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Audi A3 1997 ➤

Motronic injection and ignition system (4-cyl.)

Engine ID	APG								
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Edition 05.2000

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.)

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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01 - Self-diagnosis

1 - Self-diagnosis of Motronic

1.1 - Self-diagnosis of Motronic

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1.2 - Technical data on self-diagnosis

Features

The term "self-diagnosis" relates to the electrical/electronic section of the control system.

To enable the cause of the problem to be rapidly established in the event of failure of an electrical/electronic component or an open circuit in the wiring, the control unit is equipped with a fault memory.

Full use of the features offered by the self-diagnosis function can only be made using the vehicle diagnostic, testing and information system VAS 5051 or the fault reader V.A.G 1551 in mode 1 "Rapid data transfer".

For a list of functions covered by the vehicle diagnostic, testing and information system VAS 5051 or the fault reader V.A.G 1551, refer to => Page 1, List of available functions.

The fault memory is designed as a non-volatile memory and is therefore not dependent on the power supply.

Faults of relevance to the electronic throttle system are additionally indicated by way of a warning lamp in the dash panel insert.

Functions available when using fault reader V.A.G 1551/1552 or VAS 5051

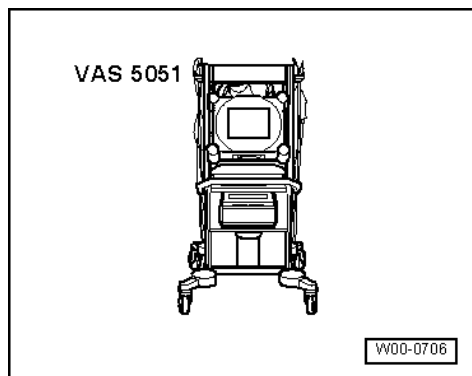
The following table indicates the conditions under which the desired functions can be selected.

Address words and functions for fault reader		Ignition on, engine stopped	Engine running, idling	Vehicle in operation
Address words				
00	Automatic test sequence	yes	yes	yes
01	Engine electronics	yes	yes	yes
Functions				
01	Interrogate control unit version	yes	yes	yes
02	Interrogate fault memory	yes	yes	yes
03	Final control diagnosis	yes	no	no
04	Basic setting	yes	yes	yes
05	Erase fault memory	yes	yes	yes
06	End output	yes	yes	yes
07	Encode control unit	yes	no	no
08	Read measured value block	yes	yes	yes



1.3 - Connecting up vehicle diagnostic, testing and information system VAS 5051 and selecting engine electronics control units

All the functions implemented to date using V.A.G 1551/1552 can also be performed with the new vehicle diagnostic, testing and information system VAS 5051 in vehicle self-diagnosis mode.



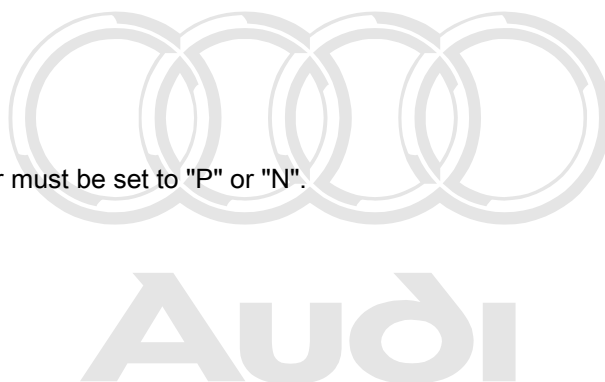
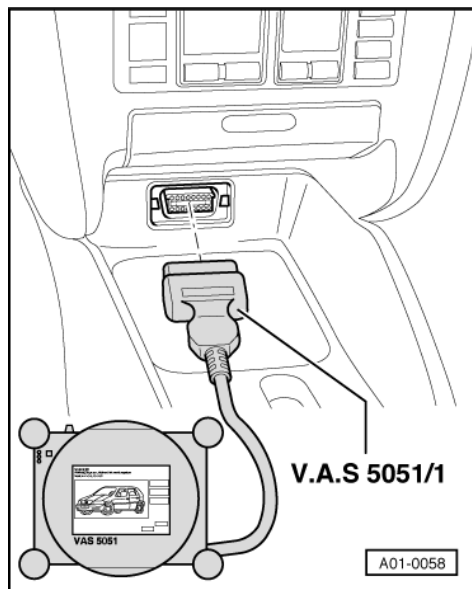
=> Operating instructions for vehicle diagnostic, testing and information system VAS 5051.

Special tools, workshop equipment, testers, measuring instruments and other items required

- ♦ Vehicle diagnostic, testing and information system VAS 5051

Test requirements

- Fuse OK
- Battery voltage at least 11.5 V.
- Switch off air conditioner.
- On vehicles with automatic gearbox, selector lever must be set to "P" or "N".



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Sequence of operations

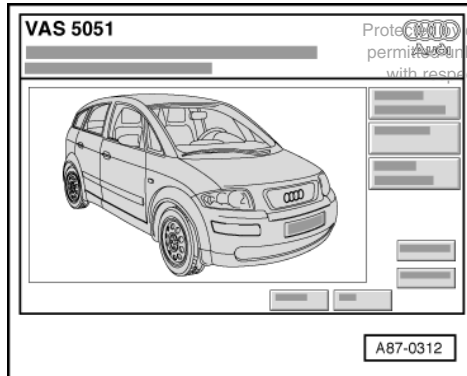
- -> Use diagnostic wire VAS 5051/1 to connect up vehicle diagnostic, testing and information system VAS 5051.

Attention:

- ◆ If measurements/tests have to be performed whilst driving, vehicle diagnostic, testing and information system VAS 5051 is always to be attached to rear seat and operated from there.

Depending on desired function:

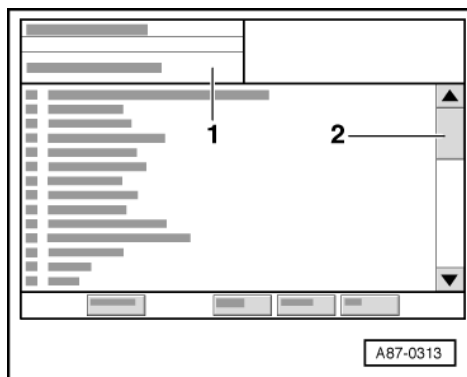
- Switch on ignition.



or
start engine => Page 1, "Available functions" table.

