1309	17717	Ignition actuation cyl. 10 Short to positive 1)	
P1310	17718	Ignition actuation cyl. 10 Short to earth 1)	
P1311	17719	Ignition actuation cyl. 11 Open circuit 1)	
P1312	17720	Ignition actuation cyl. 11 Short to positive 1)	

P1313	17721	Ignition actuation cyl. 11 Short to earth 1)	
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1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1314	17722	Ignition actuation cyl. 12 Open circuit 1)	Test output stages =>Page 237
P1315	17723	Ignition actuation cyl. 12 Short to positive 1)	
P1316	17724	Ignition actuation cyl. 12 Short to earth 1)	
P1321	17729	Knock sensor 3 -G198 Signal too small	Check knock sensor =>Page 252
P1322	17730	Knock sensor 3 -G198 Signal too high	
P1323	17731	Knock sensor 4 -G199 Signal too small	
P1324	17732	Knock sensor 4 -G199 Signal too high	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1325	17733	Knock control, cylinder 1 Control limit reached	Check knock control =>Page 252
P1326	17734	Knock control, cylinder 2 Control limit reached	
P1327	17735	Knock control, cylinder 3 Control limit reached	
P1328	17736	Knock control, cylinder 4 Control limit reached	
P1329	17737	Knock control, cylinder 5 Control limit reached	
P1330	17738	Knock control, cylinder 6 Control limit reached	
P1331	17739	Knock control, cylinder 7 Control limit reached	
P1332	17740	Knock control, cylinder 8 Control limit reached	

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1335	17743	Engine torque monitoring 2 Control limit exceeded 1) 2)	Check throttle valve control part => Page 120



P1336	17744	Engine torque monitoring Control limit exceeded	Replace engine control unit =>Page 120
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- 1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2
- 2) With this fault, engine control unit switches on EPC warning lamp in dash panel insert immediately after recognising the fault. Meaning of EPC warning lamp => 3 .

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1337	17745	Bank 1, camshaft position sensor => -G40 Short to earth 1)	Check Hall sender =>Page 255
P1338	17746	Bank 1, camshaft position sensor => -G40 Open circuit/short to positive 1)	
P1340	17748	Camshaft/crankshaft position sensor wrong allocation 1)	Check camshaft timing control => Mechanical Components; Repair group 15
P1347	17755	Bank 2, camshaft/crankshaft position sensor wrong allocation 1)	

- 1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2
- 2) With this fault, engine control unit switches on EPC warning lamp in dash panel insert immediately after recognising the fault. Meaning of EPC warning lamp => 3 .

Note:

Fault code "P1340" refers to the camshaft position sensor -G40 for the inlet camshaft on cylinder bank 1

Fault code "P1347" refers to the camshaft position sensor -G163 for the inlet camshaft on cylinder bank 2

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1355	17763	Ignition actuation cyl. 1 Open circuit 1)	Output stages check 237
P1356	17764	Ignition actuation cyl. 1 Short to positive 1)	
P1357	17765	Ignition actuation cyl. 1 Short to earth 1)	
P1358	17766	Ignition actuation cyl. 2 Open circuit 1)	
P1359	17767	Ignition actuation cyl. 2 Short to positive 1)	
P1360	17768	Ignition actuation cyl. 2 Short to earth 1)	
P1361	17769	Ignition actuation cyl. 3 Open circuit 1)	
P1362	17770	Ignition actuation cyl. 3 Short to positive 1)	
P1363	17771	Ignition actuation cyl. 3 Short to earth 1)	

- 1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Fault code		Fault readout	Fault remedy
SAE	V.A.G		

P1364	17772	Ignition actuation cyl. 4 Open circuit 1)	Output stages check 237
P1365	17773	Ignition actuation cyl. 4 Short to positive 1)	
P1366	17774	Ignition actuation cyl. 4 Short to earth 1)	
P1367	17775	Ignition actuation cyl. 5 Open circuit 1)	
P1368	17776	Ignition actuation cyl. 5 Short to positive 1)	
P1369	17777	Ignition actuation cyl. 5 Short to earth 1)	
P1370	17778	Ignition actuation cyl. 6 Open circuit 1)	
P1371	17779	Ignition actuation cyl. 6 Short to positive 1)	
P1372	17780	Ignition actuation cyl. 6 Short to earth 1)	

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Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1373	17781	Ignition actuation cyl. 7 Open circuit 1)	Output stages check 237
P1374	17782	Ignition actuation cyl. 7 Short to positive 1)	
P1375	17783	Ignition actuation cyl. 7 Short to earth 1)	
P1376	17784	Ignition actuation cyl. 8 Open circuit 1)	
P1377	17785	Ignition actuation cyl. 8 Short to positive 1)	
P1378	17786	Ignition actuation cyl. 8 Short to earth 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => **2**

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1386	17794	Control unit defective	Replace engine control unit =>Page 120
P1387	17795	Control unit defective	
P1388	17796	Control unit defective 1) 2)	
P1391	17799	Bank 2, camshaft position sensor => - G163 Short to earth 1)	Check Hall sender



P1392	17800	Bank 2, camshaft position sensor => - G163 Open circuit/short to positive1)	=>Page 255
P1409	17817	Tank breather valve -N80 Electrical fault in circuit 1)	Check solenoid valve 1 for activated charcoal filter => Page 198
P1410	17818	Tank breather valve -N80 Short to positive 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

2) With this fault, engine control unit switches on EPC warning lamp in dash panel insert immediately after recognising the fault. Meaning of EPC warning lamp => 3.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1411	17819	Bank 2, secondary air system Throughput too small 1)	Check secondary air pump fuse Check vacuum hoses Check hoses from pump to secondary air inlet valve => 12-cyl. engine, Mechanical Components; Repair group 26; Secondary air system
P1414	17822	Bank 2, secondary air system Leakage detected 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1420	17828	Secondary air inlet valve -N112 Electrical fault in circuit 1)	Check secondary air system => 12-cyl. engine, Mechanical Components; Repair group 26; Secondary air system
P1421	17829	Secondary air inlet valve -N112 Short to earth 1)	
P1422	17830	Secondary air inlet valve -N112 Short to positive 1)	

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Fault code		Fault readout	Fault remedy
P1423	17831	Bank 1, secondary air system Throughput too small 1)	Check secondary air pump fuse Check vacuum hoses Check hoses from pump to secondary air inlet valve => 12-cyl. engine, Mechanical Components; Repair group 26; Secondary air system
P1424	17832	Bank 1, secondary air system Leakage detected 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => **2**

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1425	17833	Tank breather valve -N80 Short to earth 1)	Check solenoid valve 1 for activated charcoal filter =>Page 198
P1426	17834	Tank breather valve -N80 Open circuit 1)	
P1432	17840	Secondary air inlet valve - N112 Open circuit 1)	Check secondary air system => 12-cyl. engine, Mechanical Components; Repair group 26; Secondary air system
P1433	17841	Secondary air pump relay - J299 Open circuit 1)	Check relay for secondary air system
P1434	17842	Secondary air pump relay - J299 Short to positive 1)	=> 12-cyl. engine, Mechanical Components; Repair group 26; Secondary air system
P1435	17843	Secondary air pump relay - J299 Short to earth 1)	
P1436	17844	Secondary air pump relay - J299 Electrical fault in circuit 1)	

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1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => **2**

Fault code		Fault readout	Fault remedy
SAE	V.A.G		



P1481	17889	Secondary air pump relay 2 - J545 (Open circuit 1)	Check relay for secondary air system
P1482	17890	Secondary air pump relay 2 - J545 (Short to positive 1)	=> 12-cyl. engine, Mechanical Components; Repair group 26; Secondary air system
P1483	17891	Secondary air pump relay 2 - J545 (Short to earth 1)	
P1484	17892	Secondary air pump relay 2 - J545 (Electrical fault in circuit 1)	
P1485	17893	Secondary air inlet valve 2 - N320 (Open circuit 1)	
P1486	17894	Secondary air inlet valve 2 - N320 (Electrical fault in circuit 1)	
P1487	17895	Secondary air inlet valve 2 - N320 (Short to earth 1)	
P1488	17896	Secondary air inlet valve 2 - N320 (Short to positive 1)	

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1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1489	17897	Fuel tank breather valve 2 -N333 (Short to positive 1)	Check solenoid valve 2 for activated charcoal filter => Page 198
P1490	17898	Fuel tank breather valve 2 -N333 (Short to earth 1)	
P1491	17899	Fuel tank breather valve 2 -N333 (Open circuit 1)	

Fault code		Fault readout	Fault remedy
P1492	17900	Fuel tank breather valve 2 -N333 Electrical fault in circuit 1)	
P1494	17902	Fuel tank breather system 2 Through flow faulty 1)	

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1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1500	17908	Fuel pump relay -J17 Electrical fault in circuit 1)	Check fuel pump relay =>Page 127
P1502	17910	Fuel pump relay -J17 Short to positive 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1517	17925	Main relay => -J271 Electrical fault in circuit	Check power supply relay -J271 for Motronic => Page 141 => Mechanical Components; Repair group 15; Checking camshaft timing control; Checking function of camshaft timing control Checking camshaft timing control; Checking function of camshaft timing control
P1519	17927	Bank 1, camshaft timing control Malfunction 1)	
P1522	17930	Bank 2, camshaft timing control Malfunction 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Note:

Fault code P1519 refers to the adjustment of the inlet camshaft on cylinder bank 1 (cylinders 1 to 6).

Fault code P1522 refers to the adjustment of the inlet camshaft on cylinder bank 2 (cylinders 7 to 12).

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1523	17931	Crash signal from airbag control unit Implausible signal	Check crash signal => Page 226 => Mechanical Components; Repair group 15; Checking camshaft timing control; Checking function of camshaft timing control Checking camshaft timing control; Checking function of camshaft timing control
P1526	17934	Bank 1, camshaft timing control => -N205 Short to positive 1)	



Fault code		Fault readout	Fault remedy
P1527	17935	Bank 1, camshaft timing control => -N205 Short to earth 1)	
P1528	17936	Bank 1, camshaft timing control => -N205 Open circuit 1)	
P1529	17937	Camshaft timing control Short to positive 1)	
P1530	17938	Camshaft timing control Short to earth 1)	
P1531	17939	Camshaft timing control Open circuit 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => **2**

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Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1534	17942	Bank 2, camshaft timing control => -N208 Short to positive 1)	=> Mechanical Components; Repair group 15; Checking camshaft timing control; Checking function of camshaft timing control Checking camshaft timing control; Checking function of camshaft timing control
P1535	17943	Bank 2, camshaft timing control => -N208 Short to earth 1)	
P1536	17944	Bank 2, camshaft timing control => -N208 Open circuit 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => **2**

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1542	17950	Angle sender for throttle valve actuator -G187 Implausible signal 1) 2)	Check angle sender for throttle valve actuator =>Page 209
P1543	17951	Angle sender for throttle valve actuator -G187 Signal too small 1) 2)	
P1544	17952	Angle sender for throttle valve actuator -G187 Signal too great 1)	
P1545	17953	Throttle valve control Malfunction 1) 2)	Check throttle valve control part =>Page 206
P1558	17966	Throttle valve actuator -G186 Electrical fault in circuit 1) 2)	
P1559	17967	Throttle valve control part -J338 Fault in basic setting 1) 2)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => **2**

2) With this fault, engine control unit switches on EPC warning lamp in dash panel insert immediately after recognising the fault. Meaning of EPC warning lamp => **3**.

5 - Fault table (17972 to 19761)

5.1 - Fault table (17972 to 19761)

Important: Observe the notes on Page **11**

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1564	17972	Throttle valve control part -J338 Undervoltage during basic setting	Check throttle valve control part =>Page 206
P1565	17973	Throttle valve control part -J338 Lower stop not reached 1) 2)	
P1568	17976	Throttle valve control part -J338 mechanical fault 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => **2**

2) With this fault, engine control unit switches on EPC warning lamp in dash panel insert immediately after recognising the fault. Meaning of EPC warning lamp => **3**.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1569	17977	CCS switch -E45 Implausible signal	Check the power supply for the switch and the wiring from the switch to the engine control unit according to the current flow diagram
P1570	17978	Engine control unit disabled	Adapt electronic immobiliser to engine control unit => Electrical System; Repair group 01; Immobiliser Self-diagnosis
P1571	17979	Left valve for engine mounting - N144 Short to positive	Check valve -N144
P1572	17980	Left valve for engine mounting - N144 Short to earth	=> 12-cylinder engine, Mechanical components; Repair group 10 <small>Copyright by Audi AG. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee any liability with respect to the correctness of information in this document. Copyright by AUDI AG.</small>
P1573	17981	Left valve for engine mounting - N144 Open circuit	
P1574	17982	Left valve for engine mounting - N144 Electrical fault in circuit	

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1575	17983	Right valve for engine mounting - N145 Short to positive	Check valve -N145
P1576	17984	Right valve for engine mounting - N145 Short to earth	=> 12-cylinder engine, Mechanical components; Repair group 10
P1577	17985	Right valve for engine mounting - N145 Open circuit	



Fault code		Fault readout	Fault remedy
P1578	17986	Right valve for engine mounting - N145 Electrical fault in circuit	
P1579	17987	Throttle valve control part -J338 Adaption not started	Check throttle valve control part Check => Page 206
P1602	18010	Voltage supply, terminal 30 Voltage too low	Charge battery Check supply voltage to engine control unit =>Page 142
P1603	18011	Control unit defective 1)	Replace engine control unit =>Page 120
P1604	18012	Control unit defective 1) 2)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

2) With this fault, engine control unit switches on EPC warning lamp in dash panel insert immediately after recognising the fault. Meaning of EPC warning lamp => 3

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Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1609	18017	Crash cut-off was activated	Accident involving activation of airbag or Final control diagnosis was performed in airbag control unit; thus fault entry in engine control unit (First erase fault memory in engine control unit 1, then in engine control unit 2 and finally again in engine control unit 1)
P1612	18020	Engine control unit incorrectly encoded	Encode engine control unit =>Page 51 .
P1615	18023	Oil temperature sender -G8 Implausible signal	Check sender for (engine) oil temperature => 12-cylinder Engine, Mechanical Components; Repair group 17

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1623	18031	Drive data bus No communication 1) 2)	Check CAN bus => Page 226
P1624	18032	Request fault lamp on, active	Exhaust-related fault from gearbox control unit, MIL lamp is switched on by gearbox control unit Read out fault memory of gearbox control unit
P1626	18034	Drive data bus No message from gearbox-CU	Check CAN bus => Page 226

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

2) With this fault, engine control unit switches on EPC warning lamp in dash panel insert immediately after recognising the fault. Meaning of EPC warning lamp => 3 .

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1630	18038	Accelerator position sender -G79 Signal too small 1) 2)	Check accelerator position sender =>Page 219
P1631	18039	Accelerator position sender -G79 Signal too great 1) 2)	
P1633	18041	Accelerator position sender 2 -G185 Signal too small 1)2)	

P1634	18042	Accelerator position sender 2 -G185 Signal too great 1) 2)	
P1639	18047	Accelerator position sender 1/2 -G79/-G185 Implausible signal 1) 2)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => **2**

2) With this fault, engine control unit switches on EPC warning lamp in dash panel insert immediately after recognising the fault. Meaning of EPC warning lamp => **3**.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1640	18048	Control unit defective 1)	Replace engine control unit =>Page 120
P1647	18055	Encoding/variations in control units in drive train check	See note below
P1648	18056	Data bus drive Defective 1)	Check CAN bus => Page 229

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => **2**

2) With this fault, engine control unit switches on EPC warning lamp in dash panel insert immediately after recognising the fault. Meaning of EPC warning lamp => **3**.

Note:

Fault "P1647" refers to both engine control units. If this appears, then there is an impermissible difference between the two control units, e.g. different software levels (visible after interrogating the control unit identification); the ignition timing has been adjusted manually on one control unit and not on the other; the cruise control system (CCS) has been enabled on one control unit and not on the other.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1649	18057	Drive data bus No message from ABS-CU	Check CAN bus => Page 229
P1650	18058	Drive data bus No message from dash panel insert 1)	Check CAN bus => Page 229
P1659	18067	Radiator fan actuation 1 Short circuit to positive	Check radiator fan actuation
P1660	18068	Radiator fan actuation 1 Short circuit to earth	=> 12-cyl. Engine, Mechanical Components; Repair group 19
P1661	18069	Radiator fan actuation 2 Short circuit to positive	
P1662	18070	Radiator fan actuation 2 Short circuit to earth	
P1672	18080	Radiator fan actuation 1 Open/short circuit to earth	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => **2**

**Note:**

"Radiator fan actuation 1" relates to the wiring connection via which the engine control unit activates the relay for the electric fan.

"Radiator fan actuation 2" relates to the wiring connection via which the engine control unit activates the solenoid valve for the hydraulic fan. This solenoid valve is mounted directly onto the power steering pump.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1853	18261	Drive data bus Implausible message from ABS- CU	Interrogate ABS fault memory => Running Gear Self-diagnosis for ABS, ESP; Repair group 01; Interrogating fault memory Check CAN bus => Page 229
P1854	18262	Drive data bus defective	Check CAN bus => Page 229
P1900	18308	Radiator fan actuation 2 Open/short circuit to earth	Check radiator fan actuation => 12-cyl. Engine, Mechanical Components; Repair group 19

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Note:

"Radiator fan actuation 2" relates to the wiring connection via which the engine control unit activates the solenoid valve for the hydraulic fan. This solenoid valve is mounted directly onto the power steering pump.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1909	18317	Engine data bus/engine No message from engine control unit 1	Fault is only stored in engine control unit 2 Engine control unit 2 is not receiving from engine control unit 1; see note
P1910	18318	Engine data bus/engine No message from engine control unit 2	Fault is only stored in engine control unit 1 Engine control unit 1 is not receiving message from engine control unit 2

Note:

If fault "P1909" is recognised, then the signal wires (CAN wires) between the two engine control units must be checked according to the current flow diagram for open circuits (pins 58 and 60 on the appropriate engine control unit). If the wiring is OK, replace engine control unit 1.

If fault "P1910" is recognised, then the signal wires (CAN wires) between the two engine control units must be checked according to the current flow diagram for open circuits (pins 58 and 60 on the appropriate engine control unit). If the wiring is OK, replace engine control unit 2.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1923	18331	Please read out fault memory from engine control unit 2	Read out fault memory from engine control unit 2 (address word 11) and rectify faults according to table
P1924	18332	Control unit pin code implausible signal	See note below

Note:

Both engine control units have the same part number. Engine control unit 1 communicates with engine control unit 2. Engine control unit 1 takes on certain tasks, for example determining the target idling speed. Engine control unit 2 also takes on certain tasks, for example displaying misfires for all 12 cylinders.

Because both engine control units are identical -each engine control unit needs to know what tasks it has to fulfil, however - each engine control unit is given a so-called pin code. This means that there is a positive signal (terminal 15) on pin 49 of control unit 1. On pin 49 of control unit 2, in contrast, there is a negative signal (earth).

If the signals are not recognised correctly, then fault P1924 is entered. The positive on engine control unit 1 and the negative on engine control unit 2 is then to be checked using the current flow diagram.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1925	18333	Relay for auxiliary coolant pump -J496 Short to positive	Check relay for auxiliary coolant pump -J496 => 12-cyl. Engine, Mechanical Components; Repair group 19
P1926	18334	Relay for auxiliary coolant pump -J496 Short to earth	
P1927	18335	Relay for auxiliary coolant pump -J496 Open circuit	
P1934	18342	Temperature sensor for radiator fan drive circuit -G382 Signal too small	Check temperature sensor for radiator fan drive circuit -G382 => 12-cyl. Engine, Mechanical Components; Repair group 19
P1935	18343	Temperature sensor for radiator fan drive circuit -G382 Signal too great	

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P3017	19473	Valve for exhaust flap 1 -N321 Short to positive	Check valve for exhaust flap 1 -N321 => 12-cyl. Engine, Mechanical Components; Repair group 26
P3018	19474	Valve for exhaust flap 1 -N321 Short to earth	
P3019	19475	Valve for exhaust flap 1 -N321 Open circuit	
P3020	19476	Valve for exhaust flap 1 -N321 Elec. fault in circuit	

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P3025	19481	Angle sender 1 for throttle valve actuator 2 - G297 Implausible signal 1) 2)	Check angle sender for throttle valve actuator =>Page 216
P3026	19482	Angle sender 1 for throttle valve actuator 2 - G297 Signal too small 1) 2)	
P3027	19483	Angle sender 1 for throttle valve actuator 2 - G297 Signal too high 1)2)	
P3028	19484	Angle sender 2 for throttle valve actuator 2 - G298 Implausible signal 1) 2)	Check angle sender for throttle valve actuator



Fault code		Fault readout	Fault remedy
P3029	19485	Angle sender 2 for throttle valve actuator 2 - G298 Signal too small 1) 2)	=>Page 216
P3030	19486	Angle sender 2 for throttle valve actuator 2 - G298 Signal too high 1)2)	
P3031	19487	Throttle valve actuator 2 -G296 Electrical fault in circuit 1) 2)	Check throttle valve control part =>Page 212

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

2) With this fault, engine control unit switches on EPC warning lamp in dash panel insert immediately after recognising the fault. Meaning of EPC warning lamp => 3 .

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P3032	19488	Throttle valve control part 2 -J544 Fault in basic setting 1) 2)	Check throttle valve control part =>Page 212
P3033	19489	Intake air temperature sender 2 -G299 Signal too small 1)	Check the intake air temperature sender =>Page 243
P3034	19490	Intake air temperature sender 2 -G299 Signal too great 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

2) With this fault, engine control unit switches on EPC warning lamp in dash panel insert immediately after recognising the fault. Meaning of EPC warning lamp => 3 .

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P3035	19491	Throttle valve control part 2 -J544 Mechanical fault 1) 2)	Check throttle valve control part =>Page 212
P3036	19492	Throttle valve control part 2 -J544 Undervoltage during basic setting	
P3037	19493	Throttle valve control part 2 -J544 Adaption not started	
P3038	19494	Throttle valve control part 2 -J544 Lower stop not reached 1) 2)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

2) With this fault, engine control unit switches on EPC warning lamp in dash panel insert immediately after recognising the fault. Meaning of EPC warning lamp => 3 .

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Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P3200	19656	Exhaust bank 3, probe 1, heating circuit Short to earth 1)	Check lambda probe heating for lambda probe => Page 190
P3201	19657	Exhaust bank 3, probe 1, heating circuit Short to positive 1)	

P3202	19658	Exhaust bank 3, probe 1, heating circuit Open circuit 1)	
P3203	19659	Exhaust bank 3, probe 1, heating circuit Electrical fault 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Note:

In each case, 3 cylinders are controlled independently from each other with respect to the lambda control:

Cylinders 1, 2 and 3 (exhaust bank 1); cylinders 4, 5 and 6 (exhaust bank 2); cylinders 7, 8 and 9 (exhaust bank 3); cylinders 10, 11 and 12 (exhaust bank 4).

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P3206	19662	Exhaust bank 3, probe 1 Voltage too high 1)	Check the wiring to the engine control unit and the basic voltage =>Page 188
P3207	19663	Exhaust bank 3, probe 1 Electrical fault in circuit 1)	
P3208	19664	Exhaust bank 3, probe 1 No activity 1)	
P3209	19665	Exhaust bank 3, probe 1 Signal too slow 1)	Fit a new lambda probe
P3210	19666	Exhaust bank 3, probe 1, heating circuit Too inefficient 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Note:

In each case, 3 cylinders are controlled independently from each other with respect to the lambda control:

Cylinders 1, 2 and 3 (exhaust bank 1); cylinders 4, 5 and 6 (exhaust bank 2); cylinders 7, 8 and 9 (exhaust bank 3); cylinders 10, 11 and 12 (exhaust bank 4).

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P3215	19671	Exhaust bank 3, probe 2, heating circuit Short to earth 1)	Check lambda probe heating for lambda probe => Page 194
P3216	19672	Exhaust bank 3, probe 2, heating circuit Short to positive 1)	
P3217	19673	Exhaust bank 3, probe 2, heating circuit Open circuit 1)	



Fault code		Fault readout	Fault remedy
P3218	19674	Exhaust bank 3, probe 2, heating circuit Electrical fault1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => **2**

Note:

In each case, 3 cylinders are controlled independently from each other with respect to the lambda control:

Cylinders 1, 2 and 3 (exhaust bank 1); cylinders 4, 5 and 6 (exhaust bank 2); cylinders 7, 8 and 9 (exhaust bank 3); cylinders 10, 11 and 12 (exhaust bank 4).

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P3219	19675	Exhaust bank 3, probe 2 Internal resistance too high 1)	Check the basic voltage and the wiring =>Page 193
P3220	19676	Exhaust bank 3, probe 2 Voltage too low 1)	
P3221	19677	Exhaust bank 3, probe 2 Voltage too high 1)	
P3222	19678	Exhaust bank 3, probe 2 Electrical fault in circuit 1)	Check the basic voltage and the wiring =>Page 193
P3223	19679	Exhaust bank 3, probe 2 No activity 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => **2**

Note:

In each case, 3 cylinders are controlled independently from each other with respect to the lambda control:

Cylinders 1, 2 and 3 (exhaust bank 1); cylinders 4, 5 and 6 (exhaust bank 2); cylinders 7, 8 and 9 (exhaust bank 3); cylinders 10, 11 and 12 (exhaust bank 4).

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P3224	19680	Exhaust bank 3, probe 2 Signal too slow	Up to engine control unit data status (software status) 0003 (see control unit identification => Page 197

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => **2**

Note:

In each case, 3 cylinders are controlled independently from each other with respect to the lambda control:

Cylinders 1, 2 and 3 (exhaust bank 1); cylinders 4, 5 and 6 (exhaust bank 2); cylinders 7, 8 and 9 (exhaust bank 3); cylinders 10, 11 and 12 (exhaust bank 4).

Fault code		Fault readout	Fault remedy
SAE	V.A.G		

Fault code		Fault readout	Fault remedy
P3230	19686	Exhaust bank 4, probe 1, heating circuit Short to earth 1)	Check lambda probe heating for lambda probe => Page 190
P3231	19687	Exhaust bank 4, probe 1, heating circuit Short to positive 1)	
P3232	19688	Exhaust bank 4, probe 1, heating circuit Open circuit 1)	
P3233	19689	Exhaust bank 4, probe 1, heating circuit Electrical fault1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => **2**

Note:

In each case, 3 cylinders are controlled independently from each other with respect to the lambda control:

Cylinders 1, 2 and 3 (exhaust bank 1); cylinders 4, 5 and 6 (exhaust bank 2); cylinders 7, 8 and 9 (exhaust bank 3); cylinders 10, 11 and 12 (exhaust bank 4).

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P3236	19692	Exhaust bank 4, probe 1 Voltage too high 1)	Check the wiring to the engine control unit and the basic voltage =>Page 188
P3237	19693	Exhaust bank 4, probe 1 Electrical fault in circuit 1)	
P3238	19694	Exhaust bank 4, probe 1 No activity 1)	
P3239	19695	Exhaust bank 4, probe 1 Signal too slow 1)	Fit a new lambda probe
P3240	19696	Exhaust bank 4, probe 1, heating circuit Too inefficient 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => **2**

Note:

In each case, 3 cylinders are controlled independently from each other with respect to the lambda control:

Cylinders 1, 2 and 3 (exhaust bank 1); cylinders 4, 5 and 6 (exhaust bank 2); cylinders 7, 8 and 9 (exhaust bank 3); cylinders 10, 11 and 12 (exhaust bank 4).

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Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P3245	19701	Exhaust bank 4, probe 2, heating circuit Short to earth 1)	Check lambda probe heating for lambda probe => Page 194
P3246	19702	Exhaust bank 4, probe 2, heating circuit Short to positive 1)	



Fault code		Fault readout	Fault remedy
P3247	19703	Exhaust bank 4, probe 2, heating circuit Open circuit 1)	
P3248	19704	Exhaust bank 4, probe 2, heating circuit Electrical fault 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Note:

In each case, 3 cylinders are controlled independently from each other with respect to the lambda control:

Cylinders 1, 2 and 3 (exhaust bank 1); cylinders 4, 5 and 6 (exhaust bank 2); cylinders 7, 8 and 9 (exhaust bank 3); cylinders 10, 11 and 12 (exhaust bank 4).

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P3249	19705	Exhaust bank 4, probe 2 Internal resistance too high 1)	Check the basic voltage and the wiring =>Page 193
P3250	19706	Exhaust bank 4, probe 2 Voltage too low 1)	
P3251	19707	Exhaust bank 4, probe 2 Voltage too high 1)	
P3252	19708	Exhaust bank 4, probe 2 Electrical fault in circuit 1)	Check the basic voltage and the wiring =>Page 193
P3253	19709	Exhaust bank 4, probe 2 No activity 1)	

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Note:

In each case, 3 cylinders are controlled independently from each other with respect to the lambda control:

Cylinders 1, 2 and 3 (exhaust bank 1); cylinders 4, 5 and 6 (exhaust bank 2); cylinders 7, 8 and 9 (exhaust bank 3); cylinders 10, 11 and 12 (exhaust bank 4).

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P3254	19710	Exhaust bank 4, probe 2, Signal too slow	Up to engine control unit data status (software status) 0003 (see control unit identification => Page 197)

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

Note:

In each case, 3 cylinders are controlled independently from each other with respect to the lambda control:

Cylinders 1, 2 and 3 (exhaust bank 1); cylinders 4, 5 and 6 (exhaust bank 2); cylinders 7, 8 and 9 (exhaust bank 3); cylinders 10, 11 and 12 (exhaust bank 4).

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P3260	19716	Exhaust bank 1 / 2 lambda probes upstream of catalytic converter interchanged	Lambda probe connectors for primary catalytic converter probes and lambda probes upstream from main catalytic converter interchanged; please check the connectors using the fitting locations overview
P3261	19717	Exhaust bank 3 / 4 lambda probes upstream of catalytic converter interchanged	
P3262	19718	Exhaust bank 1 / 2 lambda probes downstream of catalytic converter interchanged.	Lambda probe connectors for primary catalytic converter probes and lambda probes downstream of main catalytic converter interchanged; please check the connectors using the fitting locations overview
P3263	19719	Exhaust bank 3 / 4 lambda probes downstream of catalytic converter interchanged.	

Note:

In each case, 3 cylinders are controlled independently from each other with respect to the lambda control:

Cylinders 1, 2 and 3 (exhaust bank 1); cylinders 4, 5 and 6 (exhaust bank 2); cylinders 7, 8 and 9 (exhaust bank 3); cylinders 10, 11 and 12 (exhaust bank 4).

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P3264	19720	Primary catalytic converter exhaust bank 3, Inefficient 1)	Produce readiness code => Page 56 , if the same fault is displayed again replace the primary catalytic converter bank 3. => Mechanical Components; Repair group 26; Removing and installing parts of the exhaust gas system; Removing and installing catalytic converter Removing and installing parts of the exhaust gas system; Removing and installing catalytic converter
P3265	19721	Primary catalytic converter exhaust bank 4, Inefficient 1)	Produce readiness code => Page 56 , if the same fault is displayed again replace the primary catalytic converter bank 4. => Mechanical Components; Repair group 26; Removing and installing parts of the exhaust gas system; Removing and installing catalytic converter Removing and installing parts of the exhaust gas system; Removing and installing catalytic converter

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

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Important note:

The primary catalytic converter bank 3 is the primary catalytic converter for cylinders 7, 8 and 9.

The primary catalytic converter bank 4 is the primary catalytic converter for cylinders 10, 11 and 12.

Please also refer to the fitting locations overview

Fault code		Fault readout	Fault remedy
SAE	V.A.G		



Fault code		Fault readout	Fault remedy
P3300	19756	Bank 1, camshaft position sensor, exhaust => - G300 Short to earth 1)	Check Hall sender
P3301	19757	Bank 1, camshaft position sensor, exhaust => - G300 Open circuit/short to positive 1)	=>Page 255
P3302	19758	Bank 2, camshaft position sensor, exhaust => - G301 Short to earth 1)	
P3303	19759	Bank 2, camshaft position sensor, exhaust => - G301 Open circuit/short to positive 1)	
P3304	19760	Bank 1, exhaust camshaft position -G300/ crankshaft position Sensor -G28 wrong allocation 1)	Check camshaft timing control
P3305	19761	Bank 2, exhaust camshaft position -G301/ crankshaft position Sensor -G28 wrong allocation 1)	=> Mechanical Components; Repair group 15

1) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Meaning of MIL warning lamp => 2

6 - Final control diagnosis

6.1 - Final control diagnosis

Notes:

- ♦ The final control diagnosis is carried out separately in both engine control units (engine control unit 1: address word 01, then function 03 -final control diagnosis-; engine control unit 2: address word 11, then function 03 -final control diagnosis-).
- ♦ The final control diagnosis actuates the components that are connected to the appropriate engine control unit; see listing below.
- ♦ The final control diagnosis can only be performed with the engine stopped and the ignition switched on.
- ♦ The final control diagnosis is terminated if the engine is started or if an engine speed pulse is detected.
- ♦ During final control diagnosis, the individual control elements (with the exception of the injectors) are actuated in turn for about one minute unless the next actuator is selected by pressing the ▶ key.
- ♦ The control elements can be checked acoustically or by way of touch.
- ♦ The electric fuel pump runs throughout the final control diagnosis.
- ♦ Before restarting the final control diagnosis the engine must be started and the ignition switched off and on again.

The final control diagnosis actuates the following components in the stated order:

Fitting location of control elements => Page 93 .

Sequence for engine control unit 2 (address word 11): =>Page 47

Sequence for engine control unit 1 (address word 01):

- | |
|---|
| <ol style="list-style-type: none"> 1. Solenoid valve 1 for activated charcoal filter -N80
(fuel tank breather valve -N80) 2. Secondary air inlet valve -N112 3. Secondary air pump relay -J299 4. Bank 1, camshaft timing control -N205 |
|---|

5. Right valve for engine mounting -N145 (on the right in the direction of travel)
6. Valve for exhaust flap 1 -N321 (in luggage compartment next to CD changer)
7. Bank 1, exhaust camshaft timing control (Solenoid valve)
8. Radiator fan actuation 2 (solenoid valve direct to power steering pump)

Continued on next page

9. Radiator fan actuation 1 (display appears after pressing the ►key a second time, caution: The electrical radiator fan is switched on)
10. Relay for auxiliary coolant pump -J496
11. Injector, cylinder 1 -N30 (display appears after pressing the ►key a second time, then the injector must click 5 times; this is also the case with the following injectors)
12. Injector, cylinder 5 -N83
13. Injector, cylinder 3 -N32
14. Injector, cylinder 6 -N84
15. Injector, cylinder 2 -N31
16. Injector, cylinder 4 -N33

Sequence for engine control unit 2 (address word 11):

1. Solenoid valve 2 for activated charcoal filter -N333 (fuel tank breather valve 2 -N333)
2. Secondary air inlet valve 2 -N320
3. Secondary air pump relay 2 -J545
4. Bank 2, camshaft timing control -N208
5. Left valve for engine mounting -N144 (on the left in the direction of travel)
6. Bank 2, exhaust camshaft timing control (Solenoid valve)

Continued on next page

7. Injector, cylinder 12 -N302 (display appears after pressing the ►key a second time, then the injector must click 5 times; this is also the case with the following injectors)
8. Injector, cylinder 8 -N86
9. Injector, cylinder 10 -N300
10. Injector, cylinder 7 -N85
11. Injector, cylinder 11 -N301
12. Injector, cylinder 9 -N299

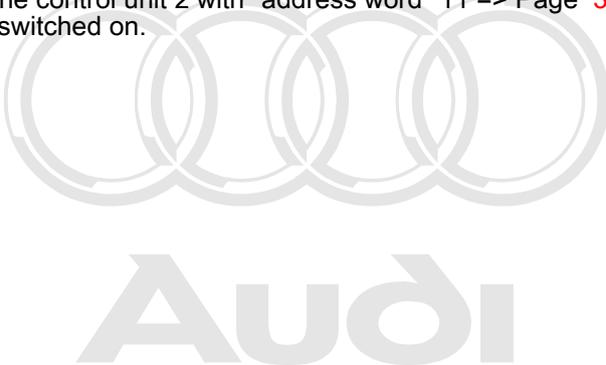
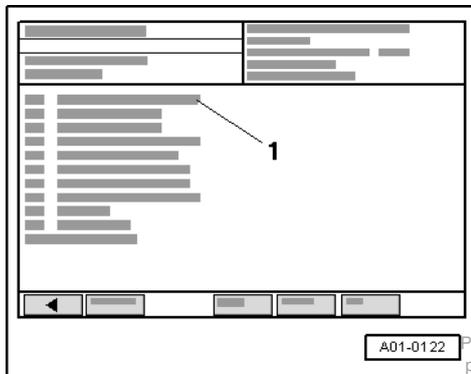
Test conditions

- Fuses for engine electronics OK
- => Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder
- Fuel pump relay OK.



Test sequence

- Connect the vehicle diagnostic, testing and information system VAS 5051 and select engine control unit 1 with "address word" 01, and then engine control unit 2 with "address word" 11 => Page 3 .
For this purpose, the ignition must be switched on.



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-> Display on VAS 5051:

- Under -1- select the diagnostic function "03 - Final control diagnosis".

Note:

Final control diagnosis in engine control unit 1: Fuel pump relay should pull, fuel pump should run, flow noise at fuel pressure regulator is clearly audible. If fuel pump does not run, check actuation =>Page 139 .

Notes:

Fitting location of control elements => Page 93 .

Now the control elements can be actuated in the sequence described on the previous pages.

The control elements are displayed in uncoded text.

Pressing the ▶ key advances to the next control element, until the control element test is completed.

Before restarting the final control diagnosis the engine must be started and the ignition switched off and on again.

7 - Basic setting

7.1 - Basic setting

Notes:

- ♦ The basic setting is carried out separately in both engine control units (engine control unit 1: address word 01, then function 04 -basic setting-; engine control unit 2: address word 11, then function 04 -basic setting-).
- ♦ The control unit identification (display on tester) indicates which engine control unit is involved.

With engine stopped and ignition switched on, the following operation can be carried out with the "Function 04" basic setting:

- ♦ Adaption of the throttle valve control parts to the engine control units =>display group 60

With the "engine running", the following operations can be performed in the basic setting mode "Function 04":

- ♦ Adaption of the lambda control =>Page 173

- ◆ Fault finding by selective activation and deactivation of the lambda control => Page 170 .

Test conditions for operations with engine running

- No fault in fault memories
- Coolant temperature at least 85 °C.
- Electrical consumers switched off (radiator fan must not run during the check)
- Air conditioner switched off
- Gear selector lever in P or N position
- Wheels in straight-ahead position

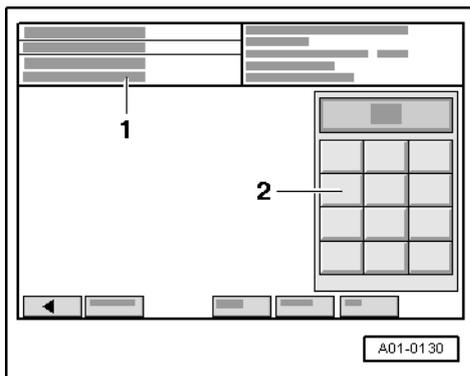
Test sequence

- Connect the vehicle diagnostic, testing and information system VAS 5051 and select engine control unit 1 with "address word" 01, and then engine control unit 2 with "address word" 11 => Page 3 .
For this purpose, the ignition must be switched on.



or after each required process:

- Start the engine.
- > Display on VAS 5051:
- Under -1- select the diagnostic function "04 - Basic setting".



-> Display on VAS 5051:

- 1 - Enter display group
max. input value = 255
- Enter the desired 3-digit display group number in zone -2- and confirm the entry by pressing the Q key.



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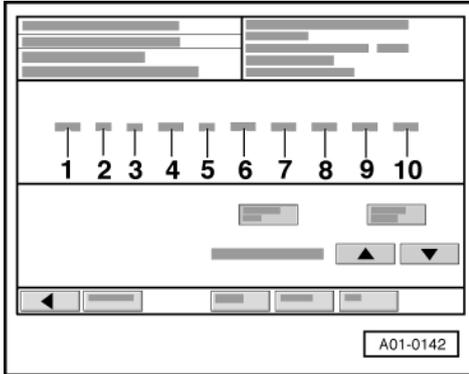


Example:

- Enter "000" for "display group 000" and confirm the entry by pressing the Q key.

Note:

After the display group number is selected, the activated charcoal filter valve is closed and the air conditioner compressor is switched off.



-> Display on VAS 5051:

- 1 - Display group 0
- 2 - Display zone 1 2 3 4 5 6 7 8 9 10

- Exit the function "04 - Basic setting" by pressing the < key.

Specifications for display group 001 for engine control unit 1 are on the next page; for engine control unit 2, please refer to the page after that.

Display group 000 (decimal display values), control unit 1; cylinders 1 to 6											
▪ Engine idling (coolant temperature not less than 85 °C)											
Display zones										Specified value	
1	2	3	4	5	6	7	8	9	10	Learned value for mixture formation (Lambda adaption. Bank 2, cyl. 4-6)	115...139
										Learned value for mixture formation (Lambda adaption exhaust bank 1, cyl. 1-3)	115...139
										Control value for mixture formation (Lambda control exhaust bank 2, cyl. 4-6) (if outside tolerance, perform test drive)	120...136
										Control value for mixture formation (Lambda control exhaust bank 1, cyl. 1-3) (if outside tolerance, perform test drive)	120...136
										Learned value from idling speed control	111...135
										Idling speed control	110...135
										Throttle valve angle	0...3
										Engine speed (idling speed) 1)	52...70
										Engine load (no consumption units)	14...23
										Coolant temperature (requirement for basic setting)	180...207

1) Current values:

=> Exhaust Emissions Test binder

Display group 000 (decimal display values), control unit 2; cylinders 7 to 12	
▪ Engine idling (coolant temperature not less than 85 °C)	
Display zones	Specified value
10 Learned value for mixture formation (Lambda adaption. Bank 4, cyl. 10-12)	115...139
Learned value for mixture formation, (Lambda adaption exhaust bank 3, cyl. 7-9)	115...139
Control value for mixture formation, (Lambda control exhaust bank 4, cyl. 10-12) (if outside tolerance, perform test drive)	120...136
Control value for mixture formation (Lambda control exhaust bank 3, cyl. 7-9) (if outside tolerance, perform test drive)	120...136
Learned value from idling speed control	111...135
Idling speed control	110...135
Throttle valve angle	0...3
Engine speed (idling speed) 1)	52...70
Engine load (no consumption units)	14...23
Coolant temperature (requirement for basic setting)	180...207

1) Current values:

=> Exhaust Emissions Test binder

8 - Encoding control unit

8.1 - Encoding control unit

Notes:

- ◆ If the code needs to be checked, this must occur in both engine control units (engine control unit 1: address word 01; engine control unit 2: address word 11)
 - ◆ The encoding process is shown in the following. Each engine control unit must be encoded individually. (Again engine control unit 1: address word 01; engine control unit 2: address word 11)
 - ◆ Notes on pin coding the control units =>Page 54 .
- Connect the vehicle diagnostic, testing and information system VAS 5051 and select engine control unit 1 with "address word" 01, and then engine control unit 2 with "address word" 11 => Page 3 . For this purpose, the ignition must be switched on.

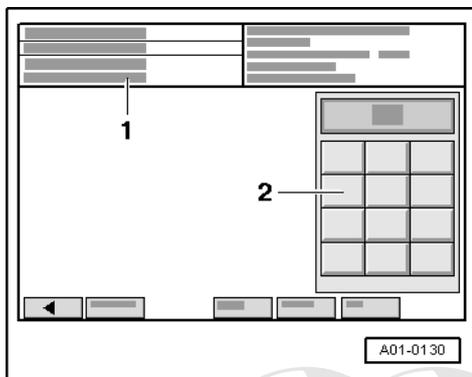
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-> Display on VAS 5051:

- Under -1- select the diagnostic function "07 - encode control unit".



-> Display on VAS 5051:

- 1 - Enter code
max. input value = 32767

- Enter control unit code in zone -2- in line with encoding table => Page 53 .

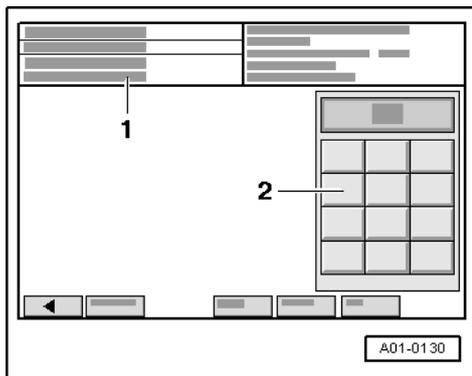
Key to code

XX	Country/emissions
X	Drive/auxiliary functions
X	Gearbox
X	Vehicle type

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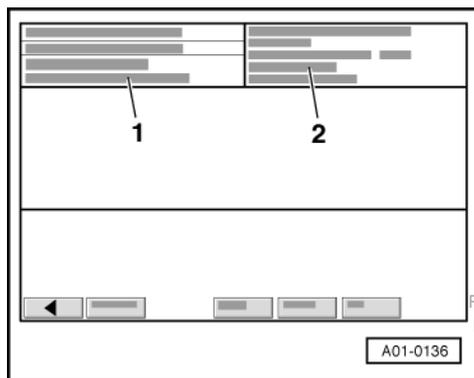
Example of encoding	
11753	EU4 (emission standard), four-wheel drive with electronic stability program (ESP), 5-speed automatic gearbox, Audi A8

- Confirm entry by pressing the Q key.



-> Display on VAS 5051:

- 1 - Encoding is carried out
- Wait until the next display appears.



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-> Display on VAS 5051:

- 1 - Encoding is carried out in the vehicle system

Note:

If "function is unknown or cannot be carried out" appears here, then the control unit cannot be encoded, or an unapproved code has been entered.

- 2 - Control unit identification with new code (previous code in brackets)
- Exit the function "07 - encode control unit" by pressing the ◀ key.

8.2 - Encoding table

Country/emissions	11	EU4 (country/emission standard) see page 53 .
Drive/auxiliary functions	7	Four-wheel drive with electronic stability program (ESP)
Gearbox	5	5-speed automatic gearbox
Vehicle type	3	Audi A8

The following list shows which figures to enter for which country as the first two digits of the control unit code.

The digits 05 for:

Hungary, Bahrain, Qatar, Kuwait, Oman, Saudi Arabia, United Arab Emirates, New Zealand, Singapore, Hong Kong, Australia, Thailand, South Africa, North Africa, Brunei, Argentina

The digits 08 for:

China

The digits 11 for:

Germany, Italy, Spain, Portugal, Greece, Austria, France, Luxembourg, Belgium, Netherlands, Denmark, Finland, Sweden, Great Britain, Ireland, Norway, Liechtenstein, Switzerland

The digits 26 (vapour-pressure-critical countries) for:

Turkey, Israel, Taiwan, South Korea, Commonwealth of Independent States (CIS), Mexico, Bulgaria, Rumania, Chile, Baltic States (Estonia, Latvia, Lithuania), Jordan, Syria, Lebanon, Iraq, Yemen, Afghanistan, Malaysia, Albania, Philippines,

The digits 27 for:

Brazil



Notes on "pincoding the control units"

The pincoding of the control units has nothing to do with the actual encoding itself (function 07, as described above).

Both engine control units have the same part number. Engine control unit 1 communicates with engine control unit 2. Engine control unit 1 takes on certain tasks, for example determining the target idling speed. Engine control unit 2 also takes on certain tasks, for example displaying misfires for all 12 cylinders.

Because both engine control units are identical -each engine control unit needs to know what tasks it has to fulfil, however - each engine control unit is given a so-called pin code. This means that there is a positive signal (terminal 15) on pin 49 of control unit 1. On pin 49 of control unit 2, in contrast, there is a negative signal (earth).

If the signals are not recognised correctly, then fault P1924 is entered. The positive on engine control unit 1 and the negative on engine control unit 2 is then to be checked using the current flow diagram.

9 - Reading measured value block

9.1 - Reading measured value block

Safety precautions

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

Important

- ◆ **When driving the vehicle for measurement and test purposes, always secure the vehicle diagnostic, testing and information system VAS 5051 on the rear seat only and operate it from this position.**

If test equipment were operated from the front passenger seat, the person sitting there could be injured if the front passenger airbag were triggered in the event of an accident.

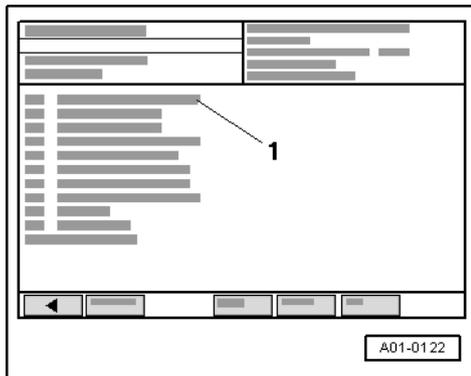
Test conditions

- Coolant temperature at least 85 °C.
- Electrical consumers switched off (radiator fan must not run during the check)
- Air conditioner switched off
- Gear selector lever in P or N position
- **No fault stored in fault memory**

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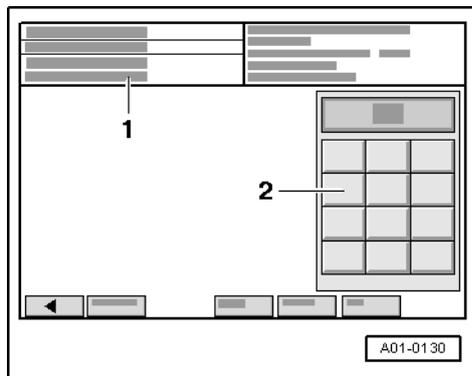
Procedure

- Connect the vehicle diagnostic, testing and information system VAS 5051 and select engine control unit 1 with "address word" 01, and then engine control unit 2 with "address word" 11 => Page 3 . For this purpose, the engine must be running at idle speed.



-> Display on VAS 5051:

- Under -1- select the diagnostic function "08 - Read measured value block".



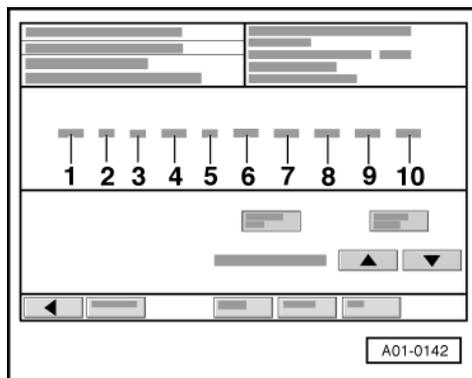
-> Display on VAS 5051:

- 1 - Enter display group
max. input value = 255

- Enter the desired 3-digit display group number in zone -2- and confirm the entry by pressing the Q key.

Note:

The choice of display group depends on the particular functions and components to be tested.



-> Display on VAS 5051 for display group 000:

- 1 - Display group 0
- 2 - Display zone 1 2 3 4 5 6 7 8 9 10



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-> Display on VAS 5051 for display group 001...255:

- 1 - Display group X
- 2 - Display zone 1
- Display zone 2
- Display zone 3
- Display zone 4

Notes:

- ◆ If a display zone is vacant, nothing is displayed.
- ◆ The display can also appear in split format, i.e. in the upper half the function "Read measured value block" is shown, while in the lower half, the function "Basic setting" is shown. By pressing the appropriate "keys", it is possible to jump backwards and forwards between the two functions.
- ◆ To change to another display group, proceed as follows:

Display group	VAS 5051
Higher	Press s key
Lower	Press t key

- Exit the function "08 - Read measured value block" by pressing the ◀ key.

10 - Readiness code

10.1 - Readiness code

The readiness code must be produced separately in both engine control units. If the readiness code is produced in control unit 1 (address word 01), then all the operations carried out relate to cylinder bank 1 (cylinders 1 to 6). If the readiness code is produced in control unit 2 (address word 11), then all the operations carried out relate to cylinder bank 2 (cylinders 7 to 12).

The readiness code appears as an 8-digit display on measured value block 086, display zone 1. Each of the 8 digits is allocated to a particular emission-related system.

If the function of these systems is checked by self-diagnosis through a test, which has to be run fully as OK, the allocated position in the 8-digit display is set from "1" to "0".

If a test is carried out fully but with "not OK" a fault is stored in the fault memory. Interrogate fault memory

If the readiness code is produced after the test has been run successfully it is also called "0 0 0 0 0 0 0 0" (measured value block 086, display zone 1).

The readiness code is reset to

"1 1 1 0 0 1 0 1" if:

- ◆ the fault memory has been erased,
- ◆ if a new engine control unit is installed

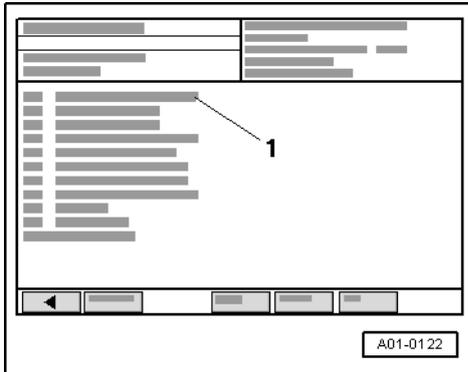
Note:

Systems, which are not checked while producing the readiness code, which are however expected to have a position in the 8-digit display, are in principle set to "0".

When driving with varying loads the exhaust relevant tests are initiated by the control unit and the readiness code generates itself. In this case the concluding control possibility is omitted, i.e. it is not obvious whether the vehicle was handed over to the customer without any faults.

10.2 - Reading out readiness code -engine control unit 1-

Note:



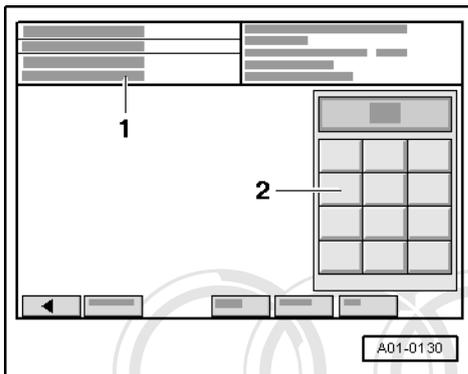
The following sequence applies for engine control unit 1; the sequence for engine control unit 2 is identical, apart from address word 11 => Page 74.

Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 and select engine control unit 1 using "address word" 01 => Page 3.
For this purpose, the ignition must be switched on.

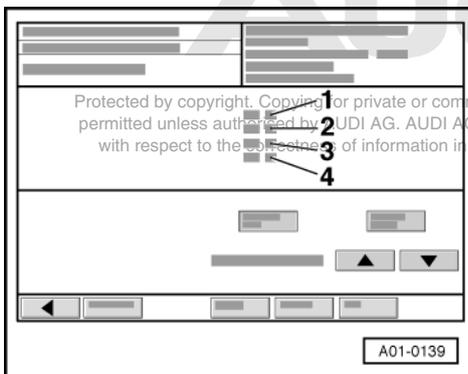
-> Display on VAS 5051:

- Under -1- select the diagnostic function "08 - Read measured value block".



-> Display on VAS 5051:

- 1 - Enter display group
max. input value = 255
- Enter "086" for "display group number 086" in zone -2- and confirm the entry by pressing the Q key.





-> Display on VAS 5051:

- Check readiness code in display zone -1-.
 - Specified value: 0 0 0 0 0 0 0 0

	Display zones			
	1	2	3	4
Display group 086: Readiness code				
Display	0 0 0 0 0 0 0 0	X X X X X X X X	X X X X X X X X	
Display	Ready bits Completed tests	Individual tests performed	Individual tests performed	
Range	1 = not completed 0 = completed	1 = not completed 0 = completed	1 = not completed 0 = completed	
Specified value	0 0 0 0 0 0 0 0	X X X X X X X X	X X X X X X X X	
Note:	Explanation of readiness code => Page 58			

Note on display zone 1:

Display zone 1 is the most important. This display indicates which system has been checked by the self-diagnosis since the last time the fault memory was erased or since installation of a new control unit. After erasing the fault memory, all testable values are set to "1" and then to "0" after successful completion of the test.

X	X	X	X	X	X	X	X	Notes on display group 086, display zone 1
								Catalytic converter diagnosis - Display 0 = Test was carried out - Display 1 = Test was not carried out (produce readiness code - =>Page 59) Display always 0
								Activated charcoal filter system - Display 0 = Test was carried out - Display 1 = Test was not carried out (produce readiness code - =>Page 59) Display always 0
								Secondary air system - Display 0 = Test was carried out - Display 1 = Test was not carried out (produce readiness code - =>Page 59) Display always 0
								Lambda probes - Display 0 = Test was carried out - Display 1 = Test was not carried out (produce readiness code - =>Page 59) Display always 0
								Lambda probe heater - Display 0 = Test was carried out - Display 1 = Test was not carried out (produce readiness code - =>Page 59) Display always 0

Note:

The readiness code is only produced when all display digits in display zone 1 are set to "0".

If the specification "0 0 0 0 0 0 0 0" is achieved in display zone 1:

- Select the * key.
- Interrogate fault memory to make sure it is clear; there must not be any stored faults.

If specified value is not attained:

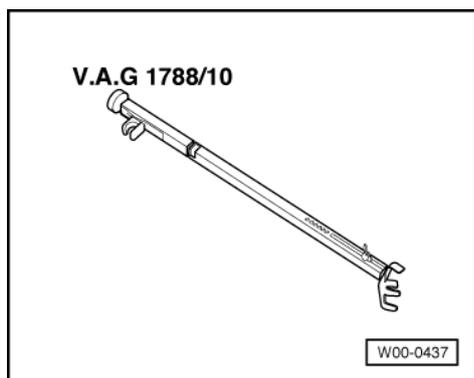
- Producing readiness code => Page 59 .

10.3 - Producing readiness code -engine control unit 1-

Note:

The following sequence applies for engine control unit 1; the sequence for engine control unit 2 is identical, apart from address word 11 => Page 76 .

Special tools and workshop equipment required



- ◆ Engine speed controller V.A.G 1788/10

Preconditions:

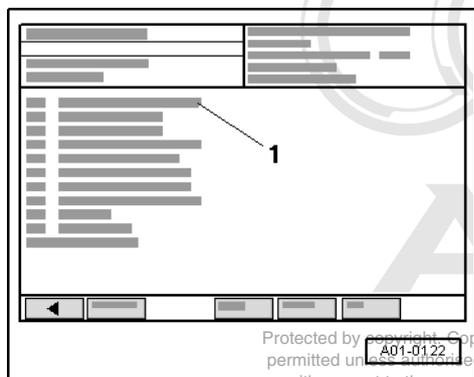
- Vehicle stationary.
- Electrical consumers switched off (radiator fan must not run during the test).
- Air conditioning switched off.
- Coolant temperature at least 80 °C=>display group 004, display zone 3. Important: Warm up engine as far as possible by means of a road test.

Important note:

If the test result is immediately displayed as "OK" after selecting a display group during an operation, the test has already been performed and you can continue with the next operation.

Operation 1: Interrogating fault memory

Test conditions:



- Engine stopped, ignition switched on.

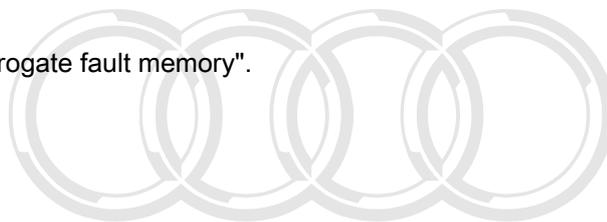
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- Connect vehicle diagnostic, testing and information system VAS 5051 and select engine control unit 1 using "address word" 01 => Page 3 .
For this purpose, the ignition must be switched on.

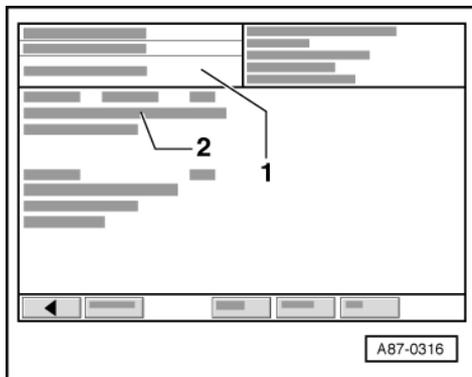
-> Display on VAS 5051:

- Under -1- select the diagnostic function "02 - interrogate fault memory".



Audi

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-> Display on VAS 5051:

- 1 - Contents of the fault memory:
 - 0 faults recognised
 - or
 - X faults recognised
- 2 - Fault
 - fault code
 - fault location
 - type of fault

If a fault is stored:

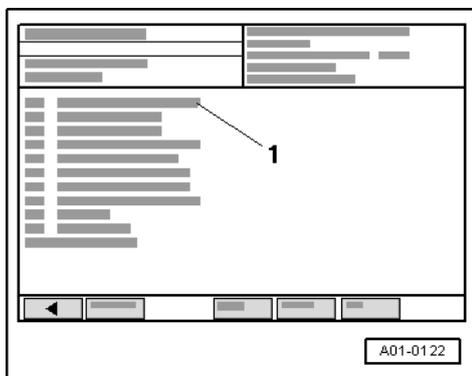
- Rectify fault and erase the fault memory. Perform a road test and interrogate the fault memory again to check.

If no fault is stored:

- Select the ◀ key.

Operation 2: Erasing fault memory

Test conditions:



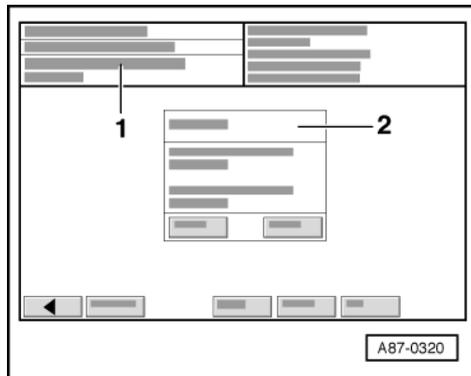
- Engine stopped, ignition switched on.

-> Display on VAS 5051:

- Under -1- select the diagnostic function "05 - erase fault memory".

Note:

The readiness code is reset when the fault memory is erased and must therefore be reproduced.



-> Display on VAS 5051:

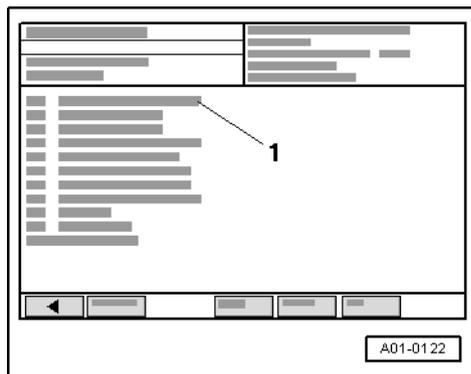
- 1 - - No display (before erasing)
or
- fault memory erased
- 2 - Note:

Should the function be carried out?
 Note: Data will be erased!

- Press the "OK"key in display -2-.
- Select the ◀ key.

Operation 3: Adapting the throttle valve control part to the engine control unit

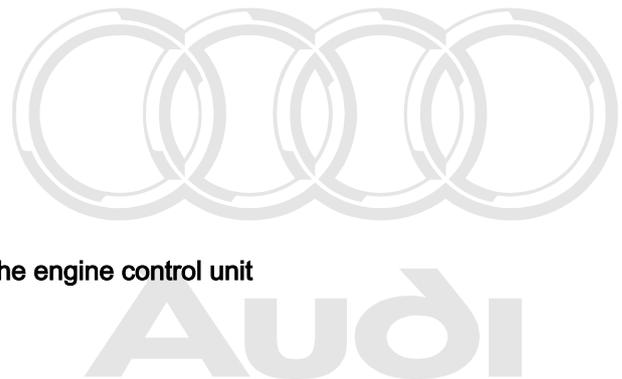
Test conditions:



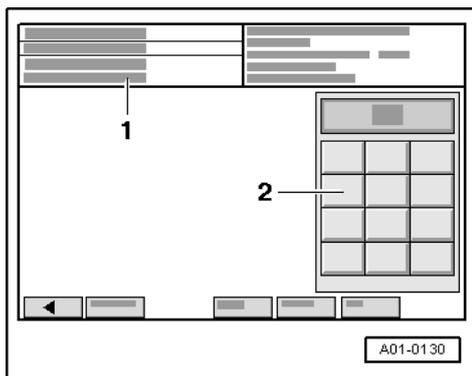
- Engine stopped, ignition switched on.

-> Display on VAS 5051:

- Under -1- select the diagnostic function "04 - Basic setting".



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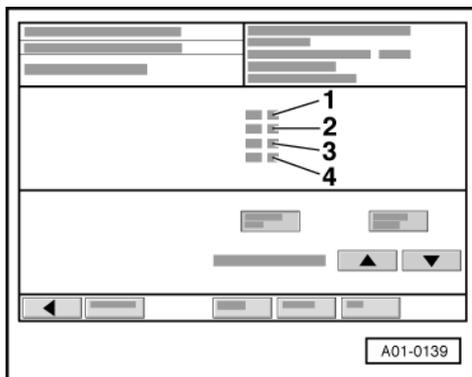


-> Display on VAS 5051:

1 - Enter display group
max. input value = 255

- Enter "060" for "display group number 060" in zone -2- and confirm the entry by pressing the Q key.

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-> Display on VAS 5051:

- Check specifications in display zones -3- and -4-.

Note:

The display can also appear in split format, i.e. in the upper half the function "Read measured value block" is shown, while in the lower half, the function "Basic setting" is shown. Any adaptations and diagnoses are carried out in the "basic setting". This also applies for all the other operations.

	Display zones			
	1	2	3	4
Display group 060: Adaption of throttle valve control part				
Display	xx %	xx %	x	---
Display	Throttle valve angle (angle sender 1)	Throttle valve angle (angle sender 2)	Adaption stage counter	Adaption status
Range			0...8	ADP process running ADP OK ERROR
Specified value	3...93 %	97...3 %	8	ADP OK

		Display zones	
Note:			The adaption stage counter reaches the number 8 after adaption (some numbers may also be skipped).
			If "ERROR" is displayed: Interrogate fault memory => Page 7 .

