

Audi A8 1994 >

Motronic injection and ignition system (6-cylinder)									
Engine ID	AQD	APR							

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

Audi A8 1994 ➤

Motronic injection and ignition system (6-cylinder)

Repair Group

01 - Self-diagnosis

24 - Mixture preparation, Injection

28 - Ignition system

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Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.

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Contents

01 - Self-diagnosis	1
1 Self-diagnosis of Motronic system	1
1.1 Self-diagnosis of Motronic system	1
1.2 Technical data for self-diagnosis	1
1.3 Connecting vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and selecting functions	2
2 Interrogating and erasing fault memory	4
2.1 Interrogating and erasing fault memory	4
2.2 Fault table	5
3 Final control diagnosis	15
3.1 Final control diagnosis	15
4 Basic setting	17
4.1 Basic setting	17
5 Coding control unit	19
5.1 Coding control unit	19
6 Reading measured value block	21
6.1 Reading measured value block	21
24 - Mixture preparation, Injection	22
1 Servicing Motronic injection system	22
1.1 Servicing Motronic injection system	22
1.2 Safety precautions	22
1.3 Rules for cleanliness	22
1.4 Technical data	23
1.5 Fitting locations overview	23
1.6 Dismantling and assembling fuel rail with injectors	28
1.7 Removing and installing parts of intake manifold change-over	29
1.8 Wiring and component check with test box V.A.G 1598/31	30
1.9 Renewing engine control unit -J220	31
1.10 Testing idling speed	33
1.11 Checking fuel pressure regulator and holding pressure	34
1.12 Checking injectors	36
1.13 Testing injection quantity, leak-tightness and spray pattern of injectors	40
1.14 Testing fuel pump relay -J17 and relay activation	42
1.15 Testing air mass meter -G70	45
1.16 Checking intake air system for leaks (unmetered air)	48
1.17 Testing intake air temperature sender -G42	49
1.18 Testing coolant temperature sender-G62	51
2 Testing lambda control	52
2.1 Testing lambda control	52
2.2 Operation of lambda control	52
2.3 Testing lambda probe and lambda control	53
2.4 Testing lambda probe heating	57
2.5 Testing lambda probe signal wiring and activation	60
2.6 Removing and installing lambda probe	63
3 Testing intake manifold change-over function	63
3.1 Testing intake manifold change-over function	63
3.2 Testing operation	63
3.3 Testing intake manifold change-over valve -N156	64
3.4 Testing vacuum system	67
4 Testing secondary air system	68
4.1 Testing secondary air system	68
4.2 Testing secondary air inlet valve	68



4.3	Testing secondary air pump relay -J299	70
5	Testing fuel tank breather system	72
5.1	Testing fuel tank breather system	72
5.2	Testing solenoid valve 1 for activated charcoal filter -N80	72
6	Testing electronic engine power control (electronic throttle)	76
6.1	Testing electronic engine power control (electronic throttle)	76
6.2	Operation of electronic throttle system	76
6.3	Testing throttle valve control part -J338	76
6.4	Performing adaption of throttle valve control part	76
6.5	Testing angle senders for throttle valve drive	79
6.6	Notes on EPC warning lamp (fault warning lamp for electronic throttle) in dash panel insert	80
7	Checking accelerator position senders-G79 and -G185	81
7.1	Checking accelerator position senders-G79 and -G185	81
7.2	Checking brake light switch -F and brake pedal switch -F47	83
7.3	Testing clutch pedal switch -F36	85
8	Testing auxiliary signals	88
8.1	Testing auxiliary signals	88
8.2	Checking engine speed signal	88
8.3	Testing air conditioner compressor shut-off	88
8.4	Testing data exchange between control units	90
28 - Ignition system		94
1	Testing ignition system	94
1.1	Testing ignition system	94
1.2	General notes on ignition system	94
1.3	Safety precautions	94
1.4	Technical data for ignition system	94
1.5	Removing and installing parts of the ignition system	95
1.6	Testing ignition coils	97
1.7	Testing engine speed sender -G28	101
1.8	Checking control unit voltage supply	102
1.9	Testing knock sensor control limit	104
1.10	Testing knock sensors-G61and-G66	104
1.11	Testing Hall senders-G40and-G163	106

01 - Self-diagnosis

1 - Self-diagnosis of Motronic system

1.1 - Self-diagnosis of Motronic system

1.2 - Technical data for self-diagnosis

Equipment

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.

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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 and the fault reader V.A.G 1551 can register => Page 1, List of selectable functions.

The fault memory is equipped with a non-volatile memory and therefore does not depend on the power supply.

Faults relating to the electronic throttle are also indicated by a warning lamp in the dash panel insert.

Selectable functions when using fault reader V.A.G 1551

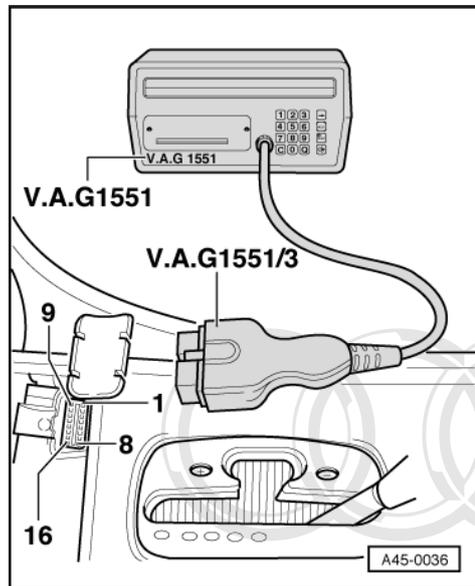
The requirements for selecting the desired functions can be taken from the following table.

Address words and functions on Fault reader V.A.G 1551		Ignition on, engine not running	Engine idling	Vehicle being driven
Address words				
00	Automatic test sequence	yes	yes	yes
01	Engine electronics	yes	yes	yes
Functions				
01	Interrogate control unit version	yes	yes	yes
02	Interrogate fault memory	yes	yes	yes
03	Final control diagnosis	yes	no	no
04	Basic setting	yes	yes	yes
05	Erase fault memory	yes	yes	yes
06	End output	yes	yes	yes
07	Code control unit	yes	no	no
08	Read measured value block	yes	yes	yes



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

Test conditions



- Fuses 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 vehicle diagnostic, testing and information system VAS 5051 with diagnosis cable VAS 5051/1. As an alternative, connect fault reader V.A.G 1551 with diagnosis cable V.A.G 1551/3.

Warning!

- ◆ When performing test-drives and checks, the vehicle diagnostic, testing and information system VAS 5051 as well as the fault reader V.A.G. 1551 may be secured only on rear seat, from where it is to be operated.
- ◆ Please follow safety precautions => Page 22

Note:

The following description only covers the procedure for performing self-diagnosis with fault reader V.A.G 1551.

If using vehicle diagnostic, testing and information system VAS 5051, follow the operating instructions supplied with the equipment.

-> Indicated on display:

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

* Appears alternately

- If no display appears, check diagnostic cables:

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

Depending on the function required:

- Switch ignition on.
- or
- Start the engine
- => Page 1, table of selectable functions.
- Switch on printer with the Print button (Warning lamp in button lights up).
- Press key 1 for "Rapid data transfer".

-> Indicated on display:

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

Note:

Address word 00 is used to start the automatic test sequence (i.e. fault memory interrogation for all vehicle systems with self-diagnosis capability in "Rapid data transfer" mode).

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

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

-> If the display shows one of the messages reproduced here, run through the fault-finding procedure as described in the Fault-Finding Programme for diagnosis wiring.

```
Rapid data transfer      HELP
Control unit does not answer
```

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

```
Rapid data transfer      HELP
Fault in communication build up
```

```
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 will show the control unit identification, as in this example.

```
3B0907551.. 2.8l      V6/5V      G
D      ..□
Coding 05753      WSC 06388
```

- | | |
|-----------------|--|
| - 3B0907551.. | Control unit number (see Parts List) |
| - 2.8 ltr. | Engine capacity |
| - V6/5V | Engine type (V engine, 6 cylinders, 5 valves per cylinder) |
| - "G" | With cruise control (G) |
| - or no display | or without cruise control |
| - D.. | Software version in control unit |
| - Coding 05753 | Engine control unit coding; Coding table => Page 19 |
| - WSC 06388 | Workshop Code of the V.A.G 1551 with which the last coding was performed |



If the coding differs from the vehicle version, then:

- Check control unit coding
=> Coding engine control unit, Page 19
- Press =>key.

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

Note:

Press the HELP key to obtain a printout of the functions which are available.

2 - Interrogating and erasing fault memory

2.1 - Interrogating and erasing fault memory

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 2 .)
- When doing this the engine must be idling.

Note:

If the engine does not start, turn over the engine with the starter motor for at least 5 seconds, then leave the ignition switched on.

- Switch on printer with the Print button (Warning lamp in button lights up).

-> 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 function "Interrogate fault memory" and confirm entry with Q key.

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-> The display will show either the number of faults stored or the message "No fault recognised!".

X Faults recognised!

If no fault is stored:

- Press =>key.

If one or more faults are stored:

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

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

- Locate and eliminate faults printed out as per fault table
=> Page 5 .
- Press keys 0 and 5 for the function "Erase fault memory" and confirm entry with Q key.

-> 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, 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 function "End output" and confirm entry with the Q key.

Automatic test sequence

During test and assembly work faults can be recognised from other control units like e.g. plug disconnected. Therefore on completion the fault memories of all control units must be interrogated and erased. To do this:

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

When a control unit answers with its identification the number of stored faults appears on the display or "No fault recognised".

Any system faults that are stored will be displayed one after the other 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 road test.
- Interrogate the fault memories of all control units again using the "automatic test sequence". No faults must be stored in fault memory.

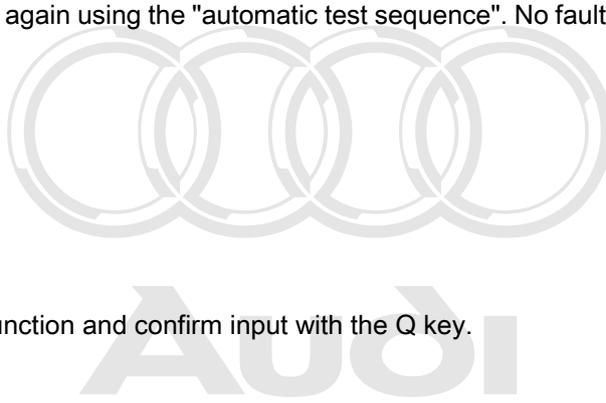
If no fault is stored:

- Press the =>key.

-> Indicated on display:

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

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



2.2 - Fault table

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Notes:

- ◆ If faults occur in the sensors and components being monitored, they will be stored in the fault memory together with an indication of the type of fault.
- ◆ Faults relating to the electronic throttle are also indicated by the EPC (Electronic Power Control) warning lamp in the dash panel insert. Notes on electronic throttle system=>Page 76 .
- ◆ If the connector for the engine control unit is unplugged or if the battery is disconnected, all the learned values stored in the control unit will be erased, although the contents of the fault memory will remain intact. The next time the engine is started the idling may be rough at first. In addition, the following adaption procedures must be performed => Page 76 .
- ◆ The fault table is arranged according to the 5-digit fault codes in the left-hand column.
- ◆ If a fault is stored in the fault memory and then does not occur again during the next 40 engine warm-up phases, the fault code will be automatically erased.



- ◆ Sporadically occurring faults (temporary faults) will be indicated on the V.A.G 1551 display as "SP". The word "sporadic" means "intermittent" or "occurring at irregular intervals".
- ◆ Components that are indicated as being faulty by the V.A.G 1551/VAS 5051 should not be renewed immediately. Always start by checking the wiring, connectors and earth connections for the component using the current flow diagram. This is particularly important in the case of sporadic faults (indicated by the letters "SP" on the fault reader display).

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P0102	16486	Air mass meter -G70 Signal too small	Test air mass meter => Page 45
P0103	16487	Air mass meter -G70 Signal too large	
P0112	16496	Intake air temp. sender -G42 Signal too small	Test intake air temperature sender => Page 49
P0113	16497	Intake air temp. sender -G42 Signal too large	
P0116	16500	Coolant temp. sender -G62 Implausible signal	Test coolant temperature sender => Page 51
P0117	16501	Coolant temp. sender -G62 Signal too small	
P0118	16502	Coolant temp. sender -G62 Signal too large	

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P0130	16514	Bank 1, Probe 1 Electrical fault in current circuit	Test lambda control => Page 52
P0131	16515	Bank 1, Probe 1 Voltage too low	
P0132	16516	Bank 1, Probe 1 Voltage too high	
P0134	16518	Bank 1, Probe 1 No activity	

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P0150	16534	Bank 2, Probe 1 Electrical fault in current circuit	Test lambda control => Page 52
P0151	16535	Bank 2, Probe 1 Voltage too low	
P0152	16536	Bank 2, Probe 1 Voltage too high	
P0154	16538	Bank 2, Probe 1 No activity	
P0321	16705	Engine speed sender -G28 Implausible signal	Test engine speed sender => Page 101
P0322	16706	Engine speed sender -G28 No signal	

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		

P0327	16711	Knock sensor 1 -G61 Signal too small	Test knock sensor => Page 104
P0328	16712	Knock sensor 1 -G61 Signal too large	
P0332	16716	Knock sensor 2 -G66 Signal too small	
P0333	16717	Knock sensor 2 -G66 Signal too large	
P0501	16885	Vehicle speed signal Implausible signal	Interrogate fault memory of dash panel insert => Electrical system; Repair group 01; Self-diagnosis of dash panel insert; Interrogating fault memory Self-diagnosis of dash panel insert; Interrogating fault memory
P0560	16944	Voltage supply Implausible signal	Test voltage supply => Page 102
P0562	16946	Voltage supply Voltage too low	
P0563	16947	Voltage supply Voltage too high	

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P0571	16955	Brake light switch -F Implausible signal	Test brake light switch => Page 83
P0601	16985	Control unit defective	Renew engine control unit => Page 31
P0604	16988	Control unit defective	
P0605	16989	Control unit defective	
P0606	16990	Control unit defective	
P1102	17510	Bank 1 - Probe 1, Heating element circuit Short to Positive	Test lambda probe heating => Page 57
P1107	17515	Bank 2 - Probe 1, Heating element circuit Short to Positive	
P1111	17519	Lambda control (Bank 1), System too lean	Test lambda control Page => 52 .
P1112	17520	Lambda control (Bank 1), System too rich	

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1113	17521	Bank 1 - Probe 1 Internal resistance too great	Test lambda probe heating => Page 57
P1115	17523	Bank 1 - Probe 1, Heating element circuit Short to Earth	
P1116	17524	Bank 1 - Probe 1, Heating element circuit Open circuit	
P1119	17527	Bank 2 - Probe 1, Heating element circuit Short to Earth	
P1120	17528	Bank 2 - Probe 1, Heating element circuit Open circuit	

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		



Fault code		Readout on fault reader display	Fault rectification
P1127	17535	Bank 1, Mixture adaption (mult.) System too rich	Take car for test drive (fuel in oil) Check fuel system pressure => Page 34 Test air mass meter => Page 45 Test lambda probe => Page 52 Test injectors => Page 40 Test lambda probe heating => Page 57
P1128	17536	Bank 1, Mixture adaption (mult.) System too lean	
P1129	17537	Bank 2, Mixture adaption (mult.) System too rich	
P1130	17538	Bank 2, Mixture adaption (mult.) System too lean	
P1131	17539	Bank 2 - Probe 1 Internal resistance too great	

Note:

mult. = multiplicative, i.e. the fault occurs across the whole range of engine speeds and engine loads.

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		Take car for test drive (fuel in oil) Check fuel system pressure => Page 34 Test air mass meter => Page 45 Test lambda probe => Page 72
P1136	17544	Bank 1, Mixture adaption (add.) System too lean	
P1137	17545	Bank 1, Mixture adaption (add.) System too rich	
P1138	17546	Bank 2, Mixture adaption (add.) System too lean	
P1139	17547	Bank 2, Mixture adaption (add.) System too rich	

Note:

add. = additive, i.e. the fault only occurs at idling speed.

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		Test lambda control =>Page 52 . Test angle sender for throttle valve drive => Page 79
P1147	17555	Lambda control, Bank 2 System too lean	
P1148	17556	Lambda control, Bank 2 System too rich	
P1149	17557	Lambda control, Bank 1 Implausible control value	
P1150	17558	Lambda control, Bank 2 Implausible control value	
P1171	17579	Angle sens. 2 for throt. valve drive -G188 Implausible signal 1)	
P1172	17580	Angle sens. 2 for throt. valve drive -G188 Signal too small 1)	
P1173	17581	Angle sens. 2 for throt. valve drive -G188 Signal too large 1)	

1) If this fault occurs the engine control unit activates the EPC warning lamp in the dash panel insert.

Notes on EPC warning lamp =>Page 80 .

Note:

add. = additive, i.e. the fault only occurs at idling speed.

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1213	17621	Injector Cyl. 1 -N30 Short to Positive	Test injectors =>Page 36
P1214	17622	Injector Cyl. 2 -N31 Short to Positive	
P1215	17623	Injector Cyl. 3 -N32 Short to Positive	
P1216	17624	Injector Cyl. 4 -N33 Short to Positive	
P1217	17625	Injector Cyl. 5 -N83 Short to Positive	
P1218	17626	Injector Cyl. 6 -N84 Short to Positive	

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1225	17633	Injector Cyl. 1 -N30 Short to Earth	Test injectors =>Page 36
P1226	17634	Injector Cyl. 2 -N31 Short to Earth	
P1227	17635	Injector Cyl. 3 -N32 Short to Earth	
P1228	17636	Injector Cyl. 4 -N33 Short to Earth	
P1229	17637	Injector Cyl. 5 -N83 Short to Earth	
P1230	17638	Injector Cyl. 6 -N84 Short to Earth	

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1237	17645	Injector Cyl. 1 -N30 Open circuit	Test injectors =>Page 36
P1238	17646	Injector Cyl. 2 -N31 Open circuit	
P1239	17647	Injector Cyl. 3 -N32 Open circuit	
P1240	17648	Injector Cyl. 4 -N33 Open circuit	
P1241	17649	Injector Cyl. 5 -N83 Open circuit	
P1242	17650	Injector Cyl. 6 -N84 Open circuit	

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		



P1325	17733	Knock control Cyl. 1 Control limit reached	Test knock control => Page 104
P1326	17734	Knock control Cyl. 2 Control limit reached	
P1327	17735	Knock control Cyl. 3 Control limit reached	
P1328	17736	Knock control Cyl. 4 Control limit reached	
P1329	17737	Knock control Cyl. 5 Control limit reached	
P1330	17738	Knock control Cyl. 6 Control limit reached	

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1335	17743	Engine torque monitoring 2 (Control limit surpassed 1)	Test throttle valve control part => Page 31
P1336	17744	Engine torque monitoring Control limit surpassed	Renew engine control unit => Page 31

1) If this fault occurs the engine control unit activates the EPC warning lamp in the dash panel insert.

Notes on EPC warning lamp =>Page 80 .

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1337	17745	Bank 1, Camshaft pos. sensor => -G163 Short to Earth	Test Hall sender => Page 106
P1338	17746	Bank 1, Camshaft pos. sensor => -G163 Open circuit / Short to Positive	
P1340	17748	Camshaft pos. / Crankshaft pos. sens. Wrong allocation	Test phase position of hall senders => Page 106
P1347	17755	Bank 2, Camshaft pos. / Crankshaft pos. sens. Wrong allocation	
P1386	17794	Control unit defective	Renew engine control unit => Page 31
P1387	17795	Control unit defective	

P1388	17796	Control unit defective 1)	
-------	-------	---------------------------	--

1) If this fault occurs the engine control unit activates the EPC warning lamp in the dash panel insert.

Notes on EPC warning lamp =>Page **80** .

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1391	17799	Bank 2, Camshaft pos. sensor => -G40 Short to Earth	Test Hall sender => Page 106 Test activation and/or wiring from engine control unit to ignition output stage => Page 99 .
P1392	17800	Bank 2, Camshaft pos. sensor => -G40 Open circuit / Short to Positive	
P1393	17801	Ignition output 1: Electrical fault in current circuit	
P1394	17802	Ignition output 2: Electrical fault in current circuit	
P1395	17803	Ignition output 3: Electrical fault in current circuit	

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Note on fault codes 17801, 17802, 17803:

"Ignition output 1", "Ignition output 2" and "Ignition output 3" refer to the outputs at the engine control unit from which the control unit activates the output stage on the ignition coils.

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1410	17818	Tank breather valve -N80 Short to Positive	Test solenoid valve 1 for activated charcoal filter => Page 72 Test secondary air inlet valve => Page 68
P1420	17828	Secondary air inlet valve - N112 Electrical fault in current circuit	
P1421	17829	Secondary air inlet valve - N112 Short to Earth	
P1422	17830	Secondary air inlet valve - N112 Short to Positive	



P1425	17833	Tank breather valve -N80 Short to Earth	Test solenoid valve 1 for activated charcoal filter => Page 72
P1426	17834	Tank breather valve -N80 Open circuit	

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1432	17840	Secondary air inlet valve - N112 Open circuit	Test secondary air inlet valve => Page 68
P1433	17841	Relay for secondary air pump -J299 Open circuit	
P1434	17842	Relay for secondary air pump -J299 Short to Positive	Test secondary air pump relay => Page 70
P1435	17843	Relay for secondary air pump -J299 Short to Earth	
P1436	17844	Relay for secondary air pump -J299 Electrical fault in current circuit	

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1500	17908	Fuel pump relay -J17 Electrical fault in current circuit	Test fuel pump relay => Page 42
P1501	17909	Fuel pump relay -J17 Short to Earth	
P1502	17910	Fuel pump relay -J17 Short to Positive	Test intake manifold change-over function => Page 64 .
P1511	17919	Intake manifold change-over valve -N156 Electrical fault in current circuit	
P1512	17920	Intake manifold change-over valve -N156 Short to Positive	

P1515	17923	Intake manif. change-over valve -N156 Short to Earth	
P1516	17924	Intake manif. change-over valve -N156 Open circuit	

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1519	17927	Bank 1, Variable valve timing Faulty	=> Mechanics; Repair group 15; Testing camshaft timing control, Testing operation of camshaft timing control Testing camshaft timing control, Testing operation of camshaft timing control
P1522	17930	Bank 2, Variable valve timing Faulty	
P1529	17937	Variable valve timing Short to Positive	=> Mechanics; Repair group 15; Testing camshaft timing control, Testing solenoid valves forcamschaft adjustment Testing camshaft timing control, Testing solenoid valves forcamschaft adjustment
P1530	17938	Variable valve timing Short to Earth	
P1531	17939	Variable valve timing Open circuit	

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1539	17947	Clutch pedal switch -F36 Implausible signal	Test clutch pedal switch => Page 85
P1542	17950	Angle sender for throt. val. drive -G187 Implausible signal 1)	Test angle sender for throttle valve drive => Page 79
P1543	17951	Angle sender for throt. val. drive -G187 Signal too small 1)	
P1544	17952	Angle sender for throt. val. drive -G187 Signal too large 1)	
P1545	17953	Throttle valve control Faulty 1)	Test throttle valve control part => Page 76
P1558	17966	Throttle valve drive -G186 Electrical fault in current circuit 1)	
P1559	17967	Throttle valve control part -J338 Fault in basic setting 1)	Perform adaption => Page 76

1) If this fault occurs the engine control unit activates the EPC warning lamp in the dash panel insert.

Notes on EPC warning lamp =>Page **80** .

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1560	17968	Maximum engine revs surpassed	Repair mechanical damage
P1564	17972	Throttle valve control part -J338 Low voltage at base setting	Charge battery or test throttle valve control part => Page 76 .
P1565	17973	Throttle valve control part -J338 Lower stop is not reached 1)	Test throttle valve control part => Page 76



P1568	17976	Throttle valve control part -J338 Mechanical fault 1)	
P1569	17977	CCS switch -E45 Implausible signal	=> Electrical system; => Repair group 01; Self-diagnosis of cruise control system (CCS)

1) If this fault occurs the engine control unit activates the EPC warning lamp in the dash panel insert.

Notes on EPC warning lamp =>Page 80 .

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1570	17978	Engine control unit blocked	Perform adaption of electronic immobilizer to engine control unit => Electrical system; Repair group 01; Self-diagnosis for immobilizer
P1579	17987	Throttle valve control part -J338 Adaption not started	Check requirements for performing adaption => Page 76 .
P1600	18008	Voltage supply Kl. 15 Voltage too low	Test voltage supply to engine control unit => Page 102
P1602	18010	Voltage supply Kl. 30 Voltage too low	
P1603	18011	Control unit defective	Renew engine control unit => Page 31
P1604	18012	Control unit defective 1)	
P1612	18020	Engine control unit Wrongly coded	Check coding => Page 19 .
P1626	18034	Data bus drive No message from gearbox CU	Test CAN data bus =>Page 90

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1) If this fault occurs the engine control unit activates the EPC warning lamp in the dash panel insert.

Notes on EPC warning lamp =>Page 80 .

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1630	18038	Accelerator position sender -G79 Signal too small 1)	Test accelerator position sender =>Page 81
P1631	18039	Accelerator position sender -G79 Signal too large 1)	
P1633	18041	Accelerator position sender 2 -G185 Signal too small 1)	
P1634	18042	Accelerator position sender 2 -G185 Signal too large 1)	
P1639	18047	Accelerator position sender 1/2 -G79/-G185 Implausible signal 1)	

1) If this fault occurs the engine control unit activates the EPC warning lamp in the dash panel insert.

Notes on EPC warning lamp =>Page 80 .

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1640	18048	Control unit defective	Renew engine control unit => Page 31

P1648	18056	Data bus drive defective	Test CAN data bus =>Page 90 .
P1649	18057	Data bus drive No message from ABS CU	Test CAN data bus =>Page 90 .
P1650	18058	Data bus drive No message from dash panel insert	Test CAN data bus =>Page 90 .
P1853	18261	Data bus drive Implausible message from ABS CU	Test CAN data bus =>Page 90 .

3 - Final control diagnosis

3.1 - Final control diagnosis

Notes:

- ◆ The final control diagnosis can only be performed with the ignition switched on and the engine not running.
- ◆ The final control diagnosis is terminated if the engine is started or if an engine speed pulse is detected.
- ◆ During the final control diagnosis, each control element is activated for about 1 minute unless the test programme is deliberately advanced to the next control element by pressing the => key.
- ◆ The control elements can be tested either by listening or by touching.
- ◆ If the final control diagnosis is to be repeated, the engine must be started. (The engine control unit needs to detect an engine speed of more than 300 rpm.)
- ◆ The electric fuel pump runs continuously throughout the final control diagnosis.

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

1. Solenoid valve 1 for activated charcoal filter -N80
(fuel tank breather valve)
2. Secondary air inlet valve -N112
(only on vehicles with secondary air system)
3. Relay for secondary air pump -J299
(only on vehicles with secondary air system)
4. Intake manifold change-over valve -N156
5. Camshaft timing control 1 (camshaft adjustment valves 1 and 2,
-N205 and -N208)

Test requirements

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- Fuses for engine electronics okay
 - Fuel pump relay okay
- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 2 .)
 When doing this the ignition must be switched on.

-> Indicated on display:

Rapid data transfer HELP Select function XX

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

-> Indicated on display:

Rapid data transfer Q 03-Final control diagnosis
--



Activating solenoid valve for activated charcoal filter

(fuel tank breather valve)

- Confirm input with Q key.

Note:

The fuel pump relay should pick up and the fuel pump should run. Fuel flow at the fuel pressure regulator will be clearly audible. If the fuel pump does not run, test activation

=>Page 42

-> Indicated on display:

Final control diagnosis Tank breather valve -N80

The solenoid valve will continue to be activated (i.e. will click) for about 1 minute unless the => key is pressed to deliberately advance the programme to the next control element.

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

- Test solenoid valve 1 for activated charcoal filter -N80
=> Page 72 .

Activating secondary air inlet valve

(only on vehicles with secondary air system)

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- Press =>key.

-> Indicated on display:

Final control diagnosis Secondary air inlet valve -N112
--

The solenoid valve will continue to be activated (i.e. will click) for about 1 minute unless the => key is pressed to deliberately advance the programme to the next control element.

If the secondary air inlet valve does not click:

Test secondary air inlet valve =>Page 68 or

=> Mechanics; Repair Group 26; Secondary air system Secondary air system

Activating relay for secondary air pump

(only on vehicles with secondary air system)

- Press =>key.

-> Indicated on display:

Final control diagnosis Secondary air pump relay -J299

The secondary air pump relay (J299) activates the secondary air pump motor (V101) which runs at intervals for about one minute, or until the final control diagnosis is advanced to the next control element by pressing the => key.

If the secondary air pump motor (V101) does not run at intervals:

Testsecondary air pump relay

=>Page 70 , or

=> Mechanics; Repair Group 26; Secondary air system Secondary air system

Activating intake manifold changeover valve

- Press =>key.

-> Indicated on display:

