Audi A8 1994 ➤

Motronic Injection and Ignition System (8-cylinder)									
Engine ID	AQG	AQF	AQH	ARU	AKC	AUW	AVN	AVP	

Edition 01.1999

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

Audi A8 1994 ➢

Motronic Injection and Ignition System (8-cylinder)

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 term "self-diagnosis" relates specifically to the electrical and electronic part of the control system.

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

The advantages of self-diagnosis can only be fully exploited by using the vehicle diagnostic, testing and information system VAS 5051 or the fault reader V.A.G 1551, in operating mode 1 "Rapid data transfer".

Functions which the vehicle diagnostic, testing and information system VAS 5051 or the fault reader V.A.G 1551 can register => Page 1 , List of selectable functions.

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

Important:

- If the engine control unit detects faults which result in a deterioration of exhaust emissions, these faults will be indicated by illumination of exhaust gas warning lamp (MIL) in dash panel insert.
  Explanations on this lamp => Page 2 .
- Faults related to the electronic throttle are additionally indicated by the warning lamp for the electronic throttle control ("EPC warning lamp") which is situated in the dash panel insert.

Explanations on this lamp => Page 3 .

Functions which can be selected when using fault reader V.A.G 1551

The conditions to be met when selecting the desired functions are given in the following table.

Address words and functions on Fault reader V.A.G 1551		Ignition on, engine stopped	Engine running at idle	Vehicle running
Address words				
00	Automatic test sequence	yes	yes	yes
01	Engine electronics	yes	yes	yes
Functions				
01	Interrogating control unit version	yes	yes	yes
02	Interrogating fault memory	yes	yes	yes
03	Final control diagnosis	yes	no	no
04	Basic setting	yes	yes	yes
05	Erasing fault memory	yes	yes	yes
06	End of output	yes	yes	yes
07	Encoding control unit	yes	no	no

08	Reading measured value block	yes	yes	yes

Mode under address word 33:	
Mode 1: Transfer diagnostic data	Switch on ignition or leave engine idling
Mode 2: Transfer operating conditions	Switch on ignition or leave engine idling
Mode 3: Interrogating fault memory	Switch on ignition or leave engine idling
Mode 4: Erasing diagnostic information	Switch on ignition or leave engine idling
Mode 5: Output of lambda probe signals	Switch on ignition or leave engine idling
Mode 6: Transferring measured values	Switch on ignition or leave engine idling
Mode 7: Interrogating fault memory	Switch on ignition or leave engine idling
Mode 8: Checking tank system for leaks	Switch on ignition or leave engine idling
Mode 9: Reading of vehicle information	Allow engine to idle.

Mode 1 to mode 9 can be selected under address word 33.

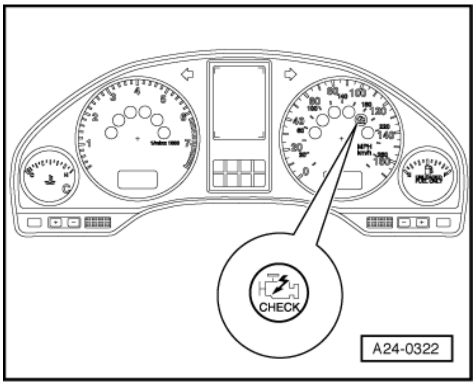
Individual measured values can be read out under mode 1. Mode 1 is not recommended for the Audi workshop as this data can also be read out in greater detail under address word 01/function 04 or function 08. Mode 2 shows the operating conditions under which a fault was recognised. The fault memory was interrogated with mode 3 and erased with mode 4.

Under mode 5 the static size of the lambda probes required by law is shown. As these sizes are not directly related to the lambda probe diagnosis, mode 5 is insignificant for the Audi workshop. All measured values of components and systems which are not monitored continually can be interrogated with mode 6. Mode 7 can be used to interrogate faults where the malfunction indicator light (MIL) has not yet been switched on as the fault has not yet been confirmed (MIL is not on, no fault under mode 3).

- Mode 8 is used to check tank for leaks.
- The following vehicle information can be read out with mode 9: Chassis number, part number and program/data status of engine control unit and the check total (this value is an internally calculated value).

1.3 - Significance of exhaust warning lamp -K83 MIL (Malfunction Indicator Lamp)

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



-> -> Fitting location of exhaust gas warning lamp

Note:

When switched on, the exhaust gas warning lamp may flash or illuminate constantly. In any case the fault memory must be interrogated => Page 9 .

Flashing of exhaust warning lamp

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

Continuous light of exhaust warning lamp

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

Functional check:

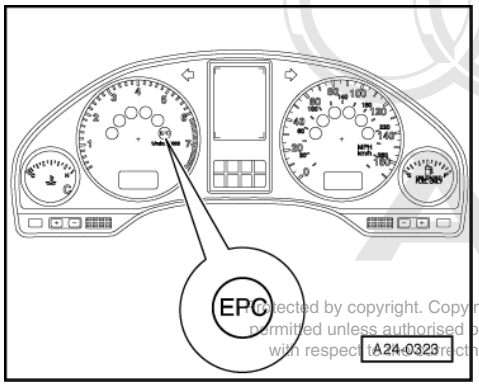
- Switch on ignition

The exhaust warning lamp must illuminate.

- If exhaust warning lamp does not illuminate, interrogate fault memory => Page 9 .

1.4 - Significance of the EPC warning lamp -K132 (fault warning lamp for electronic throttle)

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



-> Fitting location of the EPC warning lamp

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

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

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

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

Functional check on warning lamp

- Start the engine.

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

If the EPC warning lamp does not come on:

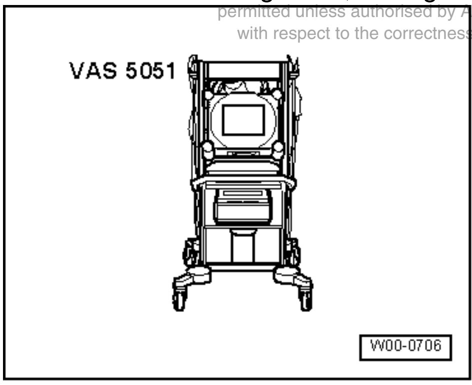
- Check wiring from engine control unit to EPC warning lamp in dash panel.

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

- Interrogate fault memory of engine control unit => Page 9 .

1.5 - Connecting vehicle diagnostic, testing and information system VAS 5051 and selecting control unit for engine electronics

All functions which have until now been performed with the V.A.G 1551/1552, can also be performed with the new tester vehicle diagnostic, testing and information system VAS 5051 in vehicle self-diagnosis mode:



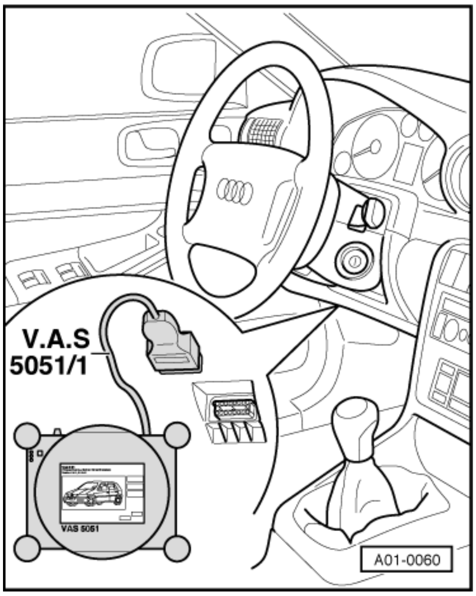
=> Operating instructions for vehicle diagnostic, testing and information system VAS 5051

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

- VAS 5051 vehicle diagnostic, testing and information system

Test conditions

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



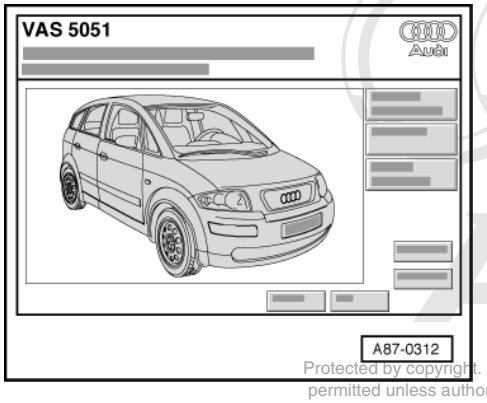
Procedure

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

Important
- **When driving the vehicle for measurement and test purposes, always secure the vehicle diagnostic, testing and information system VAS 5051on the rear seat only and operate it from this position.**
- **Observe the safety precautions => Page 57**

Depending on the function required:

- Switch on ignition

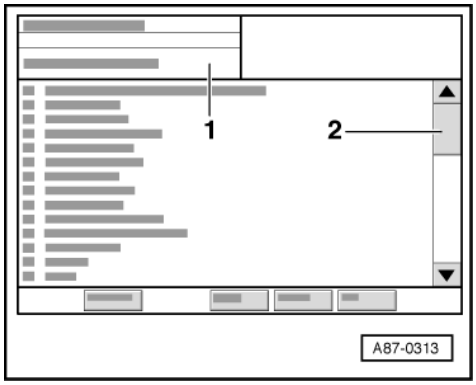


or

start engine => Page 1 , "Selectable functions" table.

Selecting operating mode:

- -> Select function "Vehicle self-diagnosis" on VAS 5051.



-> Indicated on display:

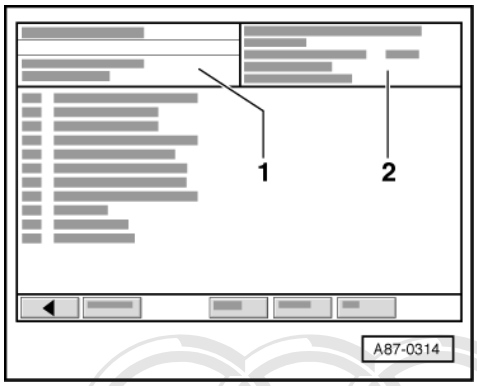
Selecting vehicle system:

Select engine control unit 1 -J220

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

Notes:

- The prompt for selection of a vehicle system appears in display zone -1-.
- Vehicle systems (for all vehicle types and equipment) which are intended for self-diagnosis but at present cannot be displayed on the screen, can be displayed by "rolling " the screen display with scroll bar -2-.

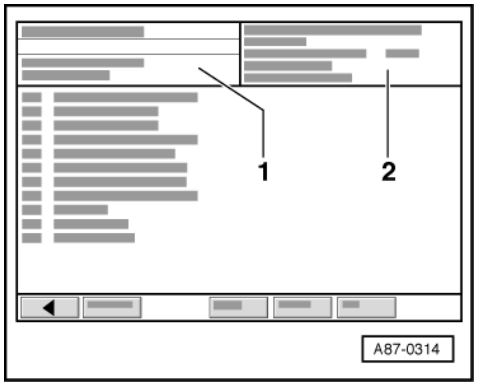


-> Wait until "Select diagnostic function" appears in the display zone -1- on the VAS 5051 display.

The control unit identification and the coding appear in display zone -2-, e.g.:

- 4D0 907 409..	Control unit number (see also spare parts list)
- 4.2l	Engine capacity
- V8 / 5V	Type of engine (V engine, 8-Cyl., 5-valve)
- G	"G" appears in vehicles with cruise control system
- D00	Control unit software version
- Code 07753	Coding of engine control unit (Coding of engine control unit => Page 41)
- WSC 12345	Workshop Code of fault reader which was used to carry out last coding

Selecting diagnostic function:



At this point all diagnostic functions are available.

- -> Select the desired function on the display.
- For further procedure see repair sequences.

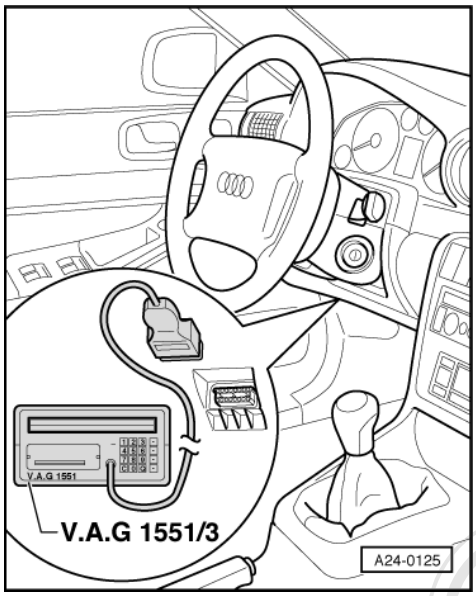
Notes:

- The display zones are displayed in function 04 - Basic setting or 08 - Reading measured value block, from the top downwards.

- If the displays shown in the procedure do not appear in the display:

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

1.6 - Connecting fault reader V.A.G 1551 and selecting engine electronics control unit



Test conditions

- Fuse for engine electronics OK.
- Fuel pump relay OK
- Battery voltage at least 11 V
- Earth connections on engine and gearbox OK.

- Switch ignition off.
- -> Connect fault reader V.A.G 1551 with diagnostic wire V.A.G 1551/3A.

Note:

- The diagnostic connection is located in the front left knee protector.

Important
- **When driving the vehicle for measurement and test purposes, always secure the fault reader VAS 1551on the rear seat only and operate it from this position.**
- **Observe the safety precautions => Page 57**

Note:

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

-> Indicated on display:

```
V.A.G self diagnosis     HELP
1 - Rapid data transfer*
2 - Flash code output*
```

*Displays appear alternately

- If no display appears, check diagnostic wires:

=> "Current Flow Diagrams, Electrical Fault-finding and Fitting Locations" binder; Fault-finding program "Diagnostic wiring"

Depending on the function required:

- Switch the ignition on.

or

start engine => Page 1 , "Selectable functions" table.

- Switch on printer using the Print button (Warning lamp in switch illuminates).
- Press key 1 for "Rapid data transfer".

-> Indicated on display:

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

```
Rapid data transfer      Q
01 - Engine electronics
```

-> Press keys 0 and 1 for address word "Engine electronics" and press the Q key to confirm entry.

-> If the display shows one of the messages, run through the fault finding procedure as described in the diagnosis management fault finding program.

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


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

```
Rapid data transfer      HELP
Communication problem
```

```
Rapid data transfer      HELP
K-wire not switching to earth
```

```
Rapid data transfer      HELP
K-wire not switching to positive
```

-> The display on fault reader V.A.G 1551 shows the control unit identification code e.g.:

```
4D0907558.. 4.2l V8/5V     G     D.
Code 07753     WSC 06388
```

- 4D0907558...	Control unit number (current control unit version - see Parts list)
- 4.2 l	Engine capacity
- V8 / 5V	Type of engine (V engine, 8-Cyl., 5-valve)
- G	"G" appears in vehicles with cruise control system
- D...	Software version of the control unit => Page 41
- Code 07753	Coding of engine control unit => Page 41
- WSC 06388	Workshop Code from V.A.G 1551 which was used to perform the last coding

Notes:

- Incorrect coding may lead to higher emissions and increased strain on the automatic gearbox resulting from harsh gearshift jolts.

- A wrong coding also leads to storing of faults in the fault memory which are not present.

If the coding differs from the vehicle version, then:

- Checking engine control unit coding
  =>Page 41 , code engine control unit
- Press ⇒key.

-> Indicated on display: (relevant chassis number)

```
WAUZ4DZYN000126     AUZ7ZOW0801181
```

- WAUZZZ4DZXN002341: 17-digit vehicle identification no. (Chassis number)
- AUZ7Z0X0590944: 14-digit identification number for immobiliser control unit

- Press ⇒key.

-> Indicated on display:

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

Note:

Press HELP key to obtain a printout of available functions.

2 - Interrogating and erasing fault memory

2.1 - Interrogating and erasing fault memory

Important note:

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

- Connect the 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 7 .
  For this purpose, the engine must be running at idling speed.
- Switch on printer using the Print button
  (Warning lamp in switch illuminates).

-> Indicated on display:

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


Operate fault reader, taking into account the information on the display:

- Press keys 0 and 2 for "Interrogate fault memory" function and press Q key to confirm entry.

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

```
X fault(s) detected
```

If no fault is stored:

- Press ⇒key.

If one or more faults are stored:

The stored faults are displayed and printed out one after the other.

-> The display then shows the following:

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

- Locate and eliminate faults listed on printout as per fault table => Page 11 .
- Press keys 0 and 5 for the "Erase fault memory" function and press the Q key to confirm entry.

-> Indicated on display:

```
Rapid data transfer
Fault memory is erased
```

Note:

If the ignition is switched off between interrogating the fault memory and erasing the fault memory, then the fault memory will not be erased. It is therefore important to follow the procedure exactly, i.e. first interrogate the fault memory and then erase it.

- Press ⇒key.

-> Indicated on display:

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

- Press keys 0 and 6 for the "End output" function and press the Q key to confirm entry.

Note:

During test and assembly work, faults such as detached connectors may also be recognised by other control units. Therefore on completion, the fault memories of all the control units must be interrogated and erased. The automatic test sequence must be carried out.

Automatic test sequence

- Press key 0 twice for the address word "Automatic test sequence" and confirm entry with the Q key. The V.A.G 1551 transmits all known address words in sequence.

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 - SELF-DIAGNOSIS     HELP
1 - Rapid data transfer*
2 - Flash code output*
```

- Erase all fault memories and then carry out a test run.
- Interrogate the fault memories of all control units again using the "automatic test sequence". No faults must be stored in the fault memory.

If no fault is stored:

- Press ⇒key.

-> Indicated on display:

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

- Press keys 0 and 6 for the function "End data transfer" and confirm entry with the Q key.

3 - Fault table (16486 to 17607)

3.1 - Fault table (16486 to 17607)

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 relevant to the "electronic throttle" are additionally indicated by a warning light ("EPC warning light") located in the dash panel.
- Faults which cause deterioration of the exhaust emissions are displayed via an exhaust warning lamp (MIL) which is also located in the dash panel insert. Some faults cause the exhaust gas warning lamp to switch on immediately after detection. There are also faults where the exhaust warning lamp is only switched on when the fault is recognised again after engine was started again.
- 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, idling may be irregular for a short period.
  In addition, the following adaption procedures must be performed=>Page 136 .

- 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.
- Do not immediately renew components indicated as faulty by the V.A.G 1551 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).

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0101	16485	Air mass meter -G70 Implausible signal	Check air mass meter =>Page 88 .
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 92 .
P0113	16497	Intake air temperature sender -G42 Signal too great 1)	
P0116	16500	Coolant temperature sender -G62 Implausible signal 1)	Check coolant temperature sensor =>Page 93 .
P0117	16501	Coolant temperature sender -G62 Signal too small 1)	
P0118	16502	Coolant temperature sender -G62 Signal too great 1)	

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0130	16514	Bank 1, probe 1 Electrical fault in circuit 1)	Check lambda probe heating for lambda probe =>Page 108 .
P0131	16515	Bank 1, probe 1 Voltage too low 1)	Lambda probe signal wiring and actuation =>Page 111 .
P0132	16516	Bank 1, probe 1 Voltage too high 1)	

Fault code		Fault readout	Fault remedy
P0133	16517	Bank 1, probe 1 Signal too slow 1)	
P0134	16518	Bank 1, probe 1 No activity 1)	Check lambda probe heating =>Page 108 .

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0136	16520	Bank 1, probe 2 Electrical fault in circuit 1)	Check lambda probe heating for lambda probe =>Page 108 .
P0137	16521	Bank 1, probe 2 Voltage too low 1)	Lambda probe signal wiring and actuation =>Page 111 .
P0138	16522	Bank 1, probe 2 Voltage too high 1)	
P0140	16524	Bank 1, probe 2 No activity 1)	Check lambda probe heating =>Page 108 .

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0150	16534	Bank 2, probe 1 Electrical fault in circuit 1)	Check lambda probe heating =>Page 108 .
P0151	16535	Bank 2, probe 1 Voltage too low 1)	Lambda probe signal wiring and actuation =>Page 111 .
P0152	16536	Bank 2, probe 1 Voltage too high 1)	
P0153	16537	Bank 2, probe 1 Signal too slow 1)	
P0154	16538	Bank 2, probe 1 No activity 1)	Check lambda probe heating for lambda probe =>Page 108 .

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0156	16540	Bank 2, probe 2 Electrical fault in circuit 1)	Check lambda probe heating =>Page 108 .
P0157	16541	Bank 2, probe 2 Voltage too low 1)	Lambda probe signal wiring and actuation =>Page 111 .
P0158	16542	Bank 2, probe 2 Voltage too high 1)	
P0160	16544	Bank 2, probe 2 No activity 1)	Check lambda probe heating for lambda probe =>Page 108 .

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0300	16684	Misfire detected 1)	- Check misfire detection => Page 162 - Refuel the vehicle
P0301	16685	Cyl. 1 misfire detected 1)	
P0302	16686	Cyl. 2 misfire detected 1)	
P0303	16687	Cyl. 3 misfire detected 1)	
P0304	16688	Cyl. 4 misfire detected 1)	
P0305	16689	Cyl. 5 misfire detected 1)	
P0306	16690	Cyl. 6 misfire detected 1)	
P0307	16691	Cyl. 7 misfire detected 1)	
P0308	16692	Cyl. 8 misfire detected 1)	

Note:

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

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0321	16705	Engine speed sender -G28 Implausible signal 1)	Check engine speed sender =>Page 163
P0322	16706	Engine speed sender -G28 No signal 1)	
P0327	16711	Knock sensor 1 -G61 Signal too small	Check knock sensor =>Page 165
P0328	16712	Knock sensor 1 -G61 Signal too great	
P0332	16716	Knock sensor 2 -G66 Signal too small	
P0333	16717	Knock sensor 2 -G66 Signal too great	

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0340	16724	Camshaft positioning sensor Fault 1)	Check Hall sender =>Page 166
P0341	16725	Camshaft sensor =>sender -G40 Implausible signal 1)	
P0346	16730	Camshaft pos sensor =>sender -G163 Implausible signal 1)	

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

Fault code	Fault readout	Fault remedy

SAE	V.A.G		
P0420	16804	Bank 1, catalytic converter system Inefficient 1)	Produce readiness code =>Page 44 Replace relevant catalytic converter
P0421	16805	Primary catalytic converter, Bank 1 Inefficient	
P0422	16806	Bank1, main catalytic converter Inefficient 1)	
P0430	16814	Bank 2, catalytic converter system Inefficient 1)	
P0431	16815	Primary catalytic converter, Bank 2 Inefficient	
P0432	16816	Bank 2, main catalytic converter Inefficient 1)	

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0441	16825	Fuel tank breather system Throughput faulty 1)	Check solenoid valve 1 for activated charcoal filter, perform final control diagnosis => Page 28
P0501	16885	Vehicle speed signal Implausible signal 1)	Interrogate dash panel => Electrical System; Repair group 01; Self-diagnosis of dash panel; Interrogating fault memory

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0560	16944	Voltage supply Implausible signal	Check supply voltage to engine control unit
P0562	16946	Voltage supply Voltage too low	
P0563	16947	Voltage supply Voltage too high	
P0571	16955	Brake light switch -F Implausible signal	Check brake light switch and brake pedal switch => Page 143
P0601	16985	Control unit defective 1)	Replacing engine control unit =>Page 66
P0604	16988	Control unit defective 1)	
P0605	16989	Control unit defective 1)	
P0606	16990	Control unit defective 1)	
P0685	17069	Main relay => -J271 Open circuit 1)	Check power supply relay for Motronic system -J271 =>Page 85
P0686	17070	Main relay => -J271 Short to earth 1)	
P0687	17071	Main relay => -J271 Short to positive 1)	

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

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

P1102	17510	Bank 1, lambda probe 1, heating circuit Short to positive 1)	Check lambda probe heating =>Page 108
P1105	17513	Bank 1, probe 2, heating circuit Short to positive 1)	
P1107	17515	Bank 2, lambda probe 1, heating circuit Short to positive 1)	
P1110	17518	Bank 2, probe 2, heating circuit Short to positive 1)	

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1111	17519	Lambda control (bank 1) System too lean	Check lambda probe learned values and lambda control =>Page 98
P1112	17520	Lambda control (bank 1) System too rich	
P1113	17521	Bank 1, probe 1 Internal resistance too high 1)	Check lambda probe heating for lambda probe => Page 108 Check lambda probe signal wiring and actuation =>Page 111
P1114	17522	Bank 1, probe 2, Internal resistance too high 1)	
P1115	17523	Bank 1, lambda probe 1, heating circuit Short to earth 1)	Check lambda probe heating for lambda probe => Page 108
P1116	17524	Bank 1, lambda 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)	

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1119	17527	Bank 2, lambda probe 1, heating circuit Short to earth 1)	Check lambda probe heating =>Page 108
P1120	17528	Bank 2, lambda 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) With this fault the engine control unit only switches on exhaust gas warning lamp (MIL), if fault has been re-detected after two engine re-starts. Significance of MIL warning lamp => 2

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1127	17535	Bank 1, mixture adaption (mult.) System too rich 1)	Perform road test (fuel in oil) Check fuel system pressure =>Page 74

Fault code		Fault readout	Fault remedy
P1128	17536	Bank 1, mixture adaption (mult.) System too lean 1)	Check air mass meter =>Page 88
P1129	17537	Bank 2, mixture adaption (mult.) System too rich 1)	Check lambda probe upstream of catalytic converter => Page 103
P1130	17538	Bank 2, mixture adaption (mult.) System too lean 1)	Check injectors =>Page 78
P1131	17539	Bank 2, probe 1 Internal resistance too high 1)	Check lambda probe heating for lambda probe => Page 111

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

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 1)	Perform road test (fuel in engine oil)
P1137	17545	Bank 1, mixture adaption (add.) System too rich 1)	Check fuel system pressure =>Page 74
P1138	17546	Bank 2, mixture adaption (add.) System too lean 1)	Check air mass meter =>Page 88
P1139	17547	Bank 2, mixture adaption (add.) System too rich 1)	Check lambda probe upstream of catalytic converter=> Page 129

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

Note:

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1140	17548	Bank 2, probe 2 Internal resistance too high 1)	Check lambda probe heating for lambda probe => Page 111
P1141	17549	Load recognition Implausible value 1)	Check whether the correct throttle valve control part was installed (see part number) Test air mass meter =>Page 88
P1143	17551	Load recognition Limit exceeded	Replacing engine control unit =>Page 66
P1147	17555	Lambda control, bank 2 System too lean	Check lambda probe learned values and lambda control =>Page 98
P1148	17556	Lambda control, bank 2 System too rich	

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

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

P1149	17557	Lambda control, bank 1 Implausible control value	Check lambda probe learned values and lambda control => Page 98 Check fuel system pressure =>Page 74 Check unmetered air
P1150	17558	Lambda control, bank 2 Implausible control value	
P1171	17579	Angle sender 2 for throttle valve actuator -G188 Implausible signal 1) 2)	Check angle sender for throttle valve actuator =>Page 138
P1172	17580	Angle sender 2 for throttle valve actuator -G188 Signal too small 1)2)	
P1173	17581	Angle sender 2 for throttle valve actuator -G188 Signal too great 1) 2)	
P1176	17584	Bank 1, lambda correction downstream of catalytic converter Control limit reached	Check lambda probe ageing of lambda probe upstream of catalytic converter =>Page 100
P1177	17585	Bank 2, lambda correction downstream of catalytic converter Control limit reached	Check lambda probe and lambda control downstream of catalytic converter =>Page 103

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

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		Check lambda probe heating for lambda probe => Page 108
P1198	17606	Bank 1, probe 2, Electrical fault in heating circuit 1)	
P1199	17607	Bank 2, probe 2 Electrical fault in heating circuit 1)	

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

4 - Fault table (17609 to 18261)

4.1 - Fault table (17609 to 18261)

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 relevant to the "electronic throttle" are additionally indicated by a warning light ("EPC warning light") located in the dash panel.
- Faults which cause deterioration of the exhaust emissions are displayed via an exhaust warning lamp (MIL) which is also located in the dash panel insert. Some faults cause the exhaust gas warning lamp to switch on immediately after detection. There are also faults where the exhaust warning lamp is only switched on when the fault is recognised again after engine was started again.
- 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, idling may be irregular for a short period.
  In addition, the following adaption procedures must be performed=>Page 136 .

- 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.

- Do not immediately renew components indicated as faulty by the V.A.G 1551 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).

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1201	17609	Injector, cylinder 1 -N30 Electrical fault in circuit 1)	Check injectors =>Page 78
P1202	17610	Injector, cylinder 2 -N31 Electrical fault in circuit 1)	
P1203	17611	Injector, cylinder 3 -N32 Electrical fault in circuit 1)	
P1204	17612	Injector, cylinder 4 -N33 Electrical fault in circuit 1)	
P1205	17613	Injector, cylinder 5 -N83 Electrical fault in circuit 1)	
P1206	17614	Injector, cylinder 6 -N84 Electrical fault in circuit 1)	
P1207	17615	Injector, cylinder 7 -N85 Electrical fault in circuit 1)	
P1208	17616	Injector, cylinder 8 -N86 Electrical fault in circuit 1)	

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1213	17621	Injector, cylinder 1 -N30 Short to positive 1)	Check injectors =>Page 78
P1214	17622	Injector, cylinder 2 -N31 Short to positive 1)	
P1215	17623	Injector, cylinder 3 -N32 Short to positive 1)	
P1216	17624	Injector, cylinder 4 -N33 Short to positive 1)	
P1217	17625	Injector, cylinder 5 -N83 Short to positive 1)	
P1218	17626	Injector, cylinder 6 -N84 Short to positive 1)	
P1219	17627	Injector, cylinder 7 -N85 Short to positive 1)	
P1220	17628	Injector, cylinder 8 -N86 Short to positive 1)	

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1225	17633	Injector, cylinder 1 -N30 Short to earth 1)	Check injectors =>Page 78
P1226	17634	Injector, cylinder 2 -N31 Short to earth 1)	

Fault code		Fault readout	Fault remedy
P1227	17635	Injector, cylinder 3 -N32 Short to earth 1)	
P1228	17636	Injector, cylinder 4 -N33 Short to earth 1)	
P1229	17637	Injector, cylinder 5 -N83 Short to earth 1)	
P1230	17638	Injector, cylinder 6 -N84 Short to earth 1)	
P1231	17639	Injector, cylinder 7 -N85 Short to earth 1)	
P1232	17640	Injector, cylinder 8 -N86 Short to earth 1)	

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1237	17645	Injector, cylinder 1 -N30 Open circuit 1)	Check injectors =>Page 78
P1238	17646	Injector, cylinder 2 -N31 Open circuit 1)	
P1239	17647	Injector, cylinder 3 -N32 Open circuit 1)	
P1240	17648	Injector, cylinder 4 -N33 Open circuit 1)	
P1241	17649	Injector, cylinder 5 -N83 Open circuit 1)	
P1242	17650	Injector, cylinder 6 -N84 Open circuit 1)	
P1243	17651	Injector, cylinder 7 -N85 Open circuit 1)	
P1244	17652	Injector, cylinder 8 -N86 Open circuit 1)	

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1250	17658	Fuel level too low	- Resulting fault, see note Refuel vehicle, erase fault memory Interrogate fault memory of dash panel insert => Electrical System; Repair group 01; Dash panel insert self-diagnosis Dash panel insert self-diagnosis
P1296	17704	Fault in coolant system	Check coolant temperature sender -G62 =>Page 24-65 Check coolant thermostat => 8-cyl. Engine, Mechanical Components; Repair group 19; Removing and installing thermostat Removing and installing thermostat

Note:

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1325	17733	Knock control cylinder 1 Control limit reached	Check knock control =>Page 165
P1326	17734	Knock control cylinder 2 Control limit reached	
P1327	17735	Knock control cylinder 3 Control limit reached	
P1328	17736	Knock control cylinder 4 Control limit reached	
P1329	17737	Knock control cylinder 5 Control limit reached	
P1330	17738	Knock control cylinder 6 Control limit reached	
P1331	17739	Knock control cylinder 7 Control limit reached	
P1332	17740	Knock control cylinder 8 Control limit reached	

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1335	17743	Engine torque monitoring 2 Control limit exceeded 1) 2)	Check throttle valve control part => Page 66
P1336	17744	Engine torque monitoring Control limit exceeded	Replace engine control unit =>Page 66
P1337	17745	Bank 1, camshaft position sensor => -G40 Short to earth 1)	Check Hall sender =>Page 166
P1338	17746	Bank 1, camshaft position sensor => -G40 Open circuit/short to positive1)	
P1340	17748	Camshaft/crankshaft position sensor wrong allocation 1)	
P1347	17755	Bank 2, camshaft/crankshaft position sensor wrong allocation 1)	

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

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1355	17763	Ignition actuation, cylinder 1 Open circuit 1)	Output stages,
P1356	17764	Ignition actuation, cylinder 1 Short to positive 1)	checking 160

P1357	17765	Ignition actuation, cylinder 1 Short to earth 1)	
P1358	17766	Ignition actuation, cylinder 2 Open circuit 1)	
P1359	17767	Ignition actuation, cylinder 2 Short to positive 1)	
P1360	17768	Ignition actuation, cylinder 2 Short to earth 1)	
P1361	17769	Ignition actuation, cylinder 3 Open circuit 1)	
P1362	17770	Ignition actuation, cylinder 3 Short to positive 1)	
P1363	17771	Ignition actuation, cylinder 3 Short to earth 1)	

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1364	17772	Ignition actuation, cylinder 4 Open circuit 1)	Output stages,
P1365	17773	Ignition actuation, cylinder 4 Short to positive 1)	checking 160
P1366	17774	Ignition actuation, cylinder 4 Short to earth 1)	
P1367	17775	Ignition actuation, cylinder 5 Open circuit 1)	
P1368	17776	Ignition actuation, cylinder 5 Short to positive 1)	
P1369	17777	Ignition actuation, cylinder 5 Short to earth 1)	
P1370	17778	Ignition actuation, cylinder 6 Open circuit 1)	
P1371	17779	Ignition actuation, cylinder 6 Short to positive 1)	
P1372	17780	Ignition actuation, cylinder 6 Short to earth 1)	

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

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

P1373	17781	Ignition actuation, cylinder 7 Open circuit 1)	Output stages, checking 160
P1374	17782	Ignition actuation, cylinder 7 Short to positive 1)	
P1375	17783	Ignition actuation, cylinder 7 Short to earth 1)	
P1376	17784	Ignition actuation, cylinder 8 Open circuit 1)	
P1377	17785	Ignition actuation, cylinder 8 Short to positive 1)	
P1378	17786	Ignition actuation, cylinder 8 Short to earth 1)	

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		Replace engine control unit =>Page 66
P1386	17794	Control unit defective	
P1387	17795	Control unit defective	
P1388	17796	Control unit defective 1) 2)	
P1391	17799	Bank 2, camshaft position sensor => -G163 Short to earth 1)	Check Hall sender =>Page 166
P1392	17800	Bank 2, camshaft position sensor => -G163 Open circuit/ short to positive1)	
P1409	17817	Tank breather valve -N80 Electrical fault in circuit 1)	Check solenoid valve 1 for activated charcoal filter => Page 129
P1410	17818	Tank breather valve -N80 Short to positive 1)	

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

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

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

P1411	17819	Bank 2, secondary air system Throughput too small 1)	Check secondary air pump fuse Check vacuum hoses Check hoses from pump to secondary air inlet valve => 8-cyl. Engine, Mechanical Components; Repair group 26; Secondary air system
P1420	17828	Secondary air inlet valve - N112 Electrical fault in circuit 1)	Check secondary air-system =>Page 132
P1421	17829	Secondary air inlet valve - N112 Short to earth 1)	
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 hoses from pump to secondary air inlet valve => 8-cyl. Engine, Mechanical Components; Repair group 26; Secondary air system

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1425	17833	Tank breather valve -N80 Short to earth 1)	Check solenoid valve 1 for activated charcoal filter =>Page 129
P1426	17834	Tank breather valve -N80 Open circuit 1)	
P1432	17840	Secondary air inlet valve - N112 Open circuit 1)	Check secondary air-system =>Page 132
P1433	17841	Secondary air pump relay - J299 Open circuit 1)	Relay for secondary air system Checking => Page 134
P1434	17842	Secondary air pump relay - J299 Short to positive 1)	

P1435	17843	Secondary air pump relay - J299 Short to earth 1)	
P1436	17844	Secondary air pump relay - J299 Electrical fault in circuit 1)	

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1500	17908	Fuel pump relay -J17 Electrical fault in circuit 1)	Check fuel pump relay =>Page 74
P1502	17910	Fuel pump relay -J17 Short to positive 1)	

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1511	17919	Intake manifold changeover valve -N156 Electrical fault in circuit	Intake manifold changeover function Check => Page 118
P1512	17920	Intake manifold changeover valve -N156 Short to positive	
P1513	17921	Intake manifold changeover valve 2 -N261 Short to positive	
P1514	17922	Intake manifold changeover valve 2 -N261 Short to earth	
P1515	17923	Intake manifold changeover valve -N156 Short to earth	
P1516	17924	Intake manifold changeover valve -N156 Open circuit	
P1517	17925	Main relay => -J271 Electrical fault in circuit	Check power supply relay -J271 for Motronic => Page 85

P1519	17927	Bank 1, camshaft timing control Fault 1)	Check camshaft timing control => Page 170

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1520	17928	Intake manifold changeover valve 2 -N261 Open circuit	Intake manifold changeover function Check => Page 118
P1522	17930	Bank 2, camshaft timing control Fault 1)	Check camshaft timing control => Page 170
P1523	17931	Crash signal from airbag control unit Implausible signal	Test crash signal => Page 147
P1526	17934	Bank 1, camshaft timing control => -N205 Short to positive 1)	Check camshaft timing control => Page 170
P1527	17935	Bank 1, camshaft timing control => -N205 Short to earth 1)	
P1528	17936	Bank 1, camshaft timing control => -N205 Open circuit 1)	
P1529	17937	Camshaft timing control Short to positive 1)	
P1530	17938	Camshaft timing control Short to earth 1)	
P1531	17939	Camshaft timing control Open circuit 1)	

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1534	17942	Bank 2, camshaft timing control => -N208 Short to positive 1)	Check camshaft timing control => Page 170
P1535	17943	Bank 2, camshaft timing control => -N208 Short to earth 1)	
P1536	17944	Bank 2, camshaft timing control => -N208 Open circuit 1)	
P1539	17947	Clutch pedal switch -F36 Implausible signal	Check clutch pedal switch => Page 145

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1542	17950	Angle sender for throttle valve actuator -G187 Implausible signal 1) 2)	Check angle sender for throttle valve actuator =>Page 138
P1543	17951	Angle sender for throttle valve actuator -G187 Signal too small 1) 2)	
P1544	17952	Angle sender for throttle valve actuator -G187 Signal too great 1)	

P1545	17953	Throttle valve control Malfunction 1) 2)	Check throttle valve control part =>Page 136
P1558	17966	Throttle valve actuator -G186 Electrical fault in circuit 1) 2)	
P1559	17967	Throttle valve control part -J338 Fault in basic setting	

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

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		Check throttle valve control part =>Page 136
P1564	17972	Throttle valve control part -J338 Undervoltage during basic setting	
P1565	17973	Throttle valve control part -J338 Lower stop not reached 1) 2)	
P1568	17976	Throttle valve control part -J338 mechanical fault 1)	

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

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		Check cruise control system switch => Electrical System; Repair group 01; Self-diagnosis for cruise control system (CCS)
P1569	17977	CCS switch -E45 Implausible signal	
P1570	17978	Engine control unit disabled	Adapt electronic immobiliser to engine control unit => Electrical System; Repair group 01; Immobiliser Self-diagnosis
P1571	17979	Valve for engine mounting left -N144 Short to positive	Perform final control diagnosis =>Page 28 . Check valve for engine mounting =>Page 150 .
P1572	17980	Valve for engine mounting left -N144 Short to earth	
P1573	17981	Valve for engine mounting left -N144 Open circuit	

Fault code		Fault readout	Fault remedy
SAE	V.A.G		Perform final control diagnosis =>Page 28 Check valve for engine mounting =>Page 150
P1575	17983	Valve for engine mounting right -N145 Short to positive	
P1576	17984	Valve for engine mounting right -N145 Short to earth	
P1577	17985	Valve for engine mounting right -N145 Open circuit	
P1579	17987	Throttle valve control part -J338 Adaption not started	Check throttle valve control part Check => Page 136

P1602	18010	Voltage supply, terminal 30 Voltage too low	Battery discharged Check supply voltage to engine control unit =>Page 86
P1603	18011	Control unit defective 1)	Replace engine control unit =>Page 66
P1604	18012	Control unit defective 1) 2)	

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

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1609	18017	Crash cut-off was activated	Accident involving activation of airbag or Final control diagnosis was performed in airbag control unit; thus fault entry in engine control unit (Erase fault memory)
P1612	18020	Engine control unit incorrectly encoded	Encode engine control unit =>Page 41
P1624	18032	Request fault lamp on, active	Exhaust-related fault from gearbox control unit, MIL lamp is switched on by gearbox control unit Read out fault memory of gearbox control unit Automatic Gearbox 01L
P1626	18034	Data bus drive No message from gearbox-CU1)	Check CAN bus => Page 147

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

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1630	18038	Accelerator position sender -G79 Signal too small 1) 2)	Check accelerator position sender =>Page 140
P1631	18039	Accelerator position sender -G79 Signal too great 1) 2)	
P1633	18041	Accelerator position sender 2 -G185 Signal too small 1)2)	
P1634	18042	Accelerator position sender 2 -G185 Signal too great 1) 2)	
P1639	18047	Accelerator position sender -G79/G185 Implausible signal 1) 2)	
P1640	18048	Control unit defective 1)	Replace engine control unit =>Page 66 .
P1648	18056	Data bus drive Defective 1)	Check CAN bus => Page 154

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

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

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

P1649	18057	Data bus drive No message from ABS-CU	Check CAN bus => Page 154
P1650	18058	Data bus drive No message from dash panel 1)	Check CAN bus => Page 154
P1853	18261	Data bus drive Implausible message from ABS CU	Interrogate ABS fault memory => Running Gear Self-diagnosis for ABS, ESP; Repair group 01; Interrogating fault memory Check CAN bus => Page 154
P3262	19718	Exhaust bank 1 / 2 lambda probes exchanged according to cat.	Lambda probe connector for probes downstream from catalytic converter interchanged

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

5 - Final control diagnosis

5.1 - Final control diagnosis

for Vehicles up to Model Year 2001 =>Page 28

for Vehicles as of Model Year 2001 =>Page 34

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 the final control diagnosis the individual control elements are actuated (approx. 1 minute) or advance the program to the next control element 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.
- Engine must be started before repeating the final control diagnosis. (Engine control unit has to have recognised a speed greater than 300 rpm.)

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

Sequence for all vehicles up to Model Year 2001:

1. Solenoid valve 1 for activated charcoal filter -N80 (fuel tank breather valve)
2. Secondary air inlet valve -N112
3. Secondary air pump relay -J299
4. Intake manifold changeover solenoid valve -N156
5. Camshaft adjuster 1 (valve 1 -N205 for camshaft timing control and valve 2 -N208 for camshaft timing control)
6. Intake manifold changeover solenoid valve 2-N261 (omitted in S8-models)
7. Engine mounting 1 left (in direction of travel) (Not installed in all vehicles)
8. Engine mounting 2 right (in direction of travel) (Not installed in all vehicles)

9. Injector, cylinder 1 -N30 (Not installed in all vehicles)
10. Injector, cylinder 5 -N83 (Not installed in all vehicles)

11.	Injector, cylinder 4 -N33 (Not installed in all vehicles)
12.	Injector, cylinder 8 -N86 (Not installed in all vehicles)
13.	Injector, cylinder 6 -N84 (Not installed in all vehicles)
14	Injector, cylinder 3 -N32 (Not installed in all vehicles)
15.	Injector, cylinder 7 -N85 (Not installed in all vehicles)
16.	Injector, cylinder 2 -N31 (Not installed in all vehicles)

Fitting location of control elements => Page 59 .

Test conditions

- Fuses for engine electronics OK
- Fuel pump relay OK.

- Connect the 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 7 .
  For this purpose, the ignition must be switched on.

-> Indicated on display:

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

- Press keys 0 and 3 for "Final control diagnosis" function

-> Indicated on display:

```
Rapid data transfer        Q
03 - Final control diagnosis
```

- Confirm input with Q key.

Actuating solenoid valve 1 for activated charcoal filter -N80 (fuel tank breather valve)

- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Tank breather valve -N80
```

This solenoid valve will continue to be actuated (clicks) until the ⇒ key is pressed to switch to the next control element.