Note on display zone 3:

During adaption, various digits are displayed in display zone 3 which represent the relevant adaption status. The most crucial factor is not the way in which the adaption stage counter (display zone 3) behaves during the adaption process, but that the specification "ADP OK" is displayed after adaption in display zone 4.

If specification "ADP OK" is attained:

- Perform next operation.

Operation 4: Check operating status of lambda control

- Start the engine.

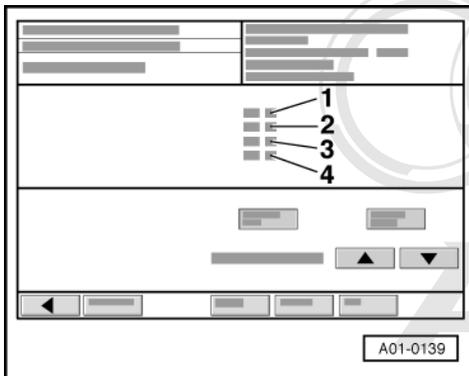
Note:

If necessary, reselect the vehicle system "01 - engine electronics" and the diagnostic function "04 - basic setting" after starting the engine.

- Install the engine speed controller V.A.G 1788/10 on the accelerator and increase the engine speed to 2000 rpm.

Test conditions:

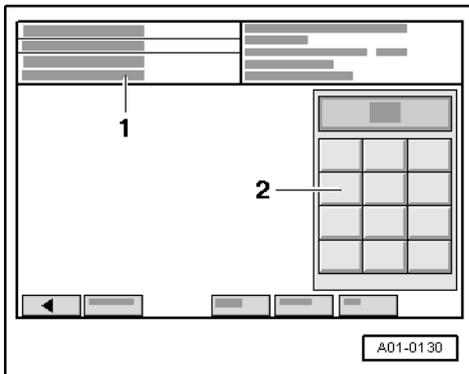
- Engine running at 2000 rpm.



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-> Display on VAS 5051:

- Select the ◀ key.

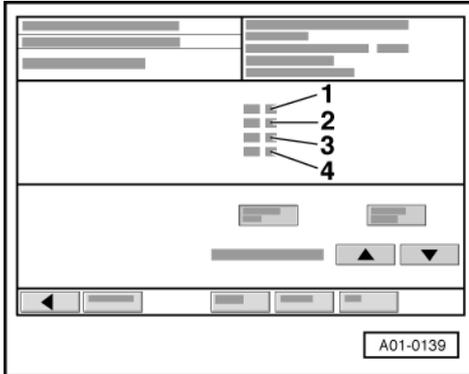




-> Display on VAS 5051:

1 - Enter display group
max. input value = 255

- Enter "030" for "display group number 030" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Check lambda probe status in display zones 1, 2, 3 and 4.

Note:

It may take a few minutes until the result of the diagnosis is obtained.

	Display zones			
	1	2	3	4
Display group 030: Lambda probe status				
Display	X X X	X X X	X X X	X X X
Display	Lambda probe status, bank 1, probe 1 (Cyl. 1, 2, 3 primary catalytic converter)	Lambda probe status, bank 1, probe 2 (Cyl. 1, 2, 3 post catalytic converter)	Lambda probe status, bank 1, probe 2 (Cyl. 4, 5, 6 primary catalytic converter)	Lambda probe status, bank 2, probe 2 (Cyl. 4, 5, 6 post catalytic converter)
Range	0 = off 1 = on	0 = off 1 = on	0 = off 1 = on	0 = off 1 = on
Specif. value	1 1 1	1 1 0	1 1 1	1 1 0

Meaning of 3-digit readout of display group 030			
X	X	X	Display zones 1, 2, 3 and 4
		X	Lambda control: 0 = not active; 1 = active
	X		Lambda probe condition: 0 = not active; 1 = active
X			Condition of lambda probe heating: 0 = not active; 1 = active

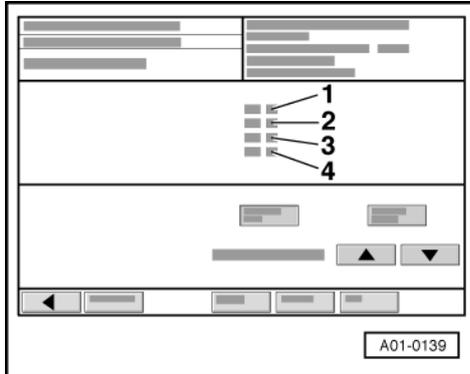
Notes:

- ♦ The first digit of the 3-digit display (heating) fluctuates between 0 and 1 at certain operating points.
 - ♦ The lambda control for lambda probes downstream of catalytic converter (bank 1, probe 2 and bank 2, probe 2) is not active without engine load, i.e. the last digit of the 3-digit display is 0.
- Only continue the test when the displays have achieved "111" at least once in display zones 1 and 3 and "110" in display zones 2 and 4.

Operation 5: Diagnosis of lambda probe ageing upstream of catalytic converter

Test conditions:

- Engine continues to run at 2000 rpm.



-> Display on VAS 5051:

- Select the s key 4 times in order to change to display group 034.
- Check specification in display zone -4-.

Note:

It may take a few minutes until the result of the diagnosis is obtained.

	Display zones			
	1	2	3	4
Display group 034: Diagnosis of lambda probe ageing, lambda probe upstream of catalytic converter bank 1 (cyl. 1, 2, 3)				
Display	xxxx rpm	xxx °C	x.x	---
Display	Engine speed	Exhaust gas temperature	Dynamics factor	Diagnosis status
Range				Test OFF Test ON B1-P1 OK B1-P1 NOK
Specified value	2000 rpm	300...600 °C	0.5...2.5	B1-P1 OK
Note:				If "B1-P1 NOK" is displayed: Interrogate fault memory => Page 7 .

If specification "B1-P1 OK" is attained:

- Select the s key once in order to change to display group 035.

	Display zones			
	1	2	3	4
Display group 035: Diagnosis of lambda probe ageing, lambda probe upstream of catalytic converter bank 2 (cyl. 4, 5, 6)				
Display	xxxx rpm	xxx °C	x.x	---
Display	Engine speed	Exhaust gas temperature	Dynamics factor	Diagnosis status
Range				Test OFF Test ON B2-P1 OK B2-P1 NOK

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	Display zones			
Specified value	2000 rpm	300...600 °C	0.5...2.5	B2-P1 OK
Note:				If "B2-P1 NOK" is displayed: Interrogate fault memory => Page 7.

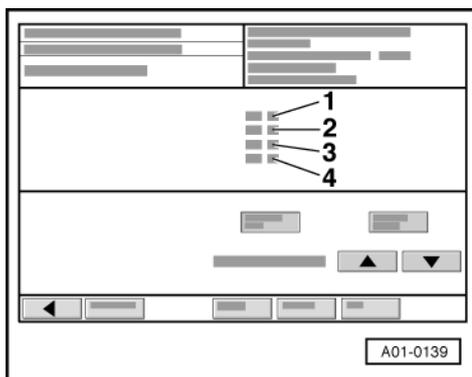
If specification "B2-P1 OK" is attained:

- Perform next operation.

Operation 6: Diagnosis of lambda control system

Test conditions:

- Engine continues to run at 2000 rpm.



-> Display on VAS 5051:

- Select the s key twice in order to change to display group 037.
- Check specification in display zone -4-.

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Note:

It may take a few minutes until the result of the diagnosis is obtained.

	Display zones			
	1	2	3	4
Display group 037: Diagnosis of lambda control system bank 1 (cylinders 1, 2 and 3)				
Display	xxx %	x.xxx V	x.xx	---
Display	Load	Lambda probes voltage bank 1, probe 2	Lambda correction value between bank 1, probe 1 and bank 1, probe 2	Diagnosis status
Range				Test OFF Test ON Syst. OK Syst. NOK
Specified value	12...19 %	0.100...0.950 V	-0.004...0.01	Syst. OK
Note:				If "Syst. NOK" is displayed: Interrogate fault memory => Page 7.

If specification "Syst. OK" is attained:

- Select the s key once in order to change to display group 038.

	Display zones			
	1	2	3	4
Display group 038: Diagnosis of lambda control system bank 2 (cylinders 4, 5 and 6)				
Display	xxx %	x.xxx V	x.xx	---
Display	Load	Lambda probes voltage bank 2, probe 2	Lambda correction value between bank 2, probe 1 and bank 2, probe 2	Diagnosis status
Range				Test OFF Test ON Syst. OK Syst. NOK
Specified value	12...19 %	0.100...0.950 V	-0.004...0.01	Syst. OK
Note:				If "Syst. NOK" is displayed: Interrogate fault memory => Page 7

If specification "Syst. OK" is attained:

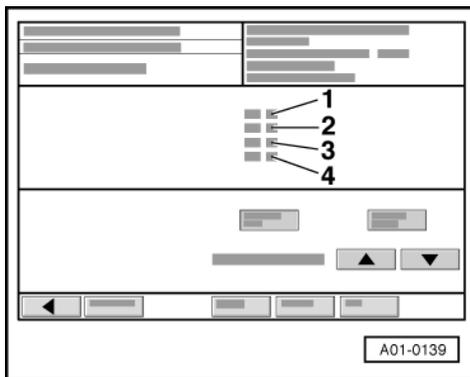
- Perform next operation.

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Operation 7: Diagnosis of lambda probe interchange downstream of catalytic converter

Test conditions:

- Engine continues to run at 2000 rpm.



-> Display on VAS 5051:

- Select the s key once in order to change to display group 039.
- Check specification in display zone -4-.

Note:

It may take a few minutes until the result of the diagnosis is obtained.

	Display zones			
	1	2	3	4
Display group 039: Diagnosis of lambda probe interchange downstream of catalytic converter				
Display	x.x g/s	x.xxx V	x.xxx V	---
Display	Air mass	Lambda probes voltage bank 1, probe 2 (Cylinders 1, 2, 3)	Lambda probes voltage bank 2, probe 2 (Cylinders 4, 5, 6)	Diagnosis status



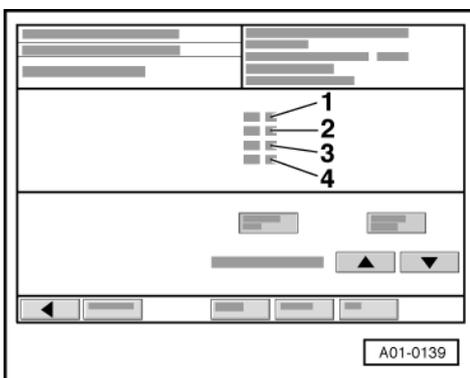
Display zones				
Range				Test OFF Test ON Syst. OK Syst. NOK
Specified value	7.5...10 g/s	0.100...0.950 V	0.100...0.950 V	Syst. OK
Note:				If "Syst. NOK" is displayed: Interrogate fault memory => Page 7 .

If specification "Syst. OK" is attained:

- Perform next operation.

Operation 8: Diagnosis of lambda probe ageing downstream of catalytic converter

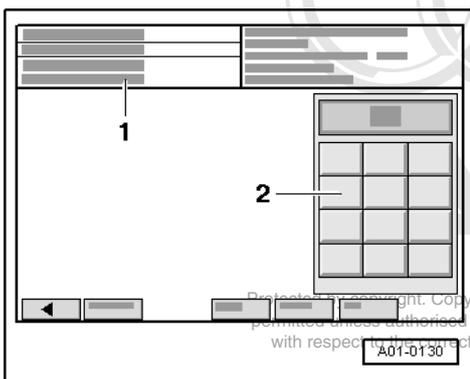
Test conditions:



- Engine continues to run at 2000 rpm.

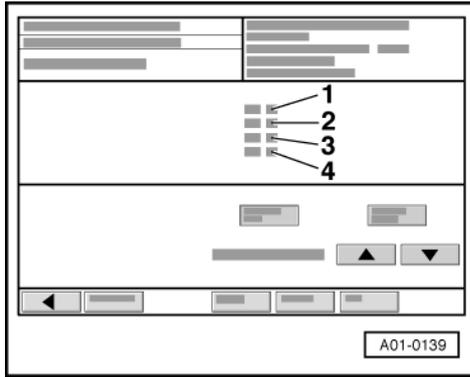
-> Display on VAS 5051:

- Select the ◀ key.



-> Display on VAS 5051:

- 1 - Enter display group
max. input value = 255
- Enter "043" for "display group number 043" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Check specification in display zone -4-

	Display zones			
	1	2	3	4
Display group 043: Diagnosis of lambda probe ageing, lambda probe downstream of catalytic converter bank 1 (cyl. 1,2,3)				
Display	xxxx rpm	xxx °C	x.xxx V	---
Display	Engine speed	Exhaust gas temperature	Lambda probes voltage bank 1, probe 2	Diagnosis status
Range				Test OFF Test ON B1-P2 OK B1-P2 NOK
Specified value	2000 rpm	300...650 °C	0.100...0.950 V	B1-P2 OK
Note:				If "B1-S2 NOK" is displayed: Interrogate fault memory => Page 7

If specification "B1-P2 OK" is attained:

- Select the s key once in order to change to display group 044.

	Display zones			
	1	2	3	4
Display group 044: Diagnosis of lambda probe ageing, lambda probe downstream of catalytic converter bank 2 (cyl. 4,5,6)				
Display	xxxx rpm	xxx °C	x.xxx V	---
Display	Engine speed	Exhaust gas temperature	Lambda probes voltage bank 2, probe 2	Diagnosis status
Range				Test OFF Test ON B2-P2 OK B2-P2 NOK
Specified value	2000 rpm	300...650 °C	0.100...0.950 V	B2-P2 OK
Note:				If "B2-S2 NOK" is displayed: Interrogate fault memory => Page 7

If specification "B2-P2 OK" is attained:

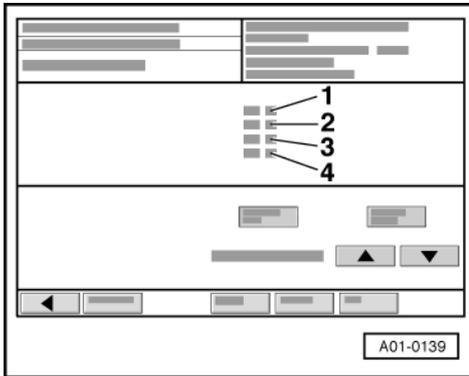


- Perform next operation.

Operation 9: Catalytic converter diagnosis

Test conditions:

- Engine continues to run at 2000 rpm.



-> Display on VAS 5051:

- Select the **s** key twice in order to change to display group **046**.
- Check specifications in display zones **2** and **4**.

Note:

The test duration for the catalytic converter diagnosis is approx. 60 seconds.

	Display zones			
	1	2	3	4
Display group 046: Diagnosis of catalytic converter bank 1 (cylinders 1, 2 and 3)				
Display	xxxx rpm	xxx °C	x.xx	---
Display	Engine speed	Exhaust gas temperature	Measured value Catalytic conversion	Diagnosis status
Range				Test OFF Test ON Cat. B1 OK Cat. B1 NOK
Specified value	2000 rpm	450...650 °C	0.0...0.65	Cat. B1 OK
Note:		As long as the exhaust gas temperature is not within the specified range, the test may not be initiated.		If "Cat. B1 NOK" is displayed: Interrogate fault memory => Page 7 . If no fault is stored, replace the catalytic converter.

If specification "Cat. B1 OK" is attained:

- Select the **s** key once in order to change to display group 047.

	Display zones			
	1	2	3	4
Display group 047: Diagnosis of catalytic converter bank 2 (cylinders 4, 5 and 6)				
Display	xxxx rpm	xxx °C	x.xx	---
Display	Engine speed	Exhaust gas temperature	Measured value Catalytic conversion	Diagnosis status

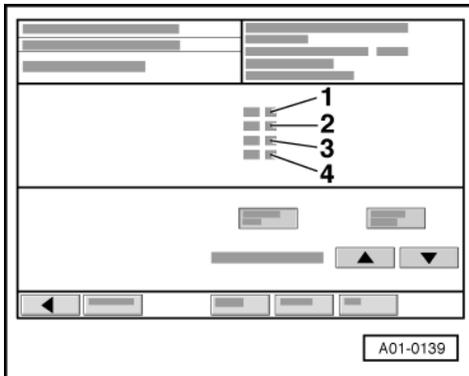
Range	Display zones			
Specified value	2000 rpm	450...650 °C	0.0...0.65	Cat. B2 OK
Note:		As long as the exhaust gas temperature is not within the specified range, the test may not be initiated.		If "Cat. B2 NOK" is displayed: Interrogate fault memory => Page 7 . If no fault is stored, replace the catalytic converter.

If specification "Cat. B2 OK" is attained:

- Perform next operation.

Operation 10: Diagnosis of fuel tank breather valve

- Remove speedometer V.A.G 1788/10 and let engine run at idling speed.

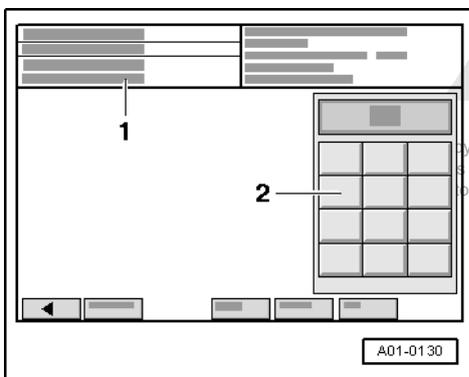


Test conditions:

- Engine running at idling speed.

-> Display on VAS 5051:

- Select the ◀ key.



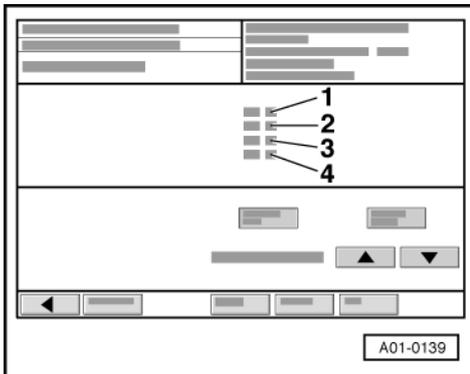
-> Display on VAS 5051:

- 1 - Enter display group



max. input value = 255

- Enter "070" for "display group number 070" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Check specification in display zone -4-.

Note:

If the test is not initiated or the display jumps from "Test ON" to "Test OFF", accelerate briefly to repeat the test.

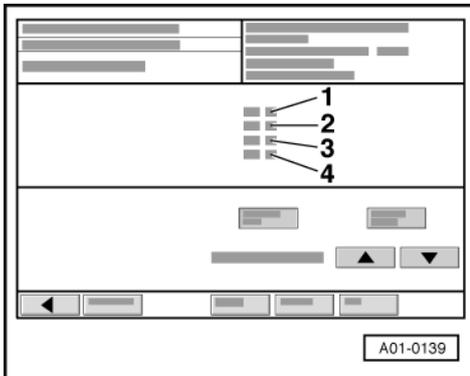
	Display zones			
	1	2	3	4
Display group 070: Diagnosis of fuel tank breather valve				
Display	xx %	xx %	x.x %	---
Display	Opening angle of fuel tank breather valve	Lambda control Average value		Diagnosis status
Range				Test OFF Test ON FTBV OK FTBV NOK Cancel
Specified value	0...100 %	-5.5...6.3 %		FTBV OK
Note:			Display is not relevant	If "FTBV NOK" is displayed: Interrogate fault memory => Page 198

If specification "FTBV OK" is attained:

- Perform next operation.

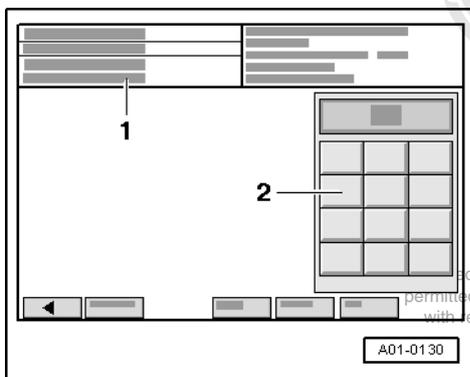
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Operation 11: Diagnosis of secondary air system (cylinder bank 1)



Test conditions:

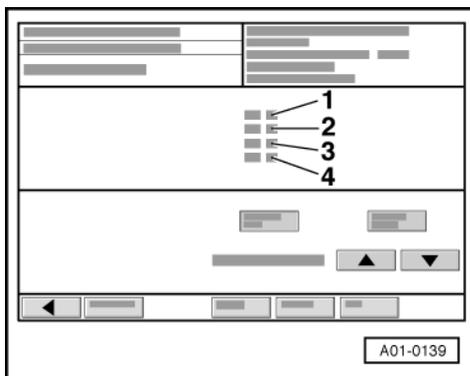
- Engine running at idling speed.
- > Display on VAS 5051:
- Select the ◀ key.



-> Display on VAS 5051:

1 - Enter display group
max. input value = 255

- Enter "077" for "display group number 077" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Check specification in display zone -4-.

Note:

If the test is not initiated or the display jumps from "Test ON" to "Test OFF", accelerate briefly to repeat the test.

	Display zones			
	1	2	3	4
Display group 077: Diagnosis secondary air system (Bank 1)				
Display	xxxx rpm	xx.x g/s	xx %	Test ON
Display	Engine speed	Air mass	Percentage deviation from secondary air specification	Diagnosis status



Range	Display zones			
				Test OFF Test ON Syst. OK Syst. NOK Cancel
Specified value	520...800 rpm	2.5...3.5 g/s	-70 %...30 %	Syst. OK
Note:				If "Syst. NOK" is displayed: Interrogate fault memory => Page 7

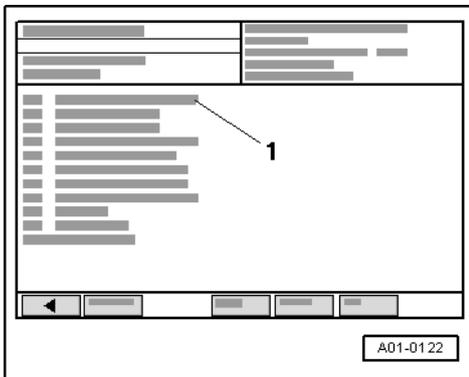
If specified value in display zone 4 "Syst OK" is attained:

Operation 12: Reading out readiness code

- Read out the readiness code => Page 57.

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10.4 - Reading out readiness code -engine control unit 2-

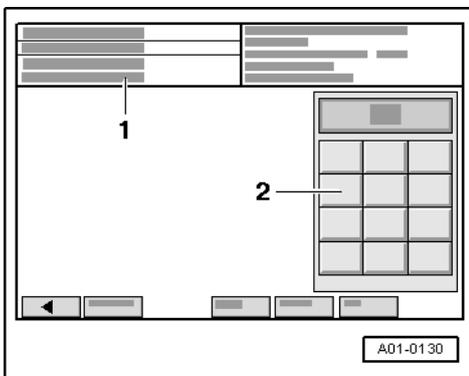


Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 and select engine control unit 2 using "address word" 11 => Page 3 .
For this purpose, the ignition must be switched on.

-> Display on VAS 5051:

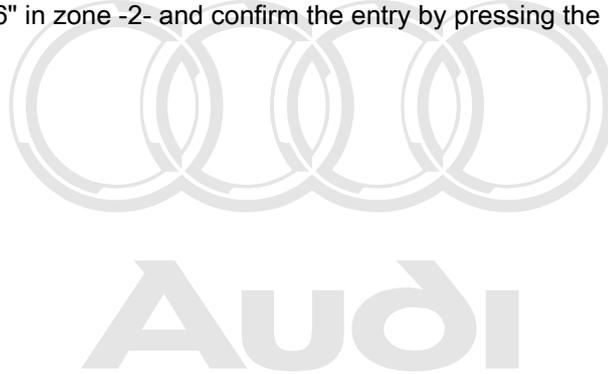
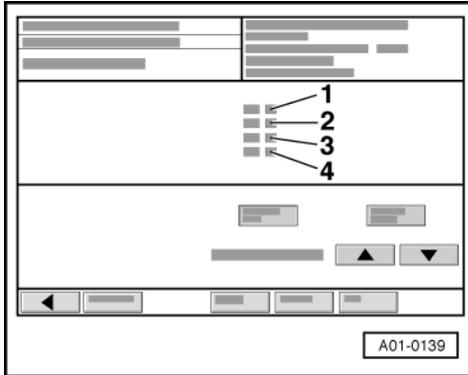
- Under -1- select the diagnostic function "08 - Read measured value block".



-> Display on VAS 5051:

1 - Enter display group
max. input value = 255

- Enter "086" for "display group number 086" in zone -2- and confirm the entry by pressing the Q key.



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-> Display on VAS 5051:

- Check readiness code in display zone -1-.
- Specified value: 0 0 0 0 0 0 0

	Display zones			
	1	2	3	4
Display group 086: Readiness code				
Display	0 0 0 0 0 0 0	X X X X X X X X	X X X X X X X X	
Display	Ready bits Completed tests	Individual tests performed	Individual tests performed	
Range	1 = not completed 0 = completed	1 = not completed 0 = completed	1 = not completed 0 = completed	
Specified value	0 0 0 0 0 0 0	X X X X X X X X	X X X X X X X X	
Note:	Explanation of readiness code => Page 58			

Note on display zone 1:

Display zone 1 is the most important. This display indicates which system has been checked by the self-diagnosis since the last time the fault memory was erased or since installation of a new control unit. After erasing the fault memory, all testable values are set to "1" and then to "0" after successful completion of the test.

X	X	X	X	X	X	X	X	X	Notes on display group 086, display zone 1
									Catalytic converter diagnosis - Display 0 = Test was carried out - Display 1 = Test was not carried out (produce readiness code - =>Page 76)
									Display always 0 Activated charcoal filter system - Display 0 = Test was carried out - Display 1 = Test was not carried out (produce readiness code - =>Page 76)
									Secondary air system - Display 0 = Test was carried out - Display 1 = Test was not carried out (produce readiness code - =>Page 76)
									Display always 0



<p>Lambda probes - Display 0 = Test was carried out - Display 1 = Test was not carried out (produce readiness code - =>Page 76)</p>
<p>Lambda probe heater - Display 0 = Test was carried out - Display 1 = Test was not carried out (produce readiness code - =>Page 76)</p>
<p>Display always 0</p>

Note:

The readiness code is only produced when all display digits in display zone 1 are set to "0".

If the specification "0 0 0 0 0 0 0" is achieved in display zone 1:

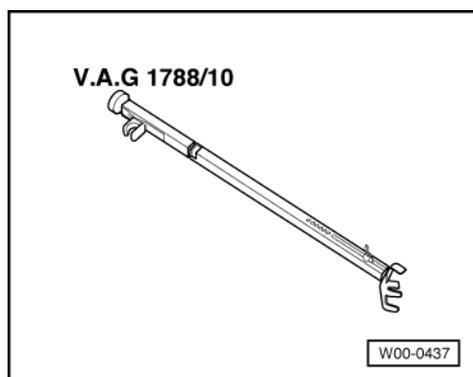
- Select the ◀ key.
- Interrogate fault memory to make sure it is clear; there must not be any stored faults.

If specified value is not attained:

- Produce the readiness code => Page 76 .

10.5 - Producing readiness code -engine control unit 2-

Special tools and workshop equipment required



- ♦ Engine speed controller V.A.G 1788/10

Preconditions:

- Vehicle stationary.
- Electrical consumers switched off (radiator fan must not run during the test).
- Air conditioning switched off.
- Coolant temperature at least 80 °C=>display group 004, display zone 3. Important: Warm up engine as far as possible by means of a road test.

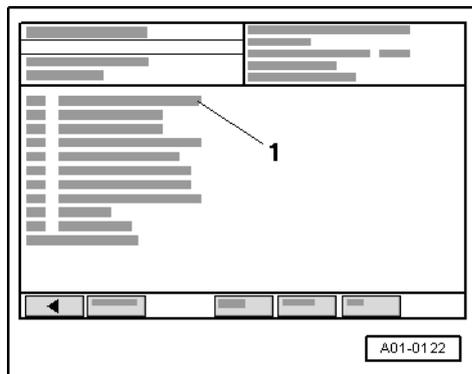
Important note:

If the test result is immediately displayed as "OK" after selecting a display group during an operation, the test has already been performed and you can continue with the next operation.

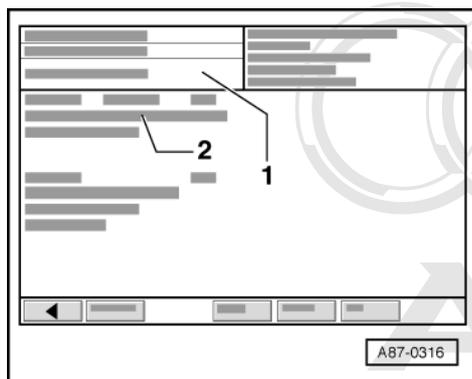
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Operation 1: Interrogating fault memory

Test conditions:



- Engine stopped, ignition switched on.
- Connect vehicle diagnostic, testing and information system VAS 5051 and select engine control unit 2 using "address word" 11 => Page 3.
For this purpose, the ignition must be switched on.
- > Display on VAS 5051:
- Under -1- select the diagnostic function "02 - interrogate fault memory".



-> Display on VAS 5051: Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- 1 - Contents of the fault memory:
 - 0 faults recognised
 - or
 - X faults recognised
- 2 - Fault
 - Fault code
 - Fault location
 - Type of fault

If a fault is stored:

- Rectify fault and erase the fault memory. Perform a road test and interrogate the fault memory again to check.

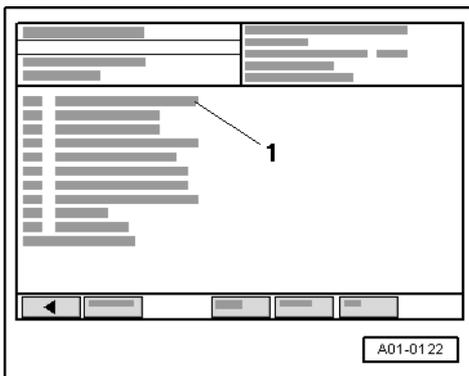
If no fault is stored:

- Select the ◀ key.



Operation 2: Erasing fault memory

Test conditions:



- Engine stopped, ignition switched on.

-> Display on VAS 5051:

- Under -1- select the diagnostic function "05 - erase fault memory".

Note:

The readiness code is reset when the fault memory is erased and must therefore be reproduced.



-> Display on VAS 5051:

- 1 - - No display (before erasing)

or

- fault memory erased

- 2 - Note:

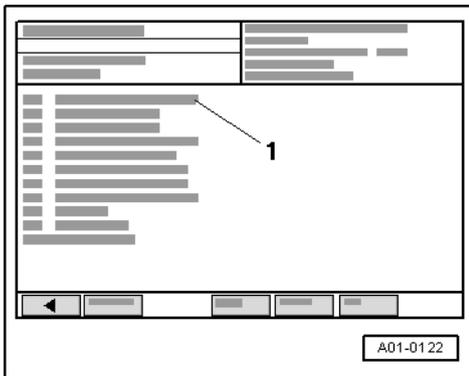
Should the function be carried out?

Note: Data will be erased!

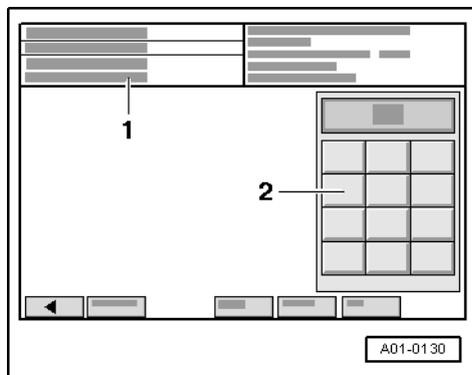
- Press the "OK" key in display -2-
- Select the ◀ key.

Operation 3: Adapting the throttle valve control part to the engine control unit

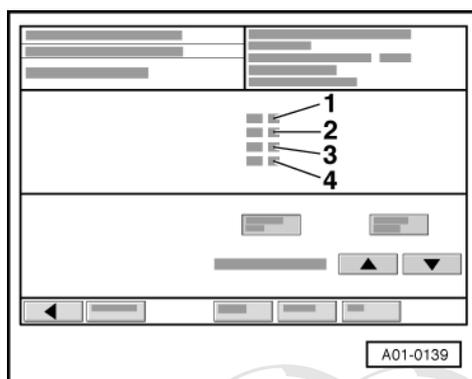
Test conditions:



- Engine stopped, ignition switched on.
- > Display on VAS 5051:
- Under -1- select the diagnostic function "04 - Basic setting".



- > Display on VAS 5051:
- 1 - Enter display group
max. input value = 255
- Enter "060" for "display group number 060" in zone -2- and confirm the entry by pressing the Q key.



- > Display on VAS 5051:
- Check specifications in display zones -3- and -4-.

Note:

The display can also appear in split format, i.e. in the upper half the function "Read measured value block" is shown, while in the lower half, the function "Basic setting" is shown. Any adaptations and diagnoses are carried out in the "basic setting". This also applies for all the other operations.

Display zones				
	1	2	3	4
Display group 060: Adaption of throttle valve control part				
Display	xx %	xx %	x	---
Display	Throttle valve angle (angle sender 1)	Throttle valve angle (angle sender 2)	Adaption stage counter	Adaption status



Range	Display zones			ADP process running ADP OK ERROR
			0...8	
Specified value	3...93 %	97...3 %	8	ADP OK
Note:			The adaption stage counter reaches the number 8 after adaption (some numbers may also be skipped).	If "ERROR" is displayed: Interrogate fault memory => Page 7 .

Note on display zone 3:

During adaption, various digits are displayed in display zone 3 which represent the relevant adaption status. The most crucial factor is not the way in which the adaption stage counter (display zone 3) behaves during the adaption process, but that the specification "ADP OK" is displayed after adaption in display zone 4.

If specification "ADP OK" is attained:

- Perform next operation.

Operation 4: Checking operating status of lambda control

- Start the engine.

Note:

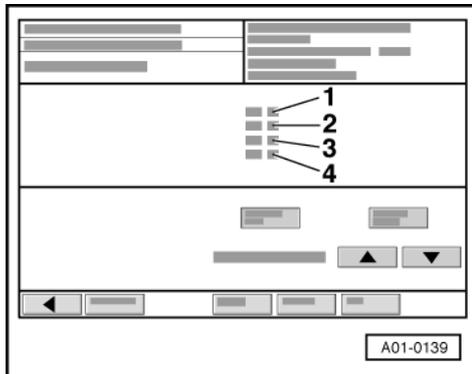
If necessary, reselect the vehicle system "11 - engine electronics II" and the diagnostic function "04 - basic setting" after starting the engine.

- Install the engine speed controller V.A.G 1788/10 on the accelerator and increase the engine speed to 2000 rpm.

Test conditions:

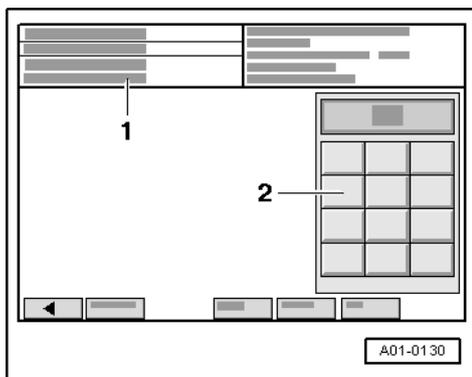
- Engine running at 2000 rpm.

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-> Display on VAS 5051:

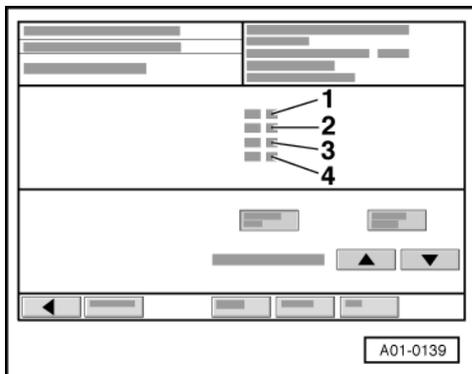
- Select the ◀ key.



-> Display on VAS 5051:

1 - Enter display group
max. input value = 255

- Enter "030" for "display group number 030" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Check lambda probe status in display zones 1, 2, 3 and 4.

Note:

It may take a few minutes until the result of the diagnosis is obtained.

	Display zones			
	1	2	3	4
Display group 030: Lambda probe status				
Display	X X X	X X X	X X X	X X X
Display	Lambda probe status, bank 1, probe 1 (Cyl. 7, 8, 9 primary catalytic converter)	Lambda probe status, bank 1, probe 2 (Cyl. 7, 8, 9 post catalytic converter)	Lambda probe status, bank 1, probe 2 (Cyl. 10, 11, 12 primary catalytic converter)	Lambda probe status, bank 2, probe 2 (Cyl. 10, 11, 12 post catalytic converter)
Range	0 = off 1 = on	0 = off 1 = on	0 = off 1 = on	0 = off 1 = on
Specif. value	1 1 1	1 1 0	1 1 1	1 1 0

Meaning of 3-digit readout of display group 030			
X	X	X	Display zones 1, 2, 3 and 4
		X	Lambda control: 0 = not active; 1 = active
	X		Lambda probe condition: 0 = not active; 1 = active
X			Condition of lambda probe heating: 0 = not active; 1 = active

Notes:

- ◆ The first digit of the 3-digit display (heating) fluctuates between 0 and 1 at certain operating points.
- ◆ The lambda control for lambda probes downstream of catalytic converter (bank 1, probe 2 and bank 2, probe 2) is not active without engine load, i.e. the last digit of the 3-digit display is 0.

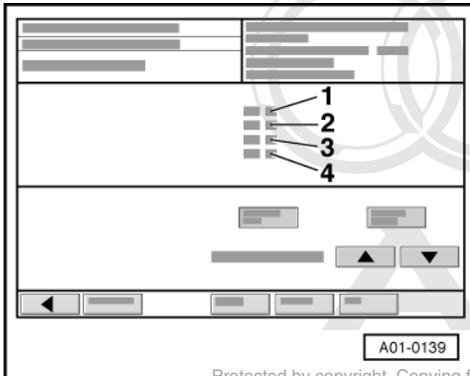
- Only continue the test when the displays have achieved "111" at least once in display zones 1 and 3 and "110" in display zones 2 and 4.



Operation 5: Diagnosis of lambda probe ageing upstream of catalytic converter

Test conditions:

- Engine continues to run at 2000 rpm.



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-> Display on VAS 5051:

- Select the s key 4 times in order to change to display group 034.
- Check specification in display zone -4-.

Note:

It may take a few minutes until the result of the diagnosis is obtained.

	Display zones			
	1	2	3	4
Display group 034: Diagnosis of lambda probe ageing, lambda probe upstream of catalytic converter bank 1 (cyl. 7, 8, 9)				
Display	xxxx rpm	xxx °C	x.x	---
Display	Engine speed	Exhaust gas temperature	Dynamics factor	Diagnosis status
Range				Test OFF Test ON B1-P1 OK B1-P1 NOK
Specified value	2000 rpm	300...600 °C	0.5...2.5	B1-P1 OK
Note:				If "B1-P1 NOK" is displayed: Interrogate fault memory => Page 7 .

If specification "B1-P1 OK" is attained:

- Select the s key once in order to change to display group 035.

	Display zones			
	1	2	3	4
Display group 035: Diagnosis of lambda probe ageing, lambda probe upstream of catalytic converter bank 2 (cyl. 10, 11, 12)				
Display	xxxx rpm	xxx °C	x.x	---
Display	Engine speed	Exhaust gas temperature	Dynamics factor	Diagnosis status
Range				Test OFF Test ON B2-P1 OK B2-P1 NOK

	Display zones			
Specified value	2000 rpm	300...600 °C	0.5...2.5	B2-P1 OK
Note:				If "B2-P1 NOK" is displayed: Interrogate fault memory => Page 7.

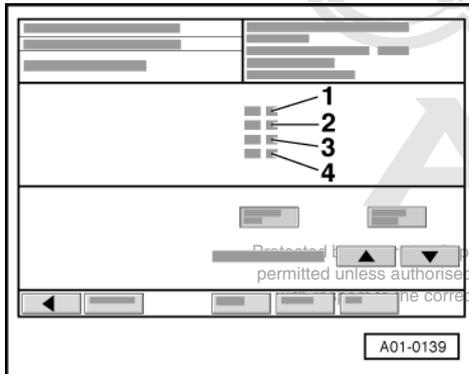
If specification "B2-P1 OK" is attained:

- Perform next operation.

Operation 6: Diagnosis of lambda control system

Test conditions:

- Engine continues to run at 2000 rpm.



-> Display on VAS 5051:

- Select the s key twice in order to change to display group 037.
- Check specification in display zone -4-.

Note:

It may take a few minutes until the result of the diagnosis is obtained.

	Display zones			
	1	2	3	4
Display group 037: Diagnosis of lambda control system bank 1 (cylinders 7, 8 and 9)				
Display	xxx %	x.xxx V	x.xx	---
Display	Load	Lambda probes voltage bank 1, probe 2	Lambda correction value between bank 1, probe 1 and bank 1, probe 2	Diagnosis status
Range				Test OFF Test ON Syst. OK Syst. NOK
Specified value	12...19 %	0.100...0.950 V	-0.004...0.01	Syst. OK
Note:				If "Syst. NOK" is displayed: Interrogate fault memory => Page 7.

If specification "Syst. OK" is attained:

- Select the s key once in order to change to display group 038.



	Display zones			
	1	2	3	4
Display group 038: Diagnosis of lambda control system bank 2 (cylinders 10, 11 and 12)				
Display	xxx %	x.xxx V	x.xx	---
Display	Load	Lambda probes voltage bank 2, probe 2	Lambda correction value between bank 2, probe 1 and bank 2, probe 2	Diagnosis status
Range				Test OFF Test ON Syst. OK Syst. NOK
Specified value	12...19 %	0.100...0.950 V	-0.004...0.01	Syst. OK
Note:				If "Syst. NOK" is displayed: Interrogate fault memory => Page 7.

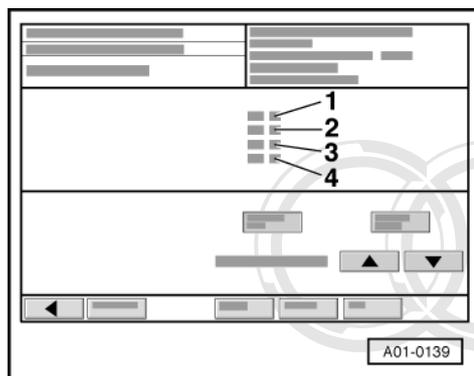
If specification "Syst. OK" is attained:

- Perform next operation.

Operation 7: Diagnosis of lambda probe interchange downstream of catalytic converter

Test conditions:

- Engine continues to run at 2000 rpm.



-> Display on VAS 5051:

- Select the s key once in order to change to display group 039.
- Check specification in display zone -4-.

Note:

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It may take a few minutes until the result of the diagnosis is obtained.

	Display zones			
	1	2	3	4
Display group 039: Diagnosis of lambda probe interchange downstream of catalytic converter				
Display	x.x g/s	x.xxx V	x.xxx V	---
Display	Air mass	Lambda probes voltage bank 1, probe 2 (Cylinders 7, 8, 9)	Lambda probes voltage bank 2, probe 2 (Cylinders 10, 11, 12)	Diagnosis status

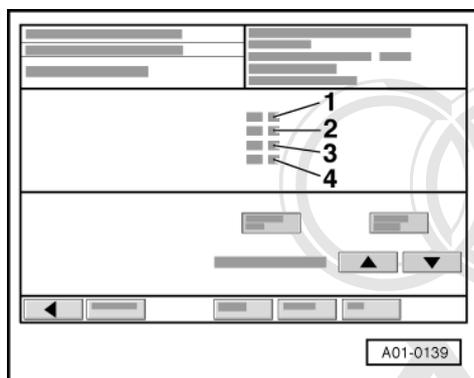
Range	Display zones			Test OFF Test ON Syst. OK Syst. NOK
Specified value	7.5...10 g/s	0.100...0.950 V	0.100...0.950 V	Syst. OK
Note:				If "Syst. NOK" is displayed: Interrogate fault memory => Page 7 .

If specification "Syst. OK" is attained:

- Perform next operation.

Operation 8: Diagnosis of lambda probe ageing downstream of catalytic converter

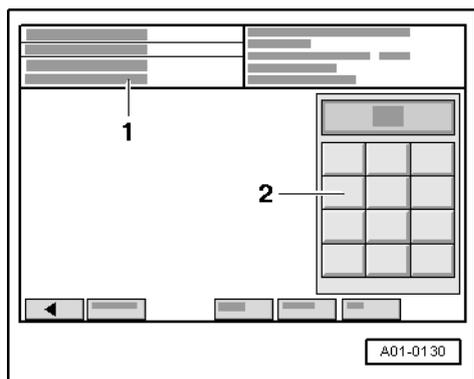
Test conditions:



- Engine continues to run at 2000 rpm.

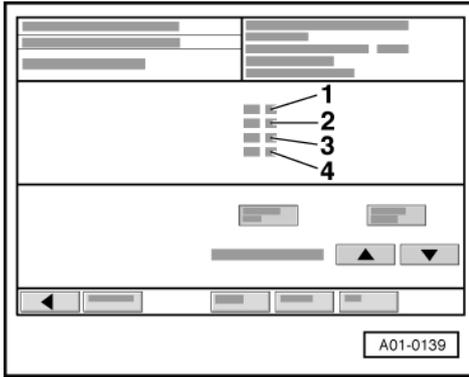
-> Display on VAS 5051:

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-> Display on VAS 5051:

- 1 - Enter display group
max. input value = 255
- Enter "043" for "display group number 043" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Check specification in display zone -4-.

	Display zones			
	1	2	3	4
Display group 043: Diagnosis of lambda probe ageing, lambda probe downstream of catalytic converter bank 1 (cyl. 7,8,9)				
Display	xxxx rpm	xxx °C	x.xxx V	---
Display	Engine speed	Exhaust gas temperature	Lambda probes voltage bank 1, probe 2	Diagnosis status
Range				Test OFF Test ON B1-P2 OK B1-P2 NOK
Specified value	2000 rpm	300...650 °C	0.100...0.950 V	B1-P2 OK
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If specification "B1-P2 OK" is attained:

- Select the s key once in order to change to display group 044.

	Display zones			
	1	2	3	4
Display group 044: Diagnosis of lambda probe ageing, lambda probe downstream of catalytic converter bank 2 (cyl. 10,11,12)				
Display	xxxx rpm	xxx °C	x.xxx V	---
Display	Engine speed	Exhaust gas temperature	Lambda probes voltage bank 2, probe 2	Diagnosis status
Range				Test OFF Test ON B2-P2 OK B2-P2 NOK
Specified value	2000 rpm	300...650 °C	0.100...0.950 V	B2-P2 OK
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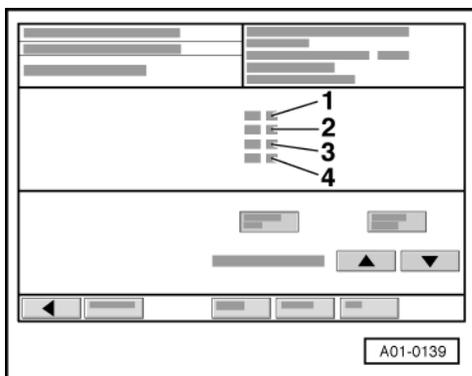
If specification "B2-P2 OK" is attained:

- Perform next operation.

Operation 9: Catalytic converter diagnosis

Test conditions:

- Engine continues to run at 2000 rpm.



-> Display on VAS 5051:

- Select the s key twice in order to change to display group 046.
- Check specifications in display zones -2- and -4-.

Note:

The test duration for the catalytic converter diagnosis is approx. 60 seconds.

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	Display zones			
	1	2	3	4
Display group 046: Diagnosis of catalytic converter bank 1 (cylinders 7, 8 and 9)				
Display	xxxx rpm	xxx °C	x.xx	---
Display	Engine speed	Exhaust gas temperature	Measurement Catalytic conversion	Diagnosis status
Range				Test OFF Test ON Cat. B1 OK Cat. B1 NOK
Specified value	2000 rpm	450...650 °C	0.0...0.65	Cat. B1 OK
Note:		As long as the exhaust gas temperature is not within the specified range, the test may not be initiated.		If "Cat. B1 NOK" is displayed: Interrogate fault memory => Page 7 . If no fault is stored, replace the catalytic converter.

If specification "Cat. B1 OK" is attained:

- Select the s key once in order to change to display group 047.

	Display zones			
	1	2	3	4
Display group 047: Diagnosis of catalytic converter bank 2 (cylinders 10, 11 and 12)				
Display	xxxx rpm	xxx °C	x.xx	---
Display	Engine speed	Exhaust gas temperature	Measurement Catalytic conversion	Diagnosis status



Display zones				
Range				Test OFF Test ON Cat. B2 OK Cat. B2 NOK
Specified value	2000 rpm	450...650 °C	0.0...0.65	Cat. B2 OK
Note:		As long as the exhaust gas temperature is not within the specified range, the test may not be initiated.		If "Cat. B2 NOK" is displayed: Interrogate fault memory => Page 7 . If no fault is stored, replace the catalytic converter.

If specification "Cat. B2 OK" is attained:

- Perform next operation.

Operation 10: Diagnosis of fuel tank breather valve

- Remove speedometer V.A.G 1788/10 and let engine run at idling speed.

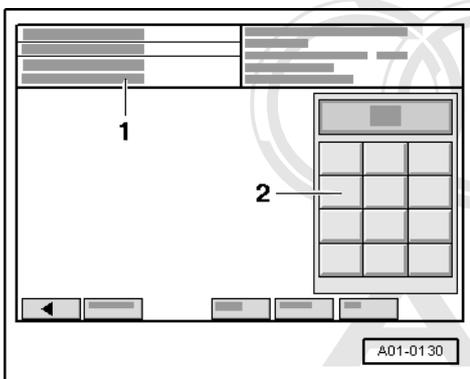


Test conditions:

- Engine running at idling speed.

-> Display on VAS 5051:

- Select the ◀ key.

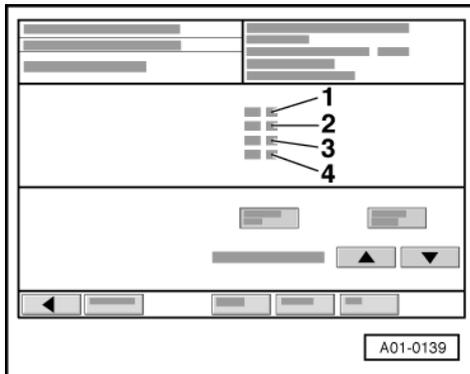


-> Display on VAS 5051: Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted; unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- 1 - Enter display group

max. input value = 255

- Enter "070" for "display group number 070" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Check specification in display zone -4-.

Note:

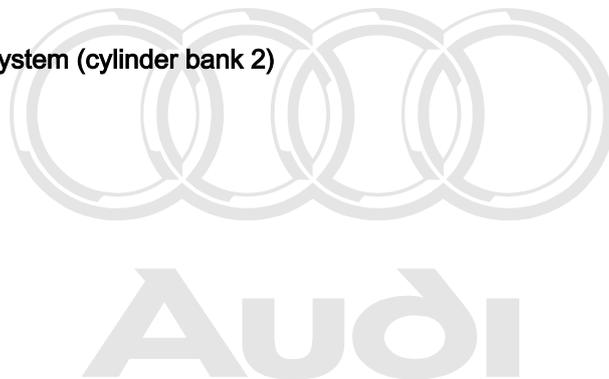
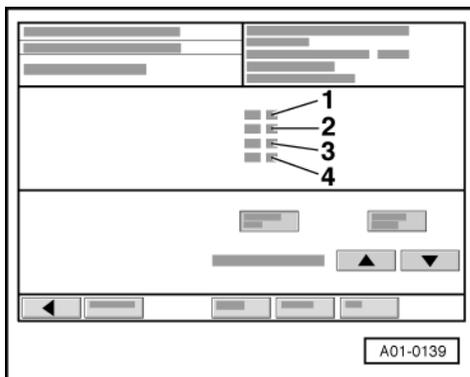
If the test is not initiated or the display jumps from "Test ON" to "Test OFF", accelerate briefly to repeat the test.

	Display zones			
	1	2	3	4
Display group 070: Diagnosis of fuel tank breather valve				
Display	xx %	xx %	x.x %	---
Display	Opening angle of fuel tank breather valve	Lambda control Average value		Diagnosis status
Range				Test OFF Test ON FTBV OK FTBV NOK Cancel
Specified value	0...100 %	-5.5...6.3 %		FTBV OK
Note:			Display is not relevant	If "FTBV NOK" is displayed: Interrogate fault memory => Page 198 .

If specification "FTBV OK" is attained:

- Perform next operation.

Operation 11: Diagnosis of secondary air system (cylinder bank 2)

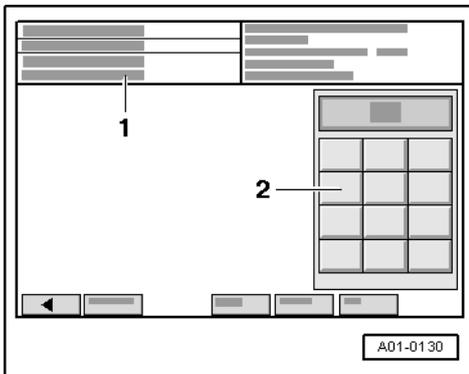


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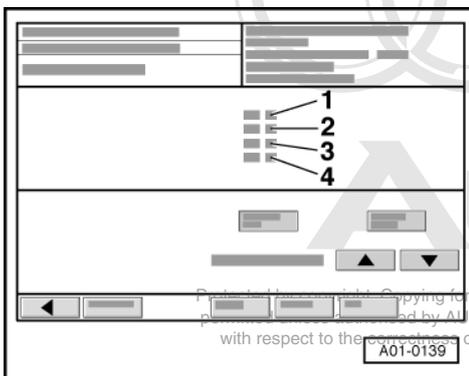
Test conditions:

- Engine running at idling speed.
- > Display on VAS 5051:
- Select the ◀ key.



-> Display on VAS 5051:

- 1 - Enter display group
max. input value = 255
- Enter "077" for "display group number 077" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Check specification in display zone -4-.

Note:

If the test is not initiated or the display jumps from "Test ON" to "Test OFF", accelerate briefly to repeat the test.

	Display zones			
	1	2	3	4
Display group 077: Diagnosis of secondary air system (cylinder bank 2)				
Display	xxxx rpm	xx.x g/s	xx %	Test ON
Display	Engine speed	Air mass	Percentage deviation from secondary air specification	Diagnosis status

	Display zones			
Range				Test OFF Test ON Syst. OK Syst. NOK Cancel
Specified value	520...800 rpm	2.5...3.5 g/s	-70 %...30 %	Syst. OK
Note:				If "Syst. NOK" is displayed: Interrogate fault memory => Page 7

If specified value in display zone 4 "Syst OK" is attained:

Operation 12: Reading out readiness code

- Read out the readiness code => Page **74** .



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24 - Mixture preparation, Injection

1 - Servicing Motronic injection system

1.1 - Servicing Motronic injection system

1.2 - Safety precautions

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

Warning!

- ◆ Always install testers and measuring instruments on the back seat and have a second person operate them from there.
- ◆ If test equipment were operated from the front passenger seat, the person sitting there could be injured if the front passenger airbag were triggered in the event of an accident.

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

- ◆ Always switch off the ignition before connecting or disconnecting injection or ignition system wiring or tester cables.
- ◆ To run engine at starting speed without actually starting it (for example, in order to test compression), unplug connector from the output stages for the ignition coils and remove fuse for the injectors (current flow diagram).
- ◆ During certain tests it is possible that faults are detected and stored by the control units. At the end of all tests and repairs, therefore, the fault memory in both engine control units should be interrogated and, if necessary, erased.
- ◆ Always switch off the ignition before washing the engine.
- ◆ Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control units may be damaged.

Important

The fuel system is pressurised. Before loosening hose connections or opening the test connection (to measure fuel pressure), place a cloth around the connection. Then release pressure by carefully loosening the connection.

1.3 - Rules for cleanliness

When working on the fuel supply/injection system, carefully observe to the following 6 cleanliness rules:

- ◆ Thoroughly clean all unions and the adjacent areas before disconnecting.
- ◆ Place removed parts on a clean surface and cover. Use lint-free cloths.
- ◆ Carefully cover or seal open components if repairs cannot be carried out immediately.
- ◆ Only install clean components:
Only remove replacement parts from packaging immediately prior to installation.
Do not use parts that have been stored loose (e.g. in toolboxes etc.).
- ◆ When the system is open:
Do not work with compressed air if this can be avoided.
Do not move vehicle unless absolutely necessary.
- ◆ Separated electrical connectors:

Protect from dirt and moisture.
Make sure connections are dry when attaching.

1.4 - Technical data

Engine code letters		AZC 6.0 L 309 kW/420 PS
Idling speed 1) Not adjustable - controlled by the idling speed stabilisation		520...770 rpm
Engine speed limitation by closing throttle valve		6200 rpm
Fuel pressure at idling speed	Vacuum hose connected	approx. 3.5 bar
	Vacuum hose detached	approx. 4.0 bar
Holding pressure after 10 minutes		at least 2.5 bar
Injectors	Spray pattern	Multiple bore jet / the same for all injectors
	Injection quantity (30 seconds)	121...131 ml
	Resistance (Room temperature at 20 °C) 2)	13...16 ω

1) Current values:

=> Exhaust Emissions Test binder

2) When the engine is at operating temperature the resistance of the injectors is increased by approx. 4 - 6 ω .

1.5 - Fitting locations overview

The components A to H are not shown in the exploded view.

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

- ◆ In footwell on pedal bracket near brake pedal

B - Diagnostic connector

- ◆ Are located in the knee protection on the driver's side

C - Fuel pump relay (J17)

- ◆ In electronics box in front passenger's footwell, central electrics unit, relay position 4

D - Power supply relay for Motronic (J271)

- ◆ In the electronics box in the front passenger's footwell in the relay carrier, relay position 2 (see current flow diagram)

E - Sender for accelerator position (G79) and sender 2 for accelerator position (G185)

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

F - "MIL" warning lamp

- ◆ In dash panel insert
(Meaning of lamp =>Page 3)

G - "EPC" warning lamp

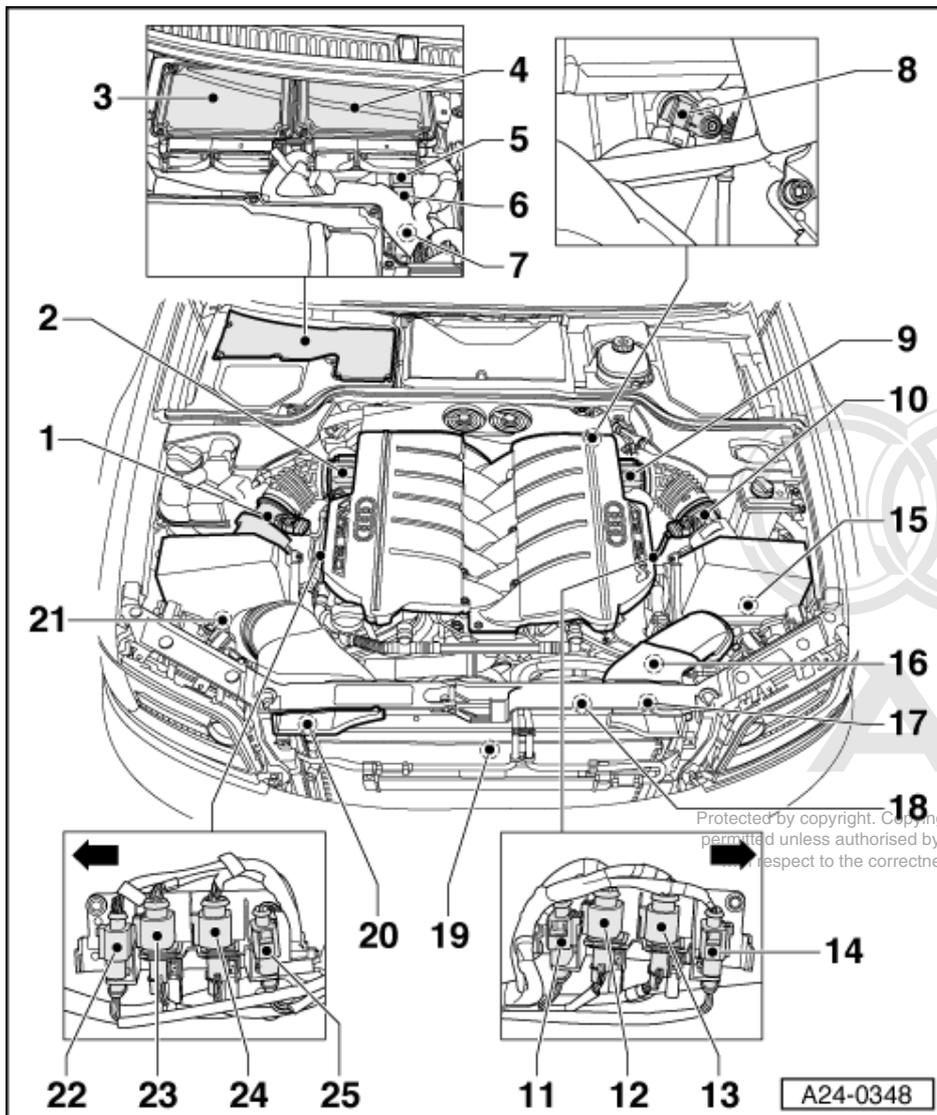
- ◆ In dash panel insert
(Meaning of lamp =>Page 3)

H - Valve for exhaust flap 1 -N321

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- ◆ In luggage compartment under the trim on the left in the direction of travel
- ◆ Next to the CD changer in the direction of the tail light

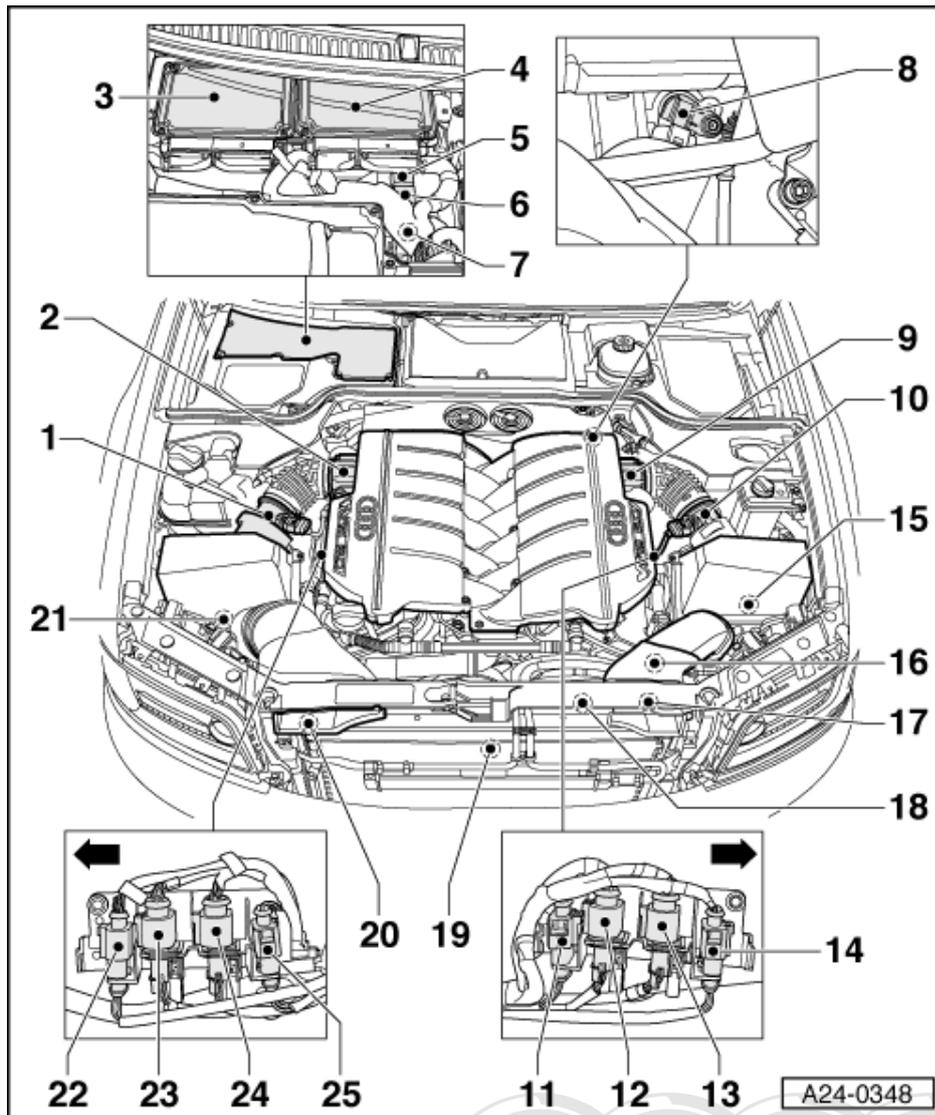


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- 1 Air mass meter 2 (G246) with intake air temperature sender 2 (G299)
- ◆ For cylinder bank 2 (cylinders 7 to 12)

Note:

The intake channels cross over in the centre of the intake manifold. For this reason, the right air mass meter in the direction of travel -G246, measures the intake air mass of the left cylinder bank 2 in the direction of travel. The same applies for the intake air temperature sender 2 -G299.