```
Final control diagnosis
Intake manifold press. change valve -
N156
```

The valve will continue to be actuated (i.e. will click) until the => key is pressed to advance the programme to the next control element.

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

- Test intake manifold change-over (pressure change) valve -N156
=> Page **63**

Activating camshaft adjustment valves

- Press =>key.

-> Indicated on display:

```
Final control diagnosis
Camshaft timing control 1
```

- Camshaft adjustment valves 1 and 2 (-N205 and -N208) will continue to be activated (i.e. will click) for about 1 minute unless the =>key is pressed to deliberately advance to the next control element.

If the valves are not actuated (do not click):

=> Mechanics; Repair group 15; Testing camshaft timing control; Testing solenoid valves for camshaft adjustment Testing camshaft timing control Testing solenoid valves for camshaft adjustment

Note:

To terminate the final control diagnosis, press the => key again.

If the final control diagnosis needs to be repeated, first start the engine, then switch the ignition off and on again.

4 - Basic setting

4.1 - Basic setting

With the ignition on and engine not running, the following operation can be performed in the "Basic setting" mode (function 04):

- ◆ Adaption of throttle valve control part to engine control unit
=>Display Group 60 (=>Page **76**)

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

- ◆ Learning process for lambda control
=> relevant Display Group
- ◆ Fault-finding by deliberate activation and deactivation of lambda control=> Display Group 99

Test conditions for operations with engine running

- No fault stored in fault memory
- Coolant temperature at least 80 °C
- Electrical consumers switched off (radiator fan **must not run during the check**)

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- Air conditioner switched off
- Gear selector lever in P or N position
- Wheels in straight-ahead position
- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 2 .)
When doing this the engine must be idling.
- Interrogate and erase fault memory => Page 4 .
There should be no faults stored in the fault memory. (If necessary rectify faults, erase fault memory and switch off engine. Start engine again, road test the vehicle and interrogate fault memory 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 Q.

-> 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 000 is used here as an example to illustrate the procedure.

- Press key 0 three times.

(000 is to select Display Group 000)

Note:

When the display group is selected the ACF valve is closed and the air conditioner compressor is switched off.

-> Indicated on display:

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

- Confirm entry by pressing Q. Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

-> 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 below 80 °C)												
Display zones										Specification	Corresponds to	
1	2	3	4	5	6	7	8	9	10	Learned value for mixture formation, Bank 2	77...179	-10...10 %
										Learned value for mixture formation, Bank 1	77...179	-10...10 %
										Control value for mixture formation, Bank 2 (if outside tolerance, road test the vehicle)	115...141	-10...10 %
										Control value for mixture formation, Bank 1 (if outside tolerance, road test the vehicle)	115...141	-10...10 %

Display Group 000 (decimal readouts)		
Learned value for torque loss at idling speed	102...169	-5...8 %
Torque at idling speed	102...154	-5.0...5.0 %
Throttle valve angle	1...8	0.5...3.0 %
Engine speed (idling speed) 1) (front-wheel drive and four-wheel drive)	65...75	650...750 rpm
Engine load (without electrical consumers)	16...34	12...26 %
Coolant temperature (requirement for basic setting)	180...205	80...105 °C

1) Up-to-date specifications:

=> Exhaust emissions test binder

- Allow engine to idle for a few minutes; coolant temperature at least 80°C (display zone 1).

Notes:

- ◆ When the PRINT key is pressed the current display will be printed out.
- ◆ Press C before selecting further display groups.
- If the readouts in all the display zones match the specifications, press the => key.

-> Indicated on display:

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

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

-> Indicated on display:

```
Rapid data transfer      Q
06 - End output
```

- Confirm entry by pressing Q.

-> Indicated on display:

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

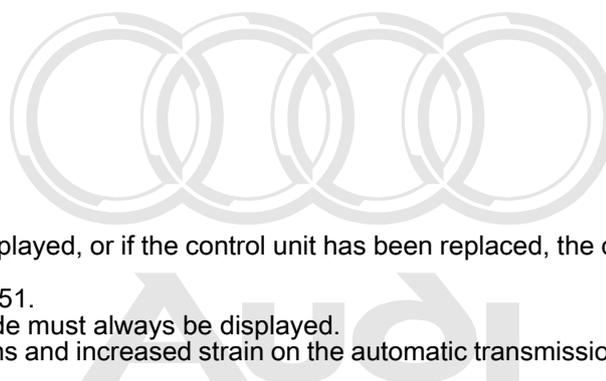
5 - Coding control unit

5.1 - Coding control unit

Notes:

- ◆ If the correct coding for the vehicle is not displayed, or if the control unit has been replaced, the control unit must be coded.
- ◆ Coding is checked via fault reader V.A.G 1551.
- ◆ 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 transmission resulting from harsh gearshift jolts.
- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 2).
When doing this the ignition must be switched on.

-> Indicated on display:





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

- Press keys 0 and 7 for the function "Code 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 according to the following example:

MVEG III (emission standard)	05
Four-wheel drive with ASR/ESP and CAN data bus	7
Automatic gearbox	5
Audi A8	3
Code number	05 7 5 3

-> The display on fault reader V.A.G 1551 will show the control unit identification, as in this example

```
3B0907551.. 2.8l      V6/5V      G
D..□
Coding 05753      WSC 06388
```

- Press =>key.

-> Indicated on display:

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

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

Note:

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

Coding variants for engine control unit

Country/emissions	Drive / extra functions	Gearbox	Vehicle model
00 = ---	0 = Front-wheel drive without traction control system	0 = 5-speed manual gearbox	0 = ---
01 = ---	1 = <small>Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability</small>	1 = ---	1 = ---
02 = ---	2 = <small>with</small> Four-wheel drive without traction control system	2 = <small>document. Copyright by AUDI AG.</small>	2 = ---
03 = ---	3 = ---	3 = ---	3 = Audi A8
04 = MVEG II (EU 2)	4 = ---	4 = ---	4 = ---
05 = MVEG III (EU 3D)	5 = Front-wheel drive with traction control system	5 = Automatic gearbox 01V	5 = ---
06 = ---	6 = ---	6 = ---	6 = ---
07 = ---	7 = Four-wheel drive with electronic stability program (ESP)	7 = ---	7 = ---
08 = ---	8 = ---	8 = Continuously-variable transmission (CVT) VL30	8 = ---
09 = ---	9 = ---	9 = ---	9 = ---

Country/emissions	Drive / extra functions	Gearbox	Vehicle model
10 = EU 3	10= ---	10= ---	10= ---
11 = EU 4	11= ---	11= ---	11= ---

6 - Reading measured value block

6.1 - Reading measured value block

Test conditions

- Coolant temperature at least 80 °C
 - Electrical consumers switched off (radiator fan must not run during the check)
 - Air conditioner switched off
 - Steering in straight-ahead position
- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 2 .)
 When doing this the engine must be idling.

-> 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
```

- Enter relevant Display Group number (3 figures) and confirm entry by pressing Q.

Note:

The choice of display group number depends on which functions and components are to be tested.

-> Indicated on display:

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

Note:

To change to another display group proceed as follows:

Display group	V.A.G 1551	VAS 5051
Higher	Press key 3	Press skey
Lower	Press key 1	Press tkey

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24 - Mixture preparation, Injection

1 - Servicing Motronic injection system

1.1 - Servicing Motronic injection system

1.2 - Safety precautions

Observe the following precautions if test and measuring instruments are required during a test drive:

Warning:

- ◆ Test equipment must always be secured on the rear seat and operated by a second person.
- ◆ If test equipment is operated from the front passenger's seat, the occupant could be injured by the passenger's airbag in 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 operate the engine at starting speed without actually starting it (for example, in order to test compression), unplug the connectors from the output stages for the ignition coils and also the connectors on the injectors.
- ◆ During some of the tests the control unit may identify and record faults. The fault memory should therefore be interrogated and (if necessary) erased after completing the tests and any repair work that may be required.
- ◆ Always switch off the ignition before cleaning the engine.
- ◆ Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.

Warning!

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 pulling off the hose or cap.

1.3 - Rules for cleanliness

When working on the fuel supply/injection system, pay careful attention to the following rules for cleanliness:

- ◆ Thoroughly clean all unions and the adjacent areas before disconnecting.
- ◆ Place parts that have been removed on a clean surface and cover them over. Do not use fluffy cloths.
- ◆ Carefully cover over or seal opened components if the repair cannot be carried out immediately.
- ◆ Only install clean components:
Only unpack replacement parts immediately prior to installation.
Do not use parts that have been stored loose (e.g. in tool boxes etc.).
- ◆ When the system is open:
Do not work with compressed air if this can be avoided.
Do not move vehicle unless absolutely necessary.
- ◆ Unplugged electrical connectors:
Keep clean and dry.

Connect only when dry.

1.4 - Technical data

Engine code letters	AQD (2.8 ltr./5V/142 kW engine with secondary air system) APR (2.8 ltr./5V/142 kW engine without secondary air system)	
Idling speed Not adjustable - controlled by idling speed stabilisation	650...750 rpm	
Engine rpm limited by closing throttle valve by shutting off injectors	6600 rpm 6800 rpm	
Fuel pressure at idling speed	Vacuum hose connected	approx. 3.2...3.8 bar
	Vacuum hose disconnected	approx. 3.8...4.2 bar
Holding pressure after 10 minutes	Engine cold - approx. 2.2 bar Engine warm - approx. 3.0 bar	
Injectors	Spray pattern	Two-hole injector
	Injection quantity (30 sec.)	90....125 ml
	Resistance (room temperature) ¹⁾	13.5....15.5 ω

1) When the engine is at operating temperature the resistance is increased by approx. 4...6 ω .

1.5 - Fitting locations overview

Components A to F are not shown in the exploded drawing.

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

- ◆ In footwell on pedal bracket near brake pedal

B - Diagnostic connector

- ◆ In front ashtray

C - Fuel pump relay (J17)

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

D - Clutch pedal switch (F36)

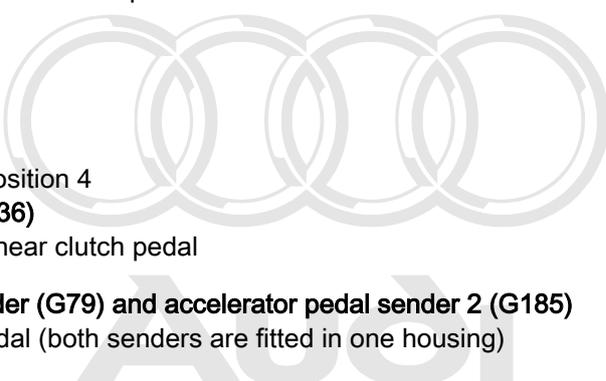
- ◆ In footwell on pedal bracket near clutch pedal

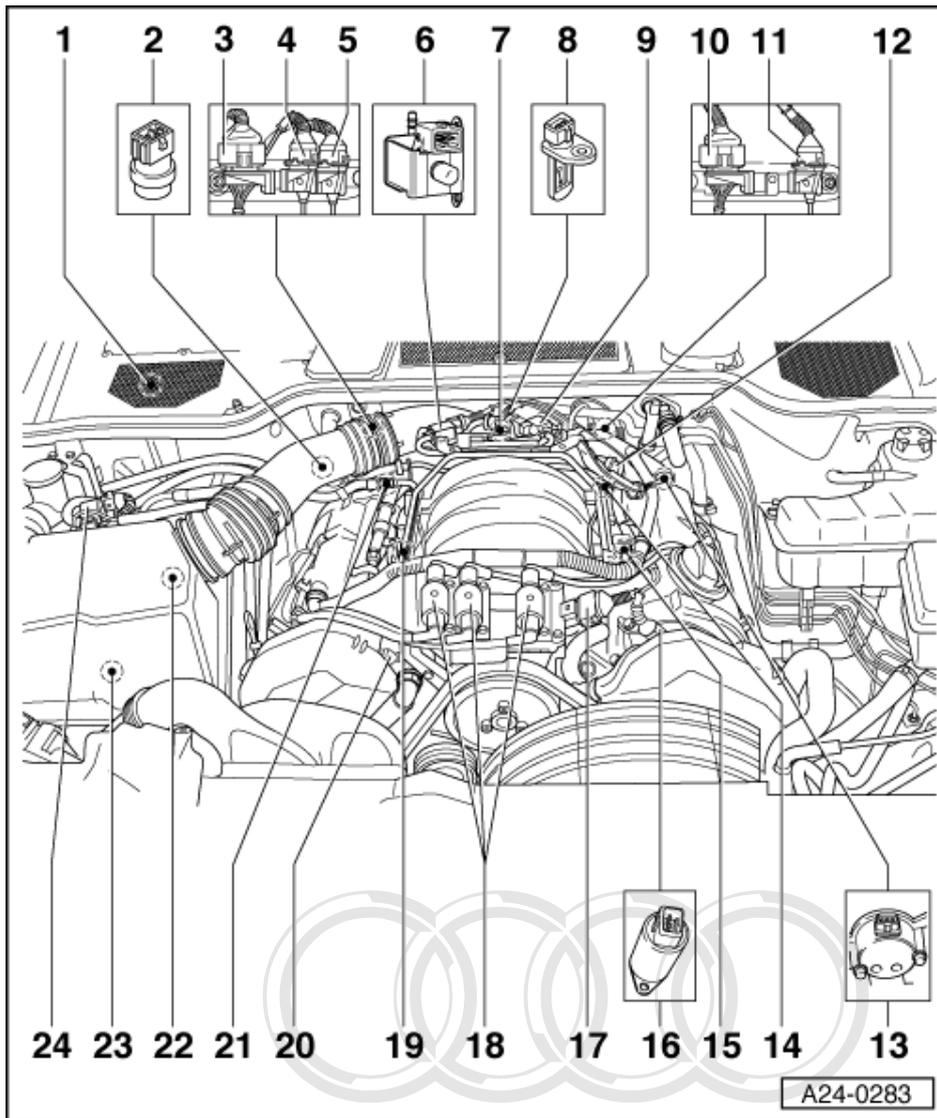
E - Accelerator pedal sender (G79) and accelerator pedal sender 2 (G185)

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

F - EPC warning lamp

- ◆ In dash panel insert
(Notes on warning lamp =>Page 80)


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1 Electronics box in plenum chamber

- ◆ Engine control unit -J220
- ◆ Secondary air pump relay -J299
(only on vehicles with secondary air system)

2 Coolant temperature sender -G62

- ◆ On coolant pipe behind cylinder head Bank 1

3 4 pin connector

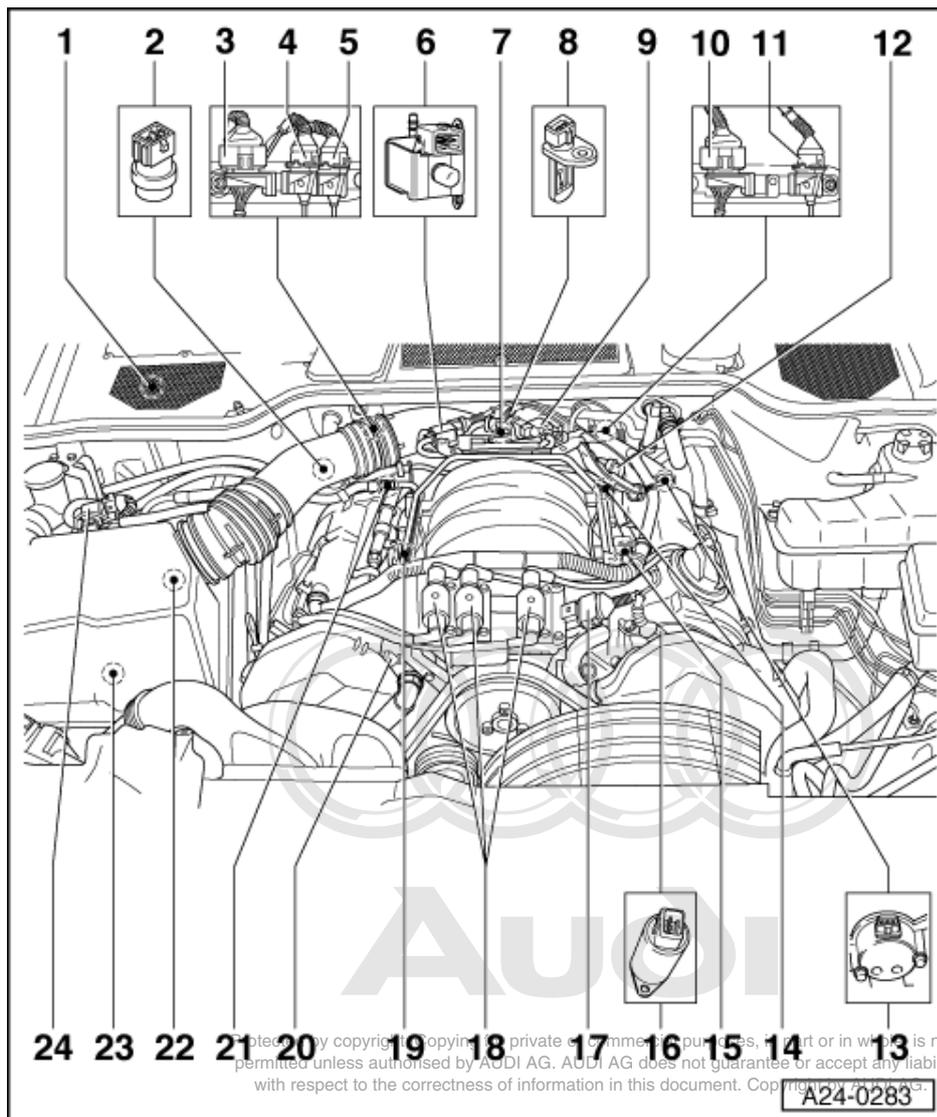
- ◆ For lambda probe 1 -G39 and lambda probe heating -Z19

4 3 pin connector

- ◆ For knock sensor 1 -G61

5 3 pin connector

- ◆ For engine speed sender -G28



6 Secondary air inlet valve
-N112

- ◆ Only on vehicles with secondary air system

7 Throttle valve control part -J338

8 Intake air temperature sender -G42

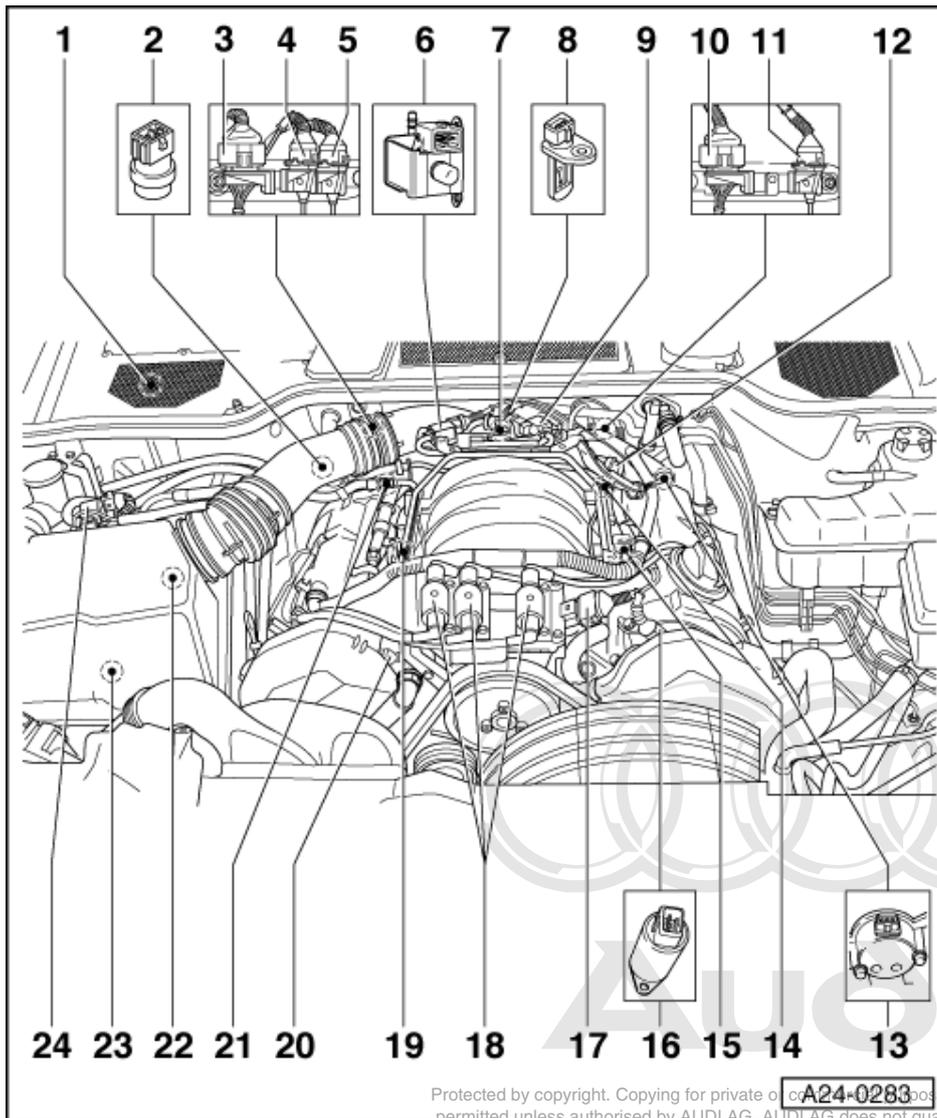
9 Intake manifold change-over valve -N156

