

## Audi A8 1994 ➤

**Motronic Fuel Injection and Ignition System (6-cylinder)**

Engine ID	AMX								
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List of Workshop Manual Repair GroupsList of Workshop Manual  
Repair GroupsList of Workshop Manual Repair Groups  
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**Repair Group**

01 - Self-diagnosis

24 - Mixture preparation, Injection

28 - Ignition system

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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# 01 - Self-diagnosis

## 1 - Self-diagnosis of Motronic system

### 1.1 - Self-diagnosis of Motronic system

### 1.2 - Technical data of self-diagnosis

#### Features

- ♦ The data transfer between control unit and vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 takes place in "Rapid data transfer" mode.
- ♦ The fault memory is a non-volatile memory and thus independent of the power supply.
- ♦ Faults related to EPC are additionally indicated by the warning lamp for the electronic throttle control ("EPC warning lamp") which is situated in the dash panel insert.
- ♦ If the engine control unit detects faults which result in deterioration of exhaust emissions, these faults will be indicated by illumination of exhaust gas warning lamp -K83. Significance of exhaust warning lamp -K83 => Page 70 .
- ♦ Each time after erasing the fault memory the readiness code must be renewed => Page 30 .

### 1.3 - Safety precautions

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

#### Important

- ♦ 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.

### 1.4 - Connecting vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and selecting functions

#### Test requirements:

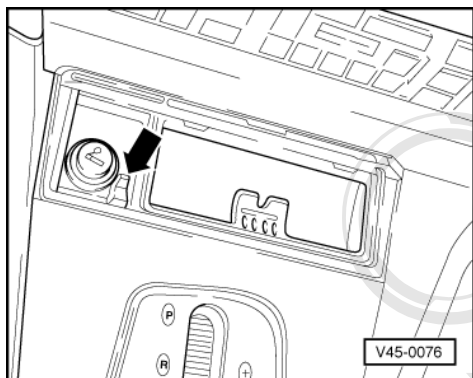
- Fuses for engine electronics OK

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

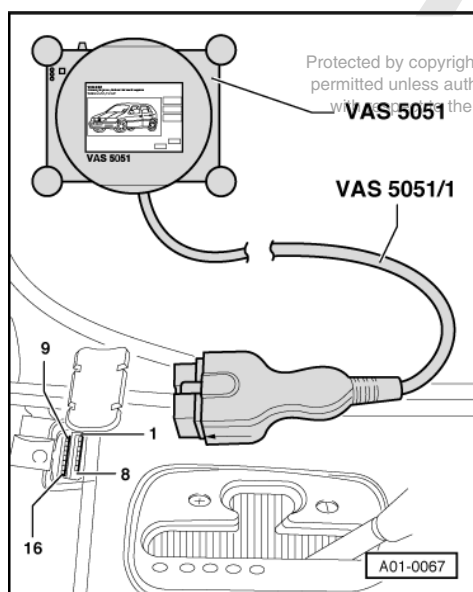
- Fuel pump relay OK; checking =>Page 85
- Battery voltage at least 12.7 V
- Earth connections on engine and gearbox OK



## Procedure



- -> Release ashtray in centre console by pressing small lever -arrow-.
- Remove ashtray from centre console and remove cover for diagnostic connector.



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- -> Connect up vehicle diagnostic, testing and information system VAS 5051 with diagnostic wire VAS 5051/1. Alternatively, connect fault reader V.A.G 1551 with diagnostic cable V.A.G 1551/3A.

**Important**  
Note the safety precautions =>

### **Note:**

*The following describes self-diagnosis using the fault reader V.A.G 1551 only.*

*When using the vehicle diagnostic, testing and information system VAS 5051, follow the procedures described in equipment operating instructions.*

Anzeige am Display: -> Indicated on display:

V . A . G

- 1) Appears alternately

### **Note:**

*If the display remains blank:*

=> Fault reader operating instructions

Depending on which function is required => "Available functions" table, Page 4 :

- Switch the ignition on.

or

- Start the engine.
- Switch on the fault reader printer with the print-key. The indicator lamp in the key must illuminate.
- Press -key 1 for "Rapid data transfer".

-> Indicated on display:

```
Rapid data transfer      HELP
Enter address word XX
```

**Note:**

Address word 00 is used to start the automatic test sequence i.e. interrogation of fault memories in all vehicle systems with self-diagnosis capability in vehicle with rapid data transfer.

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- Enter "01" for address word "Engine electronics" and confirm entry with Q-key.

-> The fault reader V.A.G 1551 display will show the control unit identification, for example:

```
3B0907551A      2.8l      V6/5V      G
0002      □
Code 11553      WSC 12345
```

**Note:**

The control unit identification can be printed out by pressing the PRINT-key on fault reader V.A.G 1551.

### Control unit identification (example)

- 3B0907551 A	Part-No.; assignment => Parts List
- 2.8 l	Engine capacity
- V6/5V	Design of engine (V-engine, 6-cylinder, 5-valve)
- "G" or no display	Vehicle with or without cruise control
- 0002	Control unit software version
- Code 11553	Control unit code
- WSC 12345	Workshop Code of V.A.G 1551 with which encoding was last performed

- Press =>-key.

-> Display function selection):

```
Rapid data transfer      HELP
Select function XX
```

**Notes:**

- ◆ The control unit identification can be displayed again by entering function "01" for "Interrogating control unit version" and confirming with the Q-key.

```
◆ Rapid data transfer      HELP
No reply from control unit
```

-> Indicated on display



- Check wiring:

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

Rapid data transfer	HELP
K-wire not switching to earth	

Rapid data transfer	HELP
K-wire not switched to positive	

Rapid data transfer	HELP
Communication problem	

### Available functions

Vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551		Ignition on, engine stopped	Engine idling	Vehicle running	Page
<b>Address words</b>					
01	Engine electronics	yes	yes	yes	1
00	Automatic test sequence	yes	yes	yes	3
<b>Functions</b>					
01	Interrogating control unit version	yes	yes	yes	3
02	Interrogating fault memory	no	yes	yes	4
03	Final control diagnosis	yes	no	no	21
04	Basic setting	yes	yes	yes	25
05	Erase fault memory	yes	yes	yes	4
06	End of output	yes	yes	yes	5
07	Encoding control unit	yes	no	no	26
08	Reading measured value block	yes	yes	yes	27

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## 2 - Interrogating and erasing fault memory

### 2.1 - Interrogating and erasing fault memory

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "Address word" 01 => Page 1  
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.*

-> Indicated on display

Rapid data transfer	HELP
Select function XX	

- Enter "02" for the function "Interrogate fault memory" and confirm entry with Q-key.

-> Indicated on display



No fault recognised!

- Press ⇒-key.

or

-> Indicated on display

X fault(s) detected!

The stored faults are displayed and printed in sequence when the printer is switched on.

- Locate and eliminate faults listed on printout as per fault table => Page 6 .

#### 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 30 .

- Press ⇒-key.

-> Indicated on display

Rapid data transfer      HELP  
Select function XX

- Enter "05" for the function "Erase fault memory" and confirm entry with Q key.

#### Note:

-> Indicated on display

Important  
Fault memory has not been interrogated

*Procedure has not been correctly followed.*

- Interrogate fault memory.

*The fault memory will also not be erased if :*

- ♦ The ignition has been switched off after interrogating the fault memory.
- ♦ A static fault has not been rectified.

-> Indicated on display

Rapid data transfer  
Fault memory is erased

- Press ⇒-key.
- Following repairs, re-interrogate the fault memory and erase if necessary.

#### 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 30 .

#### End of output

-> Indicated on display



Rapid data transfer      HELP  
Select function XX

- Enter "06" for "End output" function and confirm entry with Q-key.

-> Indicated on display

Rapid data transfer      HELP  
Enter address word XX

- Switch off ignition and detach diagnostic connector.

### 3 - Fault table (16485 to 17626)

#### 3.1 - Fault table (16485 to 17626)

#### 3.2 - Fault table

##### Notes:

- ♦ If faults occur in the monitored sensors and components, these are stored in the fault memory together with an indication of type of fault.
- ♦ Faults related to EPC are additionally indicated by the warning lamp for the electronic throttle control ("EPC warning lamp") which is situated in the dash panel insert. Notes on EPC system =>Page 130 .
- ♦ Faults which cause the exhaust emission to deteriorate are displayed with an exhaust warning lamp in the dash panel insert. Notes on exhaust warning lamp =>Page 70 .
- ♦ 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 V.A.G 1551 display. The word "sporadic" signifies individually occurring, random faults.
- ♦ Do not immediately replace components indicated as faulty by the V.A.G 1551/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 "occurring sporadically" (SP).
- ♦ 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 this case, the engine should be run at idling speed for a few minutes until the adaption process is concluded.
- ♦ After erasing the fault memory =>Page 30 .

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0101	16485	Air mass meter -G70 Implausible signal 1)	- Check air mass meter => Page 91
P0102	16486	Air mass meter -G70 Signal too small 1)	
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 167
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 172
P0117	16501	Coolant temperature sender -G62 Signal too small 1)	

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Fault code		Fault readout	Fault remedy
P0118	16502	Coolant temperature sender -G62 Signal too great 1)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 70 .

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0130	16514	Bank 1, probe 1 Electrical fault in circuit 1)	- Check lambda probe and lambda control upstream of catalytic converter => Page 103
P0131	16515	Bank 1, probe 1 Voltage too low 1)	
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)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 70 .

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0136	16520	Bank 1, probe 2 Electrical fault in circuit 1)	- Check lambda probe and lambda control downstream of catalytic converter => Page 112
P0137	16521	Bank 1, probe 2 Voltage too low 1)	
P0138	16522	Bank 1, probe 2 Voltage too high 1)	
P0139	16523	Bank 1, probe 2 Signal too slow 1)	
P0140	16524	Bank 1, probe 2 No activity 1)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 70 .

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0150	16534	Bank 2, probe 1 Electrical fault in circuit 1)	- Check lambda probe and lambda control upstream of catalytic converter => Page 103
P0151	16535	Bank 2, probe 1 Voltage too low 1)	
P0152	16536	Bank 2, probe 1 Voltage too high 1)	
P0153	16537	Bank 2, probe 1 Signal too slow 1)	



Fault code		Fault readout	Fault remedy
P0154	16538	Bank 2, probe 1 No activity 1)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 70.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0156	16540	Bank 2, probe 2 Electrical fault in circuit 1)	- Check lambda probe and lambda control downstream of catalytic converter => Page 112
P0157	16541	Bank 2, probe 2 Voltage too low 1)	
P0158	16542	Bank 2, probe 2 Voltage too high 1)	
P0159	16543	Bank 2, probe 2 Signal too slow	
P0160	16544	Bank 2, probe 2 No activity 1)	
P0219	16603	Maximum engine speed exceeded	- Rectify mechanical damage

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 70.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0300	16684	Misfire detected 1)	<ul style="list-style-type: none"> <li>- Check the fuel pressure =&gt;Page 76</li> <li>- Check spark plugs and ignition wiring</li> <li>- Check ignition coils =&gt; Page 163</li> <li>- Checking output stages =&gt; Page 164</li> <li>- Test misfire detection =&gt; Page 187</li> <li>- Refuel the vehicle</li> </ul>
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)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 70.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0321	16705	Engine speed sender -G28 Implausible signal	- Checking engine speed sender =>Page 170
P0322	16706	Engine speed sender -G28 No signal 1)	
P0327	16711	Knock sensor 1 -G61 Signal too small	- Check knock sensor => Page 180
P0328	16712	Knock sensor 1 -G61 Signal too great	
P0332	16716	Knock sensor 2 -G66 Signal too small	

Fault code		Fault readout	Fault remedy
P0333	16717	Knock sensor 2 -G66 Signal too great	
P0341	16725	Camshaft position sensor => sender -G40 Implausible signal 1)	- Check Hall sender => Page <b>183</b>
P0346	16730	Camshaft position sensor => sender -G163 Implausible signal 1)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page **70**.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0420	16804	Catalytic converter system bank 1, Inefficient 1)	- Produce readiness code => Page <b>30</b> . If the same fault is displayed again replace the primary catalytic converter, bank 1 => Engine, Mechanics; Repair group 26; Removing and installing parts of exhaust system Removing and installing parts of exhaust system
P0421	16805	Primary catalytic converter bank 1, Inefficient	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page **70**.

**Note:**

*The primary catalytic converters are located directly downstream of the exhaust manifold in the front exhaust pipe of the relevant cylinder bank.*

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0430	16814	Catalytic converter system bank 2, Inefficient 1)	- Produce readiness code => Page <b>30</b> . If the same fault is displayed again replace the primary catalytic converter, bank 2 => Engine, Mechanical Components; Repair group 26; Removing and installing parts of exhaust system Removing and installing parts of exhaust system
P0431	16815	Primary catalytic converter bank 2, Inefficient	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page **70**.

**Note:**

The primary catalytic converters are directly behind the exhaust manifold in the front exhaust pipe of the relevant cylinder bank.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0501	16885	Vehicle speed signal Implausible signal 1)	- Check speed signal =>Page 149
P0506	16890	Idling speed regulation Engine speed below specification	- Check throttle valve control part =>Page 131
P0507	16891	Idling speed regulation Engine speed above specification	- Check hose connections (valves for intake manifold change-over and secondary air inlet). Check intake system for leaks => Page 95
P0560	16944	Voltage supply Implausible signal	- Check voltage supply for control unit => Page 175
P0562	16946	Voltage supply Voltage too low	
P0563	16947	Voltage supply Voltage too high	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 70.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0571	16955	Brake light switch -F2) Implausible signal	- Check brake light switch and brake pedal switch => Page 141
P0601	16985	Control unit defective 1)	- Replace engine control unit =>Page 64
P0604	16988	Control unit defective 1)	
P0605	16989	Control unit defective 1)	
P1102	17510	Bank 1, probe 1, heating circuit Short to positive 1)	- Check lambda probe heating=>Page 120
P1105	17513	Bank 1, probe 2, heating circuit Short to positive 1)	
P1107	17515	Bank 2, probe 1, heating circuit Short to positive 1)	
P1110	17518	Bank 2, probe 2, heating circuit Short to positive 1)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 70.

2) The brake pedal switch -F is monitored in addition to the brake light switch -F47.

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

Fault code		Fault readout	Fault remedy
P1111	17519	Lambda control bank1 System too lean	- Check lambda control upstream of catalytic converter =>Page <b>102</b>
P1112	17520	Lambda control bank1 System too rich	
P1113	17521	Bank 1, probe 1 Internal resistance too high	- First check signal wires for contact resistances => Page <b>107</b> ; if there are no contact resistances: Fit a new lambda probe
P1114	17522	Bank 1, probe 2 Internal resistance too high 1)	- First check signal wires for contact resistances => Page <b>118</b> ; if there are no contact resistances: Fit a new lambda probe

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page **70**.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1115	17523	Bank 1, probe 1, heating circuit Short to earth 1)	- Check lambda probe heating =>Page <b>120</b>
P1116	17524	Bank 1, probe 1, heating circuit Open circuit 1)	
P1117	17525	Bank 1, probe 2, heating circuit Short to earth 1)	
P1118	17526	Bank 1, probe 2, heating circuit Open circuit 1)	
P1119	17527	Bank 2, probe 1, heating circuit Short to earth 1)	
P1120	17528	Bank 2, probe 1, heating circuit Open circuit 1)	
P1121	17529	Bank 2, probe 2, heating circuit Short to earth 1)	
P1122	17530	Bank 2, probe 2, heating circuit Open circuit 1)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page **70**.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1127	17535	Bank 1, mixture adaption (mult.) System too rich	- Perform road test (fuel in oil) Check fuel system pressure => Page <b>73</b>
P1128	17536	Bank 1, mixture adaption (mult.) System too lean	
P1129	17537	Bank 2, mixture adaption (mult.) System too rich	- Check lambda probes in front of catalytic converter =>Page <b>103</b>
P1130	17538	Bank 2, mixture adaption (mult.) System too lean	- Check lambda probes downstream of catalytic converter =>Page <b>76</b>
P1131	17539	Bank 2, probe 1 Internal resistance too high	- First check signal wires for contact resistances => Page <b>108</b> ; if there are no contact resistances: Fit a new lambda probe

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**Note:**

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1136	17544	Bank 1, mixture adaption (add.) System too lean	- Perform road test (fuel in oil) Check fuel system pressure => Page 73
P1137	17545	Bank 1, mixture adaption (add.) System too rich	- Check air mass meter => Page 103
P1138	17546	Bank 2, mixture adaption (add.) System too lean	- Check lambda probes downstream of catalytic converter =>Page 112
P1139	17547	Bank 2, mixture adaption (add.) System too rich	- Check solenoid valve 1 for activated charcoal filter => Page 126
P1140	17548	Bank 2, probe 2 Internal resistance too high 1)	- First check signal wires for contact resistances => Page 119 ; if there are no contact resistances: Fit a new lambda probe

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 70.

**Note:**

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1141	17549	Load recognition implausible value	- Check whether the correct throttle valve control part was installed => Parts List
P1142	17550	Load recognition Fallen below control limit	- Check air mass meter => Page 91
P1143	17551	Load recognition Control limit exceeded 1)	
P1147	17555	Lambda control bank 2 System too lean	- Check lambda probe learned values and lambda control => Page 105
P1148	17556	Lambda control bank 2 System too rich	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 70.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1149	17557	Lambda control bank1 Implausible control value	- Check lambda probe learned values and lambda control => Page 73
P1150	17558	Lambda control bank 2 Implausible control value	- Check for leaks in intake air system=>Page 95
P1171	17579	Angle sender 2 for throttle valve actuator -G188 Implausible signal 3)	- Test angle sender for throttle valve actuator => Page 135
P1172	17580	Angle sender 2 for throttle valve actuator -G188 Signal too small 3)	



Fault code		Fault readout	Fault remedy
P1173	17581	Angle sender 2 for throttle valve actuator -G188 Signal too large 3)	

3) With this fault, engine control unit switches on EPC warning lamp in dash panel insert. Notes on EPC warning lamp =>Page **131**.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1176	17584	Bank 1, lambda correction downstream of catalytic converter Control limit reached	- Check lambda probe ageing of lambda probe upstream of catalytic converter => Page <b>109</b>
P1177	17585	Bank 2, lambda correction downstream of catalytic converter Control limit reached	
P1213	17621	Injector, cylinder 1 -N30 Short to positive 1)	- Check injectors =>Page <b>76</b>
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)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page **70**.

## 4 - Fault table (17633 to 19718)

### 4.1 - Fault table (17633 to 19718)

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**Refer to the notes on => Page **6**.**

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1225	17633	Injector, cylinder 1 -N30 Short to earth 1)	- Check injectors =>Page <b>76</b>
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)	



Fault code		Fault readout	Fault remedy
P1230	17638	Injector, cylinder 6 -N84 Short to earth 1)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 70.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1237	17645	Injector, cylinder 1 -N30 Open circuit 1)	- Check injectors =>Page 76
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)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 70.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1250	17658	Fuel level too low	- Follow-on fault =>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
P1296	17704	Fault in cooling system	- Check coolant temperature sender =>Page 172 Check coolant thermostat => Engine, Mechanical Components; Repair group 19; Removing and installing parts of the coolant system Removing and installing parts of the coolant system

**Note:**

The fault "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.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1325	17733	Knock control cylinder 1 Control limit reached	- Check knock control => Page 176
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	

Fault code		Fault readout	Fault remedy
P1329	17737	Knock control cylinder 5 Control limit reached	
P1330	17738	Knock control cylinder 6 Control limit reached	

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1335	17743	Engine torque monitoring 2 Control limit exceeded 3)	- Severe leakage, check intake air system for unmetered air =>Page <b>167</b>
P1336	17744	Engine torque monitoring Control limit exceeded	
P1337	17745	Bank 1, camshaft position sensor => -G163 Short to earth 1)	- Check Hall sender => Page <b>183</b>
P1338	17746	Bank 1, camshaft position sensor => -G163 Open circuit/short to positive 1)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page **70**.

3) With this fault, engine control unit switches on EPC warning lamp in dash panel insert. Notes on EPC warning lamp =>Page **131**.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1340	17748	Camshaft/crankshaft position sensor Incorrect assignment 1)	- Check phase position of Hall sender=>Page <b>186</b>
P1347	17755	Bank 2, camshaft/crankshaft position sensor Incorrect assignment 1)	
P1386	17794	Control unit defective	- Replace engine control unit =>Page <b>64</b>
P1387	17795	Control unit defective 1)	
P1388	17796	Control unit defective 3)	
P1391	17799	Bank 2, camshaft position sensor => -G40 Short to earth 1)	- Check Hall sender => Page <b>183</b>
P1392	17800	Bank 2, camshaft position sensor => -G40 Open circuit/short to positive 1)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page **70**.

3) With this fault, engine control unit switches on EPC warning lamp in dash panel insert. Notes on EPC warning lamp => Page **131**.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1393	17801	Ignition output 1 Electrical fault in circuit 1)	- Check actuation or wiring connections from engine control unit to output stage => Page <b>165</b>
P1394	17802	Ignition output 2 Electrical fault in circuit 1)	



Fault code		Fault readout	Fault remedy
P1395	17803	Ignition output 3 Electrical fault in circuit 1)	
P1410	17818	Tank breather valve -N80 Short to positive 1)	- Check solenoid valve 1 for activated charcoal filter => Page 126
P1411	17819	Bank 2, secondary air system Throughput too small 1)	- Check secondary air pump fuse Check vacuum hoses Check hose connections from pump to combination valve for secondary air inlet => Engine, Mechanical Components; Repair group 26; Secondary air system

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 70.

**Notes on fault codes 17801 and 17802, 17803:**

"Ignition outputs 1, 2 and 3" are the outputs on the engine control unit via which the engine control unit activates the output stage of the ignition coils.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1414	17822	Bank 2, secondary air system Leaks detected	- Check hoses from pump to mechanical secondary air inlet valve, cylinder bank 2 => Engine, Mechanical Components; Repair group 26; Secondary air system
P1421	17829	Secondary air inlet valve -N112 Short to earth 1)	- Checking secondary air system => Engine, Mechanical Components; Repair group 26; Secondary air system
P1422	17830	Secondary air inlet valve -N112 Short to positive 1)	
P1423	17831	Bank 1, secondary air system Throughput too small 1)	- Check secondary air pump fuse Check vacuum hoses Check hose connections from pump to combination valve for secondary air inlet => Engine, Mechanical Components; Repair group 26; Secondary air system

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 70.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1424	17832	Bank 1, secondary air system Leaks detected	- Check hose connections and components of the secondary air system => Engine, Mechanical Components; Repair group 26; Secondary air system
P1425	17833	Tank breather valve -N80 Short to earth 1)	- Check solenoid valve 1 for activated charcoal filter => Page 126
P1426	17834	Tank breather valve -N80 Open circuit 1)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 70.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1427	17835	Actuating vacuum pump for brake system Short to positive	- Check actuation of vacuum pump for brake system => Brake System; Repair group 47; Electric vacuum pump Electric vacuum pump
P1428	17836	Actuating vacuum pump for brake system Short to earth	
P1429	17837	Actuating vacuum pump for brake system Open circuit	

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1432	17840	Secondary air inlet valve -N112 Open circuit 1)	- Checking secondary air system => Engine, Mechanical Components; Repair group 26; Secondary air system
P1433	17841	Secondary air pump relay -J229 Open circuit 1)	
P1434	17842	Secondary air pump relay -J229 Short to positive 1)	
P1435	17843	Secondary air pump relay -J229 Short to earth 1)	
P1479	17887	Brake vacuum system Mechanical fault	- Perform short trip in engine control unit (Basic setting; Display group 8 with ignition on and selector lever in "P" or "N" position) Check hoses to and from pump to brake servo Perform final control diagnosis in control unit to check whether vacuum pump is working or is actuated.

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 70.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1501	17909	Fuel pump relay -J17 Short to earth 1)	- Check fuel pump relay =>Page 85
P1502	17910	Fuel pump relay -J17 Short to positive 1)	
P1512	17920	Intake manifold changeover valve -N156 Short to positive	- Checking intake manifold changeover function =>Page 99
P1515	17923	Intake manifold changeover valve -N156 Short to earth	
P1516	17924	Intake manifold changeover valve -N156 Open circuit	
P1519	17927	Bank 1, camshaft timing control Fault 1)	=> Engine Mechanical Components; Repair group 15; Check camshaft timing control; Check function of camshaft timing control

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Fault code		Fault readout	Fault remedy
P1522	17930	Bank 2, camshaft timing control Fault 1)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 70.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1523	17931	Crash signal from airbag control unit Implausible signal 4)	=> Body, Self-diagnosis; Repair group 01; Self-diagnosis of airbag system
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)	
P1539	17947	Clutch pedal switch -F36 Implausible signal	- Testing clutch pedal switch =>Page 145
P1541	17908	Fuel pump relay -J17 Open circuit 1)	- Check fuel pump relay =>Page 85

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 70.

4) The fault is stored with the relevant signal from airbag control unit.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1542	17950	Angle sender for throttle valve actuator -G187 Implausible signal 1)3)	- Test angle sender for throttle valve actuator => Page 135
P1543	17951	Angle sender for throttle valve actuator -G187 Signal too small 1)3)	
P1544	17952	Angle sender for throttle valve actuator -G187 Signal too great 1)3)	
P1545	17953	Throttle valve control Malfunction 1)2)	- Check throttle valve control part =>Page 131
P1558	17966	Throttle valve actuator -G186 Electrical fault in circuit 1)3)	- Check throttle valve control part=>Page 131
P1559	17967	Throttle valve control part -J338 Fault in basic setting 1)	- Perform adaption =>Page 132

Fault code		Fault readout	Fault remedy
P1564	17972	Throttle valve control part -J338 Undervoltage during basic setting	- Charge battery, repeat basic setting

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page **70**.

3) With this fault, engine control unit switches on EPC warning lamp in dash panel insert. Notes on EPC warning lamp =>Page **131**.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1565	17973	Throttle valve control part -J338 Lower stop not reached 1)3)	- Check throttle valve control part =>Page <b>131</b>
P1568	17976	Throttle valve control part -J338 Mechanical fault 1)3)	
P1569	17977	CCS switch -E45 Implausible signal	=> Electrical System 02.99 >; Repair group 01; Self-diagnosis of the cruise control system (CCS)
P1570	17978	Engine control unit disabled	- Adapt electronic immobiliser to engine control unit => Electrical System 02.99 >; Repair group 01; Immobiliser III self-diagnosis
P1579	17987	Throttle valve control part -J338 Adaption not started	- Perform adaption of throttle valve control part in accordance with requirements => Page <b>132</b>

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page **70**.

3) With this fault, engine control unit switches on EPC warning lamp in dash panel insert. Notes on EPC warning lamp => Page **131**.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1602	18010	Voltage supply, terminal 30 Voltage too low	- Check voltage supply for control unit => Page <b>175</b>
P1603	18011	Control unit defective	- Replace engine control unit =>Page <b>64</b>
P1604	18012	Control unit defective 1)3)	
P1606	18014	Rough-road detection/engine specified torque from ABS control unit Electrical fault in circuit	- Check data exchange between engine control unit and other CAN-control units =>Page <b>152</b>
P1609	18017	Crash cut-off was activated (crash caused) 5)	=> Body, Self-diagnosis; Repair group 01; Self-diagnosis of airbag system After final control diagnosis of airbag system erase fault memory of the engine control unit =>Page <b>4</b>

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Fault code		Fault readout	Fault remedy
P1386	17794	Control unit defective	- Replace engine control unit =>Page 64

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 70.

3) With this fault, engine control unit switches on EPC warning lamp in dash panel insert. Notes on EPC warning lamp =>Page 131.

5) The fault is stored with the relevant signal from airbag control unit, also with final control diagnosis of the airbag system.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1612	18020	Engine control unit incorrectly coded 1)	- Code engine control unit =>Page 26
P1624	18032	Request fault lamp on, active 6)	- Exhaust-relevant fault of gearbox control unit Read out fault memory of gearbox control unit => Automatic Gearbox 01V, Self-diagnosis; Repair group 01
P1626	18034	Drive data bus No message from gearbox control unit	- Check data exchange between engine control unit and other CAN-control units =>Page 152

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 70.

6) The gearbox control unit has recognised a fault which causes the exhaust emissions of the engine to deteriorate. The fault message is sent by the gearbox control unit to the engine control unit which now switches on the fault lamp for self-diagnosis -K83. Notes on fault lamp for self-diagnosis -K83 => Page 70. At the same time the message P1624 is displayed in the engine control unit as an indication that the fault lamp for self-diagnosis -K83 was not switched on due to an engine problem but due to a gearbox problem.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1630	18038	Accelerator position sender -G79 Signal too small 1)3)	- Checking accelerator position sender =>Page 138
P1631	18039	Accelerator position sender -G79 Signal too great 1)3)	
P1633	18041	Accelerator position sender 2 -G185 Signal too small 1)3)	
P1634	18042	Accelerator position sender 2 -G185 Signal too great 1)3)	
P1639	18047	Senders 1/2 for accelerator pedal position -G79+G185 Implausible signal 1)3)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 70.

3) With this fault, engine control unit switches on EPC warning lamp in dash panel insert. Notes on EPC warning lamp =>Page 131.

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

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Fault code		Fault readout	Fault remedy
P1640	18048	Control unit defective 1)	- Replace engine control unit =>Page <b>64</b>
P1648	18056	Drive data bus defective 1)	- Check data exchange between engine control unit and other CAN-control units =>Page <b>152</b>
P1649	18057	Drive data bus No message from ABS control unit	
P1682	18090	Drive data bus Implausible message from ABS control unit	
P1853	18261	Drive data bus Implausible message from ABS control unit	

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1912	18320	Pressure sensor for brake servo - G294 Open circuit / short to positive	- Check pressure sensor for brake servo -G294 => Brake System; Repair group 47; Electric vacuum pump Electric vacuum pump
P1913	18321	Pressure sensor for brake servo - G294 Short to earth	
P1914	18322	Pressure sensor for brake servo - G294 Implausible signal	
P3262	19718	Exhaust gas bank 1/2 Lambda probes downstream of catalytic converter interchanged	- Check connections

## 5 - Final control diagnosis

### 5.1 - Final control diagnosis

#### Notes:

- ◆ 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:

Actuation sequence
1 Solenoid valve 1 for activated charcoal filter -N80
2 Secondary air inlet valve -N112
3 Secondary air pump relay -J299
4 Intake manifold changeover valve -N156
5 Camshaft adjuster 1 (camshaft timing control valve 1 -N205 and camshaft timing control valve 2 -N208)



Actuation sequence
6 Brake vacuum pump (only for vehicles with automatic/ininitely variable gearbox as of week 36/00)
7 Injector, cylinder 1 -N30
8 Injector, cylinder 4 -N33
9 Injector, cylinder 3 -N32
10 Injector, cylinder 6 -N84
11 Injector, cylinder 2 -N31
12 Injector, cylinder 5 -N83

### Test requirements:

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- Fuses for engine electronics OK

### Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "Address word" 01 => Page **1**  
For this purpose, the ignition must be switched on.

-> Indicated on display

Rapid data transfer      HELP  
Select function XX

- Enter "03" to select the function "Final control diagnosis".

-> Indicated on display

Rapid data transfer      Q  
03- Final control diagnosis

### Actuating activated charcoal filter system solenoid valve (tank breather valve)

- Confirm entry with Q-key.

#### Note:

*Fuel pump relay should switch, fuel pump should run, flow noise at fuel pressure regulator is clearly audible. If fuel pump does not run, check actuation =>Page **87**.*

-> Indicated on display  
(or display: Tank breather valve -N80)

Final control diagnosis  
Solenoid valve 1 for activated charcoal  
filter -N80

- ♦ This valve is actuated (clicks) for approx. one minute if the operation is not switched to the next control element by pressing the ➡-key.

If the valve is not activated (does not click),

- Check solenoid valve 1 for activated charcoal filter -N80 => Page **126**.

### Actuating secondary air inlet valve

- Press ➡-key.

-> Indicated on display

Final control diagnosis  
Secondary air inlet valve -N112

- ◆ This valve is actuated (clicks) for approx. one minute if the operation is not switched to the next control element by pressing the ➔-key.

If the valve is not activated (does not click),

- Check secondary air inlet valve -N112:

=> 6-cylinder Engine (5 valve), Mechanical Components; Repair group 26; Secondary air system Secondary air system

#### Activating secondary air pump relay

- Press ➔-key.

-> Indicated on display

Final control diagnosis  
Secondary air pump relay -J299

- ◆ The secondary air pump relay -J299 (in relay and fuse carrier in electronics box, plenum chamber, position 4) switches on the motor for the secondary air pump -V101 on and off in approx. 1 minute intervals if it has not been switched to the next control element by pressing the ➔-key.

If secondary air pump motor -V101 does not run in intervals:

- Check secondary air pump relay -J299:

=> 6-cylinder Engine (5 valve), Mechanical Components; Repair group 26; Secondary air system Secondary air system

#### Actuation of intake manifold changeover valve

- Press ➔-key.

-> Indicated on display

Final control diagnosis  
Intake manifold changeover valve -N156

- ◆ This valve is actuated (clicks) for approx. one minute if the operation is not switched to the next control element by pressing the ➔-key.

If the valve is not activated (does not click).

- Check intake manifold changeover valve -N156 => Page 96

#### Actuating valves for camshaft timing control

- Press ➔-key.

-> Indicated on display

Final control diagnosis  
Camshaft adjuster 1

- ◆ Valve 1 for camshaft timing control -N205 and valve 2 for camshaft timing control -N208 are actuated (click) for approx. one minute if the operation is not switched on to the next control element by pressing the ➔-key.

If the valve is not actuated (does not click).

- Check valves for camshaft timing control:

=> 6-cylinder Engine (5 valve), 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



## Actuating brake vacuum pump

### **Note:**

*The brake vacuum pump is only installed in vehicles with automatic/ininitely variable gearboxes as of week 36/00.*

- Press ➡-key.

-> Indicated on display

Final control diagnosis  
Actuating vacuum pump for brake system

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The vacuum pump is actuated for approx. 10 seconds, unless the ➡-key is pressed to switch to the next control element.

If the vacuum pump is not actuated:

=> Brake System; Repair group 47

## Actuating injectors

### **Note:**

*The injectors are actuated according to the ignition sequence: Cyl. 1, cyl. 4, cyl. 3, cyl 6, cyl. 2, cyl 5.*

- Press ➡-key.

-> Indicated on display

Final control diagnosis  
Injector, cylinder 1 -N30

- Press ➡-key.

-> Indicated on display

Final control diagnosis  
Injector, cylinder 1 -N30

- ♦ After pressing the ➡-key the injector must click five times.

- Press ➡-key.
- Use this procedure to check all the injectors in sequence.

If one of the injectors is not actuated (does not click):

- Check injectors => Page 76 .
- Press the ➡-key after actuating the last injector (cylinder 5).

-> Indicated on display

Final control diagnosis  
END

- Press ➡-key.

-> Display function selection)

Rapid data transfer      HELP  
Select function XX

**Note:**

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

## 6 - Basic setting

### 6.1 - Basic setting

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 part to the engine control unit => display group 060  
(=>Page 132)

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With the engine running, the following operations can be performed with the basic setting function:

- ♦ Adaption process of the lambda control =>Page 105
- ♦ Fault finding by selective activation and deactivation of the lambda control => display group 099  
Pay attention to the safety precautions on Page 104 .

**Test conditions for operations with engine running:**

- No faults stored in fault memory.
- Coolant temperature at least 80 °C.
- Electrical consumers switched off (radiator fan must not run during the test).
- Air conditioning switched off.
- Vehicles with automatic gearbox: Selector lever in position P or N.

**Test sequence**

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "Address word" 01 => Page 1  
For this purpose, the ignition must be switched on.

or after each required process:

- Start the engine.

-> Indicated on display

Rapid data transfer	HELP
Select function XX	

- Enter "04" to select "Start basic setting" and confirm with Q-key.

-> Indicated on display

Initiate basic setting	Q
Enter display group number XXX	

- Enter the required display group number.

**Example:**

- Enter "000" for "display group number 000" and confirm entry with Q-key.

**Note:**

After this display group number is selected, the ACF valve is closed and the air conditioner compressor is switched off.

-> Indicated on display



Basic setting 0 Q  
 1 2 3 4 5 6 7  
 8 9 10

**Notes:**

- ♦ In display group 000 the measured values are shown in decimal form.
- ♦ If the printer is switched on, the current display can be printed out on the record slip.
- ♦ To change to another display group, proceed as follows:

Display group	V.A.G 1551	VAS 5051
Higher	Press key 3	Press s-key
Lower	Press key 1	Press t-key

- Run engine at idling speed for a few minutes, coolant temperature at least 80 °C.
- If all the display zones show the specified values, press the ➡-key.

-> Display function selection

Rapid data transfer HELP  
 Select function XX

**Display group 000 (decimal readouts)**

▪ Engine idling (coolant temperature not less than 80 °C)												
1	2	3	4	5	6	7	8	9	10	Display zones	Specified value	Corresponds to
										Learned value for mixture formation, bank 2	77...179	-10...10 %
										Learned value for mixture formation, bank 1	77...179	-10...10 %
										Control value for mixture formation, bank 2 (if outside tolerance, perform test drive)	115...141	-10...10 %
										Control value for mixture formation, bank 1 (if outside tolerance, perform test drive)	115...141	-10...10 %
										Learned value for torque loss at idle	102...169	-5...8 %
										Idling torque	77...179	-10.0...10.0 %
										Throttle valve angle	0...8	0...3.0 %
										Engine speed	65...75	650...750 rpm
										Engine load (without consumers)	16...34	12...26 %
Coolant temperature (requirement for basic setting)											180...207	80...107 °C

**7 - Encoding control unit****7.1 - Encoding control unit**

If the appropriate code for the vehicle is not displayed or if the control unit has been replaced, the control unit must be encoded as follows.

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "Address word" 01 ➡ Page 1
- For this purpose, the ignition must be switched on.

-> Indicated on display

Rapid data transfer HELP  
 Function XX

- Enter "07" for the function "Encode control unit" and confirm entry with Q-key.

-> Indicated on display

Code control unit Q  
Enter code number XXXXX (0-32000)

- Enter the control unit code in accordance with the encoding table => Page 27 .

#### Key to code

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

#### Example of coding

11553	EU4 (emission standard), front wheel drive with TCS/ESP, automatic gearbox 01V, Audi A8
-------	---

- Confirm entry with Q-key.

-> The fault reader V.A.G 1551 display will show the control unit identification, for example:

3B0907551A 2.8l V6/5V G  
0002 ☐  
Code 11553 WSC 12345

#### Note:

-> Indicated on display

Function unknown or cannot  
be carried out at present.

The code number that was entered was not authorised.

- Press =>-key.

-> Display function selection

Rapid data transfer HELP  
Select function XX

## 7.2 - Encoding table

Country/emissions	11	EU4 (exhaust emission standard)
Drive/auxiliary functions	5	Front-wheel drive with TCS/ESP
	7	4WD with electronic stability program
Gearbox	0	5-speed Manual Gearbox
	5	Automatic Gearbox 01V
Vehicle type	3	Audi A8

## 8 - Reading measured value block

### 8.1 - Reading measured value block

#### Test requirements:

- Coolant temperature at least 80 °C.
- Electrical consumers switched off (radiator fan must not run during the test).



- Air conditioning switched off.
- Steering in "straight-ahead position"

**Test sequence**

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "Address word" 01 => Page 1  
For this purpose, the engine must be running at idle speed.

-&gt; Indicated on display

```
Rapid data transfer      HELP
Select function XX
```

- Enter "08" to select the function "Reading measured value block" and confirm entry with Q-key.

-&gt; Indicated on display

```
Reading measured value block  Q
Enter display group number XXX
```

- Enter desired display group in three digits and confirm input with Q-key.

**Note:**

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

-&gt; Display for display group 000

```
Read measured value block 0
1      2      3      4      5      6      7
8      9      10
```

-&gt; Display for display group 001 (example)

```
Read measured value block 1
1      2      3      4
```

**Notes:**

- ♦ If the printer is switched on, the current display can be printed out on the record slip.
- ♦ To change to another display group, proceed as follows:

Display group	V.A.G 1551	VAS 5051
Higher	Press key 3	Press s-key
Lower	Press key 1	Press t-key

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## 9 - Readiness code

### 9.1 - Readiness code

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.

The function of each of these systems is checked by the self-diagnosis and the relevant position for the system in the 8-digit display is changed from "1" to "0" in a test sequence which must be fully completed.

The readiness code produced after successful completion of the test sequence is then "0 0 0 0 0 0 0 0" (measured value block 086, display zone 1).



If an individual test has been completed, but is "not OK", a fault is entered in the fault memory. Interrogating fault memory =>Page 4 .

The readiness code is set to

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

- ♦ the fault memory has been erased,
- ♦ a new engine control unit has been installed

In this case the readiness code must be regenerated =>Page 30 .

*Note:*

*During driving in various load situations, the emission-related tests are induced by the control unit during a "short trip" and the readiness code is then generated automatically. However, in this case the final checking option is not available, i.e. it is not possible to see whether all digits of the readiness code have been set to "0".*

9.2 - Reading out readiness code

Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "Address word" 01 => Page 1  
For this purpose, the ignition must be switched on.

-> Indicated on display

Rapid data transfer                      HELP  
Select function XX

- Enter "08" to select the function "Reading measured value block" and confirm entry with Q-key.

-> Indicated on display

Reading measured value block                      Q  
Enter display group number XXX

- Enter "086" for "display group number 086" and confirm entry with Q-key.

-> Indicated on display

Read measured value block                      86  
1                      2                      3                      4

- 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	X X X X X X X X
Display	Ready bits Completed tests	Individual tests per- formed	Individual tests per- formed	Individual tests per- formed
Range	1 = not completed 0 = completed	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	X X X X X X X X
Note	Explanation of readiness code => Page 30			

**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 30 <b>Display always 0</b>
								Activated charcoal filter system - Display 0 = Test was carried out - Display 1 = Test was not carried out (produce readiness code =>Page 30 <b>Display always 0</b>
								Secondary air system - Display 0 = Test was carried out - Display 1 = Test was not carried out (produce readiness code =>Page 30 <b>Display always 0</b>
								Lambda probes - Display 0 = Test was carried out - Display 1 = Test was not carried out (produce readiness code =>Page 30 <b>Display always 0</b>
								Lambda probe heater - Display 0 = Test was carried out - Display 1 = Test was not carried out (produce readiness code =>Page 30 <b>Display always 0</b>

**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:

- Press =>-key.

-> Display function selection):

Rapid data transfer	HELP
Select function XX	

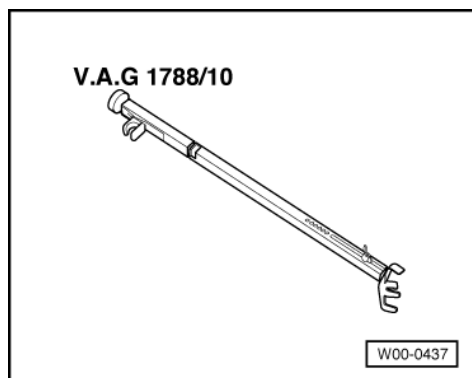
- Interrogate fault memory to check =>Page 4 (there must not be any stored faults).

If specified value is not attained:

- Generate the readiness code => Page 30 .

**9.3 - Generating the readiness code**

Special tools and workshop equipment required



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

**Preconditions:**

- Vehicle stationary.
- Vehicles with automatic gearbox: Selector lever in position P or N.
- 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
- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "Address word" 01 => Page 1

-> Indicated on display

Rapid data transfer	HELP
Select function XX	

- Enter "02" for the function "Interrogate fault memory" and confirm entry with Q-key.

-> The display shows the number of stored faults or "No fault detected!"

X fault(s) detected!
----------------------

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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:

- Press =>-key.

**Operation 2: Erase fault memory**

**Test conditions**

- Engine stopped, ignition switched on

-> Indicated on display

Rapid data transfer	HELP
Select function XX	

- Enter "05" for the function "Erase fault memory" and confirm entry with Q-key.

**Note:**

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

-> Indicated on display



Rapid data transfer  
Fault memory is erased

- Press ➡-key.

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

#### Test conditions

- Engine stopped, ignition switched on

-> Indicated on display

Rapid data transfer      HELP  
Select function XX

- Enter "04" to select "Start basic setting" and confirm with Q-key.

-> Indicated on display

Basic setting      Q  
Enter display group number XXX

- Enter "060" for "display group number 060" and confirm entry with Q-key.

-> Indicated on display

System in basic setting      60  
1      2      3      4

- Check specification in display zone 4:

	Display zones			
	1	2	3	4
<b>Display group 060: Adaption of throttle valve control part</b>				
<b>Display</b>	xx %	xx %	x	---
<b>Display</b>	Throttle valve angle (angle sender 1)	Throttle valve angle (angle sender 2)	<b>Adaption stage counter</b>	<b>Adaption status</b>
<b>Range</b>			0...8	ADP running ADP OK ERROR
<b>Specified value</b>	3...93 %	97...3 %	8	ADP OK
<b>Note</b>			The adaption stage counter reaches the number 8 after adaption (some numbers may also be skipped)	If "ERROR" is displayed: Interrogate fault memory => Page 134

#### 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:

- Press C-key.

### Operation 4: Check operating status of lambda control

- Start the engine (for vehicles with manual gearbox: press clutch pedal).

**Note:**

*If necessary, you must reselect the engine control unit with the "address word" 01 and initiate the "basic setting" function after starting the engine.*

- Install the engine speed controller V.A.G 1788/10 on the accelerator and increase the engine speed to 2200 rpm.

**Test conditions**

- Engine running at 2200 rpm.

-> Indicated on display

Basic setting      Q
Enter display group number XXX

- Enter "030" for "display group number 030" and confirm entry with Q-key.

-> Indicated on display

System in basic setting      30
1          2          3          4

- Check the lambda probe status in display zones 1 to 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	Lambda probe status, bank 1, probe 2	Lambda probe status, bank 2, probe 1	Lambda probe status, bank 2, probe 2
Range	0 = off 1 = on	0 = off 1 = on	0 = off 1 = on	0 = off 1 = on
Specified 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...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 2200 rpm.

-> Indicated on display

Basic setting            Q  
Enter display group number XXX

- Enter "034" for "display group number 034" and confirm entry with Q-key.

-> Indicated on display

System in basic setting    34  
1            2            3            4

- 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
<b>Display group 034: Diagnosis of lambda probe ageing, lambda probe upstream of catalytic converter (bank 1)</b>				
<b>Display</b>	xxxx rpm	xxx °C	x.x s	---
<b>Display</b>	Engine speed	Exhaust gas temperature	Period Lambda probe upstream of catalytic converter	Diagnosis status
<b>Range</b>				Test OFF Test ON B1-P1 OK B1-P1 NOK
<b>Specified value</b>	2200 rpm	greater than 380 °C	0.1...1.8 s	B1-P1 OK
<b>Note</b>				If "B1-P1 NOK" is displayed: Interrogate fault memory => Page 4

If specification "B1-P1 OK" is attained:

- Press C-key.

