

Audi A3 1997 ➤

Motronic injection and ignition system (4-cyl. turbo)								
Engine ID	AJQ	APP	AQA	ARZ				

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

Audi A3 1997 ➤

Motronic injection and ignition system (4-cyl. turbo)

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 Safety precautions	1
1.4 Connecting vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and selecting functions	1
2 Interrogating and erasing fault memory	4
2.1 Interrogating and erasing fault memory	4
2.2 Fault table	5
3 Final control diagnosis	14
3.1 Final control diagnosis	14
4 Basic setting	18
4.1 Basic setting	18
5 Coding control unit	19
5.1 Coding control unit	19
5.2 Coding table	20
6 Reading measured value block	20
6.1 Reading measured value block	20
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	24
1.6 Dismantling and assembling air cleaner	35
1.7 Wiring and component check with test box V.A.G 1598/31	36
1.8 Renewing engine control unit	38
1.9 Testing idling speed	39
1.10 Checking system pressure, fuel pressure regulator and holding pressure	41
1.11 Testing injectors	44
1.12 Dismantling and assembling fuel rail with injectors	49
1.13 Removing and installing injectors	52
1.14 Checking injection quantity, leak-tightness and spray pattern of injectors	54
1.15 Testing fuel pump relay -J17 and activation	56
1.16 Testing air mass meter -G70	60
1.17 Checking intake air system for leaks (unmetered air)	64
2 Testing lambda control	66
2.1 Testing lambda control	66
2.2 Function of lambda control (before catalytic converter)	66
2.3 Testing lambda probe and lambda control (before catalytic converter)	67
2.4 Testing lambda probe and lambda control (after catalytic converter) - not on vehicles with engine code letters AJQ, AQA	73
2.5 Testing lambda probe heating -Z19 and -Z29 at lambda probes (before and after catalytic converter)	78
2.6 Removing and installing lambda probe	82
3 Testing secondary air system-not on vehicles with engine code letters AJQ, AQA	84
3.1 Testing secondary air system-not on vehicles with engine code letters AJQ, AQA	84
3.2 Testing secondary air inlet valve -N112	87
3.3 Testing secondary air pump relay -J299 and activation	90
4 Testing fuel tank breather	96



4.1	Testing fuel tank breather	96
4.2	Testing solenoid valve 1 for activated charcoal filter -N80	96
5	Testing electronic engine power control (electronic throttle)	100
5.1	Testing electronic engine power control (electronic throttle)	100
5.2	Operation of electronic throttle system	100
5.3	Notes on EPC warning lamp (fault warning lamp for electronic throttle) in dash panel insert	101
5.4	Testing electronic throttle warning lamp -K132	102
5.5	Testing throttle valve control part -J338	103
5.6	Performing adaption of throttle valve control part	104
5.7	Testing angle senders for throttle valve drive	106
5.8	Testing accelerator position senders	110
5.9	"Learning" kickdown function	114
6	Testing auxiliary signals	116
6.1	Testing auxiliary signals	116
6.2	Checking engine speed signal	117
6.3	Testing fuel consumption signal for on-board computer	117
6.4	Testing speed signal	117
6.5	Testing air conditioner compressor shut-off	118
6.6	Testing brake light switch and brake pedal switch	119
6.7	Testing clutch pedal switch -F36	122
6.8	Testing power steering pressure switch -F88	124
6.9	Testing crash signal wiring - Vehicles from model year 2000 >	126
6.10	Testing data exchange between engine control unit, gearbox control unit, ABS/EDL control unit and airbag control unit or dash panel insert	127
7	Vacuum system layout	131
7.1	Vacuum system layout	131
28 - Ignition system	Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorized by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.	135
1	Testing ignition system	135
1.1	Testing ignition system	135
1.2	General notes on ignition system	135
1.3	Safety precautions	135
1.4	Technical data	135
1.5	Testing ignition coils with output stages	136
1.6	Testing Motronic current supply relay -J271 - Vehicles model year 2000 >	141
1.7	Testing intake air temperature sender -G42	146
1.8	Testing engine speed sender -G28	149
1.9	Testing coolant temperature sender -G62	152
1.10	Testing voltage supply for control unit	156
1.11	Testing knock sensor control limit	158
1.12	Testing knock sensors	159
1.13	Testing Hall sender -G163	162

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 data transfer between the control unit and vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) is carried out in "Rapid data transfer" mode.
- ◆ 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 the EPC warning lamp in the dash panel insert (EPC = electronic power control).

1.3 - Safety precautions

Note the following points if test equipment has to be used during a road test:

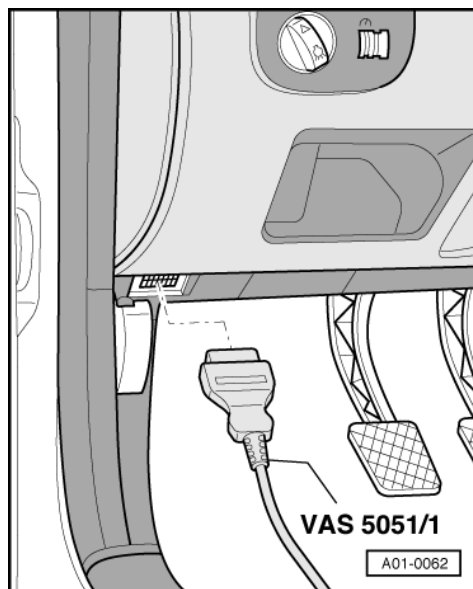
Warning

- ◆ Test equipment must always be secured on the rear seat and operated from the rear seat by a second person.
- ◆ If test equipment is operated from the front passenger seat, the occupant could be injured by the passenger's airbag in an accident.

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

Requirements for test:

- Fuses for engine electronics OK.
- Battery voltage not less than 11 V
- Earth connections on engine and gearbox OK



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Work sequence

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

Warning

Observe safety precautions => Page **1** .

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 in display

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

- 1) appears alternately

Note:

If the display remains blank:

=> Fault reader operating instructions

Depending on the function required, see table of selectable functions => Page **4** .

- Switch on ignition.

or

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

-> When this display appears:

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).

- Press keys 0 and 1 for address word "Engine electronics" and confirm entry with Q key.

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

06A906018S 1.8l R4/5VT G
0005
Coding 05500 WSC 12345

Note:

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

Control unit identification (example)

- 06A906018S Part No.
=> Parts list
- 1.8 ltr. Engine capacity
- R4/5VT In-line engine, 4 cylinders,
5 valves per cylinder, turbo
- "G" With cruise control (G)
- or no display or without cruise control
- 0005 Software version in control unit
- Coding 05500 Control unit coding
- WSC 12345 Workshop Code of V.A.G 1551 which
was used to perform the last coding

- Press =>key.

-> Indicated on display (function selection):

Rapid data transfer HELP
Select function XX

Notes:

- ♦ By entering "01" ("Interrogate control unit version") and confirming with the Q key, the control unit identification can be displayed again.

Rapid data transfer HELP
Control unit does not answer

-> Indicated on display:

- Perform fault-finding procedure as described in "Fault-finding programme: diagnostic wiring".

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

Rapid data transfer HELP
K wire not switching to earth

Rapid data transfer HELP
K wire not switching to positive

Rapid data transfer HELP
Fault in communication build-up

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Selectable functions

Vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551		Ignition on, engine not running	Engine idling	Vehicle being driven	Page
Address words					
01	Engine electronics	Yes	Yes	Yes	1
00	Automatic test sequence	Yes	Yes	Yes	3
Functions					
01	Interrogate control unit version	Yes	Yes	Yes	3
02	Interrogate fault memory	Yes	Yes	Yes	4
03	Final control diagnosis	Yes	No	No	14
04	Basic setting	No	Yes	No	18
05	Erase fault memory	Yes	Yes	Yes	4
06	End output	Yes	Yes	Yes	5
07	Code control unit	Yes	No	No	19
08	Read measured value block	Yes	Yes	Yes	20

2 - Interrogating and erasing fault memory

2.1 - Interrogating and erasing fault memory

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- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 1).
When doing this the engine must be running at idling speed.

Note:

If the engine does not start, turn the engine over for at least 5 seconds using the starter. After doing this, do not switch off the ignition.

-> Indicated on display:

Rapid data transfer HELP
Select function XX

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

-> Indicated on display:

No fault recognised

- Press =>key.

or

-> Indicated on display:

X faults recognised

If the printer on the fault reader is switched on the stored faults will be displayed and printed out in sequence.

- Locate and eliminate faults printed out as per fault table
=> Page 5 .
- Press =>key.

-> Indicated on display:

Rapid data transfer HELP
Select function XX

- Press keys 0 and 5 for the function "Erase fault memory" and confirm entry with Q key.

Notes:

-> Indicated on display:

Attention!
Fault memory is not interrogated

This means that the proper sequence of steps was not followed.

- Interrogate fault memory.

In the following cases the fault memory is not erased:

- ◆ If the ignition was switched off after interrogating the fault memory
- ◆ If an existing static fault was not rectified

-> Indicated on display:

Rapid data transfer
Fault memory is erased!

- Press =>key.
- After completing repair work, interrogate the fault memory again.

Note:

This has the effect of erasing any faults that may have been stored while carrying out repairs (e.g. as a result of unplugging connectors).

End output

-> Indicated on display:

Rapid data transfer HELP
Select function XX

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

-> Indicated on display:

Rapid data transfer HELP
Insert address word XX

- Switch off ignition and unplug the diagnostic connector.

2.2 - Fault table

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 warning lamp in the dash panel insert (EPC = Electronic Power Control).
- ◆ 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 should not be renewed immediately.
 - Always start by checking the wiring and connectors for the component using the current flow diagram.
 - Also test the earth connections 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).
- ◆ 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 which case it should be left to idle for a few minutes until the learning process has been completed.

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P0101	16485	Air mass meter -G70 Implausible signal	Test air mass meter => Page 60
P0102	16486	Air mass meter -G70 Signal too small	
P0103	16487	Air mass meter -G70 Signal too large	
P0106	16490	Intake manif. press./air press. => -G71/-F96 1) Implausible signal	=> 4-cylinder engine (5-valve turbo), Mechanics; Repair group 21; Charge air system with turbocharger; Testing charge pressure sender -G31 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.
P0107	16491	Intake manif. press./air press. => -G71/-F96 1) Signal too small	
P0108	16492	Intake manif. press./air press. => -G71/-F96 1) Signal too large	
P0112	16496	Intake air temp. sender -G42 Signal too small	- Test intake air temperature sender => Page 146
P0113	16497	Intake air temp. sender -G42 Signal too large	

1) The intake manifold pressure is measured by charge pressure sender -G31 (not by -G71 as indicated on the display). The air pressure is measured by altitude sender -F96 (in the engine control unit).

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P0116	16500	Coolant temp. sender -G62 Implausible signal	- Test coolant temperature sender => Page 152
P0117	16501	Coolant temp. sender -G62 Signal too small	
P0118	16502	Coolant temp. sender -G62 Signal too large	
P0130	16514	Bank 1, Probe 1 Electrical fault in current circuit	- Test lambda control => Page 66
P0131	16515	Bank 1, Probe 1 Voltage too low	
P0132	16516	Bank 1, Probe 1 Voltage too high	
P0133	16517	Bank 1, Probe 1 Signal too slow	
P0134	16518	Bank 1, Probe 1 No activity	

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

Fault code		Readout on fault reader display	Fault rectification
P0136	16520	Bank 1, Probe 2 Electrical fault in current circuit	- Test lambda probe and lambda control (after catalytic converter) => Page 73
P0137	16521	Bank 1, Probe 2 Voltage too low	
P0138	16522	Bank 1, Probe 2 Voltage too high	
P0139	16523	Bank 1, Probe 2 Signal too slow	
P0140	16524	Bank 1, Probe 2 No activity	
P0236	16620	Charge pressure sender -G31 Implausible signal	=> 4-cylinder engine (5-valve turbo), Mechanics; Repair group 21; Charge air system with turbocharger; Testing charge pressure sender -G31
P0237	16621	Charge pressure sender -G31 Signal too small	
P0238	16622	Charge pressure sender -G31 Signal too large	

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P0321	16705	Engine speed sender -G28 Implausible signal	- Test engine speed sender =>Page 149
P0322	16706	Engine speed sender -G28 No signal	
P0327	16711	Knock sensor 1 -G61 Signal too small	- Test knock sensor => Page 159
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	
P0346	16730	Bank 1, Camshaft pos. sensor => -G163 Implausible signal	- Test Hall sender => Page 162

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P0411	16795	Secondary air system Through-flow defective	- Check secondary air system => Page 84
P0501	16885	Vehicle speed signal Implausible signal	- Test vehicle speed signal=> Page 117
P0506	16890	Idling speed control Revs below specification	- Test throttle valve control part => Page 103
P0507	16891	Idling speed control Revs above specification	
P0560	16944	Voltage supply Implausible signal	- Test voltage supply to control unit => Page 156
P0562	16946	Voltage supply Voltage too low	
P0563	16947	Voltage supply Voltage too high	



Fault code		Readout on fault reader display	Fault rectification
P0571	16955	Brake light switch -F 1) Implausible signal	- Test brake light switch and brake pedal switch => Page 119

1) The system monitors both brake light switch -F and brake pedal switch -F47.

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P0601	16985	Control unit defective	- Renew engine control unit => Page 38
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 78
P1105	17513	Bank 1 - Probe 2, Heating element circuit Short to Positive	
P1111	17519	Lambda control, Bank1 System too lean	- Test lambda control => Page 66
P1112	17520	Lambda control, Bank1 System too rich	

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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 78
P1114	17522	Bank 1, Probe 2 Internal resistance too great	
P1115	17523	Bank 1 - Probe 1, Heating element circuit Short to Earth	
P1116	17524	Bank 1 - Probe 1, Heating element circuit Open circuit	
P1117	17525	Bank 1 - Probe 2, Heating element circuit Short to Earth	
P1118	17526	Bank 1 - Probe 2, Heating element circuit Open circuit	

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1127	17535	Bank 1, Mixture adaption (mult.) System too rich	- Take car for road test (fuel in oil) Check fuel system pressure => Page 66
P1128	17536	Bank 1, Mixture adaption (mult.) System too lean	- Check fuel system pressure => Page 45
P1136	17544	Bank 1, Mixture adaption (add.) System too lean	- Test air mass meter => Page 66
P1137	17545	Bank 1, Mixture adaption (add.) System too rich	- Take car for road test (fuel in oil) Check fuel system pressure => Page 66

Note:

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

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

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1141	17549	Load determination Implausible value	- Test air mass meter => Page 103 ; in addition make sure that the correct throttle valve control part is installed (part number)
P1149	17557	Lambda control, Bank 1 Implausible control value	- Test lambda control => Page 66
P1171	17579	Angle sens. 2 for throt. valve drive -G188 Implausible signal 1)	- Test angle sender for throttle valve drive => Page 107
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)	
P1176	17584	Bank 1, Lambda corr. rear cat (after catalytic converter) Control limit reached	- Check lambda probe and lambda control after catalytic converter => Page 73
P1198	17606	Bank 1 - Probe 2, Heating element circuit Electrical fault	- Test lambda probe heating => Page 78

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 101 .

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 45
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	
P1225	17633	Injector Cyl. 1 -N30 Short to Earth	
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	

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Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1237	17645	Injector Cyl. 1 -N30 Open circuit	- Test injectors =>Page 45
P1238	17646	Injector Cyl. 2 -N31 Open circuit	



Fault code		Readout on fault reader display	Fault rectification
P1239	17647	Injector Cyl. 3 -N32 Open circuit	=> 4-cylinder engine (5-valve turbo), Mechanics; Repair group 21; Charge air system with turbocharger; Testing air recirculation valve for turbocharger -N249 Charge air system with turbocharger; Testing air recirculation valve for turbocharger -N249
P1240	17648	Injector Cyl. 4 -N33 Open circuit	
P1287	17695	Air recirc. valve for turbocharger -N249 Open circuit	
P1288	17696	Air recirc. valve for turbocharger -N249 Short to Positive	
P1289	17697	Air recirc. valve for turbocharger -N249 Short to Earth	

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		- Test knock control => Page 158
P1325	17733	Knock control Cyl. 1 Control limit reached	
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	
P1335	17743	Engine torque monitoring 2 Control limit surpassed	- Major leak; test intake system for unmetered air => Page 146
P1336	17744	Engine torque monitoring Control limit surpassed	- Test air mass meter => Page 152

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 101 .

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		- Test Hall sender => Page 162
P1337	17745	Bank 1, Camshaft pos. sensor => -G163 Short to Earth	
P1338	17746	Bank 1, Camshaft pos. sensor => -G163 Open circuit / Short to Positive	
P1340	17748	Camshaft pos. -/Crankshaft pos. -sens. Wrong allocation	- Unbolt Hall sender and check that the rotor ring on the camshaft is installed properly. (Otherwise the retainer tab is crushed when tightening the securing bolt.) Test engine valve timing as well => 4-Cylinder engine (5-valve turbo), Mechanics; Repair group 13; Dismantling and assembling engine; Removing and installing toothed belt Dismantling and assembling engine; Removing and installing toothed belt

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

Fault code		Readout on fault reader display	Fault rectification
P1355	17763	Ignition activation Cyl. 1 Open circuit	- Test activation of output stages => Page 139
P1356	17764	Ignition activation, Cyl. 1 Short to Positive	
P1357	17765	Ignition activation, Cyl. 1 Short to Earth	
P1358	17766	Ignition activation, Cyl. 2 Open circuit	
P1359	17767	Ignition activation, Cyl. 2 Short to Positive	

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1360	17768	Ignition activation, Cyl. 2 Short to Earth	- Test activation of output stages => Page 139
P1361	17769	Ignition activation, Cyl. 3 Open circuit	
P1362	17770	Ignition activation, Cyl. 3 Short to Positive	
P1363	17771	Ignition activation, Cyl. 3 Short to Earth	
P1364	17772	Ignition activation, Cyl. 4 Open circuit	
P1365	17773	Ignition activation, Cyl. 4 Short to Positive	
P1366	17774	Ignition activation, Cyl. 4 Short to Earth	

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1386	17794	Control unit defective	Renew engine control unit => Page 38
P1387	17795	Control unit defective	
P1388	17796	Control unit defective 1)	
P1410	17818	Tank breather valve -N80 Short to Positive	- Test ACF solenoid valve 1 => Page 96
P1421	17829	Secondary air inlet valve -N112 Short to Earth	- Test secondary air system=>Page 84
P1422	17830	Secondary air inlet valve -N112 Short to Positive	
P1424	17832	Bank 1, Secondary air system Leak recognised	- Check pipes/hoses and components of secondary air system => 4-cylinder engine (5-valve turbo), Mechanics; Repair group 26; Secondary air system

- 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 101 .

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1425	17833	Tank breather valve -N80 Short to Earth	- Test ACF solenoid valve 1 => Page 96



Fault code		Readout on fault reader display	Fault rectification
P1426	17834	Tank breather valve -N80 Open circuit	- Test secondary air system=>Page 84
P1432	17840	Secondary air inlet valve -N112 Open circuit	
P1433	17841	Relay for secondary air pump -J299 Open circuit	
P1434	17842	Relay for secondary air pump -J299 Short to Positive	
P1435	17843	Relay for secondary air pump -J299 Short to Earth	

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 56
P1502	17910	Fuel pump relay -J17 Short to Positive	
P1517	17925	Main relay => -J271 Fault in electrical circuit	- Test Motronic current supply relay J271 => Page 141
P1523	17931	Crash signal from airbag control unit (Implausible signal 2)	=> Body, Self-diagnosis; Repair group 01; => Self-diagnosis of airbag system
P1539	17947	Clutch pedal switch -F36 Implausible signal	- Test clutch pedal switch => Page 122
P1542	17950	Angle sender for throt. val. drive -G187 (Implausible signal 1)	- Test angle sender for throttle valve drive => Page 107
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)	

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 101 .

2) This fault is stored if the airbag control unit transmits an implausible signal.

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1545	17953	Throttle valve control (Faulty 1)	- Test throttle valve control part => Page 103
P1546	17954	Charge press. control solenoid valve -N75 Short to Positive	=> 4-cylinder engine (5-valve turbo), Mechanics; Repair group 21; Charge air system with turbocharger; Testing air recirculation valve for turbocharger -N249 Charge air sys- tem with turbocharger; Testing air recirculation valve for turbocharger -N249
P1547	17955	Charge press. control solenoid valve -N75 Short to Earth	
P1548	17956	Charge press. control solenoid valve -N75 Open circuit	
P1555	17963	Maximum charge pressure sur- passed	
P1556	17964	Charge pressure control Regulating limit not reached	

Fault code		Readout on fault reader display	Fault rectification
P1557	17965	Charge pressure control Regulating limit surpassed	
P1558	17966	Throttle valve drive -G186 Fault in electrical circuit 1)	- Test throttle valve control part => Page 103

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 101 .

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1559	17967	Throttle valve control part -J338 Fault in base setting 1)	- Perform adaption=> Page 104
P1560	17968	Maximum engine revs surpassed	- Rectify mechanical faults
P1564	17972	Throttle valve control part -J338 Low voltage at base setting	- Charge battery and repeat basic setting
P1565	17973	Throttle valve control part -J338 Lower stop is not reached 1)	- Test throttle valve control part => Page 103
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)
P1570	17978	Engine control unit blocked	- Perform adaption of electronic immobilizer to engine control unit => Electrical system; Repair group 01; Self-diagnosis of immobilizer

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 101 .

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1579	17987	Throttle valve control part -J338 Adaption not started	- Perform adaption of throttle valve control part; observe test requirements => Page 104
P1602	18010	Voltage supply Kl. 30 Voltage too low	- Test voltage supply from terminal 30 to control unit => Page 156
P1603	18011	Control unit defective	- Renew engine control unit => Page 38
P1604	18012	Control unit defective 1)	
P1609	18017	Crash switch-off triggered (Crash triggered) 2)	=> Body - Self-diagnosis; Repair group 01; Self-diagnosis of airbag system Erase fault memory of engine control unit after performing final control diagnosis of airbag system =>Page 4

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 101 .

2) This fault is stored if the corresponding signal is transmitted from the airbag control unit (also when final control diagnosis is performed on the airbag system).

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



Fault code		Readout on fault reader display	Fault rectification
P1612	18020	Engine control unit wrongly coded 3)	- Code engine control unit => Page 19
P1626	18034	Data bus drive No message from gearbox CU	- Test CAN bus =>Page 127
P1630	18038	Accelerator position sender -G79 Signal too small 1)	- Test accelerator position sender =>Page 110
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)	- Renew engine control unit => Page 38
P1640	18048	Control unit defective	

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 101 .

3) Does not apply to engine control unit No.06A 906 032 Q and 06A 906 032 AG

or No. 06A 906 032 BB and 06A 906 032 AF.

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1648	18056	Data bus drive Defective	- Test CAN bus =>Page 127
P1649	18057	Data bus drive No message from ABS CU	
P1676	18084	Electr. throttle control fault lamp -K132 Electrical fault in current circuit 1)	- Test EPC warning lamp => Page 102
P1677	18085	Electr. throttle control fault lamp -K132 Short to Positive 1)	
P1853	18261	Data bus drive Implausible message from ABS CU	- Test CAN bus => Page 127

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 101 .

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 electric fuel pump runs continuously throughout the final control diagnosis.
- ♦ 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.
- ♦ The final control diagnosis is terminated if the engine is started or if an engine speed pulse is detected.

- ♦ 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 final control diagnosis activates the following components in the stated sequence:

Activation sequence
1 ACF solenoid valve 1 (-N80)
2 Secondary air inlet valve -N112 1)
3 Secondary air pump relay -J299 1)
4 Charge pressure control valve -N75
5 Air recirculation valve for turbocharger -N249
6 Injector Cyl. 1 -N30 1)
7 Injector Cyl. 3 -N32 1)
8 Injector Cyl. 4 -N33 1)
9 Injector Cyl. 2 -N31 1)

- 1) Not on vehicles with engine code letters AJQ and AQA

Requirements for test:

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

Test sequence

- Connect vehicle diagnostic testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 1.)
When doing this the ignition must be switched on.

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

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

-> Indicated on display:

Rapid data transfer	Q
03-Final control diagnosis	

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. There will be a clearly audible fuel flow at the fuel pressure regulator. If the fuel pump does not run, test activation

=>Page 58.

-> Indicated on display:

(Appears on V.A.G 1551 as "Tank breather valve -N80")

Final control diagnosis
ACF solenoid 1 -N80

This valve will be actuated (i.e. will click) for about 1 minute, or until the => key is pressed to advance the programme to the next control element.



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

- Test solenoid valve 1 for activated charcoal filter -N80
=> Page **96**.

Activating secondary air inlet valve1)

- 1) Not on vehicles with engine code letters AJQandAQA

- Press =>key.

-> Indicated on display:

Final control diagnosis
Secondary air inlet valve -N112

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This valve will be actuated (i.e. will click) for about 1 minute, or until the => key is pressed to advance the programme to the next control element.

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

- Test secondary air inlet valve -N112
=> Page **87**.

Activating relay for secondary air pump1)

- 1) Not on vehicles with engine code letters AJQandAQA

- Press =>key.

-> Indicated on display:

Final control diagnosis
Secondary air pump relay -J299

The secondary air pump relay -J299 switches the secondary air pump motor -V101 on and off continuously for about 1 minute, or until the=>key is pressed to advance the programme to the next control element.

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

- Test secondary air pump relay -J299
=> Page **90**.

Activating charge pressure control valve -N75

- Press =>key.

-> Indicated on display:

Final control diagnosis
Boost pressure control solenoid -N75

This valve will be actuated (i.e. will click) for about 1 minute, or until the => key is pressed to advance the programme to the next control element.

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

=> 4-cylinder engine (5-valve turbo), Mechanics; Repair group 21; Charge air system with turbocharger; Testing charge pressure control valve -N75 Charge air system with turbocharger Testing charge pressure control valve -N75

Activating air recirculation valve for turbocharger

- Press =>key.

-> Indicated on display:

Final control diagnosis
Air recirculation valve for turbocharger
-N249

This valve will be actuated (i.e. will click) for about 1 minute, or until the ➔ key is pressed to advance the programme to the next control element.

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

=> 4-cylinder engine (5-valve turbo), Mechanics; Repair group 21; Charge air system with turbocharger; Testing air recirculation valve for turbocharger -N249 Charge air system with turbocharger Testing air recirculation valve for turbocharger -N249

Testing injectors1)

- 1) Not on vehicles with engine code letters AJQandAQA

Note:

The injectors are actuated according to the firing order: Cyl. 1, Cyl. 3, Cyl. 4, Cyl. 2.

- Press ➔key.

-> Indicated on display:

Final control diagnosis
Injector, cylinder 1 -N30

- Press ➔key.

-> Indicated on display:

Final control diagnosis
Injector, cylinder 1 -N30

The injector should click five times.

- Use this procedure to test all the injectors in sequence.

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

- Test injectors => Page 45 .
- Press➔key after the last injector (cylinder 2) has been actuated.

-> Indicated on display:

Final control diagnosis
END

- Press ➔key.

-> Indicated on display (function selection):

Rapid data transfer HELP
Select function XX

Note:

If the final control diagnosis has to be repeated, the engine must be started again first.



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
=>Page **104**
- ♦ Vehicles with automatic gearbox: Learning kickdown function of accelerator position sender (adaption of engine control unit)
=>Display group 063, Page **114**.

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

- ♦ Learning process for lambda control => Page **69**
- ♦ Fault-finding by deliberate activation and deactivation of lambda control=> Page **67**

Requirements for operations performed with the engine running:

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

Test sequence

- 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 **1** .)
- When doing this the engine must be idling.
- Interrogate fault memory =>Page **4** . The fault memory must be clear. If necessary, rectify any faults and erase the fault memory. Switch off the engine, then start up again. Take vehicle for a test drive and interrogate the fault memory again to make sure it is clear.
- Leave engine idling.

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

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

-> Indicated on display:

Basic setting	Q
Enter display group number XXX	

- Enter the required Display Group number.

Example:

- Enter "000" to select Display Group number 000 and confirm entry with Q key.

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

Notes:

- ♦ In Display Group 00 the measured values are shown in decimal form.
- ♦ If the printer is switched on, the current display can be printed out.

- ◆ Other display groups can be selected as follows:

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

- Allow engine to idle for a few minutes (coolant temperature at least 80 °C).
- If all the display zones show the specified values, press the ⇒ key.

→ Indicated on display (function selection):

Rapid data transfer HELP
 Select function XX

Display Group 000 (decimal readouts)										
▪ Engine idling (coolant temperature not below 80 °C)										
1	2	3	4	5	6	7	8	9	10	▪ Display zones
										Learned value for mixture formation at part throttle
										Learned value for mixture formation at idling speed
										Control value for mixture formation
										Learned value for torque loss at idling speed
										Torque at idling speed
										Throttle valve angle
										Voltage of on-board electrical system
										Engine speed (idling speed)
										▪ Front-wheel drive and four-wheel drive with manual gearbox
										▪ Front-wheel drive with automatic gearbox
										Engine load (without electrical consumers)
										Coolant temperature (requirement for basic setting)
										Specification
										Corresponds to
										103...153
										-10...10%
										78...178
										-10...10 %
										115...141
										-10...10 %
										113...143
										-3...3 %
										106...189
										-4.3...12.2 %
										1...7
										0.4...2.75 %
										142...206
										10...14.5 V
										70...82
										700...820 rpm
										64...76
										640...760 rpm
										21...39
										15...30 %
										185...205
										85...105 °C

5 - Coding control unit

5.1 - Coding control unit

Notes:

- ◆ The control units with Part No. 06A 906 032 Q and 06A 906 032 BB have the fixed code "05500".
- ◆ The control units with Part No. 06A 906 032 AG and 06A 906 032 AF have the fixed code "05600".
- ◆ It is not possible to change the coding on these control units.
- 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 1.)
When doing this the ignition must be switched on.

→ Indicated on display:

Rapid data transfer HELP
 Select function XX

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- Enter "07" 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 control unit coding as specified in coding table ⇒ Page 20.

**Meaning of coding:**

XX	Country / emissions
X	Drive layout / additional functions
X	Gearbox
X	Model

Example of coding	
05500	EU3, EU4 or D4 emissions standard), front-wheel drive with traction control/electronic stability program (ASR/ESP), 5-speed manual gearbox, Audi A3

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

06A906018S 1.8l R4/5VT G
 0005
 Coding 05500 WSC 12345

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- Press =>key.

-> Indicated on display (function selection):

Rapid data transfer HELP
 Select function XX

5.2 - Coding table

Country/emissions	05	EU3, EU4 or D4 (exhaust emissions standard)
Drive/additional functions	5	Front-wheel drive with traction control/electronic stability program (ASR/ESP)
	6	Four-wheel drive without traction control/electronic stability program (ASR/ESP)
	7	Four-wheel drive with traction control/electronic stability program (ASR/ESP)
Gearbox	0	5-speed manual gearbox
	1	6-speed manual gearbox
	3	Automatic gearbox 01M (4-speed)
Model	0	Audi A3

6 - Reading measured value block**6.1 - Reading measured value block****Requirements for test:**

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

Test sequence

- 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 1 .)

When doing this the engine must be idling.

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

- Enter "08" to select 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	

- Enter the required Display Group number (3 figures) and confirm entry with Q key.

Note:

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

-> Indicated on display for Display Group 000:

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

-> Indicated on display (example) for Display Group 001:

Read measured value block	1
1 2 3 4	

Notes:

- ♦ If the printer is switched on, the current display can be printed out.
- ♦ Other display groups can be selected 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

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.
- ♦ In order to run the engine at starting speed without actually starting it (for example, to test compression), unplug the connectors on 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

Fuel system is under pressure. Before opening the system place a cloth around the connection. Then release pressure by carefully loosening the connection.

Note the following points if test equipment has to be used during a road test:

Warning

- ♦ **Test equipment must always be secured on the rear seat and operated from the rear seat by a second person.**
- ♦ **If test equipment is operated from the front passenger seat, the occupant could be injured by the passenger's airbag in an accident.**

1.3 - Rules for cleanliness

When working on the fuel supply/injection system, pay careful attention to the following 6 rules for ensuring maximum 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 completed 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.
- ♦ Electrical connectors:
Protect against dirt and moisture when disconnected.

Make sure they are dry before re-connecting.

1.4 - Technical data

Engine code letters		AQA, ARZ 1) (1.8 ltr. / 5V / 110 kW engine) AJQ, APP1) (1.8 ltr. / 5V / 132 kW engine)
Idling speed Not adjustable - controlled by idling speed stabilisation		700 ... 820 rpm (Manual gear-box, Front-wheel drive and four-wheel drive) 640 ... 760 rpm (Automatic gearbox, Front-wheel drive)
Engine speed limitation by switching off the injectors		approx. 6800 rpm
Fuel pressure at idling speed	Vacuum hose connected	approx. 2.5 bar
	Vacuum hose disconnected	approx. 3.0 bar
Holding pressure after 10 minutes		at least 1.5 bar
Injectors	Spray pattern	Two-hole nozzle (same on all injectors)
	Injection qty. (30 s)	145 ±12 ml
	Resistance (room temperature)	12 ... 13 Ω

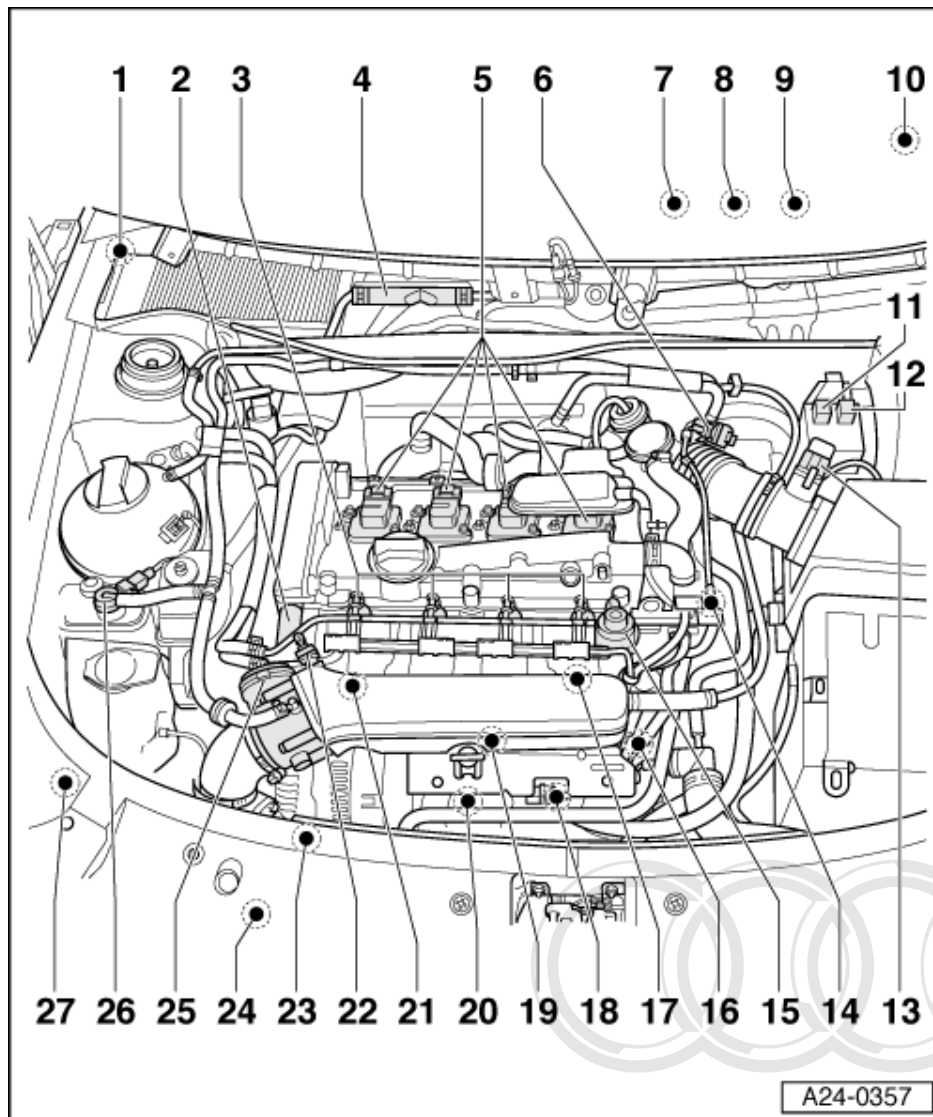
1) With secondary air system

2) Relevant values:

=> Exhaust emission test binder

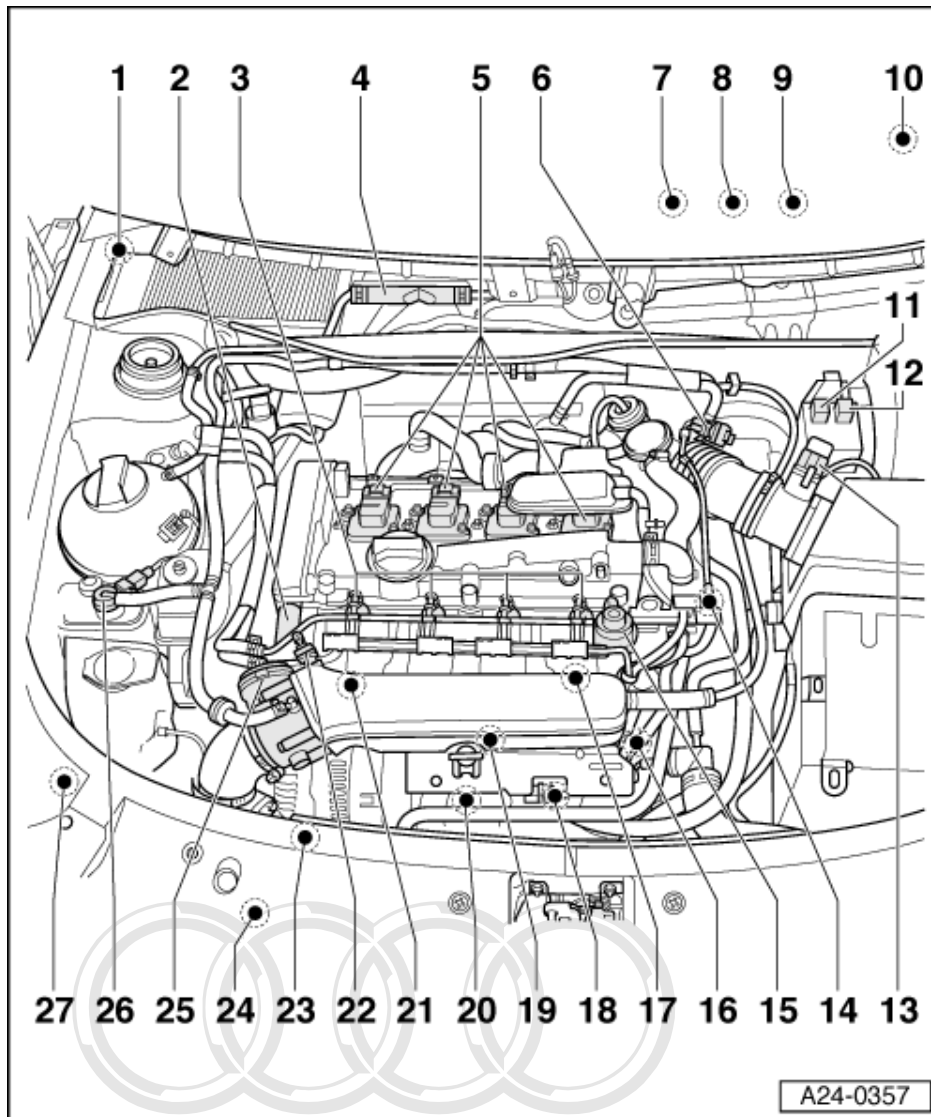


1.5 - Fitting locations overview



- 1 Lambda probe (before catalytic converter) -G39 with lambda probe heater -Z19
 Lambda probe (after catalytic converter) -G130 with lambda probe 1 heater (after catalytic converter) -Z29
 - ♦ Engine code letters AJQ, AQA are not equipped with G130/-Z29
 - ♦ Fitting location of lambda probes and connector cover
 =>Fig. 31
 - ♦ Colour coding of lambda probe connectors=>Fig. 32
- 2 Hall sender -G163
 - ♦ Checking => Page 162
- 3 Injector -N30...-N33
 - ♦ Testing => Page 45
 - ♦ Removing and installing
 => Page 52