Selecting mode:

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



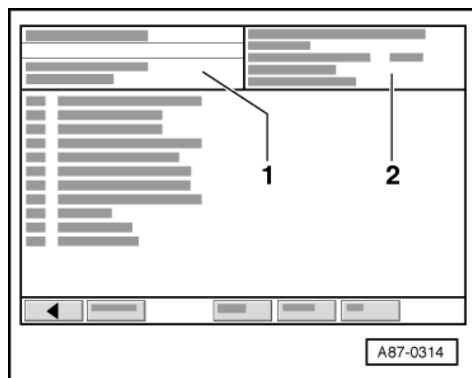
-> Indicated on display:

Selecting vehicle system:

- On display, select
"01 - Engine electronics".

Notes:

- ◆ Vehicle system selection prompt appears in display zone -1-.
- ◆ "Scrolling" screen display with bar -2- permits display of vehicle systems (for all vehicle models and equipment levels) which are envisaged for self-diagnosis but are not currently visible on the screen.



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

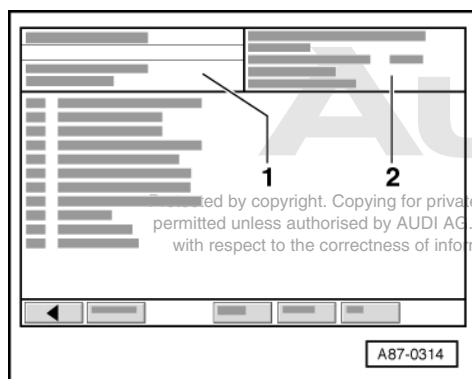
Display zone -2- shows control unit identification and code, e.g.:

- 8D1906018..	Control unit number (refer to Parts List)
- 1.8l	Engine capacity
- R4S/5V	In-line engine, 4-cyl. normally aspirated / 5-valve
- MOTR	Motronic
- HS	HS = Manual gearbox
- AT	AT = Automatic gearbox
- GRA	Only displayed for vehicles with cruise control system
- ...	Data level (software version) of control unit
- Code 10500	Control unit code (encoding => Page 31)
- WSC 06388	Workshop code from V.A.G 1551 with which encoding was last performed

If encoding does not coincide with corresponding version in vehicle:

- Check control unit encoding => Page 31 ,
Encoding engine control unit.

Selecting diagnostic function:



All diagnostic functions are available at this stage.

- -> Select desired function on display.

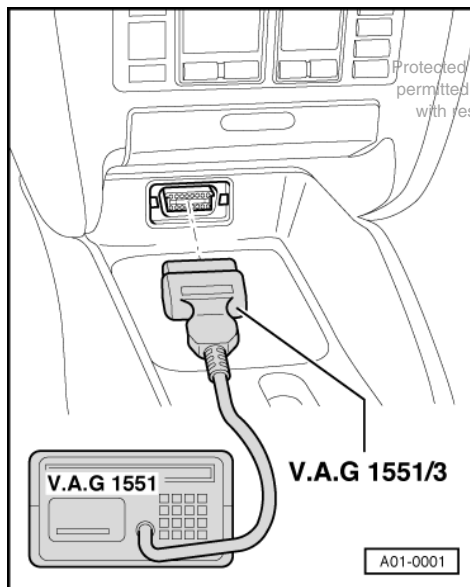
- Refer to repair operations for further procedure.

Notes:

- ♦ The display zones are shown from top to bottom in functions 04 - Basic setting and 08 - Read measured value block.
- ♦ If displays indicated in sequence of operations do not appear:

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

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



Test requirements

- Fuses for engine electronics OK
 - Fuel pump relay OK
 - Battery voltage at least 11 V
 - Earth connections at engine and gearbox OK
- Switch off ignition.
 - -> Connect vehicle diagnostic, testing and information system VAS 5051 with diagnostic lead VAS 5051/1. Alternatively, use can be made of diagnostic wire V.A.G 1551/3 to connect up fault reader V.A.G 1551.

Note:

- ♦ Diagnostic connection is located in front left knee restraint.

Attention:

- ♦ On test drives the vehicle diagnostic, testing and information system VAS 5051 or the fault reader V.A.G 1551 must only be secured on the rear seat and operated from there.
- ♦ Observe the safety precautions => Page 34

Note:

The following description refers solely to implementation of self-diagnosis using fault reader V.A.G 1551.



Proceed in line with equipment operating instructions if use is made of vehicle diagnostic, testing and information system VAS 5051.

-> Indicated on display:

V.A.G SELF-DIAGNOSIS	HELP
1 - Rapid data transfer 1)	
2 - Flash code output1)	

1) Displayed alternately

- If display remains blank, check diagnostic wiring:

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

Depending on desired function => "Available functions" table, Page 1 :

- Switch on ignition.

or

- Start engine.
- Switch on printer of fault reader by pressing Print key. Lamp in key must light.
- Press key 1 for "Rapid data transfer".

-> Indicated on display:

Rapid data transfer	HELP
Enter address word XX	

Rapid data transfer	Q
01 - Engine electronics	

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

Note:

-> If one of the adjacent messages appears on the display, perform fault-finding in line with fault-finding program for diagnostic wire.

Rapid data transfer	HELP
No control unit response	

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

Rapid data transfer	HELP
Fault in communication link	

Rapid data transfer	HELP
K-wire not switched to earth	

Rapid data transfer	HELP
K-wire not switched to positive	

-> Fault reader V.A.G 1551 displays control unit identification, e.g.:

8D1906018..	1.8l	R4S/5V	MOTR	HS
D..	□			
Code	10500	WSC	06388	

- | | | |
|---|-------------|---|
| - | 8D1906018.. | Control unit number
(refer to Parts List) |
| - | 1.8l | Engine capacity |
| - | R4S/5V | In-line engine, 4-cyl. normally aspirated / 5-valve |
| - | MOTR | Motronic |

- HS	HS = Manual gearbox
- AT	AT = Automatic gearbox
- GRA	Only displayed for vehicles with cruise control system
- ...	Data level (software version) of control unit
- Code 10500	Control unit code (encoding => Page 31)
- WSC 06388	Workshop code from V.A.G 1551 with which encoding was last performed

Notes:

- ◆ Incorrect encoding can lead to poorer emission values and greater strain on the automatic gearbox due to gearshift jolts.
- ◆ Incorrect encoding also results in non-existent faults being stored in the fault memory.