-> Indicated on display

Basic setting            Q  
Enter display group number XXX

- Enter "035" for "display group number 035" and confirm entry with Q-key.

-> Indicated on display

System in basic setting    35  
1            2            3            4

- Check specification in display zone 4:

	Display zones			
	1	2	3	4
<b>Display group 035: Diagnosis of lambda probe ageing, lambda probe upstream of catalytic converter (bank 2)</b>				

	Display zones			
<b>Display</b>	xxxx rpm	xxx °C	x.x s	---
<b>Display</b>	Engine speed	Exhaust gas temperature	Period Lambda probe upstream of catalytic converter	Diagnosis status
<b>Range</b>				Test OFF Test ON B2-P1 OK B2-P1 NOK
<b>Specified value</b>	2200 rpm	greater than 380 °C	0.1...1.8 s	B2-P1 OK
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If specification "B2-P1 OK" is attained:

- Press C-key.

#### Operation 6: Diagnosis of lambda probe condition downstream of catalytic converter

##### Test conditions

- Engine continues to run at 2200 rpm.

-> Indicated on display

Basic setting Q Enter display group number XXX
---

- Enter "036" for "display group number 036" and confirm entry with Q-key.

-> Indicated on display

System in basic setting 36
1 2 3 4

- Check specifications in display zones 2 and 4:

	Display zones			
	1	2	3	4
<b>Display group 036: Condition of lambda probe downstream of catalytic converter (banks 1 and 2)</b>				
<b>Display</b>	x.xxx V	---	x.xxx V	---
<b>Display</b>	Voltage of lambda probe downstream of catalytic converter, bank 1	<b>Diagnosis status</b>	Voltage of lambda probe downstream of catalytic converter, bank 2	<b>Diagnosis status</b>
<b>Range</b>		Test OFF Test ON B1-P2 OK B1-P2 NOK		Test OFF Test ON B2-P2 OK B2-P2 NOK
<b>Specified value</b>	less than 0.4 V or Greater than 0.5 V	B1-P2 OK	less than 0.4 V or Greater than 0.5 V	B2-P2 OK
<b>Note</b>		If "B1-S2 NOK" is displayed: Interrogate fault memory => Page 4		If "B2-S2 NOK" is displayed: Interrogate fault memory => Page 4

If the specified values "B1-S2 OK" and "B2-S2 OK" are achieved:

- Press C-key.



## Operation 7: Diagnosis of lambda control system

**Test conditions**

- Engine continues to run at 2200 rpm.

-> Indicated on display

Basic setting Q  
Enter display group number XXX

- Enter "037" for "display group number 037" and confirm entry with Q-key.

-> Indicated on display

System in basic setting 37  
1 2 3 4

- Check specification in display zone 4:

	Display zones			
	1	2	3	4
<b>Display group 037: Lambda control system diagnosis (bank 1)</b>				
<b>Display</b>	xxx %	x.xxx V	xxx ms	---
<b>Display</b>	Load	Voltage of lambda probe downstream of catalytic converter, bank 1	Lambda correction value between probes 1 and 2 (bank 1)	Diagnosis status
<b>Range</b>				Test OFF Test ON Syst. OK Syst. NOK
<b>Specified value</b>	12...26 %	0.100...1.000 V	-800...800 ms	Syst. OK
<b>Note</b>				If "Syst. NOK" is displayed: Interrogate fault memory => Page 4

If specification "Syst. OK" is attained:

- Press C-key.

-> Indicated on display

Basic setting Q  
Enter display group number XXX

- Enter "038" for "display group number 038" and confirm entry with Q key.

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-> Indicated on display

System in basic setting 34  
1 2 3 4

- Check specification in display zone 4:

	Display zones			
	1	2	3	4
<b>Display group 038: Lambda control system diagnosis (bank 2)</b>				
<b>Display</b>	xxx %	x.xxx V	xxx ms	---
<b>Display</b>	Load	Voltage of lambda probe downstream of catalytic converter, bank 2	Lambda correction value between probes 1 and 2 (bank 2)	Diagnosis status



	Display zones			
Range				Test OFF Test ON Syst. OK Syst. NOK
Specified value	12...26 %	0.100...1.000 V	-800...800 ms	Syst. OK
Note				If "Syst. NOK" is displayed: Interrogate fault memory => Page 4

If specification "Syst. OK" is attained:

- Press C-key.

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

##### Test conditions

- Engine continues to run at 2200 rpm.

-> Indicated on display

Basic setting Q  
Enter display group number XXX

- Enter "043" for "display group number 043" and confirm entry with Q-key.

-> Indicated on display

System in basic setting 43  
1 2 3 4

- Check specification in display zone 4.

	Display zones			
	1	2	3	4
<b>Display group 043: Diagnosis of lambda probe ageing, lambda probe downstream of catalytic converter (bank 1)</b>				
Display	xxxx rpm	xxx °C	x.xxx V	---
Display	Engine speed	Exhaust gas temperature	Voltage of lambda probe downstream of catalytic converter, bank 1	Diagnosis status
Range				Test OFF Test ON B1-P2 OK B1-P2 NOK
Specified value	2200 rpm	greater than 380 °C	0.100...1.000 V	B1-P2 OK
Note				If "B1-S2 NOK" is displayed: Interrogate fault memory => Page 4

If specification "B1-P2 OK" is attained:

- Press C-key.

-> Indicated on display

Basic setting Q  
Enter display group number XXX

- Enter "044" for "display group number 044" and confirm entry with Q-key.



-> Indicated on display

System in basic setting	44
1      2      3      4	

- Check specification in display zone 4:

	Display zones			
	1	2	3	4
<b>Display group 044: Diagnosis of lambda probe ageing, lambda probe downstream of catalytic converter (bank 2)</b>				
<b>Display</b>	xxxx rpm	xxx °C	x.xxx V	---
<b>Display</b>	Engine speed	Exhaust gas temperature	Voltage of lambda probe downstream of catalytic converter, bank 2	Diagnosis status
<b>Range</b>				Test OFF Test ON B2-P2 OK B2-P2 NOK
<b>Specified value</b>	2200 rpm	greater than 380 °C	0.100...1.000 V	B2-P2 OK
<b>Note</b>				If "B2-S2 NOK" is displayed: Interrogate fault memory => Page 4

If specification "B2-P2 OK" is attained:

- Press C-key.

#### Operation 9: Catalytic converter diagnosis

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

#### Test conditions

- Engine running at idling speed

-> Indicated on display

Basic setting	Q
Enter display group number XXX	

- Enter "046" for "display group number 046" and confirm entry with Q-key.

-> Indicated on display

System in basic setting	46
1      2      3      4	

- Check specification in display zone 4:

#### Note:

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

	Display zones			
	1	2	3	4
<b>Display group 046: Catalytic converter diagnosis (bank 1)</b>				
<b>Display</b>	xxxx rpm	xxx °C	x.xx	---
<b>Display</b>	Engine speed	Exhaust gas temperature	Measurement Catalytic conversion	Diagnosis status

	Display zones			
Range				Test OFF Test ON Cat. B1 OK Cat. B1 NOK
<b>Specified value</b>	650...750 rpm	Above 420 °C		Cat. B1 OK
<b>Note</b>				If "Cat. B1 NOK" is displayed: Interrogate fault memory => Page 4. If no fault is stored, replace the catalytic converter

If specification "Cat. B1 OK" is attained:

- Press C-key.

-> Indicated on display

```
Basic setting      Q
Enter display group number XXX
```

- Enter "047" for "display group number 047" and confirm entry with Q-key.

-> Indicated on display

```
System in basic setting 47
1      2      3      4
```

- Check specification in display zone 4:

	Display zones			
	1	2	3	4
<b>Display group 047: Catalytic converter diagnosis (bank 2)</b>				
<b>Display</b>	xxxx rpm	xxx °C	x.xx	---
<b>Display</b>	Engine speed	Exhaust gas temperature	Measurement Catalytic conversion	Diagnosis status
<b>Range</b>				Test OFF Test ON Cat. B2 OK Cat. B2 NOK
<b>Specified value</b>	650...750 rpm	Above 420 °C		Cat. B2 OK
<b>Note</b>				If "Cat. B2 NOK" is displayed: Interrogate fault memory => Page 4. If no fault is stored, replace the catalytic converter

If specification "Cat. B2 OK" is attained:

- Press C-key.

## Operation 10: Diagnosis of fuel tank breather valve

### Test conditions

- Engine running at idling speed

-> Indicated on display

```
Basic setting      Q
Enter display group number XXX
```

- Enter "070" for "display group number 070" and confirm entry with Q-key.



-> Indicated on display

System in basic setting	70
1      2      3      4	

- 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
<b>Display group 070: Diagnosis of fuel tank breather valve</b>				
<b>Display</b>	xx %	xx %	xx %	---
<b>Display</b>	Opening angle of fuel tank breather valve	Lambda control Diagnosis value	Idling speed control deviation	<b>Diagnosis status</b>
<b>Range</b>				Test OFF Test ON FTBV OK FTBV NOK Cancel
<b>Specified value</b>	0...99 %			FTBV OK
<b>Note</b>				If "FTBV NOK" is displayed: Interrogate fault memory => Page 126

If specification "FTBV OK" is attained:

- Press C-key.

## Operation 11: Diagnosis of secondary air system

### Test conditions

- Engine running at idling speed

**Note:**

During the diagnosis of the secondary air system the secondary air pump runs several seconds.

-> Indicated on display

Basic setting	Q
Enter display group number XXX	

- Enter "077" for "display group number 077" and confirm entry with Q-key.

-> Indicated on display

System in basic setting	77
1      2      3      4	

- Check specification in display zone 4:

**Note:**

The time of the test of the secondary air system is approx. 60 seconds.

	Display zones			
	1	2	3	4

Display zones				
<b>Display group 077: Diagnosis secondary air system (bank 1)</b>				
Display	xxxx rpm	xx.x g/s	%	---
Display	Engine speed	Air mass	Relative air mass bank 1, secondary air system	Diagnosis status
Range				Test OFF Test ON Syst. OK Syst. NOK Cancel
Specified value	650...750 rpm	1...8 g/s	-80...20 %	Syst. OK
Note				If "Syst. NOK" is displayed: Interrogate fault memory => Page 4

If specification "Syst. OK" is attained:

- Press C-key.

-> Indicated on display

```
Basic setting      Q
Enter display group number XXX
```

- Enter "078" for "display group number 078" and confirm entry with Q-key.

-> Indicated on display

```
System in basic setting      78
1      2      3      4
```

- Check specification in display zone 4:

Display zones				
	1	2	3	4
<b>Display group 078: Diagnosis secondary air system (bank 2)</b>				
Display	xxxx rpm	xx.x g/s	%	---
Display	Engine speed	Air mass	Relative air mass bank 2, secondary air system	Diagnosis status
Range				Test OFF Test ON Syst. OK Syst. NOK Cancel
Specified value	650...750 rpm	1...8 g/s	-80...20 %	Syst. OK
Note				If "Syst. NOK" is displayed: Interrogate fault memory => Page 4

If specification "Syst. OK" is attained:

- Press =>-key.

-> Display function selection):

```
Rapid data transfer      HELP
Select function XX
```



## Operation 12: Reading out readiness code

- Read out the readiness code => Page **29** .



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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:

**Important**

- ◆ 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 stage of the ignition coils and also the connectors on the injectors.
- ◆ 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. After erasing the fault memory the readiness code must be produced => Page 30 .
- ◆ Always switch off the ignition before washing the engine.
- ◆ Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.

**Important**

The fuel system is pressurised. Before opening the system 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 tool boxes 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.

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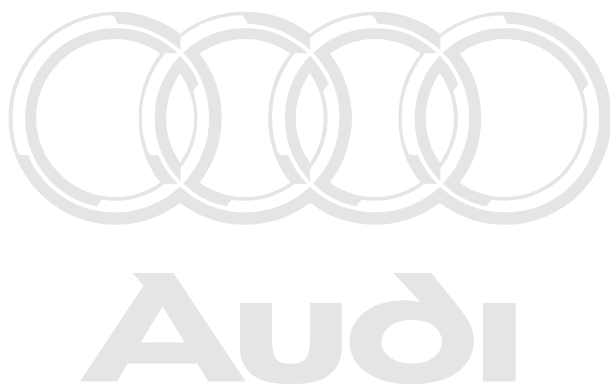


Make sure connections are dry when attaching.

## 1.4 - Technical data

Engine code letters		AMX (2.8 litre / 5V / 147 kW-engine)
Idling speed Not adjustable - controlled by the idling speed stabilisation		650...750 rpm
Engine speed limitation by deactivation of injectors		approx. 6800 rpm
Fuel pressure at idling speed	Vacuum hose connected	3.2...3.8 bar
	Vacuum hose detached	3.8...4.2 bar
Holding pressure after 10 minutes	Engine cold	approx. 2.2 bar
	Engine warm	approx. 3.0 bar
Injectors	Spray pattern	Two-hole nozzle / same for all injectors
	Injection quantity (30 s)	90...125 ml
	Resistance (ambient temperature) 1)	13.5...15.5 $\omega$

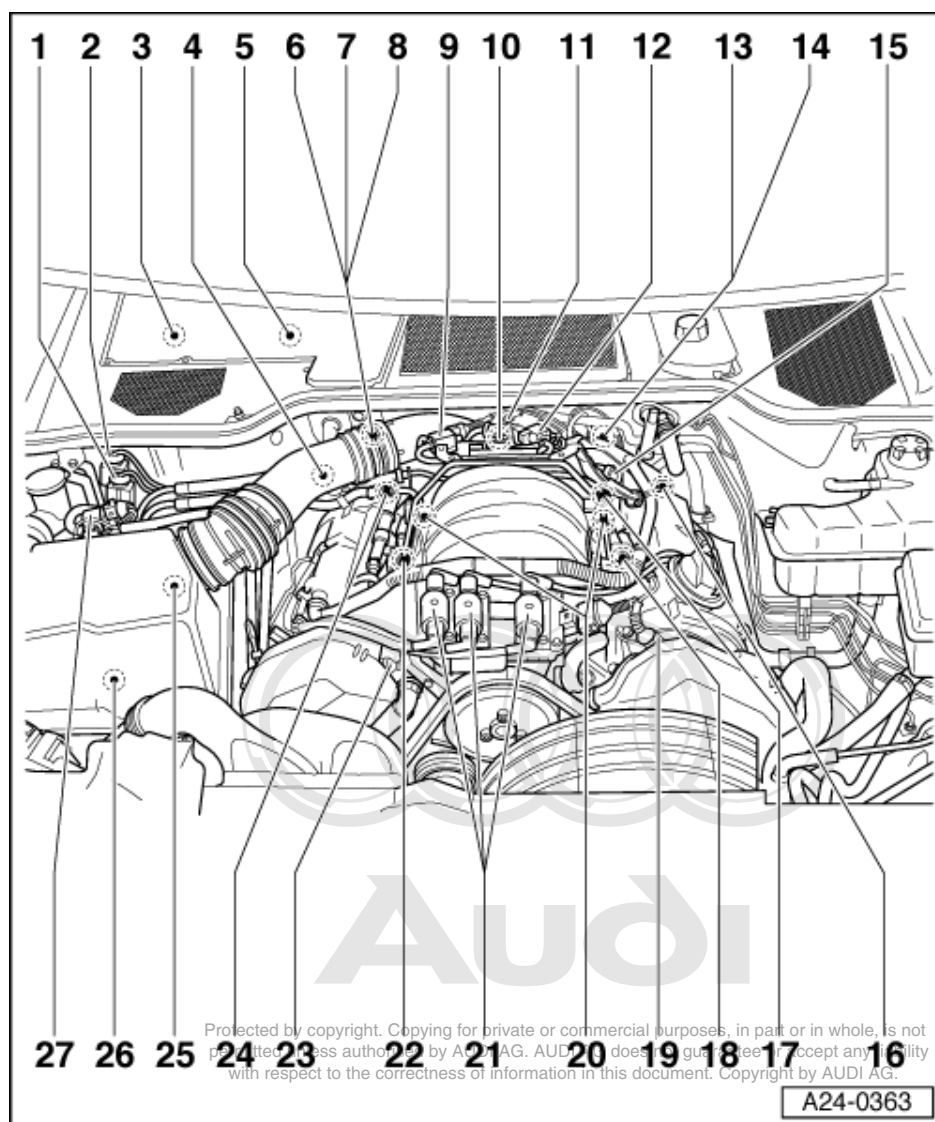
1) When the engine is at operating temperature the resistance of the injectors is increased by approx. 4...6  $\omega$ .



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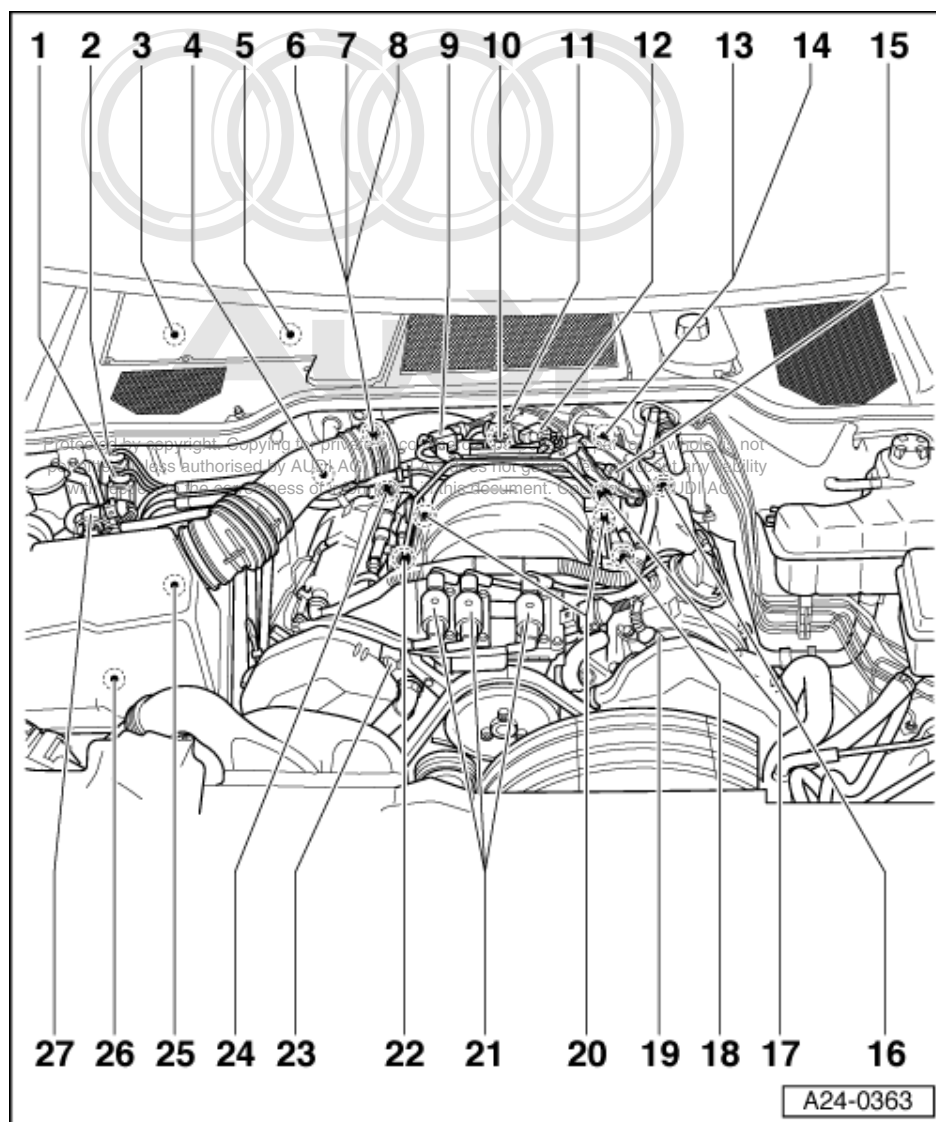


## 1.5 - Fitting locations overview



### Notes:

- ◆ Further fitting locations => Fig. 56
- ◆ A...D - Fitting locations without illustration:
  - A - Lambda probe upstream of catalytic converter -G39 with heater for lambda probe -Z19
    - ◆ Bank 1, probe 1
  - B - Lambda probe upstream of catalytic converter -G108 with heater for lambda probe -Z28
    - ◆ Bank 2, probe 1



**C - Lambda probe downstream of catalytic converter -G130 with heater for lambda probe -Z29**

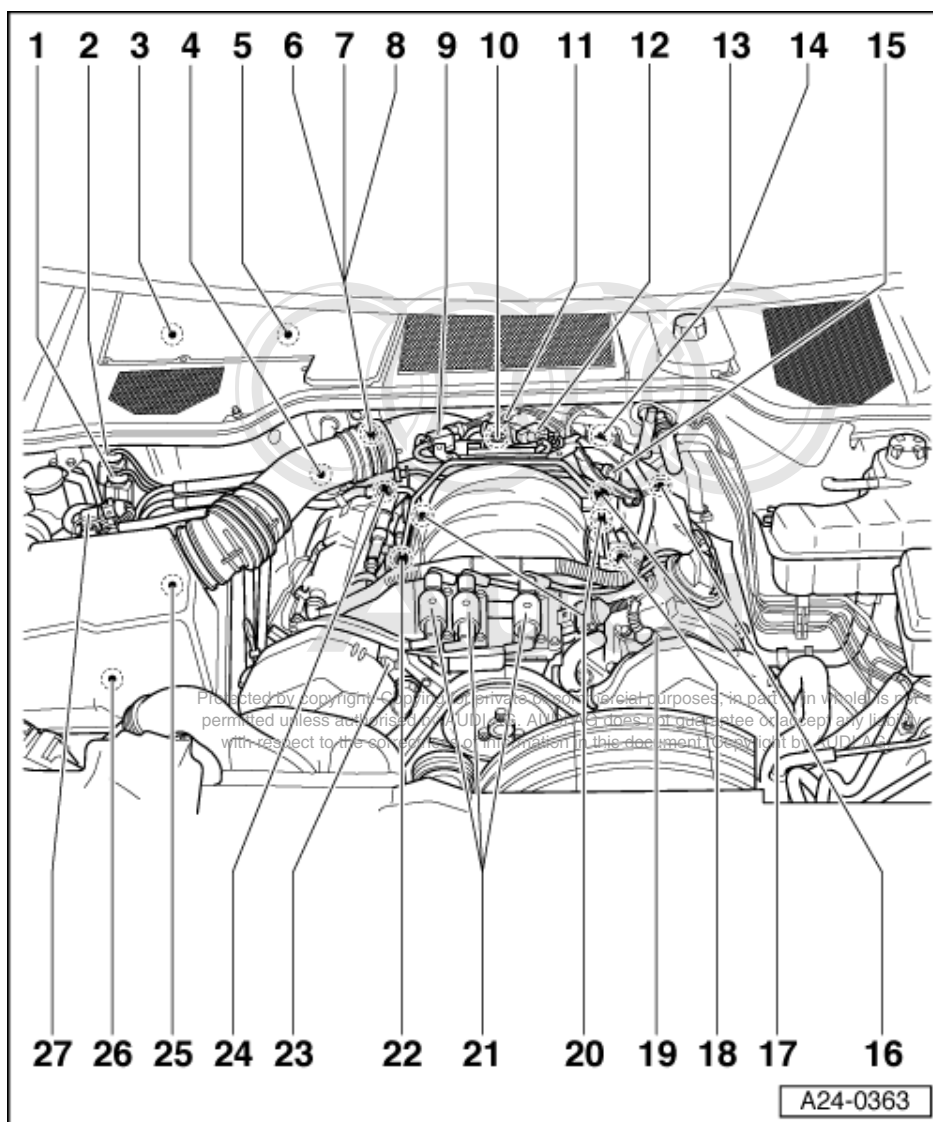
- ◆ Bank 1, probe 2
- ◆ Accessible from below after lifting the vehicle

**D - Lambda probe downstream of catalytic converter -G131 with heater for lambda probe -Z30**

- ◆ Bank 2, probe 2
- ◆ Accessible from below after lifting the vehicle

**1 4-way connector**

- ◆ For lambda probe downstream of catalytic converter -G130 and heater for lambda probe -Z29 (bank 1, probe 2)
- ◆ Green
- ◆ Fitting location =>Fig. 53



**2 4-way connector**

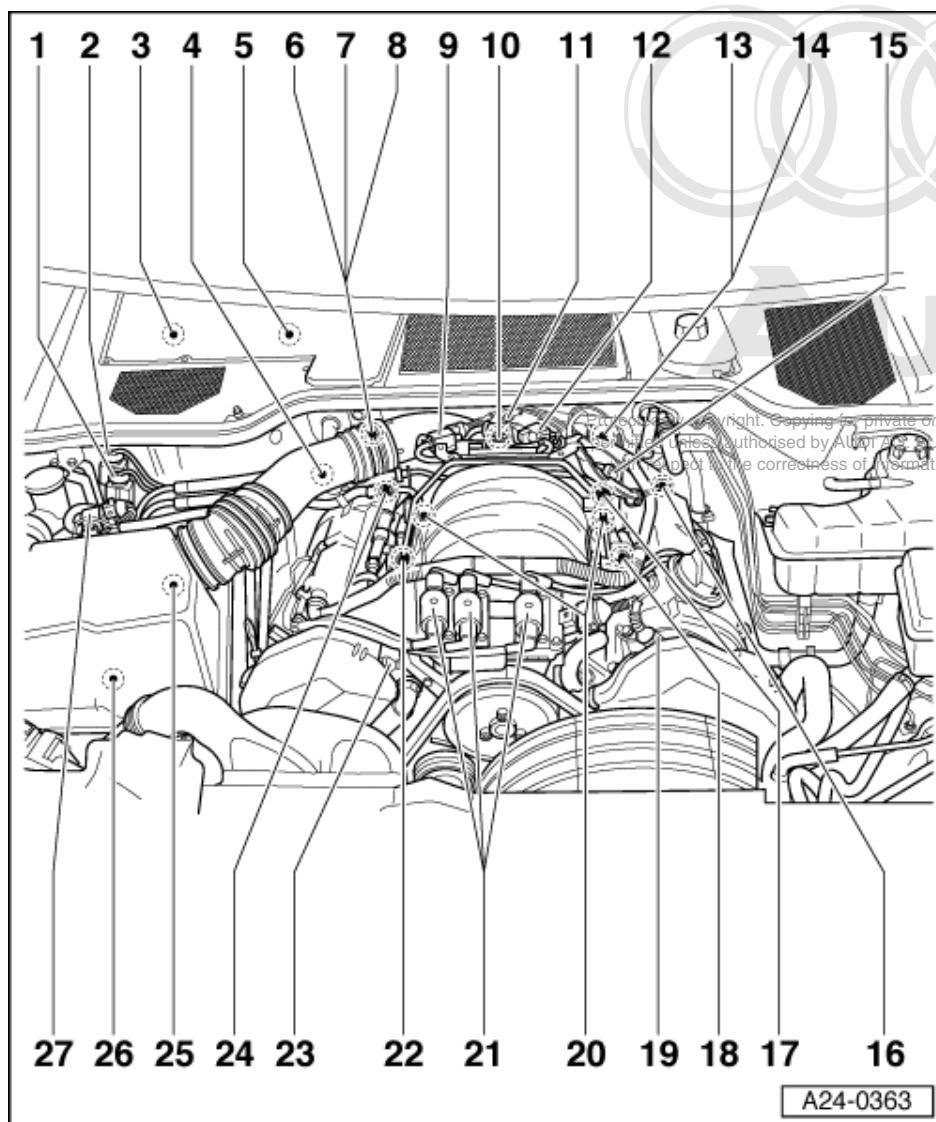
- ◆ For lambda probe downstream of catalytic converter -G131 and heater for lambda probe -Z30 (bank 2, probe 2)
- ◆ Brown
- ◆ Fitting location => Fig. 53

**3 Engine control unit -J220**

- ◆ In electronics box in plenum chamber
- ◆ Replacing => Page 64

**4 Coolant temperature sender -G62**

- ◆ For engine control unit
- ◆ On coolant pipe behind cylinder head, bank 1
- ◆ With coolant temperature gauge sender -G2
- ◆ Checking => Page 172
- ◆ If necessary, release cooling system pressure before removal



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**5 Secondary air pump relay -J299**

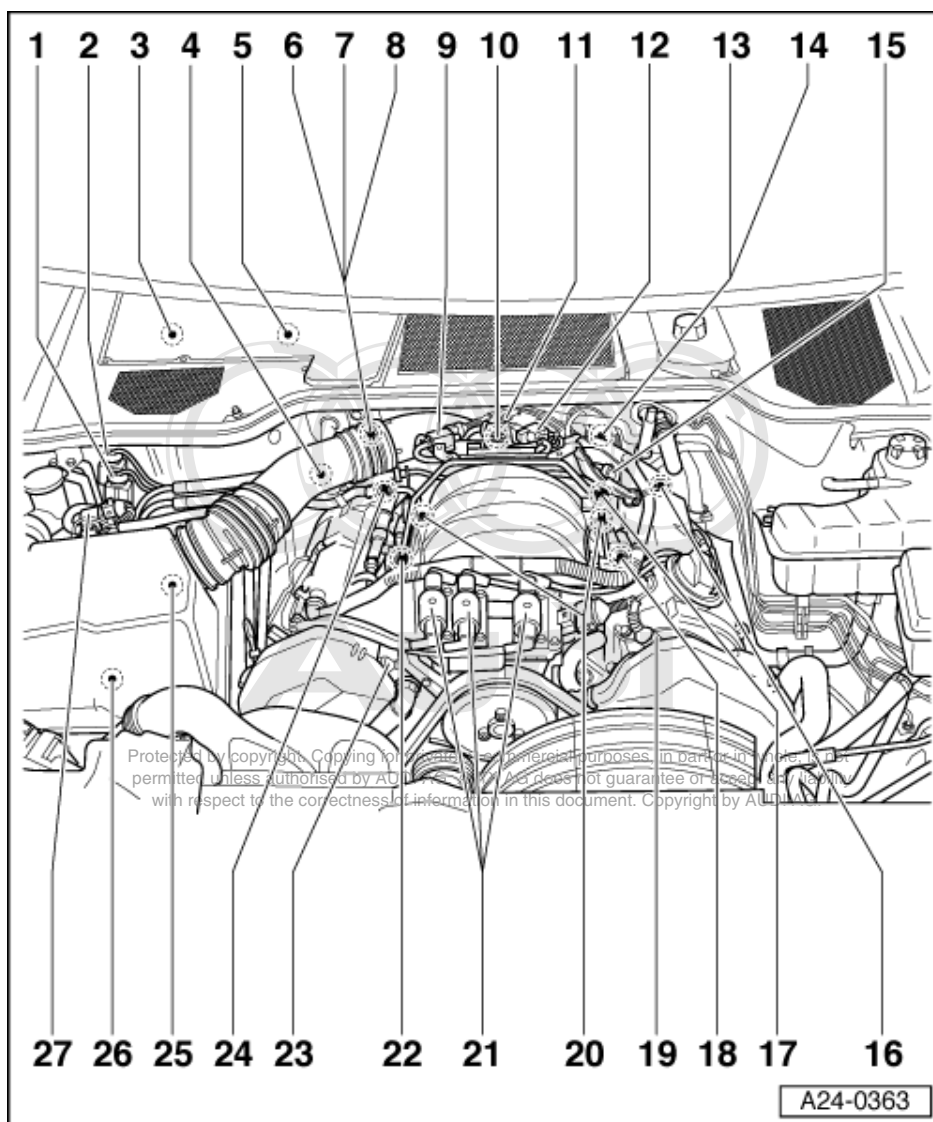
- ◆ In electronics box in plenum chamber
- ◆ Fitting location =>Fig. 54

**6 4-way connector**

- ◆ For lambda probe upstream of catalytic converter -G39 and heater for lambda probe -Z19 (bank 1, probe 1)
- ◆ Black
- ◆ Fitting location =>Fig. 54

**7 3-pin connector**

- ◆ For knock sensor 1 -G61
- ◆ Green
- ◆ Fitting location =>Fig. 54



**8 3-pin connector**

- ◆ For engine speed sender -G28
- ◆ Grey
- ◆ Fitting location => Fig. 54

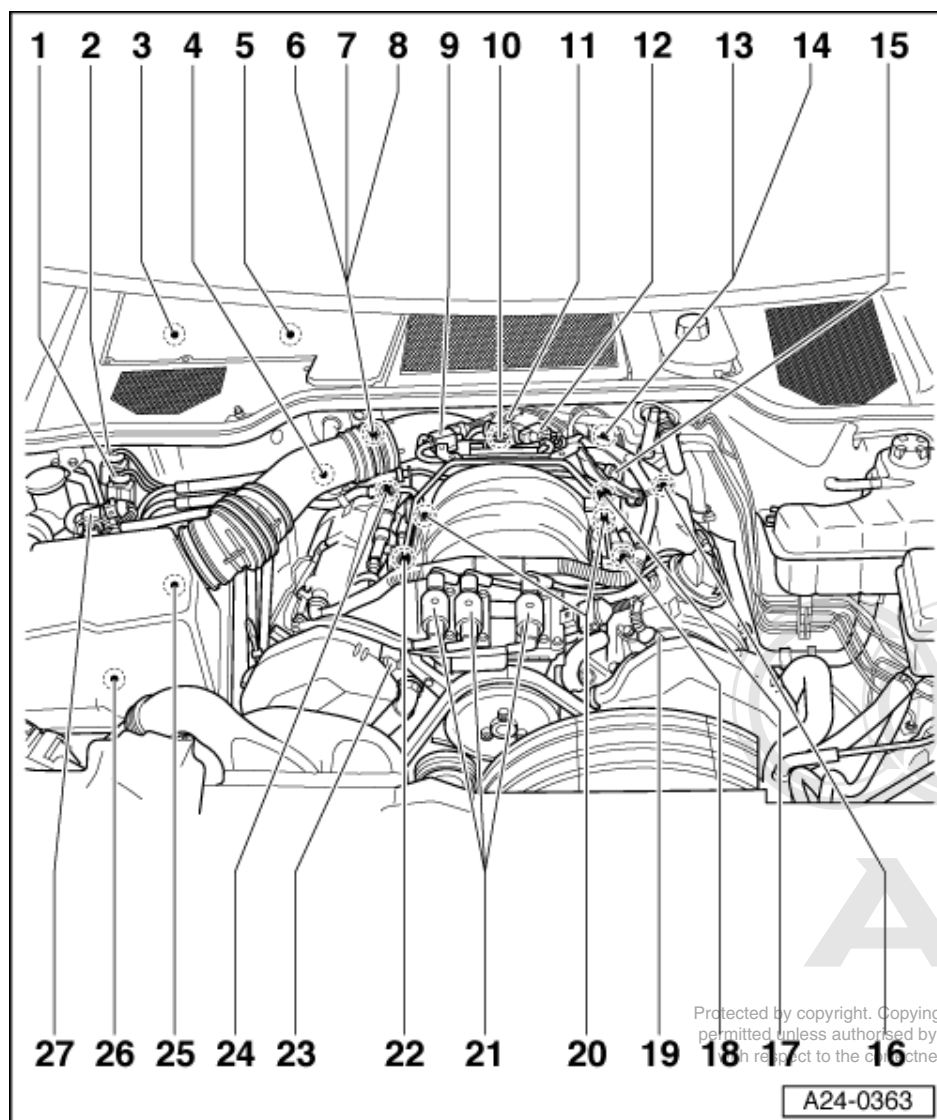
**9 Secondary air inlet valve -N112**

- ◆ Fitting location => Fig. 55

**10 Throttle valve control part -J338**

- ◆ With throttle valve drive -G186, angle sender for throttle valve drive -G187 and angle sender 2 for throttle valve drive -G188
- ◆ Fitting location => Fig. 54
- ◆ Checking => Page 131



**11 Intake air temperature sender -G42**

- ◆ Fitting location=> Fig. 54
- ◆ Checking => Page 167

**12 Intake manifold changeover solenoid valve -N156**

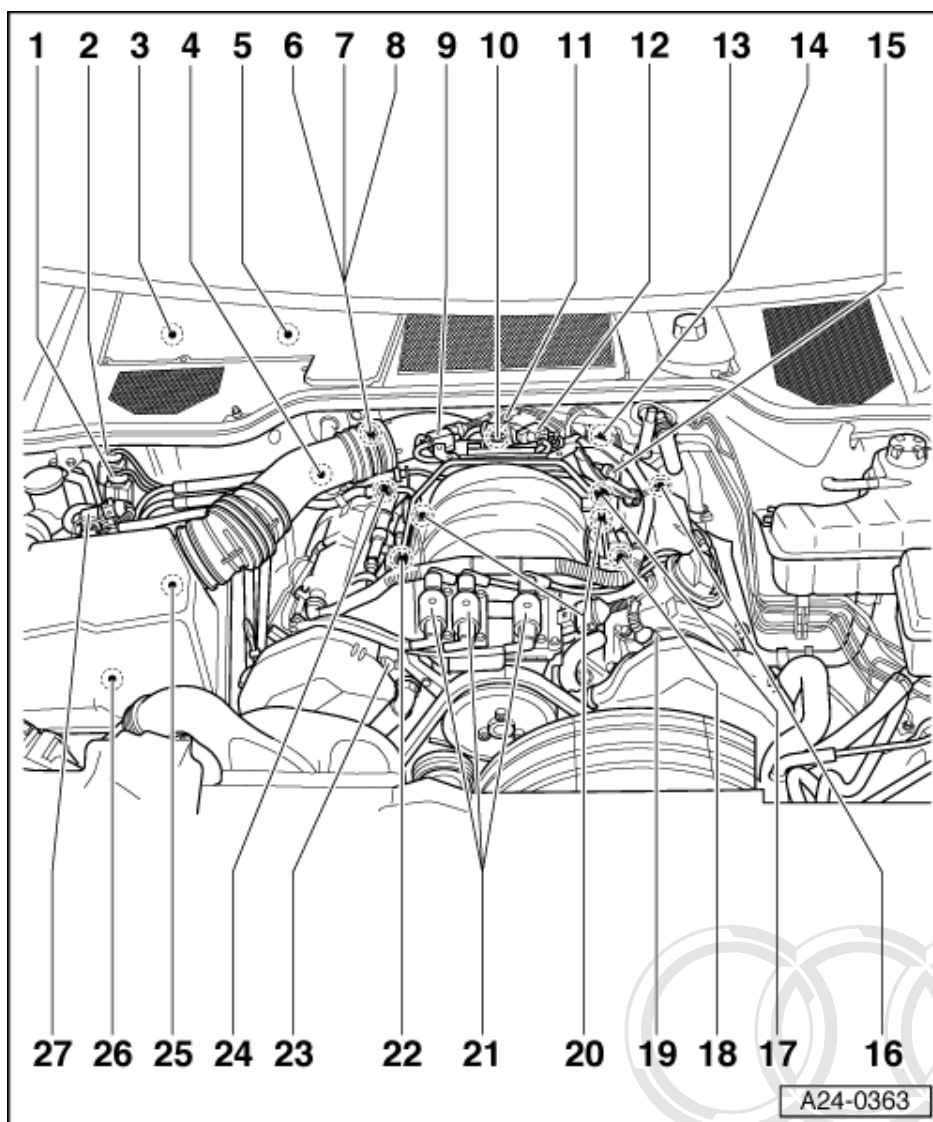
- ◆ Fitting location=> Fig. 55

**13 4-way connector**

- ◆ For lambda probe upstream of catalytic converter -G108 and heater for lambda probe -Z28 (bank 2, probe 1)
- ◆ Black
- ◆ Fitting location =>Fig. 53

**14 3-pin connector**

- ◆ For knock sensor 2 -G66
- ◆ Green
- ◆ Fitting location =>Fig. 53



**15 Fuel pressure regulator**

- ♦ Checking => Page **73**

**16 Hall sender -G40**

- ♦ Bank 2
- ♦ Checking => Page **183**

**17 Engine speed sender -G28**

- ♦ In gearbox housing case above ring gear
- ♦ Checking => Page **170**

**18 Knock sensor 2 -G66**

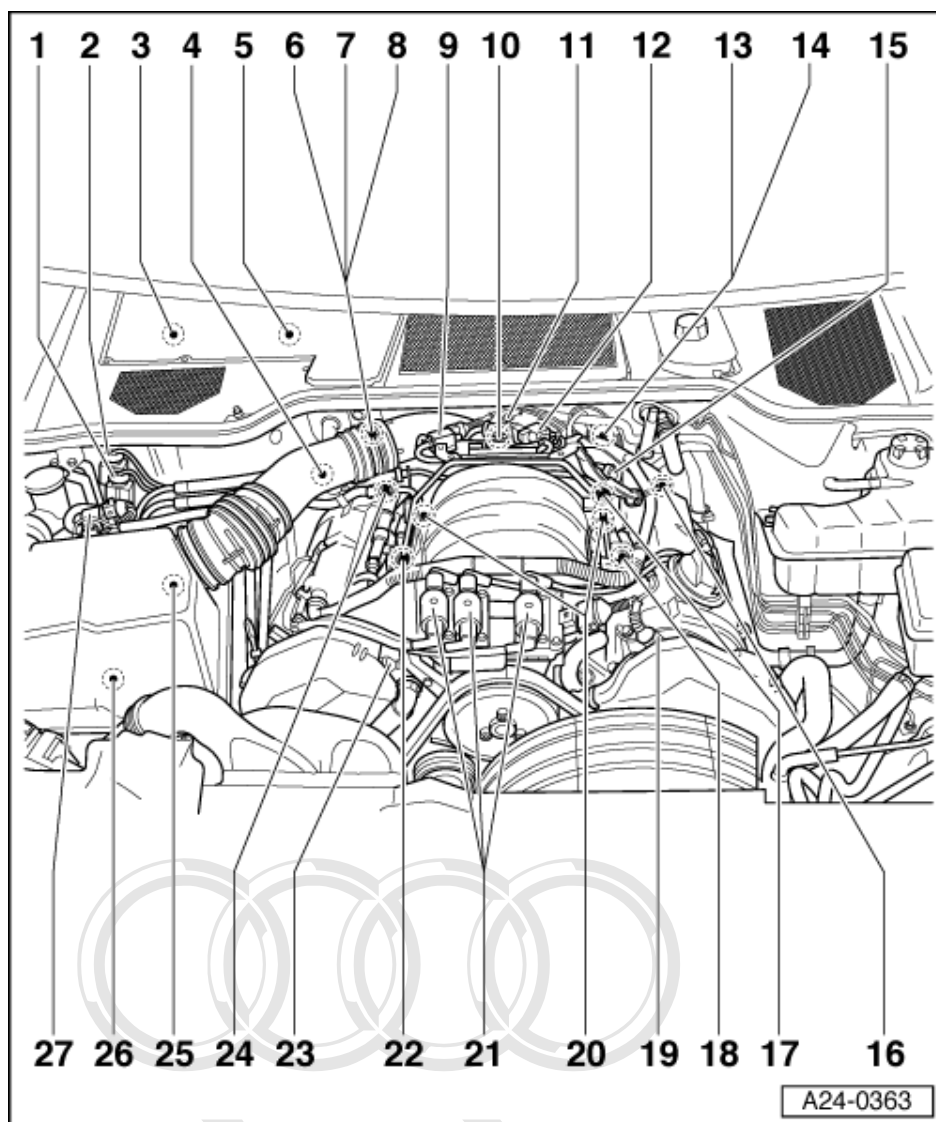
**19 Solenoid valve 2 for camshaft timing control -N208**

**20 Injectors -N30...-N33, -N83, -N84**

**21 Ignition coils -N, -N128, -N158**

- ♦ With output stage -N122

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22 Knock sensor 1 -G61

23 Hall sender -G163

- ♦ Bank 1
- ♦ Checking => Page 183

24 Solenoid valve 1 for camshaft timing control -N205

25 Air mass meter -G70

- ♦ Fitting location => Fig. 55
- ♦ Checking => Page 91

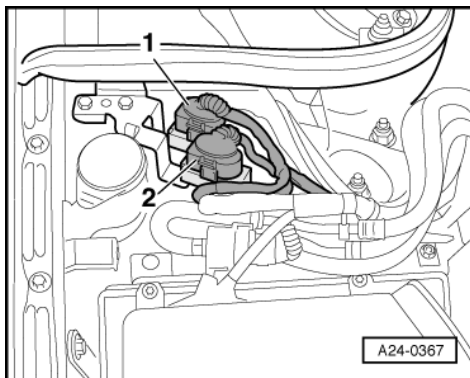
26 Secondary air pump motor -V101

- ♦ Fitting location => Fig. 59

27 Solenoid valve 1 for activated charcoal filter -N80

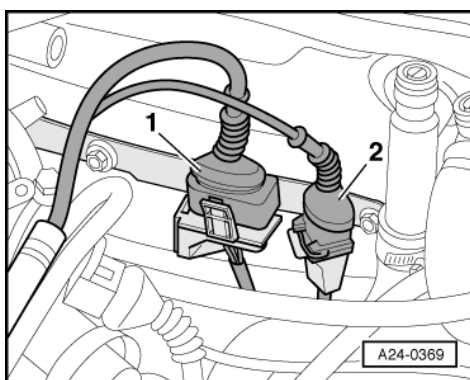
- ♦ Checking => Page 126





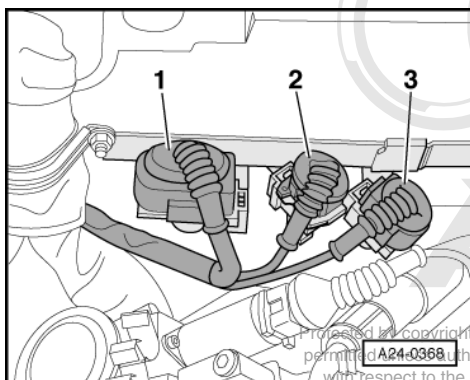
-> Fig.1 Fitting location of connectors in right of engine compartment

- 1 - 4-pin connector, green  
For lambda probe downstream of catalytic converter -G130 and heater for lambda probe -Z29 (bank 1, probe 2)
- 2 - 4-pin connector, brown  
For lambda probe downstream of catalytic converter -G131 and heater for lambda probe -Z30 (bank 2, probe 2)



-> Fig.2 Fitting location of connectors under the cover on right behind the air cleaner

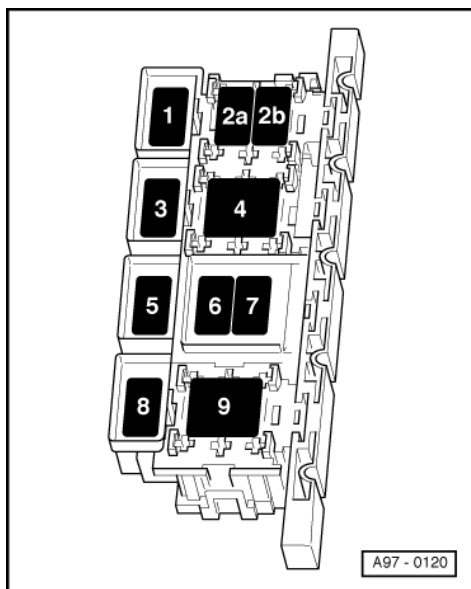
- 1 - 4-pin connector, black  
For lambda probe upstream of catalytic converter -G108 and heater for lambda probe -Z28 (bank 2, probe 1)
- 2 - 3-pin connector, green  
For knock sensor 2 -G66