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4 Engine control unit -J220

- ♦ Renewing=>Page **38**

5 Ignition coils -N, -N128, -N158, -N163

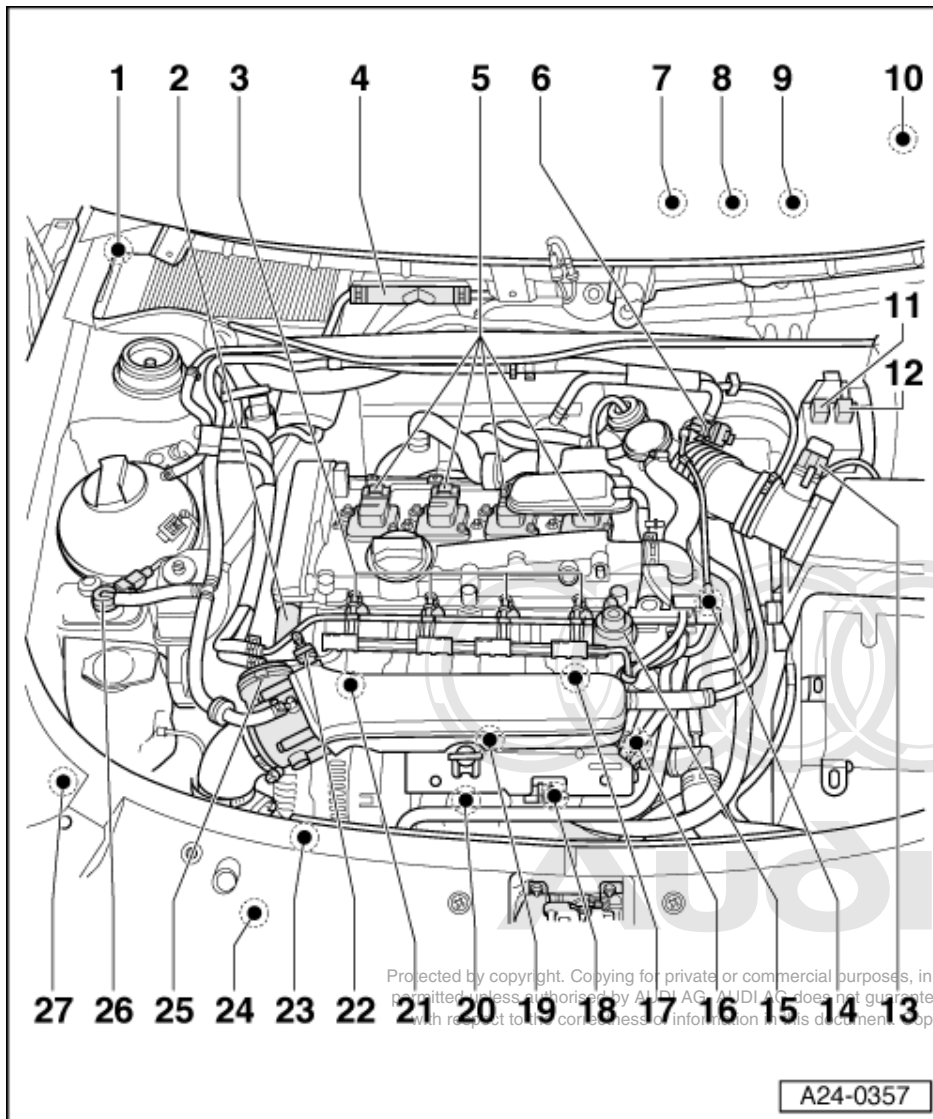
6 Solenoid valve for charge pressure control -N75

- ♦ Checking:

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted.
 => 4-Cylinder engine (5-valve turbo); Mechanics; Repair group 21; Testing charge air system with turbocharger and charge pressure control valve Testing charge air system with turbocharger and charge pressure control valve

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

- ♦ Fitting location
=> Fig. **31**
- ♦ Testing =>Page **110**
- ♦ Programming kickdown function ("Learning" kickdown function) on vehicles with automatic gearbox=>Page **114**



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

- ♦ Fitting location
=> Fig. 33

9 Clutch pedal switch -F36

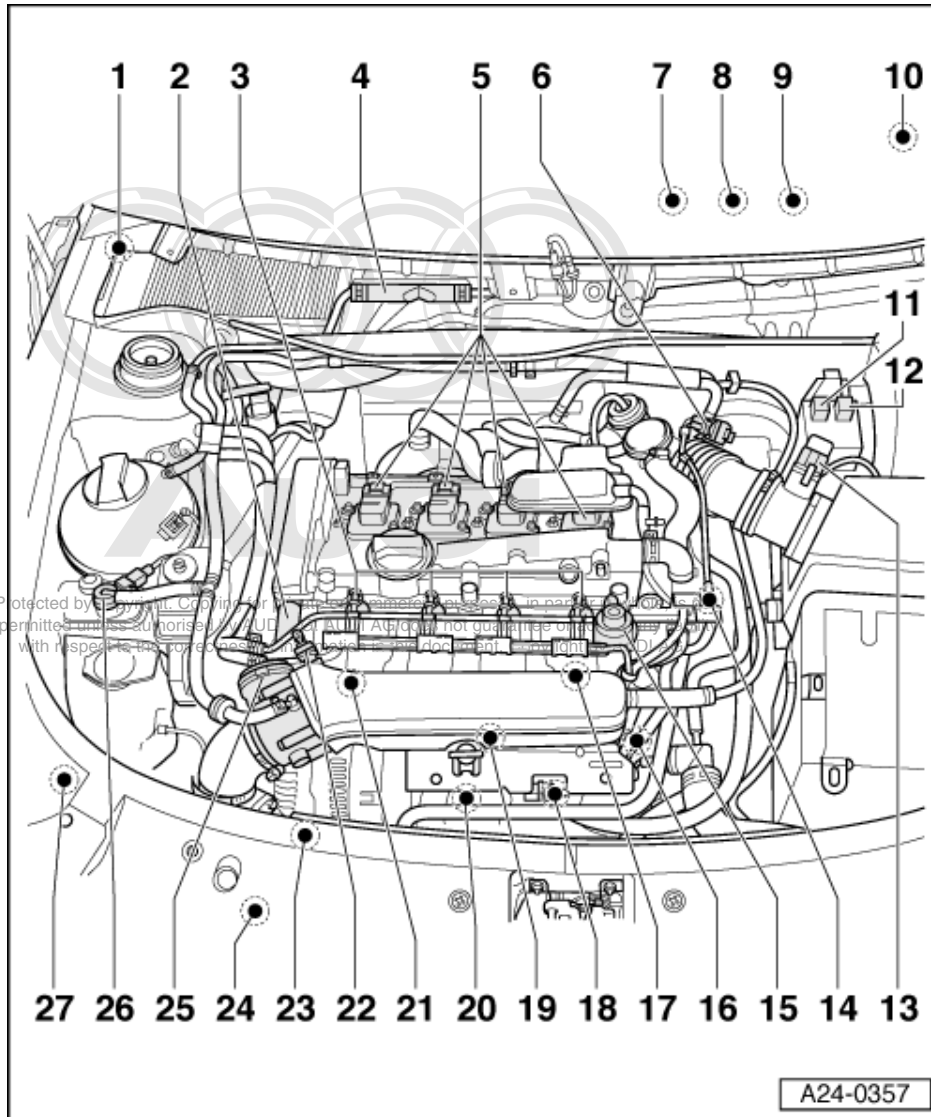
- ♦ Fitting location
=> Fig. 33

10 Electronic throttle control warning lamp -K132

- ♦ EPC warning lamp
- ♦ Fitting location
=> Fig. 32

11 Motronic current supply relay -J271

- ♦ Only on vehicles from model year 2000 >
- ♦ Fitting location
=> Fig. 34
- ♦ Testing=>Page 141



12 Secondary air pump relay -J299

- ♦ On vehicles with secondary air system
- ♦ Fitting location
=>Fig. 34
- ♦ Testing=>Page 90

13 Air mass meter -G70

- ♦ Checking =>Page 90

14 Coolant temperature sender -G62

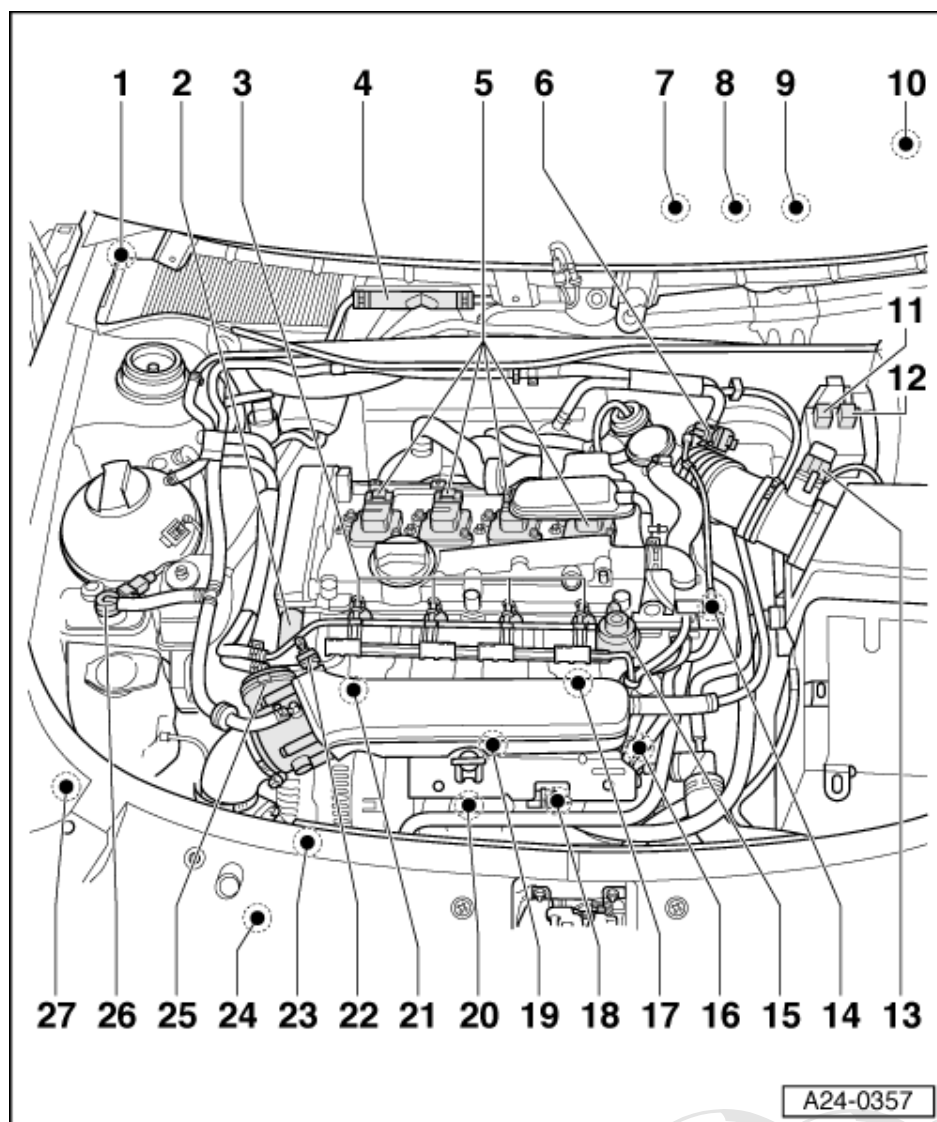
- ♦ Testing =>Page 152
- ♦ If necessary release pressure in cooling system before removing

15 Fuel pressure regulator

16 Engine speed sender -G28

- ♦ Checking => Page 149

17 Knock sensor 2 -G66



18 Air recirculation valve for turbocharger -N249

- ◆ Fitting location => Fig. 31

19 3 pin connector

- ◆ Qty. 3
- ◆ Fitting location => Fig. 33
- ◆ For knock sensor 1 -G61
- ◆ For engine speed sender -G28
- ◆ For knock sensor 2 -G66

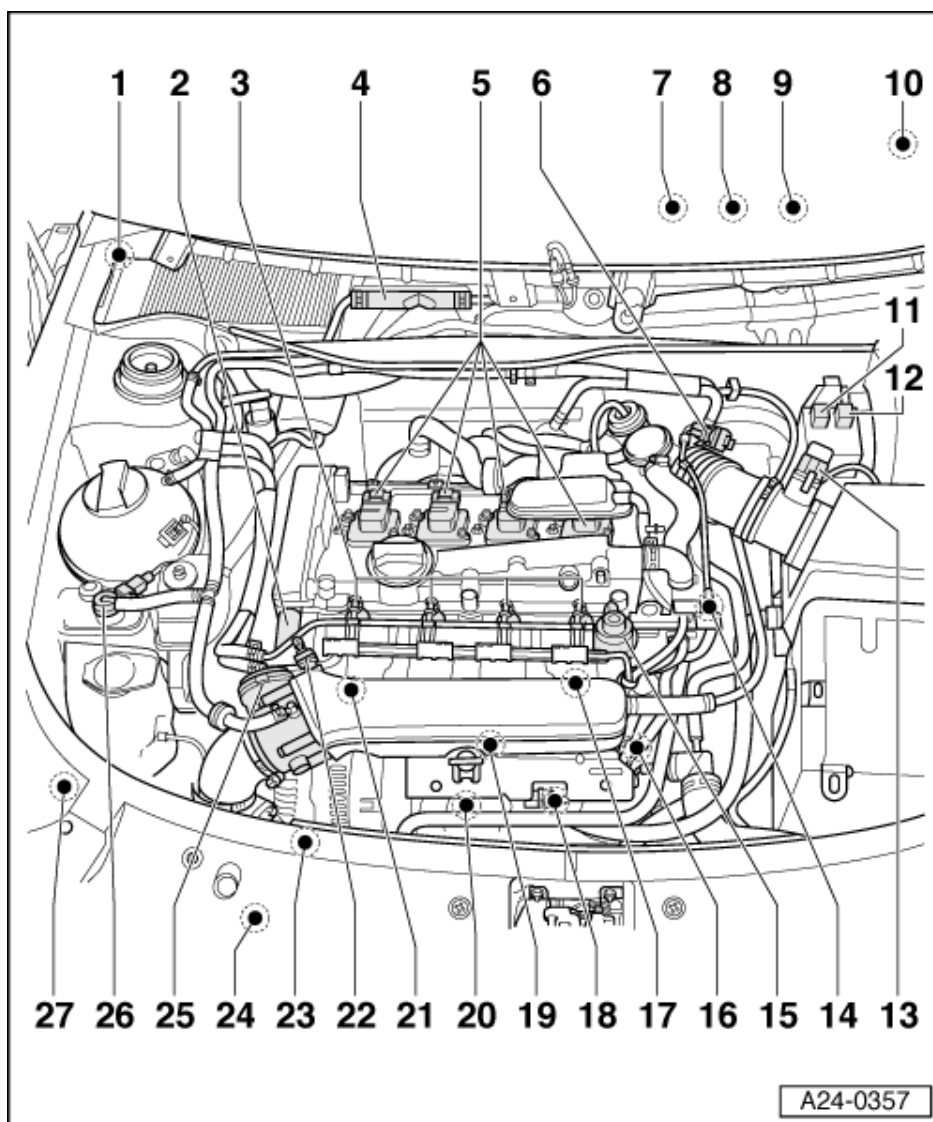
20 Secondary air inlet valve -N112

- ◆ On vehicles with secondary air system
- ◆ Fitting location => Fig. 31

21 Knock sensor 1 -G61

22 Intake air temperature sender -G42

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23 Secondary air pump motor -V101

- ♦ On vehicles with secondary air system
- ♦ Checking:

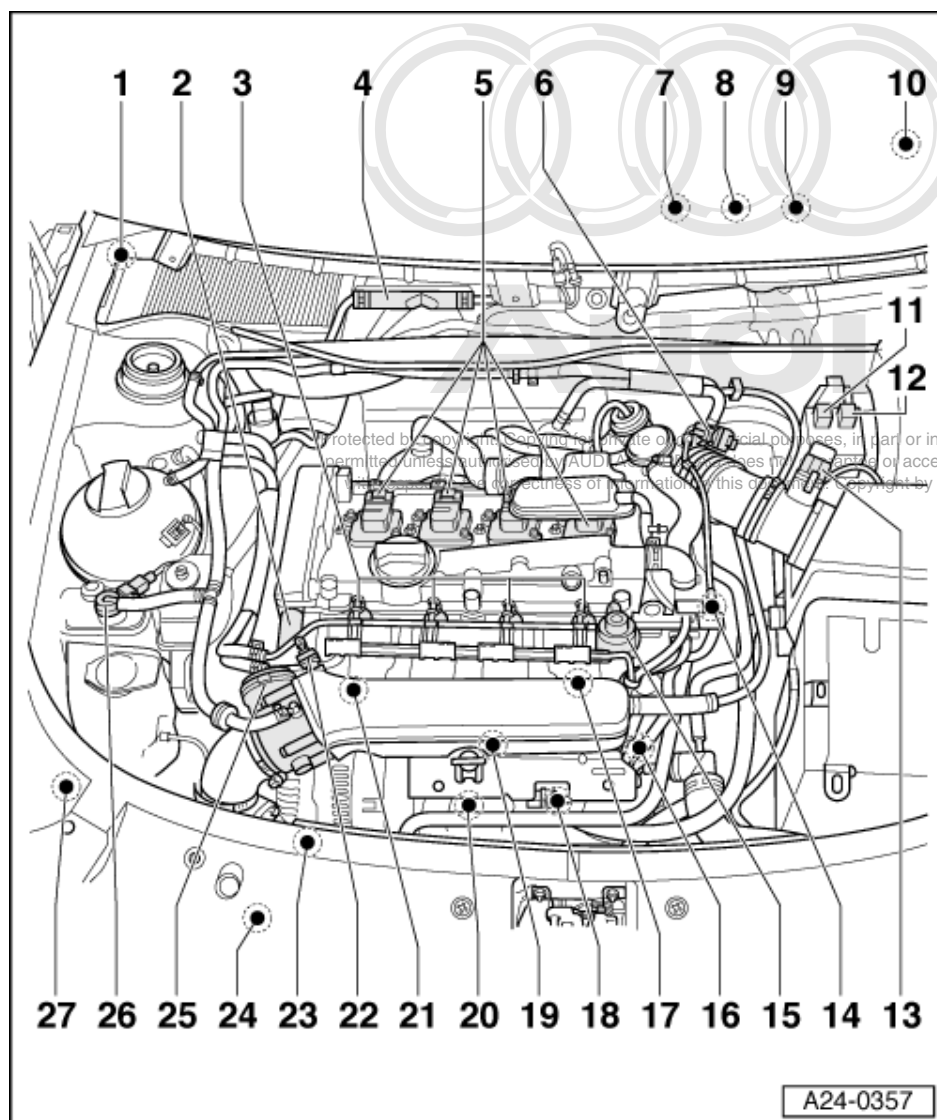
=> 4-Cylinder engine (5-valve turbo), Mechanics; Repair group 26; Secondary air system; Removing and installing parts of secondary air system Secondary air system Removing and installing parts of secondary air system

24 Power steering pressure switch -F88

- ♦ Fitting location
=> Fig. 34

25 Throttle valve control part -J338

- ♦ With throttle valve drive -G186, angle sender for throttle valve drive -G187 and angle sender 2 for throttle valve drive -G188
- ♦ Testing => Page 103
- ♦ If replaced perform adaption
=> Page 104



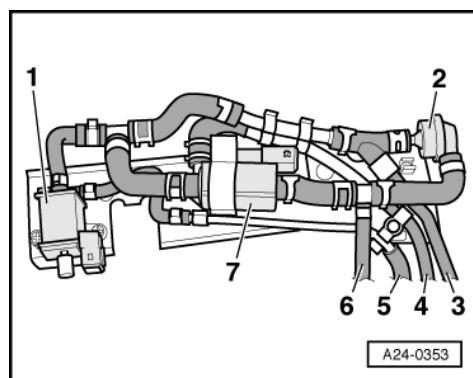
26 Activated charcoal filter solenoid valve 1 -N80

- ♦ Testing =>Page **96**

27 Charge pressure sender -G31

- ♦ Fitting location: screwed into charge air cooler (top)
- ♦ Checking:

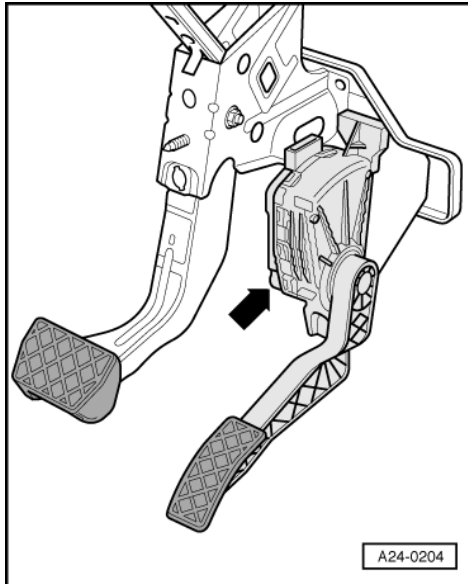
=> 4-Cylinder engine (5-valve turbo), Mechanics; Repair group 21; Charge air system with turbocharger; Testing charge pressure sender -G31 Charge air system with turbocharger Testing charge pressure sender -G31



-> Fig.1 Fitting location of air recirculation valve for turbocharger -N249 and secondary air inlet valve -N112

- ◆ Fitting location: under metal bracket at front of intake manifold

- 1 - Secondary air inlet valve -N112
- 2 - Non-return valve
- 3 - To vacuum reservoir
- 4 - To mechanical air recirculation valve
- 5 - To combination valve of secondary air system

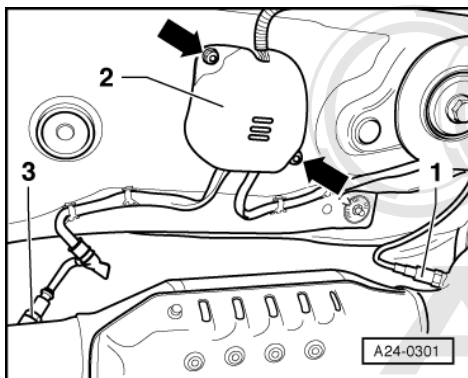


- 6 - To connection on intake manifold
- 7 - Air recirculation valve for turbocharger -N249

-> Fig.2 Fitting location of accelerator position senders -G79 and -G185

Note:

Illustration shows arrangement on LHD vehicles

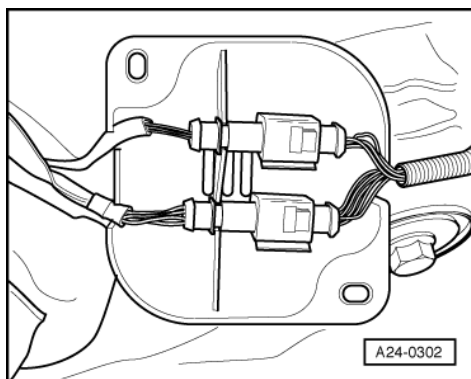


-> Fig.3 Fitting location of lambda probes and connector cover

- 1 - Lambda probe (before catalytic converter) -G39 and lambda probe heater -Z19
 - 2 - Connector cover
 - 3 - Lambda probe after catalytic converter -G130 with lambda probe 1 heater, after catalytic converter
- Z29

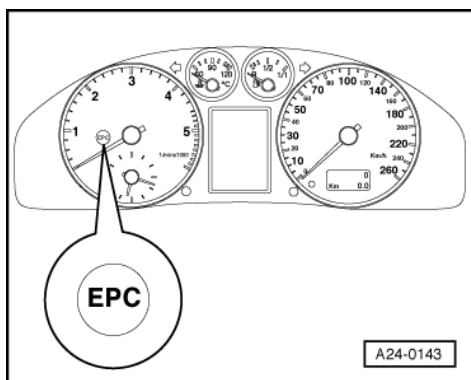


The 4-pin connectors for lambda probes and lambda probe heaters are accessible after unscrewing the connector cover from the underside of the vehicle (right side) -arrows-.



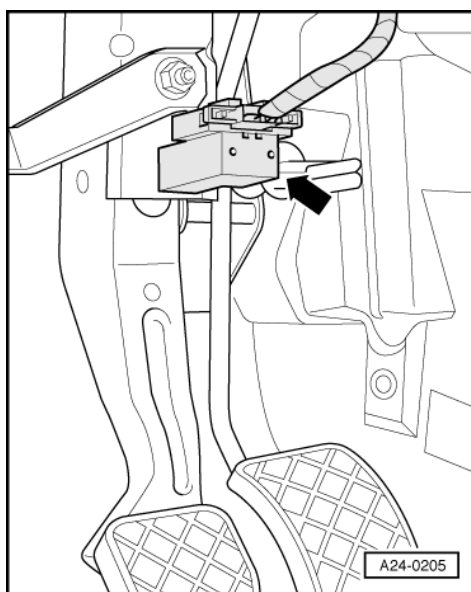
-> Fig.4 Colour coding of lambda probe connectors

Black connector	Lambda probe (before catalytic converter) -G39 and lambda probe heater -Z19
Brown connector	Lambda probe after catalytic converter -G130 with lambda probe 1 heater, after catalytic converter -Z29

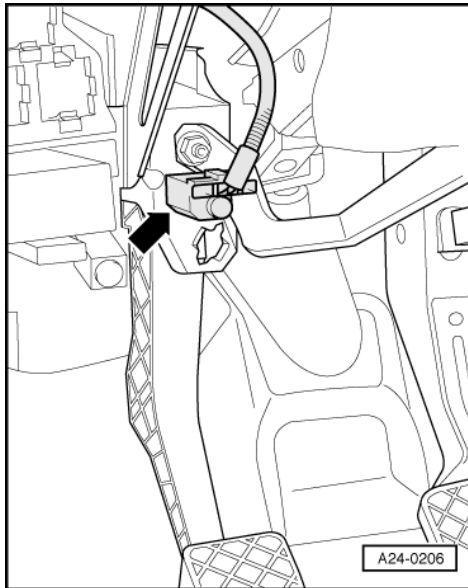


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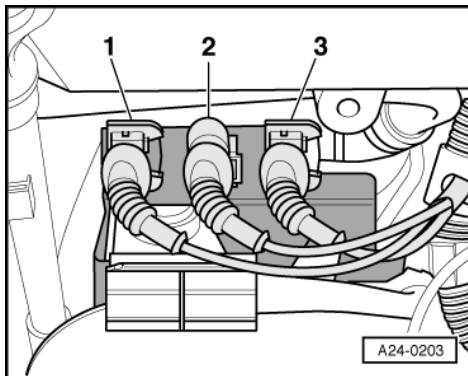
-> Fig.5 Fitting location of electronic throttle control warning lamp -K132



-> Fig.6 Fitting location of brake light switch -F and brake pedal switch -F47

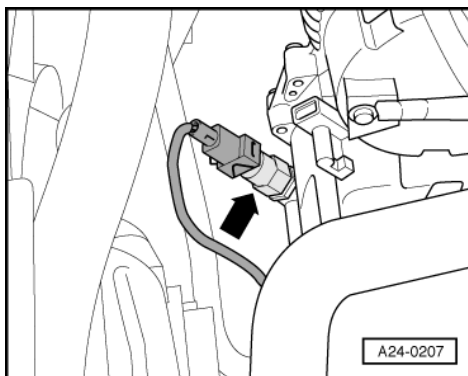


-> Fig.7 Fitting location of clutch pedal switch -F36



-> Fig.8 Fitting locations of 3-pin connectors

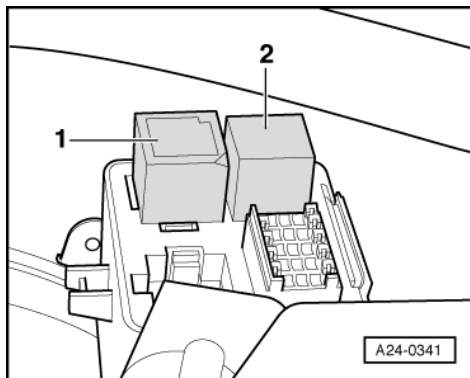
- 1 - For knock sensor 1 -G61
- 2 - For engine speed sender -G28
- 3 - For knock sensor 2 -G66



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-> Fig.9 Fitting location of power steering pressure switch -F88



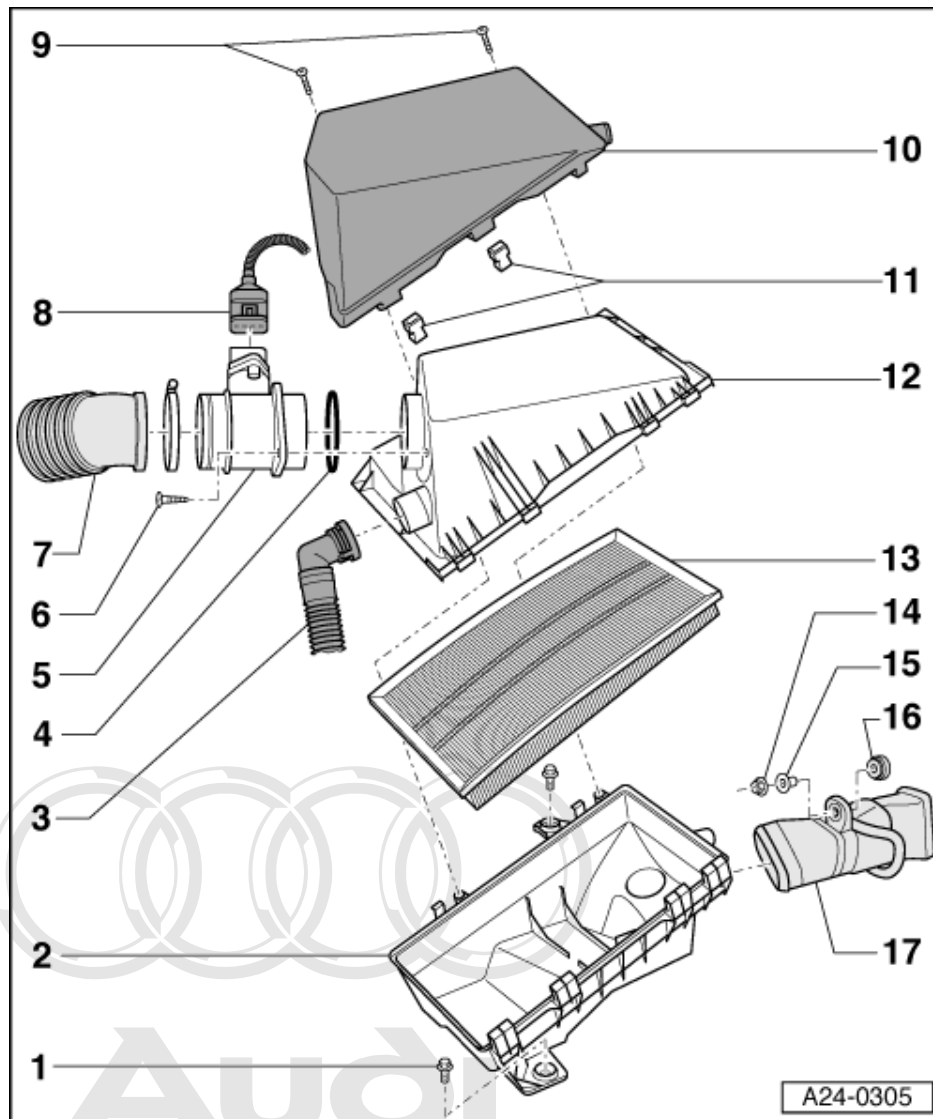
-> Fig.10 Fitting location of Motronic current supply relay -J271 and secondary air pump relay -J299

♦ Under cover on bulkhead (left side)

- 1 - Secondary air pump relay -J299
- 2 - Motronic current supply relay -J271

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1.6 - Dismantling and assembling air cleaner



1 Hexagon bolt - 10 Nm

2 Air cleaner lower part

3 Hose

♦ To secondary air pump

4 Seal

5 Air mass meter -G70

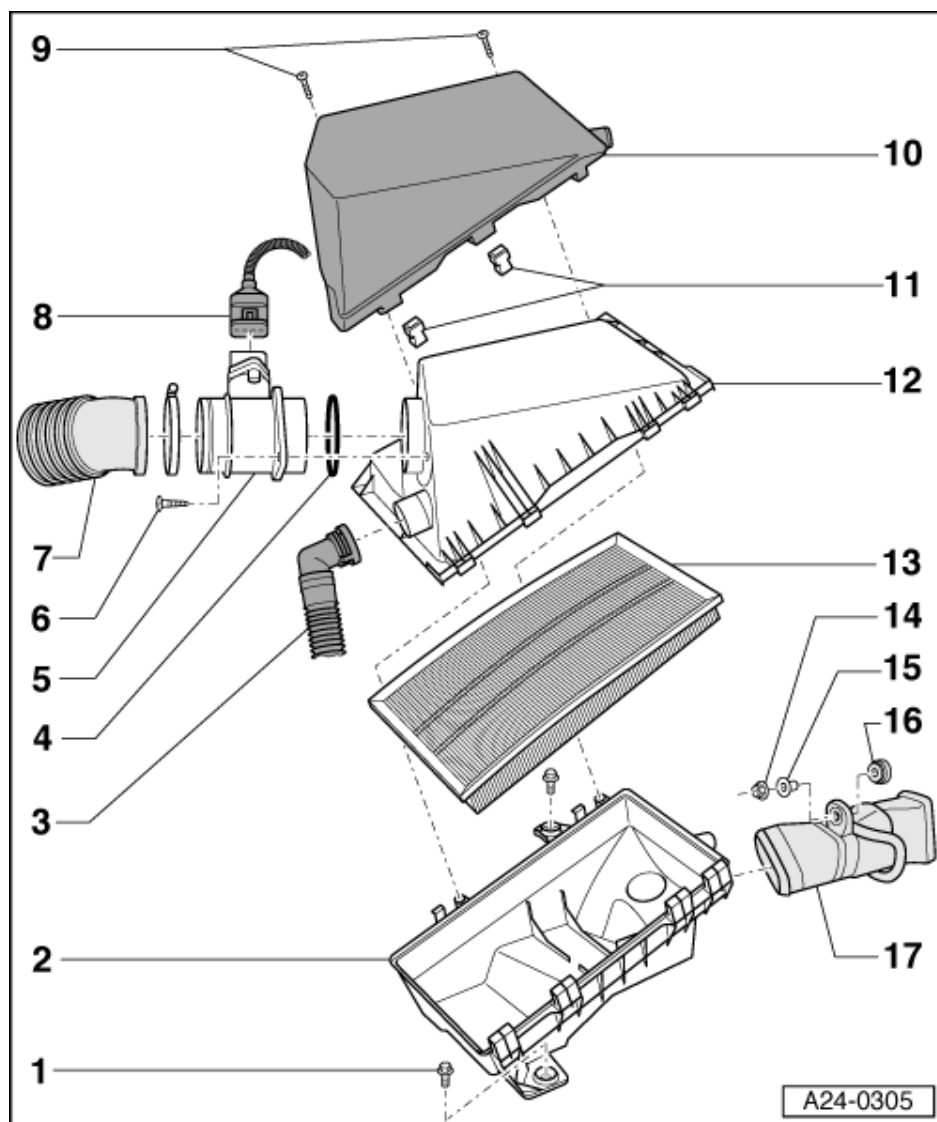
6 Cross-head screw

7 Air ducting

8 5 pin connector

9 Cross-head screw

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- 10 Cover
- 11 Retaining clip
- 12 Air cleaner upper part
- 13 Filter element
- 14 Nut - 10 Nm
- 15 Bush
- 16 Rubber grommet
- 17 Air intake connection

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

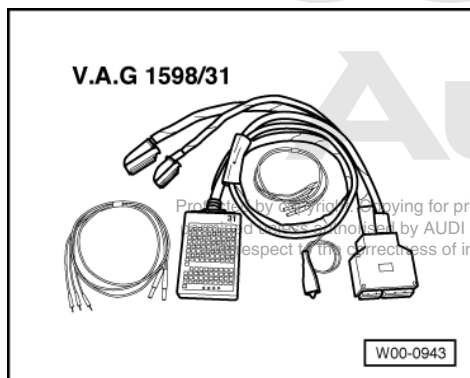
Notes:

- ♦ 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.

- ♦ Always use adapter set V.A.G 1594A to connect test equipment (e.g. voltage tester V.A.G 1527B, hand-held multimeter V.A.G 1526A etc.).

Warning!

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

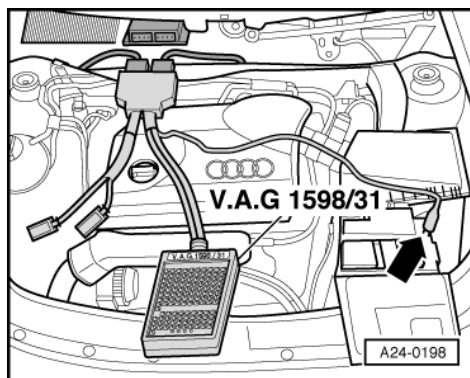


Special tools and workshop equipment required

- ♦ V.A.G 1598/31

Work sequence

- Switch off ignition.
- Unbolt windscreen wiper arms.
- Remove plenum chamber cover and rest it against the windscreen.
- Release catches and unplug control unit connectors.



- -> Connect test box V.A.G 1598/31 to wiring harness connector. Also connect earth clamp on test box - arrow- to battery negative terminal. 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 repair instructions.

Note:

After re-connecting the engine control unit, perform adaption of engine control unit to throttle valve control part

=>Page 104 .

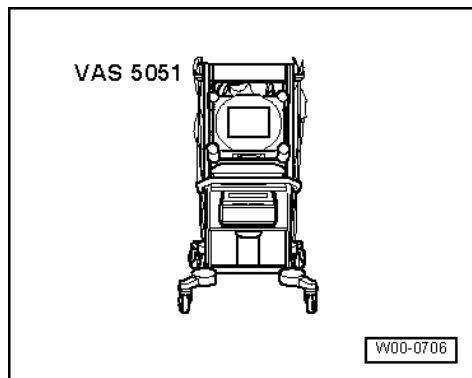


1.8 - Renewing engine control unit

Note:

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

Special tools and workshop equipment required



- ♦ VAS 5051 and VAS 5051/1

or

- ♦ V.A.G 1551 and V.A.G 1551/3 A

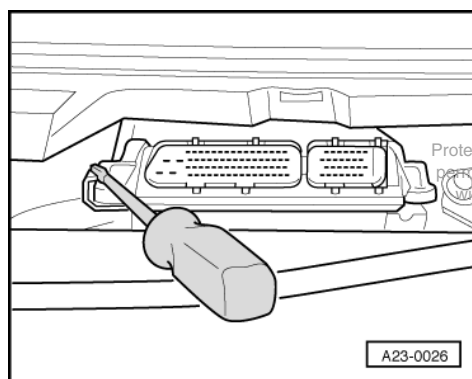
Removing

- Connect the vehicle diagnostic, test and information system VAS 5051 (or fault reader V.A.G 1551). Select engine electronics control unit by entering address word "01" => Page 1; when doing this the ignition must be on.

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

06A906018S	1.8l	R4/5VT	G
0005	□		
Coding 05500	WSC 12345		

- Always start by calling up and printing out the control unit identification => Page 3.
- Check the coding against the list of coding variants => Page 20.
- Switch off ignition.
- Unbolt windscreen wiper arms.
- Remove plenum chamber cover and rest it against the windscreen.