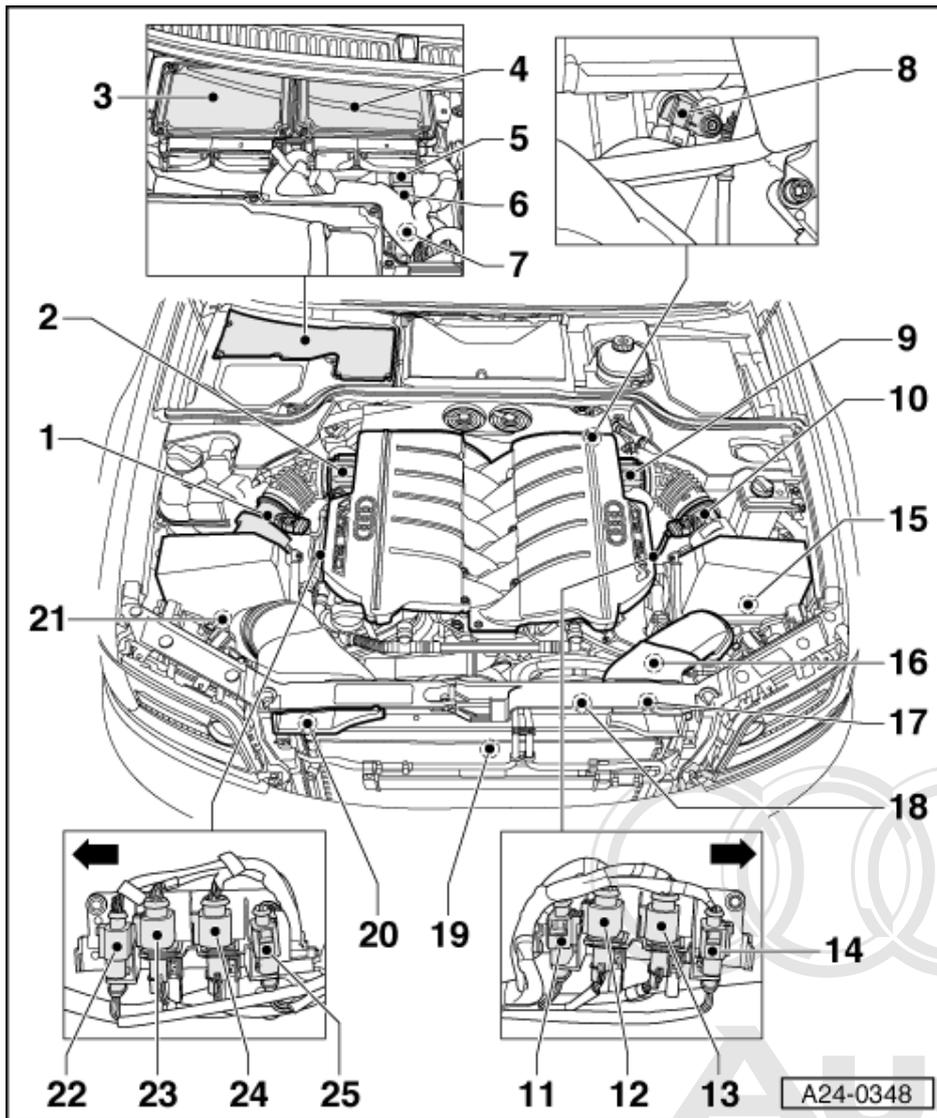
2 Throttle valve control part 2 (J544)

- ◆ With throttle valve actuator (G296), angle sender 1 for throttle valve actuator 2 (G297) and angle sender 2 for throttle valve actuator 2 (G298)
- ◆ For cylinder bank 2 (cylinders 7 to 12)
- ◆ Please also refer to the first sentence in the above tinote.

3 Engine control unit 2

- ◆ In electronics box in plenum chamber
- ◆ Blue wiring harness covering
- ◆ Please mark control unit before unplugging, in order to avoid confusing with control unit 1

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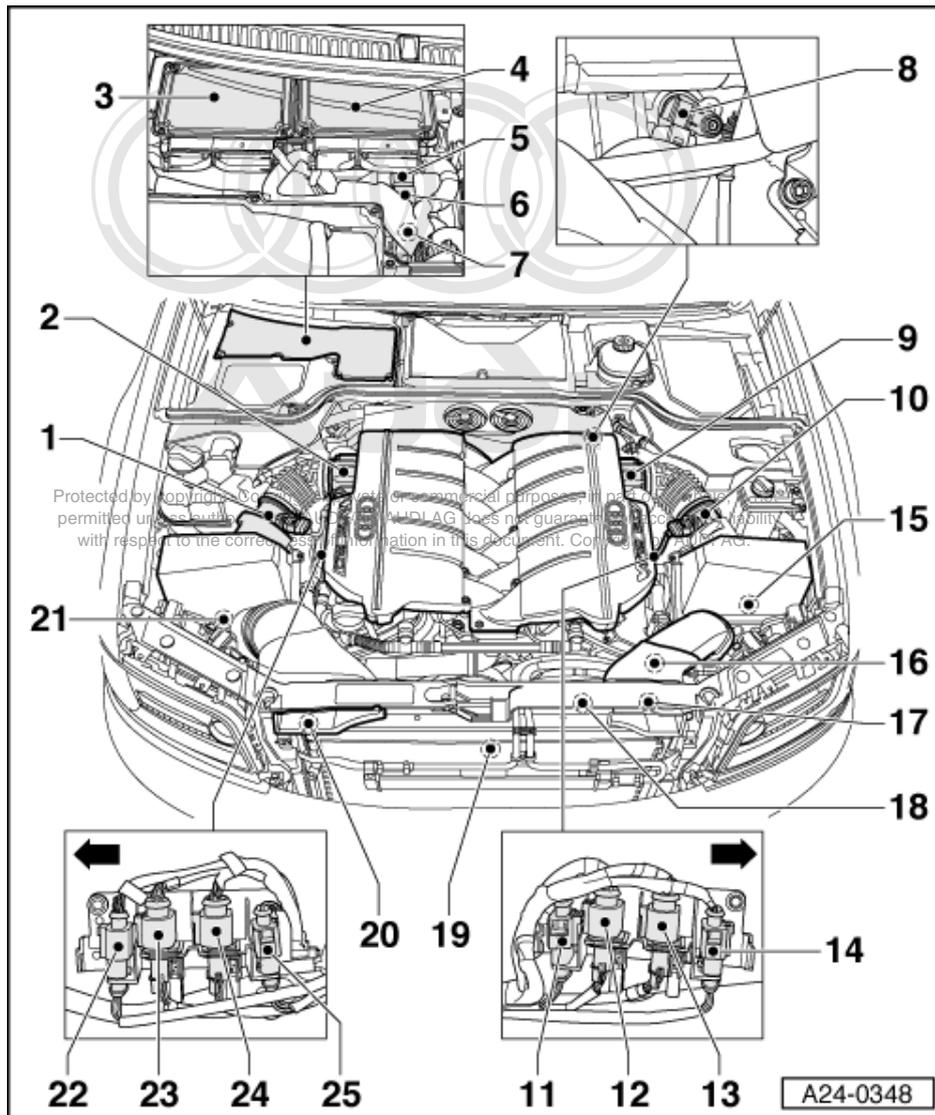
4 Engine control unit 1

- ◆ In electronics box in plenum chamber
- ◆ Black wiring harness covering
- ◆ Please mark control unit before unplugging, in order to avoid confusing with control unit 2

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5 Secondary air pump relay 2 (J545)

- ◆ In electronics box in plenum chamber on the right
- ◆ The secondary air pump 2 is located in the lower section of the air filter housing on the left in the direction of travel



6 Relay for auxiliary coolant pump (J496)

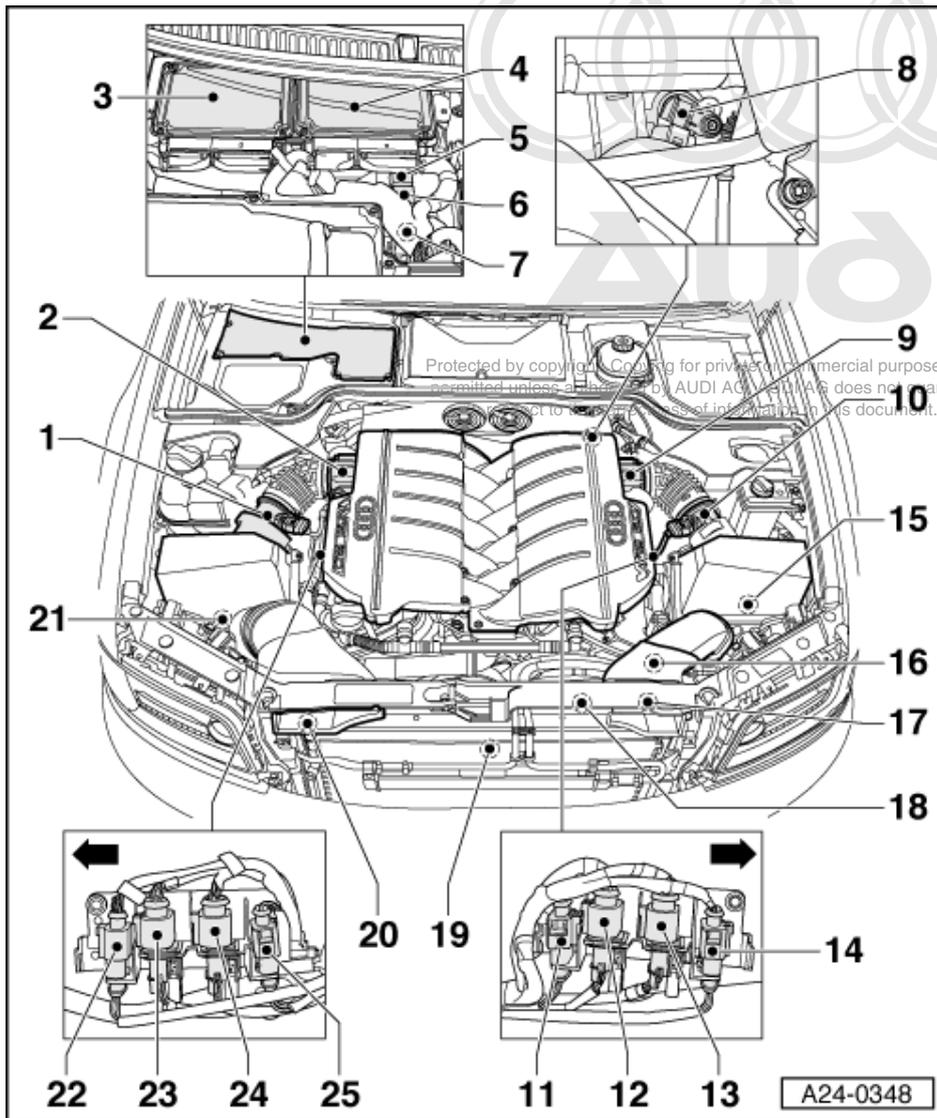
7 Secondary air pump relay 1 (J299)

- ◆ In electronics box in plenum chamber on the right
- ◆ The secondary air pump 1 is located in the lower section of the air filter housing on the right in the direction of travel

8 Engine speed sender (G28)

9 Throttle valve control part (J338)

- ◆ With throttle valve actuator (G186), angle sender for throttle valve actuator (G187) and angle sender 2 for throttle valve actuator (G188)
- ◆ For cylinder bank 1 (cylinders 1 to 6)

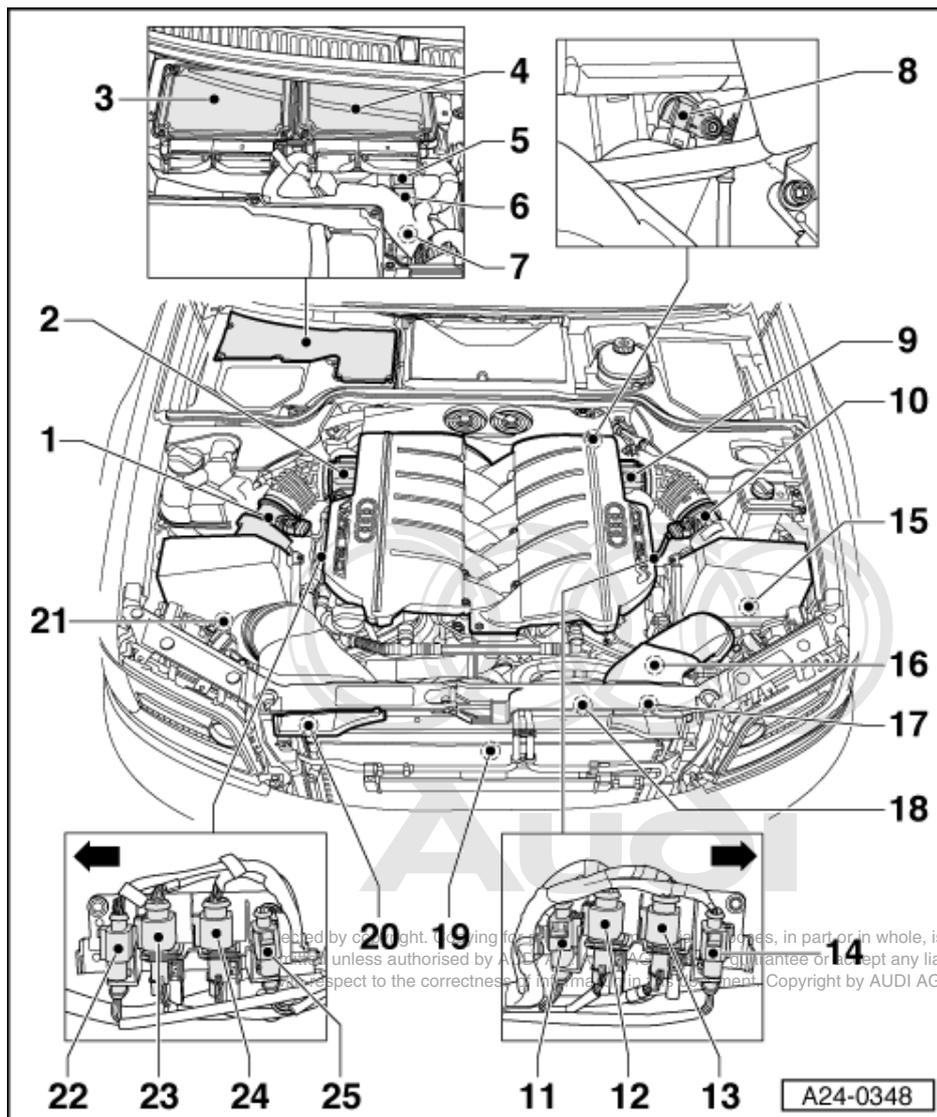


10 Air mass meter (G70) with intake air temperature sensor (G42).

- ♦ For cylinder bank 1 (cylinders 1 to 6)

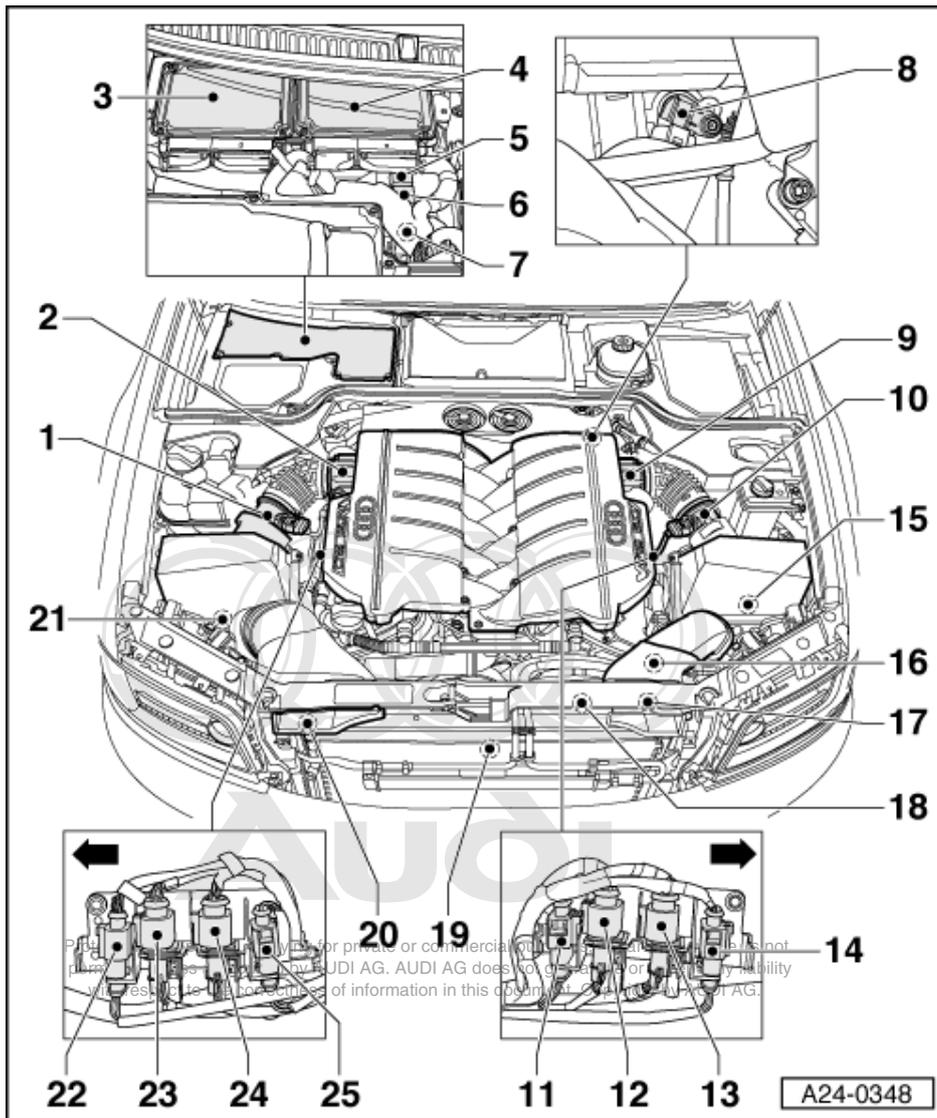
Note:

The intake channels cross over in the centre of the intake manifold. For this reason, the left air mass meter in the direction of travel -G70, measures the intake air mass of the right cylinder bank 1 in the direction of travel. The same applies for the intake air temperature sensor -G42.

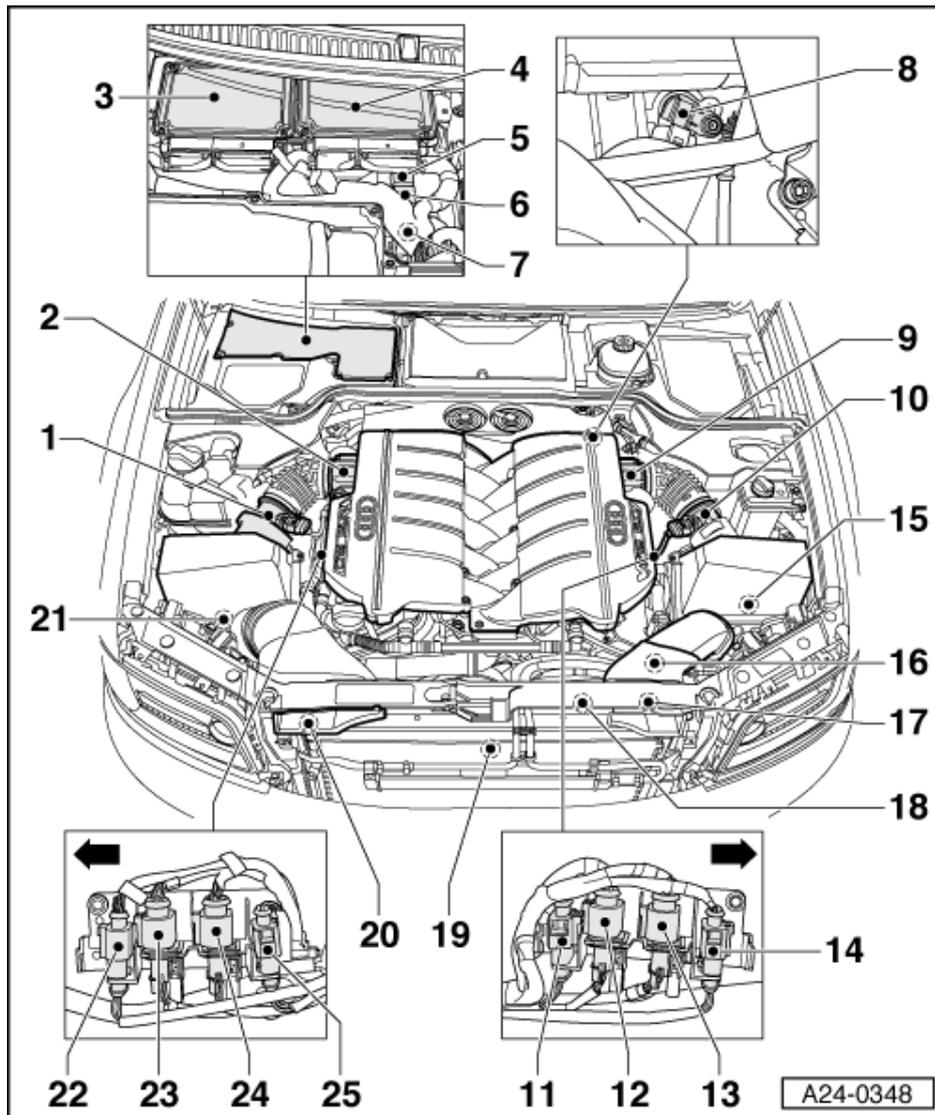


Notes on the following connectors for the lambda probes on cylinder bank 2:

- ◆ In total, the engine is equipped with four engine-compartment primary catalytic converters (one primary catalytic converter for three cylinders in each case)
- ◆ Two lambda probes are installed on each primary catalytic converter, one upstream of the relevant catalytic converter, and one downstream. In total, therefore, the engine is equipped with eight lambda probes (four primary catalytic converters with two lambda probes each add up to eight lambda probes).
- ◆ The indication "lambda probe 1" or "lambda probe 2" simply means that the lambda probe is located either in upstream of (lambda probe 1) or downstream of (lambda probe 2) the applicable engine-compartment primary catalytic converter.



- 11 Connector for lambda probe 2 -G288, downstream of catalytic converter**
 - ◆ Exhaust bank 4 (cylinders 10, 11, 12)
 - ◆ 4-pin/brown
- 12 Connector for lambda probe 1 -G286, upstream of catalytic converter**
 - ◆ Exhaust bank 4 (cylinders 10, 11, 12)
 - ◆ 6-pin/brown
- 13 Connector for lambda probe 1 -G285, upstream of catalytic converter**
 - ◆ Exhaust bank 3 (cylinders 7, 8, 9)
 - ◆ 6-pin/black
- 14 Connector for lambda probe 2 -G287, downstream of catalytic converter**
 - ◆ Exhaust bank 3 (cylinders 7, 8, 9)
 - ◆ 4-pin/black



15 Secondary air pump -V189

- ◆ For cylinder bank 2
- ◆ In lower section of air filter housing

16 Left valve for engine mounting -N144

17 Radiator fan valve -N313

- ◆ Direct to the power steering pump

18 Temperature sensor for radiator fan drive circuit -G382

- ◆ Direct on the radiator fan

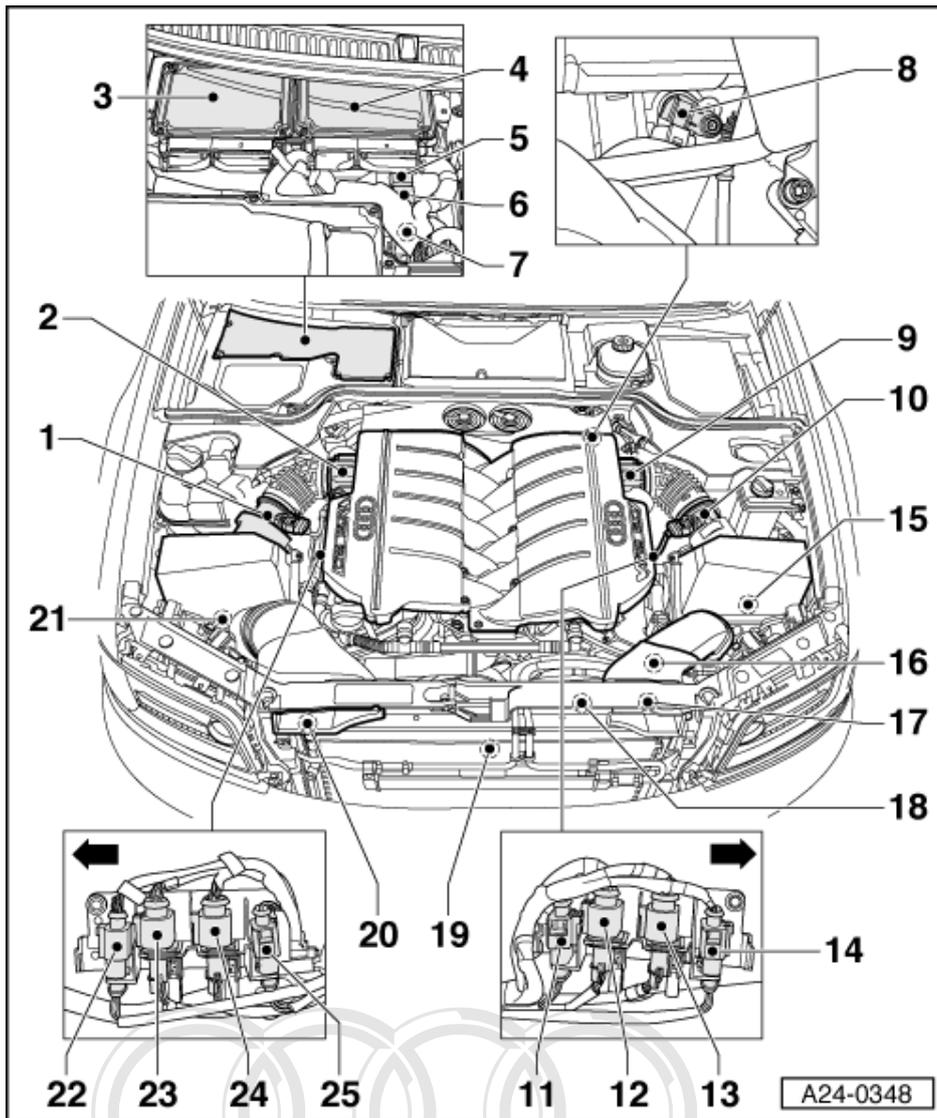
19 Auxiliary water pump -V51

20 Sender for (engine) oil temperature -G8

- ◆ Direct in engine oil container

21 Secondary air pump -V101

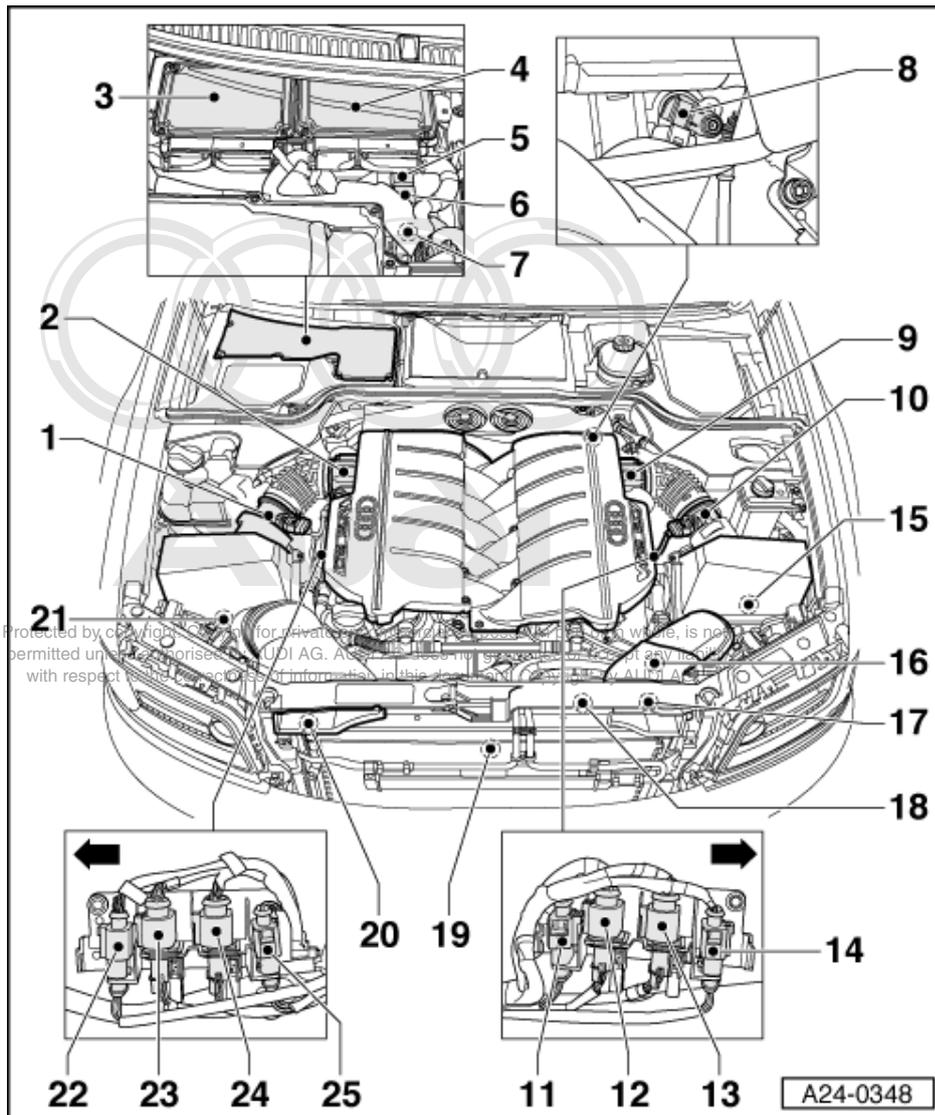
- ◆ For cylinder bank 1
- ◆ In lower section of air filter housing



Notes on the following connectors for the lambda probes on cylinder bank 1:

- ◆ In total, the engine is equipped with four engine-compartment primary catalytic converters (one primary catalytic converter for three cylinders in each case)
- ◆ Two lambda probes are installed on each primary catalytic converter, one upstream of the relevant catalytic converter, and one downstream. In total, therefore, the engine is equipped with eight lambda probes (four primary catalytic converters with two lambda probes each add up to eight lambda probes).
- ◆ The indication "lambda probe 1" or "lambda probe 2" simply means that the lambda probe is located either in upstream of (lambda probe 1) or downstream of (lambda probe 2) the applicable engine-compartment primary catalytic converter.

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22 Connector for lambda probe 2 -G130, downstream of catalytic converter

- ◆ Exhaust bank 1 (cylinders 1, 2, 3)
- ◆ 4-pin/black

23 Connector for lambda probe 1 -G39, upstream of catalytic converter

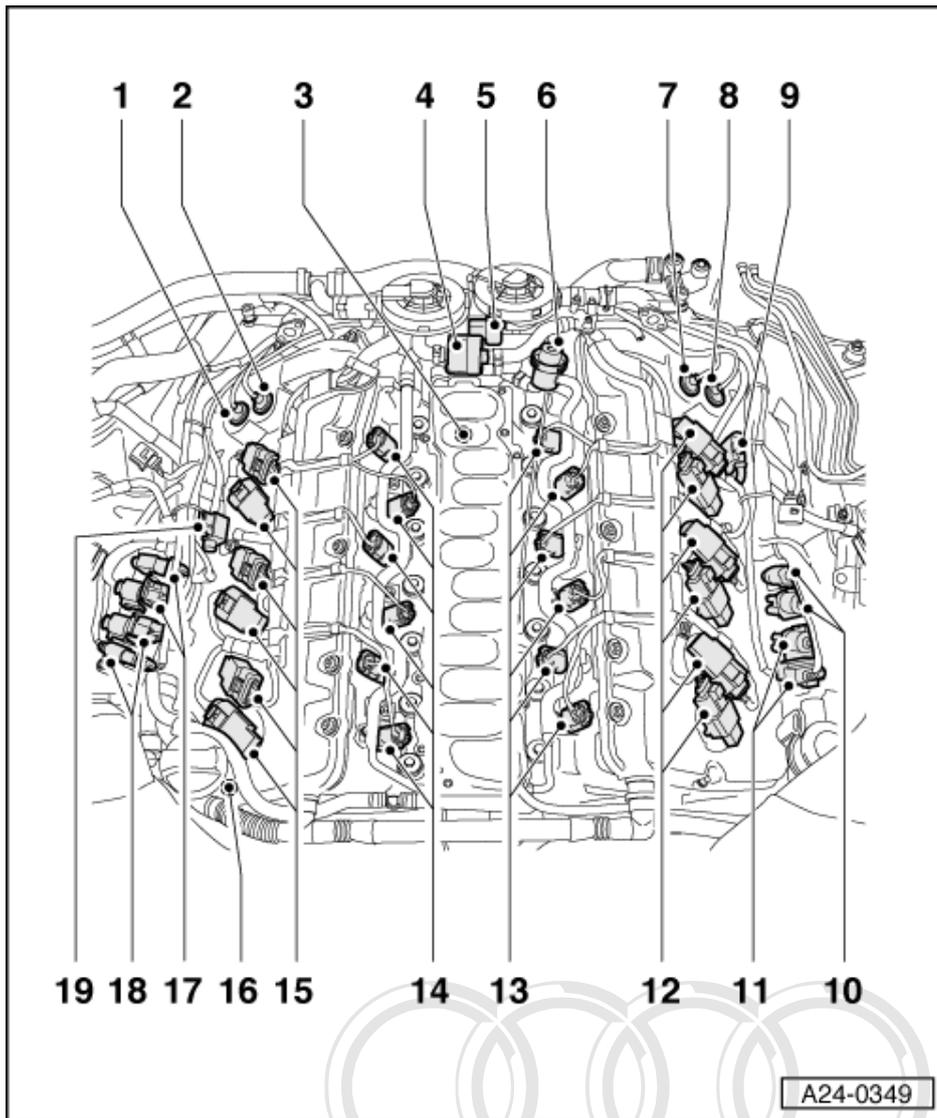
- ◆ Exhaust bank 1 (cylinders 1, 2, 3)
- ◆ 6-pin/black

24 Connector for lambda probe 1 -G108, upstream of catalytic converter

- ◆ Exhaust bank 2 (cylinders 4, 5, 6)
- ◆ 6-pin/brown

25 Connector for lambda probe 2 -G131, downstream of catalytic converter

- ◆ Exhaust bank 2 (cylinders 4, 5, 6)
- ◆ 4-pin/brown

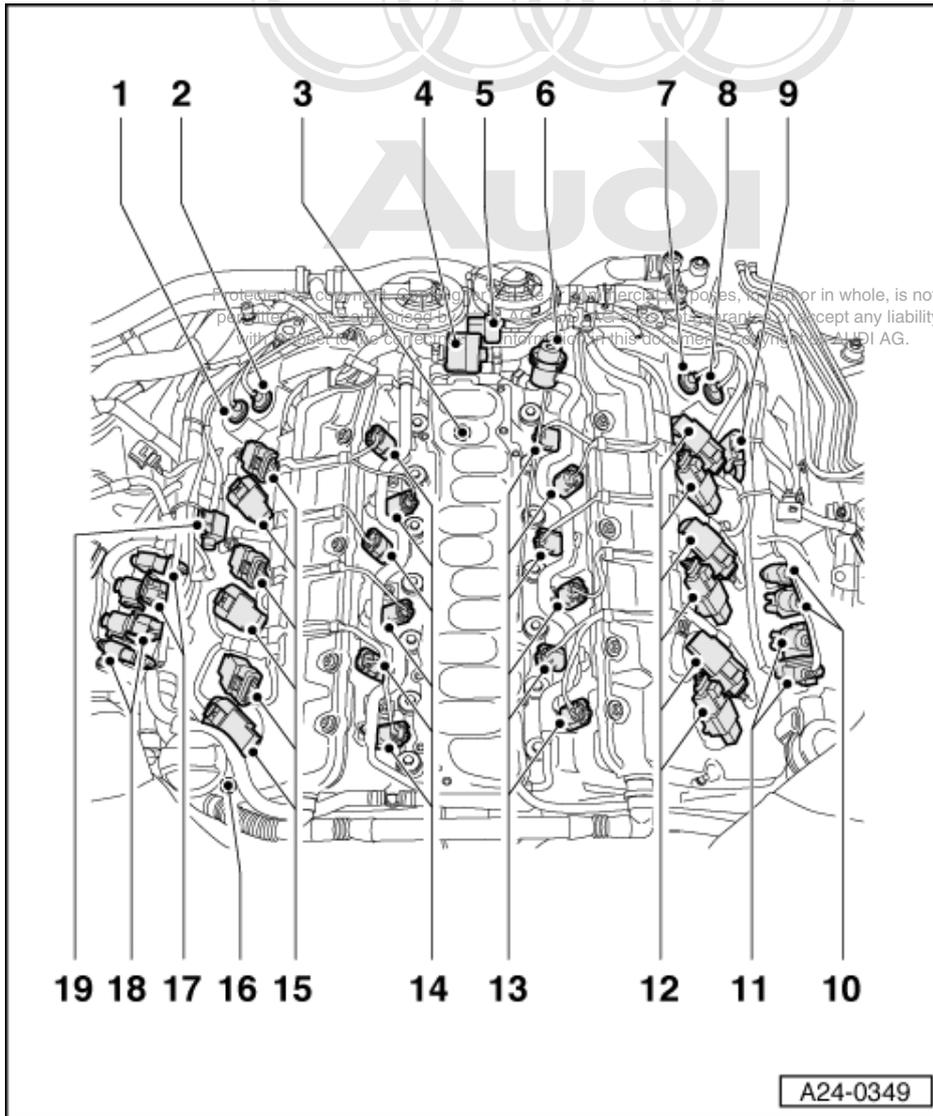


Note:

The intake manifold is removed in this overview.

- 1 Exhaust camshaft adjustment valve bank 1 -N318
- 2 Inlet camshaft adjustment valve bank 1 -N205
- 3 Thermostat for map-controlled engine cooling system -F265
- 4 Activated charcoal filter solenoid valve 1 (N80)
 - ◆ For cylinder bank 1
 - ◆ Black connector
- 5 Activated charcoal filter solenoid valve 2 (N333)
 - ◆ For cylinder bank 2
 - ◆ Brown connector
- 6 Fuel pressure regulator

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7 Inlet camshaft adjustment valve bank 2 -N208

8 Exhaust camshaft adjustment valve bank 2 -N319

9 Secondary air inlet valve -N320

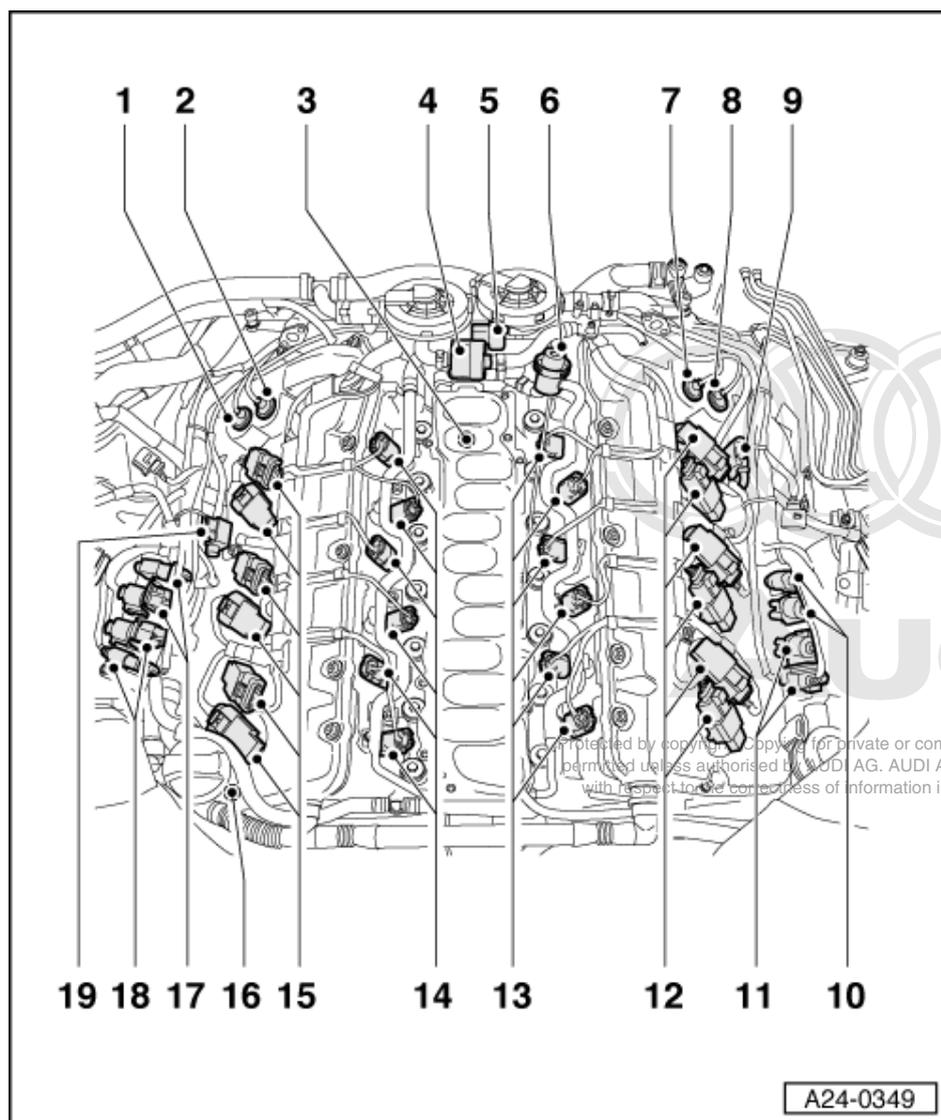
- ◆ For cylinder bank 2

10 Connectors for lambda probes on exhaust bank 4 (cylinders 10, 11, 12)

- ◆ Brown
- ◆ Primary catalytic converter probe 6-pin, post catalytic converter probe 4-pin
- ◆ For special notes, see further above

11 Connectors for lambda probes on exhaust bank 3 (cylinders 7, 8, 9)

- ◆ Black
- ◆ Primary catalytic converter probe 6-pin, post catalytic converter probe 4-pin
- ◆ For special notes, see further above



**12 Ignition coils with output stages
cylinder bank 2**

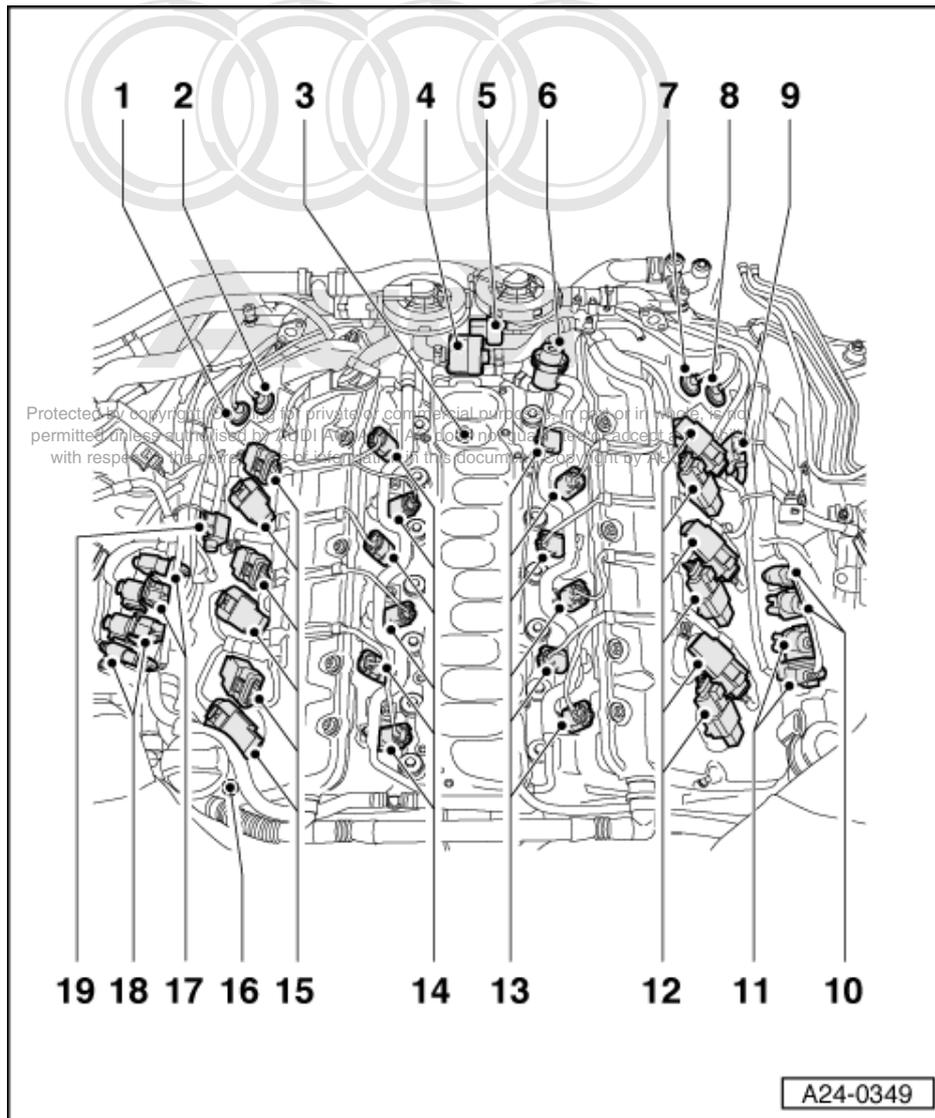
- ◆ Cylinder 7 -N325
- ◆ Cylinder 8 -N326
- ◆ Cylinder 9 -N327
- ◆ Cylinder 10 -N328
- ◆ Cylinder 11 -N329
- ◆ Cylinder 12 -N330

Note:

The numbering of the cylinders is stamped into the valve covers.

13 Injectors cylinder bank 2

- ◆ Cylinder 7 -N85
- ◆ Cylinder 8 -N86
- ◆ Cylinder 9 -N299
- ◆ Cylinder 10 -N300
- ◆ Cylinder 11 -N301
- ◆ Cylinder 12 -N302



Note:

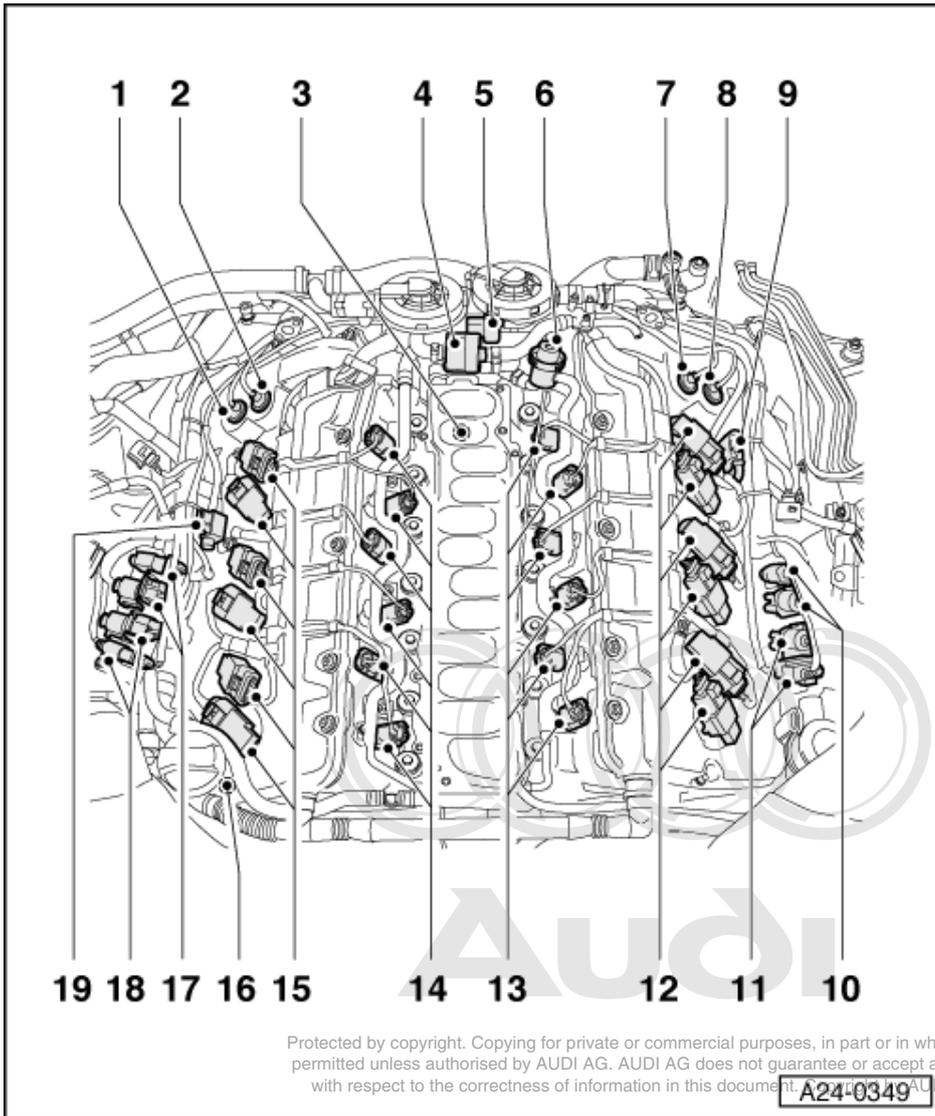
The numbering of the cylinders is stamped into the valve covers.

14 Injectors cylinder bank 1

- ◆ Cylinder 1 -N30
- ◆ Cylinder 2 -N31
- ◆ Cylinder 3 -N32
- ◆ Cylinder 4 -N33
- ◆ Cylinder 5 -N83
- ◆ Cylinder 6 -N84

**15 Ignition coils with output stages
cylinder bank 1**

- ◆ Cylinder 1 -N70
- ◆ Cylinder 2 -N127
- ◆ Cylinder 3 -N291
- ◆ Cylinder 4 -N292
- ◆ Cylinder 5 -N323
- ◆ Cylinder 6 -N324



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A24-0349

16 Right valve for engine mounting -N145

17 Connectors for lambda probes on exhaust bank 2 (cylinders 4, 5, 6)

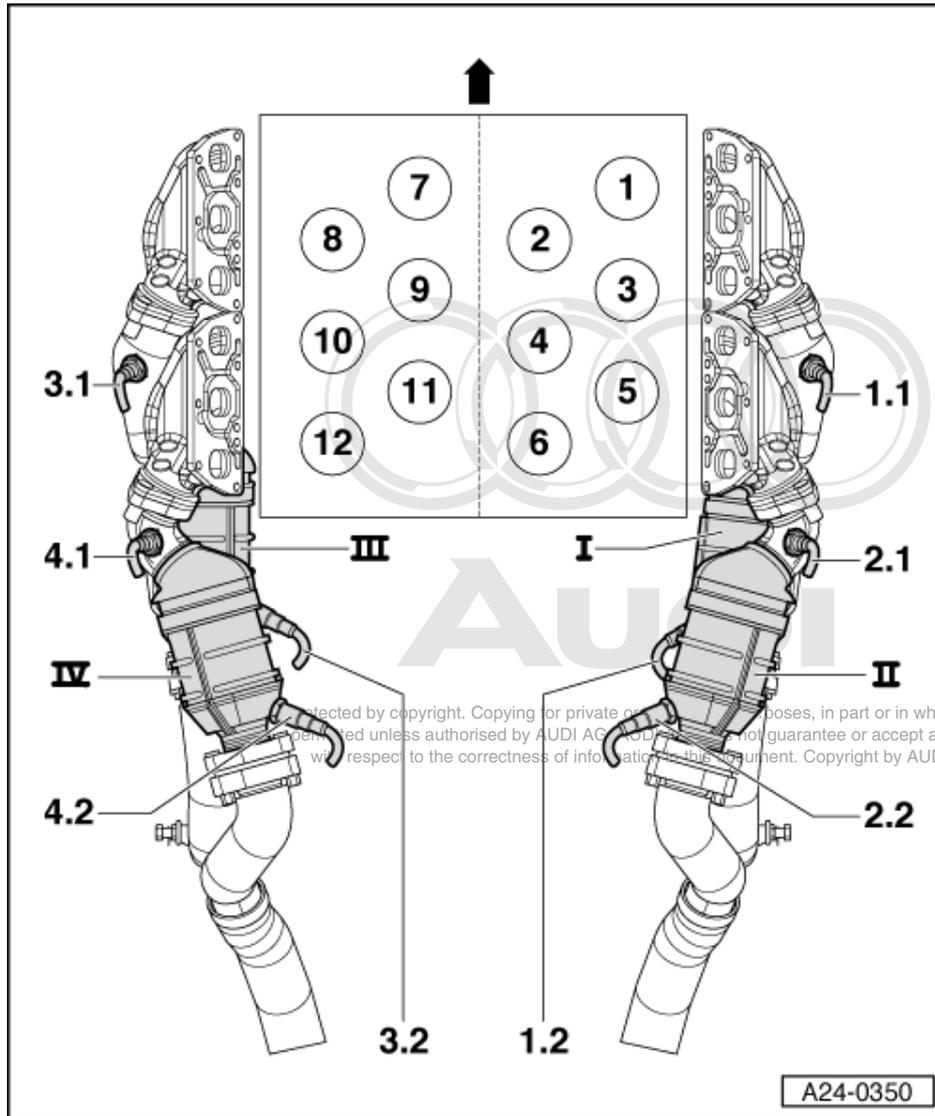
- ◆ Brown
- ◆ Primary catalytic converter probe 6-pin, post catalytic converter probe 4-pin
- ◆ For special notes, see further above

18 Connectors for lambda probes on exhaust bank 1 (cylinders 1, 2, 3)

- ◆ Black
- ◆ Primary catalytic converter probe 6-pin, post catalytic converter probe 4-pin
- ◆ for special notes, see further above

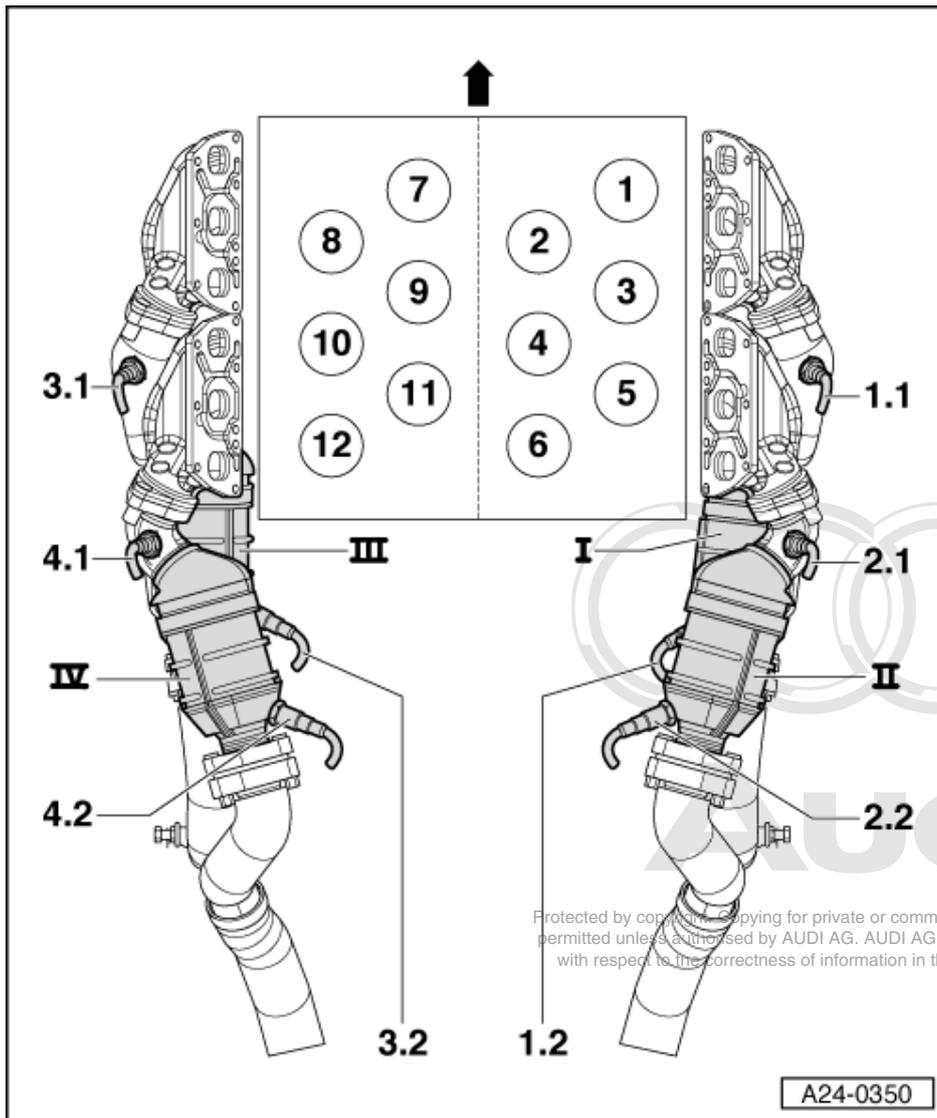
19 Secondary air inlet valve -N112

- ◆ For cylinder bank 1



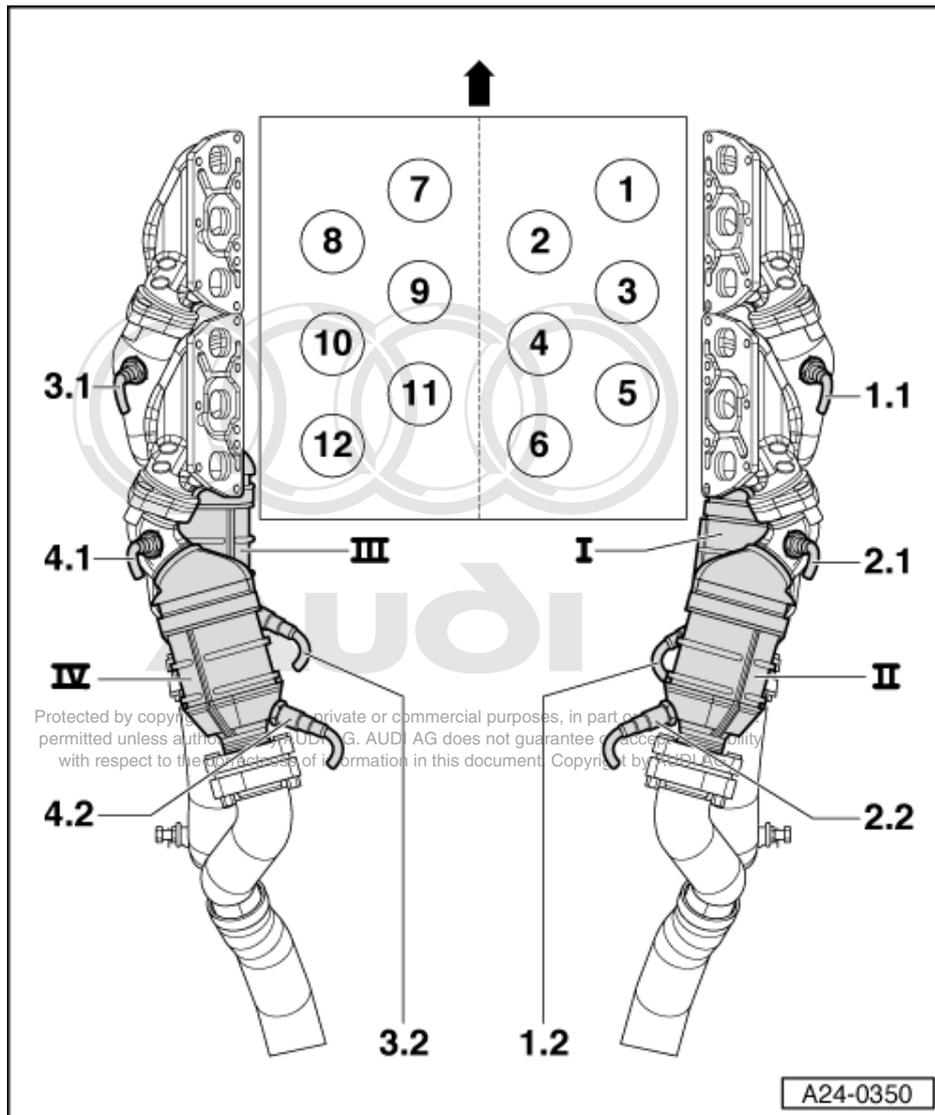
Notes:

- ◆ The lambda probes, the exhaust manifold and the primary catalytic converters are shown below.
- ◆ The engine is equipped with eight lambda probes in total.
- ◆ For clarity, the crankcase is only shown schematically with the cylinders (numbers 1 to 12).
- ◆ The lambda probes, the exhaust manifold and the primary catalytic converters, however, are shown as they are actually installed in the vehicle.
- ◆ The arrow signifies the direction of travel.