10 4 pin connector

- ◆ For lambda probe 2 -G108 and lambda probe heating -Z28

11 3 pin connector

- ◆ For knock sensor 2 -G66



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12 Fuel pressure regulator

13 Hall sender -G40

- ◆ Cylinder bank 2

14 Engine speed sender -G28

- ◆ In gearbox housing above starter ring gear

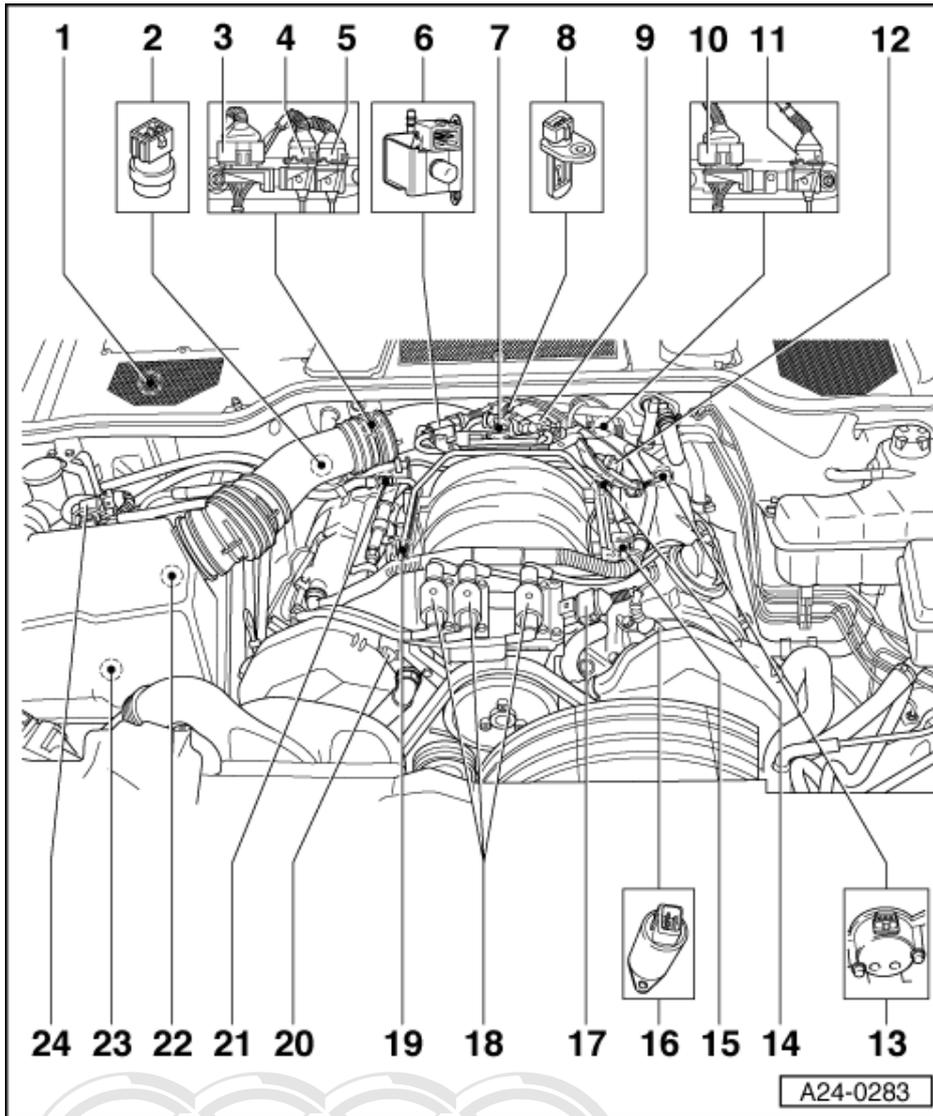
15 Knock sensor 2 -G66

16 Camshaft adjustment valve 2 -N208

17 5-pin connector for ignition output stage

18 Ignition coils -N, -N128 and -N158

- ◆ With output stage -N122

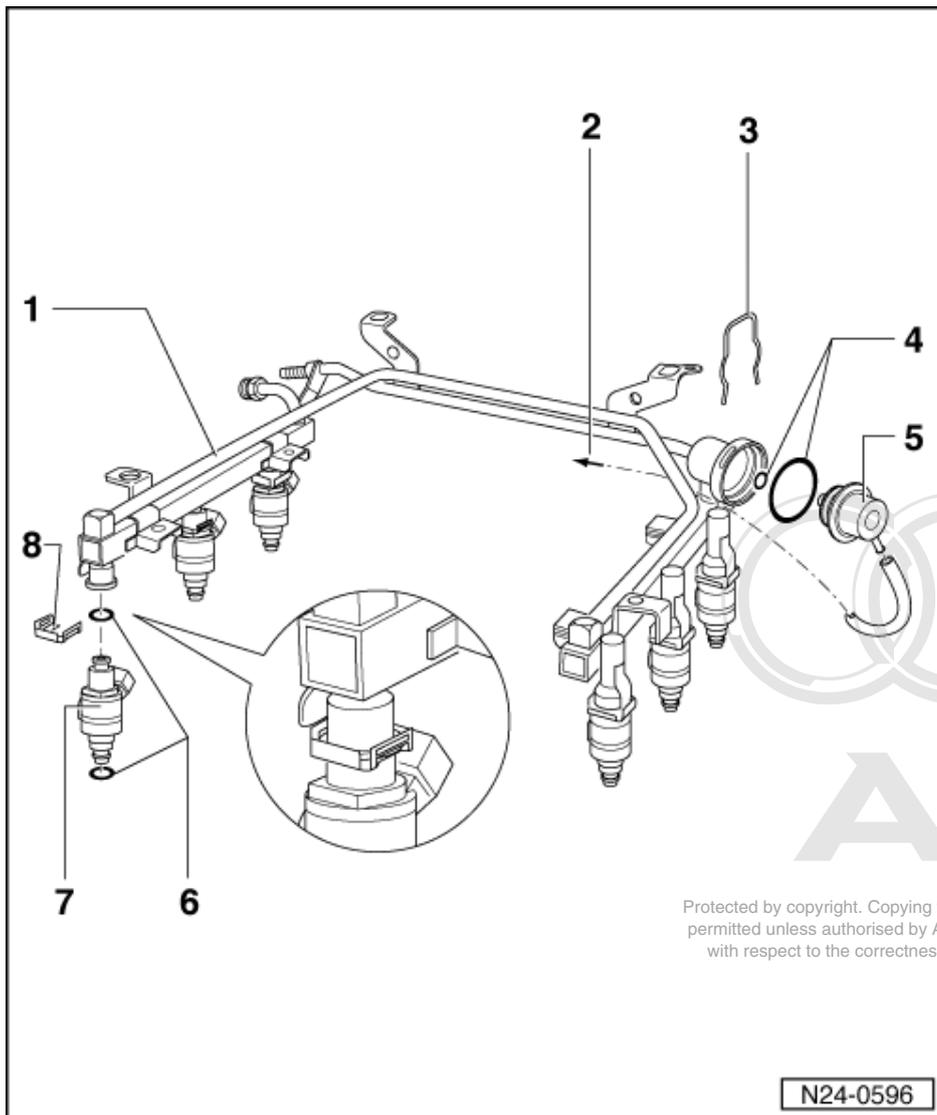


- 19 Knock sensor 1 -G61
- 20 Hall sender -G163
 - ◆ Cylinder bank 1
- 21 Camshaft adjustment valve 1 -N205
- 22 Air mass meter -G70
- 23 Secondary air pump motor -V101
- 24 Activated charcoal filter solenoid valve 1 -N80

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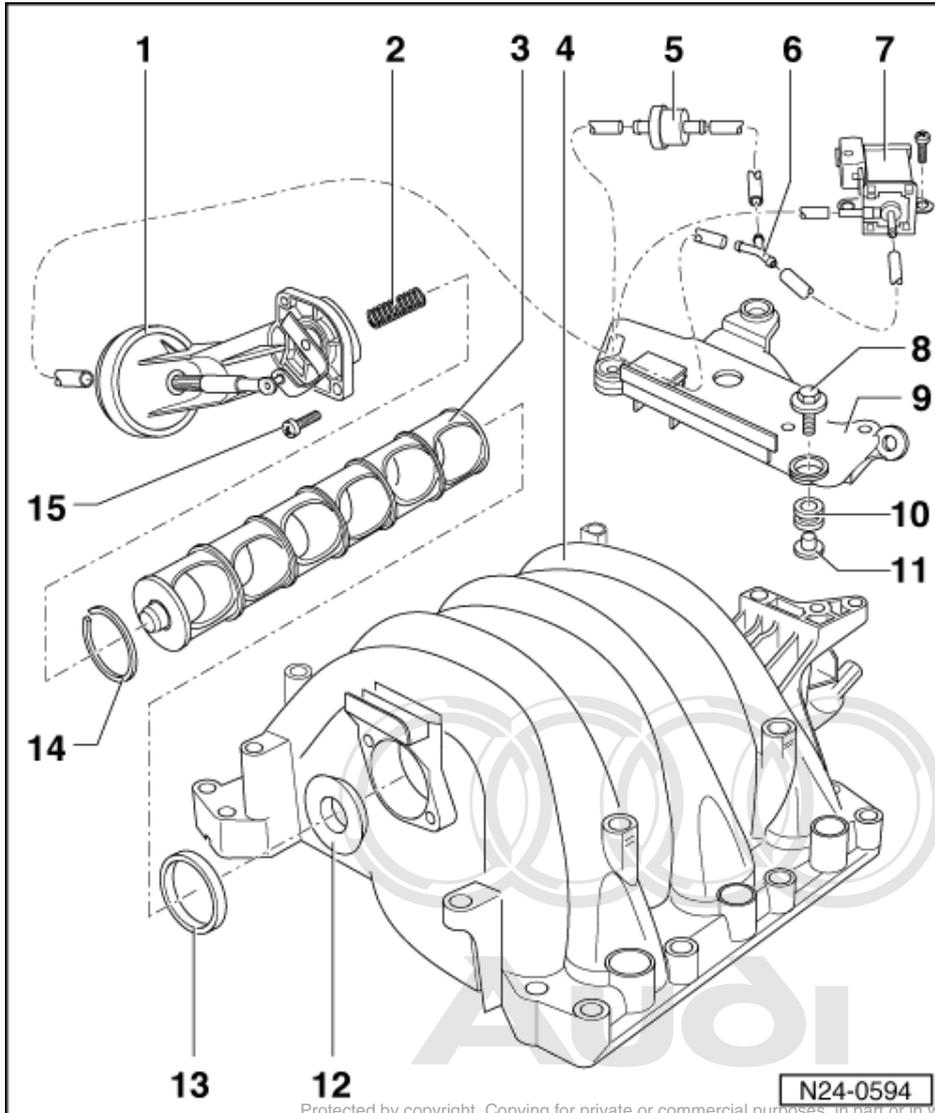
1.6 - Dismantling and assembling fuel rail with injectors



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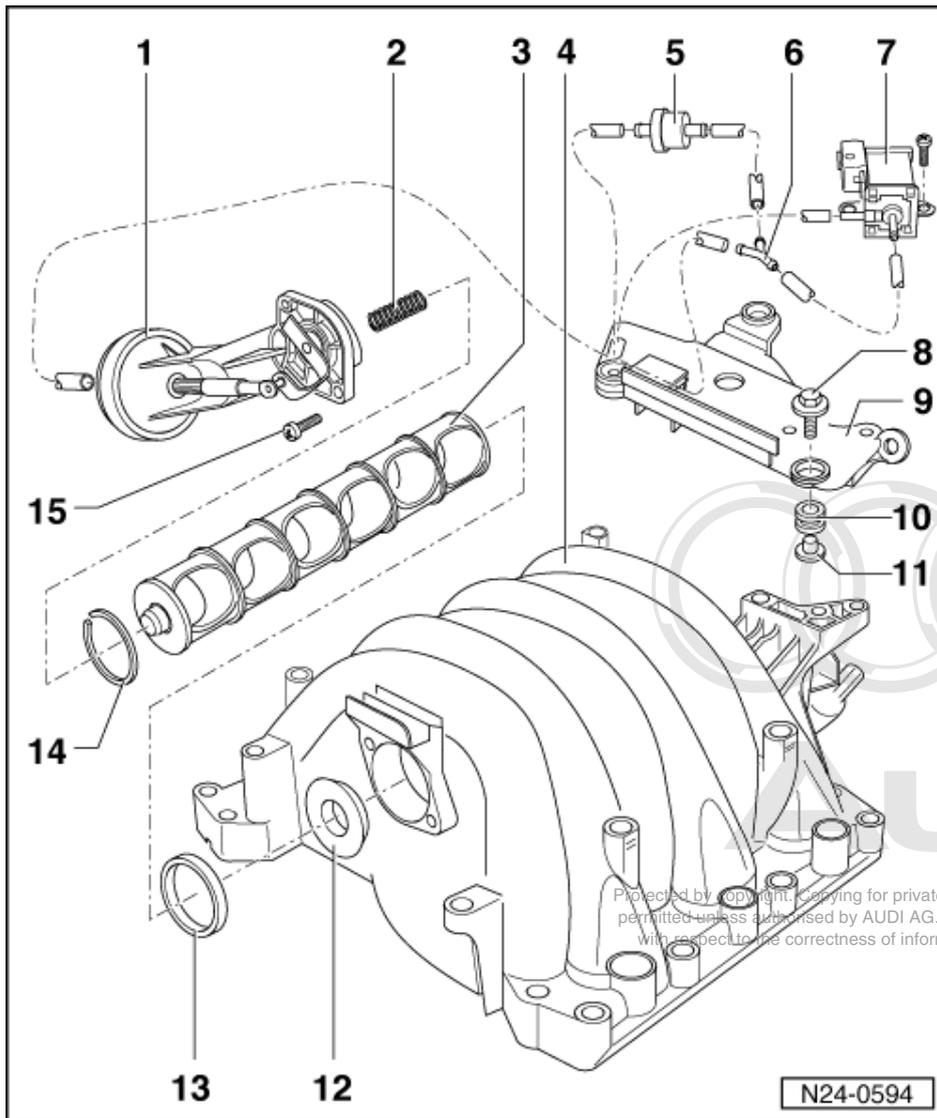
- 1 Fuel rail
- 2 To T piece
- 3 Retaining clip
- 4 O ring
 - ◆ Renew
- 5 Fuel pressure regulator
- 6 O ring
 - ◆ Renew
- 7 Injector -N30...-N33, -N83, -N84
- 8 Retaining clip
 - ◆ Ensure clip is seated correctly on injector and fuel rail

1.7 - Removing and installing parts of intake manifold change-over



- 1 Vacuum unit
 2 Spring
 3 Change-over barrel
 4 Intake manifold
 5 Non-return valve
 ♦ Installation position: Blue end to Y piece
 6 Y piece
 7 Intake manifold change-over valve -N156

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- 8 10 Nm
- 9 Securing plate
- 10 Rubber grommet
- 11 Spacer sleeve
- 12 Washer
 - ◆ Conical side to intake manifold
- 13 Seal
 - ◆ Renew if damaged
- 14 Seal
 - ◆ For change-over barrel
- 15 6 Nm

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

Notes:

- ◆ Test box V.A.G 1598/31 is designed so that it can be connected to the wiring harness for the engine control unit and to the engine control unit itself at the same time.
- ◆ This has the advantage of enabling the engine management system to remain fully operational even with the test box connected (for example, when testing signals while the engine is running).

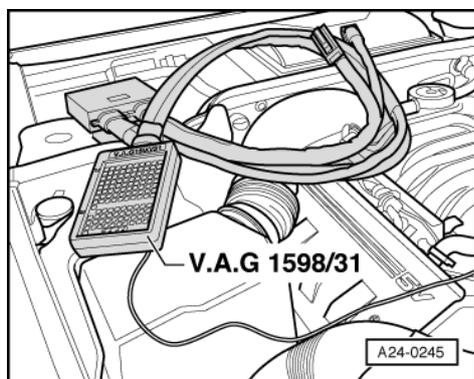
- ◆ The instructions for performing the individual tests indicate whether or not the engine control unit itself also needs to be connected to the test box.
- ◆ Use the hand multimeter V.A.G 1526 or the multimeter V.A.G 1715 and the diode test lamp V.A.G 1527 for the checks.
- ◆ To connect the testers to test box 1598/31, always use the adapter leads from adapter set V.A.G 1594.

Warning!

To prevent damage to the electronic components, switch to the respective measuring range before connecting the measuring cable and observe the test prerequisites.

Connecting test box V.A.G 1598/31

- Switch off ignition.
- 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.



- -> Connect test box V.A.G 1598/31 to wiring harness connector. Also connect the earth clamp on the test box to earth. The instructions for performing the individual tests indicate whether or not the engine control unit itself also needs to be connected to the test box.
- Carry out test as described in the relevant repair instructions.

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

- After re-connecting the engine control unit, perform adaption of engine control unit to throttle valve control part
=>Page 76 .

1.9 - Renewing engine control unit -J220

Note:

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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

- Switch off ignition.
- 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 the old engine control unit and install the new one.



Installing engine control unit

Installation is performed in the reverse sequence.

Note:

During the initial learning phase for the engine control unit the idling may be slightly rough and the engine may pull a little unevenly.

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

- Perform adaption of immobilizer to engine control unit

=> Electrical system; Repair group 01; Self-diagnosis of immobilizer; Adaptation procedure when engine control unit is replaced Self-diagnosis of immobilizer Adaptation procedure when engine control unit is replaced

- Code the new engine control unit
=> Page 19 .
- Perform adaption of throttle valve control part (J338)
=> Page 76 .
- On vehicles with cruise control (recognisable from the steering column switch), activate the cruise control function in the engine control unit => Page 32 .
- Interrogate fault memory and erase if necessary
=> Page 4 .

Activating cruise control system

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 2 .)
When doing this the ignition must be switched on.

-> Indicated on display:

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

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

-> Indicated on display:

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

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

Deactivating cruise control system

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 2 .)
When doing this the ignition must be switched on.

-> Indicated on display:

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

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

-> Indicated on display:

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

- Enter code number 16167 and confirm entry with Q key.

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1.10 - Testing idling speed

Test conditions

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

Testing idling speed

Notes:

- ◆ The idling speed cannot be adjusted.
 - ◆ The idling speed is tested during the basic setting of the engine.
 - ◆ During the basic setting of the engine the air conditioner compressor is automatically switched off and the solenoid valve for the activated charcoal filter (ACF valve) is closed.
- Interrogate fault memory. The fault memory must be clear. If necessary, rectify any faults and erase the fault memory. Switch off the engine, then start up again. Take the vehicle for a test drive and interrogate the fault memory again to make sure it is clear.
- Run the engine at idling speed.

Warning!
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 "Introduction of basic setting" and confirm entry with the Q key.

-> Indicated on display:

Basic setting
Enter display group number XXX

- Press keys 0, 5 and 6 for Display Group 56 and confirm entry with the Q key.

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

System in basic setting 56
1 2 3 4

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

	Display zones			
	1	2	3	4
Display Group 56: Idling speed stabilisation with engine idling at normal operating temperature				
Display	xxx rpm	xxx rpm	x.x %	0 0 0 0
Indicates	Engine speed (actual)	Engine speed (specified)	Idling speed control - torque change	Operating status
Range	min.: 550 rpm max.: 6600 rpm	min.: 550 rpm max.: 6600 rpm		
Specification	same as display zone 1 ±20 rpm	650 ± 750 rpm	x.x %	0 0 0 0



Display zones				
Note	If readout does not match specification =>Page 34			Relevance of figures => Page 34

Note:

- ♦ The value shown in display zone 1 is the actual engine speed.
 - ♦ The value shown in display zone 2 (specified engine speed) is a theoretical value calculated by the engine control unit.
 - ♦ When the engine is idling the engine control unit tries constantly to adjust the actual engine speed so that it matches the specified value.
 - ♦ This means that the actual engine speed when idling should always be approximately the same as the specified engine speed.
 - ♦ Display zones 3 and 4 provide additional information which is not relevant when checking the idling speed.
- Press =>key.
 - Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
 - If the readout does not match the specification, interrogate fault memory again.

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

- Test for unmetered air in the intake system =>Page 48 .
- Test throttle valve control part
=>Page 76 .
- Solenoid valve for activated charcoal filter constantly open
Test =>Page 72 .
- Perform adaption of throttle valve control part =>Page 76 .

Relevance of figures in 5-digit readout in 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 (not possible in function 04)
				0	Gear selector lever in P or N 0 = Gear selector lever in P or N 1 = Gear selector lever in 2/3/4/R/D
			0		Air conditioner requirement 0 = minimum warm or cool air delivery 1 = maximum warm or cool air delivery (not possible in function 04)
	0				Not used
0					Not used

1.11 - Checking fuel pressure regulator and holding pressure**Test conditions**

- Fuel pump relay OK. Testing=>Page 42 .
- Fuel pump OK
- Fuel filter OK
- Battery voltage at least 11 V

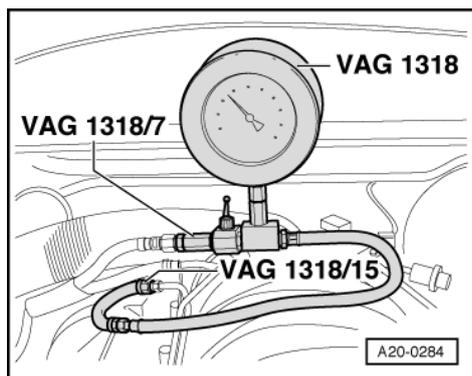
Note:

The fuel pressure regulator regulates the fuel pressure according to the intake manifold pressure. This ensures that the drop in pressure at the injectors remains the same throughout all engine speed and engine load ranges.

Warning!

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 pulling off the hose or cap.

Testing system pressure



- -> Connect pressure gauge V.A.G 1318 to supply pipe using adapters 1318/7, 1318/8 (pressure hose) and 1318/15.
- Disconnect vacuum hose between fuel pressure regulator and intake manifold at fuel pressure regulator end; seal off end of hose.

Note:

If fuel flows out at the vacuum connection on the fuel pressure regulator during the following pressure test, fit a new fuel pressure regulator.

- Start the engine and run at idling speed.
- Measure fuel pressure.

Specification: approx. 3.8...4.2 bar

- If fuel pressure does not match specification, fit a new fuel pressure regulator for test purposes and repeat pressure test.
- If fuel pressure still does not match specification, check fuel pump and supply pipe for damage (e.g. pinching) and renew if necessary.
- If pressure is higher than specification, check return pipe for damage (e.g. pinching) and renew if necessary.

Note:

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During the following test, do not allow the engine to run for too long with the vacuum hose disconnected, otherwise the increased fuel pressure will enrich the air/fuel mixture and may cause the lambda control limits to be exceeded. This would be stored as a fault in the fault memory.

- Start the engine and run at idling speed.
- Switch off electrical consumers (air conditioner etc.).
- Re-connect vacuum hose to fuel pressure regulator and observe drop in pressure on pressure gauge.
- When the vacuum hose is re-connected the fuel pressure should drop by around 0.5 bar.

If the pressure does not change as specified, carry out the following tests:

- Check vacuum hose for cracks and other damage.
- Test vacuum hose for blockages at intake manifold.



To do this, disconnect hose at fuel pressure regulator and blow into it.

- If there are no leaks and no blockages in the vacuum hose, fit a new fuel pressure regulator.

Testing holding pressure

- Holding pressure 10 minutes after switching off engine (minimum pressure)

With engine cold: at least 2.2 bar

With engine at operating temperature: at least 3.0 bar

Note:

A rise in pressure (due to fuel expansion) when the engine is at operating temperature is normal.

- Start the engine and run at idling speed.
- Switch ignition off after the pressure has built-up. At the same time close pressure gauge cut-off tap (lever at 90° to throughflow direction).

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
- ◆ Return valve in fuel pump leaking

=> 6-cylinder Engine, Mechanics; Repair Group 20; Removing and installing fuel pump Removing and installing fuel pump

Note:

When the cut-off tap is closed the pressure gauge will indicate the pressure downstream of the cut-off tap, i.e. on the same side as the intake manifold, injectors and fuel pressure regulator. If there is then a drop in pressure upstream of the cut-off tap (same side as fuel tank), the change will not be registered by the pressure gauge. This is why the paragraph beginning "If the pressure does not drop..." has been included above.

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

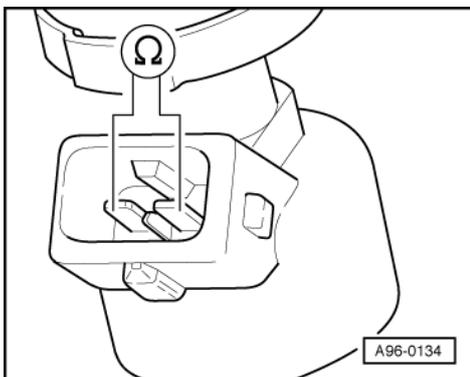
- ◆ Fuel pressure regulator defective
- ◆ Injectors leaking
- ◆ Unions on pressure gauge downstream of cut-off valve leaking

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

1.12 - Checking injectors



A - Electrical testing of injectors

- Remove plug connector from the injector which is to be tested.
- -> Connect hand-held multimeter to injector (resistance measurement range).

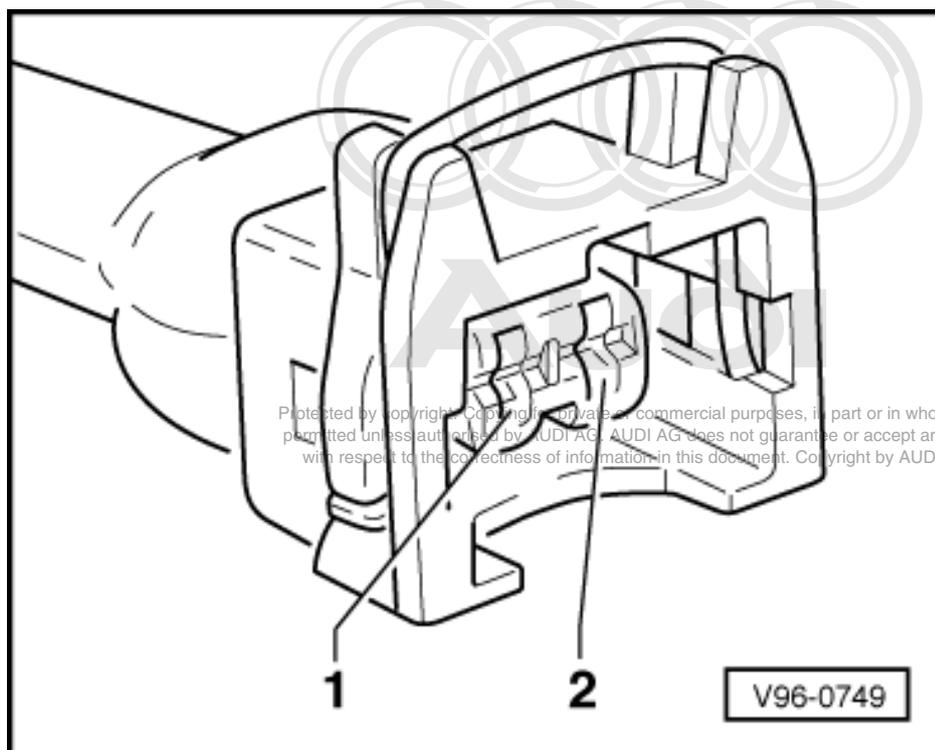
Specification: 13.5...15.5 ω

Note:

When the engine is at operating temperature the electrical resistance of the injectors will be about 4...6 ω higher.

If the specification is not obtained:

- Renew injector



If specification is met:

- Test voltage supply
=> Page 37 .

Testing voltage supply

- Remove plug 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).

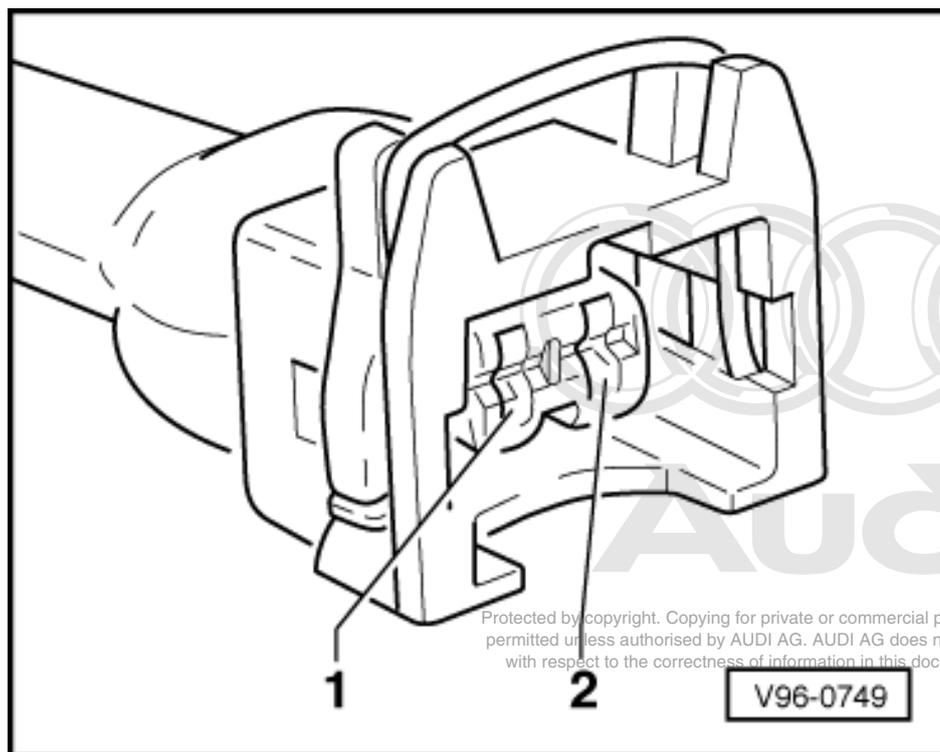
Specification: The diode test lamp should light up.