- -> Press back retainer on bracket using a screwdriver, then pull engine control unit towards the front of the vehicle to remove.

- Release catches and unplug control unit connectors.

Installing

Install in reverse sequence; note the following points:

- Bend back retainer on bracket.

Note:

During the initial learning phase of the basic setting operation for the engine the idling may be slightly rough and the engine may pull a little unevenly.

Note:

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

- Interrogate and if necessary erase the fault memory => Page 4 .
- Check the notes on coding new engine control units => Page 19 .
- Perform adaption of throttle valve control part -J338 => Page 104 .
- Programme kickdown function ("Learning" kickdown function) on vehicles with automatic gearbox=>Page 114 .
- On vehicles with cruise control (identifiable by controls on steering column), activate the cruise control via the engine control unit.

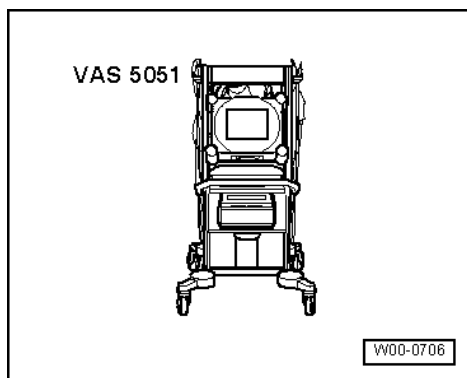
=> Electrical system; Repair group 01; Self-diagnosis of cruise control system (CCS); Testing cruise control system (CCS) Self-diagnosis of cruise control system (CCS) Testing cruise control system (CCS)

- Perform adaption of immobilizer to engine control unit.

=> Electrical System; Repair Group 01; Self-diagnosis of electronic immobilizer; Adaptation procedure when engine control unit is replaced Self-diagnosis of electronic immobilizer Adaptation procedure when engine control unit is replaced

1.9 - Testing idling speed

Special tools and workshop equipment required



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

Requirements for test:

- Exhaust system free of leaks
- Coolant temperature at least 80 °C



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- Electrical consumers switched off (radiator fan must not run during the test)
- Air conditioner switched off
- Pressure gauge not connected
- Vehicles with automatic gearbox: selector lever in position P or N

Notes:

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

Test sequence

- Interrogate fault memory =>Page 4 . The fault memory must be clear. If necessary, rectify any faults and erase the fault memory. Switch off the engine, then start up again. Take 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.

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-> Indicated on display:

Rapid data transfer HELP
Select function XX

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

-> Indicated on display:

Basic setting Q
Enter display group number XXX

- Enter "056" for Display Group 056 and confirm entry with Q key.

-> Indicated on display:

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 056: Idling speed stabilisation with engine idling at normal operating temperature				
Display	xxx rpm	xxx rpm	x.x %	X X X X X
Indicates	Engine speed (actual)	Engine speed (specified)	Idling speed control - torque change	Operating status
Specification	700...820 rpm 1) 640...760 rpm2)	760 rpm 1) 700 rpm2)	x.x %	0 0 0 0 0
Note	If readout does not match specification =>Page 41			Relevance of figures => Page 41

- 1) Manual gearbox, front-wheel drive and four-wheel drive
- 2) Automatic gearbox, front-wheel drive

Notes:

- ♦ 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.

If the specification is attained:

- Press ➔key.

-> Indicated on display (function selection):

Rapid data transfer HELP
 Select function XX

If the specification is not attained:

- Interrogate fault memory again =>Page 4 .

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):

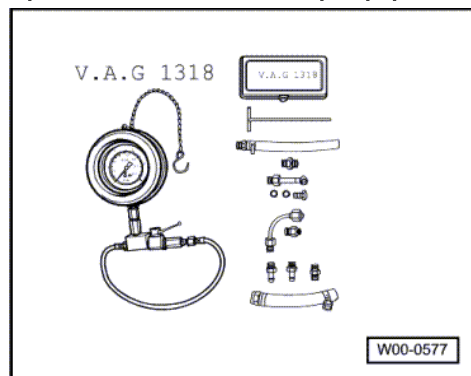
- Test for unmetered air in the intake system =>Page 64 .
- Test throttle valve control part =>Page 103 .
- Solenoid valve for activated charcoal filter constantly open
Test =>Page 96 .
- Perform adaption of throttle valve control part =>Page 104 .

Relevance of figures in 5-digit readout for Display Group 056

x	x	x	x	x	Display zone 4
				0	Air conditioner compressor 0 = air conditioner compressor off 1 = air conditioner compressor on
				0	Vehicles with manual gearbox: display constantly 0 Vehicles with automatic gearbox: ▪ 0 = Selector lever position P or N ▪ 1 = Selector lever position 1/2/3/D/R
			0		Air conditioner requirement - maximum warm or cold air output
			0		Display always reads "0"
0					Power steering pressure 0 = no signal from pressure switch for power assisted steering 1 = signal from pressure switch for power assisted steering (steering wheel on full lock, rapid steering movement)

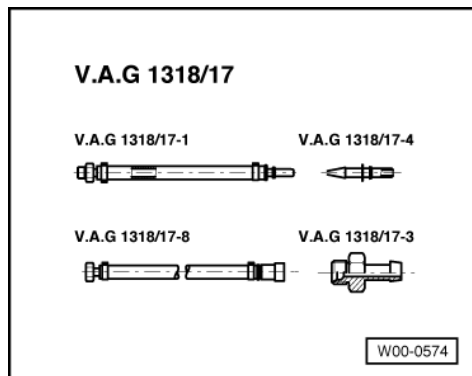
1.10 - Checking system pressure, fuel pressure regulator and holding pressure

Special tools and workshop equipment required





- ♦ V.A.G 1318
- ♦ V.A.G 1318/7



- ♦ V.A.G 1318/17 (2x)

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.

Requirements for test:

- Fuel pump relay OK. Testing => Page 56 .
- Fuel pump OK. Testing:

=> Fuel supply system; Repair group 20; Testing fuel pump Testing fuel pump

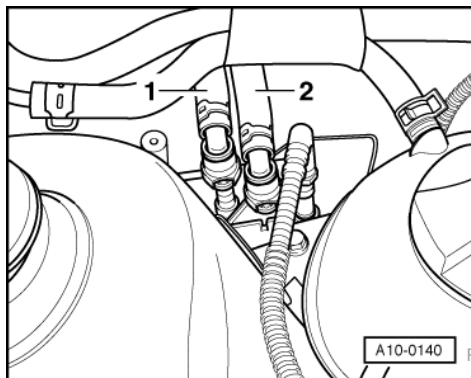
- Fuel filter OK
- Battery voltage not less than 11 V

Warning

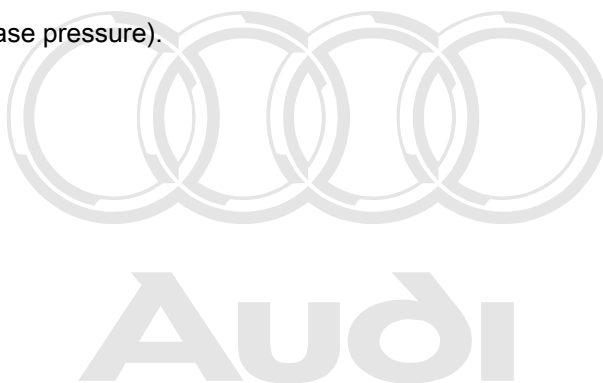
Fuel system is under pressure. Before opening the system place a cloth around the connection. Then release pressure by carefully loosening the connection.

Testing system pressure

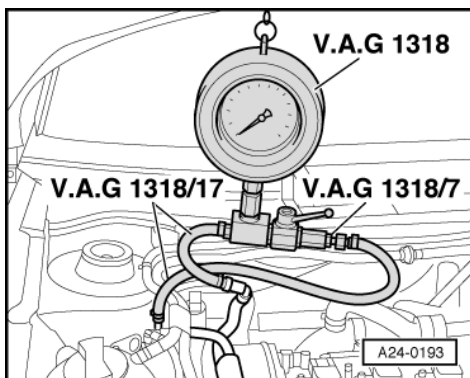
- Briefly open fuel tank filler cap (to release pressure).



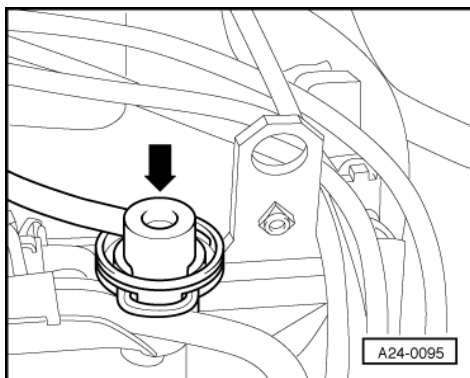
- -> Disconnect fuel supply hose -1- (with white marking) from fuel supply pipe.



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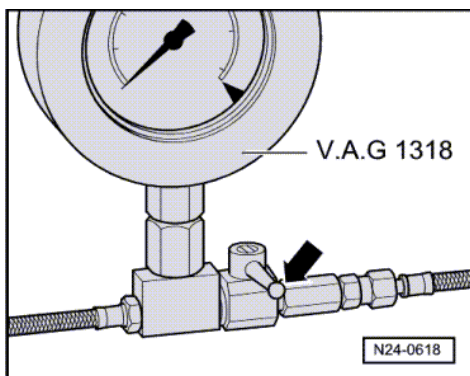
- -> Connect pressure gauge V.A.G 1318 to fuel supply pipe using adapters 1318/7 and 1318/17 (x 2).
- Open cut-off valve on pressure gauge (valve handle points in direction of flow).
- Start the engine and run at idling speed.
- Measure fuel pressure.
 - Specification: approx. 2.5 bar



- -> Disconnect vacuum hose from fuel pressure regulator.
- The fuel pressure should rise to approx. 3.0 bar.
- Switch off ignition.
- Check leak-tightness and holding pressure by watching the drop in pressure on the pressure gauge.
 - After 10 minutes there should still be a pressure of at least 1.5 bar.

If the holding pressure drops below 1.5 bar:

- Start the engine and run at idling speed.



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

If the pressure does not drop:

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- Check fuel pump non-return valve.

If the pressure drops again:

- Open cut-off valve on pressure gauge V.A.G 1318 (valve handle points in direction of flow).
- Start the engine and run at idling speed.
- Allow the pressure to build up, then switch off the ignition. At the same time pinch the return hose (with blue marking) firmly together.

If the pressure does not drop:

- Renew fuel pressure regulator.

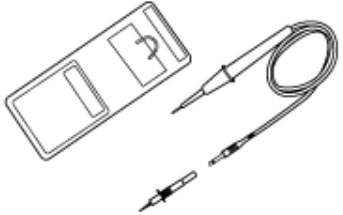
If the pressure drops again:

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

Note:

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

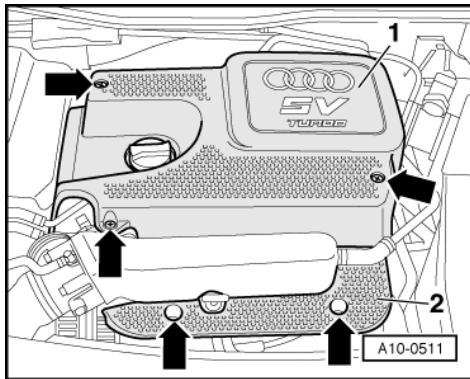
1.11 - Testing injectors

V.A.G 1526 A 	V.A.G 1527 B 
V.A.G 1594 A 	V.A.G 1598/31 
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Special tools and workshop equipment required

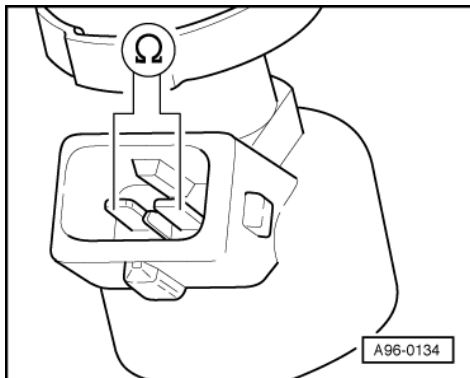
- ♦ V.A.G 1526 A
- ♦ V.A.G 1527 B
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/31

Testing internal resistance



- -> Remove engine cover panel -arrows-.

- Unplug connector from injector to be tested.



- -> Connect multimeter to injector (resistance measurement range)
- Specification: 12 ... 13 ω (at room temperature)

If the specification is not attained:

- Renew injector=>Page 52 .

If the specification is attained:

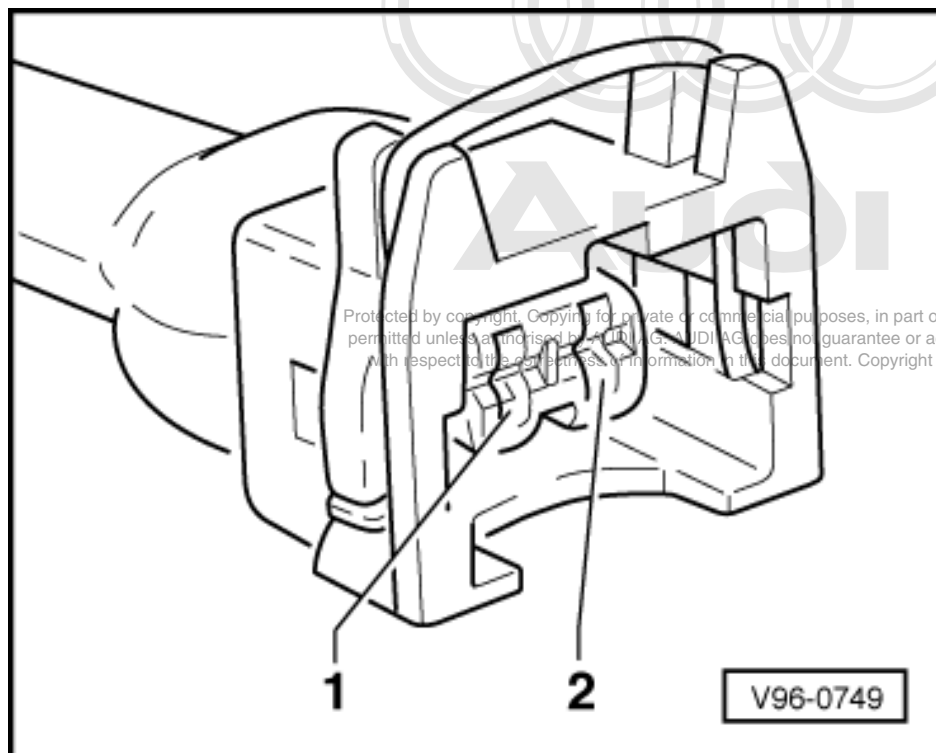
Checking voltage supply

Requirements for test:

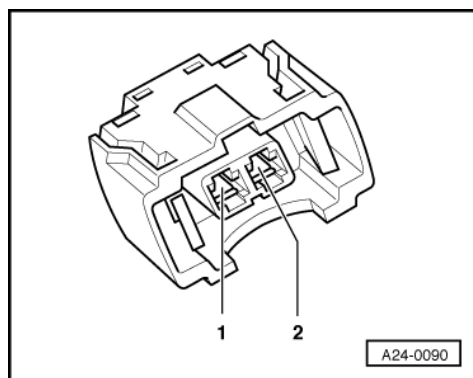
- Fuel pump relay OK. Testing => Page 56 .



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- Fuse for injectors OK.
- => Current flow diagrams, Electrical fault finding and Fitting locations
- Unplug connector from injector to be tested.
- -> Connector with wire clip



- -> Connector with metal clamps
- Connect voltage tester V.A.G 1527 B as follows:

Connector Contact	Measure against
1	Engine earth

- Operate the starter briefly. (The engine can be allowed to start.)
 - The LED should light up.

If the LED does not light up:

- Test for open circuit in wiring between contact 1 and fuse for injectors.

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

- Rectify any open circuits.

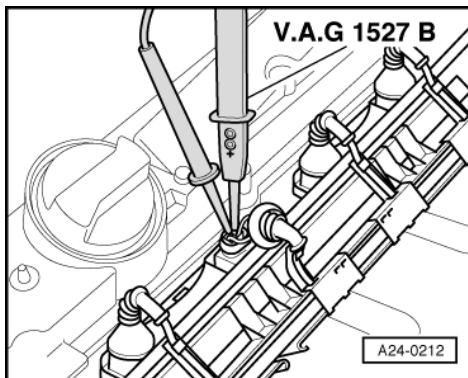
If the LED lights up:

- Test activation of injectors.

Checking activation

Test requirement:

- Internal resistance of injector OK.
- Slide back rubber sleeve on connector for injector, but do not unplug the connector.



- -> Connect voltage tester V.A.G 1527 B between contact 2 (signal) and contact 1 (positive).

Note:

Use test probes V.A.G 1594 A on vehicles with sealed connectors.

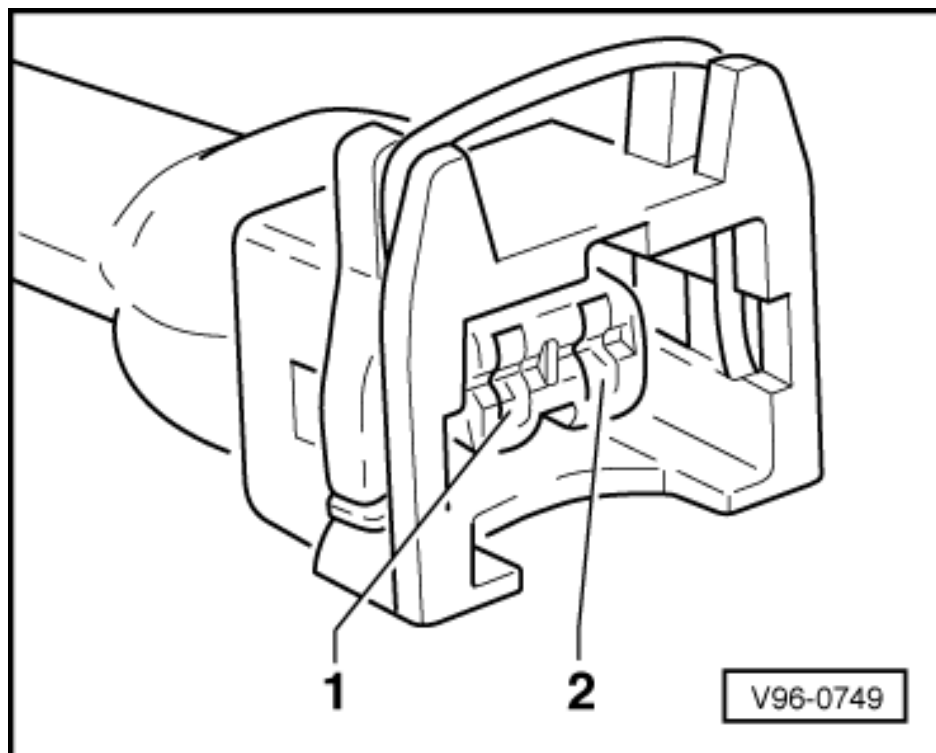
- Operate the starter briefly. (The engine can be allowed to start.)
 - The LED should flash.

Note:

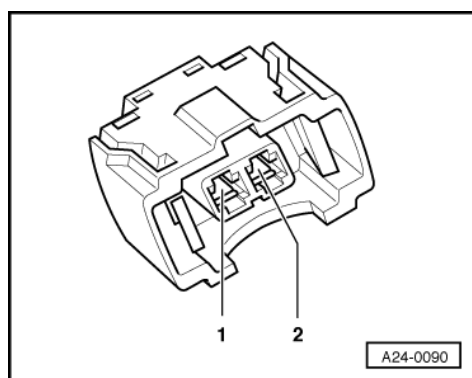
The LEDs on voltage testers with a low current draw continue to glow faintly between impulses from the engine control unit (rather than going out completely) and become much brighter when receiving an impulse.

If the LED does not flash:

- 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 36 .



- -> Connector with wire clip



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

Cylinder	Connector for injector Contact	Test box V.A.G 1598/31 Socket
1	2	96
2	2	89
3	2	97
4	2	88

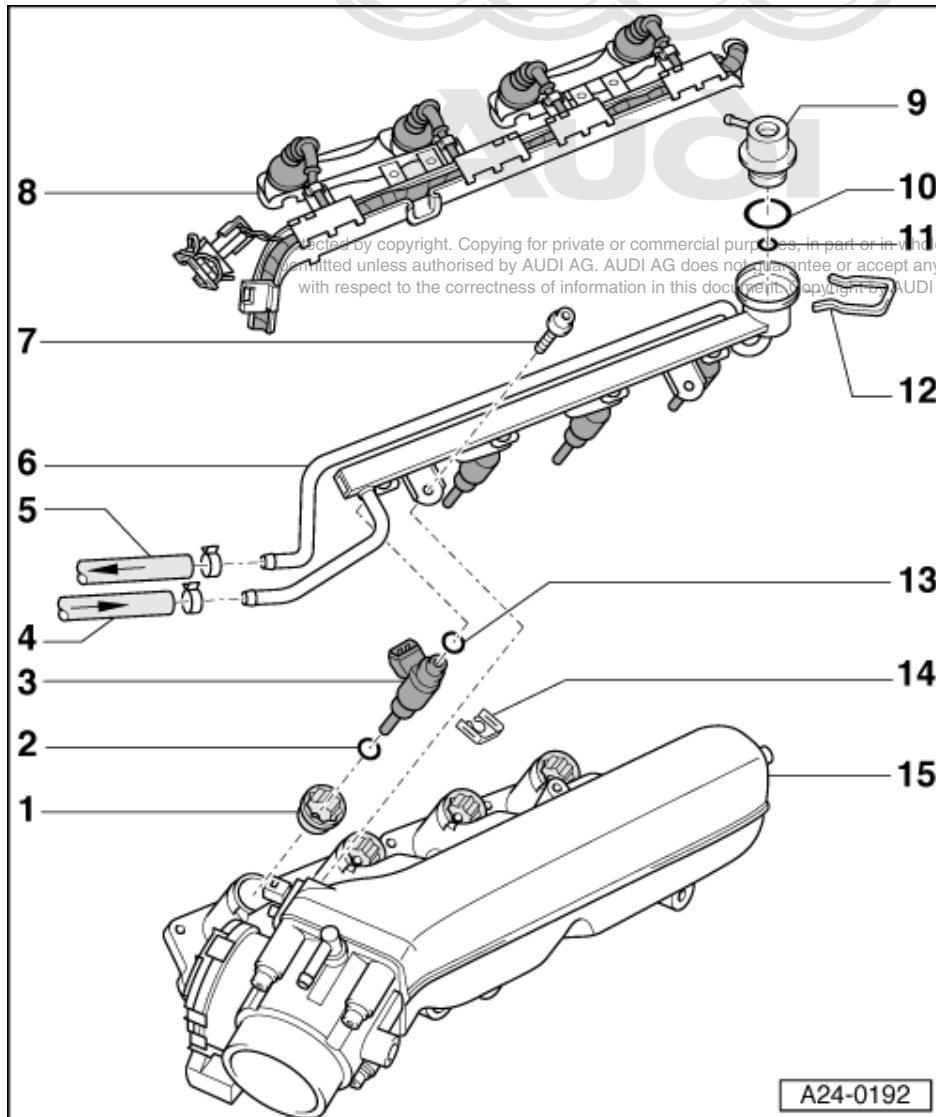
- Rectify short circuit or open circuit if necessary.

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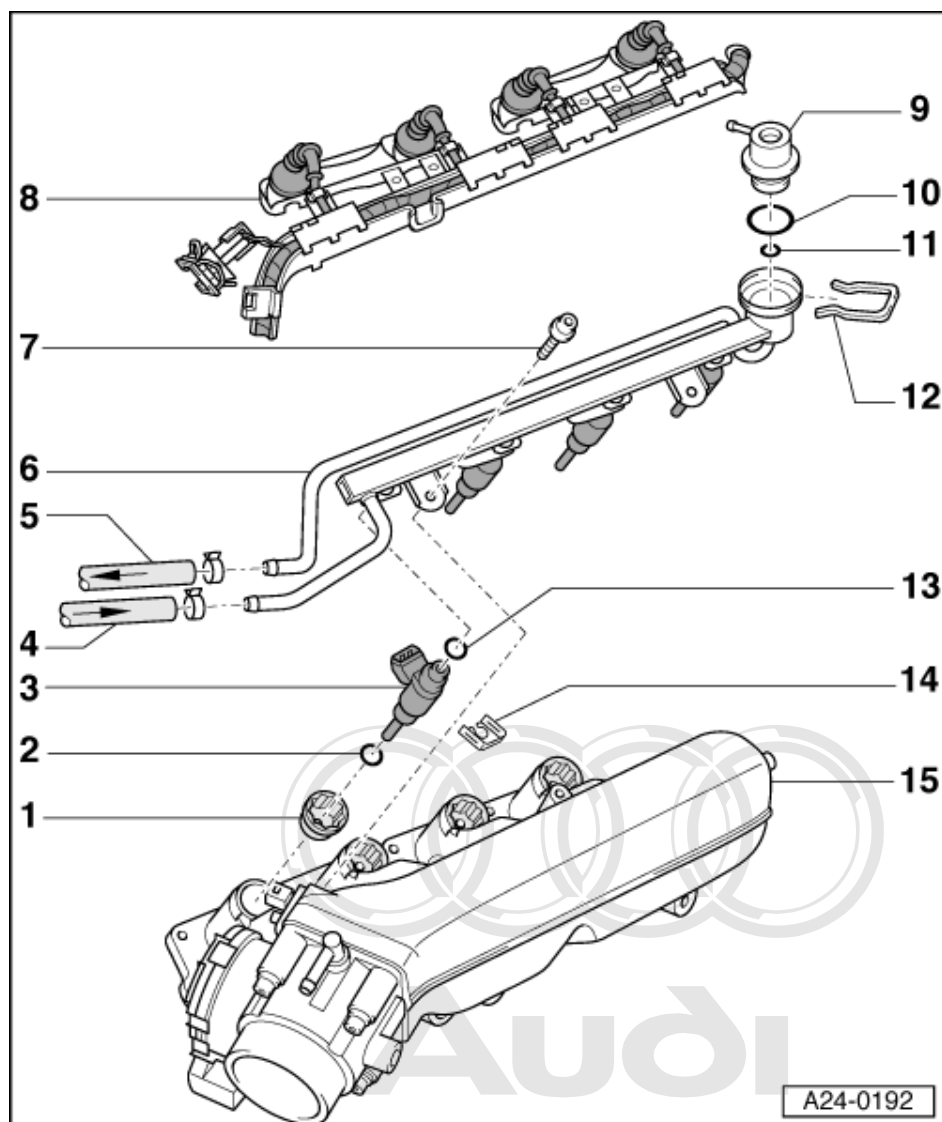
If the wiring is OK:

- Fit a new engine control unit => Page 38 .

1.12 - Dismantling and assembling fuel rail with injectors

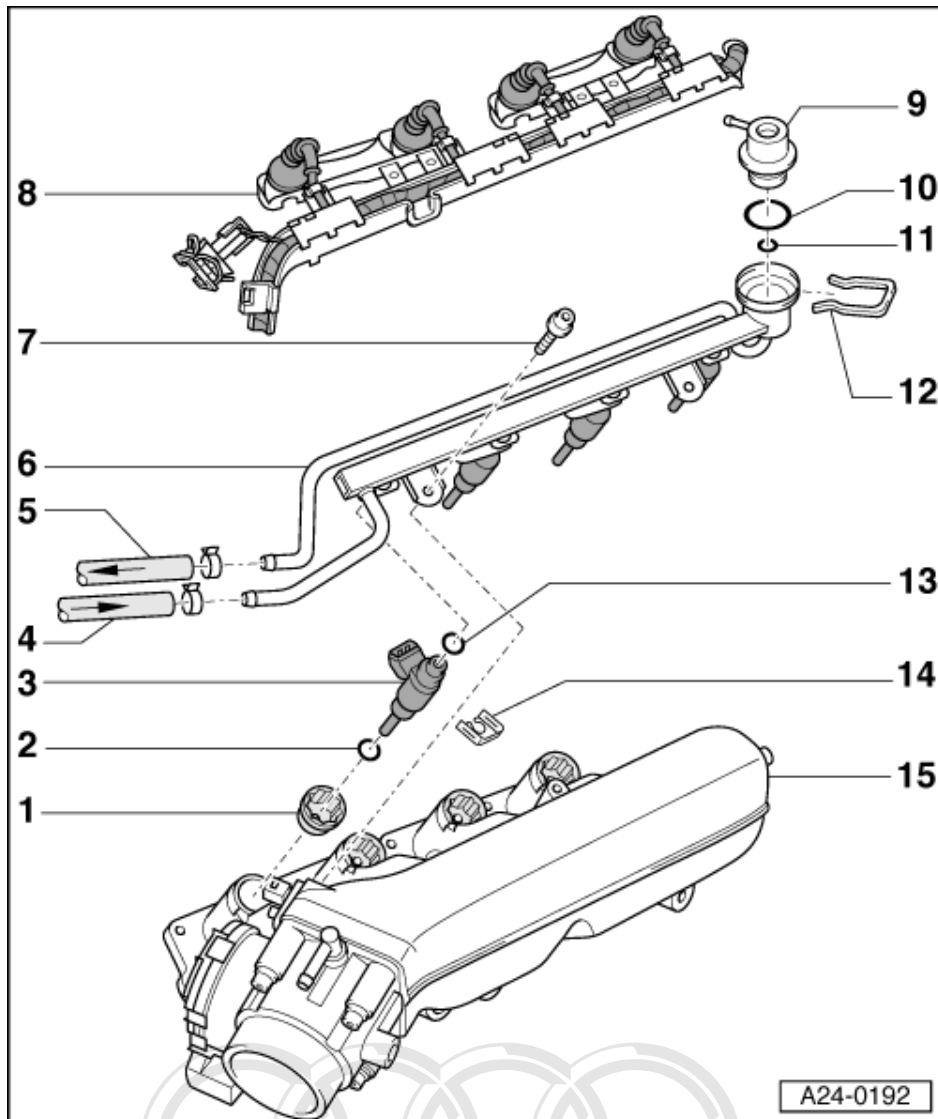


- 1 **Insert for injector - 3 Nm**
 - ♦ Install with locking fluid D 000 600 A2
- 2 **O ring**
 - ♦ Removing and installing
=> Page 52
 - ♦ Renew
 - ♦ Lubricate with clean engine oil
- 3 **Injector -N30...-N33**
 - ♦ Removing and installing
=> Page 52
- 4 **Supply hose**



- 5 **Return hose** Protected by copyright
6 **Fuel rail** permitted unless
7 **Hexagon socket head bolt,** with respect
-10Nm
8 **Connector**
♦ For injectors
♦ Qty. 4
9 **Fuel pressure regulator**
10 **O ring**
♦ Renew
11 **O ring**
♦ Renew
12 **Retaining clip**

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13 O ring

- ◆ Removing and installing
=> Page 52
- ◆ Renew
- ◆ Lubricate with clean engine oil

14 Retaining clip

- ◆ Ensure that clip is seated correctly on injector and fuel rail

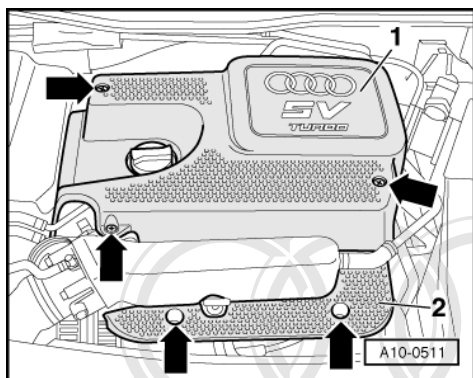
15 Intake manifold

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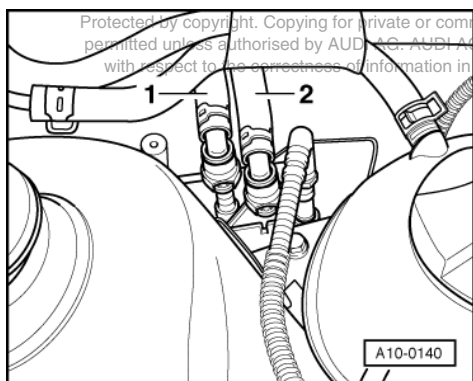


1.13 - Removing and installing injectors

Removing



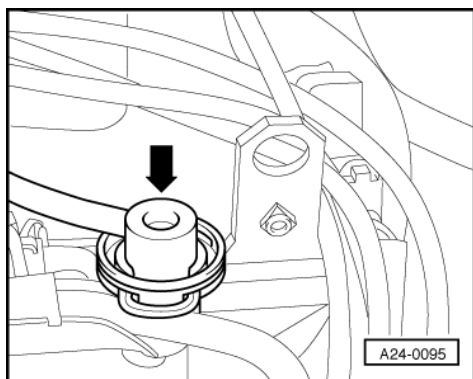
- -> Remove engine cover panel -arrows-.
- Disconnect wiring and unplug connectors for the following components:
 - Intake air temperature sender -G42
 - Hall sender -G163
 - Throttle valve control part -J338



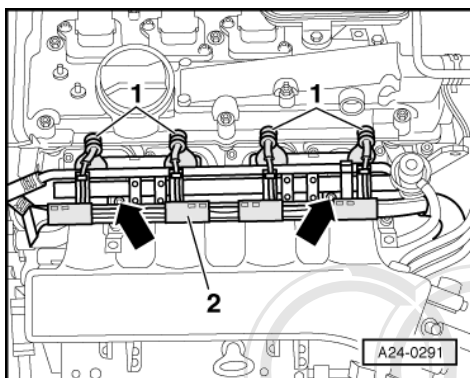
- -> Press release tabs and pull fuel supply line -1- and fuel return line -2- off connections.

Warning

Fuel system is under pressure. Before opening the system place a cloth around the connection. Then release pressure by carefully loosening the connection.



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



- -> Unplug connectors -1-.
- Disengage wiring duct -2-.
- Remove the 2 hexagon socket head bolts -arrows- securing the fuel rail.
- Pull fuel rail together with injectors off intake manifold (pull off evenly from the top) and place it on a clean cloth in the engine compartment.
- Take off retaining clip and remove injector.

Note:

To install a new fuel rail, first disconnect the fuel hoses.

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Installing

Installation is carried out in the reverse order. When doing this, note the following:

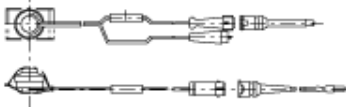
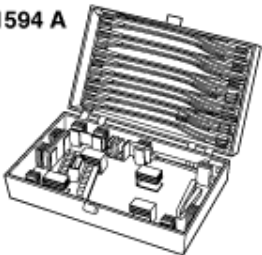
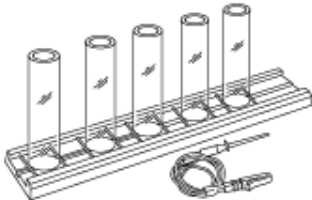
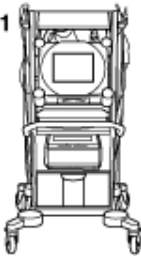
- Renew the O-rings at all opened connections. (When renewing the front O-ring, make sure not to remove the plastic cap from the injector head. The O-ring must be pulled off over the plastic cap.)
- Moisten the O-rings with clean engine oil.
- Make sure that the injectors are installed in the correct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

Tightening torque

Component	Nm
Fuel rail to intake manifold	10



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

V.A.G 1348/3-2 	V.A.G 1348/3A 
V.A.G 1594 A 	V.A.G 1602 
VAS 5051 	G24-0001

Special tools and workshop equipment required

- ♦ V.A.G 1348/3-2
- ♦ V.A.G 1348/3A
- ♦ V.A.G 1594 A
- ♦ V.A.G 1602
- ♦ VAS 5051 with VAS 5051/1

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

Test requirement:

- Fuel pressure OK. Testing => Page 41 .

Test sequence

- Remove fuel rail (together with injectors) from intake manifold => Page 52 . Do not disconnect the fuel hoses.
- 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 36 .

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

Testing for leaks

- Switch on ignition.

Note:

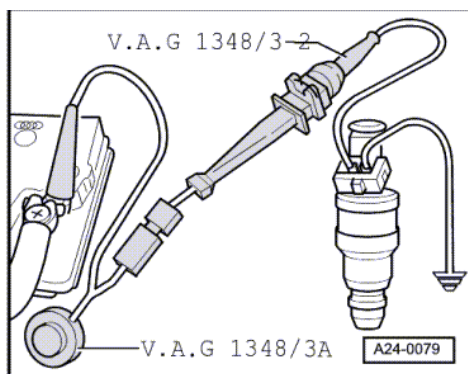
Once the ignition has been switched on the fuel pump runs continuously, even if the engine is not running. This is because when the ignition is switched on the fuel pump relay receives a positive voltage supply via the central electrics. The negative voltage supply for the fuel pump relay comes via the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

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- 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 => Page 52 .

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 lead and crocodile clamp from V.A.G 1594 A.
- 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 on ignition.
 - The fuel pump should run.
- Activate remote control V.A.G 1348/3A for 30 seconds.
- Carry out measurement on all injectors.
- Once all four injectors have been actuated, place measuring glasses on a level surface.
 - Specification for each injector: 145 ±12 ml
- If the measured value for one or more of the injectors is outside the tolerance range, switch off the fuel pump (by switching off the ignition) and renew the defective injector => Page 52 .

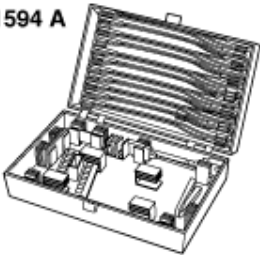
Note:

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

- Install injectors together with fuel rail => Page 53 .



1.15 - Testing fuel pump relay -J17 and activation

V.A.G 1526 A 	V.A.G 1594 A 
V.A.G 1598/31 	
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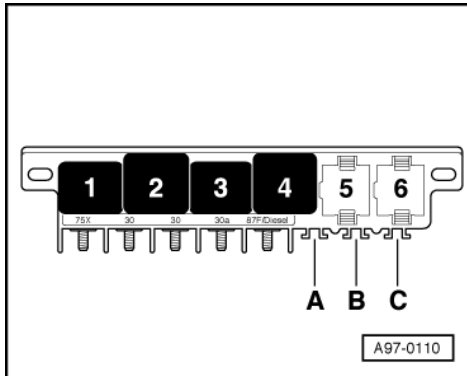
Special tools and workshop equipment required

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

The fuel pump and some of the injection system components receive their voltage supply via fuel pump relay -J17.

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 revolution impulses.

Note:



-> The fuel pump relay is located in the micro central electrics on the left of the driver's footwell, relay position 4.

Test requirement:

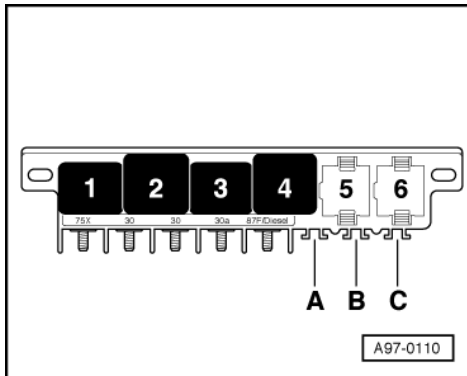
- Battery voltage not less than 11 V

Testing operation of fuel pump relay

- Remove storage compartment on driver's side.

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

- 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 1 .)
When doing this the ignition must be switched on.
- Start final control diagnosis (=> Page 14) and activate ACF solenoid valve 1 (-N80).



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- -> The fuel pump relay should pick up and the fuel pump should run. (Relay is located in relay position 4 in micro central electrics on left of driver's footwell).