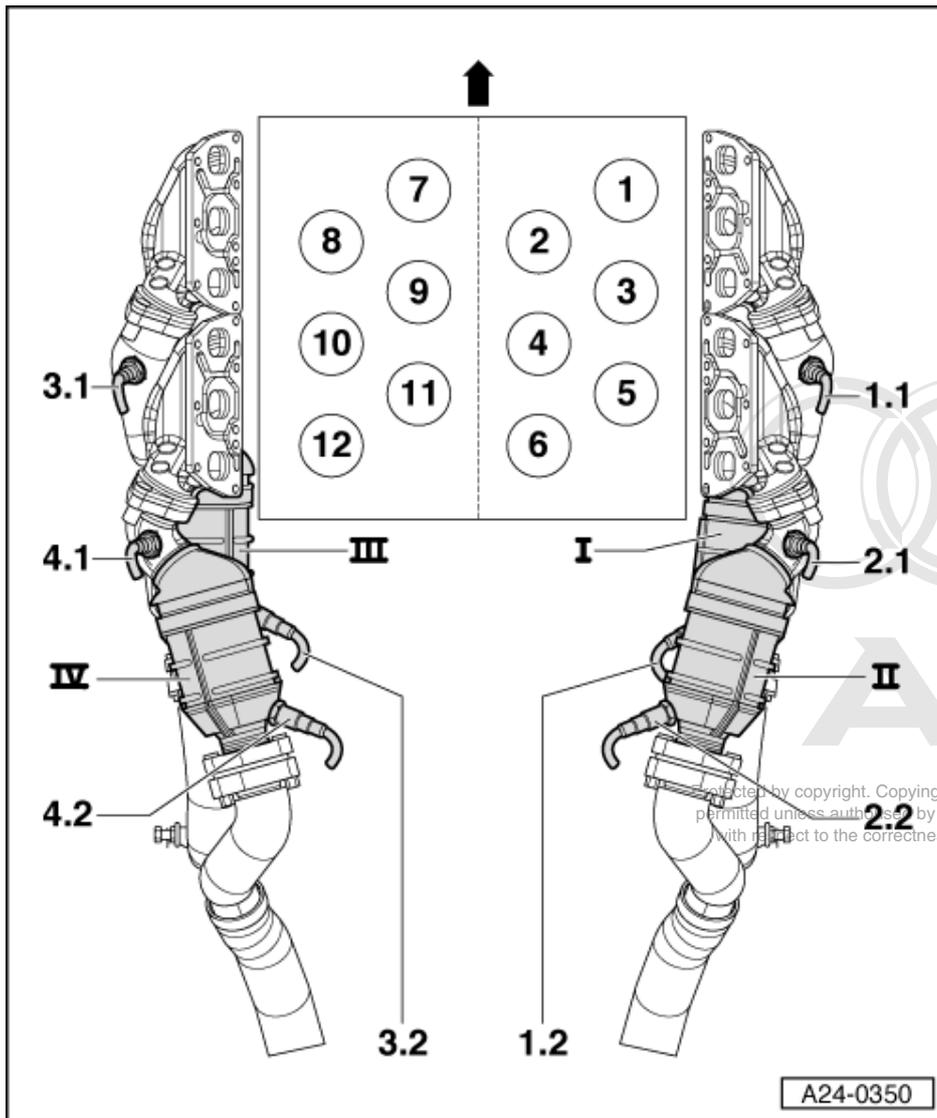
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- I - Primary catalytic converter for cylinders 1, 2, 3; is also described as -exhaust bank 1-
- II - Primary catalytic converter for cylinders 4, 5, 6; is also described as -exhaust bank 2-
- III - Primary catalytic converter for cylinders 7, 8, 9; is also described as -exhaust bank 3-
- IV - Primary catalytic converter for cylinders 10, 11, 12; is also described as -exhaust bank 4-
- 1.1 - Lambda probe 1 -G39 with lambda probe heating; upstream of catalytic converter
- ◆ Exhaust bank 1 (cylinders 1, 2, 3)
- 1.2 - Lambda probe 2 -G130 with lambda probe heating; downstream of catalytic converter
- ◆ Exhaust bank 1 (cylinders 1, 2, 3)



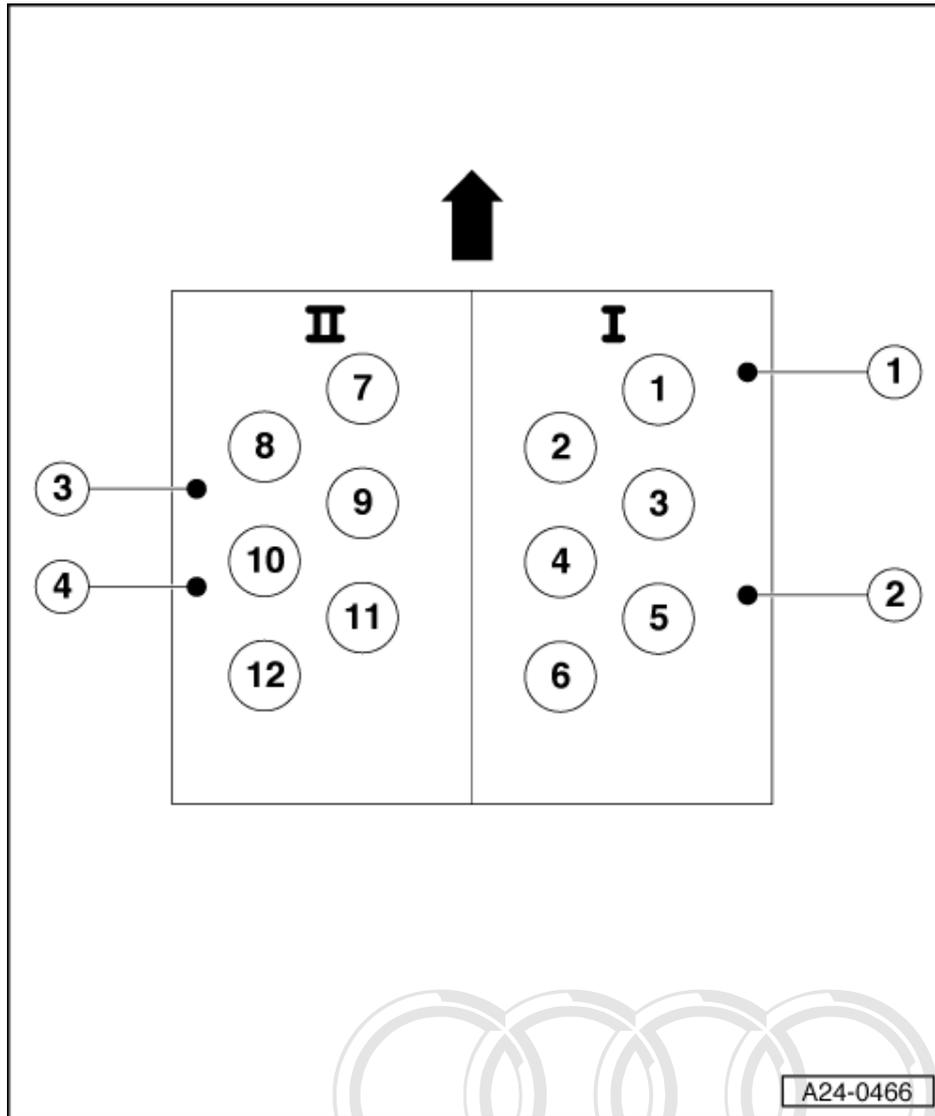
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- 2.1 - Lambda probe 1 -G108 with lambda probe heating; upstream of catalytic converter
 - ◆ Exhaust bank 2 (cylinders 4, 5, 6)
- 2.2 - Lambda probe 2 -G131 with lambda probe heating; downstream of catalytic converter
 - ◆ Exhaust bank 2 (cylinders 4, 5, 6)
- 3.1 - Lambda probe 1 -G285 with lambda probe heating; upstream of catalytic converter
 - ◆ Exhaust bank 3 (cylinders 7, 8, 9)
- 3.2 - Lambda probe 2 -G287 with lambda probe heating; downstream of catalytic converter
 - ◆ Exhaust bank 3 (cylinders 7, 8, 9)



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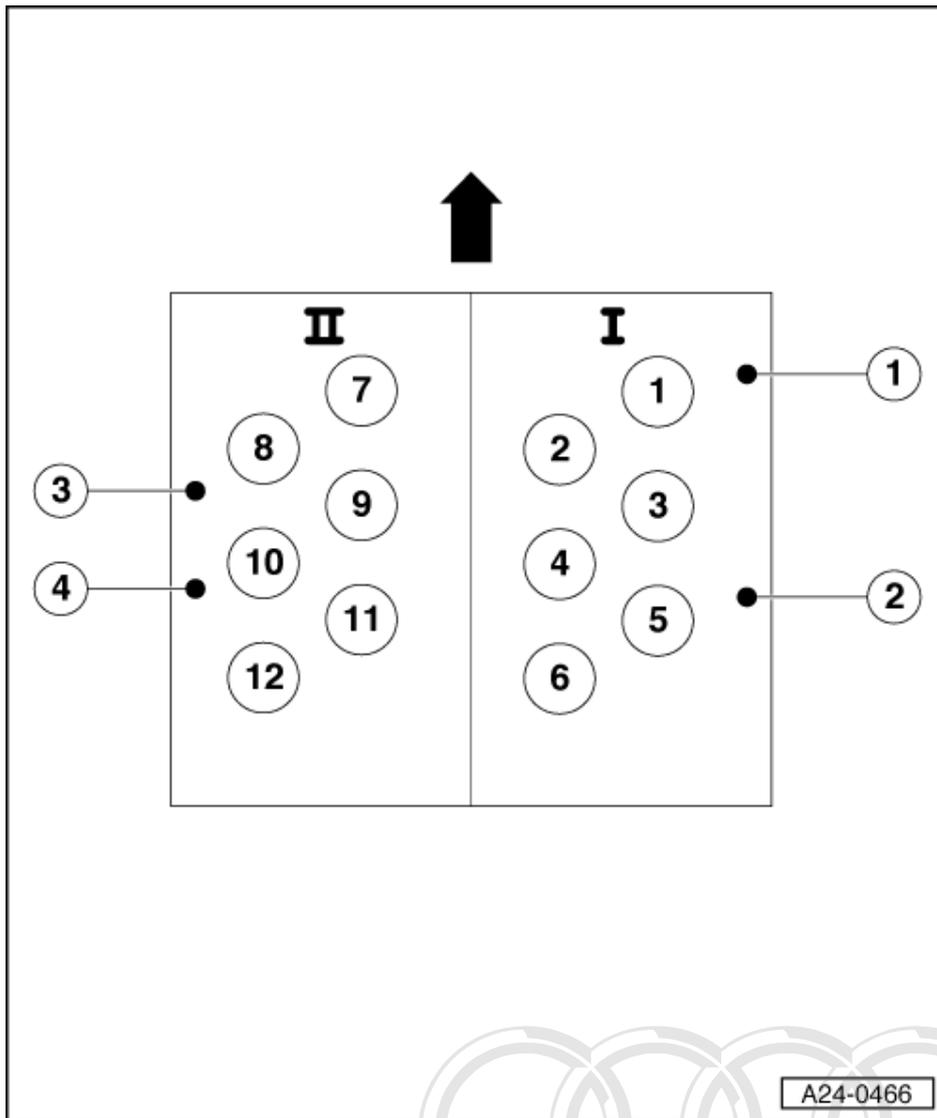
- 4.1 - Lambda probe 1 -G286 with lambda probe heating; upstream of catalytic converter**
 - ◆ Exhaust bank 4 (cylinders 10, 11, 12)
- 4.2 - Lambda probe 2 -G288 with lambda probe heating; downstream of catalytic converter**
 - ◆ Exhaust bank 4 (cylinders 10, 11, 12)



Notes:

- ◆ The fitting locations for the knock sensors are shown schematically below.
- ◆ The knock sensors are located in each case on the outside of the crankcase, and not in the "V", as is the case with the bi-turbo engine, for example.
- ◆ The engine is equipped with four knock sensors in total.
- ◆ The arrow signifies the direction of travel.
- ◆ Continued on next page

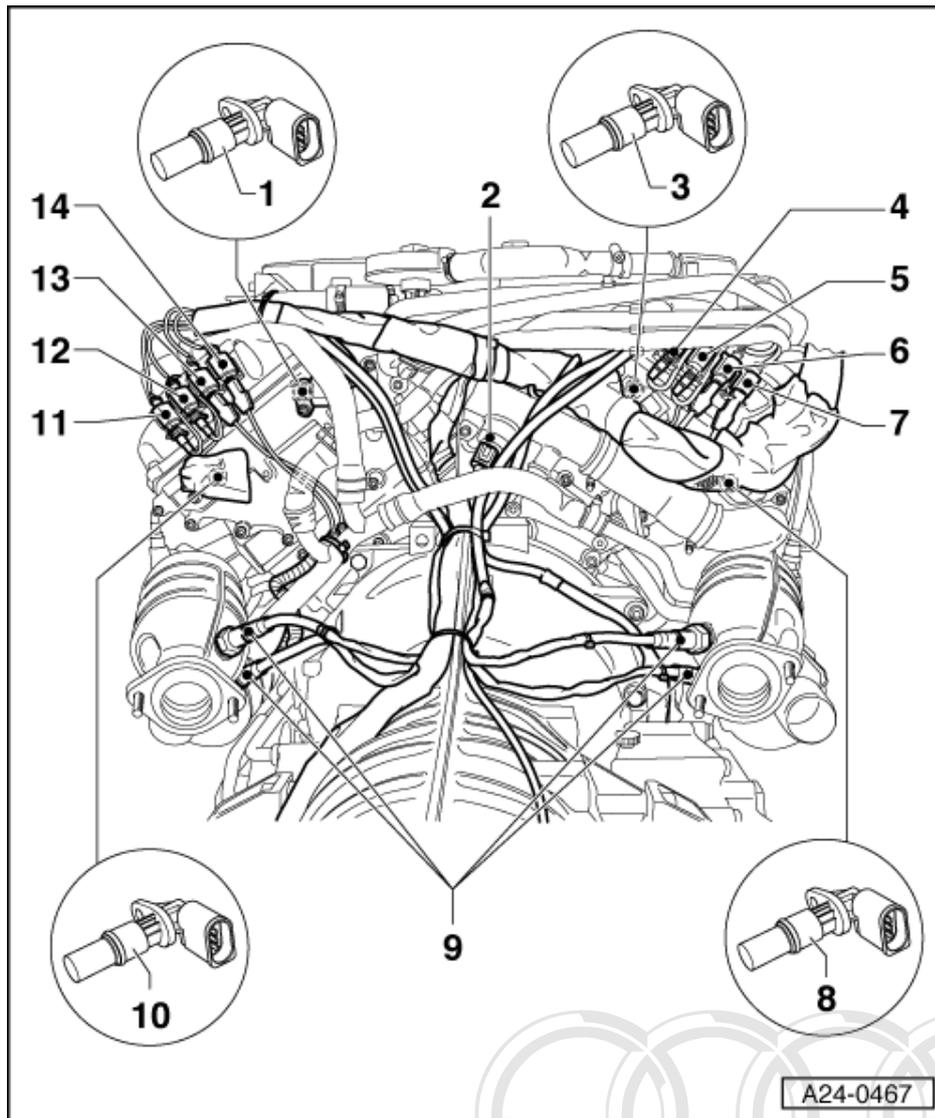
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I - Cylinder bank 1 (cylinders 1 to 6)
 II - Cylinder bank 2 (cylinders 7 to 12)

- 1 Knock sensor 1 (G61)**
 - ◆ Knock sensor 1 detects the knocking combustion of cylinders 1, 2 and 3.
- 2 Knock sensor 2 (G66)**
 - ◆ Knock sensor 2 detects the knocking combustion of cylinders 4, 5 and 6.
- 3 Knock sensor 3 (G198)**
 - ◆ Knock sensor 3 detects the knocking combustion of cylinders 7, 8 and 9.
- 4 Knock sensor 4 (G199)**
 - ◆ Knock sensor 4 detects the knocking combustion of cylinders 10, 11 and 12.

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Note:

For reasons of clarity, the rear view of the engine (from the gearbox side) is shown in this figure.

1 Hall sender (G163); (Bank 2, camshaft position sensor)

- ◆ For inlet camshaft
- ◆ Cylinder bank 2

2 Coolant temperature sender (G62)

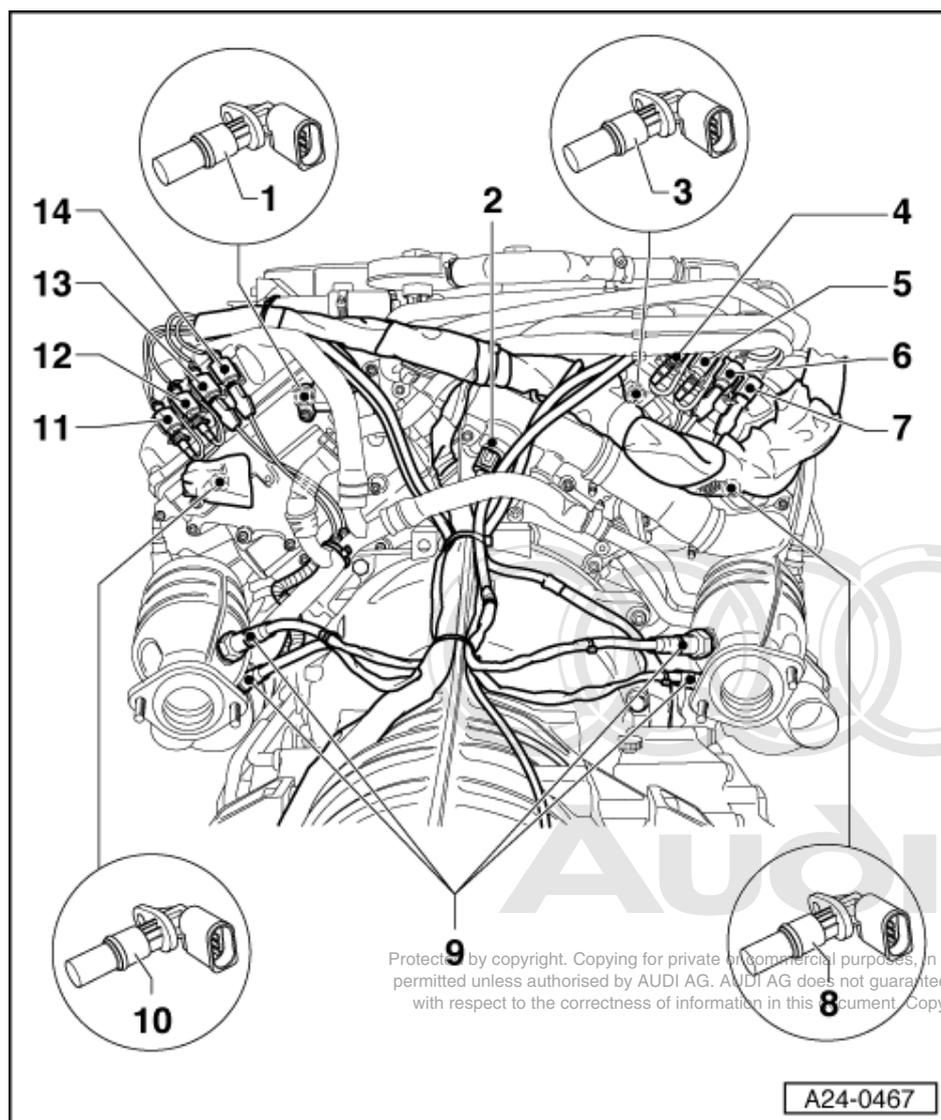
3 Hall sender (G40); (Bank 1, camshaft position sensor)

- ◆ For inlet camshaft
- ◆ Cylinder bank 1

4 Connector for inlet camshaft adjustment valve bank 1 -N205

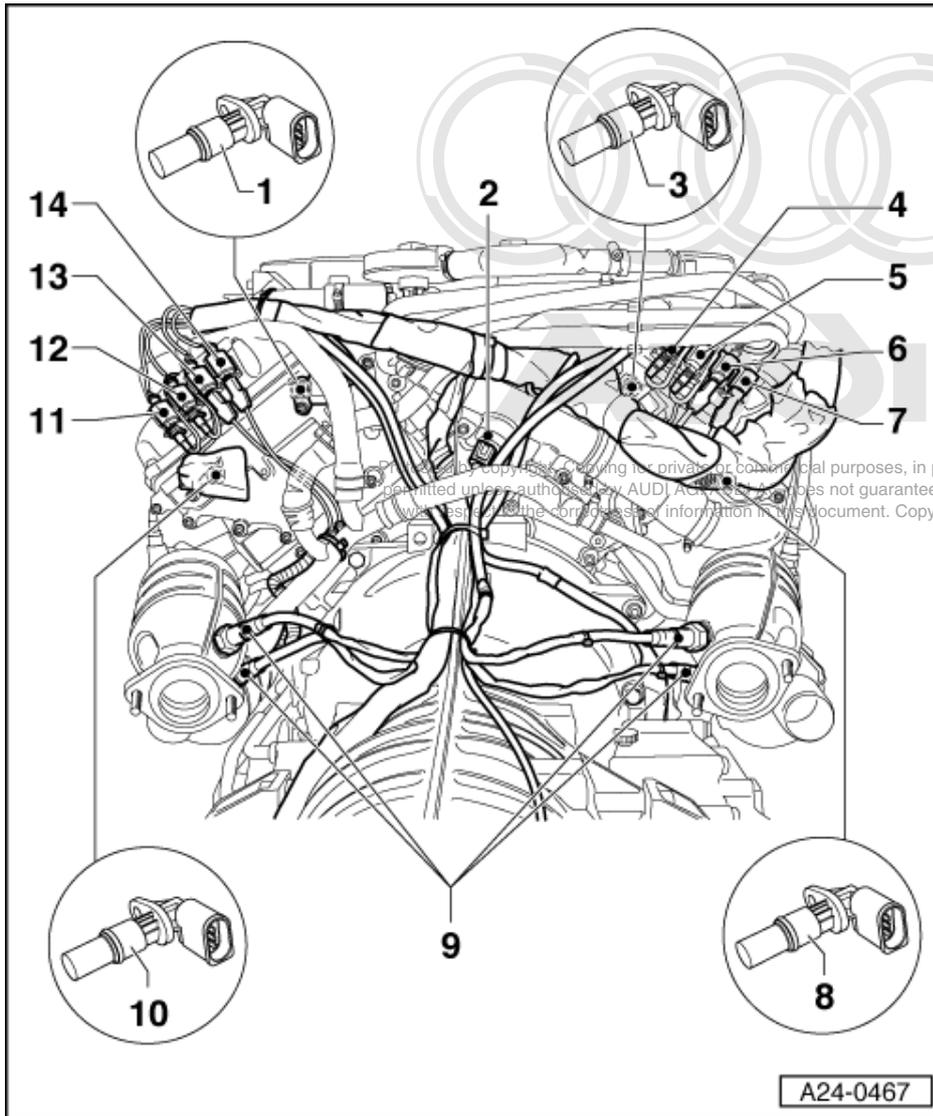
- ◆ 2-pin, black

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- 5 Connector for exhaust camshaft adjustment valve bank 1 -N318
 - ◆ 2-pin, brown
- 6 Connector for knock sensor 2 -G66
 - ◆ 3-pin, white
- 7 Connector for knock sensor 1 -G61
 - ◆ 3-pin, grey
- 8 Bank 1 camshaft position sensor -G300
 - ◆ For exhaust camshaft
 - ◆ Cylinder bank 1
- 9 Lambda probes downstream of the primary catalytic converters (for special information see further above)



10 Bank 2 camshaft position sensor -G301

- ◆ For exhaust camshaft
- ◆ Cylinder bank 2

11 Connector for exhaust camshaft adjustment valve bank 2 -N319

- ◆ 2-pin, brown

12 Connector for inlet camshaft adjustment valve bank 2 -N208

- ◆ 2-pin, black

13 Connector for knock sensor 4 -G199

- ◆ 3-pin, black

14 Connector for knock sensor 3 -G198

- ◆ 3-pin, orange

1.6 - Wiring and component check with test box V.A.G 1598/31

The current flow diagram should always be used as an aid.

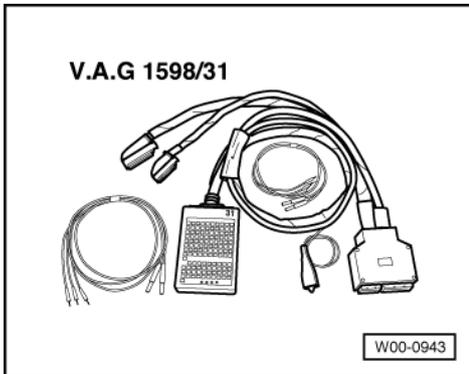
If, in a component test, it is not stated whether the test box should be connected to the wiring harness for engine control unit 1 or engine control unit 2, it is possible to find this out from the current flow diagram.



For example, if the wiring from knock sensor 1 -G61 "to the engine control unit" must be checked (in this example it is not stated whether the wiring to engine control unit 1 or to engine control unit 2 should be checked), then look on the current flow diagram to see that knock sensor 1 -G61 is connected to engine control unit 1.

This means that the test box should logically be connected to the engine wiring harness which leads to engine control unit 1.

Notes:

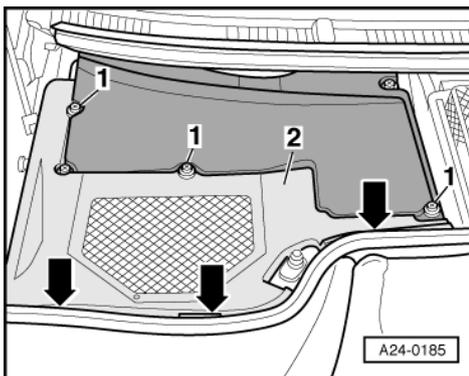


- ◆ -> The test box V.A.G 1598/31 is designed in such a way that it can be connected simultaneously to the engine control unit wiring harness and to the engine control unit itself.
- ◆ This has the advantage that the electronic motor control system remains fully functional when the test box is connected (for example, for measuring signals when the engine is running).
- ◆ Whether the engine control unit has to be additionally connected to the test box or not is described in the respective test procedures.
- ◆ Use the hand-held multimeter V.A.G 1526 or the multimeter V.A.G 1715 and the diode test lamp V.A.G 1527 for the checks.
- ◆ To connect the test devices to the V.A.G 1598/31 test box, always use auxiliary cables from adapter set V.A.G 1594.

Important

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

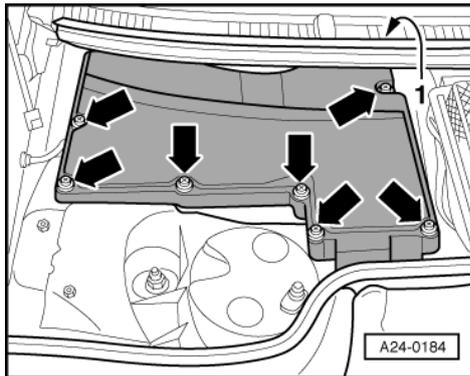
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Connecting test box V.A.G 1598/31

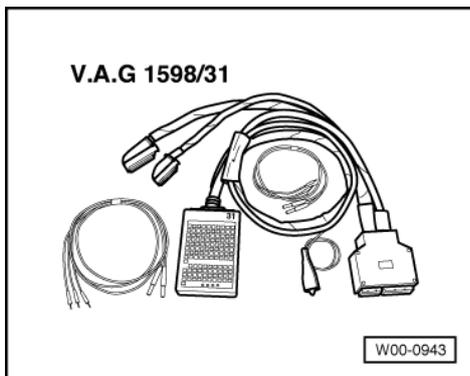
Important: Switch ignition off.

- -> Slacken off cross-head screws -1- at electronics box (plenum chamber).
- Unclip plenum chamber cover -2- at front at bulkhead -arrows-.
- Take out plenum chamber cover.



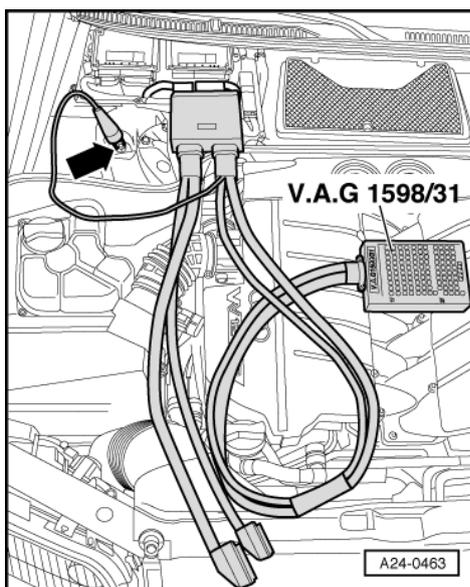
- -> Prise out cover -1- in cowl panel trim and slacken off rear cross-head screw -arrow- rear right.
- Slacken off remaining cross-head screws -arrows-.
- Detach cover for electronics box (plenum chamber).

- Slacken the fixing bracket which fixes both control units.
- Remove engine control unit 1 or engine control unit 2.
- To access connectors of control unit 1 and control unit 2, these must first be detached from anti-theft protection housing (if fitted) => Page 122 .



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- Release connectors on engine control unit 1 or engine control unit 2 and unplug connectors.
- -> Connect test box V.A.G 1598/31 to connector on relevant wiring harness.
- Carry out test as described in the appropriate repair procedures.

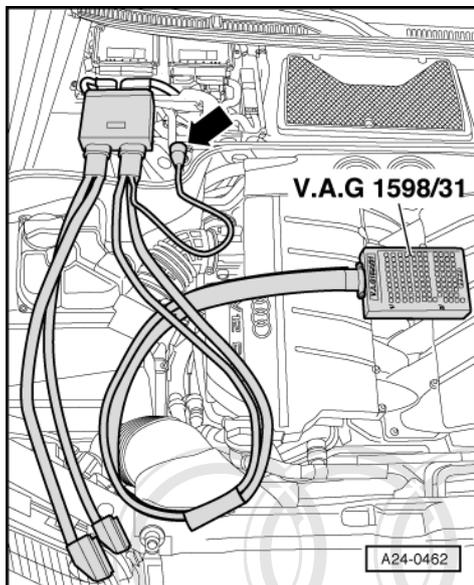


- -> The figure shows the test box on the wiring harness to engine control unit 1



After installing the engine control unit, carry out the following operations:

- Perform adaption of throttle valve control part -J338 => Page 206 .
- Interrogate fault memory and erase, if necessary.
- If the fault memory is erased the readiness code must be produced again => Page 59 .



- -> The figure shows the test box on the wiring harness to engine control unit 2

After installing the engine control unit, carry out the following operations:

- Perform adaption of throttle valve control part -J544 => Page 213
- Interrogate fault memory and erase, if necessary.
- If the fault memory is erased the readiness code must be produced again => Page 59 .

1.7 - Replacing engine control unit

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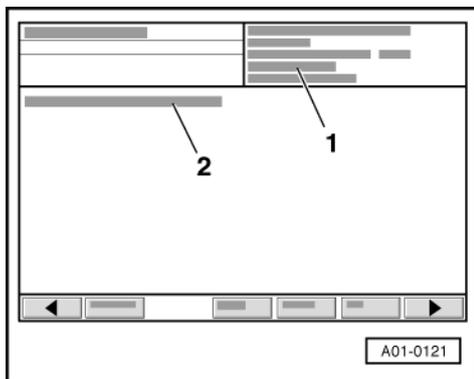
Note:

Fitting location of engine control units => Page 93 .

Only that engine control unit which has been found to be defective through self-diagnosis or has been diagnosed as defective during the course of fault finding must be replaced.

Removing

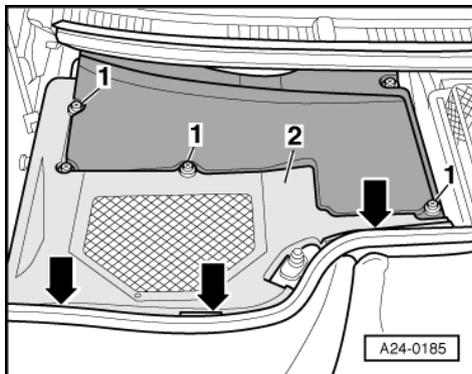
- Connect the vehicle diagnostic, testing and information system VAS 5051 and select engine control unit 1 with "address word" 01, and then engine control unit 2 with "address word" 11 => Page 3 .
For this purpose, the ignition must be switched on.



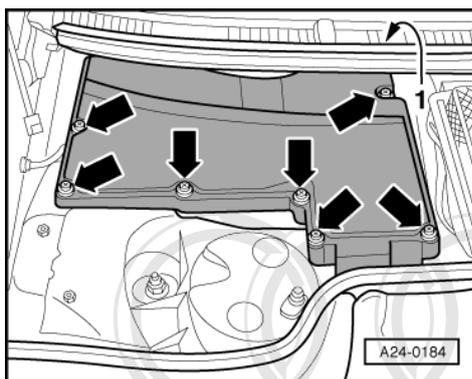
-> Display on VAS 5051:

- 1 - Control unit identification of the engine control unit => Page 6
- 2 - Control unit identification of the immobiliser => Page 6

- Always start by displaying and printing out the control unit identification.



- -> Slacken off cross-head screws -1- at electronics box (plenum chamber).
- Unclip plenum chamber cover -2- at front at bulkhead -arrows-.
- Remove plenum chamber cover.

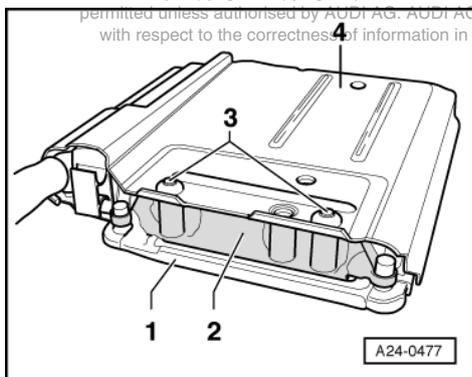


- -> Prise out cover -1- in cowl panel trim and slacken off rear cross-head screw -arrow-rear right.
- Slacken off remaining cross-head screws -arrows-.
- Remove cover for electronics box (plenum chamber).

Note:

The two engine control units are secured in the electronics box with a bracket. Detach this bracket to gain access to engine control units.

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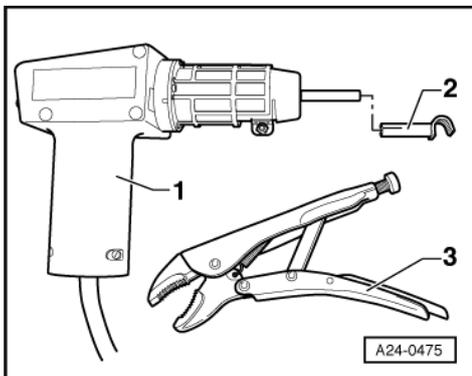


-> To make access to connectors on engine control units more difficult (anti-theft protection), the engine control units -1- are each secured with a metal housing -4- with a catch -2- and shear bolts -3- (currently only engine control unit 1, at a later date both engine control units will be fitted with a metal housing).

The thread of shear bolts is coated with locking fluid, to additionally hinder removal of shear bolts.

In order to detach connectors from corresponding engine control unit (e.g. when connecting test box or replacing engine control unit), the engine control unit must first be detached from metal housing. This process is described in the following.

The following tools are required:

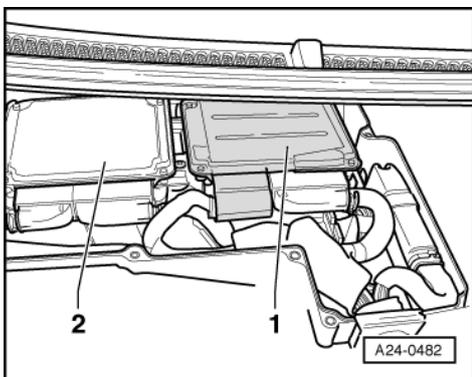


- ♦ -> Hot air blower -1- (from wiring harness repair set VAS 1978)
- ♦ Clip-on nozzle -2- (also from wiring harness repair set VAS 1978)
- ♦ Commercial gripper (self-grip pliers)

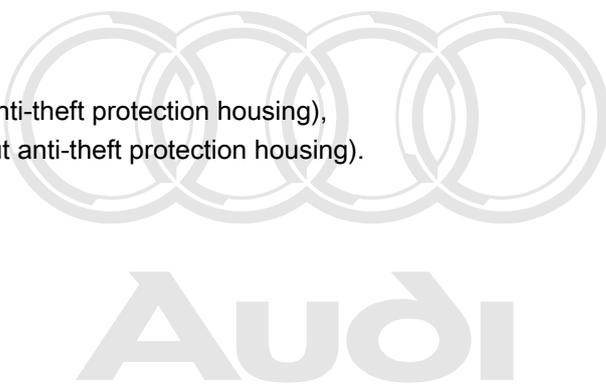
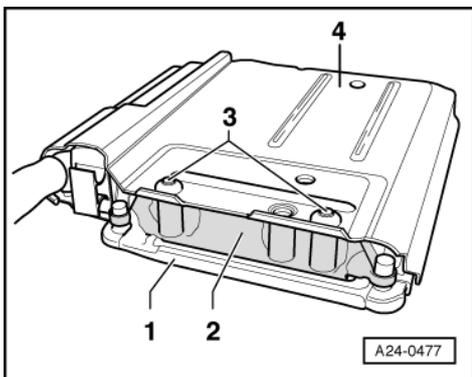
Procedure:

Important

To avoid damage (burning) to wire connections and connectors, insulation and control units, the following sequence of operations must be observed exactly! Please observe operating instructions for hot air blower.

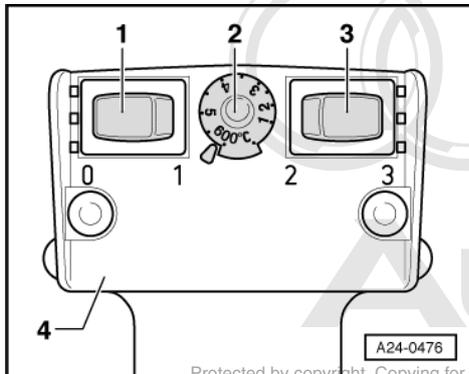


- > Item -1- shows engine control unit 1 (with anti-theft protection housing),
- > Item -2- shows engine control unit 2 (without anti-theft protection housing).



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- -> "Tilt" corresponding engine control unit with anti-theft protection housing in direction of engine compartment, so that catch (item -2- on illustration) is visible, place a clean cloth under engine control unit with anti-theft protection housing.



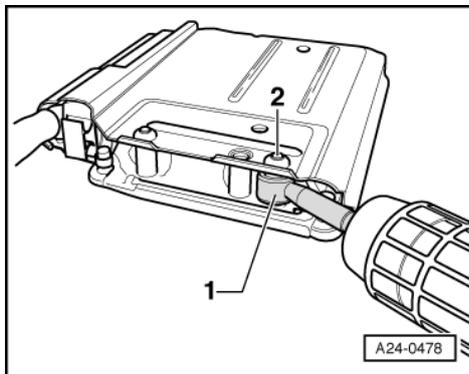
- -> Adjust settings on hot air blower as shown in illustration, i.e. set potentiometer for temperature setting -2- at maximum heat output and the two-speed switch for air volume -3- to position 3.

Note:

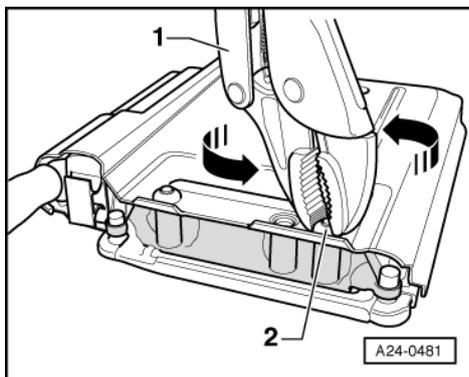
Then heat thread of catch, into which shear bolts are screwed, using hot air blower. This reduces the bonding effect of locking fluid on thread of shear bolts, which then eases removal of shear bolts.

Important

When heating thread of catch, the shear bolts and parts of metal housing are also highly heated. Avoid burns! Ensure that as far as possible, only thread is heated and no other parts in the vicinity. If necessary, cover these parts.



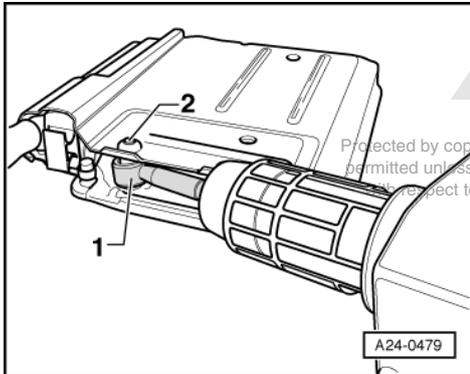
- -> Direct nozzle -1- of hot air blower onto thread of catch, so that nozzle "encloses" thread. The nozzle can safely be allowed to contact upper end of metal housing.
- Switch on hot air blower and heat thread for approx. 20 to 25 seconds.



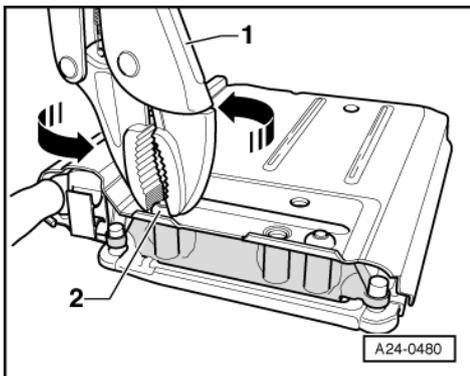


- -> Then grip bolt head -2- using gripper -1- and unscrew shear bolt in direction of arrow.

The procedure for removing second shear bolt is identical. Be particularly careful here, as this shear bolt is in immediate vicinity of control unit connector.



- -> Direct nozzle -1- of hot air blower onto thread of catch again, so that nozzle "encloses" thread. The nozzle can safely be allowed to contact upper end of metal housing.
- Switch on hot air blower and heat thread for approx. 20 to 25 seconds.



- -> Then grip bolt head -2- using gripper -1- and unscrew shear bolt in direction of arrow.

Engine control unit can now be detached from metal housing and engine wiring harness can be disconnected from engine control unit.

Refit metal housing to new control unit on completion of repairs or after replacing engine control unit. Use new shear bolts.

Installing

Install in reverse order.

Important:

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

- Interrogate and erase fault memory, if required.
- Perform adaption of throttle valve control part => Page 213
- Note instructions for encoding new engine control unit => Page 51 .
- In vehicles with cruise control (recognisable from steering column switch), this should be enabled in engine control unit:

=> Electrical System; Repair group 01; Cruise control system self-diagnosis; Checking cruise control system
Cruise control system self-diagnosis Checking cruise control system

- Adapt the immobiliser to the engine control unit (if both engine control units have been replaced, then both need to be adapted to the immobiliser):

=> Electrical System; Repair group 01; Immobiliser self-diagnosis; Adaption after renewal of engine control unit
 Immobiliser self-diagnosis Adaption after renewal of engine control unit

- Generate the readiness code => Page 59.

1.8 - Checking idling speed

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Test conditions

- No leaks in exhaust system.
- Coolant temperature at least 85 °C (measured value block 04, display zone 3 in engine control unit 1)
- Electrical consumers switched off (radiator fan must not run during the check)
- Air conditioner switched off
- Pressure gauge not connected.
- Place selector lever in P or N position (vehicles with automatic gearboxes).

Checking idling speed

Notes:

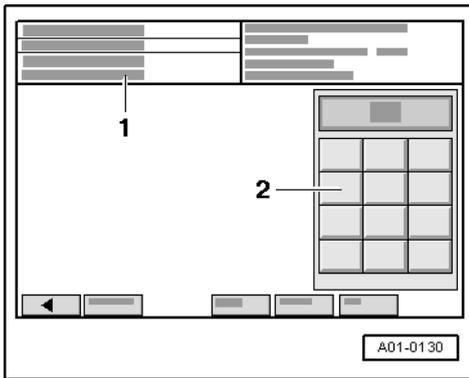
- ◆ The idling speed cannot be adjusted.
 - ◆ The idling speed is tested during the basic setting of the engine.
 - ◆ During the basic setting of the engine, the air conditioner compressor is automatically switched off and the solenoid valve for the activated charcoal filter (ACF valve) is closed.
- Connect the vehicle diagnostic, testing and information system VAS 5051 and select engine control unit 1 with "address word" 01, and then engine control unit 2 with "address word" 11 => Page 3.
 For this purpose, the engine must be running at idle speed.
 - Interrogate fault memory => Page 7. The fault memory must be clear. If necessary, rectify any faults and erase the fault memory. Switch off the engine, then start up again. Perform road test and interrogate the fault memory again to make sure it is clear.
 - Leave engine idling.
 - Carry out the other test in engine control unit 1 (address word 01)

Important
 The electric radiator fan should not be running.



-> Display on VAS 5051:

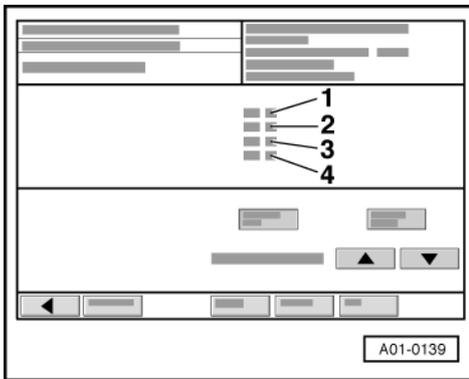
- Under -1- select the diagnostic function "04 - Basic setting".



-> Display on VAS 5051:

1 - Enter display group
max. input value = 255

- Enter "056" for "display group number 056" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

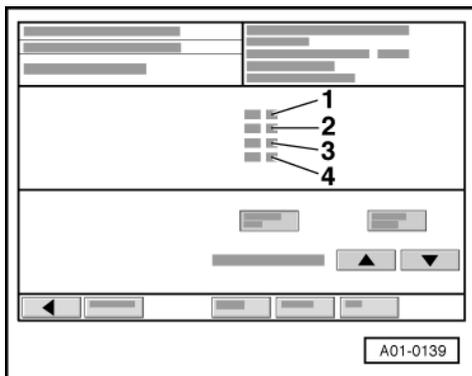
- Check whether the engine speed in display zone -1- (actual speed) is within the permitted tolerance range.

	Display zones			
	1	2	3	4
Display group 056: Idling speed stabilisation at operating temperature				
Display	xxx rpm	xxx rpm	x.x %	XXXXXX
Display	Engine speed (actual)	Engine speed (specified)	Idling speed control Change in torque	Operating conditions
Specified value	520...770 rpm	600 rpm	x.x %	0 0 0 0
Note:	If the specification is not attained =>Page 127			Meaning of figures =>Page 127

Notes:

- ♦ The engine speed in display zone 1 (actual speed) is the actual engine speed.
- ♦ The engine speed in display zone 2 (specified speed) is a theoretical value calculated by the engine control unit.
- ♦ When idling, the engine control units always try to adapt the actual speed to the prescribed target speed. (The target idling speed is calculated in engine control unit 1).
- ♦ This means that during idling the actual engine speed must always approximate to the specified engine speed.

- ◆ Display zones 3 and 4 are there for information but are irrelevant to the control of the engine idling speed.



-> Display on VAS 5051:

If specified value is attained:

- Exit the function "04 - Basic setting" by pressing the ◀ key.

If specified value is not attained:

- Interrogate fault memory of both engine control units again => Page 7 .
- If the fault memory is erased the readiness code must be produced again => Page 59 .

If the idling speed is too high or too low and there are no faults recorded in the fault memory, carry out the following tests marked with a dot:

- Check intake air system for unmetered air => Page 151 .
- Check throttle valve control part =>Page 206 .
- Check whether solenoid valve for activated charcoal filter is continuously open =>Page 198 .
- Perform adaption of throttle valve control part =>Page 206 .

Meaning of 5-digit readout of display group 056

x	x	x	x	x	Display zone 4
				0	Air conditioner compressor: 0 = air conditioner compressor off; 1 = air conditioner compressor on
			0		Display always 0
		0			Air conditioning, ready for maximum heating or cooling
	0				Display always 0
0					Power steering pressure 0 = no signal from power steering pressure switch 1 = signal from power steering pressure switch (full steering lock, fast steering movement)

1.9 - Checking fuel pressure regulator and holding pressure

Test conditions

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- Fuel pump relay OK
- Fuel pump OK

=> Fuel Supply - Petrol Engines; Repair group 20

- Fuel filter OK



- Battery voltage at least 11 volts

Note:

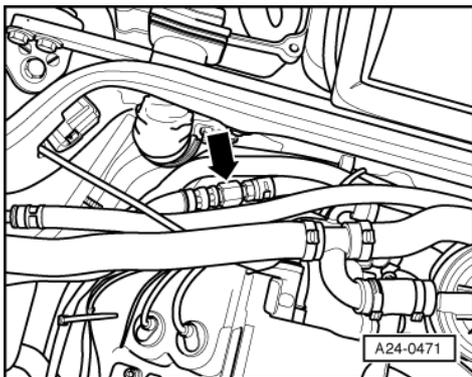
Fuel pressure regulator regulates fuel pressure as a function of intake pressure. As a result, the pressure drop at the injectors remains constant for each engine speed and load range.

Important

The fuel system is pressurised! Before loosening hose connections or opening the test connection (to measure fuel pressure), place a cloth around the connection. Then release pressure by carefully loosening the connection.

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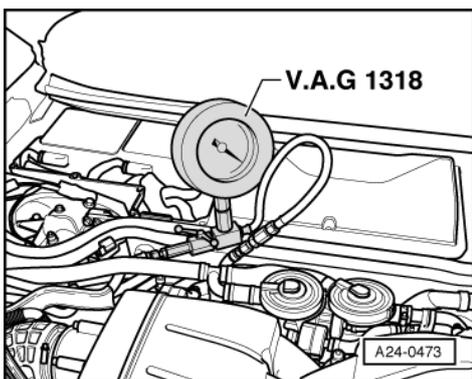
- Briefly open the fuel tank filler cap (to release pressure):



- Cover the pressurised screw connection with a cloth.
- -> Open the screw connection -arrow- and catch escaping fuel in a cloth.

Note:

The screw connection is located behind the cylinder head on cylinder bank 1 (cylinders 1 to 6) under the black plastic cover

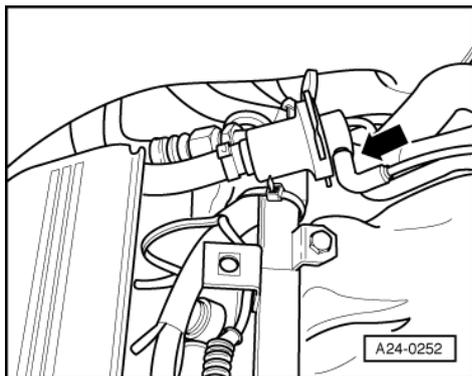


- -> Install pressure gauge V.A.G 1318 together with adapters V.A.G 1318/15, 1318/7 between feed line and fuel rail tube.
- -> Open cut-off valve on pressure gauge. The lever points in the direction of flow.

Note:

The cut-off valve of the pressure gauge should be open (lever facing in the direction of flow).

- Start the engine and run at idling speed.



- Measure the fuel pressure.

Specified value: approx. 3.5 bar

- -> Disconnect vacuum hose -arrow- from fuel pressure regulator.

Note:

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Replace pressure regulator if fuel emerges at the vacuum connection of the pressure regulator in the course of the following pressure test.

The fuel pressure should rise to approx. 4.0 bar.

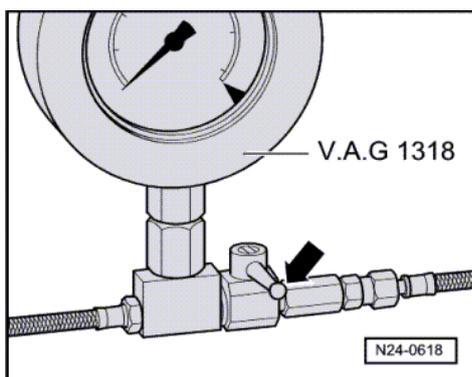
If specification is not attained:

- Replace pressure controller as a test and repeat pressure test.
- If specification is still not attained, check the fuel pump/feed pipe for damage (e.g. crushing) and replace, if necessary.

If specified value is attained:

- Reconnect vacuum hose.
- Switch ignition off.
- Test for leaks and holding pressure by watching pressure drop on gauge.

After 10 minutes the remaining pressure should be at least 3 bar.



If the holding pressure drops below 3.0 bar:

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



If the pressure drops again, the following faults are possible:

- ◆ Unions on pressure gauge after cut-off valve leaking
- ◆ Fuel pressure regulator defective
- ◆ Injectors leaking

If the pressure does not drop, the following faults are possible:

Note:

Whether the reduction in pressure can be observed on the pressure gauge depends on whether the cut-off valve for the pressure gauge points in the direction of the fuel tank or in the direction of the intake manifold.

- ◆ Union between pressure gauge and fuel supply pipe leaking
- ◆ Supply pipe leaking at fuel tank

- Non-return valve in fuel pump leaking

=> Fuel Supply - Petrol Engines; Repair group 20; Fuel supply Fuel supply

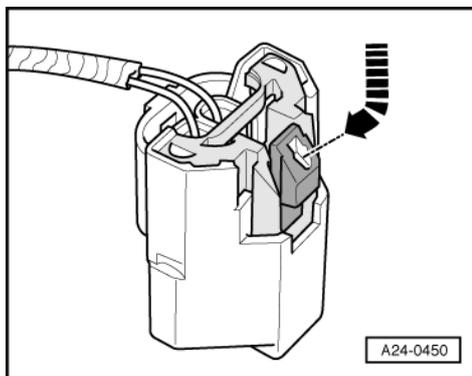
Note:

Before removing the pressure gauge, release the fuel pressure by opening the cut-off valve; hold a container over the connection.

1.10 - Testing injection quantity, leak tightness and spray pattern of injectors

Test conditions

- Fuel pressure OK
- In order to reach the injectors, the intake manifold must be removed =>Page 154 .



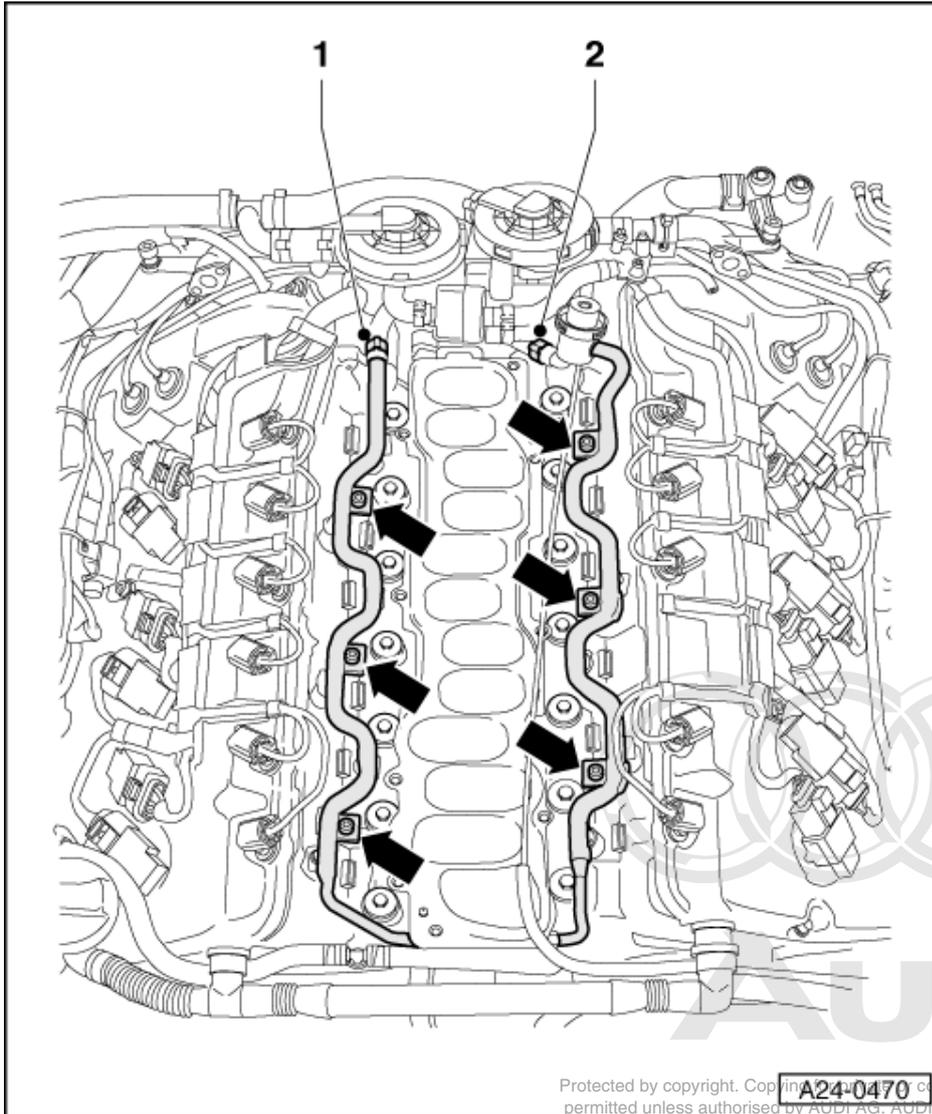
- -> Unplug electrical connectors on injectors, by pressing release tab down and then inwards arrow.

Note:

When the connector is released, the release tab remains in the lower position by itself. When the connector is re-connected, the release tab springs back up.



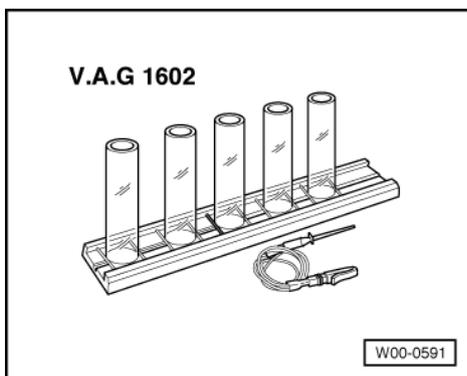
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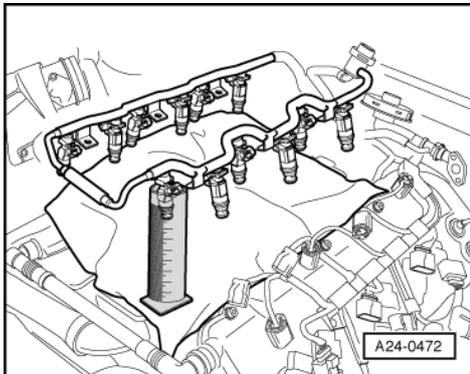
- Loosen the fuel supply pipe -1- and fuel return pipe -2- from the fuel rail pipe. Catch emerging fuel with a clean cloth.
- Detach vacuum hose from fuel pressure regulator.
- Remove the fixing screws for the fuel rail pipe -arrows- (tightening torque 10 Nm).
- Pull fuel rail pipe on the gearbox side complete with injectors evenly off the intake manifold and place it on a clean cloth in the engine compartment.
- Connect the fuel supply pipe -1- and the fuel return pipe -2- back onto the fuel rail pipe.

Checking injectors for leaks





- -> Place injector to be tested in a measuring glass from injection quantity tester V.A.G 1602.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit 1; do not connect the engine control unit => Page 117 .
- Bridge contacts 1 and 65 on the test box using test leads from adapter set V.A.G 1594 A (this creates an earth connection to one side of the fuel pump relay coil).



- Switch the ignition on.

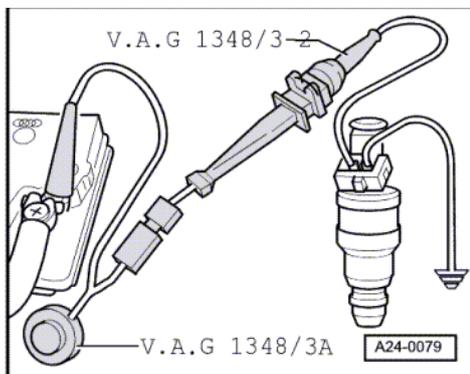
Note:

Once the ignition has been switched on, the fuel pump runs continuously even if the engine is not running. This is because with the ignition is switched on, the fuel pump relay receives its positive voltage supply via the central electrics. The earth voltage supply for the fuel pump relay comes via the cable bridge in the test box.

- Check injectors for leaks (visual check). When the fuel pump is running, only 1 or 2 drops a minute should escape from each injector.
- If the fuel loss is greater than this, switch off the fuel pump (switch off ignition) and renew faulty injector.

Checking injection quantity

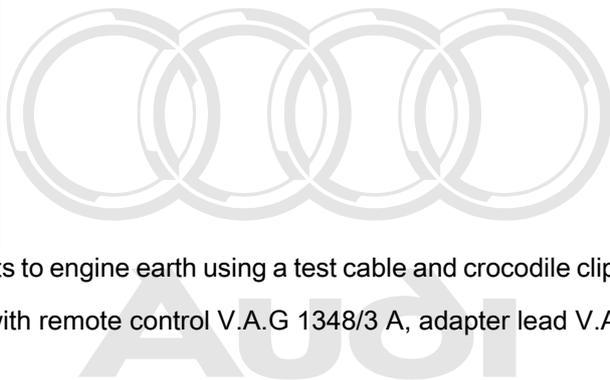
- Place the injector which is to be tested into measuring glass of injection quantity tester V.A.G 1602.



- -> Connect one of the injector contacts to engine earth using a test cable and crocodile clip from V.A.G 1594 A.
- Connect second contact of injector with remote control V.A.G 1348/3 A, adapter lead V.A.G 1348/3-2 and auxiliary cable to positive.
- Switch the ignition on.
 - The fuel pump should run.
- Activate remote control V.A.G 1348/3A for 30 seconds.
- Perform measurements on all injectors.
- Once four injectors in each case have been actuated, place measuring glasses on a level surface.

Specification per injector:

- 121...131 ml



If the specified result is not attained for all injectors:

- Check fuel pressure => Page 127 .

If the specified results are not attained for one injector:

- Replace the relevant injector.

Note:

When checking the injection quantity, also check the spray pattern. The spray pattern should be the same for all the injectors.

Installation of the fuel rail together with injectors is performed in the reverse sequence. The following points should be noted when installing:

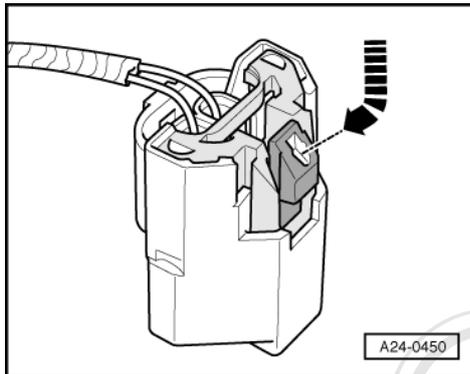
- Renew the O-rings at all opened connections. (when renewing the front O-ring, ensure that the plastic cap is not removed from the injector head. The O-ring must be pulled off over the plastic cap).
- Coat the O-rings with clean engine oil.
- Check to make sure that the retainer clamps are properly seated.
- Ensure that the injectors are installed in the correct positions.

1.11 - Checking injectors

- In order to reach the injectors, the intake manifold must be removed =>Page 154 .

Electrical checks on injectors

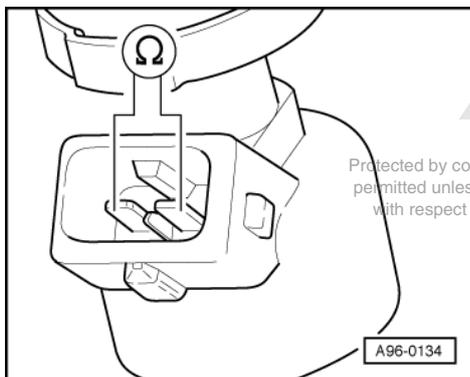
- Remove connector from the injector which is to be tested.



- -> For this purpose, firstly push the release tabs downwards and then inwards -arrow-.

Note:

When the connector is released, the release tab remains in the lower position by itself. When the connector is re-connected, the release tab springs back up.



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- -> Connect hand-held multimeter to injector to measure the resistance.

Specified value: 13...16 ω

Note:

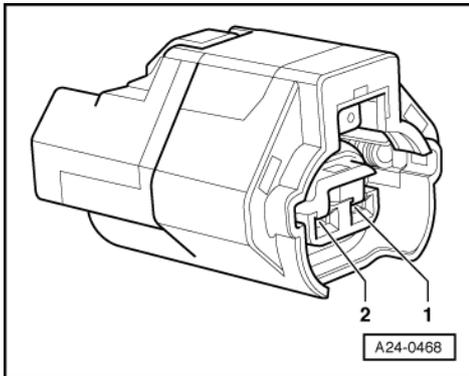
When the engine is at operating temperature the resistance of the injectors is increased by approx. 4...6 ω .

If specified value is not attained:

- Replace injector.

If specified value is attained:

- Check the voltage supply
=>Page 134 .



Audi

Checking power supply

- Remove connector from the injector which is to be tested => Page 133 .
- -> Connect diode test lamp for measuring voltage between earth and socket 1 of connector.

- Operate starter for a few seconds (the engine can be allowed to start).

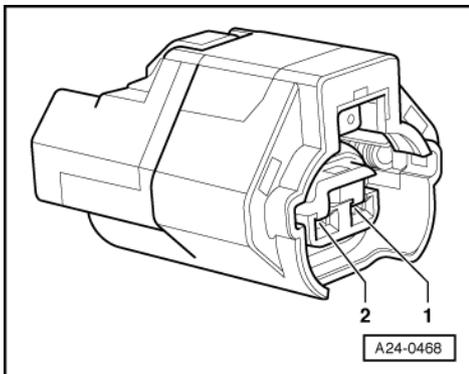
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Specified value: The diode test lamp should illuminate.

If the diode test lamp illuminates:

- Check the wiring for the earth connection from the engine control units =>Page 135 .

If the diode test lamp does not illuminate:



- -> Check the wiring from socket 1 via the injector fuse to the fuel pump relay for continuity and, if necessary, rectify open circuit.

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

Checking wiring

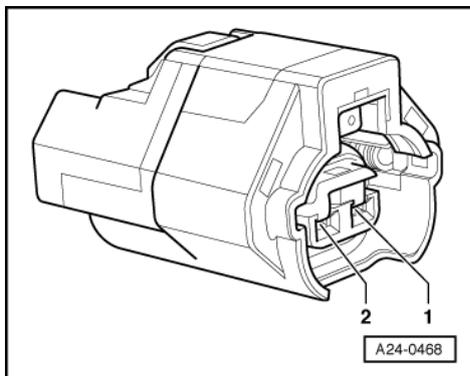
- Switch ignition off.
- Remove connector from the injector which is to be tested => Page 133
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 117 .
- In order to be able to understand the operations, the current flow diagram must be used as an aid.

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

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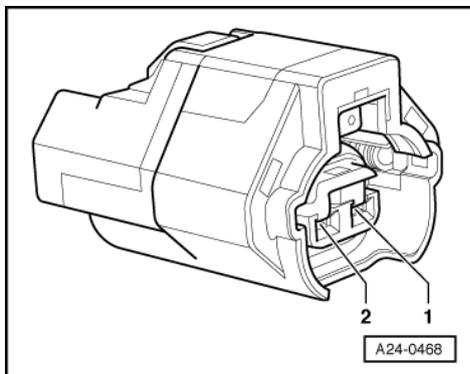
The injectors on cylinder bank 1 (cylinders 1 to 6) are activated by engine control unit 1.

The injectors on cylinder bank 2 (cylinders 7 to 12) are activated by engine control unit 2.



- -> Check for open circuit and short to positive or earth in the following wiring connection:

Cylinder	2-pin connector on wiring harness, socket	Test box V.A.G 1598/31 on wiring harness for engine control unit 1 socket
1	2	96
2	2	112
3	2	88
4	2	113
5	2	97
6	2	89



- -> Check for open circuit and short to positive or earth in the following wiring connection:



Cylinder	2-pin connector on wiring harness, socket	Test box V.A.G 1598/31 on wiring harness for engine control unit 2 socket
7	2	89
8	2	97
9	2	113
10	2	88
11	2	112
12	2	96

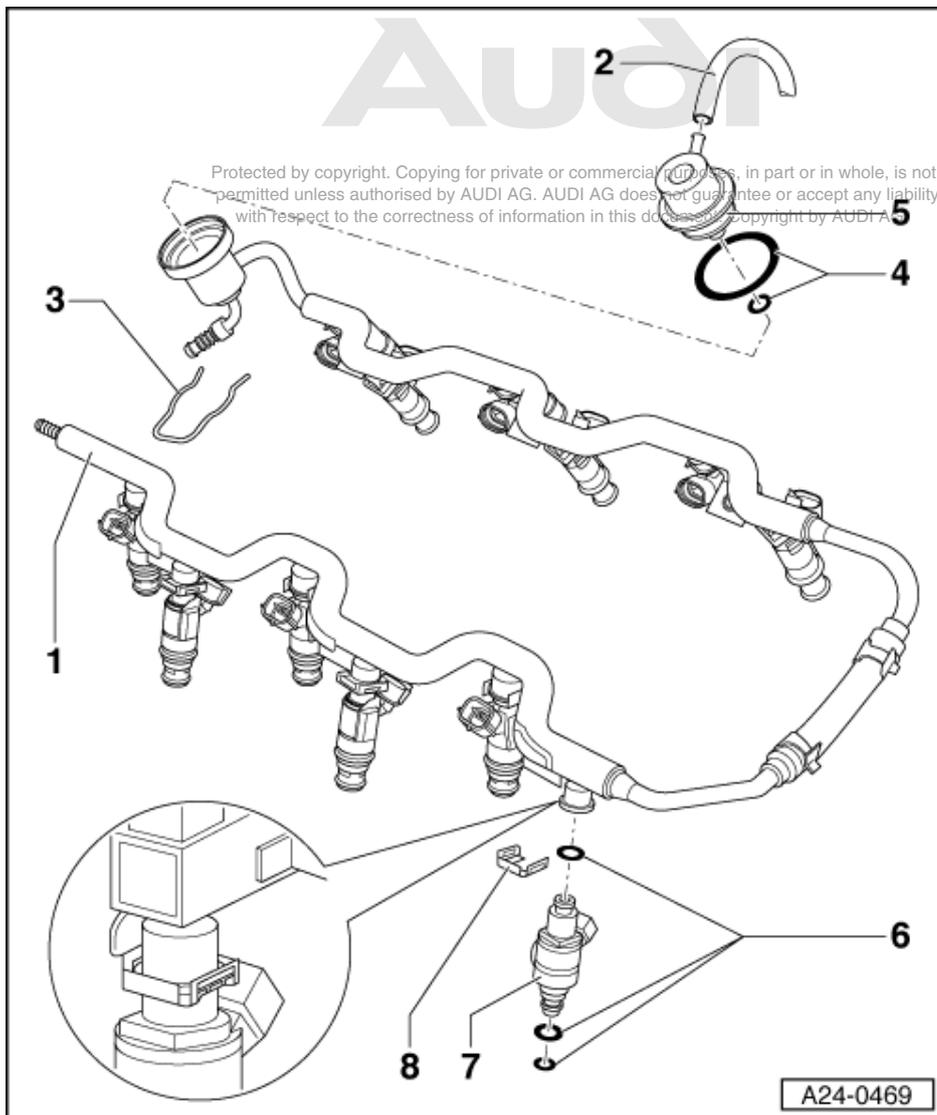
Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

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

- If the wiring is OK replace the applicable engine control unit => Page 120 .