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

- Check solenoid valve 1 for activated charcoal filter -N80 => Page 129 .

Actuating secondary air inlet valve -N112

- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Secondary air inlet valve -N112
```

This solenoid valve will continue to be actuated (clicks) until the ⇒ key is pressed to switch to the next control element.

If the secondary air inlet valve does not click:

- Check secondary air inlet valve -N112
  =>Page 132 .

Actuating secondary air pump relay -J299

- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Secondary air pump relay -J299
```

Secondary air pump relay -J299 actuates secondary air pump motor -V101. This runs in intervals.

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

- Checking secondary air pump relay -J299 (in electronics box of plenum chamber on the right) => Page 134 .

Actuating intake manifold changeover solenoid valve -N156

- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Intake manifold changeover valve -N156
```

The solenoid valve must click.

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

- Checking intake manifold changeover solenoid valve -N156 => Page 118 .

Actuating valves for camshaft timing control

- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Camshaft timing control
```

- The solenoid valve for camshaft timing control -N205 and the solenoid valve 2 for camshaft timing control -N208 are actuated for approx. 1minute (click).

If the solenoid valve 1 or the solenoid valve 2 are not actuated (one solenoid valve or neither of the solenoid valves are not clicking).

- Check solenoid valves for camshaft timing control => Page 170 .

Actuating solenoid valve 2 for intake manifold changeover -N261 (check omitted in S8 models)

- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Intake manifold changeover valve 2 -N261
```

The solenoid valve must click.

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

- Checking intake manifold changeover solenoid valve 2 -N156 => Page 118 .

Check engine mounting on left and right

(Not installed in all vehicles)

- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Valve left for engine mounting -N144
```

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

- Check engine mounting => Page 150 .
- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Valve right for engine mounting -N145
```

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

- Check engine mounting => Page 150 .

Actuating injectors

(Not installed in all vehicles)

Note:

The injectors are actuated in firing order sequence, i.e. cyl. 1, cyl. 5, cyl. 4, cyl. 8, cyl. 6, cyl. 3, cyl. 7, cyl. 2.

- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 1 -N30
```

- Press ⇒key.

After the arrow key is pressed, the injector must click five times.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 1 -N30
```

If the injector does not click:

- Check injectors => Page 78 .
- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 5 -N83
```

- Press ⇒key.

After the arrow key is pressed, the injector must click five times.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 5 -N83
```

If the injector does not click:

- Check injectors => Page 78 .

- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 4 -N33
```

- Press ⇒key.

After the arrow key is pressed, the injector must click five times.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 4 -N33
```

If the injector does not click:

- Check injectors => Page 78 .
- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 8 -N86
```

- Press ⇒key.

After the arrow key is pressed, the injector must click five times.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 8 -N86
```

If the injector does not click:

- Check injectors => Page 78 .
- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 6 -N84
```


- Press ⇒key.

After the arrow key is pressed, the injector must click five times.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 6 -N84
```

If the injector does not click:

- Check injectors => Page 78 .

- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 3 -N32
```

- Press ⇒key.

After the arrow key is pressed, the injector must click five times.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 3 -N32
```


If the injector does not click:

- Check injectors => Page 78 .
- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 7 -N85
```

- Press ⇒key.

After the arrow key is pressed, the injector must click five times.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 7 -N85
```

If the injector does not click:

- Check injectors => Page 78 .
- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 2 -N31
```

- Press ⇒key.

After the arrow key is pressed, the injector must click five times.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 2 -N31
```

If the injector does not click:

- Check injectors => Page 78 .
- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
END
```

- Press ⇒key.

-> Display function selection):

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

Note:

The final control diagnosis can only then be started again after the engine has started and the ignition has been switched off and on again.

- Press keys 0 and 6 for the "End output" function and press the Q key to confirm entry.

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

Sequence for all vehicles as of Model Year 2001:

1. Solenoid valve 1 for activated charcoal filter -N80 (fuel tank breather valve)
2. Secondary air inlet valve -N112
3. Secondary air pump relay -J299
4. Intake manifold changeover solenoid valve -N156
5. Bank 2, camshaft timing control
6. Intake manifold changeover solenoid valve 2 -N261 (omitted in S8-models)
7. Engine mounting 1 left (in direction of travel)
8. Engine mounting 2 right (in direction of travel)
9. Bank 1, camshaft timing control

10. Injector, cylinder 1 -N30
11. Injector, cylinder 5 -N83
12. Injector, cylinder 4 -N33
13. Injector, cylinder 8 -N86
14. Injector, cylinder 6 -N84
15. Injector, cylinder 3 -N32
16. Injector, cylinder 7 -N85
17. Injector, cylinder 2 -N31

Fitting location of control elements => Page 59 .

Test conditions

- Fuses for engine electronics OK
- Fuel pump relay OK.

- Connect the 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 7 .
  For this purpose, the ignition must be switched on.

-> Indicated on display:

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

- Press keys 0 and 3 for "Final control diagnosis" function

-> Indicated on display:

```
Rapid data transfer      Q
03 - Final control diagnosis
```

- Confirm input with Q key.

Actuating solenoid valve 1 for activated charcoal filter -N80 (fuel tank breather valve)

- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Tank breather valve -N80
```

This solenoid valve will continue to be actuated (clicks) until the ⇒ key is pressed to switch to the next control element.

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

- Check solenoid valve 1 for activated charcoal filter -N80 => Page 129 .

Actuating secondary air inlet valve -N112

- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Secondary air inlet valve -N112
```

This solenoid valve will continue to be actuated (clicks) until the ⇒ key is pressed to switch to the next control element.

If the secondary air inlet valve does not click:

- Check secondary air inlet valve -N112
  =>Page 132 .

Actuating secondary air pump relay -J299

- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Secondary air pump relay -J299
```

Secondary air pump relay -J299 actuates secondary air pump motor -V101. This runs in intervals.

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

- Checking secondary air pump relay -J299 (in electronics box of plenum chamber on the right) => Page 134 .

Actuating intake manifold changeover solenoid valve -N156

- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Intake manifold changeover valve -N156
```

The solenoid valve must click.

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

- Checking intake manifold changeover solenoid valve -N156 => Page 118 .

Bank 2, actuating valve for camshaft timing control

- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Bank 2, camshaft timing control
```

- The solenoid valve 2 for camshaft timing control -N208 is actuated for approx. 1 minute (click).

If the solenoid valve 2 is not actuated (the solenoid valve does not click):

- Check solenoid valves for camshaft timing control => Page 170 .

Actuating solenoid valve 2 for intake manifold changeover -N261 (check omitted in S8 models)

- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Intake manifold changeover valve 2 -N261
```

The solenoid valve must click.

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

- Checking intake manifold changeover solenoid valve 2 -N156 => Page 118 .

Checking engine mounting on left and right

- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Valve left for engine mounting -N144
```

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

- Check engine mounting => Page 150 .
- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Valve right for engine mounting -N145
```

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

- Check engine mounting => Page 150 .

Bank 1, actuating valve for camshaft timing control

- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Bank 1, camshaft timing control
```

- The solenoid valve 1 for camshaft timing control -N205 is actuated for approx. 1 minute (click).

If the solenoid valve 1 is not actuated (the solenoid valve does not click):

- Check solenoid valves for camshaft timing control => Page 170 .

Actuating injectors

Note:

The injectors are actuated in firing order sequence, i.e. cyl. 1, cyl. 5, cyl. 4, cyl. 8, cyl. 6, cyl. 3, cyl. 7, cyl. 2.

- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 1 -N30
```

- Press ⇒key.

After the arrow key is pressed, the injector must click five times.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 1 -N30
```

If the injector does not click:

- Check injectors => Page 78 .

- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 5 -N83
```

- Press ⇒key.

After the arrow key is pressed, the injector must click five times.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 5 -N83
```


If the injector does not click:

- Check injectors => Page 78 .
- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 4 -N33
```

- Press ⇒key.

After the arrow key is pressed, the injector must click five times.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 4 -N33
```

If the injector does not click:

- Check injectors => Page 78 .

- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 8 -N86
```

- Press ⇒key.

After the arrow key is pressed, the injector must click five times.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 8 -N86
```

If the injector does not click:

- Check injectors => Page 78 .
- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 6 -N84
```

- Press ⇒key.

After the arrow key is pressed, the injector must click five times.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 6 -N84
```

If the injector does not click:

- Check injectors => Page 78 .

- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 3 -N32
```


- Press ⇒key.

After the arrow key is pressed, the injector must click five times.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 3 -N32
```

If the injector does not click:

- Check injectors => Page 78 .
- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 7 -N85
```

- Press ⇒key.

After the arrow key is pressed, the injector must click five times.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 7 -N85
```

If the injector does not click:

- Check injectors => Page 78 .

- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 2 -N31
```

- Press ⇒key.

After the arrow key is pressed, the injector must click five times.

-> Indicated on display:

```
Final control diagnosis
Injector, cylinder 2 -N31
```

If the injector does not click:

- Check injectors => Page 78 .
- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
END
```

- Press ⇒key.

-> Display function selection):

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

Note:

The final control diagnosis can only then be started again after the engine has started and the ignition has been switched off and on again.

- Press keys 0 and 6 for the "End output" function and press the Q key to confirm entry.

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 60:

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

- Adaption of the lambda control =>Page 98
- Fault finding by selective activation and deactivation of the lambda control => Page 96

Test conditions for operations with engine running

- No fault stored in fault memory

- Coolant temperature at least 85 °C.
- Electrical consumers switched off (radiator fan must not run during the check)
- Air conditioner switched off
- Gear selector lever in P or N position
- Wheels in straight-ahead position

- Connect the vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit 1 with "Address word" 01 => Page 7 .
  For this purpose, the engine must be running at idling speed.
- Interrogate and erase fault memory of both engine control units => Page 9 . No faults must be stored (if necessary, rectify fault, erase fault memory, switch off and re-start engine, perform test drive and interrogate fault memory of both engine control units again to check).
- Leave engine idling.

-> Indicated on display:

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

- Press keys 0 and 4 for function "Basic Setting" and confirm entry by pressing the Q key.

-> Indicated on display:

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

- Select the required display group number from the display group overview in the "Read measured value block" section.

Note:

Display group number 000 is used here as an example to demonstrate the procedure.

- Press key 0 three times.

(000 is used to select the function "display group 000").

Note:

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

-> Indicated on display:

```
Basic setting      Q
Enter display group number     000
```

- Confirm entry with Q key.

-> Indicated on display:

```
System in basic setting 0
1     2     3     4     5     6     7
8     9     10
```

Display group 000 (decimal readouts)											
▪ Engine idling (coolant temperature not less than 85 °C)											
Display zones											Specified value
1	2	3	4	5	6	7	8	9	10	Learned value for mixture formation (Lambda adaption bank 2)	115...139
										Learned value for mixture formation (Lambda adaption bank 1)	115...139
										Control value for mixture formation (Lambda control Bank 2) (if outside tolerance, perform test drive)	120...136 Value must fluctuate

Display group 000 (decimal readouts)	
Control value for mixture formation (Lambda control Bank 1) (if outside tolerance, perform test drive)	120...136 Value must fluctuate
Learned value from idling speed control	123...143
Idling speed control	118...138
Throttle valve angle	2...7
Engine speed (idling speed) 1)	60...82
Engine load (no consumers)	18...32
Coolant temperature (requirement for basic setting)	180...203

1) Current values:

=> Exhaust Emission Test binder

- Allow engine to idle for a few minutes; coolant temperature at least 85 °C (display zone 1: at least 180).

Notes:

- Each time the PRINT key is pressed, the current display readout is printed out.
- Press the C key before selecting further display groups.

- If specifications are achieved in all display zones, press the ⇒ key.

-> Indicated on display:

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

- Press keys 0 and 6 for the "End output" function and press the Q key to confirm entry.

-> Indicated on display:

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


7 - Encoding control unit

7.1 - Encoding control unit

Notes:

- If the appropriate code for the vehicle is not displayed or if the control unit has been replaced, the control unit must be encoded.
- During control unit identification a 5-digit code must always be displayed.
- Incorrect coding may lead to higher emissions and increased strain on the automatic gearbox resulting from harsh gearshift joints.

- Connect the 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 7 .
  For this purpose, the ignition must be switched on.

-> Indicated on display:

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

- Press keys 0 and 7 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 appropriate code number for this vehicle and confirm with Q key.

Compose the code number as follows (example):

EU IV (emission standard)	11
4WD with ESP	7
Automatic gearbox	5
Audi A8 + S8	3
Code number	11 7 5 3

-> The display on fault reader V.A.G 1551 shows the control unit identification code e.g.:

```
4D0907558.. 4.2l V8/5V     G     D.
Code 11753     WSC 06388
```

- Press ⇒key.

-> Indicated on display:

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

- Press keys 0 and 6 for the "End output" function and press the Q key to confirm entry.
- Switch the ignition off and then on again.

Note:

The next time the ignition is switched on the newly entered code will be activated.

Coding variations for the engine control unit

Country/emissions	Drive/auxiliary functions	Gearbox	Vehicle type
00 = ----------	0 = ----------	0 = ----------	0 = ----------
01 = ----------	1 = ----------	1 = 6-speed manual gearbox	1 = ----------
02 = ----------	2 = ----------	2 = ----------	2 = ----------
03 = ECE 1504/83A	3 = ----------	3 = ----------	3 = Audi A 8 + S 8
04 = ----------	4 = ----------	4 = ----------	4 = ----------
05 = EU II D3	Front wheel drive with TCS 5 = ---------- Front wheel drive with ESP	5 = automatic gearbox ZF 5-speed	5 = ----------
06 = ----------	6 = 4WD without ESP	6 = ----------	6 = ----------
07 = LEV	7 = 4WD with ESP	7 = ----------	7 = ----------
10 = EU - III	10 = ----------	10 = ----------	10 = ----------
11 = EU - IV	11 = ----------	11 = ----------	11 = ----------
26 = Mexico/Taiwan/Korea	----------	----------	----------
27 = Brazil	----------	----------	----------

Note:

- "TCS" stands for Traction Control System
- "ESP" means Electronic Stabilising Program

8 - Reading measured value block

8.1 - Reading measured value block

Safety precautions

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

Important
- **When driving the vehicle for measurement and test purposes, always secure the vehicle diagnosis, measurement and information system VAS 1551 or fault reader V.A.G 1551 to the rear seat and operate it 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.

Test conditions

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

Procedure

- Connect the vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit 1 with "Address word" 01 => Page 7 .
  For this purpose, the engine must be running at idling speed.

-> Indicated on display:

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

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block 08
Enter display group number XXX
```

- Enter relevant display group number (3 figures) and confirm entry by pressing the Q key.

Note:

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

-> Display readout (for example):

```
Read measured value block     1

     1     2     3     4
```

Note:

To change to another display group, proceed as follows:

Display group	V.A.G 1551
higher	Press key 3
lower	Press key 1

Display group	V.A.G 1551
skip	Press the C key

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.

If the function of these systems is checked by self-diagnosis through a test which has to be run fully the allocated position in the 8-digit display is set from "1" to "0". This happens regardless whether the test is carried out with "OK" or with "not OK". This is under the condition that the test has been fully completed.

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

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

The readiness code is reset to

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

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

9.2 - Reading out readiness code

Test sequence

- Connect the 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 7 .
  For this purpose, the ignition must be switched on.

-> Indicated on display

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

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display

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

- Press keys 0.8 and 6 for "display group number 86" and confirm entry by pressing 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 0

	Display zones			
	1	2	3	4

	Display zones			
Display group 086: Readiness code				
Display	0 0 0 0 0 0 0 0	X X X X X X X X	X X X X X X X X	**X X X X X X X X**
Display	**Ready bits completed tests**	Cycle flags Individual tests performed	Cycle flags Individual tests performed	Cycle flags Individual tests performed
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 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	Significance of readiness code on the next pages			

Note on display zone 1:

This display shows which diagnosis was checked since the last erasing of the fault memory or use of the new control unit. After erasing the fault memory all checkable values are set to 1, after test OK has been carried out the values are set to 0.

Note on display zones 2, 3 and 4:

This display shows which diagnosis was started since the last engine start. When engine is switched off the conditions of the diagnosis are set to 1. After diagnosis has been carried out the checkable values are set to 0.

X	X	X	X	X	X	X	X	Notes on display group 86 display zone 1 (ready bits)
								1 = Catalytic converter diagnosis - Display 0 = Test was carried out - Display 1 = Test was not carried out (produce readiness code - =>Page 47 .
								2 = Catalytic converter heater (not occupied) display still 0
								3 = Activated charcoal filter system (0 = ready) - Display 0 = Test was carried out - Display 1 = Test was not carried out (produce readiness code - =>Page 47 .
								4 = Secondary air-system - Display 0 = Test was carried out - Display 1 = Test was not carried out (produce readiness code - =>Page 47 .
								5 = Catalytic converter heater (not occupied) display still 0
								6 = Lambda probes (0 = ready) - Display 0 = Test was carried out - Display 1 = Test was not carried out (produce readiness code - =>Page 47 .
								7 = Lambda probe heating (0 = ready) no short trip necessary - Display 0 = Test was carried out - Display 1 = Test was not carried out
								8 = Exhaust gas recirculation (not occupied) display always 0

Note:

The readiness code is only produced when all the display positions are 0

X	X	X	X	X	X	X	X	Notes for display group 86 display zone 2 (diagnosis - catalytic converter condition, tank vent valve and lambda probe heating)
								Catalytic converter Bank 1 - Display 0 = Diagnosis is carried out in this drive cycle - Display 1 = Diagnosis is not carried out in this drive cycle

Catalytic converter Bank 2
- Display 0 = Diagnosis is carried out in this drive cycle
- Display 1 = Diagnosis is not carried out in this drive cycle

Unallocated

Fuel tank breather valve
- Display 0 = Diagnosis is carried out in this drive cycle
- Display 1 = Diagnosis is not carried out in this drive cycle

Lambda probe heating upstream of catalytic converter bank 1
- Display 0 = Diagnosis is carried out in this drive cycle
- Display 1 = Diagnosis is not carried out in this drive cycle

Lambda probe heating behind catalytic converter bank 1
- Display 0 = Diagnosis is carried out in this drive cycle
- Display 1 = Diagnosis is not carried out in this drive cycle

Lambda probe heating upstream of catalytic converter bank 2
- Display 0 = Diagnosis is carried out in this drive cycle
- Display 1 = Diagnosis is not carried out in this drive cycle

Lambda probe heating behind catalytic converter bank 2
- Display 0 = Diagnosis is carried out in this drive cycle
- Display 1 = Diagnosis is not carried out in this drive cycle

X X X X X X X X **Notes for display group 86 display zone 3 (diagnosis - lambda probe condition, bank 1 and secondary air system)**

Lambda probe upstream of catalytic converter bank 1 (electrical testing)
- Display 0 = Diagnosis is carried out in this drive cycle
- Display 1 = Diagnosis is not carried out in this drive cycle

Lambda probe downstream of catalytic converter bank 1 (electrical testing)
- Display 0 = Diagnosis is carried out in this drive cycle
- Display 1 = Diagnosis is not carried out in this drive cycle

Lambda correction bank 1
- Display 0 = Diagnosis is carried out in this drive cycle
- Display 1 = Diagnosis is not carried out in this drive cycle

Lambda probe heating downstream of catalytic converter bank 1
- Display 0 = Diagnosis is carried out in this drive cycle
- Display 1 = Diagnosis is not carried out in this drive cycle

Lambda probe upstream of catalytic converter bank 1 (periodic duration)
- Display 0 = Diagnosis is carried out in this drive cycle
- Display 1 = Diagnosis is not carried out in this drive cycle

Secondary air system Bank 1
- Display 0 = Diagnosis is carried out in this drive cycle
- Display 1 = Diagnosis is not carried out in this drive cycle

Secondary air system Bank 2
- Display 0 = Diagnosis is carried out in this drive cycle
- Display 1 = Diagnosis is not carried out in this drive cycle

Unallocated

X X X X X X X X **Notes for display group 86 display zone 4 (diagnosis - lambda probe condition, bank 2)**

Lambda probe upstream of catalytic converter bank 2 (electrical testing)
- Display 0 = Diagnosis is carried out in this drive cycle
- Display 1 = Diagnosis is not carried out in this drive cycle

Lambda probe downstream of catalytic converter bank 2 (electrical testing)
- Display 0 = Diagnosis is carried out in this drive cycle
- Display 1 = Diagnosis is not carried out in this drive cycle

Lambda correction bank 2
- Display 0 = Diagnosis is carried out in this drive cycle
- Display 1 = Diagnosis is not carried out in this drive cycle

	Lambda probe heating downstream of catalytic converter bank 2 - Display 0 = Diagnosis is carried out in this drive cycle - Display 1 = Diagnosis is not carried out in this drive cycle
	Lambda probe upstream of catalytic converter bank 2 (periodic duration) - Display 0 = Diagnosis is carried out in this drive cycle - Display 1 = Diagnosis is not carried out in this drive cycle
	Unallocated
	Unallocated
	Unallocated

If the specified value in display zone 1: "0 0 0 0 0 0 0 0" is achieved:

- Press ⇒key.

-> Display function selection):

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

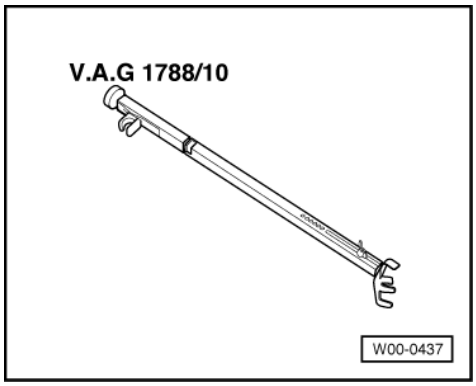
- Interrogate fault memory to check (there must not be any stored faults).

If specified value is not attained:

- Produce the readiness code => Page 47 .

9.3 - Producing the readiness code

Special tools and workshop equipment required



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

Test conditions

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

Operation 1: Interrogating fault memory

- Connect the 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 7 .
  For this purpose, the ignition must be switched 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.

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

```
X fault(s) detected
```

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: Erasing fault memory

- 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.

The readiness code can be produced in two ways:

- When driving with varying loads the exhaust relevant tests are initiated by the control unit and the readiness code generates itself.

or

- Produce the readiness code as follows.

Operation 3: Diagnosis of fuel tank breather valve

Test conditions

- Engine idling
- Coolant temperature greater than 85 °C (display group 4, display zone 3)

-> Indicated on display:

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


- Press keys 0 and 4 for function "Basic Setting" and confirm entry by pressing the Q key.

-> Indicated on display

```
Initiate 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:

	Display zones			
	1	2	3	4
Display group 070: Diagnosis of fuel tank breather valve				
Display	xx %	xx.x %	xx %	---
Display	Opening angle of fuel tank breather valve	Lambda control deviation	Relative earth flow through fuel tank breather valve	**Diagnosis status**
Range	min.: 0 % max.: 100 %	min.: -25.0 % max.: 25.0 %		**Test OFF** **Test ON** **FTBV OK** **FTBV NOK** **Cancel**
Specified value	xx %	-5.5...6.3 %	xx...xx %	**FTBV OK**
Note			**see note =>Page 49 .**	**If "FTBV NOK" is displayed: Interrogate fault memory => Page 129 .**

Note on display zone 3:

A display only occurs when the diagnostic result occurred not due to a deviation of the lambda controller (e.g. Lambda 1 from activated charcoal filter) but due to a deviation of the idling controller within a certain tolerance range. Otherwise display zone 3 remains empty.

If specification "FTBV OK" is attained:

- Press C key.

Operation 4: Diagnosis of fuel supply system

- Engine idling
- Lambda control active

-> Indicated on display

```
Initiate basic setting      Q
Enter display group number XXX
```

- Enter "107" for "display group number 107" and confirm entry with Q key.

-> Indicated on display

```
System in basic setting 107
     1     2     3     4
```

- Check specification in display zone 4:

	Display zones			
	1	2	3	4
Display group 107: Diagnosis fuel supply system				
Display	xxx rpm	x.x %	x.x %	**Test ON**
Display	Engine speed (actual)	Lambda control Medium value (bank 1)	Lambda control Medium value (bank 2)	**Diagnosis status**

	Display zones			
Range	min.: 550 rpm max.: 7200 rpm	-25.0...25.0 %		Test OFF Test ON FTBV OK FTBV NOK
Specified value	600...820 rpm	-23 %...23 %	-23 %...23 %	Syst. OK
Note				If the display shows "Syst. NOK", interrogate fault memory =>Page 9

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

- Press C key.

Operation 5: Checking lambda probe heater

-> Indicated on display

```
Initiate basic setting      Q
Enter display group number XXX
```

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

-> Indicated on display

```
System in basic setting 41
     1     2     3     4
```

- Check specified values in display zones 1 and 3:

Note:

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

	Display zones			
	1	2	3	4
Display group 41: Lambda probe heating, bank 1 at idling speed				
Display	xxx kOhm	Htg. u.c.c. ON	xxx kOhm	Htg. d.c.c. ON
Display	Bank 1, probe 1	Status of heating	Bank 1, probe 2	Status of heating
Range		Htg. u.c.c. ON Htg. u.c.c. OFF		Htg. d.c.c. ON Htg. d.c.c. OFF
Specified value	Smaller than 2 kOhm	Htg. u.c.c. ON	Smaller than 2 kOhm	Htg. d.c.c. ON
Note				

- Press the Ckey.
- Press keys 0, 4 and 2 for "display group number 42" and confirm entry with Q key.

	Display zones			
	1	2	3	4
Display group 42: Lambda probe heating, bank 2 at idling speed				
Display	xxx kOhm	Htg. u.c.c. ON	xxx kOhm	Htg. d.c.c. ON
Display	Bank 1, probe 2	Status of heating	Bank 2, probe 2	Status of heating
Range		Htg. u.c.c. ON Htg. u.c.c. OFF		Htg. d.c.c. ON Htg. d.c.c. OFF
Specified value	Smaller than 2 kOhm	Htg. u.c.c. ON	Smaller than 2 kOhm	Htg. d.c.c. ON

	Display zones			
Note	Notes see below		Notes see below	

Important notes for display groups 41 and 42: Display zones 1 and 3:

- 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 Ohm 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.

- Press C key.

Operation 6: Diagnosis of lambda probe ageing upstream of catalytic converter

Test conditions

- Increase engine speed until exhaust temperature 200 °C display zone 2 has been reached.

-> Indicated on display

```
Initiate 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:

	Display zones			
	1	2	3	4
Display group 034: Lambda probe ageing, lambda probe upstream of catalytic converter (Bank 1)				
Display	xxxx rpm	xxx °C	x.x s	**Test ON**
Display	Engine speed	Exhaust gas temperature	Period Lambda probe upstream of catalytic converter	Diagnosis status
Range	min.: 550 rpm max.: 7200 rpm	70...850 °C	0.0... 3.0 seconds.	Test OFF Test ON B1-P1 OK B1-P1 NOK
Specified value	600...820 rpm	greater than 200°C	0.1...10.8 seconds	B1-P1 OK
Note				**If "B1-P1 NOK" is displayed: Interrogate fault memory => Page 9**

If the specified value in display zone 4 "B1-S1 OK" is attained:

- Press C key.
- Press keys 0, 3 and 5 for "display group number 35" and confirm entry with Q key.

	Display zones			
	1	2	3	4
Display group 035: Lambda probe ageing, lambda probe upstream of catalytic converter (Bank 2)				
Display	xxxx rpm	xxx °C	x.x s	---

	Display zones			
Display	Engine speed	Exhaust gas temperature	Period Lambda probe upstream of catalytic converter	Diagnosis status
Range	min.: 550 rpm max.: 7200 rpm	70...850 °C	0.0...3.0 seconds	Test OFF Test ON B2-P1 OK B2-P1 NOK
Specified value	600...820 rpm	greater than 200°C	0.1...10.8 seconds	B2-P1 OK
Note				**If "B2-P1 NOK" is displayed: Interrogate fault memory => Page 9**

If the specified value in display zone 4 "B1-S1 OK" is attained:

- Press C key.

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

- Engine idling

-> Indicated on display

```
Initiate 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 specified values in display zones 2 and 4.

	Display zones			
	1	2	3	4
Display group 036: Condition of lambda probe downstream of catalytic converter (Banks 1 and 2)				
Display	x.xxx V	**Test ON**	x.xxx V	**Test ON**
Display	Voltage of lambda probe downstream of catalytic converter, bank 1	**Diagnosis status**	Voltage of lambda probe downstream of catalytic converter, bank 2	**Diagnosis status**
Range	0.000V...1.000 volts	**Test OFF Test ON B1-P2 OK B1-P2 NOK**	0.000V...1.000V	**Test OFF Test ON B2-P2 OK B2-P2 NOK**
Specified value	lower than 0.4 volts or greater than 0.5 volts	**B1-P2 OK**	lower than 0.4 volts or greater than 0.5 volts	**B2-P2 OK**
Note		**If "B1-S2 not OK" is displayed, interrogate fault memory => Page 9 .**		**If "B2-S2 not OK" is displayed, interrogate fault memory => Page 9**

If the specified value in

display zone 2 "B1-S2 OK" and in

display zone 4 "B2-S2 OK" is achieved:

- Press C key.

Operation 8: Diagnosis, lambda control system

- Engine idling

-> Indicated on display

```
Initiate 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
Display group 037: Lambda control system (Bank 1)				
Display	xx.x %	x.xxx V	xxx ms	**Test ON**
Display	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**
Range	0...175 %	0.000...1.000 volts	---	**Test OFF Test ON Syst. OK Syst. NOK**
Specified value	14...24 %	0.000...1.000 volts	-800ms...800ms	**Syst. OK**
Note				**If the display shows "Syst. NOK", interrogate fault memory =>Page 9**

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

- Press C key.
- Press keys 0, 3 and 8 for "display group number 38" and confirm entry with Q key.

	Display zones			
	1	2	3	4
Display group 038: Lambda control system (Bank 2)				
Display	xx.x %	x.xxx V	xxx ms	**Test ON**
Display	Load	Voltage of lambda probe downstream of catalytic converter, bank 2	Lambda correction value between lambda probe 2 and lambda probe 2, bank 1	**Diagnosis status**
Range	0...175 %	0.000...1.000 volts	---	**Test OFF Test ON Syst. OK Syst. NOK**
Specified value	14...24 %	0.000...1.000 volts	-800ms...800ms	**Syst. OK**

	Display zones			
Note				If the display shows "Syst. NOK", interrogate fault memory =>Page 9

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

- Press C key.

Operation 9: Catalytic converter diagnosis

-> Indicated on display

```
Initiate 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
```

- Increase engine speed to approx. 3,000 rpm until the exhaust temperature 550 °C (display zone 2) is reached, and then leave engine idling.

- Check specification in display zone 4:

Note:

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

	Display zones			
	1	2	3	4
Display group 046: Catalytic converter diagnosis (Bank 1)				
Display	xxxx rpm	xxx °C	x.x s	---
Display	Engine speed	Exhaust gas temperature	Catalytic conversion	Diagnosis status
Range	min.: 550 rpm max.: 7200 rpm	70...850 °C	0.0...1.0 seconds	Test OFF Test ON Cat. B1 OK Cat. B1 NOK
Specified value	600...820 rpm	400... 540 °C	0.0...0.73 s	Cat. B1 OK
Note				**If "Cat. B1 NOK" is displayed: Interrogate fault memory => Page 9 . If no fault is stored, replace the catalytic converter.**

If the specified value in display zone 4 "Cat B1 OK" is attained:

- Press C key.
- Press keys 0, 4 and 7 for "display group number 47" and confirm entry with Q key.

	Display zones			
	1	2	3	4
Display group 047: Catalytic converter diagnosis (Bank 2)				
Display	xxxx rpm	xxx °C	x.x s	---
Display	Engine speed	Exhaust gas temperature	Catalytic conversion	Diagnosis status

	Display zones			
Range	min.: 550 rpm max.: 7200 rpm	70...850 °C	0.0...1.0 seconds	Test OFF Test ON Cat. B2 OK Cat. B2 NOK
Specified value	600...820 rpm	400... 540 °C	0.0...0.73 s	Cat. B2 OK
Note				**If "Cat. B2 NOK" is displayed: Interrogate fault memory => Page 9 . If no fault is stored, replace the catalytic converter.**

If the specified value in display zone 4 "Cat B2 OK" is attained:

- Press C key.

Operation 10: Diagnosis of secondary air system

- Increase engine speed to approx. 1800...2400 rpm use speed adjuster V.A.G 1788/10 to keep the engine speed.