A - If the relay does not pick up:

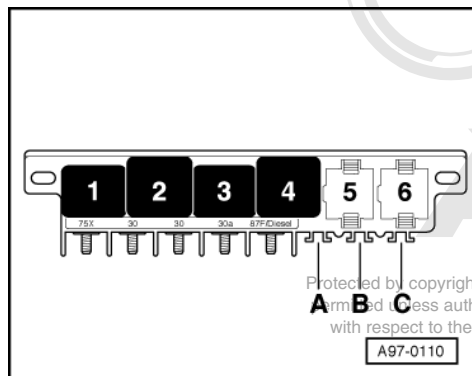
- Test activation of fuel pump relay.

B - If the relay picks up but the fuel pump does not run:

- Test voltage supply to fuel pump and other components (via fuel pump relay) =>Page 59 .

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 36 .
- Bridge contacts 1 and 65 on the test box using test leads from adapter set V.A.G 1594 A.
- Switch ignition on.



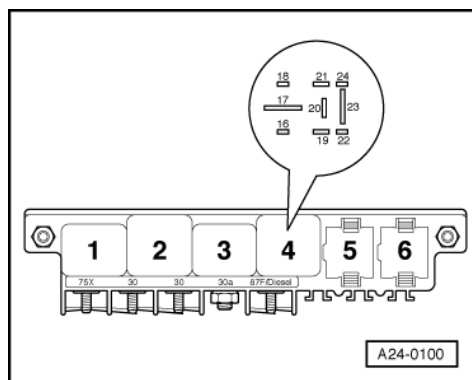
- -> The fuel pump relay should pick up. (Relay is located in relay position 4 in micro central electrics on left of driver's footwell).

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

- Fit a new engine control unit => Page 38 .

If the relay does not pick up:

- Switch off ignition.
- Disconnect fuel pump relay.



- -> Connect multimeter (voltage measurement range) between earth and contact 19 on relay panel.
- Switch ignition on.
 - Specification: approx. battery voltage

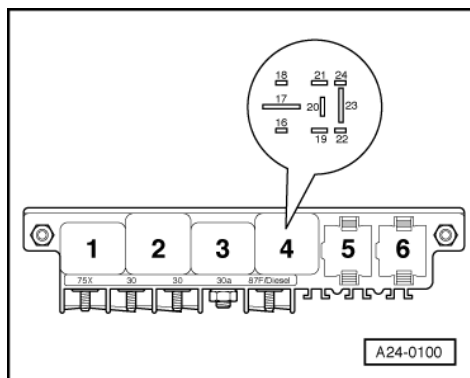
If the specification is not obtained:

- Check the wiring.

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

If the specification is obtained:

- Switch off ignition.



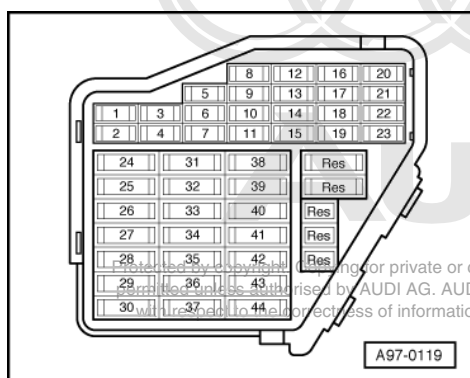
- -> Test for open circuit and short to positive or earth in the following wiring connections:

Micro central electrics on left of driver's footwell, relay position 4 Contact	Test box V.A.G 1598/31 Socket
16	65

- Rectify any open/short circuit as necessary.

If no fault is found:

- Fit a new fuel pump relay -J17.



- Reconnect the engine control unit.

Testing voltage supply to fuel pump and other components

- -> Remove fuse Nos. S228, S232, S234 and S243 (sockets 28, 32, 34 and 43) from fuse holder.
- Start final control diagnosis (=> Page 14) and activate ACF solenoid valve 1 (-N80).
- For each of the following fuse positions in the fuse holder, connect the multimeter (voltage measurement range) between earth and one of the fuse contacts:

Fuse	Specification (for one contact)
S228	Approx. battery voltage
S232	Approx. battery voltage
S234	Approx. battery voltage
S243	Approx. battery voltage

If the specifications are not obtained:

- Repeat the test on the other fuse contact.



If the specifications are again not attained:

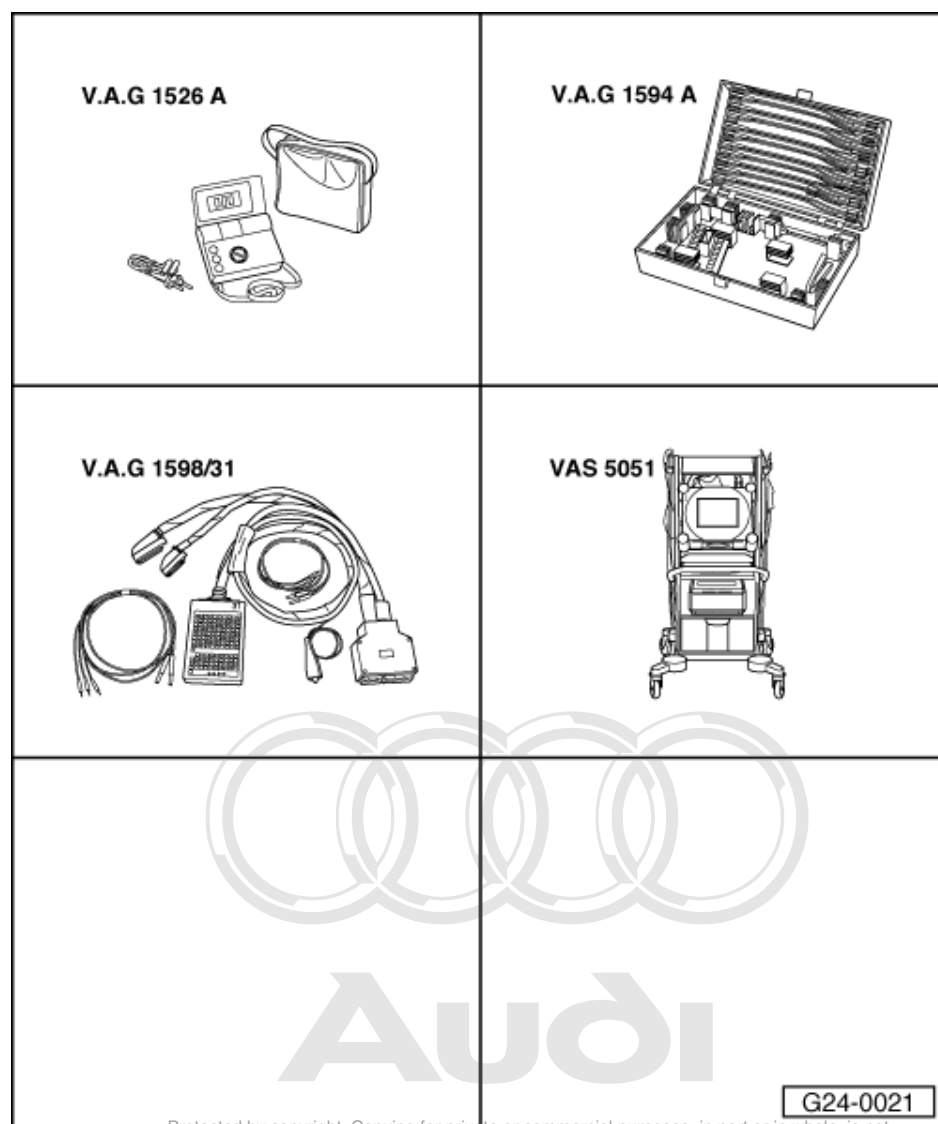
- Check wiring

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

If no fault is found:

- Fit a new fuel pump relay -J17.
- Refit fuses.

1.16 - Testing air mass meter -G70



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Special tools and workshop equipment required

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

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

Requirements for test:

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

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

- Fuel pump relay OK. Testing => Page 56 .

Note:

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

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 1 .)
- When doing this the engine must be idling.

-> Indicated on display:

Rapid data transfer HELP
Select function XX

- Enter "04" to select "Basic setting" and confirm with 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 Q
Enter display group number XXX

- Enter "002" to select Display Group 002 and confirm entry with Q key.

-> Indicated on display:

Basic setting 2
1 2 3 4

- Check display values for engine load.

	Display zones			
	1	2	3	4
Display Group 002: 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	Average injection period	Air mass
Range	0...6800 rpm	110 kW: 15...150 % 132 kW: 15...175 %	110 kW: 2.0...18.0 ms 132 kW: 2.0...19.0 ms	110 kW: 2.0...154g/s 132 kW: 2.0...170 g/s
Specification	700...820 rpm 1) 640...760 rpm2)	15.0....25.0 %	2.0....4.0 ms	2.0....4.5 g/s



Note	Display zones			
	---	---	If readout does not match specification, see table for display zone 3 => Page 62	If readout does not match specification, see table for display zone 4 => Page 62

- 1) Manual gearbox, front-wheel drive and four-wheel drive
- 2) Automatic gearbox, front-wheel drive

If the specification is obtained:

- Press =>key.

-> Indicated on display (function selection):

Rapid data transfer HELP
Select function XX

Reading Display Group 002

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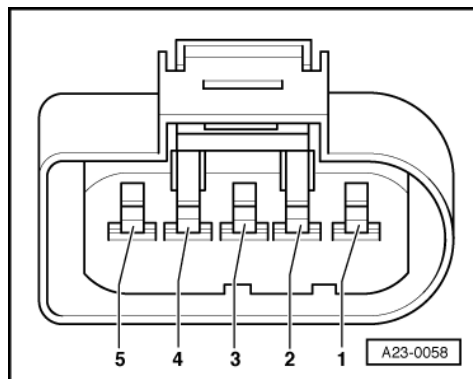
Display zone 3	Possible cause of fault	Fault remedy
Less than 2.0 ms	- Lower values can only occur when vehicle is on overrun	
More than 4.0 ms	- Load on engine due to ancillaries	- Eliminate load (air conditioner, power steering, alternator)
	- Rough idling (engine not running on all cylinders)	- Test spark plugs Test injectors => Page 45
	- Throttle valve control part -J338 defective	- Test throttle valve control part => Page 103

Reading Display Group 002

Display zone 4	Possible cause of fault	Fault remedy
Less than 2.0 g/s	- Large quantity of unmetered air between intake manifold and air mass meter - Voltage supply to air mass meter or wiring to engine control unit	- Check intake system for leaks (unmetered air) => Page 62
More than 4.5 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 62

Testing voltage supply to air mass meter

- Unplug connector from air mass meter.



- -> Connect multimeter (voltage measurement range) as follows:

Connector Contact	Measure against
2	Engine earth

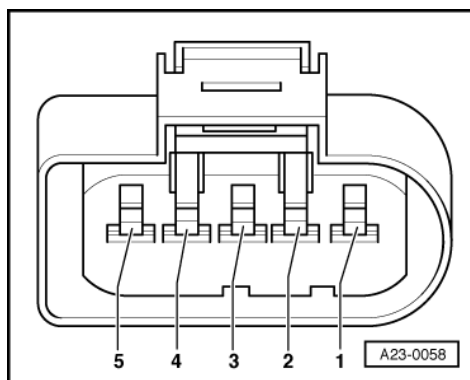
- Operate starter briefly.
 - Specification: approx. battery voltage

If the specification is not attained:

- Test for open circuit or short to earth in wiring between fuel pump relay and contact 2 on connector via fuse.

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

- Rectify short circuit or open circuit if necessary.



- -> Connect hand-held multimeter (voltage measurement range) between contacts 2 and 3 of connector.
- Operate starter briefly.
 - Specification: approx. battery voltage

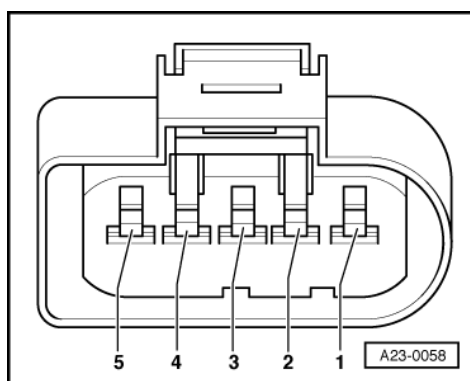
Note:

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Contact 3 on the connector is for the earth connection from the engine control unit.

If the specification is not attained:

- Test the wiring => Page 64 .



- -> Connect hand-held multimeter (voltage measurement range) between contacts 3 and 4 of connector.
- Switch ignition on.
 - Specification: approx. 5 V

If the specification is not attained:

- Test the wiring => Page 64 .

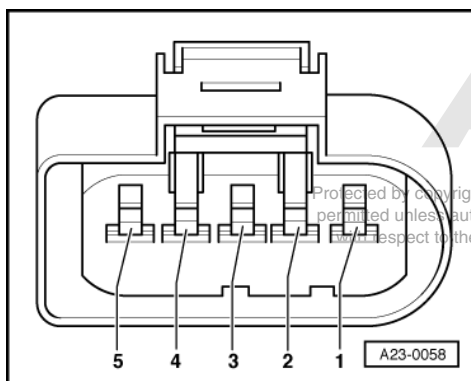


Testing wiring for air mass meter

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 36 .



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

Connector Contact	Test box V.A.G 1598/31 Socket
3	27
4	53
5	29

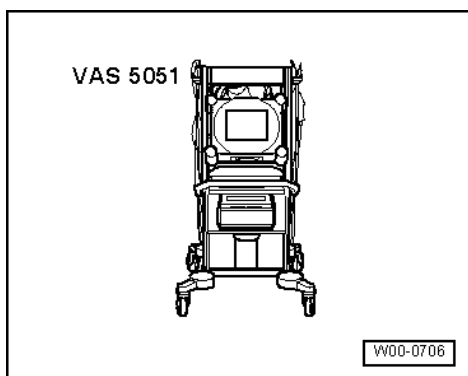
- Rectify short circuit or open circuit if necessary.
- Test all wires for short circuits with each other.

If the wiring is OK:

- Fit a new air mass meter -G70.

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

Special tools and workshop equipment required



- ♦ VAS 5051 with VAS 5051/1

or

- ♦ V.A.G 1551 and V.A.G 1551/3 A
- ♦ Engine leak detector spray G 001 800 A1

Notes:

- ♦ The vacuum in the intake system will cause the leak detector spray to be drawn in with the 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.
- ♦ The safety precautions listed on the container must be adhered to.

Test sequence

- 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 1.)
When doing this the engine must be idling.

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

- Enter "08" to select 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	

- Enter "001" to select Display Group 001 and confirm entry with Q key.

-> Indicated on display:

(1...4 = Display zones)

Read measured value block	1
1 2 3 4	

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

If the engine speed does not change:

- Press the =>key.

-> Indicated on display (function selection):

Rapid data transfer	HELP
Select function XX	

If the engine speed drops:

- Press the =>key.
- Enter "06" to select the function "End output" and confirm entry with Q key.
- Switch off ignition.
- Check sprayed areas of intake system for leaks and rectify if necessary.

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2 - Testing lambda control

2.1 - Testing lambda control

2.2 - Function of lambda control (before catalytic converter)

Notes:

The lambda probe compares the oxygen content in the air with the residual oxygen content in the exhaust gas and sends a voltage signal to the control unit.

The voltage signal for "Mixture too rich" (low residual oxygen) is between about 0.7 and 1.1 V (based on reference earth).

The voltage signal for "Mixture too lean" (high residual oxygen) is between about -0.1 and +0.3 V (based on reference earth).

The transition from "rich" to "lean" is accompanied by a voltage jump from between 0.7 and 1.1 V to between -0.1 and +0.3 V (based on 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".

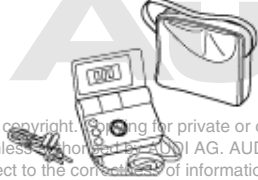
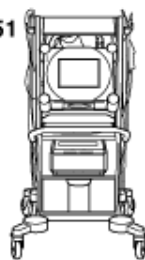
If the voltage does not change or only changes slowly the following faults are possible:

- ♦ 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 into the probe via the fine cavities in the electrical wiring as a result of temperature 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.)



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2.3 - Testing lambda probe and lambda control (before catalytic converter)

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V.A.G 1598/31 	VAS 5051 
	G24-0021

Special tools and workshop equipment required

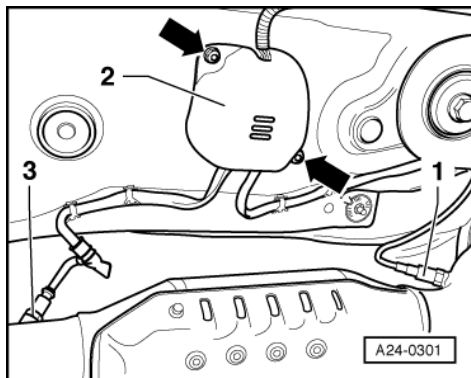
- ♦ V.A.G 1526 A
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/31
- ♦ VAS 5051 with VAS 5051/1

or

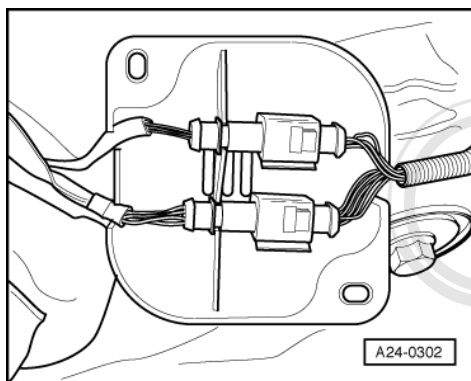
- ♦ V.A.G 1551 with V.A.G 1551/3 A

Notes:

- ♦ For the purposes of fault-finding it is possible to switch off the lambda control by selecting Display Group 099 in "Basic setting" mode and to switch it on again by selecting Display Group 099 in "Read measured value block" mode.



- ♦ After selecting Display Group 099 (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.
- ♦ -> The 4-pin connectors for lambda probes and lambda probe heating are accessible after unscrewing - arrows- the connector cover -2- from the underside of the vehicle (right side).



- ♦ -> Colour coding of connectors:
Black for lambda probe (before catalytic converter) -G39 and lambda probe heater -Z19;
Brown for lambda probe after catalytic converter -G130 and lambda probe 1 heater, after catalytic converter -Z29.

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Requirements for test:

- 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 1 .)
- When doing this the engine must be idling.

-> Indicated on display:

Rapid data transfer HELP
Select function XX

- Enter "04" to select "Basic setting" and confirm with 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 Q
Enter display group number XXX

- Enter "030" to select Display Group 030 and confirm entry with Q key.

-> Indicated on display:

Basic setting 30			
1	2	3	4

- Check lambda probe status in display zone 1.

Note:

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

	Display zones			
	1	2	3	4
Display Group 030: Lambda probe status				
Display	X X X	XXX		
Indicates	Lambda probe status Bank 1, probe 1	Lambda probe status Bank 1, probe 2		
Range	0 = off 1 = on	0 = off 1 = on		
Specification	1 1 1	110		
Note	If readout does not match specification => Page 69 .			

Relevance of 3-figure display in Display Group 030

X	X	X	Display zone 1
			Lambda control active
	1		Lambda probe condition
1			Status of lambda probe heating

Note:

The first digit in this three-digit display (heating) fluctuates between 0 and 1.

Testing lambda probe learned values and lambda control

- Press C key.
- Enter "032" to select Display Group 032 and confirm entry with Q key.

-> Indicated on display:

Basic setting 32			
1	2	3	4

- Check readouts for lambda control in display zones 1 and 2.

	Display zones			
	1	2	3	4
Display Group 032: Lambda learned values				
Display	xx.x %		xx.x %	
Indicates	Lambda learned value, Bank 1, Probe 1 at idling speed (additive)		Lambda learned value, Bank 1, Probe 1 at part throttle (multiplicative)	
Specification	-10.0...10.0 % (slight fluctuation possible)		-10.0...10.0 % (slight fluctuation possible)	



	Display zones		
Note	If the specification is not attained =>Page 70		

- Press C key.
- Enter "033" to select Display Group 033 and confirm entry with Q key.

-> Indicated on display:

Basic setting 33

1 2 3 4

- Check readouts for lambda control in display zones 1 and 2.

	Display zones		
	1	2	3 4
Display Group 033: Lambda control			
Display	xx.x %	x.xxx V	
Indicates	Lambda control Bank 1	Lambda probe voltage Bank 1	
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 about 0.3 V	
Note	If readout does not match specification =>Further notes, Page 70	If readout does not match specification =>Reading Display Group 033, Page 71	

Further notes

If the readout in display zone 1 does not match the specification, 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 readout in display zone 1 still does not match the specification even after the test drive, or if the readout still does not fluctuate by at least 2 %:

- Test the basic voltage => Page 71 .
- Test the lambda probe heating=> Page 78 .

Reading Display Group 032

Display zone 1 / 2	Possible cause of fault	Fault remedy
Lambda learned values between -10.0 and -25.0 %	- Air leak in intake system (pressure side between turbocharger and intake manifold)	- Check intake system for leaks and eliminate unmetered air => Page 64
	- Oil dilution	- Change oil 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 60
	- Solenoid valve for activated charcoal filter sticking in open position	- Test solenoid valve for activated charcoal filter => Page 96
	- Fuel pressure too high	- Test fuel pressure regulator => Page 41
	- Injector does not close	- Test injectors => Page 45

	- Lambda probe heating defective - Lambda probe defective	- Test lambda probe heating => Page 78
--	--	--

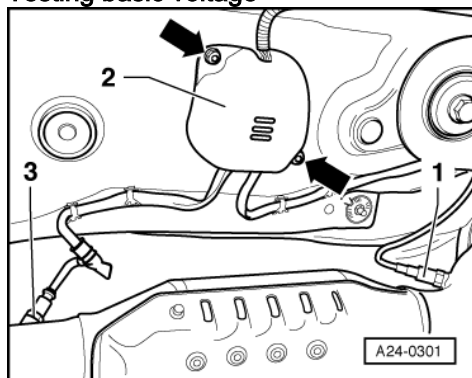
Reading Display Group 032

Display zone 1 / 2	Possible cause of fault	Fault remedy
Lambda learned values between 10.0 and 25.0 %	- Unmetered air in intake tract	- Check intake system for leaks and eliminate unmetered air => Page 64
	- Fuel pressure too low	- Test fuel pressure regulator => Page 41
	- Air mass meter defective	- Test air mass meter => Page 60
	- Lambda probe heating defective - Lambda probe defective	- Test lambda probe heating => Page 78
	- Injector not opening or only opening partially	- Test injectors => Page 45
	- Solenoid valve for activated charcoal filter sticking	- Test solenoid valve for activated charcoal filter => Page 96

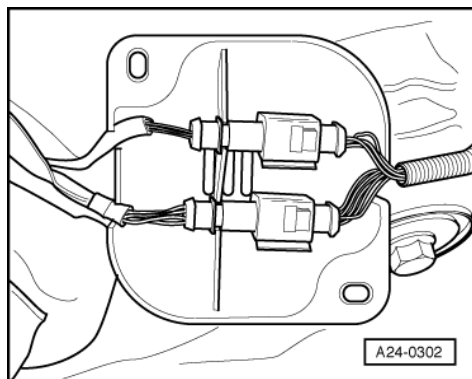
Reading Display Group 033

Display zone 2	Possible cause of fault	Fault remedy
Approx. 0.450 V (constant)	- Open circuit in wire 4 between lambda probe and control unit	- Test basic voltage => Page 71
	- Open circuit in wire 3 between lambda probe and control unit	
Approx. 0.200 V (constant)	- Lambda probe defective	- Renew lambda probe
More than 1.100 V	- Short to positive in wire 4 between lambda probe and control unit	- Test lambda probe (before catalytic converter) => Page 72
Less than 0.150 V	- Short to earth in wire 4 between lambda probe and control unit	

Testing basic voltage

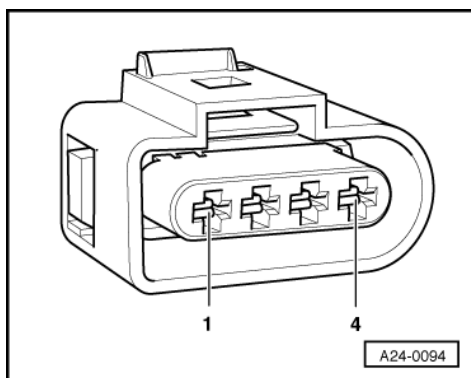


- -> Unbolt connector cover -arrows-.





- -> Unplug 4-pin connector (black) for lambda probe (before catalytic converter) -G39.



- -> Connect multimeter (voltage measurement range) between contacts 3 and 4.
- Switch ignition on.
 - Specification: 0.400 ... 0.500 V
- Switch off ignition.

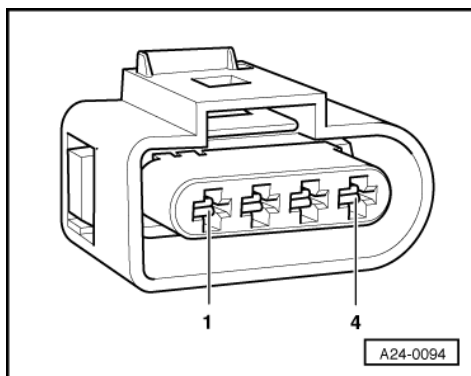
If the specification is not obtained:

- Test lambda probe wiring.

If the specification is obtained:

- Replace the lambda probe (before catalytic converter) -G39.

Testing lambda probe 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 36 .
- -> Test the following wiring connections for open circuits:

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

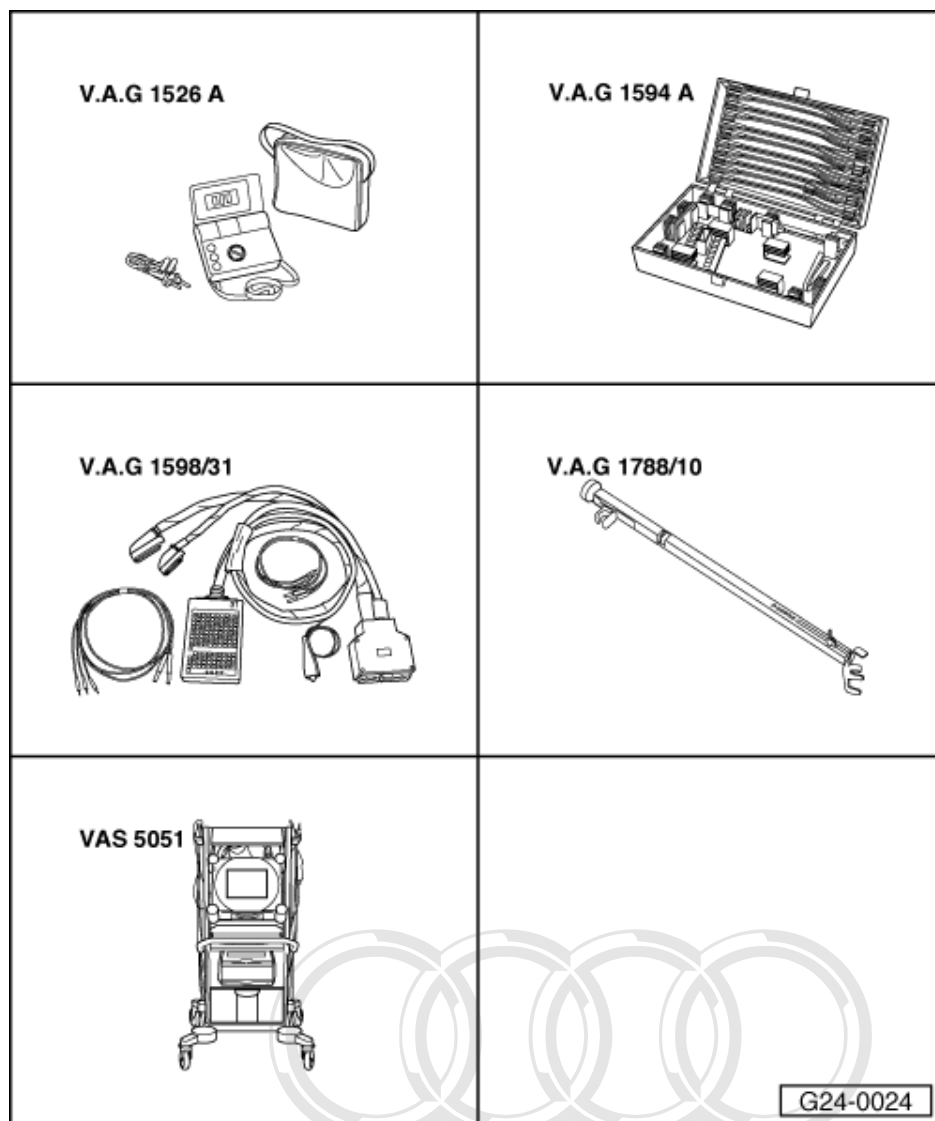
- Rectify any open circuits.
- Test for short circuits between the wires.

If the wiring is OK:

- Fit a new engine control unit => Page 38.

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2.4 - Testing lambda probe and lambda control (after catalytic converter) - not on vehicles with engine code letters AJQ, AQA



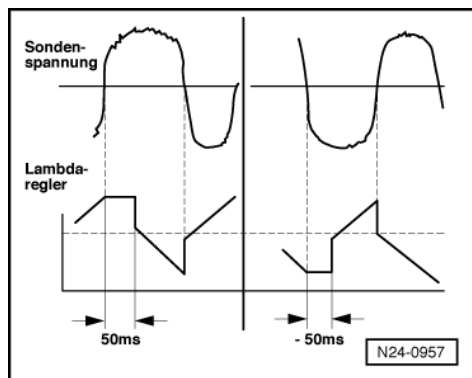
Special tools and workshop equipment required

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

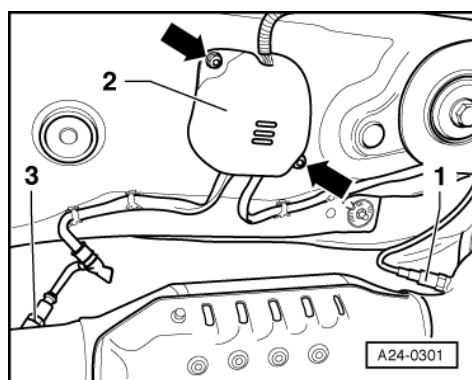
- ◆ V.A.G 1551 with V.A.G 1551/3 A

Notes:

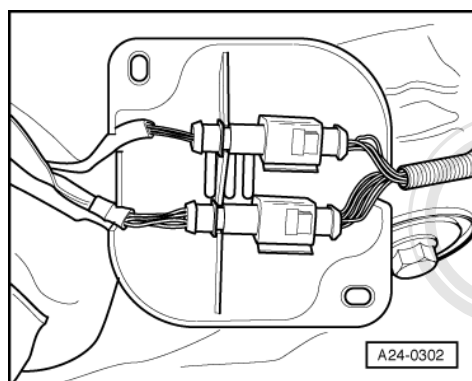
- ◆ The lambda control after catalytic converter governs the lambda control before catalytic converter and regulates variations in the control values.



- -> If the air/fuel mixture provided by the lambda probe before catalytic converter deviates slightly from the required value (e.g. mixture too rich), the lambda probe after catalytic converter maintains the voltage signal transmitted by the lambda probe before catalytic converter at minimum/maximum for a certain period (control period). If the voltage signal is held in the positive range (e.g. 50 ms), the air/fuel mixture is enriched, if it is held in the negative range (e.g. -50ms), the air/fuel mixture is leaned down.



- -> The 4-pin connectors for lambda probes and lambda probe heaters are accessible after unscrewing - arrows- the connector cover -2- from the underside of the vehicle (right side).



- -> Colour coding of connectors:
Black for lambda probe (before catalytic converter) -G39 and lambda probe heater -Z19;
Brown for lambda probe after catalytic converter -G130 and lambda probe 1 heater, after catalytic converter -Z29.

Requirements for test:

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

Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 1 .)

When doing this the engine must be idling.

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

- Enter "04" to select "Basic setting" and confirm with 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	Q
Enter display group number XXX	

- Enter "030" to select Display Group 030 and confirm entry with Q key.
- Set an engine speed of 1800...2200 rpm using speed regulator V.A.G 1788/10:

Note:

The lambda control of the lambda probe after catalytic converter (B1-S2) is not actuated without engine load.

-> Indicated on display:

System in basic setting	30
1 2 3 4	

- Check status of lambda probe (after catalytic converter) in display zone 2.

Notes:

- ♦ It can take some minutes to perform this process.
- ♦ The "lambda probe status" indicates the state of the lambda control and of the lambda probe.

	Display zones			
	1	2	3	4
Display Group 030: Lambda probe status at idling speed				
Display	X X X	X X X		
Display	Lambda probe status Bank 1, Probe 1	Lambda probe status Bank 1, Probe 2		
Range	0 = off 1 = on	0 = off 1 = on		
Specification	1 1 1	1 1 0		
Note	If readout does not match specification => Page 71 .			

Note:

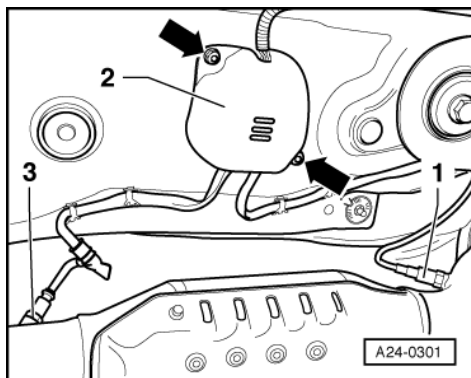
The first digit of the three digit display (lambda probe heating) jumps between 0 and 1.

Relevance of 3-figure display in Display Group 030

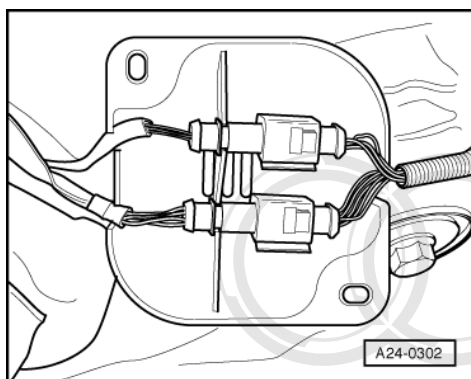
X	X	X	Display zone 2
		1	Lambda control active
	1		Lambda probe condition
1			Status of lambda probe heating



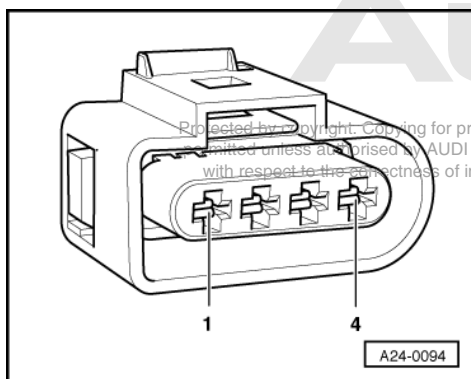
Testing basic voltage



- -> Remove connector cover -arrows-.,



- -> Unplug 4-pin connector (brown) for lambda probe (after catalytic converter) -G130.



- -> Connect multimeter (voltage measurement range) between contacts 3 and 4.
- Switch ignition on.
 - Specification: 0.400 ... 0.500 V
- Switch off ignition.

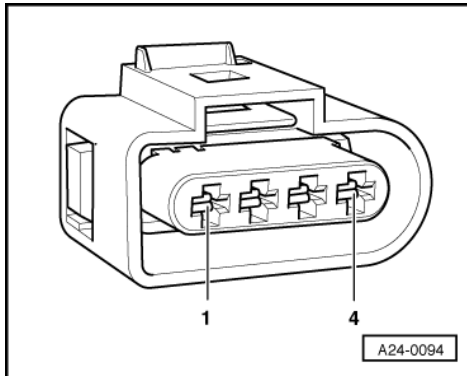
If the specification is not obtained:

- Test lambda probe wiring.

If the specification is obtained:

- Renew lambda probe after catalytic converter.

Testing lambda probe 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 36 .
- -> Test the following wiring connections for open circuits:

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

- Rectify any open circuits.
- Test for short circuits between the wires.

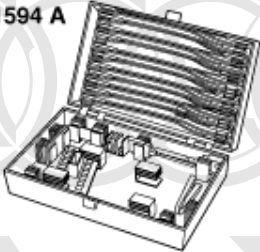
If the wiring is OK:

- Fit a new engine control unit => Page 38 .

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2.5 - Testing lambda probe heating -Z19 and -Z29 at lambda probes (before and after catalytic converter)

V.A.G 1526 A 	V.A.G 1594 A 
V.A.G 1598/31 	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.
	G24-0020

Special tools and workshop equipment required

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

Requirements for test:

- Coolant temperature at least 80 °C
- Fuse for lambda probe heating OK

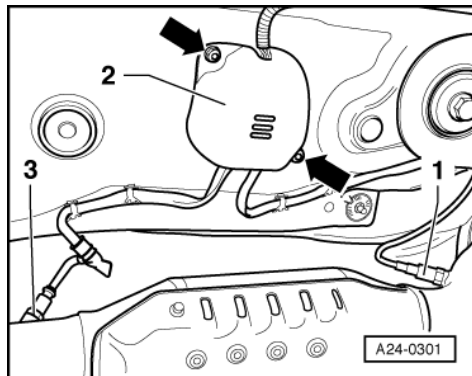
=> Current flow diagrams, Electrical fault finding and Fitting locations

- Fuel pump relay OK. Testing => Page 56 .

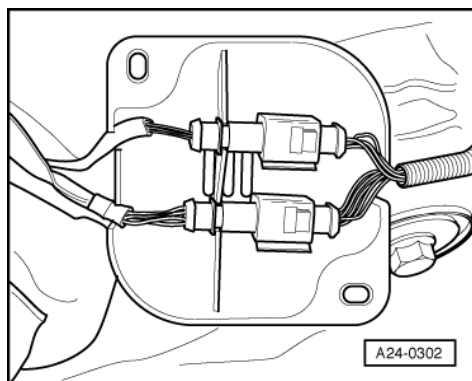
Note:

The lambda probe heating for lambda probes before and after catalytic converter receives its voltage supply via the fuel pump relay.

Test sequence



- -> Remove connector cover -arrows-

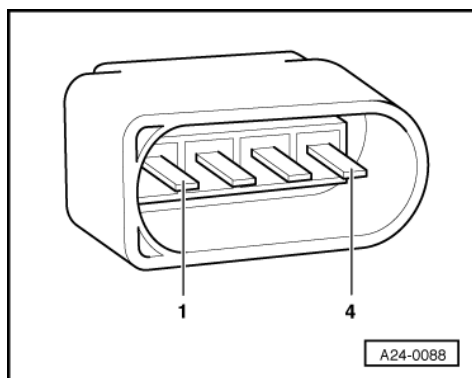


- -> Unplug 4-pin connector (black) for lambda probe (before catalytic converter) -G39.

Not on vehicles with engine code letters AJQ, AQA:

- Unplug 4-pin connector -1- (brown) for lambda probe (after catalytic converter) -G130.

All models



- -> Connect multimeter (resistance measurement range) between contacts 1 and 2 of the corresponding connector.
- Specification: 1 ... 5 ω (at room temperature)



Note:

The resistance will increase sharply at higher temperatures.

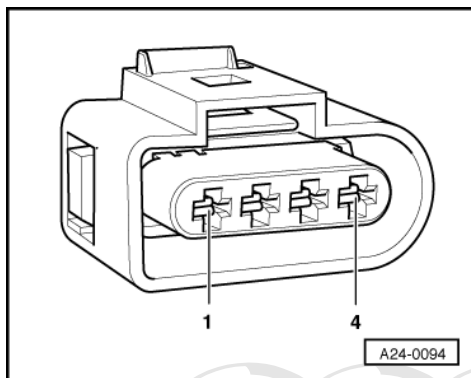
If the specification is not attained:

- Renew the lambda probe.