If the diode test lamp lights up:

- Check wiring connections => Page 38 .



If the diode test lamp does not light up:

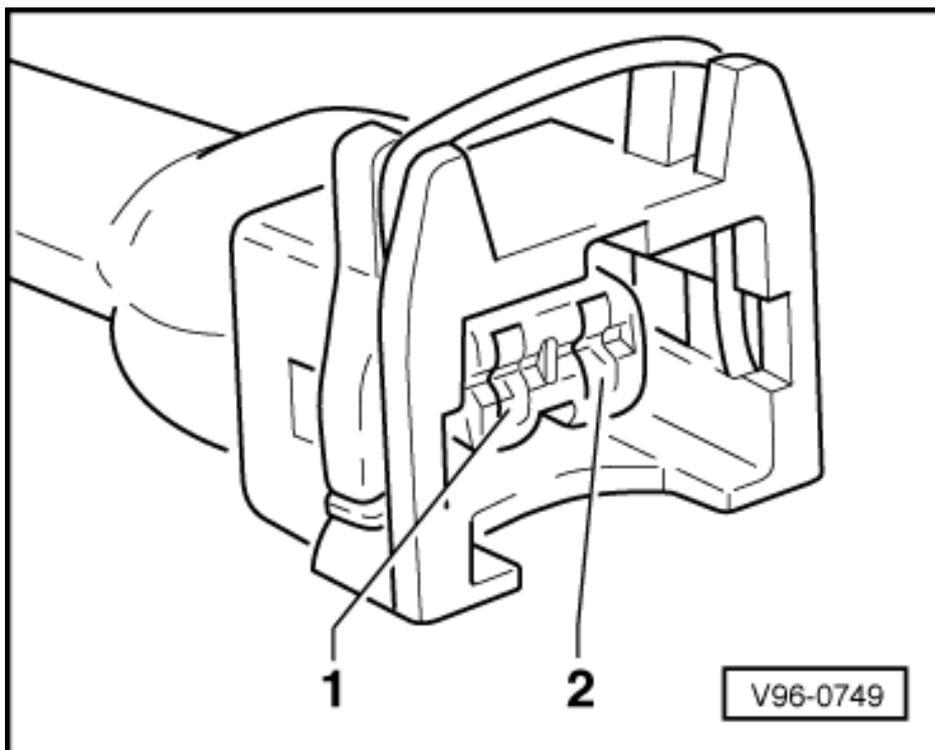


- -> Test for continuity in the wiring from socket 1 to fuel pump relay via fuse for injectors. If necessary, rectify open circuit.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

Checking wiring connections

- Switch off ignition.
 - Remove plug 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 to the engine control unit itself.
- => Page 30 .



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

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

- Rectify any open/short circuit as necessary.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

- If the wiring is OK, fit a new engine control unit
=> Page 31 .

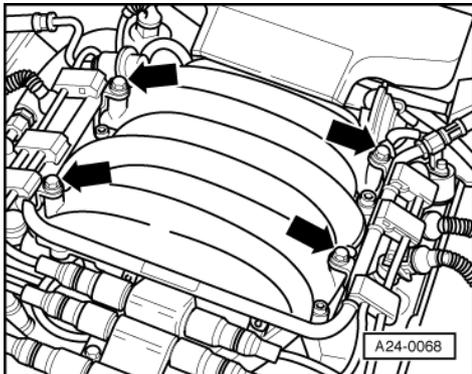

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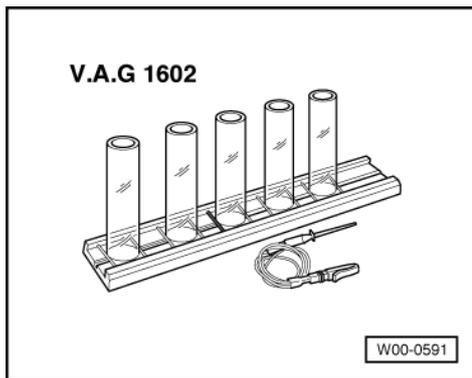


1.13 - Testing injection quantity, leak-tightness and spray pattern of injectors

Test conditions



- Fuel pressure OK; testing => Page 34 .
- Remove intake hose between air mass meter and intake silencer.
- Unplug connectors from injectors.
- -> Unbolt fuel rail from intake manifold.
- Disconnect vacuum hose from fuel pressure regulator.
- Lift fuel rail off intake manifold together with injectors and support fuel rail.



- -> Place the injector which is to be tested into 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 to the engine control unit itself.
=>Page 30 .
- Bridge contacts 1 and 65 on the test box using test leads from adapter set V.A.G 1594. (This creates an earth connection to one side of the fuel pump relay coil.)

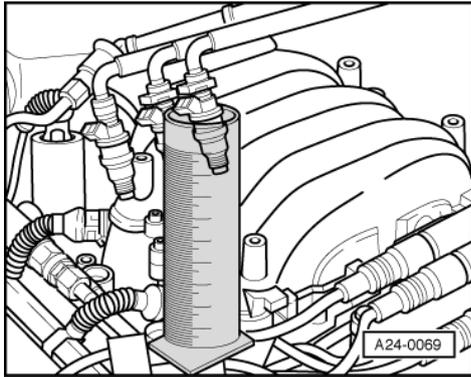
Testing for leaks

- Switch 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 when the ignition is switched on the fuel pump relay receives its positive voltage supply via the central electrics. The negative voltage supply for the fuel pump relay comes via the cable bridge on the test box.

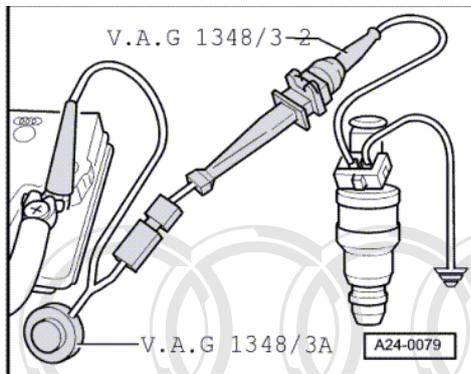
- Check injectors for leaks (visual check). When the fuel pump is running, only 1 or 2 drops should escape per minute from each injector.



- If the fuel loss is greater, switch off the fuel pump (i.e. switch off the ignition) and renew the faulty injector.
 - Renew seals.

Checking injection quantity

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



- -> Connect one of the injector contacts to engine earth using test cable and crocodile clamp from V.A.G 1594.
- Connect second injector contact to positive using remote control V.A.G 1348/3 A, adapter cable V.A.G 1348/3-2 and auxiliary cable.
- Switch ignition on.

The fuel pump should run.

- Activate remote control V.A.G 1348/3 A for 30 seconds.
- **When all three injectors from the first bank of cylinders have been activated, place the three measuring glasses on a level surface.**

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Specification for each injector: 90 ... 125 ml

- If the measured value for one or more of the injectors is outside the tolerance range, switch off the fuel pump (i.e. switch off the ignition) and renew the defective injector.
- Repeat test for injectors from second bank of cylinders.
- If the measured values for all the injectors are outside the tolerance range, check the fuel pressure => Page 34 .

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, make sure not to remove the plastic cap from the injector head. The O-ring must be pulled off over the plastic cap.)
- Moisten the O-rings with clean engine oil.



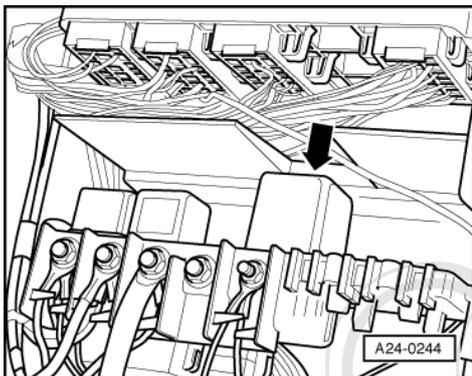
- Make sure injectors are correctly positioned, insert vertically into fuel rail and secure with retainer clips.
- Position fuel rail together with injectors (properly secured) against intake manifold and press into place evenly all round.

1.14 - Testing fuel pump relay -J17 and relay activation

The fuel pump and some of the injection system components are powered via the fuel pump relay -J17.

The fuel pump relay -J17 will only close if the engine is turning over. In other words, the relay is only earthed (via the engine control unit) when the engine control unit is receiving engine speed impulses.

Test conditions



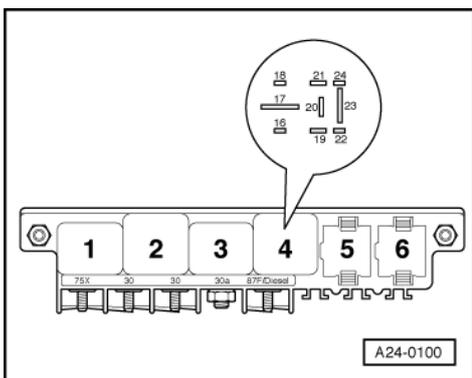
- Battery voltage OK.

Functional test of fuel pump relay

Note:

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

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 2)
- When doing this the ignition must be switched on.



- Start final control diagnosis => Page 15 . The fuel pump must be running.

-> The fuel pump relay should pick up and the fuel pump should run.

If the relay does not pick up:

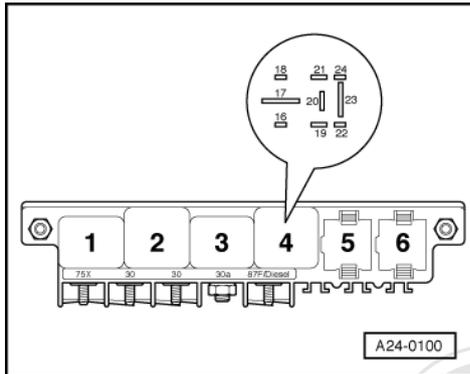
- Test activation of fuel pump relay=>Page 43 .

If fuel pump does not run:

- Test activation of fuel pump and other components =>Page 44 .

Testing activation of fuel pump relay

- Switch off ignition.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
=> Page 30 .
- Connect sockets 65 and 2 of test box to each other using auxiliary cable from V.A.G 1594.



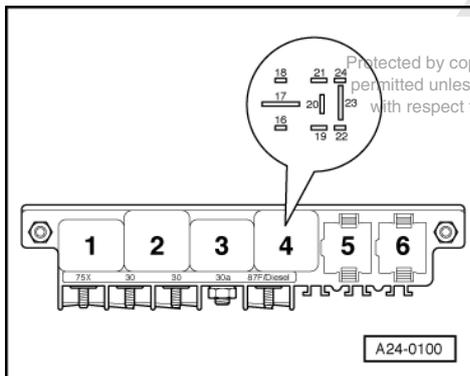
Specification: the fuel pump relay (relay position 4) should pick up.

If the relay picks up now but not during the final control diagnosis:

- Replace engine control unit =>Page 31 .

If the relay does not pick up:

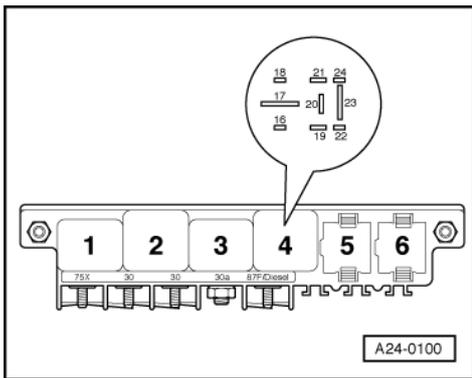
- -> Disconnect fuel pump relay from relay panel (relay position 4).



- -> Connect hand-held multimeter (voltage measurement range) between earth and contact 19 on relay panel.

Specification: approx. battery voltage

If the specification is not obtained:



- Check the wiring.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

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If the specification is obtained:

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

Micro central electrics in passenger's footwell (right), relay position 4 Contact	Test box V.A.G 1598/31 Socket
16	65

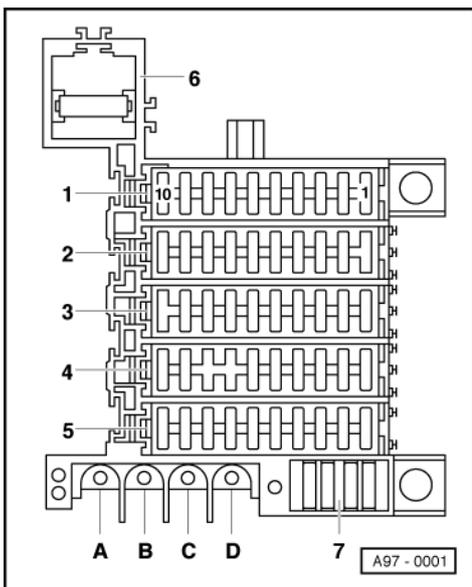
- Rectify any open/short circuit as necessary.

If no fault in wire is detected:

- Fit a new fuel pump relay -J17.

Testing activation for fuel pump and other 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).
- Start final control diagnosis => Page 15 .

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

Fuse No.	Specification for left or right contact
1	approx. battery voltage
2	approx. battery voltage
3	approx. battery voltage

If the specifications are not obtained:

- Check wiring

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

If no fault in wire is detected:

- Fit a new fuel pump relay -J17.

1.15 - Testing air mass meter -G70

Test conditions

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

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 2 .)
When doing this the engine must be idling.

-> Indicated on display:

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

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

Note:

During the basic setting the engine control unit closes the activated charcoal filter solenoid valve (ACF valve - N80) and switches off the air conditioner compressor.

-> Indicated on display:

```
Introduction of basic setting      HELP
Enter display group number XXX
```

- Press keys 0, 0 and 2 for Display Group 02 and confirm entry with the Q key.

-> Indicated on display:

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

- Check display values for engine load.



	Display zones			
	1	2	3	4
Display Group 2: Intake air mass at idling speed with engine at normal operating temperature				
Display	xxx rpm	xx.x %	x.x ms	xxx.x g/s
Indicates	Engine speed (in steps of 40 rpm)	Load	Meaninjection period	Air mass
Range	min.: 550 rpm max.: 6800 rpm	min.: 0 % max.: 100 %	min.: 1.0 ms max.: 20.0 ms	min.: 3.0 g/s max.: approx. 150 g/s
Specification	650...750 rpm	12.0...26.0 %	1.0...4.0 ms	3.0...5.0 g/s
Note	---	---	If readout does not match specification, see table for display zone 3 => Page 46	If readout does not match specification, see table for display zone 4 => Page 46

If the specification is obtained:

- Press =>key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- Switch off the ignition.

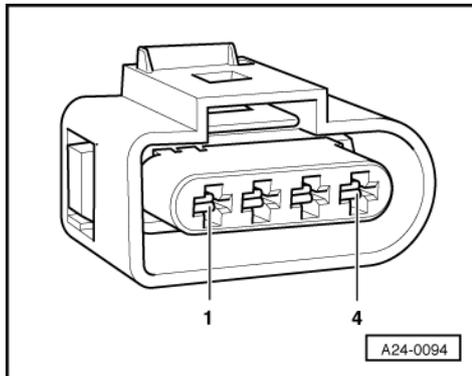
Reading Display Group 2

Display zone 3	Possible cause of fault	Fault remedy
Less than 1.0 ms	- Lower values can only occur when vehicle is on overrun	
More than 4.0 ms	- Load on engine due to ancillaries	- Eliminate load (air conditioner, power steering, alternator)
	- Rough idling (engine not running on all cylinders)	- Test spark plugs Test injectors => Page 36
	- Throttle valve control part -J338 defective	- Test throttle valve control part => Page 76

Reading Display Group 2

Display zone 4	Possible cause of fault	Fault remedy
Less than 3.0 g/s	- Large quantity of unmetered air between intake manifold and air mass meter - Voltage supply to air mass meter or wiring to engine control unit	- Check intake system for leaks (unmetered air) => Page 46
More than 5.0 g/s	- Load on engine due to ancillaries	- Eliminate load (air conditioner, power steering, alternator)
	- Voltage supply to air mass meter or wiring to engine control unit	- Test voltage supply and wiring => Page 46

Testing power supply to air mass meter



- -> Unplug connector from air mass meter.
- Connect hand-held multimeter (voltage test range) between engine earth and contact 3 of connector.
- Operate the starter briefly.

Specification: approx. battery voltage

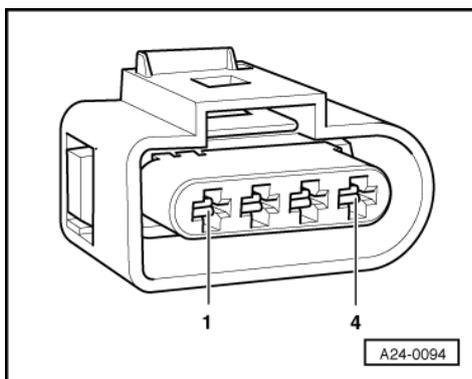
Note:

The air mass meter receives its voltage supply via the fuel pump relay.

If the reading does not match the battery voltage:

- Test for open circuit or short to earth in wiring between fuel pump relay and contact 3 on connector via fuse.
- Repair if necessary.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder



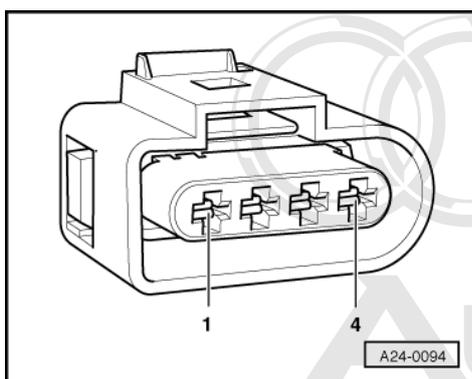
- -> Connect hand-held multimeter (voltage test range) between sockets 2 and 3 of connector.
- Operate the starter briefly.

Specification: approx. battery voltage

Note:

Contact 2 on the connector is for the earth connection from the engine control unit.

If the specification is not attained:



- -> Connect hand-held multimeter (voltage test range) between sockets 1 and 2 of connector.
- Switch ignition on.

Specification: approx. 5 V

If the specification is not attained, test wiring => Page 48 .

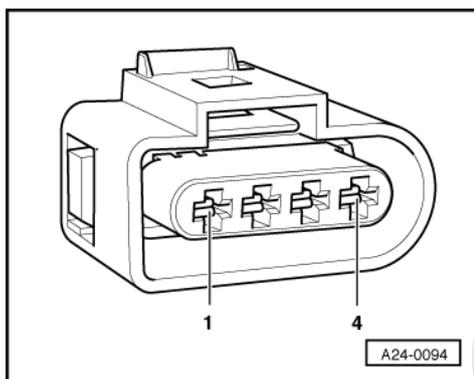


Testing wiring for air mass meter

Note:

The wiring test also tests the signal wire.

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
=> Page 30 .



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

Connector for air mass meter -G70	Test box V.A.G 1598/31 Contact
1	53
2	27
4	29

Resistance in wiring: max. 1.5 ω Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- Test all wires for short circuits with each other.

Specification: infinity ω (open circuit)

- If the wiring and the power supply are OK, fit a new air mass meter -G70.

1.16 - Checking intake air system for leaks (unmetered air)

Checking with engine leak detector spray G 001 800 A1

Notes:

- ♦ The vacuum in the intake system will cause the leak detector spray to be drawn in with the outside air. The leak detector spray reduces the ignitability of the mixture. This leads to a drop in engine speed and to a significant increase of the CO content.
- ♦ Observe the safety precautions listed on the container.
- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 2 .)
When doing this the engine must be idling.

-> Indicated on display:

Rapid data transmission	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 1 for "Display Group 01" and confirm entry by pressing Q.

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

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

- Note engine speed in display zone 1.
- Systematically spray parts of the intake system with engine leak detector spray.

If the engine speed does not change:

- Press the =>key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.

If the engine speed drops:

- Press the =>key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- Check sprayed areas of intake system for leaks and rectify if necessary.

1.17 - Testing intake air temperature sender -G42

Fitting location of sender and connector

=> Page 23 .

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 2 .)
- When doing this 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
Input display group number XXX
```

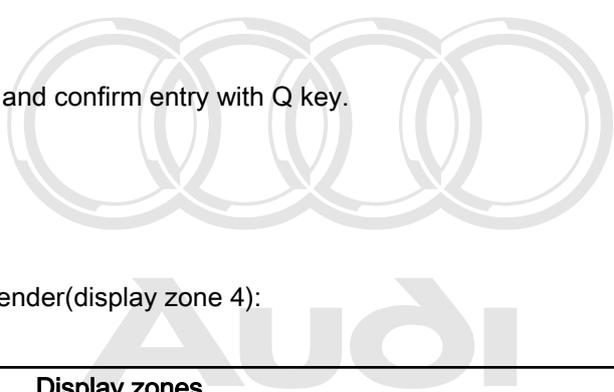
- Press keys 0, 0 and 4 to select Display Group 4 and confirm entry with Q key.

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

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

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

	Display zones			
	1	2	3	4
Display Group 4: Intake air temperature with engine idling				



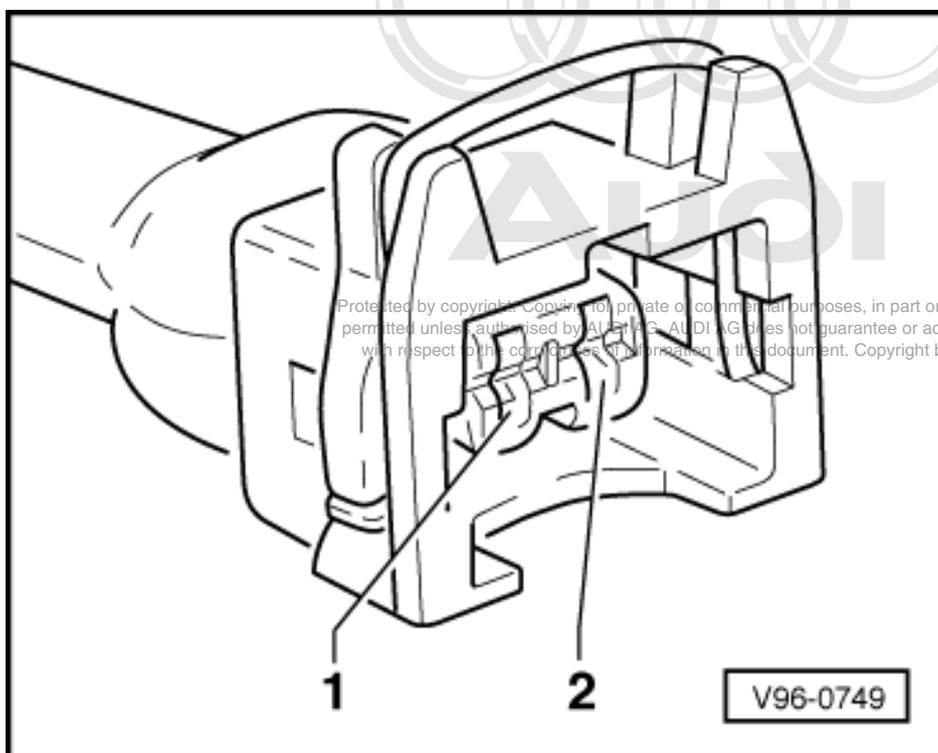


	Display zones			
Display	xxxx rpm	xx.xxx V	xxx.x °C	xxx.x °C
Indicates	Engine speed	Battery voltage	Coolant temperature	Intake air temperature
Range	min.: 550 rpm max.: 6800 rpm	min.: 0.000 V max.: 15.000 V	min.: -48.0 °C max.: 143.0 °C	min.: -48.0 °C max.: 143.0 °C
Specification	xxxx rpm	12.000...15.000 V	80.0...105.0 °C	Between ambient temperature and 120 °C
Note				If the display shows a temperature that differs excessively from surrounding temperature, test wiring => Page 50

Testing wiring

- Switch off ignition.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
=> Page 30 .

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



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2-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
1	85
2	108

Resistance in wiring: max. 1.5 ω

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

- -> Test for short circuit between wires:

2-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
1	108

Specification: infinity ω(no connection)

- Rectify any open/short circuit as necessary.

If no fault in wire is detected:

- Fit a new intake air temperature sender (G42).

1.18 - Testing coolant temperature sender-G62

Notes:

- ◆ Fitting location of coolant temperature sender
=> Page 23 .
- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 2 .)
When doing this the engine must be idling.

-> 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
```

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- Press keys 0, 0 and 4 to select Display Group 4 and confirm entry with Q key.

-> Indicated on display

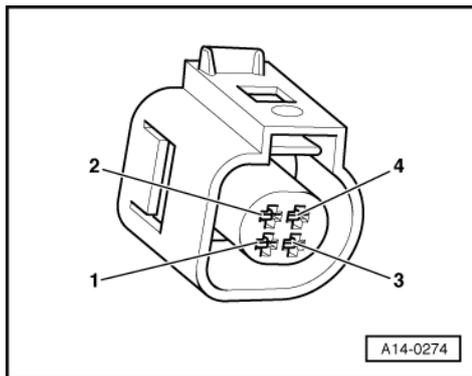
```
Read measured value block 4
1      2      3      4
```

- Check readout 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 V	xxx.x °C	xxx.x °C
Indicates	Engine speed (in steps of 40 rpm)	Battery voltage	Coolant temperature	Intake air temperature
Range	min.: 550 rpm max.: 6800 rpm	min.: 0.000 V max.: 15.000 V		
Specification	xxx rpm	12.000...14.500 Volt	80.0...105.0 ° C	Ambient temperature
Note			-The temperature readout should increase steadily -If specification is not obtained, test sender or sender wiring => Page 51	

Testing wiring

- Switch off ignition.



- -> Unplug connector from sender.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
=> Page 30 .
- -> Test for open circuit and short to positive or earth in the following wiring connections:

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

Resistance in wiring: max. 1.5 ω

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

- Fit a new coolant temperature sender -G62.

2 - Testing lambda control

2.1 - Testing lambda control

2.2 - Operation 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 too rich" (low residual oxygen) is between about 0.5 and 1.0 V (relative to reference earth).

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

The transition from "rich" to "lean" is accompanied by a voltage jump from between 0.5 and 1.0 V to between 0 and 0.5 V (relative to reference earth), and vice versa ($\lambda = 1.0$).