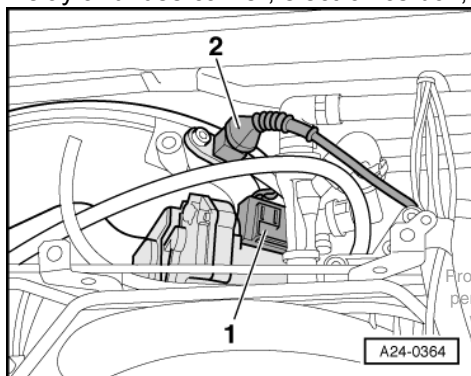
-> Fig.3 Fitting location of connectors under the air pump in the right of engine compartment

- 1 - 4-pin connector, black  
For lambda probe upstream of catalytic converter -G39 and heater for lambda probe -Z19 (bank 1, probe 1)
- 2 - 3-pin connector, green  
For knock sensor 1 -G61
- 3 - 3-pin connector, grey  
For engine speed sender -G28



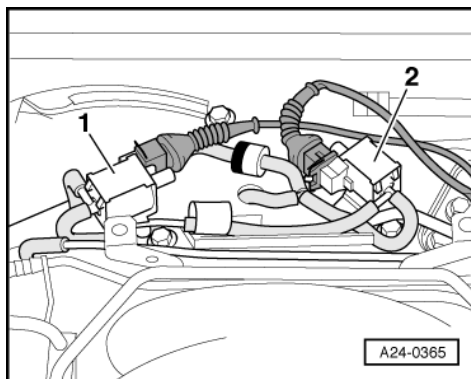
-> Fig.4 Fitting location of secondary air pump relay -J299

Relay and fuse carrier, electronics box, plenum chamber, position 4



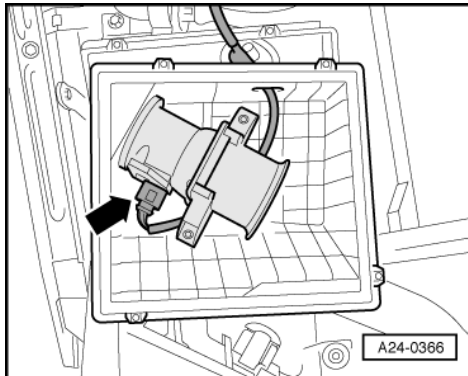
-> Fig.5 Fitting location of throttle valve control part -J338 and sender for intake air temperature -G42

- 1 - Throttle valve control part -J338
- 2 - Intake air temperature sender -G42



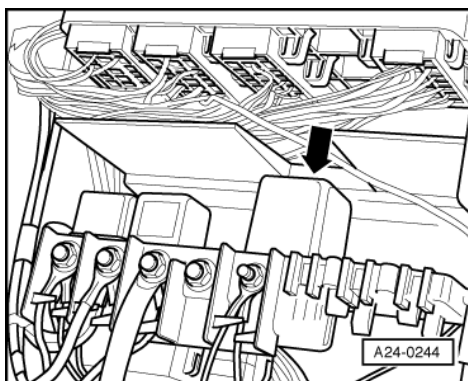
-> Fig.6 Fitting location for secondary air inlet valve -N112 and solenoid valve for intake manifold changeover -N156

- 1 - Secondary air inlet valve -N112
- 2 - Solenoid valve for intake manifold changeover -N156



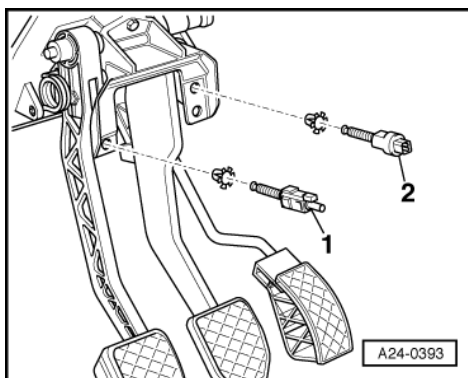
-> Fig.7 Fitting location of air mass meter -G70

- ◆ In upper part of air filter housing



-> Fig.8 Fitting location secondary air inlet valve -J17

Central electrics, electronics box in passenger's footwell, position 4



-> Fig.9 Fitting location brake light switch -F and brake pedal switch -F47, clutch pedal switch -F36

- 1 - Clutch pedal switch -F36

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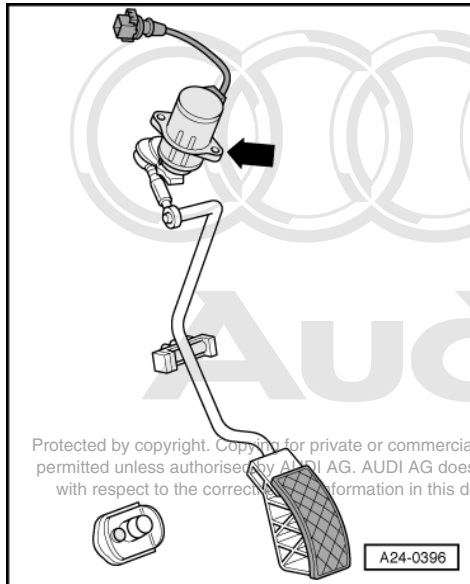
2 - Brake light switch -F, brake pedal switch -F47

**Note:**

*Switch must only be installed once in order to ensure that it is sufficiently tight.*

**Adjust switch:**

=> Brake System; Repair group 46; Assembly overview: Pedal cluster Assembly overview: Pedal cluster

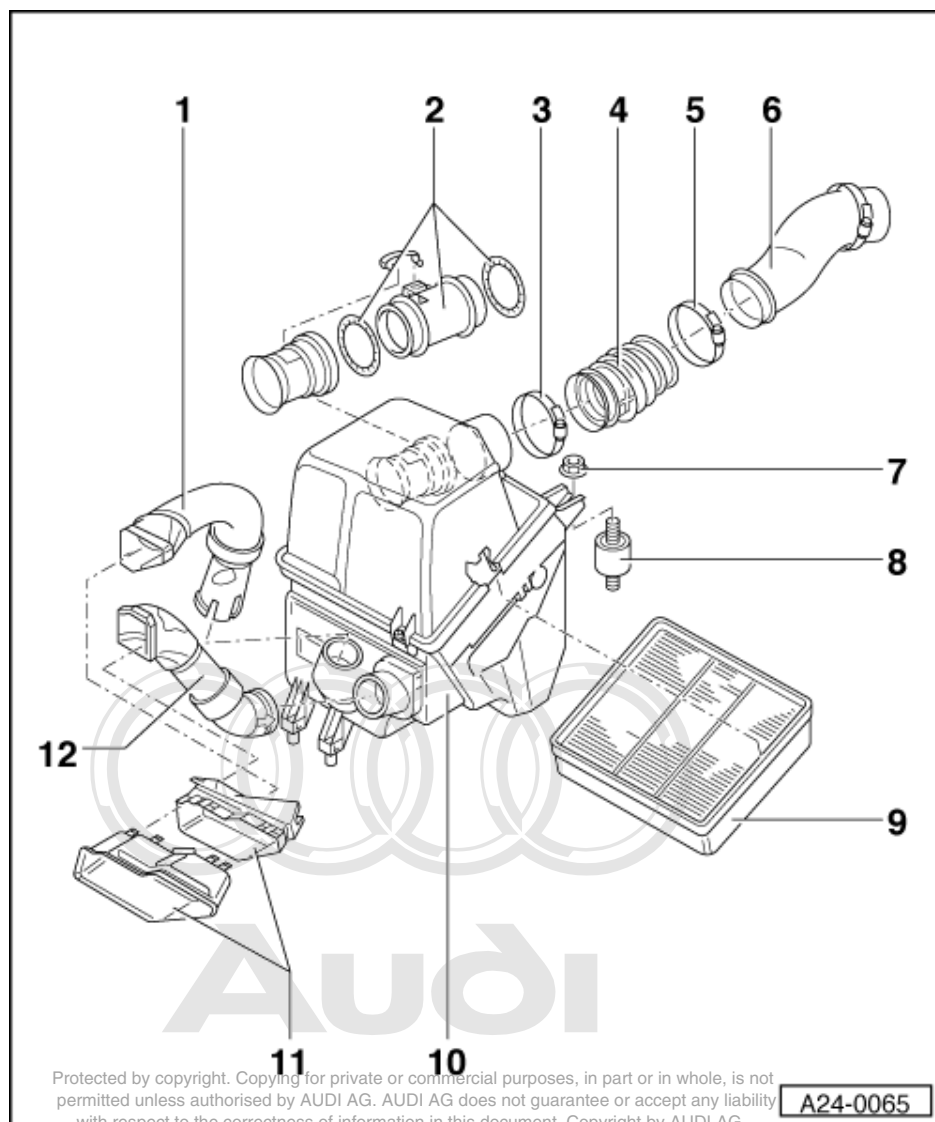


-> Fig.10 Fitting location for accelerator pedal position sender -G79 and sender 2 for accelerator pedal position -G185

**Note:**

*Illustration shows left-hand drive vehicle.*

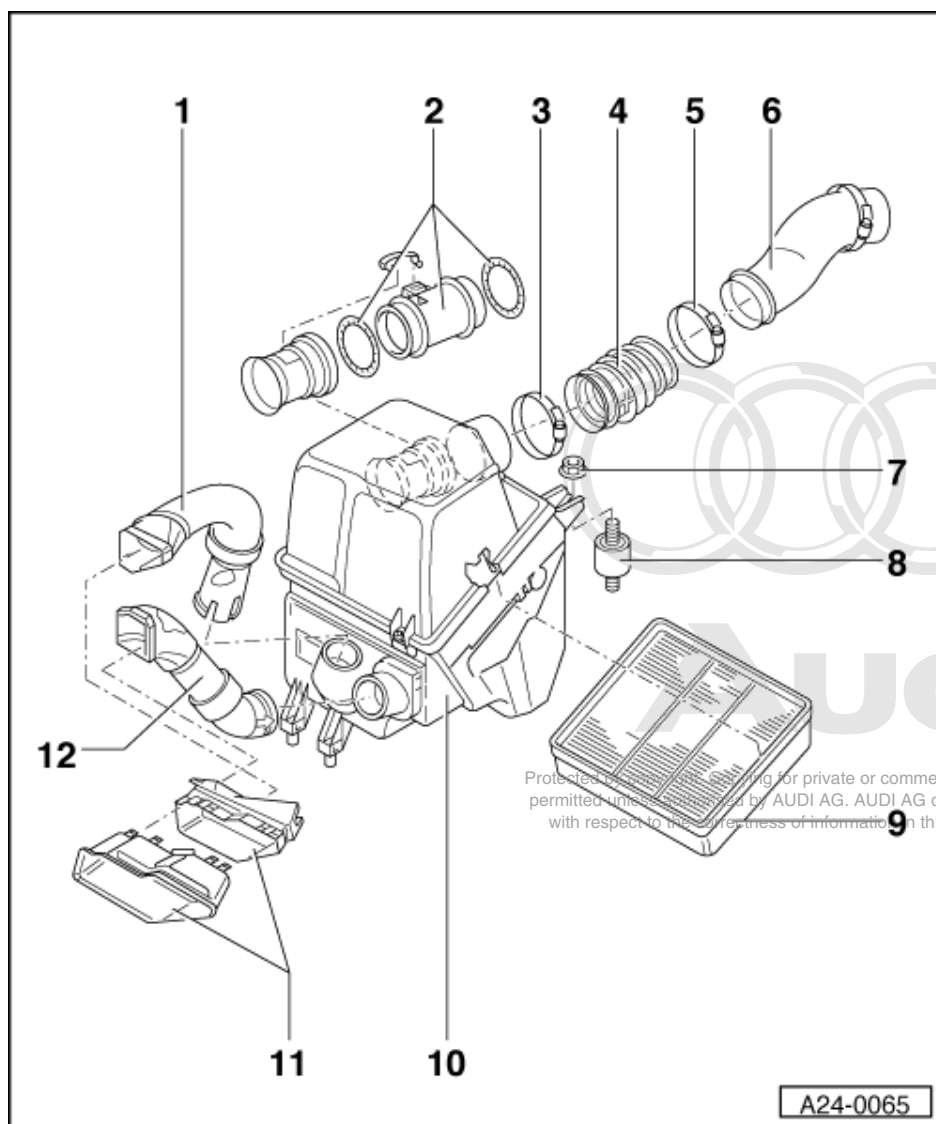
## 1.6 - Dismantling and assembling air cleaner



### Note:

The illustration shows the air cleaner housing for vehicles without secondary air inlet. On vehicles with secondary air inlet, the secondary air pump motor -V101 is located in the bottom section of the air cleaner housing=> Fig. 59.

- 1 Air duct
- 2 Air mass meter -G70
- 3 Hose clamp
- 4 Intake hose
- 5 Hose clamp
- 6 Intake pipe



7 Nut

8 Bonded rubber bush

9 Filter element

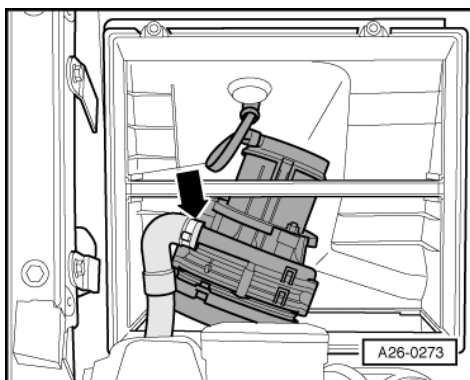
- ♦ Observe change intervals

=> Maintenance Manual

10 Air cleaner housing

11 Air duct

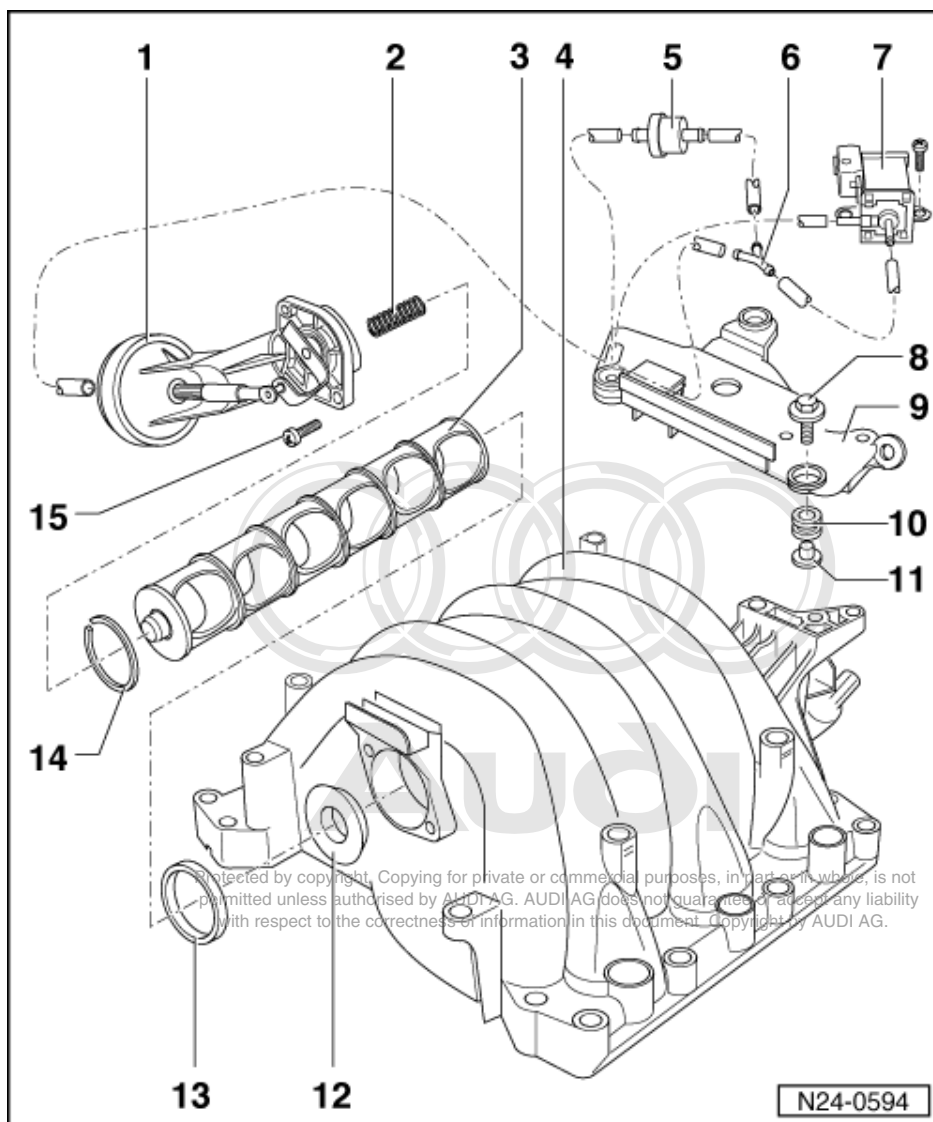
12 Air duct



-> Fig.1 Installation position, motor for secondary air pump -V101

♦ in lower section of air filter housing

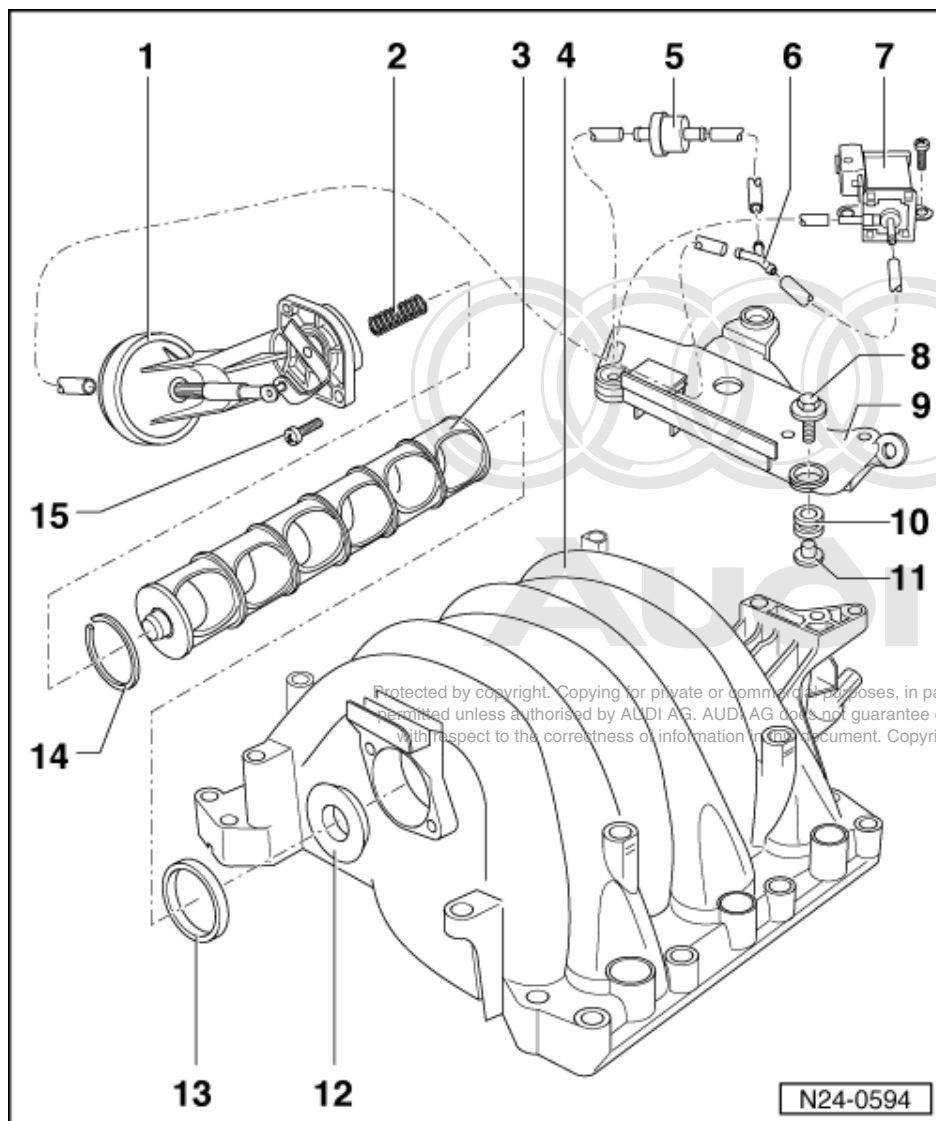
## 1.7 - Removing and installing intake manifold changeover system components



- 1 Vacuum actuator
- 2 Spring



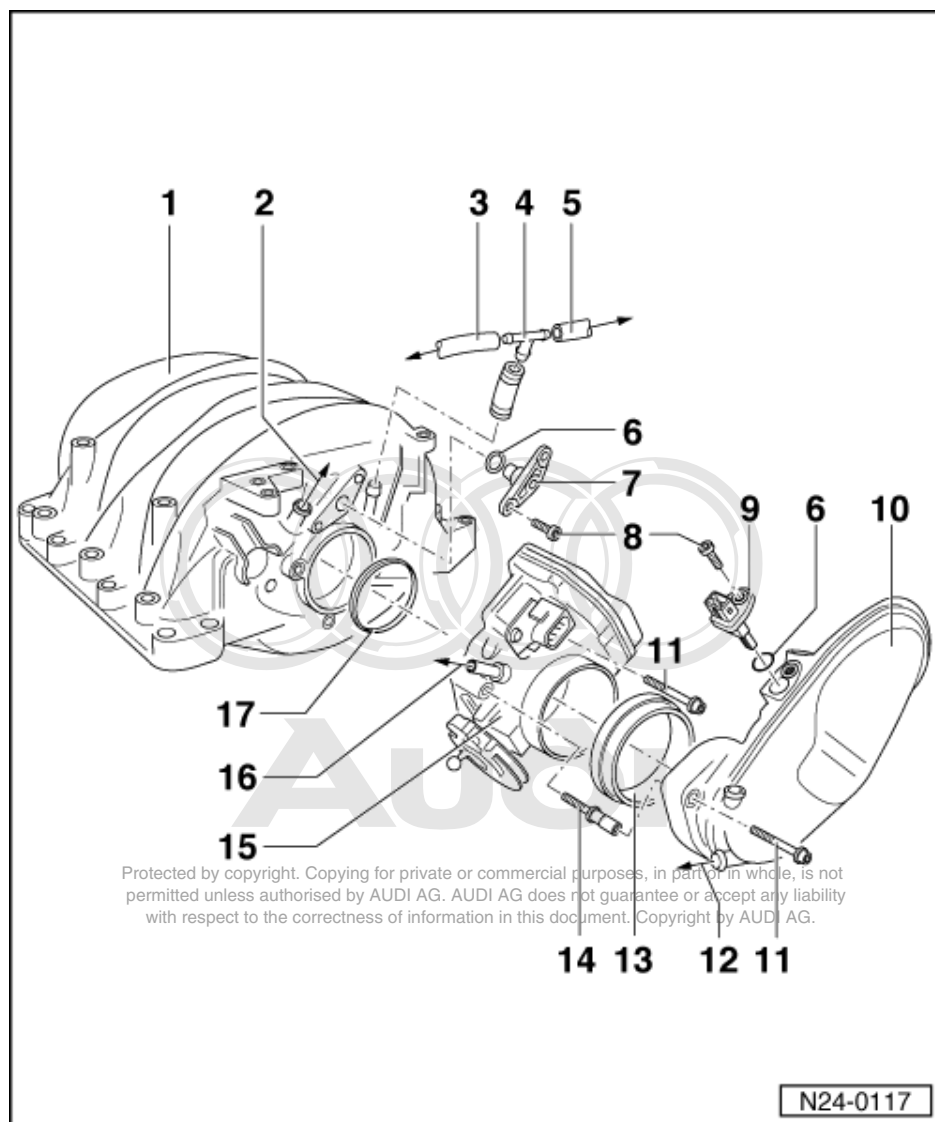
- 3 Changeover mechanism
- 4 Intake manifold
- 5 Non-return valve
  - ♦ Installation position: Blue side facing Y-piece
- 6 Y-piece
- 7 Intake manifold changeover valve -N156



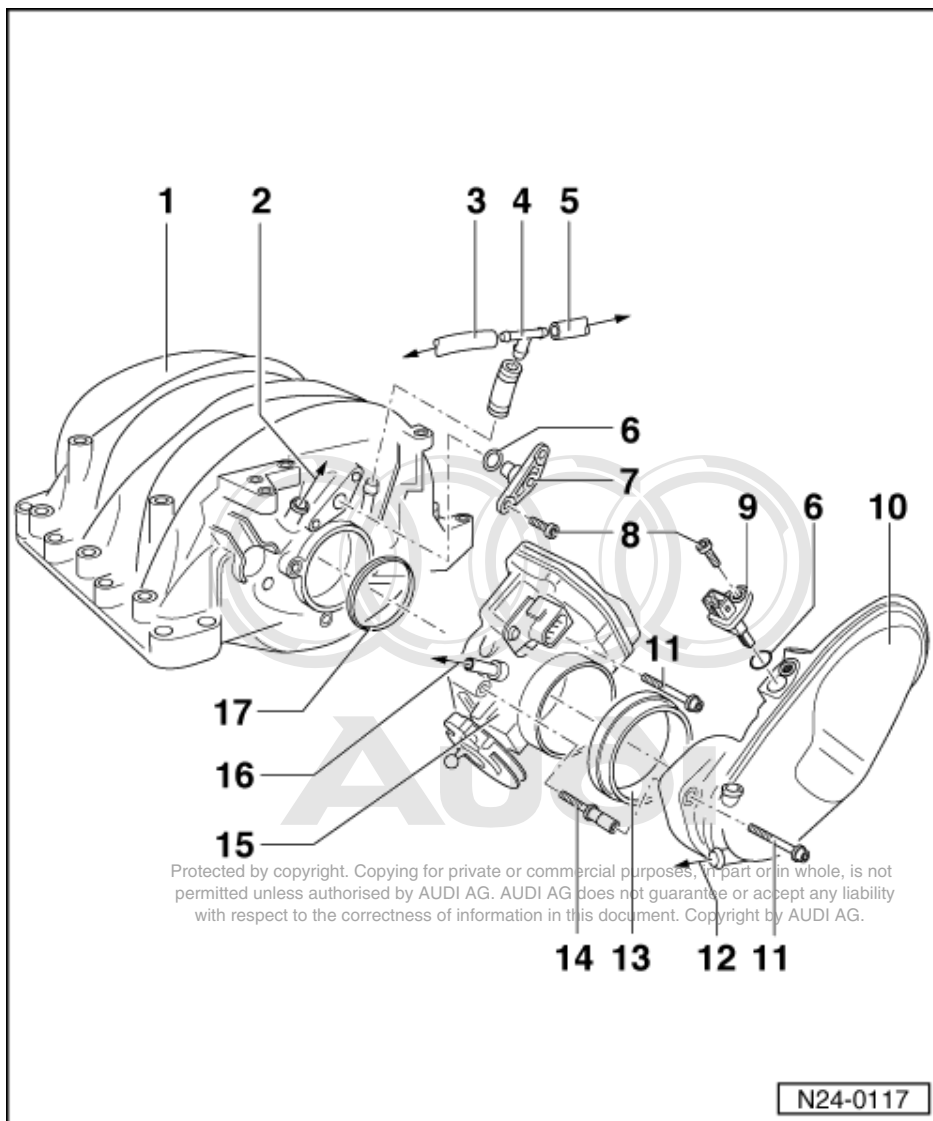
- 8 10 Nm
- 9 Mounting plate
- 10 Rubber grommet
- 11 Spacer sleeve
- 12 Washer
  - ♦ Tapered side facing intake manifold
- 13 Sealing ring
  - ♦ Replace if damaged
- 14 Sealing ring
  - ♦ For changeover mechanism
  - ♦ Replace if damaged
- 15 6 Nm



## 1.8 - Removing and installing throttle valve control part



- 1 Intake manifold
- 2 To suction jet pump
- 3 To fuel pressure regulator
  - ♦ => Page 80 , item 5
- 4 T-piece
- 5 To non-return valve
  - ♦ => Page 60 , item 5
- 6 O-ring
  - ♦ Replace if damaged
- 7 Support bracket
  - ♦ For changeover mechanism
- 8 6 Nm



**9 Intake air temperature sender -G42**

**10 Air intake elbow**

**11 10 Nm**

**12 To crankcase breather valve**

**13 Sealing ring**

**14 10 Nm**

- ♦ Install with locking compound D 000 600 A2

**15 Throttle valve control part -J338**

**16 To solenoid valve 1 for ACF -N80**

**17 Sealing ring**

- ♦ Replace if damaged

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

### Notes:

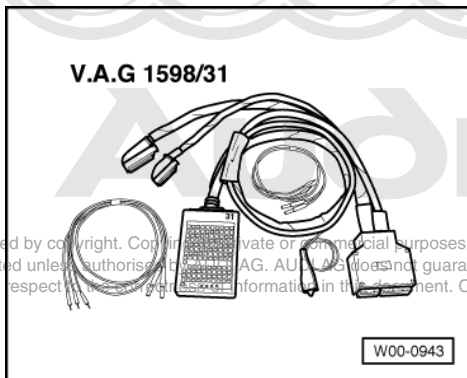
- ♦ The test box V.A.G 1598/31 is designed in such a way that it can be connected simultaneously to the engine control unit wiring harness and to the engine control unit itself.
- ♦ This has the advantage that the electronic motor control system remains fully functional when the test box is connected (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.
- ◆ Always use adapter set V.A.G 1594 A for connecting up measuring instruments (e.g. voltage tester V.A.G 1527 B, hand-held multimeter V.A.G 1526 A etc.).

#### Important

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

#### Special tools and workshop equipment required



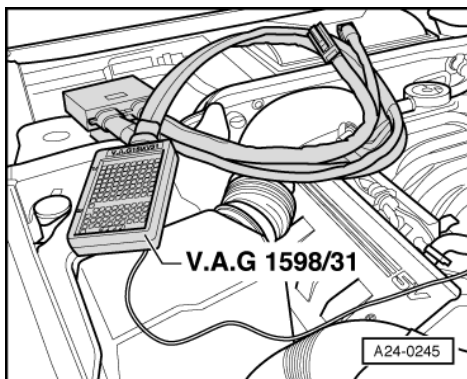
- ◆ V.A.G 1598/31

#### Procedure

- Switch ignition off.
- Remove engine control unit => Page 64 .

#### Note:

*If engine control unit is fitted with a protective housing, the sheet-metal housing must be detached from engine control unit in order to connect test box. Procedure=>Page 66 . Refit sheet-metal housing to control unit on completion of repairs.*



- -> Connect V.A.G 1598/31 test box to connectors of wiring harness. Earth clamp must be connected to earth. Whether or not the engine control unit has to be additionally connected to the test box is described in the respective test procedures.
- Carry out test as described in the appropriate repair procedures.

#### Important note:

*After reinstalling the engine control unit the following operations must be performed:*

- Perform adaption of throttle valve control part -J338 => Page 132 .
- Interrogate fault memory and erase, if necessary => Page 4 .



- If the fault memory is erased the readiness code must be produced again => Page 30 .

**Note:**

*In the first adaption phase irregular idling and slight jolting when driving are possible.*

## 1.10 - Procedure following interruption of voltage supply

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*After reconnecting the voltage supply the following operations must be performed:*

- Perform adaption of throttle valve control part -J338 => Page 132 .
- Interrogate fault memory and erase, if necessary => Page 4 .
- If the fault memory is erased the readiness code must be produced again => Page 30 .

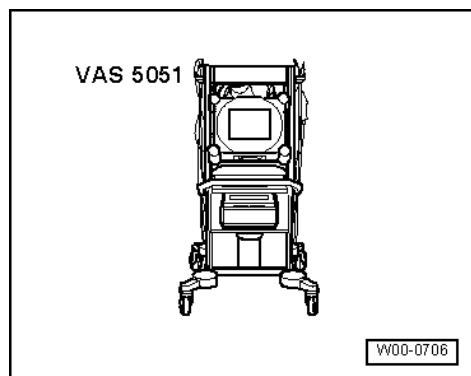
**Note:**

*In the first adaption phase irregular idling and slight jolting when driving are possible.*

## 1.11 - Replacing engine control unit

The following procedure is for engine control units which are not fitted with a sheet-metal housing. The procedure for engine control units with a metal housing is on => Page 66 .

**Special tools and workshop equipment required**



- ♦ VAS 5051 with VAS 5051/1

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

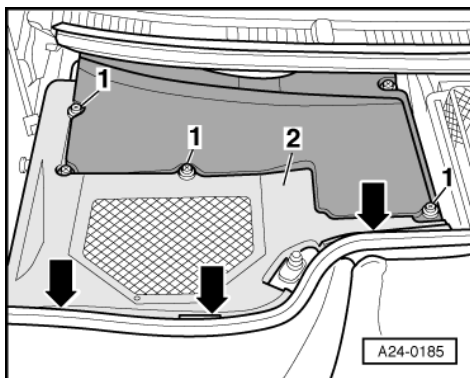
**Removing**

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "Address word" 01=> Page 1  
For this purpose, the ignition must be switched on.

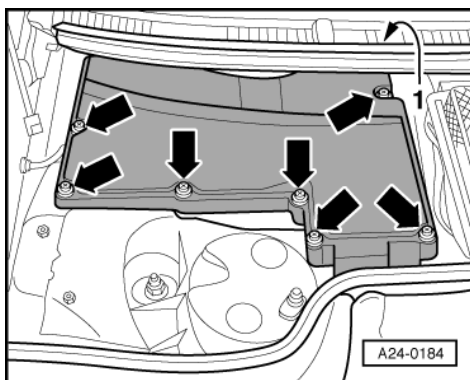
-> The fault reader V.A.G 1551 display will show the control unit identification, for example:

3B0907551A	2.8l	V6/5V	G
0002	□		
Code 11553	WSC 12345		

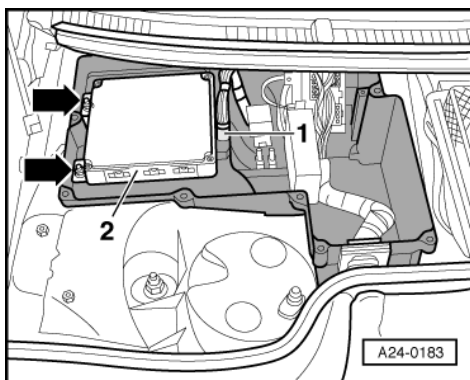
- Always start by displaying and printing out the control unit identification => Page **3**.
- Compare code to encoding versions => Page **27**.
- Switch ignition off.



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



- -> Lever out cover -1- in scuttle trim and loosen rear cross-head bolt -rear right arrow-.
- Loosen remaining cross-head screws -arrows-.
- Detach cover for electronics box (plenum chamber).

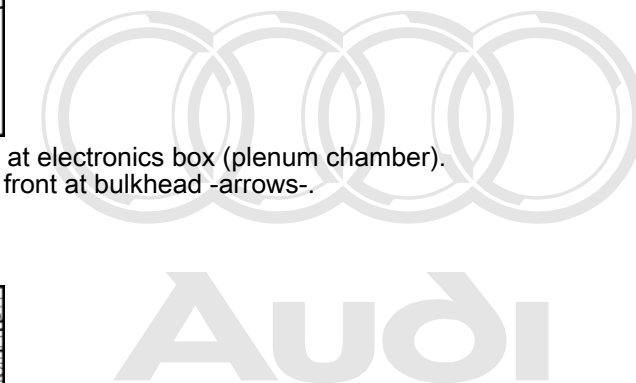


- -> Unfasten catch and unplug control unit connectors -1-.

**Note:**

*Always switch off ignition before detaching or attaching connectors of control unit.*

- Unscrew engine control unit -2- from electronics box (plenum chamber) -arrows-.



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**Note:**

There is a further bolt under the engine control unit connectors.

- Remove engine control unit.

**Installing**

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

**Important note:**

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

- Perform adaption of throttle valve control part -J338 => Page 132 .
- Note instructions for encoding new engine control unit => Page 26 .
- In vehicles with cruise control (recognisable from steering column switch), this should be enabled in engine control unit:

=> Electrical System Self-diagnosis; Repair group 01; Self-diagnosis for the cruise control system (CCS) Self-diagnosis for the cruise control system (CCS)

- Adapt immobiliser to engine control unit.

=> 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 30 .

**Note:**

In the first adaption phase irregular idling and slight jolting when driving are possible.

The following procedure is for replacing engine control units fitted with a protective housing

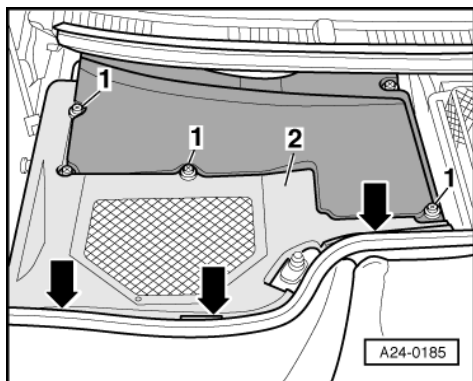
**Removing**

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "Address word" 01 => Page 1  
For this purpose, the ignition must be switched on.

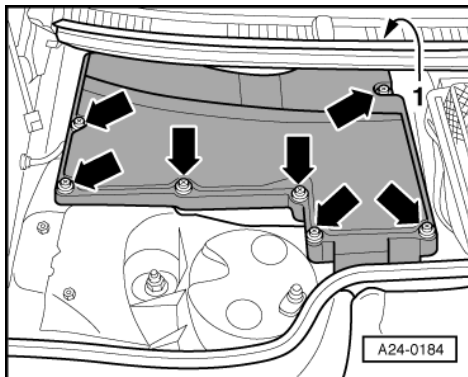
-> The fault reader V.A.G 1551 display will show the control unit identification, for example:

3B0907551A	2.81	V6/5V	G
0002	□		
Code 11553	WSC 12345		

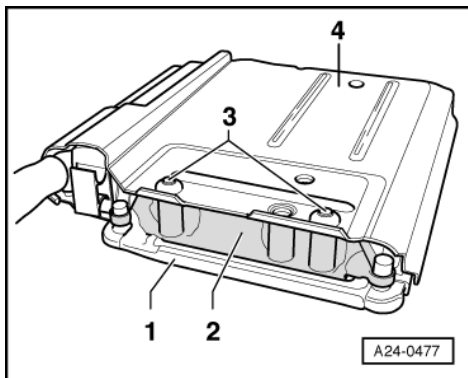
- Always start by displaying and printing out the control unit identification => Page 3 .
- Compare code to encoding versions => Page 27 .
- Switch ignition off.



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



- -> Lever out cover -1- in scuttle trim and loosen rear cross-head bolt -rear right arrow-.
- Loosen remaining cross-head screws -arrows-.
- Detach cover for electronics box (plenum chamber).
- Remove engine control unit (see following page).

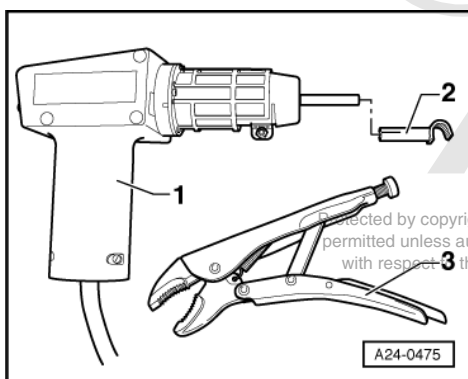


-> To make access to connectors on engine control unit more difficult, the engine control unit -1- is fitted with a sheet-metal housing -4- via a locking device -2- and shear bolts -3-.

The thread of shear bolts is coated with locking compound, to make removal of shear bolts more difficult.

In order to detach connectors from engine control unit (e.g. when connecting test box or replacing engine control unit), the engine control unit must first be detached from sheet-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)
- ◆ Nozzle attachment -2- (also from wiring harness repair set VAS 1978)

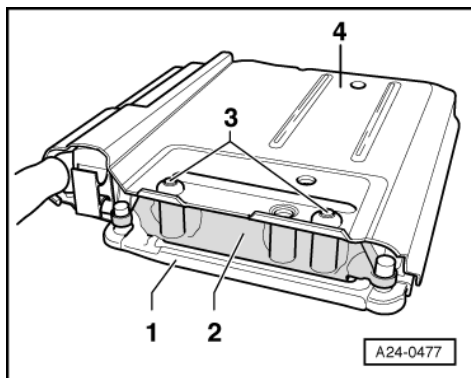


- ♦ Commercially available vice-grip wrench

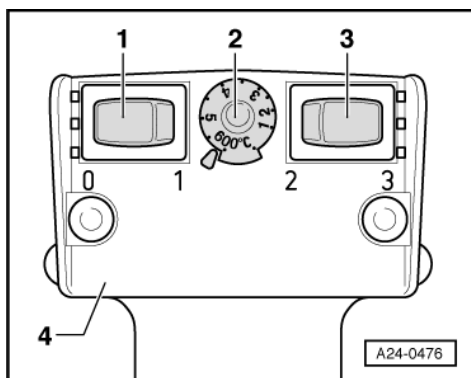
**Procedure:**

**Important**

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



- -> "Tilt" engine control unit with protective housing in direction of engine compartment, so that locking device (item -2- in illustration) becomes visible, place a clean cloth under engine control unit with protective housing.



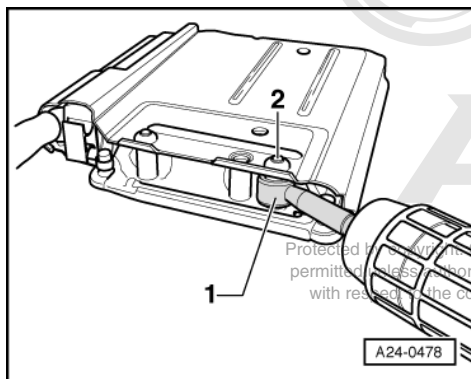
- -> Adjust settings on hot air blower as shown in illustration, i.e. set potentiometer for temperature setting -2- at maximum heat output and the two-speed switch for air volume -3- to position 3.

**Note:**

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

**Important**

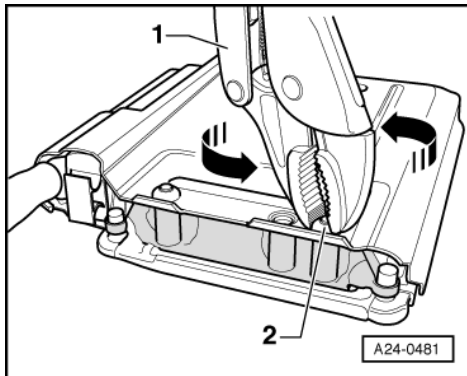
When heating thread of locking device, the shear bolts and parts of sheet-metal housing reach high temperatures. Avoid burns! Ensure that as far as possible, only thread is heated and no other parts in the vicinity. If necessary, cover these parts.



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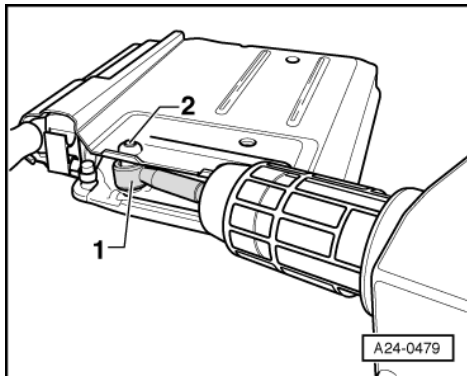


- -> Direct nozzle -1- of hot air blower onto thread of locking device, so that nozzle "encloses" thread. The nozzle can safely be allowed to contact upper end of sheet-metal housing.
- Switch on hot air blower and heat thread for approx. 20 to 25 seconds.

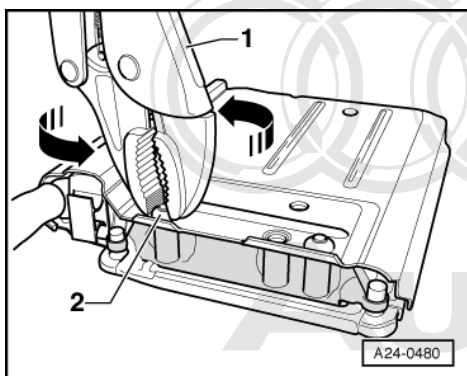


- -> Then grip bolt head -2- using vice-grip wrench -1- and unscrew shear bolt in direction of arrow.

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 locking device 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 vice grip wrench -1- and unscrew shear bolt in direction of arrow.

Engine control unit can now be detached from sheet-metal housing.

- Release connectors on engine control unit and unplug connectors.
- Take out old engine control unit and install new engine control unit.



## Installing engine control unit

Installation is performed in reverse sequence, the engine control unit must be re-fitted with sheet-metal housing. Use new shear bolts.

**After installing a new engine control unit, it is essential to carry out the following steps:**

- Perform adaption of throttle valve control part -J338 => Page 132 .
- Note instructions for encoding new engine control unit => Page 26 .
- In vehicles with cruise control (recognisable from steering column switch), this should be enabled in engine control unit:

=> Electrical System Self-diagnosis; Repair group 01; Self-diagnosis for the cruise control system (CCS) Self-diagnosis for the cruise control system (CCS)

- Adapt immobiliser to engine control unit.

=> 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 30 .

### **Note:**

*In the first adaption phase irregular idling and slight jolting when driving are possible.*

## 1.12 - Exhaust warning lamp -K83 in dash panel insert

If the engine control unit detect faults which result in deterioration of exhaust emissions, these faults will be indicated by illumination of exhaust gas warning lamp.

After switching on the ignition the engine control unit switches on the EPC warning lamp. Shortly after starting the engine the exhaust warning lamp goes out if the engine control unit does not detect a fault through which the exhaust emissions deteriorate and if the actuation of the lamp is ok from the engine control unit.

If faults which cause the exhaust emission to deteriorate are detected when operating the engine the engine control unit switches on the exhaust warning lamp. (These faults are listed in the fault table). At the same time, an entry is made in the engine control unit fault memory.

When switched on, the exhaust gas warning lamp may flash or illuminate constantly. In any case the fault memory must be interrogated => Page 4

### **Continuous illumination:**

A fault is present which causes deterioration of the exhaust emission. Interrogate fault memory for Motronic-control unit or automatic gearbox (if available).

If there is a drive problem or a customer query and the exhaust warning lamp is not illuminated the fault memory must be interrogated. Faults which do not switch on the exhaust warning lamp immediately but only after recognising the fault after restarting the engine can also be stored.

### **Flashing:**

A fault is present which under these driving conditions will cause damage to the catalytic converter (e.g. mis-firing). In this case driving may only continue at reduced power.