If encoding does not coincide with corresponding version in vehicle:

- Check engine control unit encoding
=> Page 31 , Encoding engine control unit
- Press =>key.

-> Indicated on display:

Rapid data transfer HELP
Select function XX

Note:

Pressing **HELP** key prints out a list of possible functions.

2 - Interrogating and erasing fault memory

2.1 - Interrogating and erasing fault memory

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 2 .
Engine must be idling.

Note:

If engine does not start, crank it with starter for at least 5 seconds and then leave ignition switched on.

- Press Print key to switch on printer
(lamp in key lights).

-> Indicated on display:

Rapid data transfer HELP
Select function XX

- Operate fault reader in line with display.
- Press keys 0 and 2 for "Interrogate fault memory" function and confirm entry with Q key.

-> The number of stored faults or "No faults detected" appears on the display.

X faults detected

If no fault has been stored:



- Press ⇒key.

If one or more fault(s) has/have been stored:

The stored faults are consecutively displayed and printed out.

-> Adjacent display then appears:

Rapid data transfer	HELP
Select function XX	

- Use fault table to locate and eliminate faults printed out=>Page 9 .
- Press keys 0 and 5 for "Erase fault memory" function and confirm entry with Q key.
- Read out readiness code => Page 24 .

-> Indicated on display:

Rapid data transfer
Fault memory erased

Note:

Fault memory is not erased if ignition is switched off between interrogation and clearing of fault memory. It is therefore important to adhere exactly to sequence of operations, i.e. first interrogate fault memory and then erase it.

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- Press ⇒key.

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

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

Automatic test sequence

When performing testing and assembly work, faults from other control units such as unplugged connectors may also be detected. As a final step it is therefore important to interrogate and erase the fault memories of all control units as follows:

- Press key 0 for address word "Automatic test sequence" twice and confirm entry with Q key. Fault reader V.A.G 1551 then consecutively transmits all known address words.

If a control unit responds with its identification, the number of stored faults or "No faults detected" appears on the display.

Any stored system faults are consecutively displayed and printed out. V.A.G 1551 then transmits the next address word.

-> The automatic test sequence is over if the adjacent display appears:

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

- Erase all fault memories and then perform test drive.
- Interrogate fault memories of all control units again with "automatic test sequence". Fault memory must not contain any faults.

If no fault has been stored:

- Press ⇒key.

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

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

2.2 - Fault table

Notes:

- ♦ Faults occurring in monitored sensors or components are stored in fault memory together with an indication of the type of fault.
- ♦ Faults of relevance to the electronic throttle system are additionally indicated by way of a warning lamp ("EPC warning lamp") in the dash panel insert.
- ♦ Unplugging engine control unit connector or disconnecting battery causes all learned values in control unit to be erased. Content of fault memory is however retained. If engine is then started, rough idling may occur for a brief period. If this is the case, allow engine to idle for several minutes until learning process has been completed.
- ♦ The fault table is arranged according to the 5-digit fault codes on the left.
- ♦ If a stored fault does not reoccur within the next 40 warm-up phases, the fault code is erased automatically.
- ♦ Sporadic faults are marked "SP" on the V.A.G 1551 display.
- ♦ Do not immediately replace components indicated as being defective by V.A.G 1551, but rather: Start by checking wiring and connectors to these components in line with current flow diagram. Also use current flow diagram to check earth connections. This is particularly important if faults are output as being "sporadic" (SP).

Fault code		Fault message	Fault remedy
SAE	V.A.G		
P0101	16485	Air-mass meter -G70 Implausible signal	Check air-mass meter => Page 65
P0102	16486	Air-mass meter -G70 Signal too low	
P0103	16487	Air-mass meter -G70 Signal too high	
P0112	16496	Intake air temp. sender -G42 Signal too low	Check intake-air temperature sender => Page 70
P0113	16497	Intake air temp. sender -G42 Signal too high	
P0116	16500	Coolant temp. sender -G62 Implausible signal	Check coolant temperature sender => Page 72
P0117	16501	Coolant temp. sender -G62 Signal too low	
P0118	16502	Coolant temp. sender -G62 Signal too high	

Fault code		Fault message	Fault remedy
SAE	V.A.G		
P0130	16514	Bank 1, probe 1 Fault in electrical circuit	Check lambda control => Page 73
P0131	16515	Bank 1, probe 1 Voltage too low	
P0135	16519	Bank 1, probe 1, heating element circuit Short to positive	Check lambda probe heating => Page 80
P0137	16521	Bank 1, probe 2 Voltage too low	Check lambda control => Page 73
P0138	16522	Bank 1, probe 2 Voltage too high	
P0139	16523	Bank 1, probe 2 Signal too slow	Check lambda control



Fault code		Fault message	Fault remedy
P0140	16524	Bank 1, probe 2 No activity	=> Page 73

Fault code		Fault message	Fault remedy
SAE	V.A.G		
P0300	16684	Misfiring recognised	- Check whether there is fuel in tank Check hoses (intake manifold changeover and secondary air inlet valves); check intake system for leaks => Page 57 - Check spark plugs and ignition cables with connector - Check ignition coils => Page 132 - EGR valve not closing - perform adaption => Page 100 Checking => 4-Cylinder (5-Valve) Engine, Mechanics; Repair Group 26 - Check misfiring detection => Page 148 If none of the above measures proves successful, the cause of the trouble may be the flywheel.
P0301	16685	Cyl. 1 misfiring recognised	
P0302	16686	Cyl. 2 misfiring recognised	
P0303	16687	Cyl. 3 misfiring recognised	
P0304	16688	Cyl. 4 misfiring recognised	

Fault code		Fault message	Fault remedy
SAE	V.A.G		
P0321	16705	Engine speed sender -G28 Implausible signal	Check engine speed sender => Page 135
P0322	16706	Engine speed sender -G28 No signal	
P0327	16711	Knock sensor 1 -G61 Signal too low	Check knock sensor => Page 137
P0328	16712	Knock sensor 1 -G61 Signal too high	
P0332	16716	Knock sensor 2 -G66 Signal too low	
P0333	16717	Knock sensor 2 -G66 Signal too high	
P0341	16725	Camshaft pos. sensor => Sensor -G40 Implausible signal	- Check valve timing => 4-Cylinder (5-Valve) Engine, Mechanics; Repair Group 26 138