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

If the voltage does not change or only changes slowly the following faults are possible:

- ◆ Slots or holes in probe head are blocked.
- ◆ Lambda probe has been subjected to excessive thermal stress.
- ◆ Contact resistance in signal wire or earth wire.
- ◆ Lambda probe too cold; lambda probe heating not working.
- ◆ Lambda probe damaged by contact spray or similar product. (The contact spray is drawn through the fine cavities in the electrical wiring as a result of thermal fluctuations and capillary effect.)
- ◆ 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 - Testing lambda probe and lambda control

Notes:

- ◆ For the purposes of fault-finding it is possible to switch off the lambda control by selecting Display Group 99 in "Basic setting" mode and to switch it on again by selecting Display Group 99 in "Read measured value block" mode.
- ◆ After selecting Display Group 99 (either in "Basic setting" mode or in "Read measured value block" mode) it is possible to switch back and forth between function 04 ("Basic setting") and function 08 "Read measured value block") by pressing keys 4 and 8 on fault reader V.A.G 1551.
- ◆ When exiting the "Basic setting" mode (function 04) the lambda control is automatically switched on again.
- ◆ Connector for Bank1 Probe 1 (G39) and lambda probe heating (Z19): 4-pin, black
- ◆ Connector for Bank 2 Probe 1 (G108) and lambda probe heating (Z28): 4-pin, black
- ◆ Fitting locations =>Page **23**

Test conditions

- Take the car for a test drive and do not erase the fault memory.
- Coolant temperature at least 80 °C

Testing operation

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page **2** .)
 When doing this the engine must be idling.

-> Indicated on display:

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

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

Note:

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

-> Indicated on display:

```
Introduction of basic setting      HELP
Enter display group number XXX
```

- Press keys 0, 3 and 0 to select Display Group 30 and confirm entry with the Q key.

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

```
Basic setting 30
  1      2      3      4
```

- Check lambda probe status



(display zones 1 and 3).

Note:

The "Lambda probe status" display indicates the status of the lambda control and lambda probes.

	Display zones			
	1	2	3	4
Display Group 30: Lambda probe status at idling speed				
Display	0 0 0		0 0 0	
Indicates	Lambda probe status Bank 1 (upstream of catalytic converter)		Lambda probe status Bank 2 (upstream of catalytic converter)	
Range	0 = off 1 = on		0 = off 1 = on	
Specification	1 1 1		1 1 1	
Note	Relevance of figures=>Page 60		Relevance of figures=>Page 60	

Relevance of 3-figure display in Display Group 30

1	1	1	Display zones 1 and 3
		X	Lambda control 0= inactive 1= active
	X		Lambda probe condition 0= inactive 1= active
X			Status of lambda probe heating 0= inactive 1= active

Testing lambda probe learned values and lambda control

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 2 .)
When doing this the engine must be idling.

-> Indicated on display:

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

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

Note:

During the basic setting the activated charcoal filter solenoid valve (ACF 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 2 to select Display Group 32 and confirm entry with the Q key.

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

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Basic setting 32
 1 2 3 4

- Test drive vehicle for about 10 minutes.

Important:
 Secure fault reader to rear seat and operate from this location. When doing this, always observe the relevant safety precautions => Page 22.

	Display zones			
	1	2	3	4
Display Group 32: Lambda learned values at idling speed				
Display	xx.x %	xx.x %	xx.x %	xx.x %
Indicates	Lambda learned value, Bank 1 at idling speed (additive)	Lambda learned value, Bank 1 at part throttle (multiplicative)	Lambda learned value, Bank 2 at idling speed (additive)	Lambda learned value, Bank 2 at part throttle (multiplicative)
Range	min.: -25.0 % max.: 25.0 %	min.: -25 % max.: 25 %	min.: -25.0 % max.: 25.0 %	min.: -25 % max.: 25 %
Specification	-10.0...10.0 % (slight fluctuation possible)	-10.0...10.0 % (slight fluctuation possible)	-10.0...10.0 % (slight fluctuation possible)	-10.0...10.0 % (slight fluctuation possible)
Note	If readout does not match specification =>Page 56	If readout does not match specification =>Page 56	If readout does not match specification =>Page 56	If readout does not match specification =>Page 56

- Press key C.
- Press keys 0, 3 and 3 to select Display Group 33 and confirm entry with the 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 idling speed				
Display	xx.x %	x.xxx V	xx.x %	x.xxx V
Indicates	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.: 0.000 V max.: 1.000 V	min.: -25.0 % max.: 25.0 %	min.: 0.000 V max.: 1.000 V
Specification	Between -10.0 and 10.0 % the readout should fluctuate by at least 2 %	Between 0.000 and 1.000 V the voltage should fluctuate by at least 0.3 V	Between -10.0 and 10.0 % the readout should fluctuate by at least 2 %	Between 0.000 and 1.000 V the voltage should fluctuate by at least 0.3 V
Note	If readout does not match specification =>Further notes, Page 56	If readout does not match specification =>Reading Display Group 33, Page 57	If readout does not match specification =>Further notes, Page 56	If readout does not match specification =>Reading Display Group 33, Page 57



Further notes

If the readouts in display zones 1 and/or 3 do not match the specifications, or if the readout does not fluctuate by at least 2 %:

- Take car for a test drive to free lambda probe of any deposits, then repeat the test.

If the readouts in display zones 1 and/or 3 still do not match the specifications even after the test drive, or if the readout still does not fluctuate by at least 2 %:

- Test the lambda probe signal wiring and activation => Page 60.
- Test the lambda probe heating => Page 57.
- Press =>key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- Switch off the ignition.

Reading Display Group 32

Display Group 32	Possible cause of fault	Fault remedy
Display zones 1...4		
Lambda learned values between -10.0 and -25.0 %	- Oil dilution	- Carry out oil change or drive car at moderate to high speeds on out-of-town roads
	- High oil consumption	
	- Air mass meter defective	- Test air mass meter => Page 45
	- Solenoid valve for activated charcoal filter sticking in open position	- Test solenoid valve for activated charcoal filter => Page 72
	- Fuel pressure too high	- Test fuel pressure regulator => Page 34
	- Injector leaking	- Test injectors => Page 36
	- Lambda probe heating defective	- Test lambda probe heating
	- Lambda probes dirty	-> Page 57

Reading Display Group 32

Display Group 32	Possible cause of fault	Fault remedy
Display zones 1...4		
Lambda learned values between 10.0 and 25.0 %	- Unmetered air in intake tract	- Check intake system for leaks and eliminate unmetered air => Page 48
	- Fuel pressure too low	- Test fuel pressure regulator => Page 34
	- Lambda probe heating defective	- Test lambda probe heating => Page 57
	- Injector not opening or only opening partially	- Test injectors => Page 36
	- Solenoid valve for activated charcoal filter sticking in open position	- Test solenoid valve for activated charcoal filter => Page 72
	- Ignition coil or spark plug defective	- Test ignition coils => Page 97

Reading Display Group 33

Display Group 33		
Display zone 2 / 4	Possible cause of fault	Fault remedy
Approx. 0.450 V	- Open circuit in wire 4 between lambda probe and control unit	- Test signal wire and activation => Page 60
	- Open circuit in wire 3 between lambda probe and control unit	
More than 1.100 V	- Short to positive in wire 4 between lambda probe and control unit	- Test lambda probe wiring for Bank 1, Probe 1 => Page 60
Less than 0.150 V	- Short to earth in wire 4 between lambda probe and control unit	- Test lambda probe wiring for Bank 2, Probe 1 => Page 62

2.4 - Testing lambda probe heating

Note:

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

Interrogate fault memory => Page 4.

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 2.)
 When doing this the engine must be idling.

-> 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 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	x.xx Kw	Htg.bC.ON		
Indicates	Bank 1, Probe 1	Status of heating		
Range	min.: 0 Kw max.: 100 Kw	Htg.bC.ON Htg.bC.OFF		
Specification	less than 2 Kw	Htg.bC.ON		



Display zones			
Note			

- Press key C.
- Press keys 0, 4 and 2 to select "Display Group 42" and confirm entry with Q key.

Display zones				
	1	2	3	4
Display Group 42: Lambda probe heating, Bank 2 (at idling speed)	Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted. The publisher and the author do not guarantee or accept any liability with regard to the correctness of information in this document. Copyright by AUDI AG.			
Display	x.xx Kw	Htg.bC.ON		
Indicates	Bank 2, Probe 1	Status of heating		
Range	min.: 0 Kw max.: 100 Kw	Htg.bC.ON Htg.bC.OFF		
Specification	less than 2 Kw	Htg.bC.ON		
Note				

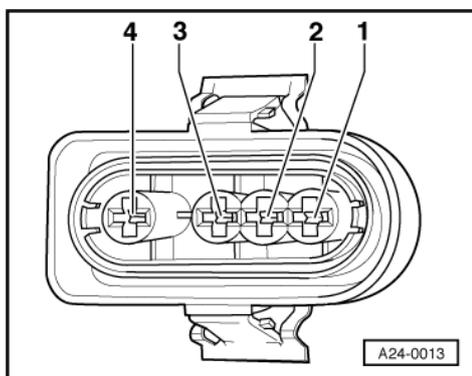
If the specification is not attained:

- Test voltage supply for lambda probe heating
=> Page 58.

Testing voltage supply for lambda probe heating

- Test fuse for lambda probe heating

=> Current flow diagrams, Electrical fault finding and Fitting locations binder



- -> Connect hand-held multimeter (voltage measurement range) between sockets 1 (positive) and 2 (earth) using test leads from V.A.G 1594.
- Operate the starter briefly.

Specification: approx. battery voltage

If there is no voltage reading:

- -> Connect hand-held multimeter (voltage measurement range) between socket 1 (positive) and vehicle earth using test leads from V.A.G 1594.
- Operate the starter briefly.

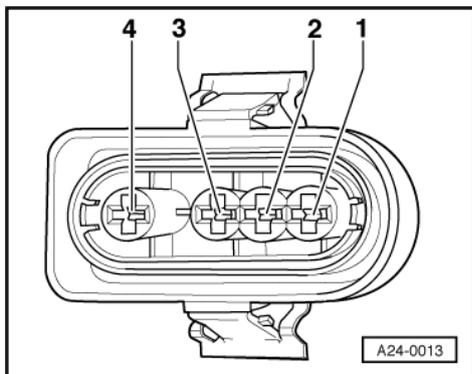
Specification: approx. battery voltage

If there is still no voltage reading:

- Test for open circuit and/or short circuit in wiring between fuel pump relay and socket 1 on the relevant lambda probe connector (on wiring harness) via fuse.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

If the voltage supply is OK:



- -> Connect hand-held multimeter (voltage measurement range) between socket 2 (switched earth connection from engine control unit) and battery positive terminal using test leads from V.A.G 1594.
- Start the engine.

Specification: approx. battery voltage (fluctuating)

Note:

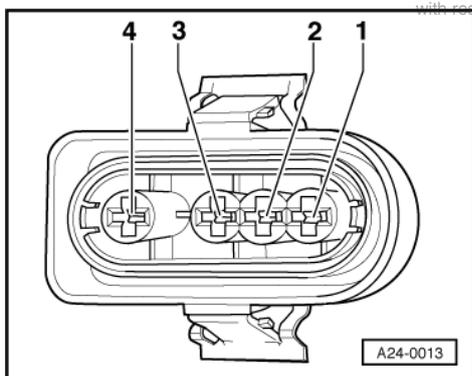
At certain points in the operating range the engine control unit continuously "switches" the earth connection to the lambda probe heating. In other words, it repeatedly makes and breaks the earth connection at these points. For this reason the voltage reading on the tester may fluctuate.

- Switch off ignition.

If there is no voltage reading:

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
- => Page 30 .

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- -> Test for open circuits in the following wiring connection:

Lambda probe, Bank 1 -G39

Connector on wiring harness, socket	Test box V.A.G 1598/31, socket
2	5



Lambda probe, Bank 2 -G108

Connector on wiring harness, socket	Test box V.A.G 1598/31, socket
2	4

Resistance in wiring: max. 1.5 ω

=> Current flow diagrams, Electrical fault finding and Fitting locations binder
If the wiring is OK but the lambda probe heating still has no earth connection:

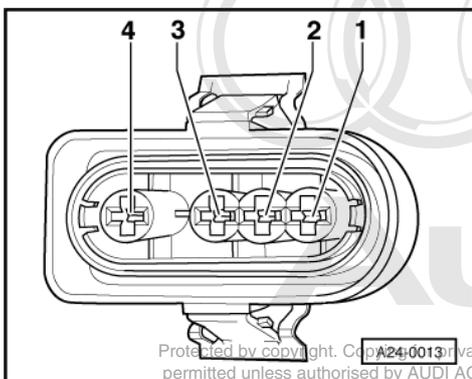
- Fit a new engine control unit => Page 31 .

2.5 - Testing lambda probe signal wiring and activation

Note:

The lambda probe signal is monitored by the self-diagnosis system.

- Interrogate fault memory =>Page 4 .
- 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.



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- -> Test voltage by connecting hand-held multimeter V.A.G 1526 (measuring range 2 V) between sockets 3 and 4 of connector on wiring harness.
- Switch ignition on.

Specification: 450 \pm 50 mV.

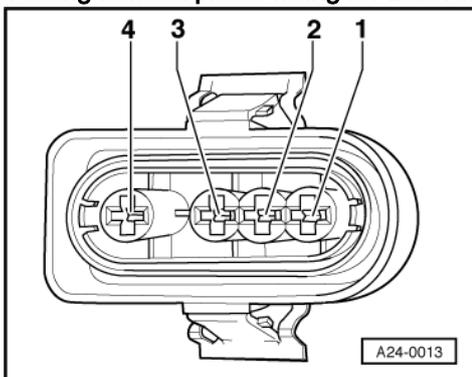
If the specification is not obtained:

- Test lambda probe wiring
=> Page 62 (Bank 2)

If the specification is obtained:

- Renew the relevant lambda probe.

Testing lambda probe wiring for Bank 1, Probe 1

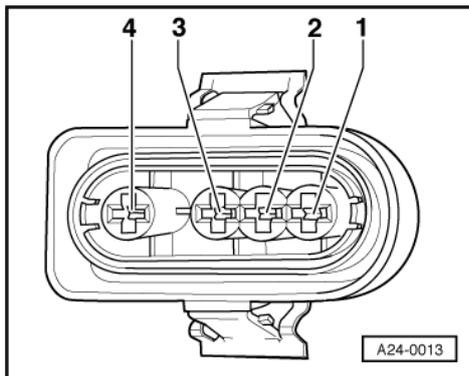


- Unplug 4-pin connector (black) for Bank 1, Probe 1 (-G39).
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
=>Page 30 .
- -> Test the following wiring connections for open circuits:

Connector on wiring harness, socket	Test box V.A.G 1598/31 Socket
3	51
4	70

Resistance in wiring: max. 1.5 ω

- Test wires on 4-pin connector for short circuits with each other.



Connector on wiring harness, socket	Test box V.A.G 1598/31 Socket
4	51

Specification: infinity ω (open circuit)

- Test screening wire for short circuit to probe wiring.

Connector on wiring harness, socket	Test box V.A.G 1598/31 Socket
4	32
3	32

Specification: infinity ω (open circuit)

If no faults are found in the wiring:

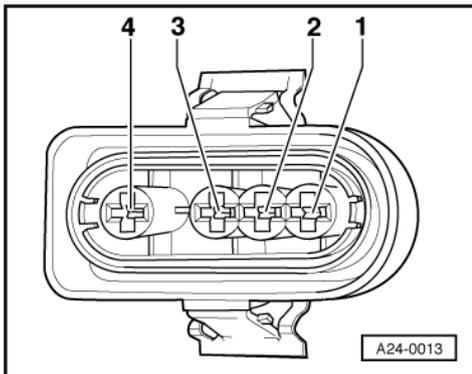
- Fit a new engine control unit -J220
=> Page 31 .



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Testing lambda probe wiring for Bank 2, Probe 1

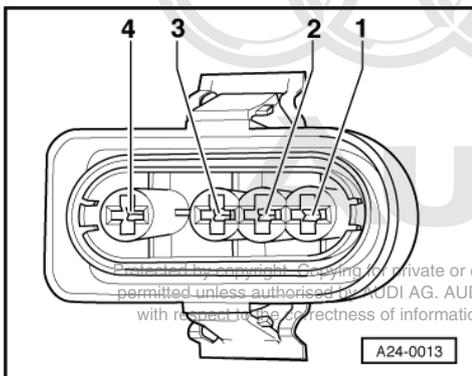


- Unplug 4-pin connector (black) for Bank 2, Probe 1 (-G108).
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
- =>Page 30 .
- -> Test the following wiring connections for open circuits:

Connector on wiring harness, socket	Test box V.A.G 1598/31 Socket
3	12
4	13

Resistance in wiring: max. 1.5 ω

- Test wires on 4-pin connector for short circuits with each other.



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Connector on wiring harness, socket	Test box V.A.G 1598/31 Socket
4	12

Specification: infinity ω (open circuit)

- Test screening wire for short circuit to probe wiring.

Connector on wiring harness, socket	Test box V.A.G 1598/31 Socket
4	32
3	32

Specification: infinity ω (open circuit)

If no faults are found in the wiring:

- Fit a new engine control unit -J220

=> Page 31 .

2.6 - Removing and installing lambda probe

Special tools, testers and auxiliary items

- ◆ Hot paste G 052 112 A3

Removing

- Unplug lambda probe connector for left-hand or right-hand cylinder bank.
(Fitting locations => Pages 25)
- Release cable ties.
- Unscrew lambda probe.

Installing

When installing, note the following points:

Notes:

- ◆ Tightening torque: 50 Nm.
- ◆ The screw thread on the lambda probe is coated with a special paste. This paste must not be allowed to penetrate the openings on the probe.
- ◆ When installing, the cable ties must be re-fitted at exactly the same points in order to prevent contact between the lambda probe wire and the exhaust pipe.

3 - Testing intake manifold change-over function

3.1 - Testing intake manifold change-over function

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

The intake manifold change-over function switches over from the long intake tract to the short intake tract at about 4500 rpm.

3.2 - Testing operation

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 2 .)
When doing this the engine must be idling.

-> 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 5 for Display Group 95 and confirm entry with the 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.xx ms	xxx.x ° C	IMC-V OFF
Indicates	Engine speed (in steps of 40 rpm)	Load	Coolant temperature	Intake manifold change-over
Range	min.: 550 rpm max.: 6800 rpm	min.: 0.00 ms max.: 100.00 ms		IMC-V OFF Stage 1
Specification	650...750 rpm	12.0... 26.0 ms	80.0...105.0 ° C	IMC-V OFF
Note				

- Check readout in display zone 4.
Specification: IMC-V OFF
- Increase engine speed to about 4700 rpm (display zone 1) and observe readout in display zone 4.
- The intake manifold change-over function should be activated (display zone 4).

	Display zones			
	1	2	3	4
Display Group 95: Intake manifold change-over with vehicle being driven				
Display	xxxx rpm	x.xx ms	xxx.x ° C	Stage 1
Indicates	Engine speed (in steps of 40 rpm)	Load	Coolant temperature	Intake manifold change-over
Range	min.: 550 rpm max.: 6800 rpm	min.: 0.00 ms max.: 120.00 ms		IMC-V OFF Stage 1
Specification	4500...6800 rpm	16.0...120.00 ms	80.0...105.0 ° C	Stage 1
Note				

- If the display shows "Stage 1" but the vacuum unit for the intake manifold change-over is not activated (fitting location: on front left of intake manifold):
 - Test intake manifold change-over valve
=> Page 64
 - Check vacuum system for leaks
=> Page 67

3.3 - Testing intake manifold change-over valve -N156

Fitting location=>Page 23 .

Testing intake manifold change-over valve -N156

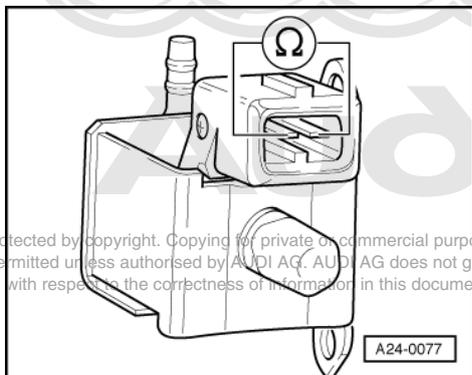
- Run engine at idling speed for 2 or 3 minutes to build up vacuum.
 - Switch engine off.
 - Switch ignition on.
- > Perform final control diagnosis and activate intake manifold change-over valve

=>Page 15.

Final control diagnosis
 Intake manifold press. change valve -
 N156

The valve should click (clicking can be heard and felt). After 1 minute the final control diagnosis is terminated.

- If the valve does not click, switch off the ignition.



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- Unplug connector from intake manifold change-over valve -N156.
- -> Measure resistance between contacts of solenoid valve using V.A.G 1526.

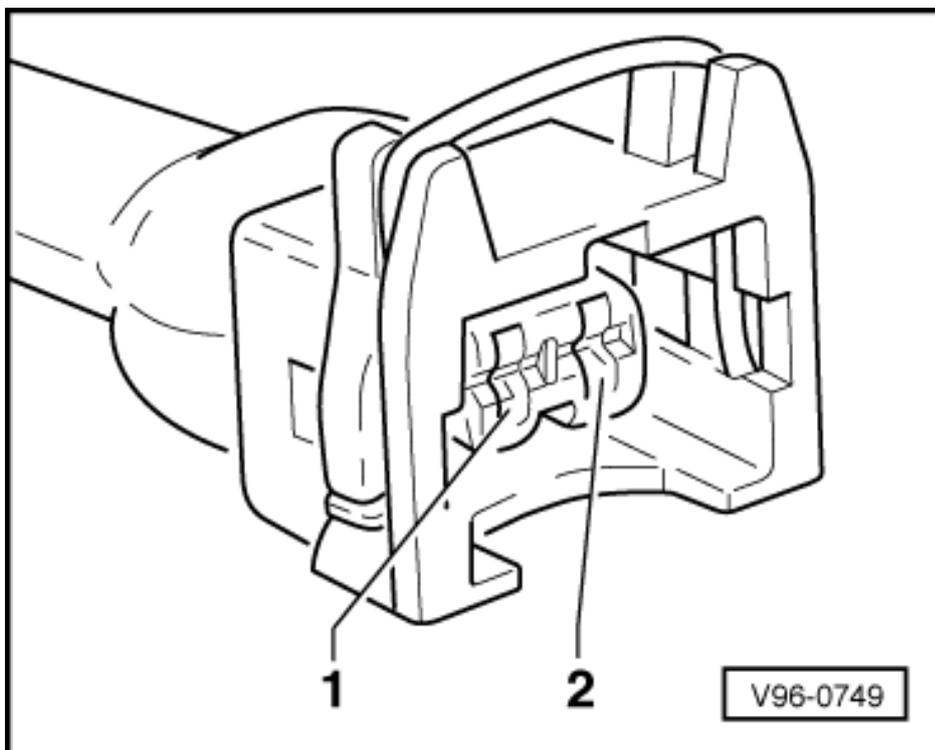
Specification: 25...35 ω

If the reading does not match the specification:

- Renew intake manifold change-over valve -N156.

If the reading matches the specification:

- Test voltage supply
 =>Page 66.





Testing voltage supply to intake manifold change-over valve

-N156

- -> Connect diode test lamp V.A.G 1527 between engine earth and socket 1 on connector using test leads from auxiliary test set V.A.G 1594.
- Operate the starter briefly.

The diode test lamp should light up.

- If the diode test lamp does not light up:
- Test fuse for intake manifold change-over valve.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

If the fuse is OK:

- Test for open circuit and short circuit in wiring between fuel pump relay and socket 1 on connector via fuse for intake manifold change-over valve.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

If the voltage supply is OK, test activation. => Page 66

Testing activation of intake manifold change-over valve

- Connect diode test lamp V.A.G 1527 between sockets 1 (positive) and 2 on connector for intake manifold change-over valve using test leads from auxiliary test set V.A.G 1594.

-> Perform final control diagnosis and activate intake manifold change-over valve

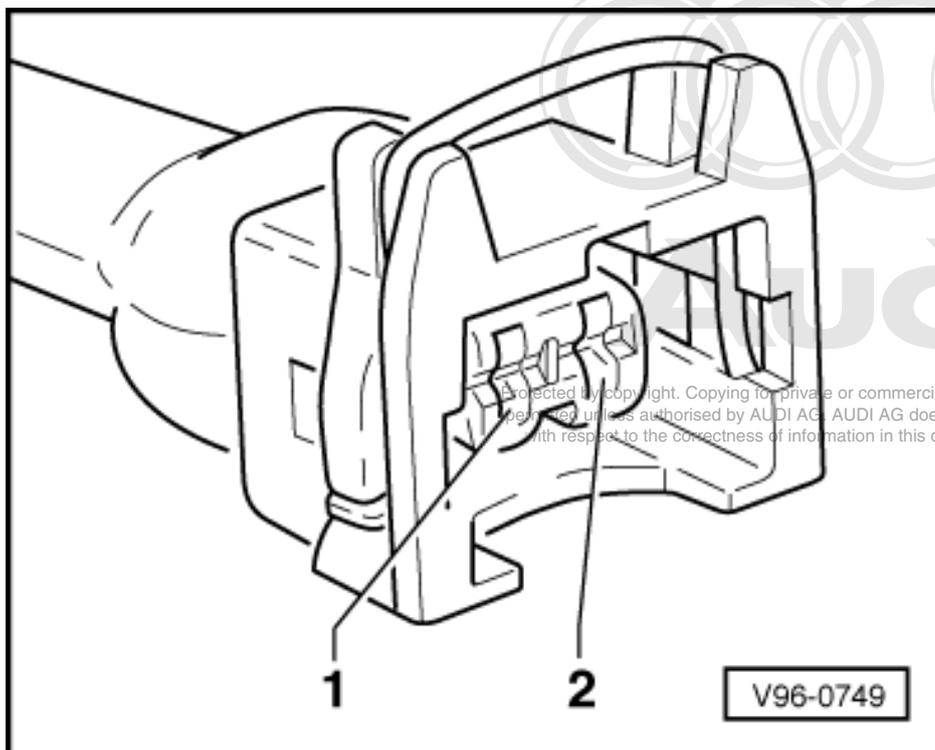
=>Page 15.

Final control diagnosis Intake manifold press. change valve - N156
--

If the diode test lamp does not flash or lights up continuously, test the wiring.

Testing wiring

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
- => Page 30 .



Test the following wiring connections for open circuits and short to positive or earth.