If the specification is obtained:

- Test voltage supply for lambda probe heating.

Testing voltage supply for lambda probe heating



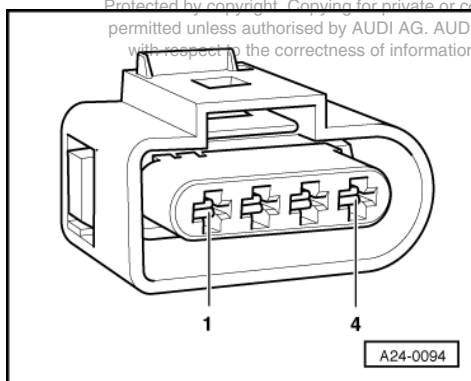
- -> Connect multimeter (voltage measurement range) between contacts 1 (positive) and 2 (earth).
- Start the engine.
 - Specification: approx. battery voltage (may fluctuate)

Notes:

- ♦ At certain points during operation, the engine control unit intervenes by constantly connecting and disconnecting the earth connection for lambda probe heating. For this reason the voltage displayed on the tester may fluctuate.
- ♦ If required, observe Display Group 041 in the "Read measured value block" function to find out when the engine control unit is switching the lambda probe heating on and off.

If no voltage is present:

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- -> Connect multimeter (voltage measurement range) as follows:

Connector Contact	Measure against
1 (positive)	Vehicle earth

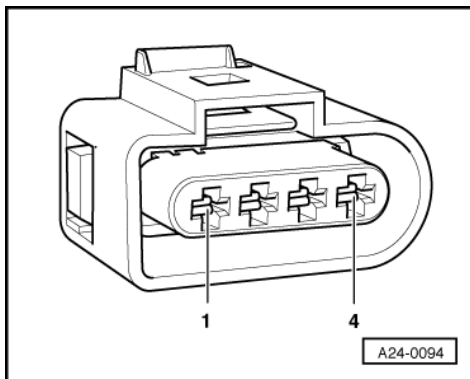
- Operate starter briefly.

- Specification: approx. battery voltage

If there is still no voltage reading:

- Test for open circuit in wiring from contact 1 to fuel pump relay via fuse.

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



If the voltage supply is OK:

- -> Connect multimeter (voltage measurement range) as follows:

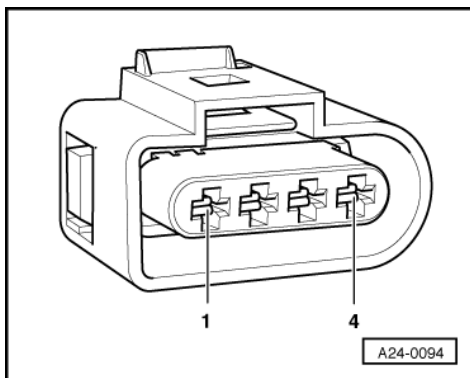
Connector Contact	Measure against
2 (switched earth connection for engine control unit)	Battery positive

- Start the engine.
 - Specification: approx. battery voltage (may fluctuate)
- Switch off ignition.

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If no voltage is present:

- 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 36 .



- -> Test for open circuits in the following wiring connection:
 - Lambda probe heater -Z19 for lambda probe before catalytic converter (black connector):

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



2	5
---	---

- Lambda probe heater -Z29 for lambda probe after catalytic converter (brown connector; not on vehicles with engine code letters AJQ, AQA):

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

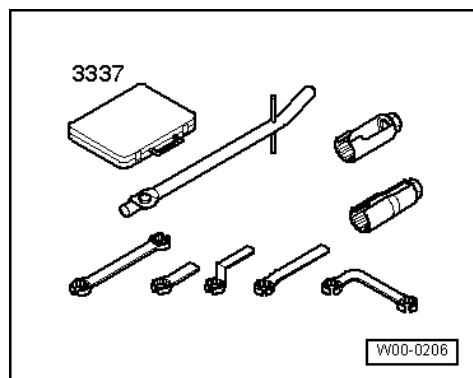
- Rectify any open circuits.

If the wiring connection is O.K. but the lambda probe heating still has no earth connection:

- Fit a new engine control unit => Page **38** .

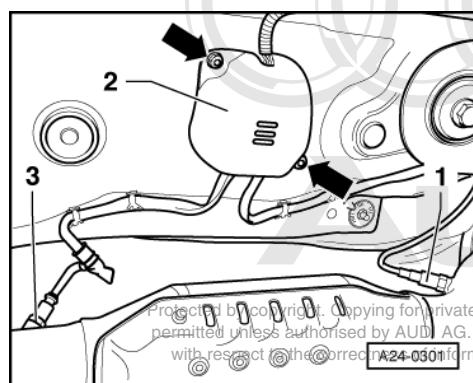
2.6 - Removing and installing lambda probe

Special tools and workshop equipment required

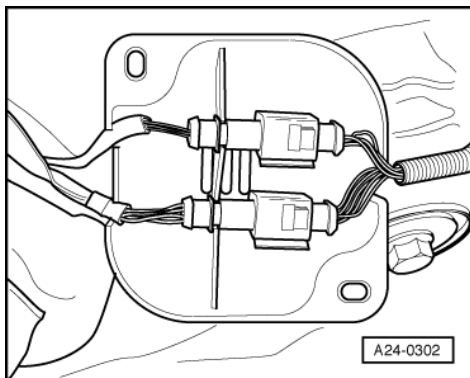


- ♦ Special tool 3337/9
- ♦ Hot paste G 052 112 A3

Removing



- -> Unbolt connector cover -arrows-.



- ◆ -> Colour coding of connectors:
Black for lambda probe (before catalytic converter) -G39 and lambda probe heater -Z19;
Brown for lambda probe after catalytic converter -G130 and lambda probe 1 heater, after catalytic converter -Z29.
- Unscrew lambda probe using special tool 3337/9.

Installing

When installing, note the following points:

Notes:

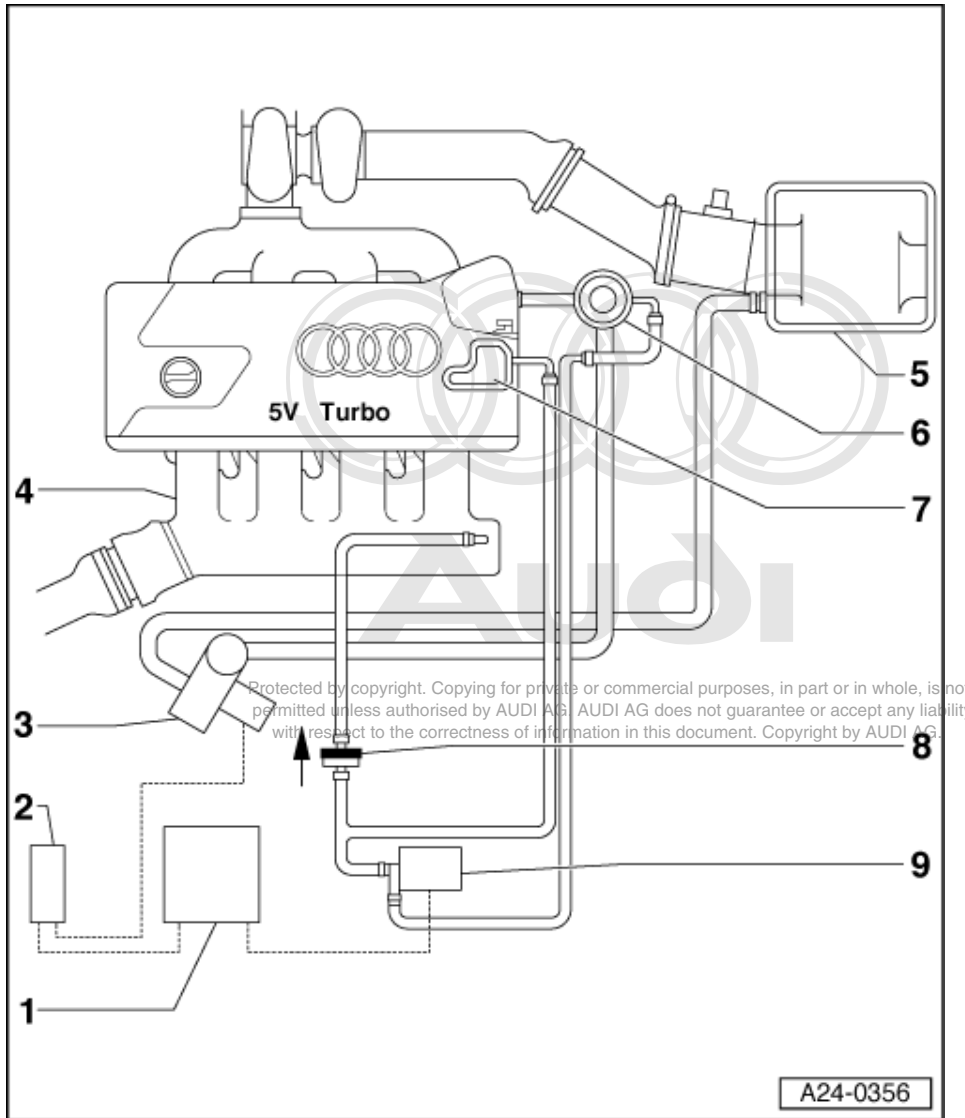
- ◆ When installing, the lambda probe wire must be secured in exactly the same position as before in order to avoid contact between the wire and the exhaust pipe.
- ◆ The screw thread on the lambda probe is coated with a special paste. This paste must not be allowed to penetrate the openings on the probe.
- ◆ Tightening torque: 55 Nm.

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3 - Testing secondary air system-not on vehicles with engine code letters AJQ, AQA

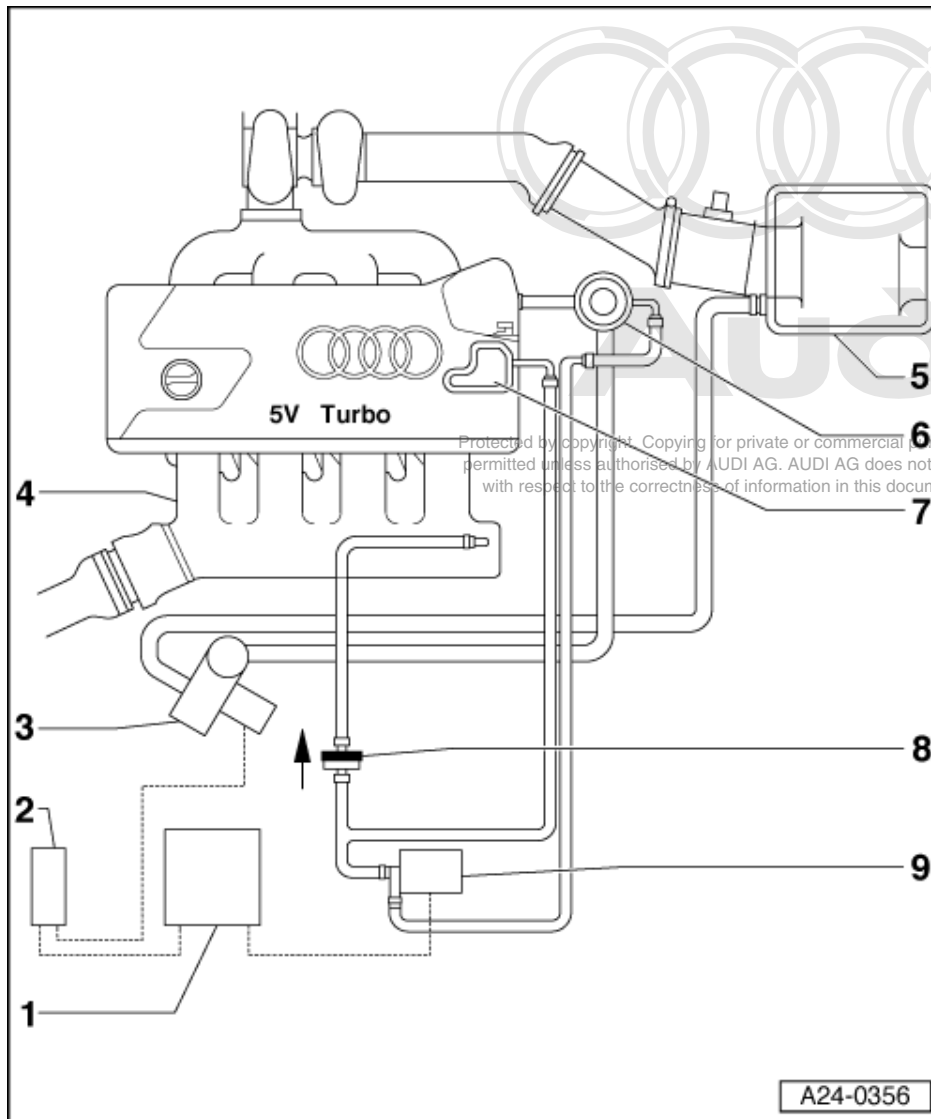
3.1 - Testing secondary air system-not on vehicles with engine code letters AJQ, AQA



The secondary air system is designed to enable the catalytic converter to heat up and reach its operating temperature more quickly after a cold start.

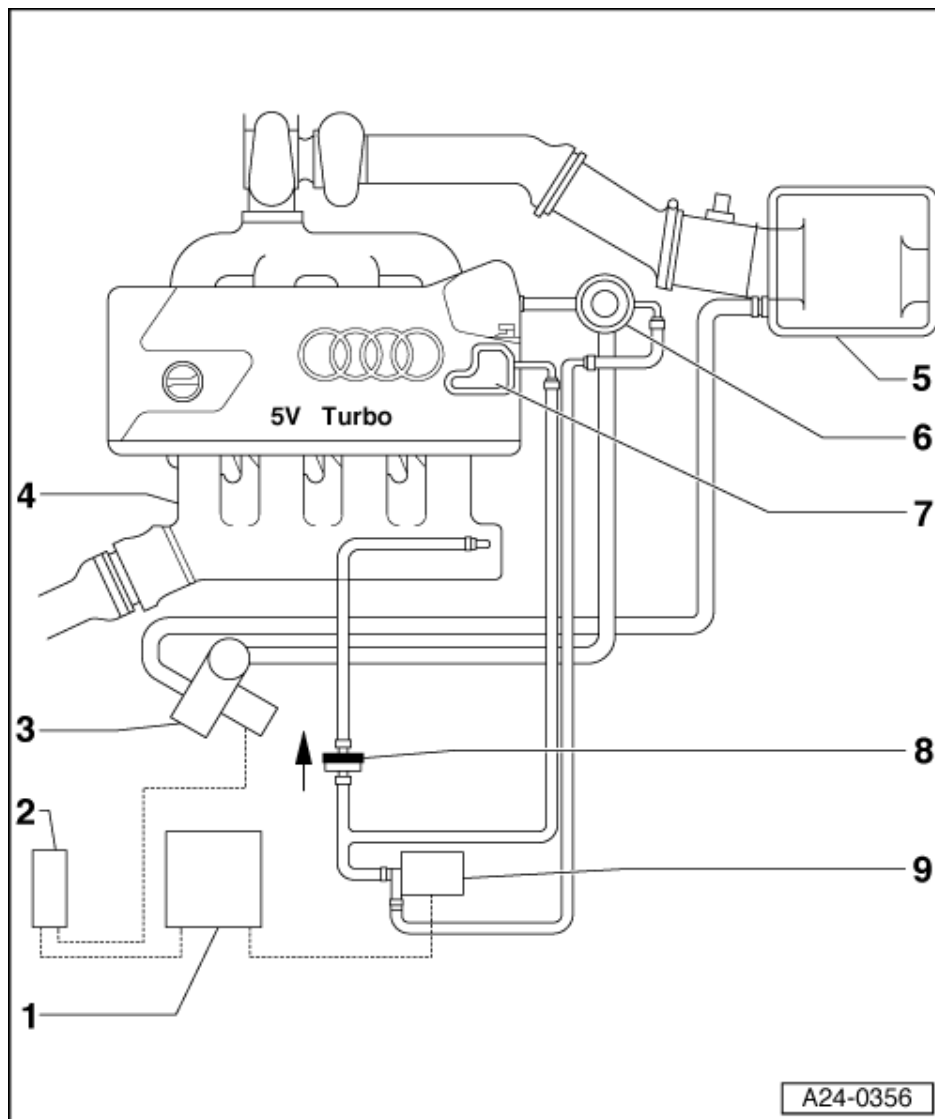
Principle of operation

Due to the extra mixture enrichment during the cold-start phase, an increased amount of unburnt hydrocarbons is carried in the exhaust gas. The secondary air system improves the afterburning (oxidation) process in the catalytic converter, and in this way reduces toxic emissions. The heat generated by oxidation accelerates the "light off" of the catalytic converter and significantly improves exhaust gas quality during warm-up.



Function

- ♦ After a cold start engine control unit -1-activates secondary air pump -3- via secondary air pump relay -2-, and air is fed to combination valve -6-.
- ♦ At the same time, the system activates secondary air inlet valve -9-, which supplies vacuum to combination valve -6-. In this way, the combination valve opens a passage for the secondary air system to supply air to the exhaust ports in the cylinder head.

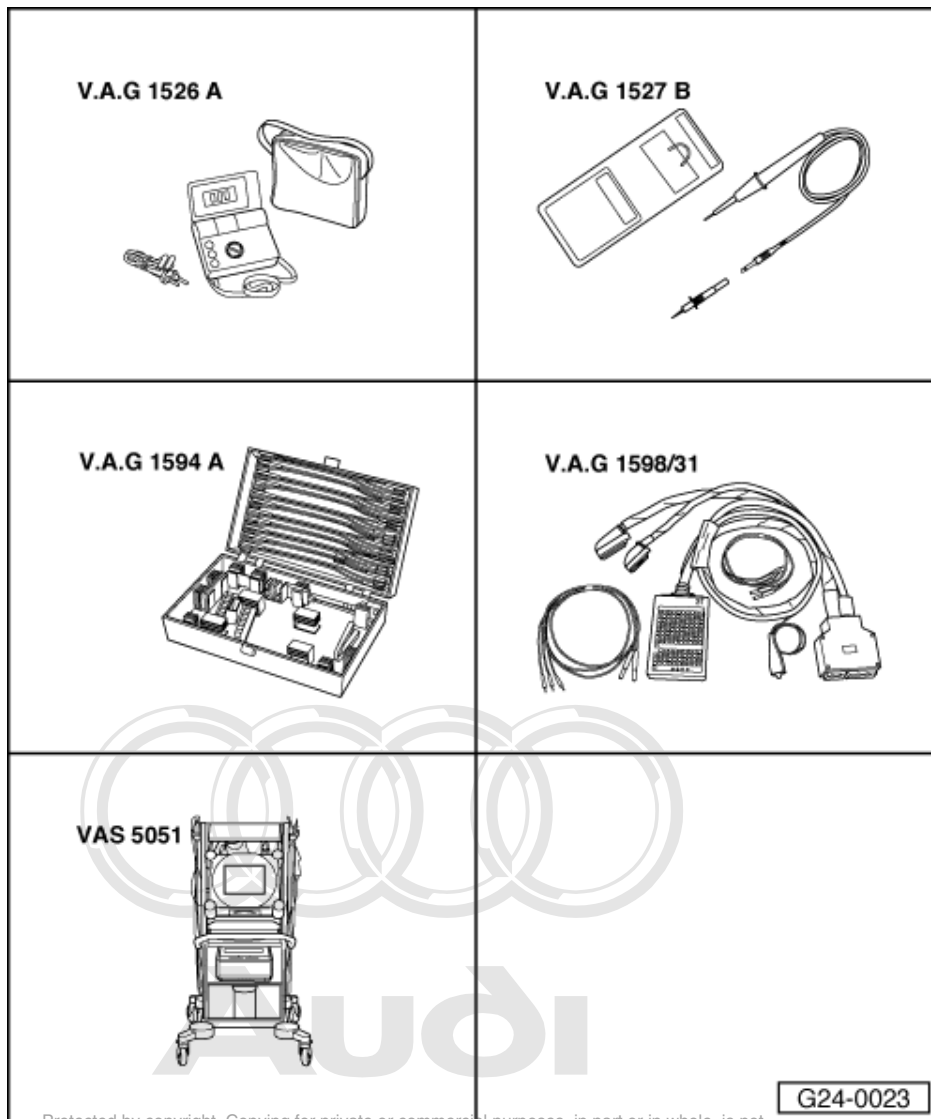


A24-0356

- 1 Engine control unit -J220
- 2 Secondary air pump relay -J299
- 3 Secondary air pump motor -V101
- 4 Intake manifold
- 5 Air cleaner
- 6 Combination valve for secondary air system
- 7 Vacuum reservoir
- 8 Non-return valve
 - ♦ Installation position (light side/ dark side) as shown in illustration. Arrow indicates direction of flow
- 9 Secondary air inlet valve -N112

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3.2 - Testing secondary air inlet valve -N112



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Special tools and workshop equipment required

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

or

- ◆ V.A.G 1551 with V.A.G 1551/3 A

Fitting location => Fitting locations overview, Page **24**

Requirements for test:

- Final control diagnosis has been performed
- Fuse for secondary air inlet valve OK

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



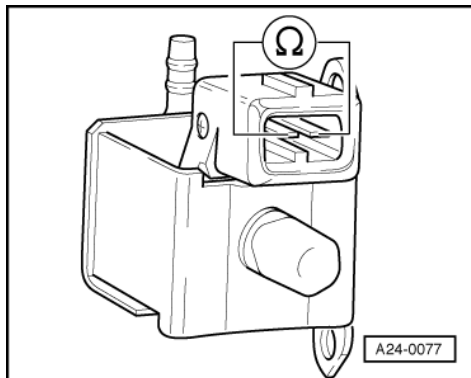
- Fuel pump relay OK. Testing => Page 56 .

Note:

The secondary air inlet valve receives its voltage supply via the fuel pump relay.

Testing internal resistance

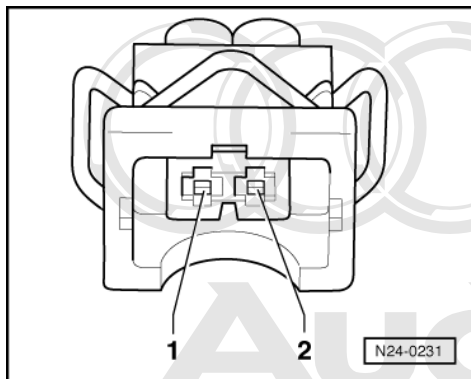
- Unbolt bracket for secondary air inlet valve from intake manifold.



- Unplug connector from secondary air inlet valve -N112
- -> Connect multimeter to valve (resistance measurement range)
- Specification: 25 ... 35 ω
- If the reading does not match the specification, renew secondary air inlet valve -N112.

Checking voltage supply

- Unplug connector from secondary air inlet valve -N112



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

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Connector Contact	Measure against
1	Engine earth

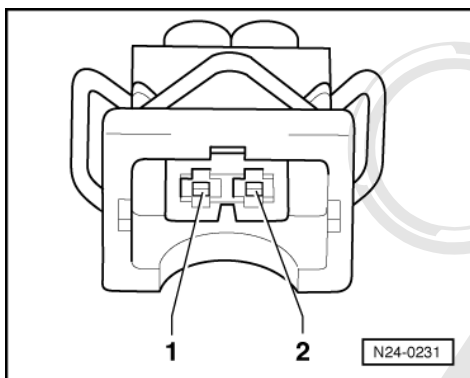
- Operate the starter briefly. (The engine can be allowed to start.)
- The LED should light up.

If the LED does not light up:

- Test for open circuit in wiring from contact 1 to fuel pump relay via fuse.

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

Testing activation



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

Connector Contact	Measure against
2	Battery positive

- Start final control diagnosis and select secondary air inlet valve -N112.
=> Page 14 .

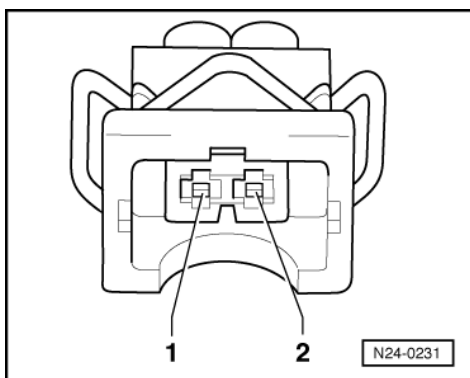
-> Indicated on display:

Final control diagnosis
Secondary air inlet valve -N112

- The LED should flash slowly.

If the LED 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 36 .



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

Connector Contact	Test box V.A.G 1598/31 Socket
2	9

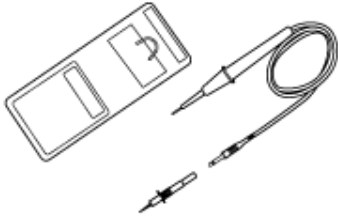
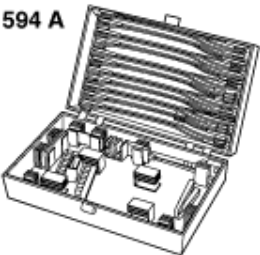
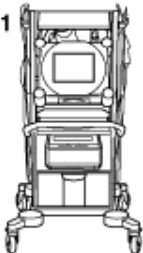
- Rectify any open/short circuit as necessary.

If the wiring is OK:

- Fit a new engine control unit => Page 38 .



3.3 - Testing secondary air pump relay -J299 and activation

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

Special tools and workshop equipment required

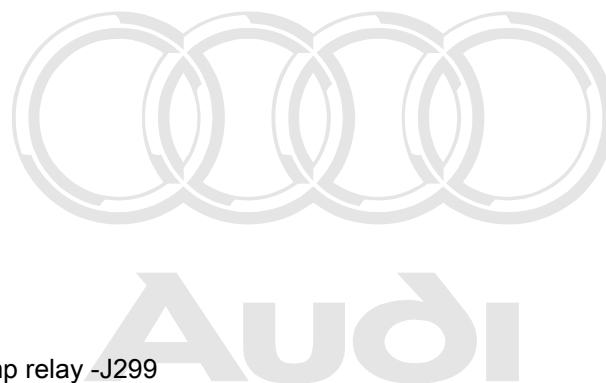
- ♦ V.A.G 1526 A
- ♦ V.A.G 1527 B
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/31
- ♦ VAS 5051

or

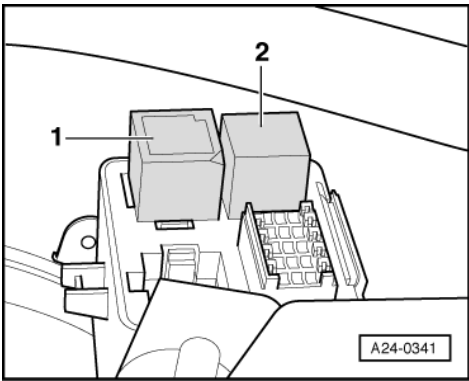
- ♦ V.A.G 1551 with V.A.G 1551/3 A

Fitting location => Fitting locations overview, Page 24

- Start final control diagnosis and select secondary air pump relay -J299
=> Page 14 .



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- -> Secondary air pump relay -1- should pick up and secondary air pump motor -V101 should run in intervals. (The relay is located under a cover on the left of the bulkhead).

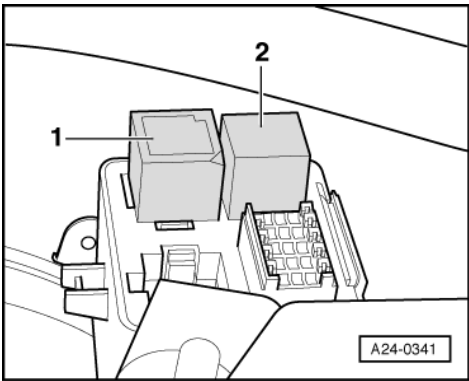
A - If the relay does not pick up:

- Test voltage supply of secondary air pump relay => Page 91 .
- Test activation of secondary air pump relay => Page 93 .

B - If the relay picks up but the secondary air pump motor does not run:

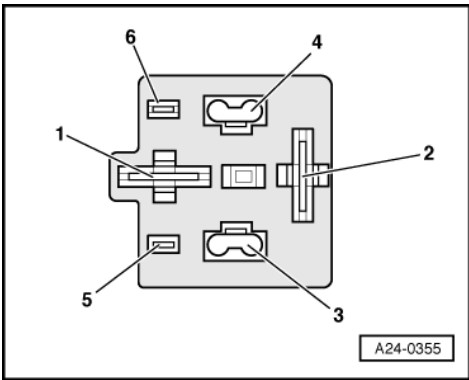
- Test voltage supply of secondary air pump motor =>Page 94 .

Testing voltage supply of secondary air pump relay



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- -> Disconnect secondary air pump relay -1-. (The relay is located under a cover on the left of the bulkhead).



- -> Connect multimeter (voltage measurement range) as follows:

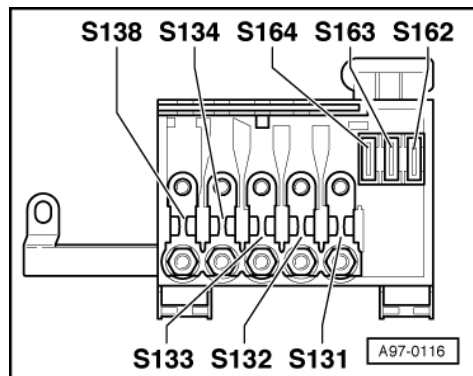
Relay carrier below cover on left side of bulkhead Contact	Measure against
1	Engine earth



- Specification: approx. battery voltage

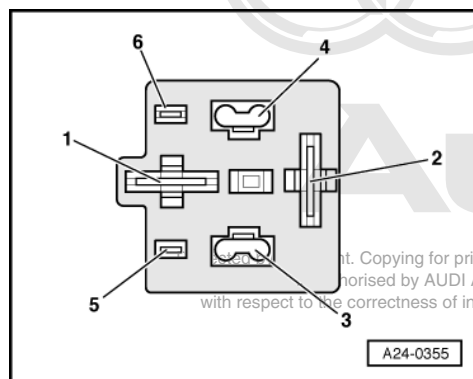
If the specification is not obtained:

- Carry out the following tests (marked with dots):



- -> Check fuse S131 (50 A) in main fuse box on battery.
- Test for open circuit in wiring from battery + (terminal 30) via fuse S131 to secondary air pump relay -J299 (below cover on left side of bulkhead):

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



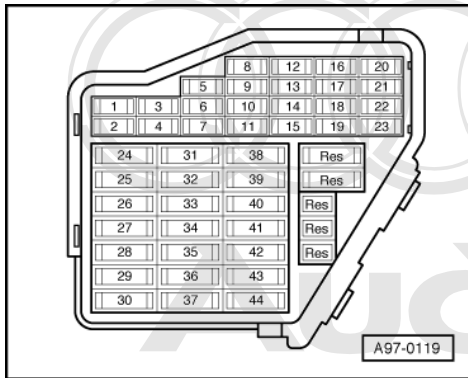
- -> Connect multimeter (voltage measurement range) as follows:

Relay carrier below cover on left side of bulkhead Contact	Measure against
3	Engine earth

- Operate the starter briefly. (The engine can be allowed to start.)
 - Specification: approx. battery voltage

If the specification is not obtained:

- Carry out the following tests (marked with dots):

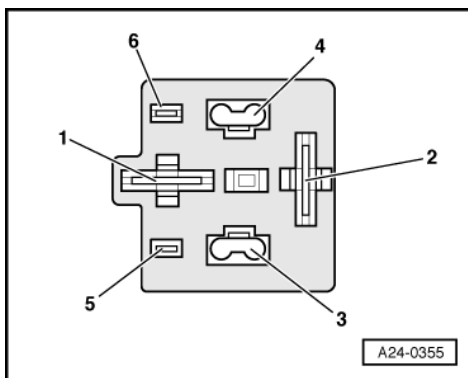


- -> Check fuse S243 (fuse position 43 in fuse holder).
- Test for open circuit in wiring from secondary air pump relay -J299 (below cover on left side of bulkhead) to fuel pump relay via fuse S243 (fuse position 43 in fuse holder):

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

Testing activation of secondary air pump relay

- Switch off ignition.
- Disconnect secondary air pump relay.



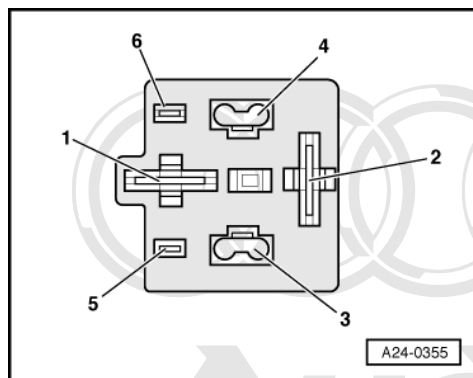
- -> Connect voltage tester V.A.G 1527 B as follows:

Relay carrier below cover on left side of bulkhead Contact	Measure against
4	Battery positive

- Start final control diagnosis and select secondary air pump relay -J299
- => Page 14 .
- The LED should flash.

If the LED 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 36 .



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

Relay carrier below cover on left side of bulkhead Contact	Test box V.A.G 1598/31 Socket
4	66

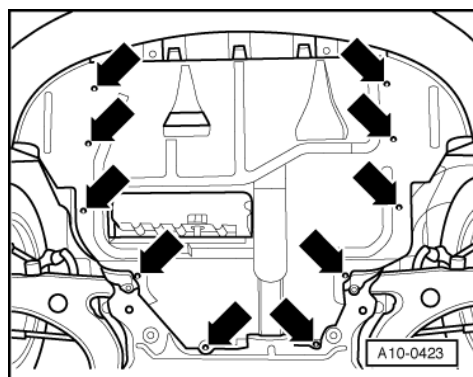
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- Rectify any open/short circuit as necessary.

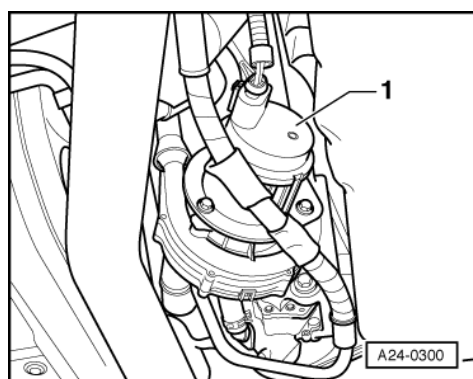
If no fault is found:

- Fit a new secondary air pump relay -J299.

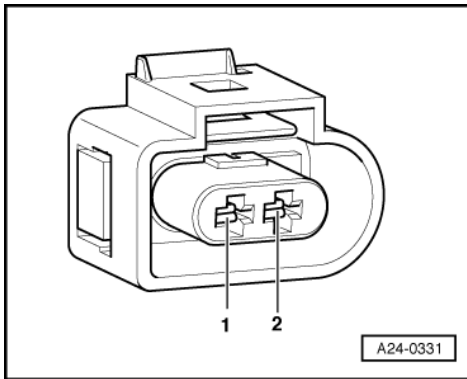
Testing voltage supply to secondary air pump motor



- -> Remove centre section of noise insulation -arrows-.



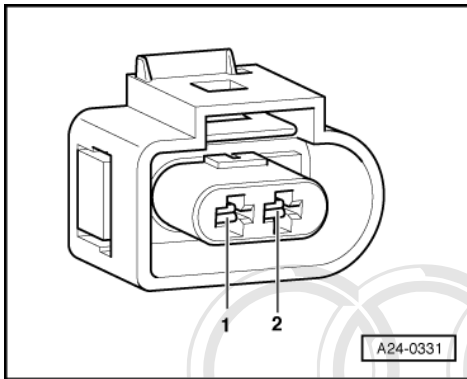
- -> Unplug connector from secondary air pump motor -V101.



- -> Connect voltage tester V.A.G 1527 B between contacts 1 and 2
- Start final control diagnosis and select secondary air pump relay -J299
=> Page 14 .
- The LED should flash.

If the LED does not flash:

- Carry out the following tests (marked with dots):



- -> Test for open circuit in wiring from contact 1 of connector to earth point in engine compartment (left side):
=> Current flow diagrams, Electrical fault finding and Fitting locations
- Test for open circuit in wiring from contact 2 of connector to secondary air pump relay -J299 (in relay carrier under cover on left side of bulkhead):
=> Current flow diagrams, Electrical fault finding and Fitting locations

If no fault is found:

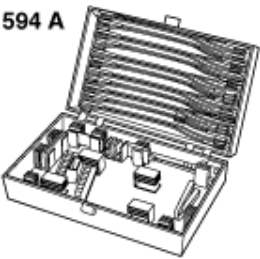
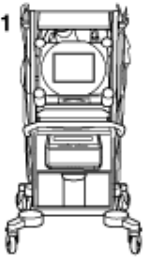
- Renew secondary air pump motor -V101.

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4 - Testing fuel tank breather

4.1 - Testing fuel tank breather

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V.A.G 1594 A 	V.A.G 1598/31 
VAS 5051 	G24-0023

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

Special tools, testers and other equipment required

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

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

Note:

In this context, solenoid valve 1 for activated charcoal filter is also designated as fuel tank breather valve, or ACF valve.

Testing for leaks

ACF solenoid valve -N80 remains closed when it is not receiving any current.

- Disconnect hoses from ACF valve but leave the electrical connector plugged in.
- 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 1 .)
- When doing this the ignition must be switched on.
- Start final control diagnosis and select solenoid valve for activated charcoal filter -N80=>Page 14 .

-> 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:

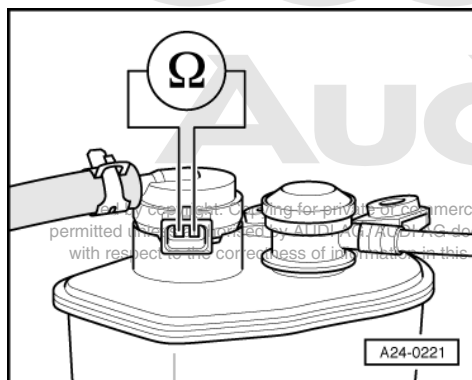
- Test internal resistance of ACF valve.

If the valve does not open and close properly:

- Renew activated charcoal filter system solenoid valve -N80.

Testing internal resistance

- Unplug connector on ACF valve.



- -> Connect multimeter to valve (resistance measurement range)
- Specification: 22 ... 30 ω

If the specification is not attained:

- Renew activated charcoal filter system solenoid valve -N80.

If the specification is attained:

- Test voltage supply => Page 98 .



Testing voltage supply

Note:

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

Test requirement:

- Fuse for ACF valve OK

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

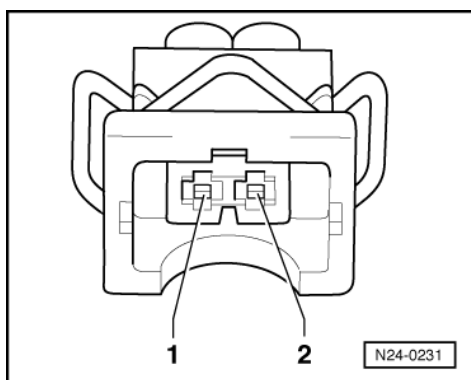
- Fuel pump relay OK. Testing => Page 56 .

Note:

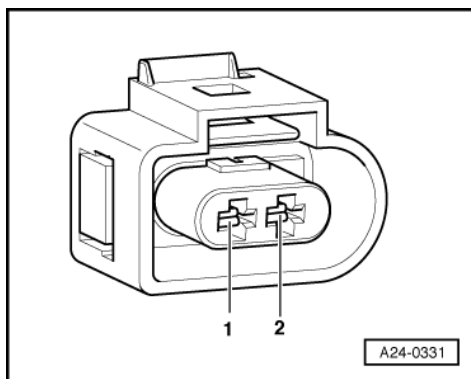
The ACF valve receives its voltage supply via the fuel pump relay.