Fault code		Fault message	Fault remedy
SAE	V.A.G		
P0403	16787	EGR valve -N18 malfunction	- EGR valve not closing - perform adaption => Page 100 Check EGR valve => => 4-Cylinder (5-Valve) Engine, Mechanics; Repair Group 26
P0411	16795	Secondary air system Through-flow defective	
P0422	16806	Bank 1, main catalyst Efficiency too low	- Replace catalytic converter
P0441	16825	Tank breathing system Flow rate faulty	- Perform diagnosis of fuel tank breather system => Page 96

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

P0506	16890	Idling speed control Revs below specification	- Check throttle valve control part => Page 106
P0507	16891	Idling speed control Revs above specification	- Check hoses (intake manifold changeover and secondary air inlet valves); check intake system for leaks => Page 69
P0560	16944	Voltage supply Implausible signal	Voltage supply from Check engine control unit => Page 63
P0562	16946	Voltage supply Voltage too low	
P0563	16947	Voltage supply Voltage too high	
P0571	16955	Brake light switch -F Implausible signal	Check brake light switch and brake pedal switch => Page 117 => Electrical System; Repair Group 01; Self-diagnosis of CCS; Checking brake light switch Self-diagnosis of CCS; Checking brake light switch

Fault code		Fault message	Fault remedy
SAE	V.A.G		
P0601	16985	Control unit defective	Replacing engine control unit => Page 44
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	Checking lambda probe heating upstream of catalytic converter => Page 80
P1103	17511	Bank 1, probe 1, heating element circuit Performance too low	
P1105	17513	Bank 1, probe 2, heating element circuit Short to positive	Checking lambda probe heating downstream of catalytic converter => Page 87
P1111	17519	Lambda control (bank 1) System too lean	Check lambda probe and lambda control upstream of catalytic converter => Page 73
P1112	17520	Lambda control (bank 1) System too rich	

Fault code		Fault message	Fault remedy
SAE	V.A.G		
P1114	17522	Bank 1, probe 2 Internal resistance too high	Check lambda probe and lambda control downstream of catalytic converter => Page 83
P1115	17523	Bank 1, probe 1, heating element circuit Short to earth	
P1116	17524	Bank 1, probe 1, heating element circuit Open circuit	Checking lambda probe heating upstream of catalytic converter => Page 80
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		Fault message	Fault remedy
SAE	V.A.G		
P1127	17535	Bank1, mixture adaption (mult.) System too rich	Perform test drive (fuel in oil) Check fuel system pressure => Page 53 Check air-mass meter => Page 57 Eliminate unmetered air
P1128	17536	Bank1, mixture adaption (mult.) System too lean	
P1136	17544	Bank1, mixture adaption (add.) System too lean	Perform test drive (fuel in oil) Check fuel system pressure => Page 97
P1137	17545	Bank1, mixture adaption (add.) System too rich	

Notes:

- ♦ mult. = multiplicative, i.e. fault takes effect over entire engine-speed and load range
- ♦ add. = additive, i.e. fault only takes effect at idle

Fault code		Fault message	Fault remedy
SAE	V.A.G		
P1149	17557	Lambda control bank 1 Implausible control value	Check lambda probe and lambda control =>Page 73
P1171	17579	Angle sens. 2 for throt. valve drive -G188 Implausible signal 1)	
P1172	17580	Angle sens. 2 for throt. valve drive -G188 Signal too low 1)	Check throttle valve drive angle sender => Page 109 .
P1173	17581	Angle sens. 2 for throt. valve drive -G188 Signal too high 1)	
P1176	17584	Bank 1, Lambda corr. rear cat Control limit reached	- Checking ageing of lambda probe upstream of catalytic converter => Page 23
P1198	17606	Bank 1, probe 2, heating element circuit Electrical fault	Checking lambda probe heating downstream of catalytic converter => Page 87

1) This fault causes engine control unit to switch on EPC warning lamp in dash panel insert; significance of EPC warning lamp =>Page 111

Fault code		Fault message	Fault remedy
SAE	V.A.G		
P1201	17609	Injector, cylinder 1 -N30 Fault in electrical circuit	Checking injectors => Page 57
P1202	17610	Injector, cylinder 2 -N31 Fault in electrical circuit	
P1203	17611	Injector, cylinder 3 -N32 Fault in electrical circuit	
P1204	17612	Injector, cylinder 4 -N33 Fault in electrical circuit	
P1213	17621	Injector, cylinder 1 -N30 Short to positive	Check injectors => Page 57
P1214	17622	Injector, cylinder 2 -N31 Short to positive	

P1215	17623	Injector, cylinder 3 -N32 Short to positive	
P1216	17624	Injector, cylinder 4 -N33 Short to positive	

Fault code		Fault message	Fault remedy
SAE	V.A.G		Check injectors => Page 57
P1225	17633	Injector, cylinder 1 -N30 Short to earth	
P1226	17634	Injector, cylinder 2 -N31 Short to earth	
P1227	17635	Injector, cylinder 3 -N32 Short to earth	
P1228	17636	Injector, cylinder 4 -N33 Short to earth	
P1237	17645	Injector, cylinder 1 -N30 Open circuit	Check injectors => Page 57
P1238	17646	Injector, cylinder 2 -N31 Open circuit	
P1239	17647	Injector, cylinder 3 -N32 Open circuit	
P1240	17648	Injector, cylinder 4 -N33 Open circuit	

Fault code		Fault message	Fault remedy
SAE	V.A.G		- Fill tank with fuel Check wiring between engine control unit and dash panel insert => Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder Check signal from sender for fuel gauge/check fuel gauge => Electrical System; Repair Group 01; Self-diagnosis of dash panel insert Self-diagnosis of dash panel insert
P1250	17658	Fuel status too low	
P1325	17733	Knock control, cylinder 1 Control limit reached	
P1326	17734	Knock control, cylinder 2 Control limit reached	
P1327	17735	Knock control, cylinder 3 Control limit reached	
P1328	17736	Knock control, cylinder 4 Control limit reached	Check knock control => Page 136

Fault code		Fault message	Fault remedy
SAE	V.A.G		Check intake air temperature sender => Page 44
P1335	17743	Engine torque monitoring 2 Control limit surpassed 1)	
P1336	17744	Engine torque monitoring Control limit surpassed	Replace engine control unit => Page 44
P1337	17745	Bank 1, camshaft pos. sensor => -G163 Short to earth	Check Hall sender => Page 138
P1338	17746	Bank 1, camshaft pos. sensor => -G163 Open circuit/short to positive	