-> Indicated on display

```
Initiate 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:

Duration of test of secondary air system is approx. 60 seconds.

	Display zones			
	1	2	3	4
Display group 077: Diagnosis secondary air system (Bank 1)				
Display	xxxx rpm	xx.x g/s	xx %	**Test ON**
Display	Engine speed	Air mass	Procedural deviation from values specified for secondary air system	Diagnosis status
Range	min.: 550 rpm max.: 7200 rpm			**Test OFF Test ON Syst. OK Syst. NOK Cancel**
Specified value	1800... 2400 rpm	Greater than 14 g/s	-70 %...30 %	**Syst. OK**
Note				**If "Syst. NOK" is displayed: Interrogate fault memory => Page 9**

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

- Press C key.
- Press keys 0, 7 and 8 for "display group number 78" and confirm entry with Q key.

	Display zones			
	1	2	3	4
Display group 078: Diagnosis secondary air system (Bank 2)				
Display	xxxx rpm	xx.x g/s	xx.x %	**Test ON**
Display	Engine speed	Air mass	Procedural deviation from values specified for secondary air system	Diagnosis status
Range	min.: 550 rpm max.: 7200 rpm			**Test OFF** **Test ON** **Syst. OK** **Syst. NOK** **Cancel**
Specified value	1800... 2400 rpm	Greater than 13 g/s	-70 %...30 %	**Syst. OK**
Note				**If "Syst. NOK" is displayed: Interrogate fault memory => Page 9**

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

- Press ⇒ key.

Operation 11: Reading out readiness code

- Read out readiness code (for checking) again => Page 44 .

24 - Mixture preparation, Injection

1 - Servicing Motronic injection system

1.1 - Servicing Motronic injection system

1.2 - Safety precautions

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

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

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

- Always switch off the ignition before connecting or disconnecting injection or ignition system wiring or tester cables.

- To run engine at starting speed without actually starting it (for example, in order to test compression), unplug connector from the output stages 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.
- 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 loosening hose connections or opening the test connection (to measure fuel pressure), place a cloth around the connection. Then release pressure by carefully loosening the connection.

1.3 - Rules for cleanliness

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

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

Make sure connections are dry when attaching.

1.4 - Technical Data (A8-models)

Engine code letters		AQF 4.2 L 228 KW / AUW 4.2 L 228 KW ARU 4.2 L 175 KW / AVN 4.2 L 175 KW AQG 3.7 L 191 KW / AKC 3.7 L 191 KW
Idling speed 1) Not adjustable - controlled by the idling speed stabilisation		600... 720 rpm
Engine speed limitation by closing throttle valve		6600 rpm
Fuel pressure at idling speed	Vacuum hose connected	approx. 3.5 bar
	Vacuum hose detached	approx. 4.0 bar
Holding pressure after 10 minutes		at least 2.5 bar
Injectors	Spray pattern	Multiple bore jet / the same for all injectors
	Injection quantity (30 seconds)	95...115 ml
	Resistance (Room temperature at 20 °C) 2)	13... 16 ω

1) Current values:

=> Exhaust Emission Test binder

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

1.5 - Technical Data (S8-models)

Engine code letters		AQH 4.2 L 265 KW / AVP 4.2 L 265 KW
Idling speed 1) Not adjustable - controlled by the idling speed stabilisation		740... 820 rpm
Engine speed limitation by closing throttle valve		7200 rpm
Fuel pressure at idling speed	Vacuum hose connected	approx. 3.5 bar
	Vacuum hose detached	approx. 4.0 bar
Holding pressure after 10 minutes		at least 2.5 bar
Injectors	Spray pattern	Multiple bore jet / the same for all injectors
	Injection quantity (30 seconds)	105...125 ml

Engine code letters		AQH 4.2 L 265 KW / AVP 4.2 L 265 KW
	Resistance (Room temperature at 20 °C) 2)	13... 16 ω

1) Current values:

=> Exhaust Emission Test binder

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

1.6 - Fitting locations overview

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

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

- In footwell on pedal bracket near brake pedal

B - Diagnostic connector

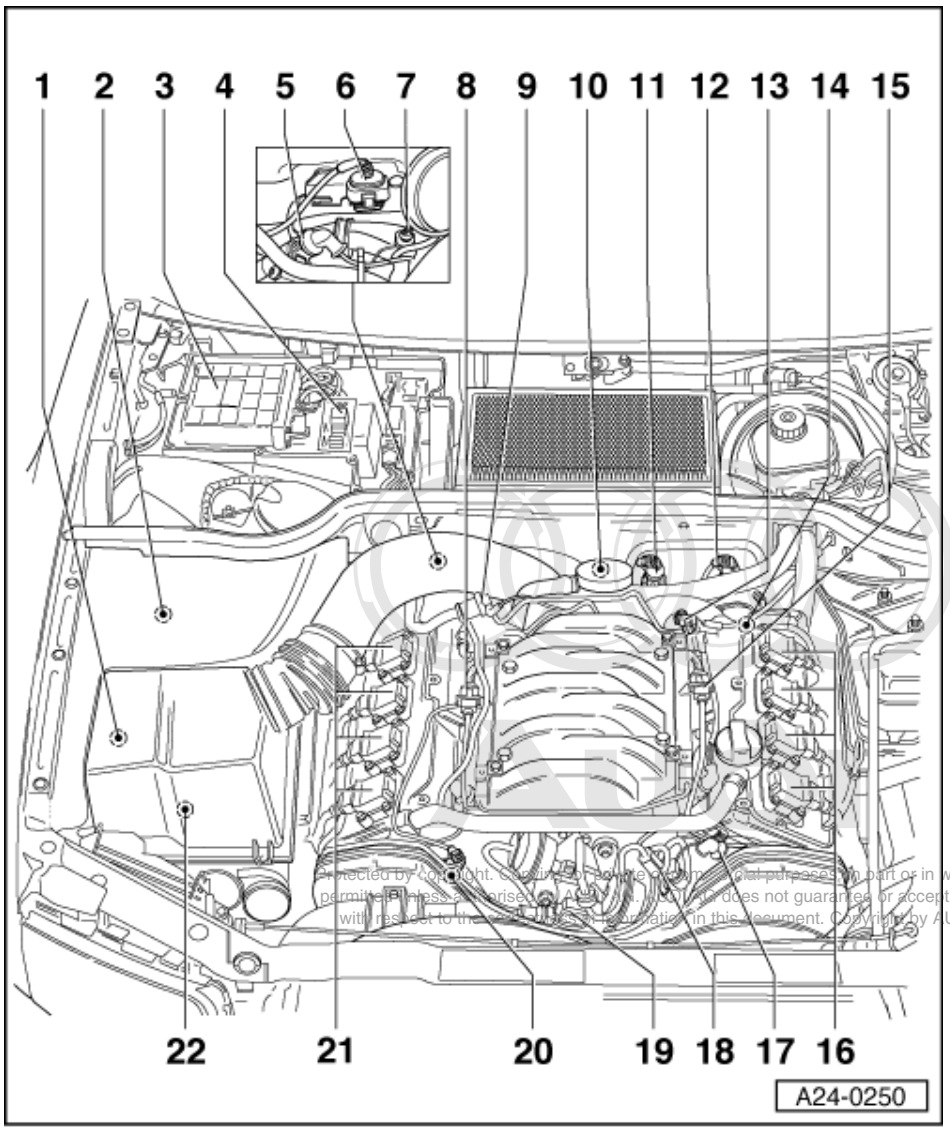
- Located in the knee protection on the driver's side

C - Fuel pump relay (J17)

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

D - Power supply relay for Motronic (J271)

- In electronics box in front passenger's footwell, central electrics unit, relay position 2



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

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

F - "MIL" warning light

- In dash panel insert
(Significance of lamp
=>Page 3 .

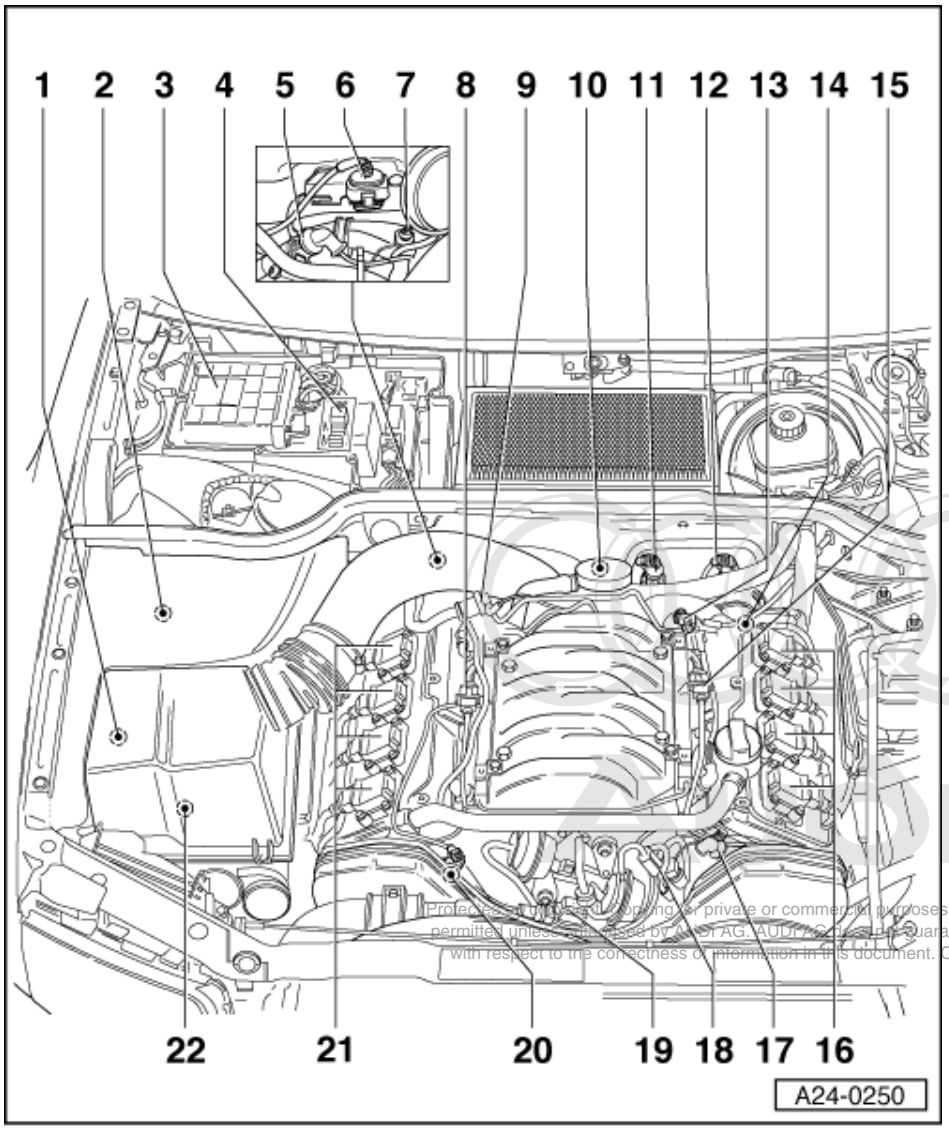
G - "EPC" warning light

- In dash panel insert
(Significance of lamp
=>Page 3 .

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

- In the air filter element

2 Activated charcoal filter solenoid valve 1 (N80)



3 Engine control unit (J220)
- In electronics box in plenum chamber on the right

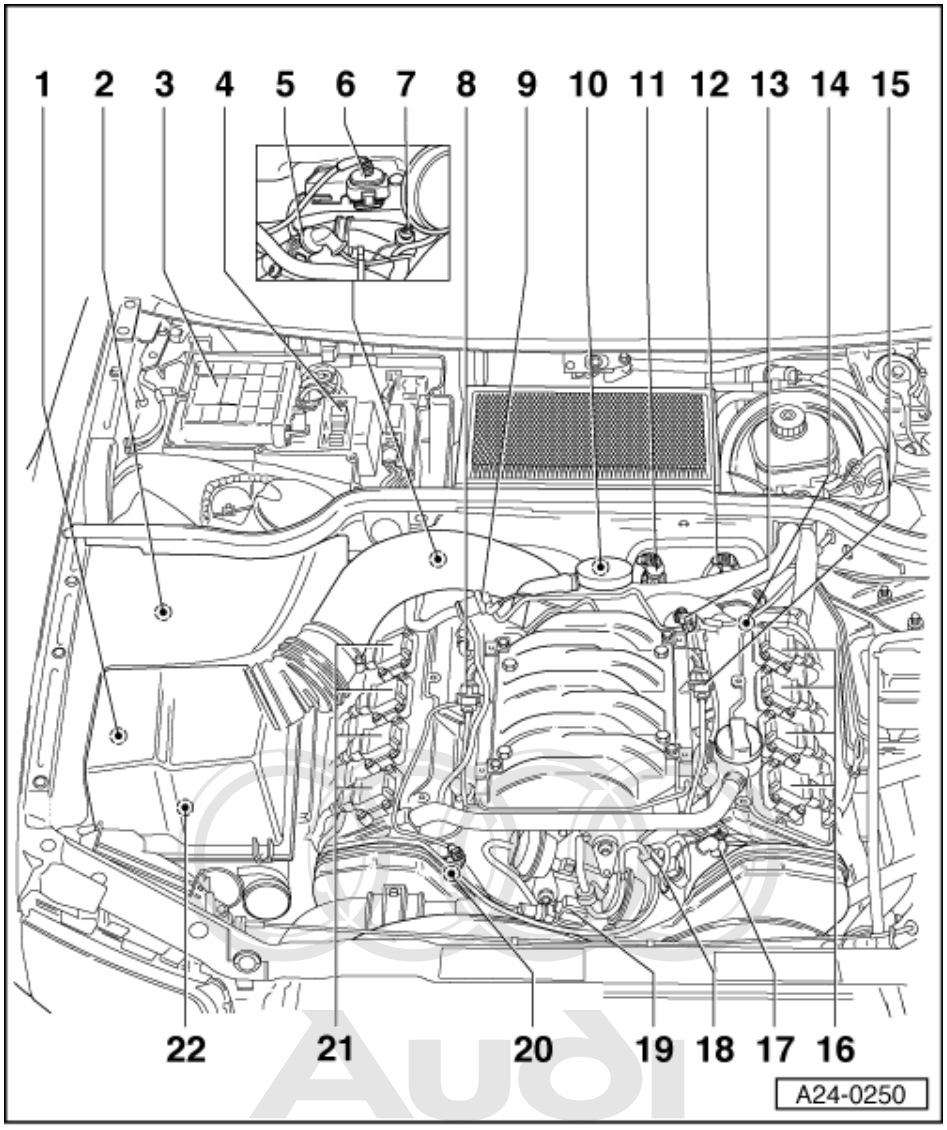
4 Secondary air pump relay (J299)
- In electronics box in plenum chamber on the right

5 Solenoid valve 1 for camshaft timing control (N205)

6 4-way connector
- For lambda probe 1 (G39) and lambda probe heating (Z19)
- Bank 1

Note:

The four-way connector for the lambda probe 2 (G130) and the lambda probe heating (Z29) downstream of catalytic converter bank 1 is under the mat on the passenger side.

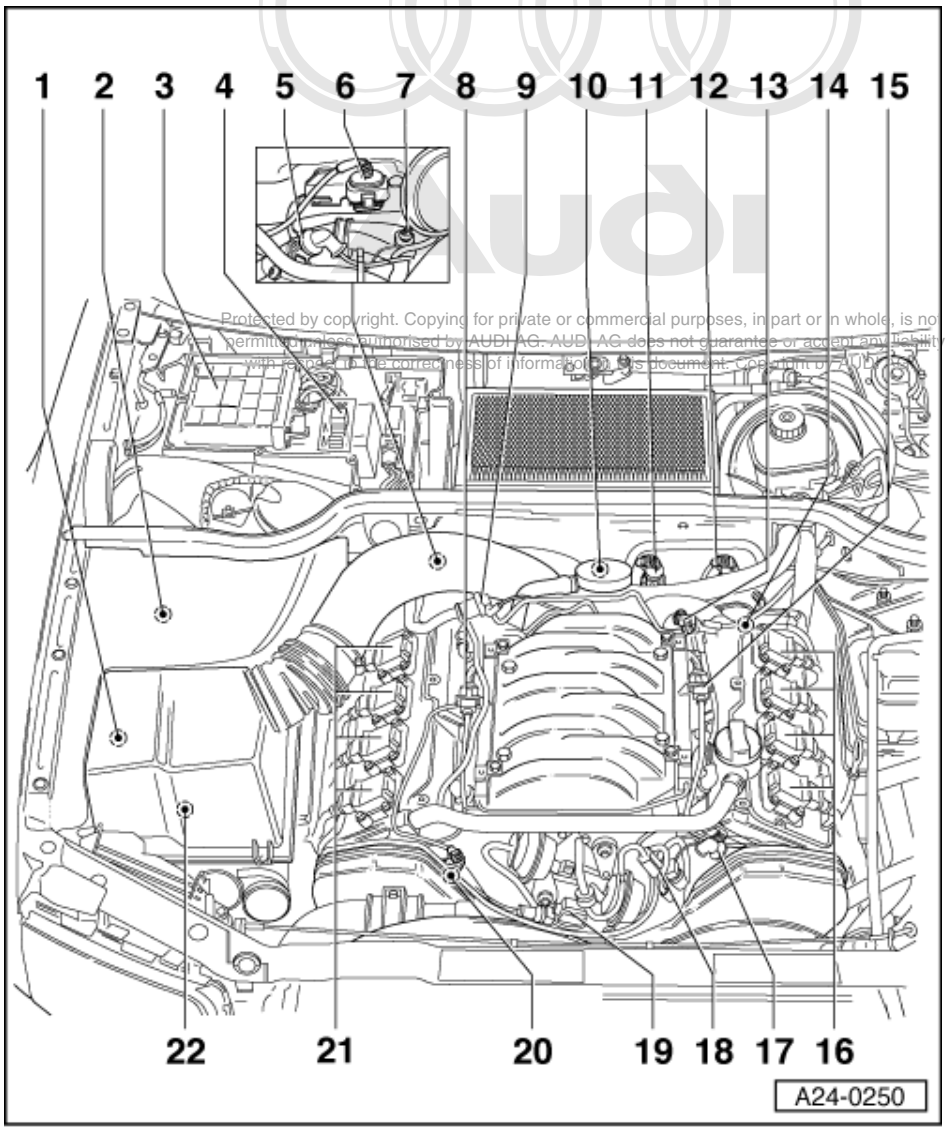


7 Coolant temperature sender (G62)
- On coolant pipe behind cylinder head, bank 1

8 3-pin connector
- For knock sensor 1 (G61)

9 Fuel pressure regulator

10 Throttle valve control part (J338)
- With throttle valve actuator (G186), angle sender for throttle valve actuator (G187) and angle sender 2 for throttle valve actuator (G188)



11 4-way connector

- For lambda probe 1 (G108) and lambda probe heating (Z28) upstream of catalytic converter
- Bank 2

Note:

The four-way connector for the lambda probe 2 (G131) and the lambda probe heating (Z30) downstream of catalytic converter bank 2 is under the mat on the driver's side.

12 3-pin connector

- For engine speed sender (G28)

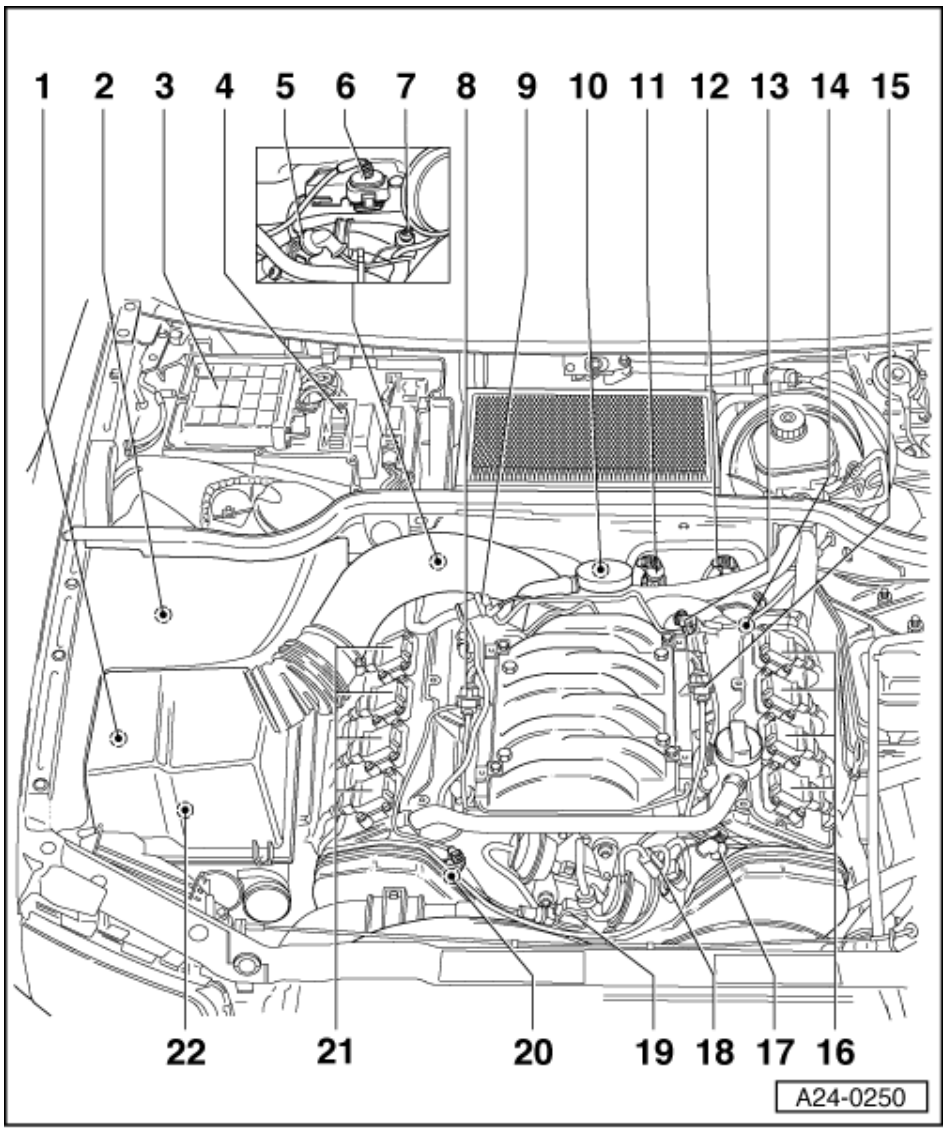
13 Secondary air inlet valve (N112)

14 Hall sender (G163)

- Cylinder bank 2

15 3-pin connector

- For knock sensor 2 (G66)



16 Ignition coils with output stages
- Cylinder bank 2

17 Solenoid valve 2 for camshaft timing control (N208)

18 Intake manifold changeover valve (N156)

19 Intake manifold changeover valve (N261)
- Omitted in S8-models

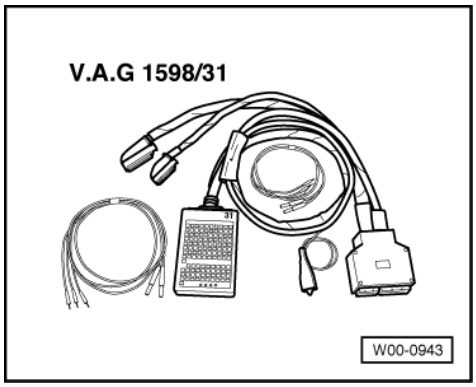
20 Hall sender (G40)
- Cylinder bank 1

21 Ignition coils with output stages
- Cylinder bank 1

22 Secondary air pump (V101)

- In air cleaner housing

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



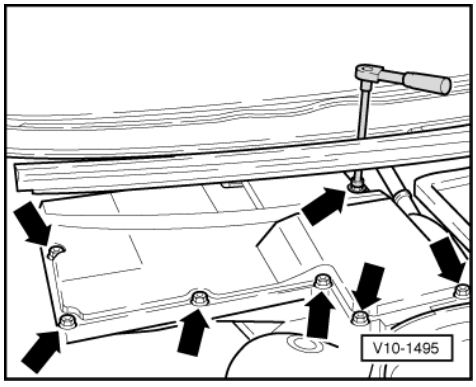
Notes:

- -> 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.

- Use the hand-held multimeter V.A.G 1526 or the multimeter V.A.G 1715 and the diode test lamp V.A.G 1527 for the checks.
- To connect the test devices to the V.A.G 1598/31 test box, always use auxiliary cables from adapter set V.A.G 1594.

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

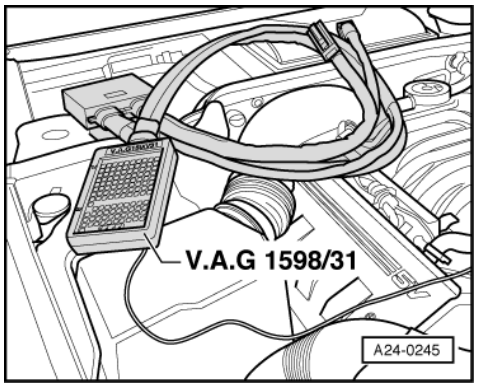
Connecting test box V.A.G 1598/31



- Switch ignition off.
- -> Remove cover of electronics box for control units in plenum chamber, right side.
- Remove engine control unit.

Note:
If the engine control unit is fitted with a sheet-metal housing (anti-theft protection), the sheet-metal housing must be detached from the engine control unit in order to connect the test box. Procedure =>Page 68 . Following the repair, the engine control unit must be refitted with the sheet-metal housing.

- Release connectors on engine control unit and unplug connectors.



- -> Connect V.A.G 1598/31 test box to connector on 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.

The following operations must be carried out after installing the engine control unit:

- After reconnecting the engine control unit, perform adaption of engine control unit to throttle valve control part=>Page 136 .

1.8 - Replacing engine control unit -J220

The following procedure applies for engine control units which are not fitted with a sheet-metal housing (anti-theft protection). For the procedure for engine control units with sheet metal housing, refer to => Page 68 .

Note:
When the engine control unit is disconnected, the learned values are erased but the contents of the fault memory remain intact.

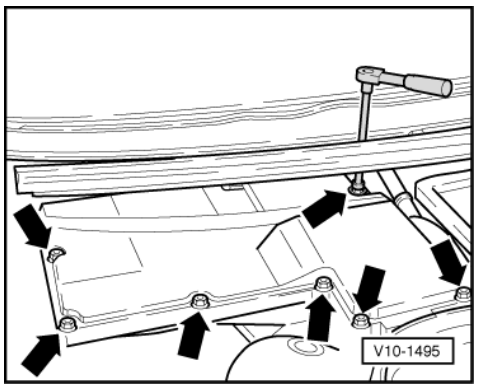
Removing engine control unit

- Connect the 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 7 .
  For this purpose, the ignition must be switched on.

-> The display on fault reader V.A.G 1551 shows the control unit identification code e.g.:

```
4D0907558.. 4.2l V8/5V     G     D.
Code 07753     WSC 06388
```


- Always start by displaying and printing out the control unit identification.
- Compare code to encoding versions => Page 41 .



- Switch ignition off.
- -> Remove cover of electronics box for control units in plenum chamber, right side.
- Remove engine control unit.
- 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 the reverse sequence.

The following operations must be carried out after installing a new engine control unit:

- Code the new engine control unit => Page 41 .
- 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

- Adapt throttle valve control part (J338) =>Page 136
- In vehicles with cruise control (recognisable from steering column switch), this should be actuated in engine control unit =>Page 67 .
- Interrogate fault memory and erase, if necessary => Page 9 .

Activating cruise control system

- Connect the 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 7 .
  For this purpose, the ignition must be switched on.

-> Indicated on display:

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

- Press the "1" key twice for "Log-in procedure" function and confirm entry with Q key.

-> Indicated on display:

```
Log-in procedure     HELP
Enter code number XXXXX
```

- Enter code number 11463 and confirm entry with Q key.
- Select address word "01" to control engine electronics control unit.

-> Indicated on display:

```
4D0907558.. 4.2l V8/5V     G     D.
Code 07753     WSC 06388
```

Specified value: "G"

Deactivating cruise control system

- Connect the 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 7 .
  For this purpose, the ignition must be switched on.

-> Indicated on display:

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


- Press the "1" key twice for "Log-in procedure" function and confirm entry with Q key.

-> Indicated on display:

```
Log-in procedure     HELP
Enter code number XXXXX
```

- Enter code number 16167 and confirm entry with Q key.
- Select address word "01" to control engine electronics control unit.

-> Indicated on display:

```
4D0907558.. 4.2l V8/5V     D.
Code 07753     WSC 06388
```

Procedure when replacing engine control unit for engine control units which are fitted with a sheet-metal housing (anti-theft protection)

Note:

When the engine control unit is disconnected, the learned values are erased but the contents of the fault memory remain intact.

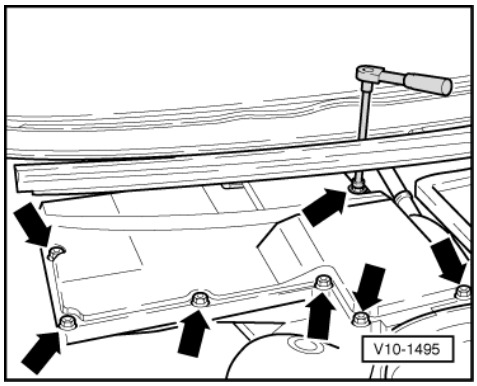
Removing engine control unit

- Connect the 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 7 .
  For this purpose, the ignition must be switched on.

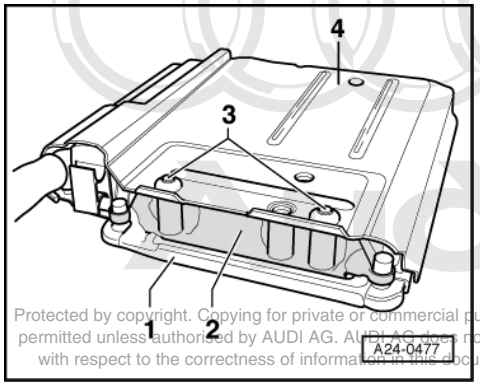
-> The display on fault reader V.A.G 1551 shows the control unit identification code e.g.:

```
4D0907558.. 4.2l V8/5V     G     D.
Code 07753     WSC 06388
```

- Always start by displaying and printing out the control unit identification.
- Compare code to encoding versions => Page 41 .



- Switch ignition off.
- -> Remove cover of electronics box for control units in plenum chamber, right side.
- Remove engine control unit.

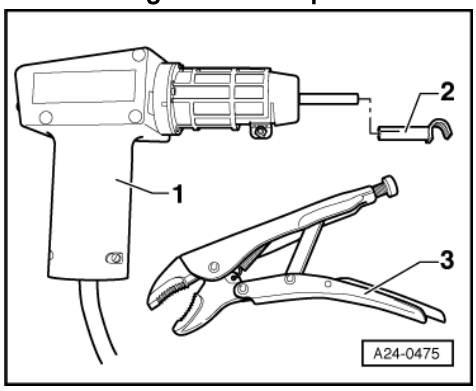


-> In order to make access to the connectors for the engine control unit more difficult (anti-theft protection), the engine control unit -1- is fitted with a sheet-metal housing -4- by means of a locking device -2- and shear bolts -3-.

The thread of the shear bolts is coated with a locking compound in order to make removal of the shear bolts more difficult.

In order to be able to unplug the connectors from the engine control unit (e.g. when connecting the test box or when replacing the engine control unit), the engine control unit must be detached from the sheet-metal housing. This procedure is described below.

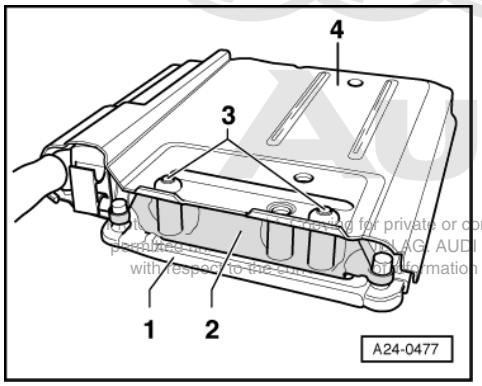
The following tools are required:



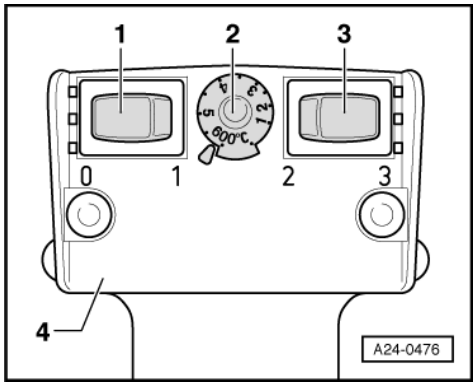
- -> Hot air blower -1- (from wiring harness repair set VAS 1978)
- Nozzle attachment -2- (also from wiring harness repair set VAS 1978)
- Commercially available vice-grip wrench

Procedure:

Important
In order to rule out the possibility of damage (burning) to wiring, connectors, insulation and control units, the following operations must be adhered to exactly. Please note the operating instructions for the hot air blower.



- -> "Swivel" the engine control unit with anti-theft protection towards the engine compartment so that the locking device (item -2- in illustration) becomes visible; please place a clean cloth under the engine control unit with protective housing.

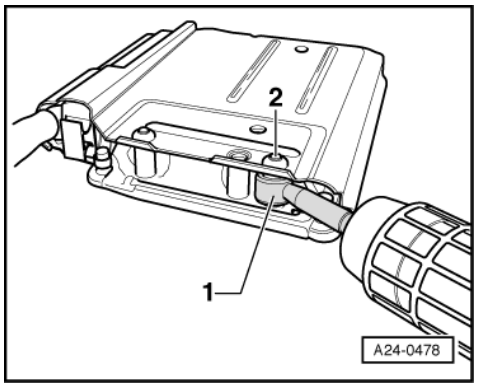


- -> Please adjust the hot air blower as shown in the illustration, i.e., the potentiometer for temperature regulation -2- is set to maximum heat and the two-step switch for air flow -3- to position 3.

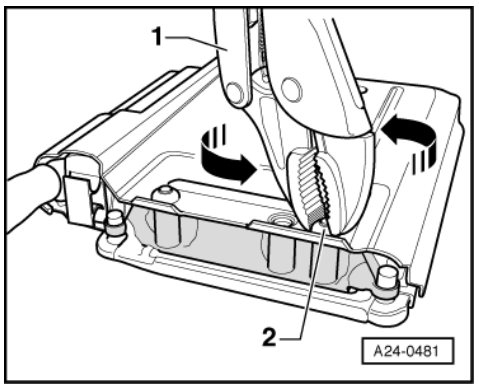
Note:

Then the thread of the locking device in which the shear bolts are screwed must be heated using the hot air blower. With this step, the bonding effect of the locking compound on the thread of the shear bolts is reduced, facilitating removal of the shear bolts.

Important
When heating the thread of the locking device, the shear bolts and parts of the sheet-metal housing reach a high temperature. Take care not to get burned. Ensure that as far as possible only the thread is heated, and no nearby parts. If necessary, cover up such parts.

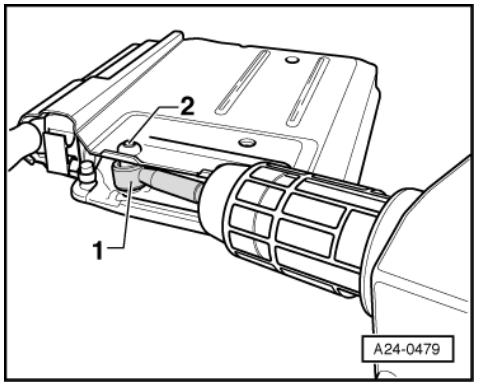


- -> Direct the nozzle -1- of the hot air blower at the thread of the locking device so that the nozzle "surrounds" the thread. You may rest the nozzle on the upper end of the sheet-metal housing.
- Switch on the hot air blower and heat the thread for approx. 20 to 25 seconds.

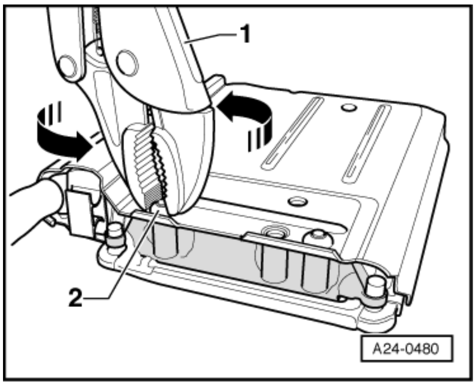


- -> Then hold the bolt head -2- with the vice-grip wrench -1- and screw the shear bolt out in the direction of the arrow.

The procedure for the second shear bolt is identical. Please be particularly careful here, as the connector for the control unit is located in the immediate vicinity.



- -> Once again direct the nozzle -1- of the hot air blower at the thread of the locking device so that the nozzle "surrounds" the thread. You may rest the nozzle on the upper end of the sheet-metal housing.
- Switch on the hot air blower and heat the thread for approx. 20 to 25 seconds.



- -> Then hold the bolt head -2- with the vice-grip wrench -1- and screw the shear bolt out in the direction of the arrow.

The engine control unit can now be detached from the 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 the reverse sequence; the engine control unit must be installed with a sheet metal housing. New shear bolts must be used.

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

- Code the new engine control unit => Page 41 .
- 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

- Adapt throttle valve control part (J338) =>Page 136
- In vehicles with cruise control (recognisable from steering column switch), this should be actuated in engine control unit.
  =>Page 71 .
- Interrogate fault memory and erase, if necessary => Page 9 .

Activating cruise control system

- Connect the 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 7 .
  For this purpose, the ignition must be switched on.

-> Indicated on display:

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

- Press the "1" key twice for "Log-in procedure" function and confirm entry with Q key.

-> Indicated on display:

```
Log-in procedure     HELP
Enter code number XXXXX
```

- Enter code number 11463 and confirm entry with Q key.

- Select address word "01" to control engine electronics control unit.

-> Indicated on display:

```
4D0907558.. 4.2l V8/5V     G     D.
Code 07753     WSC 06388
```

Specified value: "G"

Deactivating cruise control system

- Connect the 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 7 .
  For this purpose, the ignition must be switched on.

-> Indicated on display:

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

- Press the "1" key twice for "Log-in procedure" function and confirm entry with Q key.

-> Indicated on display:

```
Log-in procedure     HELP
Enter code number XXXXX
```

- Enter code number 16167 and confirm entry with Q key.
- Select address word "01" to control engine electronics control unit.

-> Indicated on display:

```
4D0907558.. 4.2l V8/5V     D.
Code 07753     WSC 06388
```

1.9 - Checking idling speed

Test conditions

- No leaks in exhaust system
- Coolant temperature at least 85 °C.
- Electrical consumers switched off (radiator fan must not run during the check)
- Air conditioner switched off
- Pressure gauge not connected
- Place selector lever in P or N position (vehicles with automatic gearboxes).

Checking idling speed

Notes:

- The idling speed cannot be adjusted.
- The idling speed is tested during the basic setting of the engine.
- During the basic setting of the engine, the air conditioner compressor is automatically switched off and the solenoid valve for the active carbon canister (ACF valve) is closed.

- Interrogate fault memory => Page 9 . 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.
- Start the engine and run at idling speed.
- Switch off air conditioner.
- Switch off rear window heating.
- Position selector lever in P or N position (vehicles with automatic gearboxes).

Important
The electric radiator fan should not be running.

-> Indicated on display:

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

- Press keys 0 and 4 for the function "Initiate basic setting" and confirm entry with Q key.

-> Indicated on display:

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

- Press keys 0, 5 and 6 for "display group number 56" and confirm entry with Q key.

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

```
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 (600 rpm...780 rpm).

	Display zones			
	1	2	3	4
Display group 56: Idling stabilisation when idling at operating temperature				
Display	**xxx rpm**	**xxx rpm**	x.x %	0 0 0 0 0
Display	**Engine speed (actual)**	**Engine speed (specified)**	Idling speed control Change in torque	Operating conditions
Range	**min.: 550 rpm max.: 7200 rpm**	**min.: 550 rpm max.: 7200 rpm**		
Specified value	**±20 rpm as display zone 2**	**600...820 rpm**	-1....1 %	0 0 0 0 0
Note	**If the specification is not attained =>Page 73**			Significance of figures =>Page 74 .

Note:

- 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.
- The display zones three and four are there for information but are irrelevant for checking the engine idling speed.

- Press ⇒key.
- Press keys 0 and 6 for the "End output" function and press the Q key to confirm entry.
- If specification is not attained, interrogate the fault memory again.

If the idling speed is too high or too low or not smooth and there are no faults recorded in the fault memory, carry out the following tests marked with a dot:

- Checking lambda probe learned values and lambda control =>Page 98 .
- Unmetered air in intake system, check
- Check whether solenoid valve for activated charcoal filter is continuously open =>Page 129 .

- Perform adaption of throttle valve control part =>Page 136 .