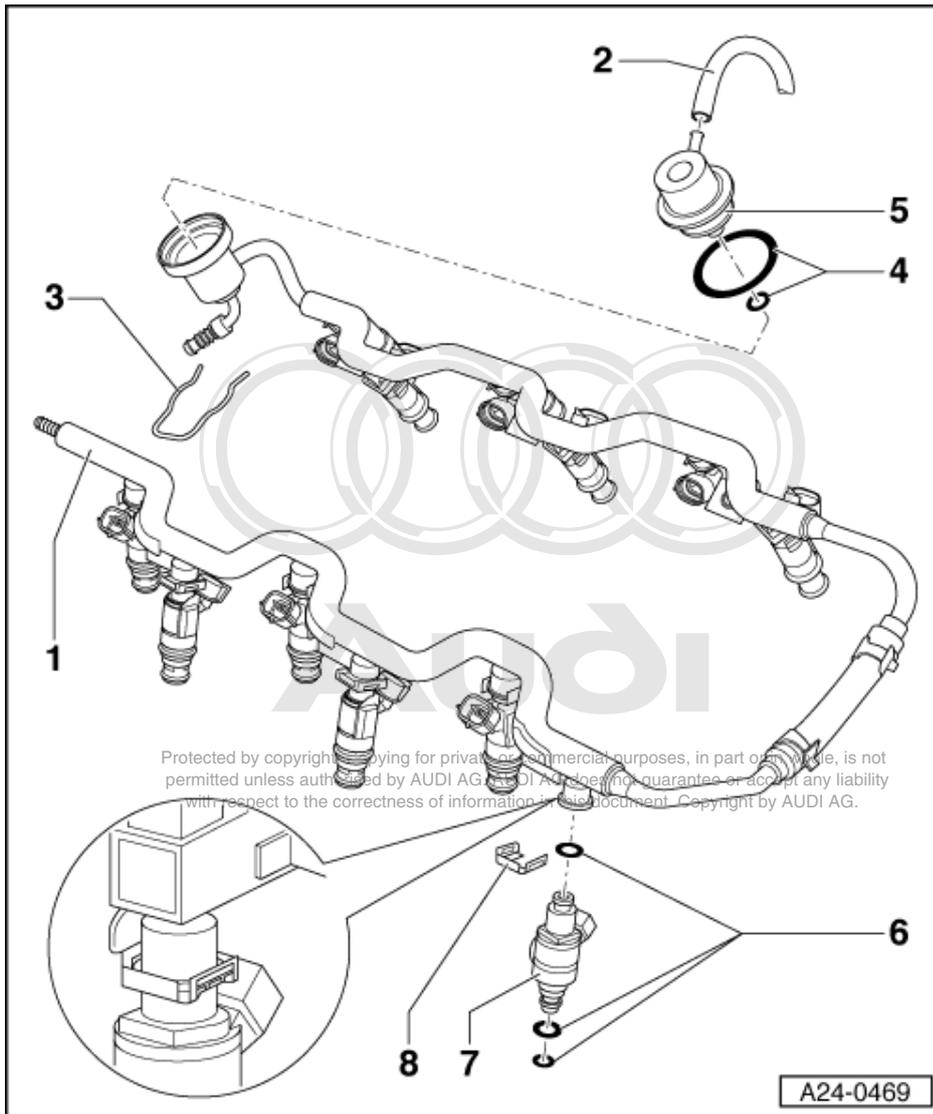
1.12 - Dismantling and assembling fuel rail with injectors



Note:

Depending on version, the fuel rail may differ slightly to that illustrated.

- 1 Fuel rail pipe
- 2 To intake manifold
- 3 Bracket
- 4 O-ring
- ◆ Replace



- 5 Fuel pressure regulator
- 6 O-ring
- ◆ Replace
- 7 Injector
- 8 Bracket
- ◆ Ensure it is positioned correctly on injector and fuel rail

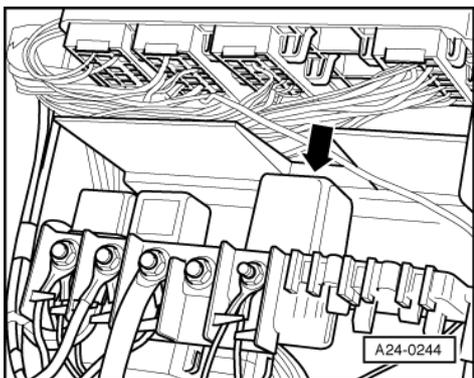


1.13 - Checking fuel pump relay -J17 and relay actuation

The fuel pump and certain components of the injection system are supplied with power by way of the fuel pump relay -J17.

The fuel pump relay -J17 is only energised when the engine is running, i.e. the relay is only connected to earth (via the engine control unit) when engine speed pulses are detected in the engine control unit.

Test conditions



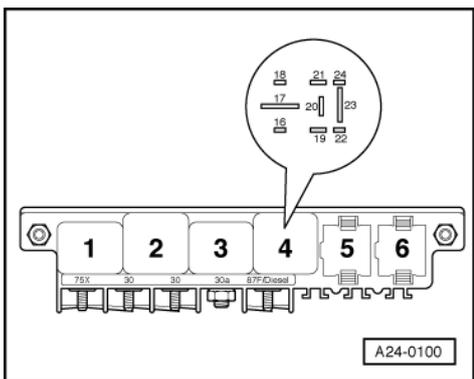
- Battery voltage OK.

Functional testing of fuel pump relay

Note:

-> The fuel pump relay is located in the electronics box in the front passenger's footwell (micro central electrics unit, relay position 4.)

- Connect vehicle diagnostic, testing and information system VAS 5051 and select engine control unit 1 using "address word" 01 => Page 3 .
For this purpose, the ignition must be switched on.



- Start final control diagnosis and actuate fuel tank breather valve -N80 =>Page 46 .

-> The fuel pump relay should respond and the fuel pump should run.

- Exit the function "03 - Final control diagnosis" by pressing the < key.

If the relay does not respond:

- Check actuation of fuel pump relay from engine control unit 1 =>Page 139 .

If the fuel pump does not run.

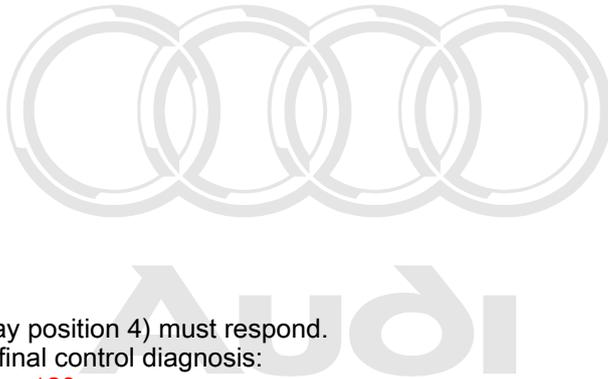
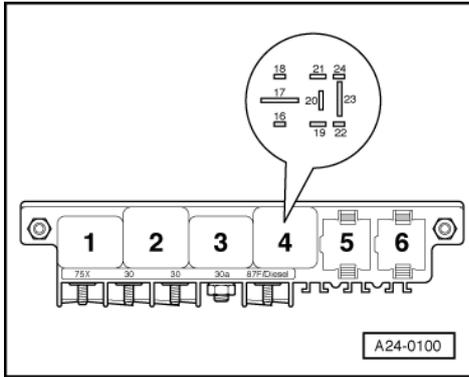


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- Check actuation of fuel pump and components from fuel pump relay =>Page 140

Checking actuation of fuel pump relay

- Switch ignition off.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit 1; do not connect the engine control unit => Page 117 .
- Connect together sockets 65 and 2 on the test box using an auxiliary cable from V.A.G 1594.
- Switch the ignition on.



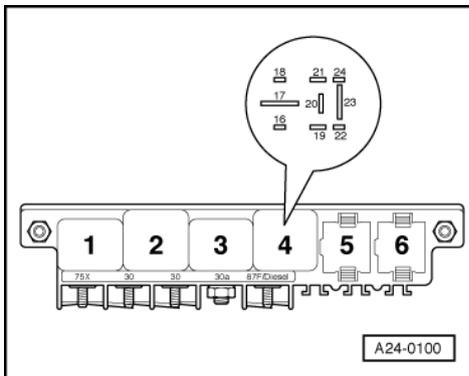
Specified value: The fuel pump relay (relay position 4) must respond.
 If the relay responds now, but not during final control diagnosis:

- Fit a new engine control unit 1 => Page 120 .

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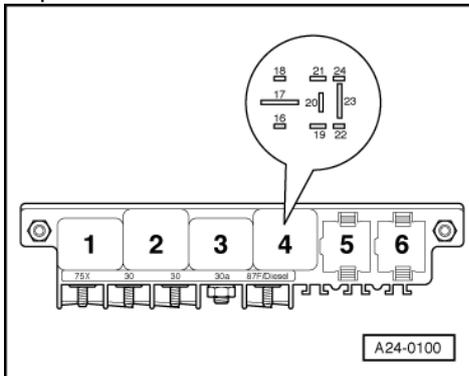
If the relay does not respond:

- -> Remove fuel pump relay from relay base (relay position 4)
- Switch the ignition on.



- -> Connect the hand-held multimeter to contact 19 of relay socket and earth to measure voltage.

Specified value: approx. battery voltage
 If specified value is not attained:





- Check the wiring connections.

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If specified value is attained:

- -> Check for open circuit and short to positive or earth in the following wiring connection:

Test box V.A.G 1598/31 on engine control unit 1 Socket	Micro central electrics on right in passenger's footwell position 4 Contact
65	16 => Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

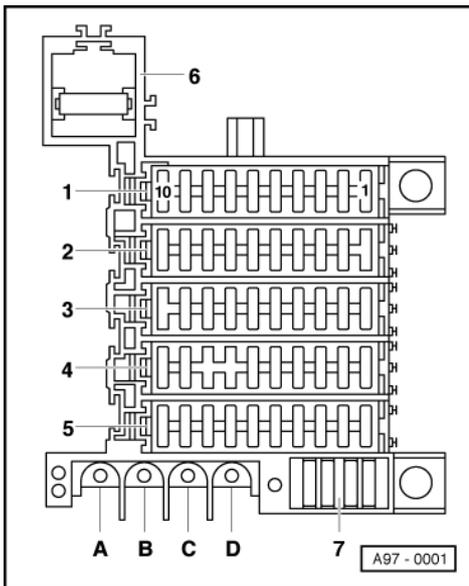
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If no wiring fault is detected:

- Replace the fuel pump relay -J17.

Checking actuation of fuel pump and components



- Remove fuse cover on A-pillar in footwell on right side.
- -> Remove the fuses by which the fuel pump relay supplies components with voltage.

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- Start the final control diagnosis => Page 46 .

Note:

The final control diagnosis is terminated after approximately one minute. For this reason, switch to the next control element in the meantime. Then another minute's time, etc. is available

- Connect the hand-held multimeter for voltage measurement) to one of the contacts on the appropriate fuse and earth.

Specified value: approx. battery voltage

If specified value is not attained:

Repeat the test at the other contact.

If specified value is not attained:

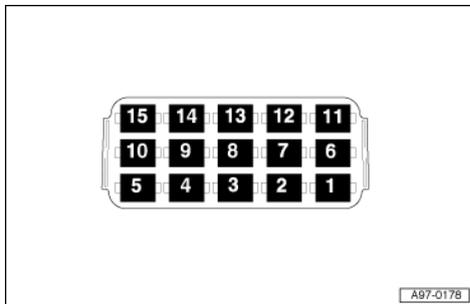
- Check the wiring connections.

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

If no wiring fault is detected:

- Replace the fuel pump relay -J17.

1.14 - Checking power supply relay for Motronic system -J271



Note:

-> The power supply relay for the Motronic system -J271 is located in the electronics box in the front passenger's footwell, auxiliary relay carrier, relay position 2.

Checking actuation of power supply relay

- Switch ignition off.
- Detach power supply relay -J271 from the relay carrier.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit 1; do not connect the engine control unit => Page 117 .
- Check the following wiring for an open circuit or short circuit

Test box V.A.G 1598/31 on wiring harness for engine control unit 1 socket	Power supply relay, contact
23	4

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

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

If no wiring fault is detected:

- Check the power supply for the power supply relay => Page 142 .



Checking power supply.

- Switch the ignition on.
- Connect the hand-held multimeter to contact 1 and 2 in each case of relay socket and earth to measure voltage.

Specified value: approx. battery voltage

If the specification is not achieved, test the wiring connections according to the current flow diagram.

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If the specified value is achieved, check the wiring connections between power supply relay and engine control unit => Page 142 .

Checking wiring between power supply relay and engine control unit

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- Check the fuse (see current flow diagram)

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If no fault is detected at the fuse.

- Check the following wiring for an open circuit or short circuit to both engine control units.

Test box V.A.G 1598/31 on wiring harness for engine control unit 1 socket	Power supply relay, contact
3	8 => Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder
Test box V.A.G 1598/31 on wiring harness for engine control unit 2 socket	Power supply relay, contact
3	8 => Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

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If no faults have been found in any of the above checks, replace power supply relay -J271.

1.15 - Checking control unit power supply

Check requirements:

- Fuse for engine control unit OK

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- Battery voltage at least 11 V
- Alternator OK

Important note:

The current flow diagram must be used as an aid.

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit 1 / engine control unit 2. Engine control unit 1 must also be connected to text box, as main relay (power supply relay -J271) is actuated by engine control unit 1 =>Page 117 .
- Switch the ignition on.
- Connect the hand-held multimeter for voltage measurement to the following contacts on the test box, one after the other, and to earth:

Test box V.A.G 1598/31 on wiring harness for engine control unit 1 socket	Meaning
3	Positive from main relay
21	Positive, terminal 15
49	Positive, terminal 15
62	Positive, terminal 30

Specified value: approx. battery voltage

If the specified value is not achieved, test the supply voltage according to the current flow diagram.

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Please also check whether earth is present at sockets 1 and 2 on the test box.

Test box V.A.G 1598/31 on wiring harness for engine control unit 2 socket	Meaning
3	Positive from main relay
21	Positive, terminal 15
62	Positive, terminal 30

Specified value: approx. battery voltage

If the specified value is not achieved, test the supply voltage according to the current flow diagram.

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

Please also check whether earth is present at sockets 1, 2 and 49 on the test box.

1.16 - Testing air mass meter

Fitting location => Fitting locations overview - Page 93 .

Note:

The principle of the test is identical for both air mass meters.

Air mass meter -G70 measures the intake air for cylinders 1 to 6. It is connected to engine control unit 1.

Air mass meter 2 -G246 measures the intake air for cylinders 7 to 12. It is connected to engine control unit 2.

Test conditions

- Coolant temperature at least 80 °C.
- Electrical consumers switched off (radiator fan must not run during the check)



- Air conditioner switched off
- Place selector lever in P or N position (vehicles with automatic gearboxes).
- Fuse for air mass meter OK

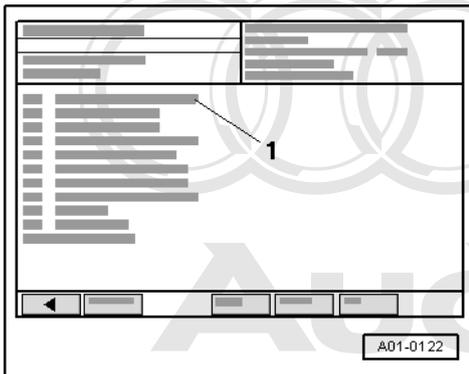
=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

Checking air mass meter -G70 function

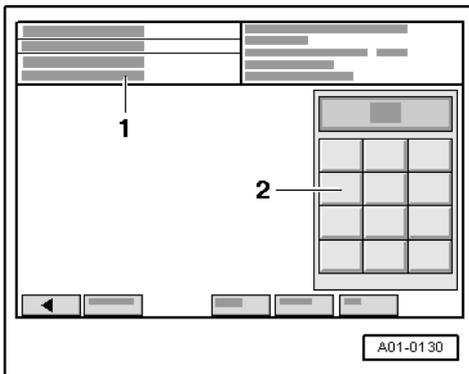
Note:

Checking the function of the air mass meter -G246 =>Page 147 .

- Connect vehicle diagnostic, testing and information system VAS 5051 and select engine control unit 1 using "address word" 01 => Page 3 .
- For this purpose, the engine must be running at idle speed.



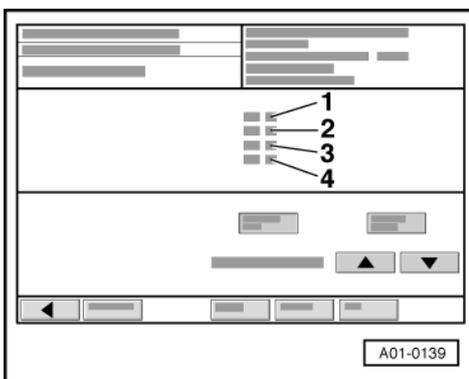
- > Display on VAS 5051:
- Under 1 select the diagnostic function "04 Basic setting".



-> Display on VAS 5051:

- 1 - Enter display group max. input value = 255

- Enter "002" for "display group number 002" in zone -2- and confirm the entry by pressing the Q key.



- > Display on VAS 5051:
 - Check specified values for load recognition in display zones -3- and -4-.

	Display zones			
	1	2	3	4
Display group 002: Intake air mass at idle and operating temperature				
Display	xxx rpm	xxx %	xx.x ms	xxx.x g/s
Display	Engine speed	Load	Average injection period	Air mass
Specified value	520...770 rpm	10...25 %	1.0...5.0 ms	2.0...7.0 g/s
Note:	If specified value is not attained: Evaluation => Page 145			

If specified value is attained:

- Exit the function "04 - Basic setting" by pressing the ◀ key.

Evaluation of display group 002

Display zone: 3	Possible causes of fault	Fault remedy
Less than 1.0 ms	- Lower values can only occur when vehicle is on overrun	
Greater than 5.0 ms	- Engine load from ancillaries	- Eliminate load (air conditioner/power steering/alternator)
	- Poor idling (not running on all cylinders)	- Check spark plugs Check injectors => Page 133 .
	- Throttle valve control part -J338 defective	- Check throttle valve control part =>Page 206 .
Display zone: 4	Possible causes of fault	Fault remedy
Less than 2.0 g/s	- Large quantity of unmetered air between intake manifold and air mass meter - Voltage supply to air mass meter or wiring to engine control unit	- Check for leaks (unmetered air) in intake air system => Page 145 .
Greater than 7.0 g/s	- Engine load from ancillaries	- Eliminate load (air conditioner/power steering/alternator)
	- Voltage supply to air mass meter or wiring to engine control unit	- Check voltage supply and/or wiring => Page 145

Testing voltage supply to air mass meter

Test requirements:

- Fuse for air mass meter OK.

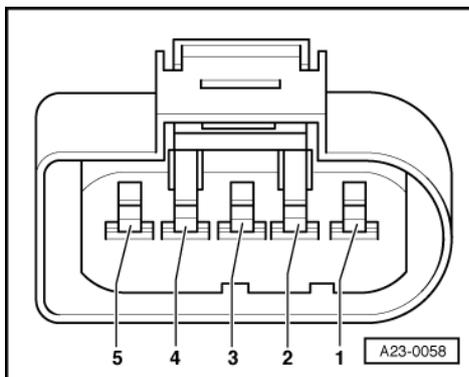
=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

- Fuel pump relay OK.

Note:

Voltage supply to air mass meter is from fuel pump relay.

- Detach connector from air mass meter.





- -> Connect multimeter as follows to measure voltage.

Connector Contact	Measure to
2	Engine earth

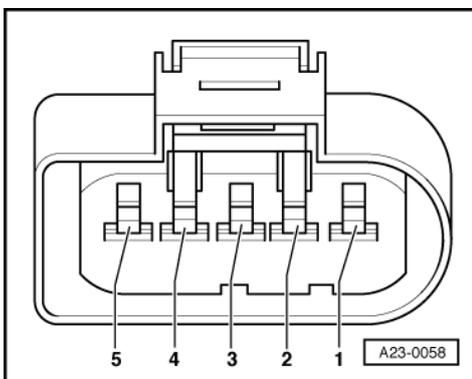
- Operate the starter briefly (the engine may start).
- Specified value: approx. battery voltage

If specified value is not attained:

- Check the wiring from contact 2 on the connector via the fuse to the fuel pump relay for open circuit or short to earth:

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

- Rectify any open/short circuit as necessary.



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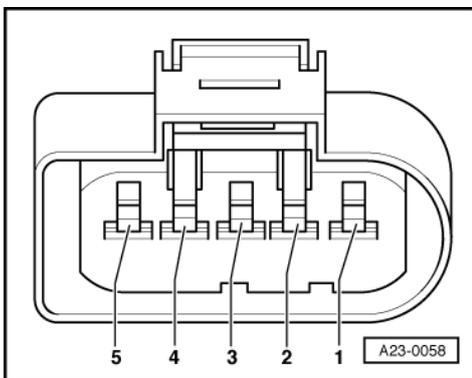
- -> Connect hand-held multimeter to contacts 2 and 3 of the connector to measure voltage.
- Operate the starter briefly (the engine may start).
- Specified value: approx. battery voltage

Note:

Engine control unit earth is present at contact 3 of the connector.

If specified value is not attained:

- Check the wiring connections
=>Page 147 .



- -> Connect hand-held multimeter to contacts 3 and 4 of the connector to measure voltage.
- Specified value: approx. 5 V

If specified value is not attained:

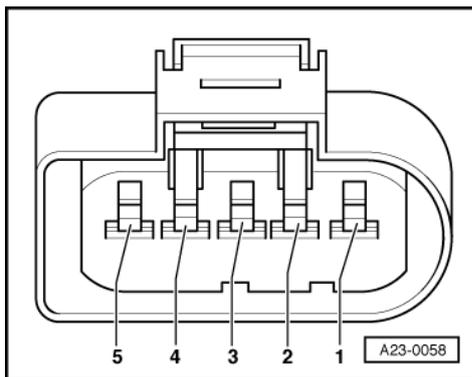
- Check the wiring connections
=>Page 147 .

Checking wiring to air mass meter.

Note:

The signal wire is also checked during the wiring check.

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit 1; do not connect the engine control unit => Page 117 .



- -> Check for open circuit and short to positive or earth in the following wiring connections:

Connector Contact	Test box V.A.G 1598/31 Socket
3	27
4	53
5	29

- Rectify any open/short circuit as necessary.
- Additionally check all wires for short to one another.

If the wiring is OK:

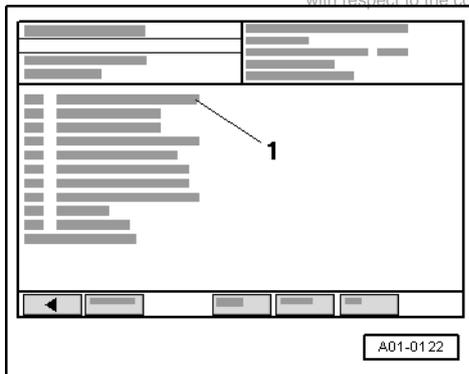
- Renew air mass meter -G70.

Checking air mass meter -G246 function

- Connect vehicle diagnostic, testing and information system VAS 5051 and select engine control unit 2 using "address word" 11 => Page 3 .

For this purpose, the engine must be running at idle speed.

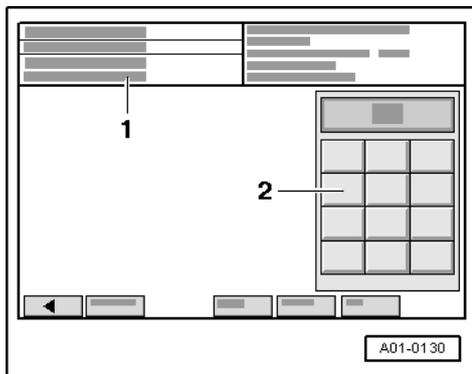
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-> Display on VAS 5051:

- Under -1- select the diagnostic function "04 - Basic setting".



-> Display on VAS 5051:

- 1 - Enter display group
max. input value = 255

- Enter "002" for "display group number 002" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Check specified values for load recognition in display zones -3- and -4-.

	Display zones			
	1	2	3	4
Display group 002: Intake air mass at idle and operating temperature				
Display	xxx rpm	xxx %	xx.x ms	xxx.x g/s
Display	Engine speed	Load	Average injection period	Air mass
Specified value	520...770 rpm	10...25 %	1.0...5.0 ms	2.0...7.0 g/s
Note:	---	---	If specified value is not attained: Evaluation => Page 149	

If specified value is attained:

- Exit the function "04 - Basic setting" by pressing the **key**

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Evaluation of display group 002

Display zone: 3	Possible causes of fault	Fault remedy
Less than 1.0 ms	- Lower values can only occur when vehicle is on overrun	
Greater than 5.0 ms	- Engine load from ancillaries	- Eliminate load (air conditioner/power steering/alternator)
	- Poor idling (not running on all cylinders)	- Test spark plugs Test injectors => Page 133 .
	- Throttle valve control part -J544 defective	- Check throttle valve control part =>Page 206 .
Display zone: 4	Possible causes of fault	Fault remedy
Less than 2.0 g/s	- Large quantity of unmetered air between intake manifold and air mass meter - Voltage supply to air mass meter or wiring to engine control unit	- Test for leaks (unmetered air) in intake air system => Page 149 .
Greater than 7.0 g/s	- Engine load from ancillaries	- Eliminate load (air conditioner/power steering/alternator)
	- Voltage supply to air mass meter or wiring to engine control unit	- Check voltage supply and/or wiring => Page 149 .

Testing voltage supply to air mass meter

Test requirements:

- Fuse for air mass meter OK.

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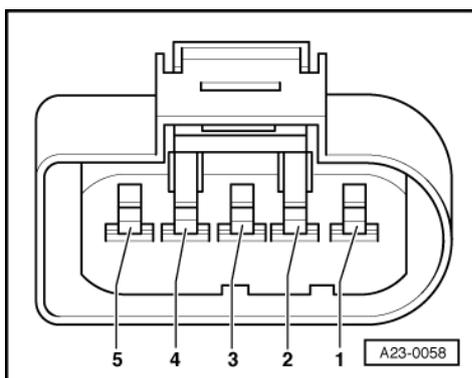
=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

- Fuel pump relay OK.

Note:

Voltage supply to air mass meter is from fuel pump relay.

- Detach connector from air mass meter.



- -> Connect multimeter as follows to measure voltage.

Connector Contact	Measure to
2	Engine earth

- Operate the starter briefly (the engine may start).



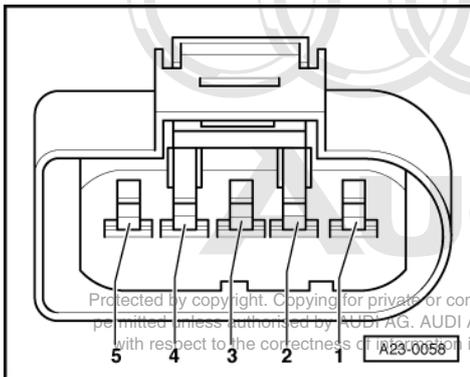
- Specified value: approx. battery voltage

If specified value is not attained:

- Check the wiring from contact 2 on the connector via the fuse to the fuel pump relay for open circuit or short to earth:

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

- Rectify any open/short circuit as necessary.



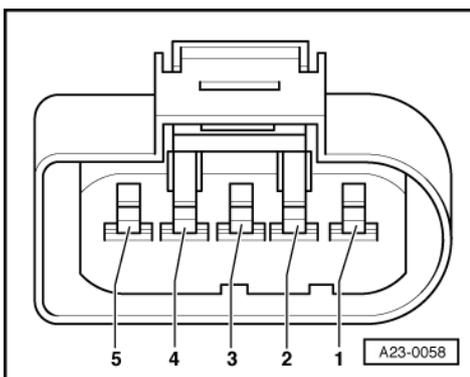
- -> Connect hand-held multimeter to contacts 2 and 3 of the connector to measure voltage.
- Operate the starter briefly (the engine may start).
 - Specified value: approx. battery voltage

Note:

Engine control unit earth is present at contact 3 of the connector.

If specified value is not attained:

- Check the wiring connections
=>Page 151 .



- -> Connect hand-held multimeter to contacts 3 and 4 of the connector to measure voltage.
 - Specified value: approx. 5 V

If specified value is not attained:

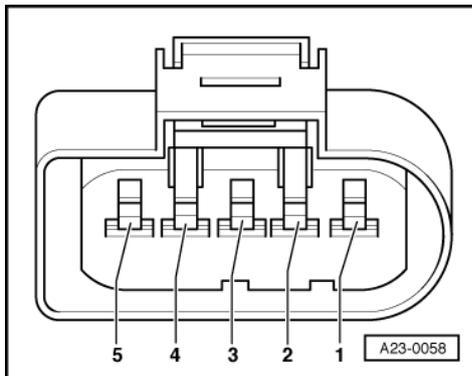
- Check the wiring connections
=>Page 151 .

Checking wiring to air mass meter.

Note:

The signal wire is also checked during the wiring check.

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit 2; do not connect the engine control unit => Page **117** .



- -> Check for open circuit and short to positive or earth in the following wiring connections:

Connector Contact	Test box V.A.G 1598/31 Socket
3	27
4	53
5	29

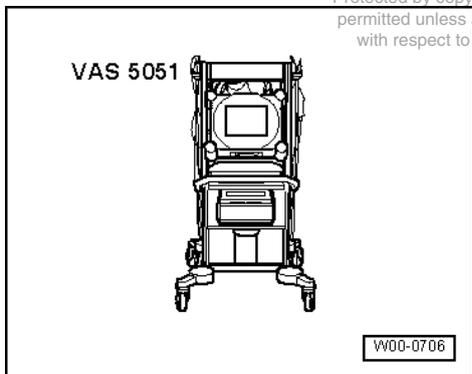
- Rectify any open/short circuit as necessary.
- Additionally check all wires for short to one another.

If the wiring is OK:

- Renew air mass meter -G246.

1.17 - Checking intake air system for leaks (unmetered air)

Special tools, workshop equipment and other items required



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- ◆ VAS 5051 with VAS 5051/1
- ◆ Engine leak detector spray G 001 800 A1



Notes:

- ◆ The vacuum in the intake system will cause the leak detector spray to be drawn in with the unmetered air. The leak detector spray reduces the ignitability of the mixture. This leads to a drop in engine speed and to a significant increase of the CO content.
- ◆ The safety precautions listed on the container must be adhered to.

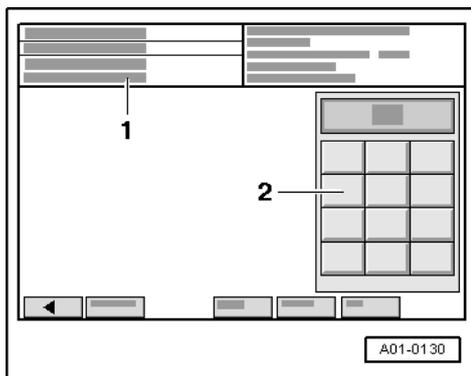
Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 and select engine control unit 1 using "address word" 01 => Page 3 .
For this purpose, the engine must be running at idle speed.



-> Display on VAS 5051:

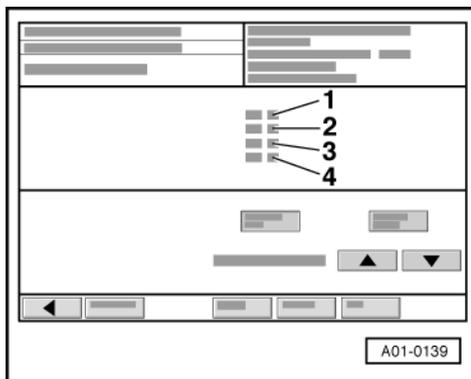
- Under -1- select the diagnostic function "08 - Read measured value block".



-> Display on VAS 5051:

1 - Enter display group
max. input value = 255

- Enter "001" for "display group number 001" in zone -2- and confirm the entry by pressing the Q key.

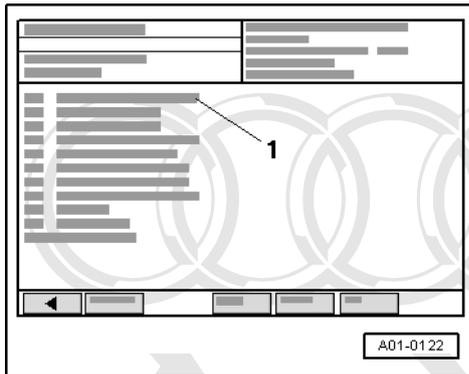


-> Display on VAS 5051:

- Note engine speed in display zone -1-.
- Systematically spray parts of the intake system with engine leak detector spray.

If engine speed drops:

- Check sprayed areas of intake system for leaks and rectify if necessary.
- Exit the function "08 - Read measured value block" by pressing the ◀ key.



-> Display on VAS 5051:

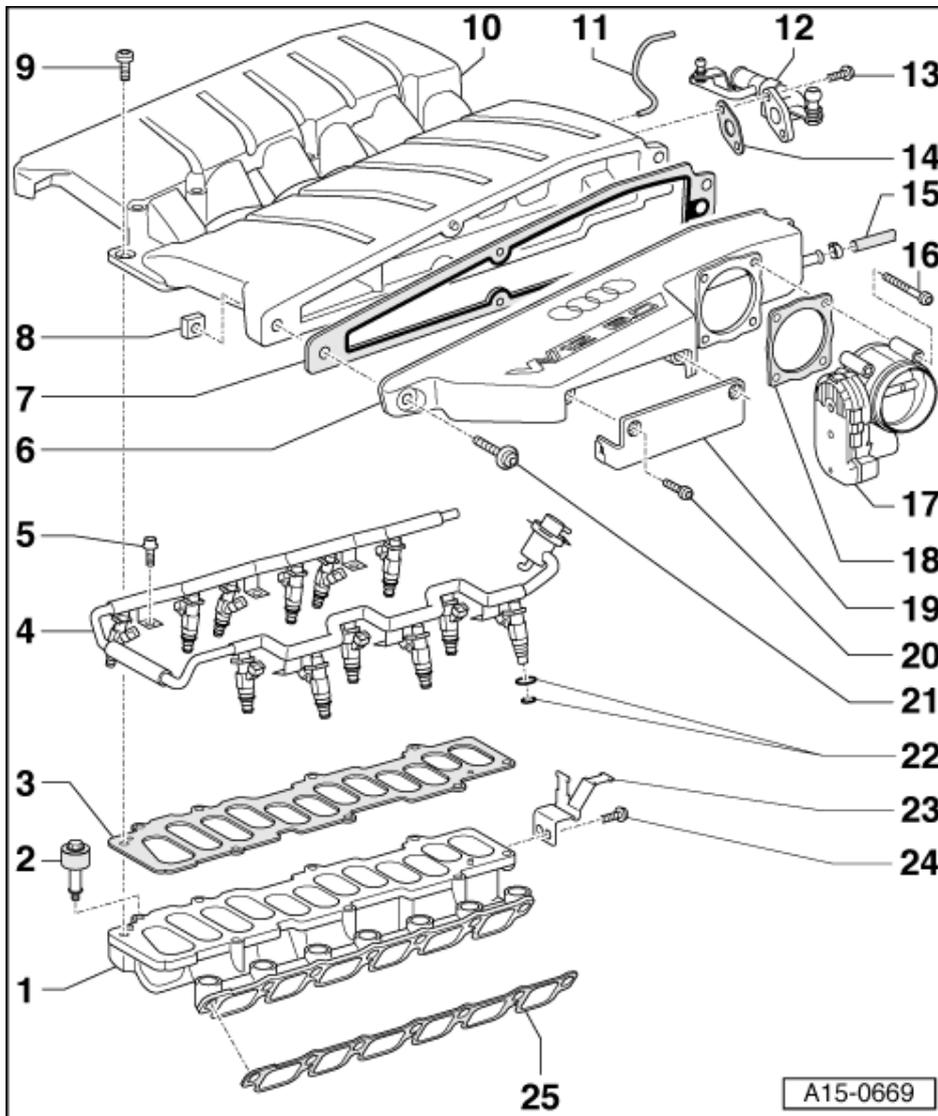
- Under -1- select the diagnostic function "06 - End output".

Switch ignition off.
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2 - Removing and installing intake manifold

2.1 - Removing and installing intake manifold



2.2 - Intake manifold overview

1 Lower section of intake manifold

- ◆ Removing and installing
=>Page 164 .

2 9 Nm

3 Gasket

- ◆ Replace

4 Fuel rail

- ◆ Removing and installing:

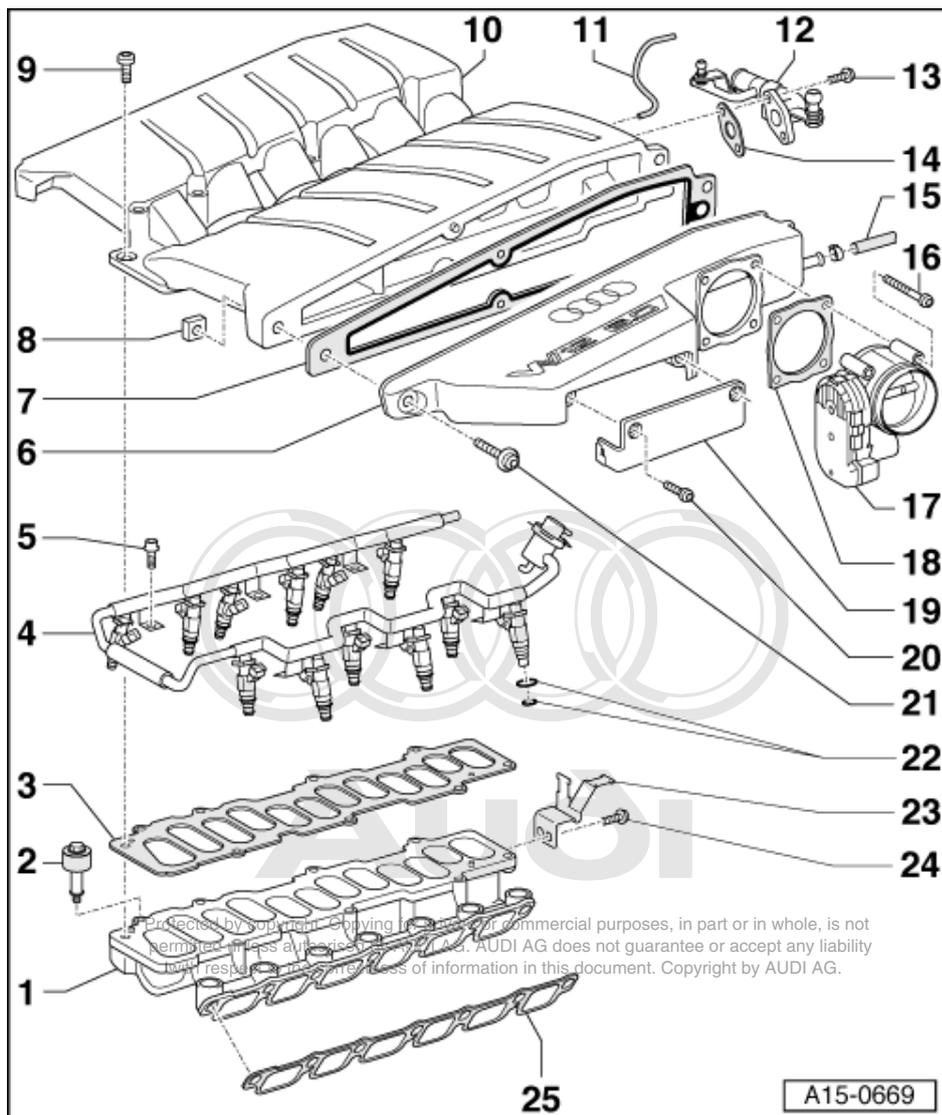
=> Motronic Injection and Ignition System; Repair group 24

5 9 Nm

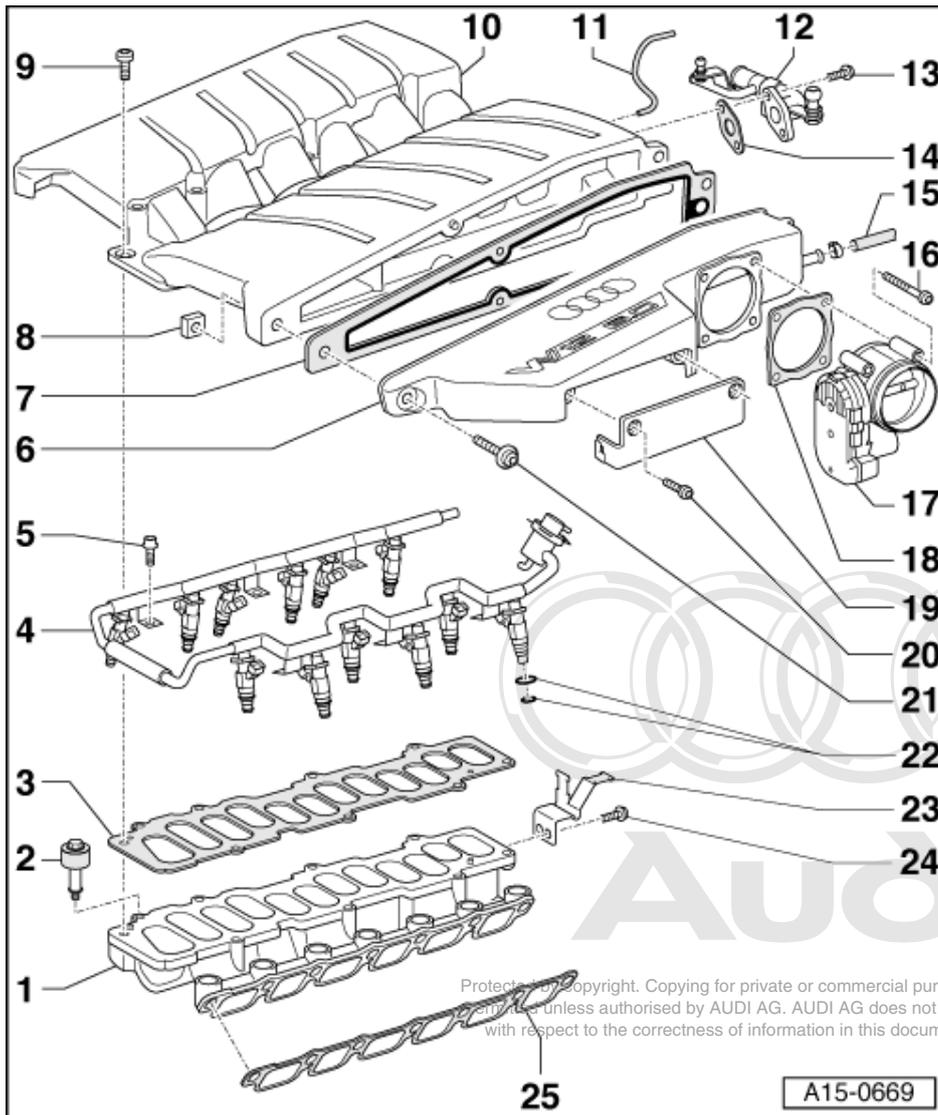
6 Side section of intake manifold

- ◆ Removing and installing left section of intake manifold => Page 158

♦ Removing and installing right section of intake manifold => Page **159**



- 7 Gasket**
 - ♦ Replace
- 8 Threaded plate**
- 9 7 Nm + 1/2 turn (180 °) further**
 - ♦ Replace
 - ♦ Tighten in diagonal sequence, starting in the middle
- 10 Upper section of intake manifold**
 - ♦ Removing and installing
=>Page **161** .
- 11 Vacuum hose**
- 12 Pipe connection**
- 13 9 Nm**
- 14 Gasket**
 - ♦ Replace



15 Vacuum hose

- ◆ To brake servo

16 22 Nm

17 Throttle valve control part -J338 (left) and throttle valve control part 2 -J544 (right)

18 Gasket

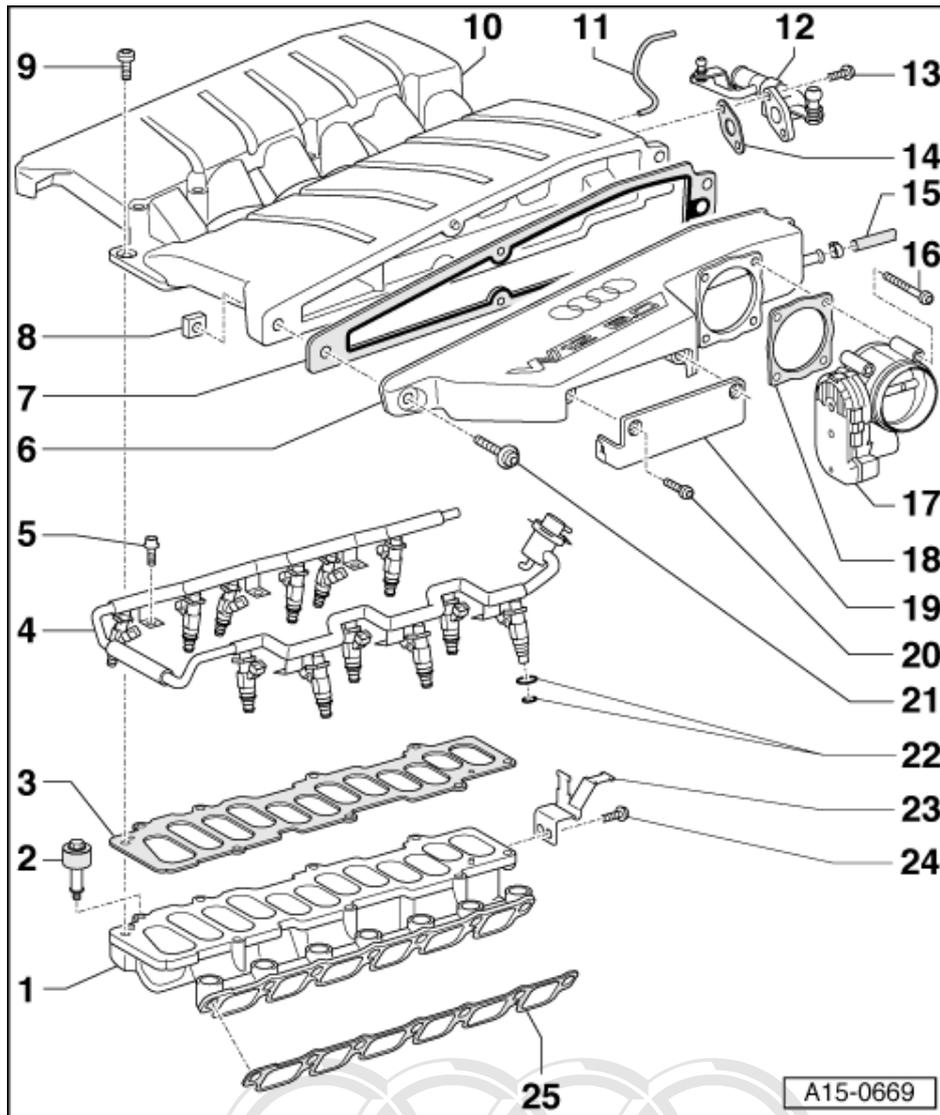
- ◆ Replace

19 Bracket

- ◆ For connector of lambda probe and lambda probe heating

20 9 Nm

21 22 Nm



22 O-rings

- ◆ Replace
- ◆ Coat with fuel when installing
- ◆ Do not use silicon-based lubricant

23 Bracket

24 9 Nm

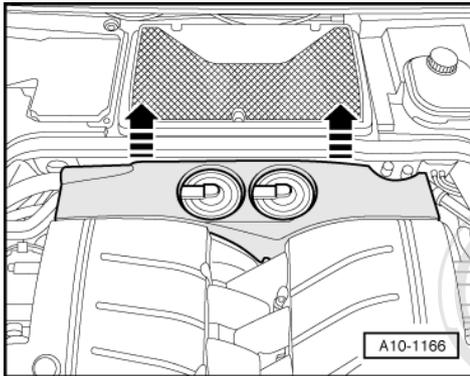
25 Gasket

- ◆ Replace
- ◆ Press into cylinder head

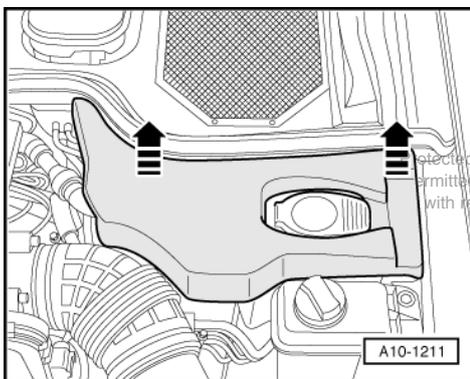
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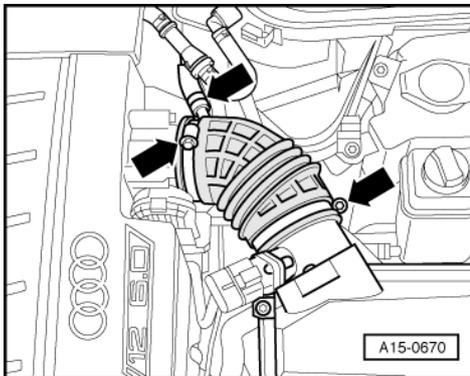
2.3 - Removing and installing left section of intake manifold



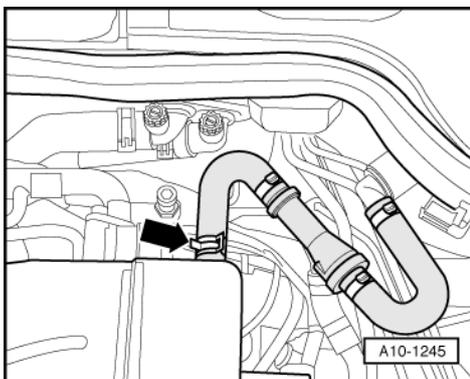
- -> Remove cover behind intake manifold -arrows-.



- -> Remove cover on left in engine compartment -arrows-.

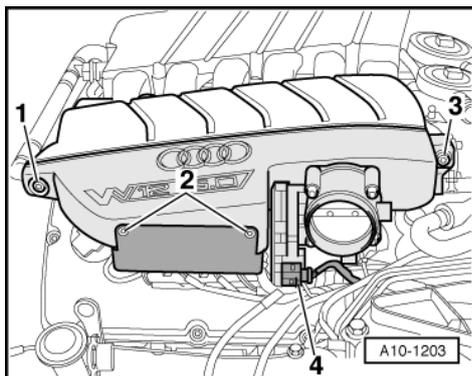


- -> Remove left air duct hose -arrows-.



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- -> Detach vacuum hose -arrow- to brake servo on left section of intake manifold.



- -> Detach connector -4-.

Note:

Secure threaded plate against dropping when slackening bolt -1-.

- Screw out bolts -1 ... 3- and detach left section of intake manifold.

Installing

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

Note:

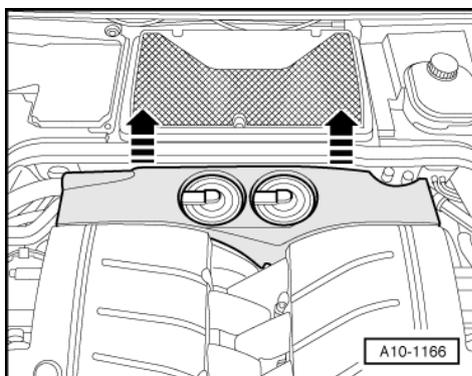
Replace gaskets and seals.

Tightening torques

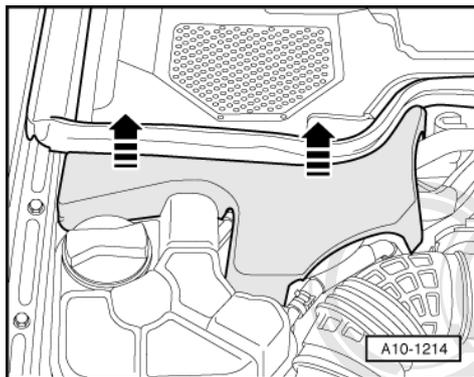
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Component	Nm
Side section of intake manifold to upper section of intake manifold	22
Bracket for connectors to side section of intake manifold	9

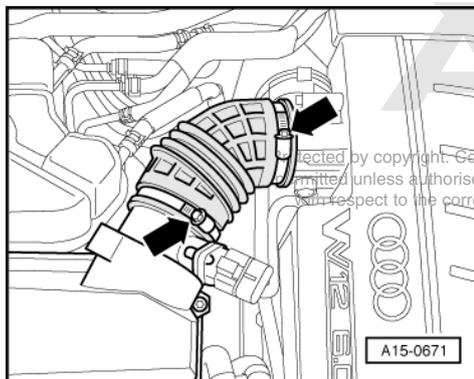
2.4 - Removing and installing right section of intake manifold



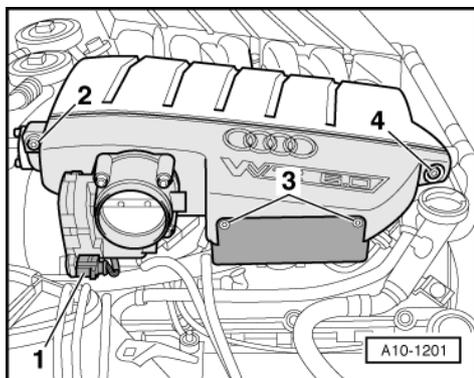
- -> Remove cover behind intake manifold -arrows-.



- -> Remove cover on right in engine compartment -arrows-.



- -> Remove right air duct hose -arrows-.



- Unscrew filler cap for oil filler connection.
- -> Detach connector -1-.

Note:

Secure threaded plate against dropping when slackening bolt -4-.

- Screw out bolts -2 ... 4- and detach right section of intake manifold.

Installing

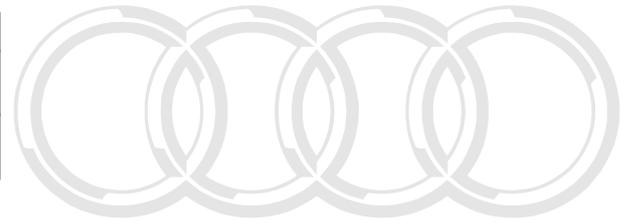
Installation is carried out in the reverse order; note the following:

Note:

Replace gaskets and seals.

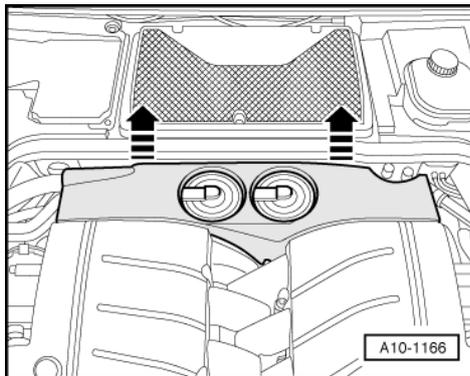
Tightening torques

Component	Nm
Side section of intake manifold to upper section of intake manifold	22
Bracket for connectors to side section of intake manifold	9



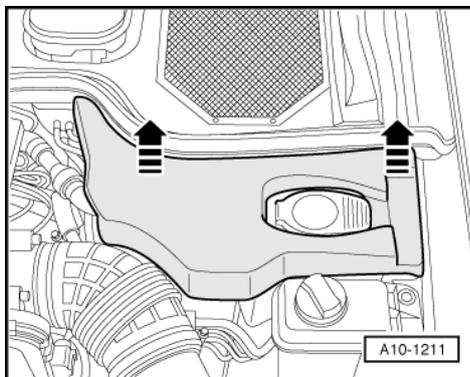
Audi

2.5 - Removing and installing upper section of intake manifold

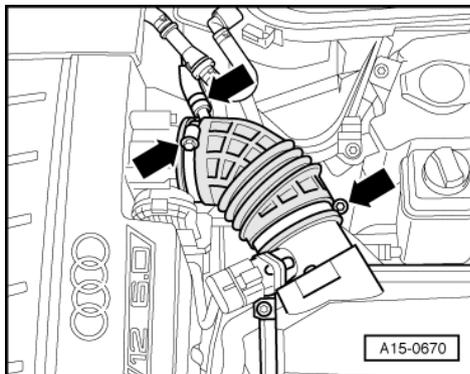


- -> Remove cover behind intake manifold -arrows-.

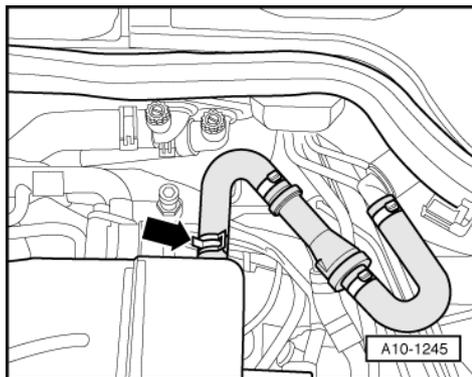
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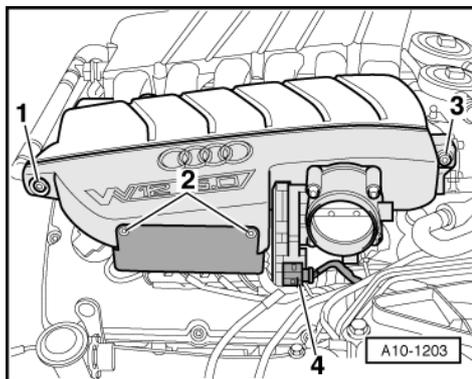
- -> Remove cover on left in engine compartment -arrows-.



- -> Remove left air duct hose -arrows-.



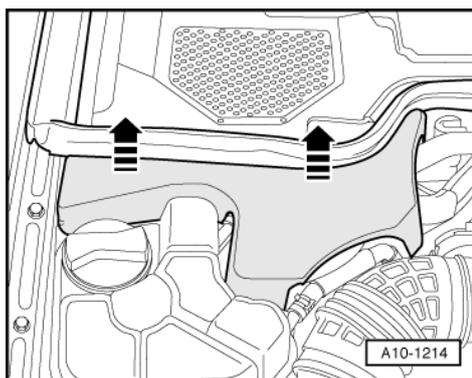
- -> Detach vacuum hose -arrow- to brake servo on left section of intake manifold.



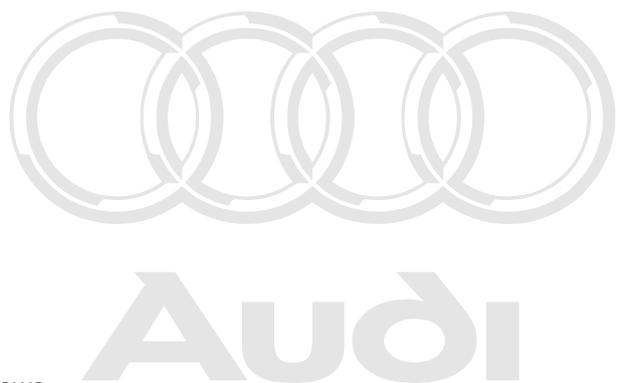
- -> Detach connector -4-.
- Screw out bolts -2- and remove bracket for connectors. The connectors remain on the holder.

Note:

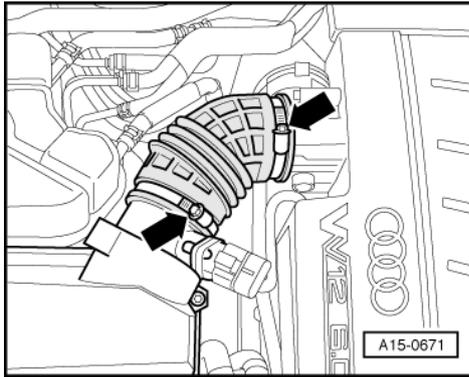
Bolts -1- and -3- are not slackened.



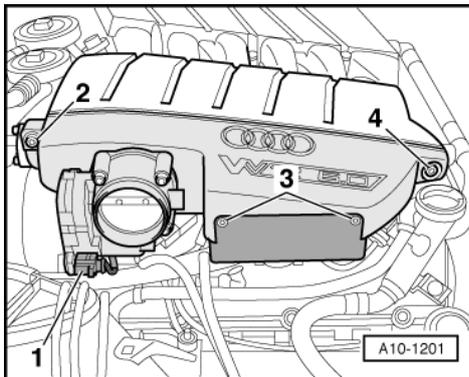
- -> Remove cover on right in engine compartment -arrows-.



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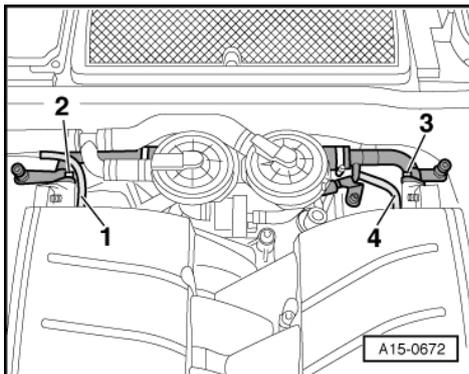
- -> Remove right air duct hose -arrows-.



- Unscrew filler cap for oil filler connection.
- -> Detach connector -1-.
- Screw out bolts -3- and remove bracket for connectors. The connectors remain on the holder.

Note:

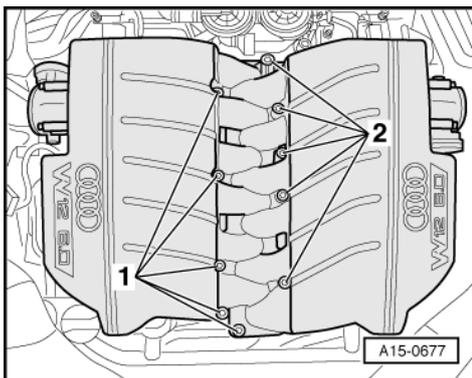
Bolts -2- and -4- are not slackened.



- -> Detach vacuum hoses -1- and -4-.
- Unbolt pipe connections from intake manifold -2- and -3-.



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- -> Remove upper section of intake manifold -bolts 1 and 2-

Installing

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

Notes:

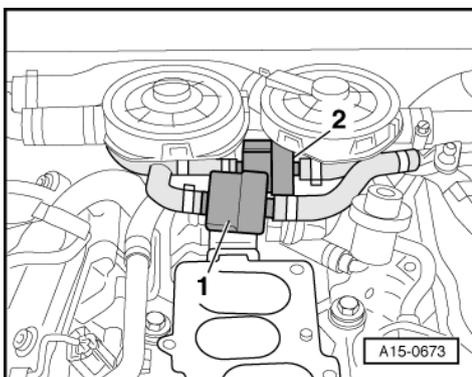
- ◆ Replace aluminium bolts.
- ◆ Replace gaskets and seals.

Tightening torques

Component	Nm
Upper section of intake manifold to lower section of intake manifold	7 + 180° 1)2)3)
Pipe connection to upper section of intake manifold	9
Side section of intake manifold to upper section of intake manifold	22
Bracket for connectors to side section of intake manifold	9

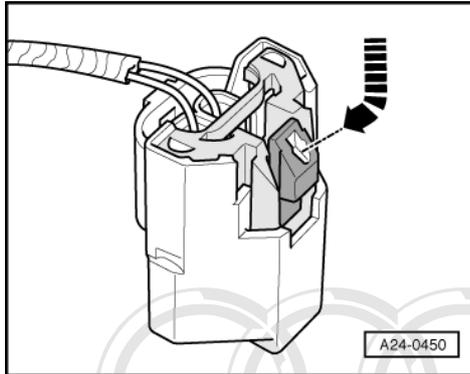
- 1) Replace bolts
- 2) 180°= 1/2 turn
- 3) Note various screw lengths

2.6 - Removing and installing lower section of intake manifold

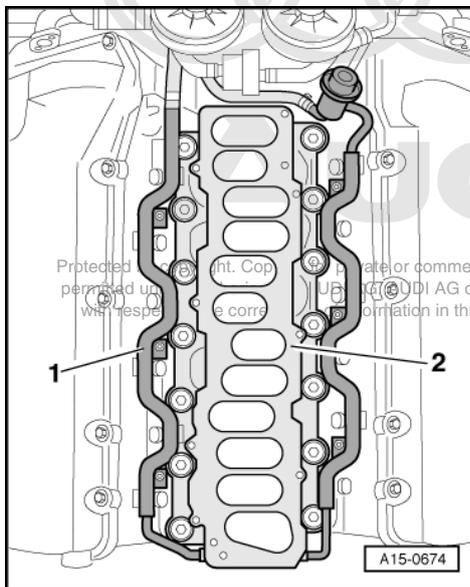


- Remove upper section of intake manifold => Page 161 .

- Press ACF valves -1- and -2- off bracket.



- -> Unplug electrical connectors on injectors, by pressing release tab down and then inwards -arrow-.



- -> Unscrew bolts for fuel rail -1-.
- Unbolt lower section of intake manifold -2-.
- Remove lower section of intake manifold together with fuel rail upwards, the fuel hoses remain connected.

Installing

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

Note:

Renew seals and gaskets.