Connector for intake manifold change-over Socket	Test box V.A.G. 1598/31 Socket
2	104

Resistance in wiring: max. 1.5 ω

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

- If the wiring is OK, fit a new engine control unit
=>Page 31 .
- Test operation of intake manifold change-over valve -N156 again
=>Page 63 .

3.4 - Testing vacuum system

Checking valve for obstructions and leaks

- Remove intake manifold change-over valve.
- Reconnect valve to wiring harness.

-> Perform final control diagnosis and activate intake manifold change-over valve
=>Page 15 .

Final control diagnosis
Intake manifold press. change valve - N156

- While the final control diagnosis is running, blow through the long valve connection to check whether the valve is opening and closing properly.

If the valve does not open and close:

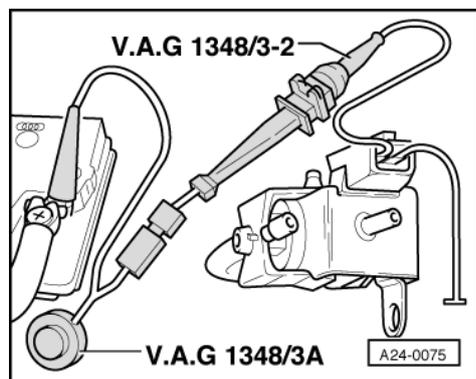
- Renew intake manifold change-over valve.

If no faults have been found in any of the tests so far:

- Re-install intake manifold change-over valve.
- Test vacuum system for leaks => Page 67

Testing vacuum system for leaks

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





- -> Connect one of the contacts on the solenoid valve to engine earth using test leads and crocodile clamp from V.A.G 1594.
- -> Connect the second contact on the solenoid valve to positive using remote control V.A.G 1348/3A, adapter lead V.A.G 1348/3-2 and an auxiliary cable.
- -> Operate remote control V.A.G 1348/3A for about 2 or 3 minutes. During this time the vacuum unit should remain in the "pulled-in" position.

If the vacuum unit returns to its original "rest" position, carry out the following test:

- Disconnect vacuum hose from vacuum unit for intake manifold change-over.
- Connect hand-held vacuum pump V.A.G 1390 to vacuum unit.
- Operate hand-held vacuum pump and check whether change-over function is working.
- Test vacuum unit for leaks. (The vacuum unit should not return to the "rest" position while a vacuum is being maintained via the hand pump.)

If specification is not met:

- Renew vacuum unit.

4 - Testing secondary air system

4.1 - Testing secondary air system

4.2 - Testing secondary air inlet valve

Fitting location => Fitting locations overview, Page [23](#)

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page [2](#) .)
When doing this the ignition must be switched on.
- Start final control diagnosis and activate secondary air inlet valve
=> Page [15](#) .

-> Indicated on display:

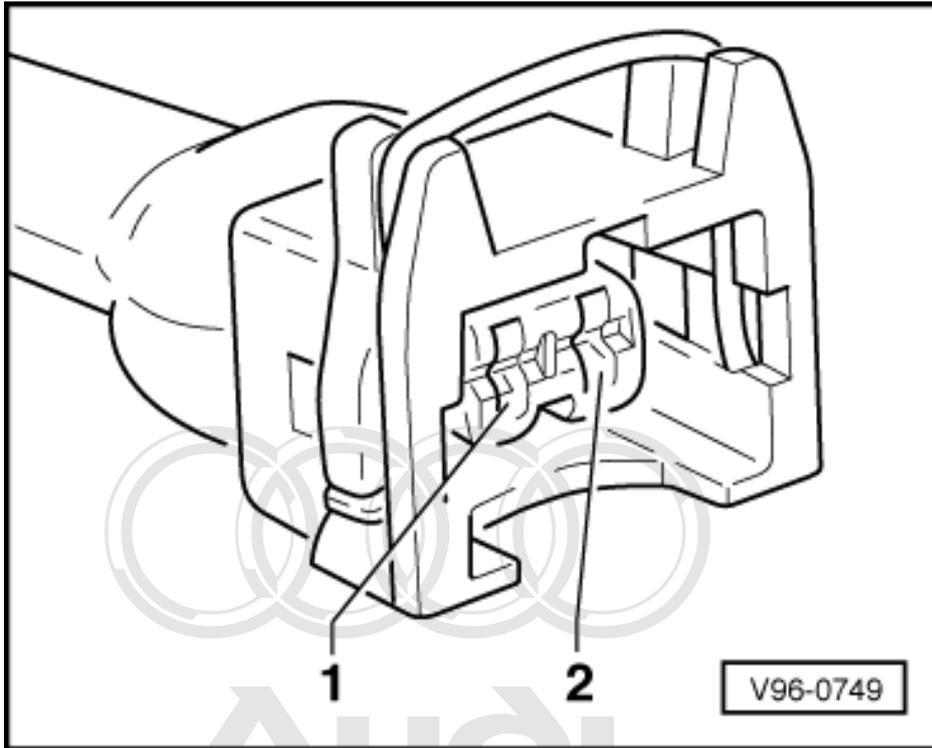
```
Final control diagnosis  
Secondary air inlet valve -N112
```

The secondary air inlet valve should click.

If the secondary air inlet valve does not click:



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- -> Unplug 2-pin connector from valve.
- Connect diode test lamp V.A.G 1527 to disconnected connector using test leads from V.A.G 1594.
- Repeat final control diagnosis.

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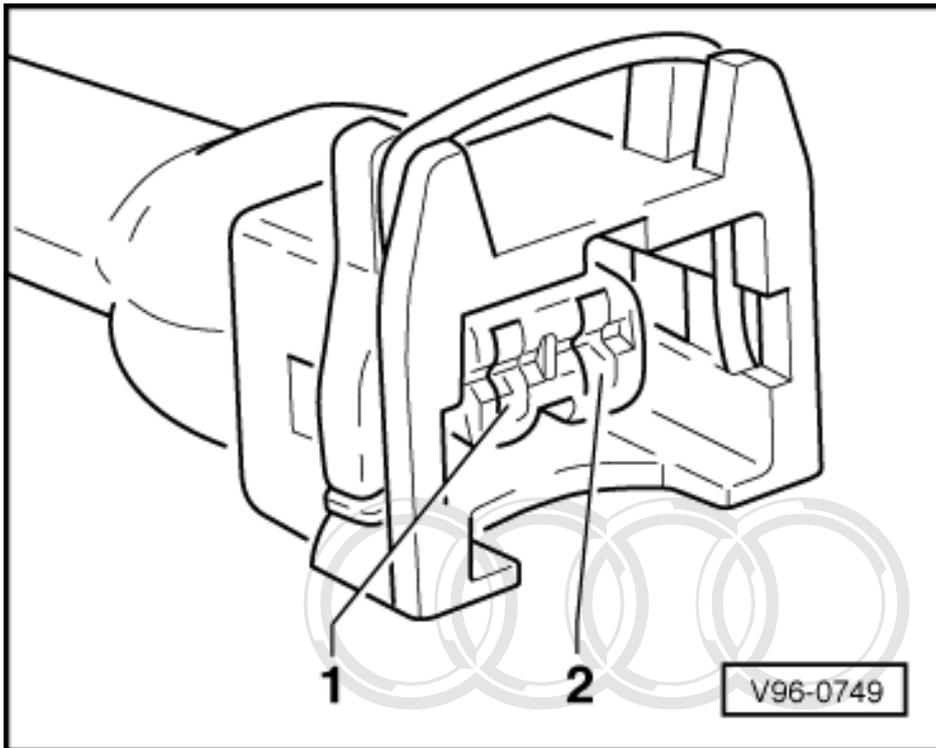
If the diode test lamp now flashes during the final control diagnosis:

- Fit a new secondary air inlet valve.

=> 6-Cylinder engine, Mechanics; Repair group 26; Secondary air system; Removing and installing parts of secondary air system

If the diode test lamp still does not flash:

- Switch off ignition.
 - Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
- => Page 30 .



- Test for open circuit in the following wiring connection:

Socket of 2-pin connector on wiring harness	Socket on test box V.A.G 1598/31
2	44

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Resistance in wiring: max 1.5 Ω

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

If no fault in wire is detected:

- Test voltage supply to secondary air inlet valve using current flow diagram.

=> Current flow diagrams, Electrical fault finding and fitting locations binder

4.3 - Testing secondary air pump relay -J299

Note:

The secondary air pump relay is located in the electronics box in the plenum chamber.

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 2 .) When doing this the ignition must be switched on.
- Start final air control diagnosis and activate secondary air pump relay => Page 15 .

-> Indicated on display:

Final control diagnosis Secondary air pump relay -J299

Secondary air pump relay -J299 activates secondary air pump motor -V101 which runs at intervals until the final control diagnosis is terminated by pressing the => key.

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

- Pull 2-pin connector off 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 final control diagnosis:

- Renew secondary air pump motor -V101.

=> Repair group 26; Secondary air system; Removing and installing parts of secondary air system

If diode test lamp does not flash and secondary air pump relay does not click, test activation of secondary air pump relay

=> Page 71 .

If diode test lamp does not flash but secondary air pump relay clicks, test voltage supply for secondary air pump relay.

Testing voltage supply for 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

- Test 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 air pump relay -J299.

Testing activation of secondary air pump relay

- Switch off ignition.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.

=> Page 30 .

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

- Test for open circuit in the following wiring connection:

Secondary air pump relay, contact	Socket on test box V.A.G 1598/31
=> Current flow diagrams, Electrical fault finding and Fitting locations	46



Resistance in wiring: max. 1.5 ω

If no fault in wire is detected:

- Renew engine control unit -J220
=> Page 31 .

5 - Testing fuel tank breather system

5.1 - Testing fuel tank breather system

5.2 - Testing solenoid valve 1 for activated charcoal filter -N80

Note:

In this context, solenoid valve 1 for activated charcoal filter (ACF valve) is also known as the fuel tank breather valve.

Testing for leaks

When there is no electrical signal the solenoid valve remains closed.

- Disconnect hoses from solenoid valve 1 for activated charcoal filter -N80.
- Connect an auxiliary hose to one of the connections on the ACF valve.
- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 2 .)
When doing this the ignition must be switched on.
- Start final control diagnosis and select solenoid valve for activated charcoal filter -N80 (tank breather valve)
=>Page 15 .

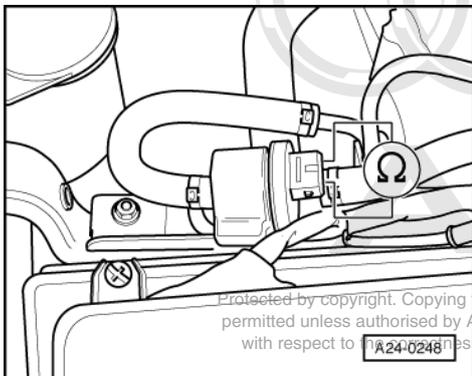
-> Indicated on display:

Final control diagnosis ACF solenoid 1 -N80
--

The valve should click...

...and should open and close (test by blowing into auxiliary hose).

- If the valve does not click, carry out electrical test of solenoid valve 1 for activated charcoal filter => Page 73 .
- If valve does not open and close properly, renew solenoid valve 1 for activated charcoal filter.



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Electrical test of solenoid valve 1 for activated charcoal filter -N80

- Unplug connector from ACF valve -N80.
- -> Measure resistance between contacts on valve using hand-held multimeter V.A.G 1526.

Specification: 22...30 ω

If the specification is not attained:

- Renew solenoid valve for activated charcoal filter system -N80.

If the specification is attained:

- Test voltage supply => Page **73** .

Testing power supply to solenoid valve

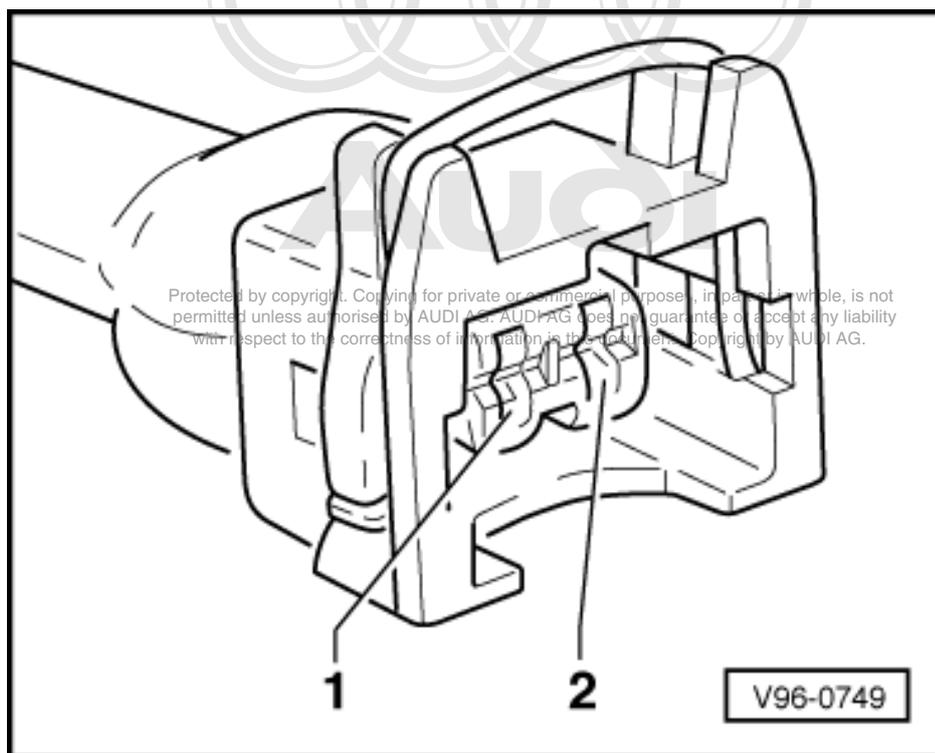
Note:

The ACF valve receives its power supply via the fuel pump relay.

- Test fuse for ACF valve

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

If the fuse is OK:



- Unplug connector on ACF valve -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 light up.

If diode test lamp does not light up:



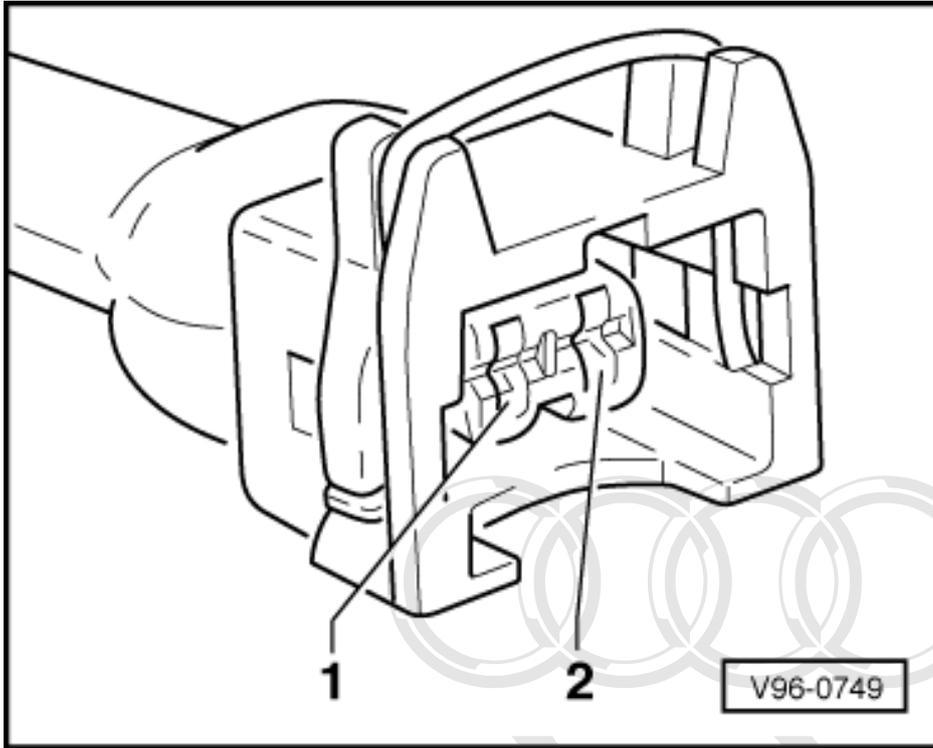
- Test continuity of wiring from socket 1 to fuel pump relay via fuse. Rectify open circuit if necessary.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

- If wiring is OK, test fuel pump relay
=> Page 42 .

If the diode test lamp lights up, test activation

=> Page 74 .



Testing activation of ACF solenoid valve

- -> Connect diode test lamp V.A.G 1527 between sockets 1 (positive) and 2 of plug connector.
- Start final control diagnosis and select solenoid valve for activated charcoal filter N80
=>Page 15 .

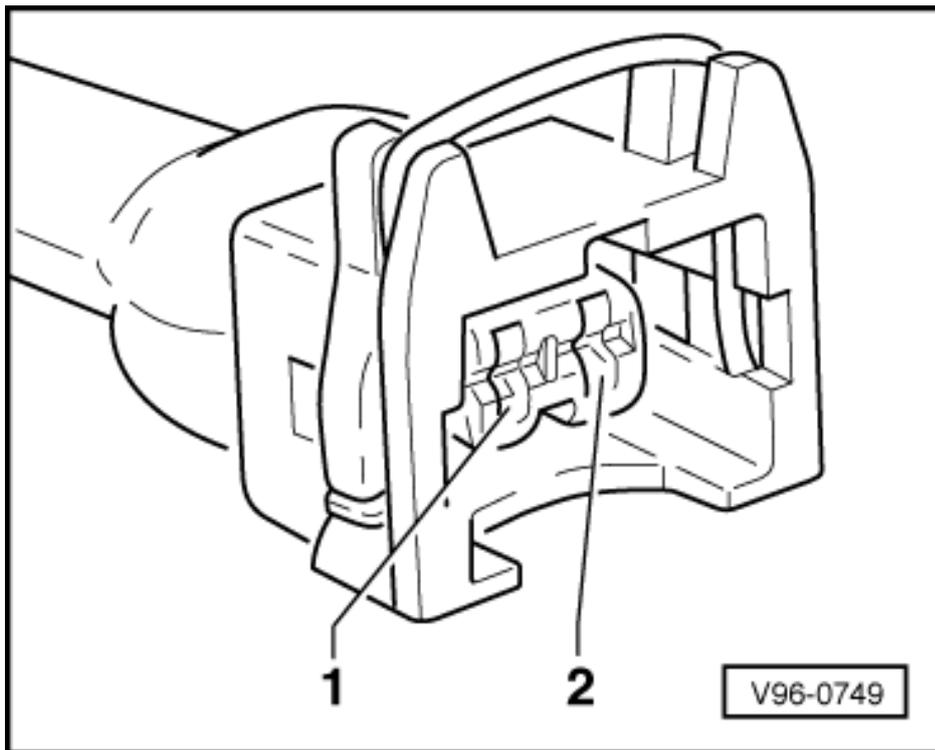
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The diode test lamp should flash.

If the diode test lamp does not flash or lights up continuously:

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
=> Page 30 .

If the diode test lamp lights up continuously:



- Test for short to earth in the following wiring connections:

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:

- Test for short to positive or open circuit in the following wiring connections:

2-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
2	64

Resistance in wiring: max. 1.5 Ω

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

- If necessary, rectify short circuit to earth or open circuit.
 - If no short circuit or open circuit is found
 - Fit a new engine control unit -J220
- => Page 31 .



6 - Testing electronic engine power control (electronic throttle)

6.1 - Testing electronic engine power control (electronic throttle)

6.2 - Operation of electronic throttle system

With the electronic throttle the throttle valve is not operated by a cable connected to the accelerator pedal. There is no mechanical link between the accelerator and the throttle valve.

The throttle valve is actuated by a servomotor (throttle valve positioner) in the throttle valve control part over the full range of engine speeds and load conditions.

The throttle valve positioner actuates the throttle valve according to the commands it receives from the engine control unit.

The position of the accelerator pedal is communicated to the engine control unit by two accelerator position senders (variable resistors, both fitted in a single housing). The senders are connected to the accelerator pedal.

The accelerator position (as determined by the driver) is one of the main input values for the engine control unit.

When the engine is running (i.e. under load) the engine control unit can open and close the throttle valve freely (i.e. independently of the signals being sent by the accelerator position sender).

The electronic throttle is not simply a combination of two or three components, but rather a complete system comprising all the elements that together determine the position of the throttle valve and also control and monitor it. For example, the accelerator position sender, throttle valve control part, EPC warning lamp, engine control unit etc.

6.3 - Testing throttle valve control part -J338

The housing for the throttle valve control part contains the following components (the housing must not be opened):

- Throttle valve drive -G186
(This is an electric motor activated by the engine control unit. The motor opens the throttle valve by applying force to overcome the spring pressure.)
- Angle sender for throttle valve drive -G187
- Angle sender 2 for throttle valve drive -G188

Note:

The angle senders are in the form of potentiometers (variable resistors). Each sends its own separate signal to inform the engine control unit of the position of the throttle valve (i.e. one of the signals is redundant).

The potentiometers cannot be adjusted mechanically. Settings are made using the basic setting function (function 04) with vehicle diagnostic, testing and information system VAS 5051 (or with fault reader V.A.G 1551).

6.4 - Performing adaption of throttle valve control part

The adaption process enables the engine control unit to learn the different 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 angle senders for throttle valve drive.

If the throttle valve control part -J338 or the engine control unit is removed and refitted or replaced, or if the power supply to the engine control unit is interrupted, an adaption must be performed.

The learning process (adaption process) is carried out:

- ◆ Automatically if the ignition is switched on for at least 6 seconds without operating the starter or depressing the accelerator, and if the engine control unit registers a "learning requirement". (In this case, however, there is no way of knowing whether the adaption process was successful or not.) The engine control unit will register a learning requirement if the previously stored voltage readings from the angle senders do not correspond (within a certain tolerance range) to the new voltage readings.
- ◆ By selecting "Basic setting" (function 04), Display Group 60 with the ignition switched on.

Test conditions

- No faults stored in fault memory
=> Page 4 , Interrogating fault memory
 - Engine not running, ignition switched on
 - Accelerator not depressed
 - Coolant temperature between 5°C and 100°C
 - Intake air temperature above 5°C
 - Power supply to engine control unit more than 11 V
Testing =>Page 102
- Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.
- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 2 .)
When doing this the ignition must be switched on.

-> Indicated on display:

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

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

-> Indicated on display:

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

- Press keys 0, 6 and 0 for Display Group 60 and confirm entry with Q key.

-> Indicated on display:

```
System in basic setting 60
  1      2      3      4
```

When the Q key is pressed the current supply to the throttle valve positioner will be disconnected.

In this condition the throttle valve is pulled into an "emergency running" or default position by a spring in the throttle valve control part. The values supplied by the two angle senders for this position are stored in the engine control unit.

The throttle valve is then opened by a predetermined amount. As soon as it reaches this position the current supply to the throttle valve positioner is again disconnected. The spring should then close the throttle valve mechanically to the previously learned default position within a specified period of time (spring test).

The throttle valve positioner then closes the throttle valve and 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 current supply to the throttle valve positioner while the vehicle is being driven, the result will be an increase in idling speed with fluctuating engine rpm (hunting) and very slow throttle response.

- Check display values for throttle valve control part (display zones 3 and 4).



	Display zones			
	1	2	3	4
Display Group 060: Adaption of throttle valve control part with ignition on				
Display	xxx %	xxx %	---	---
Indicates	Throttle valve angle (angle sender 1)	Throttle valve angle (angle sender 2)	Learning stage counter	Adaption status
Range	min.: 0 % max.: 100 %	min.: 0 % max.: 100 %	0 to 8	ADP. runs ADP. O.K. ADP. ERROR
Specification	xxx %	xxx %	8	ADP O.K.
Note	During the adaption process the learning stage counter should count from 0 to 8. (Some of the figures may skip.)			If readout does not match specification, see note => Page 78

Note:

The abbreviation "ADP" in display zone 4 stands for "Adaption".

- Check display readout 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 %	---	---
Indicates	Throttle valve angle (angle sender 1)	Throttle valve angle (angle sender 2)	Learning stage counter	Adaption status
Range	min.: 0 % max.: 100 %	min.: 0 % max.: 100 %	0 to 8	ADP. runs ADP. O.K. ADP. ERROR
Specification	xxx %	xxx %	8	ADP O.K.
Note	If specification is not met: notes => Page 78 .			

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 77 .
 - ◆ The throttle valve is unable to close completely (e.g. because of dirt)
 - ◆ Throttle valve control part or wiring is defective.
 - ◆ The engine was started or the accelerator depressed during the adaption process.
 - ◆ Distortion of throttle valve housing (check bolts)
- End the engine basic setting by pressing the→ key.
 - Press keys 0 and 6 for the "End data transfer" function and confirm input with the Q key.

6.5 - Testing angle senders for throttle valve drive

The angle senders for throttle valve drive -G187 and -G188 inform the engine control unit of the position of the throttle valve. Both angle senders are located in the throttle valve control part.

If a fault relating to angle senders for throttle valve drive -G187 or -G188 is stored in the memory, test voltage supply to throttle valve control part.

Testing voltage supply to throttle valve control part

- Test fuse for throttle valve control part

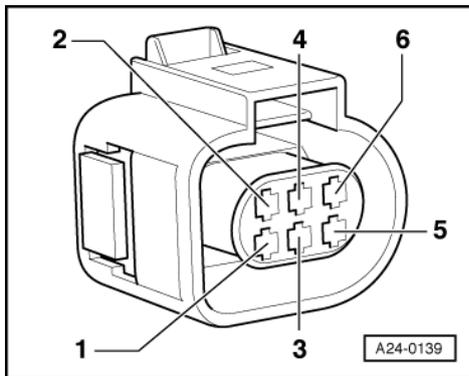
=> Current flow diagrams, Electrical fault finding and Fitting locations binder

If the fuse is OK:

- Unplug connector from throttle valve control part.

- Switch ignition on.

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- -> Connect hand-held multimeter (voltage range) between the following sockets on the connector:

6-pin connector on wiring harness, socket	Specification
2 + earth	approx. 5 V
2 + 6	approx. 5 V

If the specifications are not obtained:

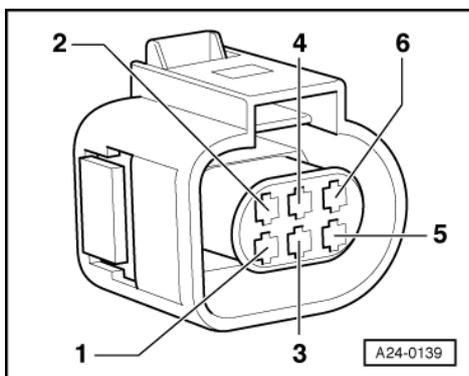
- Test wiring connections from engine control unit to throttle valve control part
=>Page 79 .