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- Unplug connector on ACF valve.



- -> Rectangular connector



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

Connector Contact	Measure against
1	Engine earth

- Operate starter briefly.
 - The LED should light up.

If the LED does not light up:

- Test for open circuit in wiring from contact 1 to fuel pump relay via fuse.

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

- Rectify any open circuits.

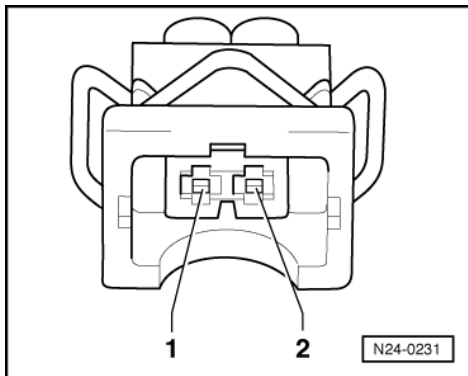
If the wiring is OK:

- Test fuel pump relay => Page 56 .

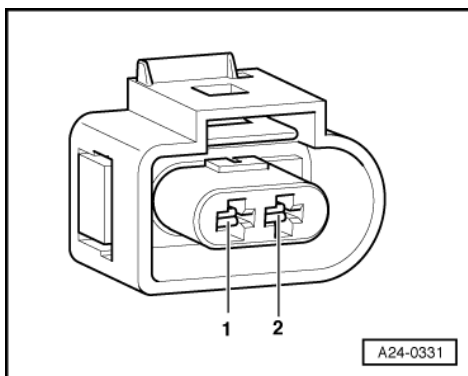
If the LED lights up:

- Test activation.

Checking activation

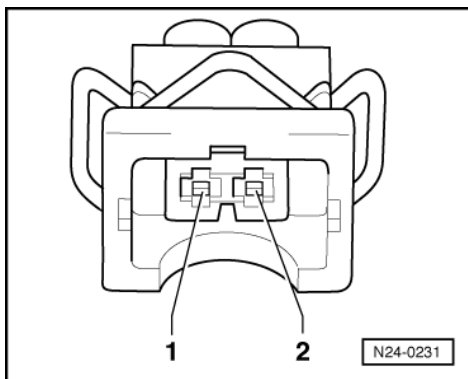


- -> Rectangular connector



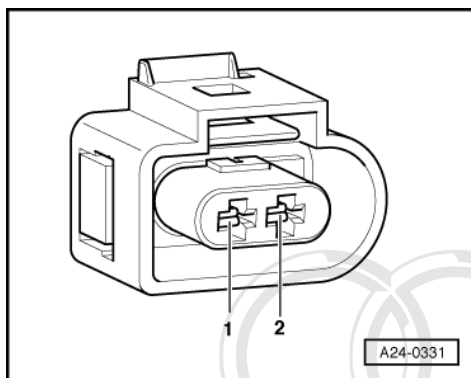
- -> Oval connector

- Connect voltage tester V.A.G 1527 B between contacts 1 and 2.
- Start final control diagnosis and select solenoid valve for activated charcoal filter -N80 =>Page 14 .
 - The LED should flash.



If the LED 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 **36** .
- -> Rectangular connector



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

Connector Contact	Test box V.A.G 1598/31 Socket
2	64

- Rectify short circuit or open circuit if necessary.

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If the wiring is OK:

- Fit a new engine control unit => Page **38** .

5 - Testing electronic engine power control (electronic throttle)

5.1 - Testing electronic engine power control (electronic throttle)

5.2 - 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 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) which 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.

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.

When the ignition is on and the engine is not running, the engine control unit operates the throttle valve positioner in exact accordance with the signals from the accelerator position senders. For example, when the accelerator is pressed down half way, the throttle valve positioner opens the throttle valve by an equivalent amount, i.e. about half way.

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).

For example, the throttle valve might already be fully open even though the accelerator is only pressed down half way. This has the advantage of preventing throttling losses at the throttle valve.

Under certain engine load conditions there is also a significant reduction in harmful emissions and noticeably improved fuel consumption.

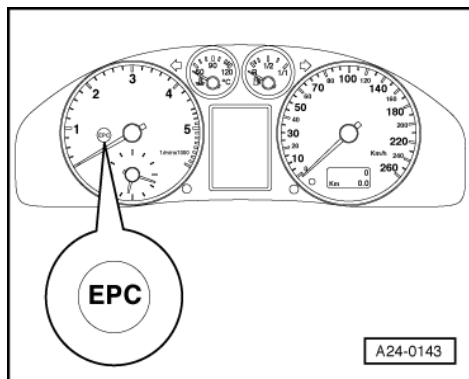
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The engine control unit can provide the optimum combination of throttle valve opening and charge pressure in order to create the required torque.

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.

5.3 - 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

When the ignition is switched on the engine control unit tests all the components whose functions relate to the electronic throttle system.

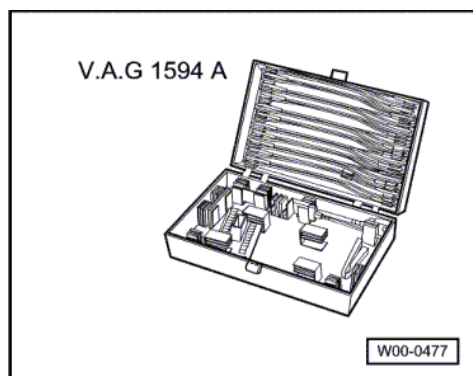
During the test sequence the engine control unit activates the EPC warning lamp. After a fixed test phase or as soon as the engine is idling the warning lamp will go out if no fault is detected.

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 (see Fault Table for list of possible faults). At the same time a fault code is stored in the fault memory of the engine control unit.



5.4 - Testing electronic throttle warning lamp -K132

Note:



Electronic throttle warning lamp -K132 is also known as the EPC warning lamp (EPC = electronic power control).

Special tools, testers and auxiliary items

- ♦ V.A.G 1594 A



- ♦ V.A.G 1598/31

Testing operation of warning lamp

- Switch on ignition.
 - The EPC warning lamp should light up.

A - Electronic throttle warning lamp

(EPC warning lamp) -K132 does not light up

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. **Do not** connect to the engine control unit itself.
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- => Page 36 .
- Bridge contacts 1 and 48 on the test box.
- Switch on ignition.
 - The warning lamp should light up.

If the warning lamp does not light up:

- Switch off ignition.
- Remove dash panel insert:

=> Electrical system; Repair group 90; Dash panel insert; Removing and installing dash panel insert Dash panel insert Removing and installing dash panel insert

- Test for open circuit and short to positive in the following wiring connection:

Test box V.A.G 1598/31 Socket	Dash panel insert Contact
48	=> Current flow diagrams, => Electrical fault-finding => and Fitting locations

- Rectify short circuit or open circuit if necessary.

If the wiring is OK:

- Renew dash panel insert.

B - Electronic throttle warning lamp

-K132 lights up continuously after engine start

- Interrogate fault memory of engine control unit.

If no faults are stored:

- 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 36 .
- Test for short to earth in the following wiring connection:

Test box V.A.G 1598/31 Socket	Dash panel insert Contact
48	=> Current flow diagrams, => Electrical fault-finding => and Fitting locations

- Rectify any short circuits.

If the wiring is OK:

- Fit a new engine control unit => Page 38 .

5.5 - Testing throttle valve control part -J338

The housing for the throttle valve control part contains the following components:

- ♦ Throttle valve drive -G186.
(This is an electric motor that is operated by the engine control unit. The motor has to overcome spring pressure in order to open the throttle valve.)
- ♦ Angle sender 1 for throttle valve drive -G187
- ♦ Angle sender 2 for throttle valve drive -G188

Notes:

- ♦ The housing for the throttle valve control part must not be opened.
- ♦ The angle senders are potentiometers with variable resistance. They inform the engine control unit of the position of the throttle valve and are completely independent of each other.



- ♦ It is not possible to adjust the potentiometers mechanically. Adjustments can be made using vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 (in basic setting mode, function 04).

5.6 - 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, the adaption process must be performed.

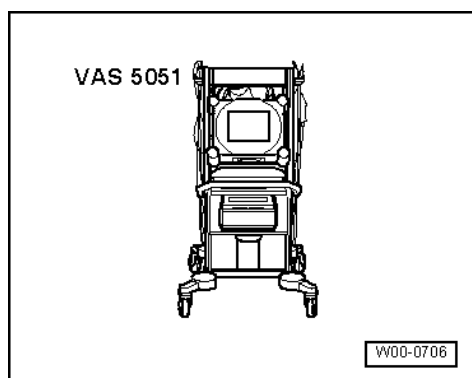
The learning process (adaption process) is carried out:

- ♦ 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 060 with the ignition switched on.

Note:

The engine will not start while the automatic adaption process is being performed.

Special tools, testers and auxiliary items



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

Requirements:

- No faults stored in fault memory. Interrogating fault memory => Page 4 .
 - Engine not running; ignition switched on.
 - Accelerator not depressed.
 - Coolant temperature 10 ... 95 °C.
 - Intake air temperature 10 ... 90 °C.
 - Voltage supply to engine control unit more than 11 V.
- Testing=>Page 156 .

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Work sequence

- 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 1 .)
- When doing this the ignition must be switched on.

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

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

-> Indicated on display:

Basic setting	Q
Enter display group number XXX	

- Enter "060" for Display Group 060 and confirm entry with Q key.

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.

-> Indicated on display:

System in basic setting 60			
1	2	3	4

- 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				
Display	xx %	xx %	---	---
Indicates	Throttle valve angle (angle sender 1)	Throttle valve angle (angle sender 2)	Learning stage counter	Adaption status
Range	0 ... 100 %	0 ... 100 %	0 to 8	ADP. runs ADP. O.K. ADP. ERROR
Specification	3...93 %	97...3 %	8	ADP O.K.
Note			During the adaption process the learning stage counter should count from 0 to 8. (Some of the figures may be skipped)	If readout does not match specification, see note => Page 106



Note:

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

Note:

If the adaption process is interrupted by the control unit, the cause could be one of the following:

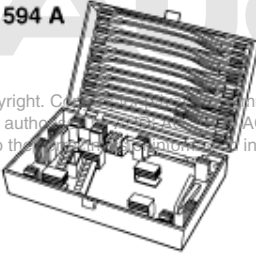
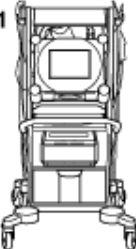
- ♦ The throttle valve is unable to close completely (e.g. because of dirt)
- ♦ Battery voltage too low.
- ♦ Throttle valve control part or wiring is defective.
- ♦ The engine was started or the accelerator depressed during the adaption process.
- ♦ Distortion of throttle valve housing (check bolts)

- End the engine basic setting by pressing the⇒ key.

-> Indicated on display (function selection):

Rapid data transfer HELP
Select function XX

5.7 - Testing angle senders for throttle valve drive

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V.A.G 1598/31 	VAS 5051 
	G24-0021

Special tools, testers and other equipment required

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

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

The 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.

Test sequence

- 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 1 .)
- When doing this the ignition must be switched on.

-> Indicated on display:

Rapid data transfer HELP
 Select function XX

- Enter "08" to select 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

- Enter "062" for Display Group 062 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 062: Electronic throttle potentiometer voltages				
Display	xx %	xx %	xx %	xx %
Indicates	Throttle valve angle (angle sender 1)	Throttle valve angle (angle sender 2)	Accelerator position sender	Accelerator position sender 2
Range	0 ... 100 %	0 ... 100 %	0 ... 100 %	0 ... 100 %
Specification	3...93 %	97...3 %	12...97 %	4...49 %

Note:

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

- Observe display zones 1 and 2.
- Slowly depress accelerator to full throttle position.

The percentage value in display zone 1 should rise steadily between 3 and 93 % but without covering the full range of values.

The percentage value in display zone 2 should fall steadily between 97 and 3 % but without covering the full range of values.

Notes:

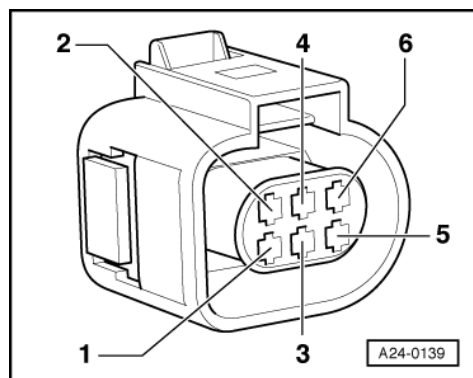
- ♦ The reason why the value in display zone 1 rises and the value in display zone 2 falls is because the potentiometers (angle senders) in the throttle valve control part work in opposite directions.
- ♦ The percentage value for the first potentiometer increases as the voltage rises towards 5 V because the voltage at this potentiometer increases as the throttle valve opens.
- ♦ The percentage value for the second potentiometer decreases as the voltage drops away from 5 V and towards 0 V because the voltage at this potentiometer decreases as the throttle valve opens.

If the display values do not appear as described:

- Test voltage supply and wiring to throttle valve control part =>Page 108 . Pay particular attention to the connectors, which may have corroded or become detached.
- Test accelerator position senders
=>Page 110 .

Testing voltage supply to throttle valve control part

- Unplug connector from throttle valve control part.
- Switch ignition on.



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- -> Connect multimeter (voltage measurement range) as follows:

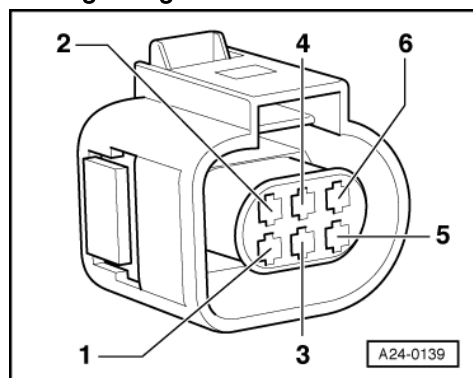
Connector Contact	Specification
2 + earth	approx. 5 V
2 + 6	approx. 5 V

If the specifications are obtained:

- Test signal wires and activation wires for throttle valve positioner
=> Page 108 .

If the specifications are not obtained:

- Test wiring between engine control unit and throttle valve control part => Page 108 .

Testing wiring


- -> 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 36 .
- Test for open circuit and short to earth or positive in the following wiring connections:

Connector Contact	Test box V.A.G 1598/31 Socket
1	92
2	83
3	117
4	84
5	118
6	91

- Rectify any open/short circuit as necessary.

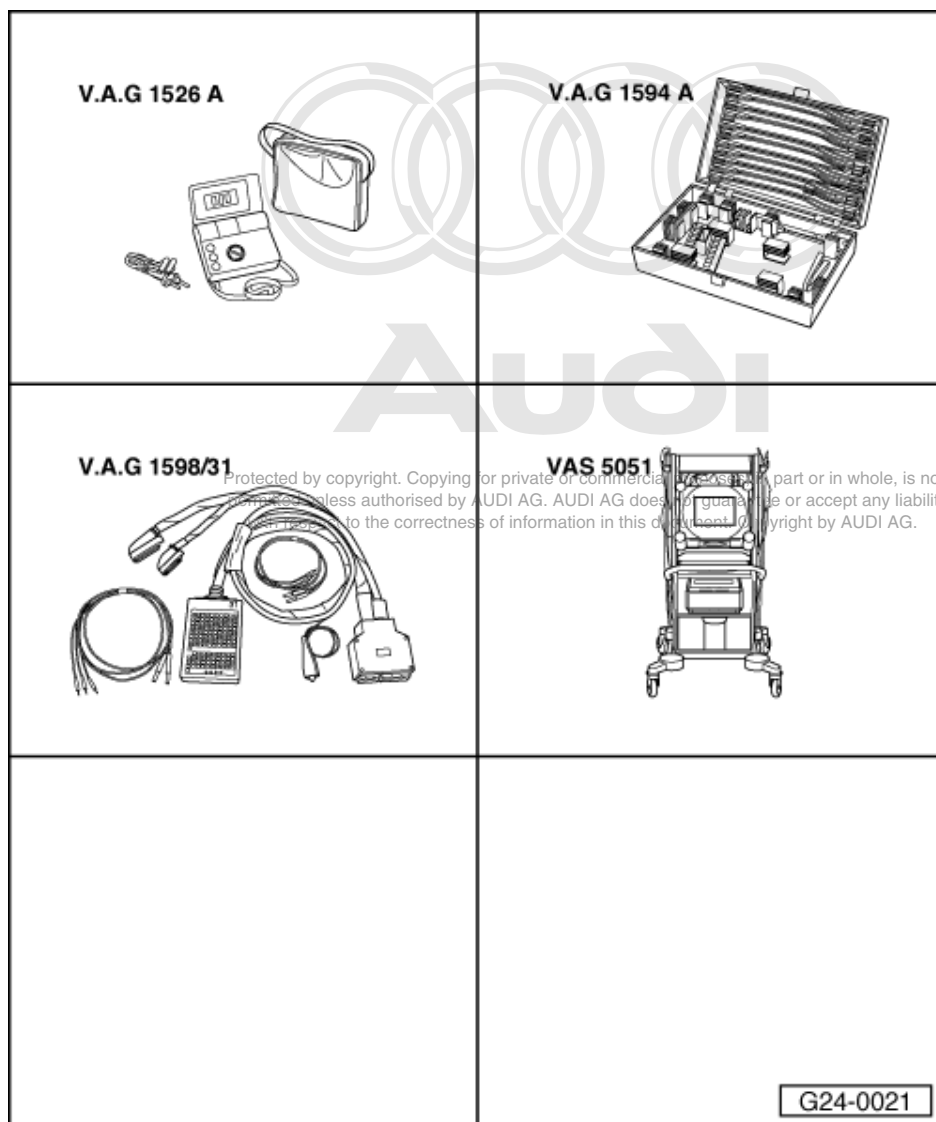
If no wiring fault is detected:

- Fit a new throttle valve control part.

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5.8 - Testing accelerator position senders



Special tools, testers and other equipment required

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

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

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.

Test sequence

- 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 1 .)
When doing this the ignition must be switched on.

-> Indicated on display:

Rapid data transfer HELP
 Select function XX

- Enter "08" to select 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

- Enter "062" for Display Group 062 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 062: Electronic throttle potentiometer voltages				
Display	xx %	xx %	xx %	xx %
Indicates	Throttle valve angle (angle sender 1)	Throttle valve angle (angle sender 2)	Accelerator position sender	Accelerator position sender 2
Range	0 ... 100 %	0 ... 100 %	0 ... 100 %	0 ... 100 %
Specification	3...93 %	97...3 %	12...97 %	4...49 %

Note:

The engine control unit converts the voltage readings from the angle senders into percentages of 5 V and displays them as percentages. (A supply 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 between 12 and 97 % but without covering the full range of values.

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 111.
- Adjust accelerator position senders (right-hand drive vehicles
>approx. 05.99 only).

=> Fuel supply system, Petrol engines; Repair group 20; Servicing accelerator linkage - Vehicles with electronic throttle; Right-hand drive vehicles Servicing accelerator linkage - Vehicles with electronic throttle Right-hand drive vehicles

Testing voltage supply to accelerator position senders

- Remove storage compartment on driver's side.



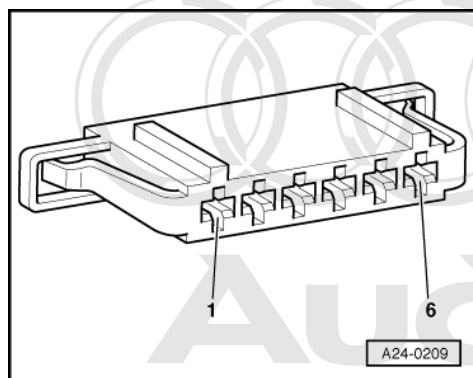
=> General body repairs; Repair group 68; Storage compartments, covers and trim panels; Removing and installing driver's storage compartment Storage compartments, covers and trim panels Removing and installing driver's storage compartment

- Unplug connector for accelerator position sender.

Left-hand drive vehicles,

Right-hand drive vehicles approx. 05.99>:

- Switch ignition on.



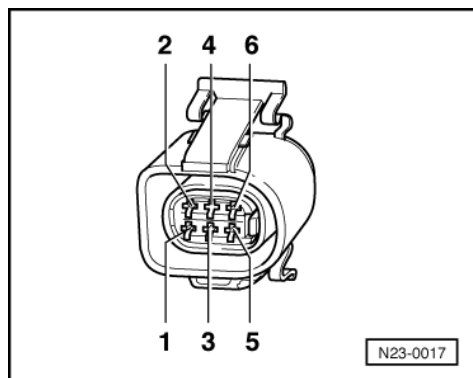
- > Connect multimeter (voltage measurement range) as follows:

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Connector Contact	Specification
1 + earth	approx. 5 V
1 + 5	approx. 5 V
2 + earth	approx. 5 V
2 + 3	approx. 5 V

Right-hand drive vehicles approx. 05.99

- Switch ignition on.



- -> Connect multimeter (voltage measurement range) as follows:

Connector Contact	Specification
2 + earth	approx. 5 V
2 + 3	approx. 5 V
5 + earth	approx. 5 V

5 + 4	approx. 5 V
-------	-------------

All models

If the specifications are obtained:

- Test the signal wires.

If the specifications are not obtained:

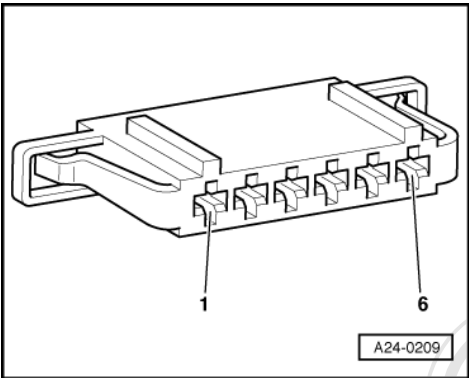
- Test wiring between engine control unit and accelerator position senders.

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 36 .

Left-hand drive vehicles,

Right-hand drive vehiclesapprox. 05.99>:

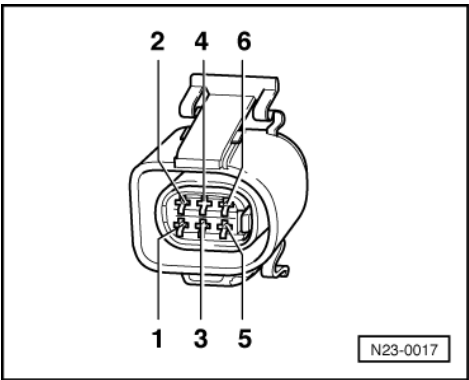


- -> Test for open circuit and short to positive or earth in the following wiring connections:

Connector Contact	Test box V.A.G 1598/31 Socket
1	72
2	73
3	36
4	35
5	33
6	34

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Right-hand drive vehicles>approx. 05.99:





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

Connector Contact	Test box V.A.G 1598/31 Socket
1	35
2	73
3	36
4	33
5	72
6	34

All models

- 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

Note:

The kickdown function must be "learned" (adaption process) on vehicles with automatic gearbox=>Page 114.

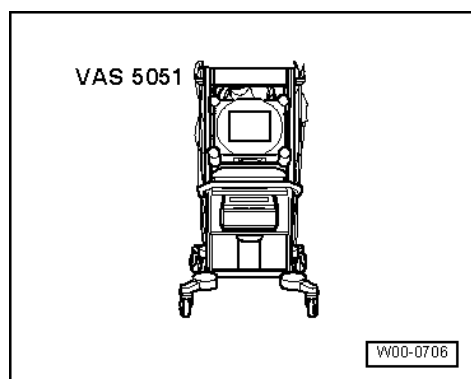
5.9 - "Learning" kickdown function

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If the throttle valve control part -J338 or the engine control unit is replaced the kickdown function must be "learned" (adaption process) on vehicles with automatic gearbox.

On vehicles with automatic gearbox / continuously-variable transmission the kickdown function must be programmed into the engine control unit if the accelerator position sender or the engine control unit is replaced.

Special tools and workshop equipment required



- ♦ VAS 5051 and VAS 5051/1

or

- ♦ V.A.G 1551 and V.A.G 1551/3 A

Requirements:

- No faults stored in fault memory.

- Interrogating fault memory => Page 4 .
- Engine not running; ignition switched on.

Work sequence

- 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 1 .)
- When doing this the ignition must be switched on.

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

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

-> Indicated on display:

Introduction of basic setting	Q
Enter display group number XXX	

- Enter "063" for Display Group 063 and confirm entry with Q key.

-> Indicated on display:

System in basic setting 63
1 2 3 4

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The display will now instruct you to operate kickdown ("Kick Down: operate").

- Press accelerator all the way down past the kickdown point and hold in position.

Note:

While the system is learning the kickdown point, the display on V.A.G 1551 will indicate "Kick Down ADP. runs". When the kickdown point has been successfully learnt, the display will indicate "Kick Down ADP. O.K.".

- Check the readout in display zone 4:

	Display zones			
	1	2	3	4
Display Group 063: Learning kickdown function				
Display	xx %	xx %	Kick Down	---
Indicates	Accelerator position sender 1	Accelerator position sender 2	Kick Down	Adaption status
Range	0...100 %	0...50 %	Kick Down	Operate ADP. runs ADP. O.K. ADP. ERROR
Specification	12...97 %	4...49 %	Kick Down	ADP O.K.
Note				If readout shows "ADP ERROR", see note => Page 4

If the specification "ADP. O.K." is attained:

- Press =>key.

-> Indicated on display (function selection):

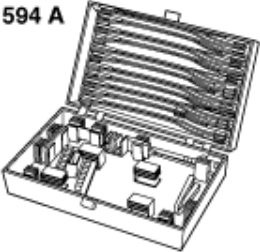
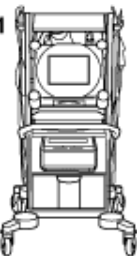
Rapid data transfer	HELP
Select function XX	



- Enter "06" to select the function "End output".

6 - Testing auxiliary signals

6.1 - Testing auxiliary signals

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

Special tools and workshop equipment required

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

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

6.2 - Checking engine speed signal

Notes:

- ◆ The signal generated by engine speed sender -G28 is processed by the engine control unit and transmitted via contact 37 (on the engine control unit) to various electronic systems, e.g. the air conditioner control unit and ABS/EDL control unit. These systems monitor the engine speed signal and the wiring.
- ◆ Testing engine speed signal:

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

6.3 - Testing fuel consumption signal for on-board computer

Notes:

- ◆ The fuel consumption is calculated by the engine control unit on the basis of the injection period, and the signal is transmitted to the on-board computer via contact 81 of the engine control unit (on vehicles with dash panel insert without CAN bus interface).
- ◆ Testing fuel consumption signal

=> Electrical system; Repair group 90; Dash panel insert; Testing fuel consumption signal Dash panel insert
Testing fuel consumption signal

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6.4 - Testing speed signal

Notes:

- ◆ The road speed signal is generated by the road speed sender -G68 (on the gearbox) and is processed in the dash panel insert.
- ◆ The processed signal goes to contact 54 on the engine control unit and is used for idling speed stabilisation and for the damping of load change jolts when changing gear.

Test requirement:

- Speedometer (including display) must be functioning properly.
Fault-finding:

=> Electrical system; Repair group 90; Dash panel insert; Testing road speed signal Dash panel insert Testing road speed signal

Test sequence

- 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 1 .)
When doing this the engine must be idling.

Warning:

To avoid accident risks when road testing the vehicle with test equipment, always observe the relevant safety precautions =>

-> Indicated on display:

Rapid data transfer Select function XX	HELP
---	------



- Enter "08" to select 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	

- Enter "005" for Display Group 005 and confirm entry with Q key.

-> Indicated on display:

Read measured value block 5
1 2 3 4

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- Take vehicle for a test drive and check whether the road speed appears in display zone 3.
- If the road speed does not appear, raise the vehicle (preferably using a lifting platform) until the front left wheel is clear of the ground.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
=> Page 36 .
- Connect voltage tester V.A.G 1527 B to sockets 3 (positive) and 54 (road speed signal) on test box V.A.G 1598/31.
- Switch on the ignition and turn the front left wheel by hand.
 - The LED should flash very briefly.

If the LED does not flash:

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

Test box V.A.G 1598/31 Socket	Dash panel insert Contact
54	=> Current flow diagrams, => Electrical fault-finding => and Fitting locations

- Rectify short circuit or open circuit if necessary.

6.5 - 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:
 - Under heavy acceleration (full throttle in 1st gear)
 - In emergency running mode (back-up)
 - When the "Basic setting" function is started (function 04)

Requirements for test:

- Air conditioner okay
- No faults stored in fault memory of engine control unit
- Vehicle at room temperature (above +15 °C)

Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 1 .)

When doing this the engine must be idling

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

- Enter "08" to select 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	

- Enter "050" for Display Group 050 and confirm entry with Q key.

-> Indicated on display:

Read measured value block 50
1 2 3 4

- Switch off air conditioner.
 - Specification for display zone 4: "Compr.OFF"
- Switch on air conditioner by pressing "AUTO" key and select maximum warm or cold air setting. The compressor should run.
 - Specification for display zone 4: "Compr. ON"
- Floor and release the accelerator quickly (short blip).
 - Specification for display zone 4: The display should change from "Compr.ON" to "Compr.OFF" for a few seconds (air conditioner compressor shut-off during acceleration).

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

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
=> Page 36 .
- Test for open circuit and short to positive or earth in the following wiring connection:

Test box V.A.G 1598/31 Socket	AC operating and display unit -E87 Contact
41	=> Current flow diagrams => Electrical fault-finding => and Fitting locations binder

- Rectify short circuit or open circuit if 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

6.6 - Testing brake light switch and brake pedal switch

Note:

For safety reasons, the signal from the accelerator position sender (potentiometer) instructing the engine control unit to open the throttle valve is suppressed whenever the brake is operated. The engine control unit therefore needs the brake light signal and also the brake pedal signal.

If the brake is operated while the accelerator is held down at a constant position, the engine is immediately governed down to idling speed. A defective switch can cause the engine to be throttled back when this is not desired.



Test sequence

- 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 1 .)
When doing this the ignition must be switched on.

-> Indicated on display:

Rapid data transfer HELP
Select function XX

- Enter "08" to select 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

- Enter "066" for Display Group 066 and confirm entry with Q key.

-> Indicated on display:

Read measured value block 66
1 2 3 4

- Check display value for brake light switch / brake pedal switch (display zone 2)

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	Display zones			
	1	2	3	4
Display Group 066: Signals to engine control unit				
Display	xxx km/h	XXXX	xxx km/h	XXXX
Indicates	Actual road speed	Switch positions	Specified road speed	Switch positions
Range		XX00 XX11		
Specification		XX00 (brake pedal not depressed)		
		XX11 (brake pedal depressed)		
Note		X = irrelevant The switching points do not coincide exactly.		

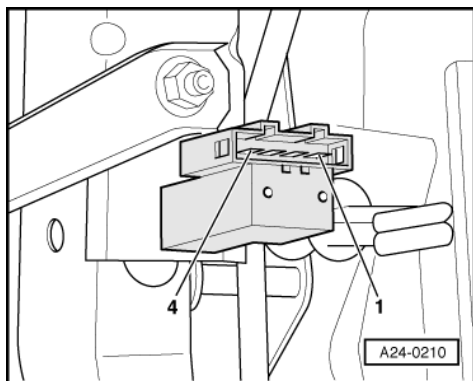
If the display values do not appear as described:

Testing switches

- Remove storage compartment on driver's side.

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

- Unplug connector from brake light switch / brake pedal switch.



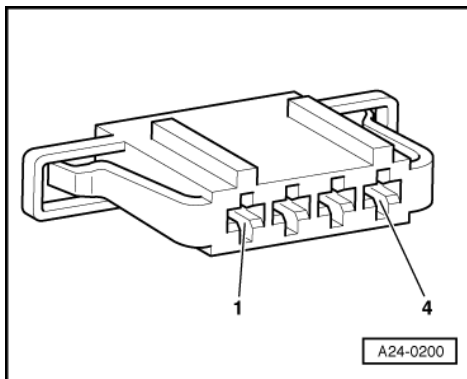
- -> Connect multimeter (resistance measurement range) between contacts 1 and 4.
 - Specification: $\infty \omega$ (no continuity)
- Depress the brake pedal.
 - Specification: approx. 0ω
- Connect multimeter (resistance measurement range) between contacts 2 and 3.
 - Specification: approx. 0ω
- Depress the brake pedal.
 - Specification: $\infty \omega$ (no continuity)

If the specifications are not obtained:

- Renew brake light switch / brake pedal switch.

If the specifications are obtained:

Checking voltage supply



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

Connector Contact	Measure against
1	Body earth

- The LED should light up.

Connector Contact	Measure against
2	Body earth

- Switch on ignition.
 - The LED should light up.

If the LED does not light up:

- Test for open circuit or short to earth in wiring between connector and micro central electrics via fuse

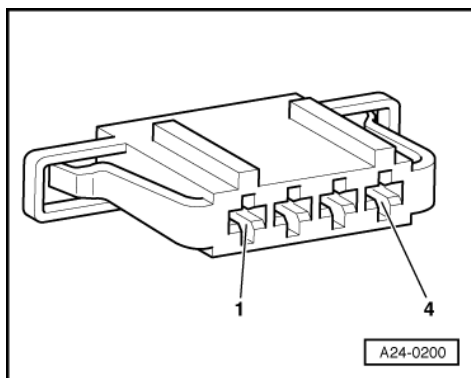
=> Current flow diagrams, Electrical fault finding and Fitting locations

- Rectify short circuit or open circuit if necessary.

If the LED lights up:

Checking activation

- 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 36 .



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

Connector Contact	Test box V.A.G 1598/31 Socket
3	55
4	56

- Rectify short circuit or open circuit if necessary.

6.7 - Testing clutch pedal switch -F36

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This signal is used to avoid over-revving and load change jolts when disengaging the clutch. It is also needed for the cruise control system.

Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 1 .)
When doing this the ignition must be switched on.

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

- Enter "08" to select 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	

- Enter "066" for Display Group 066 and confirm entry with Q key.

-> Indicated on display:

Read measured value block 66
1 2 3 4

- Check display value for clutch pedal switch (display zone 2).

	Display zones			
	1	2	3	4
Display Group 066: Signals to engine control unit				
Display	xxx km/h	XXXX	xxx km/h	XXXX

	Display zones			
Indicates	Actual road speed	Switch positions	Specified road speed	Switch positions
Range		X0XX X1XX		
Specification		X0XX (clutch pedal not depressed)		
		X1XX (clutch pedal depressed)		
Note		X = irrelevant		

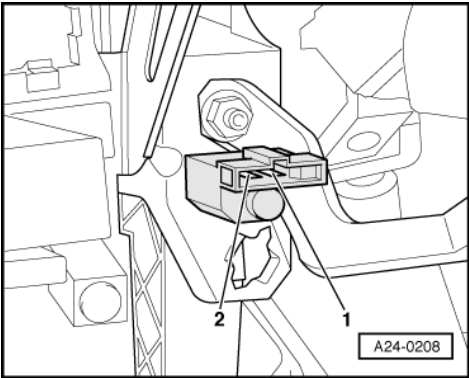
If the display values do not appear as described:

Testing switch

- Remove storage compartment on driver's side.

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

- Unplug connector from clutch pedal switch.



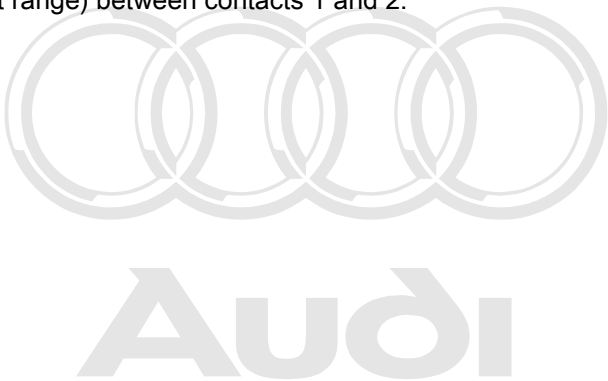
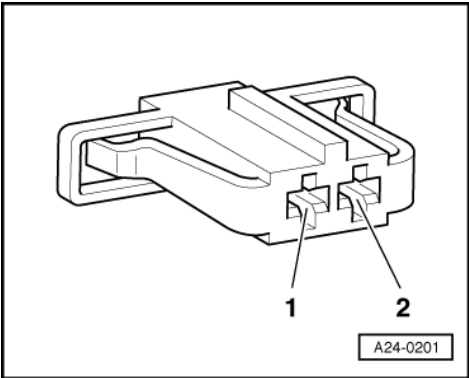
- -> Connect multimeter (resistance measurement range) between contacts 1 and 2.
- Specification: approx. 0 ω
- Depress the clutch pedal.
- Specification: $\infty \omega$ (no continuity)

If the specification is not attained:

- Test adjustment of clutch pedal switch
or
- Renew clutch pedal switch.

If the specification is attained:

Testing voltage supply



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

Connector Contact	Measure against
1	Body earth

- Switch on ignition.
 - The LED should light up.

If the LED does not light up:

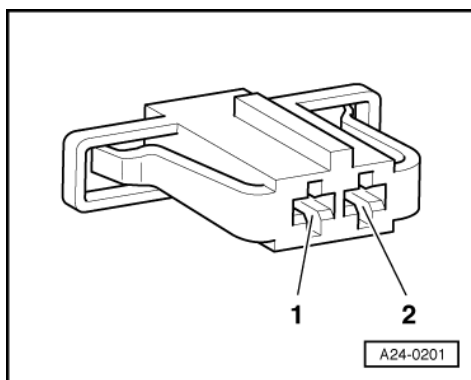
- Test for open circuit or short to earth in wiring between contact 1 on connector and micro central electrics via fuse.

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

If the LED lights up:

Checking activation

- 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 36 .



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

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

- Rectify short circuit or open circuit if necessary.

6.8 - Testing power steering pressure switch -F88

The function of the power steering pressure switch is to stabilise the idling speed when the steering wheel is on full lock (left or right).

Test sequence

- 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 1 .)
When doing this the engine must be idling.

-> Indicated on display:

Rapid data transfer Select function XX	HELP
---	------

- Enter "08" to select 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

- Enter "056" for Display Group 056 and confirm entry with Q key.

-> Indicated on display:

Basic setting 56
1 2 3 4

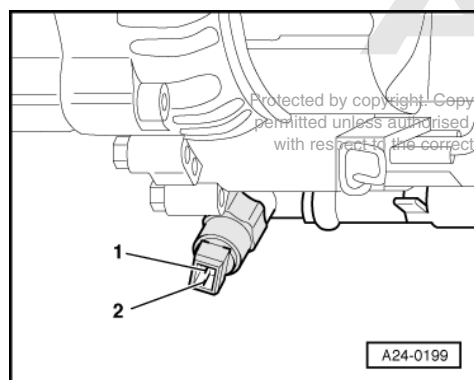
- Check display value for power steering pressure switch (display zone 4).

	Display zones			
	1	2	3	4
Display Group 056: Idling speed stabilisation with engine idling at normal operating temperature				
Display	xxx rpm	xxx rpm	x.x %	X X X X X
Indicates	Actual engine speed	Specified engine speed	Idling speed control Torque change	Operating status
Range				0XXXX 1XXXX
Specification				0XXXX (steering wheel in straight ahead position or slightly turned)
				1XXXX (steering wheel at full lock, or turned rapidly)
Note				X = irrelevant

If the display values do not appear as described:

Testing switch

- Unplug connector from power steering pressure switch -F88 on power steering pump.