P1340	17748	Camshaft pos./crankshaft pos. sens. Wrong allocation	Check phase position from Hall sender => Page 141
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1) This fault causes engine control unit to switch on EPC warning lamp in dash panel insert; significance of EPC warning lamp => 111

Fault code		Fault message	Fault remedy
SAE	V.A.G		
P1355	17763	Ignition circuit, cylinder 1 Open circuit	Check ignition coils => Page 132
P1356	17764	Ignition circuit, cylinder 1 Short to positive	
P1357	17765	Ignition circuit, cylinder 1 Short to earth	
P1358	17766	Ignition circuit, cylinder 2 Open circuit	
P1359	17767	Ignition circuit, cylinder 2 Short to positive	
P1360	17768	Ignition circuit, cylinder 2 Short to earth	

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Fault code		Fault message	Fault remedy
SAE	V.A.G		
P1361	17769	Ignition circuit, cylinder 3 Open circuit	Check ignition coils => Page 132
P1362	17770	Ignition circuit, cylinder 3 Short to positive	
P1363	17771	Ignition circuit, cylinder 3 Short to earth	
P1364	17772	Ignition circuit, cylinder 4 Open circuit	
P1365	17773	Ignition circuit, cylinder 4 Short to positive	
P1366	17774	Ignition circuit, cylinder 4 Short to earth	
P1386	17794	Control unit defective	Replace engine control unit => Page 44
P1388	17796	Control unit defective 1)	

1) This fault causes engine control unit to switch on EPC warning lamp in dash panel insert; significance of EPC warning lamp => 111

Fault code		Fault message	Fault remedy
SAE	V.A.G		
P1400	17808	Exhaust gas recirculation valve - N18 Electrical fault in current circuit	- Check exhaust gas recirculation valve => 4-Cylinder (5-Valve) Engine, Mechanics; Repair Group 26
P1401	17809	Exhaust gas recirculation valve - N18 Short to earth	- Check exhaust gas recirculation valve => 4-Cylinder (5-Valve) Engine, Mechanics; Repair Group 26
P1402	17810	Exhaust gas recirculation valve - N18 Short to positive	
P1404	17812	Basic setting not carried out on exhaust gas recirculation system	Perform basic setting (measured value block 74) => Page 100

Fault code		Fault message	Fault remedy
SAE	V.A.G		
P1409	17817	Fuel tank breather valve -N80 Fault in electrical circuit	Check activated charcoal filter solenoid valve 1 => Page 97
P1410	17818	Fuel tank breather valve -N80 Short to positive	
P1420	17828	Secondary air inlet valve -N112 Fault in electrical circuit	Check secondary air inlet valve => Page 101
P1421	17829	Secondary air inlet valve -N112 Short to earth	
P1422	17830	Secondary air inlet valve -N112 Short to positive	
P1424	17832	Bank 1, secondary air system Leak recognised	- Check secondary air system => 4-Cylinder (5-Valve) Engine, Mechanics; Repair Group 26 69

1) This fault causes engine control unit to switch on EPC warning lamp in dash panel insert; significance of EPC warning lamp => 111

Fault code		Fault message	Fault remedy
SAE	V.A.G		
P1425	17833	Fuel tank breather valve -N80 Short to earth	Check activated charcoal filter solenoid valve 1 => Page 97
P1426	17834	Fuel tank breather valve -N80 Open circuit	
P1432	17840	Secondary air inlet valve -N112 Open circuit	Check secondary air inlet valve => Page 101
P1433	17841	Secondary air pump relay -J299 Open circuit	Check secondary air pump relay => Page 103
P1434	17842	Secondary air pump relay -J299 Short to positive	
P1435	17843	Secondary air pump relay -J299 Short to earth	
P1436	17844	Secondary air pump relay -J299 Fault in electrical circuit	

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

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P1439	17847	Exh. gas recirc. potentiometer - G212 Fault in basic setting	- Perform basic setting (measured value block 74) => Page 100 Check exhaust gas recirculation valve => 4-Cylinder (5-Valve) Engine, Mechanics; Repair Group 26
P1440	17848	Exhaust gas recirculation valve - N18 Open circuit	- Check exhaust gas recirculation valve => 4-Cylinder (5-Valve) Engine, Mechanics; Repair Group 26
P1442	17850	Exh. gas recirc. potentiometer - G212 Signal too high	
P1443	17851	Exh. gas recirc. potentiometer - G212 Signal too low	
P1444	17852	Exh. gas recirc. potentiometer - G212 Implausible signal	

Fault code		Fault message	Fault remedy
SAE	V.A.G		
P1500	17908	Fuel pump relay - J17 Fault in electrical circuit	Check fuel pump relay => Page 59
P1502	17910	Fuel pump relay - J17 Short to positive	
P1511	17919	Intake manifold changeover valve - N156 Fault in electrical circuit	Check intake manifold changeover => Page 91
P1512	17920	Intake manifold changeover valve - N156 Short to positive	
P1515	17923	Intake manifold changeover valve - N156 Short to earth	
P1516	17924	Intake manifold changeover valve - N156 Open circuit	
P1517	17925	Main relay => - J271 Fault in electrical circuit	Check voltage supply relay for Motronic => Page 62

Fault code		Fault message	Fault remedy
SAE	V.A.G		
P1519	17927	Bank 1, variable valve timing Malfunction	Check camshaft timing control =>Page 141
P1523	17931	Crash signal from airbag control unit Implausible signal	
P1529	17937	Variable valve timing => -N205 Short to positive	Check camshaft timing control =>Page 141

Fault code		Fault message	Fault remedy
P1530	17938	Variable valve timing => -N205 Short to earth	=> Mechanics; Repair Group 15; Checking camshaft timing control; Checking operation of camshaft timing control Checking camshaft timing control; Checking operation of camshaft timing control
P1531	17939	Variable valve timing => -N205 Open circuit	
P1539	17947	Clutch pedal switch -F36 Implausible signal	Check clutch pedal switch => Page 120

Fault code		Fault message	Fault remedy
SAE	V.A.G		
P1542	17950	Angle sender for throt. val. drive -G187 Implausible signal 1)	Check throttle valve drive angle senders => Page 109
P1543	17951	Angle sender for throt. val. drive -G187 Signal too low 1)	
P1544	17952	Angle sender for throt. val. drive -G187 Signal too high 1)	
P1545	17953	Throttle valve control Faulty 1)	Check throttle valve control part => Page 106
P1559	17967	Throttle valve control unit (part) -J338 Fault in base setting 1)	Perform adaption => Page 107 .
P1560	17968	Maximum engine revs surpassed	Eliminate mechanical damage
P1564	17972	Throttle valve control unit (part) -J338 Low voltage at basic setting	Charge battery, repeat adaption => Page 107 .
P1565	17973	Throttle valve control unit (part) -J338 Lower stop is not reached 1)	Check throttle valve control part =>Page 106 .