## 1.13 - Checking exhaust warning lamp -K83

### Functional check on warning lamp

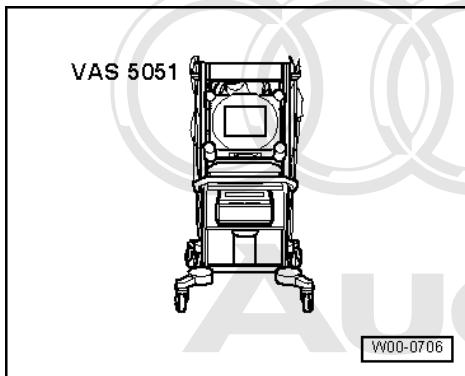
- Switch the ignition on.
  - The fault lamp for self-diagnosis (exhaust warning lamp) must illuminate.
- Start the engine.
  - Shortly after starting the engine the exhaust warning lamp goes out if no exhaust emission relevant fault is stored in the fault memory.

#### **Note:**

*The switch-on signal for the fault lamp is transferred via CAN bus to the dash panel insert by the engine control unit. Check the data exchange between engine control unit and other CAN-control units =>Page 152*

## 1.14 - Checking idling speed

### Special tools and workshop equipment required



- ♦ VAS 5051 with VAS 5051/1
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or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

#### **Test requirements:**

- No leaks in exhaust system
- Coolant temperature at least 80 °C.
- Electrical consumers switched off (radiator fan must not run during the test).
- Air conditioning switched off.
- Pressure gauge not connected.
- Vehicles with automatic gearbox: Selector lever in position P or N.

#### **Notes:**

- ♦ The idling speed cannot be adjusted.
- ♦ The idling speed is tested during the basic setting of the engine.
- ♦ During basic setting, the solenoid valve for the activated charcoal filter (valve -N80) is closed and the air conditioner compressor is switched off.

#### **Test sequence**

- Interrogate fault memory => Page 4. 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.

**Important**

The electric radiator fan should not be running.

-> Indicated on display

Rapid data transfer      **HELP**  
Select function XX

- Enter "04" to select "Start basic setting" and confirm with Q-key.

-> Indicated on display

Basic setting      **Q**  
Enter display group number XXX

- Enter "056" for "display group number 056" and confirm entry with Q-key.

-> Indicated on display

System in basic setting      **56**  
1      2      3      4

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

	Display zones			
	1	2	3	4
<b>Display group 056: Idling speed stabilisation at operating temperature</b>				
<b>Display</b>	xxx rpm	xxx rpm	x.x %	X X X X X
<b>Display</b>	Engine speed (actual)	Engine speed (specified)	Idling speed control Change in torque	Operating conditions
<b>Specified value</b>	650...750 rpm	700 rpm	-10...10 %	0 0 0 0 0
<b>Note</b>	If the specification is not attained =>Page <b>73</b>			Meaning of figures => Page <b>73</b>

**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.
- ♦ During idling, the engine control unit always tries to adapt the actual engine speed to the specified engine speed.
- ♦ 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.

If specified value is attained:

- Press ➡-key.
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-> Display function selection

Rapid data transfer      **HELP**  
Select function XX

If specified value is not attained:

- Interrogate fault memory again =>Page **4** .
- If the fault memory is erased the readiness code must be produced again => Page **30** .

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 95 .
- Check throttle valve control part =>Page 131 .
- Check whether solenoid valve for activated charcoal filter is continuously open =>Page 126 .
- Perform adaption of throttle valve control part =>Page 132 .

Meaning of 5-digit readout of display group 056

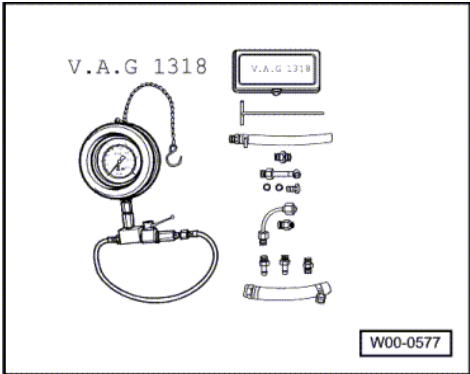
x	x	x	x	x	Display zone 4
				0	Air conditioner compressor: 0 = air conditioner compressor off; 1 = air conditioner compressor on
				0	Manual gearbox: Display always 0 Gear with automatic gearbox: 0 = Selector lever in P or N; 1 = selector lever in 2/3/4/D/R
			0		Air conditioner, ready for maximum heating or cooling
		0			Display always 0
0					Display always 0

1.15 - Checking fuel pressure regulator and holding pressure

*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.

Special tools and workshop equipment required



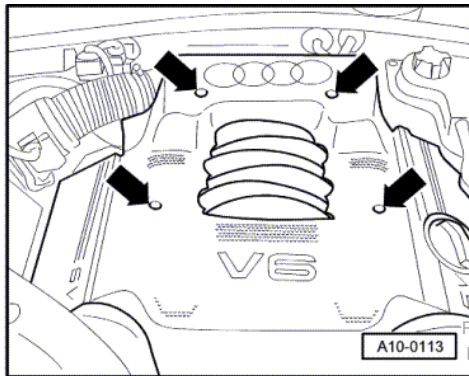
- ♦ V.A.G 1318 with V.A.G 1318/7, V.A.G 1318/8 and V.A.G 1318/15

*Test requirements:*

- Fuel pump relay OK; checking =>Page 85 .
- Fuel pump OK; checking:

=> Fuel Supply - Petrol Engines; Repair group 20

- Fuel filter OK
- Battery voltage at least 12.7 V
- Vehicles with automatic gearbox: Selector lever in position P or N.



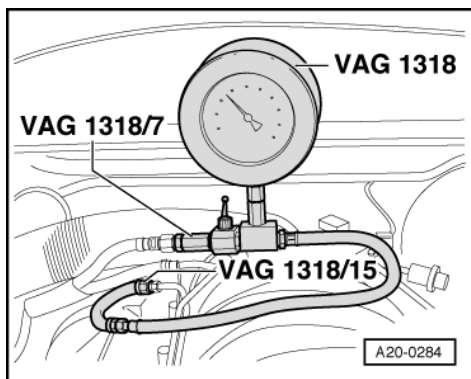
- -> Remove engine cover-arrows-

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#### 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.

#### Checking system pressure



- -> Connect pressure gauge V.A.G 1318 to fuel supply line using adapters 1318/7, 1318/8 (pressure hose) and 1318/15.
- Withdraw vacuum line from pressure regulator to induction manifold at pressure regulator and close off line.

#### Note:

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

- Start the engine and run at idling speed.
- Measure the fuel pressure.
  - Specified value: 3.8...4.2 bar
- If specification is not attained, try replacing the pressure regulator and repeating the pressure test.
- If specification is still not attained, check the fuel pump/feed pipe for damage (e.g. crushing) and replace, if necessary.
- If specification is exceeded, check the return pipe for damage (e.g. crushing) and replace, if necessary.

#### Note:

*When performing the following test, do not leave the engine running for an unnecessarily long time with the vacuum hose detached, because the higher fuel pressure causes the fuel/air mixture to be enriched. This could lead to the lambda control limits being exceeded, which would then result in a fault being recorded.*

- Start the engine and run at idling speed.
- Switch off electrical consumers (air conditioner system, etc).

- Attach vacuum hose to pressure regulator and observe drop in pressure on pressure gauge.
- Fuel pressure must decrease by approx. 0.5 bar when vacuum hose is attached.

Perform the following checks if there is no change in pressure as described above:

- Check vacuum hose for cracks and damage.
- Check vacuum hose at intake manifold for blockage; to do so, detach hose at pressure regulator and blow into it.
- If there is no leak and no blockage in the vacuum hose, replace the pressure regulator.

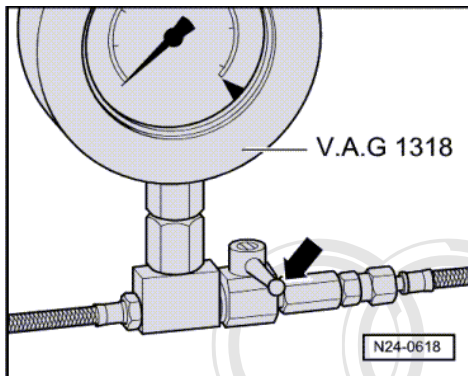
#### Checking holding pressure:

- Holding pressure 10 minutes after switching off engine (minimum pressure).
  - Specified value for cold engine: approx. 2.2 bar
  - Specified value with engine at operating temperature: approx. 3.0 bar

#### Note:

*The increase in temperature with the engine at operating temperature is caused by the expansion of the fuel and is normal.*

- 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 -arrow-).

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

- ◆ 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

#### Note:

*After the isolating valve has been closed, the pressure gauge shows the pressure after the isolating valve "induction manifold end" (direction of injectors, fuel pressure regulator). If the pressure before the isolating valve (tank direction) should now fall, the equipment cannot recognise this fact. For this reason, "If the pressure does not drop..." appears in the middle of this page.*

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

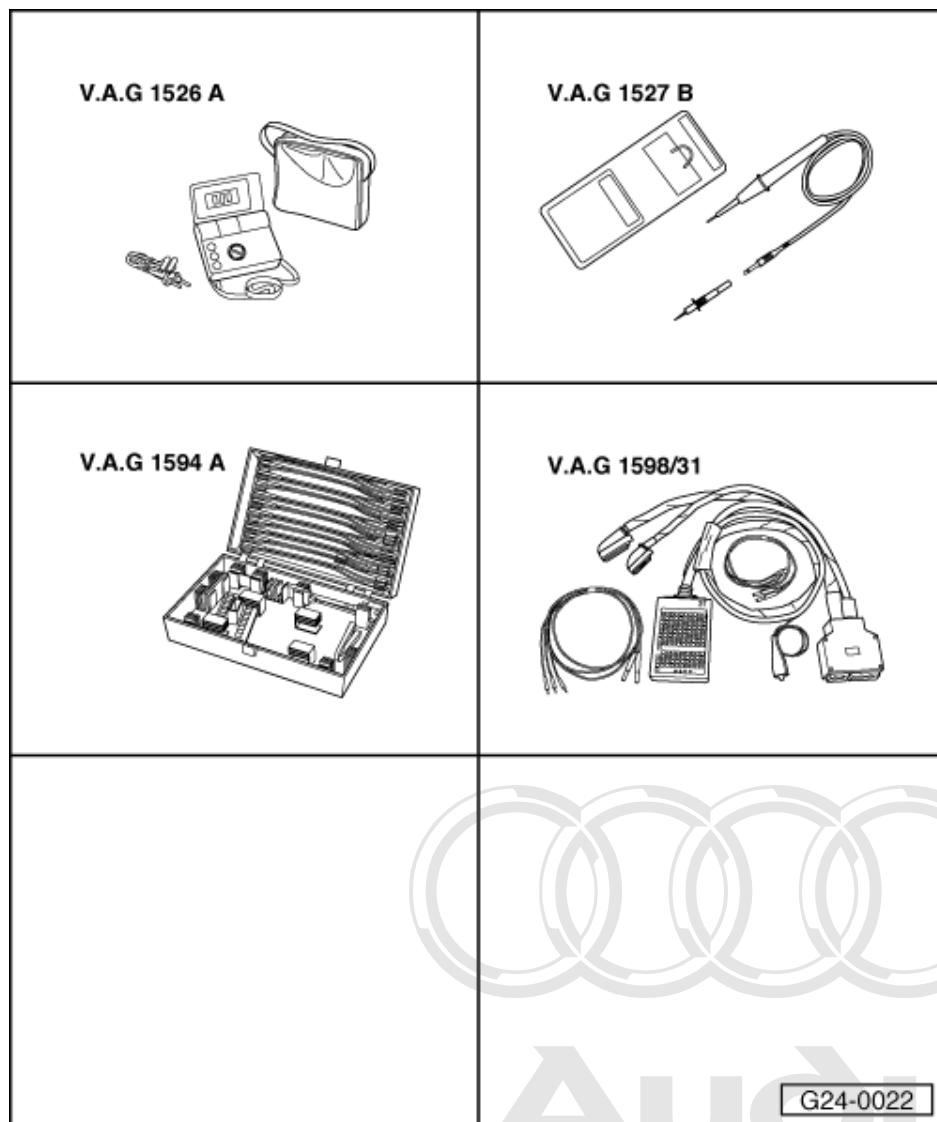
- ◆ Fuel pressure regulator defective
- ◆ Injectors leaking
- ◆ Unions on pressure gauge after cut-off valve leaking



**Note:**

*To remove the pressure gauge, close the shut-off valve, unscrew the union on adapter V.A.G 1318/15, then open the shut-off valve to drain off excess fuel into a suitable container.*

## 1.16 - Checking injectors



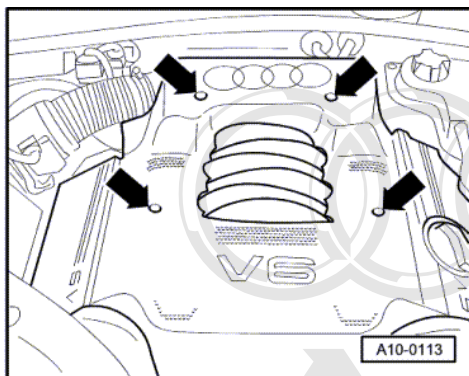
### Special tools and workshop equipment required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1527 B
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/31

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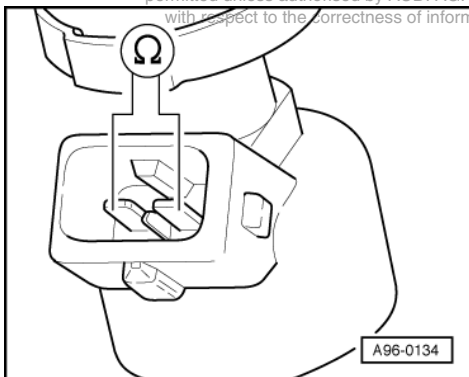


## Checking internal resistance



- -> Remove engine cover-arrows-

- Unplug connector on injector to be checked.



- -> Connect multimeter to injector to measure resistance.
- Specified value: 13.5...15.5  $\Omega$

When the engine is at operating temperature the resistance is increased by approx. 4...6  $\Omega$ .

If specified value is not attained:

- Replacing injector => Page 82

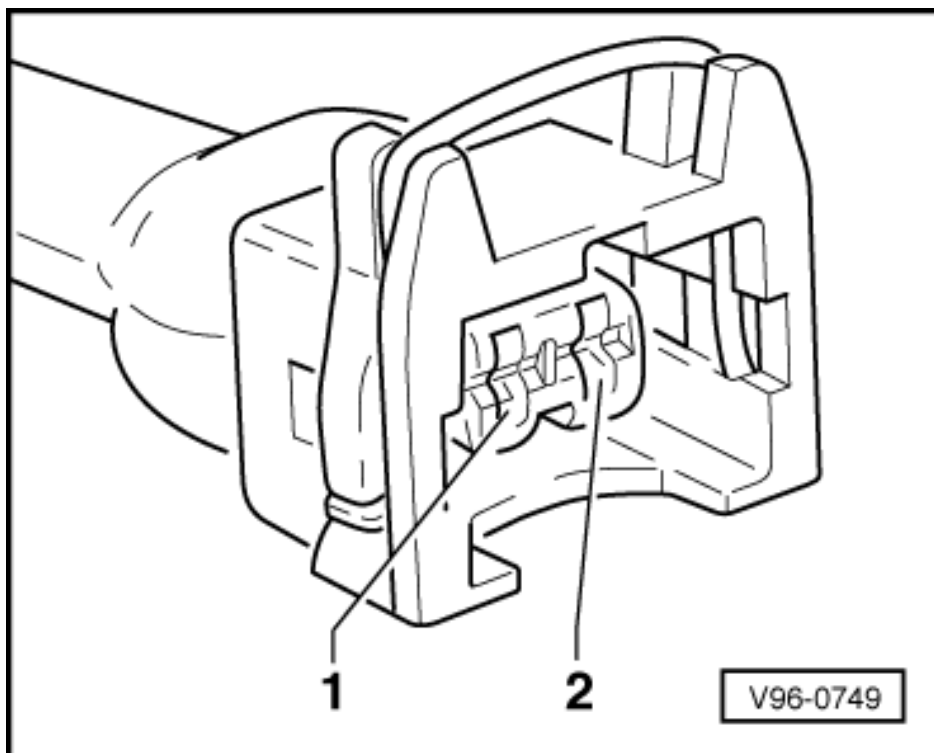
## Checking power supply

### Test requirements:

- Fuse for injectors OK

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

- Fuel pump relay OK; checking =>Page 85 .
- Unplug connector on injector to be checked.



- -> Connect voltage tester V.A.G 1527 B as follows:

Connector Contact	Measure to
1	Engine earth

- Switch the ignition on.
- The LED should illuminate.

If the LED does not illuminate:

- Check wiring connection between contact 1 and fuse for injector for open circuit:

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

- Rectify open circuit, if necessary.

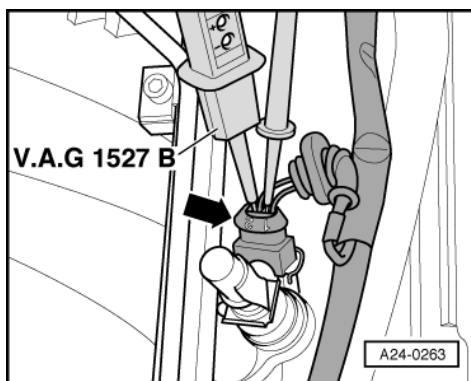
If the LED illuminates:

- Check actuation.

#### Checking actuation

##### **Test requirements:**

- Internal resistance of the valve OK



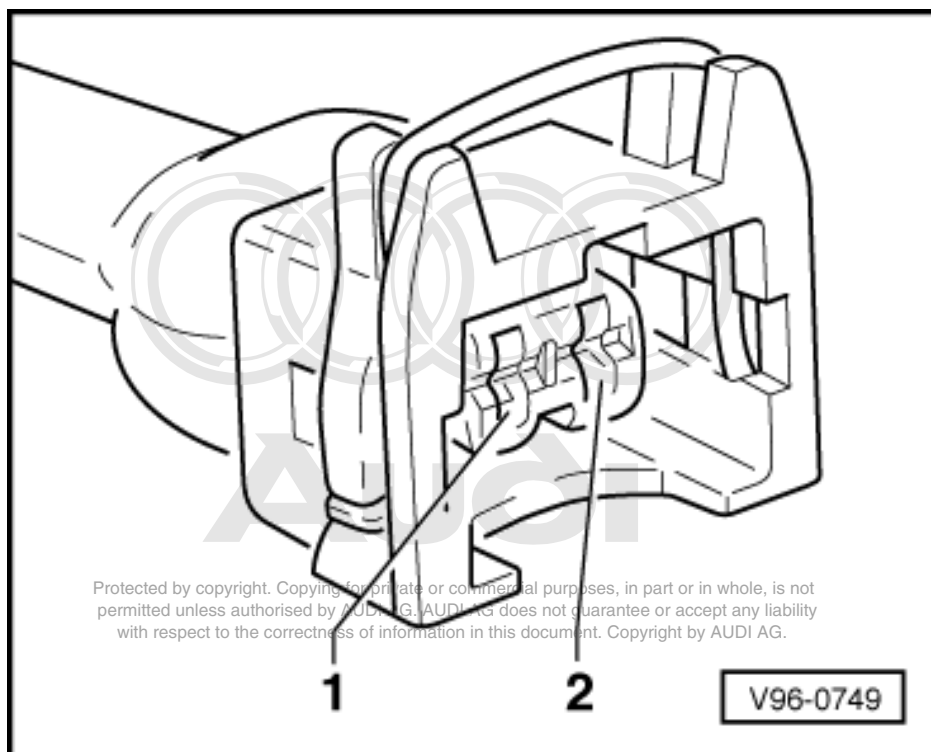
- -> Push back rubber grommet of plug -arrow- of injector but leave plug attached.
- Connect up voltage tester V.A.G 1527 B between contacts 2 (signal) and 1 (positive).
- Operate the starter briefly (the engine may start).
  - The LED should flash.

**Note:**

*Voltage testers with a low current draw continue to glow faintly between actuation from the engine control unit (rather than extinguishing completely) and become slightly brighter when actuated.*

If LED does not flash:

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 62 .



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

Cylinder	Injector connector Contact	Test box V.A.G 1598/31 Socket
1	2	96
2	2	112
3	2	88
4	2	97
5	2	113
6	2	89

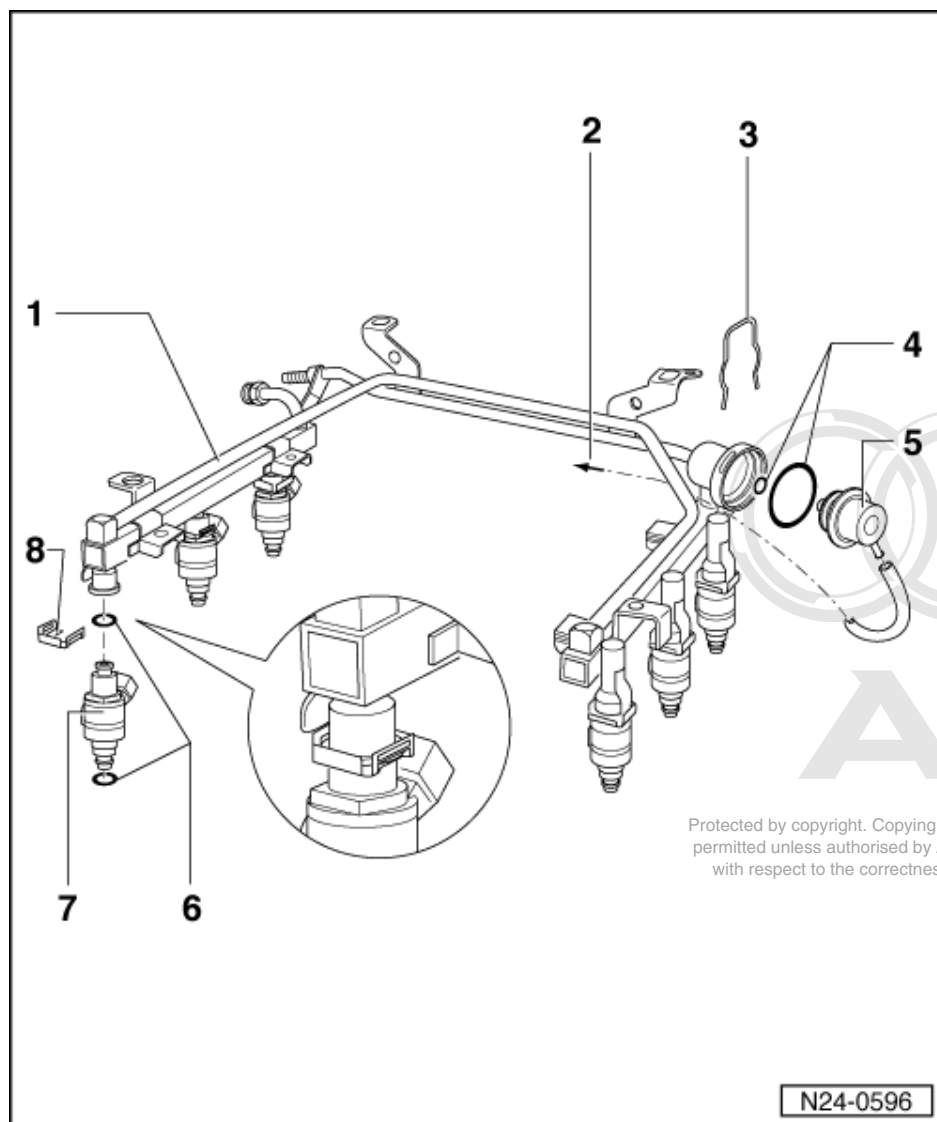
- Rectify any open/short circuit as necessary.

If the wiring is OK:

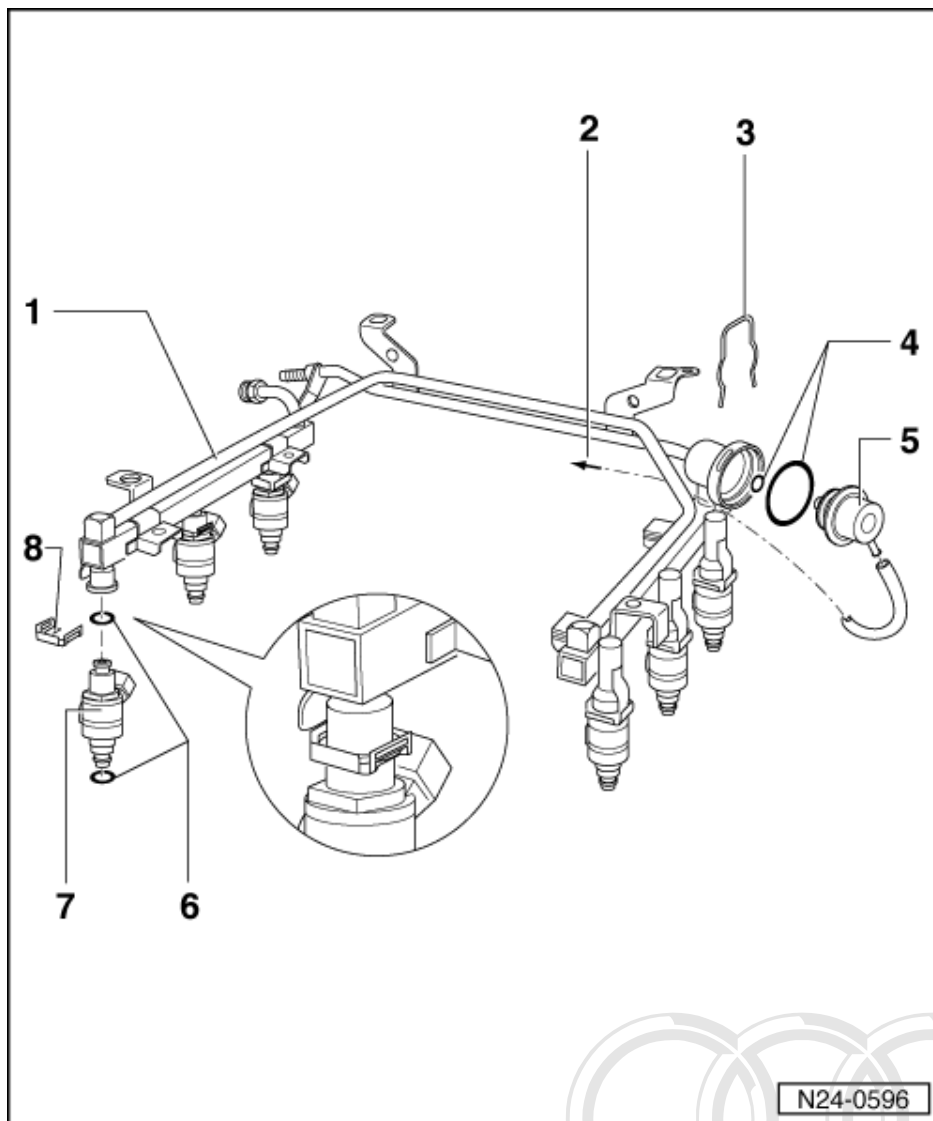
- Replace engine control unit => Page 64 .



## 1.17 - Dismantling and assembling fuel rail with injectors



- 1 Fuel rail
- 2 To T-piece
- 3 Bracket
  - ◆ Ensure tight fit
- 4 O-ring
  - ◆ Removing and installing =>Page 82 .
  - ◆ Replace
  - ◆ Moisten with clean engine oil
- 5 Fuel pressure regulator



**6 O-ring**

- ◆ Removing and installing=>Page 82 .
- ◆ Replace
- ◆ Moisten with clean engine oil

**7 Injectors -N30...-N33, -N83, -N84**

- ◆ Removing and installing=>Page 82

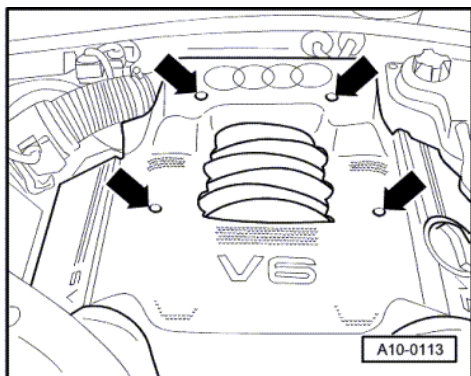
**8 Bracket**

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

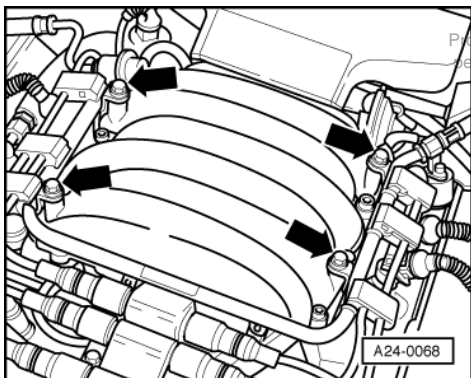
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## 1.18 - Removing and installing injectors



- -> Remove engine cover-arrows-.
- Remove the intake hose between air mass meter and air intake elbow.
- Unplug connectors from all injectors.
- Detach vacuum hose from fuel pressure regulator.
- Expose wires at fuel rail.



- -> Unscrew fuel rail -arrows-.
- Detach fuel rail together with injectors from intake manifold and place it on a clean cloth at the back of the engine compartment.

### Important

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

- Detach retainer and detach injector.

### **Note:**

*Replacement of fuel rail involves detaching fuel hoses.*

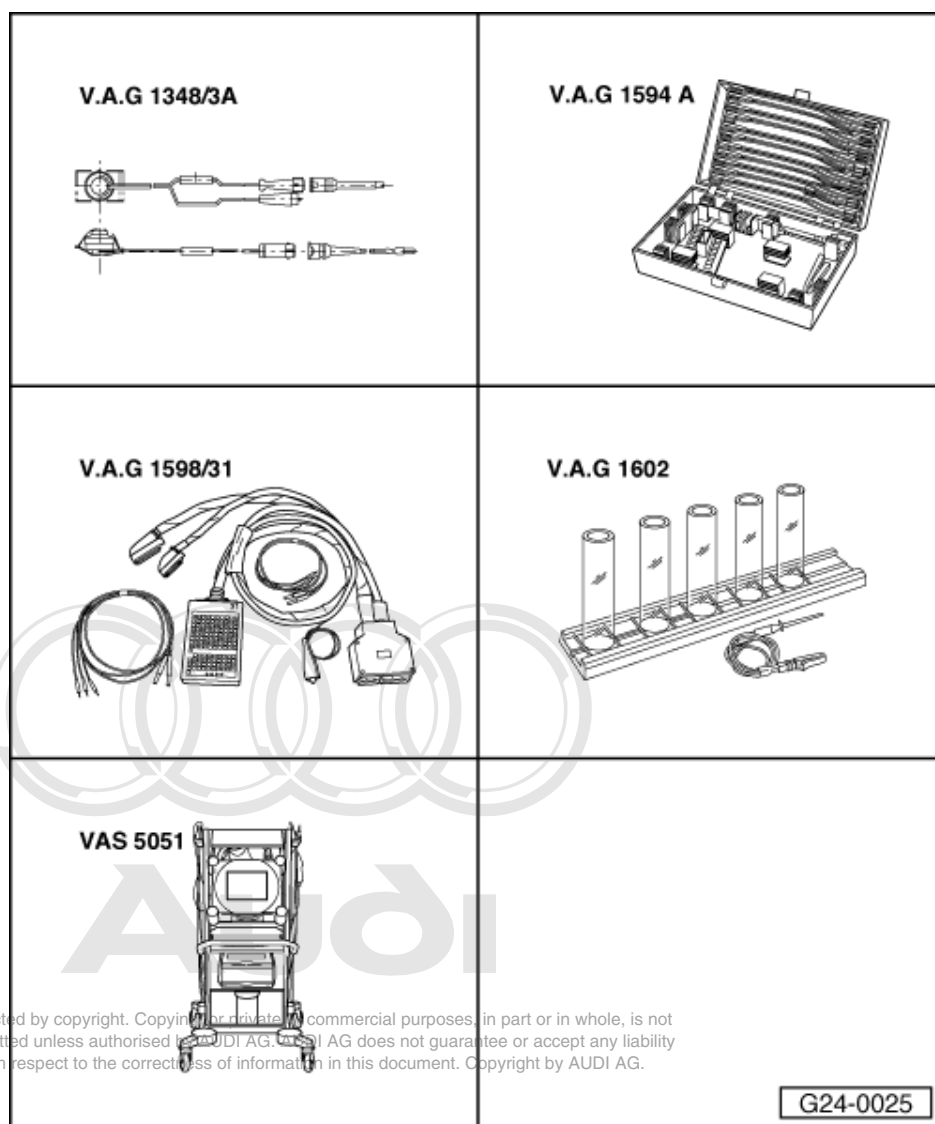
Install in reverse order, paying attention to the following:

- Renew the O-rings at all opened connections. (when renewing the front O-ring, ensure that the plastic cap is not removed from the injector head. The O-ring must be pulled off over the plastic cap).
- Coat the O-rings with clean engine oil.
- Make sure that the injectors are installed in the correct positions.
- Check to make sure that the retainer clamps are properly seated.
- Position fuel rail with secured injectors on intake manifold and press evenly into place.

### Tightening torque

Component	Nm
Fuel rail to intake manifold	10

## 1.19 - Checking injection quantity, leak tightness and spray pattern of injectors



### Special tools and workshop equipment required

- ◆ V.A.G 1348/3 A with 1348/3-2
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/31
- ◆ V.A.G 1602
- ◆ VAS 5051 with VAS 5051/1

or

- ◆ V.A.G 1551 with V.A.G 1551/3 A

### Test requirements:

- Fuel pressure OK, checking =>Page 73 .

### Test sequence

- Remove fuel rail with injectors fitted from intake manifold => Page 82 . Fuel hoses remain connected.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 62 .



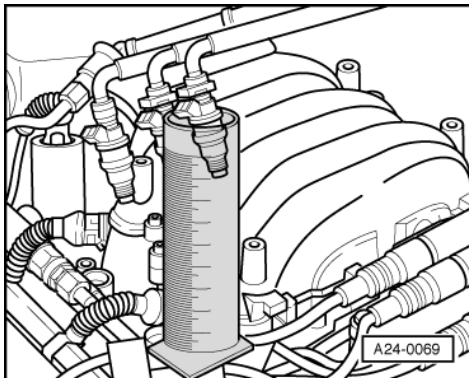
- Bridge contacts 1 and 65 on the test box using test leads from adapter set V.A.G 1594 A (this creates an earth connection to one side of the fuel pump relay coil).

**Note:**

*The fuel pump relay obtains positive supply (terminal 30) directly via central electrical system. The negative voltage supply for the fuel pump relay comes via the cable bridge in the test box. The fuel pump now runs constantly.*

**Leak test**

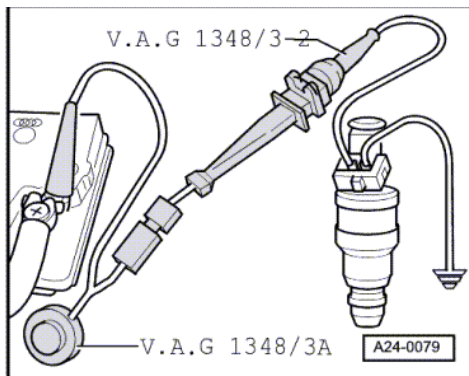
- Check injectors for leaks (visual check). When the fuel pump is running, only 1 or 2 drops a minute should escape from each injector.



- If the fuel loss is greater switch off fuel pump (remove cable bridge) and replace defective injector => Page **82**.

**Checking injection quantity**

- -> Place injector to be tested in a measuring glass from injection quantity tester V.A.G 1602.



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- -> 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.
- Jumper contacts 1 and 65 at test box with leads from adapter set V.A.G 1594 A.
  - The fuel pump should run.
- Activate remote control V.A.G 1348/3 A for 30 seconds.
- Once all three injectors of a cylinder bank have been actuated, place the three measuring glasses on a flat surface.
  - Specification per injector: 90...125 ml
- If measured values for one or more injectors are outside tolerance, switch off fuel pump (pull off cable bridge) and replace defective injector => Page **82** ;
- Repeat the check on injectors of second cylinder bank.



- If the measured values for all the injectors are outside the tolerance range, check the fuel pressure => Page 73 .


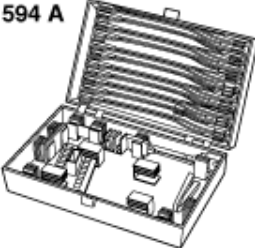

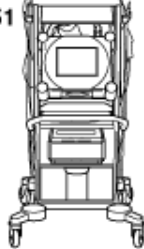
**Note:**

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

- Install injectors with fuel rail => Page 82 .

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## 1.20 - Checking fuel pump relay -J17 and actuation

<p><b>V.A.G 1526 A</b></p> 	<p><b>V.A.G 1594 A</b></p> 
<p><b>V.A.G 1598/31</b></p> 	<p><b>VAS 5051</b></p> 
	<p>G24-0021</p>

### 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

or



- ♦ V.A.G 1551 with V.A.G 1551/3 A

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

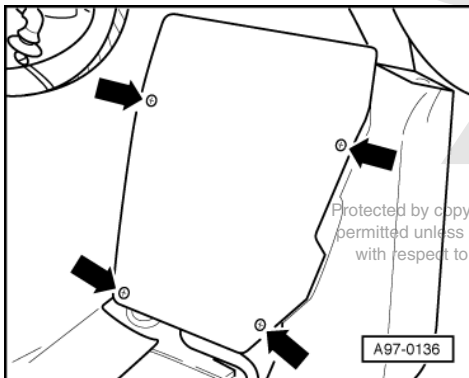
The fuel pump relay -J17 is only energised when the engine is running, i.e. the relay is only connected to earth (via the engine control unit) when engine speed pulses are detected in the engine control unit.

**Test requirements:**

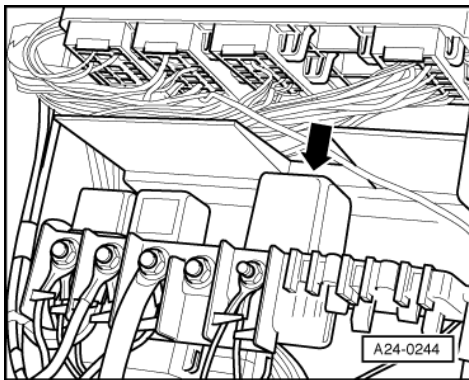
- Battery voltage at least 12.7 V

**Functional check of fuel pump relay**

- Take out floor covering in front right footwell.



- -> Remove screws on cover for electronics box -arrows- and take off cover.
- Initiate final control diagnosis =>Page 21 and actuate ACF solenoid valve -N80.



- -> Fuel pump relay -arrow- (in the central electronics, electronics box, passenger's footwell, position 4) should pull and fuel pump should run.

A - If relay does not pull:

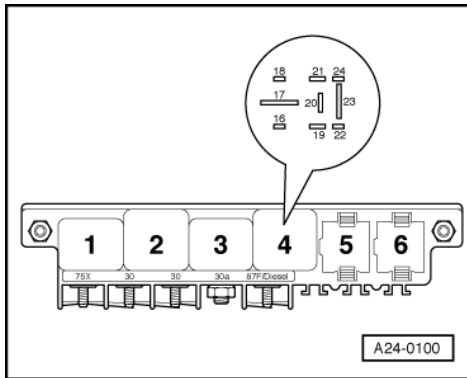
- Check voltage supply of fuel pump relay => Page 86 .
- Check actuation of fuel pump relay =>Page 87 .

B - If relay pulls but fuel pump does not run:

- Check voltage supply for fuel pump and components (via fuel pump relay) =>Page 89 .

**Checking voltage supply of fuel pump relay**

- Switch ignition off.



- Disconnect fuel pump relay.
- -> Connect the multimeter to contact 17 of relay socket and to earth to measure voltage.
  - Specified value: approx. battery voltage

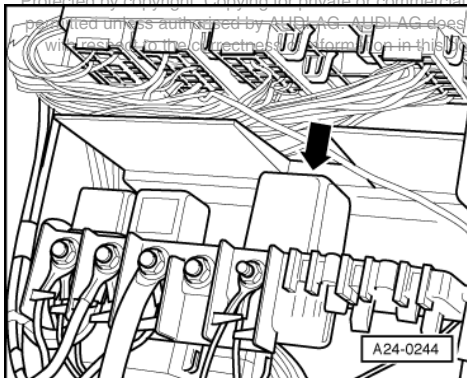
If specified value is not attained:

- Replace central electrics.

### Checking actuation of fuel pump relay

- Switch ignition off.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 62 .
- Jumper contacts 1 and 65 at test box with leads from adapter set V.A.G 1594 A.

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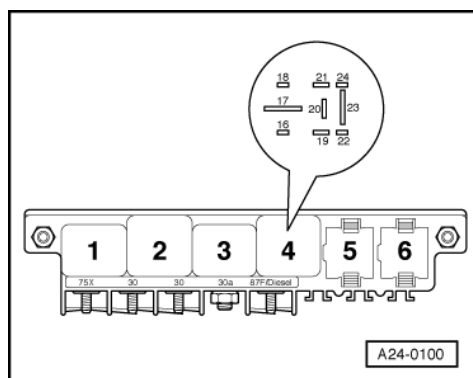
- -> Fuel pump relay -arrow- (in the central electrics, electronics box, passenger's footwell, position 4) should pull and fuel pump should run.

If the relay pulls now, but not during final control diagnosis:

- Replace engine control unit => Page 64 .

If the relay does not respond:

- Disconnect cable bridge.
- Disconnect fuel pump relay.

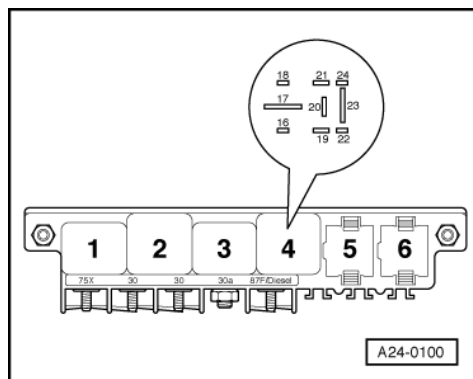


- -> Connect the multimeter to contact 19 of relay socket and to earth to measure voltage.
- Specified value: approx. battery voltage

If specified value is not attained:

- Check the wiring connections.

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



If specified value is attained:

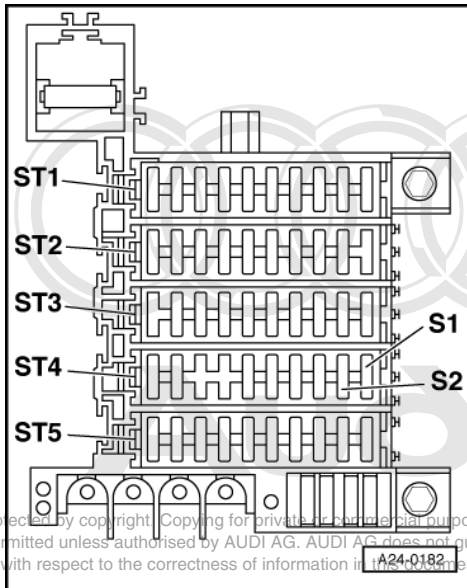
- -> Check for open circuit and short to positive or earth in the following wiring connection:

Central electrics in driver's footwell on left, position 4 Contact	Test box V.A.G 1598/31 Socket
16	65

- Rectify any open/short circuit as necessary.



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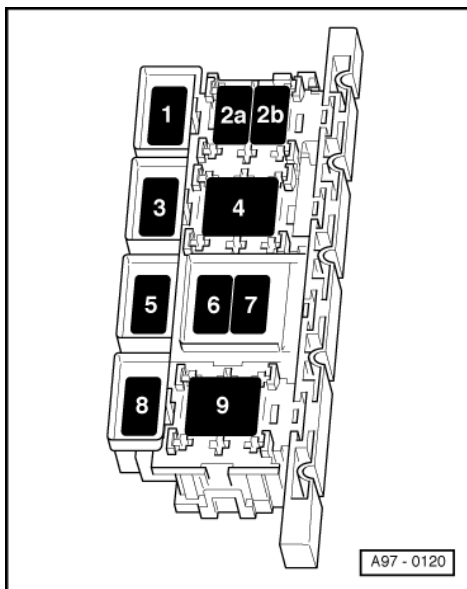
If no fault is found:

- Replace the fuel pump relay -J17.
- Reconnect engine control unit.

#### Checking voltage supply of fuel pump and components

- Slacken off knurled screw and detach cover at A-pillar from fuse holder.
- ➔ Pull fuses S1, S2 and S3 out of fuse carrier ST4 in fuse holder.

ST4 - Blue fuse carrier



- ➔ Pull fuse S117 (position 6) out of relay and fuse carrier, electronics box, plenum chamber.
- Initiate final control diagnosis =>Page **21** and actuate ACF solenoid valve -N80.
- To measure the voltage, connect multimeter to earth and to one of the contacts of the following fuses in the fuse holder.

Fuse	Specified value at one of the contacts
S1 (in fuse holder, fuse carrier ST4 - blue)	approx. battery voltage



Fuse	Specified value at one of the contacts
S2 (in fuse holder, fuse carrier ST4 - blue)	approx. battery voltage
S3 (in fuse holder, fuse carrier ST4 - blue)	approx. battery voltage
S117 In relay and fuse carrier, electronics box, plenum chamber, position 6	approx. battery voltage

If the specified values are not obtained:

- Repeat the test at the other contact of the fuse base.

If the specifications are still not attained:

- Check the wiring connections.