Meaning of 5 digit readout of display group 56

x	x	x	x	x	Display zone 4
				0	Air conditioner compressor off/on 0 = A/C compressor off 1 = A/C compressor on
			0		Selector lever in position P or N 0 = selector lever set to "P" or "N" 1 = selector lever in 2/3/4/R/D
		0			Air conditioner requirement 0 = minimum heating or cooling output 1 = maximum heating or cooling output
	0				Not used
0					Not used

1.10 - Checking fuel pressure regulator and holding pressure

Test conditions

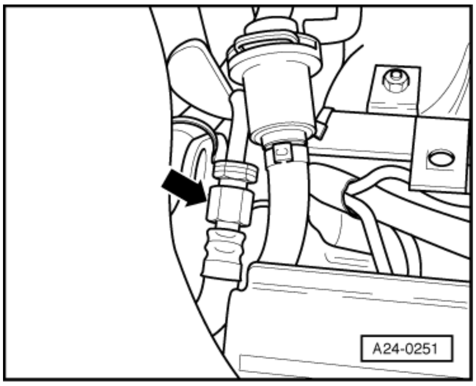
- Fuel pump relay OK
- Fuel pump OK
- Fuel filter OK
- Battery voltage at least 11 volts

Note:

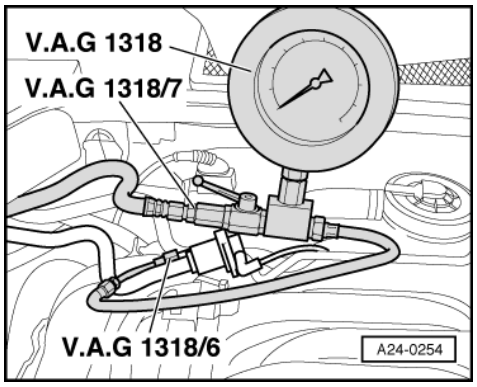
Fuel pressure regulator regulates fuel pressure as a function of intake pressure.

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.

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



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

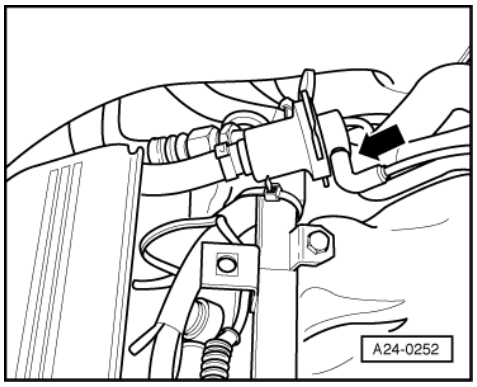


- -> Install pressure measuring device V.A.G 1318 together with adapters V.A.G 1318/6, 1318/7 between feed line and fuel rail pipe.
- -> Open cut-off valve on pressure gauge. The lever points in the direction of flow.

Note:

The shut-off cock of the pressure measuring device should be open (lever facing in the direction of flow).

- Start the engine and run at idling speed.



- Measure the fuel pressure.

Specified value: approx. 3.5 bar

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

Note:

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

The fuel pressure should rise to approx. 4.0 bar.

If specification is not attained:

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

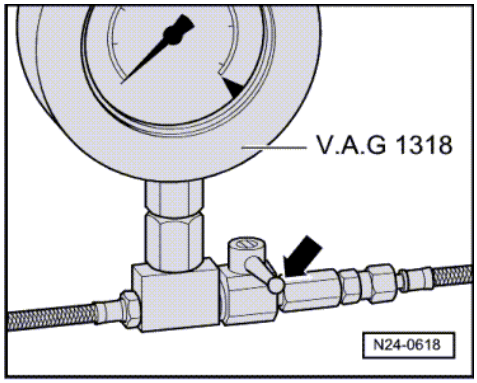
If specified value is attained:

- Reconnect vacuum hose.

- Switch ignition off.

- Test for leaks and holding pressure by watching pressure drop on gauge.

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



If the holding pressure drops below 3.0 bar:

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

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

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

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

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

- Non-return valve in fuel pump leaking

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

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

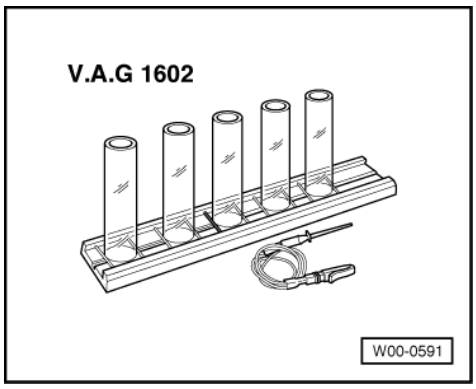
Test conditions

- Fuel pressure OK

Removing fuel rail pipe

- Remove engine compartment cover.
- Remove connecting pipe between air cleaner housing and throttle valve body.
- Disconnect vacuum hose from fuel pressure regulator.
- Unplug the connectors for the knock sensors and remove cable ties as necessary.
- Detach solenoid valve for secondary air inlet from fuel rail pipe.
- Unplug the connectors from the injectors and remove cable ties as necessary.
- Unbolt the fuel rail from the variable intake manifold and pull it upwards and off the intake manifold together with the injectors.

Checking injectors for leaks



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

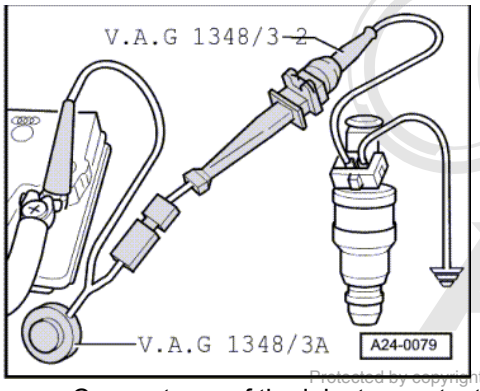
Note:

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

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

Checking injection quantity

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



- -> Connect one of the injector contacts to the 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 1348/3A, adapter lead V.A.G 1348/3-2 and auxiliary cable to positive.
- Switch the ignition on.
  - The fuel pump should run.
- Activate remote control V.A.G 1348/3A for 30 seconds.
- Perform measurements on all injectors.
- Once all four injectors have been actuated, place measuring glasses on a level surface.

Specification per injector:

A8-models	S8-models
95 ... 115 ml	105 ... 125 ml

If the specified result is not attained for all injectors:

- Check fuel pressure => Page 74 .

If the specified results are not attained for one injector:

- Replace the relevant injector.

Note:

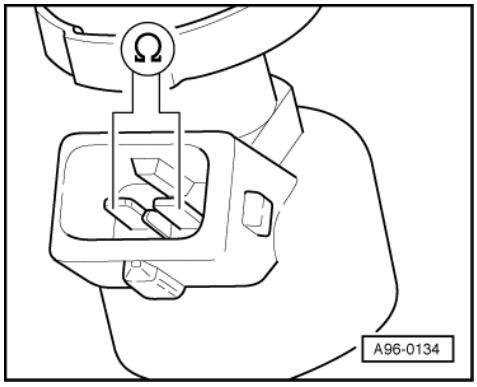
When checking the injection quantity, also check the spray pattern. The spray pattern should be the same for all the injectors.

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

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

1.12 - Checking injectors

Electrical checks on injectors



- Remove connector from the injector which is to be tested.
- -> Connect hand-held multimeter to injector to measure the resistance.

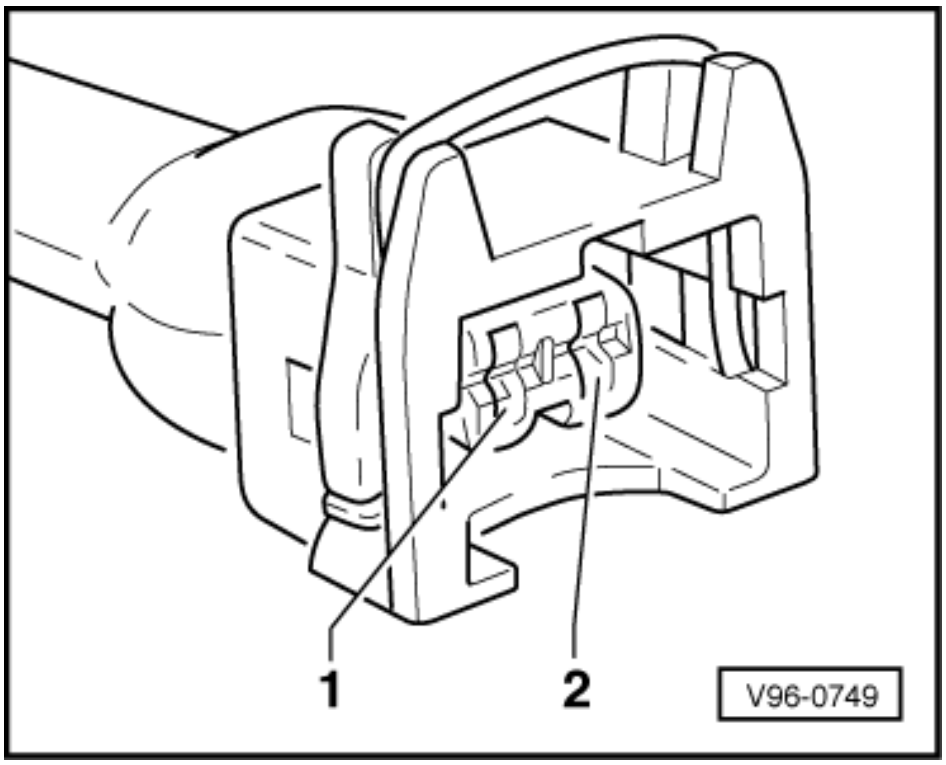
Specified value: 13...16 ω

Note:

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

If specified value is not attained:

- Replace injector.



If specified value is attained:

- Check the voltage supply
  =>Page 79 .

Checking power supply

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

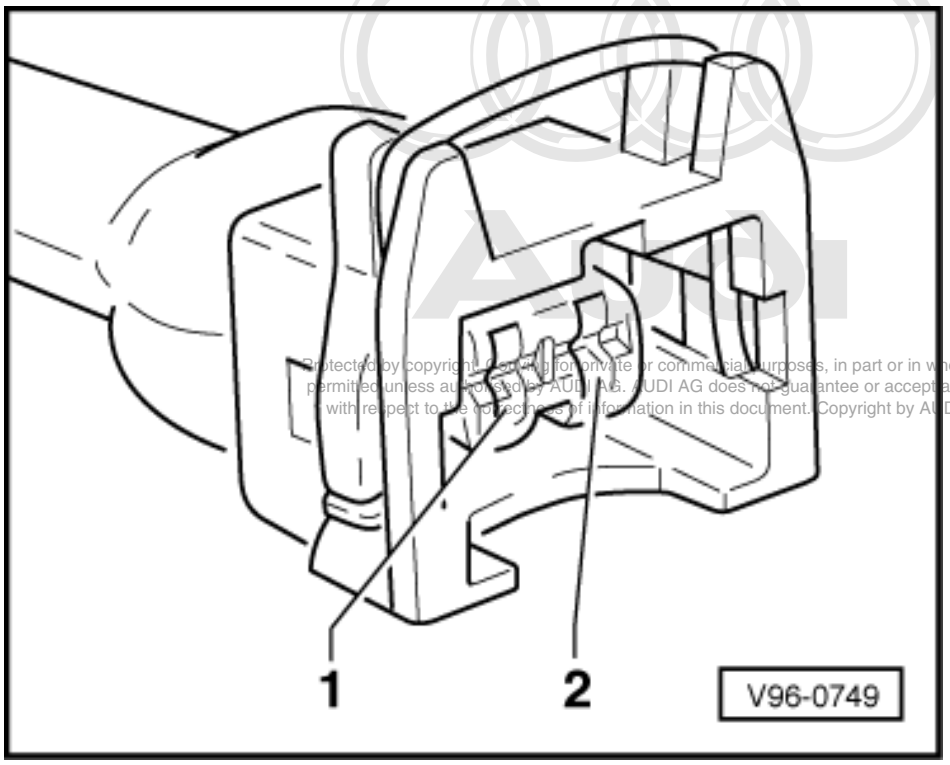
- Operate starter for a few seconds (the engine can be allowed to start).

Specified value: The diode test lamp should illuminate.

If the diode test lamp illuminates:

- Check wiring => Page 80

If the diode test lamp does not illuminate:

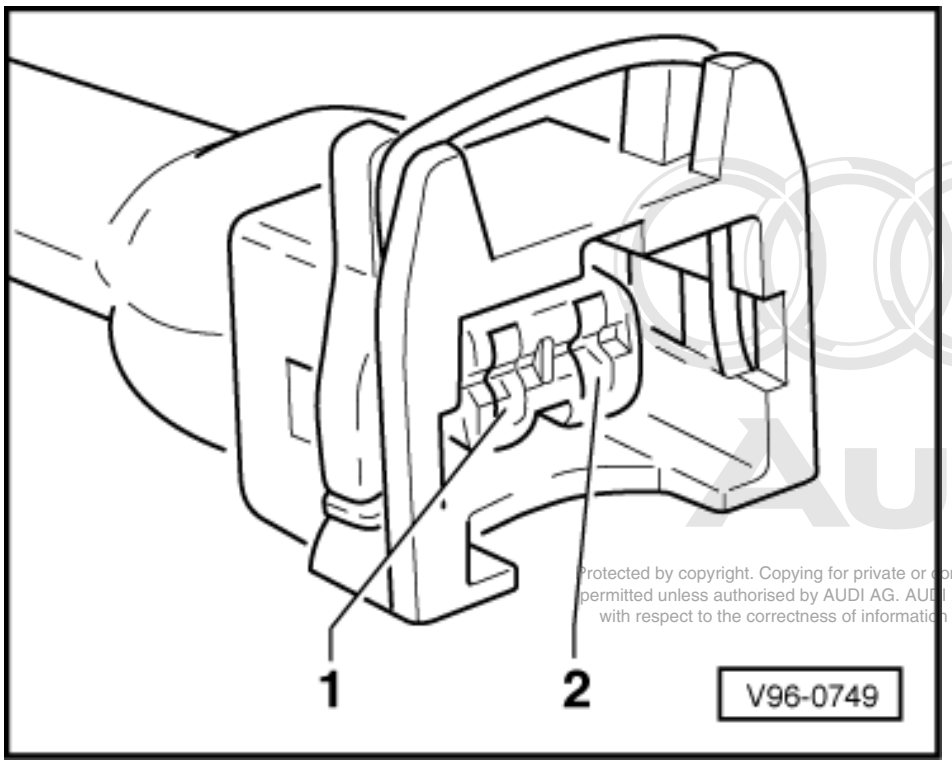


- -> Check the wiring from socket 1 via the injector fuse to the fuel pump relay for continuity and, if necessary, rectify open circuit.

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

Checking wiring

- Switch ignition off.
- Remove connector from the injector which is to be tested.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 65 .



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

Cylinder	2-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
1	2	96
2	2	19 or 23
3	2	113
4	2	88
5	2	97
6	2	112
7	2	24
8	2	89

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

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

- If the wiring is OK replace engine control unit => Page 66 .

1.13 - Checking fuel pump relay -J17 and relay actuation

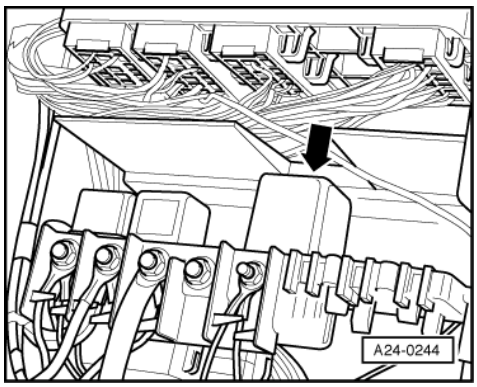
The fuel pump and certain components of the injection system are supplied with power by way of the fuel pump relay -J17.

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

Test conditions

- Battery voltage OK.

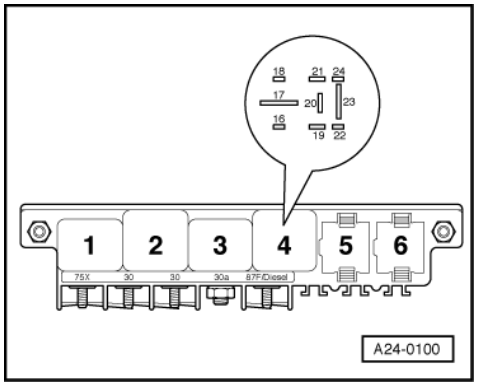
Functional testing of fuel pump relay



Note:

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

- Connect the 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 7 .
  For this purpose, the ignition must be switched on.



- Start the final control diagnosis => Page 28 . The fuel pump should run.

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

If the relay does not respond:

- Checking actuation of fuel pump relay
  =>Page 82 .

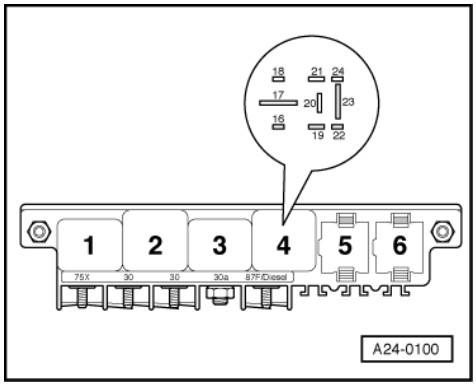
If the fuel pump does not run.

- Check actuation of fuel pump and components =>Page 84

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 65 .

- Connect together sockets 65 and 2 on the test box using an auxiliary cable from V.A.G 1594.



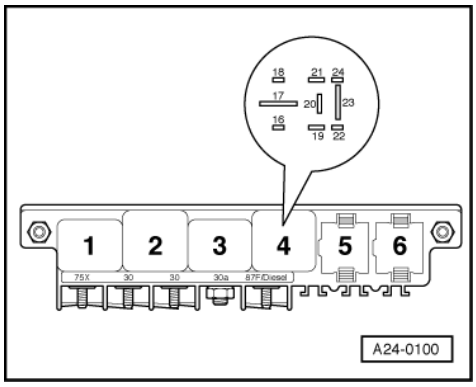
Specified value: The fuel pump relay (relay position 4) must respond.

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

- Replace engine control unit => Page 66 .

If the relay does not respond:

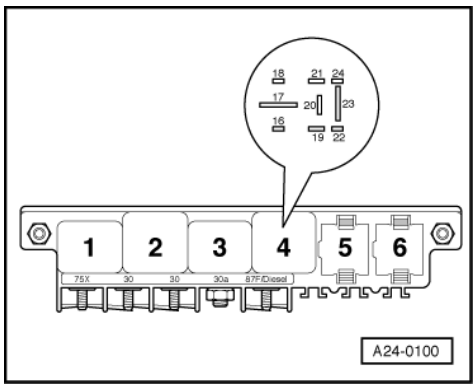
- -> Remove fuel pump relay from relay base (relay position 4)



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

Specified value: approx. battery voltage

If specified value is not attained:



- Check the wiring connections.

=> 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:

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

Wire resistance: max. 1.5 Ohm

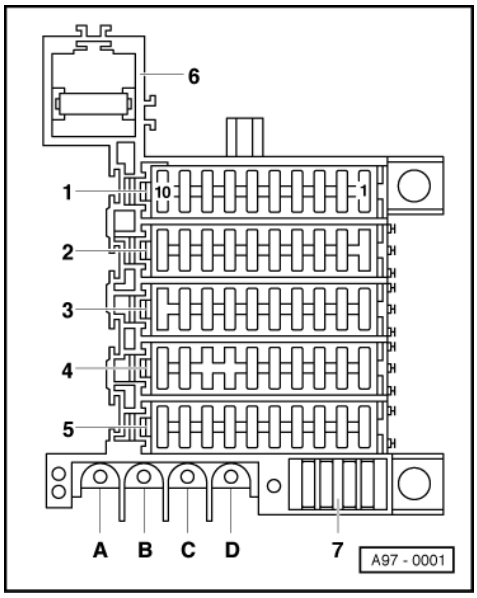
- Rectify any open/short circuit as necessary.

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

If no wiring fault is detected:

- Replace the fuel pump relay -J17.

Checking actuation of fuel pump and components



- Remove fuse cover on A-pillar in footwell on right side.
- -> Pull out fuses 1, 2 and 3 (in blue fuse carrier, 4th row from the top).

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

- Start the final control diagnosis => Page 28 .

- Connect hand-held multimeter (voltage measurement range) between earth and either left or right contact of the following fuses (only fuse contact is live).

Fuse No.	Specified value at left or right contact
1	approx. battery voltage
2	approx. battery voltage
3	approx. battery voltage

If the specified values are not obtained:

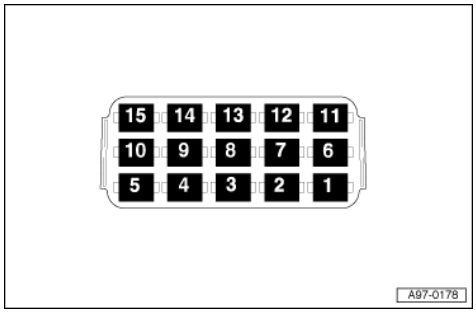
- Check the wiring connections.

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

If no wiring fault is detected:

- Replace the fuel pump relay -J17.

1.14 - Checking power supply relay for Motronic system -J271



Note:

-> The power supply relay for Motronic system -J271 is located in the electronics box in the front passenger's footwell (central electrics unit, relay position 2.)

Checking actuation of power supply relay

- Switch ignition off.
- Detach power supply relay -J271 from the relay carrier.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 65 .

- Check the following wiring for an open circuit or short circuit

Test box V.A.G 1598/31, socket	Power supply relay, contact
23	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

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

If no wiring fault is detected:

- Check the power supply for the power supply relay => Page 85 .

Checking the power supply

- Switch ignition off.
- Connect hand-held multimeter between earth and the respective contacts on the relay panel in order to measure the voltage.

Specified value: approx. battery voltage

If the specification is not achieved, test the wiring connections according to the current flow diagram.

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

If the specified value is achieved, check the wiring connections between power supply relay and engine control unit => Page 86 .

Checking wiring between power supply relay and engine control unit

- Check the fuse (see current flow diagram)

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

If no fault is detected at the fuse.

- Check the following wiring for an open circuit or short circuit

Test box V.A.G 1598/31, socket	Power supply relay, contact
3	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

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

If no faults have been found in any of the above checks, replace power supply relay -J271

1.15 - Checking control unit power supply

Test requirements:

- Fuse for engine control unit OK

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

- Battery voltage at least 11 V
- Alternator OK

- Connect the vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit 1 with "Address word" 01 => Page 7 .
  For this purpose, the engine must be running at idling speed.

-> Indicated on display:

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

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block 08
Enter display group number XXX
```

- Press keys 0, 0 and 4 for "display group number 4" and confirm entry with Q key.

-> Indicated on display:

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

- Check specified value for battery voltage in display zone 2:

	Display zones			
	1	2	3	4
Display group 4: Battery voltage with engine idling				
Display	xxxx rpm	**xx.xxx volts**	xxx.x °C	xxx.x °C
Display	Engine speed	**Battery voltage**	Coolant temperature	Intake air temperature
Range	min.: 550 rpm max.: 7200 rpm	**min.: 0 V max.: 16.500 V**		
Specified value	600...820 rpm	**12.000...14.500 volts**	80.0...105.0 °C	From ambient temperature up to 90 °C
Note		**If specified result is not achieved =>Page 87 Evaluation display zone 2**		

Evaluation of display group 4

Display zone 2	Possible causes of fault	Fault remedy
Readout fluctuates between 10.000-14.500 Volt	- Loose contact	- Check voltage supply from terminals 15 and terminal 30 => Page 87
0.000...10.000 volts	- Battery discharged / defective - Voltage regulator defective	- Check voltage supply from terminals 15 and terminal 30 => Page 87 Test battery Check voltage regulator Check alternator
14.500...16.500 volts	- Voltage regulator defective - Alternator defective	- Check voltage regulator Check alternator

Checking voltage supply from terminal 15 and terminal 30

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 65 .
- Connect hand- held multimeter V.A.G 1526 (voltage range) to the following sockets on the test box.

Voltage supply from terminal 15

	Socket	Specified value
up to model year 2001:	1 or 2 (earth) +3 (positive)	approx. battery voltage
from model year 2001:	1 or 2 (earth) +21 (positive)	approx. battery voltage

Voltage supply from terminal 30

Socket	Specified value
1 (earth) +62 (positive)	approx. battery voltage

Socket	Specified value
2 (earth) +62 (positive)	approx. battery voltage

If the specified values are not obtained:

- Check the wiring connections.

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

1.16 - Checking air mass meter -G70

Test conditions

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

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

Checking function

- Connect the vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit 1 with "Address word" 01 => Page 7 .
  For this purpose, the engine must be running at idling speed.

-> Indicated on display:

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

- Press keys 0 and 4 for the function "Initiate basic setting" and confirm entry with Q key.

Note:

During basic setting, the solenoid valve for the activated charcoal filter (ACF valve -N80) is closed and the air conditioning compressor is switched off by the engine control unit.

-> Indicated on display:

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

- Press keys 0, 0 and 2 for "display group number 2" and confirm entry with Q key.

-> Indicated on display:

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

- Check specified results for recorded load.

	Display zones			
	1	2	3	4
Display group 2: Intake air mass at idle and operating temperature				
Display	xxx rpm	xx.x %	x.x ms	xxx.x g/s
Display	Engine speed (in steps of 40 rpm)	Load	Average injection period	Air mass

	Display zones			
Range	min.: 550 rpm max.: 7200 rpm	min.: 0 % max.: 110 %		
Specified value	600...820 rpm	14.0...24.0 %	**1.0...5.0 ms**	**3.5...7.0 g/s**
Note	---	---	**If specified value is not attained: Evaluation, display zone 3 =>Page 89 .**	**If specified value is not attained: Evaluation, display zone 4 =>Page 89 .**

If specified value is attained:

- Press ⇒key.
- Press keys 0 and 6 for the "End output" function and press the Q key to confirm entry.
- Switch ignition off.

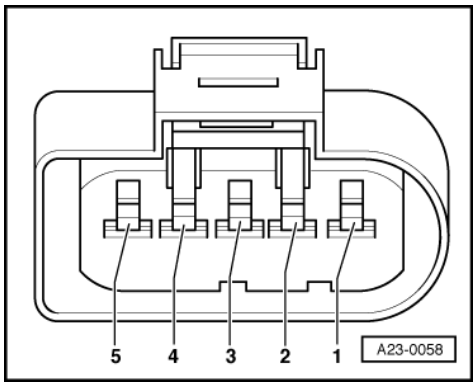
Evaluation of display group 002

Display zone: 3	Possible causes of fault	Fault remedy
Less than 1.0 ms	- Lower values can only occur when vehicle is on overrun	
Greater than 5.0 ms	- Engine load from ancillaries	- Eliminate load (air conditioner system/ power steering/alternator)
	- Poor idling (not running on all cylinders)	- Test spark plugs Check injectors =>Page 78
	- Throttle valve control part -J338 defective	- Check throttle valve control part =>Page 135 .

Evaluation of display group 002

Display zone: 4	Possible causes of fault	Fault remedy
Less than 3.5 g/s	- Large quantity of unmetered air between intake manifold and air mass meter - Voltage supply to air mass meter or wiring to engine control unit	- Test for leaks (unmetered air) in intake air system => Page 89
Greater than 7.0 g/s	- Engine load from ancillaries	- Eliminate load (air conditioner system/ power steering/alternator)
	- Voltage supply to air mass meter or wiring to engine control unit	- Check voltage supply and/or wiring => Page 89

Testing voltage supply to air mass meter



- Detach connector from air mass meter.
- -> Connect hand-held multimeter for voltage measuring to socket 2 of connector and engine earth.

- Operate the starter briefly.

Specified value: approx. battery voltage

Note:

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

If battery voltage is not present.

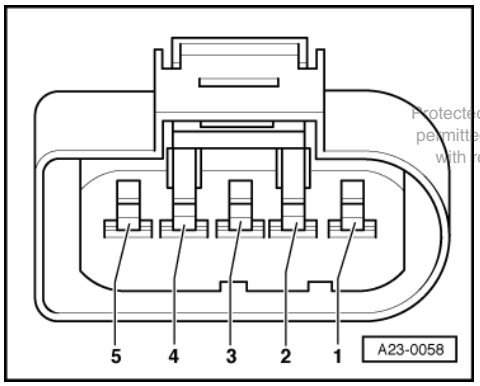
- Test wiring from socket 2 on connector via fuse to fuel pump relay for open circuit or short to earth. Rectify, if necessary.

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

If the specified value is achieved.

- Check earth connection to engine control unit => Page 90 .

Checking earth connection



- -> Connect hand-held multimeter for voltage measuring to sockets 2 and 3 of the connector.
- Operate the starter briefly.

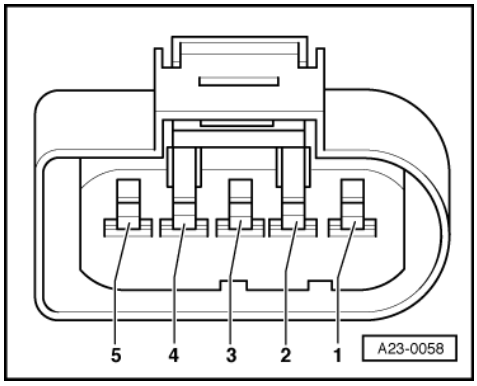
Specified value: approx. battery voltage

Note:

Engine control unit earth is present at socket 3 of the connector.

If specified value is not attained:

- Check the wiring connections
  =>Page 91 .



- -> Connect hand-held multimeter for voltage measuring to sockets 3 and 4 of the connector.

- Switch the ignition on.

Specified value: approx. 5 V.

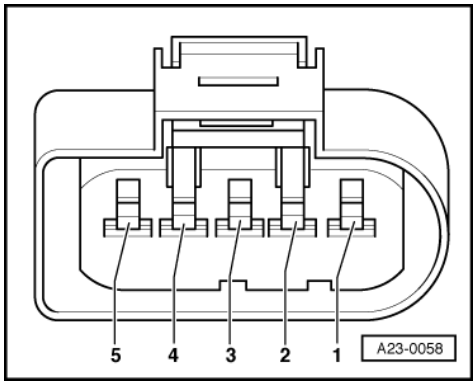
If specified value is not attained:

- Check the wiring connections
  =>Page 91 .

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 65 .
- -> Check for open circuit and short to positive or earth in the following wiring connections:

Connector for air mass meter -G70, socket	Test box V.A.G 1598/31 socket
3	27
4	53
5 (signal wire)	29

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

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

- Additionally check all wires for short to one another.

Connector for air mass meter -G70, socket	Test box V.A.G 1598/31 socket
3	53 and 29
4	27 and 29
5 (signal wire)	27 and 53

Specified value: infinite resistance (no continuity)

- If the voltage supply and the wiring are OK, renew the air mass meter -G70.

1.17 - Checking intake air temperature sender -G42

Fitting location of sender (common component: Air mass meter and intake air temperature sender in air filter element) => Page 59 .

- Connect the 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 7 .
  For this purpose, the ignition must be switched on.

-> Indicated on display:

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

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block HELP
Enter display group number XXX
```

- Press keys 0, 0 and 4 for "display group number 4" and confirm entry with Q key.

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

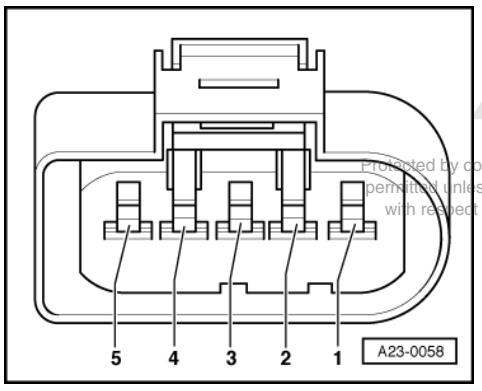
```
Read measured value block 4
     1     2     3     4
```

- Check specified result for intake air temperature sender (display zone 4):

	Display zones			
	1	2	3	4
Display group 4: Intake air temperature with engine idling				
Display	xxxx rpm	xx.xxx volts	xxx.x °C	**xxx.x °C**
Display	Engine speed	Battery voltage	Coolant temperature	**Intake air temperature**
Range	min.: 550 rpm max.: 7200 rpm	min.: 0 V max.: 15.000 V		
Specified value	600...820 rpm	12.000...14.500 volts	80.0...110.0 °C	**From ambient temperature up to 50 °C**
Note				**If the display shows a temperature that differs excessively from surrounding temperature check wiring =>Page 92 .**

Checking wiring

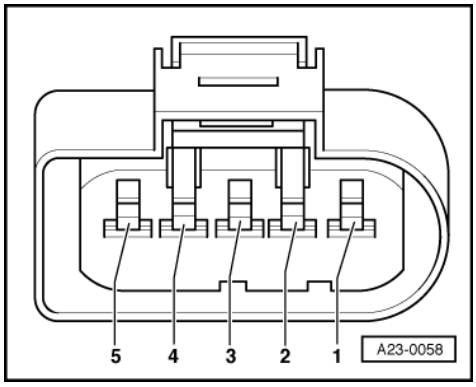
- Switch ignition off.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 65 .
- Disconnect the connector to the air mass meter => Page Fitting locations Overview 59 .



- -> Check for shorts between the two lines.

5-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
1	27

Specified value: infinity Ohm (no connection)



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

5-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
1	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder
3	27

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

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

If no wiring fault is detected:

- Replace intake air temperature sender -G42.

1.18 - Checking coolant temperature sender -G62

Fitting location of coolant temperature sender
=>Page 59

- Connect the vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit 1 with "Address word" 01 => Page 7 .
  For this purpose, the engine must be running at idling speed.

-> Indicated on display:

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

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block
Enter display group number XXX
```

- Press keys 0, 0 and 4 for "display group number 4" and confirm entry with Q key.

-> Indicated on display:

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

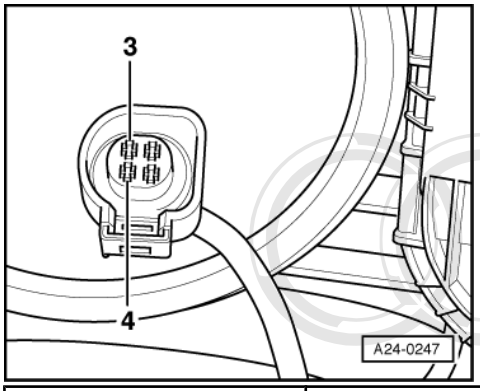
- Check specified value for coolant temperature sender in display zone 3:

	Display zones			
	1	2	3	4
Display group 4: Coolant temperature with engine idling				
Display	xxxx rpm	xx.xxx volts	**xxx.x °C**	xxx.x °C
Display	Engine speed (in steps of 40 rpm)	Battery voltage	**Coolant temperature**	Intake air temperature
Range	min.: 550 rpm max.: 7200 rpm	min.:0 volts max.: 15.000 V		
Specified value	600... 820 rpm	12.000...14.500 volts	**80.0...105.0 °C**	Ambient temperature
Note			**-The temperature reading should increase at a uniform rate. -If specified value is not attained, check sender or sender wiring =>Page 94 .**	

Checking wiring

- Switch ignition off.
- Unplug the connector from sender.

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 65 .
- Check the wiring from the 4 pin connector ...
- ... to engine control unit for open circuit and short to positive or earth.



4-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
3	108
4	93

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

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

If no wiring fault is detected:

- Replace coolant temperature sender -G62.

2 - Checking lambda control

2.1 - Checking lambda control

2.2 - Function of lambda control

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 rich" (low level of residual oxygen) is between about 0.5 and 1.0 V (in relation to reference earth).

The voltage signal for "Mixture lean" (high residual oxygen) is between about 0...0.5 V (in relation to reference earth).

During the transition from "rich" to "lean" and vice versa (λ = 1.0), there is a voltage jump from 0.5...1.0 V to 0...0.5 V or vice versa.

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

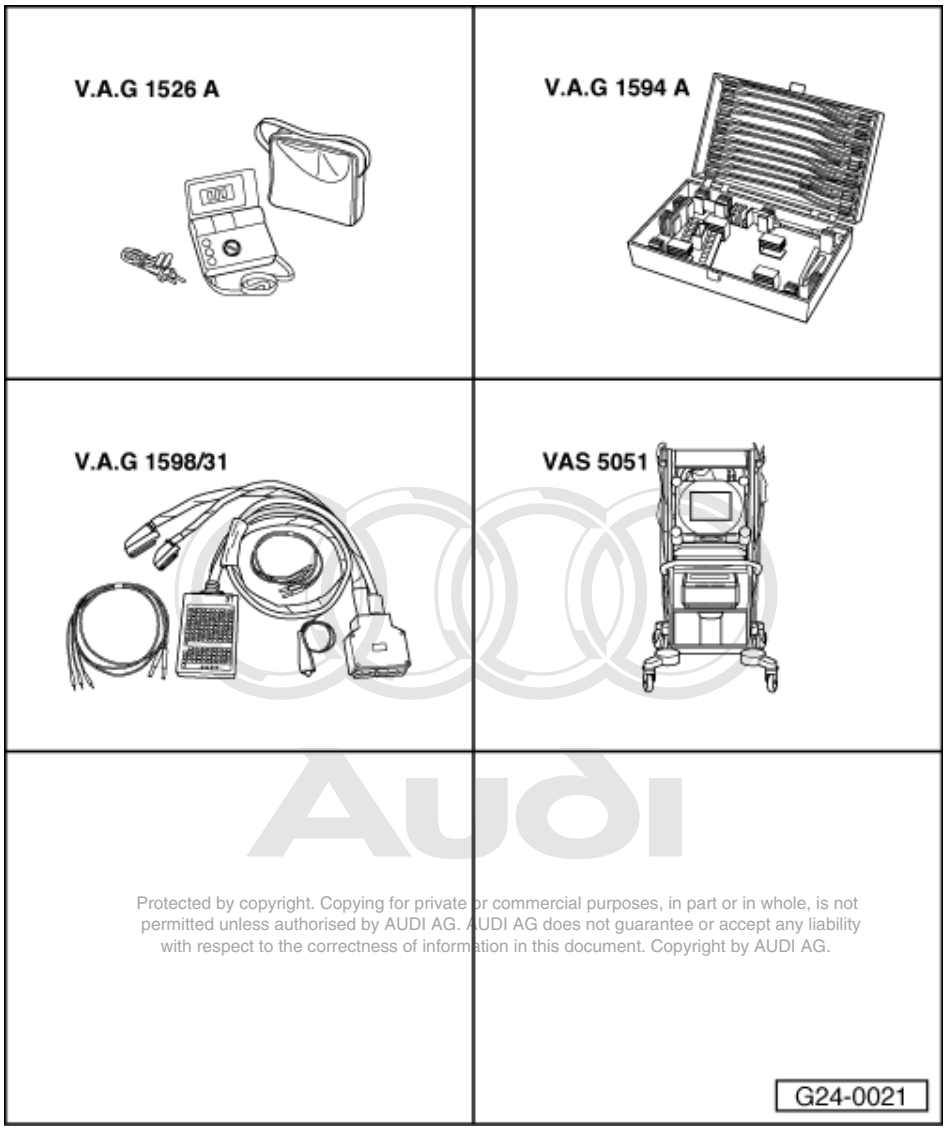
Note:

"Reference earth" means predetermined earth from engine control unit

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 probe through the fine cavities in the electrical wiring as a result of thermal fluctuations and capillary effects).
- Lambda probe damaged by silicone vapours (the engine draws in traces of any silicone based sealants that may have been used. The silicone does not burn and damages the lambda probe).

2.3 - Checking lambda control and lambda probe -G39 and -G108 upstream of catalytic converter



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 finding, it is possible to switch off the lambda control by selecting display group 99 "Basic setting" mode and to switch it on again by selecting display group 99 in "Read measured value block" mode.
- After selecting the display group 99 (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 conditions

- Perform road test and do not erase fault memory.
- Coolant temperature at least 85 °C.

Functional test

- Connect the vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit 1 with "Address word" 01 => Page 7 .
  For this purpose, the engine must be running at idling speed.

-> Indicated on display:

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

- Press keys 0 and 4 for the function "Initiate basic setting" and confirm entry 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
Enter display group number XXX
```

- Press keys 0, 3 and 0 for "display group number 30" and confirm entry with Q key.