1) This fault causes engine control unit to switch on EPC warning lamp in dash panel insert; significance of EPC warning lamp =>Page 111

Fault code		Fault message	Fault remedy
SAE	V.A.G		
P1566	17974	Load signal from A/C compressor Implausible signal	Check air conditioner compressor shutoff => Page 126 .
P1568	17976	Throttle valve control unit (part) - J338 Mechanical fault 1)	
P1569	17977	CCS switch -E45 Implausible signal	Check cruise control system switch => Electrical System; Repair Group 01; Self-diagnosis of cruise control system
P1579	17987	Throttle valve control unit (part) - J338 Adaption not started	Check throttle valve control part => Page 106
P1593	18001	Altitude adaption Signal outside tolerance	Check intake system for leaks => Page 106 .

1) This fault causes engine control unit to switch on EPC warning lamp in dash panel insert; significance of EPC warning lamp =>Page 111

Fault code		Fault message	Fault remedy
SAE	V.A.G		
P1602	18010	Voltage supply term. 30 Voltage too low	Check engine control unit power supply => Page 63 .



P1603	18011	Control unit defective	Replace engine control unit => Page 44 .
P1604	18012	Control unit defective 1)	
P1609	18017	Crash switch-off triggered	Accident involving airbag triggering or Final control diagnosis performed in airbag control unit, thus producing fault entry in engine control unit (erase fault memory)

1) This fault causes engine control unit to switch on EPC warning lamp in dash panel insert; significance of EPC warning lamp =>Page 111

Fault code		Fault message	Fault remedy
SAE	V.A.G		
P1612	18020	Engine control unit incorrectly encoded	Encode engine control unit => Page 31
P1624	18033	Request fault lamp be switched on active	Fault of relevance to emissions from gearbox control unit, MIL lamp switched on by gearbox control unit Read out fault memory of gearbox control unit => Automatic Gearbox 01L; Repair Group 01; Self-diagnosis
P1626	18034	CAN bus no message from gearbox CU	Check CAN bus =>Page 127
P1630	18038	Accelerator pedal position sender -G79 Signal too low 1)	Accelerator pedal position sender => Page 113
P1631	18039	Accelerator pedal position sender -G79 Signal too high 1)	
P1633	18041	Accelerator pedal position sender 2 -G185 Signal too low 1)	
P1634	18042	Accelerator pedal position sender 2 -G185 Signal too high 1)	
P1639	18047	Accelerator pedal position sender 1/2 -G79+G185 Implausible signal 1)	

1) This fault causes engine control unit to switch on EPC warning lamp in dash panel insert; significance of EPC warning lamp => 111

Fault code		Fault message	Fault remedy
SAE	V.A.G		
P1640	18048	Control unit defective	Replace engine control unit => Page 44
P1648	18056	Drive train data bus defective	Check CAN bus => Page 127
P1649	18057	Drive train data bus Message from ABS control unit missing	
P1676	18084	Electr. throttle control fault lamp -K132 Fault in electrical circuit 1)	Significance of EPC warning lamp => Page 111 .
P1677	18085	Electr. throttle control fault lamp -K132 Short to positive 1)	

P1853	18261	CAN bus implausible info from ABS CU	Check CAN bus =>Page 127
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1) This fault causes engine control unit to switch on EPC warning lamp in dash panel insert; significance of EPC warning lamp => 111

Note:

Electric throttle control fault lamp -K132 is also referred to as EPC warning lamp.

3 - Final control diagnosis

3.1 - Final control diagnosis

Notes:

- ◆ Final control diagnosis can only be performed with engine stopped and ignition switched on.
- ◆ Final control diagnosis is terminated if engine is started or an engine speed pulse is detected.
- ◆ During final control diagnosis the individual control elements are actuated for approx. 1 minute or until ⇒ key is pressed to select next control element.
- ◆ The control elements are checked acoustically or by means of touch.
- ◆ The electric fuel pump is in operation during the entire final control diagnosis process.
- ◆ Engine must be started before repeating final control diagnosis (engine control unit must have detected an engine speed greater than 300 rpm).

The final control diagnosis function actuates the following components in the stated sequence:

1. Activated charcoal filter solenoid valve 1 -N80 (fuel tank breather valve)
2. Exhaust gas recirculation valve -N18
3. Secondary air inlet valve -N112
4. Secondary air pump relay -J299
5. Intake manifold changeover valve -N156
6. Camshaft adjustment (camshaft adjustment valve -N205)
7. Injector, cylinder 1 -N30
8. Injector, cylinder 3 -N32
9. Injector, cylinder 4 -N33
10. Injector, cylinder 2 -N31

Test requirements

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- Fuses for engine electronics OK
- Fuel pump relay OK
- Motronic current supply relay -J271 OK
- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 5 .
Ignition must be on.

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	



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

-> Indicated on display:

Rapid data transfer Q
03-Final control diagnosis

- Confirm entry with Q key.

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

-> Indicated on display:

Final control diagnosis
Fuel tank breather valve -N80

This solenoid valve is actuated (clicks) for approx. 1 minute if ➔ key is not pressed beforehand to select next control element.

Fitting location: Exploded view of fitting locations =>Page 36

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

- Check activated charcoal filter solenoid valve 1 -N80 => Page 97 .

Actuating secondary air inlet valve -N112

- Press ➔key.

-> Indicated on display:

Final control diagnosis
Secondary air inlet valve -N112

This solenoid valve is actuated (clicks) for approx. 1 minute if ➔ key is not pressed beforehand to select next control element.

Fitting location: Exploded view of fitting locations =>Page 36

If secondary air inlet valve does not click:

Check secondary air inlet valve =>Page 101 .

Actuating secondary air pump relay -J299

- Press ➔key.

-> Indicated on display:

Final control diagnosis
Secondary air pump relay -J299

Secondary air pump relay -J299 constantly switches secondary air pump motor -V101 on and off for approx. 1 minute if ➔ key is not pressed beforehand to select next control element.