If the specifications are obtained:

- Additionally test the signal wires and activation wires for the throttle valve positioner
=>Page 79 .

Testing wiring for voltage, signal and activation

- Unplug connector from throttle valve control part.





- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
=> Page 30 .

Test the following wiring connections for open circuits and short 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

Resistance in wiring: max. 1.5 ω

- Rectify any open/short circuit as necessary.

=> Current flow diagrams, Electrical fault finding and fitting locations binder

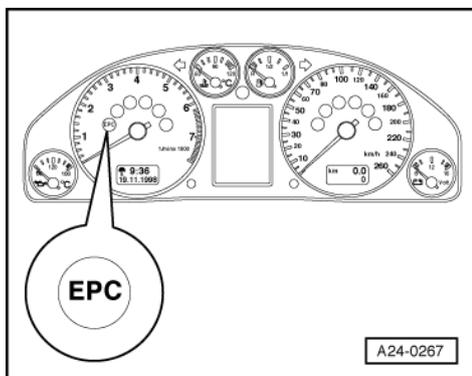
If no wiring fault is detected:

- Fit a new throttle valve control part.

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6.6 - Notes on EPC warning lamp (fault warning lamp for electronic throttle) in dash panel insert

"EPC" stands for Electronic Power Control and refers to the electronic throttle control system.



-> Fitting location of EPC warning lamp

The engine control unit switches the EPC warning lamp on 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 lights up for about 3 seconds. If a fault is detected during this test phase the warning lamp will remain lit.

If a fault is detected in the electronic throttle system while the engine is running, the engine control unit will activate the EPC warning lamp. At the same time a fault code is stored in the fault memory of the engine control unit.

Testing operation of warning lamp

- Start engine.

Specification: if no faults relating to the electronic throttle are stored in the fault memory, the EPC warning lamp should light up for about 3 seconds after the engine is started.

If the EPC warning lamp does not light up:

- Test wiring from engine control unit to EPC warning lamp in dash panel insert as follows:

=> Current flow diagrams, Electrical fault finding and fitting locations binder

- Interrogate fault memory of engine control unit => Page 4 .

7 - Checking accelerator position senders-G79 and -G185

7.1 - Checking accelerator position senders-G79 and -G185

Accelerator position senders -G79 and -G185 are located on the accelerator pedal. Both senders inform the engine control unit of the driver's throttle requirement (pedal position), but each functions completely independently of the other (redundancy principle). Both senders are located in a single housing.

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 2 .)
When doing this 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    Q
Enter display group number   XXX
```

- Press the keys 0, 6 and 2 to select Display Group 62 and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block 62
  1      2      3      4
```

- Check display values 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 %
Indicates	Throttle valve angle (angle sender 1)	Throttle valve angle (angle sender 2)	Accelerator position sender 1	Accelerator position sender 2
Range	min.: 0 % max.: 100 %	min.: 0 % max.: 100 %	min.: 0 % max.: 100 %	min.: 0 % max.: 100 %
Specification	3...93 %	97...3 %	12...92 %	4...49 %

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Note:

The engine control unit converts the voltage readings from the angle senders into percentages of 5 V and displays them as percentages. (A signal wire voltage of 5 V is equivalent to 100%.)

- Observe display zones 3 and 4.
- Slowly depress accelerator to full throttle position.

The percentage value in display zone 3 should rise steadily, but without covering the full tolerance range between 12 and 92 %.

The percentage value in display zone 4 should also rise steadily but without covering the full range of values (in this case 4...49 %).

Note:

The value shown in display zone 3 should always be about twice as high as the value shown in display zone 4.

If the display values do not appear as described:

- Test voltage supply and wiring to accelerator position senders
=>Page 82 .
- Adjust accelerator position senders.

=> 6-Cyl. engine, Mechanics; Repair group 20; Servicing accelerator linkage Servicing accelerator linkage

Testing voltage supply to accelerator position senders

- Remove storage compartment on driver's side.

=> General body repairs, Interior; Repair group 68; Storage compartments, covers and trim parts; Removing and installing driver's storage compartment Storage compartments, covers and trim parts Removing and installing driver's storage compartment

- Unplug connector for accelerator position sender.

Note:

The connector is clipped onto the pedal bracket near the brake light switch.

- Switch ignition on.
- Connect hand-held multimeter (voltage range) between the following sockets on the connector:

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6-pin connector on wiring harness, socket	Specification
2 + earth	approx. 5 V
1 + 3	approx. 5 V
5 + earth	approx. 5 V
5 + 4	approx. 5 V

If the specifications are obtained:

- Test the signal wiring => Page 82 .

If the specifications are not obtained:

- Test wiring between engine control unit and accelerator position senders => Page 82 .

Testing 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 to the engine control unit itself.

=> Page 30 .

- Test 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

- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

- Renew accelerator position senders.

=> Fuel supply system, Petrol engines; Repair group 20; Servicing accelerator linkage Servicing accelerator linkage

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7.2 - Checking brake light switch -F and brake pedal switch -F47

Because the injection system operates with an accelerator pedal sender (potentiometer) which may be defective, the engine is throttled back for reasons of safety when the brakes are applied To do this the control unit requires signals from the brake light switch and also 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 unrequired regulating action.