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

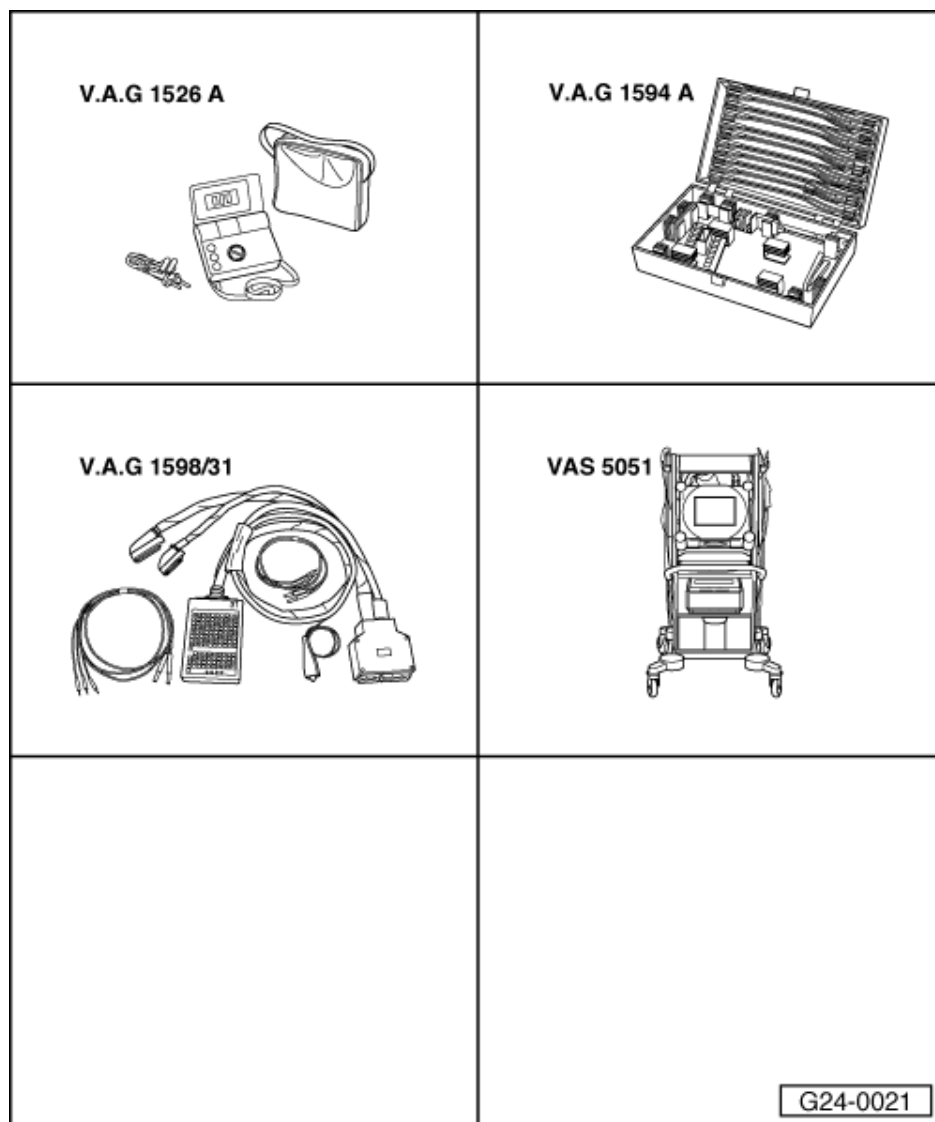
If no fault is found:

- Replace the fuel pump relay -J17.
- Reinsert the fuses.



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## 1.21 - Checking air mass meter -G70



### 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

or

- ◆ V.A.G 1551 with V.A.G 1551/3 A

### Test requirements:

- Coolant temperature at least 80 °C.
- Electrical consumers switched off (radiator fan must not run during the test).
- Air conditioning switched off.
- Fuse for air mass meter OK.

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



## Checking function

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "Address word" 01 => Page 1  
For this purpose, the engine must be running at idle speed.

-> Indicated on display

Rapid data transfer      HELP  
Select function XX

- Enter "04" to select "Start basic setting" and confirm with Q-key.

### Note:

During basic setting, the solenoid valve for the activated charcoal filter (valve -N80) is closed and the air conditioner compressor is switched off.

-> Indicated on display

Basic setting      Q  
Enter display group number XXX

- Enter "002" for "display group number 002" and confirm entry with Q-key.

-> Indicated on display

System in basic setting      2  
1      2      3      4

- Check specified values for load recognition in display zones 3 and 4.

	Display zones			
	1	2	3	4
<b>Display group 002: Intake air mass at idle and operating temperature</b>				
<b>Display</b>	xxx rpm	xx.x %	x.x ms	xxx.x g/s
<b>Display</b>	Engine speed	Load	Average injection period	Air mass
<b>Range</b>			1.0...21.0 ms	1.0...160 g/s
<b>Specified value</b>	650...750 rpm	12.0...26.0 %	1.0...4.0 ms	1.0...5.0 g/s
<b>Note</b>	---	---	If specified value is not attained: Evaluation, display zone 3 =>Page 92	If specified value is not attained: Evaluation, display zone 4 =>Page 93

If specifications are attained:

- Press =>-key.

-> Display function selection):

Rapid data transfer      HELP  
Select function XX

## 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 4.0 ms	- Engine load from ancillaries	- Eliminate load (air conditioner/power steering/alternator)



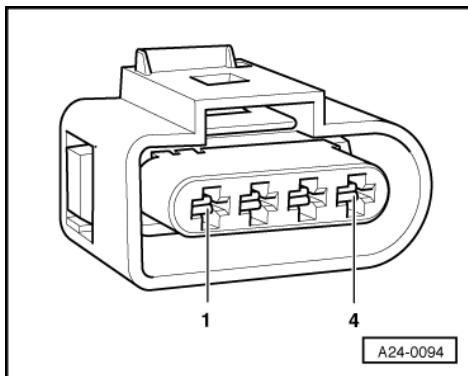
Display zone: 3	Possible causes of fault	Fault remedy
	- Poor idling (not running on all cylinders)	- Check spark plugs Check injectors =>Page 76
	- Throttle valve control part -J338 defective	- Check throttle valve control part =>Page 131

#### Evaluation of display group 002

Display zone: 4	Possible causes of fault	Fault remedy
Less than 1.0 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 93
Greater than 5.0 g/s	- Engine load from ancillaries - Voltage supply to air mass meter or wiring to engine control unit	- Eliminate load (air conditioner/power steering/alternator) - Check voltage supply and/or wiring => Page 93

#### Checking voltage supply to air mass meter

- Detach connector from air mass meter.



- -> Connect multimeter as follows to measure voltage.

Connector Contact	Measure to
3	Engine earth

- Operate starter briefly.
  - Specified value: approx. battery voltage

#### Note:

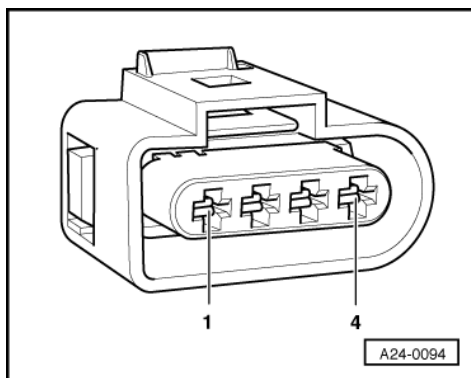
*Voltage supply to air mass meter is from fuel pump relay.*

If specified value is not attained:

- Check the wiring from contact 3 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.



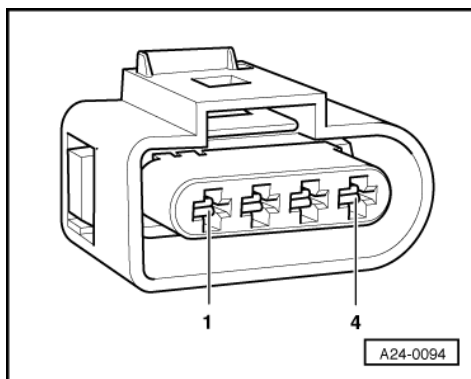
- -> Connect hand-held multimeter to contacts 2 and 3 of the connector to measure voltage.
- Operate starter briefly.
  - Specified value: approx. battery voltage

**Note:**

*Engine control unit earth is present at contact 2 of the connector.*

If specified value is not attained:

- Check the wiring connections =>Page 94 .



- -> Connect hand-held multimeter to contacts 1 and 2 of the connector to measure voltage.
- Switch the ignition on.
  - Specified value: approx. 5 V

If specified value is not attained:

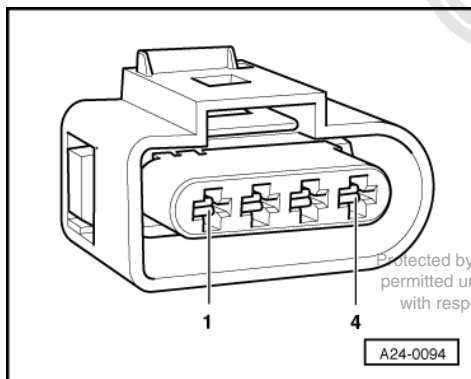
- Check the wiring connections=>Page 94 .

**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; the engine control unit must not be connected => Page 62 .



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- -> 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
1	53
2	27
4	29

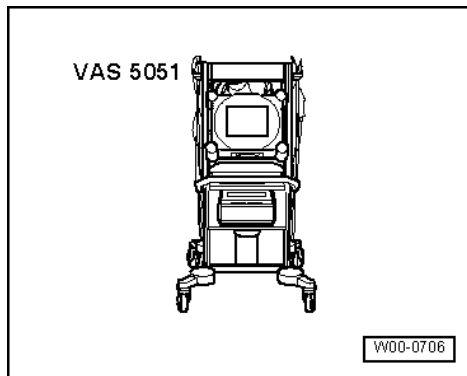
- Rectify any open/short circuit as necessary.
- Additionally check all wires for short to one another.

If the wiring is OK:

- Renew air mass meter -G70.

## 1.22 - Checking intake air system for leaks (unmetered air)

Special tools, workshop equipment and other items required



- ♦ VAS 5051 with VAS 5051/1

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A
- ♦ 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

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 - Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "Address word" 01 => Page 1  
 For this purpose, the engine must be running at idle speed.

-> Indicated on display

Rapid data transfer	HELP
Select function XX	

- Enter "08" to select the function "Reading measured value block" and confirm entry with Q-key.

-> Indicated on display



Reading measured value block	Q
Enter display group number XXX	

- Enter "001" for "display group number 001" and confirm entry with Q-key.

-> Indicated on display  
(1...4 = display zones)

Read measured value block	1
1      2      3      4	

- 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.
- Press =>-key.

-> Display function selection

Rapid data transfer	HELP
Select function XX	

- Enter "06" for "End output" function and confirm entry with Q-key.
- Switch ignition off.

## 2 - Checking intake manifold changeover function

### 2.1 - Checking intake manifold changeover function

This test should only be carried out if the engine is losing power.

The intake manifold change over function switches over from the long intake tract to the short intake tract at about 4700 rpm.

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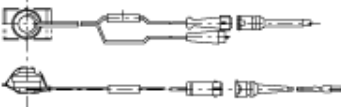
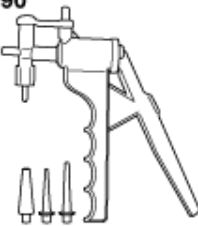
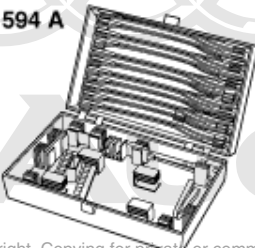
### 2.2 - Checking function

- Increase the engine speed to well above 4700 rpm; the vacuum unit for the intake manifold change over system should "actuate". (Fitting location: at front left of intake manifold beneath ignition coils).

If the changeover is not taking place, carry out the following tests:

- Check intake manifold changeover valve -N156 (perform final control diagnosis => Page 101 ).
- Checking vacuum system for leaks =>Page 97 .
- Check that vacuum hoses are properly connected and free of leaks and obstructions.
- Check that changeover mechanism operates freely (move push rod by hand).

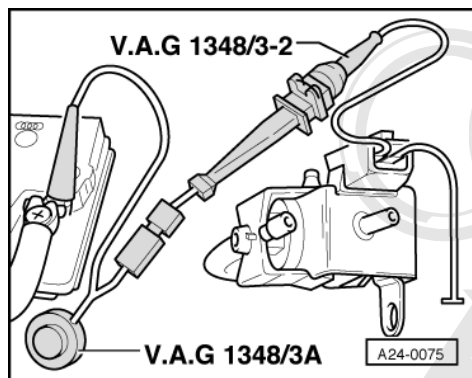
## 2.3 - Checking vacuum system for leaks

<p><b>V.A.G 1348/3-2</b></p> 	<p><b>V.A.G 1348/3A</b></p> 
<p><b>V.A.G 1390</b></p> 	<p><b>V.A.G 1594 A</b></p>  <p>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.</p>
	<p>G24-0010</p>

### Special tools and workshop equipment required

- ◆ V.A.G 1348/3-2
- ◆ V.A.G 1348/3 A
- ◆ V.A.G 1390
- ◆ V.A.G 1594 A

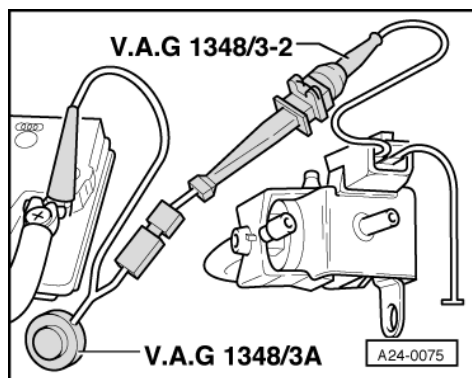
- Run engine at idling speed for 2 or 3 minutes to build up vacuum pressure.
- Switch ignition off.
- Unplug connector from intake manifold changeover valve -N156.



- -> Connect one of the contacts on the solenoid valve to engine earth using test leads and crocodile clamp from V.A.G 1594 A.
- Connect second contact on -N156 to positive using remote control V.A.G 1348/3 A, adapter lead V.A.G 1348/3-2 and auxiliary cable.
- Operate remote control V.A.G 1348/3 A approx. 2 to 3 minutes; throughout this period the vacuum unit should remain energised.

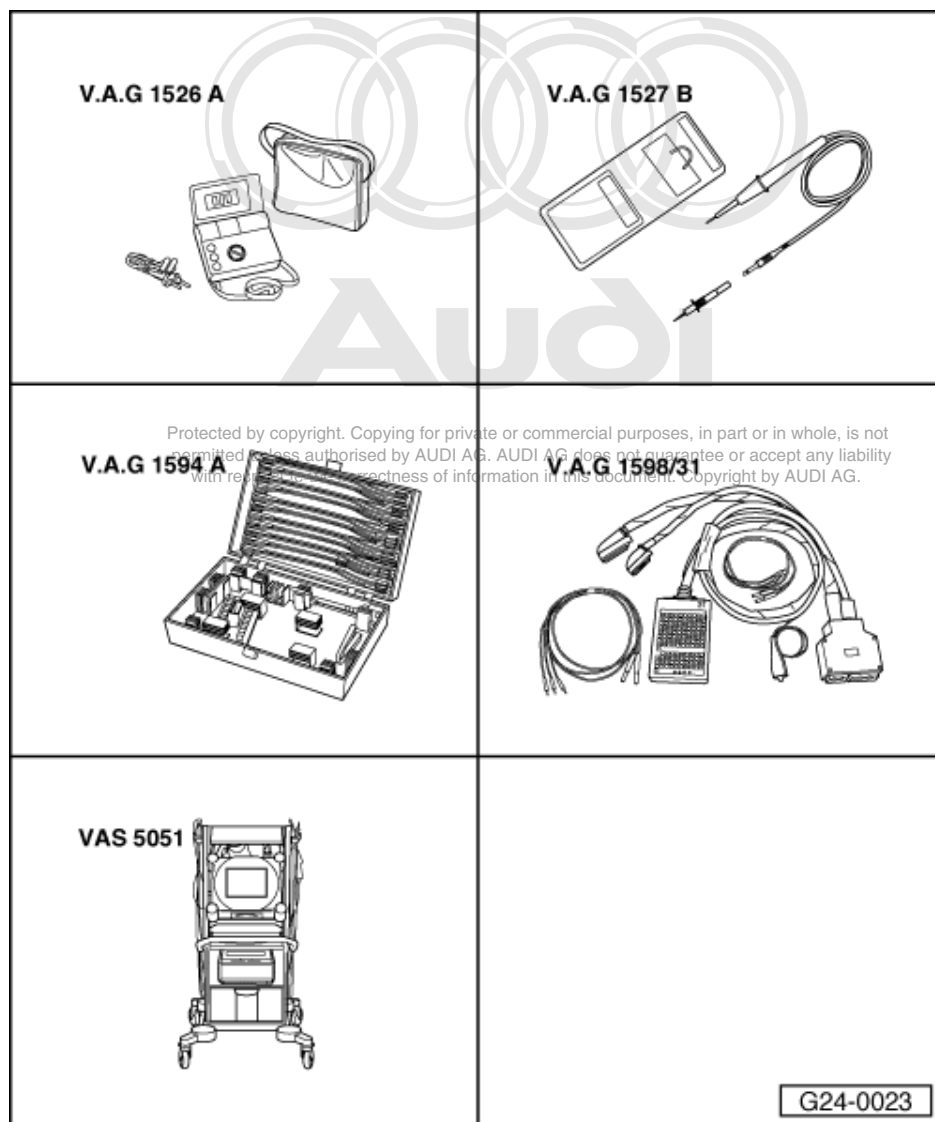
If the vacuum unit returns to its initial position, carry out the following test:

- Disconnect vacuum hoses from vacuum unit for intake manifold changeover system.
- Connect hand vacuum pump V.A.G 1390 to vacuum unit.
- Operate hand pump and check whether changeover function is working.
- Check vacuum unit for leaks. (The vacuum unit should not return to rest position until the hand pump is vented to atmosphere.)
- If necessary, replace vacuum unit.
- If the vacuum unit is not actuating, check -N156 as follows for blockage:



- -> Connect one of the contacts of -N156 to engine earth using test leads and crocodile clamp from V.A.G 1594 A.
- Connect second contact on -N156 to positive using remote control V.A.G 1348/3 A, adapter lead V.A.G 1348/3-2 and auxiliary cable.
- Operate remote control V.A.G 1348/3 A.
- Check valve for obstructions (remove vacuum hoses and blow through).
- If necessary, replace intake manifold changeover valve.
- If no faults have been found in any of the tests so far, check the vacuum system for leaks.

## 2.4 - Checking intake manifold changeover valve -N156



### Special tools and workshop equipment required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1527 B
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/31
- ♦ VAS 5051 with VAS 5051/1

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

Fitting location => Fitting locations overview, Page 45

### Test requirements:

- Final control diagnosis has been performed
- Fuse for intake manifold change-over valve OK

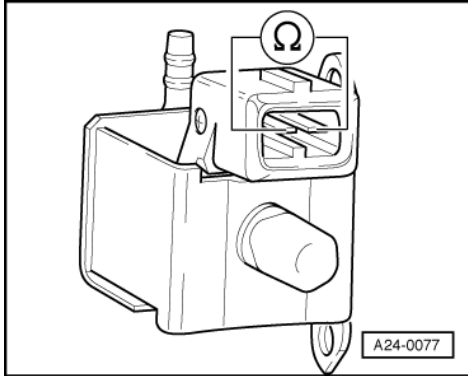
=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder



- Fuel pump relay OK; checking =>Page **85** .

#### Checking internal resistance

- Unplug connector from intake manifold changeover valve -N156.



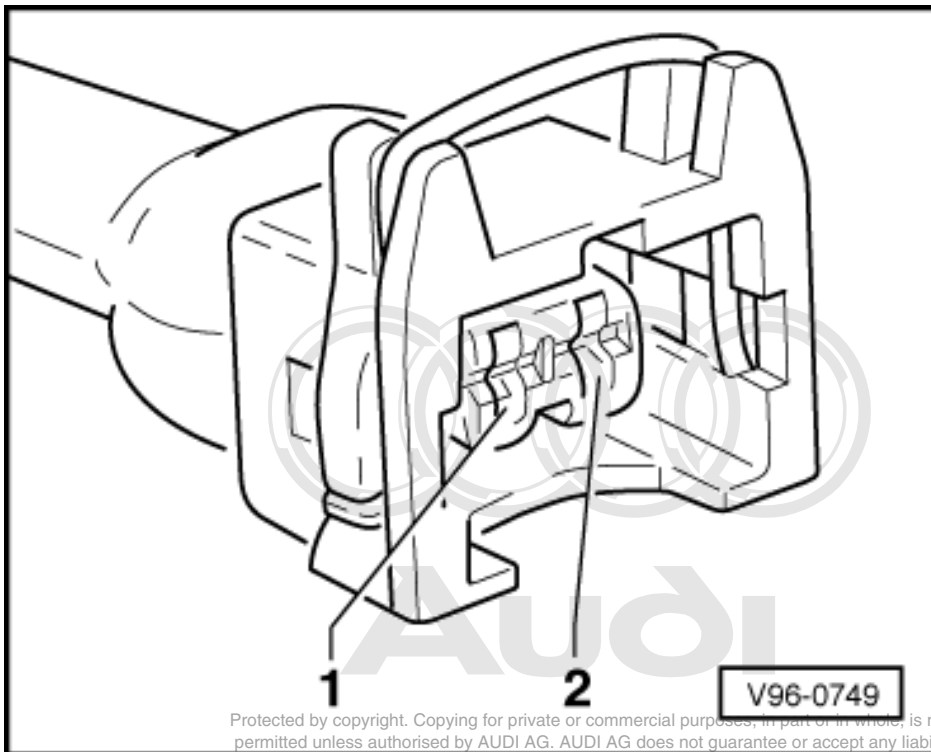
- -> Connect multimeter to injector to measure resistance.
- Specified value: 25...35  $\Omega$

If specified value is not attained:

- Replace the intake manifold changeover valve -N156.

#### Checking power supply

- Unplug connector from intake manifold changeover valve -N156.



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- -> Connect voltage tester V.A.G 1527 B as follows:

Connector Contact	Measure to
1	Engine earth



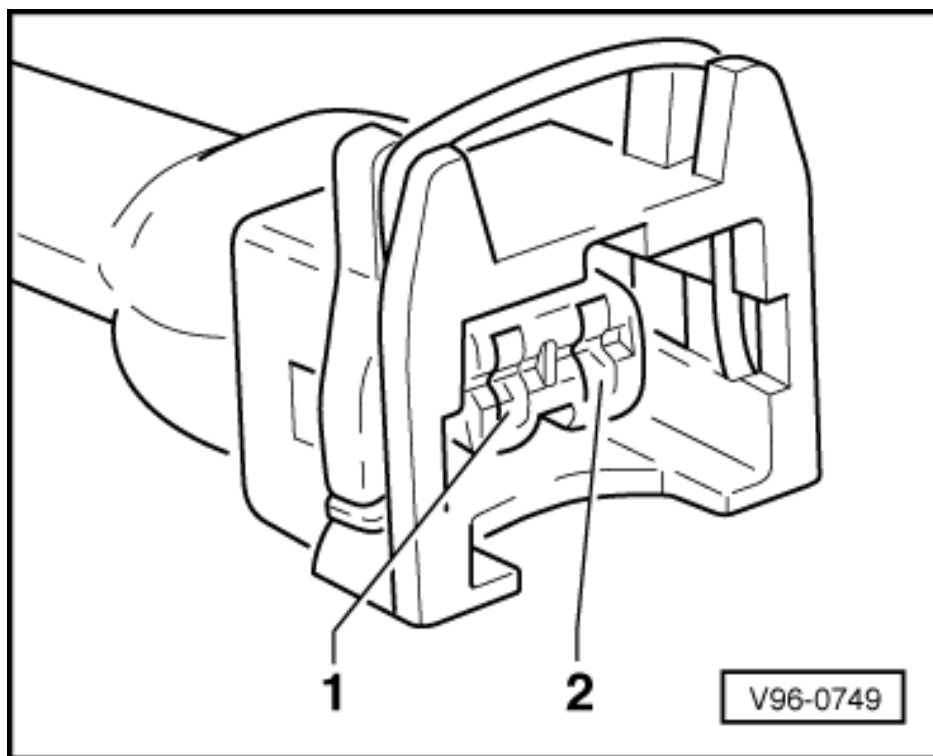
- Operate starter briefly.
  - The LED should illuminate.

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

#### Checking actuation

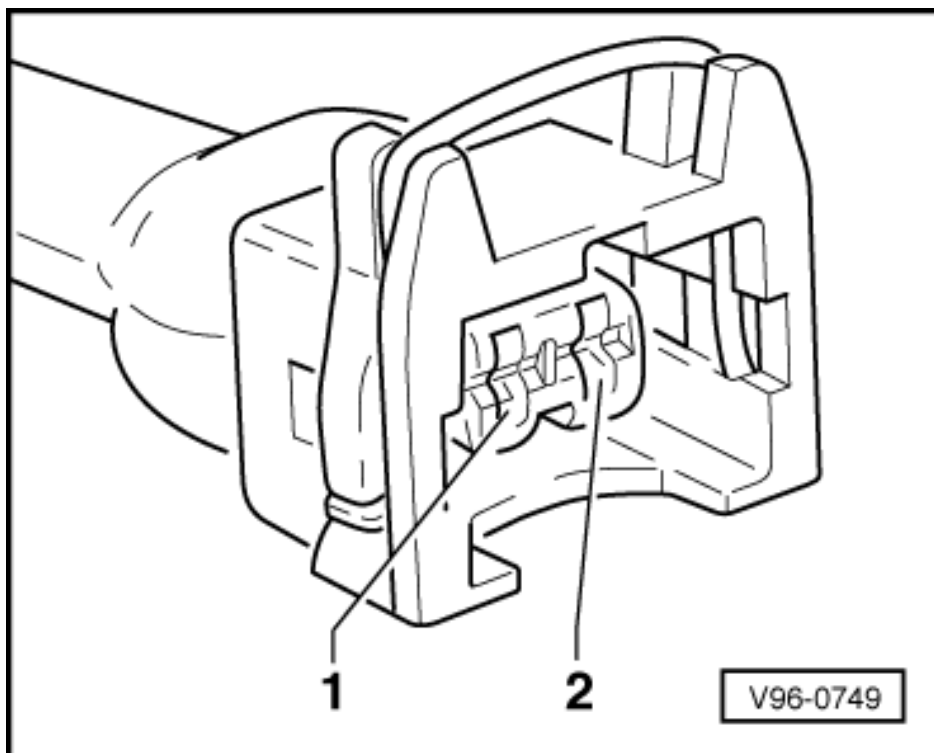


- -> Connect voltage tester V.A.G 1527 B between contacts 1 and 2.
- Initiate the final control diagnosis => Page 21 and activate intake manifold changeover valve.
  - The LED should flash.

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; the engine control unit must not be connected => Page 62 .

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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	104

- Rectify any open/short circuit as necessary.

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

If the wiring is OK:

- Replace engine control unit => Page 64 .

## 3 - Checking lambda control

### 3.1 - Checking lambda control

### 3.2 - Function of lambda control

#### **Notes:**

*The lambda probes compare the oxygen content in the air with the residual oxygen content in the exhaust gas and send a voltage signal to the control unit.*

*The voltage signal for "Mixture too rich" (low residual oxygen) is between about 0.7 and 1.0 V.*

*The voltage signal for "Mixture too lean" (high residual oxygen) is between about 0.0 and +0.3 V.*


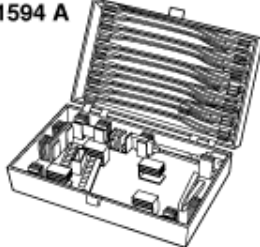

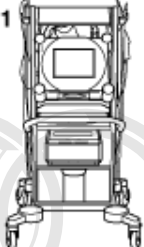
The transition from "rich" to "lean" is accompanied by a voltage jump from between 0.7 and 1.0 V to between 0.0 and +0.3 V, and vice versa ( $\lambda = 1.0$ ).

Because of the sharp voltage jump the lambda control cannot maintain a constant ideal mixture composition of  $\lambda = 1.0$ . The system fluctuates continuously between "slightly too lean" and "slightly too rich".

If the voltage does not change or only changes slowly the following faults 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 Lambda probe via the fine cavities in the electrical wiring as a result of temperature 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).

### 3.3 - Checking lambda probe and lambda control upstream of catalytic converter

<p><b>V.A.G 1526 A</b></p> 	<p><b>V.A.G 1594 A</b></p> 
<p><b>V.A.G 1598/31</b></p> 	<p><b>VAS 5051</b></p> 
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G24-0021

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

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

**Notes:**

- ♦ For specific fault search, it is possible to switch off the lambda control by selecting display group 099 under "Basic setting" mode and to switch it on again with "Read measured value block".
- ♦ After selecting the display group 099 (whether in "Basic setting" or "Read measured value block" mode), it is possible to switch back and forth between the functions 04 "Basic setting" and 08 "Read measured value block" by pressing the keys 4 or 8 on V.A.G 1551.
- ♦ On leaving function 04 "Basic setting", the lambda control is automatically re-activated.

**Test requirements:**

- Test drive performed and fault memory not erased.
- Coolant temperature at least 80 °C.

**Functional test**

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "Address word" 01 => Page 1  
For this purpose, the engine must be running at idle speed.

-> Indicated on display

Rapid data transfer	HELP
Select function XX	

- Enter "04" to select "Start basic setting" and confirm with Q-key.

**Note:**

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*During basic setting, the solenoid valve for the activated charcoal filter (valve -N80) is closed and the air conditioner compressor is switched off.*

-> Indicated on display

Basic setting	Q
Enter display group number XXX	

- Enter "030" for "display group number 030" and confirm entry with Q-key.

-> Indicated on display

System in basic setting	30
1      2      3      4	

- Check lambda probe status in display zones 1 to 3.

**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 at idle				
Display	X X X	X X X	X X X	X X X

	Display zones			
Display	Lambda probe status, bank 1, probe 1	Lambda probe status, bank 1, probe 2	Lambda probe status, bank 2, probe 1	Lambda probe status, bank 2, probe 2
Range	0 = off 1 = on	0 = off 1 = on	0 = off 1 = on	0 = off 1 = on
Specified value	1 1 1	1 1 0	1 1 1	1 1 0
Note:	If the specification is not attained =>Page 105			

Meaning of 3-digit readout of display group 030			
X	X	X	Display zones 1...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.

#### Checking lambda probe learned values and lambda control

- Press C-key.

-> Indicated on display

Basic setting Q  
Enter display group number XXX

- Enter "033" for "display group number 033" and confirm entry with Q key.

-> Indicated on display

System in basic setting 33  
1 2 3 4

- Check lambda control in display zones 1 and 3:

	1	2	3	4
Display group 033: Lambda control upstream of catalytic converter				
Display	xx.x %	x.xxx volts	xx.x %	x.xxx V
Display	Lambda control bank 1	Lambda probe voltage, bank 1	Lambda control bank 2	Lambda probe voltage bank 2
Range	-25.0...25.0 %	0.100...1.000 V	-25.0...25.0 %	0.100...1.000 V
Specified value	In range -10.0...10.0 % value must fluctuate at least 2 %	In range from 0.100 1.000 Volt, the voltage must fluctuate by approx. 0.3 V	In range -10.0...10.0 % value must fluctuate at least 2 %	In range from 0.100...1.000 Volt, the voltage must fluctuate by approx. 0.3 V
Note	If the specification is not attained =>Page 105		If the specification is not attained =>Page 105	

#### Evaluating display group 033

Display zone: 1 / 3	Possible causes of fault	Fault remedy
---------------------	--------------------------	--------------



Values in range: -10.0...-25.0 % or Values in range: 10.0...25.0 % or Value does not fluctuate by at least 2%	- Lambda probe heating defective	- Check lambda probe heating=>Page 120
	- Open circuit between lambda probe and control unit	- Check basic voltage => Page 107
	- Short to earth or positive between lambda probe and control unit	- Check lambda probe wiring bank 1 lambda probe 1 => Page 108
	- Unmetered air in intake area	- Check intake system for leaks and rectify unmetered air =>Page 95
	- Fuel system pressure too high or too low	- Check fuel pressure regulator =>Page 73
	- Fuel return pipe bent or clogged	- Check fuel return pipe

- Press C-key.
- Enter "032" for "display group number 032" and confirm entry with Q-key.

-> Indicated on display

System in basic setting	32
1 2 3 4	

- Check lambda control in display zones 1 to 4:

	Display zones			
	1	2	3	4
Display group 032: Lambda learned values upstream of catalytic converter				
Display	xx.x %	xx.x %	xx.x %	xx.x %
Display	Lambda learned value bank 1 at idle (additive)	Lambda learned value, bank 1, at part load (multiplicative)	Lambda learned value bank 2 at idle (additive)	Lambda learned value bank 2 at part load (multiplicative)
Range	-25.0...25.0 %	-25.0...25.0 %	-25.0...25.0 %	-25.0...25.0 %
Specified value	-10.0...10.0 % can fluctuate slightly	-10.0...10.0 % can fluctuate slightly	-10.0...10.0 % can fluctuate slightly	-10.0...10.0 % can fluctuate slightly
Note	If the specification is not attained =>Page 106			

### Evaluating display group 032

Display zone: 1 / 3 or 2 / 4	Possible causes of fault	Fault remedy
Lambda learned values in range -10.0....-25.0 %  <small>Protected by copyright. Copying for private or non-commercial use, in whole or in part, 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.</small>	- 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 91
	- Solenoid valve for activated charcoal filter stuck open	- Check solenoid valve for activated charcoal filter => Page 126
	- Fuel pressure too high	- Check fuel pressure regulator =>Page 73
	- Fuel return pipe bent or clogged	- Check fuel return pipe
	- Injector not closing	- Check injectors =>Page 76

## Evaluating display group 032

Display zone: 1 / 3 or 2 / 4	Possible causes of fault	Fault remedy
Lambda learned values in range 10.0...25.0 %	- Unmetered air in intake area	- Check intake system for leaks and rectify unmetered air =>Page <b>95</b>
	- Fuel pressure too low	- Check fuel pressure regulator =>Page <b>73</b>
	- Air mass meter defective	- Check air mass meter =>Page <b>91</b>
	- Lambda probe heating defective - Lambda probe defective	- Check lambda probe heating =>Page <b>120</b>
	- Injector only opens partially or not at all	- Check injectors =>Page <b>76</b>
	- Activated charcoal filter system solenoid valve sticking	- Check solenoid valve for activated charcoal filter => Page <b>126</b>
	- Ignition coil/spark plug defective	- Check ignition coils => Page <b>163</b>

## Checking basic voltage

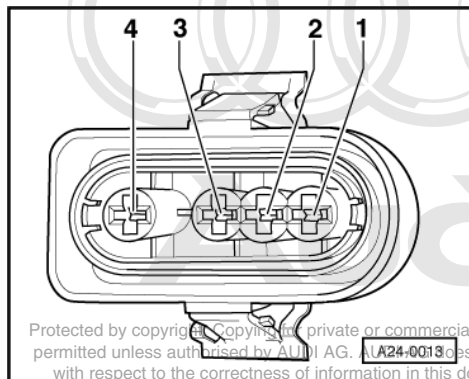
Fitting location of connectors => Fitting location overview Page **45**

### Test requirements:

- Fuse for Lambda probes OK.

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

- Disconnect 4- pin connector to relevant Lambda probe.



- -> 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 lines  
=> Bank 1 Page **108**

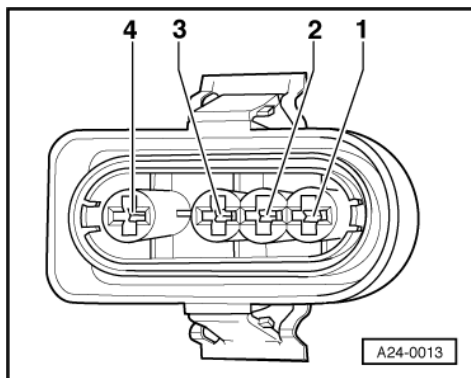
## Checking lambda probe wiring bank 1 lambda probe 1 upstream of catalytic converter -G39

Fitting location of connectors => Fitting location overview Page **45**

- Unplug 4-pin connector for bank 1, lambda probe 1 -G39.



- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; the engine control unit must not be connected => Page 62 .

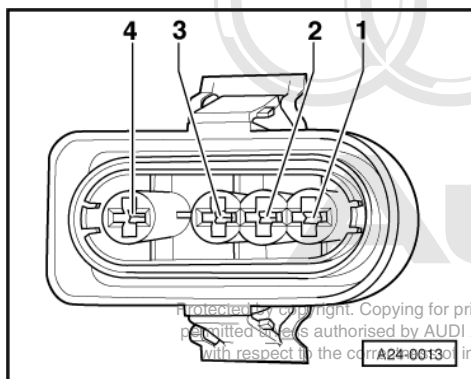


- -> Check for open circuit in the following wiring connections.

Connector Contact	Test box V.A.G 1598/31 Socket
3	51
4	70

- Rectify open circuit, if necessary.
- Check for shorts between the two lines.

Connector Contact	Test box V.A.G 1598/31 Socket
4	51



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- -> Check screen wiring for short to Lambda probe wiring.

Connector Contact	Test box V.A.G 1598/31 Socket
3	32
4	32

If no wiring fault is detected:

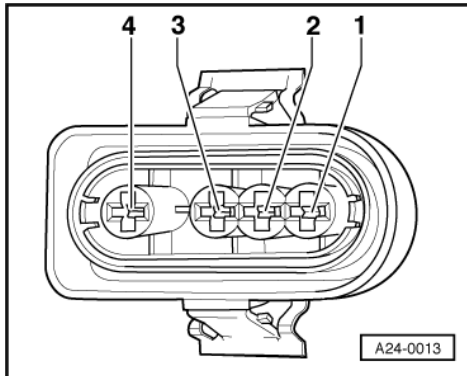
- Replace engine control unit => Page 64 .

**Checking lambda probe wiring bank 2 lambda probe 1 upstream of catalytic converter -G108**

Fitting location of connectors => Fitting location overview Page 45



- Unplug 4-pin connector for bank 2, lambda probe 1 -G108.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; the engine control unit must not be connected => Page 62 .



- -> Check for open circuit in the following wiring connections.

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Connector Contact	Test box V.A.G 1598/31 Socket
3	12
4	13

- Rectify open circuit, if necessary.
- Check for shorts between the two lines.

Connector Contact	Test box V.A.G 1598/31 Socket
4	12

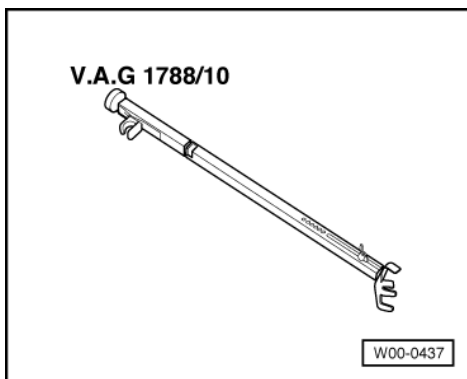
- Check screen wiring for short to lambda probe wiring.

Connector Contact	Test box V.A.G 1598/31 Socket
3	32
4	32

If no wiring fault is detected:

- Replace engine control unit => Page 64 .

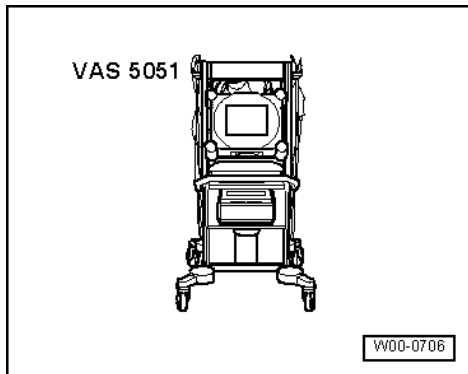
### 3.4 - Check lambda probe ageing of lambda probe upstream of catalytic converter





### Special tools and workshop equipment required

- ♦ -> V.A.G 1788/10 speedometer



- ♦ VAS 5051 with VAS 5051/1

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

### Test requirements:

- Coolant temperature at least 80 °C.

### Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "Address word" 01 => Page **1**  
For this purpose, the engine must be running at idle speed.

-> Indicated on display

Rapid data transfer	HELP
Select function XX	

- Enter "04" to select "Start basic setting" and confirm with Q-key.

-> Indicated on display

Basic setting	Q
Enter display group number XXX	

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- Enter "034" for "display group number 034" and confirm entry with Q-key.

-> Indicated on display

System in basic setting				34
1	2	3	4	

- Set engine speed to 1000...2400 rpm using engine speed controller V.A.G 1788/10.
- Check specification in display zone 4:

### Note:

*This process can take a few minutes.*

	Display zones			
	1	2	3	4
Display group 034: Diagnosis of lambda probe ageing, lambda probe upstream of catalytic converter (bank 1)				

	Display zones			
Display	xxxx rpm	xxx °C	x.x s	---
Display	Engine speed	Exhaust gas temperature	Period Lambda probe upstream of catalytic converter	Diagnosis status
Range				Test OFF Test ON B1-P1 OK B1-P1 NOK
Specified value	1000...2400 rpm	greater than 380 °C	0.1...1.8 s	B1-P1 OK
Note			If specified value is not achieved replace the lambda probe 1 upstream of catalytic converter (bank 1)	

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Calculated value from engine speed and load.

**Note on display zones 3 and 4:**

The period specifies the time between two voltage jumps in the lambda probe (e.g. rich - lean - rich) thereby providing a measurement basis for the ageing status of the lambda probe. If the specified time is exceeded, display zone 4 indicates = B1-P1 NOK.

- Press C-key.

-> Indicated on display

Basic setting	Q
Enter display group number XXX	

- Enter "035" for "display group number 035" and confirm entry with Q-key.

-> Indicated on display

System in basic setting	35
1      2      3      4	

- Check specification in display zone 4:

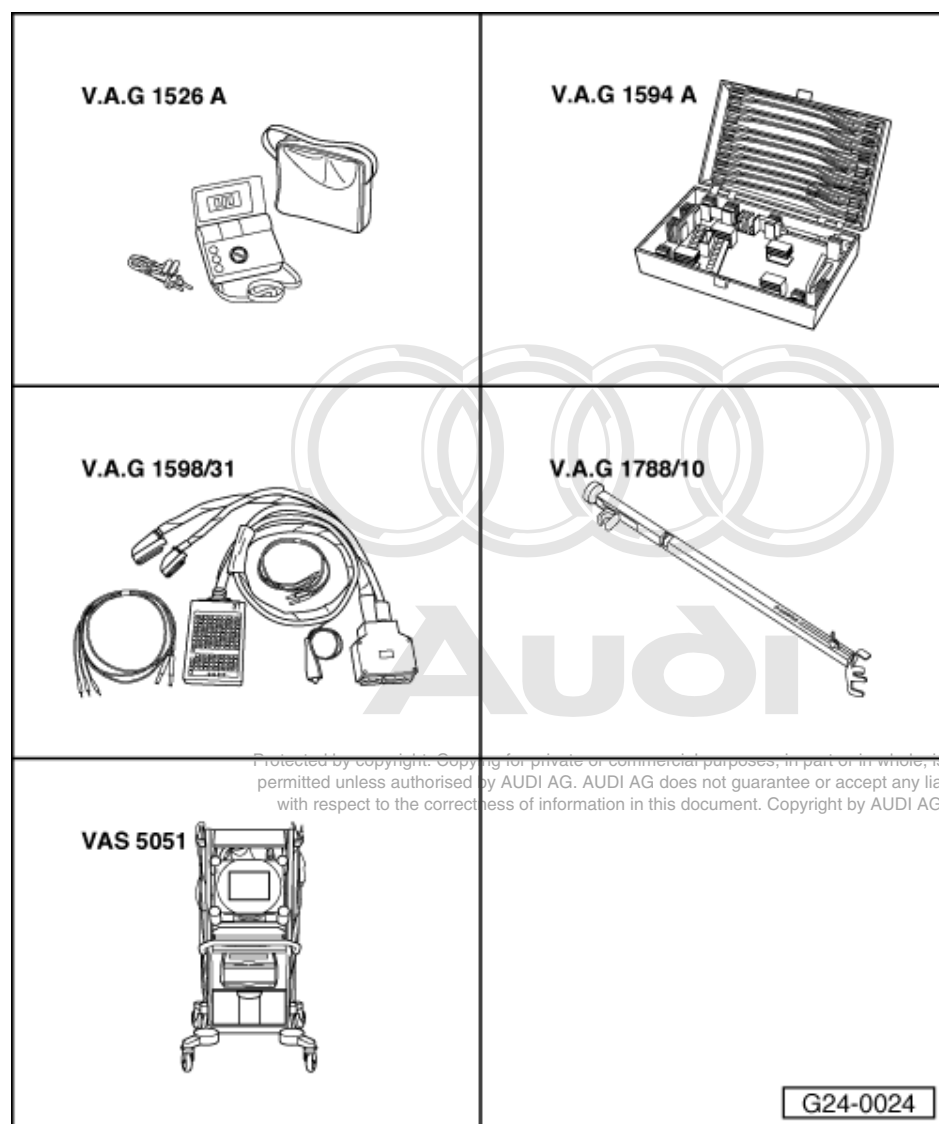
**Note:**

If the test result "OK" is displayed immediately after selecting the display group, the test has already been completed.

	Display zones			
	1	2	3	4
<b>Display group 035: Diagnosis of lambda probe ageing, lambda probe upstream of catalytic converter (bank 2)</b>				
Display	xxxx rpm	xxx °C	x.x s	---
Display	Engine speed	Exhaust gas temperature	Period Lambda probe upstream of catalytic converter	Diagnosis status
Range				Test OFF Test ON B2-P1 OK B2-P1 NOK
Specified value	2200 rpm	greater than 380 °C	0.1...1.8 s	B2-P1 OK
Note			If specified value is not achieved replace the lambda probe 1 upstream of catalytic converter (bank 2)	



### 3.5 - Check lambda probe and lambda control downstream of catalytic converter



#### Special tools and workshop equipment required

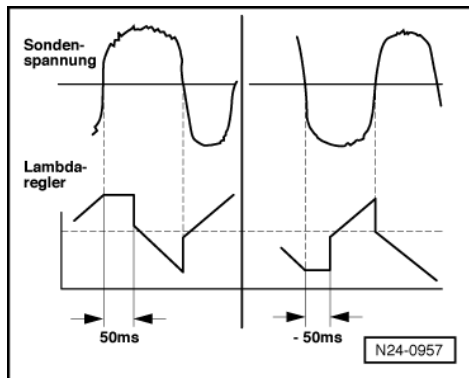
- ♦ V.A.G 1526 A
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/31
- ♦ V.A.G 1788/10
- ♦ VAS 5051 with VAS 5051/1

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

#### Notes:

- ♦ The lambda control downstream of catalytic converter is superior to lambda control upstream of catalytic converter. It is used for correction regulation.



- ♦ -> It corrects slight mixture changes (e.g. enriches) through the lambda probe upstream of catalytic converter, by maintaining the lambda control for a certain period (dwell time) at the upper / lower point. If the time is in the positive range (e.g. 50 ms), the mixture is made richer. If it is in the negative range (e.g. -50 ms), the mixture is made leaner.

#### Test requirements:

- Test drive performed and fault memory not erased.
- Coolant temperature at least 80 °C=> display group 004, display zone 3.

#### Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "Address word" 01 => Page 1  
For this purpose, the engine must be running at idle speed.

-> Indicated on display

Rapid data transfer      HELP  
Select function XX

- Enter "04" to select "Start basic setting" and confirm with Q-key.

#### Note:

*During basic setting, the solenoid valve for the activated charcoal filter (ACF valve -N80) is closed and the air conditioner compressor is switched off.*

-> Indicated on display

Basic setting      Q  
Enter display group number XXX

- Enter "034" for "display group number 034" and confirm entry with Q-key.

-> Indicated on display

System in basic setting      34  
1      2      3      4

- Set engine speed to 2800...3200 rpm using engine speed controller V.A.G 1788/10.
- Perform the test as soon as an exhaust gas temperature above 380 °C is attained in display zone 2.

#### Note:

*This process can take a few minutes.*

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

-> Indicated on display



Basic setting      Q  
Enter display group number XXX

- Enter "030" for "display group number 030" and confirm entry with Q-key.

-> Indicated on display

System in basic setting      30  
1      2      3      4

- Check lambda probe status for lambda probe downstream of catalytic converter in display zones 2 and 4.