- Press the seal lugs for the lower section of the intake manifold into the holes on the cylinder heads.
- Install lower section of intake manifold together with fuel rail.

Tightening torques

Component	Nm
Lower section of intake manifold to cylinder heads	9
Fuel rail to cylinder head	9



3 - Checking lambda control

3.1 - Checking lambda control

3.2 - Important notes relating to lambda control on 12-cylinder engine

Note:

Take five minutes to look at the arrangement of the four primary catalytic converters and the eight lambda probes in the fitting locations overview on => Page 93 or refer to the following pages.

In each case, three cylinders have their own exhaust manifold and their own primary catalytic converter. This is described as "exhaust bank".

Engine control unit 1 takes on the lambda control for cylinders 1 to 6; cylinders 1 to 6 are split into exhaust bank 1 (cylinders 1, 2 and 3) and exhaust bank 2 (cylinders 4, 5 and 6)

Engine control unit 2 takes on the lambda control for cylinders 7 to 12; cylinders 7 to 12 are split into exhaust bank 3 (cylinders 7, 8 and 9) and exhaust bank 4 (cylinders 10, 11 and 12)

Cylinders 1 to 6

If engine control unit 1 has been selected with the VAS 5051 (address word 01), then "bank 1", in relation to the lambda control, refers to the primary catalytic converter for cylinders 1, 2 and 3 and the applicable lambda probes (1.1 and 1.2). "Bank 2" refers to the primary catalytic converter for cylinders 4, 5 and 6 and the applicable lambda probes (2.1 and 2.2).

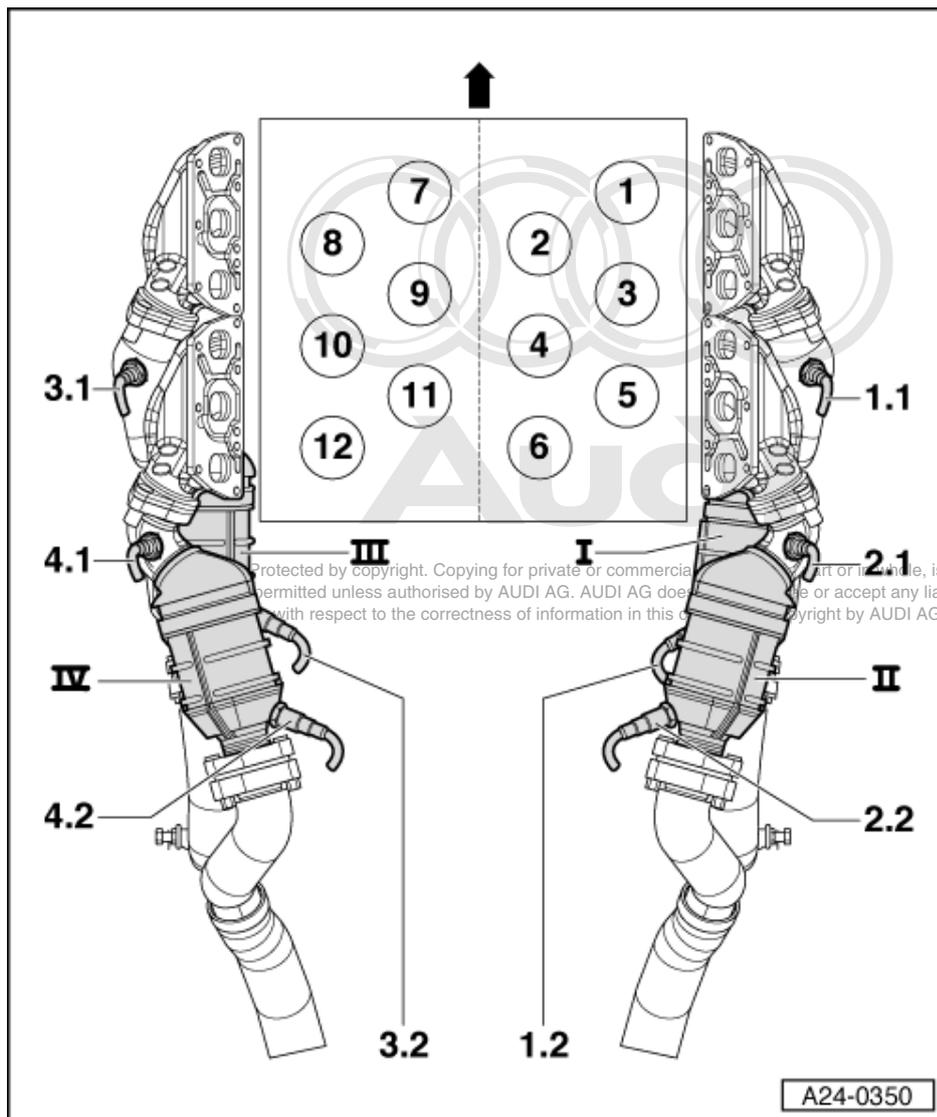
Cylinders 7 to 12

If engine control unit 2 has been selected with the VAS 5051 (address word 11), then "bank 1", in relation to the lambda control, refers to the primary catalytic converter for cylinders 7, 8 and 9 and the applicable lambda probes (3.1 and 3.2). "Bank 2" refers to the primary catalytic converter for cylinders 10, 11 and 12 and the applicable lambda probes (4.1 and 4.2).



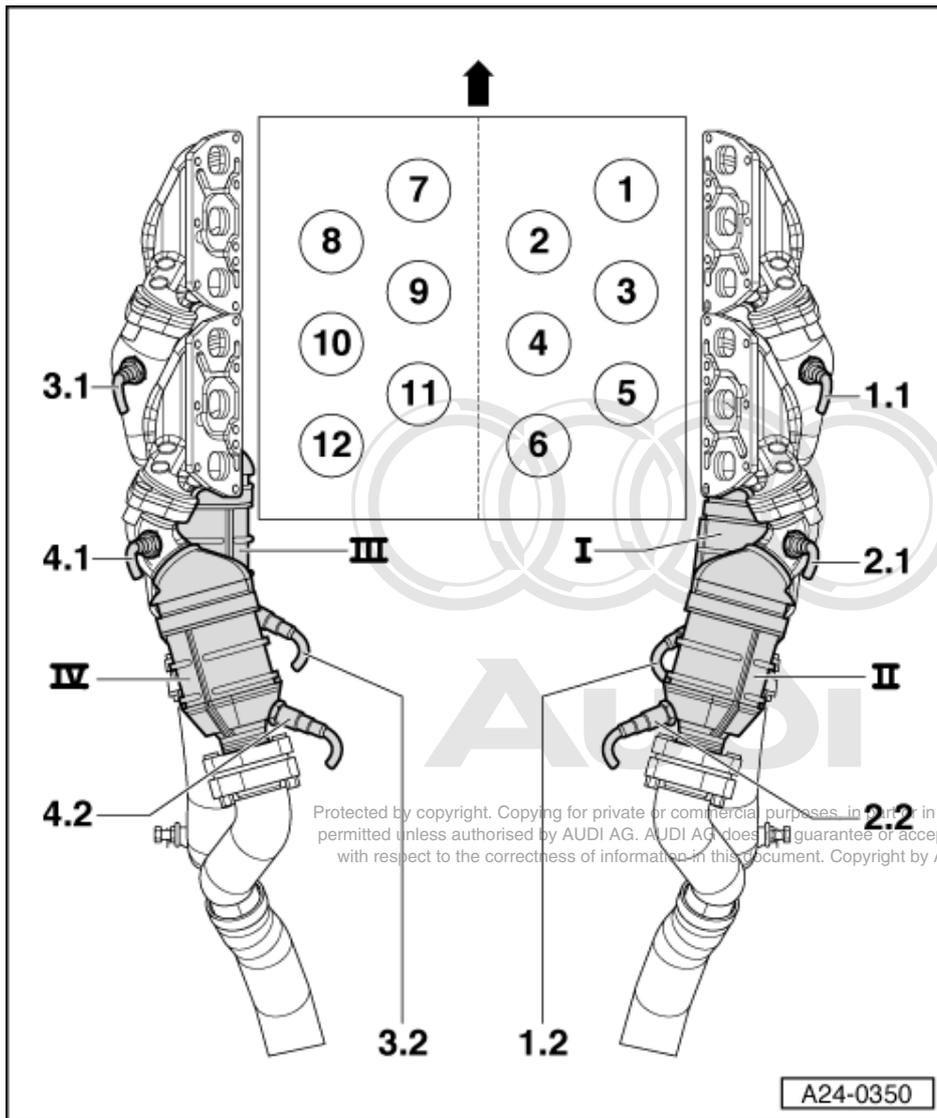
Audi

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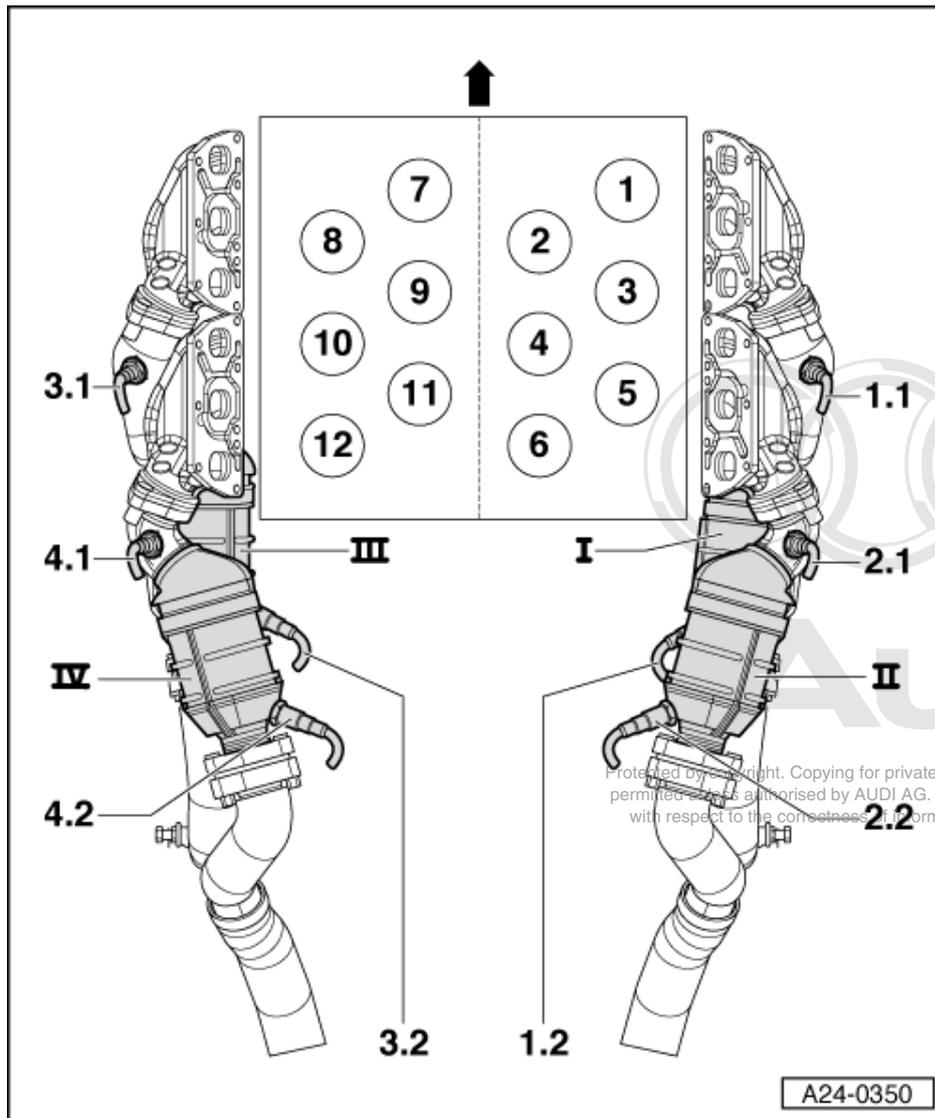


Notes:

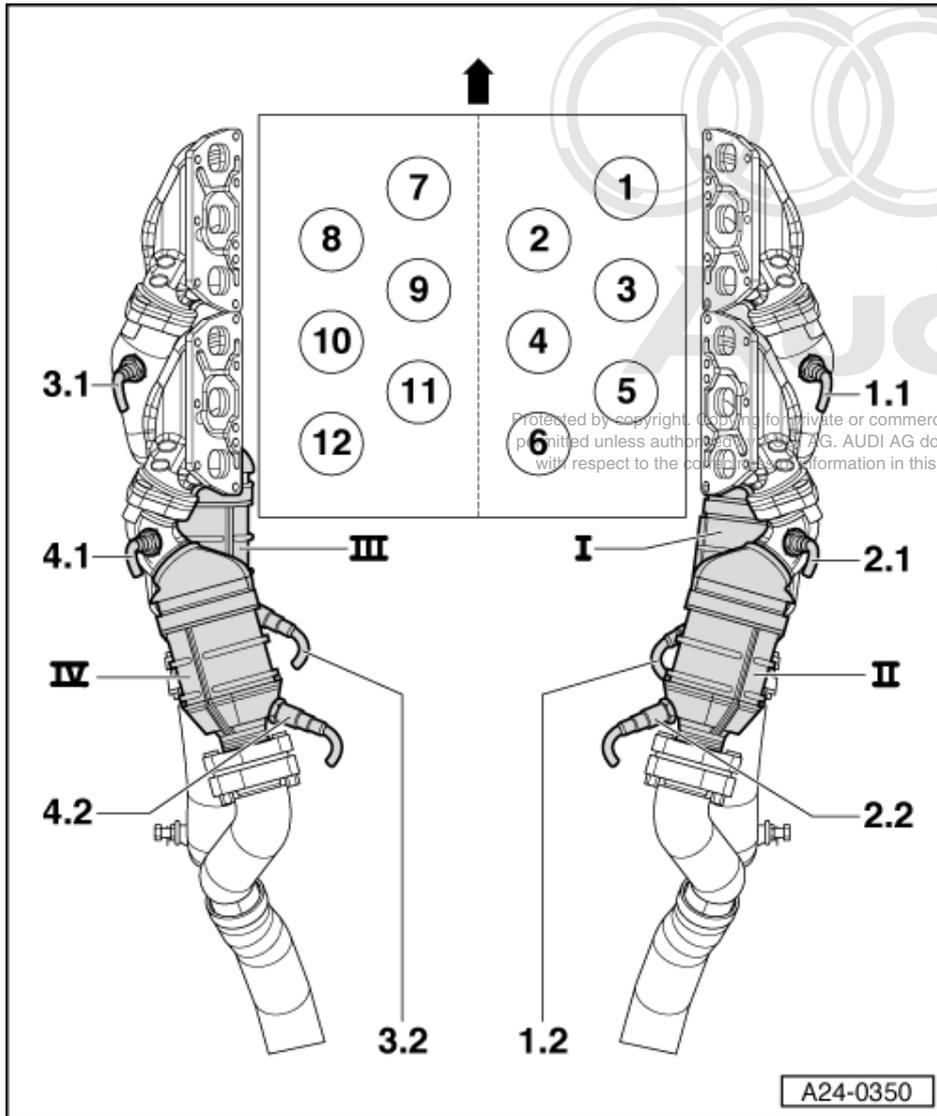
- ◆ The lambda probes, the exhaust manifold and the primary catalytic converters are shown below.
- ◆ The engine is equipped with eight lambda probes in total.
- ◆ For clarity, the crankcase is only shown schematically with the cylinders (numbers 1 to 12).
- ◆ The lambda probes, the exhaust manifold and the primary catalytic converters, however, are shown as they are actually installed in the vehicle.
- ◆ The arrow signifies the direction of travel.



- I - Primary catalytic converter for cylinders 1, 2, 3; is also described as -exhaust bank 1-
- II - Primary catalytic converter for cylinders 4, 5, 6; is also described as -exhaust bank 2-
- III - Primary catalytic converter for cylinders 7, 8, 9; is also described as -exhaust bank 3-
- IV - Primary catalytic converter for cylinders 10, 11, 12; is also described as -exhaust bank 4-
- 1.1 - Lambda probe 1 -G39 with lambda probe heating; upstream of catalytic converter
- ◆ Exhaust bank 1 (cylinders 1, 2, 3)
- 1.2 - Lambda probe 2 -G130 with lambda probe heating; downstream of catalytic converter
- ◆ Exhaust bank 1 (cylinders 1, 2, 3)



- 2.1 - Lambda probe 1 -G108 with lambda probe heating; upstream of catalytic converter
 - ◆ Exhaust bank 2 (cylinders 4, 5, 6)
- 2.2 - Lambda probe 2 -G131 with lambda probe heating; downstream of catalytic converter
 - ◆ Exhaust bank 2 (cylinders 4, 5, 6)
- 3.1 - Lambda probe 1 -G285 with lambda probe heating; upstream of catalytic converter
 - ◆ Exhaust bank 3 (cylinders 7, 8, 9)
- 3.2 - Lambda probe 2 -G287 with lambda probe heating; downstream of catalytic converter
 - ◆ Exhaust bank 3 (cylinders 7, 8, 9)



4.1 - Lambda probe 1 -G286 with lambda probe heating; upstream of catalytic converter

- ◆ Exhaust bank 4 (cylinders 10, 11, 12)

4.2 - Lambda probe 2 -G288 with lambda probe heating; downstream of catalytic converter

- ◆ Exhaust bank 4 (cylinders 10, 11, 12)

3.3 - Checking lambda control and lambda probes; operations for cylinders 1 to 6

The following operations relate to cylinders 1 to 6, i.e. to exhaust bank 1 (cylinders 1, 2 and 3) and exhaust bank 2 (cylinders 4, 5 and 6).

The operations for cylinders 7 to 12, i.e. for exhaust bank 3 (cylinders 7, 8 and 9) and exhaust bank 4 (cylinders 10, 11 and 12) can be found on =>Page 184 .

In principle, the following applies:

The ageing of the lambda probes is checked when producing the readiness code =>Page 56 .

Test requirements:

- No leaks in exhaust system.

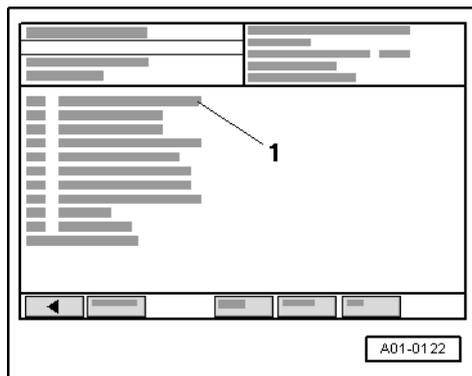
- Coolant temperature at least 80 °C.

Note:

- ◆ For specific fault search, it is possible to switch off the lambda control by selecting display group 99 "Basic setting" mode and to switch it on again by selecting display group 99 in "Read measured value block" mode.

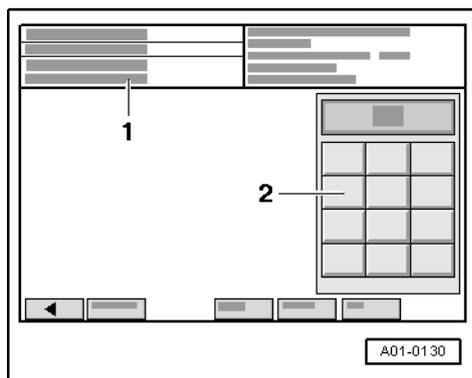
Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 and select engine control unit 1 using "address word" 01 => Page 3 .
For this purpose, the engine must be running at idle speed.



-> Display on VAS 5051:

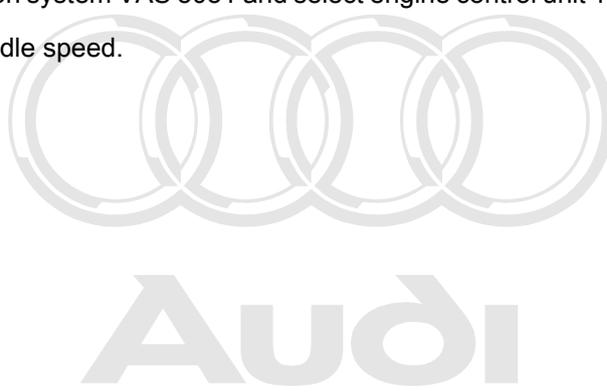
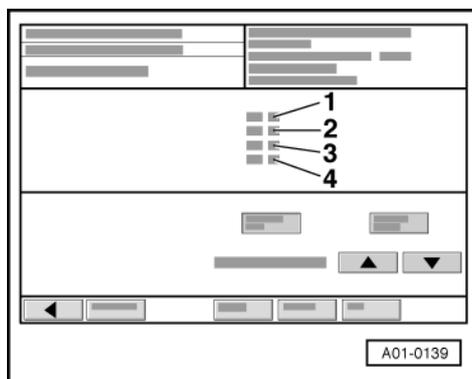
- Under -1- select the diagnostic function "04 - Basic setting".



-> Display on VAS 5051:

- 1 - Enter display group
max. input value = 255

- Enter "030" for "display group number 030" in zone -2- and confirm the entry by pressing the Q key.



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-> Display on VAS 5051:

- Check specification in display zones 1, 2, 3 and 4.

Notes:

- ◆ By increasing the engine speed the specified values are achieved more quickly.

Note:

The "lambda probe status" indicates the condition of the lambda control and the lambda probes.

	Display zones			
	1	2	3	4
Display group 030: Lambda probe status	<small>permitted unless authorized by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.</small>			
Display	XXX	XXX	XXX	XXX
Display	Lambda probe status, bank 1, probe 1 (Cyl. 1, 2, 3 primary catalytic converter)	Lambda probe status, bank 1, probe 2 (Cyl. 1, 2, 3 post catalytic converter)	Lambda probe status, bank 1, probe 2 (Cyl. 4, 5, 6 primary catalytic converter)	Lambda probe status, bank 2, probe 2 (Cylinders 4, 5, 6 post catalytic converter)
Range	0 = off 1 = on	0 = off 1 = on	0 = off 1 = on	0 = off 1 = on
Specif. value	1 1 1	1 1 0	1 1 1	1 1 0
Note:	Explanation of display => Page 177			

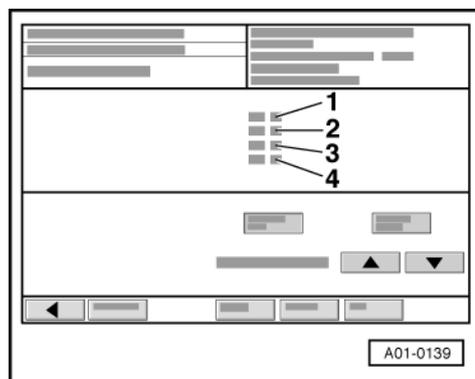
- ◆ The first digit of the 3-digit display (heating) fluctuates between 0 and 1 at certain operating points.
- ◆ The lambda control for lambda probes downstream of catalytic converter (bank 1, probe 2 and bank 2, probe 2) is not active without engine load, i.e. the last digit of the 3-digit display is 0.

Meaning of 3 digit readout of display group 30

Meaning of 3-digit readout of display group 030			
X	X	X	Display zones 1, 2, 3 and 4
		X	Lambda control: 0 = not active; 1 = active
	X		Lambda probe condition: 0 = not active; 1 = active
X			Condition of lambda probe heating: 0 = not active; 1 = active

Notes:

- ◆ For specific fault search, it is possible to switch off the lambda control by selecting display group 99 "Basic setting" mode and to switch it on again by selecting display group 99 in "Read measured value block" mode.
- ◆ On leaving function 04 "Basic setting", the lambda control is automatically re-activated.



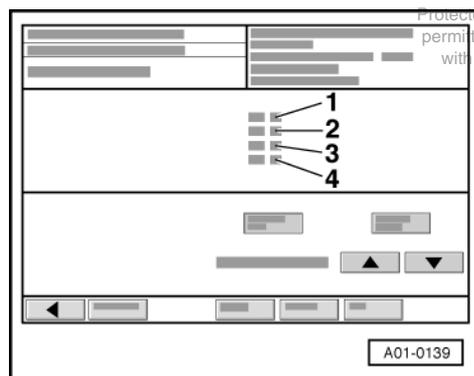
-> Display on VAS 5051:

- Only continue with the test if the displays have reached "111" at least once in display zone -1- and in display zone -3-.

Checking lambda probe learned values and lambda control

- Select the s key twice in order to change to display group 032.

	Display zones			
	1	2	3	4
Display group 32: Lambda probe-learned values at idle				
Display	xx.x %	xx.x %	xx.x %	xx.x %
Display	Lambda learned value bank 1, probe 1 at idle (range 1)	Lambda learned value bank 1, probe 1 on part throttle (range 2)	Lambda learned value bank 1, probe 2 at idle (range 1)	Lambda learned value bank 1, probe 2 on part throttle (range 2)
Range	min.: -25.0 % max.: 25.0 %	min.: -25.0 % max.: 25.0 %	min.: -25.0 % max.: 25.0 %	min.: -25.0 % max.: 25.0 %
Specified value	-5.7...5.7 % can fluctuate slightly	-15.0...15.0 % can fluctuate slightly	-5.7...5.7 % can fluctuate slightly	-15.0...15.0 % can fluctuate slightly
Note:	If the specification is not attained =>Page 174 .	If the specification is not attained =>Page 174 .	If the specification is not attained =>Page 174 .	If the specification is not attained =>Page 174 .



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-> Display on VAS 5051:

- Select the s key in order to change to display group 033.
- Check lambda control (display zones 1 to 4):

	Display zones			
	1	2	3	4
Display group 33: Lambda control at idle				
Display	xx.x %	x.xxx volts	xx.x %	x.xxx V
Display	Lambda control bank 1 (cyl. 1,2,3)	Lambda probe voltage bank 1 (cyl. 1,2,3)	Lambda control bank 2 (cyl. 4,5,6)	Lambda probe voltage bank 2 (cyl. 4,5,6)
Range	min.: -25.0 % max.: 25.0 %		min.: -25.0 % max.: 25.0 %	
Specified value	In range -10.0...10.0 % the value must fluctuate by at least 2 %	0.130...3.600 V	In range -10.0...10.0 % the value must fluctuate by at least 2 %	0.130...3.600 V



Note:	Display zones			
	If the specification is not attained =>Page 174	If the specification is not attained, see evaluation =>Page 175	If the specification is not attained =>Page 174	If the specification is not attained, see evaluation =>Page 175

Note on display zones 2 and 4:

Displayed is the lambda probe voltage signal which was prepared and smoothed in the engine control unit. 1.5 V in the display corresponds to lambda 1.

If specification is not attained in display zone 1 or display zone 3 (display group 33), or if the value does not fluctuate by at least 2 %:

- Perform test drive to free lambda probe from any possible residues and repeat the test.

If the specification is not attained in display zone 1 and display zone 3, or if the value does not fluctuate by at least 2%, even after the test drive:

- Test for leaks (unmetered air) in intake air system =>Page 151 .
- Check the lambda probe heating =>Page 177 .
- Check lambda probe signal wiring and actuation => Page 175 .
- Checking fuel pressure regulator => Page 127
- Fuel return line kinked or blocked.

Evaluation of display group 32

Display zones: 1 to 4	Possible causes of fault	Fault remedy
Lambda learned values below specified range	- Leaks in intake area	- Check intake system for leaks and rectify unmetered air =>Page 151 .
	- Oil dilution	- Carry out oil change or drive vehicle fairly fast on out-of-town roads
	- High oil consumption	
	- Air mass meter defective	- Testing air mass meter =>Page 143 .
	- Solenoid valve for activated charcoal filter stuck open	- Check solenoid valve for activated charcoal filter =>Page 198.
	- Fuel pressure too high	- Check fuel pressure regulator =>Page 127 .
	- Injector not closing	- Test injectors => Page 133 .
	- Lambda probe heating defective - Lambda probe defective	- Check lambda probe heating =>Page 177 .

Evaluation of display group 32

Display zones: 1 to 4	Possible causes of fault	Fault remedy
Lambda learnt values above specified range	- Unmetered air in intake area	- Check intake system for leaks and rectify unmetered air =>Page 151 .
	- Fuel pressure too low	- Check fuel pressure regulator =>Page 127 .
	- Air mass meter defective	- Testing air mass meter =>Page 143 .

Display zones: 1 to 4	Possible causes of fault	Fault remedy
	- Lambda probe heating defective - Lambda probe defective	- Check lambda probe heating =>Page 177 .
	- Injector only opens partially or not at all	- Test injectors => Page 133 .
	- Activated charcoal filter system - Solenoid valve sticking	- Check solenoid valve for activated charcoal filter => Page 198

Evaluation of display group 33

Display group 33	Possible causes of fault	Fault remedy
Display zone: 2 / 4		
Greater than 3.600 V	- Short to positive in wiring between lambda probe and control unit - Lambda probe defective	- Check lambda probe wiring of lambda probe upstream of catalytic converter =>Page 176 .
Less than 0.130 V	- Short to earth in wiring between lambda probe and control unit - Lambda probe defective	- Replace lambda probe upstream of catalytic converter

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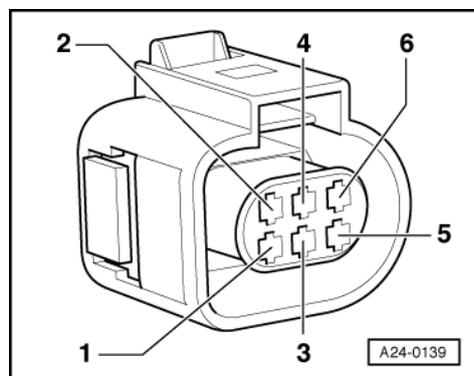
In addition, the following causes are possible:

- ◆ Slots or holes in probe head are blocked.
- ◆ Lambda probe has been subjected to excessive thermal stress.
- ◆ Contact resistance in signal wire or earth wire.
- ◆ Lambda probe too cold; lambda probe heating not working.
- ◆ Lambda probe damaged by contact spray or similar product (the contact spray is drawn into the probe through the fine cavities in the electrical wiring as a result of thermal fluctuations and capillary effects).
- ◆ Lambda probe damaged by silicone vapours (the engine draws in traces of any silicone based sealants that may have been used. The silicone does not burn and damages the lambda probe).

3.4 - Checking basic voltage of lambda probes for primary catalytic converter (cylinders 1 to 6)

Fitting locations overview => **93**

- Disconnect 6-pin connector to relevant lambda probe upstream of catalytic converter



- -> Connect multimeter between contacts 1 and 5 to measure voltage.
- Switch the ignition on.
 - Specified value: 0.400... 0.500 V
- Switch ignition off.



If specified value is not attained:

- Check the lambda probe wiring.

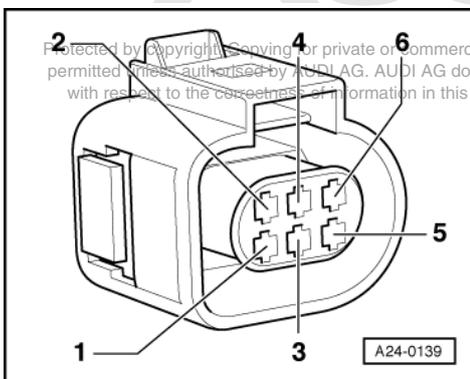
If specified value is attained:

- Replace the lambda probe upstream of catalytic converter exhaust bank 1 (cylinders 1, 2 and 3) -G39 or the lambda probe upstream of catalytic converter exhaust bank 2 (cylinders 4, 5 and 6) -G108.

Checking lambda probe wires for the primary catalytic converter lambda probes

Fitting locations overview => 93

- Disconnect 6-pin connector to relevant lambda probe upstream of catalytic converter.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit 1; the engine control unit should not be connected.
=>Page 117 .



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- -> Test for open circuit in the following wiring connections.

Connector -G39 (bank 1 probe 1) Contact	Test box V.A.G 1598/31 Socket
1	70
2	71
5	51
6	52

Connector -G108 (bank 2 probe 1) Contact	Test box V.A.G 1598/31 Socket
1	13
2	14
5	12
6	15

- Rectify open circuit, if necessary.

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

- Check for shorts between the two lines.

If the wiring is OK:

- Replace engine control unit 1

=>Page 120 .

3.5 - Checking lambda probe heating for primary catalytic converter lambda probes (cylinders 1 to 6)

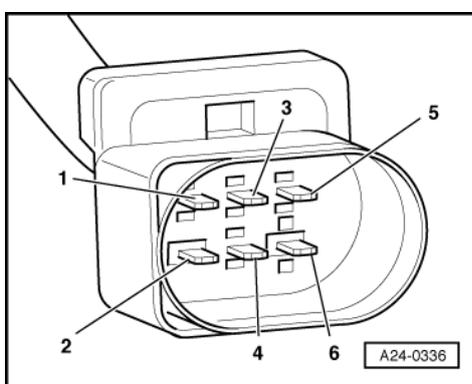
Fitting locations overview => 93

Test requirements:

- Coolant temperature at least 80 °C.
- Fuse for lambda probe heating OK.

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

Test sequence



- Disconnect 6-pin connector to relevant lambda probe upstream of catalytic converter.
- -> Connect multimeter between contacts 3 and 4 to measure resistance.
- Specified value at room temperature: 2.5...4.4 ω

When the engine is at operating temperature, the resistance is increased by approx. 4...6 ω .

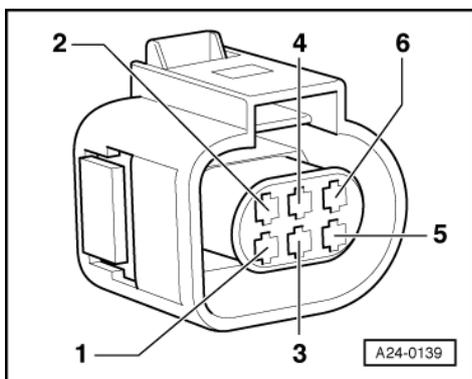
If specified value is not attained:

- Replace appropriate lambda probe upstream of catalytic converter.

If specified value is attained:

- Check the voltage supply to the lambda probe heating.

Checking voltage supply for lambda probe heating



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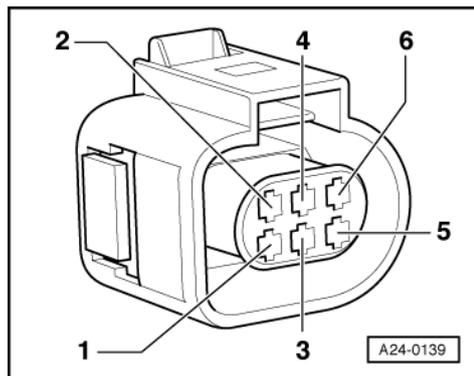


- -> Connect multimeter between contacts 3 and 4 of corresponding primary catalytic converter lambda probe to measure voltage.
- Start the engine.
 - Specified value: approx. battery voltage

Note:

Points at which lambda probe heating is switched on and off by engine control unit can be observed in the function "Reading measured value block", display group number 041/042, display zone 2.

If no voltage is present:



- -> Connect multimeter as follows to measure voltage.

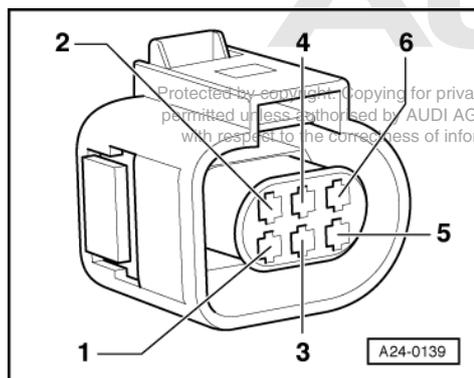
Connector Contact	Measure to
3 (positive)	Vehicle earth

- Operate starter briefly.
 - Specified value: approx. battery voltage

If no voltage is present:

- Check the wiring from contact 3 on the connector via the fuse to the fuel pump relay for an open circuit:

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



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If voltage supply is OK:

- -> Connect multimeter as follows to measure voltage:

Connector Contact	Measure to
4 (earth actuation by engine control unit)	Battery positive

- Start the engine.
 - Specified value: approx. battery voltage

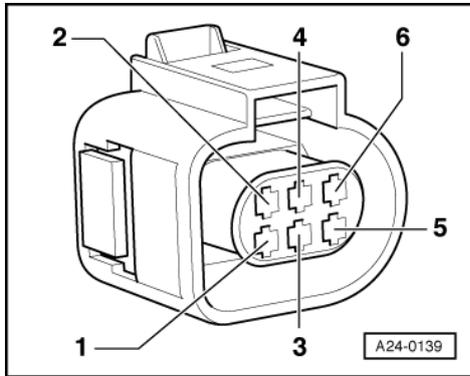
Note:

Points at which lambda probe heating is switched on and off by engine control unit can be observed in the function "Reading measured value block", display group number 041/042, display zone 2.

- Switch ignition off.

If no voltage is present:

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit 1; do not connect the engine control unit => Page **117** .



- -> Check for open circuit in the following wiring connections:

Connector -G39 (bank 1 probe 1) Contact	Test box V.A.G 1598/31 Socket
4	5

Connector -G108 (bank 2 probe 1) Contact	Test box V.A.G 1598/31 Socket
4	4

- Rectify open circuit, if necessary.

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

If wiring is OK but there is no earth supply for the lambda probe heating:

- Replace engine control unit 1
=>Page **120** .

3.6 - Checking basic voltage of lambda probes for post catalytic converter (cylinders 1 to 6)

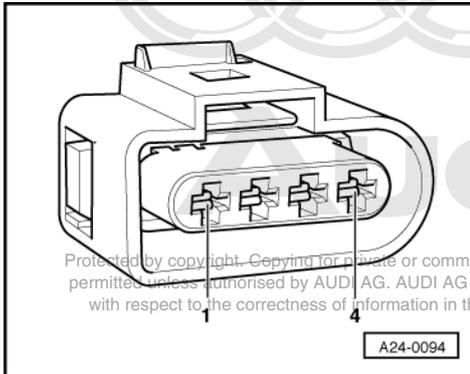
Fitting locations overview => **93**

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Checking basic voltage

- Disconnect 4-pin connector to relevant lambda probe downstream of catalytic converter.



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- -> Connect multimeter between contacts 3 and 4 to measure voltage.
- Switch the ignition on.
 - Specified value: 0.400 ... 0.500 V
- Switch ignition off.

If specified value is not attained:

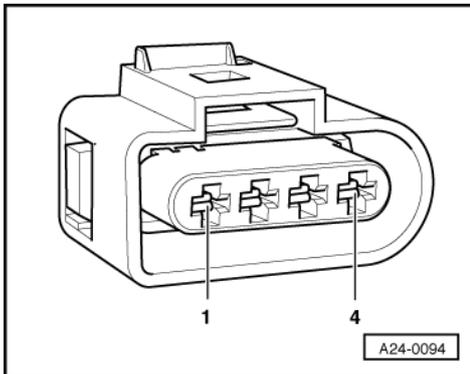
- Check the lambda probe wiring.

If specified value is attained:

- Replace appropriate lambda probe downstream of catalytic converter.

Checking lambda probe wiring

- Disconnect 4-pin connector to relevant lambda probe downstream of catalytic converter.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit 1; do not connect the engine control unit => Page 117 .



- -> Test for open circuit in the following wiring connections.

Connector -G130 (bank 1 probe 2) Contact	Test box V.A.G 1598/31 Socket
3	68
4	69

Connector -G131 (bank 2 probe 2) Contact	Test box V.A.G 1598/31 Socket
3	10

Connector -G131 (bank 2 probe 2) Contact	Test box V.A.G 1598/31 Socket
4	11

- Rectify open circuit, if necessary.

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

- Check for shorts between the two lines.

If the wiring is OK:

- Replace engine control unit 1
=>Page **120** .

3.7 - Checking lambda probe heating for post catalytic converter lambda probes (cylinders 1 to 6)

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Fitting locations overview => **93**

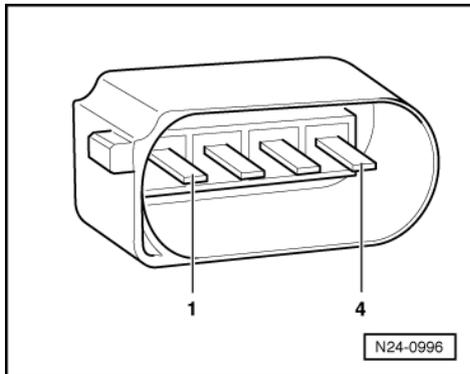
Test requirements:

- Coolant temperature at least 80 °C.
- Fuse for lambda probe heating OK.

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

Test sequence

- Disconnect 4-pin connector to relevant lambda probe downstream of catalytic converter.



- -> Connect multimeter between contacts 1 and 2 to measure resistance.
 - Specified value at room temperature: 1.0 ... 20.0 ω

If specified value is not attained:

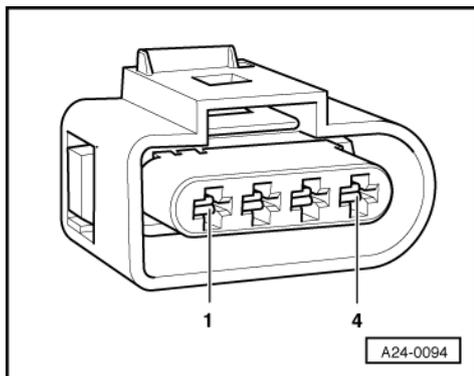
- Replace appropriate lambda probe downstream of catalytic converter.

If specified value is attained:

- Check the voltage supply to the lambda probe heating.



Checking voltage supply for lambda probe heating

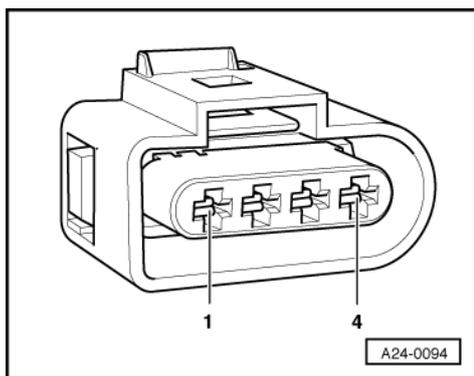


- -> Connect multimeter between contacts 1 (positive) and 2 (earth) to measure voltage.
- Start the engine.
 - Specified value: approx. battery voltage

Note:

At certain operating points, the engine control unit "cycles" the earth for the lambda probe heating. This means that at these points, the earth is continuously switched on and off. For this reason, the voltage reading on the tester may fluctuate.

If no voltage is present:



- -> Connect multimeter as follows to measure voltage:

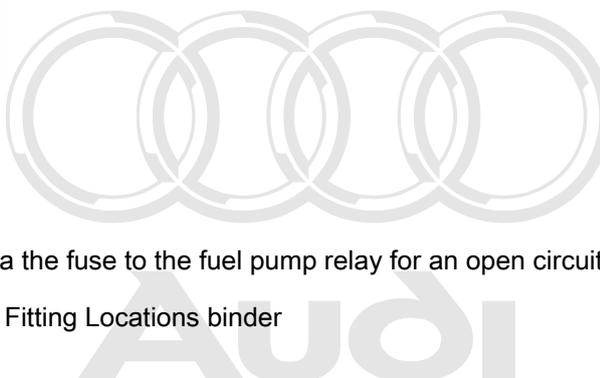
Connector Contact	Measure to
1 (positive)	Vehicle earth

- Operate starter briefly.
 - Specified value: approx. battery voltage

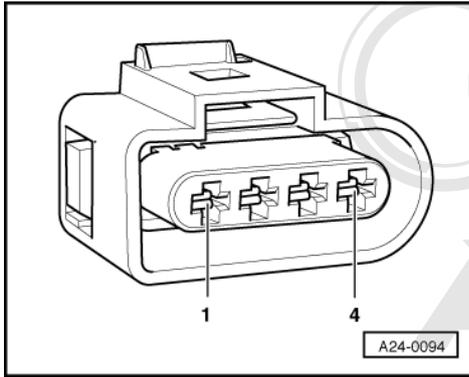
If no voltage is present:

- Check the wiring from contact 1 on the connector via the fuse to the fuel pump relay for an open circuit:

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



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If voltage supply is OK:

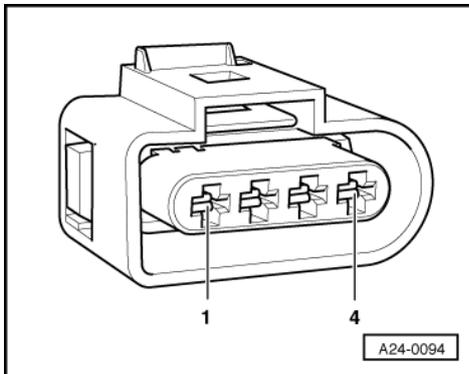
- -> Connect multimeter as follows to measure voltage:

Connector Contact	Measure to
2 (earth actuation by engine control unit)	Battery positive

- Start the engine.
 - Specified value: approx. battery voltage, may fluctuate
- Switch ignition off.

If no voltage is present:

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit 1; the engine control unit should not be connected =>Page 117 .



- -> Check for open circuit in the following wiring connections:

Connector -G130 (bank 1 probe 2) Contact	Test box V.A.G 1598/31 Socket
2	63

Connector -G131 (bank 2 probe 2) Contact	Test box V.A.G 1598/31 Socket
2	6

- Rectify open circuit, if necessary.

If wiring is OK but there is no earth supply for the lambda probe heating:



- Replace engine control unit => Page 120 .

3.8 - Checking lambda control and lambda probes; operations for cylinders 7 to 12

In principle, the following applies:

The ageing of the lambda probes is checked when producing the readiness code =>Page 56 .

Test requirements:

- No leaks in exhaust system
- Coolant temperature at least 80 °C.

Note:

- ♦ For specific fault search, it is possible to switch off the lambda control by selecting display group 99 "Basic setting" mode and to switch it on again by selecting display group 99 in "Read measured value block" mode.

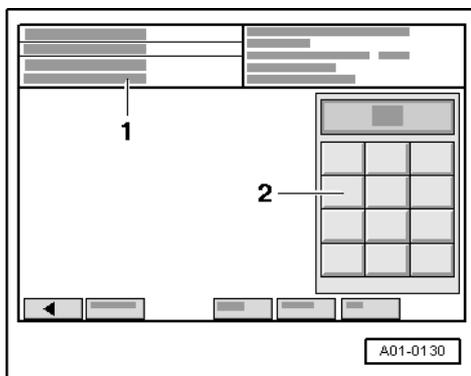
Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 and select engine control unit 2 using "address word" 11 => Page 3 .
For this purpose, the engine must be running at idle speed.



-> Display on VAS 5051:

- Under -1- select the diagnostic function "04 - Basic setting".



-> Display on VAS 5051:

- 1 - Enter display group

max. input value = 255

- Enter "030" for "display group number 030" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Check specification in display zones 1, 2, 3 and 4.

Notes:

- ◆ By increasing the engine speed the specified values are achieved more quickly.

Note:

The "lambda probe status" indicates the condition of the lambda control and the lambda probes.

	Display zones			
	1	2	3	4
Display group 030: Lambda probe status				
Display	X X X	X X X	X X X	X X X
Display	Lambda probe status, bank 1, probe 1 (Cyl. 7, 8, 9 primary catalytic converter)	Lambda probe status, bank 1, probe 2 (Cyl. 7, 8, 9 post catalytic converter)	Lambda probe status, bank 1, probe 2 (Cyl. 10, 11, 12 primary catalytic converter)	Lambda probe status, bank 2, probe 2 (Cyl. 10, 11, 12 post catalytic converter)
Range	0 = off 1 = on	0 = off 1 = on	0 = off 1 = on	0 = off 1 = on
Specif. value	1 1 1	1 1 0	1 1 1	1 1 0
Note:	Explanation of display => Page 190 .			

- ◆ The first digit of the 3-digit display (heating) fluctuates between 0 and 1 at certain operating points.
- ◆ The lambda control for lambda probes downstream of catalytic converter (bank 1, probe 2 and bank 2, probe 2) is not active without engine load, i.e. the last digit of the 3-digit display is 0.

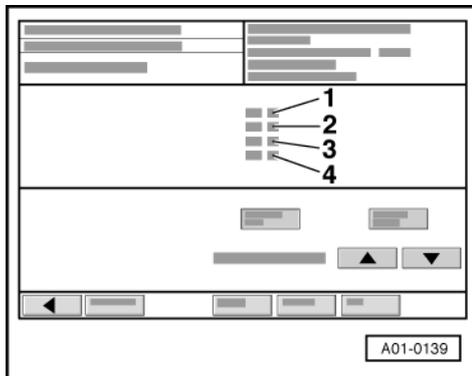
Meaning of 3 digit readout of display group 30

Meaning of 3-digit readout of display group 030			
X	X	X	Display zones 1, 2, 3 and 4
		X	Lambda control: 0 = not active; 1 = active
	X		Lambda probe condition: 0 = not active; 1 = active
X			Condition of lambda probe heating: 0 = not active; 1 = active



Notes:

- ♦ For specific fault search, it is possible to switch off the lambda control by selecting display group 99 "Basic setting" mode and to switch it on again by selecting display group 99 in "Read measured value block" mode.
- ♦ On leaving function 04 "Basic setting", the lambda control is automatically re-activated.



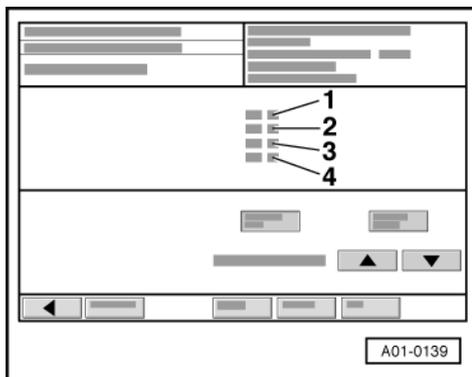
-> Display on VAS 5051:

- Only continue with the test if the displays have reached "111" at least once in display zone -1- and in display zone -3-.

Checking lambda probe learned values and lambda control

- Select the s key twice in order to change to display group 032.

	Display zones			
	1	2	3	4
Display group 32: Lambda probe-learned values at idle				
Display	xx.x %	xx.x %	xx.x %	xx.x %
Display	Lambda learned value bank 1, probe 1 at idle (range 1)	Lambda learned value bank 1, probe 1 on part throttle (range 2)	Lambda learned value bank 1, probe 2 at idle (range 1)	Lambda learned value bank 1, probe 2 on part throttle (range 2)
Range	min.: -25.0 % max.: 25.0 %	min.: -25.0 % max.: 25.0 %	min.: -25.0 % max.: 25.0 %	min.: -25.0 % max.: 25.0 %
Specified value	-5.7...5.7 % can fluctuate slightly	-15.0...15.0 % can fluctuate slightly	-5.7...5.7 % can fluctuate slightly	-15.0...15.0 % can fluctuate slightly
Note:	If the specification is not attained =>Page 188 .	If the specification is not attained =>Page 188 .	If the specification is not attained =>Page 188 .	If the specification is not attained =>Page 188 .



-> Display on VAS 5051:

- Select the s key in order to change to display group 033.
- Check lambda control (display zones 1 to 4):

	Display zones			
	1	2	3	4
Display group 33: Lambda control at idle				
Display	xx.x %	x.xxx volts	xx.x %	x.xxx V
Display	Lambda control bank 1 (cyl. 7,8,9)	Lambda probe voltage bank 1 (cyl. 7,8,9)	Lambda control bank 2 (cyl. 10,11,12)	Lambda probe voltage bank 2 (cyl. 10,11,12)
Range	min.: -25.0 % max.: 25.0 %		min.: -25.0 % max.: 25.0 %	
Specified value	In range -10.0...10.0 % the value must fluctuate by at least 2 %	0.130...3.600 V	In range -10.0...10.0 % the value must fluctuate by at least 2 %	0.130...3.600 V
Note:	If the specification is not attained =>Page 187 .	If the specification is not attained, see evaluation =>Page 188	If the specification is not attained =>Page 187 .	If the specification is not attained, see evaluation =>Page 188

Note on display zones 2 and 4:

Displayed is the lambda probe voltage signal which was prepared and smoothed in the engine control unit. 1.5 V in the display corresponds to lambda 1.

If specification is not attained in display zone 1 or display zone 3 (display group 33), or if the value does not fluctuate by at least 2 %:

- Perform test drive to free lambda probe from any possible residues and repeat the test.

If the specification is not attained in display zone 1 and display zone 3, or if the value does not fluctuate by at least 2%, even after the test drive:

- Test for leaks (unmetered air) in intake air system =>Page 151 .
- Check the lambda probe heating =>Page 190 .
- Check lambda probe signal wiring and actuation => Page 188 .
- Checking fuel pressure regulator => Page 127
- Fuel return line kinked or blocked.

Evaluation of display group 32

Display zones: 1 to 4	Possible causes of fault	Fault remedy
Lambda learned values below specified range	- Leaks in intake area	- Check intake system for leaks and rectify unmetered air =>Page 151 .
	- Oil dilution	- Carry out oil change or drive vehicle fairly fast on out-of-town roads
	- High oil consumption	
	- Air mass meter defective	- Check air mass meter =>Page 143 .
	- Solenoid valve for activated charcoal filter stuck open	- Check solenoid valve for activated charcoal filter => Page 198
	- Fuel pressure too high	- Check fuel pressure regulator =>Page 127 .



Display zones: 1 to 4	Possible causes of fault	Fault remedy
	- Injector does not close	- Check injectors => Page 133 .
	- Lambda probe heating defective - Lambda probe defective	- Check lambda probe heating =>Page 190 .

Evaluation of display group 32

Display zones: 1 to 4	Possible causes of fault	Fault remedy
Lambda learnt values above specified range	- Unmetered air in intake area	- Check intake system for leaks and rectify unmetered air =>Page 151 .
	- Fuel pressure too low	- Check fuel pressure regulator =>Page 127 .
	- Air mass meter defective	- Check air mass meter =>Page 143 .
	- Lambda probe heating defective - Lambda probe defective	- Check lambda probe heating =>Page 190 .
	- Injector only opens partially or not at all	- Check injectors => Page 133 .
	- Activated charcoal filter system solenoid valve sticking	- Check solenoid valve for activated charcoal filter => Page 198 .

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Evaluation of display group 33

Display group 33	Possible causes of fault	Fault remedy
Display zone: 2 / 4		
Greater than 3.600 V	- Short to positive in wiring between lambda probe and control unit - Lambda probe defective	- Check lambda probe wiring of lambda probe upstream of catalytic converter =>Page 188 .
Less than 0.130 V	- Short to earth in wiring between lambda probe and control unit - Lambda probe defective	- Replace lambda probe upstream of catalytic converter

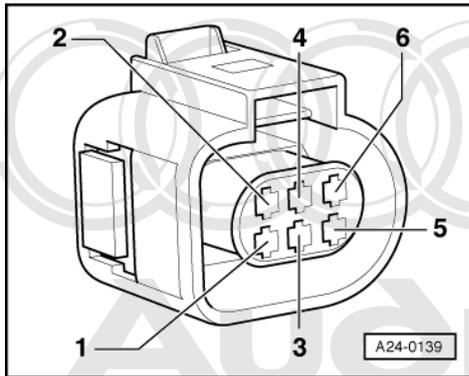
In addition, the following causes are possible:

- ♦ Slots or holes in probe head are blocked.
- ♦ Lambda probe has been subjected to excessive thermal stress.
- ♦ Contact resistance in signal wire or earth wire.
- ♦ Lambda probe too cold; lambda probe heating not working.
- ♦ Lambda probe damaged by contact spray or similar product (the contact spray is drawn into the probe through the fine cavities in the electrical wiring as a result of thermal fluctuations and capillary effects).
- ♦ Lambda probe damaged by silicone vapours (the engine draws in traces of any silicone based sealants that may have been used. The silicone does not burn and damages the lambda probe).

3.9 - Checking basic voltage of lambda probes for primary catalytic converter (cylinders 7 to 12)

Fitting locations overview => 93

- Disconnect 6-pin connector to relevant lambda probe upstream of catalytic converter



- -> Connect multimeter between contacts 1 and 5 to measure voltage.

Switch the ignition on.

Specified value: 0.400 - 0.500 V

Switch ignition off.

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If specified value is not attained:

- Check the lambda probe wiring.

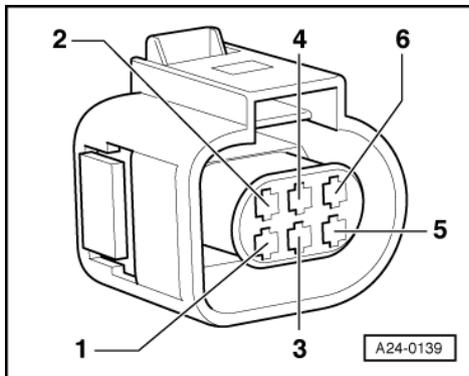
If specified value is attained:

- Replace the lambda probe upstream of catalytic converter exhaust bank 3 (cylinders 7, 8 and 9) -G285 or the lambda probe upstream of catalytic converter exhaust bank 4 (cylinders 10, 11 and 12) -G286.

Checking lambda probe wires for the primary catalytic converter lambda probes

Fitting locations overview => 93

- Disconnect 6-pin connector to relevant lambda probe upstream of catalytic converter.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit 2; the engine control unit should not be connected =>Page 117 .



- -> Test for open circuit in the following wiring connections.

Connector -G285 (bank 1 probe 1) Contact	Test box V.A.G 1598/31 Socket
1	70
2	71
5	51
6	52

Connector -G286 (bank 2 probe 1) Contact	Test box V.A.G 1598/31 Socket
1	13



Connector -G286 (bank 2 probe 1) Contact	Test box V.A.G 1598/31 Socket
2	14
5	12
6	15

- Rectify open circuit, if necessary.

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

- Check for shorts between the two lines.

If the wiring is OK:

- Replace engine control unit 2
=>Page 120 .

3.10 - Checking lambda probe heating for primary catalytic converter lambda probes (cylinders 7 to 12)

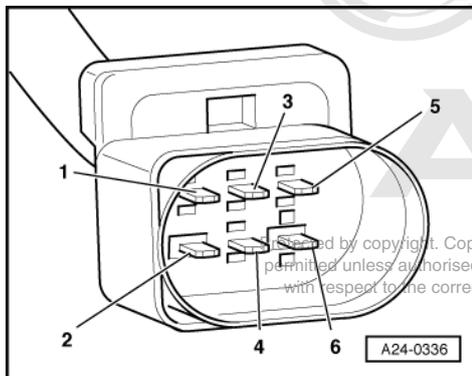
Fitting locations overview => 93

Test requirements:

- Coolant temperature at least 80 °C.
- Fuse for lambda probe heating OK.

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

Test sequence



- Disconnect 6-pin connector to relevant lambda probe upstream of catalytic converter.
- -> Connect multimeter between contacts 3 and 4 to measure resistance.
- Specified value at room temperature: 2.5 ... 4.4 ω

When the engine is at operating temperature, the resistance is increased by approx. 4 ... 6 ω .

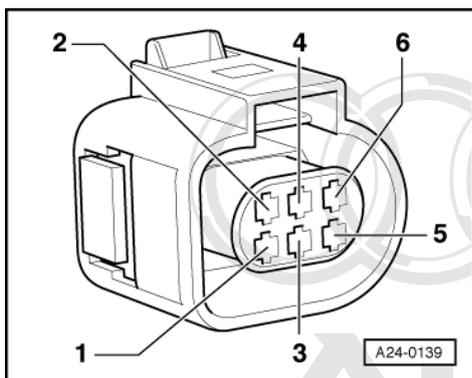
If specified value is not attained:

- Replace appropriate lambda probe upstream of catalytic converter.

If specified value is attained:

- Check the voltage supply to the lambda probe heating.

Checking voltage supply for lambda probe heating

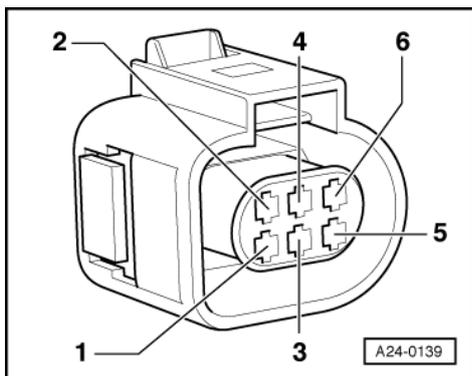


- -> Connect multimeter between contacts 3 and 4 of corresponding primary catalytic converter lambda probe to measure voltage.
- Start the engine.
 - Specified value: approx. battery voltage

Note:

Points at which lambda probe heating is switched on and off by engine control unit can be observed in the function "Reading measured value block", display group number 041/042, display zone 2.

If no voltage is present:



- -> Connect multimeter as follows to measure voltage.

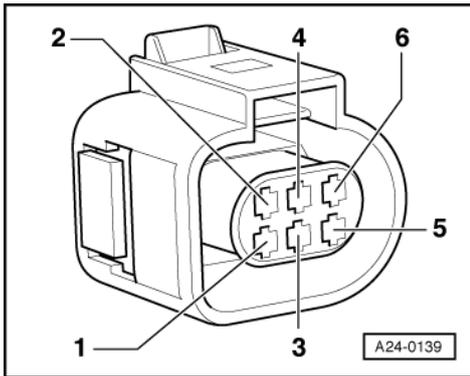
Connector Contact	Measure to
3 (positive)	Vehicle earth

- Operate starter briefly.
 - Specified value: approx. battery voltage

If no voltage is present:

- Check the wiring from contact 3 on the connector via the fuse to the fuel pump relay for an open circuit:

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



If voltage supply is OK:

- -> Connect multimeter as follows to measure voltage:

Connector Contact	Measure to
4 (earth actuation by engine control unit)	Battery positive

- Start the engine.
 - Specified value: approx. battery voltage

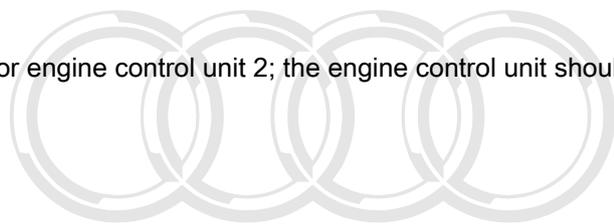
Note:

Points at which lambda probe heating is switched on and off by engine control unit can be observed in the function "Reading measured value block", display group number 041/042, display zone 2.

- Switch ignition off.

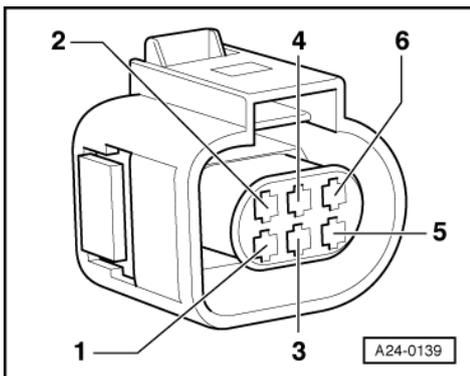
If no voltage is present:

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit 2; the engine control unit should not be connected.
=>Page 117 .



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- -> Check for open circuit in the following wiring connections:

Connector -G285 (bank 1 probe 1) Contact	Test box V.A.G 1598/31 Socket
4	5

Connector -G286 (bank 2 probe 1) Contact	Test box V.A.G 1598/31 Socket
4	4

- Rectify open circuit, if necessary.

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

If wiring is OK but there is no earth supply for the lambda probe heating:

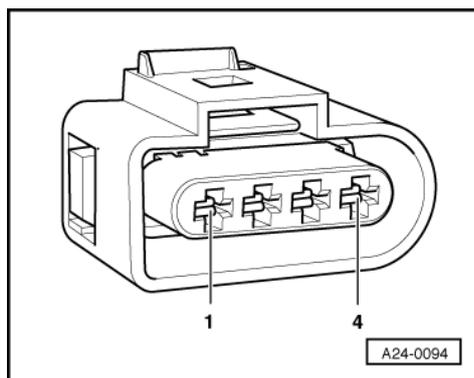
- Replace engine control unit 2
=>Page **120** .

3.11 - Checking basic voltage of lambda probes for post catalytic converter (cylinders 7 to 12)

Fitting locations overview => **93**

Checking basic voltage

- Disconnect 4-pin connector to relevant lambda probe downstream of catalytic converter.



- -> Connect multimeter between contacts 3 and 4 to measure voltage.
- Switch the ignition on.
 - Specified value: 0.400 ... 0.500 V
- Switch ignition off.

If specified value is not attained:

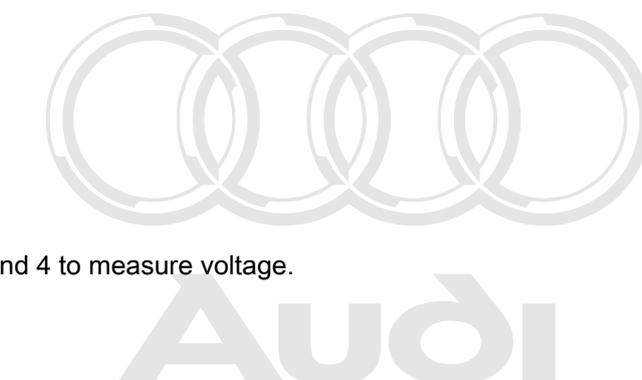
- Check the lambda probe wiring.

If specified value is attained:

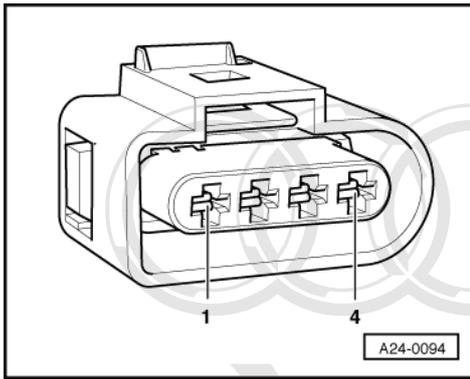
- Replace appropriate lambda probe downstream of catalytic converter.

Checking lambda probe wiring

- Disconnect 4-pin connector to relevant lambda probe downstream of catalytic converter.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit 2; the engine control unit should not be connected =>Page **117** .