- -> Connect multimeter to switch (resistance measurement range).
- Start the engine.
 - Specification: $\infty \omega$ (no continuity)
- Turn steering wheel to full lock (left and right).
 - Specification: approx. 0 ω

If the display does not change:

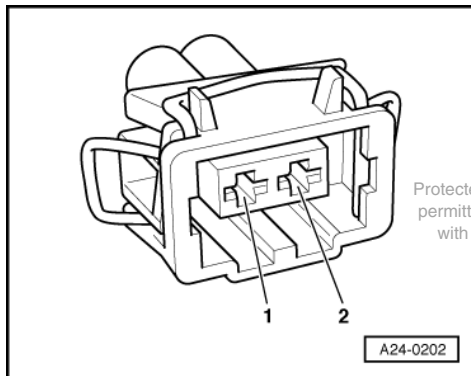
- Renew power steering pressure switch -F88.



If the display changes:

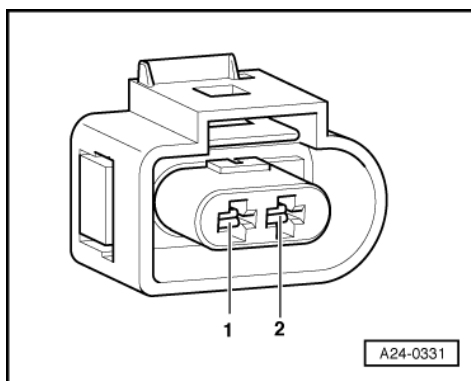
- Test the wiring => Page 126 .

Testing wiring



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- 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 36 .
- -> Rectangular connector



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

Connector Contact	Test box V.A.G 1598/31 Socket
1	49
2	50

- Rectify short circuit or open circuit if necessary.

6.9 - Testing crash signal wiring - Vehicles from model year 2000 >

The crash signal ("Crash switch-off triggered") is transmitted to the engine control unit by the airbag control unit.

If the airbag control unit transmits the crash signal to the engine control unit (in case of an accident or if a final control diagnosis for the airbag system is carried out), the engine control unit switches off the fuel pump. The engine stops but can be restarted immediately (e.g. to move the vehicle out of the danger zone).

- 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 36 .
- Test for open circuit and short to positive or earth in the following wiring connection:

Test box V.A.G 1598/31 Socket	Airbag control unit -J234 Contact
67	=> Current flow diagrams, => Electrical fault-finding => and Fitting locations

- Rectify short circuit or open circuit if necessary.
- => Current flow diagrams, Electrical fault finding and Fitting locations

If no fault in wire is detected:

- Interrogate fault memory of airbag control unit:
- => Body, Self-diagnosis; Repair group 01 ; Self-diagnosis of airbag system (basic triggering unit) with side airbag; Interrogating fault memory Self-diagnosis of airbag system (basic triggering unit) with side airbag In-terrogating fault memory

6.10 - Testing data exchange between engine control unit, gearbox control unit, ABS/EDL control unit and airbag control unit or dash panel insert

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

The fault table indicates that the data exchange between the engine control unit, gearbox control unit, ABS/EDL control unit and airbag control unit or the dash panel insert should be tested.

- 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 1 .)
When doing this the ignition must be switched on.

-> Indicated on display:

Rapid data transfer
HELP

Select function XX

- Enter "08" to select 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

- Enter "125" for "Display group 125" and confirm with Q key.
- Check display in display zones 1 ... 3.



	Display zones			
	1	2	3	4
Display group 125: CAN bus				
Display	---	---	---	
Indicates	Gearbox	Anti-locking brake system	Dash panel insert	
Range	Gearbox 1 Gearbox 0	ABS 1 ABS 0	Combi 1 Combi 0	
Specification	Gearbox 1	ABS 1	Combi 1	

- Press C key.

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-> Indicated on display:

Read measured value block Q
Enter display group number xxx

- Enter "126" for "Display group 126" and confirm with Q key.
- Check display in display zone 3.

	Display zones			
	1	2	3	4
Display group 126: CAN bus				
Display			---	
Indicates			Airbag	
Range			Airbag 1 Airbag 0	
Specification			Airbag 1	

- Press the →key.

If a specification is not met:

- Enter "06" to select the function "End output" and confirm entry with Q key.

-> When this display appears:

Rapid data transfer HELP
Enter address word xx

- Press key 0 twice for address word "Automatic test sequence" and confirm entry with Q key.
- The fault memory of all on-board systems with self-diagnostic capability will be read.

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 "Drive train data bus" or to the "CAN data bus":

- Check that the engine control unit, gearbox control unit, ABS/EDL control unit and airbag control unit or the dash panel insert are the correct versions for the vehicle (check Part No. and coding).

If the correct control units are installed:

- Check that multi-pin connectors for control units are properly seated.

If the multi-pin connectors are properly seated:

- Test CAN bus system.

Testing a "two-wire bus system"

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

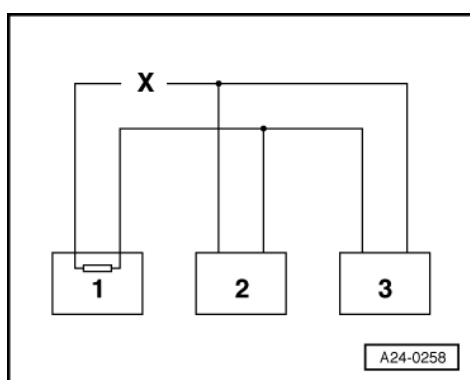
- Read out the faults stored in the control units.

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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

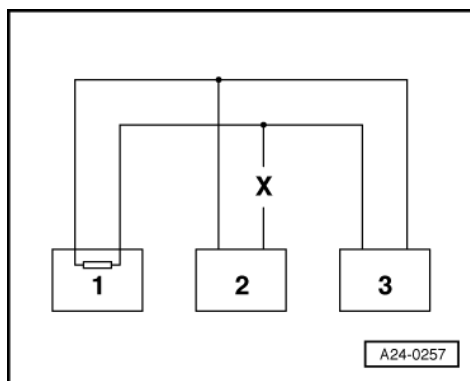
- Switch off ignition.
- Disconnect the control units which are linked by the bus wires and check whether there is an open circuit in one of the bus wires

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

- 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

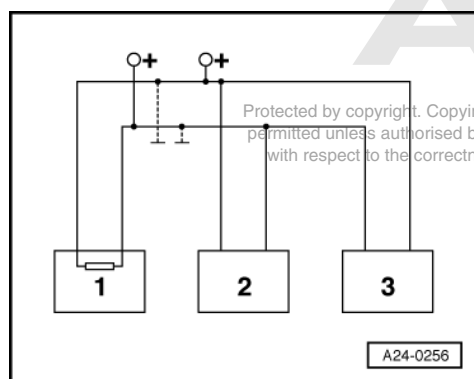
- If no fault can be found in the bus wires replace control unit 2.

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 to positive or earth in the bus wires

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

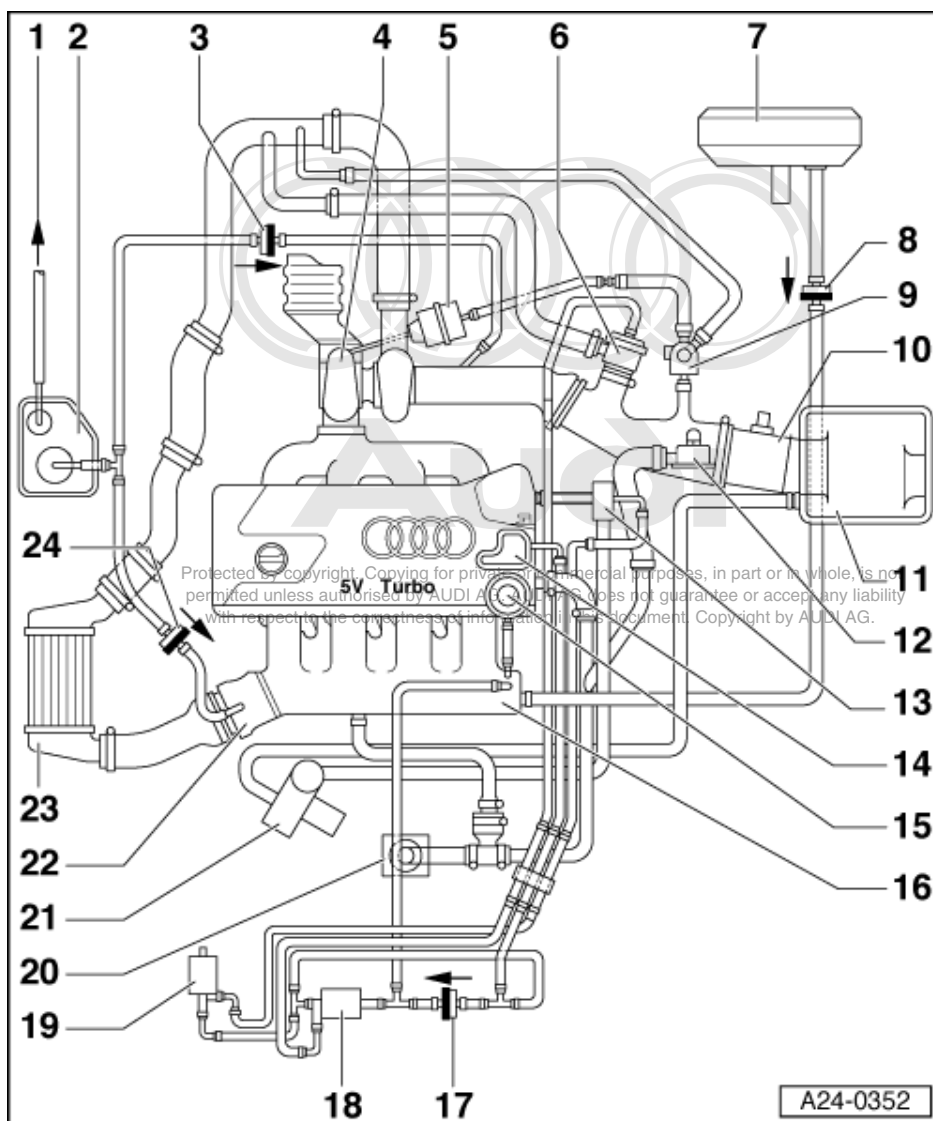
If the cause of the fault "Data bus drive defective" cannot be found in the data bus wires, check whether one of the control units is causing the fault.

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

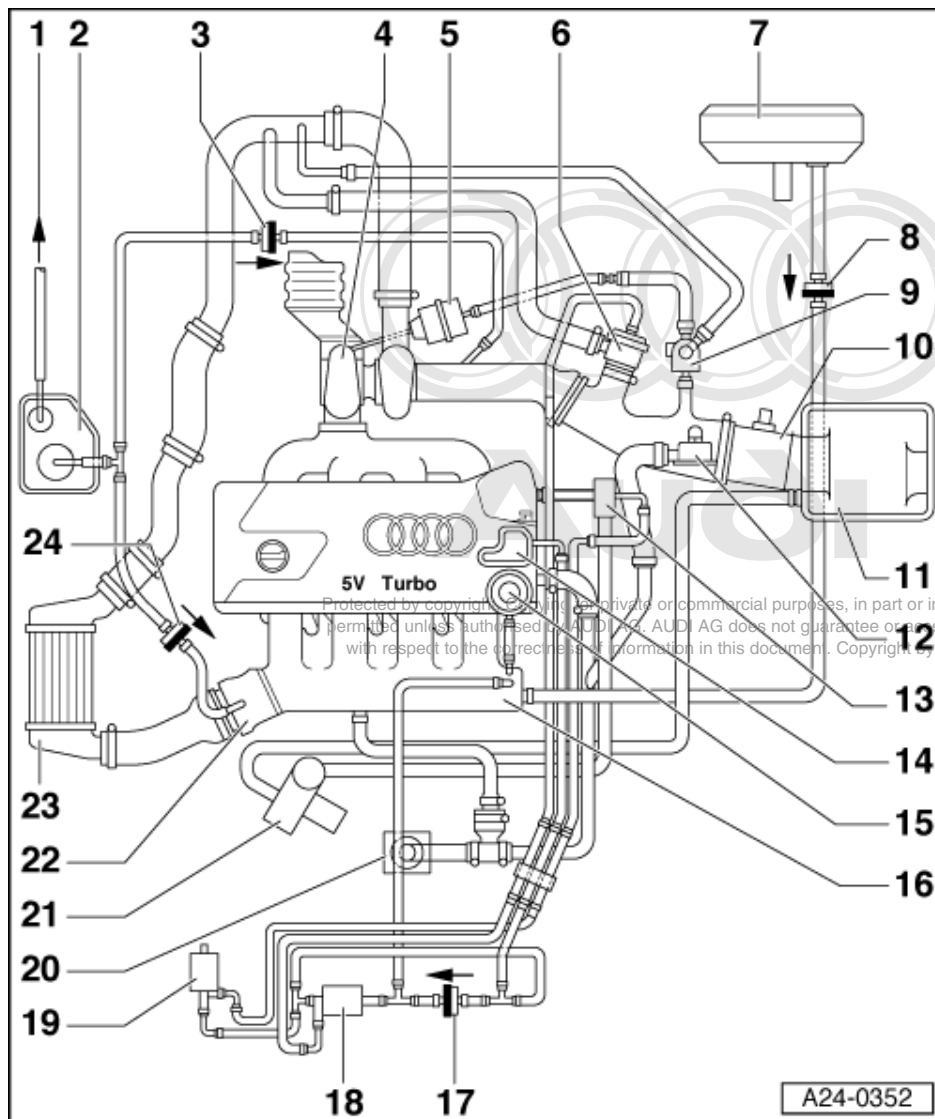
- Connect one of the control units.
- Connect fault reader V.A.G 1551. Switch on the ignition and erase the fault memory of the control unit which has just been connected. End output from fault reader with function 06 "End output".
- Switch the ignition off and then on again.
- Leave the ignition switched 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.

7 - Vacuum system layout

7.1 - Vacuum system layout



- 1 From fuel tank
- 2 Activated charcoal filter
 - ♦ With ACF solenoid valve 1 -N80
- 3 Non-return valve for ACF
 - ♦ Between activated charcoal filter and intake pipe upstream of turbocharger
 - ♦ Install with light and dark sides in the positions shown in the illustration. Arrow points in direction of flow.
- 4 Turbocharger
- 5 Pressure unit for charge pressure control



6 Mechanical air recirculation valve

7 Brake servo

8 Non-return valve

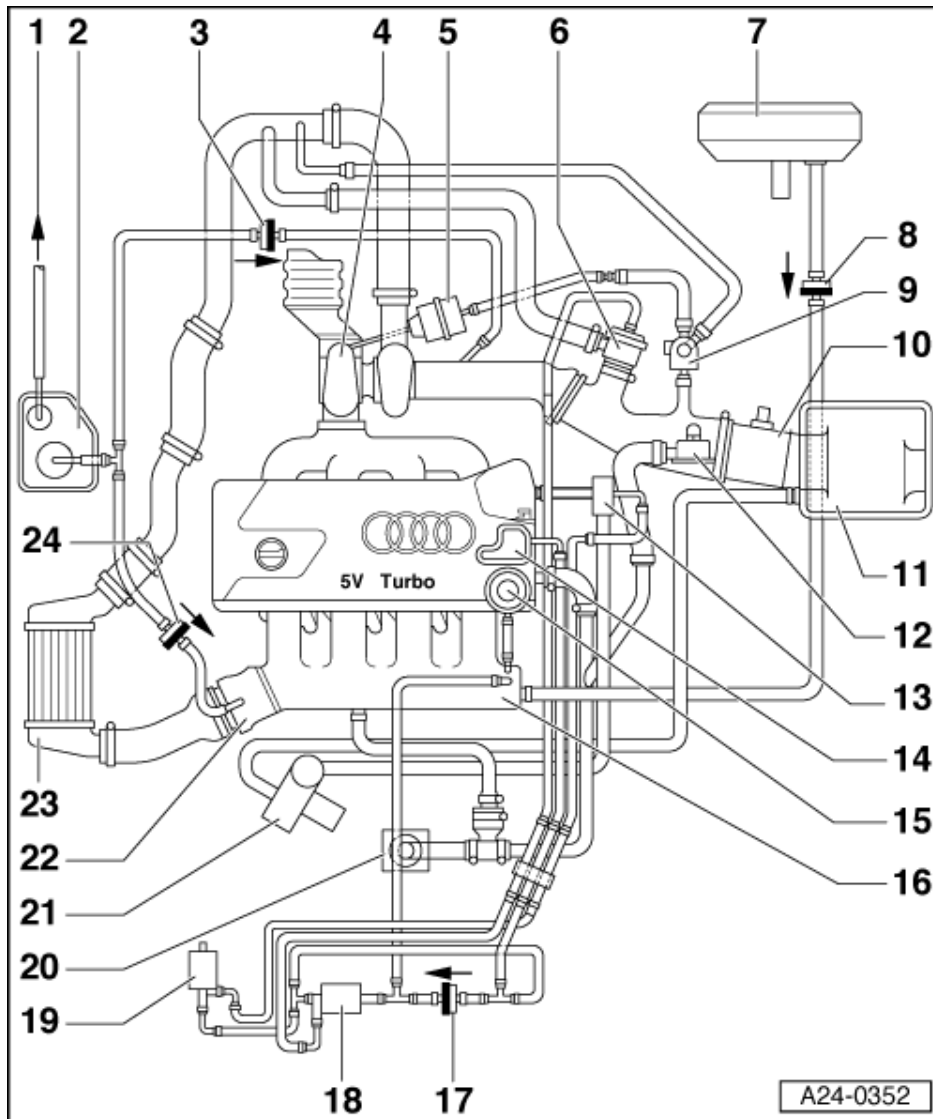
- ♦ Between brake servo and intake manifold
- ♦ Install with light and dark sides in the positions shown in the illustration. Arrow points in direction of flow.

9 Solenoid valve for charge pressure control -N75

10 Air mass meter -G70

11 Air cleaner

12 Crankcase breather pressure regulating valve



13 Combination valve for secondary air system

- ♦ On vehicles with secondary air system

14 Vacuum reservoir

- ♦ Bolted to cylinder head cover

15 Fuel pressure regulator

16 Intake manifold

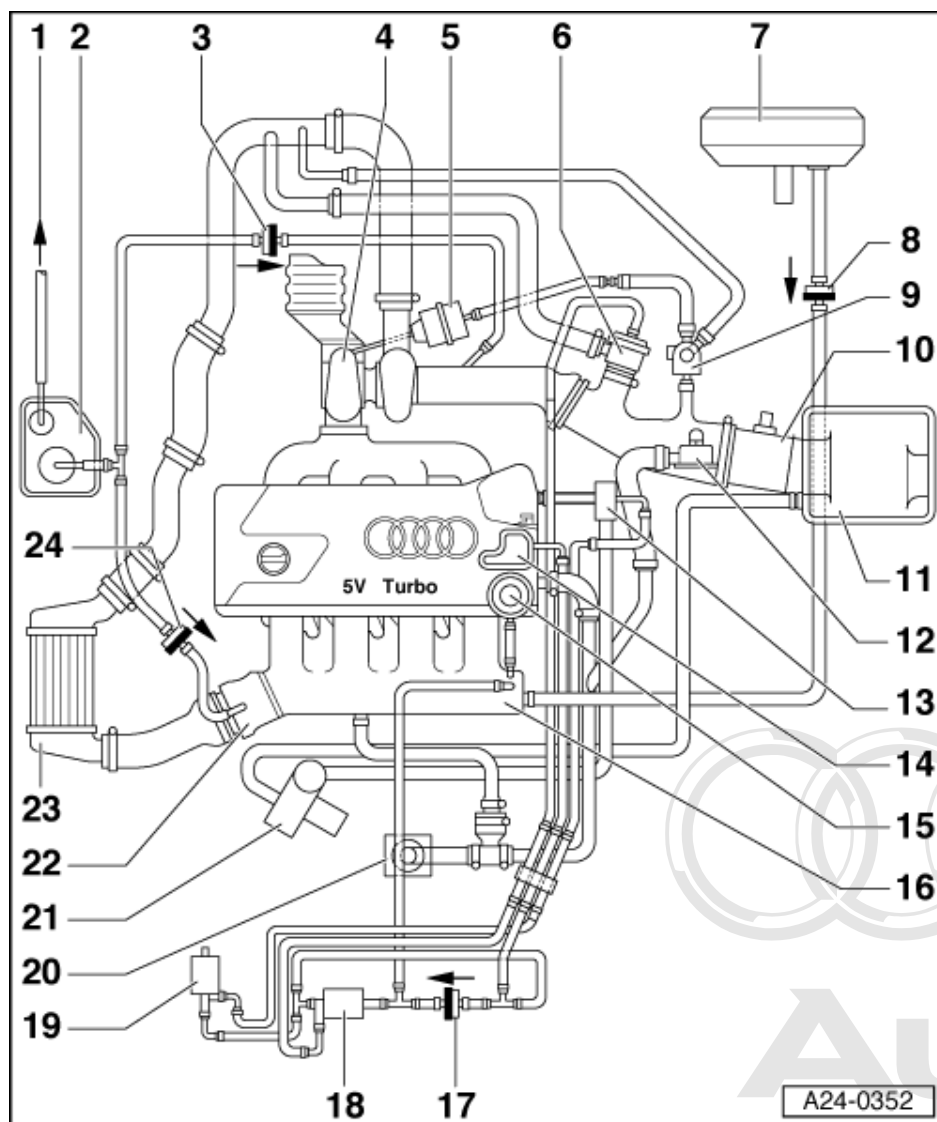
- ♦ With intake air temperature sender -G42

17 Non-return valve

- ♦ Install with light and dark sides in the positions shown in the illustration. Arrow points in direction of flow.

18 Air recirculation valve for turbocharger -N249

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**19 Secondary air inlet valve
-N112**

- ♦ On vehicles with secondary air system

20 Crankcase breather

21 Secondary air pump motor -V101

- ♦ On vehicles with secondary air system

22 Throttle valve control part -J338

23 Charge air cooler

- ♦ With charge pressure sender -G31

24 Non-return valve

- ♦ Between activated charcoal filter and intake manifold
- ♦ Install with light and dark sides in the positions shown in the illustration. Arrow points in direction of flow.

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28 - Ignition system

1 - Testing ignition system

1.1 - Testing ignition system

1.2 - General notes on ignition system

- ◆ 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, note the following points:

- ◆ 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 disconnecting or connecting ignition system wiring and high-voltage cables for test instruments.
- ◆ In order to run the engine at starting speed without actually starting it (for example, to test compression), unplug the connectors on the ignition coils and also the connectors on 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

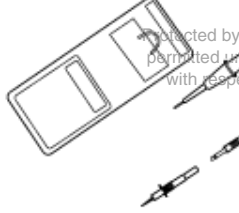
Engine code	AQA, ARZ 1) (1.8 ltr / 5V / 110 kW engine) AJQ,APP1) (1.8 ltr / 5V / 132 kW engine)
Idling speed Not adjustable - controlled by the idling speed stabilisation	Manual gearbox, front-wheel drive and four-wheel drive: 700...820 rpm 2) Automatic gearbox, front-wheel drive: 640...760 rpm 2)
Engine speed limiter - shuts off injectors	approx. 6800 rpm
Ignition timing is determined by the control unit. Ignition timing cannot be adjusted.	
Ignition system	Individual coil system with 4 ignition coils (each with an integrated output stage) connected directly to the spark plugs via the spark plug connectors
Spark plugs 1)	Tightening torque: 30 Nm



Firing order	1-3-4-2
---------------------	----------------

- 1) With secondary air system
 - 2) Relevant values:
- => Exhaust emission test binder

1.5 - Testing ignition coils with output stages

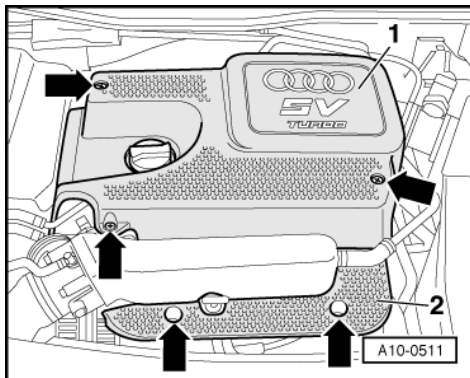
V.A.G 1526 A 	V.A.G 1527 B 
V.A.G 1594 A 	V.A.G 1598/31 
	G24-0022

Special tools and workshop equipment required

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

Note:

Each ignition coil is combined with its output stage as a single component.



- -> Remove engine cover panel -arrows-.

The procedure for identifying an inoperative or misfiring cylinder is as follows:

- Unplug the connectors from the injectors in turn with the engine running, and observe how the engine runs.
- or
- Compare the spark plugs of all cylinders with each other and check for soot on the electrodes.

When the defective cylinder has been identified:

- Swap spark plug of defective cylinder with one from another cylinder.

If the fault moves with the spark plug:

- Renew spark plug.

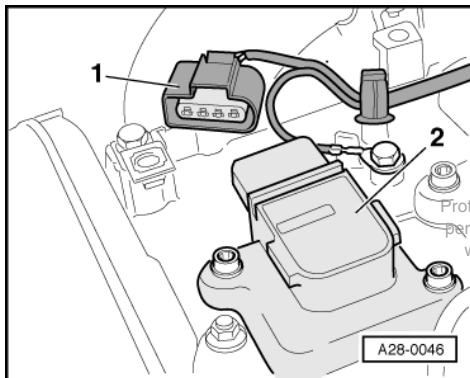
If the fault remains in the same cylinder:

- Swap ignition coil of defective cylinder with one from another cylinder.

If the fault moves with the ignition coil:

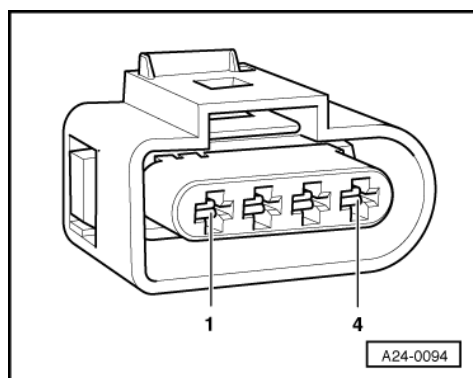
- Renew ignition coil.

If the fault remains in the same cylinder:



Testing earth connections

- Unplug 4-pin connector -1- from ignition coil -2-.



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

Connector Contact	Measure against
2	Battery positive
4	Battery positive

- The LED should light up.

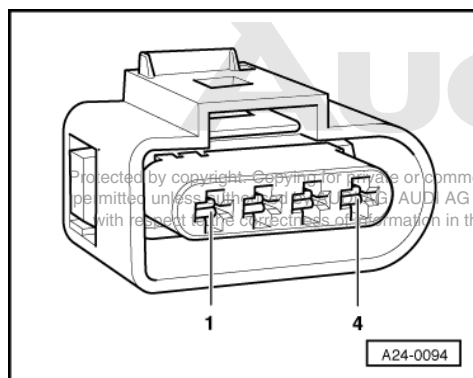
If the LED does not light up:

- Check the wiring.

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

If the LED lights up:

Checking voltage supply



- -> Connect multimeter (voltage measurement range) as follows:

Connector Contact	Measure against
1	Engine earth

- Switch on ignition.
- Specification: approx. battery voltage

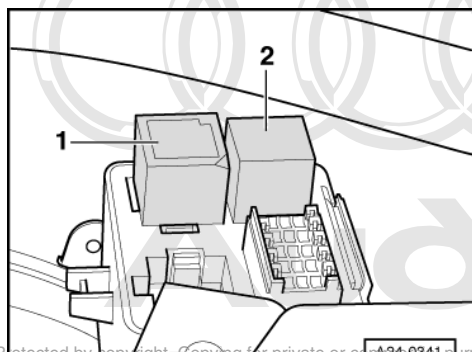
If the specification is not obtained:

Vehicles> model year1999:

- Check the wiring.

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

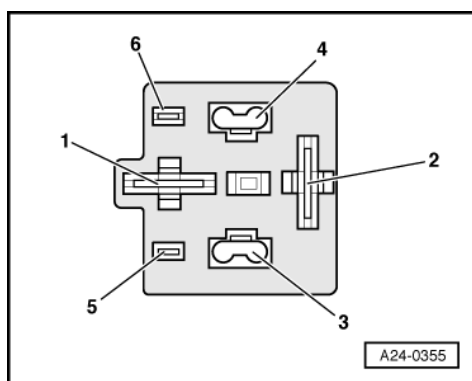
Vehicles model year 2000 >:



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-> Unplug current supply relay -2- (located under cover on left side of bulkhead).

- Carry out the following tests (marked with dots):



- > Check wiring between contact 2 of relay carrier (located under cover on left side of bulkhead) and contact 1 of ignition coil connector.
- Test Motronic current supply relay -J271=>Page 141 .

All models

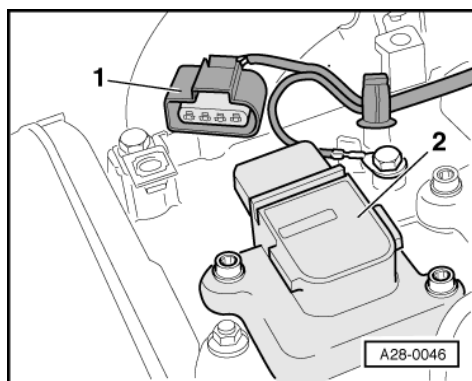
If the specification is attained:

- Test activation of output stages=>Page 139 .

Testing activation of output stages

- Unplug connectors from all injectors.

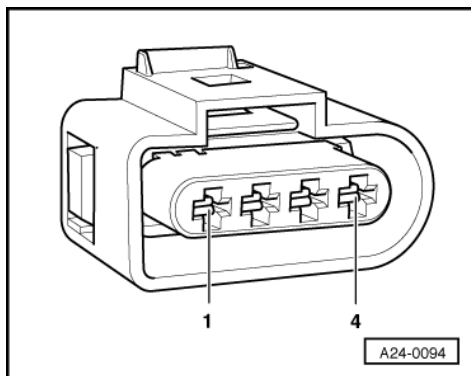
Note:





It is important to ensure that no fuel is injected during the test, as this would damage the catalytic converter. The connectors on the injectors must therefore be unplugged.

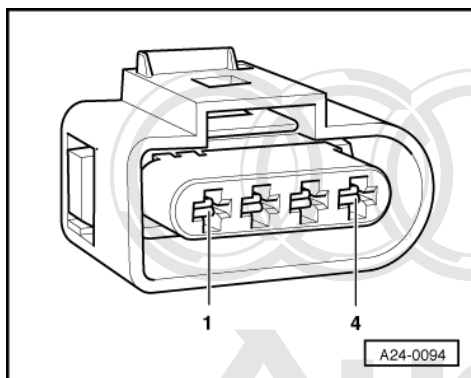
- -> Unplug 4-pin connector -1- from ignition coil -2-.



- -> Connect voltage tester V.A.G 1527 B to contacts 2 and 3 of the connector.
- Operate starter briefly.
 - The LED should flash briefly.

If the specifications are not obtained:

- 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 **36**.



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

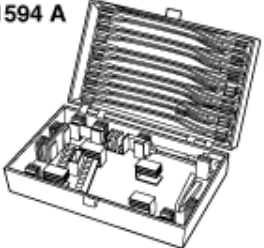
Connector Contact	Test box V.A.G 1598/31 Socket
3 (cylinder 1)	102
3 (cylinder 2)	95
3 (cylinder 3)	103
3 (cylinder 4)	94

- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

- Renew ignition coil with output stage (combined as a single component).

1.6 - Testing Motronic current supply relay -J271 - Vehicles model year 2000 >

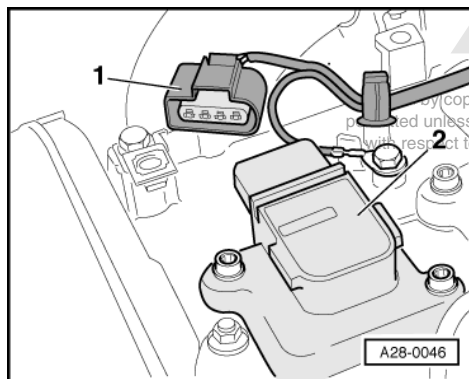
V.A.G 1526 A 	V.A.G 1594 A 
V.A.G 1598/31 	
	G24-0020

Special tools and workshop equipment required

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

Fitting location => Fitting locations overview, Page **24**

Note:



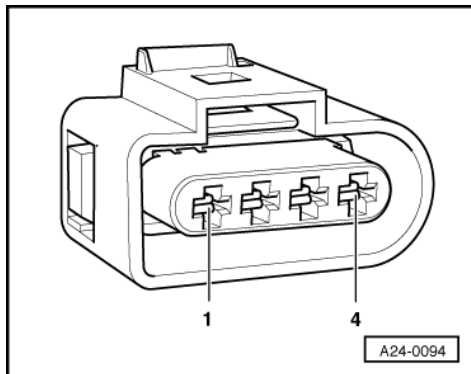
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The Motronic current supply relay -J271 supplies voltage to the ignition coils with output stages and to the engine control unit (pin 121).

Test sequence

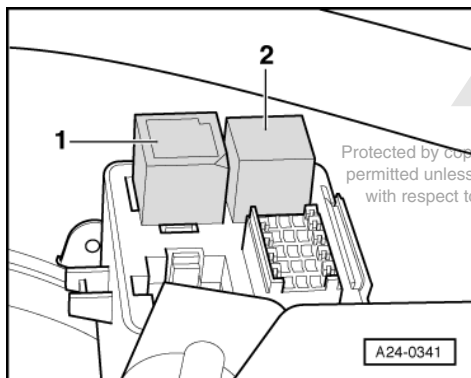
- -> Unplug 4-pin connector -1- from one ignition coil -2-.



- -> Connect multimeter (voltage measurement range) as follows:

Connector Contact	Measure against
1	Engine earth

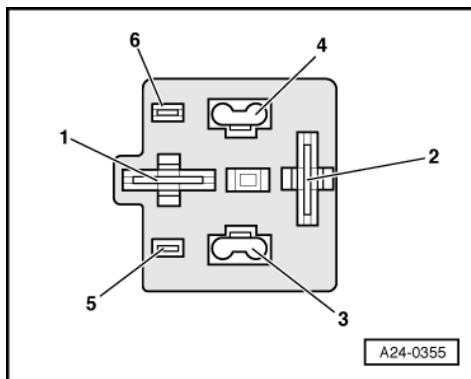
- Switch on ignition.
- Specification: approx. battery voltage



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If the specification is not attained:

- -> Unplug current supply relay -2- (located under cover on left side of bulkhead).



- -> Test for open circuits in the following wiring connection according to current flow diagram:

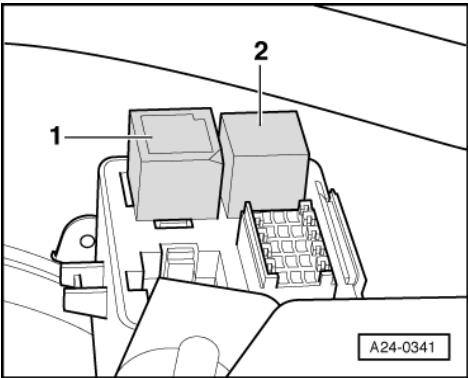
Relay carrier under cover on left side of bulkhead Contact	Connectors on ignition coils Contact
2	1

- Rectify any open circuit as necessary.

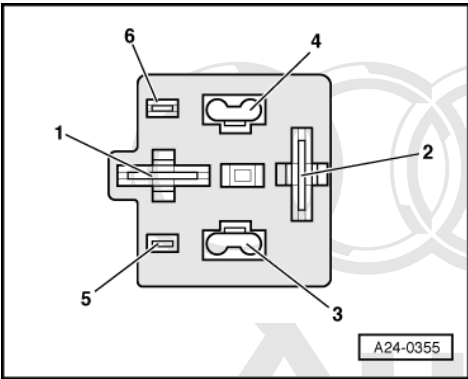
If the wiring is OK:

- Test supply voltage for Motronic current supply relay -J271=>Page 143 .
- Test activation of Motronic current supply relay -J271=>Page 144 .

Checking voltage supply



- Switch off ignition.
- -> Unplug current supply relay -2- (located under cover on left side of bulkhead).



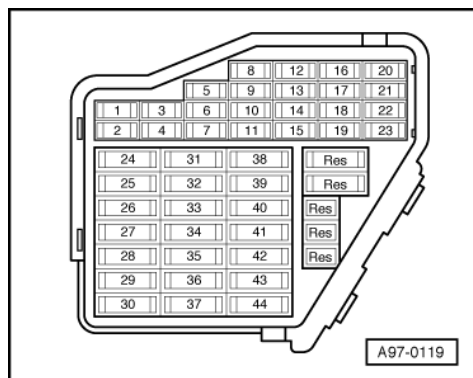
- -> Connect multimeter (voltage measurement range) as follows:

Relay carrier under cover on left side of bulkhead Contact	Measure against
1	Engine earth
3	Engine earth

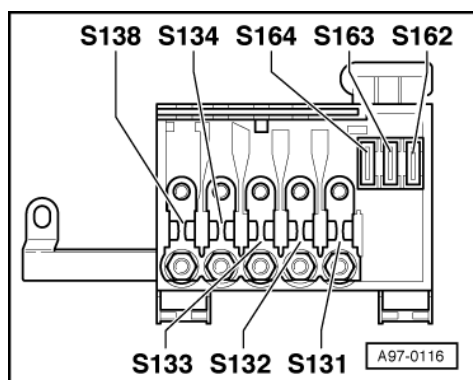
- Specification: approx. battery voltage

If the specification is not attained:

- Carry out the following tests (marked with dots):



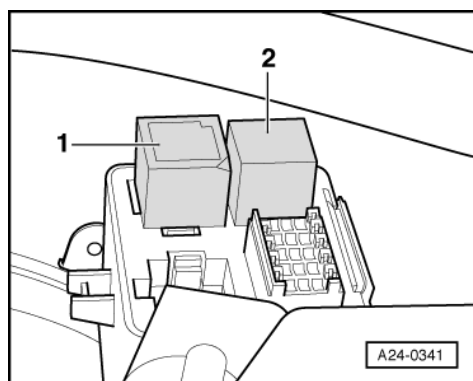
- -> Check fuse S10 (in fuse carrier, plug-in position 10).



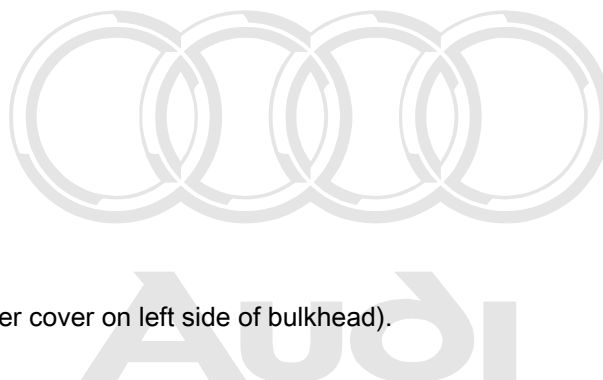
- -> Check fuse S134 (110 A) in main fuse box on battery.
- Test for open circuit in wiring from battery + (terminal 30) via fuse S134 and fuse 10 to Motronic current supply relay -J271 (under cover on left side of bulkhead):

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

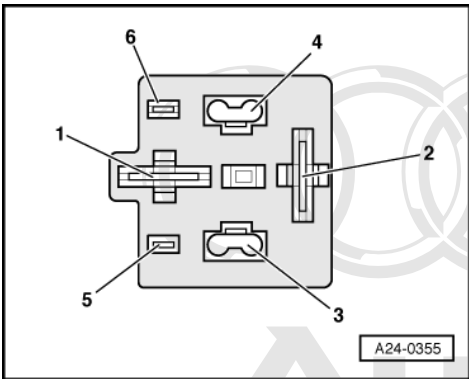
Checking activation



- Switch off ignition.
- -> Unplug current supply relay -2- (located under cover on left side of bulkhead).