#### 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 at idle				
Display	X X X	X X X	X X X	X X X
Display	Lambda probe status, bank 1, probe 1	Lambda probe status bank 1, probe 2	Lambda probe status, bank 2, probe 1	Lambda probe status bank 2, probe 2
Range	0 = off 1 = on	0 = off 1 = on	0 = off 1 = on	0 = off 1 = on
Specified value	1 1 1	1 1 0	1 1 1	1 1 0
Note	If the specification is not attained =>Page 115			

Meaning of 3-digit readout of display group 030			
X	X	X	Display zones 1...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.

- Press C-key.

-> Indicated on display

Basic setting      Q  
Enter display group number XXX

- Enter "043" for "display group number 043" and confirm entry with Q key.

-> Indicated on display

System in basic setting      43  
1      2      3      4

- Check specification in display zone 4:

	Display zones			
	1	2	3	4
Display group 043: Lambda probe ageing, lambda probe downstream of catalytic converter (bank 1)				

	Display zones			
Display	xxxx rpm	xxx °C	x.xxx V	---
Display	Engine speed	Exhaust gas temperature	Voltage, lambda probe downstream of catalytic converter, bank 1	Diagnosis status
Range				Test OFF Test ON B1-P2 OK B1-P2 NOK
Specified value	650...750 rpm	greater than 380 °C	0.100...1.000 V	B1-P2 OK
Note				If the specified value is not achieved, check the lambda probe heating=>Page 120

If specification "B1-P2 OK" is attained:

- Press C-key.
- Enter "044" for "display group number 044" and confirm entry with Q key.

-> Indicated on display

System in basic setting	44
1 2 3 4	

- Check specification in display zone 4:

**Note:**

If the test result "OK" is displayed immediately after selecting the display group, the test has already been completed.

	Display zones			
	1	2	3	4
<b>Display group 044: Lambda probe ageing, lambda probe downstream of catalytic converter (bank 2)</b>				
Display	xxxx rpm	xxx °C	x.xxx V	---
Display	Engine speed	Exhaust gas temperature	Voltage, lambda probe downstream of catalytic converter, bank 2	Diagnosis status
Range	670...6800 rpm	70...850 °C	0.100...1.000 V	Test OFF Test ON B2-P2 OK B2-P2 NOK
Specified value	650...750 rpm	Greater than 380 °C	0.100...1.000 V	B2-P2 OK
Note				If the specified value is not achieved, check the lambda probe heating =>Page 120

If specification "B2-P2 OK" is attained:

- Press C-key.

#### Checking lambda control downstream of catalytic converter

- Carry out a road test lasting at least 10 minutes.

**Important**  
To avoid danger of accident when performing measurement and test drives, observe safety precautions =>



- Leave engine idling.

-> Indicated on display

Basic setting            Q  
Enter display group number XXX

- Enter "037" for "display group number 037" and confirm entry with Q-key.

-> Indicated on display

System in basic setting    37  
1            2            3            4

- Check lambda probe voltage in display zone 2.
- Check dwell time between lambda probe 1 upstream of catalytic converter and lambda probe 2 downstream of catalytic converter in display zone 3 and diagnosis result in display zone 4.

	Display zones			
	1	2	3	4
<b>Display group 037: Diagnosis, lambda control system (bank 1)</b>				
<b>Display</b>	xxx %	x.xxx V	xxx ms	---
<b>Display</b>	Engine load	Voltage of lambda probe downstream of catalytic converter, bank 1	Lambda correction value between lambda probe 1 and lambda probe 2, bank 1	Diagnosis status
<b>Range</b>				Test OFF Test ON Syst. OK Syst. NOK
<b>Specified value</b>	12.0...26.0 %	0.100...1.000 V	-800...800 ms	Syst. OK
<b>Note</b>		If specified value is not attained: Evaluation, display zone 2 =>Page 117 .	If the specification is not attained =>Page 117	If "Syst. NOK" is displayed: Interrogate fault memory => Page 117

#### Note on display zone 3:

The lambda control downstream of catalytic converter is superior to lambda control upstream of catalytic converter. It corrects slight rich / lean mixture changes in the lambda probe upstream of catalytic converter, by maintaining the lambda control upstream of catalytic converter at the upper / lower point for a certain period of time (dwell time). If the time is in the positive range (e.g. 50 ms), the mixture is made richer. If it is in the negative range (e.g. -50 ms), the mixture is made leaner.

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- Press C-key.
- Enter "038" for "display group number 038" and confirm entry with Q-key.

-> Indicated on display

System in basic setting    38  
1            2            3            4

- Check specification in display zone 4:

#### Note:

If the test result "OK" is displayed immediately after selecting the display group, the test has already been completed.

	Display zones			
	1	2	3	4
<b>Display group 038: Lambda control system diagnosis (bank 2)</b>				



	Display zones			
Display	xxx %	x.xxx V	xxx ms	---
Display	Engine load	Voltage of lambda probe downstream of catalytic converter, bank 2	Lambda correction value between lambda probe 1 and lambda probe 2, bank 2	Diagnosis status
Range				Test OFF Test ON Syst. OK Syst. NOK
Specified value	12.0...26.0 %	0.100...1.000 V	-800...800 ms	Syst. OK
Note:		If specified value is not attained: Evaluation, display zone 2 =>Page 117	If the specification is not attained =>Page 117	If "Syst. NOK" is displayed: Interrogate fault memory => Page 117

**Note on display zone 3:**

The lambda control downstream of catalytic converter is superior to lambda control upstream of catalytic converter. It corrects slight rich / lean mixture changes in the lambda probe upstream of catalytic converter, by maintaining the lambda control upstream of catalytic converter at the upper / lower point for a certain period of time (dwell time). If the time is in the positive range (e.g. 50 ms), the mixture is made richer. If it is in the negative range (e.g. -50 ms), the mixture is made leaner.

**Evaluation of display groups 037 and 038**

Display zone: 2	Possible causes of fault	Fault remedy
Constant approx. 0.450 V	- Open circuit in line 4 between lambda probe and control unit - Open circuit in line 3 between lambda probe and control unit	- Check basic voltage => Page 117  - Check lambda probe wiring downstream of catalytic converter =>Page 118
Greater than 1.000 V	- Short to positive in line 4 between lambda probe and control unit	
Less than 0.100 V	- Short to earth in line 4 between lambda probe and control unit	

**If specification in display groups 037 and 038, display zones 3 or 4 is not attained:**

- Check for air leak at exhaust or catalytic converter (check screw clamps and exhaust for damage).
- If values of display zones 3 differ greatly (e.g. +500 ms, -500 ms) (lambda correction value) in measured value blocks 037 and 038, the lambda probes downstream of catalytic converter of cylinder bank 1 and 2 could be interchanged.

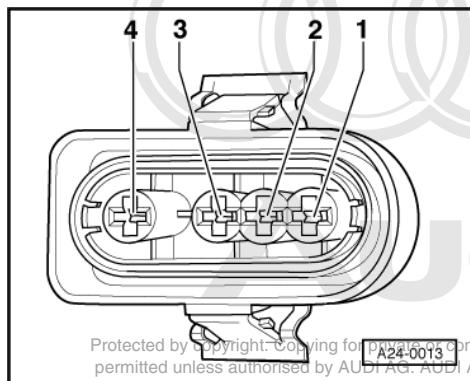
If none of the given causes apply:

- Replace respective lambda probe "upstream of" catalytic converter.

**Checking basic voltage**

Fitting location of connectors=> Fitting location overview Page 45

- Disconnect 4- pin connector to relevant Lambda probe.



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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 lines
  - => Bank 1 Page 119

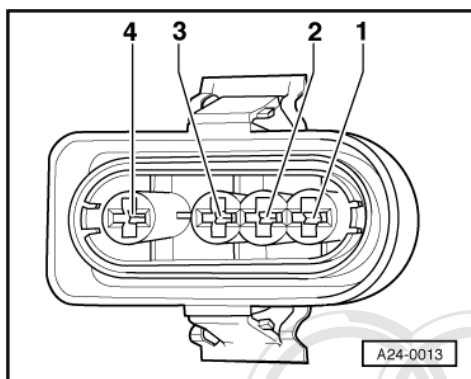
If specified value is attained:

- Replace appropriate lambda probe downstream of catalytic converter.

### Checking lambda probe wiring

Fitting location of connectors => Fitting location overview Page 45

- Unplug 4-pin connector for bank 1, lambda probe 2 downstream of catalytic converter -G130.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 62 .

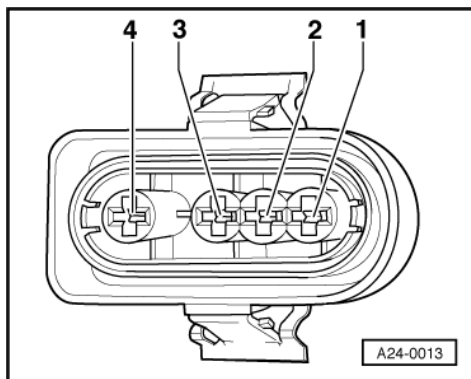


- -> Check for open circuit in the following wiring connections.

Connector Contact	Test box V.A.G 1598/31 Socket
3	68
4	69

- Rectify open circuit, if necessary.
- Check for shorts between the two lines.

Connector Contact	Test box V.A.G 1598/31 Socket
4	68



- -> Test screen wiring for short to Lambda probe wiring.

Connector Contact	Test box V.A.G 1598/31 Socket
3	32
4	32

If no wiring fault is detected:

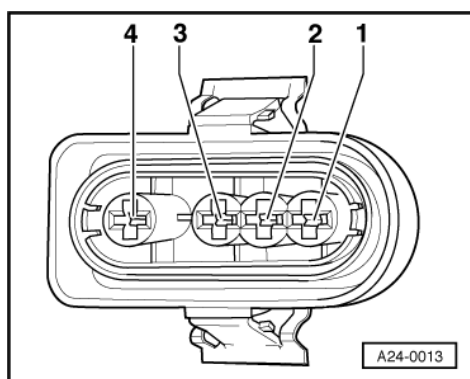
- Replace engine control unit => Page 64 .

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### Checking lambda probe wiring, bank 2 lambda probe 2-G131 downstream of catalytic converter

Fitting location of connectors => Fitting location overview Page 45

- Unplug 4-pin connector for bank 2 to lambda probe 2 downstream of catalytic converter -G131.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 62 .

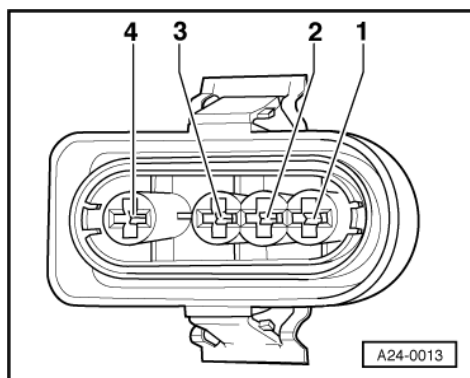


- -> Check for open circuit in the following wiring connections.

Connector Contact	Test box V.A.G 1598/31 Socket
3	10
4	11

- Rectify open circuit, if necessary.
- Check for shorts between the two lines.

Connector Contact	Test box V.A.G 1598/31 Socket
4	10





- -> Check screen wiring for short to Lambda probe wiring.




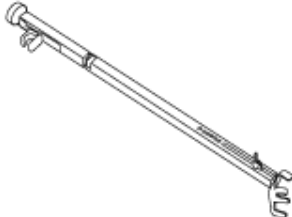
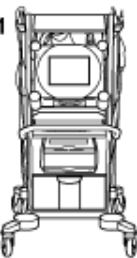
Connector Contact	Test box V.A.G 1598/31 Socket
3	32
4	32

If no wiring fault is detected:

- Replace engine control unit => Page 64 .

### 3.6 - Lambda probe heater for lambda probes upstream or downstream of catalytic converter

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<b>V.A.G 1526 A</b> 	<b>V.A.G 1594 A</b> 
<b>V.A.G 1598/31</b> 	<b>V.A.G 1788/10</b> 
<b>VAS 5051</b> 	<div>G24-0024</div>

#### Special tools and workshop equipment required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/31
- ♦ V.A.G 1788/10

- ◆ VAS 5051 with VAS 5051/1
- or
- ◆ V.A.G 1551 with V.A.G 1551/3 A

**Note:**

*The lambda probe heating circuit is monitored by the self-diagnosis system.*

*Interrogate fault memory=> Page 4 .*

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "Address word" 01=> Page 1
- For this purpose, the engine must be running at idle speed.

-> Indicated on display

Rapid data transfer
HELP

Select function XX

- Enter "08" to select the function "Reading measured value block" and confirm entry with Q-key.

-> Indicated on display

Reading measured value block
Q

Enter display group number XXX

- Enter "041" for "display group number 041" and confirm entry with Q-key.

-> Indicated on display

Read measured value block 41

1234

- Check specifications in display zones 1 and 3:

**Note:**

*By increasing the engine speed the achieving of the specified values can be accelerated.*

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	<b>Display zones</b>			
	1	2	3	4
<b>Display group 041: Lambda probe heating (bank 1) at idling speed</b>				
<b>Display</b>	xxx kOhm	---	xxx kOhm	---
<b>Display</b>	Bank 1, probe 1	Status of heating	Bank 1, probe 2	Status of heating
<b>Range</b>		Htg. u.c.c. ON Htg. u.c.c. OFF		Htg. d.c.c. ON Htg. d.c.c. OFF
<b>Specified value</b>	0...0.9 kOhm	Htg.u.c.c. ON/OFF	0...0.9 kOhm	Htg.d.c.c. ON/OFF

**Important notes on display zones 1, 2, 3 and 4:**

- ◆ If the lambda probes have not reached their operating temperature there is no display in display zones 1 and 3, i.e. both zones are empty. (Increase engine speed to achieve specified values.)
  - ◆ After reaching the operating temperature of both lambda probes a resistance of lower than 0.9 kOhm must be shown in display zones 1 and 3.
  - ◆ Only carry on with test when a resistance value lower than 0.9 kOhm is shown in display zones 1 and 3.
  - ◆ In certain operating points, the engine control unit "cycles" for the lambda probe heating. This means that at these points the lambda probe heating is continuously switched on and off. It is also possible that "Htg. u.c.c. OFF" or "Htg. d.c.c. OFF" is displayed as specified value in display zones 2 and 4.
- Press C-key.

-> Indicated on display



Reading measured value block Q  
Enter display group number XXX

- Enter "042" for "display group number 042" and confirm entry with Q-key.

-> Indicated on display

Read measured value block 42  
1 2 3 4

- Check specifications in display zones 1 and 3:

	Display zones			
	1	2	3	4
<b>Display group 042: Lambda probe heating (bank 2) at idling speed</b>				
<b>Display</b>	xxx kOhm	---	xxx kOhm	---
<b>Display</b>	Bank 2, probe 1	Status of heating	Bank 2, probe 2	Status of heating
<b>Range</b>		Htg. u.c.c. ON Htg. u.c.c. OFF		Htg. d.c.c. ON Htg. d.c.c. OFF
<b>Specified value</b>	0...0.9 kOhm	Htg. u.c.c. ON/OFF	0...0.9 kOhm	Htg. d.c.c. ON/OFF

#### Important notes on display zones 1, 2, 3 and 4:

- ♦ If the lambda probes have not reached their operating temperature there is no display in display zones 1 and 3, i.e. both zones are empty. (Increase engine speed to achieve specified values.)
- ♦ After reaching the operating temperature of both lambda probes a resistance of lower than 0.9 kOhm must be shown in display zones 1 and 3.
- ♦ Only carry on with test when a resistance value lower than 0.9 kOhm is shown in display zones 1 and 3.
- ♦ In certain operating points, the engine control unit "cycles" for the lambda probe heating. This means that at these points the lambda probe heating is continuously switched on and off. It is also possible that "Htg. u.c.c. OFF" or "Htg. d.c.c. OFF" is displayed as specified value in display zones 2 and 4.

If specified value is not attained:

- Check the voltage supply to the lambda probe heating => Page 122 .
- Check lambda probe signal line and actuation => Page 119 .

#### Checking voltage supply for lambda probe heating

Fitting location of connectors=> Fitting location overview Page 45

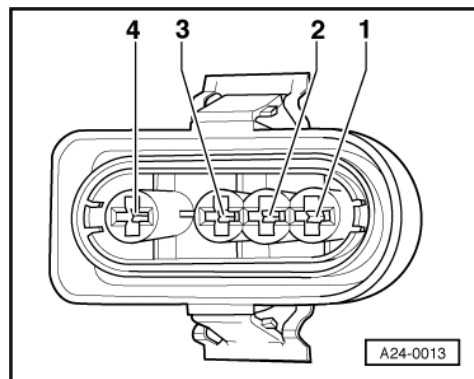
#### Test requirements:

- Fuse for lambda probe heating OK.

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

- Fuel pump relay OK; checking =>Page 85 .
- Disconnect 4- pin connector to relevant Lambda probe.

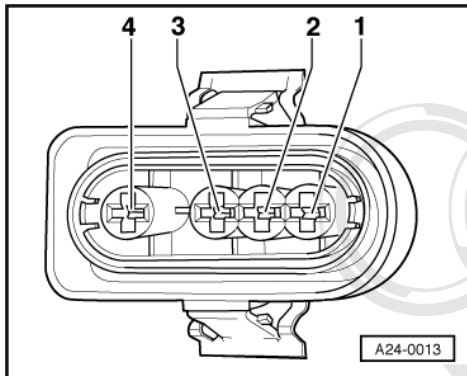


- -> Connect multimeter between contacts 1 and 2 to measure voltage.
- Start the engine.
  - Specified value: approx. battery voltage, may fluctuate

**Notes:**

- ♦ 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.
- ♦ Points at which Lambda probe heating is switched on and off by engine control unit can be observed in "Reading measured value block" function, display group number 041 and 042.

If no voltage is present:



- -> Connect multimeter as follows to measure voltage:

Connector Contact	Measure to
1 (positive)	Vehicle earth

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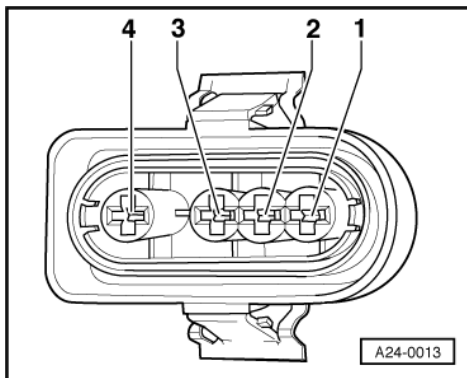
- Operate starter briefly.
  - Specified value: approx. battery voltage

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:

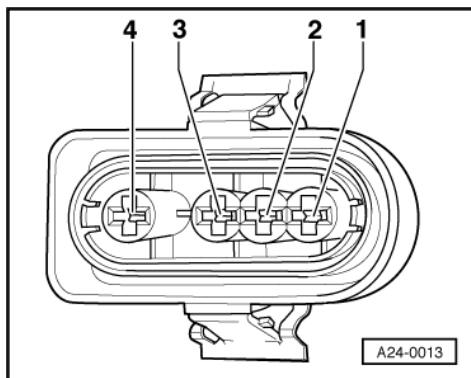


Connector Contact	Measure to
2 (earth actuation by engine control unit)	Battery positive

- 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; do not connect the engine control unit => Page 62 .



- -> Check for open circuit in the following wiring connections:

- Lambda probe heating -Z19 bank 1 upstream of Cat:

Connector Contact	Test box V.A.G 1598/31 Socket
2	5

- Lambda probe heating -Z28 bank 2 upstream of Cat:

Connector Contact	Test box V.A.G 1598/31 Socket
2	4

- Lambda probe heating -Z29 bank 1 downstream of Cat:

Connector Contact	Test box V.A.G 1598/31 Socket
2	63

- Lambda probe heating -Z30 bank 2 downstream of Cat:

Connector Contact	Test box V.A.G 1598/31 Socket
2	6

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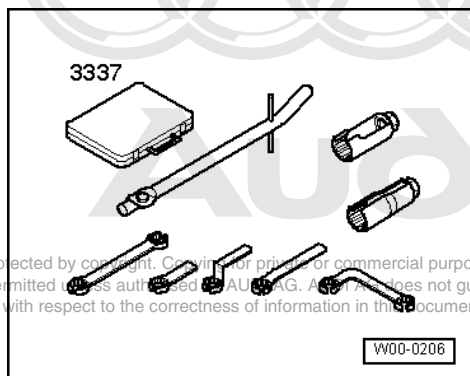
If no wiring fault is detected:

- Replace appropriate lambda probe.
- Read out readiness code =>Page 30 .



### 3.7 - Removing and installing lambda probe

#### Special tools, workshop equipment and other items required



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- ◆ Ring spanner set 3337
- ◆ High-temperature lubricant G 052 112 A3

#### Removing

Fitting location of connectors=> Fitting location overview Page 45

- Disconnect 4- pin connector to relevant Lambda probe.
- Undo cable ties.
- Screw out lambda probe using special tool 3337.

#### Installing

When installing, note the following points:


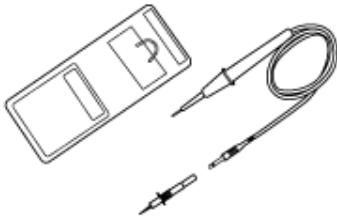
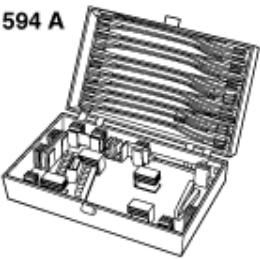

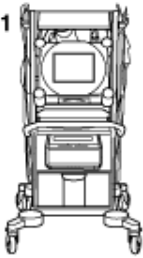
#### Notes:

- ◆ The screw thread on the lambda probe is coated with assembly paste. This lubricant must not be allowed to penetrate the openings on the probe.
- ◆ When installing, the cable ties must be re fitted at exactly the same points in order to prevent contact between the Lambda probe wire and the exhaust pipe.
- ◆ Tightening torque 55 Nm.



## 4 - Checking fuel tank breather

### 4.1 - Checking fuel tank breather

<b>V.A.G 1526 A</b> 	<b>V.A.G 1527 B</b> 
<b>V.A.G 1594 A</b> 	<b>V.A.G 1598/31</b> 
<b>VAS 5051</b> 	<p>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.</p> <p><b>G24-0023</b></p>

### 4.2 - Checking ACF system solenoid valve 1 -N80

#### Special tools and workshop equipment required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1527 B
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/31
- ♦ VAS 5051 with VAS 5051/1

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

**Note:**

The activated charcoal filter system solenoid valve 1 is also referred to in this context as fuel tank breather valve of ACF valve.

**Testing for leaks**

When there is no electrical supply, solenoid valve remains closed.

- Disconnect hoses from ACF valve but leave the electrical connector plugged in.
- Connect auxiliary hose to one connection of ACF valve.
- Initiate final control diagnosis and actuate ACF solenoid valve -N80 =>Page 21 .

-> Indicated on display

Final control diagnosis  
Solenoid valve 1 for activated charcoal  
filter -N80

- ◆ The valve should click...
- ◆ ...and should open and close (check by blowing into the auxiliary hose).

If the injector does not click:

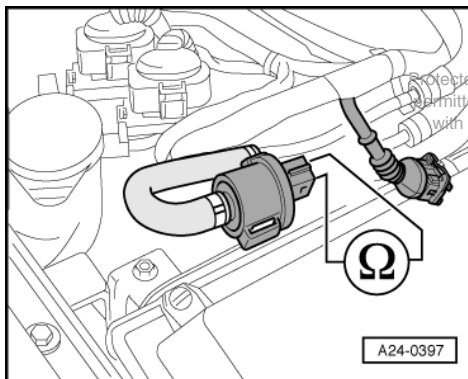
- Checking internal resistance to ACF valve.

If valve does not open and close properly:

- Replace solenoid valve for activated charcoal filter -N80.

**Checking internal resistance**

- Unplug connector on ACF valve.



- -> Connect multimeter to injector 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 127 .

**Checking power supply**

**Test requirements:**

- Fuse for ACF valve OK.



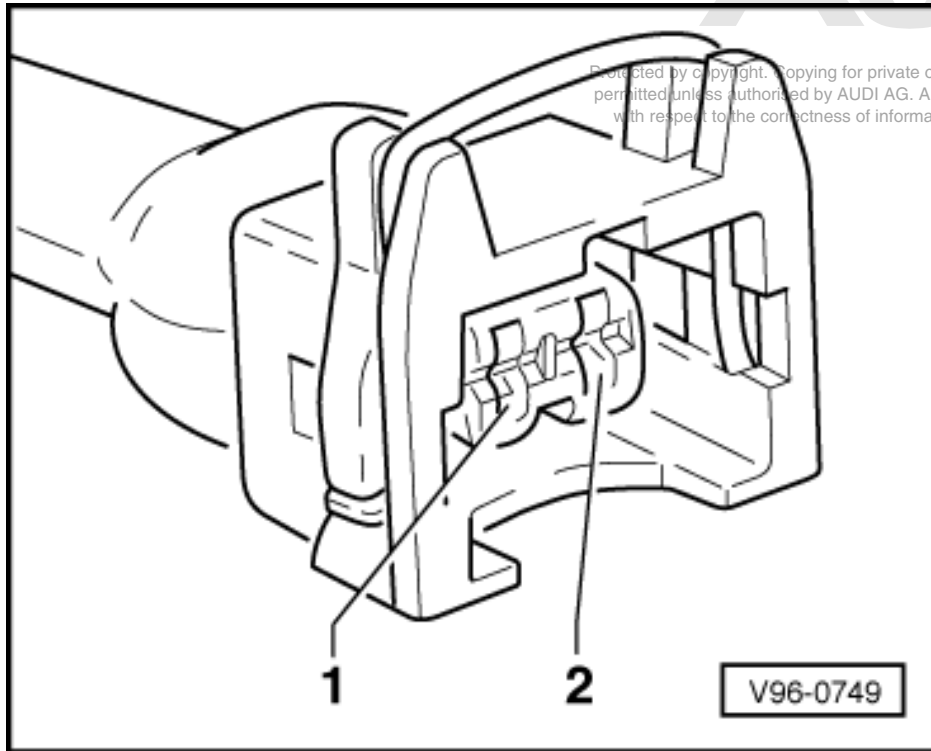
=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

- Fuel pump relay OK; checking =>Page 85 .

**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:

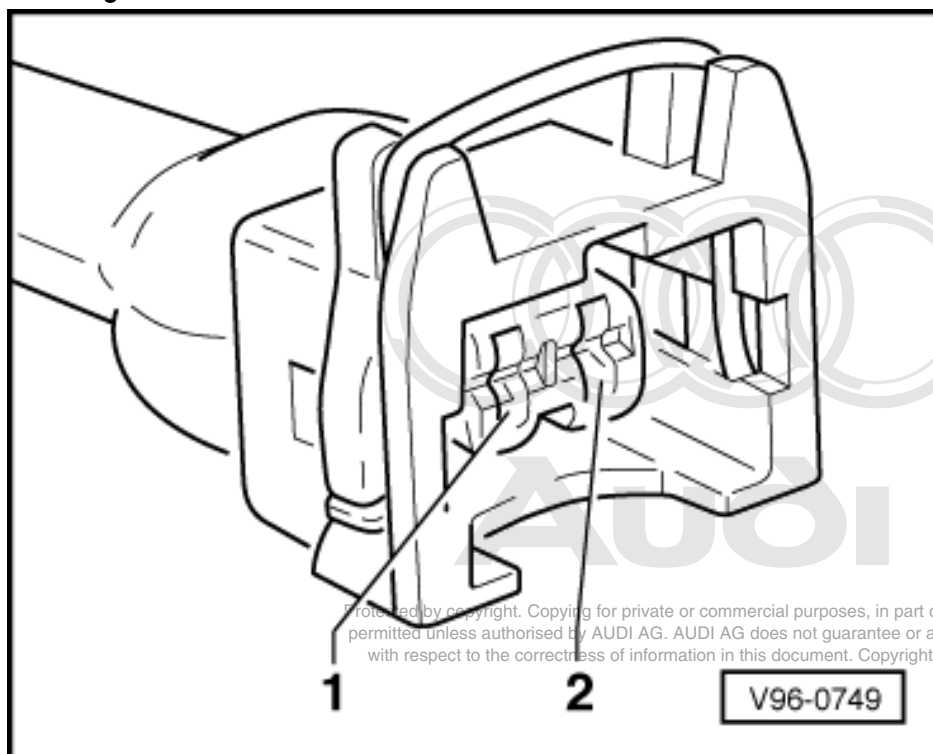
=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

- Rectify open circuit, if necessary.

If the LED illuminates:

- Check actuation.

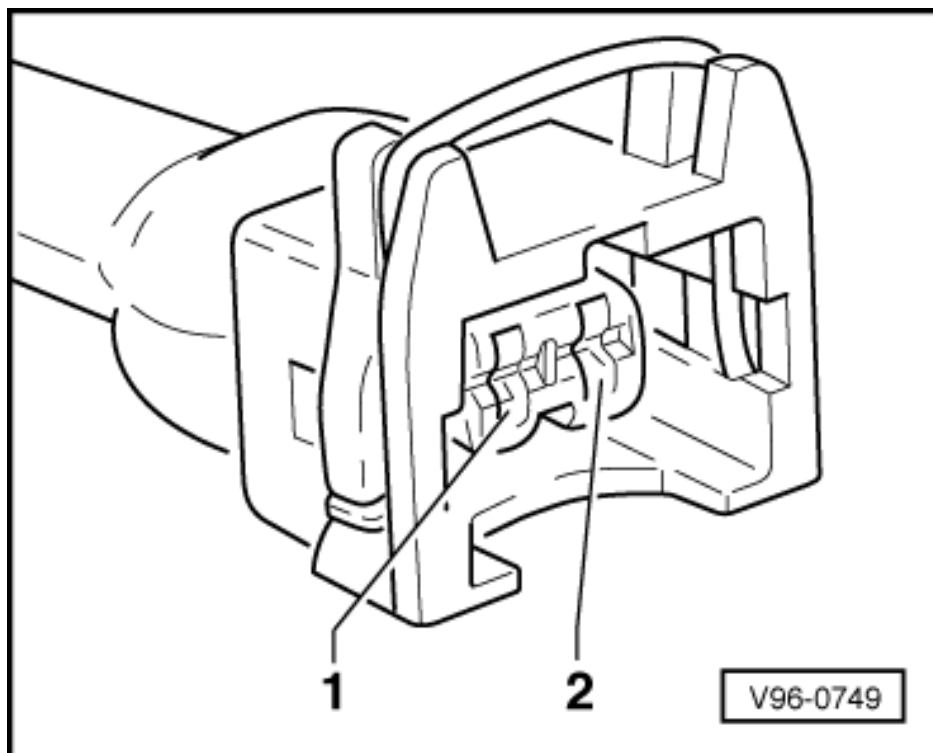
## Checking actuation



- -> Connect voltage tester V.A.G 1527 B to contacts 1 (positive) and 2 of the connector.
- Initiate final control diagnosis and actuate ACF solenoid valve -N80 =>Page 21 .
  - 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; do not connect the engine control unit => Page 62 .





- -> 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 => Page 64 .

## 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.

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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.

With the ignition switched on and the engine not running, the engine control unit controls the throttle valve precisely in accordance with the signals from the accelerator position senders. This means that when the accelerator is pressed half way down, the throttle valve actuator opens the throttle valve to an equivalent extent; the throttle valve is then about half open.

When the engine is running (and under load), the engine control unit can open and close the throttle valve independently of the accelerator position senders.

As an example, the throttle valve can be fully open even though the accelerator pedal is only pressed half way down. This has the advantage of preventing throttle losses at the throttle valve.

Under certain engine load conditions, markedly improved emission and consumption figures are also attained.

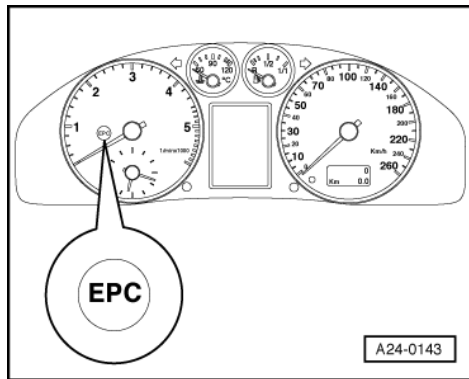
The electronic throttle does not simply consist of one or two components but is, rather, a system which includes all the components which contribute to determining the position of the throttle valve. Electronic throttle is better described as a system, which contains all components necessary to determine the throttle valve position and for controlling and monitoring this position. These components include, for example, the throttle valve control part, the EPC warning lamp, the engine control unit...

### 5.3 - Fault lamp for electronic throttle in dash panel insert

**Note:**

*The electronic throttle control fault lamp -K132 is also known as the EPC warning lamp.*

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



-> Fitting location of the EPC warning lamp

When the ignition is switched on, the engine control unit checks all the components of importance to the electronic throttle system.

After switching on the ignition the engine control unit switches on the EPC warning lamp. The EPC lamp goes out shortly after starting the engine, if, on the one hand, the engine control unit does not detect any faults in the EPC system, and, on the other, if actuation of the lamp by the engine control unit is OK.

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. (These faults are listed in the fault table). At the same time, an entry is made in the engine control unit fault memory.

### 5.4 - Checking electronic throttle control fault lamp -K132

#### Functional check on warning lamp

- Switch the ignition on.
  - The engine control unit switches on the EPC lamp.
- Start the engine.
  - Shortly after starting the engine the exhaust warning lamp goes out if no fault in relation of the electronic throttle is stored in the fault memory.

**Note:**

*The switch-on signal for the fault lamp is transferred via CAN bus to the dash panel insert by the engine control unit. Check the data exchange between engine control unit and other CAN-control units =>Page 152.*

### 5.5 - Checking throttle valve control part -J338

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 the engine control unit. 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 made as part of basic setting (function 04) using the vehicle diagnosis, testing and information system VAS 5051 or the fault reader V.A.G 1551.

## 5.6 - 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.

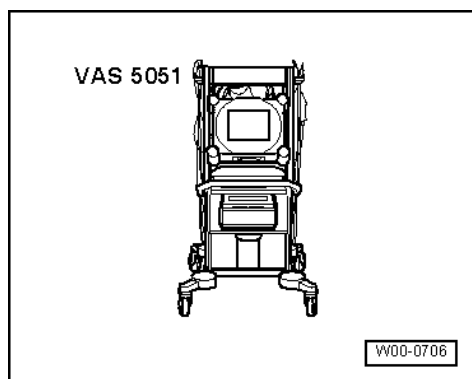
The learning process (adaption process) is performed:

- ♦ 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

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

**Preconditions:**

- ♦ No faults recorded in fault memory; interrogate fault memory => Page 4
- ♦ 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 175

#### Procedure

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "Address word" 01 => Page 1  
For this purpose, the ignition must be switched on.

-> Indicated on display

Rapid data transfer      HELP  
Select function XX

- Enter "04" to select "Start basic setting" and confirm with Q-key.

-> Indicated on display

Basic setting      Q  
Enter display group number XXX

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- Enter "060" for "display group number 060" and confirm entry with 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.

-> Indicated on display

System in basic setting      60  
1      2      3      4

- Check specified values for throttle valve control part in display fields 3 and 4.

	Display zones			
	1	2	3	4
<b>Display group 060: Adaption of throttle valve control part</b>				
<b>Display</b>	xx %	xx %	x	---
<b>Display</b>	Throttle valve angle (angle sender 1)	Throttle valve angle (angle sender 2)	Adaption stage counter	Adaption status
<b>Range</b>			0...8	ADP running ADP OK ERROR
<b>Specified value</b>	3...93 %	97...3 %	8	ADP OK
<b>Note</b>			After adaption the adaption stage counter reaches figure 8. (Figures may be skipped)	If "ERROR" is displayed: Interrogate fault memory =>Page 134



**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.*

**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.
- ♦ 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.*

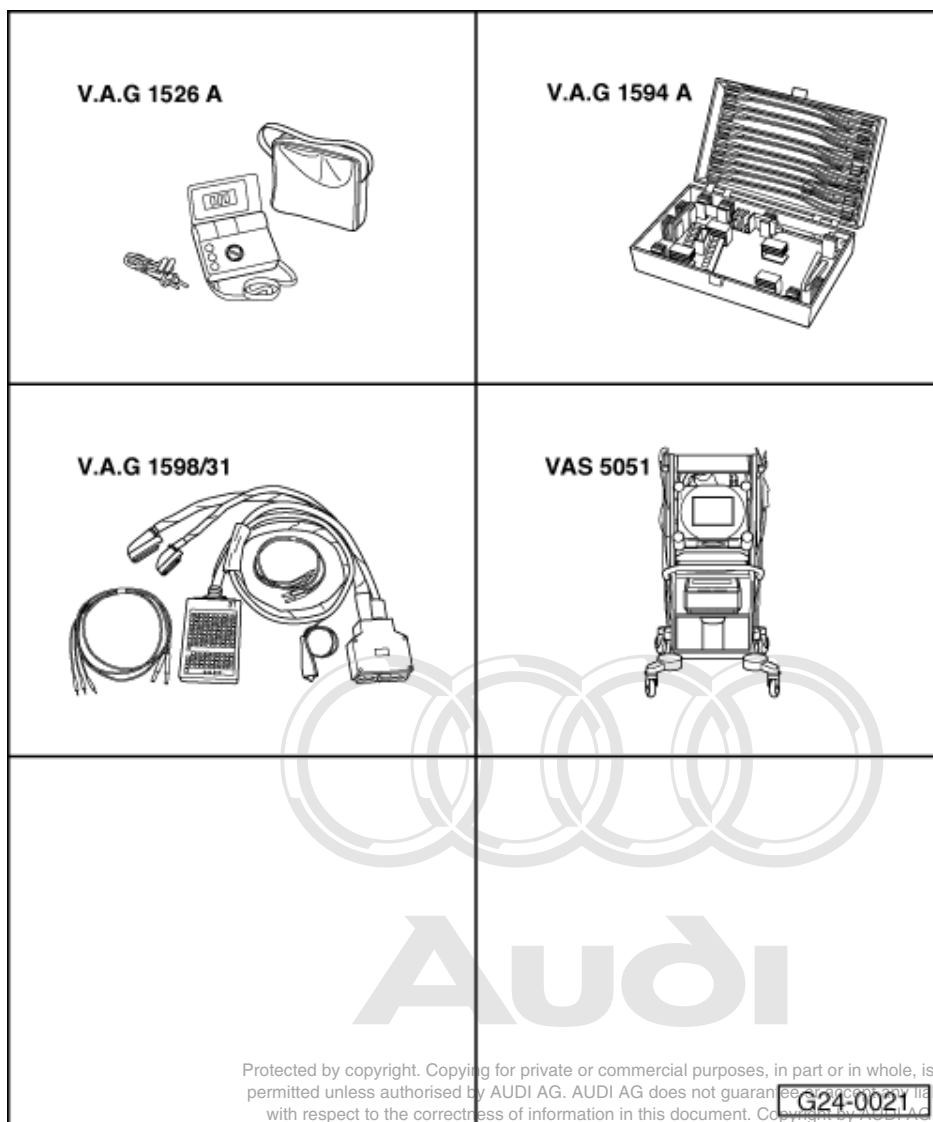
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- End the engine basic setting by pressing the **→**-key.

-> Display function selection

Rapid data transfer	HELP
Select function XX	

## 5.7 - 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

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

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 or fault reader V.A.G 1551 and select engine electronics control unit with "Address word" 01 => Page **1**  
For this purpose, the ignition must be switched on.

-> Indicated on display



Rapid data transfer      HELP  
Select function XX

- Enter "08" to select the function "Reading measured value block" and confirm entry with Q-key.

-> Indicated on display

Reading measured value block      Q  
Enter display group number XXX

- Enter "062" for "display group number 062" and confirm entry with Q-key.

-> Indicated on display:

Read measured value block 62  
1      2      3      4

- Check specified values for electronic throttle potentiometer voltages in display fields 1 and 2.

	Display zones			
	1	2	3	4
<b>Display group 062: Electronic throttle potentiometer voltages</b>				
Display	xx %	xx %	xx %	xx %
Display	Throttle valve angle (angle sender 1)	Throttle valve angle (angle sender 2)	Sender for accelerator pedal po- sition	Sender 2 for accelerator pedal po- sition
Specified value	3...93 % (Idling speed value: 8...18 %)	97...3 % (Idling speed value: 80...90 %)	8...97 %	3...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 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 towards 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).

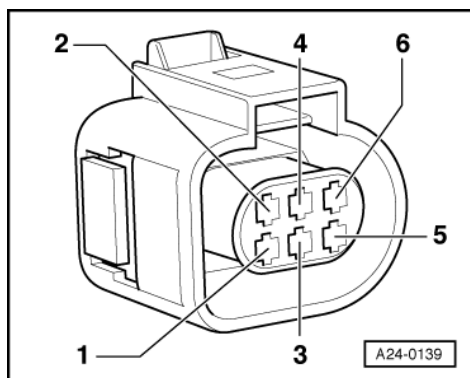
If the displays are not as described:

- Check throttle valve control part voltage supply and wiring =>Page 136 . Pay particular attention to connectors, which may be detached or corroded.
- Check the accelerator position senders =>Page 138 .

#### Checking the voltage supply to the throttle valve control part

- Unplug the connector from the throttle valve control part.

- Switch the ignition on.



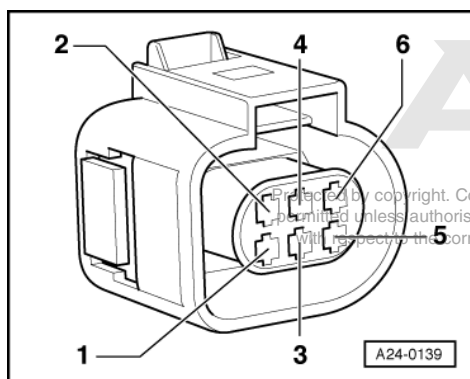
- -> Connect multimeter as follows to measure voltage:

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 137 .

#### 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; do not connect the engine control unit => Page 62 .
- 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


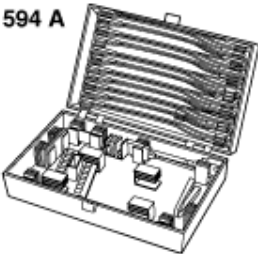

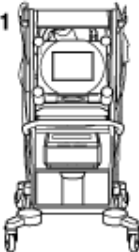
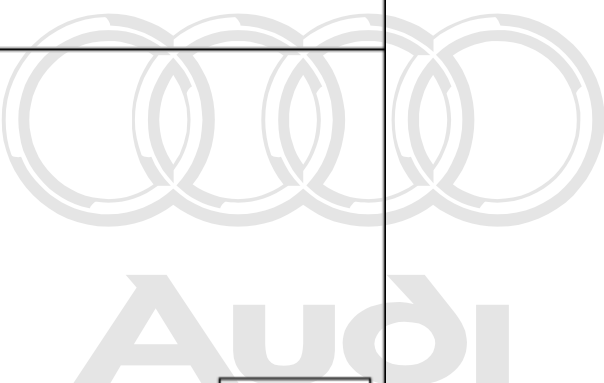
- Rectify any open/short circuit as necessary.

If no wiring fault is detected:



- Replace throttle valve control part.

## 5.8 - Checking accelerator position sender

<b>V.A.G 1526 A</b> 	<b>V.A.G 1594 A</b> 
<b>V.A.G 1598/31</b> 	<b>VAS 5051</b> 
	 <b>G24-0021</b>

### 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

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

Both accelerator pedal position sensors -G79 and -G185 are located on the accelerator pedal and completely independently signal the driver's requirements to the engine control unit. Both senders are located in one housing.

### Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "Address word" 01 => Page **1**

For this purpose, the ignition must be switched on.

-> Indicated on display

Rapid data transfer	HELP
Select function XX	

- Enter "08" to select the function "Reading measured value block" and confirm entry with Q-key.

-> Indicated on display

Reading measured value block	Q
Enter display group number XXX	

- Enter "062" for "display group number 062" and confirm entry with Q-key.

-> Indicated on display:

Read measured value block 62			
1	2	3	4

- Check specified values for electronic throttle potentiometer voltages in display fields 3 and 4.

	Display zones			
	1	2	3	4
<b>Display group 062: Electronic throttle potentiometer voltages</b>				
<b>Display</b>	xx %	xx %	xx %	xx %
<b>Display</b>	Throttle valve angle (angle sender 1)	Throttle valve angle (angle sender 2)	Sender for accelerator pedal posi- tion	Sender 2 for accelerator pedal posi- tion
<b>Specified value</b>	3...93 %	97...3 %	8...97 % (Idling speed value: 8...18 %)	3...49 % (Idling speed value: 3...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 3 and 4.

**Slowly depress accelerator pedal.**

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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.*

If the displays are not as described:

- Check voltage supply and wiring for accelerator position sensor => Page **139**.

**Checking voltage supply for accelerator position senders**

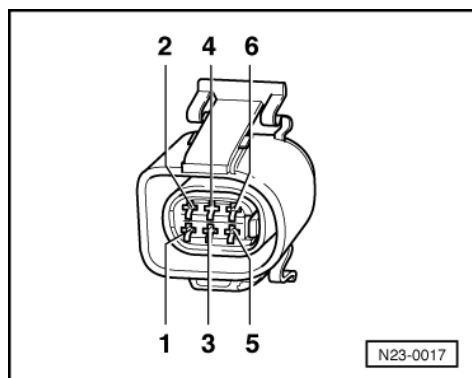
- Remove driver's storage compartment.

=> General Body Assembly, Interior; Repair group 68; Storage compartments/covers; Removing and installing driver's storage compartment Storage compartments/covers Removing and installing driver's storage compartment

- Detach connector for accelerator position senders.



- Switch the ignition on.



- -> Connect multimeter as follows to measure voltage:

Connector Contact	Specified value
2 + earth	Approx. 5 V
2 + 3	Approx. 5 V
5 + earth	Approx. 5 V
4 + 5	Approx. 5 V

If specifications are attained:

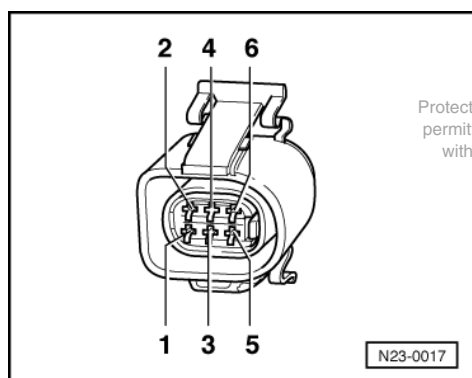
- Additionally check signal wires.

If the specified values are not obtained:

- Check wiring between engine control unit and accelerator position senders.

#### Checking wiring

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 62 .