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- -> Test for open circuit in the following wiring connections.

Connector -G287 (bank 1 probe 2) Contact	Test box V.A.G 1598/31 Socket
3	68
4	69

Connector -G288 (bank 2 probe 2) Contact	Test box V.A.G 1598/31 Socket
3	10
4	11

- Rectify open circuit, if necessary.

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

- Check for shorts between the two lines.

If the wiring is OK:

- Replace engine control unit 2
=>Page 120 .

3.12 - Checking lambda probe heating for post catalytic converter lambda probes (cylinders 7 to 12)

Fitting locations overview => 93

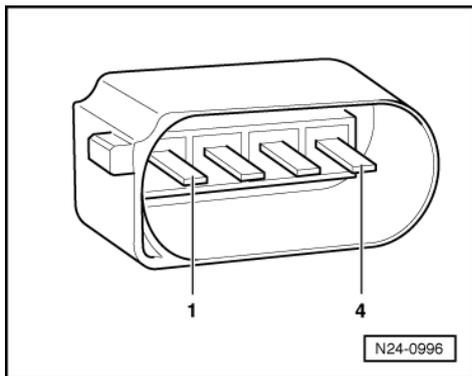
Test requirements:

- Coolant temperature at least 80 °C.
- Fuse for lambda probe heating OK.

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

Test sequence

- Disconnect 4-pin connector to relevant lambda probe downstream of catalytic converter.



- -> Connect multimeter between contacts 1 and 2 to measure resistance.
- Specified value at room temperature: 1.0 ... 20.0 ω

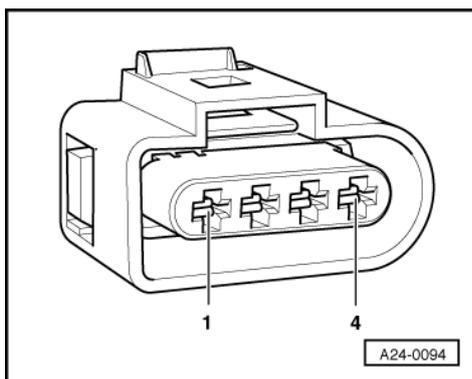
If specified value is not attained:

- Replace appropriate lambda probe downstream of catalytic converter.

If specified value is attained:

- Check the voltage supply to the lambda probe heating.

Checking voltage supply for lambda probe heating

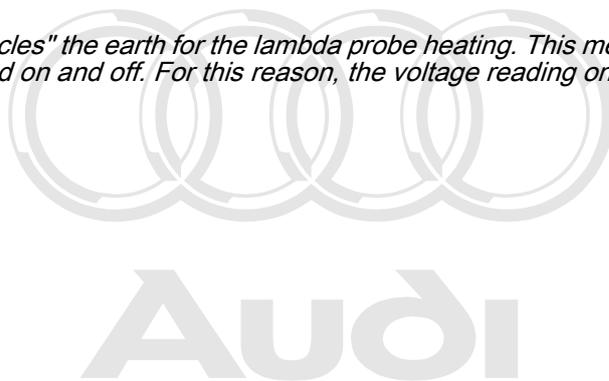
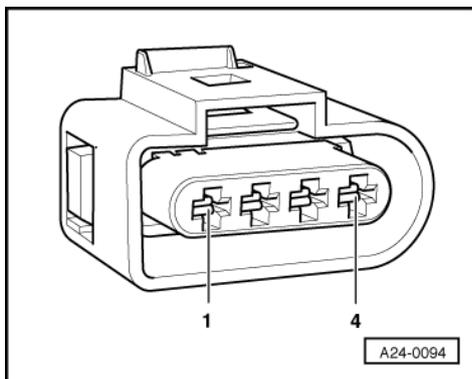


- -> Connect multimeter between contacts 1 (positive) and 2 (earth) to measure voltage.
- Start the engine.
- Specified value: approx. battery voltage

Note:

At certain operating points, the engine control unit "cycles" the earth for the lambda probe heating. This means that at these points, the earth is continuously switched on and off. For this reason, the voltage reading on the tester may fluctuate.

If no voltage is present:



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- -> Connect multimeter as follows to measure voltage:

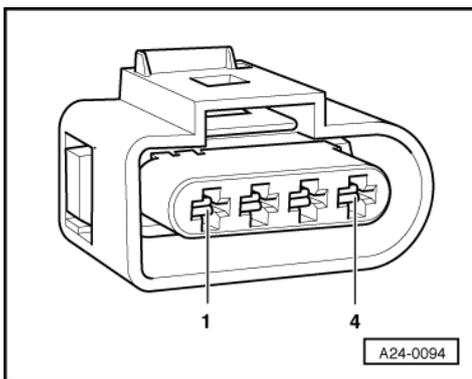
Connector Contact	Measure to
1 (positive)	Vehicle earth

- Operate starter briefly.
- Specified value: approx. battery voltage

If no voltage is present:

- Check the wiring from contact 1 on the connector via the fuse to the fuel pump relay for an open circuit:

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



If voltage supply is OK:

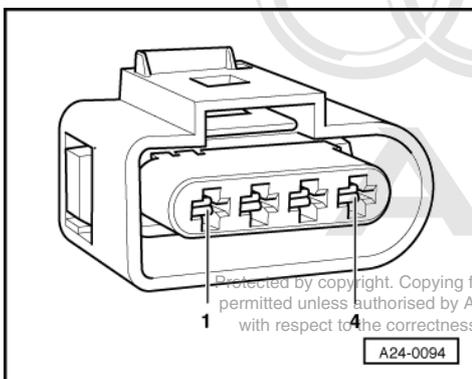
- -> Connect multimeter as follows to measure voltage:

Connector Contact	Measure to
2 (earth actuation by engine control unit)	Battery positive

- Start the engine.
- Specified value: approx. battery voltage, may fluctuate
- Switch ignition off.

If no voltage is present:

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit 2; the engine control unit should not be connected =>Page 117 .



- -> Check for open circuit in the following wiring connections:

Connector -G287 (bank 1 probe 2) Contact	Test box V.A.G 1598/31 Socket
2	63
Connector -G288 (bank 2 probe 2) Contact	Test box V.A.G 1598/31 Socket
2	6

- Rectify open circuit, if necessary.

If wiring is OK but there is no earth supply for the lambda probe heating:

- Replace engine control unit 2
=>Page 120 .

3.13 - Removing and installing lambda probes

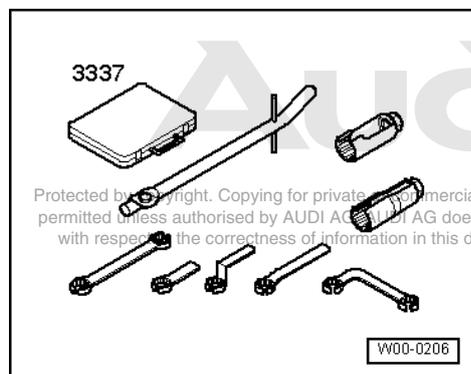
Removing

Important note:

Looking into the engine compartment, and looking at the exhaust manifold for cylinders 1 to 6 (cylinder bank 1) and for cylinders 7 to 12 (cylinder bank 2) from the front, two lambda probes for each cylinder bank will be seen. These are the applicable primary catalytic converter probes. Please do not confuse these with the post catalytic converter probes. The four post catalytic converter probes are not visible from above.

In order to replace the applicable primary catalytic converter probe, power unit must not be removed.

In order to replace the applicable post catalytic converter probe, power unit must be removed.



- Disconnect the connector to the applicable lambda probe => fitting location => Page 93 .
- -> Remove relevant lambda probe using special tool from special tool case 3337.

When installing, note the following points:

Notes:

- ◆ When installing, the lambda probe wire must be secured in exactly the same position as before in order to avoid contact between the wire and the exhaust pipe.
- ◆ The screw thread on the lambda probe is coated with assembly paste. This paste must not be allowed to penetrate the openings on the probe.
- ◆ Tightening torque 55 Nm.



4 - Checking fuel tank breather

4.1 - Checking fuel tank breather

4.2 - Checking solenoid valve 1 for activated charcoal filter -N80 (fuel tank breather valve)

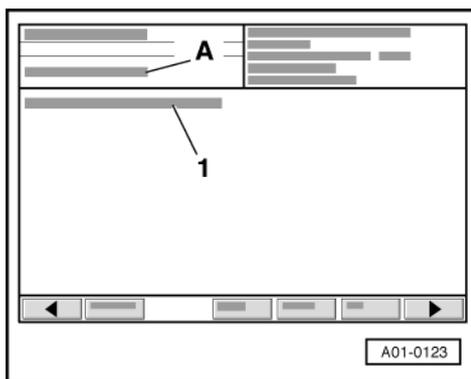
Fitting locations overview => 93

Testing for leaks

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ACF solenoid valve -N80 remains closed when deenergised.

- Disconnect hoses from ACF valve but leave the electrical connector plugged in.
- Connect auxiliary hose to one connection of ACF valve.
- Connect vehicle diagnostic, testing and information system VAS 5051 and select engine control unit 1 using "address word" 01 => Page 3 .
For this purpose, the ignition must be switched on.
- Initiate final control diagnosis and actuate ACF solenoid valve -N80 =>Page 46 .



-> Display on VAS 5051:

- A - 1st control element in test
- 1 - Fuel tank breather valve -N80

- ◆ The valve should click ...
- ◆ ... and should open and close (check by blowing into the auxiliary hose).

If the injector does not click:

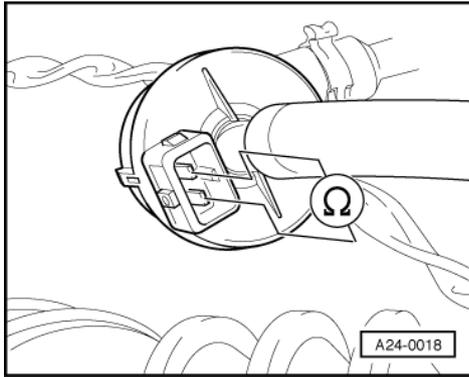
- Checking internal resistance to ACF valve.

If valve does not open or close properly:

- Replace solenoid valve for activated charcoal filter -N80.

Checking internal resistance

- Unplug connector on ACF valve.



- -> Connect multimeter between contacts 1 and 2 on valve to measure resistance.
- Specified value: 22 ... 30 ω

If specification is not attained:

- Replace solenoid valve for activated charcoal filter -N80.

If specified value is attained:

- Check the voltage supply =>Page 199 .

Checking power supply

Test requirements:

- Fuse for ACF valve OK.

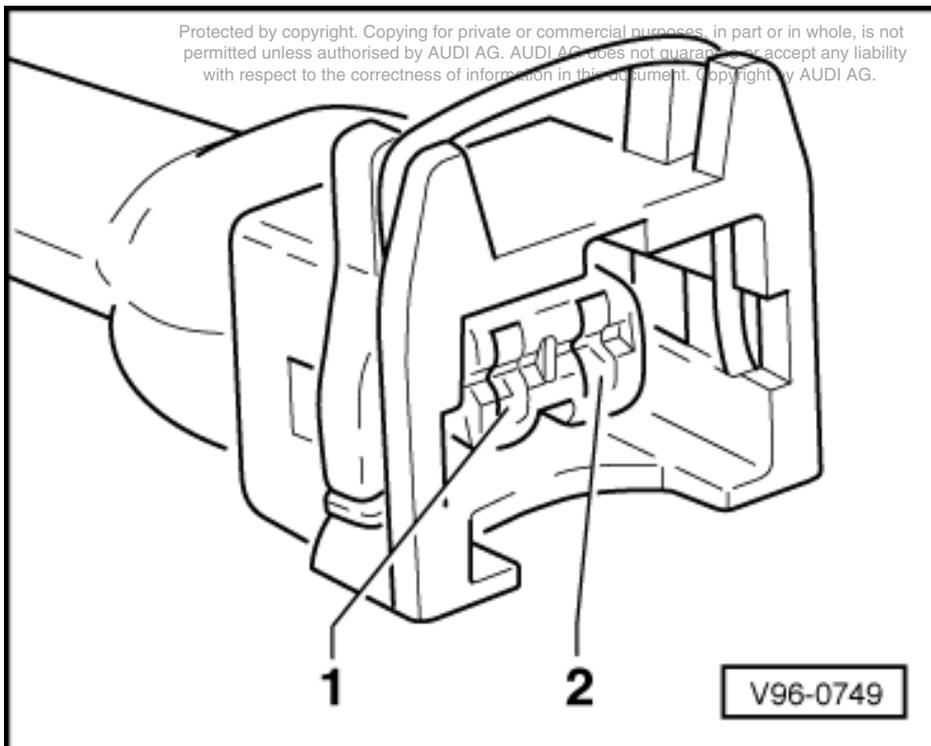
=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

- Fuel pump relay OK.

Note:

The ACF valve receives its power supply via the fuel pump relay.

- Unplug connector on ACF valve.





- -> Connect voltage tester V.A.G 1527 B as follows:

Connector Contact	Measure to
1	Engine earth

- Operate the starter briefly (the engine may start).
 - The LED should illuminate.

If the LED does not illuminate:

- Check the wiring from contact 1 on the connector via the fuse to the fuel pump relay for an open circuit:

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

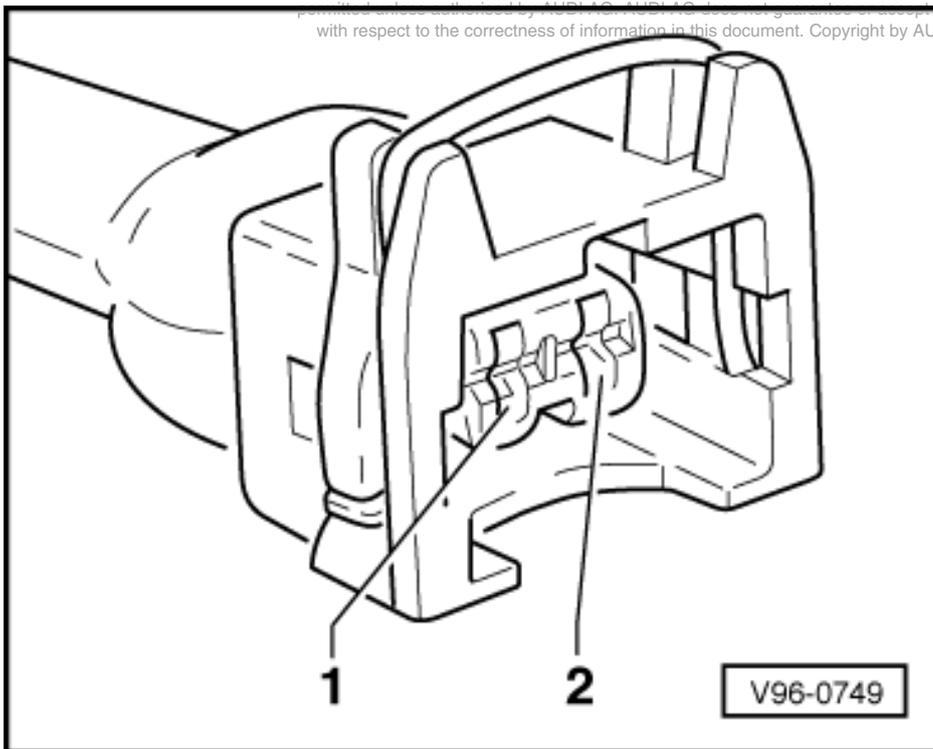
- Rectify open circuit, if necessary.

If the LED illuminates:

- Check actuation.

Checking actuation

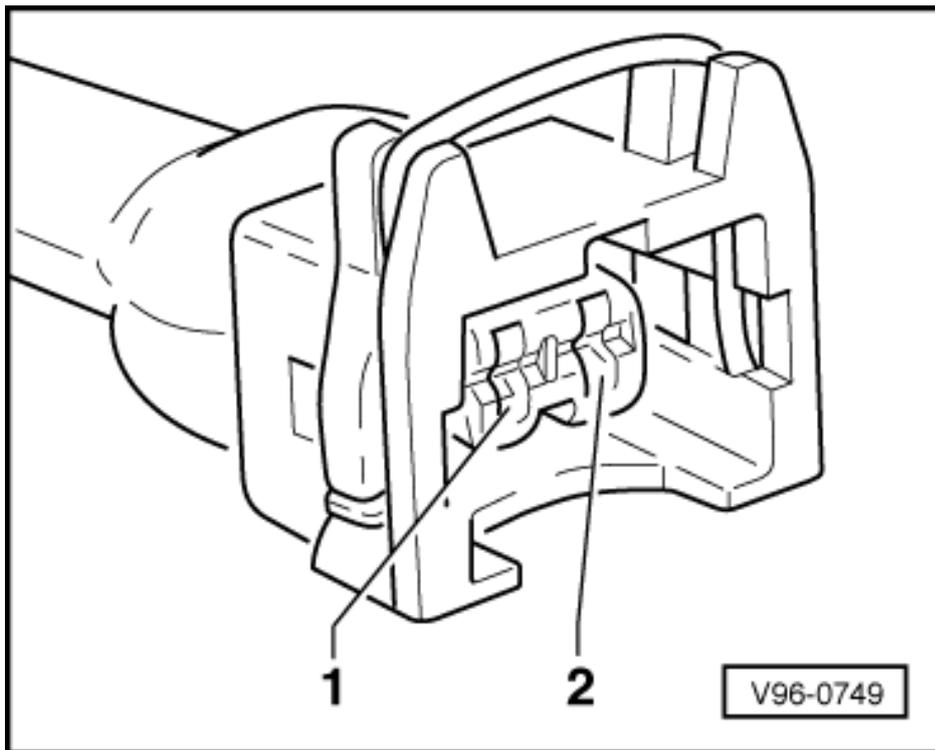
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- -> Connect voltage tester V.A.G 1527 B to contacts 1 (positive) and 2 of the connector.
- Initiate final control diagnosis and actuate ACF solenoid valve -N80 =>Page 46 .
 - The LED should flash.

If the LED lamp does not flash or if it illuminates continuously:

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit 1; do not connect the engine control unit => Page 117 .



- -> Check for open circuit and short to positive or earth in the following wiring connection:

Connector Contact	Test box V.A.G 1598/31 Socket
2	64

- Rectify any open/short circuit as necessary.

If the wiring is OK:

- Replace engine control unit 1 =>Page 120 .

4.3 - Checking solenoid valve 2 for activated charcoal filter -N333 (fuel tank breather valve 2)

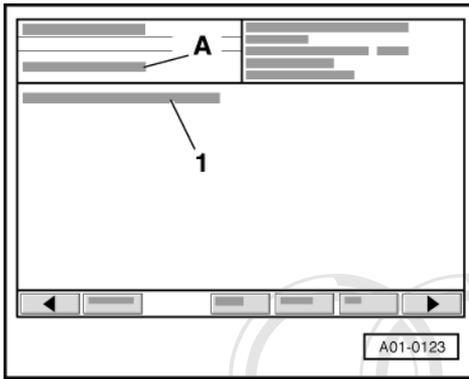
Fitting locations overview => 93

Testing for leaks

When there is no electrical supply, the fuel tank breather valve 2 -N333 remains closed.

- Disconnect hoses from ACF valve but leave the electrical connector plugged in.
- Connect auxiliary hose to one connection of ACF valve.
- Connect vehicle diagnostic, testing and information system VAS 5051 and select engine control unit 2 using "address word" 11 => Page 3 .
For this purpose, the ignition must be switched on.
- Start final control diagnosis and actuate fuel tank breather valve 2 -N333 =>Page 46 .

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-> Display on VAS 5051:

- A - 1st control element in test
- 1 - Fuel tank breather valve 2 -N333

- ◆ The valve should click ...
- ◆ ... and should open and close (check by blowing into the auxiliary hose).

If the injector does not click:

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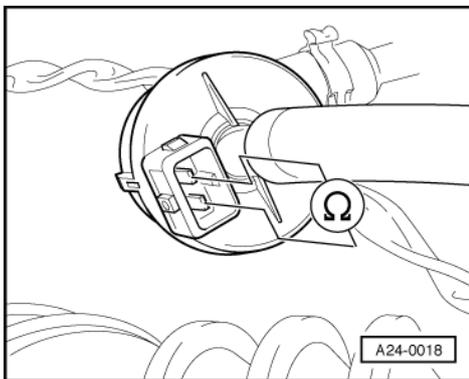
- Checking internal resistance to ACF valve.

If valve does not open or close properly:

- Replace fuel tank breather valve 2 -N333.

Checking internal resistance

- Unplug connector on ACF valve.



- -> Connect multimeter between contacts 1 and 2 on valve to measure resistance.
- Specified value: 22 ... 30 ω

If specification is not attained:

- Replace solenoid valve 2 for activated charcoal filter -N333.

If specified value is attained:

- Check the voltage supply
=>Page 203 .

Checking power supply

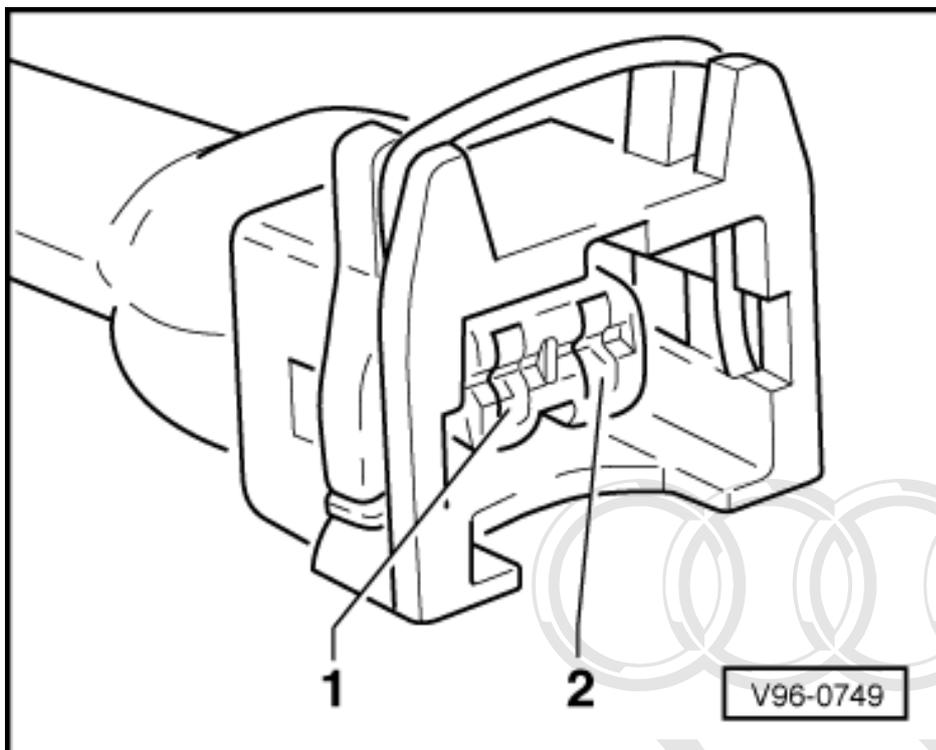
Test requirements:

- Fuse for ACF valve OK.
- => Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder
- Fuel pump relay OK.

Note:

The ACF valve receives its power supply via the fuel pump relay.

- Unplug connector on ACF valve.



- -> Connect voltage tester V.A.G 1527 B as follows:

Connector Contact	Measure to
1	Engine earth

- Operate the starter briefly (the engine may start).
 - The LED should illuminate.

If the LED does not illuminate:

- Check the wiring from contact 1 on the connector via the fuse to the fuel pump relay for an open circuit:

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

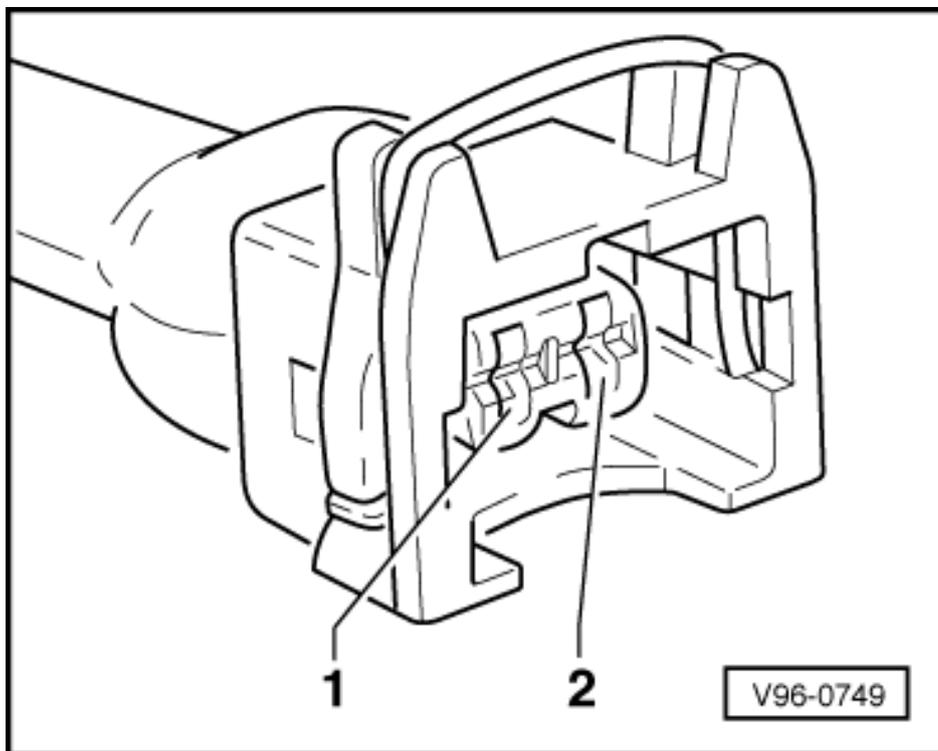
- Rectify open circuit, if necessary.

If the LED illuminates:



- Check actuation.

Checking actuation



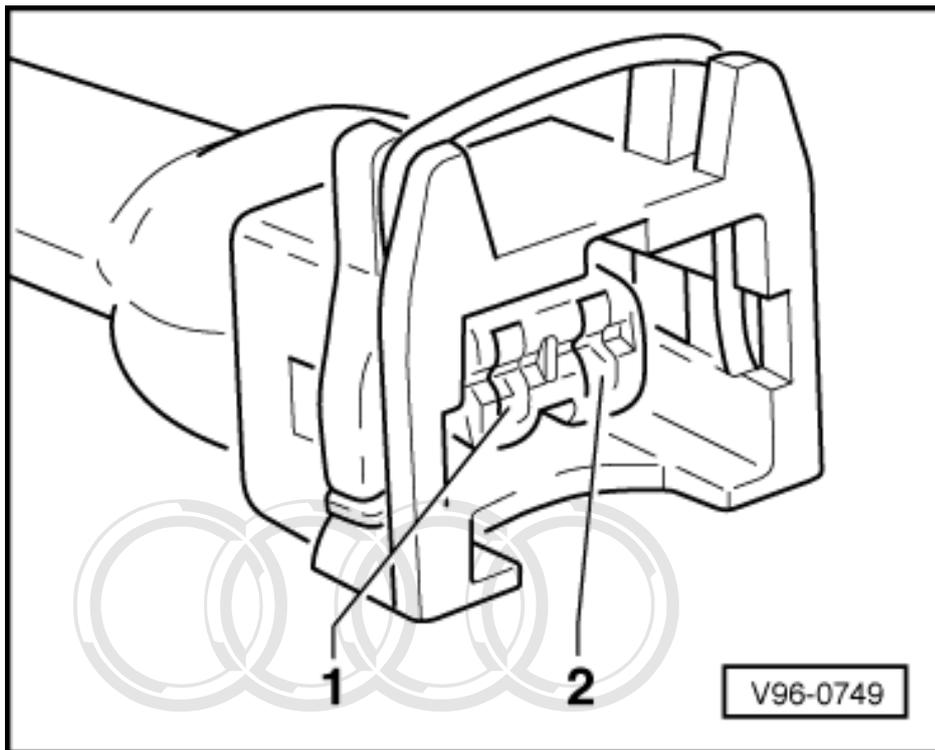
- -> Connect voltage tester V.A.G 1527 B to contacts 1 (positive) and 2 of the connector.
- Start final control diagnosis in engine control unit 2 and actuate fuel tank breather valve 2 for activated charcoal filter -N333 =>Page 46 .
 - The LED should flash.

If the LED lamp does not flash or if it illuminates continuously:

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit 2; the engine control unit should not be connected =>Page 117 .



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- -> Check for open circuit and short to positive or earth in the following wiring connection:

Connector Contact	Test box V.A.G 1598/31 Socket
2	64

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- **Rectify any open/short circuit as necessary.**

If the wiring is OK:

- Replace engine control unit 2 =>Page 120 .

5 - Checking electronic engine power control (electronic throttle)

5.1 - Checking electronic engine power control (electronic throttle)

5.2 - Function of the electronic throttle system

In the electronic throttle system, the throttle valve is not operated by a cable connected to the accelerator pedal. There is no mechanical connection between the accelerator pedal and the throttle valve.

The position of the accelerator pedal is communicated to the engine control unit by two accelerator position senders (variable resistances located in a single housing) connected to the accelerator pedal.

The position of the accelerator pedal (decided by the driver) is one of the main input parameters to the engine control unit.

The throttle valve is actuated, over the full range of engine speed and power, by an electric motor (throttle valve actuator) in the throttle valve control part.



The throttle valve actuator moves the throttle valve as instructed by the engine control unit.

When the engine is running (and under load), the engine control units can open and close the throttle valves independently of the accelerator position sender.

The electronic throttle does not simply consist of one or two components but is, rather, a system which includes all the components which contribute to determining the position of the throttle valve and to controlling and monitoring this position. These components include, for example, the accelerator position sender, the throttle valve control parts, the EPC warning lamp, the engine control units...).

5.3 - Checking throttle valve control part -J338

Fitting locations overview => 93

The following components are located in the housing of the throttle valve control part.

- ♦ Throttle valve drive -G186. (This is an electric motor which is activated by engine control unit 1. This electric motor opens the throttle valve against the force of a spring).
- ♦ Angle sender 1 for throttle valve actuator -G187
- ♦ Angle sender 2 for throttle valve actuator -G188

Notes:

- ♦ Housing of throttle valve control part must not be opened.
- ♦ The angle senders are in the form of potentiometers (variable resistances). They provide the position of the throttle valve to the engine control unit completely independently of one another.
- ♦ The potentiometers cannot be adjusted mechanically. The settings are carried out in diagnostic function "04 - basic setting" with the vehicle diagnostic, testing and information system VAS 5051.

5.4 - Performing adaption of throttle valve control part

The adaption process enables the engine control unit to learn the various positions of the throttle valve with the ignition switched on and the engine not running. These positions are stored in the control unit. The feedback signal indicating the position of the throttle valve comes from the two throttle valve actuator angle senders.

If the throttle valve control part -J338 or the engine control unit are removed, installed or replaced or if the voltage supply from the engine control unit is interrupted, adaption must always be performed.

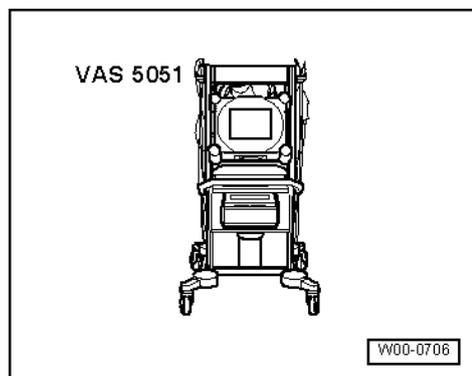
The learning process (adaption process) is performed:

- ♦ Automatically if the ignition is switched on once for at least 10 seconds without actuating the starter or the accelerator pedal and the engine control unit recognises "adaption requirement". In this case, however, it is not obvious whether the adaption process was successful or not. Adaption requirement is recognised if stored voltage values from the angle senders do not coincide with current measured voltage values in a certain tolerance band.
- ♦ By initiating the basic setting (function 04) of display group 060 with ignition switched on.

Note:

Engine will not start during automatic adaption.

Special tools and workshop equipment required

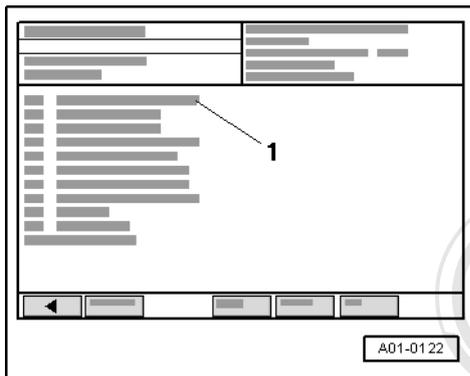


- ◆ VAS 5051 with VAS 5051/1

Preconditions:

- No faults recorded in fault memory; interrogate fault memory => Page 7 .
- Engine stopped, ignition switched on
- Accelerator pedal not depressed.
- Coolant temperature 10 ... 95 °C
- Intake air temperature 10 ... 90 °C
- Voltage supply to engine control unit greater than 12.7 V; Testing =>Page 142 .

Procedure

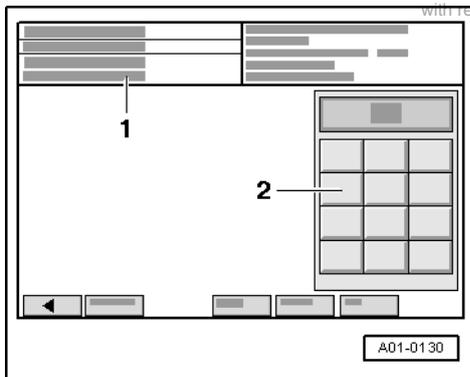


- Connect vehicle diagnostic, testing and information system VAS 5051 and select engine control unit 1 using "address word" 01 => Page 3 .
For this purpose, the ignition must be switched on.

-> Display on VAS 5051:

- Under -1- select the diagnostic function "04 - Basic setting".

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-> Display on VAS 5051:

- 1 - Enter display group
max. input value = 255
- Enter "060" for "display group number 060" in zone -2- and confirm the entry by pressing the Q key.

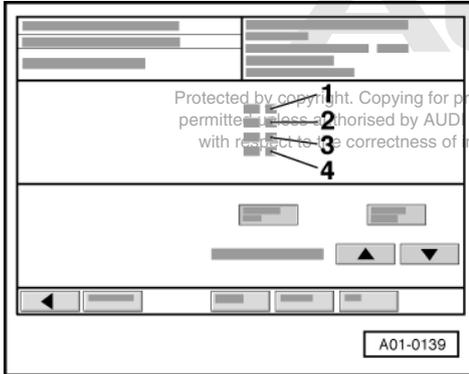
After the Q key is pressed, the throttle valve actuator is first disconnected from the electricity supply.

In this condition, the throttle valve is pulled into an emergency running position by a mechanical spring which is located in the throttle valve control part. The values supplied by the two angle senders in this emergency running position are stored in the engine control unit.



The throttle valve is then opened by a predetermined amount. When this value is reached, the throttle valve actuator is again disconnected from the electricity supply. The mechanical spring should then close the throttle valve to the previously learnt emergency running position within a specified period of time (spring test).

The throttle valve actuator then closes the throttle valve; the values supplied by the angle senders in the throttle valve control part are stored in the engine control unit.



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If the engine control unit disconnects the throttle valve actuator from the electricity supply while the vehicle is being driven, the result will be an increased and fluctuating idling speed and a very poor throttle response.

-> Display on VAS 5051:

- Check specified values for throttle valve control part in display zones -3- and -4-.

	Display zones			
	1	2	3	4
Display group 060: Adaption of throttle valve control part				
Display	xx %	xx %	x	---
Display	Throttle valve angle (angle sender 1)	Throttle valve angle (angle sender 2)	Adaption stage counter	Adaption status
Range			0...8	ADP process running ADP OK ERROR
Specified value	3...93 %	97...3 %	8	ADP OK
Note:			After adaption the adaption stage counter reaches figure 8. (Figures may be skipped)	If "ERROR" is displayed: Interrogate fault memory => Page 208

Note:

"ADP" in display zone 4 stands for "Adaption".

Note:

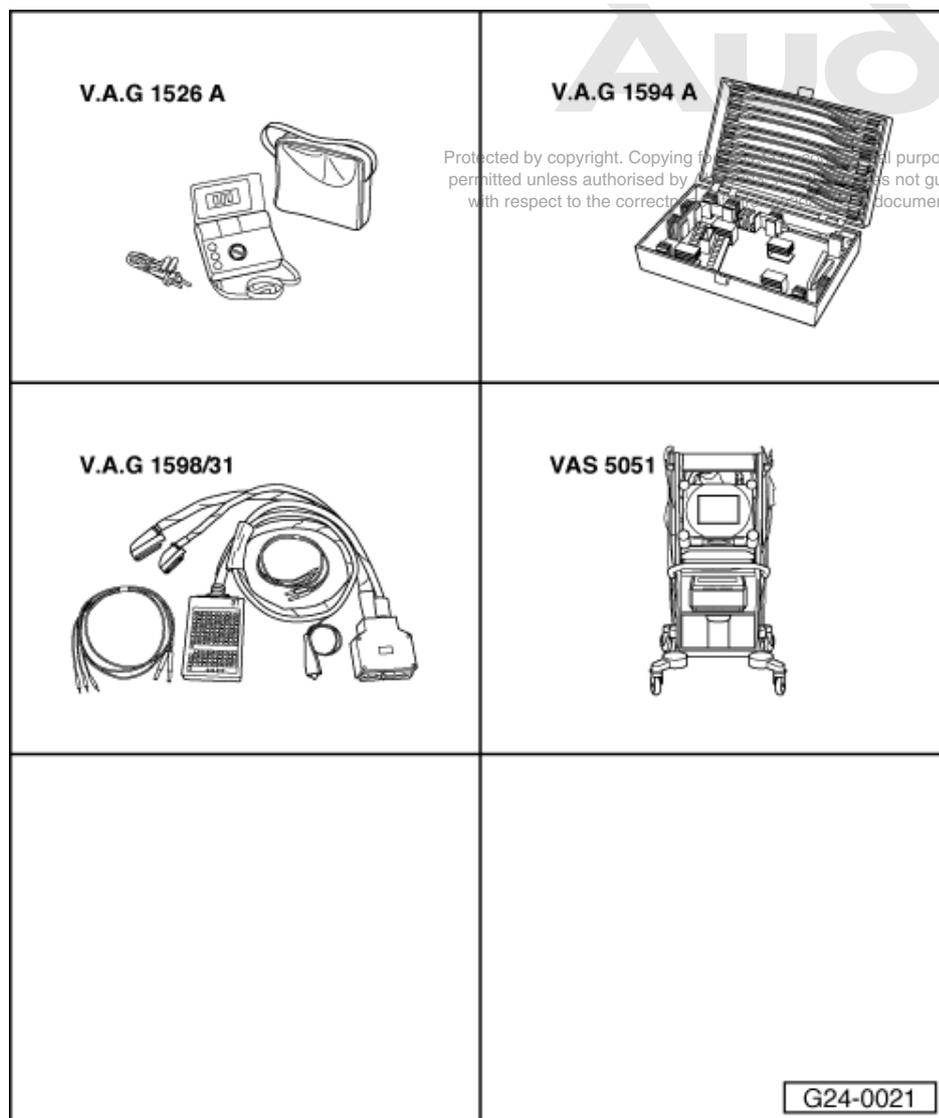
If the adaption is interrupted by the control unit, the reason could be one of the following:

- ♦ The throttle valve cannot close completely (e.g. dirt).
- ♦ The battery voltage is too low.
- ♦ throttle valve control part or wiring is defective.
- ♦ Connectors (e.g. on throttle valve control part) have become loose, are not properly engaged or contacts in plugs are corroded/bent.
- ♦ Engine was started or accelerator was actuated during the adaption process.
- ♦ Distortion of throttle valve housing (check screw connection).

When adaption process is interrupted, message "Function is unknown or cannot be carried out at the moment" is displayed on tester. The next time the ignition is switched on (for several seconds), the adaption process is automatically performed again.

- Exit the function "04 - Basic setting" by pressing the ◀ key.

5.5 - Checking angle sender for throttle valve actuator



Special tools and workshop equipment required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/31
- ◆ VAS 5051 with VAS 5051/1

The throttle valve drive angle senders -G187 and -G188 signal the position of the throttle valve to the engine control unit. Both angle senders are located in the throttle valve control part.

Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 and select engine control unit 1 using "address word" 01 => Page 3.

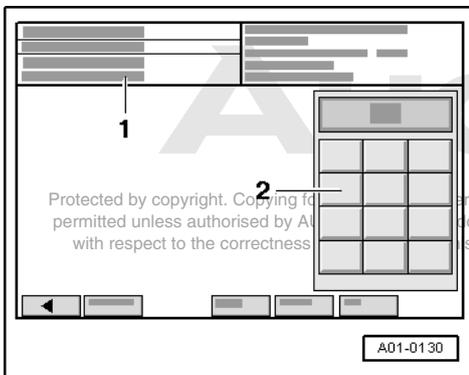


For this purpose, the ignition must be switched on.



-> Display on VAS 5051:

- Under -1- select the diagnostic function "08 - Read measured value block".



-> Display on VAS 5051:

- 1 - Enter display group
max. input value = 255

- Enter "062" for "display group number 062" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Check specified values for electronic throttle potentiometer voltages in display zones -1- and -2-.

	Display zones			
	1	2	3	4
Display group 062: Electronic throttle potentiometer voltages				
Display	xx %	xx %	xx %	xx %
Display	Throttle valve angle (angle sender 1)	Throttle valve angle (angle sender 2)	Sender 1 for accelerator pedal position	Sender 2 for accelerator pedal position
Specified value	3...93 % (Idling speed value: 8...18 %)	97...3 % (Idling speed value: 80...90%)	12...97 % (Idling speed value: 12...18%)	4...49 % (Idling speed value: 4...13%)

Note:

The engine control unit converts and displays the voltage readings from the angle senders as percentages of 5 V. (A 5 Volt supply corresponds to 100 %).

- Observe readouts in display zones 1 and 2.
- Slowly depress accelerator pedal.

Percentage displayed in zone 1 should rise evenly. The tolerance range from 3...93 % is not fully utilised.

Percentage displayed in zone 2 should fall evenly. The tolerance range from 97...3 % is not fully utilised.

Notes:

- ◆ The reason why the value in display zone 1 rises and that in zone 2 falls is that the potentiometers (angle senders) in the throttle valve control part operate in opposite directions.
- ◆ This means that the voltage picked off by one of the angle senders runs in the direction of 5 V. (As the throttle is opened, the voltage becomes greater and the percentage increases).
- ◆ The voltage picked off by the angle sender 2 runs from 5 V in the direction of 0 V. (As the throttle is opened, the voltage becomes smaller and the percentage decreases).

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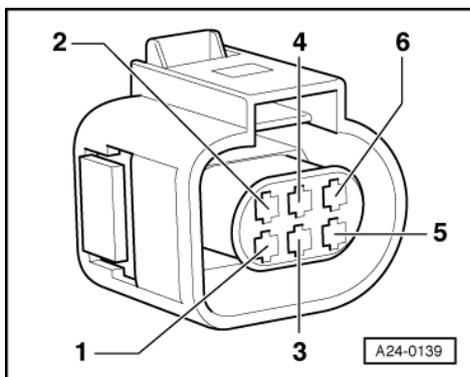
- Exit the function "08 - Read measured value block" by pressing the ◀ key.

If the displays are not as described:

- Check throttle valve control part voltage supply and wiring =>Page 211 . Pay particular attention to connectors, which may be detached or corroded.
- Check the accelerator position senders =>Page 219 .

Checking the voltage supply to the throttle valve control part.

- Unplug the connector from the throttle valve control part.
- Switch the ignition on.



- -> Connect multimeter as follows to measure voltage:

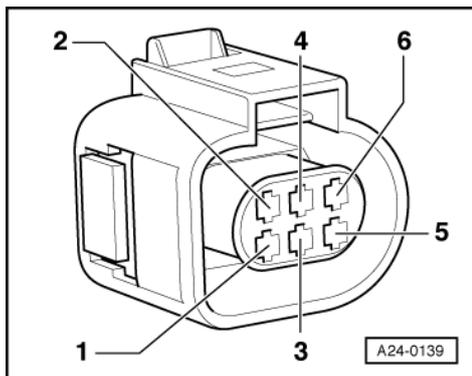


Connector Contact	Specified value
2 + earth	approx. 5 V
2 + 6	approx. 5 V

If the specified values are not obtained:

- Check wiring between engine control unit and throttle valve control part =>Page 212 .

Checking wiring



- -> Unplug the connector from the throttle valve control part.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit 1; do not connect the engine control unit => Page 117 .
- Check for open circuit and short to earth/positive or earth in the following wiring connections:

Connector Contact	Test box V.A.G 1598/31 Socket
1	92
2	83
3	117
4	84
5	118
6	91

- Rectify any open/short circuit as necessary.
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If no wiring fault is detected:

- Replace throttle valve control part -J338.

5.6 - Checking throttle valve control part -J544

Fitting locations overview => 93

The following components are located in the housing of the throttle valve control part.

- ♦ Throttle valve actuator 2 -G296. (This is an electric motor which is activated by engine control unit 2. This electric motor opens the throttle valve against the force of a spring).
- ♦ Angle sender 1 for throttle valve actuator 2 -G297
- ♦ Angle sender 2 for throttle valve actuator 2 -G298

Notes:

- ♦ Housing of throttle valve control part must not be opened.

- ◆ The angle senders are in the form of potentiometers (variable resistances). They provide the position of the throttle valve to the engine control unit completely independently of one another.
- ◆ The potentiometers cannot be adjusted mechanically. The settings are carried out in diagnostic function "04 - basic setting" with the vehicle diagnostic, testing and information system VAS 5051.

5.7 - Performing adaption of throttle valve control part

The adaption process enables the engine control unit to learn the various positions of the throttle valve with the ignition switched on and the engine not running. These positions are stored in the control unit. The feedback signal indicating the position of the throttle valve comes from the two throttle valve actuator angle senders. If the throttle valve control part -J544 or the engine control unit are removed and installed or replaced, or if the voltage supply from the engine control unit is interrupted, an adaption must always be performed.

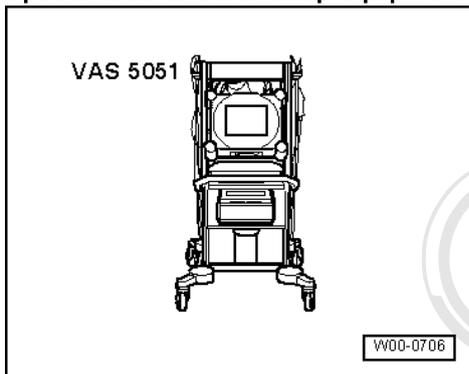
The learning process (adaption process) is performed:

- ◆ Automatically if the ignition is switched on once for at least 10 seconds without actuating the starter or the accelerator pedal and the engine control unit recognises "adaption requirement". (In this case, however, it is not obvious whether the adaption process was successful or not). Adaption requirement is recognised if stored voltage values from the angle senders do not coincide with current measured voltage values in a certain tolerance band.
- ◆ By initiating the basic setting (function 04) of display group 060 with ignition switched on.

Note:

Engine will not start during automatic adaption.

Special tools and workshop equipment required

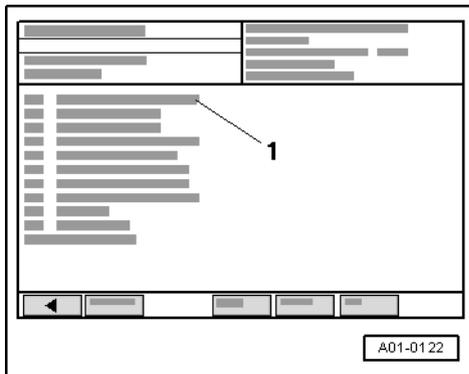


- ◆ VAS 5051 with VAS 5051/1

Preconditions:

- No faults recorded in fault memory; interrogate fault memory => Page 7 .
- Engine stopped, ignition switched on
- Accelerator pedal not depressed.
- Coolant temperature 10 ... 95 °C
- Intake air temperature 10 ... 90 °C
- Voltage supply to engine control unit greater than 12.7 V; Testing =>Page 142 .

Procedure

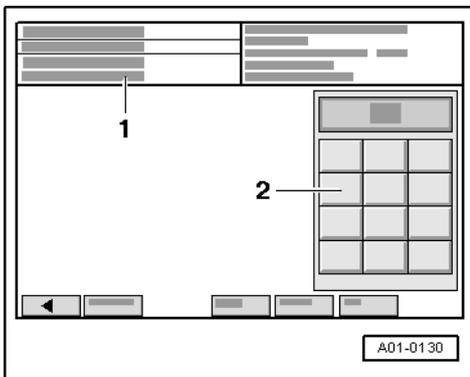




- Connect vehicle diagnostic, testing and information system VAS 5051 and select engine control unit 2 using "address word" 11 => Page 3 .
For this purpose, the ignition must be switched on.

-> Display on VAS 5051:

- Under -1- select the diagnostic function "04 - Basic setting".



-> Display on VAS 5051:

1 - Enter display group
max. input value = 255

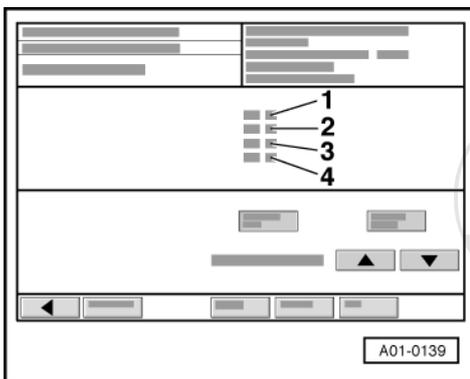
- Enter "060" for "display group number 060" in zone -2- and confirm the entry by pressing the Q key.

After the Q key is pressed, the throttle valve actuator is first disconnected from the electricity supply.

In this condition, the throttle valve is pulled into an emergency running position by a mechanical spring which is located in the throttle valve control part. The values supplied by the two angle senders in this emergency running position are stored in the engine control unit.

The throttle valve is then opened by a predetermined amount. When this value is reached, the throttle valve actuator is again disconnected from the electricity supply. The mechanical spring should then close the throttle valve to the previously learnt emergency running position within a specified period of time (spring test).

The throttle valve actuator then closes the throttle valve; the values supplied by the angle senders in the throttle valve control part are stored in the engine control unit.



If the engine control unit disconnects the throttle valve actuator from the electricity supply while the vehicle is being driven, the result will be an increased and fluctuating idling speed and a very poor throttle response.

-> Display on VAS 5051:

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- Check specified values for throttle valve control part in display zones -3- and -4-.

	Display zones			
	1	2	3	4
Display group 060: Adaption of throttle valve control part				
Display	xx %	xx %	x	---
Display	Throttle valve angle (angle sender 1)	Throttle valve angle (angle sender 2)	Adaption stage counter	Adaption status
Range			0...8	ADP process running ADP OK ERROR
Specified value	3...93 %	97...3 %	8	ADP OK
Note:			After adaption the adaption stage counter reaches figure 8. (Figures may be skipped)	If "ERROR" is displayed: Interrogate fault memory => Page 215 .

Note:

"ADP" in display zone 4 stands for "Adaption".

Note:

If the adaption is interrupted by the control unit, the reason could be one of the following:

- ◆ The throttle valve cannot close completely (e.g. dirt).
- ◆ The battery voltage is too low.
- ◆ throttle valve control part or wiring is defective.
- ◆ Connectors (e.g. on throttle valve control part) have become loose, are not properly engaged or contacts in plugs are corroded/bent.
- ◆ Engine was started or accelerator was actuated during the adaption process.
- ◆ Distortion of throttle valve housing (check screw connection).

When adaption process is interrupted, message "Function is unknown or cannot be carried out at the moment" is displayed on tester. The next time the ignition is switched on (for several seconds), the adaption process is automatically performed again.

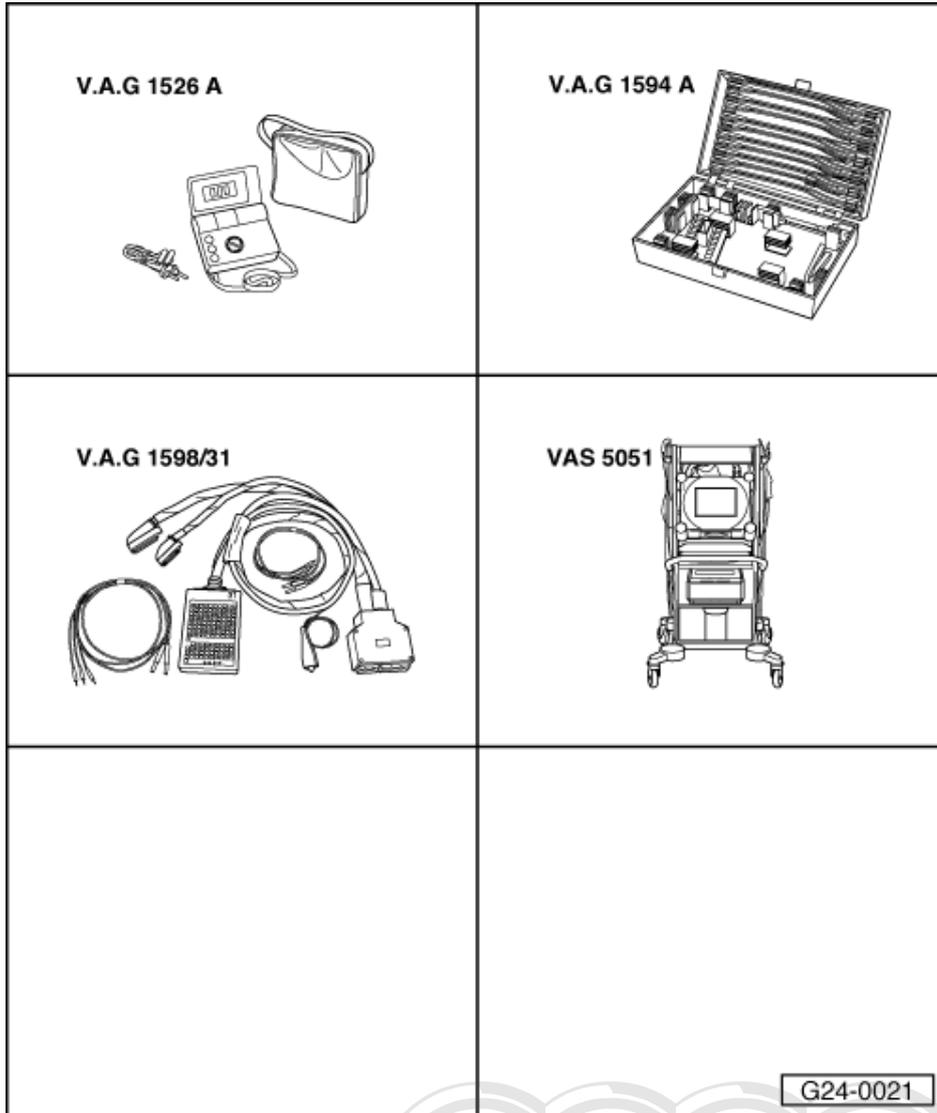
- Exit the function "04 - Basic setting" by pressing the ◀ key.



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5.8 - Checking angle sender for throttle valve actuator



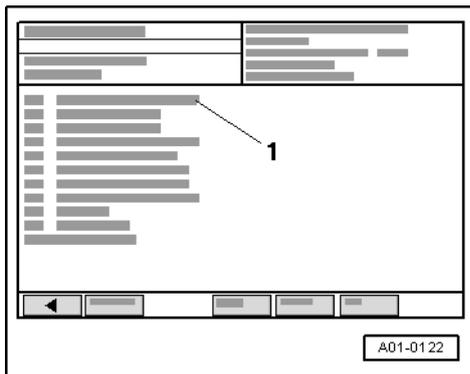
Special tools and workshop equipment required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/31
- ♦ VAS 5051 with VAS 5051/1

The throttle valve drive angle senders -G297 and -G298 signal the position of the throttle valve to the engine control unit. Both angle senders are located in the throttle valve control part.

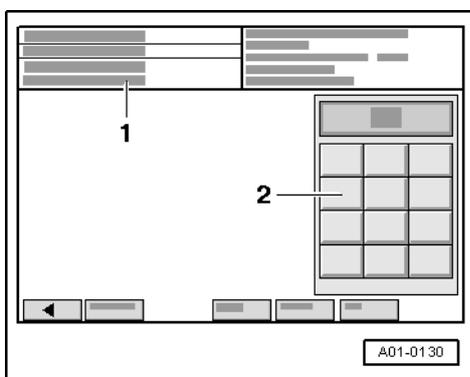
Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 and select engine control unit 2 using "address word" 11 => Page 3
For this purpose, the ignition must be switched on.



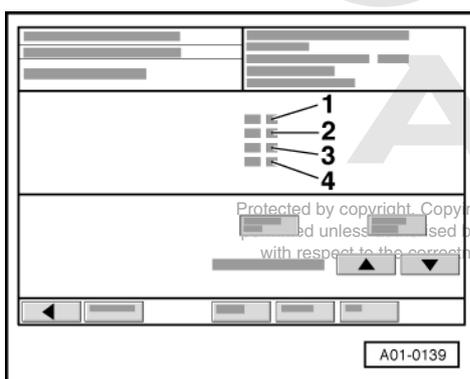
-> Display on VAS 5051:

- Under -1- select the diagnostic function "08 - Read measured value block".



-> Display on VAS 5051:

- 1 - Enter display group
max. input value = 255
- Enter "062" for "display group number 062" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Check specified values for electronic throttle potentiometer voltages in display zones -1- and -2-.

	Display zones			
	1	2	3	4



Display zones			
Display group 062: Electronic throttle potentiometer voltages			
Display	xx %	xx %	
Display	Throttle valve angle (angle sender 1)	Throttle valve angle (angle sender 2)	
Specified value	3...93 % (Idling speed value: 8...18 %)	97...3 % (Idling speed value: 80...90%)	

Note:

The engine control unit converts and displays the voltage readings from the angle senders as percentages of 5 V. (A 5 Volt supply corresponds to 100 %).

- Observe readouts in display zones 1 and 2.
- Slowly depress accelerator pedal.

Percentage displayed in zone 1 should rise evenly. The tolerance range from 3...93 % is not fully utilised.

Percentage displayed in zone 2 should fall evenly. The tolerance range from 97...3 % is not fully utilised.

Notes:

- ♦ The reason why the value in display zone 1 rises and that in zone 2 falls is that the potentiometers (angle senders) in the throttle valve control part operate in opposite directions.
- ♦ This means that the voltage picked off by one of the angle senders runs toward 5 V. (As the throttle is opened, the voltage becomes greater and the percentage increases).
- ♦ The voltage picked off by the angle sender 2 runs from 5 V towards 0 V. (As the throttle is opened, the voltage becomes smaller and the percentage decreases).

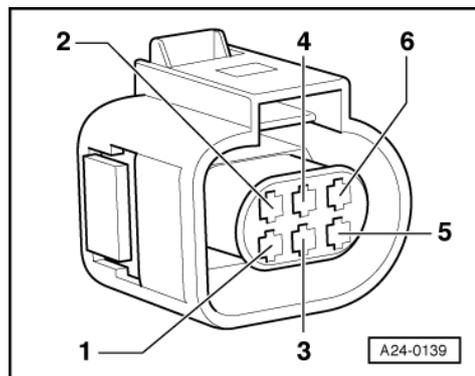
- Exit the function "08 - Read measured value block" by pressing the ←key.

If the displays are not as described:

- Check throttle valve control part voltage supply and wiring =>Page 218 . Pay particular attention to connectors, which may be detached or corroded.
- Check the accelerator position senders =>Page 219 .

Checking the voltage supply to the throttle valve control part.

- Unplug the connector from the throttle valve control part.
- Switch the ignition on.



- -> Connect multimeter as follows to measure voltage:

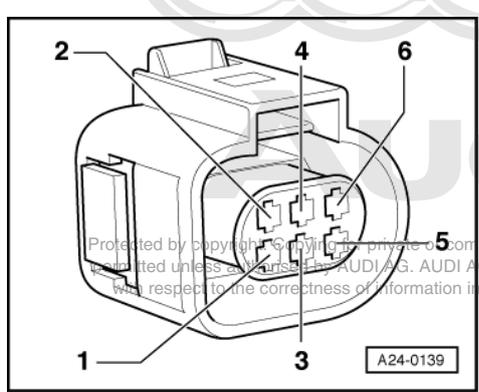
Connector Contact	Specified value
2 + earth	approx. 5 V

2 + 6	approx. 5 V
-------	-------------

If the specified values are not obtained:

- Check wiring between engine control unit and throttle valve control part =>Page **219** .

Checking wiring



- -> Unplug the connector from the throttle valve control part.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit 2; do not connect the engine control unit => Page **117** .
- Check for open circuit and short to earth/positive or earth in the following wiring connections:

Connector Contact	Test box V.A.G 1598/31 Socket
1	92
2	83
3	117
4	84
5	118
6	91

- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

- Replace throttle valve control part -J544.

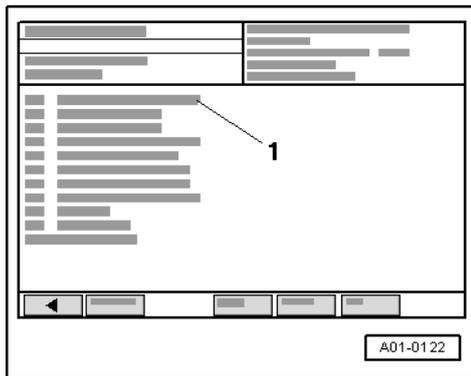
6 - Checking accelerator position sender

6.1 - Checking accelerator position sender

Both accelerator position senders -G79 and -G185 are located on the accelerator pedal and completely independently signal the driver's requirements to the engine control unit 1. Engine control unit 2 receives the driver's requirements from engine control unit 1 by CAN-data bus. Both senders are located in one housing.



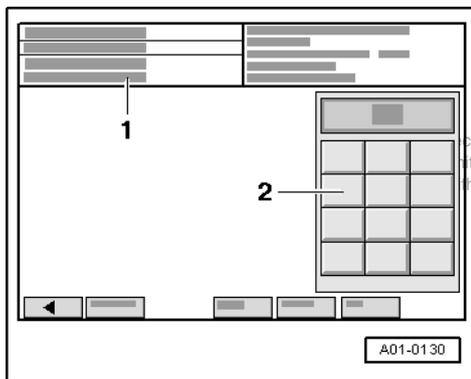
Test sequence



- Connect vehicle diagnostic, testing and information system VAS 5051 and select engine control unit 1 using "address word" 01 => Page 3 .
For this purpose, the ignition must be switched on.

-> Display on VAS 5051:

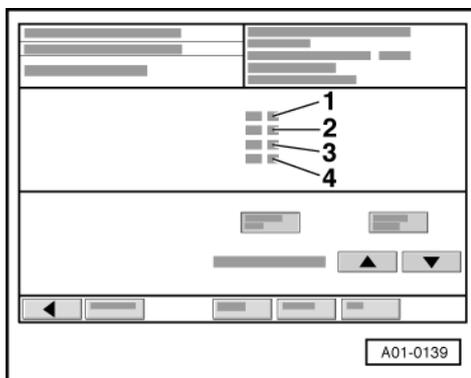
- Under -1- select the diagnostic function "08 - Read measured value block".



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-> Display on VAS 5051:

- 1 - Enter display group
max. input value = 255
- Enter "062" for "display group number 062" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Check specified values for electronic throttle potentiometer voltages in display zones -3- and -4-.

	Display zones			
	1	2	3	4
Display group 062: Electronic throttle potentiometer voltages				
Display	xx %	xx %	xx %	xx %
Display	Throttle valve angle (angle sender 1)	Throttle valve angle (angle sender 2)	Sender 1 for accelerator pedal position	Sender 2 for accelerator pedal position
Specified value	3...93 %	97...3 %	12...97 %	4...49 %

Note:

The engine control unit converts and displays the voltage readings from the angle senders as percentages of 5 V. (A 5 Volt supply corresponds to 100 %).

- Observe readouts in display zones 3 and 4.
- Slowly depress accelerator pedal.

Percentage displayed in zone 3 should rise evenly. The tolerance range from 12...97 % is not fully utilised.

Percentage displayed in zone 4 should also rise evenly. The tolerance range from 4...49 % is not fully utilised.

Note:

The value displayed in zone 3 must always be about twice as large as that in zone 4.

- Exit the function "08 - Read measured value block" by pressing the \blacktriangleleft key.

If the displays are not as described:

- Check voltage supply and wiring for accelerator position sender => Page 221
- Adjust accelerator position senders

=> Fuel Supply - Petrol Engines; Repair group 20; Fuel supply; Servicing accelerator mechanism - Vehicles with electronic engine performance control (electronic throttle) Fuel supply Servicing accelerator mechanism - Vehicles with electronic engine performance control (electronic throttle)

Checking voltage supply for accelerator position senders

- Remove driver's storage compartment.

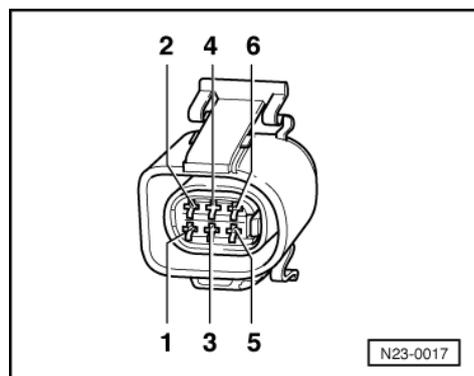
=> General Body Assembly - Interior; Repair group 68; Dash panel; Removing driver's storage compartment Dash panel Removing driver's storage compartment

- Detach connector for accelerator position senders.

Note:

The connector is clipped onto the pedal bracket near the brake light switch.

- Switch the ignition on.