Fitting location: Exploded view of fitting locations =>Page 36

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If secondary air pump motor -V101 does not run intermittently:

Check secondary air pump relay =>Page 103 .

Actuating intake manifold changeover solenoid valve -N156

- Press ➔key.

-> Indicated on display:

Final control diagnosis
 Intake manif. changeover valve -N156

This valve is actuated (clicks) until → key is pressed to select next control element.

Fitting location: Exploded view of fitting locations =>Page 36

If valve is not actuated (does not click):

- Check intake manifold changeover valve -N156 => Page 91

Actuating camshaft adjustment valves

- Press →key.

-> Indicated on display:

Final control diagnosis
 Camshaft timing control 1

- Camshaft adjustment valves 1 and 2 (-N205 and -N208) are actuated (click) for approx. 1 minute if →key is not pressed beforehand to select next control element.

Fitting location: Exploded view of fitting locations =>Page 36

- This solenoid valve is actuated (clicks) until →key is pressed to terminate final control diagnosis.

If solenoid valve is not actuated (does not click), check camshaft adjustment solenoid valve => Page 141

Actuating injectors

Note:

The injectors are actuated in line with the firing order, i.e. cyl. 1, cyl. 3, cyl. 4, cyl. 2.

- Press →key.

-> Indicated on display:

Final control diagnosis
 Injector, cyl. 1 -N30

- Press →key.

Injector must click five times after pressing arrow key.

Fitting location: Exploded view of fitting locations =>Page 36

-> Indicated on display:

Final control diagnosis
 Injector, cyl. 1 -N30

If injector does not click:

- Check injectors=>Page 57 .
- Press →key.

-> Indicated on display:

Final control diagnosis
 Injector, cyl. 3 -N32

- Press →key.



Injector must click five times after pressing arrow key.

Fitting location: Exploded view of fitting locations =>Page 36

-> Indicated on display:

Final control diagnosis
Injector, cyl. 3 -N32

If injector does not click:

- Check injectors=>Page 57 .
- Press =>key.

-> Indicated on display:

Final control diagnosis
Injector, cyl. 4 -N33

- Press =>key.

Injector must click five times after pressing arrow key.

Fitting location: Exploded view of fitting locations =>Page 36

-> Indicated on display:

Final control diagnosis
Injector, cyl. 4 -N33

If injector does not click:

- Check injectors=>Page 57 .
- Press =>key.

-> Indicated on display:

Final control diagnosis
Injector, cyl. 2 -N31

- Press =>key.

Injector must click five times after pressing arrow key.

Fitting location: Exploded view of fitting locations =>Page 36

-> Indicated on display:

Final control diagnosis
Injector, cyl. 2 -N31

If injector does not click:

- Check injectors=>Page 57 .
- Press =>key.

-> Indicated on display:

Final control diagnosis
END

- Press =>key.

-> Indicated on display (function selection):

Rapid data transfer HELP
Select function XX



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Note:

Final control diagnosis can only be restarted after starting engine and then switching ignition off and on again.

4 - Readiness code

4.1 - Readiness code

Functional description

The readiness code is an 8-digit numerical code indicating the status of the diagnostic functions of relevance to emissions.

On successful completion of the diagnostic function for a given system (e. g. fuel tank breather system), the corresponding digit in the numerical code is set from 1 to 0.

The diagnostic functions are implemented at regular intervals in the course of normal driving. Following repairs to a system of relevance to emissions, it is advisable to generate the readiness code as this ensures that these systems are operating properly. Faults detected during diagnosis are entered in the fault memory.

The readiness code is erased whenever the fault memory is erased or the power supply is interrupted.

4.2 - Reading out readiness code

Special tools, workshop equipment, testers, measuring instruments and other items required

- ◆ Fault reader V.A.G 1551 with lead V.A.G 1551/3

Sequence of operations

- Connect fault reader V.A.G 1551. Then switch on ignition and select engine control unit with "Address word" 01.
(Connecting fault reader and selecting engine control unit=>Page 5)

-> Indicated on display:

Rapid data transfer HELP
Select function XX

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- Press keys 1 and 5 for "Readiness code" function and confirm entry with Q key.

The following display must appear on successful completion of all diagnostic functions:

-> Indicated on display:

Readiness code
00000000 - Test completed

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

-> If adjacent display appears:

Readiness code
00101101 - Test not completed

One of the diagnostic functions has not been successfully implemented.

- Press ⇒key.

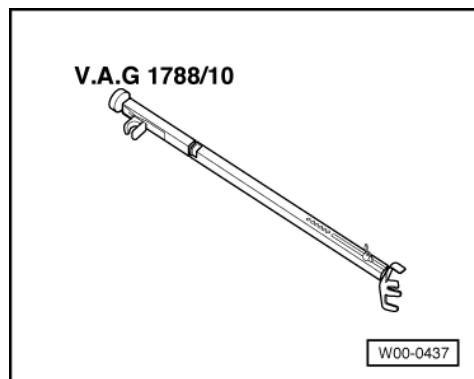


- Generate readiness code => Page 24 .

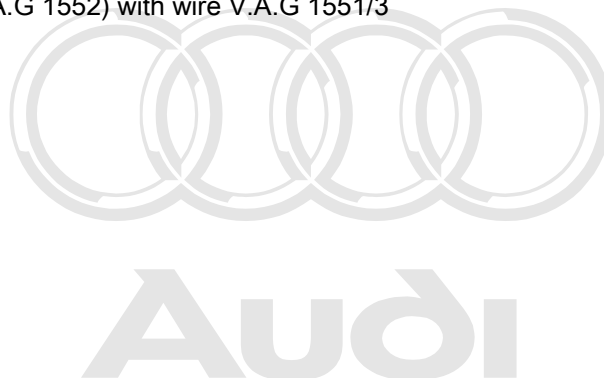
4.3 - Generating readiness code

Special tools, workshop equipment, testers, measuring instruments and other items required

- ♦ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with wire V.A.G 1551/3



- ♦ -> Engine-speed setting tool V.A.G 1788/10



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Test requirements

- Vehicle stationary
- On vehicles with automatic gearbox, selector lever must be set to "P" or "N"
- All electr. loads such as lights and heated rear window switched off
- Intake-air temperature lower than 60°C
=>Display group 04, display zone 4
- Coolant temperature must be at least 80 °C =>Display group 04, display zone 3.