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 2 .)
When doing this 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
Enter display group number XXX
```

- Press keys 0, 6 and 6 to select "Display Group 66" and confirm entry with Q key.

-> Indicated on display:

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

- Observe display in display zone 2.

	Display zones			
	1	2	3	4
Display Group 66: Signals to engine control unit with ignition on				
Display	0 km/h	0 0 0 0	xxx km/h	0 0 0 0



Display zones				
Indicates	Actual speed	Switch positions	Specified speed	Switch positions for cruise control system
Range		off = 0 on = 1		off = 0 on = 1
Specification		0 0 0 0		
Note		Relevance of figures => Page 84		

- Depress brake pedal

Relevance of figures in 4-digit readout in display zone 2

x	x	x	x	Display zone 2
			X	Brake light switch 0 = Brake pedal not depressed 1 = Brake pedal depressed
		X		Brake pedal switch 0 = Brake pedal not depressed 1 = Brake pedal depressed
	X			Clutch pedal switch 0 = Clutch pedal not depressed 1 = Clutch pedal depressed
X				Cruise control system (CCS) 0 = CCS deactivated 1 = CCS enabled

Display zones				
	1	2	3	4
Display group 66: Signals to engine control unit with ignition on				
Display	0 km/h	0 0 1 1	xxx km/h	0 0 0 0
Indicates	Actual speed	Switch positions	Specified speed	Switch positions for cruise control system
Range		off = 0 on = 1		off = 0 on = 1
Specification		0 0 1 1		
Note		Both readouts must change from 0 to 1.		

- Allow brake pedal to return slowly to its normal position.
- Both readouts should return from 1 to 0.

If one or both of the displays does not change from 0 to 1:

- Test voltage supply
=> Page **85**.

Testing voltage supply

- Remove storage compartment on driver's side.

=> General body repairs, Interior; Repair group 68; Storage compartments, covers and trim parts; Removing and installing driver's storage compartment Storage compartments, covers and trim parts Removing and installing 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	Specification
1 + earth	Battery voltage

- Switch ignition on.

4-pin connector on wiring harness, socket	Specification
3 + earth	Battery voltage

If specifications are met:

- Test wiring connections => Page 85 .

If specifications are not met:

- Test wiring connections from sockets 1 and 3 of connector for open circuit or short to earth.

=> Current flow diagrams, Electrical fault finding and fitting locations binder

- Rectify any open/short circuit as necessary.

Checking wiring connections

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
=> Page 30 .

Test the following wiring connections for open circuits and short to positive or earth:

4-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
2	56
4	55

Resistance in wiring: max. 1.5 ω

=> Current flow diagrams, Electrical fault finding and fitting locations binder

- Rectify any open/short circuit as necessary.

If no open circuits are found in wiring:

- Renew brake light switch / brake pedal switch.

7.3 - Testing clutch pedal switch -F36

This signal prevents engine speed fluctuations and load change jolts when the clutch is disengaged. The signal is also required for the cruise control system.

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 2 .)
When doing this 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 Enter display group number XXX

- Press keys 0, 6 and 6 to select "Display Group 66" and confirm entry with the Q key.

-> Indicated on display:

Read measured value block 66 1 2 3 4

- Observe display in display zone 2.

	Display zones			
	1	2	3	4
Display group 66: Signals to engine control unit with ignition on				
Display	0 km/h	0 0 0 0	xxx km/h	0 0 0 0
Indicates	Actual speed	Switch positions	Specified speed	Switch positions for cruise control system
Range		off = 0 on = 1		off = 0 on = 1
Specification		0 0 0 0		
Note		Relevance of figures => Page 86		

- Depress clutch pedal

Relevance of figures in 4-digit readout in display zone 2

x	x	x	x	Display zone 2
			X	Brake light switch 0 = Brake pedal not depressed 1 = Brake pedal depressed
		X		Brake pedal switch 0 = Brake pedal not depressed 1 = Brake pedal depressed
	X			Clutch pedal switch 0 = Clutch pedal not depressed 1 = Clutch pedal depressed
X				Cruise control system (CCS) 0 = CCS deactivated 1 = CCS enabled

	Display zones			
	1	2	3	4
Display group 66: Signals to engine control unit with ignition on				
Display	0 km/h	0 1 0 0	xxx km/h	0 0 0 0
Indicates	Actual speed	Switch positions	Specified speed	Switch positions for cruise control system
Range		off = 0 on = 1		off = 0 on = 1
Specification		0 1 0 0		

	Display zones		
Note		Readout must change from 0 to 1	

- Allow clutch pedal to return slowly to its normal position.
- Readout should return from 1 to 0.

If one or both of the displays does not change from 0 to 1:

- Test voltage supply => Page 87 .

Testing voltage supply

- Remove storage compartment on driver's side.

=> General body repairs, Interior; Repair group 68; Storage compartments, covers and trim parts; Removing and installing driver's storage compartment Storage compartments, covers and trim parts Removing and installing driver's storage compartment

- Unplug 2-pin connector from clutch pedal.
- Switch on ignition.
- Connect hand-held multimeter (voltage range) between the following sockets on the connector:

2-pin connector on wiring harness, socket	Specification
1 + earth	Battery voltage

If specification is obtained:

- Test wiring connections => Page 87 .

If specification is not obtained:

- Test wiring from socket 1 of connector for open circuit and short to earth:

=> Current flow diagrams, Electrical fault-finding and Fitting locations

Testing wiring connection

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
=> Page 30 .

Test the following wiring connections for open circuits and short to positive or earth.

2-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
2	39

Resistance in wiring: max. 1.5 ω

=> Current flow diagrams, Electrical fault finding and fitting locations binder

- Rectify any open/short circuit as necessary.

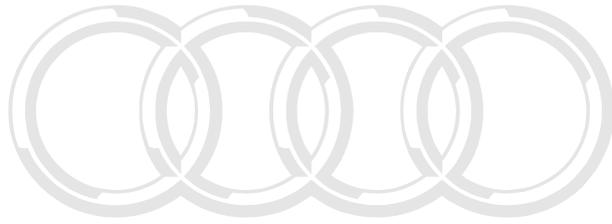
If no open circuits are found in wiring:

- Renew clutch pedal switch.



8 - Testing auxiliary signals

8.1 - Testing auxiliary signals



8.2 - Checking engine speed signal



Note:

The signal is generated by engine speed sender -G28 and processed by the engine control unit.

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To obtain engine speed, proceed as follows:

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 2 .) When doing this the ignition must be switched on.

-> Indicated on display:

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

- Test all control units for a missing rpm signal via the "Automatic test sequence."
- Press the 0 key twice to select "Automatic test sequence" function and confirm entry by pressing 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:

- Test for open circuit or short circuit between engine control unit and the control unit concerned.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

8.3 - Testing air conditioner compressor shut-off

Notes:

- ♦ The air conditioner compressor signal informs the engine control unit that the compressor will be switched on in 140 ms.
- ♦ The engine control unit can send a signal via the same wire to shut off the air conditioner compressor.
- ♦ The engine control unit will shut off the air conditioner compressor in the following circumstances:
 - In emergency running mode (back-up)
 - When a signal is received from the gearbox control unit (kickdown switch)
 - When the "Basic setting" function is started (function 04)

Test conditions

- Air conditioner functioning properly
- No faults recorded in fault memory of engine control unit
- Interior temperature of more than +15°C
- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 2 .) When doing this the engine must be idling.

-> 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 to select Display Group 50 and confirm entry with the Q key.

-> Indicated on display:

Read measured value block 50
Enter display group number XXX

- Check air conditioner compressor shut-off (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
Indicates	Actual engine speed (true value)	Specified engine speed (theoretical value)	Air conditioner require- ment	A/C compressor status
Range			A/C-Low A/C-High	Compr. OFF Compr. ON
Specification			A/C-Low	Compr. OFF

- Switch on the air conditioner by pressing the "Auto" button. The compressor should run (display zone 4).
- Set air conditioner to maximum hot/cold air 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
Indicates	Actual engine speed (true value)	Specified engine speed (theoretical value)	Air conditioner require- ment	A/C compressor status
Range		<small>Protected by copyright. Copying for private or non-commercial purposes, in part or in full, is not permitted unless authorised by AUDI AG. Audi AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by Audi AG.</small>	A/C-Low A/C-High	Compr. OFF Compr. ON
Specification			A/C-High	Compr. ON

- Switch off compressor with controls on A/C operating and display unit.
 - Specification for display zone 4: The display should change from "Compr.ON" to "Compr.OFF".

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

- Switch off ignition.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
=> Page 30 .

Test the following wiring connections for open circuit and/or short to positive or earth.

Test box V.A.G 1598/31, socket	Air conditioner, contact
41	=> Current flow diagrams, Electrical fault finding and Fitting locations binder



Resistance in wiring: max. 1.5 ω

- Rectify any open/short circuit as necessary.
- If there are no faults in the wiring, test operation of air conditioner.

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

8.4 - Testing data exchange between control units

Notes:

- ◆ The data exchange between the various control units is carried out via a data bus.
- ◆ The term "CAN data bus" refers to a system for transmitting and distributing data.
- ◆ The wires which connect the control units and convey the data between them are called data wires.
- ◆ Data is transmitted via data wires in sequence, i.e. in a specific order to the connected control units (e.g. engine rpm and accelerator pedal position).

Testing bus system

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If the fault table instructs you to test the data exchange between the engine control unit, ABS control unit, gearbox control unit and/or dash panel insert:

- Check that multi-pin connectors for control units are properly seated.
- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 2 .)
When doing this the engine must be idling.

-> 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 to select "Display Group 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 data bus messages with ignition on				
Display	Gear. 1	ABS 1		
Indicates	CAN data bus (gearbox control unit)	CAN data bus (ABS control unit)		
Range	1 = OK 0 = not OK	1 = OK 0 = not OK		
Specification	Gear. 1	ABS 1		
Note	If specification is not obtained for one or more control units, perform automatic test sequence.			

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

When a control unit answers with its identification the number of stored faults appears on the display or "No fault recognised".

Any system faults that are stored will be displayed one after the other 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 faults have been stored relating to the "Data bus drive" or to data transmission: "No message from"

- 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 Nos. and coding).

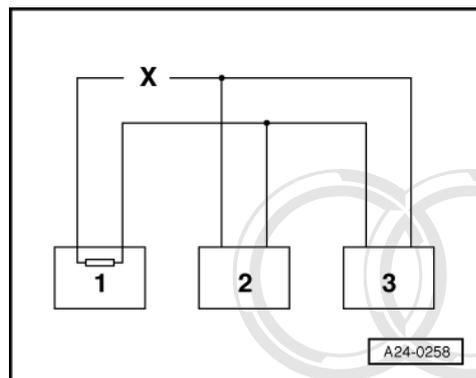
If the correct control units are installed, test the CAN data bus system.

Testing a "two-wire bus system"

Three or more control units communicating via a "two-wire bus system"

- Read out the faults stored in the control units.

This will help to trace a fault in the wiring.



Example 1:

From the faults present in the fault memories, you can see that control unit 1 has no connection to control units 2 or 3.

Control unit	Faults present 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

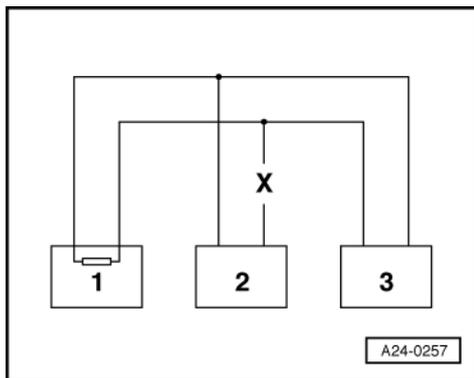
- Switch off ignition.
- Disconnect the control units which are linked by the bus wires and check whether there is an open circuit in one of the bus wires

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

- If no fault can be found in the bus wires replace control unit 1.



Example 2:



From the faults present in the fault memories, you can see that control unit 2 has no connection to control units 1 or 3.

Control unit	Faults present 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 off ignition.
- Disconnect the control units which are linked by the bus wires and check whether there is an open circuit in one of the bus wires

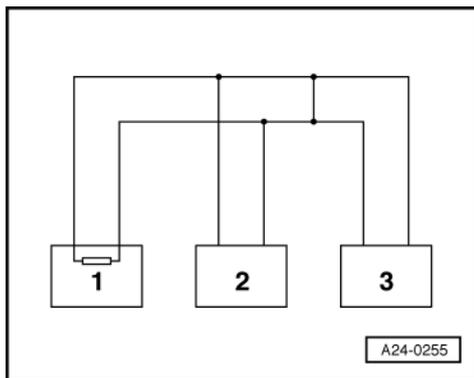
=> Current flow diagrams, Electrical fault finding and Fitting locations binder

- If no fault can be found in the bus wires replace control unit 2.

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Example 3:

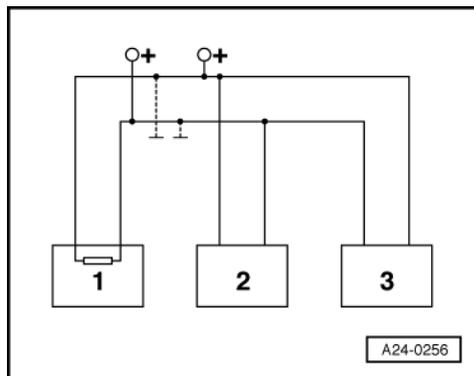
From the faults present in the fault memories, you can see that none of the control units are able to transmit or receive signals.



Control unit	Faults present in fault memory:
1	- Data bus drive defective
2	- Data bus drive defective
3	- Data bus drive defective

- Switch off ignition.

- -> Disconnect the control units which 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 the cause of the fault "Data bus drive defective" cannot be found in the data bus wires, check whether one of the control units is causing the fault.

At this stage all the control units which communicate via the CAN data bus are disconnected. The ignition is switched off.

- Connect one of the control units.
- Connect fault reader V.A.G 1551. Switch on the ignition and erase the fault memory of the control unit which has just been connected. End output from fault reader with 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 the fault "Data bus drive defective" is not indicated, connect the next control unit, and repeat the above procedure.

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28 - Ignition system

1 - Testing ignition system

1.1 - Testing ignition system

1.2 - General notes on ignition system

- ◆ The engine control unit is equipped with self diagnosis.
- ◆ For trouble-free operation of the electrical components a voltage of at least 11.5 V is necessary.
- ◆ During some of the tests it is possible that the control unit will detect and record a fault. The fault memory must therefore be interrogated and if necessary erased when all tests and repair work have been completed.
- ◆ After completing fault finding, repairs or component tests, it is possible that the engine will start, run for a short period and then cut out. If this happens it may be that the immobilizer is blocking the engine control unit. In such cases the fault memory must be interrogated and if necessary the control unit must be adapted.

1.3 - Safety precautions

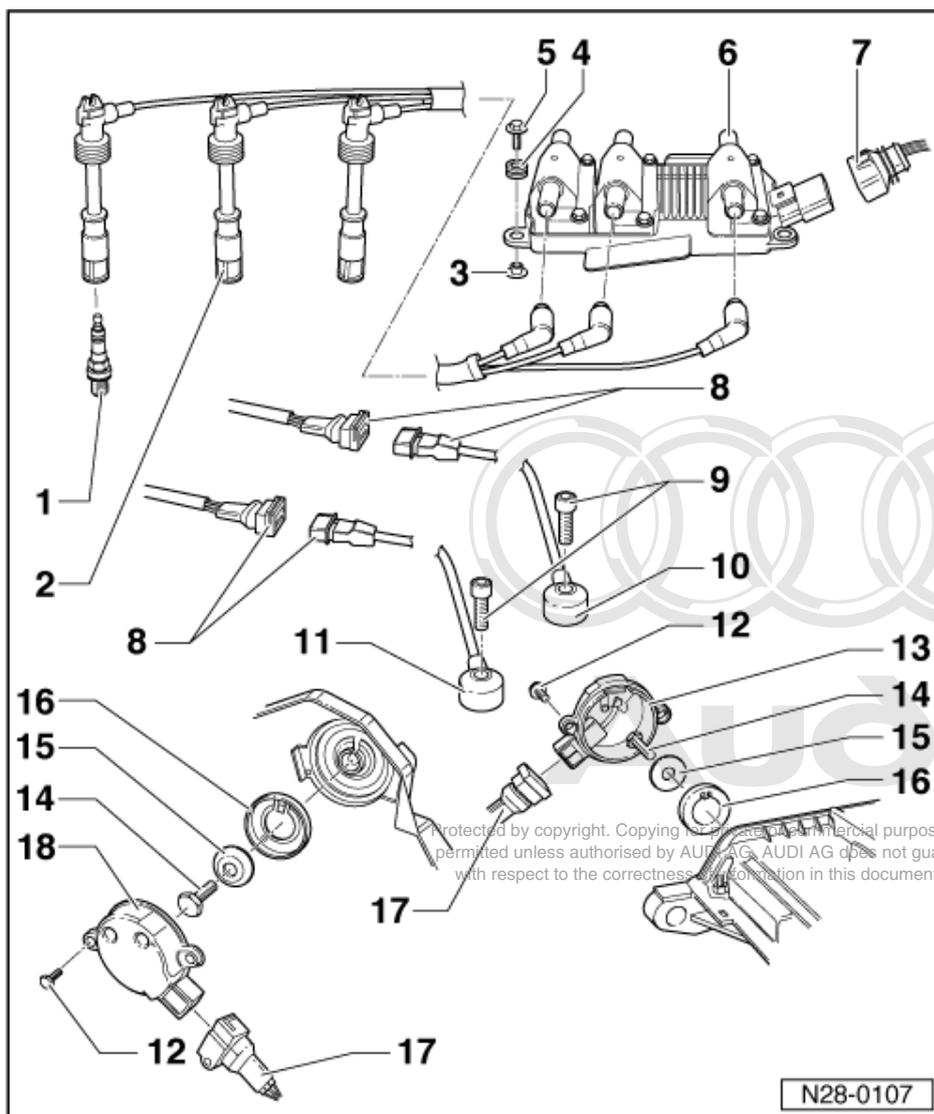
To prevent injuries to persons and/or damage to the fuel injection and ignition system, the following must be noted:

- ◆ Do not touch or disconnect ignition wiring when the engine is running or being turned at starter speed.
- ◆ The ignition must be switched off before connecting or disconnecting injection or ignition system wiring or tester cables.
- ◆ In order to run the engine at starting speed without actually starting it (e.g. to test compression), unplug the connectors from the output stages of the ignition coils and from all the injectors. After completing the work, interrogate and erase the fault memory.
- ◆ The ignition must always be switched off when cleaning the engine.
- ◆ Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.

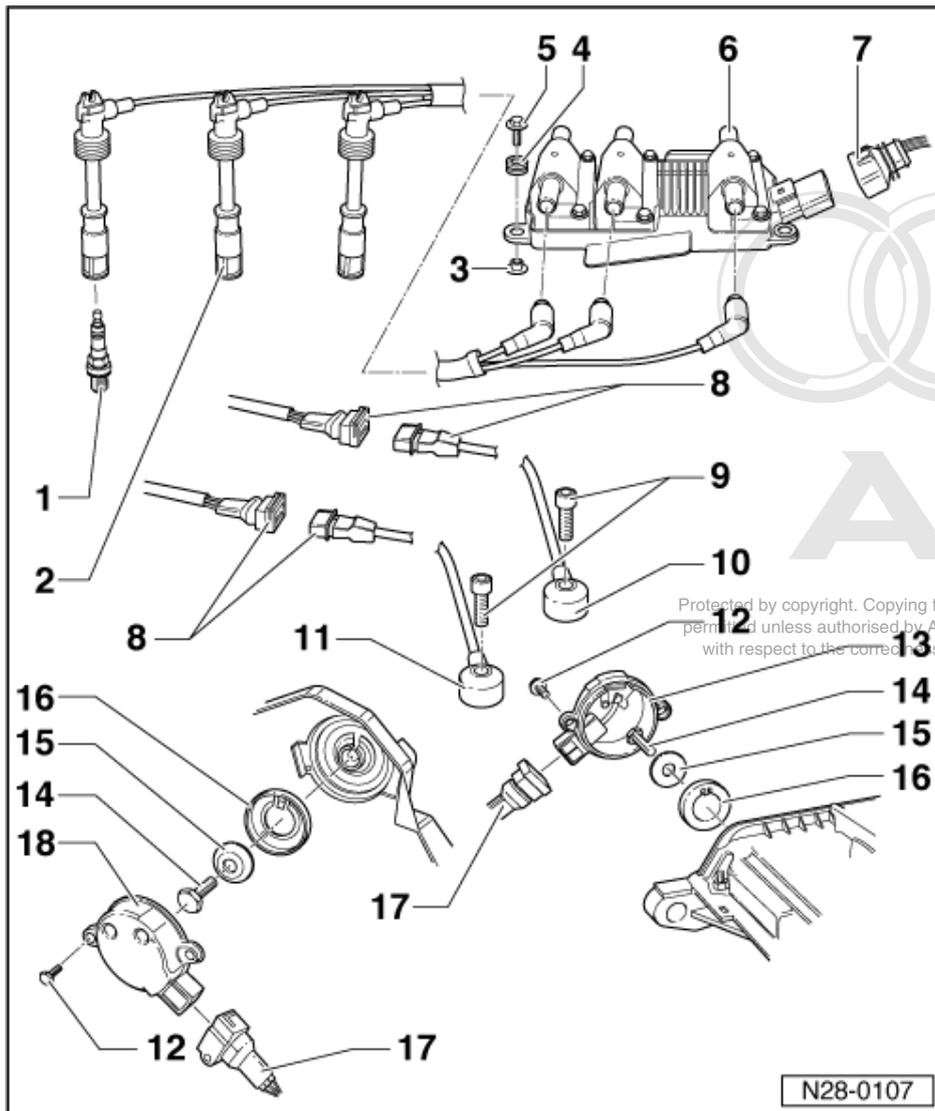
1.4 - Technical data for ignition system

Engine code letters	AQD (2.8ltr. /5V/142 kW with secondary air system) APR (2.8ltr. /5V/142 kW without secondary air system)
Idling speed Not adjustable - controlled by the idling speed stabilisation	650 ... 750 rpm
Engine speed limited - by closing throttle valve - by shutting off injectors	approx. 6600 rpm approx. 6800 rpm
Ignition timing is determined by the control unit. Ignition timing cannot be adjusted.	
Ignition system	Dual-spark system with three coils
Spark plugs	Tightening torque 30 Nm
Firing order	1-4-3-6-2-5

1.5 - Removing and installing parts of the ignition system



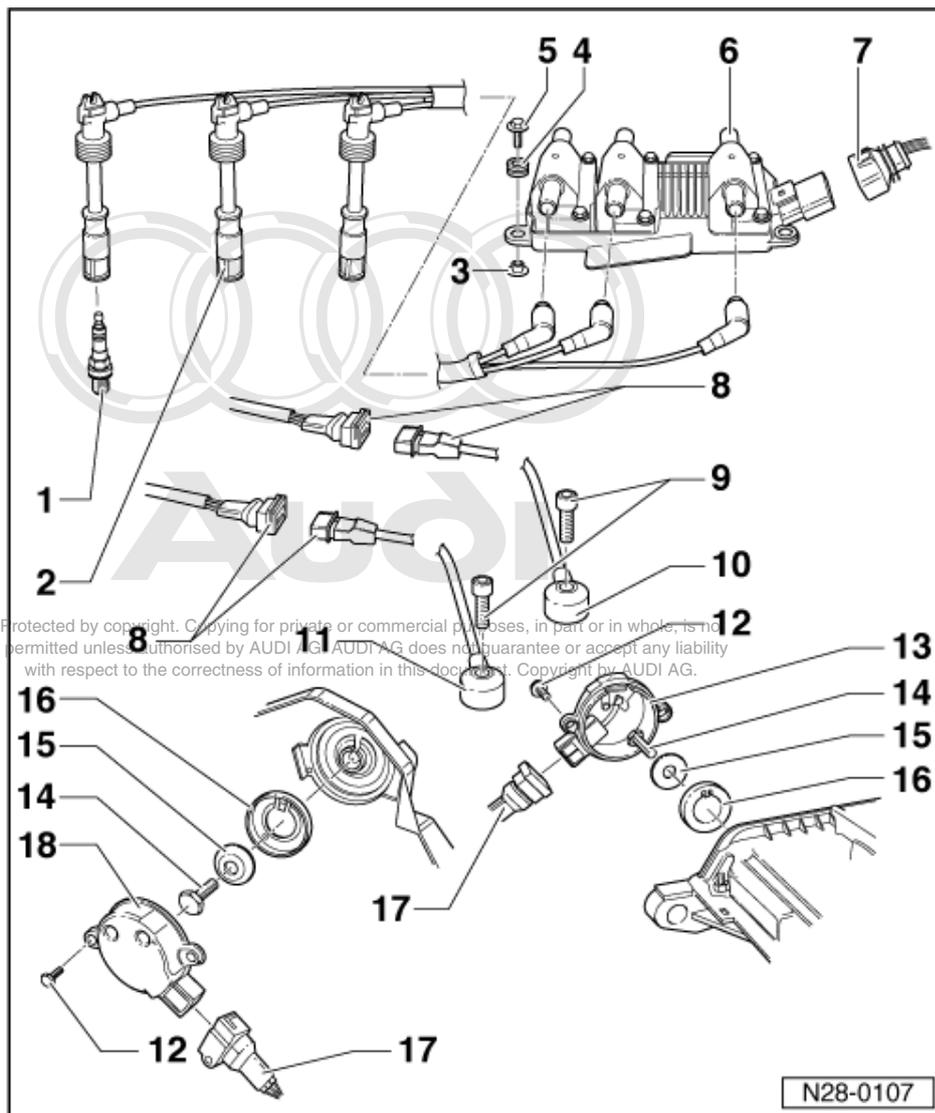
- 1 Spark plug, 30 Nm
 - ◆ Remove and install with 3122B
- 2 Spark plug connector
- 3 Spacer sleeve
- 4 Rubber grommet
- 5 10 Nm
- 6 Ignition coils -N, -N128 and -N158
 - ◆ With output stage -N122
 - ◆ With ignition cable identification, do not interchange



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- 7 Connector**
 - ◆ Black, 5 pin
- 8 3-pin connector for knock sensors**
 - ◆ Contacts gold plated
- 9 20 Nm**
 - ◆ Tightening torque influences the function of the knock sensor
- 10 Knock sensor 2, -G66**
 - ◆ Cylinder bank 2
 - ◆ Sensor and connector contacts are gold-plated
- 11 Knock sensor 1, -G61**
 - ◆ Cylinder bank 1
 - ◆ Sensor and connector contacts are gold-plated
- 12 10 Nm**

N28-0107



- 13 Hall sender -G40
 ♦ Cylinder bank 2
- 14 25 Nm
- 15 Washer
 ♦ Conical
- 16 Rotor ring
 ♦ For Hall sender
 ♦ When installing note fixing arrangement
- 17 Connector
 ♦ Black, 3-pin
 ♦ For Hall sender -G40 or -G163
- 18 Hall sender -G163
 ♦ Cylinder bank 1

1.6 - Testing ignition coils

Notes:

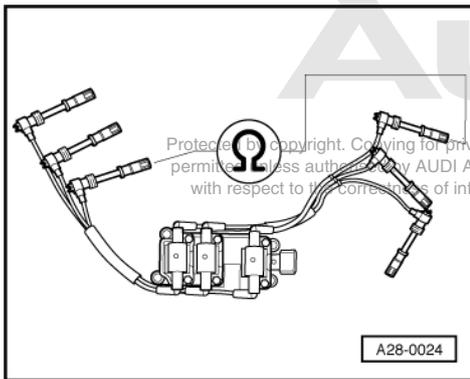
- ♦ The ignition coils and the output stage are combined as a single component.
- ♦ The primary resistance of the ignition coils cannot be measured.



- ♦ The secondary resistance must first be measured between the spark plug connectors for the relevant cylinders, without disconnecting the ignition cables from the ignition coils. This measurement also includes the interference-suppression resistance in the ignition cables.
- ♦ Fitting location => Page 23 .
- Unplug 5-pin connector from ignition coils.

Testing ignition coils -N, -N128 and -N158

- Disconnect ignition cables from spark plugs.

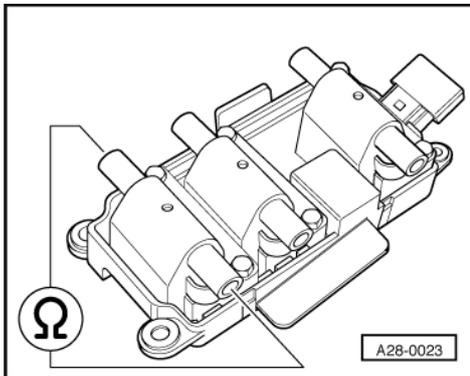


- -> Connect hand-held multimeter V.A.G 1526 between the two spark plug connectors for the ignition circuit which is to be tested.

Specification: 16 ... 27 k Ω for each measurement

If specifications are not obtained:

- Disconnect the ignition cables from the ignition coils and then measure the resistance in the cables and the coils separately.



- -> Connect hand-held multimeter V.A.G 1526 between the two ignition cable connections on the ignition coil which is to be tested.

Specification: 8.0 ... 14.0 k Ω for each measurement

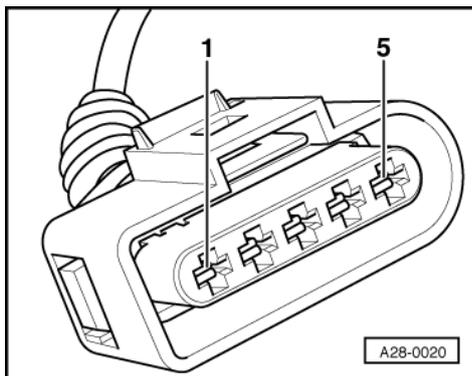
- Connect hand-held multimeter V.A.G 1526 between the two connections on the ignition cable which is to be tested.

Specification: 3.0 ... 7.0 k Ω for each measurement

If specifications are still not obtained:

- Renew defective components.

Testing earth connection to output stage



- -> Connect diode test lamp V.A.G 1527 between battery positive terminal and contact 2 (earth) on the connector.

Specification: The diode test lamp should light up.

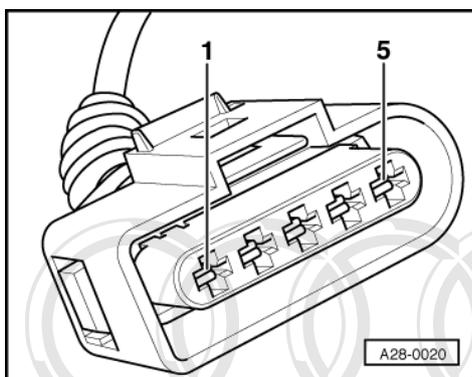
- If the diode test lamp does not light up, test wiring using current flow diagram and rectify any open circuits.

=> Current flow diagrams, Electrical fault-finding and Fitting locations

Testing power supply to ignition coils

Test requirement:

- Fuse for ignition coils OK



- -> Connect diode test lamp V.A.G 1527 between engine earth and contact 1 (positive) on the connector.
- Operate starter for a few seconds.

Specification: The diode test lamp should light up.

Note:

The supply voltage for the ignition coils is taken from the fuel pump relay.

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If specified results are not obtained, test for open circuit using current flow diagram. Rectify any open circuits and test the fuse.

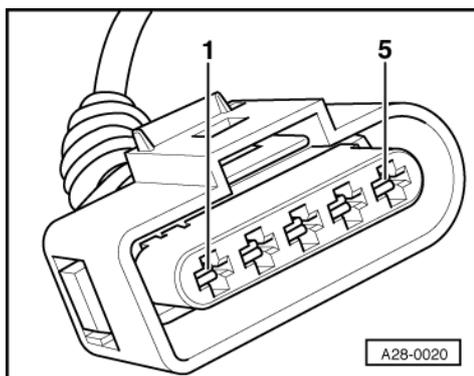
=> Current flow diagrams, Electrical fault-finding and Fitting locations

Testing activation

- Unplug connectors from all six injectors (interrogate fault memory after testing).



- Switch ignition on.



- -> Connect diode test lamp between engine earth and contacts 3, 4 and 5 in turn.
- Operate starter for a few seconds.

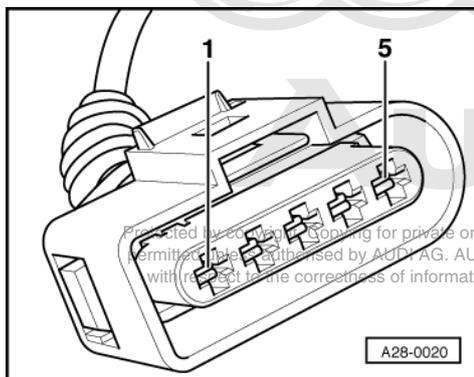
Specification: The diode test lamp should light up or flash.

If the diode test lamp does not flash:

- Test wiring

Testing wiring

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
=> Page 30 .



- -> Test wiring connection from 5-pin connector on ignition coil ...
- ... to engine control unit for open circuit and short circuit to positive or earth.

Contact on 5-pin connector for output stage	Contact on control unit connector
3	102
4	103
5	94

- Rectify any open circuits or short circuits.
- If no open circuit or short circuit to earth is found, fit a new engine control unit.
=>Page 31

1.7 - Testing engine speed sender -G28

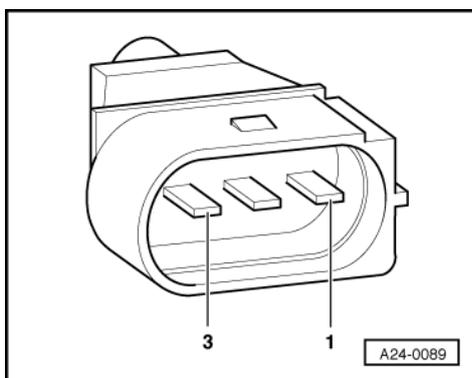
Note:

- ◆ The engine speed sender is a combined speed sender and reference mark sender. Without a signal from the -G28 the engine cannot be started. If the signal from the -G28 fails while the engine is running, the engine will cut out immediately.

Testing engine speed sender

Fitting location of sender and connector
=> Page 23 .

- Before carrying out the test, make sure that the sender is correctly installed and firmly seated.
- Unplug connector for engine speed sender (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.

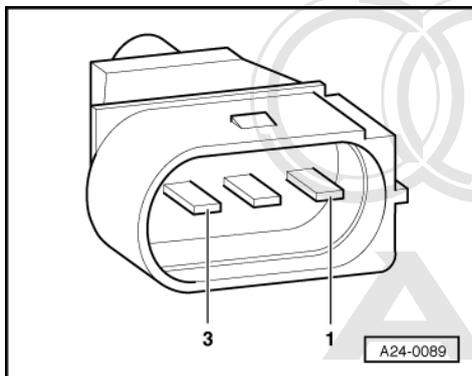
Specification: approx. 730...1000 ω

Note:

The resistance value for the engine speed sender is based on a temperature of 20 °C.

The resistance increases as the temperature rises.

If the specification is not attained:



- Fit a new engine speed sender.

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If the specification is attained:

- -> Connect hand-held multimeter V.A.G 1526 (resistance test range) between contacts 2 and 1 (earth) and between contacts 3 and 1 (earth).



Specification: $\infty\omega$ (infinity / open circuit) in each test

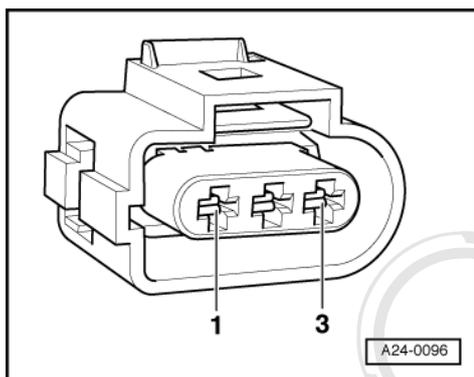
If the specification is not attained:

- Fit a new engine speed sender.

If the specification is attained:

- Test the wiring between the sender connector and the engine control unit as follows:

Testing wiring



- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
=> Page 30 .
- -> Test wiring connection from 3-pin connector (sender connector) ...
- ... to engine control unit for open circuit and/or short circuit to positive or earth.

3-pin connector on wiring harness, contact	Socket on test box V.A.G 1598/31
1 (screening)	108
2 (earth wire)	90
3 (signal wire)	82

Resistance in wiring: max. 1.5 ω

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

- Rectify any open/short circuit as necessary.

If no faults are found in the wiring:

- Slowly rotate the engine and check that sender wheel has no run-out and is securely mounted.
- If no faults have been found in any of the tests so far, fit a new engine control unit=>Page 31 .

1.8 - Checking control unit voltage 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 vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 2 .)
When doing this the engine must be idling.

-> 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 to select Display Group 4 and confirm entry with Q key.

-> Indicated on display:

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

- Check display readout for battery voltage in display zone 2.

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Display zones				
	1	2	3	4
Display Group 4: Battery voltage with engine idling				
Display	xxxx rpm	xx.xxx V	xxx.x °C	xxx.x °C
Indicates	Engine speed	Battery voltage	Coolant temperature	Intake air temperature
Range	min.: 550 rpm max.: 6800 rpm	min.: 0.000 V max.: 16.500 V		
Specification	xxxx rpm	12.000...14.000 V	80.0...105.0 °C	Between ambient temperature and 90 °C
Note		If specification is not obtained => Page 103 , Reading display zone 2		

Reading Display Group 4

Display zone 2	Possible cause of fault	Fault remedy
Readout fluctuates between 10.000 and 14.000 V	- Loose contact	- Test voltage supply from terminals 15 and 30 => Page 103 (below)
0.000...10.000 V	- Battery discharged / defective - Voltage regulator defective	- Test voltage supply from terminals 15 and 30 => Page 103 (below) Test battery Test voltage regulator Test alternator
14.000...16.500 V	- Voltage regulator defective - Alternator defective	- Test voltage regulator Test alternator

Testing voltage supply from terminals 15 and 30

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.



=> Page 30 .

- Connect hand-held multimeter V.A.G 1526 (voltage measurement range) to the following sockets on the test box:

Voltage supply from terminal 15

	Socket	Specification
Ignition on	1 (earth) + 3 (positive)	approx. battery voltage
Ignition on	2 (earth) + 3 (positive)	approx. battery voltage

Voltage supply from terminal 30

	Socket	Specification
Ignition off	1 (earth) + 62 (positive)	approx. battery voltage
Ignition off	2 (earth) + 62 (positive)	approx. battery voltage

If the specifications are not obtained:

- Check the wiring.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

1.9 - Testing knock sensor control limit

If the fault message "Knock sensor - control limit reached" is recorded in the fault memory the following tests must be carried out:

	Possible cause of fault	Fault remedy
Fault message relating to all cylinders or fault message relating to all cylinders on one bank	- Poor fuel quality	- Change to higher quality fuel (see Owner's Manual)
	- Wrong tightening torque used on knock sensor	- Slacken knock sensor and tighten to 20 Nm
	- Knock sensor defective	- Test knock sensor => Page 104 .
	- Corrosion on connector	
	- Loose components on engine	- Secure loose components
Fault message relating to one cylinder	- Mechanical engine fault	- Test compression pressure
	- Loose components on engine	- Secure loose components

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1.10 - Testing knock sensors-G61and-G66**Notes:**

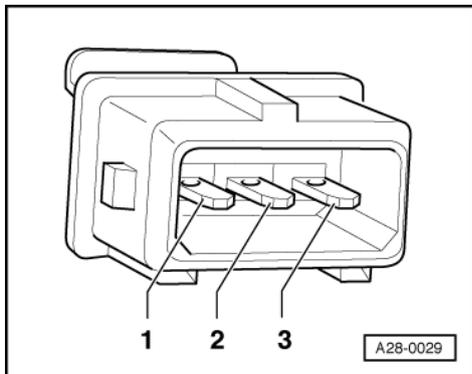
- ♦ It is not possible to carry out an electrical test of the knock sensors themselves. The test is performed using the function "Interrogate fault memory" => Page 4 .
- ♦ To ensure that the knock sensors function properly it is important to keep exactly to the specified tightening torque of 20 Nm.
- ♦ Use only gold-plated contacts when repairing the contacts in the plug connectors for the knock sensors.

- ◆ Check for corrosion in connection between knock sensor and wiring harness.

Testing knock sensors

Fitting location of connectors => Page 23 .

- Unplug the connector for the relevant knock sensor in the engine compartment.



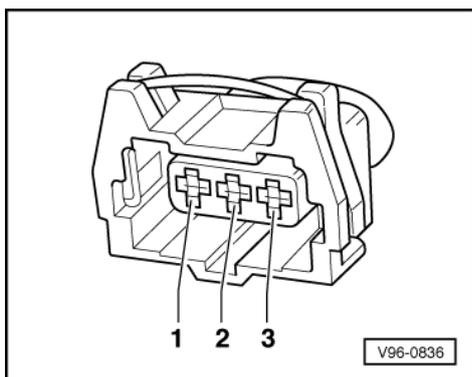
- -> Test for short circuits between all three contacts in the knock sensor connector (contacts 1+2, 1+3 and 2+3).

Specification: There must be no contact between the wires (infinity ω).

- If there is any contact between the wires, fit a new knock sensor.
- If there is no short circuit, test wiring for knock sensors.

Testing wiring between knock sensors and engine control unit

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
=> Page 30 .



- -> Test wiring connection from the relevant sensor connector ...
- ... to engine control unit for open circuit and/or 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

Resistance in wiring: max. 1.5 ω

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

- Rectify any open/short circuit as necessary.

1.11 - Testing Hall senders-G40and-G163

The Hall sender indicates the ignition position for Cylinder 1.

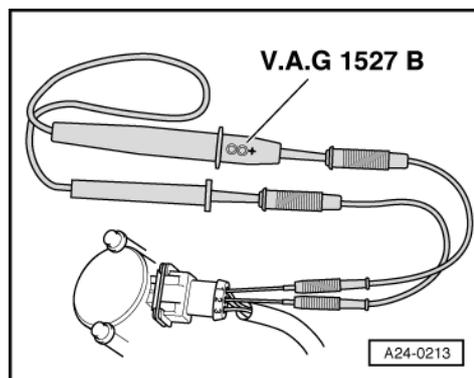
If the Hall sender fails to function, the knock control is switched off and the ignition timing is retarded slightly because the signals can no longer be assigned to the cylinders.

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- ♦ When a fault is detected the engine control unit produces one spark per crankshaft revolution for each cylinder.
- ♦ The fact that the injection system is one revolution out of phase does not have any noticeable effect on the fuel injection. The fuel is injected upstream of 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 -G40 is located at the rear of the left-hand cylinder head (Bank 2).
- ♦ Hall sender -G163 is located at the front of the right-hand cylinder head (Bank 1).
- ♦ Fitting locations of Hall senders =>Page 23 .

**Testing activation of Hall sender**

Use test leads from adapter set V.A.G 1594 when carrying out the following tests.

- Push back rubber sleeve on the relevant Hall sender connector.
- -> Connect diode test lamp V.A.G 1527 to contacts 1 and 2 of the Hall sender connector from behind (without unplugging the connector from the Hall sender).

Note:

The connector contacts are numbered on the back of the connector.

- Operate starter for a few seconds.

The diode test lamp should flash briefly once every two engine revolutions.

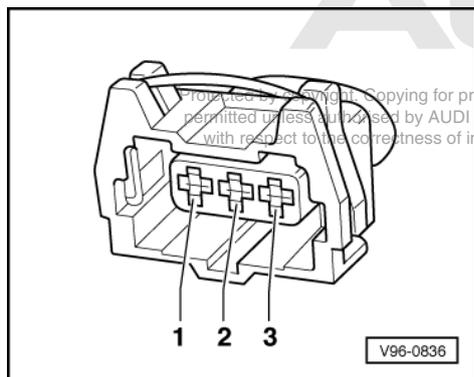
Note:

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 the diode test lamp does not flash, test the voltage supply.

Test voltage supply for Hall sender:

- Unplug connector from the relevant Hall sender.
- Switch ignition on.



- -> Connect hand-held multimeter V.A.G 1526 (voltage measurement range) between engine earth and socket 1 of connector.

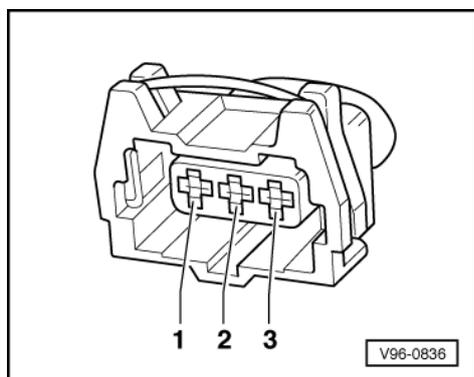
Specification: approx. 5 V

Testing signal wire for Hall sender:

- Switch ignition on.
- -> Connect hand-held multimeter V.A.G 1526 (voltage measurement range) between engine earth and socket 2 of relevant connector.

Specification: approx. battery voltage

Testing earth connection for Hall sender:



- -> Connect hand-held multimeter V.A.G 1526 (resistance measurement range) between socket 3 on connector and engine earth.

Specification: Continuity



Resistance in wiring: max. 1.5 ω

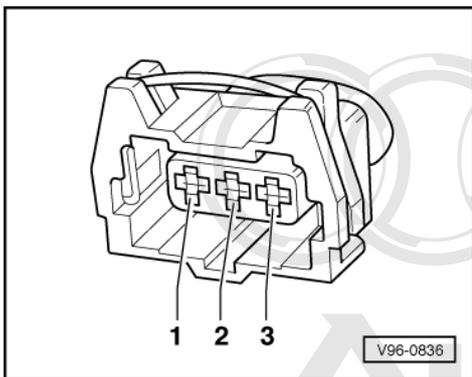
If all the readouts match the specifications but the diode test lamp does not flash (measurement taken between contacts 1 and 2 without unplugging connector and while operating starter):

- Renew the relevant Hall sender.

If the readouts do not match the specification, test the wiring.

Testing 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 to the engine control unit itself.
=> Page 30 .



- -> Test wiring connection from Hall sender
- to engine control unit for open circuit and/or short circuit to positive or earth.

Hall sender -G40 (Bank 2) Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

3-pin connector on wiring harness, socket	Test box V.A.G 1598/31, socket
1 (positive)	98
2 (signal)	86
3 (earth)	108

Hall sender -G163 (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

Resistance in wiring: max. 1.5 ω

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

- Rectify any open/short circuit as necessary.
- If all the test results so far have been OK but a fault related to the camshaft sensor (Hall sender) is displayed again after erasing the fault memory as a test measure, the cause may be as follows:
 - Rotor ring for Hall sender misaligned; test phase position.

Testing phase position of Hall sender

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 2 .)

When doing this the engine must be idling.

-> 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 to select Display Group 93 and confirm entry with Q key.

-> Indicated on display:

Read measured value block 93 1 2 3 4
--

- Check display values for Hall senders.

	Display zones			
	1	2	3	4
Display Group 93: Phase positions of Hall senders (Bank 1 and Bank 2) with engine idling				
Display	xxx rpm	xx %	$0 \pm 6^\circ$ crankshaft	$0 \pm 6^\circ$ crankshaft
Indicates	Engine speed	Engine load	Phase position Bank 1	Phase position Bank 2
Range	min.: 550 rpm max.: 6800 rpm	min.: 0 % max.: 100 %	-20.3...14.8 ° crankshaft	-20.3...14.8 ° crankshaft
Specification	650...750 rpm	12...26 %	$0 \pm 6^\circ$ crankshaft	$0 \pm 6^\circ$ crankshaft
Note	If the readouts do not match the specifications, unbolt the Hall sender and check whether the rotor ring is properly mounted on the camshaft. If it is not properly mounted, the retainer lug will be squashed flat when the securing bolt is tightened. - Also check the engine timing. => Engine, Mechanics; Repair group 13; Crankshaft group, Removing and installing ribbed belt, Removing and installing toothed belt Crankshaft group, Removing and installing ribbed belt, Removing and installing toothed belt			



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