- -> Connect hand-held multimeter between the following sockets on the connector to measure voltage:

6-pin connector on wiring harness, socket	Specified value
2 + earth	approx. 5 V
2 + 3	approx. 5 V
5 + earth	approx. 5 V
5 + 4	approx. 5 V



If specifications are attained:

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- Additionally check signal wires =>Page 222 .

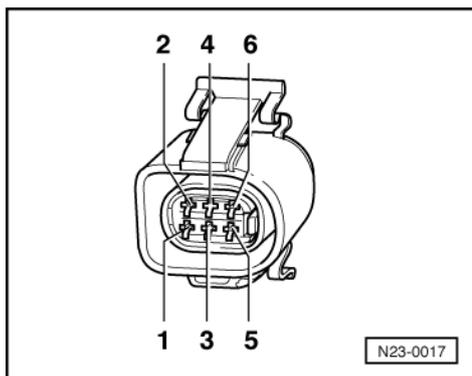
If the specified values are not obtained:

- Check wiring between engine control unit and accelerator position senders =>Page 222 .

Checking signal wiring and wiring connections between accelerator position senders and engine control unit

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit 1; do not connect the engine control unit => Page 117 .

- Check for open circuit and short to positive or earth in the following wiring connections:



Connector Socket	Test box V.A.G 1598/31 Socket
1 (signal wire)	35
2	73
3	36
4	33
5	72
6 (signal wire)	34

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

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

If no wiring fault is detected:

- Replace accelerator position senders.

=> Fuel Supply - Petrol Engines; Repair group 20; Fuel supply; Servicing accelerator mechanism - Vehicles with electronic engine power control (electronic throttle) Fuel supply Servicing accelerator mechanism - Vehicles with electronic engine power control (electronic throttle)

6.2 - Checking brake light switch -F or brake pedal switch -F47

Because the injection system operates with an accelerator pedal sender (potentiometer) which may be defective, the engine is regulated for reasons of safety when the brakes are operated. For this purpose, the control unit requires signals from both the brake light switch and the brake pedal switch. This means that if the brakes are operated when the accelerator pedal is held at a constant position, the engine speed is immediately reduced by the engine control unit. Incorrectly adjusted switches may lead to undesired control action.

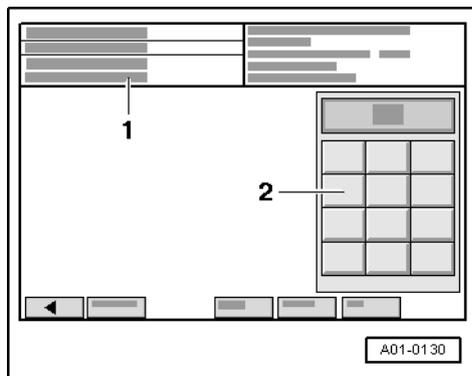


- Connect vehicle diagnostic, testing and information system VAS 5051 and select engine control unit 1 using "address word" 01 => Page 3.
For this purpose, the ignition must be switched on.

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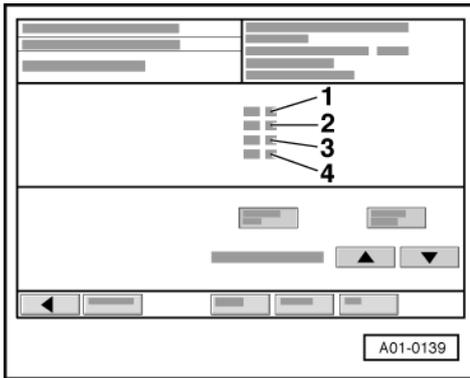
-> Display on VAS 5051:

- Under -1- select the diagnostic function "08 - Read measured value block".



-> Display on VAS 5051:

- 1 - Enter display group
max. input value = 255
- Enter "066" for "display group number 066" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Check brake light/brake pedal switch in display zone -2-.
- Observe readout in display zone 2.

	Display zones			
	1	2	3	4
Display group 66: Signals to engine control unit with ignition on				
Display	xxx km/h	x x x x 0 0 0 1	xxx km/h	x x x x 0 0 0 1
Display	ACTUAL speed	Switch settings	SPECIFIED speed	Switch positions for cruise control system
Range		off = 0 on = 1		off = 0 on = 1
Specified value		x x x x 0 0 0 1		
Note:		Explanation of figures => Page 224		

- Depress accelerator pedal.

Meaning of 4 digit readout of display zone 2:

x	x	x	x	Display zone 2
			1	Brake light switch 0 = Brake pedal not operated 1 = Brake pedal operated
		1		Brake pedal switch 0 = Brake pedal not operated 1 = Brake pedal operated
	0			Checking clutch pedal switch 0 = Clutch pedal not operated 1 = Clutch pedal operated
1				Cruise control system (CCS) 0 = CCS deactivated 1 = CCS enabled

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	Display zones			
	1	2	3	4
Display group 66: Signals to engine control unit				
Display	xxx km/h	x x x x 1 0 1 1	xxx km/h	x x x x 0 0 0 0

Display	Display zones			
	ACTUAL speed	Switch positions	SPECIFIED speed	Switch positions for cruise control system
Range		off = 0 on = 1		off = 0 on = 1
Specified value		x x x x 1 0 1 1		
Note:		The two right-hand displays must jump from 0 to 1, the switching points are slightly offset.		

- Allow brake pedal to return slowly to its normal position.
- Both displays should change from 1 back to 0.

If one or both displays do not change:

- Check the power supply =>Page 225 .

Checking power supply

- Remove driver's storage compartment.

=> General Body Assembly - Interior; Repair group 68; Dash panel; Removing driver's storage compartment
Dash panel Removing driver's storage compartment

- Unplug 4-pin connector on brake pedal.
- Switch the ignition on.
- Connect hand-held multimeter (voltage range) between the following sockets on the connector:

4-pin connector on wiring harness, socket	Specified value
1 + earth	Battery voltage

4-pin connector on wiring harness, socket	Specified value
3 + earth	Battery voltage

If the specified values are attained:

- Check the wiring =>Page 225 .

If the specified values are not achieved:

- Check the wiring connections from sockets 1 and 3 of connector for open circuit/short to earth (inspect fuse).

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

Note:

The numbering of the connector contacts is on the connector

- Rectify any open/short circuit as necessary.

Checking wiring

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit 1; the engine control unit should not be connected =>Page 117 .

Check the following wiring connections for open circuit and short circuit to positive or earth.

4-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket



2	56
4	55

Note:

The numbering of the connector contacts is on the connector

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

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

If no open circuit is detected:

- Replace brake light/brake pedal switch.

7 - Checking auxiliary signals

7.1 - Checking auxiliary signals

7.2 - Checking crash signal

The engine control units both receive the crash signal ("crash cut-off was activated") from the airbag control unit.

If the airbag control unit sends the crash signal to the engine control units (during an accident or if a final control diagnosis is carried out with respect to the airbag system), the engine control unit switches off the fuel pump, which stops the engine. It can however be restarted (e.g. to move vehicle out of danger area).

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit 1 or engine control unit 2; do not connect the engine control units => Page 117 .
- Check for open circuit and short to positive or earth in the following wiring connections:

Test box V.A.G 1598/31 on wiring harness for engine control unit 1 Socket	Control unit for Airbag -J234 Contact
67	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

Test box V.A.G 1598/31 on wiring harness for engine control unit 2 Socket	Control unit for Airbag -J234 Contact
67	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

- Rectify any open/short circuit as necessary.

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

Note:

After fault finding, erase fault memory of both engine control units as follows: First erase fault memory of engine control unit 1 (address word 01), then that of engine control unit 2 (address word 11) and finally again that of engine control unit 1.

If no wiring fault is detected:

- Interrogate fault memory of airbag control unit:

=> Body, Self-diagnosis; Repair group 01; Self-diagnosis of airbag system BTU (Basic Triggering Unit) with side airbag; Interrogating fault memory Self-diagnosis of airbag system BTU (Basic Triggering Unit) with side airbag Interrogating fault memory

7.3 - Checking engine speed signal

Note:

The signal is generated by engine speed sender -G28 and processed by the engine control unit. Engine control unit 1 issues the speed signal to contact 37.

- Locate open circuit or short circuit between engine control unit and the control unit concerned.

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

7.4 - Testing air conditioner compressor shut-off

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Notes:

- ◆ The air conditioning compressor signal informs both engine control units that the compressor will be switched on in 140 ms.
- ◆ Engine control unit 1 can send a signal via the same wire to shut off the air conditioner compressor.
- ◆ Switching off of the air conditioner compressor occurs:
 - In the emergency program (emergency running mode)
 - After initiating of basic setting (Function 04)
 - From the gearbox control unit (Kick down function)

Test requirements:

- Air conditioning system OK
- No faults recorded in fault memory of engine control unit
- Vehicle at ambient temperature (warmer than + 15°C)

Test sequence

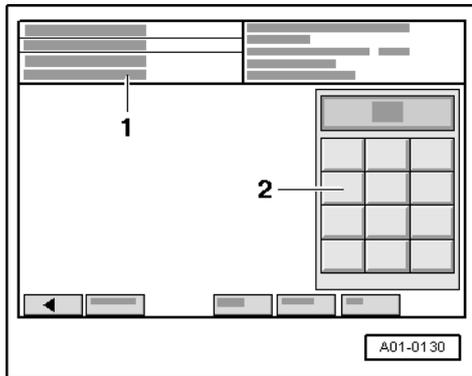
- Connect the vehicle diagnostic, testing and information system VAS 5051 and select engine control unit 1 with "address word" 01, and then engine control unit 2 with "address word" 11 => Page 3 . For this purpose, the engine must be running at idle speed.





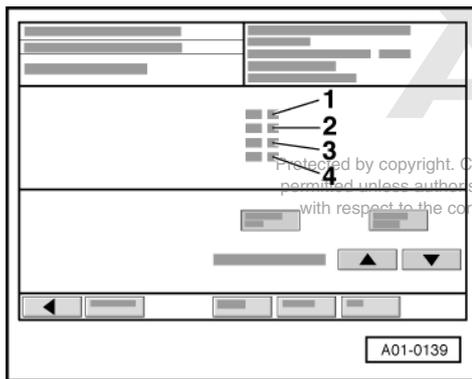
-> Display on VAS 5051:

- Under -1- select the diagnostic function "08 - Read measured value block".



-> Display on VAS 5051:

- 1 - Enter display group max. input value = 255
- Enter "050" for "display group number 050" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Switch off air conditioner.
 - Specified value in display zone -4-: Compr. OFF
- Switch on air conditioning with "auto" button and set air conditioning to maximum cooling/heating. The compressor must run.
 - Specified value in display zone -4-: Compr. ON

If the readout in display zone 4 is not as described:

- Connect test box V.A.G 1598/31 to the applicable wiring harness for the engine control unit; do not connect the engine control unit => Page 117 .
- Check for open circuit and short to positive or earth in the following wiring connections:

Test box V.A.G 1598/31 Socket	Operating and display unit -E87 Contact
41	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

- Rectify any open/short circuit as necessary.

- If there are no faults in the wiring, check the operation of air conditioner.

=> Heating, Air Conditioner; Repair group 01; Self-diagnosis for air conditioner Self-diagnosis for air conditioner

7.5 - Checking the data exchange between the engine control units and other CAN-capable control units

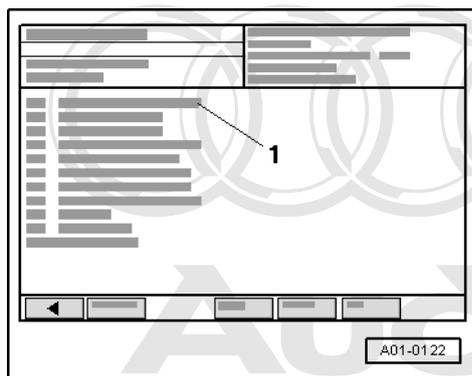
Notes:

- ◆ Data is exchanged between individual control units by means of a bus system.
- ◆ "CAN bus" is used to describe a system that transports and distributes data.
- ◆ The wires between the control units that are used to transfer the data are known as signal wires.
- ◆ Data is transmitted via data wires in sequence, i.e. in a specific order to the connected control units (e.g. engine rpm accelerator pedal position).

Checking the bus system

The fault table instructed you to check the data exchange between the engine control unit and CAN-capable control units.

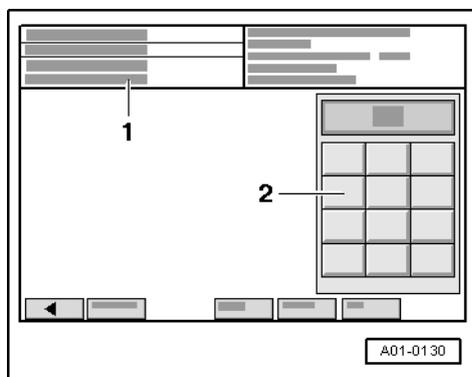
- Check that multiple connectors for control units are properly seated.
- Connect the vehicle diagnostic, testing and information system VAS 5051 and select engine control unit 1 with "address word" 01, and then engine control unit 2 with "address word" 11 => Page 3 .
For this purpose, the engine must be running at idle speed.



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-> Display on VAS 5051:

- Under -1- select the diagnostic function "08 - Read measured value block".





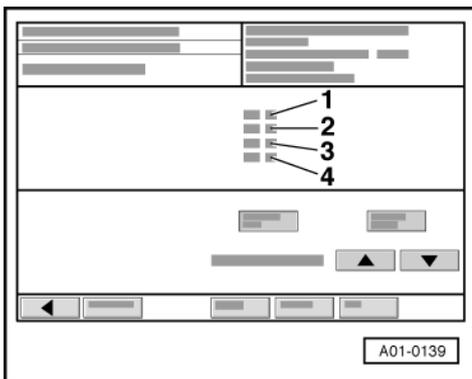
-> Display on VAS 5051:

- 1 - Enter display group
- max. input value = 255

Note:

The measured value blocks 125 and 126 indicate drive data bus users.

- Enter "125" for "display group number 125" in zone -2- and confirm the entry by pressing the Q key.

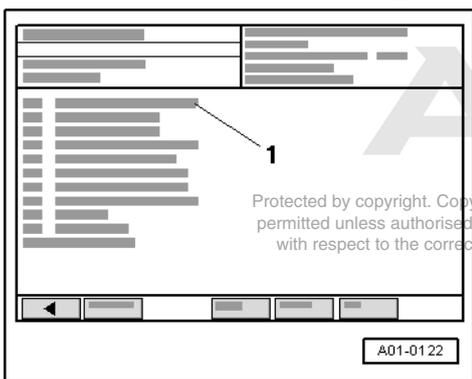


-> Display on VAS 5051:

- Check displays in display zones -1- to -4-.

CAN-compatible control units are displayed with the engine control unit:

- No display: Engine control unit not CAN-compatible
- Display 1: CAN-capable control unit is a data bus user
- Display 0: CAN-capable control unit is not user of the data bus
- Select the s key in order to change to display group 126.
- Check in the same way with display group number 126.

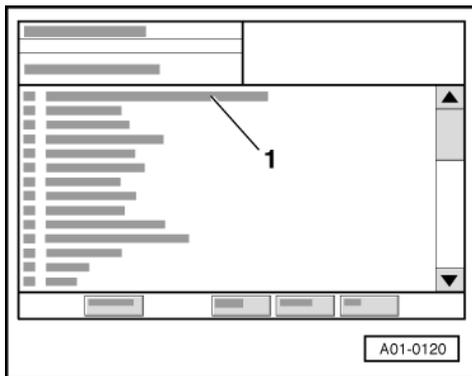


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- Exit the function "08 - Read measured value block" by pressing the ◀ key.

-> Display on VAS 5051:

- Under -1- select the diagnostic function "06 - End output".



-> Display on VAS 5051:

- Under -1- select the diagnostic function "00 - interrogate fault memory - whole system".
- The fault memory is then interrogated for all systems in the vehicle which are capable of self-diagnosis

If a control unit answers with its identification, the number of faults stored or "No fault detected" appears on the display.

Any system faults that are stored are displayed one after the other. The VAS 5051 will then transmit the next address word.

If a fault is displayed relating to "Drive data bus ..." or "...CAN bus":

- Check that the engine control unit and other CAN-capable control units installed are suitable for this vehicle (part no. and code).

If the correct control units are installed:

- Check that multiple connectors for control units are properly seated.

If the multi-pin connectors are firmly seated:

- Check the CAN bus system.

Checking a "two-wire bus system"

The communication between three or more control units is carried out over a "two-line bus system".

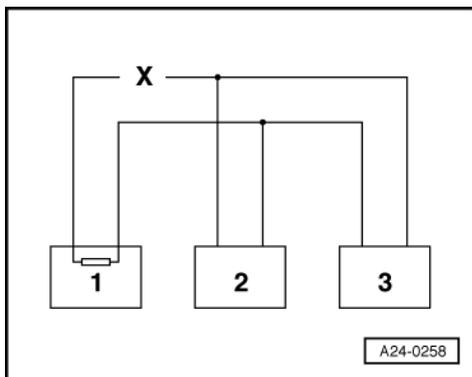
- Evaluate the faults stored in the control units.

Note:

This helps to localise line faults.

Example 1:

The faults stored in the fault memories indicate that the control unit 1 does not communicate with control units 2 and 3.



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Control unit	Faults stored in fault memory
1	- No message from control unit 2 - No message from control unit 3
2	- No message from control unit 1
3	- No message from control unit 1

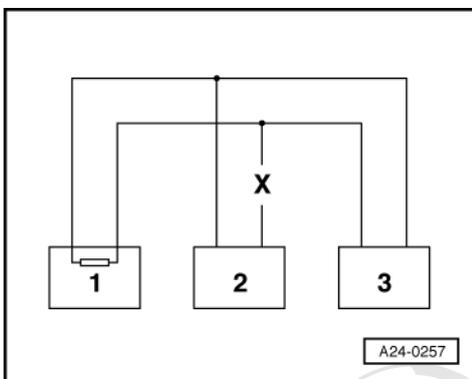
- Switch ignition off.
- Disconnect the control units linked to one another via the bus wires and investigate whether there is an open circuit between the bus wires.

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

- If no fault can be detected in the bus lines exchange control unit 1.

Example 2:

The faults stored in the fault memories indicate that the control unit 2 does not communicate with control units 1 and 3.



Control unit	Faults stored in fault memory
1	- No message from control unit 2
2	- No message from control unit 1 - No message from control unit 3
3	- No message from control unit 2

- Switch ignition off.
- Disconnect the control units linked to one another via the bus wires and investigate whether there is an open circuit between the bus wires.

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

- If no fault can be detected in the bus wires, replace control unit 2.

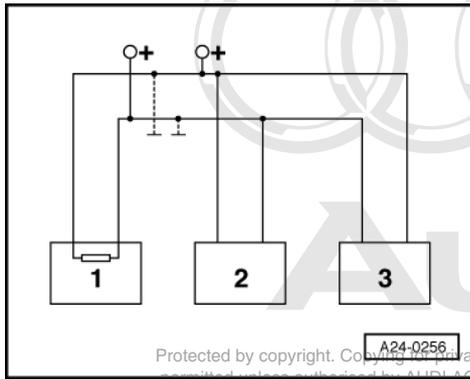
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Example 3:

The faults stored in the fault memories indicate that sending or receiving is not possible in any of the control units.

Control unit	Faults stored in fault memory
1	- Data bus drive defective
2	- Data bus drive defective
3	- Data bus drive defective

- Switch ignition off.



- -> Disconnect the control units that are linked to one another by the bus wires and check the bus wires for short circuits to positive and earth.

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

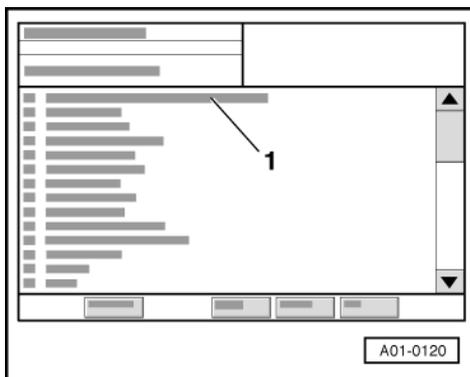
If cause of fault "Drive data bus defective" cannot be found in bus lines check whether one of the control units is responsible for the fault.

Test requirements:

- Vehicle diagnostic, testing and information system VAS 5051 connected and vehicle self-diagnosis selected.

All the control units that communicate via the CAN data bus are still disconnected. Ignition is switched off.

- Connect one of the control units.
- Switch the ignition on.



-> Display on VAS 5051:

- Select the applicable vehicle system under -1-.
- Interrogate and erase fault memory in the control unit which has just been connected.
- Select the ◀ key.
- Under -1- select the diagnostic function "06 - End output".
- Switch the ignition off and then on again.
- Leave the ignition switched on for 10 seconds. Then interrogate the fault memory of the control unit that has just been connected, using the fault reader.
- If the fault "Drive data bus defective" is now indicated, replace the control unit which has just been connected.
- If fault "Signal wire defective" is not read out, connect the next control unit and repeat the procedure.



28 - Ignition system

1 - Checking ignition system

1.1 - Checking ignition system

1.2 - General notes on ignition system

- ◆ The engine control unit is equipped with self-diagnosis.
- ◆ A voltage of at least 11,5 V is necessary for satisfactory functioning of the electrical components.
- ◆ In the case of some tests, a fault may be recognised and stored by the control unit. At the end of all tests and repairs, therefore, the fault memory should be interrogated and, if necessary, erased.
- ◆ If the engine starts briefly and then stops after fault finding, repair or tests on components, this may be because the immobiliser is blocking the engine control unit. The fault memory must then be interrogated and, if necessary, adaption carried out on the control unit.

1.3 - Safety precautions

To prevent injuries to persons and/or 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 at starter speed.
- ◆ Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.
- ◆ Always switch off the ignition before connecting or disconnecting injection or ignition system wiring or tester cables.
- ◆ To run engine at starting speed without actually starting it (for example, in order to test compression), unplug connector from the output stages for the ignition coils and remove fuse for the injectors. After completing the work, interrogate the fault memory and erase it.
- ◆ Always switch off the ignition before washing the engine.

1.4 - Technical data for ignition system

Engine code letters	AZC (6.0 L / 4 valve, 309 crankshaft)
The ignition timing is determined by the control units Ignition timing cannot be adjusted.	
Ignition system	Individual coil system with 12 ignition coils connected directly to spark plugs via spark plug connectors (common component ignition coil and output stage). In order to reach the ignition coils (spark plugs), the side sections of the intake manifold must be removed in each case =>Page 154 .
Spark plugs	See spare parts catalogue
Part number and manufacturer description	
Tightening torque	30 Nm
Firing order	1-12-5-8-3-10-6-7-2-11-4-9

1.5 - Checking ignition coils

Note:

The ignition coil and the output stage are combined in a common component. In order to reach the ignition coils, the side sections of the intake manifold must be removed in each case => Page 154.

Test conditions

- No faults relating to injector(s) stored

Identify an inoperative or misfiring cylinder as follows:

- Check misfire detection => Page 239.

If misfires are detected:

- Continue checking the indicated cylinder => "If the defective cylinder has been detected".

If no misfires were detected:

- Compare the spark plugs of all cylinders with each other and check for soot on the electrodes.

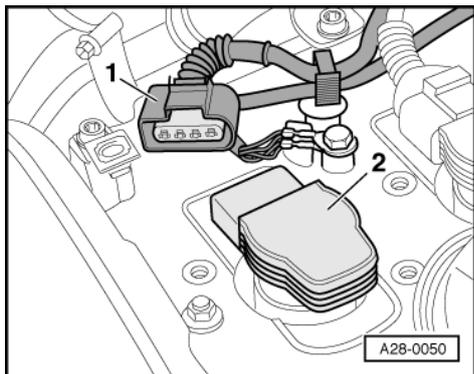
If the defective cylinder has been identified:

- Replace the spark plug of the defective cylinder with one from another cylinder.

If the fault moves with the spark plug:

- Replace spark plug.

If the fault remains in the same cylinder:

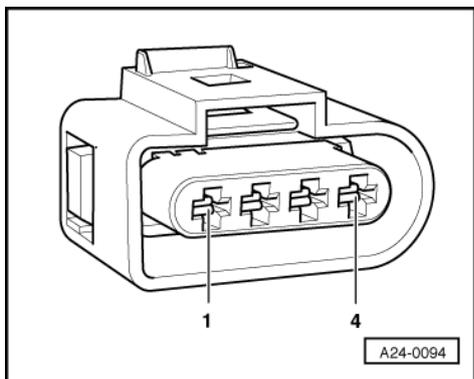


- Replace the ignition coil from the defective cylinder with one from another cylinder.
- If the fault now occurs at the other cylinder, renew the ignition coil.

If the fault remains on the cylinder, check earth wiring of ignition coil.

Checking the earth connection for the ignition coil:

- Detach the 4-pin connector from the relevant ignition coil.





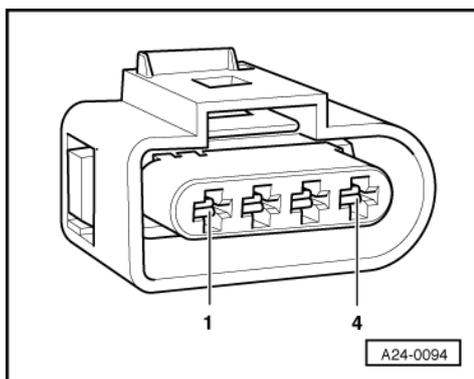
- -> Check the earth connection from socket 4 on the 4-pin connector to the engine earth for open circuit or short to positive.

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

- Rectify any open/short circuit as necessary.

If the earth connection is OK: Check supply voltage for ignition coil => Page 236 .

Checking the power supply to the ignition coil:



- -> Connect hand-held multimeter to following socket on the connector to measure voltage:
- Switch the ignition on.

4-pin connector on wiring harness, socket	Specified value
1 + earth	Battery voltage

Specified value: approx. battery voltage

If specified value is not attained:

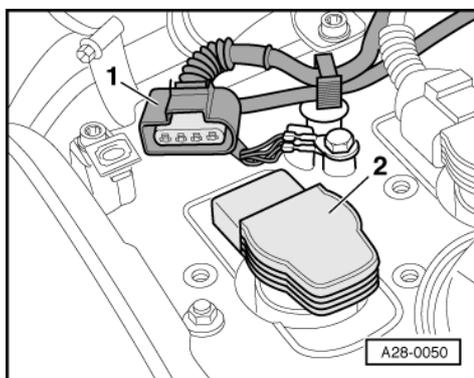
- Check the wiring from socket 1 via the fuse to the voltage supply relay -J271 for continuity.

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

If the specified value is achieved:

- Check output stage => Page 237 .

1.6 - Checking output stages for ignition coils

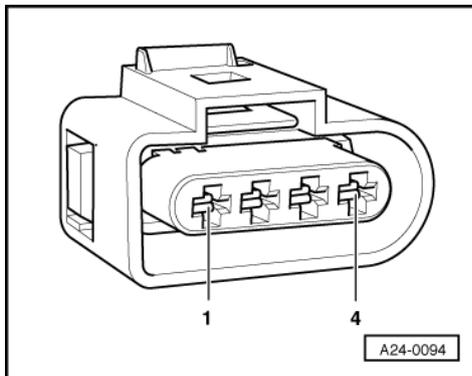


Note:

The ignition coil and the output stage are combined in a common component.

Checking earth connection of output stage

- Detach the 4-pin connector from the relevant ignition coil.



- -> Check the earth connection from socket 2 on the 4-pin connector to earth for open circuit or short circuit to positive.
- Rectify any open/short circuit as necessary.

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

If the earth connection is OK: Checking actuation of output stages =>Page 237 .

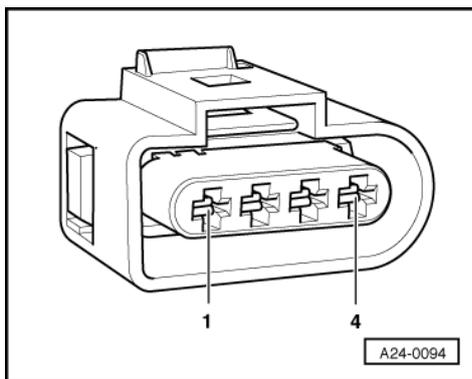
Checking actuation of output stages

- Remove fuse for injectors

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

Note:

It is important to ensure that no fuel is injected during the test, as this would damage the catalytic converter. This is why the fuse for the injectors must be removed.



- Detach the 4-pin connector from the relevant ignition coil.
- -> Connect the V.A.G 1527 diode test lamp to the following contacts on the ignition coil connector:
- Operate the starter for a few seconds.

4-pin connector of relevant ignition coil at wiring harness, socket	Specified value



3 + 2	Diode test lamp must flash (brief impulse)
-------	--

If the specified values are not obtained:

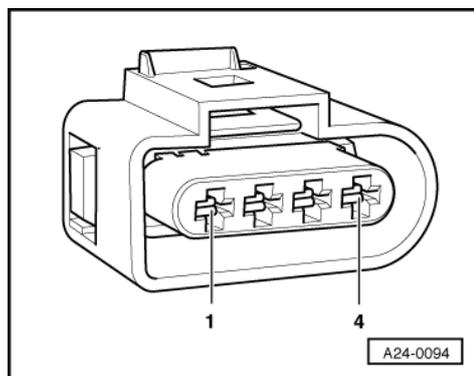
- Switch ignition off.

Checking wiring

Note:

The ignition coils for cylinders 1 to 6 are activated from engine control unit 1. The ignition coils for cylinders 7 to 12 are activated from engine control unit 2.

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit 1 or engine control unit 2; do not connect the engine control unit => Page 117 .



- -> Test wiring from 4-pin connector at ignition coil or output stage ...
- ... to engine control unit for checking for open circuit and short to positive or earth.

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

4-pin connector on the ignition coil Contact 3	Contact at test box V.A.G 1598/31 on engine control unit 1
Cyl. 1	102
Cyl. 2	110
Cyl. 3	94
Cyl. 4	111
Cyl. 5	103
Cyl. 6	95

4-pin connector on the ignition coil Contact 3	Contact at test box V.A.G 1598/31 on engine control unit 2
Cyl. 7	95
Cyl. 8	103
Cyl. 9	111
Cyl. 10	94
Cyl. 11	110
Cyl. 12	102

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

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

If no wiring fault is detected:

- Replace the common component ignition coil with output stage.

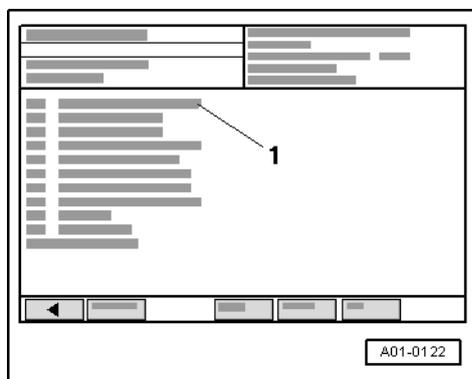
1.7 - Checking misfire detection

Note:

The display of misfires detected occurs in engine control unit 2 for all 12 cylinders.

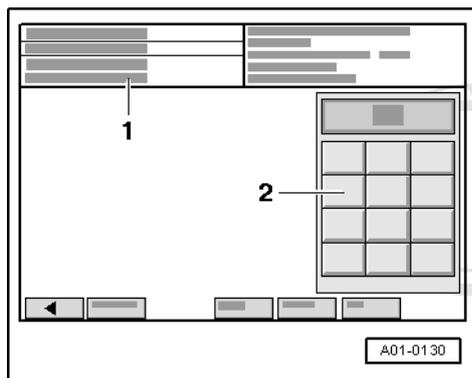
Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 and select engine control unit 2 using "address word" 11 => Page 3 .
For this purpose, the engine must be running at idle speed.



-> Display on VAS 5051:

- Under -1- select the diagnostic function "08 - Read measured value block".



-> Display on VAS 5051:

- 1 - Enter display group
max. input value = 255

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- Enter "014" for "display group number 014" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

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- Check detection of misfires in display zones 3 and 4.

	Display zones			
	1	2	3	4
Display group 014: Misfire detection				
Display	xxx rpm	xxx %	xxx	---
Display	Engine speed	Load	Total misfires	Misfire detection
Range				activated blocked
Specified value	xxxx rpm	10...25 %	0	activated
Note:			If nominal value is exceeded: Checking misfire of the individual cylinders => Page 240 .	If misfires are to be expected due to the operation (e.g. running warm, push switch off) the misfire recognition is blocked.

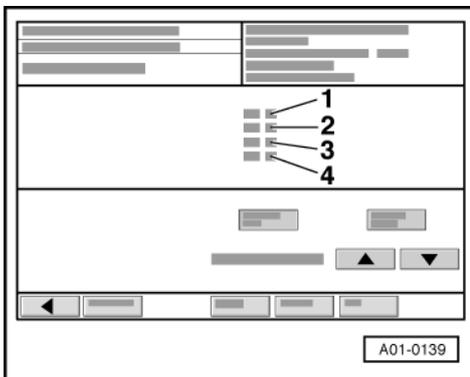
If specified value is attained:

- Exit the function "08 - Read measured value block" by pressing the ◀ key.

If specified value is not attained:

- Select the s key in order to change to display group 015.

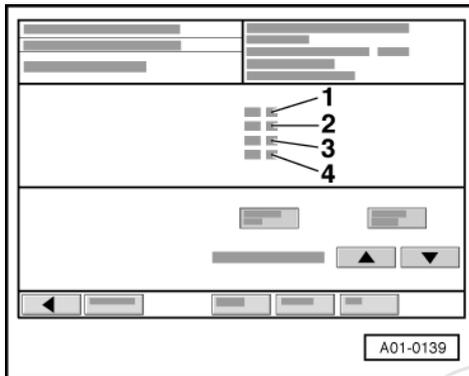
Checking misfire recognition of the individual cylinder



-> Display on VAS 5051:

- Check detection of misfires in display zones -1- to -4-.

	Display zones			
	1	2	3	4
Display group 015: Misfire detection of cylinders 1, 2 and 3				
Display	xxx	xxx	xxx	---
Display	Number of misfires in cylinder 1	Number of misfires in cylinder 2	Number of misfires in cylinder 3	Misfire detection
Range				activated blocked
Specified value	0	0	0	activated
Note:	If nominal value is exceeded: Evaluation => Page 243			---

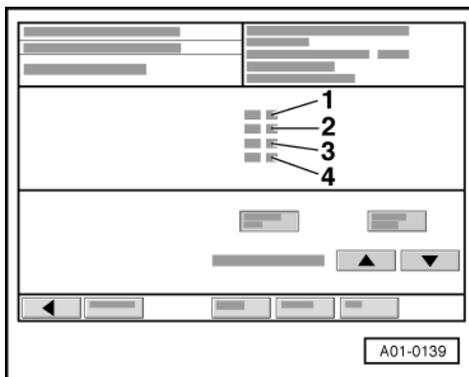


- Select the s key in order to change to display group 016.

-> Display on VAS 5051:

- Check detection of misfires in display zones -1- to -4-.

	Display zones			
	1	2	3	4
Display group 016: Misfire detection of cylinders 4, 5 and 6				
Display	xxx	xxx	xxx	---
Display	Number of misfires in cylinder 4	Number of misfires in cylinder 5	Number of misfires in cylinder 6	Misfire detection
Range				activated blocked
Specified value	0	0	0	activated
Note:	If nominal value is exceeded: Evaluation => Page 243			---



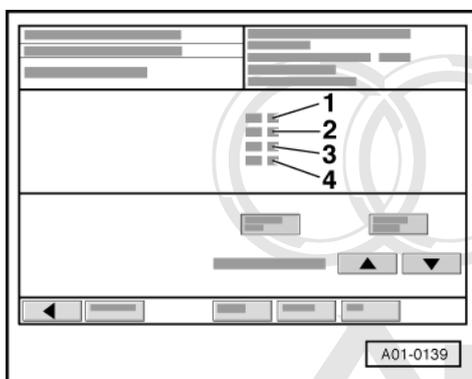


- Select the s key in order to change to display group 017.

-> Display on VAS 5051:

- Check detection of misfires in display zones -1- to -4-.

	Display zones			
	1	2	3	4
Display group 017: Misfire detection of cylinders 7, 8 and 9				
Display	xxx	xxx	xxx	---
Display	Number of misfires in cylinder 7	Number of misfires in cylinder 8	Number of misfires in cylinder 9	Misfire detection
Range				activated blocked
Specified value	0	0	0	activated
Note:	If nominal value is exceeded: Evaluation => Page 243			---



- Select the s key twice in order to change to display group 19.

-> Display on VAS 5051:

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- Check detection of misfires in display zones -1- to -4-.

	Display zones			
	1	2	3	4
Display group 019: Misfire detection of cylinders 10, 11 and 12				
Display	xxx	xxx	xxx	---
Display	Number of misfires in cylinder 10	Number of misfires in cylinder 11	Number of misfires in cylinder 12	Misfire detection
Range				activated blocked
Specified value	0	0	0	activated
Note:	If nominal value is exceeded: Evaluation => Page 243			---

- Exit the function "08 - Read measured value block" by pressing the ←key.

Interpreting display groups 014, 015, 016, 17 and 19:

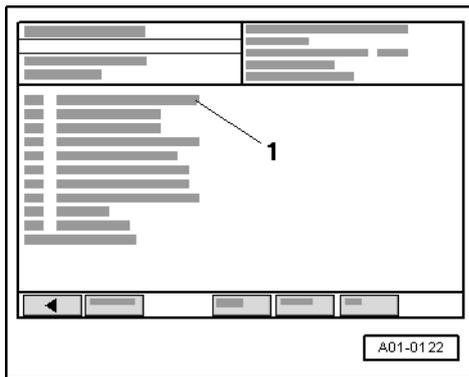
Number of misfires	Possible causes of fault	Fault remedy
Higher than 0	<ul style="list-style-type: none"> - Defective spark plug - Defective spark plug connector - Ignition coil or output stage - Injector defective - Checking compression 	<ul style="list-style-type: none"> - Check spark plugs and ignition wiring Check ignition coils => Page 237 . - Check injectors =>Page 133 .

1.8 - Checking intake air temperature sender

The test for sender -G42 is described below. Test for sender 2 for intake air temperature -G299 => Page **245** .

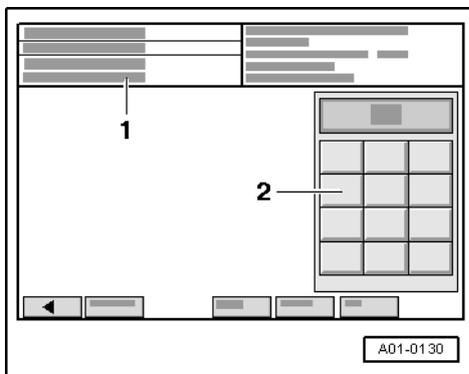
Fitting location of sender -G42 (common component: air mass meter -G70 and intake air temperature sender -G42) => Page **93** .

- Connect vehicle diagnostic, testing and information system VAS 5051 and select engine control unit 1 using "address word" 01 => Page **3** .
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- For this purpose, the engine must be running at idle speed.



-> Display on VAS 5051:

- Under -1- select the diagnostic function "08 - Read measured value block".



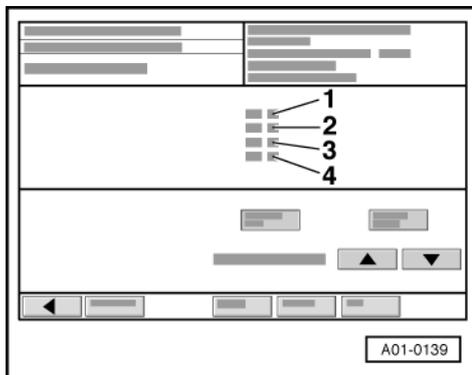
-> Display on VAS 5051:

- 1 - Enter display group



max. input value = 255

- Enter "004" for "display group number 004" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Check intake air temperature sender in display zone -4-.

	Display zones			
	1	2	3	4
Display group 004: Intake air temperature with engine idling				
Display	xxxx rpm	xx.x V	xxx.x °C	xxx.x °C
Display	Engine speed	Battery voltage	Coolant temperature	Intake air temperature
Range				-48.0...143.0 °C
Specified value	xxxx rpm	12.0...15.0 V	80.0...110.0 °C	Between ambient temperature and up to 110 °C 1)

1) If a temperature is displayed which deviates greatly from the ambient temperature of the sender, check sender and sender wiring for contact resistances and open circuit.

Note:

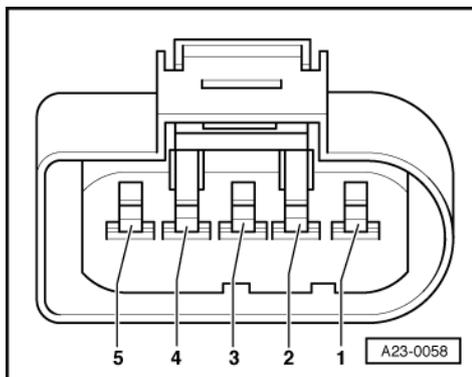
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The values must be approximately the same in display zones 3 and 4 when the engine is cold.

- Exit the function "08 - Read measured value block" by pressing the ◀ key.

Checking wiring

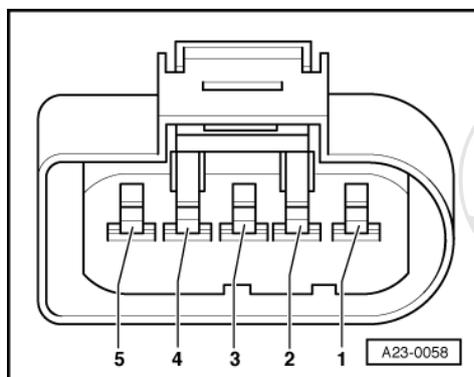
- Switch ignition off.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit 1; the engine control unit should not be connected =>Page 117 .
- Disconnect the connector to the air mass meter -G70 => Page fitting locations overview 93 .



- -> Check for shorts between the two lines.

5-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
1	27

Specified value: infinity Ohm (no connection)



- -> Check for open circuit and short to positive or earth in the following wiring connections:

5-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
1	26
3	27

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

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

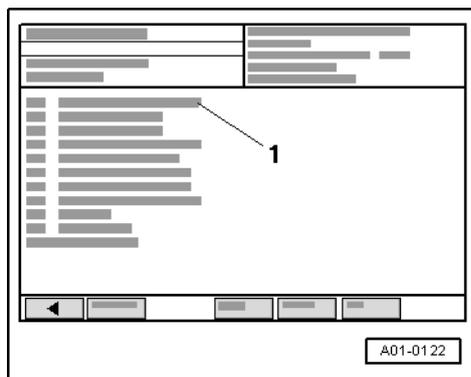
If no wiring fault is detected:

- Replace the intake air temperature sender -G42 (including air mass meter -G70)

Checking intake air temperature sender 2 -G299

Fitting location of sender -G299 (common component: air mass meter -G246 and intake air temperature sender 2 -G299) => Page 93 .

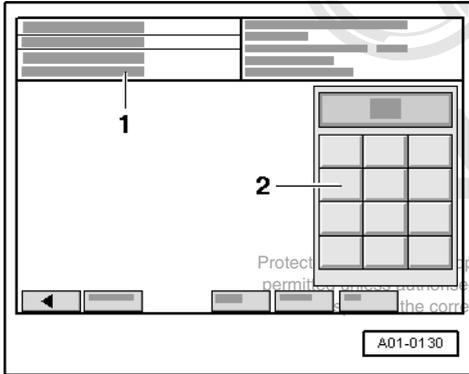
- Connect vehicle diagnostic, testing and information system VAS 5051 and select engine control unit 2 using "address word" 11 => Page 3 .
For this purpose, the engine must be running at idle speed.





-> Display on VAS 5051:

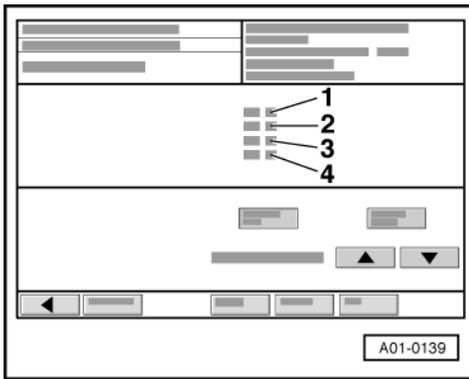
- Under -1- select the diagnostic function "08 - Read measured value block".



-> Display on VAS 5051:

- 1 - Enter display group
max. input value = 255

- Enter "004" for "display group number 004" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Check intake air temperature sender in display zone -4-.

	Display zones			
	1	2	3	4
Display group 004: Intake air temperature with engine idling				
Display	xxxx rpm	xx.x V	xxx.x °C	xxx.x °C
Display	Engine speed	Battery voltage	Coolant temperature	Intake air temperature
Range				-48.0...143.0 °C
Specified value	xxxx rpm	12.0...15.0 V	80.0...110.0 °C	Between ambient temperature and up to 110 °C 1)

1) If a temperature is displayed which deviates greatly from the ambient temperature of the sender, check sender and sender wiring for contact resistances and open circuit.

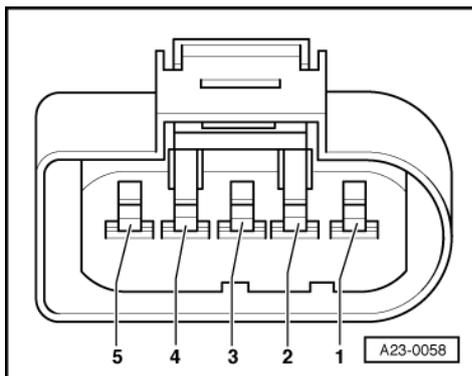
Note:

The values must be approximately the same in display zones 3 and 4 when the engine is cold.

- Exit the function "08 - Read measured value block" by pressing the ◀ key.

Checking wiring

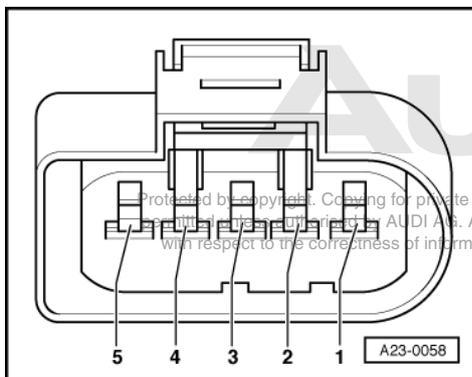
- Switch ignition off.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit 2; the engine control unit should not be connected =>Page 117 .
- Disconnect the connector to the air mass meter -G70 => Page fitting locations overview 93 .



- -> Check for shorts between the two lines.

5-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
1	27

Specified value: infinity Ohm (no connection)



- -> Check for open circuit and short to positive or earth in the following wiring connections:

5-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
1	26
3	27

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

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



If no wiring fault is detected:

- Replace the intake air temperature sender 2 -G299 (including air mass meter -G246)

1.9 - Checking coolant temperature sender -G62

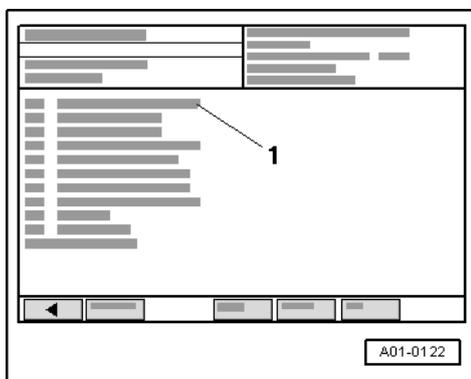
Fitting location of coolant temperature sender =>Page 93

Test requirements:

- Engine cold

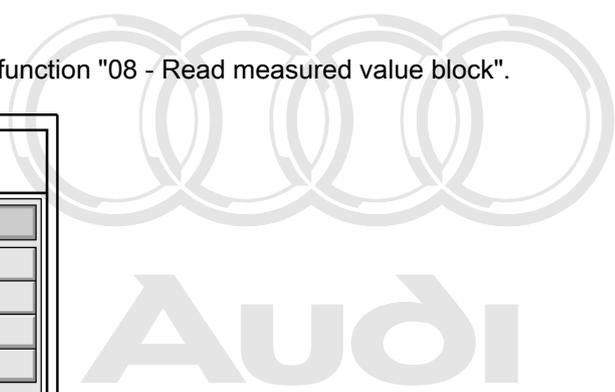
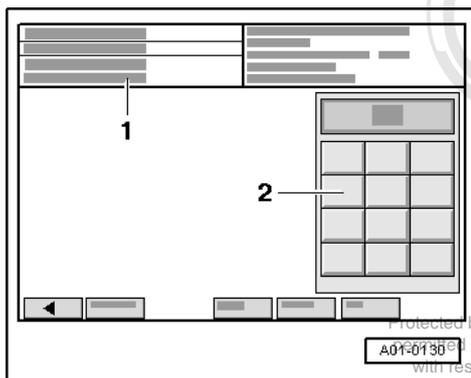
Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 and select engine control unit 1 using "address word" 01 => Page 3 .
For this purpose, the engine must be running at idle speed.



-> Display on VAS 5051:

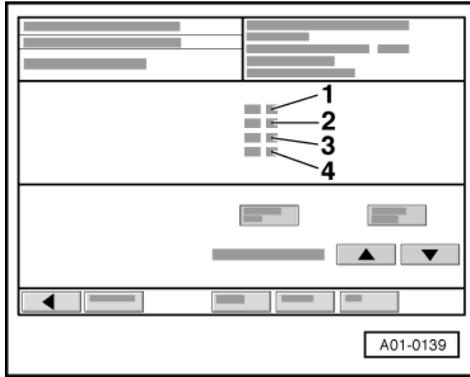
- Under -1- select the diagnostic function "08 - Read measured value block".



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-> Display on VAS 5051:

- 1 - Enter display group
max. input value = 255
- Enter "004" for "display group number 004" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Check coolant temperature sender in display zone -3-.

	Display zones			
	1	2	3	4
Display group 4: Coolant temperature with engine idling				
Display	xxxx rpm	xx.xxx volts	xxx.x °C	xxx.x °C
Display	Engine speed (in steps of 40 rpm)	Battery voltage	Coolant temperature	Intake air temperature
Range		min.:0 volts max.: 15.000 V		
Specified value	xxxx rpm	xx.xxx volts	80.0...105.0 °C	Ambient temperature
Note:			-The temperature reading should increase at a uniform rate. -If specified value is not attained, check sender or sender wiring =>Page 249 .	

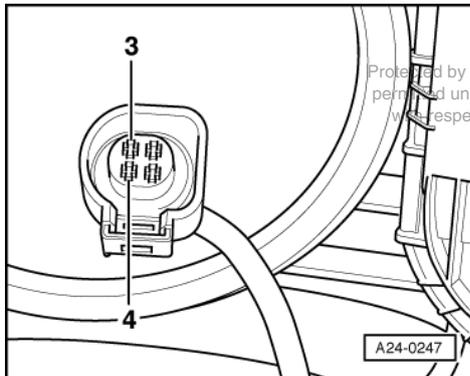
Note:

The values must be approximately the same in display zones 3 and 4 when the engine is cold.

- Exit the function "08 - Read measured value block" by pressing the ◀ key.

Checking wiring

- Switch ignition off.
- Unplug the connector from sender.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit 1; the engine control unit should not be connected =>Page 117 .
- Check the wiring from the 4 pin connector ...
- ... to engine control unit for checking for open circuit and short to positive or earth.



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4-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
3	108
4	93

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

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

If no wiring fault is detected:

- Replace coolant temperature sender -G62.

1.10 - Checking engine speed sender -G28

Note:

The engine speed sender is designed as a Hall sender.

The signal from the sender leads to both engine control units, however the voltage supply to the sender occurs from engine control unit 1.

The engine speed sender is a combined speed sender and reference mark sender.

After lifting the vehicle and after applying full steering lock to the left, the engine speed sender is accessible between the front left wheel and the wing.

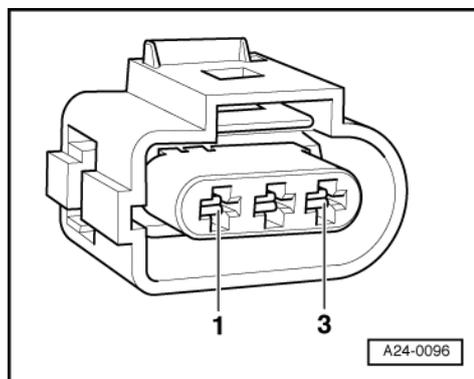
Checking engine speed sender

Fitting location of sender => Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG. **Page 93**

- Before carrying out the test, make sure that the sender is correctly installed and firmly seated.
- No shavings or damage to speed sender or sender wheel.

Checking voltage supply of engine speed sender

- Disconnect connector on engine speed sender.



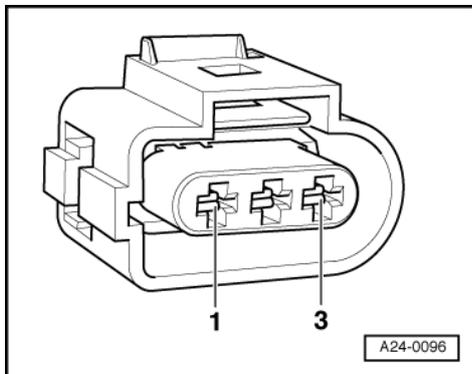
- -> Connect hand-held multimeter V.A.G 1526 for voltage measurement to sockets 1 (positive) and 3 (earth) on connector.
- Switch the ignition on.

Specified value: approx. 5 V.

If specifications are not attained, check wiring connections.

Checking wiring connections between engine speed sender and engine control units

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit 1; the engine control unit should not be connected =>Page **117** .



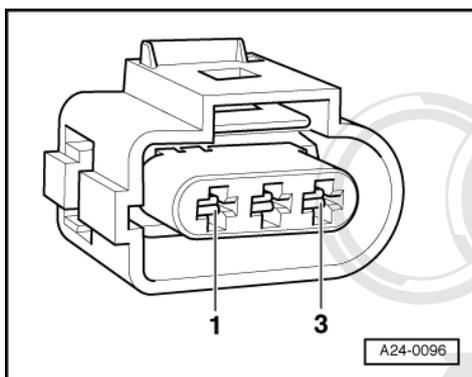
- -> Check wiring from speed sender ...
- ... to engine control unit 1 to check for open circuit and short circuit to positive or earth.

3-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
1 (positive)	98
2 (signal)	82
3 (earth)	90

- Rectify any open/short circuit as necessary.

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

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit 2; the engine control unit should not be connected =>Page **117** .



- -> Check wiring from speed sender ...
- ... to engine control unit 2 to check for open circuit and short circuit to positive or earth.

3-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
2 (signal)	82

- Rectify any open/short circuit as necessary.

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



If no wiring faults are detected:

- Slowly turn engine and check sender wheel for concentricity/tight fit.
- If no faults have been found in any of the above checks, fit a new engine speed sender.

1.11 - Checking knock control stop

If a fault entry relating to "knock control stop reached" is made, carry out the following checks:

	Possible causes of fault	Fault remedy
Fault entry for all cylinders	- Poor fuel quality	- Change fuel quality (see operating instructions)
or Fault entry for all cylinders of one bank	- Knock sensor tightened with incorrect torque	- Loosen sensor and tighten to 20 Nm
	- Knock sensor defective	- Check knock sensor => Page 252
	- Corrosion on connector	
	- Loose components on engine	- Secure components
Fault entry for one cylinder	- Engine fault	- Checking compression
	- Loose components on engine	- Secure components

1.12 - Checking knock sensors

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The test for knock sensors -G61 and -G66 is described below. Test for knock sensors -G198 and -G199 => Page 253.

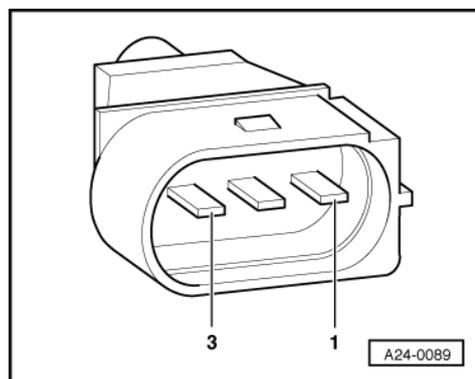
Notes:

- ◆ Knock sensor -G61 detects knocking combustion in cylinders 1, 2 and 3; Knock sensor -G66 detects knocking combustion in cylinders 4, 5 and 6.
- ◆ To ensure that the knock sensors function properly it is important to keep exactly to the specified tightening torque of 20 Nm.
- ◆ Use only gold plated contacts when repairing the contacts in the connectors for the knock sensors.
- ◆ Check connector between knock sensor and wiring harness for corrosion.

Checking knock sensors

Fitting location of connectors => Page 93 .

- Unplug the connector for the relevant knock sensor in the engine compartment.



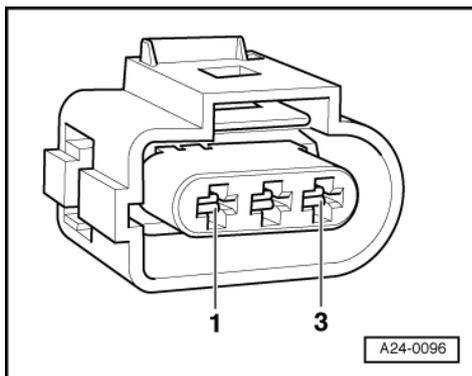
- -> Test for short between all three contacts in the knock sensor connector (contacts 1+2, 1+3, 2+3).

Specified value: There must be no connection between any of the wires (infinite resistance).

- If there is a connection between the contacts, fit a new knock sensor.
- If no short is found, check knock sensor wiring.

Checking wiring from knock sensors to engine control unit

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit 1; the engine control unit should not be connected =>Page 117 .



- -> Check wiring from the relevant sensor connector ...
- ... to engine control unit for checking for open circuit and short to positive or earth.

Knock sensor 1 -G61 (cylinders 1, 2 and 3)

3-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
1 (earth)	99
2 (signal)	106
3 (screening)	108

Knock sensor 2 -G66 (cylinders 4, 5 and 6)

3-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
1 (earth)	99
2 (signal)	107
3 (screening)	108

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

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

Checking knock sensors -G198 and -G199

Notes:

- ◆ Knock sensor -G198 detects knocking combustion in cylinders 7, 8 and 9; Knock sensor -G199 detects knocking combustion in cylinders 10, 11 and 12.
- ◆ To ensure that the knock sensors function properly it is important to keep exactly to the specified tightening torque of 20 Nm.
- ◆ Use only gold plated contacts when repairing the contacts in the connectors for the knock sensors.

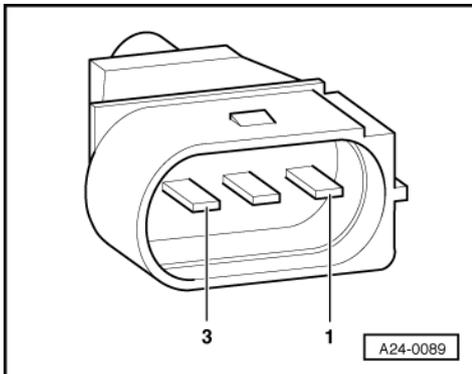


- ◆ Check connector between knock sensor and wiring harness for corrosion.

Checking knock sensors

Fitting location of connectors => Page 93 .

- Unplug the connector for the relevant knock sensor in the engine compartment.



- -> Test for short between all three contacts in the knock sensor connector (contacts 1+2, 1+3, 2+3).

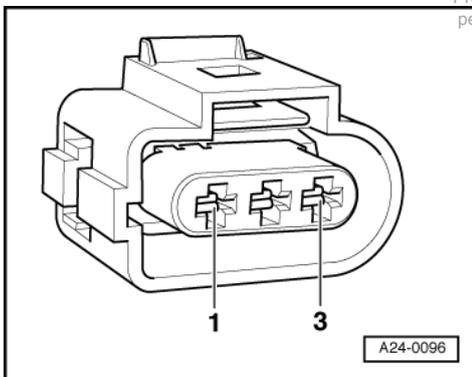
Specified value: There must be no connection between any of the wires (infinite resistance).

- If there is a connection between the contacts, fit a new knock sensor.
- If no short is found, check knock sensor wiring.

Checking wiring from knock sensors to engine control unit

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit 2; the engine control unit should not be connected =>Page 117 .

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- -> Check wiring from the relevant sensor connector ...
- ... to engine control unit for checking for open circuit and short to positive or earth.

Knock sensor 3 -G198 (cylinders 7, 8 and 9)

3-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
1 (earth)	99
2 (signal)	106
3 (screening)	108

Knock sensor 4 -G199 (cylinders 10, 11 and 12)

3-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket

1 (earth)	99
2 (signal)	107
3 (screening)	108

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

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

1.13 - Checking Hall senders (camshaft position sensors)

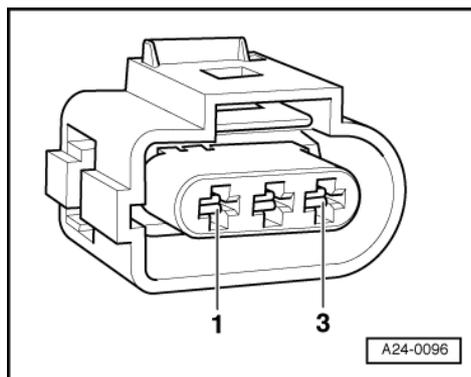
The test for Hall senders -G40 and -G300 is described below. Test for Hall senders -G163 and -G301 => Page 253 .

Note:

- ◆ Fitting location of Hall sensor => Page 93 .
- ◆ Hall sender -G40 detects the position of the inlet camshaft on cylinder bank 1 (cylinders 1 to 6)
- ◆ Hall sender -G300 detects the position of the exhaust camshaft on cylinder bank 1 (cylinders 1 to 6)
- ◆ Use only gold plated contacts when repairing the contacts in the connectors for the Hall senders.

Checking voltage supply for Hall senders

- Disconnect connector from relevant Hall sender.



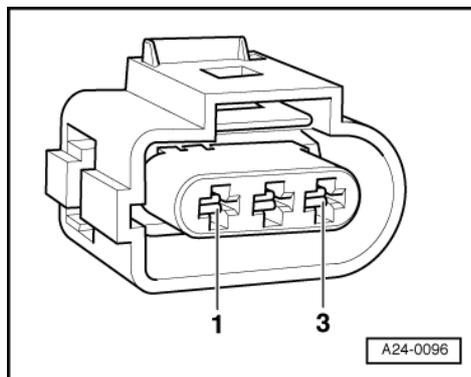
- -> Connect hand-held multimeter V.A.G 1526 for voltage measurement to sockets 1 (positive) and 3 (earth) on connector.
- Switch the ignition on.

Specified value: approx. 5 V.

If specifications are not attained, check wiring connections.

Checking wiring between Hall sender and engine control unit.

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit 1; the engine control unit should not be connected =>Page 117 .





- -> Check the wiring from the Hall sender ...
- ... to engine control unit for checking for open circuit and short to positive or earth.

Hall sender -G40 (inlet camshaft cylinders 1 to 6)

3-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
1 (positive)	98
2 (signal)	86
3 (earth)	108

Hall sender -G300 (exhaust camshaft cylinders 1 to 6)

3-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
1 (positive)	98
2 (signal)	87
3 (earth)	108

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

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

If no faults are established in the wiring and there was voltage between contacts 1+3:

- Replace relevant Hall sender.

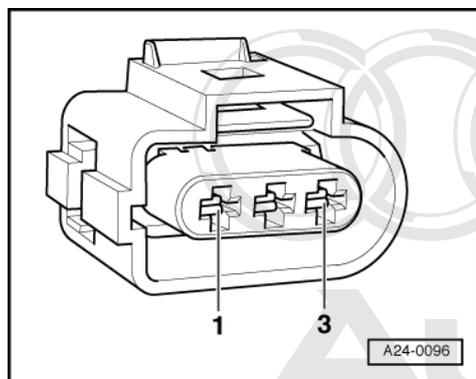
Checking Hall senders -G40 and -G163

Note:

- ♦ Fitting location of Hall sensor => Page 93 .
- ♦ Hall sender -G163 detects the position of the inlet camshaft on cylinder bank 2 (cylinders 7 to 12)
- ♦ Hall sender -G301 detects the position of the exhaust camshaft on cylinder bank 2 (cylinders 7 to 12)
- ♦ Use only gold plated contacts when repairing the contacts in the connectors for the Hall senders.

Checking voltage supply for Hall senders

- Disconnect connector from relevant Hall sender.



- -> Connect hand-held multimeter V.A.G 1526 for voltage measurement to sockets 1 (positive) and 3 (earth) on connector.
- Switch the ignition on.

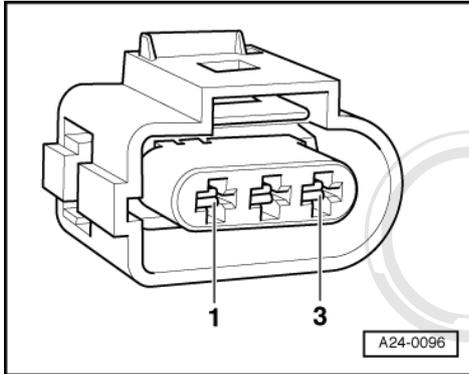
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Specified value: approx. 5 V.

If specifications are not attained, check wiring connections.

Checking wiring between Hall sender and engine control unit.

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit 2; the engine control unit should not be connected =>Page 117 .



- -> Check the wiring from the Hall sender ...
- ... to engine control unit for checking for open circuit and short to positive or earth.

Hall sender -G163 (inlet camshaft cylinders 7 to 12)

3-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
1 (positive)	98
2 (signal)	86
3 (earth)	108

Hall sender -G301 (exhaust camshaft cylinders 7 to 12)

3-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
1 (positive)	98
2 (signal)	87
3 (earth)	108

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

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

If no faults are established in the wiring and there was voltage between contacts 1+3:

- Replace relevant Hall sender.