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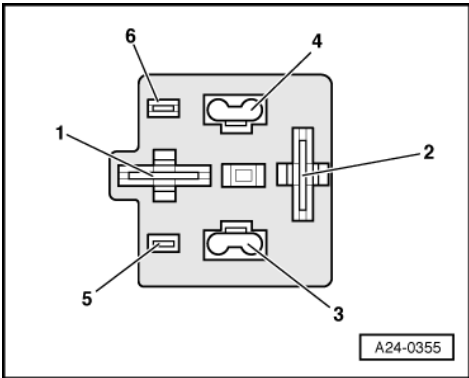
- -> Connect multimeter (voltage measurement range) as follows:

Relay carrier under cover on left side of bulkhead Contact	Measure against
5	Battery positive

- Switch on ignition.
- Specification: approx. battery voltage

If the specification is not attained:

- 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 36 .



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

Relay carrier under cover on left side of bulkhead Contact	Test box V.A.G 1598/31 Socket
5	21

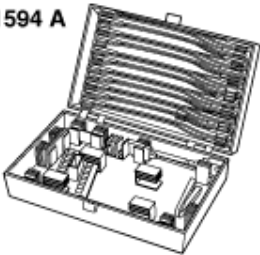
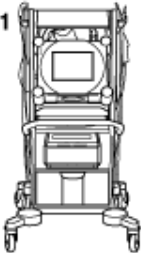
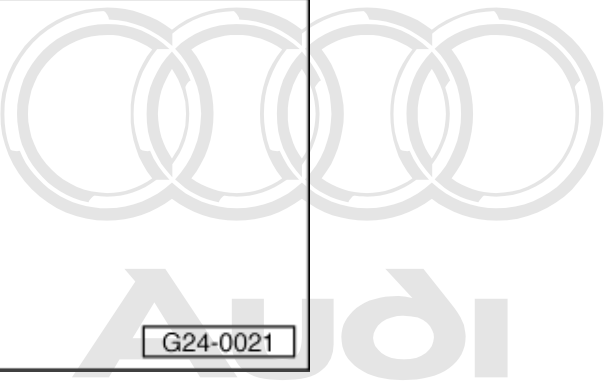
- Rectify any open/short circuit as necessary.

If no fault is found:

- Fit a new Motronic current supply relay -J271.



1.7 - Testing intake air temperature sender -G42

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

Special tools and workshop equipment required

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

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

Fitting location => Fitting locations overview, Page **24**

Test sequence

- 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 **1** .)
When doing this the ignition must be switched on.

-> Indicated on display:

Rapid data transfer HELP
Select function XX

- Enter "08" to select 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

- Enter "004" to select Display Group 004 and confirm entry with Q key.

-> Indicated on display:

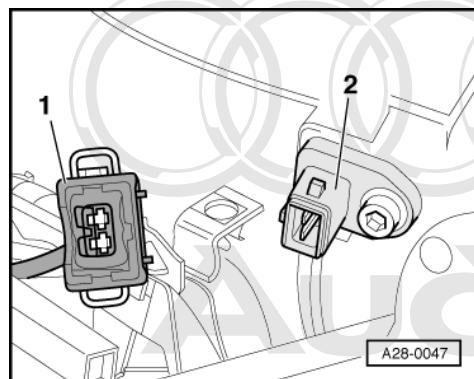
Read measured value block 4
1 2 3 4

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

	Display zones			
	1	2	3	4
Display Group 004: Intake air temperature 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	0 ... 6800 rpm	10.000 ... 15.000 V	-48.0 ... 143.0 5C	-48.0 ... 143.0 5C
Specification	xxxx rpm	12.000...15.000 V	80.0...110.0 °C	Between ambient temperature and 110 °C 1)

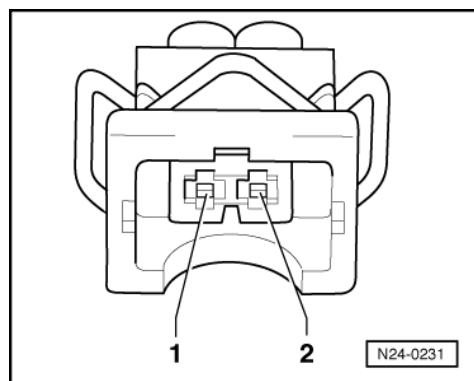
- 1) If there is a large difference between the temperature displayed and the ambient temperature at the sender, check the sender and sender wiring for contact resistance and open circuit.

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 36.

- -> Unplug connector -1- at intake air temperature sender -G42 -2-.





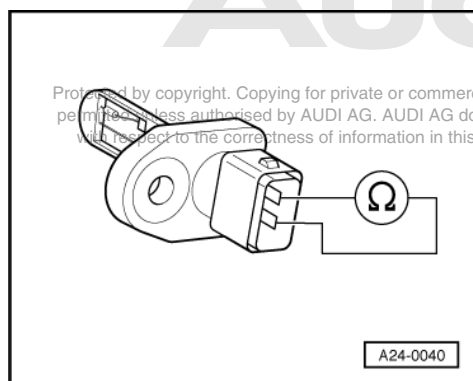
- -> Test for open circuit and short to positive or earth in the following wiring connections:

Connector Contact	Test box V.A.G 1598/31 Socket
1	85
2	108

- Test for short circuits between the two wires.
- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

Testing sender



- -> Connect multimeter (resistance measurement range) to sender.

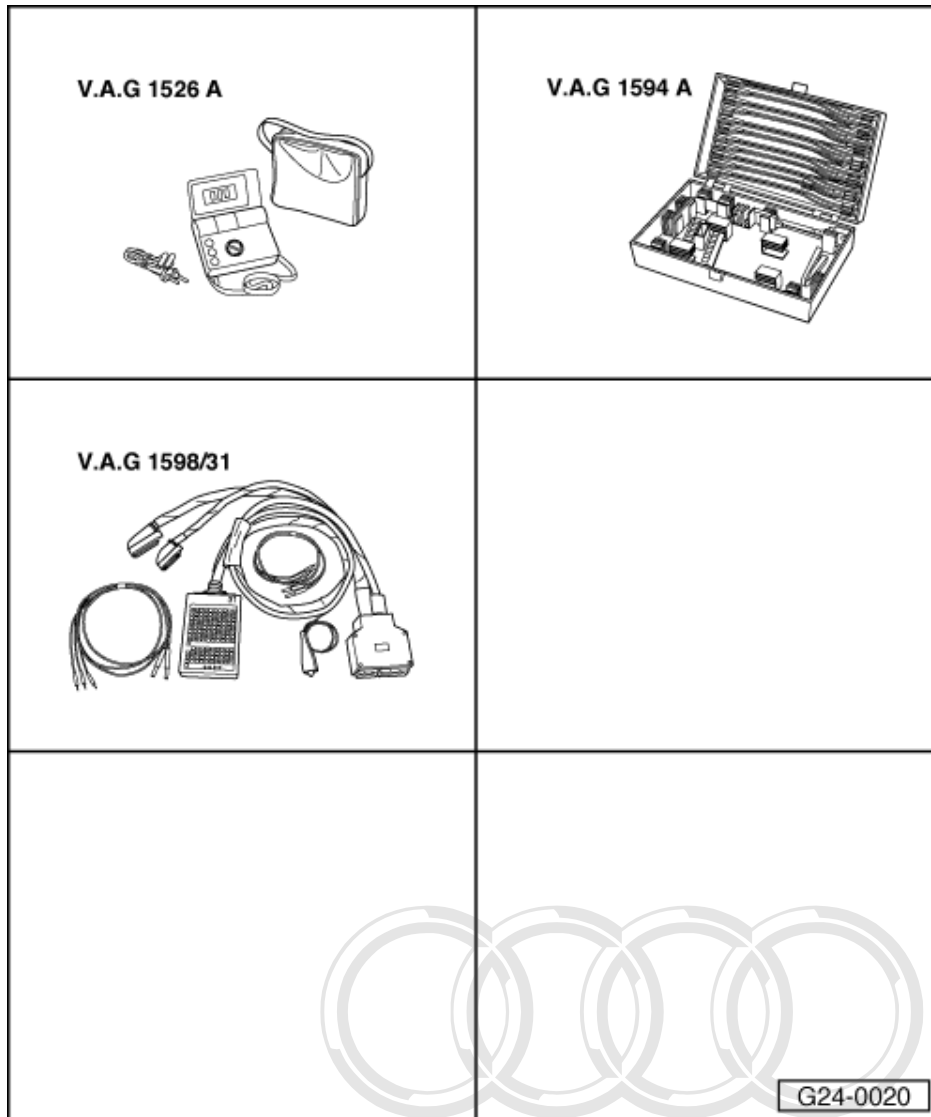
Specifications:

Temperature (°C)	Resistance (kΩ)
-20	approx. 13.8
0	approx. 5.5
20	approx. 2.4
40	approx. 1.1
60	approx. 0.6

If the specification is not attained:

- Fit a new intake air temperature sender.

1.8 - Testing engine speed sender -G28



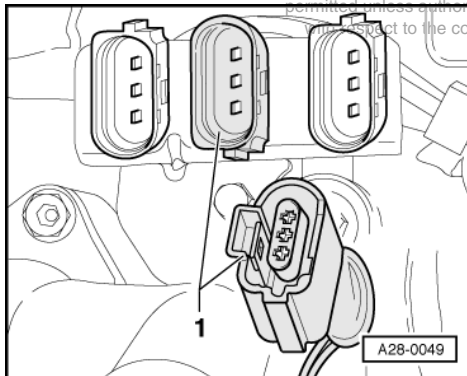
Special tools and workshop equipment required

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

Fitting location => Fitting locations overview, Page **24**

Note:

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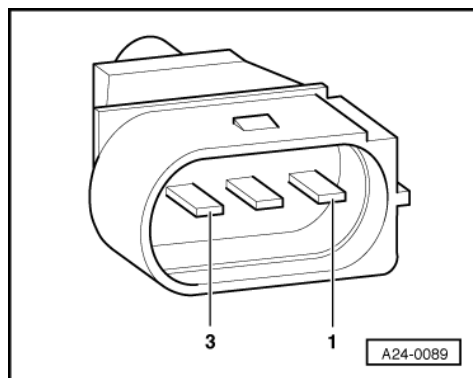




The engine speed sender is a combined speed sender and reference mark sender. Without a signal from the -G28 the engine cannot be started. If the signal from the -G28 fails while the engine is running, the engine will cut out immediately.

Test sequence

- Before carrying out the test, make sure that the sender is correctly installed and firmly seated.
- -> Unplug connector for engine speed sender -1- (colour coding: grey connector).



- -> Connect multimeter (resistance measurement range) between contacts 2 and 3.
- Specification: 730 ... 1000 Ω

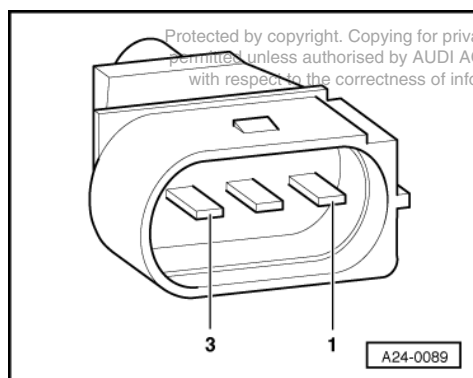
Note:

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

If the specification is not attained:

- Fit a new engine speed sender.

If the specification is attained:



- -> Connect multimeter (resistance measurement range) to contacts 2 and 1 (earth) and to contacts 3 and 1 (earth).
- Specification: $\infty \Omega$ (no continuity)

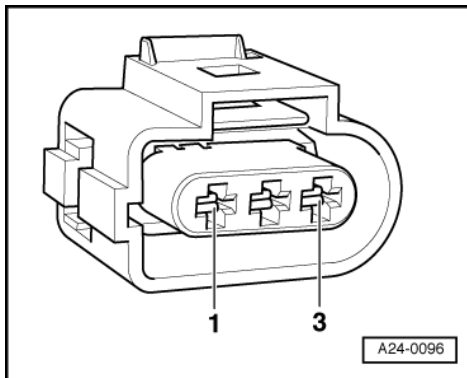
If the specification is not attained:

- Fit a new engine speed sender.

If the specification is attained:

- 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 36 .



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

Connector Contact	Test box V.A.G 1598/31 Socket
1 (screening)	108
2 (earth)	90
3 (signal)	82

- Rectify any open/short circuit as necessary.

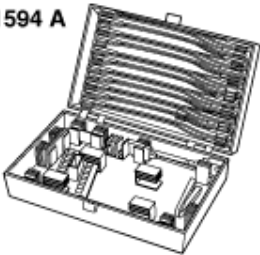
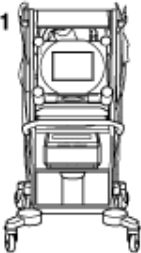
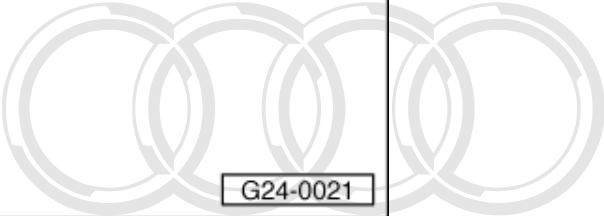
If no wiring fault is detected:

- Fit a new engine control unit => Page 38 .

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1.9 - Testing coolant temperature sender -G62

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

Special tools and workshop equipment required

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

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

Fitting location => Fitting locations overview, Page **24**

Test requirement:

- Engine cold

Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551). Select engine electronics control unit by entering the address word "01" => Page **1** ; when doing this the engine must be running at idling speed.

-> Indicated on display:

Rapid data transfer HELP
Select function XX

- Enter "08" to select 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

- Enter "004" to select Display Group 004 and confirm entry with Q key.

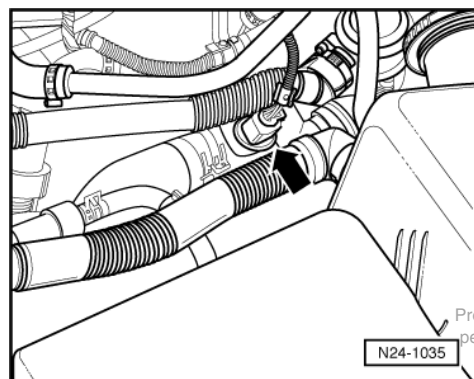
-> Indicated on display:

Read measured value block 4
1 2 3 4

- Check display in display zone 3.

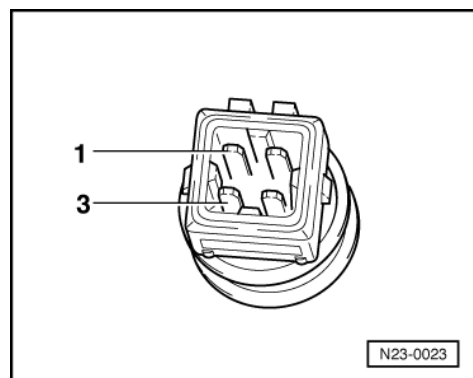
	Display zones			
	1	2	3	4
Display Group 004: Coolant temperature with engine idling				
Display	xxxx rpm	xx.xxx V	xxx.x °C	xxx.x °C
Indicates	Engine speed	Battery voltage	Coolant temperature	Intake air temperature
Range	0 ... 6800 rpm	10.000... 15.000 V	-48.0 ... 143.0 °C	-48.0 ... 143.0 °C
Specification	xxxx rpm	12.000...15.000 V	Temperature should rise steadily	Between ambient temperature and 110 °C

If display zone 3 shows an implausible value:



- -> Unplug 4-pin connector from coolant temperature sender -G62 with coolant temperature gauge sender - G2 -arrow-.

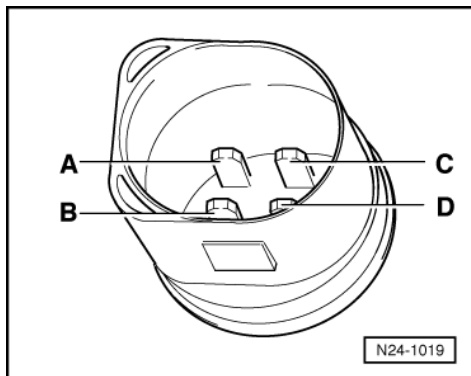
Coolant temperature sender with square plug:





- -> Connect multimeter (resistance measurement range) between contacts 1 and 3 on the sender.

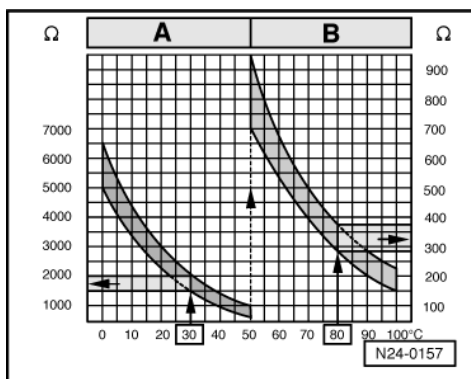
Coolant temperature sender with oval plug:



- -> Connect multimeter (resistance test range) between contacts C and D on the sender.

All models

Scale A shows resistance values for temperature range 0...50 °C and scale B the values for temperature range 50...100 °C.



-> Examples:

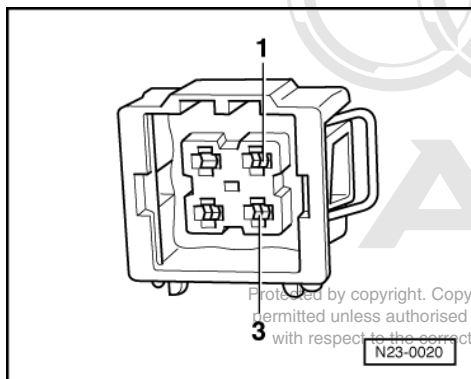
- ♦ 30 °C corresponds to a resistance from 1500...2000 ω
- ♦ 80 °C corresponds to a resistance from 275...375 ω

If the specification is not attained:

- Fit a new coolant temperature sender.

If the specification is attained:

- 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 36 .



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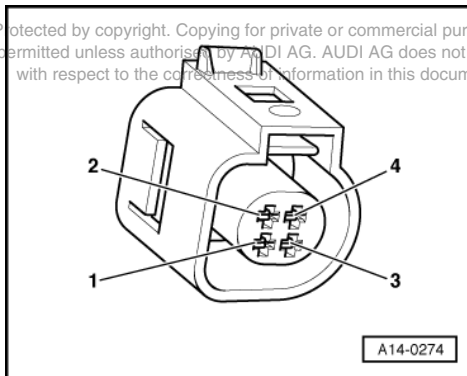
Coolant temperature sender with square plug:

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

Connector Contact	Test box V.A.G 1598/31 Socket
1	108
3	93

Coolant temperature sender with oval plug:

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

Connector Contact	Test box V.A.G 1598/31 Socket
3	93
4	108

All models

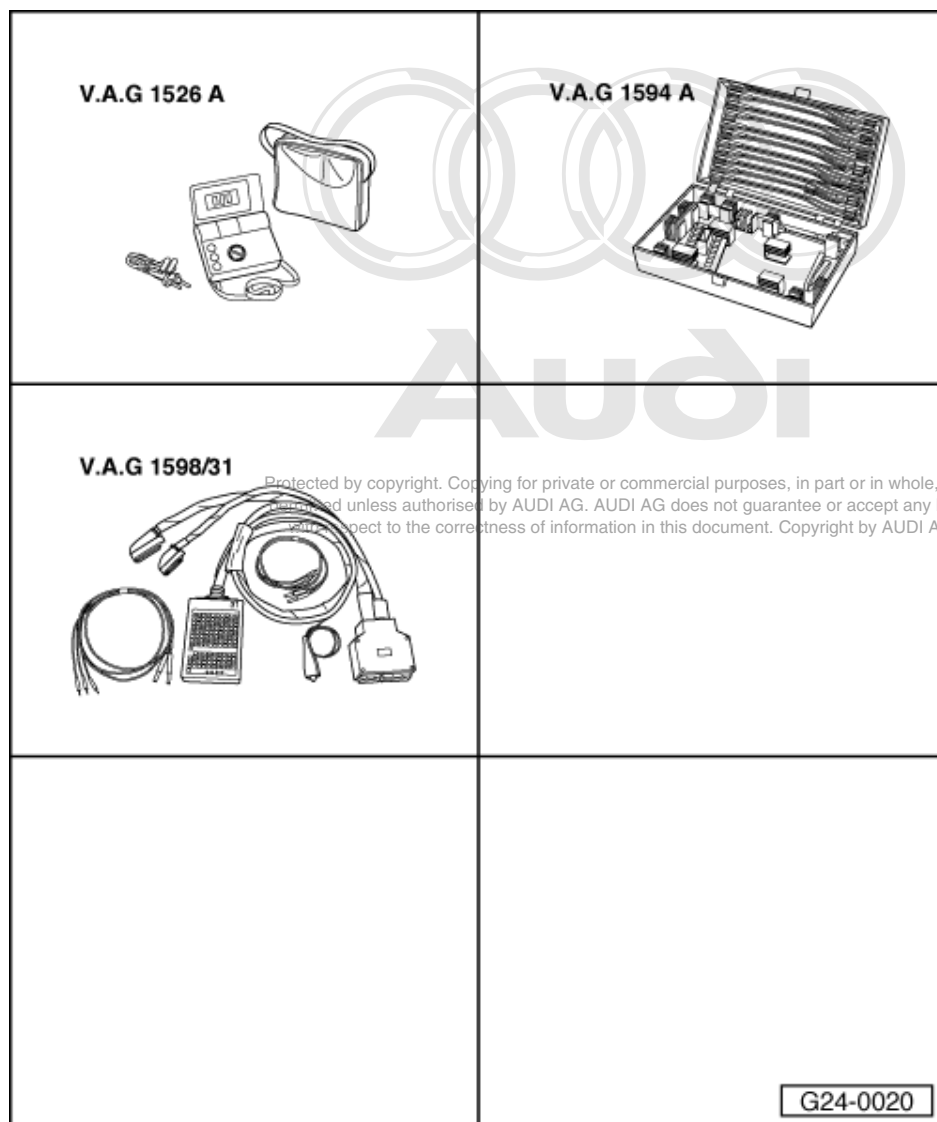
- Test for short circuits between the two wires.
- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

- Fit a new engine control unit => Page 38 .



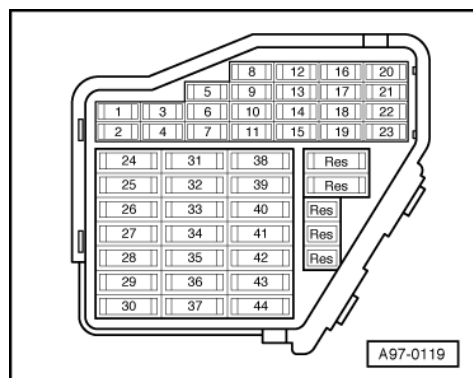
1.10 - Testing voltage supply for control unit



Special tools and workshop equipment required

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

Requirements for test:



- -> Fuses for engine control unit OK

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

- Battery voltage not less than 11 V
- Alternator OK

Test sequence

- 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 36 .
- Switch ignition on.

Notes:

- ♦ The positive voltage supply for the engine control unit comes via contact 3 (terminal 15) and contact 62 (terminal 30).
- ♦ The earth connection for the engine control unit is via contacts 1 and 2.
- Connect multimeter (voltage measurement range) as follows:

Test box V.A.G 1598/31 Socket	Measure against
1	Battery positive
2	Battery positive
62	Engine earth

- Specification: approx. battery voltage

Connect multimeter (voltage measurement range) as follows:

Test box V.A.G 1598/31 Socket	Measure against
3	Engine earth

- Switch ignition on.
- Specification: approx. battery voltage

If the specifications are not obtained:

- Check the wiring.

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

Vehicles model year 2000>:

- Connect multimeter (voltage measurement range) as follows:

Test box V.A.G 1598/31 Socket	Measure against
121 1)	Engine earth

1) The Motronic current supply relay -J271 supplies terminal 121 of the engine control unit with voltage for up to 15 minutes after switching off the ignition.

- Switch ignition on.
- Specification: approx. battery voltage

If the specification is not attained:



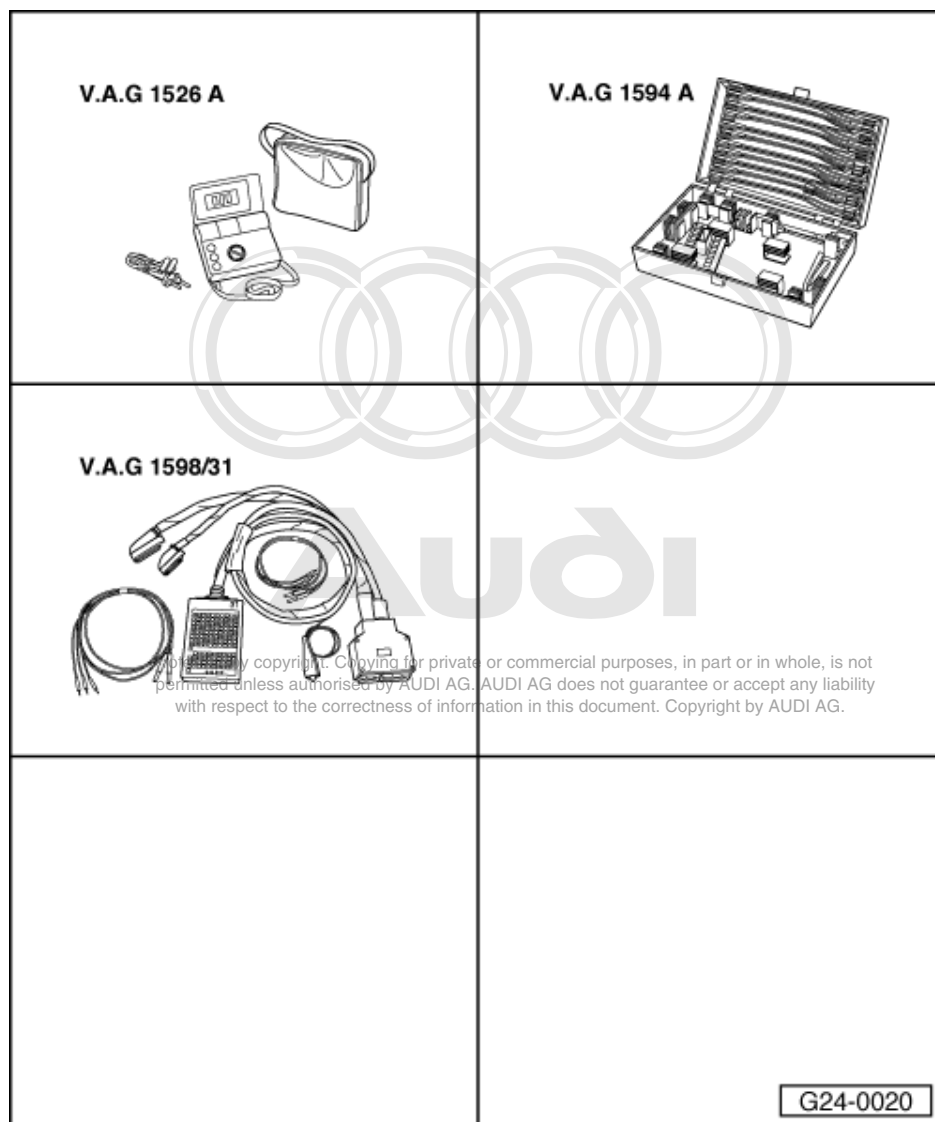
- Check the wiring.
- => Current flow diagrams, Electrical fault finding and Fitting locations
- Test Motronic current supply relay -J271=>Page **141** .

1.11 - 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 cylinders 1/2 or 3/4	- Poor fuel quality	- Change to higher quality fuel => Owner's Manual
	- Wrong tightening torque on knock sensor	- Loosen knock sensor, then tighten to 20 Nm
	- Knock sensor defective	- Test knock sensor => Page 159
	- Corrosion on connector	- Check connectors
	- 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

1.12 - Testing knock sensors



Special tools and workshop equipment required

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

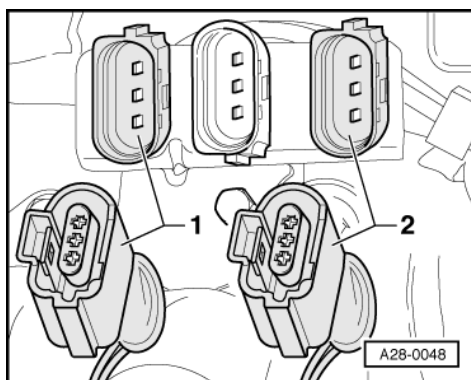
Fitting location => Fitting locations overview, Page **24**

Notes:

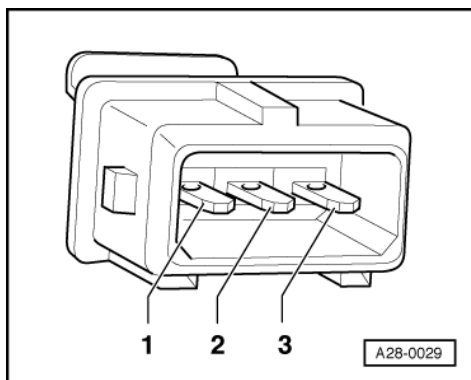
- ◆ It is not possible to carry out an electrical test of the knock sensors themselves (-G61 and -G66).
- ◆ Always use gold-plated contacts when repairing the knock sensor connectors.
- ◆ To ensure that the knock sensors function properly it is important to keep exactly to the specified tightening torque of 20 Nm.
- ◆ Check for corrosion in connection between knock sensor and wiring harness.



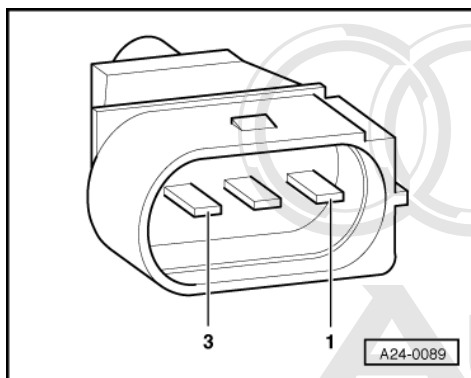
Testing knock sensor wiring



- -> Unplug the connector for knock sensor I -G61 -Item1-or knock sensor II -G66 -Item 2- 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: $\infty \omega$ (no continuity) - there must be no connection between any of the contacts.



- -> Rectangular connector



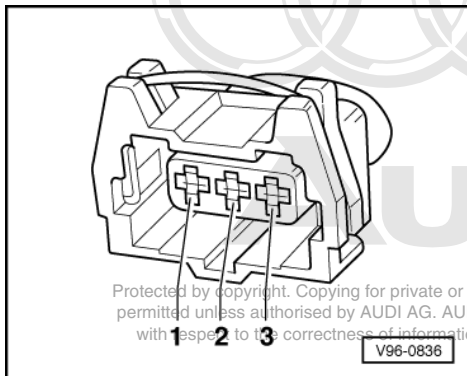
- -> Oval connector

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

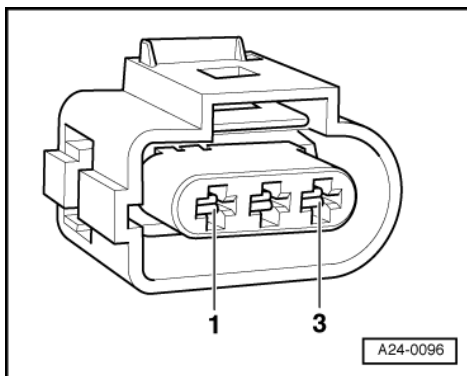
Testing wiring between knock sensors and engine control unit

- 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 36 .



- -> Knock sensor I -G61 (cylinders 1/2) or
Knock sensor -II- -G66 (cylinders 3/4)
Rectangular connector



- -> Knock sensor I -G61 (cylinders 1/2) or
Knock sensor -II- -G66 (cylinders 3/4)
Oval connector

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

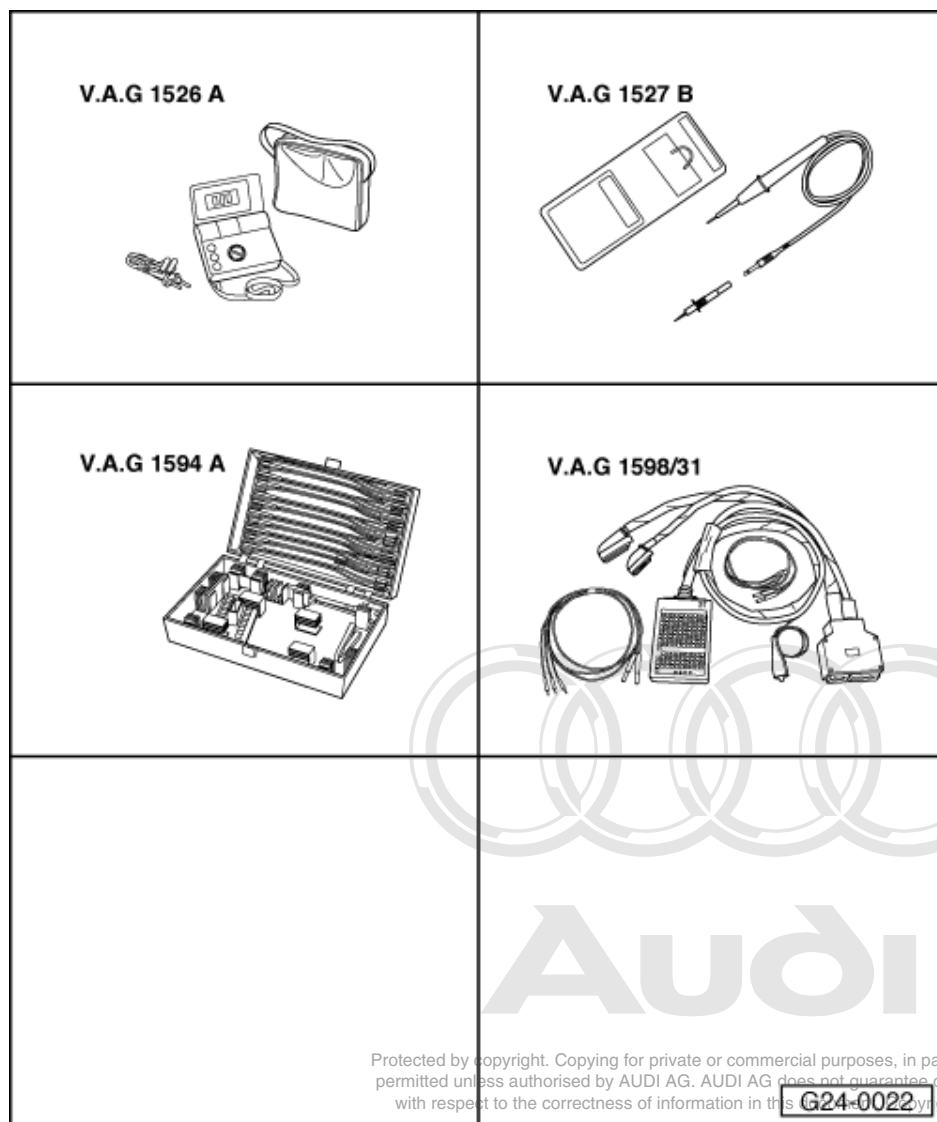
Connector for -G61 Contact	Test box V.A.G 1598/31 Socket
1 (signal)	106
2 (earth)	99
3 (screening)	108

Connector for -G66 Contact	Test box V.A.G 1598/31 Socket
1 (signal)	107
2 (earth)	99
3 (screening)	108

- Rectify any open/short circuit as necessary.



1.13 - Testing Hall sender -G163



Special tools and workshop equipment required

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

Fitting location => Fitting locations overview, Page **24**

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. In addition the charge pressure of the turbo-charger is reduced.

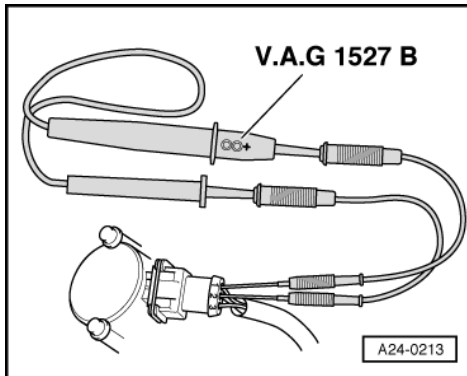
Even without a signal from the Hall sender the engine will continue to run and can also be re-started.

- ♦ 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. If this happens, 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.

Checking activation

- Slide back rubber sleeve (if fitted) on connector for Hall sender but leave connector plugged in.



- -> Connect voltage tester V.A.G 1527 B between contact 2 (Hall sender signal) and contact 1 (positive).

Note:

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

- Operate starter for a few seconds.
 - The LED should flash

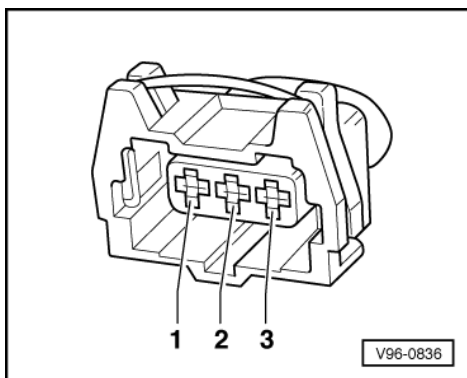
Note:

The LEDs on voltage testers 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 LED does not flash:

Checking voltage supply

- Unplug connector from Hall sender.



- -> Connect multimeter (voltage measurement range) as follows:

Connector Contact	Measure against
1	Engine earth

- Switch on ignition.



- Specification: approx. 5 V

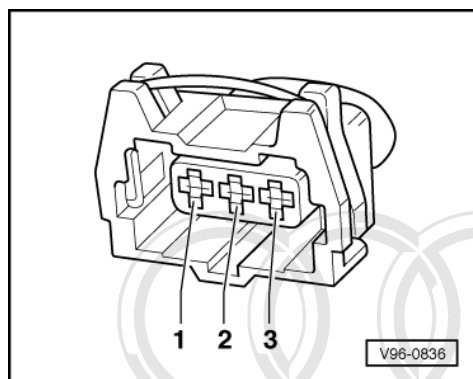
Testing signal wire

- Connect multimeter (voltage measurement range) as follows:

Connector Contact	Measure against
2	Engine earth

- Switch on ignition.
 - Specification: approx. battery voltage

Testing earth wire



- -> Test for open circuit and short to positive in the following wiring connection:

Connector Contact	Measure against
3	Engine earth

- Rectify any open/short circuit as necessary.

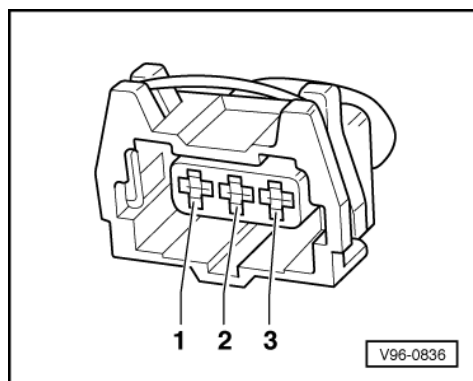
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted.
If all the readouts match the specifications but the LED does not flash (measurement taken between contacts 1 and 2 without unplugging connector and while operating starter):

- Renew the Hall sender.

If the specifications are not obtained:

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 36 .



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

Connector Contact	Test box V.A.G 1598/31 Socket
1 (positive)	98
2 (signal)	86
3 (earth)	108

- Rectify any open/short circuit as necessary.
- If all the test results so far have been OK but a fault relating 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 on Hall sender out of position
- Unbolt Hall sender, then check to ensure that the rotor ring is correctly aligned on the camshaft. If incorrectly installed, the catch will be pressed flat when the securing screw is tightened.
- If the rotor ring is correctly aligned, check the position of the camshaft in relation to the crankshaft.

=> 4-Cylinder engine (5-valve turbo), Mechanics; Repair Group 15; Cylinder head, valve gear; Removing and installing camshafts Cylinder head, valve gear Removing and installing camshafts



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