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

```
System in basic setting 30
     1     2     3     4
```


- Check lambda probe status
  (display zones 1 to 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 30: Lambda status at idle (coolant temperature at least 85 °C)				
Display	**0 0 0**		**0 0 0**	
Display	**Lambda probe status, bank 1, probe 1**	Lambda probe status, bank 1, probe 2	**Lambda probe status, bank 1, probe 2**	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 1**	
Note:	**Explanation of display => Page 108**			

Significance of 3 digit readout of display group 30

1	1	1	**Display zones 1 to 4**
		X	Lambda control 0 = inactive 1 = active

	X		Lambda probe condition 0 = inactive 1 = active
X			Condition of lambda probe heating 0 = inactive 1 = active

Checking lambda probe learned values and lambda control

- Connect the vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit 1 with "Address word" 01 => Page 7 .
  For this purpose, the engine must be running at idling speed.

-> Indicated on display:

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

- Press keys 0 and 4 for the function "Initiate basic setting" and confirm entry 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
Enter display group number XXX
```

- Press keys 0, 3 and 3 for "display group number 33" and confirm entry with Q key.

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

```
System in basic setting 33
     1     2     3     4
```

- Check lambda control
  (display zones 1 to 4):

	Display zones			
	1	2	3	4
Display group 33: Lambda control at idle				
Display	**xx.x %**	**x.xxx volts**	**xx.x %**	**x.xxx V**
Display	**Lambda control bank 1**	**Lambda probe voltage, bank 1**	**Lambda control bank 2**	Lambda probe voltage, bank 2
Range	**min.: -25.0 % max.: 25.0 %**	**min.: 0 V max.: 1.000 V**	**min.: -25.0 % max.: 25.0 %**	**min.: 0 V max.: 1.000 V**
Specified value	**In range -10.0...10.0 % the value must be at least 2 %**	**In range 0.000...1.000 volts, the voltage must fluctuate**	**In range -10.0...10.0 % the value must be at least 2 %**	**In range 0.000...1.000 volts, the voltage must fluctuate**
Note	**If the specification is not attained =>Page 99**	**If the specification is not attained, see evaluation =>Page 100**	**If the specification is not attained =>Page 99**	**If the specification is not attained, see evaluation =>Page 100**

- Press the Ckey.
- Press keys 0, 3 and 2 for "display group number 32" and confirm entry with Q key.

-> Indicated on display:

(1...4 = display zones)

```
System in basic setting 32
     1     2     3     4
```

- Check lambda control (display zones 1 to 4):

	Display zones			
	1	2	3	4
Display group 32: Lambda probe learned values at idle				
Display	xx.x %	xx.x %	xx.x %	xx.x %
Display	Lambda learned value bank 1, probe 1 at idle (additive)	Lambda learned value bank 1, probe 1 on part throttle (multiplicative)	Lambda learned value bank 1, probe 2 at idle (additive)	Lambda learned value bank 1, probe 2 on part throttle (multiplicative)
Range	min.: -25.0 % max.: 25.0 %	min.: -25.0 % max.: 25.0 %	min.: -25.0 % max.: 25.0 %	min.: -25.0 % max.: 25.0 %
Specified value	-5.7...5.7 % can fluctuate slightly	-15.0...15.0 % can fluctuate slightly	-5.7...5.7 % can fluctuate slightly	-15.0...15.0 % can fluctuate slightly
Note	If the specification is not attained =>Page 100	If the specification is not attained =>Page 100	If the specification is not attained =>Page 100	If the specification is not attained =>Page 100

If specification is not attained in display zone 1 or display zone 3 (display group 33), or if the value does not fluctuate by at least 2%:

- Check intake system for leaks and rectify unmetered air
- Check the lambda probe heating =>Page 108 .
- Check lambda probe signal wiring and actuation => Page 111
- Check fuel pressure regulator => Page 74
- Fuel return line kinked or blocked.
- Press ⇒key.
- Press keys 0 and 6 for the "End output" function and press the Q key to confirm entry.
- Switch ignition off.

Evaluation of display group 32

Display group 32 Display zone: 1 to 4	Possible causes of fault	Fault remedy
Lambda learned values in range -5.7 to -25.0 %	- Oil dilution	- Carry out oil change or drive vehicle fairly fast on out-of-town roads
Display zone: 2 / 4	- High oil consumption	
Lambda learned values in range -15.0 to -25.0 %	- Air mass meter defective	- Test air mass meter =>Page 88 .
	- Solenoid valve for activated charcoal filter stuck open	- Check solenoid valve for activated charcoal filter => Page 129 .
	- Fuel pressure too high - Fuel return line kinked or blocked.	- Check fuel pressure regulator =>Page 74 . Check fuel return line
	- Injector leaking	- Check injectors =>Page 78

Evaluation of display group 32

Display group 32 Display zone: 1 to 4	Possible causes of fault	Fault remedy
Lambda learned values in range 5.7 to 25.0 %	- Unmetered air in intake area	- Check intake system for leaks and rectify unmetered air
Display zone: 2 / 4	- Fuel pressure too low	- Check fuel pressure regulator =>Page 74 .
Lambda learned values in range 15.0 to 25.0 %	- Lambda probe heating defective	- Check lambda probe heating =>Page 108 .
	- Injector only opens partially or not at all	- Check injectors =>Page 78
	- Solenoid valve for activated charcoal filter stuck open	- Check solenoid valve for activated charcoal filter => Page 129 .

Evaluation of display group 33

Display group 33 Display zone: 2 / 4	Possible causes of fault	Fault remedy
approx. 0.450 V	- Open circuit in wire 4 between lambda probe and control unit - Open circuit in wire 3 between lambda probe and control unit - Lambda probe heating defective - Lambda probe defective	- Check signal wiring and actuation => Page 111 - Checking lambda probe heating =>Page 108 . Fit a new lambda probe
Greater than 1.100 V	- Short to positive in wire 4 between lambda probe and control unit	- Check lambda probe wiring for bank 1, lambda probe 1 => Page 112
Less than 0.100 V	- Short to earth in wire 4 between lambda probe and control unit - Short circuit between wires 3 and 4	- Check lambda probe wiring for bank 2, lambda probe 1 => Page 115

2.4 - Checking lambda control and lambda probe -G39 and -G108 upstream of catalytic converter

Test conditions

- Coolant temperature at least 85 °C.

Test sequence

- Connect the vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit 1 with "Address word" 01 => Page 7 .
  For this purpose, the engine must be running at idling speed.

-> Indicated on display

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


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

-> Indicated on display

```
Initiate 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
```

- Perform the test as soon as "Test ON" appears in display zone 4.

Note:

This process can take a few minutes.

	Display zones			
	1	2	3	4
Display group 034: Diagnosis, lambda probe ageing, (bank 1)				
Display	xxxx rpm	xxx °C	x.x s	**Test ON**
Display	Engine speed	Exhaust gas temperature	Period Lambda probe upstream of catalytic converter	Diagnosis status
Range	min.: 550 rpm max.: 7200 rpm	70...850 °C	0...3.0 seconds	**Test OFF Test ON B1-P1 OK B1-P1 NOK**
Specified value	600...820 rpm	greater than 200°C	0.1...1.8 s	B1-P1 OK
Note			**If specification not attained => ContinuePage 101**	

Note on display zone 2:

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.

Cont.

If specification in display zone 3 or 4 is not attained:

- Replace lambda probe 1 upstream of catalytic converter -G39, bank 1.

Test sequence

- Connect the vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit 1 with "Address word" 01 => Page 7 .
  For this purpose, the engine must be running at idling speed.

-> Indicated on display

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

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

-> Indicated on display

```
Initiate 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
```

- Perform the test as soon as "Test ON" appears in display zone 4.

Note:

This process can take a few minutes.

	Display zones			
	1	2	3	4
Display group 035: Diagnosis, lambda probe ageing, (Bank 2)				
Display	xxxx rpm	xxx °C	x.x s	**Test ON**
Display	Engine speed	Exhaust gas temperature	Period Lambda probe upstream of catalytic converter	Diagnosis status
Range	min.: 550 rpm max.: 7200 rpm	70...850 °C	0...3.0 seconds	**Test OFF Test ON B2-P1 OK B2-P1 NOK**
Specified value	600...820 rpm	greater than 200°C	0.1...1.8 s	B2-P1 OK
Note			**If specification not attained => ContinuePage 101**	

Note on display zone 2:

Calculated value from engine speed and load.

Note on display zones 3 and 4:

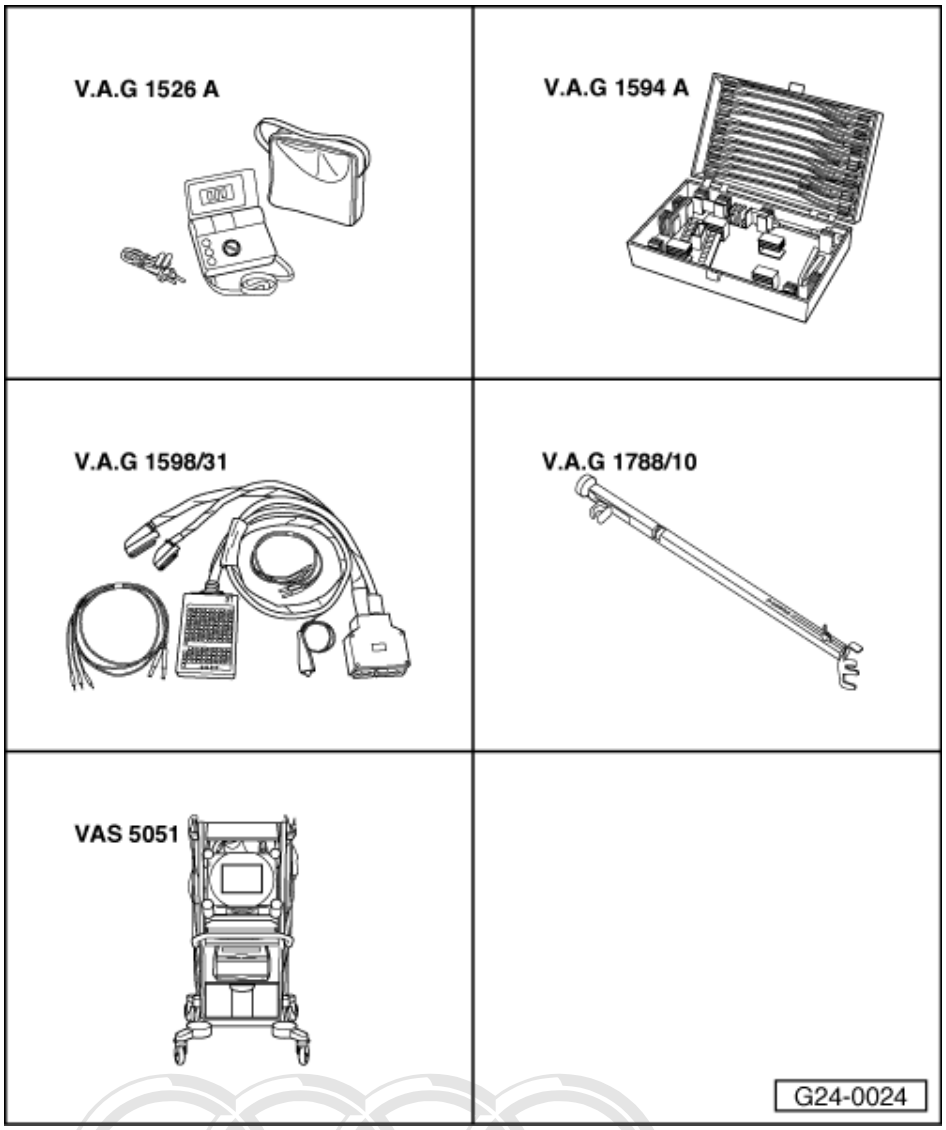
The period specifies the time between two voltage jumps in the lambda probe (e.g. rich - lean - rich) thereby providing a measurement basis for the ageing status of the lambda probe. If the specified time is exceeded, display zone 4 indicates = B1-P1 NOK.

Cont.

If specification in display zone 3 or 4 is not attained:

- Replace lambda probe 1 upstream of catalytic converter -G108, bank 2.

2.5 - Checking lambda control and lambda probe -G130 and -G131 downstream of catalytic converter

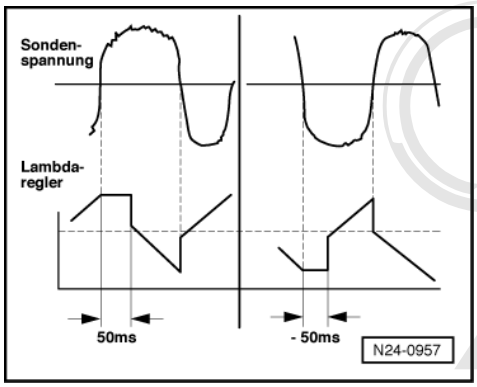


Special tools and workshop equipment required

- 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

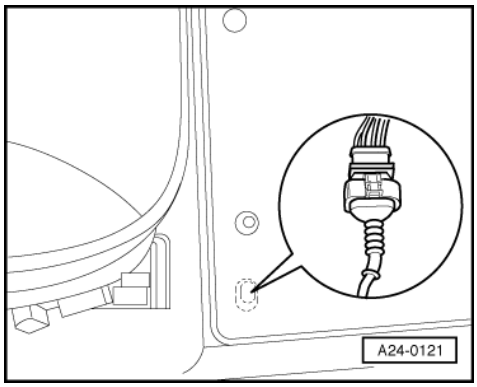


Note:

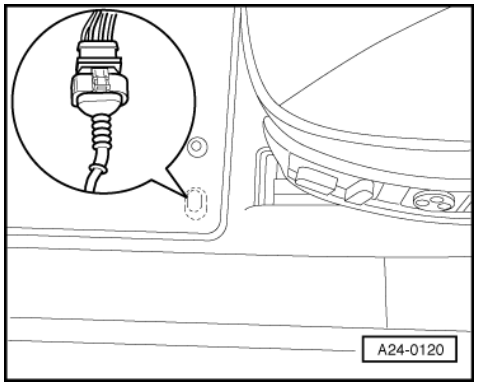
The lambda control downstream of the catalytic converter has priority over the lambda control upstream of the catalytic converter and is used as correction control.

-> 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.

Fitting location of connector for lambda probe 2 downstream of catalytic converter:



-> The four-way connector for the lambda probe 2 (G130) bank 1 is under the mat on the passenger side.



-> The four-way connector for lambda probe 2 (G131) bank 2 is under the mat on the driver's side.

Test conditions

- Perform road test and do not erase fault memory.

- Coolant temperature at least 85 °C.

Test sequence

- Connect the vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit 1 with "Address word" 01 => Page 7 .
  For this purpose, the engine must be running at idling 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

```
Initiate 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 200°C is attained in display zone 2.

Note:

This process can take a few minutes.

- Press C key.
- Set engine speed to 1900...2400 rpm using engine speed controller V.A.G 1788/10.

-> Indicated on display

```
Initiate 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 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 1, probe 2	**Lambda probe status bank 2, probe 2**

	Display zones			
Range	0 = off 1 = on	**0 = off 1 = on**	0 = off 1 = on	**0 = off 1 = on**
Specified value	1 1 1	**1 1 1**	1 1 1	**1 1 1**
Note	Explanation of display => Page 108			

Notes:

- The lambda control of lambda probe downstream of catalytic converter (bank 1-probe 2 and bank 2-probe 2) is not active without engine load.
- The first digit of the 3-digit display (heating) fluctuates between 0 and 1.
- The third digit of the 3-digit display (lambda control) fluctuates between 0 and 1.

Significance of 3 digit readout of display group 30

1	1	1	**Display zones 1 to 4**
		X	Lambda control 0 = inactive 1 = active
	X		Lambda probe condition 0 = inactive 1 = active
X			Condition of lambda probe heating 0 = inactive 1 = active

Checking lambda control downstream of catalytic converter

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

-> Indicated on display

```
Initiate 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
Display group 037: Diagnosis, lambda control system (Bank 1)				
Display	xxx %	**x.xxx volts**	**xxx ms**	**Test ON**
Display	Engine load	**Voltage of lambda probe downstream of catalytic converter, bank 1**	**Lambda correction value between lambda probe 1 and lambda probe 1, bank 2**	**Diagnosis status**
Range	15...150 %	**0...10.000 V**	**-1200...1200 ms**	**Test OFF Test ON Syst. OK Syst. NOK**
Specified value	14...24 %	**0...10.000 V**	**-800...800 ms**	**Syst. OK**

		Display zones		
Note		If specified value is not attained: Evaluation, display zone 2 =>Page 107 .	If specified value is not attained: Continued =>Page 108 .	If "Syst. NOK" is displayed: Interrogate fault memory => Page 108 .

Note on display zone 3:

The lambda control downstream of the catalytic converter has priority over the lambda control upstream of the catalytic converter and is used as a guidance control. 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.

- Press the Ckey.
- Press keys 0, 3 and 8 for "display group number 38" and confirm entry with Q key.

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

```
System in basic setting 38
     1     2     3     4
```

	Display zones			
	1	2	3	4
Display group 038: Lambda control system diagnosis (Bank 2)				
Display	xxx %	x.xxx volts	xxx ms	Test ON
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	15...150 %	0.000...1.000 volts	-1200...1200 ms	Test OFF Test ON Syst. OK Syst. NOK
Specified value	14...24 %	0...10.000 V	-800...800 ms	Syst. OK
Note		If specified value is not attained: Evaluation, display zone 2 =>Page 107 .	If specified value is not attained: Continued =>Page 108 .	If "Syst. NOK" is displayed: Interrogate fault memory => Page 108 .

Note on display zone 3:

The lambda control downstream of the catalytic converter has priority over the lambda control upstream of the catalytic converter and is used as a guidance control. 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 group 37/38 Display zone: 2	Possible causes of fault	Fault remedy
approx. 0.450 V	- Open circuit in wire 4 between lambda probe and control unit - Open circuit in wire 3 between lambda probe and control unit	- Check signal wiring and actuation => Page 111

	- Lambda probe heating defective - Lambda probe defective	- Check lambda probe heating =>Page 108 . Fit a new lambda probe
Greater than 1.100 V	- Short to positive in wire 4 between lambda probe and control unit	- Check lambda probe wiring bank 1, lambda probe 2 (downstream of catalytic converter) => Page 113
Less than 0.100 V	- Short to earth in wire 4 between lambda probe and control unit - Short circuit between wires 3 and 4	- Check lambda probe wiring bank 2, lambda probe 2 (downstream of catalytic converter) => Page 116

Cont.

If specification in display zone 3 or 4 is not attained:

- Check for air leak at exhaust or catalytic converter (check screw clamps and exhaust for damage)
- Replace appropriate lambda probe "upstream of" catalytic converter.

2.6 - Checking lambda probe heating for lambda probes

Note:

The lambda probe heating circuit is monitored by the self-diagnosis system, interrogate fault memory => Page 9 .

- Connect the vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit 1 with "Address word" 01 => Page 7 .
  For this purpose, the engine must be running at idling speed.

-> Indicated on display:

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

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block
Enter display group number XXX
```

- Press keys 0, 4 and 1 for "display group number 41" and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block     41
□
     1     2     3     4
```

- Check resistance of lambda probe heating.

	Display zones			
	1	2	3	4
Display group 41: Lambda probe heating, bank 1 at idling speed				
Display	**xxx kOhm**	**Htg. u.c.c. ON**	**xxx kOhm**	**Htg. d.c.c. ON**
Display	**Bank 1, probe 1**	**Condition of lambda probe heating upstream of catalytic converter**	**Bank 1, probe 2**	**Condition of lambda probe heating downstream of catalytic converter**

	Display zones			
Range		Htg. u.c.c. ON Htg. u.c.c. OFF		Htg. d.c.c. ON Htg. d.c.c. OFF
Specified value	Smaller than 2 kOhm	Htg. u.c.c. ON	Smaller than 2 kOhm	Htg. d.c.c. ON
Note			It may take a few minutes until specified value is attained	

- Press the Ckey.
- Press keys 0, 4 and 2 for "display group number 42" and confirm entry with Q key.

	Display zones			
	1	2	3	4
Display group 42: Lambda probe heating, bank 2 at idling speed				
Display	xxx kOhm	Htg. u.c.c. ON	xxx kOhm	Htg. d.c.c. ON
Display	Bank 1, probe 2	Condition of lambda probe heating upstream of catalytic converter	Bank 2, probe 2	Condition of lambda probe heating downstream of catalytic converter
Range		Htg. u.c.c. ON Htg. u.c.c. OFF		Htg. d.c.c. ON Htg. d.c.c. OFF
Specified value	Smaller than 2 kOhm	Htg. u.c.c. ON	Smaller than 2 kOhm	Htg. d.c.c. ON
Note			It may take a few minutes until specified value is attained	

If specified value is not attained:

- Check the voltage supply to the lambda probe heating => Page 109 .
- Check lambda probe signal wiring and actuation => Page 111 .

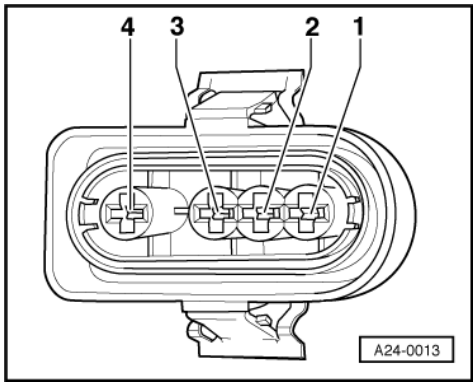
Check voltage supply for lambda probe heating

Fitting locations of 4-pin connectors for lambda probes => Page 59 .

- Check fuse for lambda probe heating.

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

- Disconnect 4-pin connector of relevant lambda probe.



- -> Using leads from V.A.G 1594, connect hand-held multimeter (voltage measurement range) to sockets 1 (positive) and 2 (earth).
- Operate starter briefly.

Specified value: approx. battery voltage

If no voltage is present:

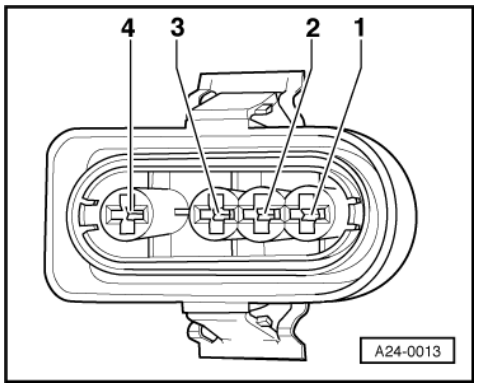
- -> Using leads from V.A.G 1594, connect hand-held multimeter (voltage measurement range) to socket 1 (positive) and vehicle earth.

- Operate starter briefly.

Specified value: approx. battery voltage

If no voltage is present:

- Check the wiring from socket 1 on the relevant lambda probe connector on the wiring harness via the fuse to the fuel pump relay for open circuit or short.



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

If the power supply is OK:

- -> Using leads from V.A.G 1594, connect hand-held multimeter (voltage measurement range) to socket 2 (earth actuation from engine control unit) and battery positive.

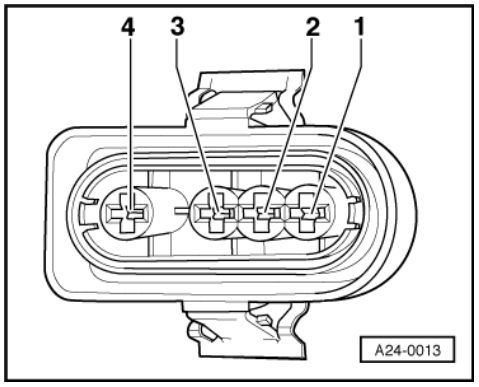
- Start the engine.

Specified value: approx. battery voltage, fluctuating

Note:

At certain operating points, the engine control unit "cycles" the earth for the lambda probe heating. This means that at these points, the earth is continuously switched on and off. For this reason, the voltage reading on the tester may fluctuate.

- 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 65 .
- -> Check for open circuit in the following wiring connections:

Lambda probe upstream of catalytic converter: Bank 1 -G39

Connector on wiring harness, socket	Test box V.A.G 1598/31 socket
2	5 (earth)

Lambda probe upstream of catalytic converter: Bank 2 -G108

Connector on wiring harness, socket	Test box V.A.G 1598/31 socket
2	4 (earth)

Lambda probe downstream of catalytic converter: Bank 1 -G130

Connector on wiring harness, socket	Test box V.A.G 1598/31 socket
2	63 (earth)

Lambda probe downstream of catalytic converter: Bank 2 -G131

Connector on wiring harness, socket	Test box V.A.G 1598/31 socket
2	6 (earth)

Wire resistance: max. 1.5 Ohm

- Rectify open circuit, if necessary.

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

If wiring connections are OK.

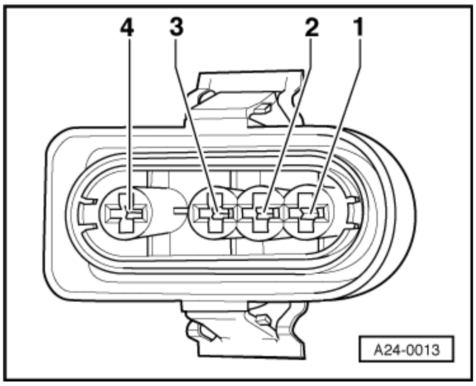
- Replace appropriate lambda probe.

2.7 - Checking lambda probe signal wiring and actuation

Note:

The lambda probe signal is monitored by the self-diagnosis system.

- Interrogate fault memory => Page 9 .
- If a fault related to the lambda probe is displayed and the lambda probe heating is OK unplug the connector for the relevant lambda probe.



Fitting locations of 4-pin connectors for lambda probes => Page 59 .

- -> Check voltage by connecting hand-held multimeter V.A.G 1526 (measuring range 2 V) between sockets 3 and 4 of plug on wiring harness.
- Switch the ignition on.

Specified value: 450 ± 50 mV.

If specified value is not attained:

- Check the lambda probe wires:

Bank 1 Probe 1 -G39 Page 112

Bank 1 Probe 2 -G130 Page 113

Bank 2 Probe 1 -G108 Page 115

Bank 2 Probe 2 -G131 Page 116

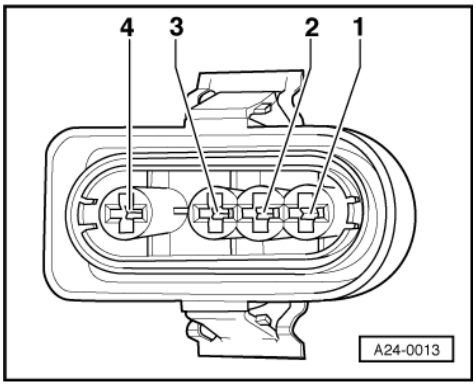
If specified value is attained:

- Renew lambda probe.

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

Fitting location of 4-pin connector for lambda probe => Page 59 .

- Unplug 4-pin connector (black) to bank 1 lambda probe 1 -G39.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 65 .



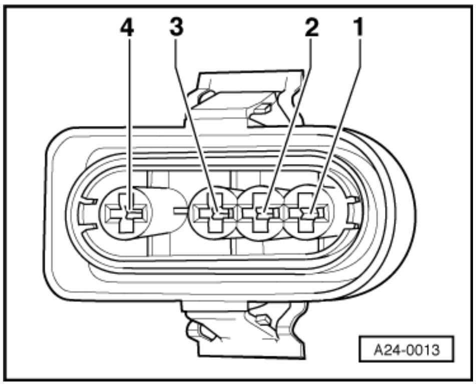
- -> Test for open circuit in the following wiring connections.

Connector on wiring harness, socket	Test box V.A.G 1598/31 socket
3	51
4	70

Wire resistance: max. 1.5 Ohm

- Rectify open circuit, if necessary.

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

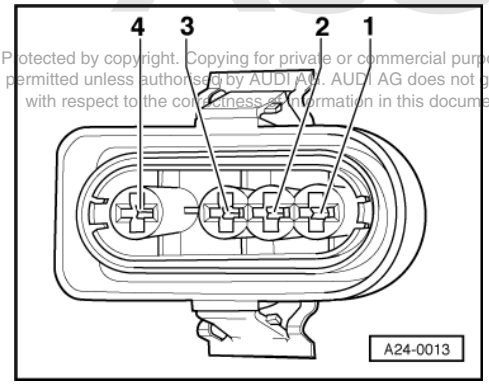


- -> Also test wires on 4-pin connection for shorts between them.

Connector on wiring harness, socket	Test box V.A.G 1598/31 socket
4	51

Specified value: infinite resistance (no continuity)

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



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

Connector on wiring harness, socket	Test box V.A.G 1598/31 socket
4	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder
3	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

Specified value: infinite resistance (no continuity)

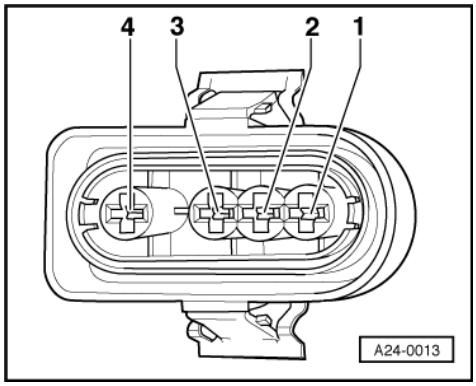
=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

If no wiring fault is detected:

- Replace engine control unit -J220
  =>Page 66 .

Checking lambda probe wiring, bank 1 lambda probe 2 -G130 downstream of catalytic converter

Fitting location of 4-pin connector for lambda probe => Page 104 .



- Unplug 4-pin connector for bank 1, lambda probe 2 -G130.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 65 .
- -> Test for open circuit in the following wiring connections.

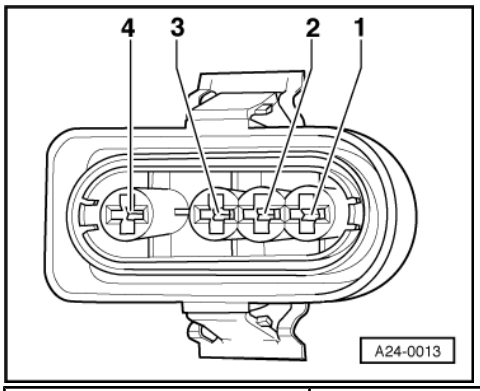
Connector on wiring harness, socket	Test box V.A.G 1598/31 socket
3	68
4	69

Wire resistance: max. 1.5 Ohm

- Rectify open circuit, if necessary.

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

- Also test wires on 4-pin connector for shorts between them.



Connector on wiring harness, socket	Test box V.A.G 1598/31 socket
4	68

Specified value: infinite resistance (no continuity)

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

- Test screen wiring for short to lambda probe wiring.

Connector on wiring harness, socket	Test box V.A.G 1598/31 socket
4	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder
3	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

Specified value: infinite resistance (no continuity)

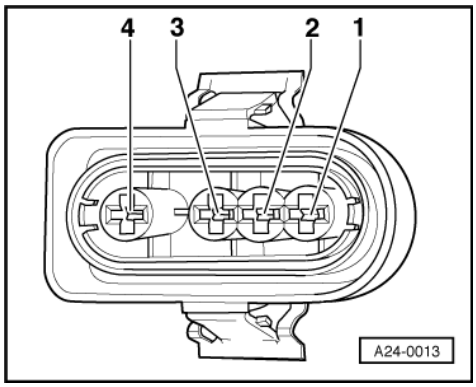
=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

If no wiring fault is detected:

- Replace engine control unit -J220
  =>Page 66 .

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

Fitting location of 4-pin connector for lambda probe => Page 59 .



- Unplug 4-pin connector (black) to bank 2 lambda probe 1 -G108.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 65 .
- -> Test for open circuit in the following wiring connections.

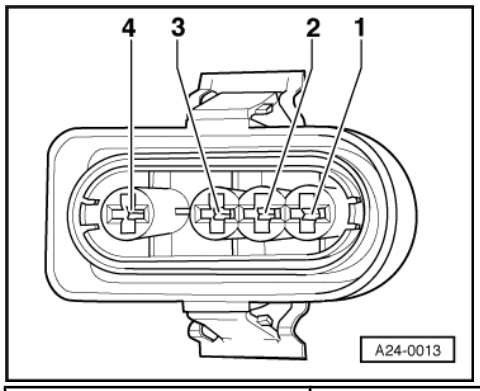
Connector on wiring harness, socket	Test box V.A.G 1598/31 socket
3	12
4	13

Wire resistance: max. 1.5 Ohm

- Rectify open circuit, if necessary.

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

- Also test wires on 4-pin connector for shorts between them.



Connector on wiring harness, socket	Test box V.A.G 1598/31 socket
4	12

Specified value: infinite resistance (no continuity)

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

- Test screen wiring for short to lambda probe wiring.

Connector on wiring harness, socket	Test box V.A.G 1598/31 socket
4	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder
3	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

Specified value: infinite resistance (no continuity)

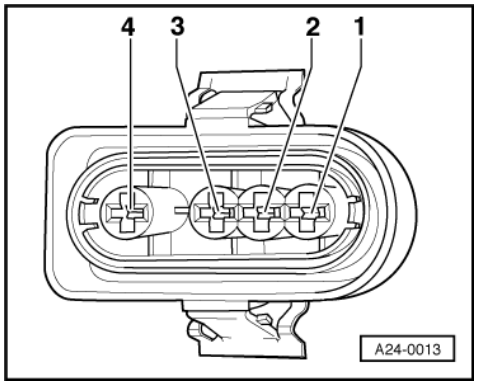
=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

If no wiring fault is detected:

- Replace engine control unit -J220
  =>Page 66 .

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

Fitting location of 4-pin connector for lambda probe => Page 104 .



- Unplug 4-pin connector for bank 2, lambda probe 2 -G131.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 65 .
- -> Test for open circuit in the following wiring connections.

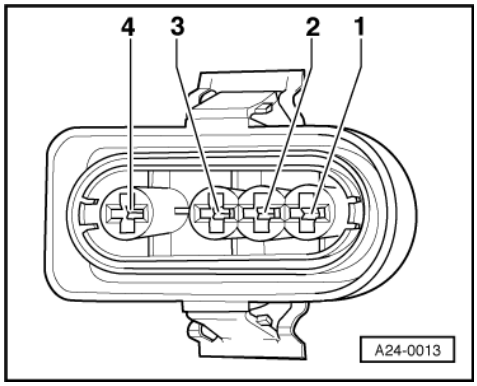
Connector on wiring harness, socket	Test box V.A.G 1598/31 socket
3	10
4	11

Wire resistance: max. 1.5 Ohm

- Rectify open circuit, if necessary.

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

- Also test wires on 4-pin connector for shorts between them.



Connector on wiring harness, socket	Test box V.A.G 1598/31 socket
4	10

Specified value: infinite resistance (no continuity)

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

- Test screen wiring for short to lambda probe wiring.

Connector on wiring harness, socket	Test box V.A.G 1598/31 socket
4	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder
3	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

Specified value: infinite resistance (no continuity)

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

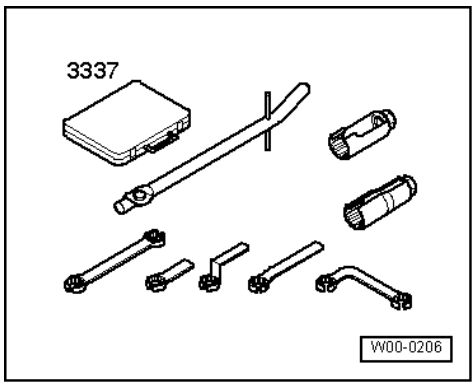
If no wiring fault is detected:

- Replace engine control unit -J220
  =>Page 66 .

2.8 - Removing and installing lambda probes

Removing

- Disconnect connector of relevant lambda probe upstream of catalytic converter from cylinder bank 1 and cylinder bank 2 (fitting location => Page 59).
- Disconnect connector of relevant lambda probe downstream of catalytic converter from cylinder bank 1 and cylinder bank 2 (fitting location => Page 104).
- Remove left or right front exhaust pipe with catalytic converter.



=> 8-cylinder Engine, Mechanical Components; Repair group 26; Exhaust system; Removing and installing front exhaust pipe with catalytic converter on left Exhaust system Removing and installing front exhaust pipe with catalytic converter on left

=> 8-cylinder Engine, Mechanical Components; Repair group 26; Exhaust system; Removing and installing front exhaust pipe with catalytic converter on right Exhaust system Removing and installing front exhaust pipe with catalytic converter on right

- -> Remove relevant lambda probe using special tool 3337/9.

When installing, note the following points:

Notes:

- When installing, the lambda probe wire must be secured in exactly the same position as before in order to avoid contact between the wire and the exhaust pipe.
- The screw thread on the lambda probe is coated with assembly paste. This paste must not be allowed to penetrate the openings on the probe.
- Tightening torque 55 Nm.

3 - Checking intake manifold changeover (A8 models)

3.1 - Checking intake manifold changeover (A8 models)

Only perform test when there is a lack in performance or a fault was registered.

The changeover of the intake manifold from long to short intake is dependent on speed.

3.2 - Checking function

- Connect the vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit 1 with "Address word" 01 => Page 7
  For this purpose, the engine must be running at idling speed.

-> Indicated on display:

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

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block 08
Enter display group number XXX
```

- Press keys 0, 9 and 5 for "display group number 95" and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block     95
□
     1     2     3     4
```

- Check display values for intake manifold change-over.

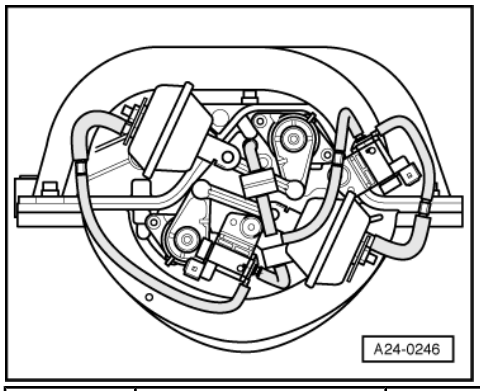
	Display zones			
	1	2	3	4
Display group 95: Intake manifold change-over at idling speed				
Display	xxx rpm	x.x %	xxx.x °C	**IMC-V OFF**
Display	Engine speed (in steps of 40 rpm)	Load	Coolant temperature	**Intake manifold changeover function**

	Display zones			
Range	min.: 550 rpm max.: 7200 rpm	min.: 0.00 % max.: 110.00 %		**IMC-V OFF Stage 1 Stage 2**
Specified value	600...820 rpm	14....24 %	80.0...105.0 °C	**IMC-V OFF**
Note				**Both vacuum units must be tightened**

- Check display in display zone 4.

Specified value: "IMC-V OFF"

Increase engine speed to the following speed to initiate the intake manifold changeover pipe.