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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
1	35
2	73
3	36
4	33
5	72



Connector Contact	Test box V.A.G 1598/31 Socket
6	34

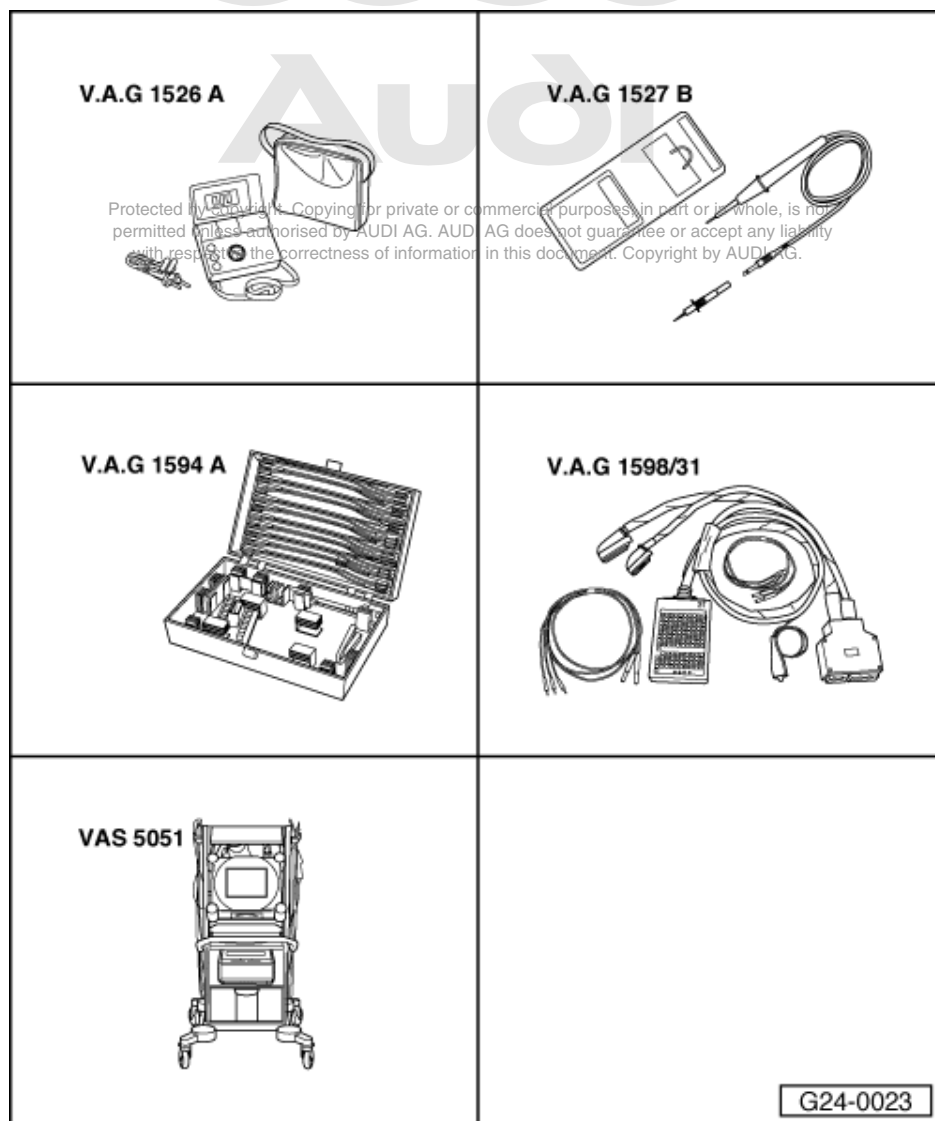
- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

- Replace accelerator position senders.

=> Fuel Supply - Petrol Engines; Repair group 20; Servicing throttle mechanism; Vehicles with electronic throttle mechanism Servicing throttle mechanism Vehicles with electronic throttle mechanism

## 5.9 - Checking brake light switch and brake pedal switch



### Special tools and workshop equipment required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1527 B
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/31



- ♦ VAS 5051 with VAS 5051/1
- or
- ♦ V.A.G 1551 with V.A.G 1551/3 A

**Note:**

Command from accelerator pedal sender (potentiometer) to engine control unit for opening throttle valve is suppressed for safety reasons when brake is pressed. For this purpose, the control unit requires signals from both the brake light switch and the brake pedal switch.

If the brakes are actuated when the accelerator pedal is held at a constant position, the engine speed is immediately reduced to idling speed. *Incorrectly adjusted switches may lead to unwanted regulating actions.*

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**Test sequence**

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "Address word" 01 => Page 1
- For this purpose, the ignition must be switched on.

-> Indicated on display

```
Rapid data transfer      HELP
Select function XX
```

- Enter "08" to select the function "Reading measured value block" and confirm entry with Q-key.

-> Indicated on display

```
Reading measured value block    Q
Enter display group number XXX
```

- Enter "066" for "display group number 066" and confirm entry with Q-key.

-> Indicated on display:

```
Read measured value block 66
1      2      3      4
```

- Check brake light/brake pedal switch in display zone 2.

	Display zones			
	1	2	3	4
<b>Display group 066: Signals to engine control unit</b>				
<b>Display</b>	xxx km/h	XXXX	xxx km/h	XXXX
<b>Display</b>	ACTUAL speed	Switch settings	SPECIFIED speed	Switch settings
<b>Range</b>		XX00 XX11		
<b>Specified value</b>		XX00 (with brake pedal not pressed)		
		XX11 (with brake pedal pressed)		
<b>Note</b>		Value: X = no significance. Switching points are slightly offset		

If the display is not as described:

## Checking switch

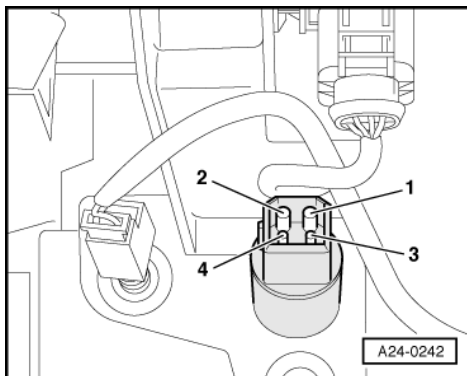
- Remove driver's storage compartment.

=> General Body Assembly, Interior; Repair group 68; Storage compartments/covers; Removing and installing driver's storage compartment Storage compartments/covers Removing and installing driver's storage compartment

- Unplug connector from brake light/brake pedal switch.

### Note:

Contacts are marked on back of plug.



- -> Connect multimeter between contacts 1 and 2 to measure resistance.
  - Specified value:  $\infty \omega$  (no continuity)
- Press brake pedal.
  - Specified value: approx. 0  $\omega$
- Connect multimeter between contacts 3 and 4 to measure resistance.
  - Specified value: approx. 0  $\omega$
- Press brake pedal.
  - Specified value:  $\infty \omega$  (no continuity)

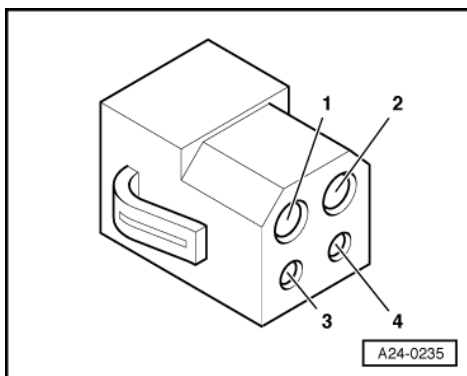
If the specified values are not obtained:

- Checking setting of switch or
- Replace brake light/brake pedal switch.

If specifications are attained:

- Check the power supply.

## Checking power supply



- -> Connect voltage tester V.A.G 1527 B as follows:

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Connector Contact	Measure to
1	body earth

- The LED should illuminate.  
Switch the ignition on.

Connector Contact	Measure to
3	body earth

- The LED should illuminate.

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If the LED does not illuminate:

- Check the wiring of contacts 1 and 3 of connector for open circuit/short to earth:

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

- Rectify any open/short circuit as necessary.

If the LED illuminates:

- Check actuation.


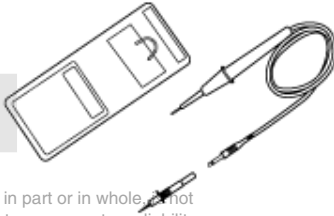


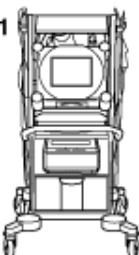
#### Checking actuation

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 62 .
- 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
2	56
4	55

- Rectify any open/short circuit as necessary.

## 5.10 - Clutch pedal switch -F36

<p><b>V.A.G 1526 A</b></p> 	<p><b>V.A.G 1527 B</b></p> 
<p><b>V.A.G 1594 A</b></p> 	<p><b>V.A.G 1598/31</b></p> 
<p><b>VAS 5051</b></p> 	<p>G24-0023</p>

### Special tools and workshop equipment required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1527 B
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/31
- ◆ VAS 5051 with VAS 5051/1

or

- ◆ V.A.G 1551 with V.A.G 1551/3 A

### Note:

*This signal is designed to prevent speed overshoots and jerkiness on switching from throttle open to throttle closed and vice versa when disengaging clutch. It is needed for the cruise control system.*

### Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with Address word" 01 => Page **1**



For this purpose, the ignition must be switched on.

-> Indicated on display

Rapid data transfer	HELP
Select function XX	

- Enter "08" to select the function "Reading measured value block" and confirm entry with Q-key.

-> Indicated on display

Reading measured value block	Q
Enter display group number XXX	

- Enter "066" for "display group number 066" and confirm entry with Q-key.

-> Indicated on display:

Read measured value block 66
1      2      3      4

- Check clutch pedal switch in display zone 2.

	Display zones			
	1	2	3	4
<b>Display group 066: Signals to engine control unit</b>				
<b>Display</b>	xxx km/h	XXXX	xxx km/h	XXXX
<b>Display</b>	ACTUAL speed	Switch settings	SPECIFIED speed	Switch settings
<b>Range</b>		X0XX X1XX		
<b>Specified value</b>		X0XX (clutch pedal not pressed)		
		X1XX (clutch pedal pressed)		
<b>Note</b>		Value: X = no significance		

If the display is not as described:

#### Checking switch

- Remove driver's storage compartment.

=> General Body Assembly, Interior; Repair group 68; Storage compartments/covers; Removing and installing driver's storage compartment Storage compartments/covers Removing and installing driver's storage compartment

- Unplug the connector from clutch pedal switch.
- Connect multimeter between contacts 1 and 2 to measure resistance.
  - Specified value: approx. 0  $\Omega$
- Press clutch pedal.
  - Specified value:  $\infty \Omega$  (no continuity)

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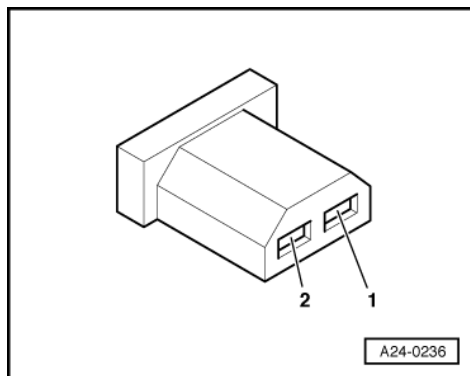
If specified value is not attained:

- Checking setting of switch or
- Replace clutch pedal switch.

If specified value is attained:

- Check the power supply.

#### Checking power supply



- -> Connect voltage tester V.A.G 1527 B as follows:

Connector Contact	Measure to
1	Body earth

- Switch the ignition on.
- The LED should illuminate.

If the LED does not illuminate:

- Check the wiring between contact 1 of connector and fuse for open circuit/short to earth.

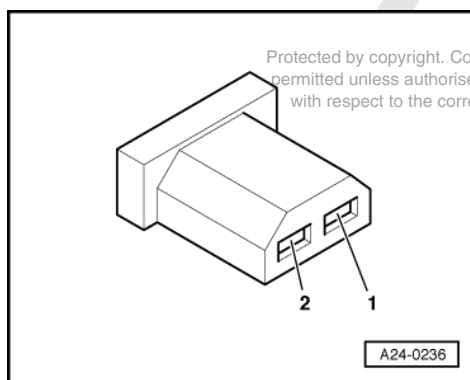
=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

If the LED illuminates:

- Check actuation.

#### Checking actuation

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 62 .



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


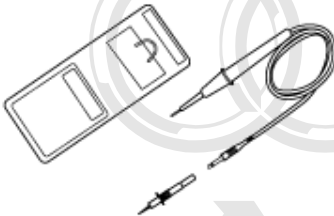
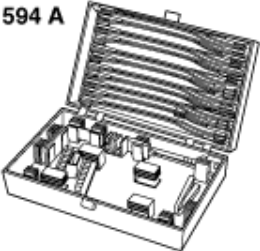

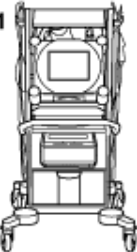
Connector Contact	Test box V.A.G 1598/31 Socket
2	39

- Rectify any open/short circuit as necessary.



## 6 - Checking auxiliary signals

### 6.1 - Checking auxiliary signals

<b>V.A.G 1526 A</b> 	<b>V.A.G 1527 B</b> 
<b>V.A.G 1594 A</b> 	<b>V.A.G 1598/31</b> 
<b>VAS 5051</b> 	<div>G24-0023</div>

#### Special tools and workshop equipment required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1527 B
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/31
- ♦ VAS 5051 with VAS 5051/1

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A



## 6.2 - Checking engine speed signal

### Note:

*The engine speed signal is taken from contact 37 of the engine control unit. The signal is used, among other things, for the engine speed display in the dash panel insert.*

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page **62** .
- Check for open circuit and short to positive or earth in the following wiring connections:

Test box V.A.G 1598/31 Socket	Instrument cluster: Contact
37	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

- Rectify any open/short circuit as necessary.

## 6.3 - Checking vehicle speed signal

### Notes:

- ◆ The speed signal is generated by the speedometer sender -G22 (at the gearbox) and processed in the dash panel insert.
- ◆ The processed signal goes to contact 54 on the engine control unit and is used for idling speed stabilisation and for the damping of load change jolts when changing gear.

### Test requirements:

- Speedometer function and display OK, fault-finding:

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

### Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "Address word" 01 => Page **1**  
For this purpose, the engine must be running at idle speed.

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**To avoid danger of accident when performing measurement and test drives, observe safety precautions =>**

-> Indicated on display

Rapid data transfer      **HELP**  
 Select function XX

- Enter "08" to select the function "Reading measured value block" and confirm entry with Q-key.

-> Indicated on display

Reading measured value block      **Q**  
 Enter display group number XXX

- Enter "005" for "display group number 005" and confirm entry with Q-key.

-> Indicated on display:



Read measured value block 5



1 2 3 4

- Take vehicle for a test drive and check whether the vehicle speed appears in display zone 3.
- If the road speed does not appear, raise the vehicle (preferably using a lifting platform) until the front left wheel is clear of the ground.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 62 .
- Connect voltage tester V.A.G 1527 B to sockets 3 (positive) and 54 (speed signal) of test box V.A.G 1598/31.
- Switch on the ignition and turn the front left wheel by hand.
  - The LED lamp should flash (very brief flashes).

If LED does not flash:

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

Test box V.A.G 1598/31 Socket	Instrument cluster: Contact
54	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

- Rectify any open/short circuit as necessary.

## 6.4 - Checking air conditioner compressor shut-off

### Notes:

- ♦ The air conditioning compressor signal informs the engine control unit that the compressor will be switched on in 140 ms.
- ♦ The engine control unit can send a signal via the same wire to shut off the air conditioner compressor.
- ♦ The engine control unit will shut off the air conditioner compressor in the following cases:
  - During powerful acceleration (full throttle in first gear)
  - In the emergency program (emergency running mode)
  - After initiating of basic setting (function 04)

### 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 vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "Address word" 01 => Page 1  
For this purpose, the engine must be running at idle speed.

-> Indicated on display

Rapid data transfer HELP

Select function XXX

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- Enter "08" to select the function "Reading measured value block" and confirm entry with Q-key.

-> Indicated on display

Reading measured value block Q  
Enter display group number XXX

- Enter "050" for "display group number 050" and confirm with Q-key.

-> Indicated on display  
(1...4 = display zones)

Read measured value block	50
1      2      3      4	

- Switch off air conditioner.
  - Specified value in display zone 4: Compr. OFF
- Switch on air conditioner with "AUTO" button and set air conditioner to maximum cooling/heating. The compressor must run.
  - Specified value in display zone 4: Compr. ON
- Fully depress the accelerator pedal and release again (brief actuation).
  - Specification for display zone 4: Display switches for a few seconds from "Compr. ON" to "Compr. OFF" (compressor shut-off on vehicle acceleration)

If the readout in display zone 4 is not as described:

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 62 .
- 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.

=> Air Conditioner; Repair group 01; Self-diagnosis for air conditioner Self-diagnosis for air conditioner

## 6.5 - Checking wiring for crash signal

The engine control unit receives 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 unit (during an accident or if a final control diagnosis is carried out relating 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; do not connect the engine control unit => Page 62 .
- Check for open circuit and short to positive or earth in the following wiring connections:

Test box V.A.G 1598/31 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

If no wiring fault is detected:



- Interrogate fault memory of airbag control unit:

=> Body, Self-diagnosis; Repair group 01; Self-diagnosis of airbag system Self-diagnosis of airbag system

## 6.6 - Checking consumption signal for on-board computer

### **Note:**

*The consumption signal is transferred to the dash panel insert via CAN bus by the engine control unit. Check the data exchange between engine control unit and other CAN-control units =>Page 152*

## 6.7 - Checking fuel level signal wiring

### **Notes:**

- ♦ The signal is used for finding the cause for certain recognised faults (e.g. misfiring)
- ♦ The signal for fuel tank level is transferred from the dash panel insert via CAN bus to the engine control unit. Check the data exchange between engine control unit and other CAN-control units =>Page 152

## 6.8 - Checking signal for rough-road recognition

### **Notes:**

- ♦ If the ABS/EDS control unit detects a spinning wheel, the ABS/EDS control unit generates the rough road signal.  
If the engine control unit detects the rough road signal, the misfire detection is switched off in engine control unit
- ♦ The rough-road signal must only be tested if the fault "18014 (P1606) Rough-road detection/engine specified torque ABS CU, electrical fault in circuit" is stored.  
The possible additional fault "Misfire" is then a sequential fault and can be ignored
- ♦ The rough- road signal is transferred to the engine control unit from the ABS/EDL control unit via the CAN bus. Check the data exchange between engine control unit and other CAN-control units =>Page 152

## 6.9 - Checking the data exchange between engine control unit and other CAN-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.

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "Address word" 01 => Page 1  
For this purpose, the ignition must be switched on.

-> Indicated on display

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Rapid data transfer      HELP  
Select function XX

- Enter "08" to select the function "Reading measured value block" and confirm entry with Q-key.

**Note:**

*The measured value blocks 125 and 126 indicate data bus users.*

-> Indicated on display

Reading measured value block      Q  
Enter display group number XXX

- Enter "125" for "display group number 125" and confirm entry with Q-key.

-> Indicated on display

Read measured value block      125  
1      2      3      4

- Check displays in display zones 1 to 4.

CAN-capable control units are displayed with the engine control unit:

- No display: Engine control unit not CAN-capable
- Display 1: CAN-capable control unit is a data bus user
- Display 0: CAN-capable control unit is not user of the data bus

Read measured value block      126  
1      2      3      4

-> Check in the same way with display group number 126.

Press → key.

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-> Indicated on display

Rapid data transfer      HELP  
Select function XX

- Enter "06" for "End output" function and confirm entry with Q-key.

-> Indicated on display

Rapid data transfer      HELP  
Enter address word XX

- Press the 0-key twice for the "automatic test sequence" address word and confirm entry with Q-key.
- 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 stored will be displayed in sequence and printed out. The V.A.G 1551 will then transmit the next address word.

-> The automatic test sequence has ended when the following appears on the display:

V.A.G

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".

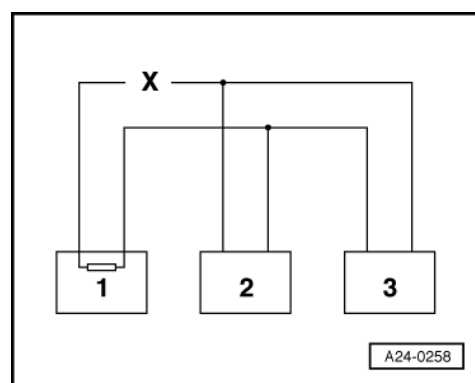
- Evaluate the faults stored in the control units.

#### **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.



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

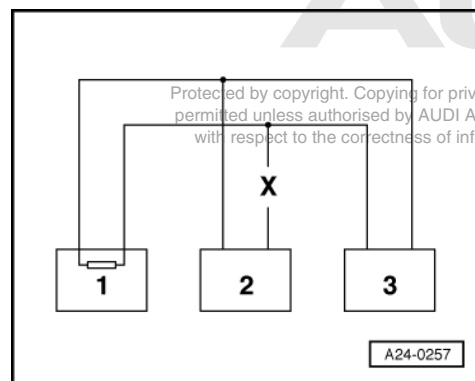
- Switch ignition off.
- Disconnect the control units linked to one another via the bus wires and investigate whether there is an open circuit between the bus wires.

=> 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

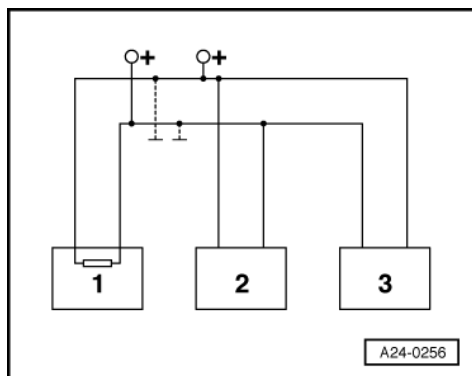
- If no fault can be detected in the bus lines exchange control unit 2.

### 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	- Drive data bus defective
2	- Drive data bus defective
3	- Drive data bus 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.**

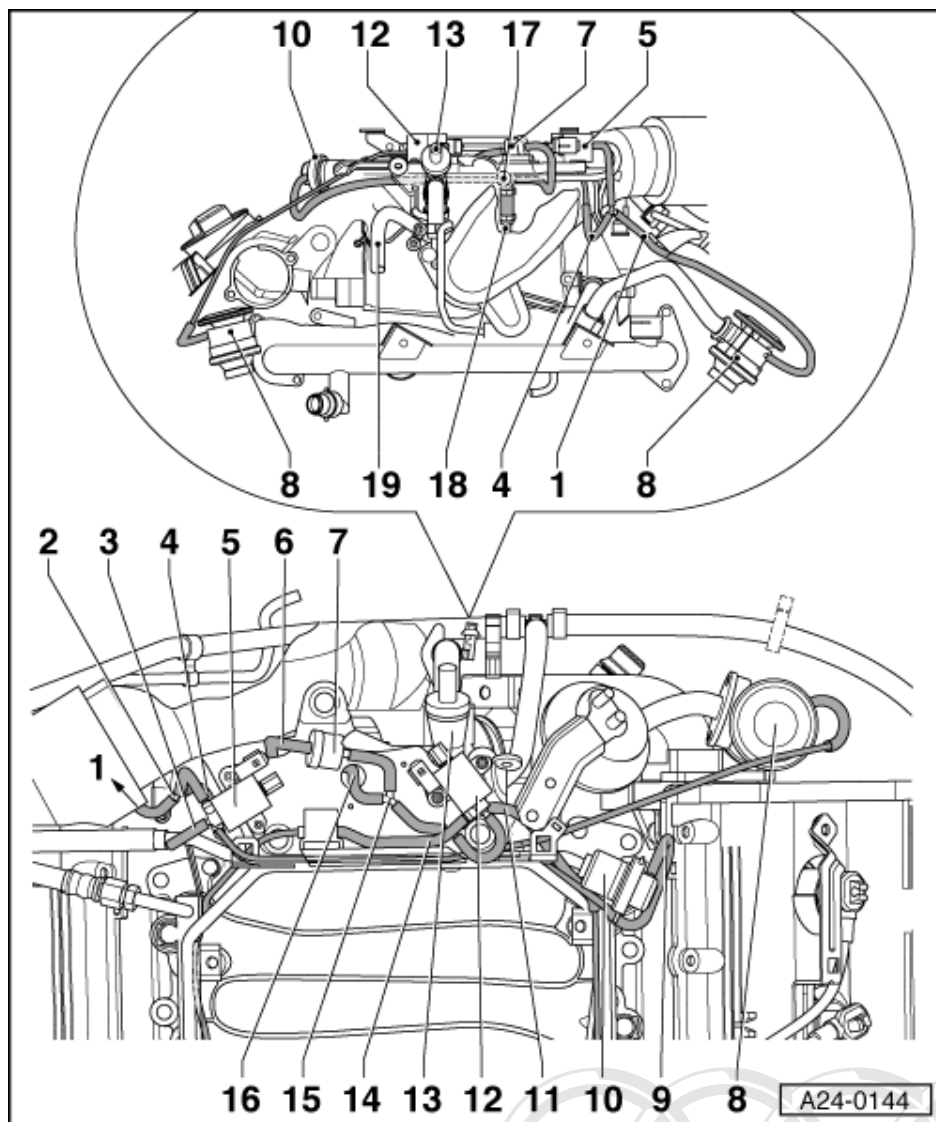
All the control units that communicate via the CAN data bus are still disconnected. Ignition is switched off.

- Connect one of the control units.
- Connect fault reader V.A.G 1551. Switch the ignition on and erase the fault memory of the control unit that has just been connected. Terminate fault readout by selecting 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.



## 7 - Vacuum diagram

### 7.1 - Vacuum diagram



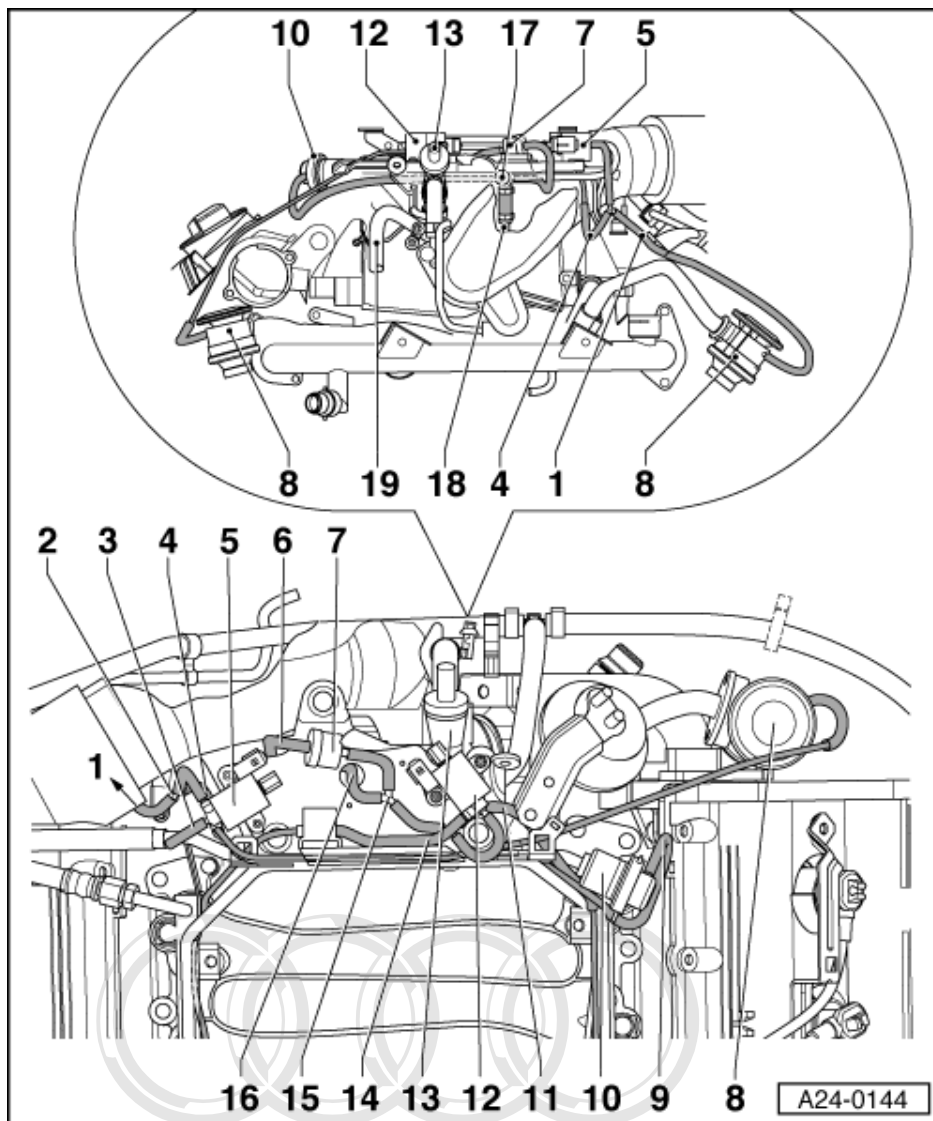
Top part of Fig. - back of engine

Bottom part of Fig. - top view of engine

- 1 Pipe to combi valve for secondary air inlet
- 2 T-piece
- 3 To Y-piece
  - ♦ -Item 15 -
- 4 Pipe to combi valve for secondary air inlet
- 5 Secondary air inlet valve -N122
- 6 To T-piece at intake manifold
  - ♦ -Item 17 -

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7 Non-return valve

8 Combi valve for secondary air inlet

- ♦ Combi valve 1 for bank 1
- ♦ Combi valve 2 for bank 2

9 To T-piece at intake manifold

- ♦ -Item 17 -

10 Fuel pressure regulator

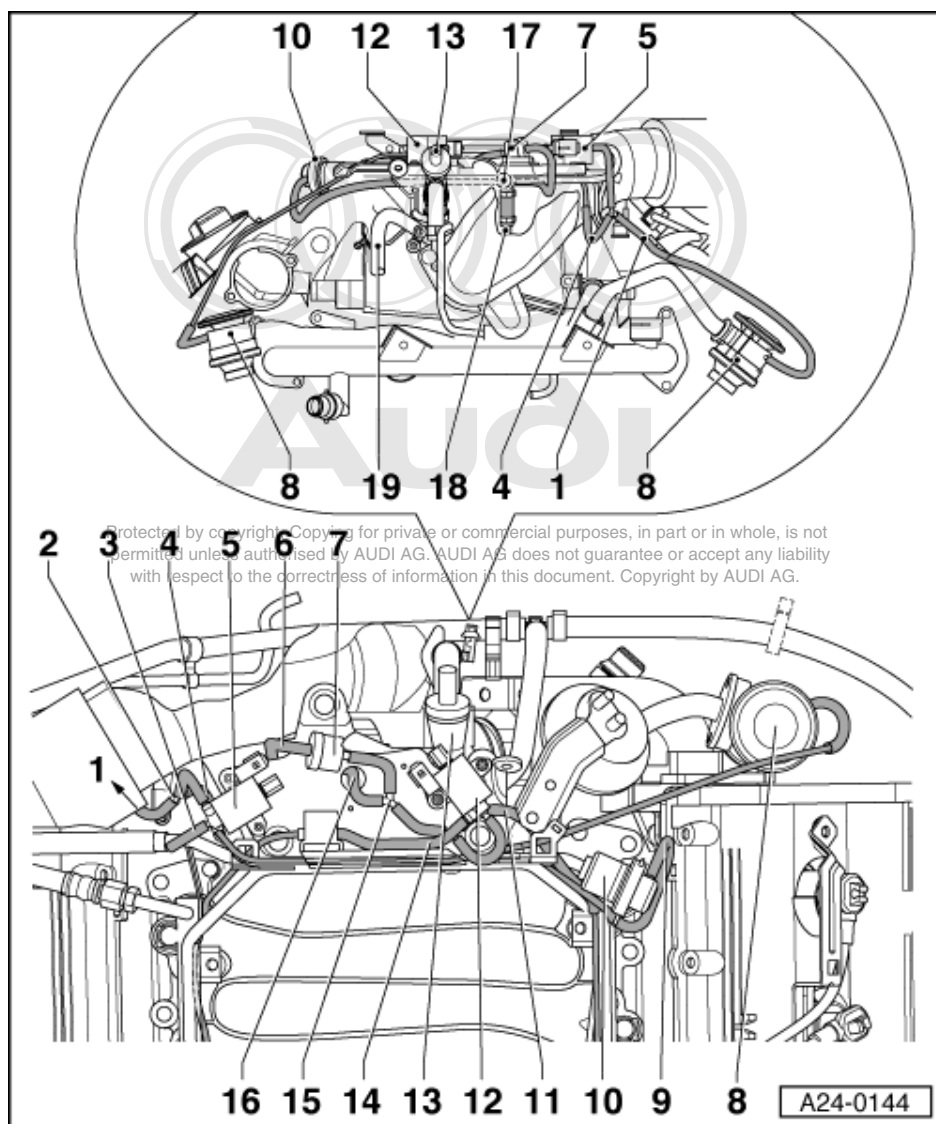
11 Pipe to vacuum reservoir in left wheel housing

12 Intake manifold changeover valve -N156

13 Suction jet pump

14 To vacuum actuator for intake manifold changeover

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15 Y-piece

16 Pipe to secondary air inlet valve -N122

♦ -Item 5 -

17 T-piece at intake manifold

18 Pipe to intake manifold connection

19 Hose to activated charcoal filter

## 28 - Ignition system

### 1 - Checking ignition system

#### 1.1 - Checking ignition system

#### 1.2 - General notes on ignition system

- ◆ Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.
- ◆ A voltage of at least 12.7 V is 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 ignition system wiring. This also applies to HT cables and measuring instrument leads.
- ◆ To run engine at starting speed without actually starting it (for example, in order to check compression), unplug connector from the output stage of the ignition coils and also the connectors on the injectors.
- ◆ 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. After erasing the fault memory the readiness code must be produced => Page 30.
- ◆ Always switch off the ignition before washing the engine.
- ◆ Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.

#### 1.4 - Technical data for ignition system

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Engine code letters	AMX (2.8 litre / 5V / 147 kW-engine)
Idling speed Not adjustable - controlled by the idling speed stabilisation	650...750 rpm
Engine speed limitation by deactivation of injectors	Approx. 6800 rpm
Ignition timing is determined by the control unit Ignition timing cannot be adjusted	
Ignition system	Twin-spark ignition system with three ignition coils
Spark plugs 1)	Tightening torque 30 Nm

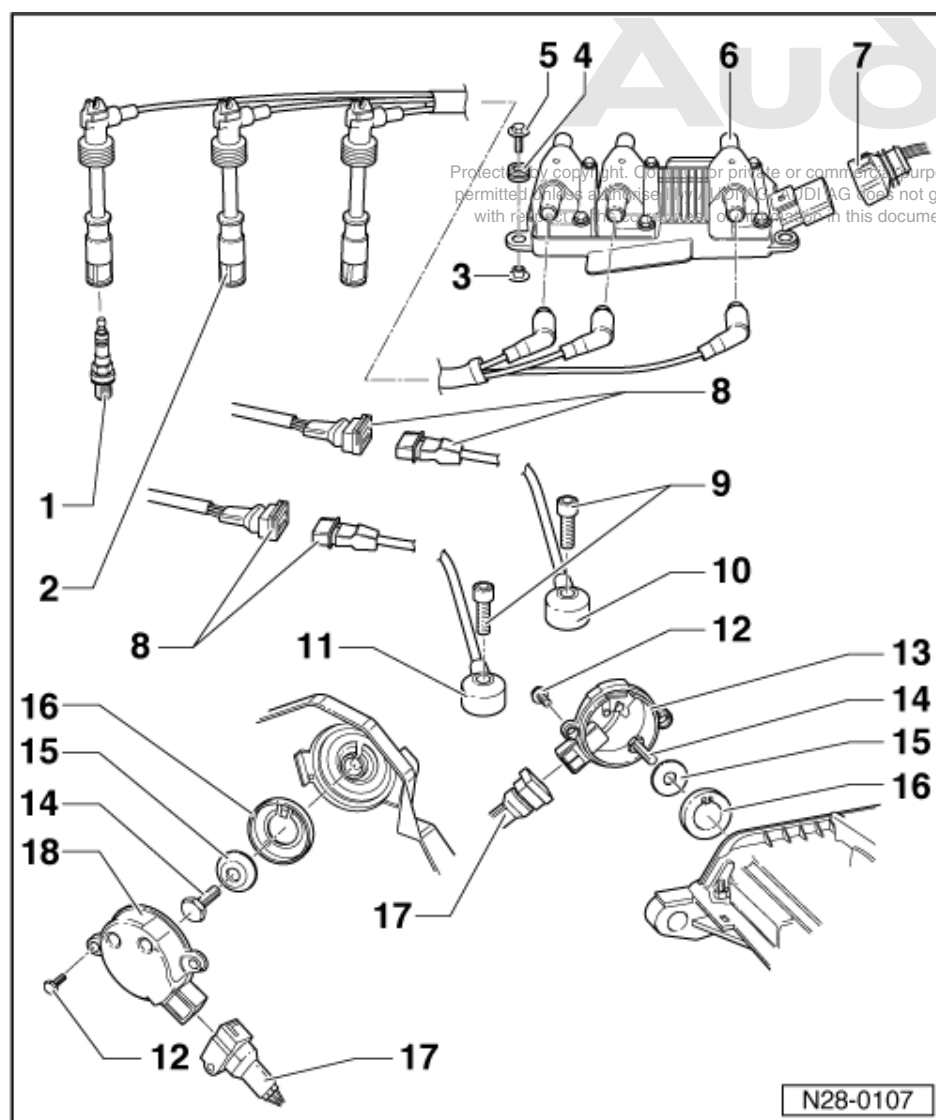


Engine code letters	AMX (2.8 litre / 5V / 147 kW-engine)
Firing order	1-4-3-6-2-5

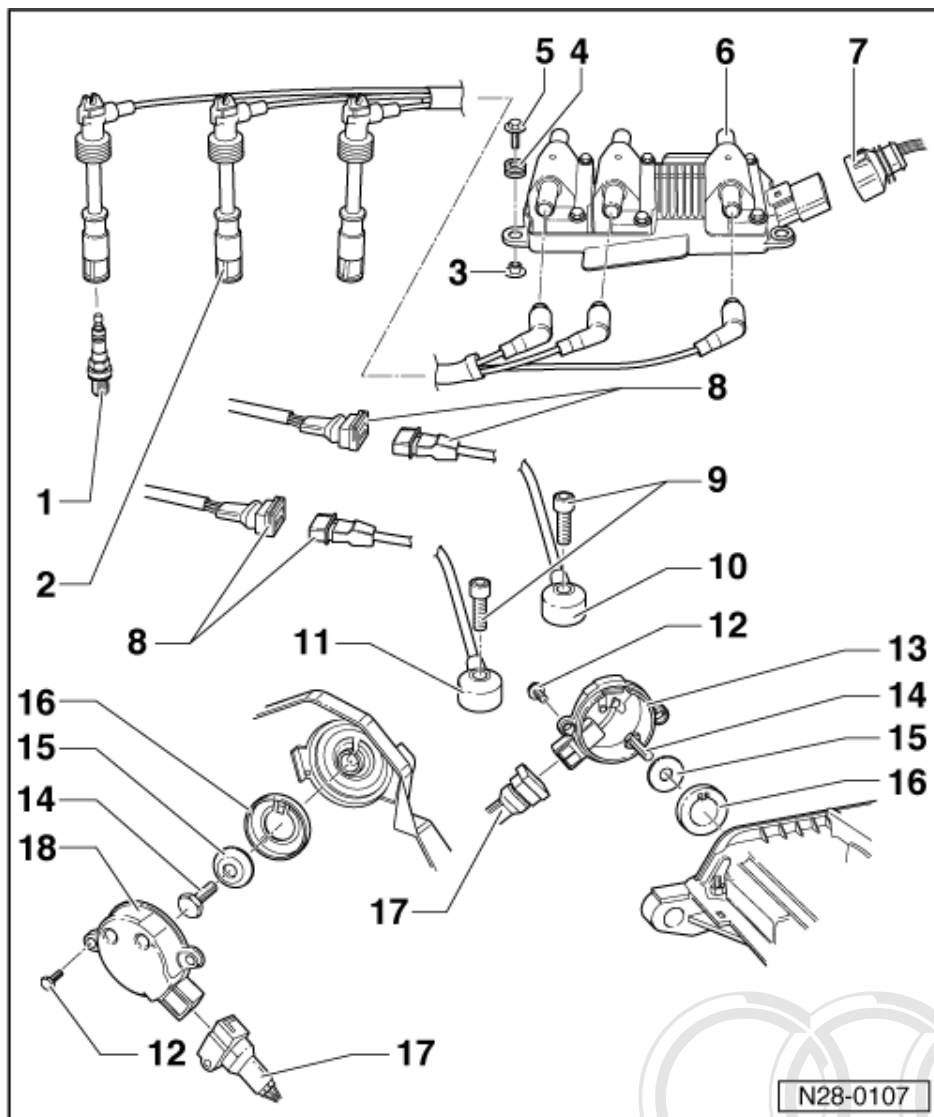
1) Current values:

=> Exhaust Emissions Test binder

## 1.5 - Removing and installing ignition system components

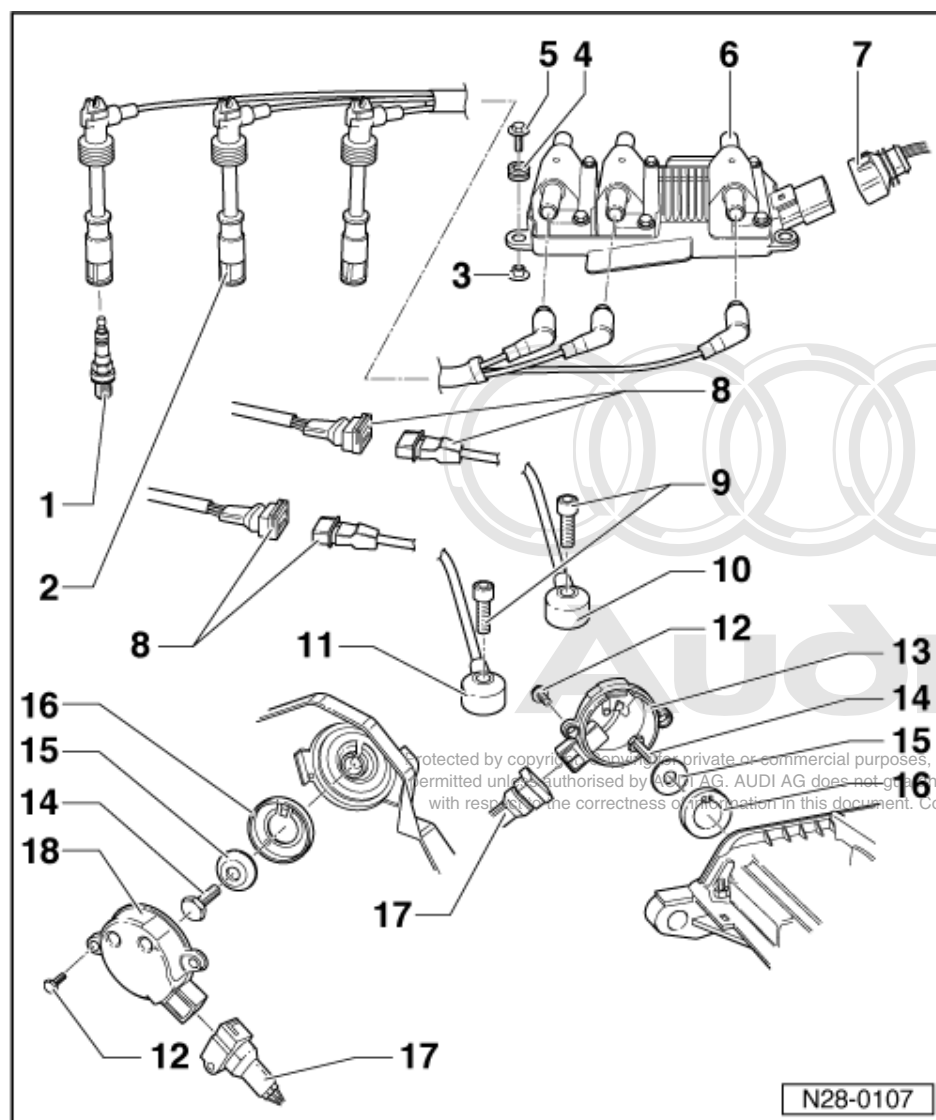


- 1 Spark plug, 30 Nm
  - ♦ Use 3122 B to remove and install
- 2 Spark plug connector with ignition cable
- 3 Spacer sleeve
- 4 Rubber grommet
- 5 10 Nm
- 6 Ignition coils -N, -N128, -N158
  - ♦ With output stage -N122
  - ♦ With ignition cable identification, do not interchange



- 7 5-pin connector
  - ♦ Black
- 8 3-pin connector
  - ♦ Gold plated contacts
- 9 20 Nm
  - ♦ Tightening torque affects the knock sensor function
- 10 Knock sensor 2 -G66
  - ♦ Bank 2
  - ♦ Sensor and connector contacts gold plated
- 11 Knock sensor 1 -G61
  - ♦ Bank 1
  - ♦ Sensor and connector contacts gold plated
- 12 10 Nm

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**13 Hall sender -G40**

- ♦ Bank 2

**14 25 Nm**

**15 Washer**

- ♦ Tapered

**16 Panel**

- ♦ For Hall sender
- ♦ Pay attention to locating element on assembly

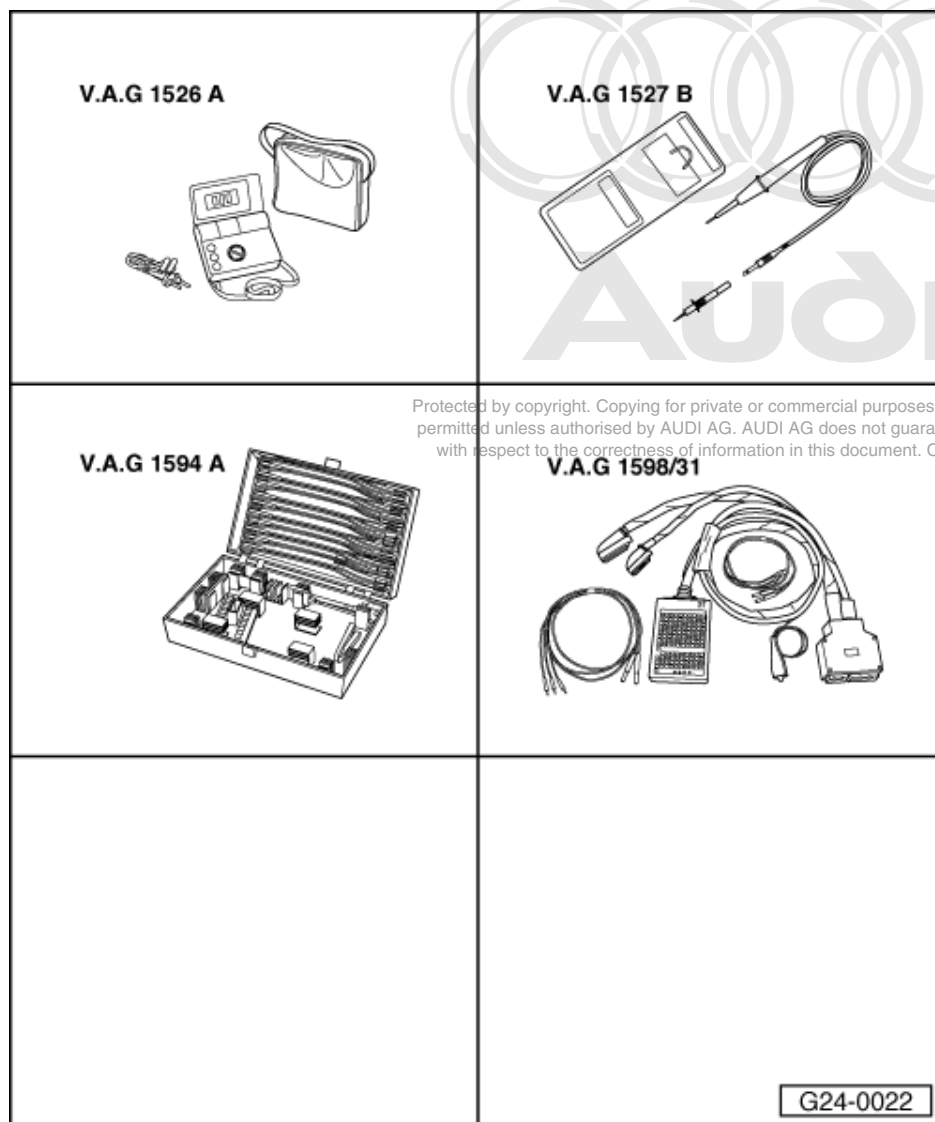
**17 3-pin connector**

- ♦ Black
- ♦ For Hall sender -G40/-G163

**18 Hall sender -G163**

- ♦ Bank 1

## 1.6 - Checking ignition coils



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### Special tools and workshop equipment required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1527 B
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/31

Fitting location => Fitting locations overview, Page 45

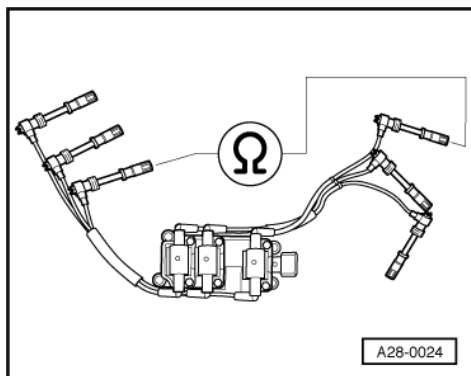
### Notes:

- ◆ Ignition coils and output stage form a joint component.
  - ◆ Primary resistance of ignition coils cannot be measured.
  - ◆ Secondary resistance should be measured first with ignition cables connected to ignition coils by way of spark plug connectors of respective cylinders (interference suppression resistances of ignition cables are also measured in the course of this).
- Unplug 5-pin connector from ignition coils.