Capacity	Engine speed	Vacuum unit
3.7 l	approx. 3300 rpm	Stage 1 lower vacuum unit
3.7 l	approx. 5000 rpm	Stage 2 upper vacuum unit

Capacity	Engine speed	Vacuum unit
4.2 l	approx. 3400 rpm	Stage 1 lower vacuum unit
4.2 l	approx. 5300 rpm	Stage 2 upper vacuum unit

	Display zones			
	1	2	3	4
Display group 95: Intake manifold change-over with vehicle being driven				
Display	xxxx rpm	xx.xx %	xxx.x ° C	**Stage 1 or 2**
Display	Engine speed (in steps of 40 rpm)	Load	Coolant temperature	**Intake manifold changeover**
Range	min.: 550 rpm max.: 7200 rpm	min.: 0.00 % max.: 110.00 %		**IMC-V OFF Stage 1 Stage 2**
Specified value	xxxx rpm	xx.xx %	80.0...105.0 ° C	**Stage 1 or 2**
Note				**Observe changeover procedure at vacuum units (fitting location is at front of intake pipe)**

- Check whether the correct vacuum unit is actuated with the relevant speed.

If "stage 1 or 2" is displayed but the intake manifold changeover valve is not initiated (vacuum units must be vent) check the following components.

- Check solenoid valves for intake manifold changeover => Page 120 .

3.3 - Checking solenoid valves -N156 and -N261 for intake manifold changeover

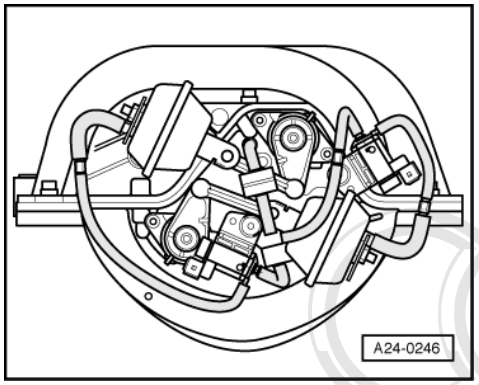
- Run engine at idling speed for 2 or 3 minutes to build up vacuum pressure.
- Switch engine off.
- Switch the ignition on.
- Perform final control diagnosis and activate intake manifold changeover solenoid valves =>Page 28 .

-> Indicated on display:

```
Final control diagnosis
Intake manifold changeover valve      -
N156
```

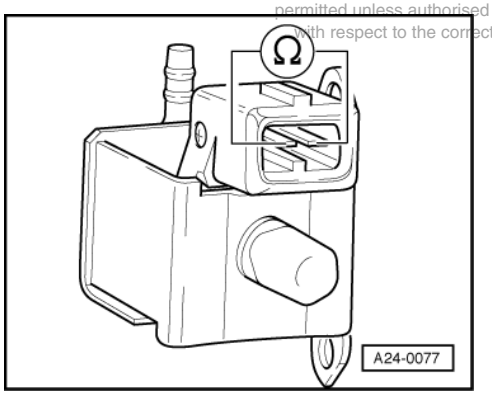
-> Indicated on display:

```
Final control diagnosis
Intake manifold changeover valve 2    -
N261
```



The solenoid valves should click (clicking can be heard and felt). After 1 minute the final control diagnosis is terminated.

- If one of the solenoid valves does not click.
- Switch ignition off.



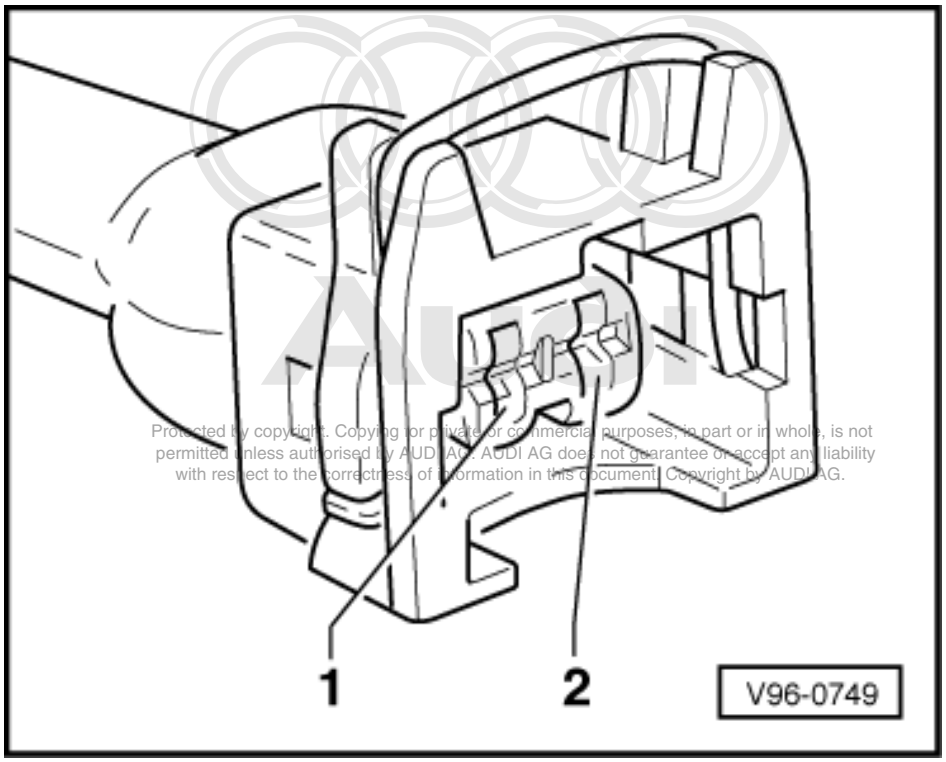
- Unplug connector from relevant intake manifold change-over solenoid valve.
- -> Measure resistance between the solenoid valve contacts using V.A.G 1526.

Specified value: 25...35 Ohms

- If the specified value is not achieved, renew the solenoid valve for intake manifold changeover.

If specification is attained, check voltage supply => Page 121 .

Checking voltage supply of intake manifold changeover solenoid valve



- -> Connect diode test lamp V.A.G 1527 between engine earth and socket 1 (positive) on connector using cables from adapter set V.A.G 1594.
- Operate starter briefly.

The diode test lamp should illuminate.

- If the diode test lamp does not illuminate.
- Check fuse for intake manifold change-over solenoid valve.

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

If the fuse is OK:

- Check for open circuit and short in wiring between fuel pump relay and socket 1 on connector via fuse for intake manifold change-over solenoid valve.

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

If the voltage supply is OK, check actuation => Page 121 .

- Re-insert the fuel pump relay and fuse.

Checking actuation of intake manifold changeover solenoid valve

- Connect diode test lamp V.A.G 1527 between sockets 1 and 2 on connector for intake manifold changeover solenoid valve using cables from adapter set V.A.G 1594.
- Perform final control diagnosis and actuate relevant solenoid valve for intake manifold changeover solenoid valve => Page 28 .

-> Indicated on display:

```
Final control diagnosis
Intake manifold changeover valve      -
N156
```

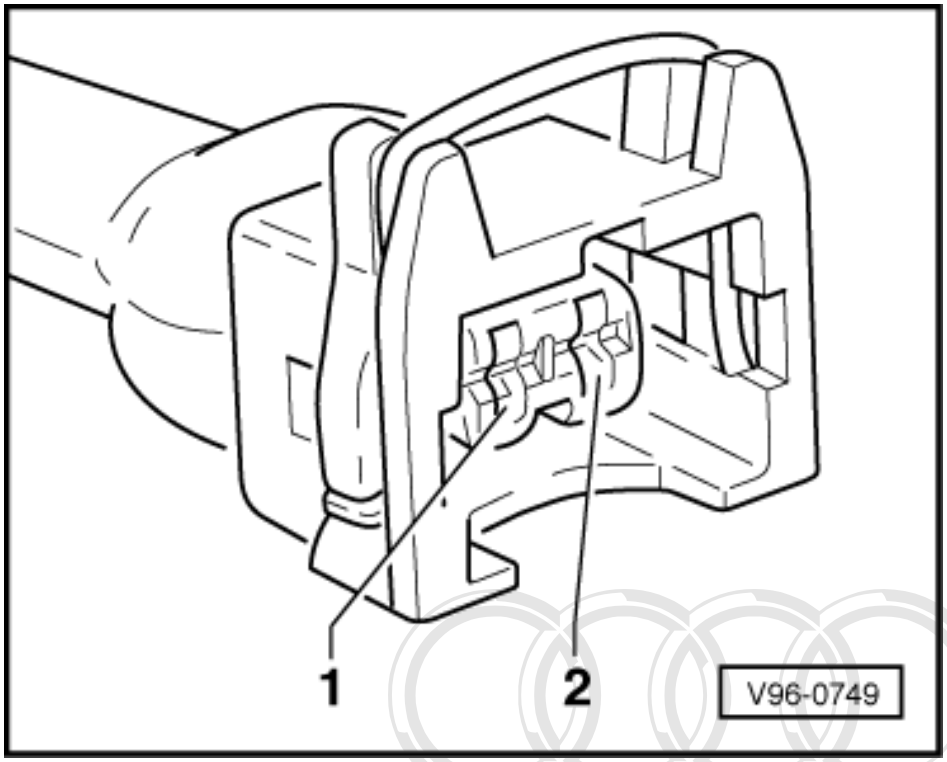
-> Indicated on display:

```
Final control diagnosis
Intake manifold changeover valve 2    -
N261
```

If the diode test lamp does not flash or is continuously lit: Check the wiring.
=>Page 122 .

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 65 .



Check the following wiring connections for open circuit and short circuit to positive or earth.

Intake manifold changeover connector 1 -N156 socket	Test box V.A.G 1598/31 socket
2	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder
Intake manifold changeover connector 2 -N261 socket	**Test box V.A.G 1598/31 socket**
2	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

Wire resistance: max. 1.5 Ohm

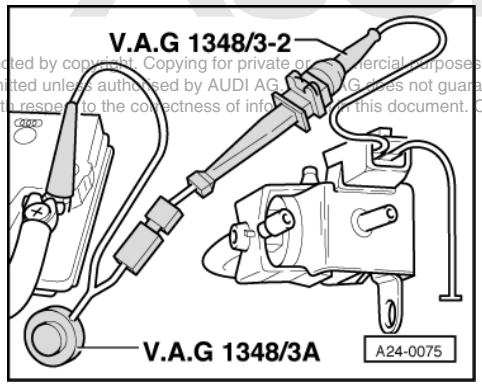
- Rectify any open/short circuit as necessary.

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

- If the wiring is OK replace engine control unit => Page 66 .
- Check intake manifold changeover valve again for function =>Page 118 .

3.4 - Checking vacuum system

Checking solenoid valves for obstruction and leaks



- Remove relevant solenoid valve for intake manifold changeover solenoid valve.
- Detach connector from solenoid valve for intake manifold changeover solenoid valve to be checked.
- -> 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 of solenoid valve with remote control V.A.G 1348/3A, adapter lead V.A.G 1348/3-2 and auxiliary cable.
- Operate remote control V.A.G 1348/3A.
- Check by blowing into the connection whether solenoid valve opens correctly.

If a solenoid valve does not open.

- Replace relevant solenoid valve for intake manifold changeover solenoid valve.

If none of the checks already performed indicate any fault.

- Re-install relevant solenoid valve intake manifold changeover solenoid valve.
- Check vacuum system for leaks => Page 123 .

Checking vacuum system for leaks

- Disconnect vacuum hoses from relevant vacuum unit for intake manifold changeover valve.
- 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 vacuum unit retracts.

- If necessary, replace vacuum unit.

If the vacuum unit does not have any leaks check all vacuum hoses for leaks.

4 - Checking intake manifold changeover (S8 models)

4.1 - Checking intake manifold changeover (S8 models)

The first stage of the intake manifold changeover function is omitted with all S8 models

Only perform test when there is a lack in performance or a fault was registered.

The changeover of the intake manifold from long to short intake is dependent on speed.

4.2 - Checking function

- Connect the vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit 1 with "Address word" 01 => Page 7 .
  For this purpose, the engine must be running at idling speed.

-> Indicated on display:

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

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block 08
Enter display group number XXX
```

- Press keys 0, 9 and 5 for "display group number 95" and confirm entry with Q key.

-> Indicated on display:

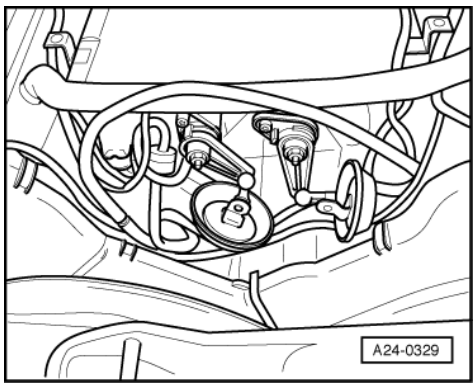
```
Read measured value block     95
□
     1     2     3     4
```

- Check display values for intake manifold change-over.

	Display zones			
	1	2	3	4
Display group 95: Intake manifold change-over at idling speed				
Display	xxx rpm	x.x %	xxx.x °C	**IMC-V OFF**
Display	Engine speed (in steps of 40 rpm)	Load	Coolant temperature	**Intake manifold changeover function**
Range	min.: 550 rpm max.: 7200 rpm	min.: 0.00 % max.: 110.00 %		**IMC-V OFF IMC-V ON**
Specified value	600...820 rpm	14...24 %	80.0...105.0 °C	**IMC-V OFF**
Note				**Both vacuum units must be tightened**

- Check display in display zone 4.

Specified value: "IMC-V OFF"



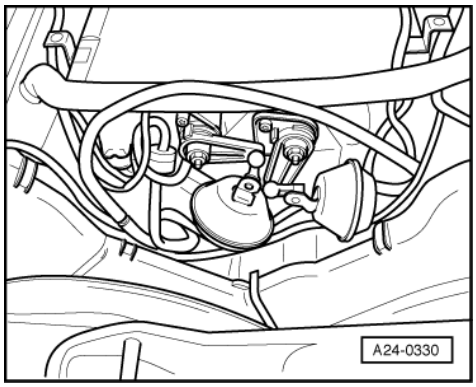
-> Specification for display zone 4:

"IMC-V OFF" vacuum units tightened

Increase engine speed to approx. 5400 rpm to initiate the intake manifold changeover.

	Display zones			
	1	2	3	4
Display group 95: Intake manifold change-over with vehicle being driven				
Display	xxxx rpm	xx.xx %	xxx.x °C	**IMC-V ON**
Display	Engine speed (in steps of 40 rpm)	Load	Coolant temperature	**Intake manifold changeover function**
Range	min.: 550 rpm max.: 7200 rpm	min.: 0.00 % max.: 110.00 %		**IMC-V OFF** **IMC-V ON**
Specified value	xxxx rpm	xx.xx %	80.0...105.0 °C	**IMC-V ON**
Note				

- Check whether the vacuum units are actuated.



-> If "SU-V ON" is displayed but the intake manifold changeover valve is not initiated (vacuum units must vent) check the following component:

- Check intake manifold changeover solenoid valve => Page 120 .

4.3 - Checking intake manifold changeover solenoid valve -N156

- Run engine at idling speed for 2 or 3 minutes to build up vacuum pressure.
- Switch engine off.
- Switch the ignition on.

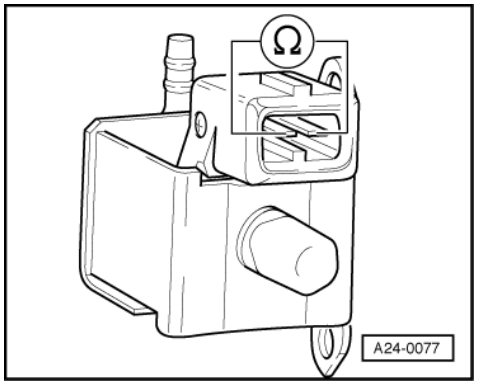
- Perform final control diagnosis and activate intake manifold changeover solenoid valves =>Page 28 .

-> Indicated on display:

```
Final control diagnosis
Intake manifold changeover valve      -
N156
```

The valve should click (clicking can be heard and felt). After 1 minute the final control diagnosis is terminated.

- If the solenoid valve does not click:
- Switch ignition off.



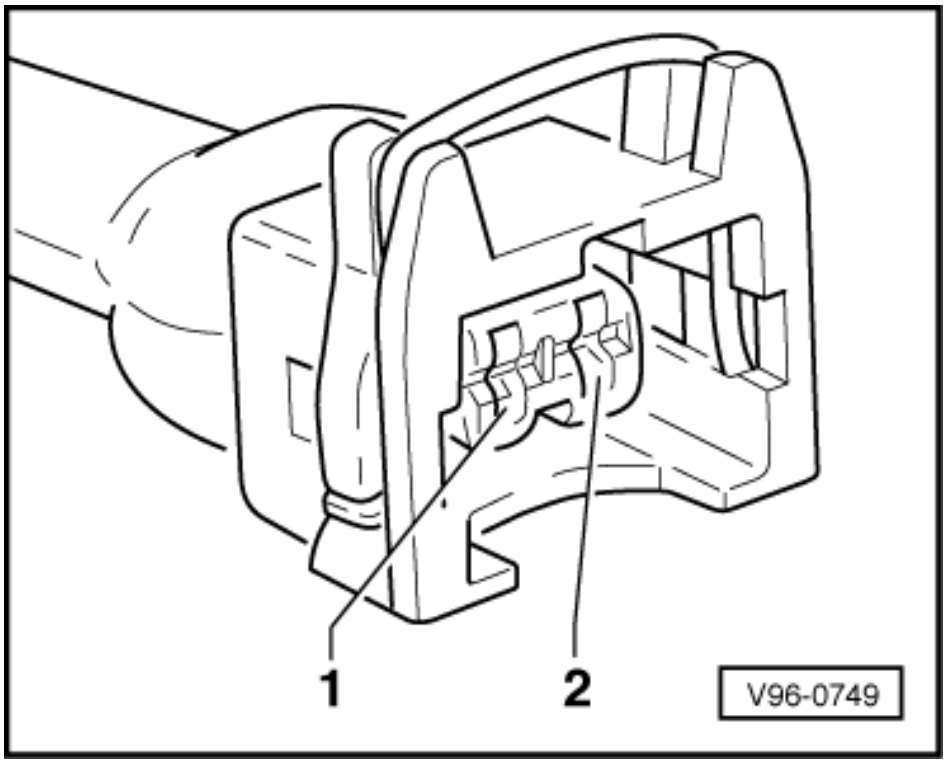
- Detach connector from relevant solenoid valve for intake manifold changeover solenoid valve.
- -> Measure resistance between the solenoid valve contacts using V.A.G 1526.

Specified value: 25...35 Ohms

- If the measured value is not as specified, renew the solenoid valve for intake manifold changeover solenoid valve.

If the specified value is achieved, check the voltage supply.

Checking voltage supply of intake manifold changeover solenoid valve



- -> Connect diode test lamp V.A.G 1527 between engine earth and socket 1 (positive) on connector using cables from adapter set V.A.G 1594.
- Operate starter briefly.

The diode test lamp should illuminate.

- If the diode test lamp does not illuminate:
- Check fuse for solenoid valve for intake manifold changeover solenoid valve.

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

If the fuse is OK:

- Check for open circuit and short in wiring between fuel pump relay and socket 1 on connector via fuse for intake manifold change-over solenoid valve.

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

If the voltage supply is OK, check actuation.

- Re-insert the fuel pump relay and fuse.

Checking actuation of intake manifold changeover solenoid valve

- Connect diode test lamp V.A.G 1527 between sockets 1 and 2 on connector for intake manifold changeover solenoid valve using cables from adapter set V.A.G 1594.
- Perform final control diagnosis and actuate relevant solenoid valve for intake manifold changeover solenoid valve => Page 28 .

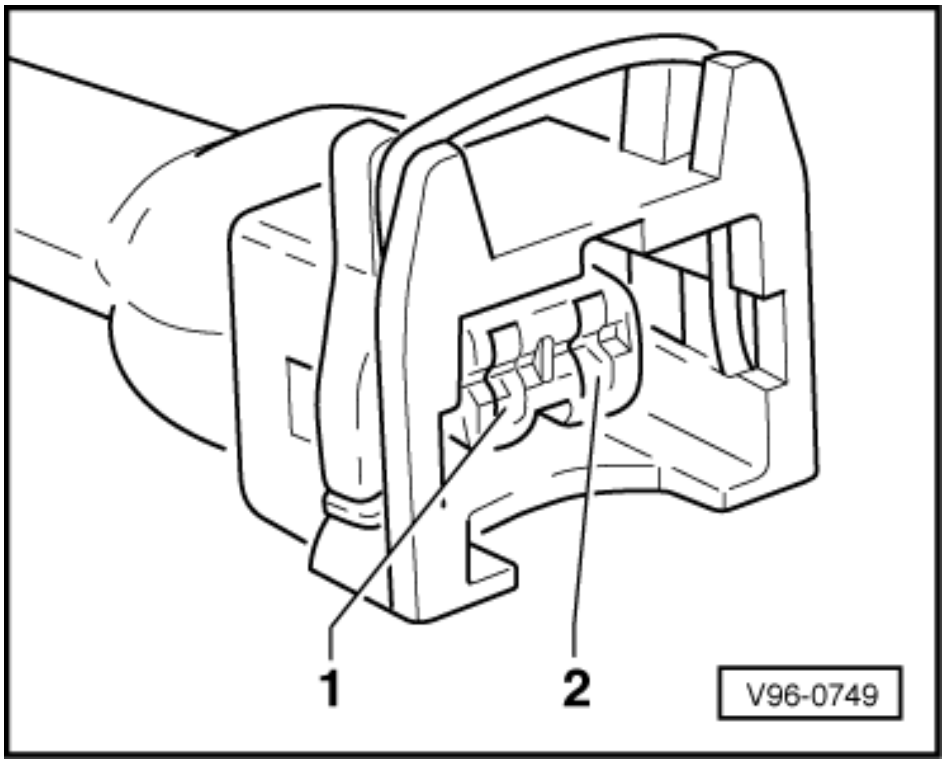
-> Indicated on display:

```
Final control diagnosis
Intake manifold changeover valve      -
N156
```

If the diode test lamp does not flash or is continuously lit: Check the wiring.

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 65 .



Check the following wiring connections for open circuit and short circuit to positive or earth.

Intake manifold change-over connector 1 -N156 socket	Test box V.A.G 1598/31 socket
2	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

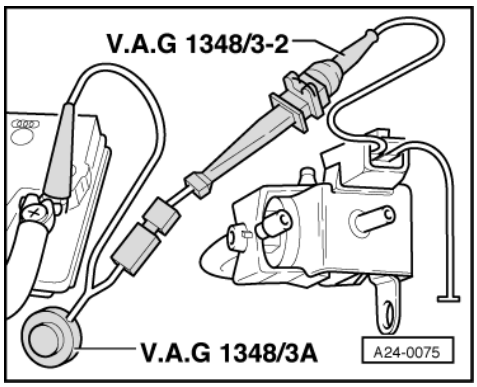
Wire resistance: max. 1.5 Ohm

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

- If the wiring is OK replace engine control unit => Page 66 .
- Check intake manifold changeover valve again for function =>Page 118 .

4.4 - Checking vacuum system

Checking valve for obstruction and leaks



- Remove intake manifold change-over solenoid valve.
- Detach connector from relevant solenoid valve for intake manifold changeover solenoid valve.
- -> 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 of solenoid valve with remote control V.A.G 1348/3A, adapter lead V.A.G 1348/3-2 and auxiliary cable.
- Operate remote control V.A.G 1348/3A.
- Check by blowing into the connection whether solenoid valve opens correctly.

If a solenoid valve does not open.

- Replace intake manifold change-over solenoid valve.

If none of the checks already performed indicate any fault.

- Re-install intake manifold change-over solenoid valve.
- Check vacuum system for leaks => Page 123 .

Checking vacuum system for leaks

- 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 vacuum unit retracts.

- If necessary, replace vacuum unit.

If the vacuum unit does not have any leaks check all vacuum hoses for leaks.

5 - Checking fuel tank breather

5.1 - Checking fuel tank breather

5.2 - Checking activated charcoal filter system solenoid valve 1 -N80

Testing for leaks

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

- Disconnect hoses from solenoid valve for activated carbon canister -N80.
- Connect auxiliary hose to one connection of ACF valve.
- Connect the 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 7 .
  For this purpose, the ignition must be switched on.
- Start final control diagnosis and select solenoid valve for activated charcoal filter -N80 (tank breather valve) =>Page 28 .

-> Indicated on display:

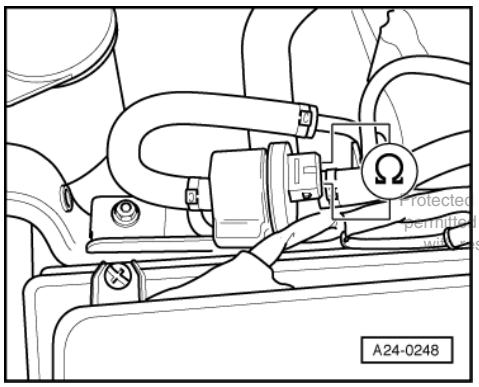
```
Final control diagnosis
Tank breather valve -N80
```

The solenoid valve must click...

...and should open and close (check by blowing into the auxiliary hose).

- If the valve does not click, electrically check the solenoid valve 1 for activated charcoal filter =>Page 129 .
- If the valve does not open and close correctly, Replace solenoid valve 1 for activated charcoal filter.

Electrical check for solenoid valve 1 for activated charcoal filter -N80



- Disconnect hose from the solenoid valve for the activated charcoal filter -N80.
- -> Measure resistance between contacts on valve using hand-held multimeter V.A.G 1526.

Specified value: 22...30 Ohms

If specification is not attained:

- Replace solenoid valve for activated charcoal filter -N80.

If specified value is attained:

- Check the voltage supply =>Page 130 .

Checking solenoid valve voltage supply

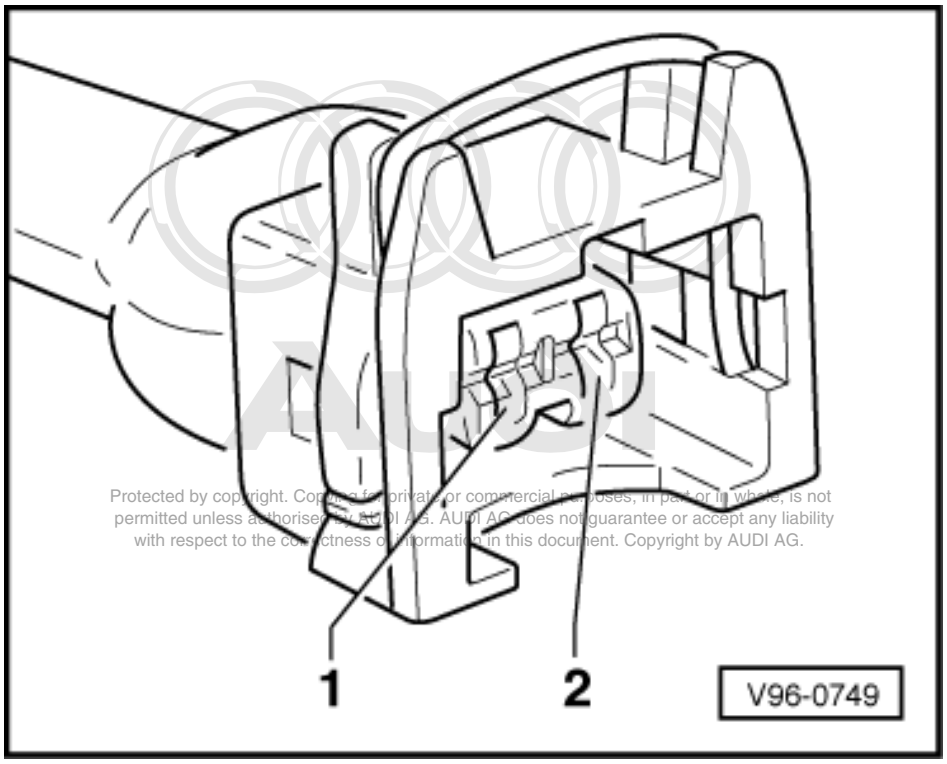
Note:

The ACF valve receives its power supply via the fuel pump relay.

- Check fuse for ACF valve.

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

If the fuse is OK:



- Disconnect hose from the solenoid valve for the activated charcoal filter -N80.
- -> Connect diode test lamp V.A.G 1527 between engine earth and socket 1 on the connector.
- Operate starter.

The diode test lamp should illuminate.

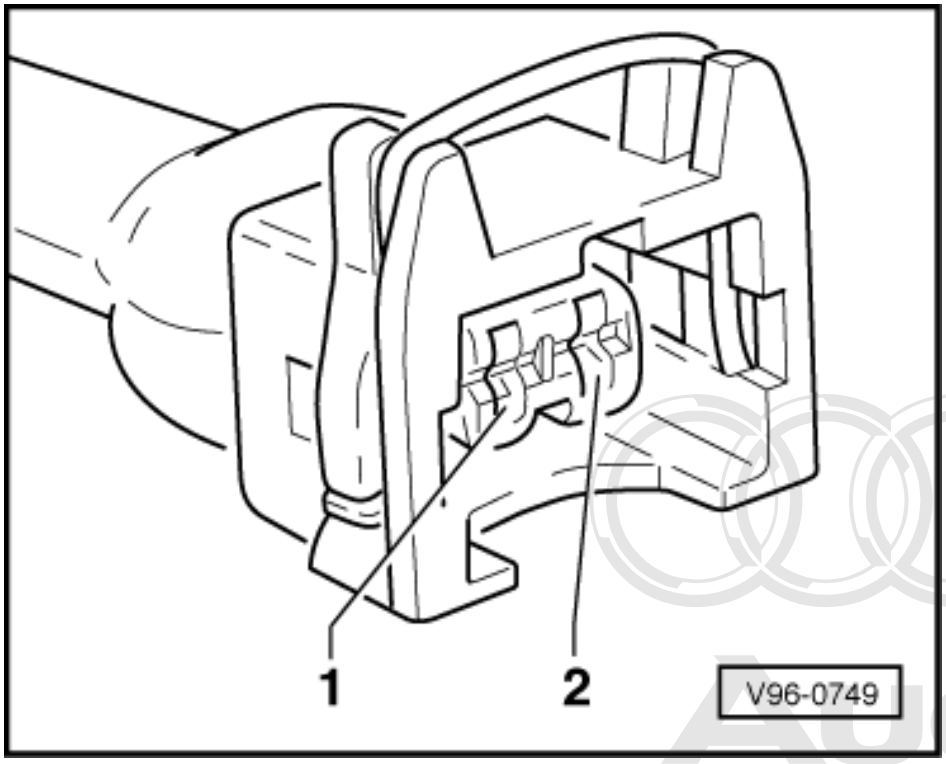
If the diode test lamp does not illuminate:

- Check the wiring from socket 1 via the fuse to the fuel pump relay for continuity, repair, if necessary.

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

If diode test lamp illuminates check actuation => Page 131 .

Checking ACF valve actuation



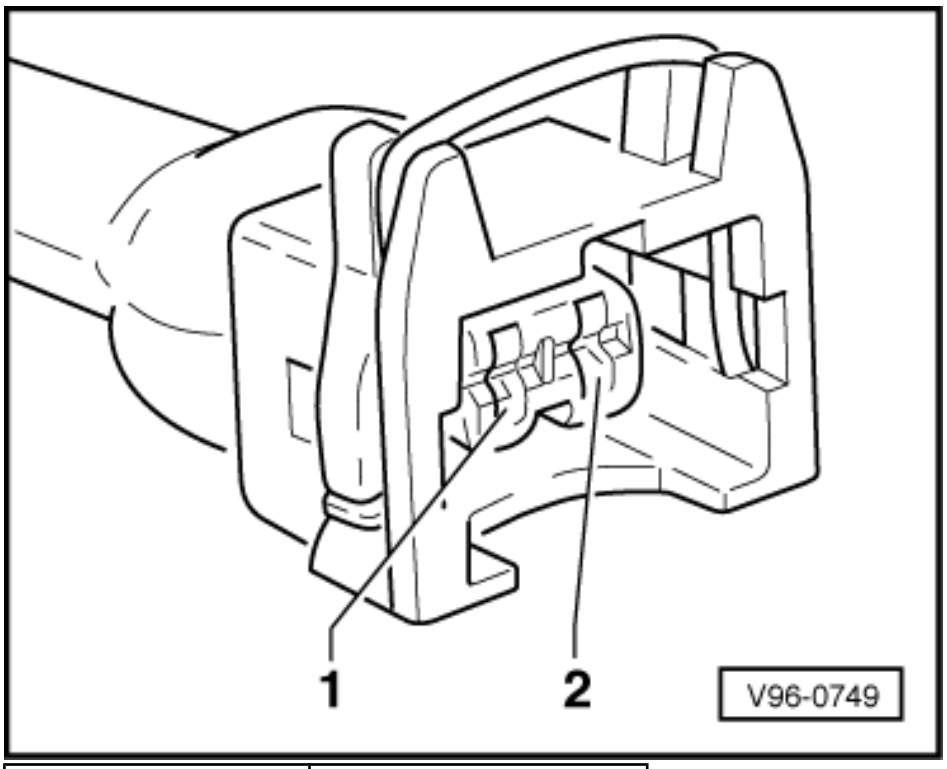
- -> Connect the V.A.G 1527 diode test lamp between socket 1 (positive) and socket 2 in the connector.
- Start final control diagnosis and select solenoid valve for activated charcoal filter -N80 =>Page 28 .

Diode test lamp should flash.

If the diode test lamp does not flash or is continuously lit:

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 65 .

If the diode test lamp is continuously illuminated check the following wiring for short to earth.



2-pin connector on wiring harness, socket	Test box V.A.G 1598/31 socket
2	64

If the diode test lamp does not flash check for open circuit and short to positive or open circuit in the following wiring connection.

2-pin connector on wiring harness, socket	Test box V.A.G 1598/31 socket
2	64

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

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

- If no short or open circuit is found.
- Replace engine control unit -J220 =>Page 66 .

6 - Checking secondary air inlet valve -N112

6.1 - Checking secondary air inlet valve -N112

Fitting location of secondary air inlet valve => Page 59

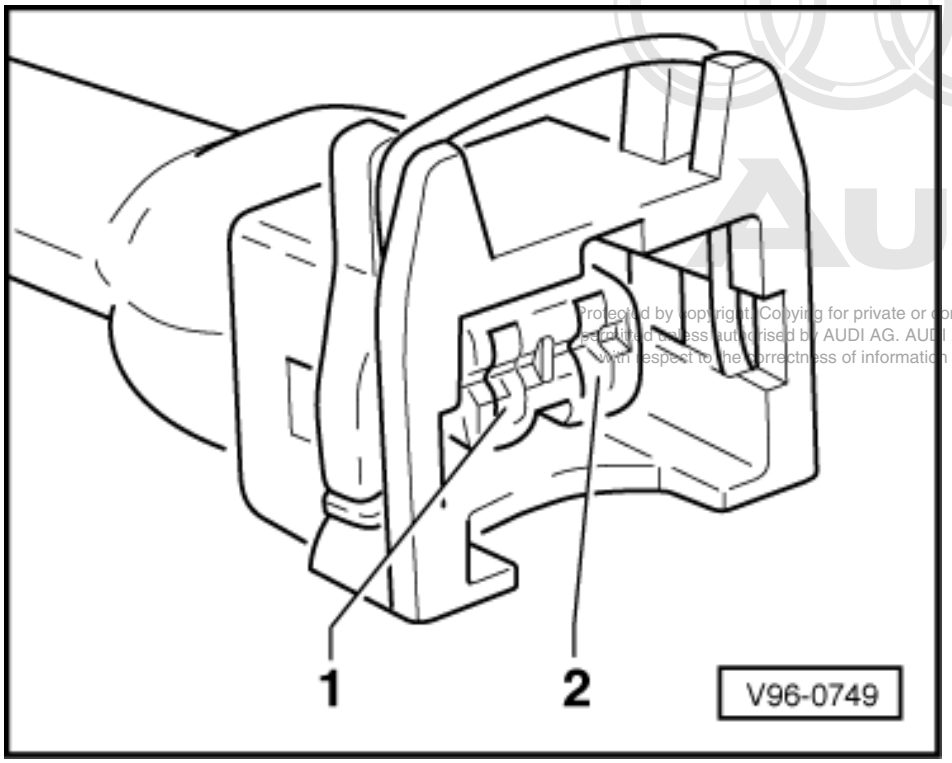
- Connect the vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "Address word" 01 => Page 7 .
  For this purpose, the ignition must be switched on.
- Start final control diagnosis and activate secondary air inlet valve => Page 28 .

-> Indicated on display:

```
Final control diagnosis
Secondary air inlet valve -N112
```

The secondary air inlet valve must click.

If the secondary air inlet valve does not click



- -> Unplug 2-pin connector from solenoid valve.
- Connect diode test lamp V.A.G 1527 to disconnected connector using test leads from V.A.G 1594.
- Repeat final control diagnosis.

If the diode test lamp now flashes during the final control diagnosis

- Replace secondary air inlet valve.

If the diode test lamp still does not flash:

- 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 65 .
- Check for open circuit in the following wiring connections:

2-pin connector on wiring harness, socket	Test box V.A.G 1598/31 socket
2	44

Wire resistance: max. 1.5 Ohm

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

If no wiring fault is detected:

- Check voltage supply for secondary air inlet system according to current flow diagram

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

6.2 - Checking secondary air pump relay -J299

Note:

The secondary air pump relay is located in the electronics box in the plenum chamber => Page 59 .

- Connect the 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 7 .
  For this purpose, the ignition must be switched on.
- Start the final control diagnosis and activate secondary air pump relay
  =>Page 28 .

-> Indicated on display:

```
Final control diagnosis
Secondary air pump relay -J299
```

Secondary air pump relay -J299 actuates secondary air pump motor -V101. This runs in intervals.

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

- Unplug 2-pin connector from secondary air pump motor and connect diode test lamp V.A.G 1527 to disconnected connector using auxiliary cables from V.A.G 1594.

- Repeat final control diagnosis.

If the diode test lamp now flashes during the final control diagnosis

- Fit a new secondary air pump motor -V101:

=> 8-cylinder Engine, Mechanical Components; Repair group 26; Exhaust system; Removing and installing parts of secondary air system Exhaust system Removing and installing parts of secondary air system

If the diode test lamp does not flash and the secondary air pump relay does not click, check actuation of the secondary air pump relay => Page 135 .

If the diode test lamp does not flash, but the secondary air pump relay does click, check the voltage supply to the secondary air pump relay.

Checking voltage supply of secondary air pump relay

- Check fuse for secondary air pump relay -J299.

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

If the fuse is not faulty:

Note:

The secondary air pump relay is located in the electronics box in the plenum chamber.

- Remove secondary air pump relay from relay carrier.

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

- Check voltage supply (positive 30) for relay.

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

If no faults are found in the voltage supply for the relay fit a new secondary pump relay -J299.

Checking actuation of secondary air 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 65 .

Note:

The secondary air pump relay is located in the electronics box in the plenum chamber.

- Remove secondary air pump relay from relay carrier.

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

- Check for open circuit in the following wiring connections:

Test box V.A.G 1598/31 socket	Secondary air pump relay, contact
46	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

Wire resistance: max. 1.5 Ohm

If no wiring fault is detected:

- Replace engine control unit -J220 =>Page 66 .

7 - Checking electronic engine power control (electronic throttle)

7.1 - Checking electronic engine power control (electronic throttle)

7.2 - 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 sensors (variable resistances located in a single housing) connected to the accelerator pedal.

The position of the accelerator pedal (decided by the driver) is one of the main input parameters to the engine control unit.

The throttle valve is actuated, over the full range of engine speed and power, by an electric motor (throttle valve actuator) in the throttle valve control part.

The throttle valve actuator moves the throttle valve as instructed by the engine control unit.

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

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

7.3 - Checking throttle valve control part -J338

The following components are located in the housing of the throttle valve control part.

(This housing must not be opened):

- Throttle valve actuator -G186 (This is an electric motor which is activated by the engine control unit. The electric motor opens the throttle valve against the force of a spring).
- Angle sender for throttle valve actuator -G187
- Angle sender 2 for throttle valve actuator -G188

Note:

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 (redundant system).

The potentiometers cannot be adjusted mechanically. The settings are made as part of basic setting (function 04) using the vehicle diagnostic, testing and information system VAS 5051 or the fault reader V.A.G 1551.

7.4 - Performing adaption of throttle valve control part

The adaption process enables the engine control unit to learn the various positions of the throttle valve with the ignition switched on and the engine not running. These positions are stored in the control unit. The feedback signal indicating the position of the throttle valve comes from the two throttle valve actuator angle senders.

If the throttle valve unit -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:

- By initiating the basic setting (Function 04) of display group 60 with ignition switched on.
- Automatically if the ignition is switched on once for at least 6 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.

Test conditions for adaption of the throttle valve control part

- No fault stored in fault memory
- Engine stopped, ignition switched on
- Accelerator not depressed.
- Coolant temperature greater than 5 °C but less than 105 °C.
- Intake air temperature above 5 °C.
- Voltage supply to engine control unit greater than 11 V, Testing =>Page 86 .

- Connect the 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 7. For this purpose, the ignition must be switched on.

-> Indicated on display:

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

- Press keys 0 and 4 for the function "Initiate basic setting" and confirm entry with Q key.

-> Indicated on display:

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

- Press keys 0, 6 and 0 for "display group number 60" and confirm entry with Q key.

-> Indicated on display:

```
System in basic setting 60
     1     2     3     4
```

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.

- Check specified value for throttle valve control part (display zones 3 and 4).

	Display zones			
	1	2	3	4
Display group 60: Adaption of throttle valve control part with ignition on				
Display	xxx %	xxx %	---	---
Display	Throttle valve angle (angle sender 1)	Throttle angle (angle sender 2)	**Adaption stage counter**	**Adaption status**
Range	min.: 0 % max.: 100 %	min.: 0 % max.: 100 %	**0 to 8**	**ADP process running** **ADP process OK** **ERROR**
Specified value	xxx %	xxx %	**During the adaption process, the adaption stage counter should run up from 0 to 8. (Some of the numbers may not appear).**	**ADP process running**
Note			**If specified value is not attained: Notes =>Page 138 .**	

- Check specified value for throttle valve control part (display zones 3 and 4).

	Display zones			
	1	2	3	4
Display group 60: Adaption of throttle valve control part with ignition on				
Display	xxx %	xxx %	---	---
Display	Throttle valve angle (angle sender 1)	Throttle valve angle (angle sender 2)	**Adaption stage counter**	**Adaption status**
Range	min.: 0 % max.: 100%	min.: 0 % max.: 100%	**0 to 8**	**ADP process running** **ADP process OK** **ERROR**
Specified value	xxx %	xxx %	**8**	**ADP process OK**
Note			**If specified value is not attained: Notes =>Page 138 .**	

Note:

If the adaption process is interrupted by the control unit and the tester display indicates "Function is unknown or cannot be carried out at the moment" the cause could be one of the following:

- All test conditions must be met
  =>Page 136 .
- Engine was started or accelerator was actuated during the adaption process.
- The throttle valve cannot close completely (e.g. dirt).
- Connector (6-pin connector) at throttle valve control part not engaged.
- Wiring connections defective.
- Distortion of throttle valve housing (check screw connection).
- The throttle valve control part is defective.

- End the engine basic setting by pressing the ⇒key.
- Press keys 0 and 6 for the function "End data transfer" and confirm entry with the Q key.

7.5 - Checking drive angle sender for throttle valve drive -G187 and -G188

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.

- Connect the 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 7 .
  For this purpose, the ignition must be switched on.

-> Indicated on display:

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

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

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

- Press keys 0, 6 and 2 for "display group number 62" and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block     62
□
    1     2     3     4
```

- Check specifications for electronic throttle potentiometer voltages.

	Display zones			
	1	2	3	4
Display group 62: Electronic throttle potentiometer voltages with ignition on				
Display	**xx %**	**xx %**	xx %	xx %
Display	**Throttle valve angle (angle sender 1)**	**Throttle valve angle (angle sender 2)**	Sender for accelerator pedal position	Sender 2 for accelerator pedal position
Range	**min.: 0 % max.: 100 %**	**min.: 0 % max.: 100 %**	min.: 0 % max.: 100 %	min.: 0 % max.: 100 %
Specified value	**3...93 %**	**97...3 %**	12...97 %	4...94 %

Note:

The engine control unit converts and displays the voltage readings from the angle senders as percentages of 5 V. (A5 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.

If the displays are not as described:

- Check throttle valve control part voltage supply and wiring =>Page 139 . Pay particular attention to connectors, which may be detached or corroded.
- Check the accelerator position senders =>Page 140 .

Notes:

- The reason why the value in display zone 1 rises and that in zone 2 falls is that the potentiometers (angle senders) in the throttle valve control part operate in opposite directions.
- This means that the voltage picked off by one of the angle senders runs in the direction of 5 V. (As the throttle is opened, the voltage becomes greater and the percentage increases).
- The voltage picked off by the angle sender 2 runs from 5 V in the direction of 0 V. (As the throttle is opened, the voltage becomes smaller and the percentage decreases).

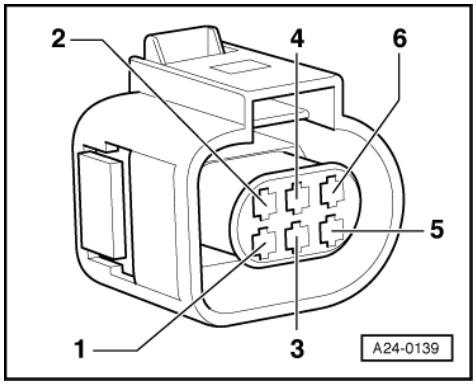
Checking the voltage supply to the throttle valve control part.

- Check fuse for throttle valve control part.

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

If the fuse is OK:

- Unplug the connector from the throttle valve control part.
- Switch the ignition on.



- -> Connect hand-held multimeter between the following sockets on the connector to measure voltage:

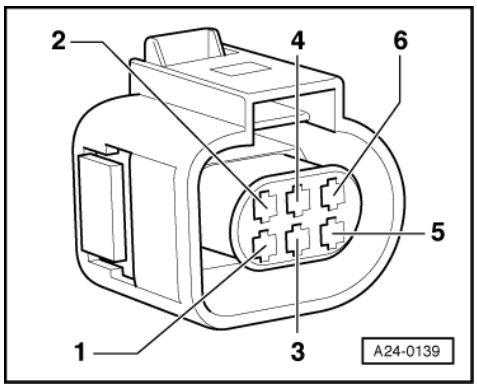
6-pin connector on wiring harness, socket	Specified value
2 + earth	approx. 5 V
2 + 6	approx. 5 V

If the specified values are not attained, test wiring between the engine control unit to the throttle valve control part =>Page 140 .

If specifications are not attained, also check the signal and actuation lines of the throttle valve actuator => Page 140 .

Checking wiring for voltage, signal and actuation

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 65 .



Check the following wiring connections for open circuit and short circuit to positive or earth.

6-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
1	92
2	83
3	117
4	84
5	118
6	91

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

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

If no wiring fault is detected:

- Replace throttle valve control part.

8 - Checking accelerator position senders -G79 and -G185

8.1 - Checking accelerator position senders -G79 and -G185

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.

- Connect the 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 7 .
  For this purpose, the ignition must be switched on.

-> Indicated on display:

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

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

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

- Press keys 0, 6 and 2 for "display group number 62" and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block     62

     1     2     3     4
```

- Check specifications for electronic throttle potentiometer voltages.

	Display zones			
	1	2	3	4
Display group 62: Electronic throttle potentiometer voltages with ignition on				
Display	xx %	xx %	**xx %**	**xx %**
Display	Throttle valve angle (angle sender 1)	Throttle valve angle (angle sender 2)	**Sender 1 for accelerator pedal position**	**Sender 2 for accelerator pedal position**
Range	min.: 0 % max.: 100 %	min.: 0 % max.: 100 %	**min.: 0 % max.: 100 %**	**min.: 0 % max.: 100 %**
Specified value	3...93 %	97...3 %	**12...92 %**	**4...49 %**

Note:

The engine control unit converts and displays the voltage readings from the angle senders as percentages of 5 V. (5 Volt supply corresponds to 100 %).

- Observe readouts in display zones 3 and 4.
- Slowly depress accelerator pedal.

Percentage displayed in zone 3 should rise evenly. The tolerance range from 12...92 % 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 sender =>Page 141 .
- Adjust accelerator position sensors

=> Fuel Supply - Petrol Engine; Repair group 20; Fuel supply; Servicing accelerator mechanism - vehicles with electronic engine performance control (electronic throttle) Fuel supply Servicing accelerator mechanism - vehicles with electronic engine performance control (electronic throttle)

Checking voltage supply for accelerator position senders

- Remove driver's storage compartment:

=> General Body Assembly, Interior; Repair group 68; Dash panel; Removing driver's storage compartment Dash panel Removing driver's storage compartment

- Detach connector for accelerator position sensors.

Note:

The connector is clipped onto the pedal bracket near the brake light switch.

- Switch the ignition on.
- Connect hand-held multimeter (voltage range) between the following sockets on the connector:

6-pin connector on wiring harness, socket	Specified value
2 + earth	approx. 5 V
2 + 3	approx. 5 V
5 + earth	approx. 5 V
5 + 4	approx. 5 V

If specifications are attained:

- Additionally check signal wires =>Page 142 .

If the specified values are not obtained:

- Check wiring between engine control unit and accelerator position senders =>Page 142 .

Checking signal wiring and wiring connections between accelerator position senders and engine control unit

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 65 .

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

Connector Socket	Test box V.A.G 1598/31 Socket
1 (signal wire)	35
2	73
3	36
4	33
5	72
6 (signal wire)	34

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

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

If no wiring fault is detected:

- Replace accelerator position senders.

=> Fuel Supply - Petrol Engines; Repair group 20; Fuel supply; Servicing accelerator mechanism - vehicles with electronic engine performance control (electronic throttle) Fuel supply Servicing accelerator mechanism - vehicles with electronic engine performance control (electronic throttle)

8.2 - Checking brake light switch -F or brake pedal switch -F47

Because the injection system operates with an accelerator pedal sender (potentiometer) which may be defective, the engine is regulated for reasons of safety when the brakes are operated. For this purpose, the control unit requires signals from both the brake light switch and the brake pedal switch. This means that if the brakes are operated when the accelerator pedal is held at a constant position, the engine speed is immediately reduced. Incorrectly adjusted switches may lead to undesired control action.

- Connect the 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 7 .
  For this purpose, the ignition must be switched on.

-> Indicated on display:

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

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block 08
Enter display group number XXX
```

- Press keys 0, 6 and 6 for "display group number 66" and confirm entry with Q key.

-> Indicated on display:

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

- Observe readout in display zone 2.

	Display zones			
	1	2	3	4
Display group 66: Signals to engine control unit with ignition on				
Display	xxx km/h	1 0 0 0	xxx km/h	1 0 0 0
Display	ACTUAL speed	Switch settings	SPECIFIED speed	Switch positions for cruise control system
Range		off = 0 on = 1		off = 0 on = 1
Specified value		1 0 0 0		
Note:		Relevance of figures => Page 143		

- Operate accelerator pedal.

Significance of 4 digit readout of display zone 2:

x	x	x	x	Display zone 2
			X	Brake light switch 0 = Brake pedal not operated 1 = Brake pedal operated
		X		Brake pedal switch 0 = Brake pedal not operated 1 = Brake pedal operated
	X			Checking clutch pedal switch 0 = Clutch pedal not operated 1 = Clutch pedal operated

x	x	x	x	Display zone 2
X				Cruise control system (CCS) 0 = CCS deactivated 1 = CCS activated

	Display zones			
	1	2	3	4
Display group 66: Signals to engine control unit				
Display	xxx km/h	1 0 1 1	xxx km/h	0 0 0 0
Display	ACTUAL speed	Switch settings	SPECIFIED speed	Switch positions for cruise control system
Range		off = 0 on = 1		off = 0 on = 1
Specified value		1 0 1 1		
Note		Both displays should change from 0 to 1.		

- Allow brake pedal to return slowly to its normal position.
- Both displays should change from 1 back to 0.

If one or both displays do not change:

- Check the voltage supply =>Page 145 .

Checking power supply

- Remove driver's storage compartment:

=> General Body Assembly, Interior; Repair group 68; Dash panel; Removing driver's storage compartment Dash panel Removing driver's storage compartment

- Unplug 4-pin connector on brake pedal.
- Connect hand-held multimeter (voltage range) between the following sockets on the connector:
- Switch ignition off.

4-pin connector on wiring harness, socket	Specified value
1 + earth	Battery voltage

- Switch the ignition on.

4-pin connector on wiring harness, socket	Specified value
3 + earth	Battery voltage

If the specified values are attained.

- Check the wiring =>Page 145 .

If the specified values are not achieved.

- Check the wiring connections from sockets 1 and 3 of connector for open circuit/short to earth (inspect fuse).

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

- Rectify any open/short circuit as necessary.

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 65 .

Check the following wiring connections for open circuit and short circuit to positive or earth.

4-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
2	56
4	55

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

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

If no open circuit is detected:

- Replace brake light/brake pedal switch.

8.3 - Checking clutch pedal switch -F36

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.

- Connect the 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 7 .
  For this purpose, the ignition must be switched on.

-> Indicated on display:

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

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block 08
Enter display group number XXX
```


- Press keys 0, 6 and 6 for "display group number 66" and confirm entry with Q key.

-> Indicated on display:

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

- Observe readout in display zone 2.

	Display zones			
	1	2	3	4
Display group 66: Signals to engine control unit				
Display	xxx km/h	**0 0 0 0**	xxx km/h	0 0 0 0
Display	ACTUAL speed	**Switch settings**	**SPECIFIED speed**	Switch positions for cruise control system
Range		**off = 0 on = 1**		off = 0 on = 1

	Display zones			
Specified value		0 0 0 0		
Note		Relevance of figures => Page 146		

- Operate clutch pedal

Significance of 4 digit readout of display zone 2:

x	x	x	x	Display zone 2
			X	Brake light switch 0 = Brake pedal not operated 1 = Brake pedal operated
		X		Brake pedal switch 0 = Brake pedal not operated 1 = Brake pedal operated
	X			**Checking clutch pedal switch** **0 = Clutch pedal not operated** **1 = Clutch pedal operated**
X				Cruise control system (CCS) 0 = CCS deactivated 1 = CCS activated

	Display zones			
	1	2	3	4
Display group 66: Signals to engine control unit				
Display	xxx rpm	0 1 0 0	xxx km/h	0 0 0 0
Display	Actual engine speed (actual value)	Switch settings		Switch positions for cruise control system
Range		off = 0 on = 1		off = 0 on = 1
Specified value		0 1 0 0		
Note		Display should change from 0 to 1.		

- Allow clutch pedal to return slowly to its normal position.
- Display should change from 1 back to 0.

If display does not change:

- Check the power supply =>Page 146 .

Checking power supply

- Remove driver's storage compartment:

=> General Body Assembly, Interior; Repair group 68; Dash panel; Removing driver's storage compartment Dash panel Removing driver's storage compartment

- Unplug 2-pin connector from clutch pedal.
- Connect hand-held multimeter (voltage range) between the following sockets on the connector:
- Switch the ignition on.

2-pin connector on wiring harness, socket	Specified value
2 + earth	Battery voltage

If specified value is attained:

- Check the wiring =>Page 147 .

If specified value is not attained:

- Check the wiring connections from socket 2 of connector for open circuit/short to earth.

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

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 65 .

Check the following wiring connection for open circuit and short circuit to positive or earth.

2-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
1	39

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

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

If no open circuit is detected:

- Replace clutch pedal switch.

9 - Checking auxiliary signals

9.1 - Checking auxiliary signals

9.2 - Checking crash signal

In the event of an accident (crash) which results in the triggering of the belt tensioner/airbag, the engine control unit deactivates the fuel pump relay. Excessive escape of fuel in the event of damage to the fuel system is thus prevented.

As long as the fault "Crash deactivation triggered" is stored in the engine control unit or is not erased, the fuel pump supply is blocked at "ignition ON" (no generation of preliminary pressure in the fuel system). This can result in a delay when starting the engine.

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 65 .

Check the following wiring connections for open circuit and short circuit to positive or earth.

Test box V.A.G 1598/31 Socket	Airbag control unit Contact
67	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

If no wiring fault is detected: Interrogate the fault memory of the airbag control unit.

9.3 - Checking engine speed signal

Note:

The signal is generated by engine speed sender -G28 and processed by the engine control unit.

Determine the engine speed, as follows:

- Connect the 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 7 .
  For this purpose, the ignition must be switched on.

-> Indicated on display:

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

- Check all control units for a missing rpm signal via the "Automatic test sequence".

- Press the "0" key twice for the "automatic test sequence" function and confirm entry with Q key.

No faults relating to a "missing engine speed signal" should be stored in any of the control units.

If one of the control units indicates a fault:

- Locate open circuit or short circuit between engine control unit and the control unit concerned.

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

9.4 - Testing 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.
- Switching off of the air conditioner compressor occurs:
  - In the emergency program (emergency running mode)
  - After initiating of basic setting (Function 04)
  - from the gearbox control unit (Kick down function)

Test conditions

- Air conditioning functioning properly.
- No faults recorded in fault memory of engine control unit
- Interior temperature of more than +15 °C

- Connect the vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit 1 with "Address word" 01 => Page 7 .
  For this purpose, the engine must be running at idling speed.

-> Indicated on display:

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

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block
Enter display group number XXX
```

- Press keys 0, 5 and 0 for "display group number 50" and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block 50
     1     2     3     4
```

- Check compressor shut-off in display zone 4.

	Display zones			
	1	2	3	4
Display group 50: Signals to engine control unit				
Display	xxx rpm	xxx rpm	A/C - low	**Compr. OFF**
Display	Actual engine speed (actual value)	Specified engine speed (theoretical value)	Air conditioner requirement	**Air conditioner compressor operating status**
Range			A/C - low A/C - high	**Compr. OFF** **Compr. ON**
Specified value			A/C - low	Compr. OFF
Note				

- Switch on the air conditioner by pressing the "Auto" key. Compressor should run (display zone 4).
- Set air conditioner to maximum cooling or heating output (display zone 3).

	Display zones			
	1	2	3	4
Display group 50: Signals to engine control unit				
Display	xxx rpm	xxx rpm	**A/C - high**	**Compr. ON**
Display	Actual engine speed (actual value)	Specified engine speed (theoretical value)	**Air conditioner requirement**	**Air conditioner compressor operating status**
Range			**A/C - low** **A/C - high**	**Compr. OFF** **Compr. ON**
Specified value			**A/C - high**	**Compr. ON**
Note				

- Switch off air conditioner compressor at air conditioner operating unit, for this press Econ-button.

Specification for display zone 4: Display should change from "Compr. ON" to "Compr. OFF" (compressor switch-off)

If the readout in display zone is not as described:

- 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 65 .

Check the following wiring connections for short circuit to positive or earth or open circuit.

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

Wire resistance: max. 1.5 Ohm
- Rectify any open/short circuit as necessary.
- If there are no faults in the wiring, check the operation of air conditioning.

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

9.5 - Checking engine mounting

(Not installed in all vehicles)
The hydraulically damped engine mountings with electric actuation prevent that oscillations of the engine are transferred to the body throughout the entire speed range.
In idling operation the engine mountings are soft.
In driving operation the engine mountings are hard.
- Switch the ignition on.
- Perform final control diagnosis and actuate engine mounting => Page 28 .

-> Indicated on display:

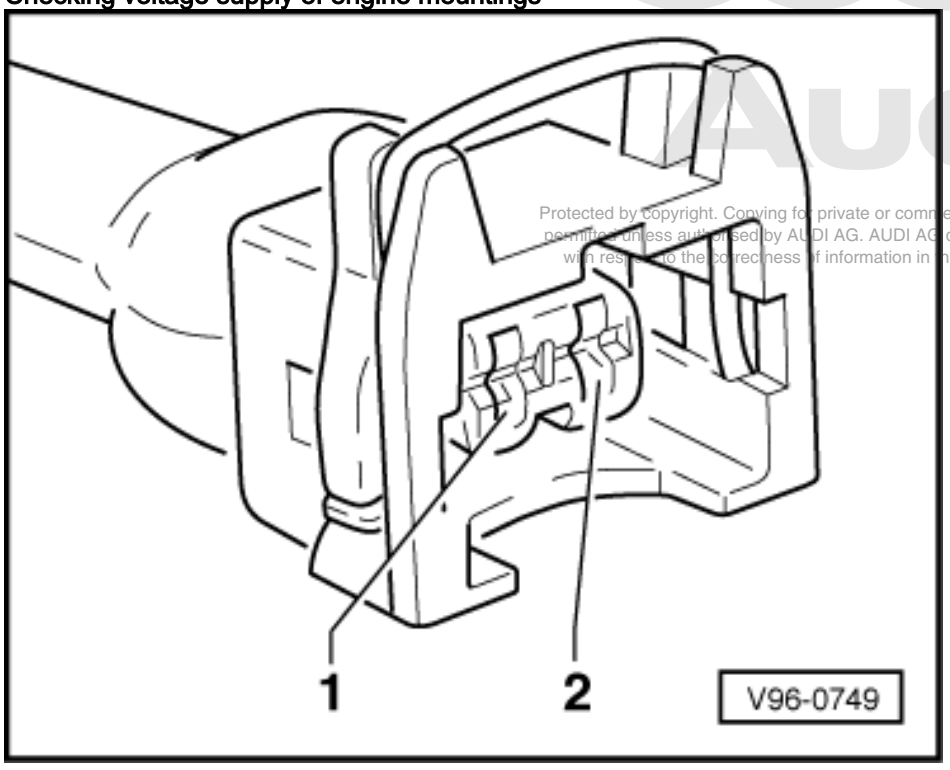
```
Final control diagnosis
Valve left for engine mounting -N144
```

- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Valve right for engine mounting -N145
```

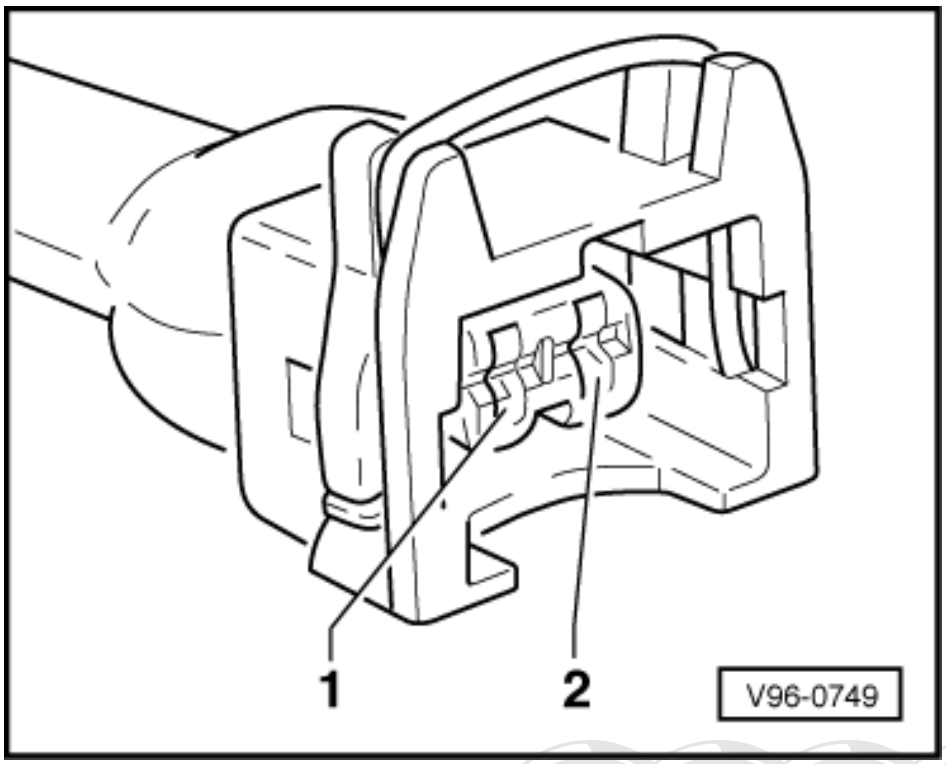
Upon actuation of engine mounting, both solenoid valves should give a clearly audible click.
If specified value is not attained, perform the following tests:
Checking voltage supply of engine mountings



- Disconnect connector from relevant solenoid valve.
- -> Connect diode test lamp V.A.G 1527 between engine earth and socket 1 (positive) on connector using cables from adapter set V.A.G 1594.
- Operate the starter for a few seconds. Engine may start.

The diode test lamp should illuminate.

If the diode test lamp does not illuminate, carry out the following tests:



- Checking fuse for engine mounting.

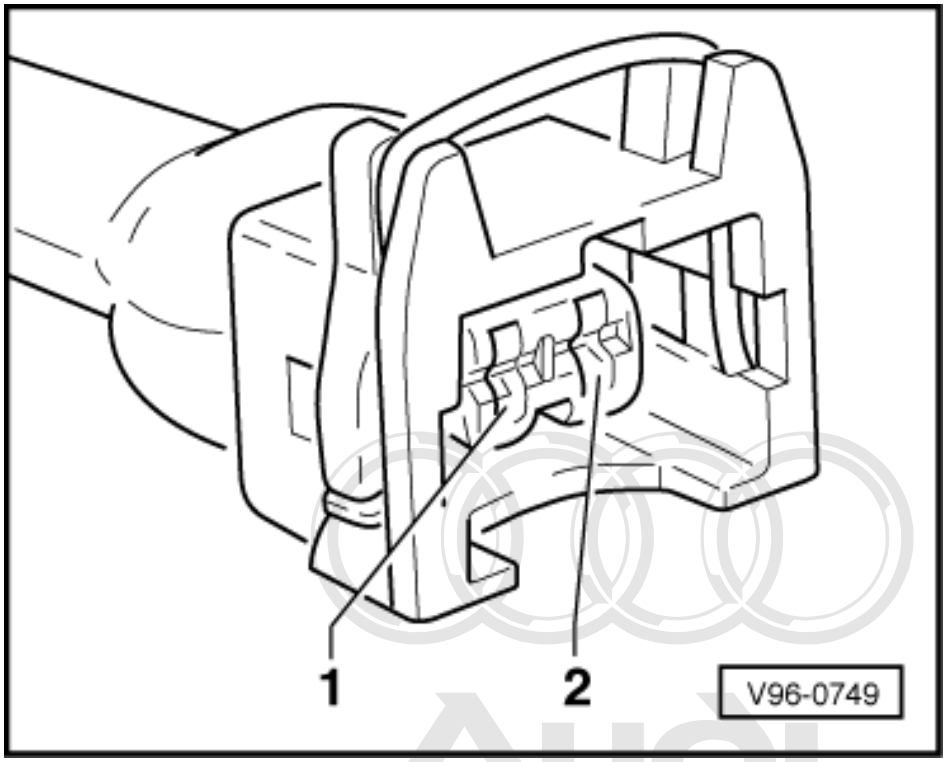
=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

If the fuse is OK:

- -> Check the wiring from socket 1 via the fuse to the fuel pump relay for continuity.

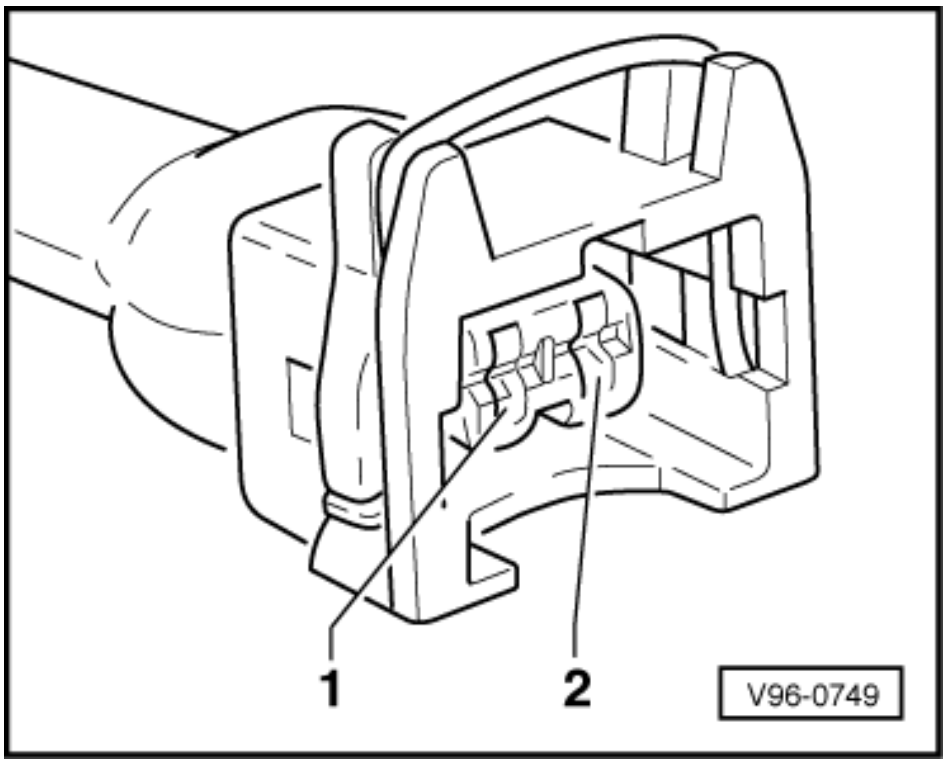
=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

Checking actuation of engine mounting



- Disconnect connector from relevant engine mounting.
- -> Connect diode test lamp V.A.G 1527 between sockets 1 (positive) and 2 on connector for intake air changeover solenoid valve using cables from adapter set V.A.G 1594.
- Actuate final control diagnosis and actuate relevant engine mounting => Page 28 .

The diode test lamp should flash upon actuation of engine mounting.



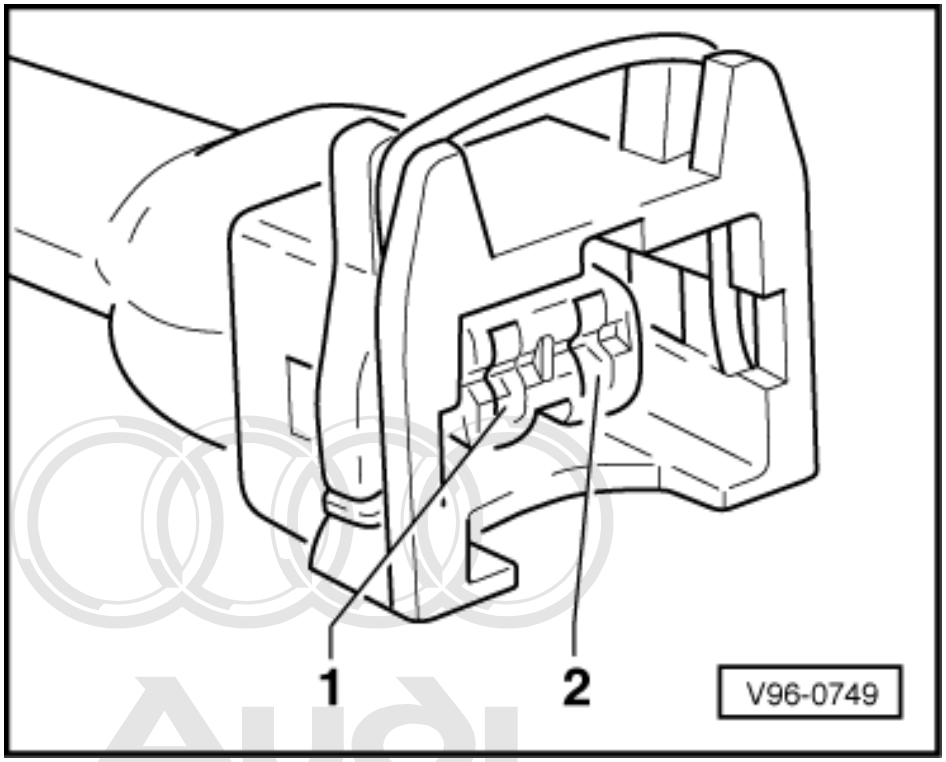
If the diode test lamp is continuously lit:

- -> Check wiring connections from socket 2 of the relevant connector for the engine mounting for earth short.

If the diode test lamp does not flash:

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 65 .



- -> Check wiring connection of the relevant connector for engine mounting for open circuits as well as shorts to positive.

2-pin connector on wiring harness, contact	Test box V.A.G 1598/31, socket
Engine mounting 1 -N144 2	105
Engine mounting 2 -N145 2	116

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

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

If no short or open circuit is found.

- Replace the relevant engine mounting.

9.6 - Checking exchange of data between connected 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 signal wires in sequence, i.e. in a specific order to the connected control units (e.g. engine speed and accelerator pedal position).

Testing the bus system

The fault table includes instructions to check the data exchange between engine control unit, gearbox control unit and ABS control unit and/or dash panel insert.

- Check that multiple connectors for control units are properly seated.

- Connect the vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit 1 with "Address word" 01 => Page 7 .
  For this purpose, the engine must be running at idling speed.

-> Indicated on display:

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

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:


```
Read measured value block
Enter display group number XXX
```

- Press keys 1, 2 and 5 for "display group number 125" and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block 125
     1     2     3     4
```

	Display zones			
	1	2	3	4
Display group 125: CAN bus messages				
Display	Gearbox 1	ABS 1	Dash 1	
Display	CAN bus Gearbox control unit	CAN bus ABS control unit	CAN bus Dash insert	
Range	1 = OK 0 = not OK	1 = OK 0 = not OK	1 = OK 0 = not OK	
Specified value	Gearbox 1	ABS 1	Dash 1	
Note				
Note	If specified value is not obtained for one or more control units perform automatic test sequence			

Automatic test sequence

- Press key 0 twice for the address word "Automatic test sequence" and confirm entry with the Q key. The V.A.G 1551 transmits all known address words in sequence.

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 - SELF-DIAGNOSIS     HELP
1 - Rapid data transfer*
2 - Flash code output*
```

If a fault relating to "Data bus"... or "...no message" is displayed:

- Check to make sure that the vehicle is fitted with the correct engine control unit, gearbox control unit, ABS control unit and dash panel insert (check part numbers and code).

If the correct control units are installed:

- Check that multiple connectors for control units are properly seated.

When multiple connectors are tight

- Check the CAN bus system.

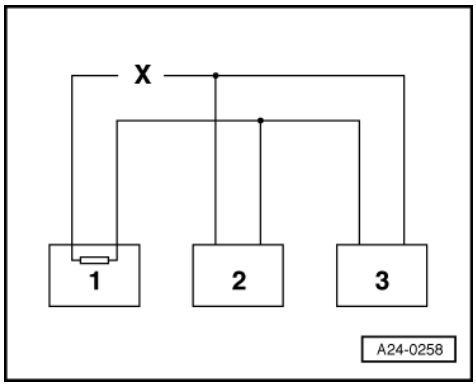
Checking a "two-wire bus system"

The communication between three or more control units is carried out over a "two-wire bus system".

- Evaluate the faults stored in the control units.

Note:

This helps to locate wiring 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.

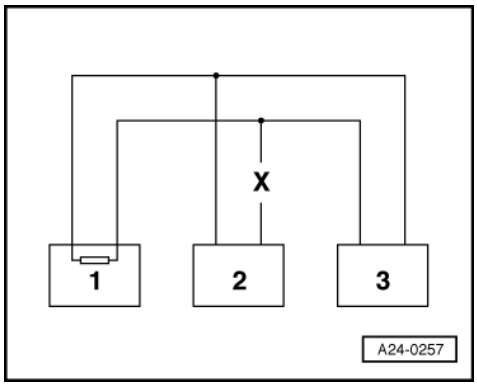
Control unit	Faults stored in fault memory
1	- No message from control unit 2 - No message from control unit 3
2	- No message from control unit 1
3	- No message from control unit 1

- Switch ignition off.
- Disconnect the control units connected to each other via the bus wires and investigate whether there is a short circuit between the bus wires.

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

- If no fault can be detected in the bus wires, replace control unit 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

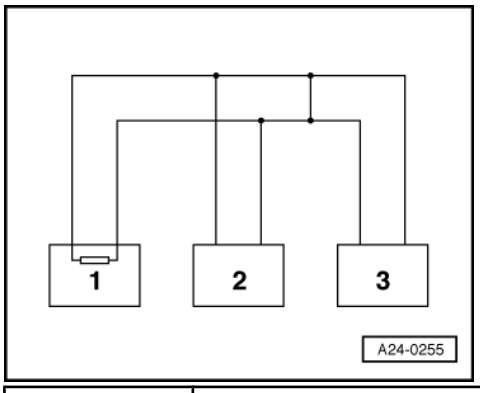
- Switch ignition off.
- Disconnect the control units connected to each other via the bus wires and investigate whether there is a short circuit between the bus wires.

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

- If no fault can be detected in the bus wires, replace control unit 2.

Example 3:

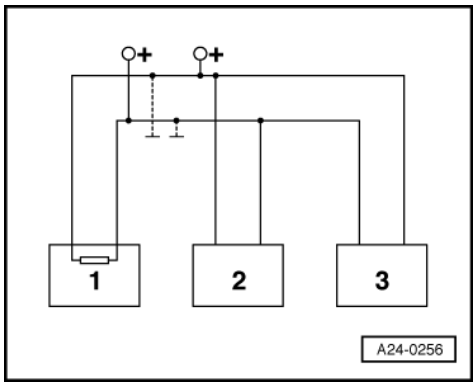
With the faults stored in the fault memories it can be seen that there is no sending or receiving operation possible in any of the control units.



Control unit	Faults stored in fault memory
1	- Data bus drive defective
2	- Data bus drive defective

Control unit	Faults stored in fault memory
3	- Data bus drive defective

- Switch ignition off.
- -> Disconnect the control units that are linked by the bus wires and check for a short circuit between the bus wires



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

- -> Check the bus wires for short to positive and short to earth.

If cause of fault "Data bus drive defective" cannot be found in bus wires 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. The 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 "Data bus drive defective" is now indicated, replace the control unit which has just been connected.
- If fault "Signal wire defect" is not read out, connect the next control unit and repeat the procedure.

28 - Ignition system

1 - Checking ignition system

1.1 - Checking ignition system

1.2 - General notes on ignition system

- The engine control unit is equipped with self-diagnosis.
- A voltage of at least 11.5 V is necessary for satisfactory functioning of the electrical components.
- In the case of some tests, a fault may be recognised and stored by the control unit. At the end of all tests and repairs, therefore, the fault memory should be interrogated and, if necessary, erased.
- If the engine starts briefly and then stops after fault search, repair or tests on components, this may be because the immobiliser is blocking the engine control unit. The fault memory must then be interrogated and, if necessary, adaption carried out on the control unit.