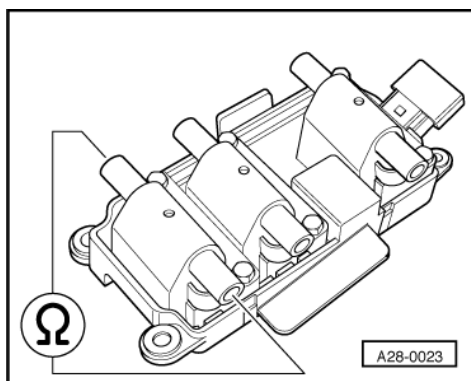


### Checking ignition coils -N, -N128, and -N158

- Disconnect ignition cables from ignition coils.

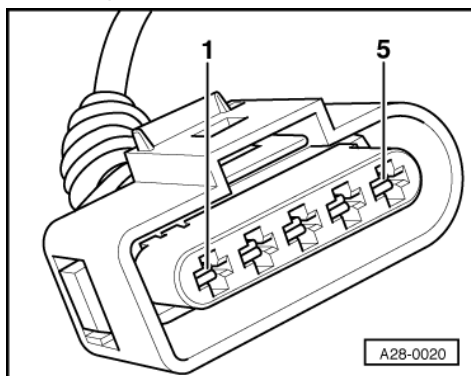


- -> Connect up multimeter between the two spark plug connectors of the ignition circuit to be checked to measure resistance.
  - Specified value: 16...27 kΩ
- If the specified values are not attained, disconnect ignition cables from ignition coils and measure ignition cables/ignition coils separately.



- -> To measure resistance, connect up multimeter between the two ignition cable connections of the ignition coil that is to be checked.
  - Specified value: 8...14 kΩ
- To measure resistance, connect up multimeter between the two ignition cable connections of the ignition cable that is to be checked.
  - Specified value: 3...7 kΩ
- Replace defective components if specified values are still not attained.

### Checking earth connection of output stage



- -> Connect voltage tester V.A.G 1527 B as follows:

Connector Contact	Measure to
-------------------	------------



2	Battery positive
---	------------------

- The LED should illuminate.

If the LED does not illuminate:

- Check for open circuit in the wiring connections:

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

- Rectify open circuit, if necessary.

### Checking voltage supply of ignition coils

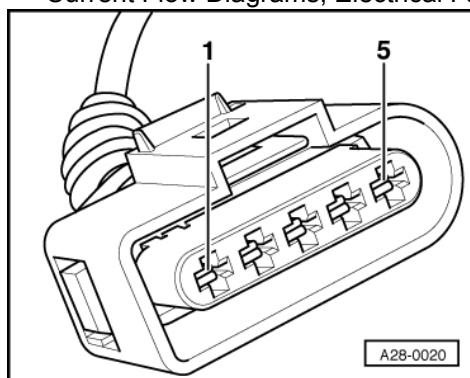
#### Note:

Voltage supply to ignition coils is from fuel pump relay.

#### Test requirements:

- Fuse for ignition coils OK.

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



- -> Connect voltage tester V.A.G 1527 B as follows:

Connector Contact	Measure to
1	Engine earth

- Operate starter.
- The LED should illuminate.

If the LED does not illuminate:

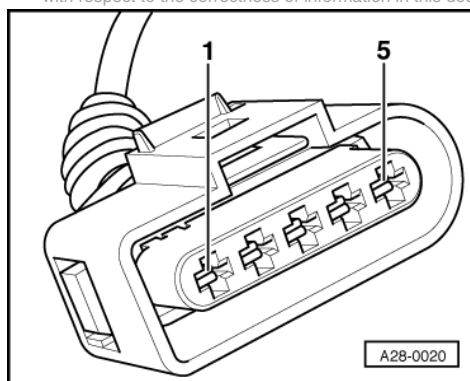
- Check for open circuit in the wiring connections:

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

- Rectify open circuit, if necessary.

### Checking actuation

- Unplug connectors from all 6 injectors (then interrogate fault memory).





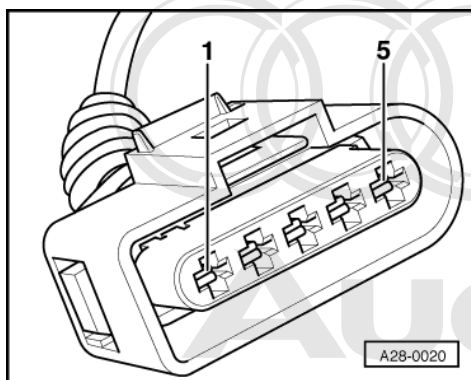
- -> Connect voltage tester V.A.G 1527 B as follows:

Connector Contact	Measure to
3	Engine earth
4	Engine earth
5	Engine earth

- Operate the starter for a few seconds.
  - The diode test lamp should flash (very brief flashes).

If the specified values are not obtained:

- Switch ignition off.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 62 .



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

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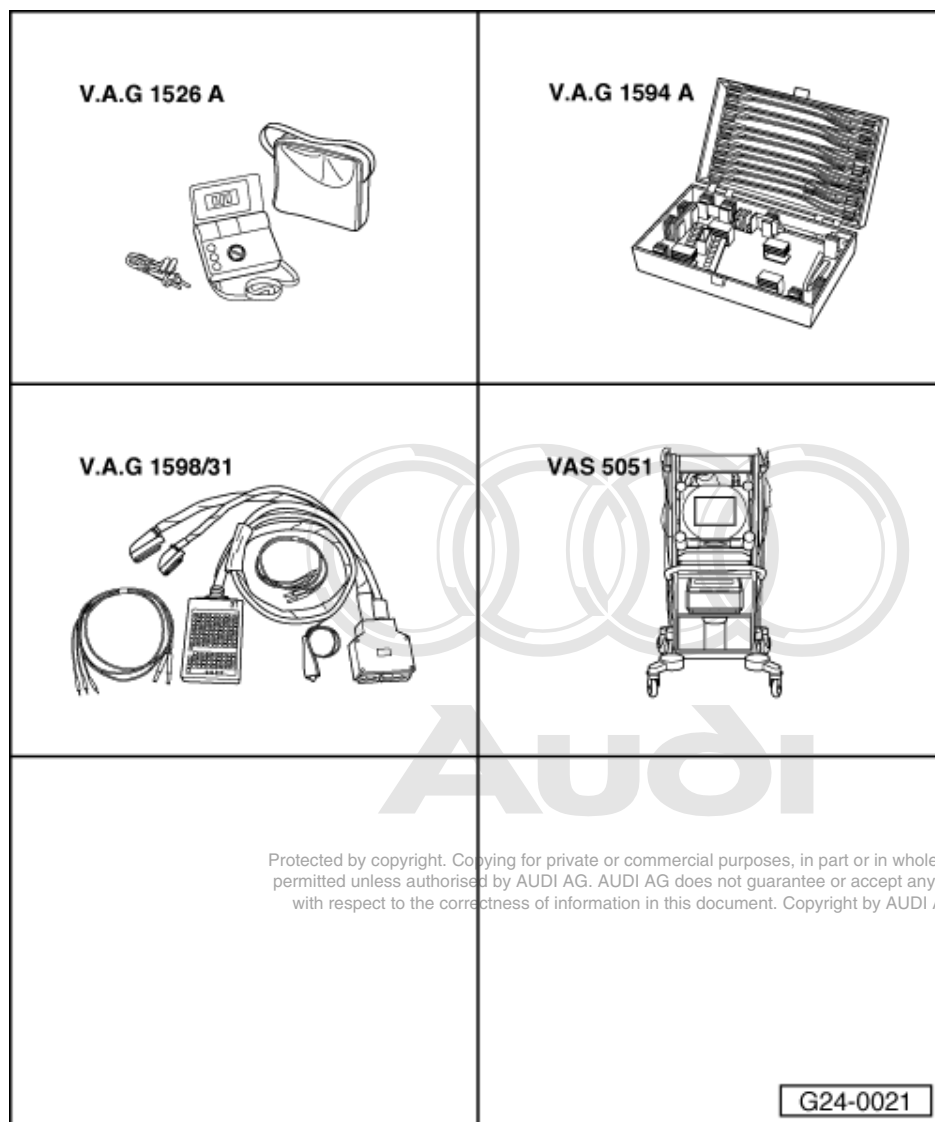
Connector Contact	Test box V.A.G 1598/31 Socket
3	102
4	103
5	94

- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

- Replace engine control unit => Page 64 .

## 1.7 - Checking intake air temperature sensor -G42



### 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

or

- ◆ V.A.G 1551 with V.A.G 1551/3 A

Fitting location => Fitting locations overview, Page **45**

### Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "Address word" 01 => Page **1**  
For this purpose, the ignition must be switched on.

-> Indicated on display



Rapid data transfer      HELP  
Select function XX

- Enter "08" to select the function "Reading measured value block" and confirm entry with Q-key.

-> Indicated on display

Reading measured value block      Q  
Enter display group number XXX

- Enter "004" for "display group number 004" and confirm entry with Q-key.

-> Indicated on display:

Read measured value block      4  
1      2      3      4

- Check specified value for intake air temperature sender in display zone 4:

	Display zones			
	1	2	3	4
<b>Display group 004: Intake air temperature with engine idling</b>				
<b>Display</b>	xxxx rpm	xx.xxx V	xxx.x °C	xxx.x °C
<b>Display</b>	Engine speed	Battery voltage	Coolant temperature	Intake air temperature
<b>Range</b>				-48.0...143.0 °C
<b>Specified value</b>	xxxx rpm	12.000...15.000 V	80.0...107.0 °C	From ambient temperature up to 120 °C 1)

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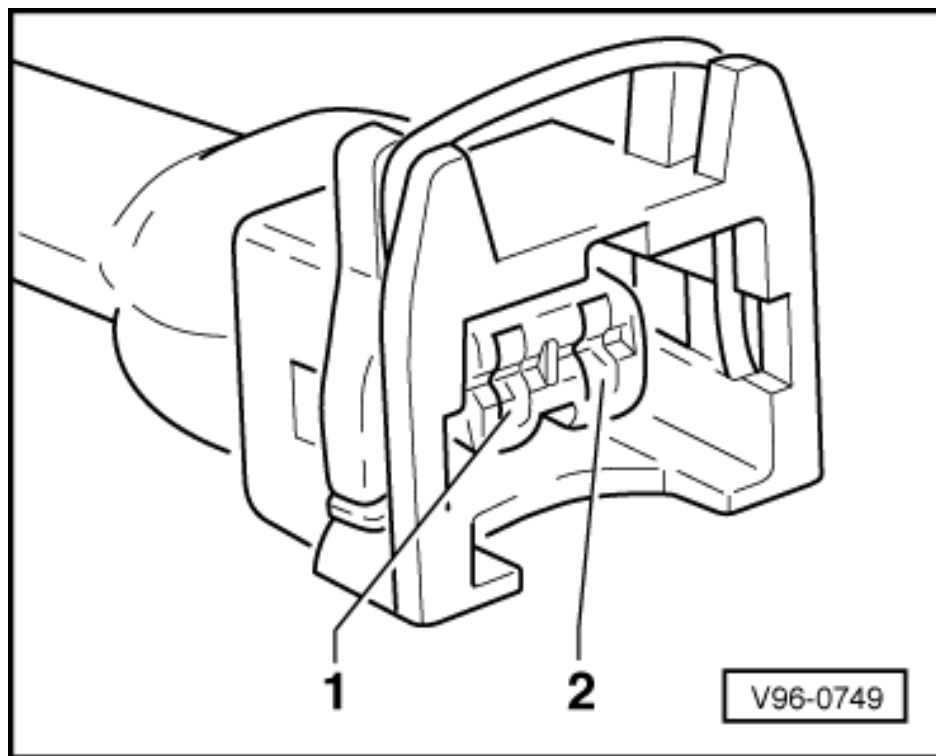
#### 1) Approximate values:

During driving up to 24 °C via ambient temperature.

When stationary, heating up to 120 °C is possible.

#### Checking wiring

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 62 .



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

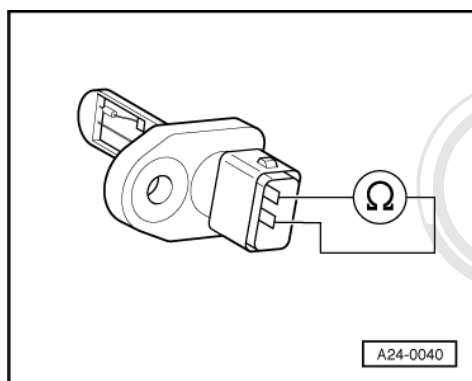
Connector Contact	Test box V.A.G 1598/31 Socket
1	85
2	108

- Check for short circuits between the two wires.
- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

#### Checking sender:

- Unplug connector from intake air temperature sender.



- -> Connect multimeter to sender to measure resistance.

#### Specifications:

Temperature °C	Resistance kΩ
-20	Approx. 13.8
0	Approx. 5.5
20	Approx. 2.4
40	Approx. 1.1
60	Approx. 0.6

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#### Example:




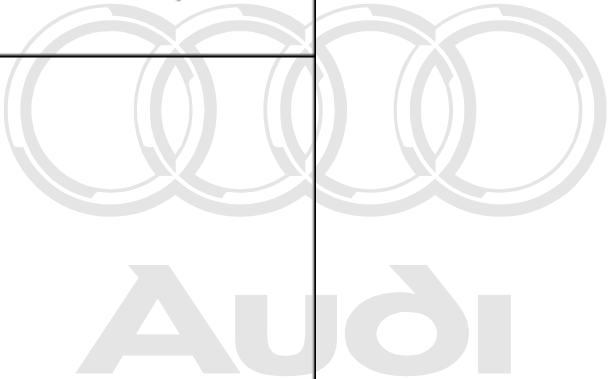
*If the ambient temperature is within a range between 0 °C and 20 °C so the resistance value must be between 5.5 kΩ and 2.4 kΩ*

If specified value is not attained:

- Replace intake air temperature sender.



## 1.8 - Checking engine speed sender -G28

<b>V.A.G 1526 A</b> 	<b>V.A.G 1594 A</b> 
<b>V.A.G 1598/31</b> 	
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### Special tools and workshop equipment required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/31

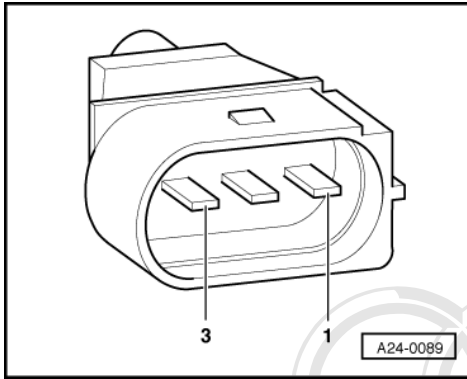
Fitting location => Fitting locations overview, Page 45

### **Note:**

*The engine speed sender is a combined speed sender and reference mark sender. The engine cannot be started without a signal from the -G28 engine speed sender. If the signal from the -G28 engine speed sender fails while the engine is running, the engine will cut out immediately.*

### Test sequence

- Before carrying out the test, make sure that the sender is correctly installed and firmly seated.
- Disconnect connector for engine speed sender (identification: grey connector).



- -> Connect multimeter between contacts 2 and 3 to measure resistance.
- Specified value: 730...1000  $\Omega$

**Note:**

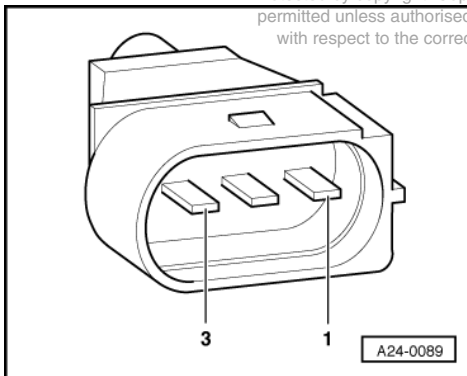
*The resistance value of the engine speed sender relates to a temperature of 20 °C. The resistance increases if the temperature increases.*

If specified value is not attained:

- Fit a new engine speed sender.

If specified value is attained:

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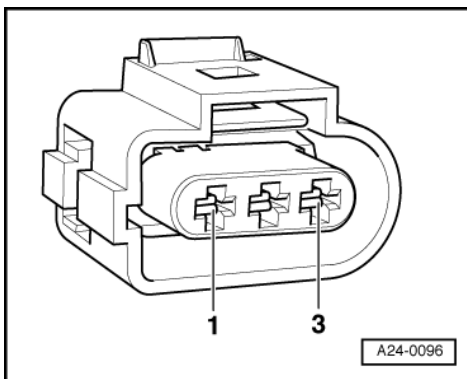
- -> Connect multimeter between contacts 2 and 1 (screening) and 3 and 1 (screening) to measure resistance.
- Specified value: each case  $\infty \Omega$  (no continuity)

If specified value is not attained:

- Fit a new engine speed sender.

If specified value is attained:

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 62 .





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




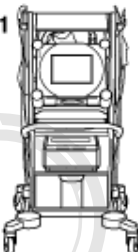
Connector Contact	Test box V.A.G 1598/31 Socket
1 (screening)	108
2 (earth)	90
3 (signal)	82

- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

- Replace engine control unit => Page 64 .

## 1.9 - Checking coolant temperature sender -G62

<p><b>V.A.G 1526 A</b></p> 	<p><b>V.A.G 1594 A</b></p> 
<p><b>V.A.G 1598/31</b></p> 	<p><b>VAS 5051</b></p> 
<p><b>Audi</b></p> <p>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.</p> <p><b>G24-0021</b></p>	

### 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

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

Fitting location => Fitting locations overview, Page 45

#### Test requirements:

- Engine cold

#### Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "Address word" 01 => Page 1  
For this purpose, the engine must be running at idle speed.

-> Indicated on display

Rapid data transfer      HELP  
Select function XX

- Enter "08" to select the function "Reading measured value block" and confirm entry with Q-key.

-> Indicated on display

Reading measured value block      Q  
Enter display group number XXX

- Enter "004" for "display group number 004" and confirm entry with Q-key.

-> Indicated on display:

Read measured value block      4  
1      2      3      4

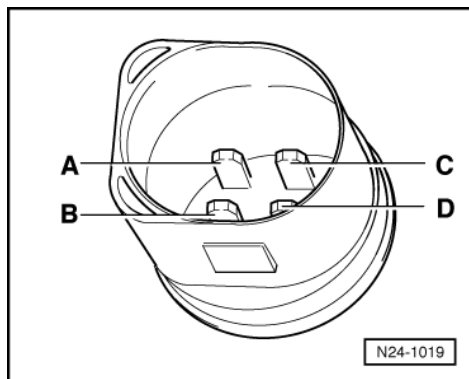
- Check display in display zone 3.

	Display zones			
	1	2	3	4
<b>Display group 004: Coolant temperature with engine idling</b>				
<b>Display</b>	xxxx rpm	xx.xxx V	xxx.x °C	xxx.x °C
<b>Display</b>	Engine speed	Battery voltage	Coolant temperature	Intake air temperature
<b>Range</b>			-48.0...143.0 °C	
<b>Specified value</b>	xxxx rpm	12.000...15.000 V	The temperature value should increase evenly	From ambient temperature up to 120 °C

If the display in display zone 3 is unrealistic:

#### Note:

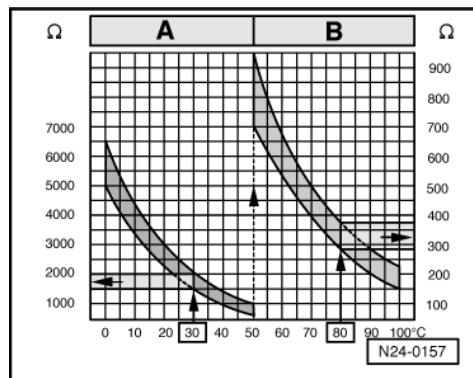
To gain access to the coolant temperature sender the intake hose between air mass meter and air intake elbow must be removed.





- Disconnect connector on coolant temperature sender.
- -> Connect multimeter between contacts C and D of sender to measure resistance.

Range A shows resistance values for temperature range 0...50 °C and range B shows the values for temperature range 50...100 °C.



-> Sample readings:

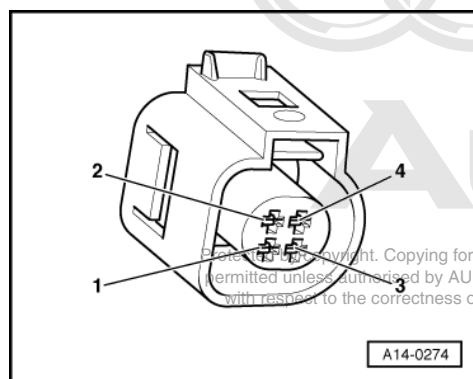
- ♦ 30 °C corresponds to a resistance of 1500...2000  $\omega$
- ♦ 80 °C corresponds to a resistance of 275...375  $\omega$

If specified value is not attained:

- Replace coolant temperature sender.

If specified value is attained:

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 62 .



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


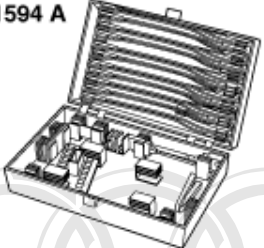

Connector Contact	Test box V.A.G 1598/31 Socket
3	108
4 (signal)	93

- Check for short circuits between the two wires.
- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

- Replace engine control unit => Page 64 .

## 1.10 - Checking control unit power supply

<p><b>V.A.G 1526 A</b></p> 	<p><b>V.A.G 1594 A</b></p> 
<p><b>V.A.G 1598/31</b></p> 	<p style="text-align: center; font-size: 2em; opacity: 0.5;">Audi</p> <p style="font-size: 0.8em;">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.</p>
	<p style="text-align: right; border: 1px solid black; padding: 2px;">G24-0020</p>

### Special tools and workshop equipment required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/31

### Test requirements:

- Fuse for engine control unit OK.

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

- Battery voltage at least 12.7 V
- Alternator OK

### Test sequence

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 62 .
- Switch the ignition on.

**Note:**

- ♦ The positive voltage supply to the engine control unit is provided via contact 3 (terminal 15) and contact 62 (terminal 30).
- ♦ The earth connection to the engine control unit is provided via contact 1 and contact 2.
- Connect multimeter as follows to measure voltage:

Test box V.A.G 1598/31 Socket	Measure to
1	Battery positive
2	Battery positive
62	Engine earth

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- Specified value: approx. battery voltage
- Connect multimeter as follows to measure voltage:

Test box V.A.G 1598/31 Socket	Measure to
3	Engine earth

- Switch the ignition on.
- Specified value: approx. battery voltage

If the specified values are not obtained:

- Check the wiring connections.

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

## 1.11 - Checking knock control stop

If a fault entry relating to "knock control stop reached" is made, carry out the following checks:

### Check ignition angle retardation of individual cylinder

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "Address word" 01 => Page 1  
For this purpose, the engine must be running at idle speed.

-> Indicated on display

Rapid data transfer	HELP
Select function XX	

- Enter "08" to select the function "Reading measured value block" and confirm entry with Q-key.

-> Indicated on display

Reading measured value block	Q
Enter display group number XXX	

- Enter "020" for "display group number 020" and confirm entry with Q-key.

-> Indicated on display

Read measured value block	20
1 2 3 4	

- Check display in all display zones.

	Display zones			
	1	2	3	4
<b>Display group 020: Ignition knock control during driving</b>				
Display	xx.x °CA	xx.x °CA	xx.x °CA	xx.x °CA
Display	Ignition angle retardation cylinder 1 through knock control	Ignition angle retardation cylinder 2 through knock control	Ignition angle retardation cylinder 3 through knock control	Ignition angle retardation cylinder 4 through knock control
Specified value	0...12 °crankshaft	0...12 °crankshaft	0...12 °crankshaft	0...12 °crankshaft
Note	Evaluation => Page 179			

**Note:**

The numbers displayed in display zones 1 to 4 represent the actual ignition timing retardation due to the knock control of the individual cylinders. The ignition angle retardation is carried out late in °CA (crankshaft degrees).

- Press C-key.

-> Indicated on display

Reading measured value block Q  
Enter display group number XXX

- Enter "021" for "display group number 021" and confirm entry with Q-key.

-> Indicated on display

Read measured value block 21  
1 2 3 4

- Check displays in display zones 1 and 2.

	Display zones			
	1	2	3	4
<b>Display Group 021: Ignition knock control during driving</b>				
Display	xx.x °CA	xx.x °CA		
Display	Ignition angle retardation cylinder 5 through knock control	Ignition angle retardation cylinder 6 through knock control		
Specified value	0...12 °crankshaft	0...12 °crankshaft		
Note	Evaluation => Page 179			

**Note:**

The numbers displayed in display zones 1 and 2 represent the actual ignition timing retardation due to the knock control of the individual cylinders. The ignition angle retardation is carried out late in °CA (crankshaft degrees).

- Press C-key.

-> Indicated on display

Reading measured value block Q  
Enter display group number XXX

- Enter "022" for "display group number 022" and confirm entry with Q-key.

-> Indicated on display

Read measured value block 22  
1 2 3 4

- Check display in zones 3 and 4.



	Display zones			
	1	2	3	4
<b>Display group 022: Ignition knock control during driving</b>				
<b>Display</b>	xxxx rpm	xxx.x %	xx.x °CA	xx.x °CA
<b>Display</b>	Engine speed	Engine load	Ignition angle retardation cylinder 1 through knock control	Ignition angle retardation cylinder 2 through knock control
<b>Specified value</b>	xxxx rpm	12...100 %	0...12 °crankshaft	0...12 °crankshaft
<b>Note</b>			Evaluation => Page 179	

**Note:**

The indicated values in display zones 3 and 4 illustrate the actual ignition angle retardation through the knock sensor of cylinders 1 and 2. The ignition angle retardation is carried out late in °CA (crankshaft degrees).

- Press C-key.

-> Indicated on display

Reading measured value block	Q
Enter display group number XXX	

- Enter "023" for "display group number 023" and confirm entry with Q-key.

-> Indicated on display

Read measured value block	23
1 2 3 4	

- Check display in zones 3 and 4.

	Display zones			
	1	2	3	4
<b>Display group 023: Ignition knock control during driving</b>				
<b>Display</b>	xxxx rpm	xxx.x %	xx.x °CA	xx.x °CA
<b>Display</b>	Engine speed	Engine load	Ignition angle retardation cylinder 3 through knock control	Ignition angle retardation cylinder 4 through knock control
<b>Specified value</b>	xxxx rpm	12...100 %	0...12 °crankshaft	0...12 °crankshaft
<b>Note</b>			Evaluation => Page 179	

**Note:**

The indicated values in display zones 3 and 4 illustrate the actual ignition angle retardation through the knock sensor of cylinders 3 and 4. The ignition angle retardation is carried out late in °CA (crankshaft degrees).

- Press C-key.

-> Indicated on display

Reading measured value block	Q
Enter display group number XXX	

- Enter "024" for "display group number 024" and confirm entry with Q-key.

-> Indicated on display

Read measured value block	24
1 2 3 4	

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- Check display in zones 3 and 4.

	Display zones			
	1	2	3	4
<b>Display group 024: Ignition knock control during driving</b>				
<b>Display</b>	xxxx rpm	xxx.x %	xx.x °CA	xx.x °CA
<b>Display</b>	Engine speed	Engine load	Ignition angle retardation cylinder 5 through knock control	Ignition angle retardation cylinder 6 through knock control
<b>Specified value</b>	xxxx rpm	12...100 %	0...12 °crankshaft	0...12 °crankshaft
<b>Note</b>	Evaluation => Page 179			

**Note:**

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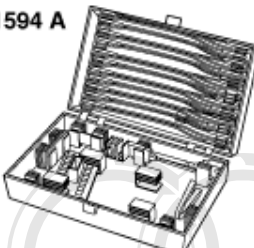

The indicated values in display zones 3 and 4 illustrate the actual ignition angle retardation through the knock sensor of cylinders 5 and 6. The ignition angle retardation is carried out late in °CA (crankshaft degrees).

**Evaluation of display group 020/021/022/023/024, - Ignition timing retardation**

Indicated on display	Possible causes of fault	Fault remedy
All cylinders greater than 12 °crankshaft	- Knock sensor defective	- Check knock sensor => Page 180
	- Connector corroded	
	- Knock sensor incorrectly tightened	- Loosen knock sensor and tighten to 20 Nm.
	- Loose components on engine	- Secure components
	- Poor fuel quality	- Change fuel quality (see operating instructions)
One cylinder deviates significantly from the others	- Connector corroded	- Check knock sensor => Page 180
	- Engine fault	- Check compression: => Repair group 15; Removing and installing cylinder head; Check compression Check compression
	- Loose components on engine	- Secure components



## 1.12 - Checking knock sensors

<p><b>V.A.G 1526 A</b></p> 	<p><b>V.A.G 1594 A</b></p> 
<p><b>V.A.G 1598/31</b></p> 	<p>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.</p>
	<p>G24-0020</p>

### Special tools and workshop equipment required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/31

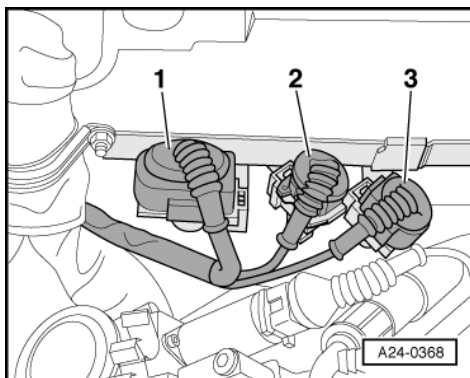
Fitting location => Fitting locations overview, Page **45**

### Notes:

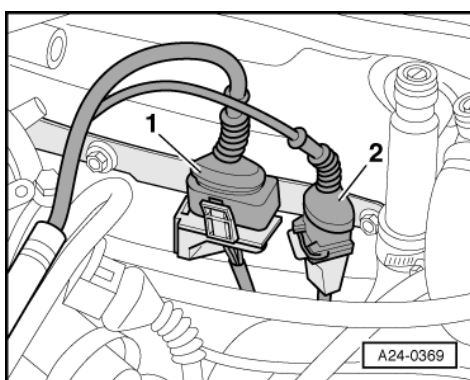
- ♦ The knock sensors -G61 and -G66 cannot themselves be tested electrically.
- ♦ Use only gold-plated contacts when repairing the cable connectors for the knock sensors.
- ♦ To ensure that the knock sensors function properly it is important to keep exactly to the specified tightening torque of 20 Nm.
- ♦ Check connector between knock sensor and wiring harness for corrosion.



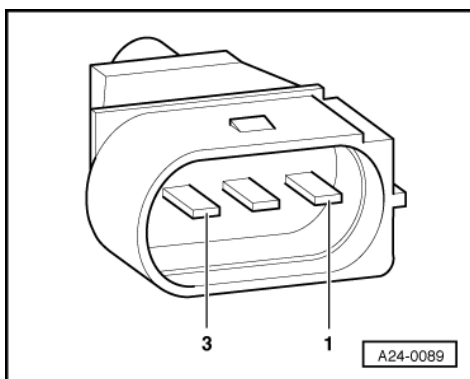
## Checking knock sensors



- -> Unplug connector -2- of knock sensor 1 -G61 in engine compartment.



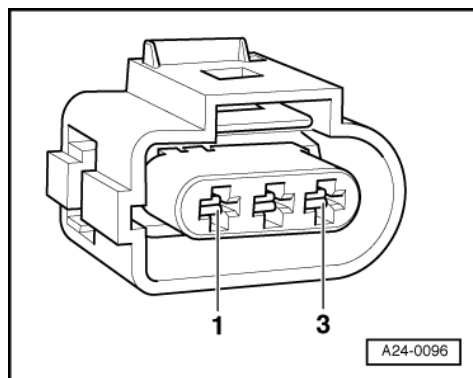
- -> Unplug connector -2- of knock sensor 2 -G66 in engine compartment.



- -> Check for short between all three contacts in the knock sensor connector (contacts 1+2, 1+3, 2+3).  
 - Specified value:  $\infty \omega$  (no continuity) - the wires must not be interconnected.  
 - 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; do not connect the engine control unit => Page 62 .



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

**Knock sensor -G61 (bank 1)**

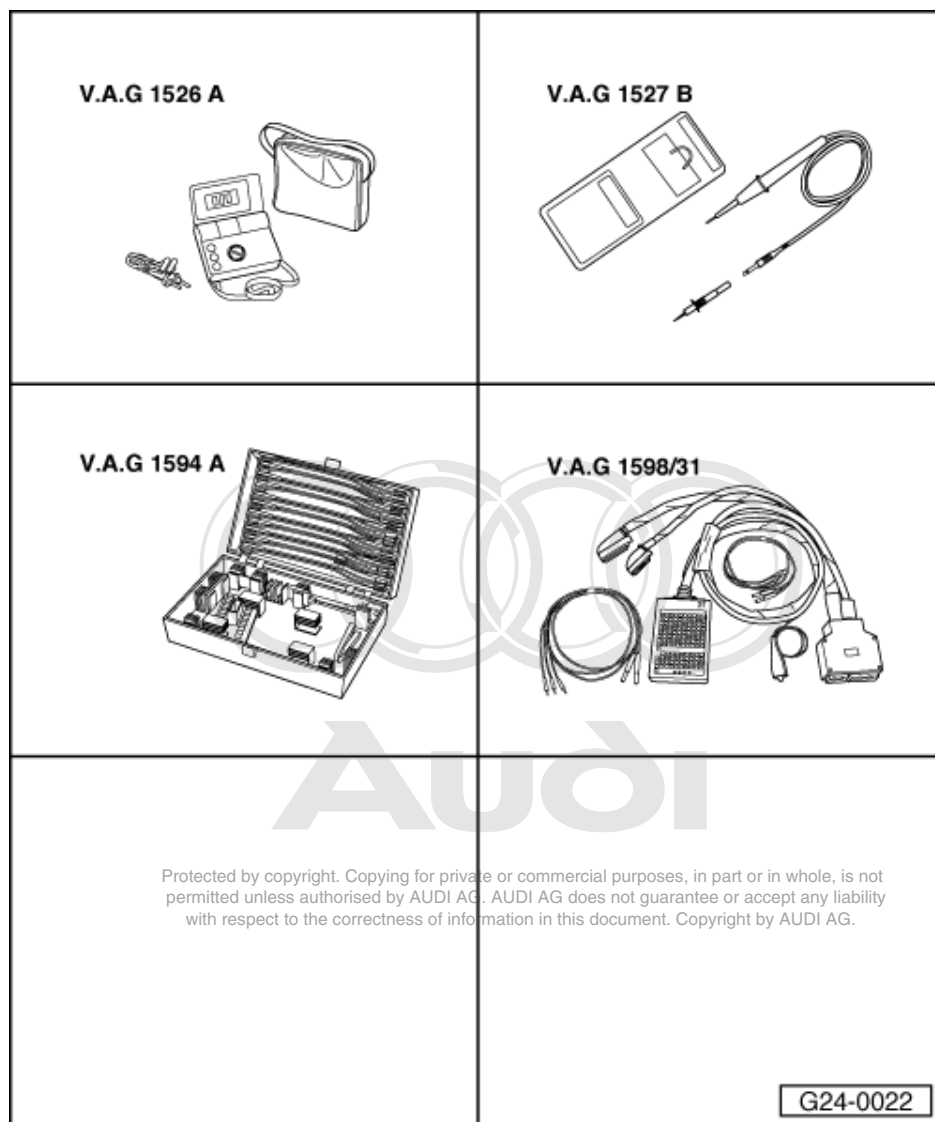
Connector Contact	Test box V.A.G 1598/31 Socket
1 (signal)	106
2 (earth)	99
3 (screening)	108

**Knock sensor -G66 (bank 2)**

Connector Contact	Test box V.A.G 1598/31 Socket
1 (signal)	107
2 (earth)	99
3 (screening)	108

- Rectify any open/short circuit as necessary.
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## 1.13 - Checking Hall sender



### Special tools and workshop equipment required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1527 B
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/31

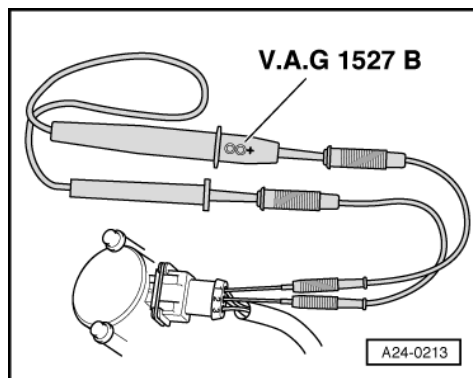
Fitting location => Fitting locations overview, Page 45

### Notes:

- ◆ Hall sender -G40 is located at rear of left cylinder head (bank 2).
- ◆ Hall sender -G163 is located at front of right cylinder head (bank 1).

### Checking actuation

- Push back rubber grommet of connector for respective Hall sender but leave connector attached.



- -> Connect voltage tester V.A.G 1527 B between receptacle 2 (Hall sensor signal) and receptacle 1 (positive).

**Note:**

*Sockets are numbered accordingly on the back of the connector.*

- Operate the starter for a few seconds.
  - The LED should flash briefly every second engine revolution.

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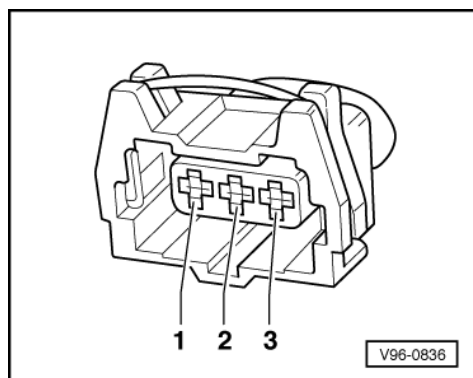
**Note:**

*Voltage testers with a low current consumption continue to glow faintly between actuation from the engine control unit (rather than extinguishing completely) and become much brighter when actuated.*

If LED does not flash:

**Checking power supply**

- Disconnect connector from relevant Hall sender.
- Switch the ignition on.

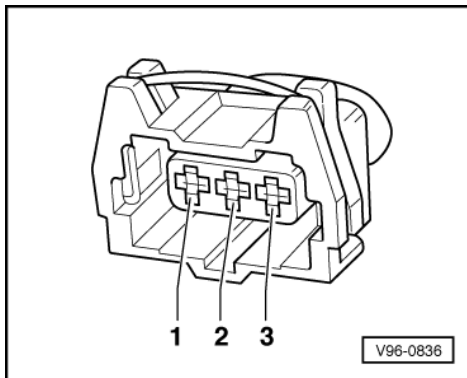


- -> Connect multimeter as follows to measure voltage:

Connector Contact	Measure to
1	Engine earth

- Specified value: approx. 5 V

### Checking signal wire



- -> Connect multimeter as follows to measure voltage:

Connector Contact	Measure to
2	Engine earth

- Specified value: approx. battery voltage

### Checking earth wire

- Connect multimeter as follows to measure voltage:

Connector Contact	Measure to
3	Battery positive

- Specified value: approx. battery voltage  
Rectify any open/short circuit as necessary.

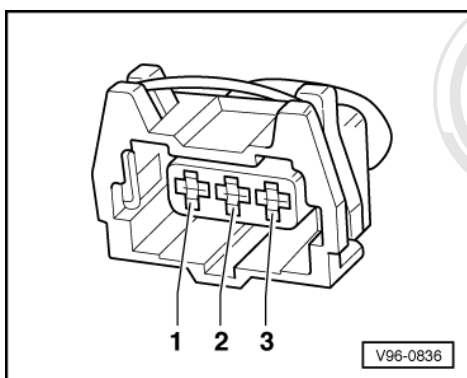
If the specified values are all achieved and the diode test lamp does not flash (measured between contacts 1 and 2 with starter connector attached),

- Replace relevant Hall sender.

If the specified values are not obtained:

### Checking wiring between Hall sender and engine control unit.

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 62 .



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



## Hall sender -G40 (bank 2)

Connector Contact	Test box V.A.G 1598/31 Socket
1 (positive)	98
2 (signal)	86
3 (earth)	108

## Hall sender -G163 (bank 1)

Connector Contact	Test box V.A.G 1598/31 Socket
1 (positive)	98
2 (signal)	87
3 (earth)	108

- Rectify any open/short circuit as necessary.
- If a trial erasure of the fault memory is followed by the replaced indication of a fault relating to the camshaft sensor (Hall sender) although all previous tests were OK, the following faults are possible:
  - Rotor ring for Hall sender misaligned

## Check phase position of Hall sender

- Connect vehicle diagnostic testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "Address word" 01 => Page 1 AG.  
For this purpose, the engine must be running at idle speed.

-&gt; Indicated on display

Rapid data transfer      HELP  
Select function XX

- Enter "08" to select the function "Reading measured value block" and confirm entry with Q-key.

-&gt; Indicated on display

Reading measured value block      Q  
Enter display group number XXX

- Enter "093" for "display group number 093" and confirm entry with Q-key.

-&gt; Indicated on display

Read measured value block 93  
1      2      3      4

- Check specified values for Hall sender.

	Display zones			
	1	2	3	4
Display group 093: Phase locations of Hall senders (bank 1 and bank 2), engine idling				
Display	xxx rpm	xx %	°Crankshaft	°Crankshaft
Display	Engine speed	Engine load	Phase location bank 1	Phase location bank 2
Range			-20...15 °crankshaft	-20...15 °crankshaft
Specified value	650...750 rpm	12...26 %	-20...15 °crankshaft	-20...15 °crankshaft

	Display zones	
<b>Note</b>		<p>If the specifications are not attained, unscrew Hall sender and check to ensure that the rotor ring is correctly mounted on the camshaft (if it is incorrectly installed, the catch will be pressed flat when the securing screw is tightened).</p> <p>- Additionally check valve timing</p> <p>=&gt; Engine, Mechanical Components; Repair group 13; Removing and installing toothed belt</p>

If specifications are attained:

- Press ➔-key.

-> Display function selection):

Rapid data transfer	HELP
Select function XX	

## 1.14 - Checking misfire detection

### Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "Address word" 01 => Page **1**  
For this purpose, the engine must be running at idle speed.

-> Indicated on display

Rapid data transfer	HELP
Select function XX	

- Enter "08" to select the function "Reading measured value block" and confirm entry with Q-key.

-> Indicated on display

Reading measured value block	Q
Enter display group number XXX	

- Enter "014" for "display group number 014" and confirm entry with Q-key.

-> Indicated on display

Read measured value block	14
1      2      3      4	

- Check misfire detection in display zones 3 and 4.

	Display zones			
	1	2	3	4
<b>Display group 014: Misfire detection</b>				
<b>Display</b>	xxxx rpm	xxx %	xxx	---
<b>Display</b>	Engine speed	Load	Total misfires	Misfire detection
<b>Range</b>				activated blocked
<b>Specified value</b>	xxxx rpm		0	activated
<b>Note</b>			If nominal value is exceeded: Checking misfire of the individual cylinders => Page <b>188</b>	In certain operating status e.g. in overrun the misfire recognition is blocked



If specified value is attained:

- Press ➡-key.

-> Display function selection):

Rapid data transfer	HELP
Select function XX	

If specified value is not attained:

- Press C-key.

### Checking misfire recognition of the individual cylinder

-> Indicated on display

Reading measured value block	Q
Enter display group number XXX	

- Enter "015" for "display group number 015" and confirm entry with Q-key.

-> Indicated on display

Read measured value block	15
1 2 3 4	

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- Check misfire recognition 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 189			---

- Press C-key.

-> Indicated on display

Reading measured value block	Q
Enter display group number XXX	

- Enter "014" for "display group number 014" and confirm entry with Q-key.

-> Indicated on display

Read measured value block	16
1 2 3 4	

- Check misfire recognition 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 zones			
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 <b>189</b>			---

Evaluation display group 014, display zone 3 and display groups 015 and 016, display zones 1, 2 and 3

Indicated on display	Possible causes of fault	Fault remedy
Higher than 0	- Defective spark plug - Defective spark plug connector - Ignition coil or output stage defective	- Check spark plugs and ignition wiring with connectors Check ignition coils and output stages =>Page <b>163</b>
	- Injector defective	- Check injectors =>Page <b>76</b>
	- Poor compression on one or more cylinders	- Check compression: => Repair group 15; Removing and installing cylinder head; Check compression Check compression



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