1.3 - Safety precautions

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

- Do not touch or disconnect ignition wiring when the engine is running or at starter speed.
- Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.
- Always switch off the ignition before connecting or disconnecting injection or ignition system wiring or tester cables.
- To run engine at starting speed without actually starting it (for example, in order to test compression), unplug connector from the output stages of the ignition coils and also the connectors on the injectors. After completing the work, interrogate the fault memory and erase it.
- Always switch off the ignition before washing the engine.

1.4 - Technical data for ignition system

Engine code letters		AQF 4.2 L 228 KW / AUW 4.2 L 228 KW ARU 4.2 L 175 KW / AVN 4.2 L 175 KW AQG 3.7 L 191 KW / AKC 3.7 L 191 KW AQH 4.2 L 265 KW / AVP 4.2 L 265 KW
Ignition timing is determined by the control unit. Ignition timing cannot be adjusted.		
Ignition system		Individual coil system with 8 ignition coils connected directly to spark plugs via spark plug connectors (common component ignition coil and performance output stage).
Spark plugs	Spare part number and manufacturer description	see spare part catalogue
	Tightening torque	30 Nm
Firing order		1-5-4-8-6-3-7-2

1.5 - Checking ignition coils

Note:
The ignition coil and the output stage are combined in a common component.

Test conditions

- No faults relating to injector(s) stored

Identify an inoperative or misfiring cylinder as follows:

- Disconnect connectors from the injectors in sequence with the engine running, and observe how the engine runs.

or

- Compare the spark plugs of all cylinders with each other and check for soot on the electrodes.

If the defective cylinder has been identified:

- Replace the spark plug of the defective cylinder with one from another cylinder.

If the fault moves with the spark plug:

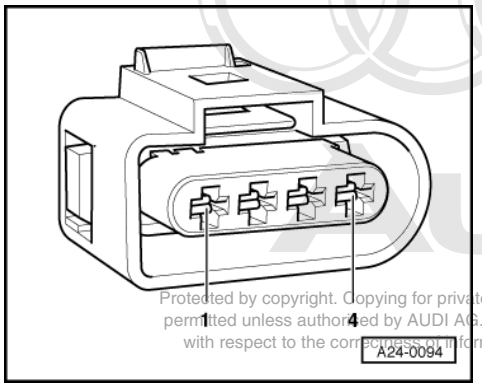
- Replace spark plug.

If the fault remains in the same cylinder:

- Replace the ignition coil from the defective cylinder with one from another cylinder.
- If the fault now occurs at the other cylinder, renew the ignition coil.

If the fault remains on the cylinder, check earth wiring of ignition coil.

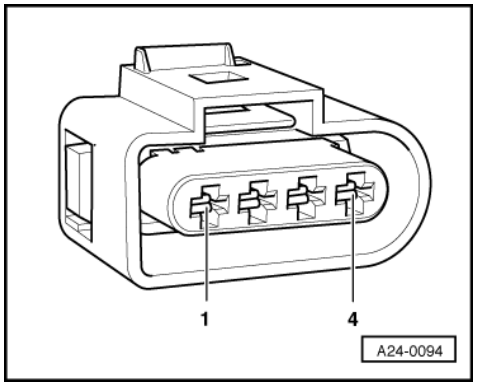
Checking the earth connection for the ignition coil:



- Detach the 4-pin connector from the relevant ignition coil.
- -> Check the earth connection from socket 4 on the 4-pin connector to the engine earth for open circuit or short to positive.
- Rectify any open/short circuit as necessary.

If the earth connection is OK: Check supply voltage for ignition coil => Page 159

Checking the power supply to the ignition coil:



- -> Connect hand-held multimeter to following socket on the connector to measure voltage:

4-pin connector on wiring harness, socket	Specified value
1 + earth	Battery voltage

- Operate starter.

Specified value: approx. battery voltage

If specified value is not attained:

- Check the wiring from socket 1 via the fuse to the fuel pump relay for continuity.

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

If the specified value is achieved.

- Check performance output stage => Page 160

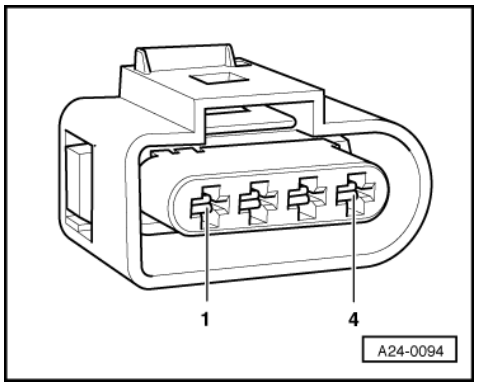
1.6 - Checking output stages for ignition coils

Note:

The ignition coil and the output stage are combined in a common component.

Checking earth connection of output stage

- Detach the 4-pin connector from the relevant ignition coil.



- -> Check the earth connection from socket 2 on the 4-pin connector to the body earth for open circuit or short to positive.
- Rectify any open/short circuit as necessary.

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

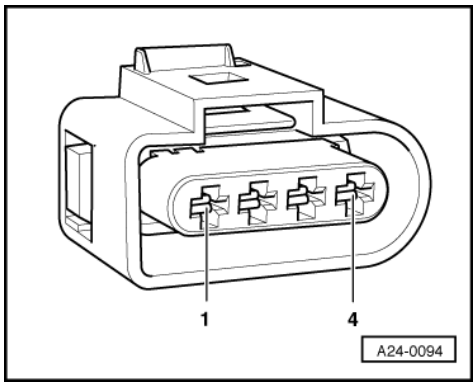
If the earth connection is OK: Checking actuation of output stages =>Page 160 .

Checking actuation of power output stages

- Unplug the connectors from all eight injectors.

Note:

It is important to ensure that no fuel is injected during the test, as this would damage the catalytic converter. Therefore, the connectors on the injectors must be unplugged.



- Detach the 4-pin connector from the relevant ignition coil.
- -> Connect the V.A.G 1527 diode test lamp to the following contacts on the power output stage connector:
- Operate the starter for a few seconds.

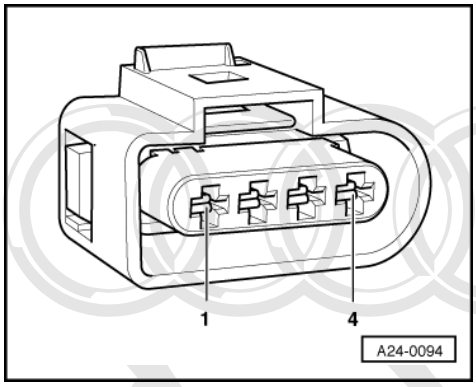
4-pin connector of relevant ignition coil at wiring harness, socket	Specified value
3 + 2	Diode test lamp must flash (brief impulse)

If the specified values are not obtained:

- Switch ignition off.

Checking wiring

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 65 .



- -> Test wiring from 4-pin connector at ignition coil or output stage ...
- ... to engine control unit for open circuit and short to positive or earth.

4-pin connector of ignition coil or performance output stage Contact 3	Contact on test box V.A.G 1598/31
Cylinder 1	102
Cylinder 2	7
Cylinder 3	111
Cylinder 4	94

Cylinder 5	103
Cylinder 6	110
Cylinder 7	8
Cylinder 8	95

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

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

If no wiring fault is detected:

- Replace the common component ignition coil with output stage.

1.7 - Checking misfire detection

Test sequence

- Connect the vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit 1 with "Address word" 01 => Page 7 .
  For this purpose, the engine must be running at idling speed.

-> Indicated on display

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

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display

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

- Press keys 0, 1 and 4 for "display group number 14" and confirm entry with Q key.

-> Indicated on display

```
Read measured value block 14
     1     2     3     4
```

- Test misfire detection.

	Display zones			
	1	2	3	4
Display group 014: Misfire detection				
Display	xxx rpm	xx.x %	**xxx**	**---**
Display	Engine speed	Load	**Total misfires**	**Misfire detection**
Range	min.: 550 rpm max.: 7200 rpm	min.: 0 max.: 100		**activated** **blocked**
Specified value	600...820 rpm	xx.x %	**0...5**	**activated**
Note	---	---	**If specified value is not attained: Evaluation, display zone 3 =>Page 163**	**---**

If specified value is attained:

- Press ⇒key.

-> Display (function selection):

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

Evaluation display group 014, display zone 3:

Display zone: 3	Possible causes of fault	Fault remedy
Higher than 5	- Defective spark plug - Defective spark plug connector - Ignition coil or output stage - Injector defective - Checking compression	- Test spark plugs and ignition wiring Check ignition coils => Page 160 . - Check injectors =>Page 78 .

1.8 - Checking engine speed sender -G28

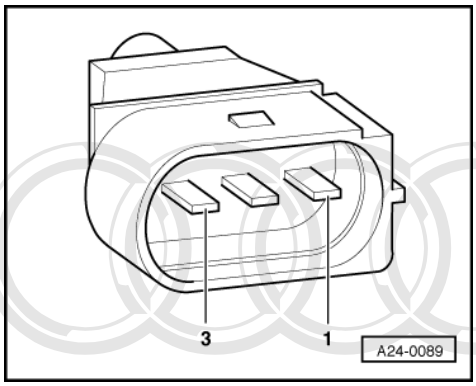
Note:

The engine speed sender is a combined speed sender and reference mark sender.

Checking engine speed sender

Fitting location of connector => Page 59 .

- Before carrying out the test, make sure that the sender is correctly installed and firmly seated.
- No swarf or damage to speed sender or sender wheel.
- The thickness of plate between sender and automatic gearbox must be 4.5 mm.
- The thickness of plate between sender and manual gearbox must be 15 mm.
- Disconnect connector for engine speed sender (identification: grey connector).

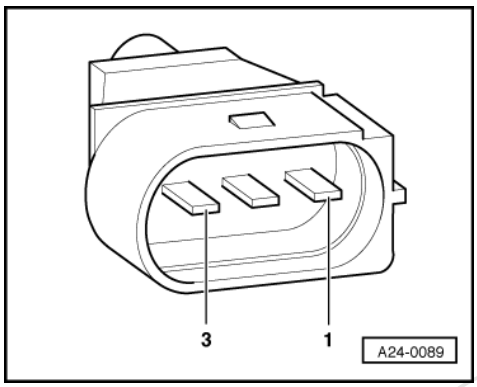


- -> Connect hand-held multimeter V.A.G 1526 (resistance test range) to contacts 2 and 3 on connector for engine speed sender using test lead from V.A.G 1594.

Specified value: approx. 450...1000 ω

Notes:

- The resistance figure for the engine speed sender is associated with a temperature of 20 °C.
- The resistance increases with increasing temperature.



If specification is not attained:

- Fit a new engine speed sender.

If the specified value is achieved.

- -> Connect the V.A.G 1526 hand-held multimeter for resistance measurement between contacts 2 and 1 (earth) as well as to contacts 3 and 1 (earth).

Specified value: infinite ω in each case (no continuity).

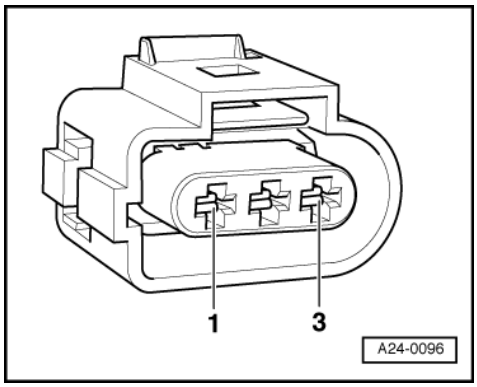
If specification is not attained:

- Fit a new engine speed sender.

If the specified value is achieved.

- Check the wiring connections.

Check wiring connections between engine speed 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 65 .
- -> Check the wiring from the 3-pin connector (sensor connector) ...
- ... to engine control unit for open circuit and short to positive or earth.

3-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
1 (screening)	108
2 (earth wire)	90
3 (signal wire)	82

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

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

If no wiring faults are detected:

- Slowly crank engine and check sender wheel for concentricity/tight fit.
- If no faults have been found in any of the above checks, fit a new engine control unit =>Page 66 .

1.9 - Checking knock control stop

If a fault entry relating to "knock control limit reached" is made, carry out the following checks:

	Possible causes of fault	Fault remedy
Fault entry for all cylinders or Fault entry for all cylinders of one bank	- Poor fuel quality	- Change fuel quality (see operating instructions)
	- Knock sensor tightened with incorrect torque	- Loosen sensor and tighten to 20 Nm.
	- Knock sensor defective	- Check knock sensor => Page 165 .
	- Corrosion on connector	
	- Loose components on engine	- Secure components
Fault entry for one cylinder	- Engine fault	- Checking compression
	- Loose components on engine	- Secure components

1.10 - Checking knock sensors -G61 and -G66

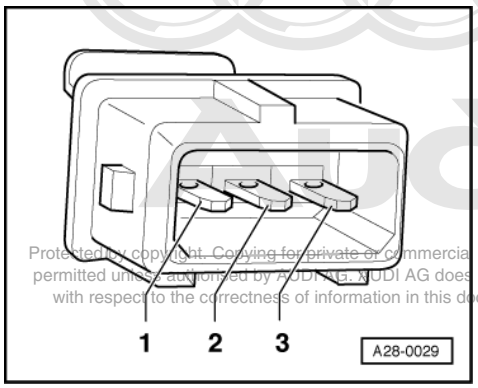
Notes:

- It is not possible to carry out an electrical test of the knock sensors -G61 and -G66 themselves (Interrogate fault memory).
- To ensure that the knock sensors function properly it is important to keep exactly to the specified tightening torque of 20 Nm.
- Use only gold plated contacts when repairing the contacts in the connectors for the knock sensors.
- Check connector between knock sensor and wiring harness for corrosion.

Checking knock sensors

Fitting location of connectors => Page 59 .

- Unplug the connector for the relevant knock sensor in the engine compartment.



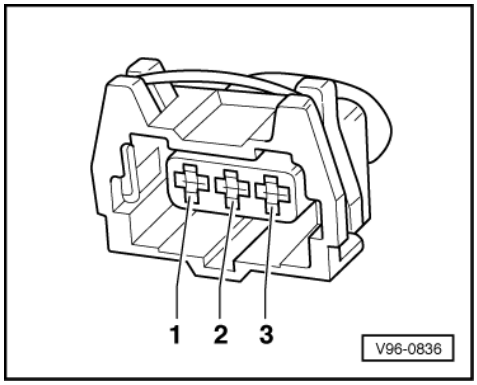
- -> Test for short between all three contacts in the knock sensor connector (contacts 1+2, 1+3, 2+3).

Specified value: The must be no connection between any of the wires (infinite resistance).

- If there is a connection between the contacts, fit a new knock sensor.
- If no short is found, check knock sensor wiring.

Checking wiring from knock sensors to engine control unit

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 65 .



- -> Check wiring from the relevant sensor connector ...
- ... to engine control unit for open circuit and short to positive or earth.

Knock sensor 1 -G61 (Bank 1)

3-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
1 (earth)	99
2 (signal)	106
3 (screening)	108

Knock sensor 2 -G66 (Bank 2)

3-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
1 (earth)	99
2 (signal)	107
3 (screening)	108

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

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

1.11 - Checking Hall senders -G40 and -G163

The Hall sender indicates the ignition position for cylinder 1.

If the Hall sender fails to function, the knock control is switched off and the ignition timing is retarded slightly because the signals can no longer be assigned to the cylinders.

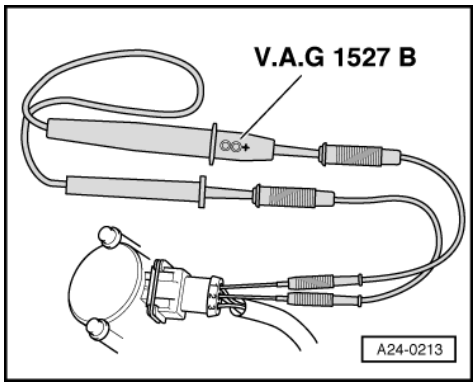
Even without a signal from the Hall sensor, the engine will continue to run and can also be re started.

- When a fault is detected, the engine control unit produces one spark for each cylinder on every crankshaft revolution.
- The fact that the control unit is out of phase by one engine revolution does not have any noticeable effect on the injection system. If this happens, the fuel is injected "upstream" (before the closed inlet valve) instead of while the inlet valve is open. This has only a minor influence on the quality of the air/fuel mixture.

Notes:

- Hall sender -G163 is located at rear of left cylinder head (bank 2).
- Hall sender -G40 is located at front of right cylinder head (bank 1).
- Fitting location of Hall sensor => Page 59 .

Checking actuation of Hall sender



For following checks, use leads from adapter set V.A.G 1594.

- Push back rubber sleeve on relevant Hall sender connector.
- -> Connect the V.A.G 1527 diode test lamp to contacts 1 and 2 on the Hall sender connector from the rear (the connector remains attached to the Hall sender).

Note:

Contracts are numbered accordingly on the back of the connector.

- Operate the starter for a few seconds.

The diode test lamp must flash briefly on each second engine revolution.

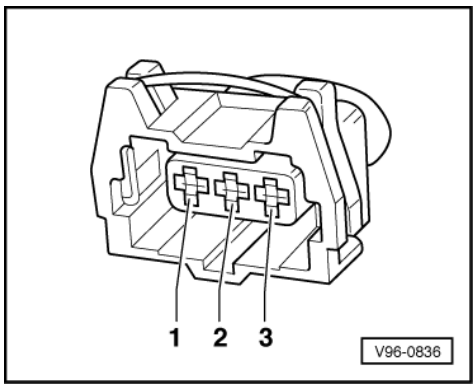
Note:

Diode test lamps with a low current draw continue to glow faintly between impulses from the engine control unit (rather than going out completely) and become much brighter when receiving an impulse.

If diode test lamp does not flash, check voltage supply.

Checking power supply for Hall sender

- Disconnect connector from relevant Hall sender.



- -> Connect hand-held multimeter V.A.G 1526 (voltage measurement range) between engine earth and socket 1 of relevant connector.
- Switch the ignition on.

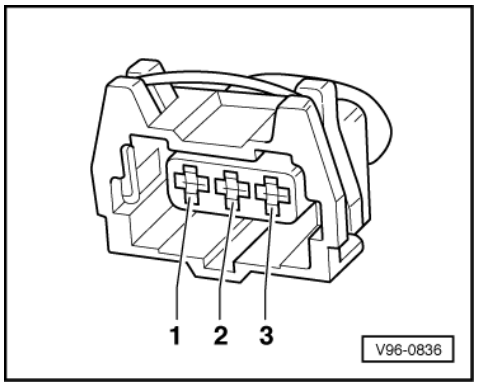
Specified value: approx. 5 V.

Checking signal wiring for Hall sender

- -> Connect hand-held multimeter V.A.G 1526 to measure voltage between engine earth and socket 2 of relevant connector.
- Switch the ignition on.

Specified value: approx. battery voltage

Checking earth wire for Hall sender



- -> Connect hand-held multimeter V.A.G 1526 for resistance measurement between socket 3 on the connector and the engine earth.

Specified value: Continuity

Wire resistance: max. 1.5 Ohm

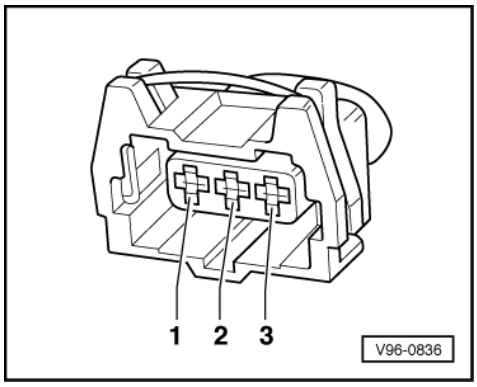
If the specified values are all achieved and the diode test lamp does not flash (measured between contacts 1 and 2 with starter connector attached).,

- Replace relevant Hall sender.

If specifications are not attained, check wiring connections.

Checking wiring between Hall sender and engine control unit

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 65 .



- -> Check the wiring from the Hall sender....

- ... to engine control unit for open circuit and short to positive or earth.

Hall sender -G40 (Bank 1)

3-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
1 (positive)	98
2 (signal)	87
3 (earth)	108

Hall sender -G163 (Bank 2)

3-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
1 (positive)	98
2 (signal)	86
3 (earth)	108

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

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

- If 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 location.

Checking phase location of Hall sender

- Connect the vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit 1 with "Address word" 01 => Page 7 .
  For this purpose, the engine must be running at idling speed.

-> Indicated on display:

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

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block
Enter display group number XXX
```


- Press keys 0, 9 and 3 for "display group number 93" and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block     93
□
    1     2     3     4
```

- Check specified results for Hall sender.

	Display zones			
	1	2	3	4
Display group 93: Phase locations of Hall senders (bank 1 and bank 2), engine idling				
Display	xxx rpm	xx %	**-15....10 °CA**	**-15....10 °CA**
Display	Engine speed	Engine load	**Phase location bank 1**	**Phase location bank 2**

	Display zones			
Range	min.: 550 rpm max.: 7200 rpm			
Specified value	600... 820 rpm	xx %	-15....10 °CA	-15....10 °CA
Note			If the specified values are not obtained: -Unbolt the Hall sender, then check to ensure that the rotor ring is correctly aligned on the camshaft (if it is incorrectly installed, the retainer tab will be pressed flat when the securing screw is tightened). -Additionally check engine timing.	

2 - Checking camshaft timing control

2.1 - Checking camshaft timing control

2.2 - Function of camshaft timing control

The adjustment of the intake camshaft is dependent on the engine load and engine speed. The exhaust camshafts are not timed.

The electrical solenoid valves for camshaft timing control switch oil pressure to the camshaft adjuster (mechanical adjustment device).

The mechanical camshaft adjusters then time the inlet camshafts of both banks of cylinders towards "advanced", i.e. such that the inlet valves open earlier.

Checking camshaft timing control function

- Connect the vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit 1 with "Address word" 01 => Page 7 .
  For this purpose, the engine must be running at idling speed.

-> Indicated on display:

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

- Press keys 0 and 4 for function "Basic Setting" and confirm entry by pressing the Q key.

-> Indicated on display:

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


- Press keys 0, 9 and 4 for "display group number 94" and confirm entry with Q key.

-> Indicated on display:

```
Basic setting     94
     1     2     3     4
```

- Check the specified value for camshaft timing control.

	Display zones			
	1	2	3	4
Display group 94: Camshaft timing control				
Display	xxx rpm	NW-St.OFF	Test OFF	Test OFF

	Display zones			
Display	Engine speed (in steps of 40 rpm)	Camshaft timing control off/on	Test result Bank 1	Test result Bank 2
Range	min.: 550 rpm max.: 7200 rpm	NW-St.OFF NW-St.ON	Test OFF Test ON Syst. OK Syst. not OK	Test OFF Test ON Syst. OK Syst. not OK
Specified value	xxx rpm	NW-St.OFF	Test OFF	Test OFF
Note			Normal position	Normal position

- Increase speed approx. 2000 rpm until "NW-St.ON" appears in display zone 2.

	Display zones			
	1	2	3	4
Display group 94: Camshaft timing control				
Display	xxx rpm	NW-St.ON	Test ON	Test ON
Display	Engine speed (in steps of 40 rpm)	Camshaft timing control off/on	Test result Bank 1	Test result Bank 2
Range	min.: 550 rpm max.: 7200 rpm	NW-St.OFF NW-St.ON	Test OFF Test ON Syst. OK Syst. not OK	Test OFF Test ON Syst. OK Syst. not OK
Specified value	xxx rpm	NW-St.ON	Test ON	Test ON
Note				

- Keep speed until Syst. OK appears in display zones 3 and 4.

	Display zones			
	1	2	3	4
Display group 94: Camshaft timing control				
Display	xxx rpm	NW-St.OFF	Syst. OK	Syst. OK
Display	Engine speed (in steps of 40 rpm)	Camshaft timing control off/on	Test result Bank 1	Test result Bank 2
Range	min.: 550 rpm max.: 7200 rpm	NW-St.OFF NW-St.ON	Test OFF Test ON Syst. OK Syst. not OK	Test OFF Test ON Syst. OK Syst. not OK
Specified value	xxx rpm	NW-St.OFF	Syst. OK	Syst. OK
Note				

If specified value in display zones 3 and 4 is not achieved check the solenoid valves for camshaft timing control => Page 171 .

2.3 - Checking solenoid valves for camshaft timing control -N205 and -N208

- Switch the ignition on.
- Perform final control diagnosis and actuate camshaft adjuster => Page 28 .

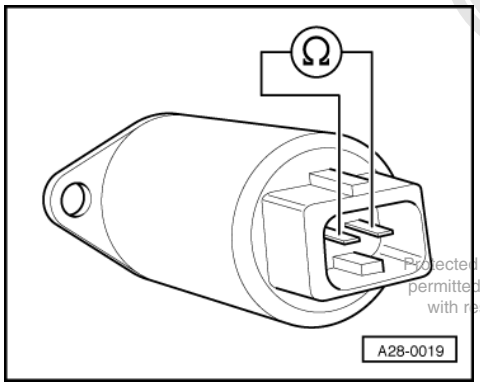
-> Indicated on display:

```
Final control diagnosis
Camshaft adjuster 1
```

Upon actuation of camshaft adjuster, both solenoid valves should give a clearly audible click.

If specified value is not attained, perform the following tests:

Checking solenoid valves for camshaft timing control electrically



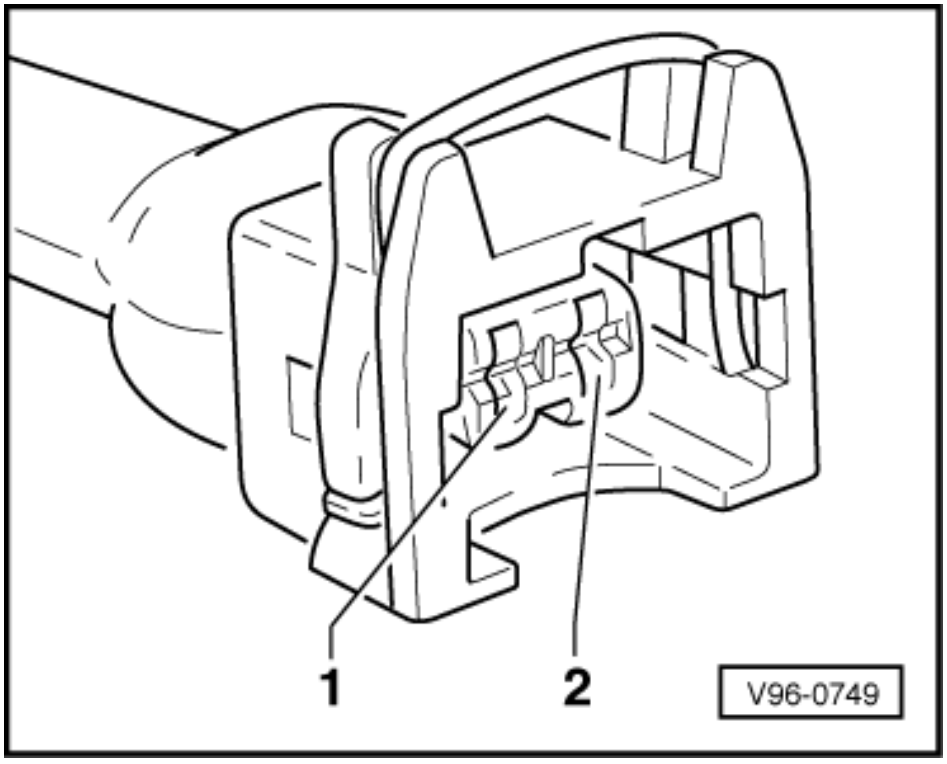
- Disconnect connector from relevant solenoid valve for camshaft timing control.
- -> Measure resistance between contacts on solenoid valve using hand-held multimeter V.A.G 1526.

Specified value: 10... 18 ohm.

If specification is not attained:

- Replace relevant solenoid valve for camshaft timing control.

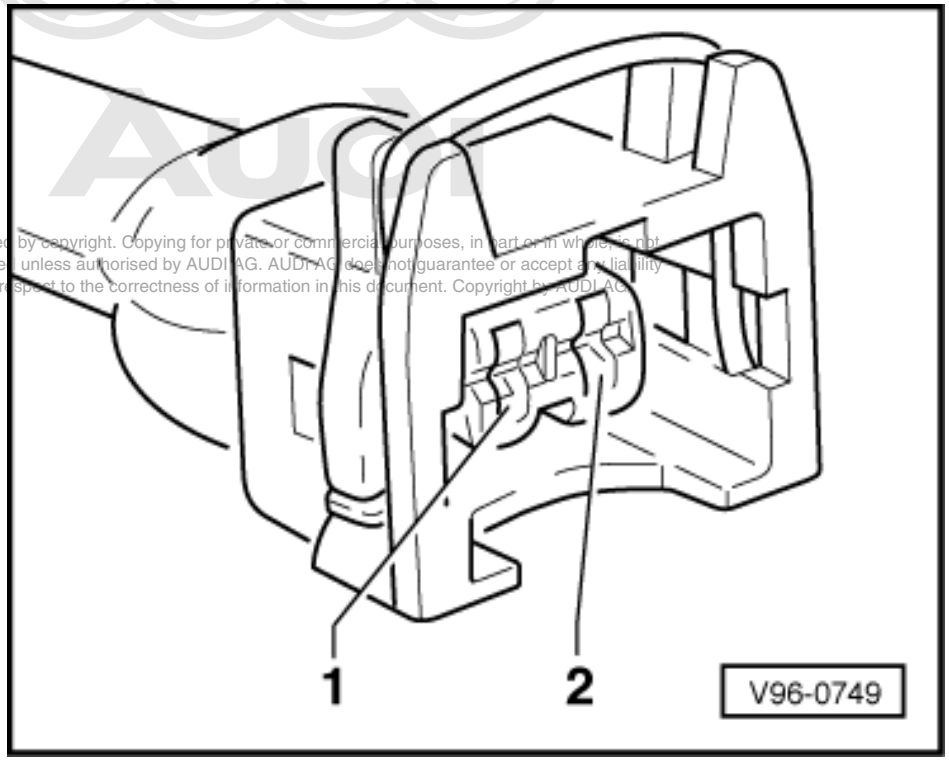
Testing voltage supply of solenoid valves for camshaft timing control



- Disconnect connector from relevant solenoid valve.
- -> Connect diode test lamp V.A.G 1527 between engine earth and socket 1 (positive) on connector using cables from adapter set V.A.G 1594.
- Operate the starter for a few seconds. Engine may start.

The diode test lamp should illuminate.

If the diode test lamp does not illuminate, carry out the following tests:



- Check fuse for solenoid valves for camshaft timing control.

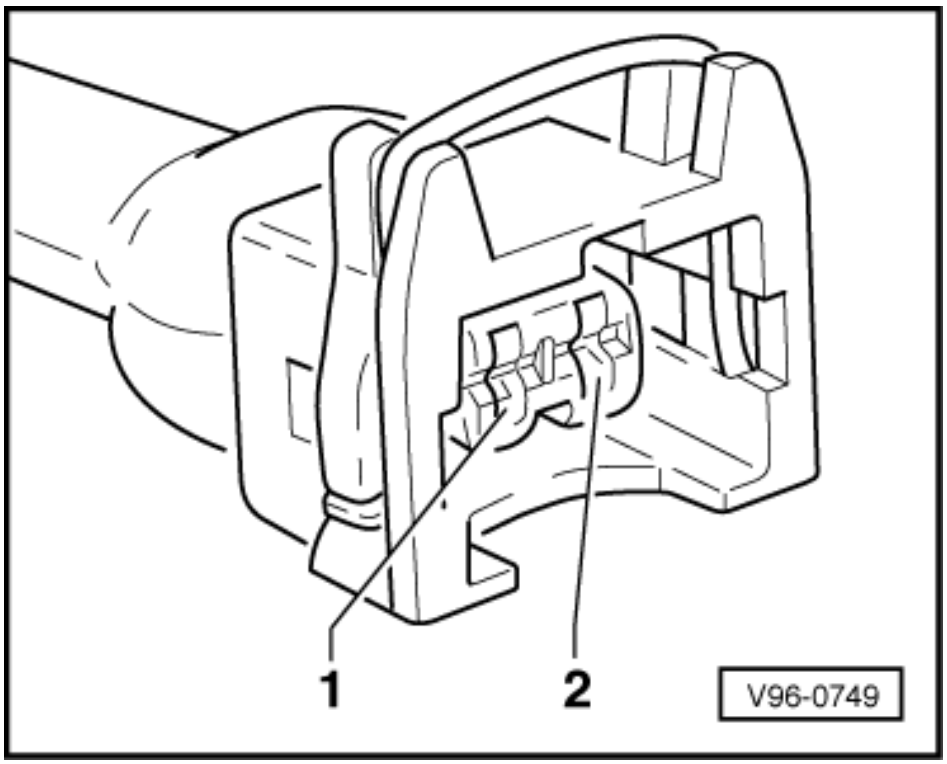
=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

If the fuse is OK:

- -> Check the wiring from socket 1 via the fuse to the fuel pump relay for continuity.

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

Checking actuation of valves for camshaft timing control

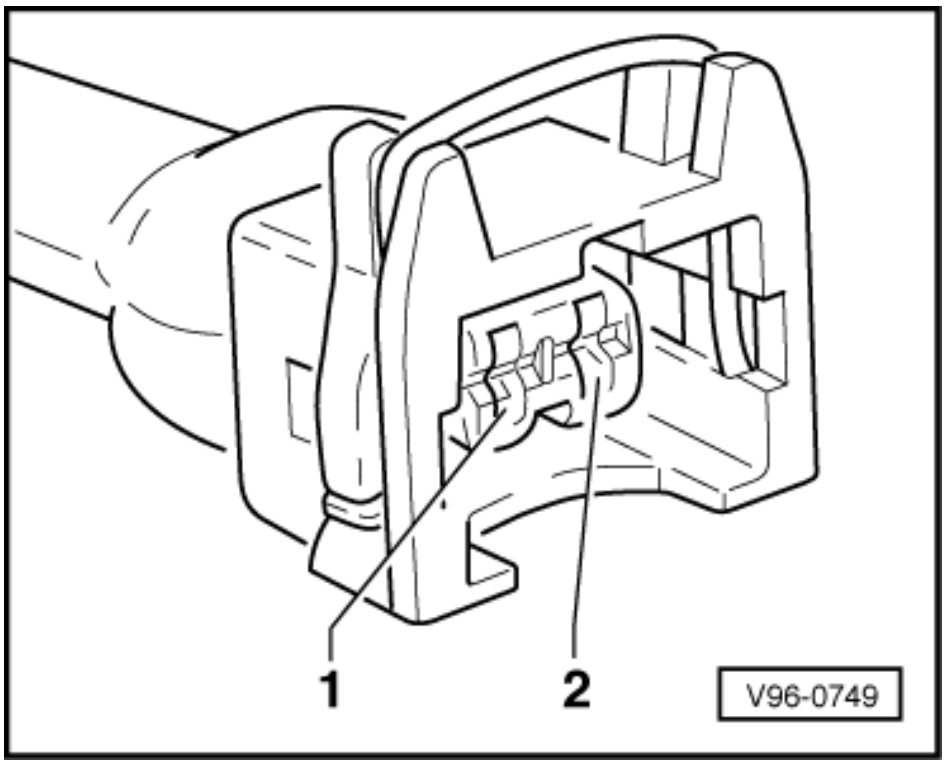


- Disconnect connector from relevant solenoid valve.
- -> Connect diode test lamp V.A.G 1527 between sockets 1 (positive) and 2 on connector for intake air changeover solenoid valve using cables from adapter set V.A.G 1594.
- Perform final control diagnosis and actuate camshaft adjuster => Page 28 .

-> Indicated on display:

```
Final control diagnosis
Camshaft adjuster 1
```

The diode test lamp should flash on and off upon actuation of camshaft adjuster.



If the diode test lamp is continuously lit:

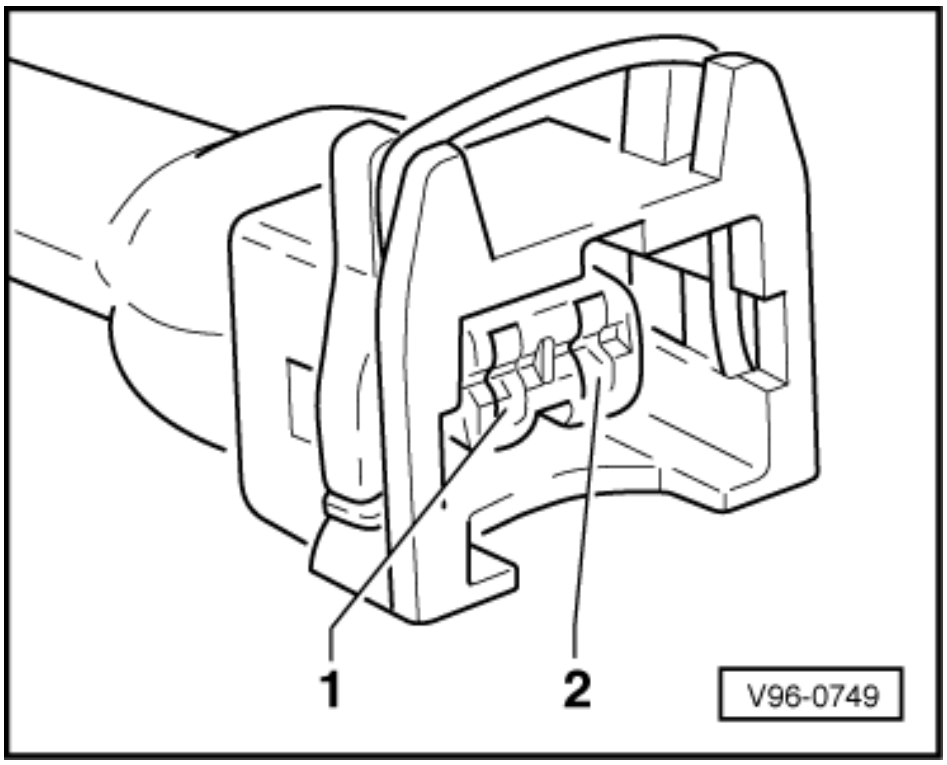
- -> Check wiring connections from socket 2 of the relevant connector for the solenoid valve for camshaft adjuster for earth short.

If the diode test lamp does not flash:

- Check wiring => Page 175 .

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 65 .



- -> Check wiring connection of the relevant connector for solenoid valve for camshaft timing control for open circuits as well as short to positive.

Camshaft timing control solenoid valve 1 -N205

2-pin connector on wiring harness, contact	Test box V.A.G 1598/31, socket
2	115

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

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

Camshaft timing control solenoid valve 2 -N208

2-pin connector on wiring harness, contact	Test box V.A.G 1598/31, socket
2	120

Wire resistance: max. 1.5 Ohm

- Rectify any open/short circuit as necessary.

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

If no short circuit or open circuit is found, replace engine control unit =>Page 66 .

- If none of the tests already performed indicate any fault, then replace the mechanical camshaft adjuster.

=> 8-cylinder Engine, Mechanics; Repair group 15; Cylinder head, valve gear; Remove and install camshafts and camshaft adjuster Cylinder head, valve gear Remove and install camshafts and camshaft adjuster