Sequence of operations

- Connect fault reader V.A.G 1551 (V.A.G 1552). Then start engine and select engine control unit with "Address word" 01.
(Connecting fault reader and selecting engine control unit=>Page 5)

Step 1: Interrogating fault memory

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

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

-> The number of stored faults or "No faults detected" appears on the display.

X faults detected

If a fault has been stored:

- Use fault table to remedy faults printed out=> Page 9 .

If no fault has been stored:

- Press =>key.

Step 2: Erasing fault memory

-> Indicated on display:

Rapid data transfer HELP
 Select function XX

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

Note:

The readiness code is reset/erased whenever the fault memory is erased.

-> Indicated on display:

Rapid data transfer
 Fault memory erased

Note:

Fault memory is not erased if ignition is switched off between "Interrogating fault memory" and "Erasing fault memory".

- Press =>key.

Note:

- ♦ Engine must not be switched off again during the sequence of operations.

Step 3: Diagnosis of fuel supply system and continuous-action lambda probe upstream of catalytic converter

Note:

This diagnostic function is only concluded if there are no faults relating to the lambda probes and fuel supply system.

-> Indicated on display:

Rapid data transfer HELP
 Select function XX

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

-> Indicated on display:

Basic setting
 Enter display group number XXX

- Press keys 2, 0 and 2 for "Display group number 202" and confirm entry with Q key.

-> Indicated on display:

(1...4 = display zones)

System in basic setting 202
 1 2 3 4

- Maintain engine speed at 1400...1800 rpm until display in zones 2 and 3 switches from "Test OFF" to "Test ON".
- Continue to maintain engine speed at 1400...1800 rpm until display zones 2 and 3 show specification "Syst. OK".

Note:

Several minutes may be required for display to switch from "Test ON" to "Syst. OK".

If readings do not match specifications:

- Interrogate fault memory => Page 7 .



If readings match specifications:

- Press C key.

Step 4: Diagnosis of activated charcoal filter system (fuel tank breather system)

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

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

-> Indicated on display:

Basic setting
Enter display group number XXX

- Press keys 0, 7 and 0 for "Display group number 70" and confirm entry with Q key.

-> Indicated on display:

(1...4 = display zones)

System in basic setting 70			
1	2	3	4

Note:

Do not press clutch and brake.

If diagnosis is initiated by engine control unit, display in zone 4 switches from "Test OFF" to "Test ON".

- Leave engine idling until display zone 4 shows specification "TEV OK".

If display is not as described:

- Interrogate fault memory => Page 7.
- Give roughly 3 bursts of throttle and repeat diagnosis.

If display is as described:

- Press C key.

Step 5: Diagnosis of secondary air system

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

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

-> Indicated on display:

Basic setting
Enter display group number XXX

- Press keys 0, 7 and 7 for "Display group number 77" and confirm entry with Q key.

-> Indicated on display:

(1...4 = display zones)

System in basic setting 77			
1	2	3	4

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Note:

Do not press clutch and brake.

If diagnosis is initiated by engine control unit, display in zone 4 switches from "Test OFF" to "Test ON".

- Leave engine idling until display zone 4 shows specification "Syst. OK".

If display is not as described:

- Interrogate fault memory => Page 7 .

If display is as described:

- Press C key.

Step 6: Diagnosis of catalytic converter

Note:

This diagnostic function is only concluded if there are no faults relating to the lambda probes and activated charcoal filter system.

-> Indicated on display:

Rapid data transfer HELP
 Select function XX

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

-> Indicated on display:

Basic setting
 Enter display group number XXX

- Press keys 0, 4 and 6 for "Display group number 46" and confirm entry with Q key.

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

System in basic setting 46
 1 2 3 4

- Maintain engine speed at 1800...2200 rpm until display in zone 4 switches from "Test OFF" to "Test ON". Catalytic converter temperature in display zone 2 must be at least 300 °C.
- Continue to maintain engine speed at 1800...2200 rpm until display zone 4 shows specification "Cat. B1 OK".

Note:

Several minutes may be required for display to switch from "Test ON" to "Cat. B1 OK".

If readings do not match specifications:

- Interrogate fault memory => Page 7 .

If readings match specifications:

- Press C key.

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

-> Indicated on display:



Basic setting
Enter display group number XXX

- Press keys 0, 3 and 6 for "Display group number 36" and confirm entry with Q key.

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

System in basic setting 36
1 2 3 4

- Press ➡key.

If diagnosis is initiated by engine control unit, display in zone 2 switches from "Test OFF" to "Test ON".

- Leave engine idling until
display zone 2 shows specification "B1 S2 OK".

Note:

Several minutes may be required for display to switch from "Test ON" to "B1 S2 OK".

If readings do not match specifications:

- Interrogate fault memory => Page **7**.

If readings match specifications:

- Press C key.

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

Note:

This diagnostic function is only concluded if there are no faults relating to the lambda probes.

-> Indicated on display:

Rapid data transfer HELP
Select function XX

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

-> Indicated on display:

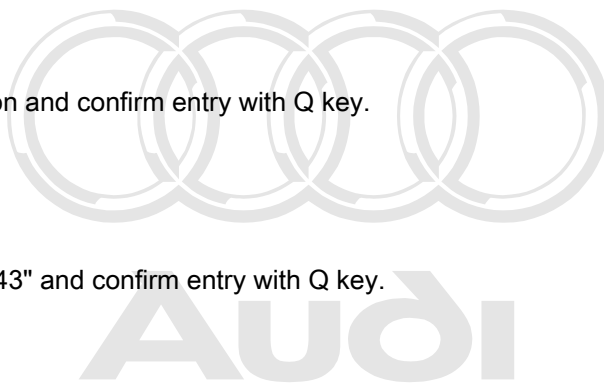
Basic setting
Enter display group number XXX

- Press keys 0, 4 and 3 for "Display group number 43" and confirm entry with Q key.

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

System in basic setting 43
1 2 3 4

- Maintain engine speed at 1800...2200 rpm until display in
zone 4 switches from "Test OFF" to "Test ON". Catalytic converter temperature in
display zone 2 must be at least 350 °C.
- Continue to maintain engine speed at 1800...2200 rpm until
display zone 4 shows specification "B1 S2 OK".



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Note:

Several minutes may be required for display to switch from "Test ON" to "Syst. OK".

If readings do not match specifications:

- Interrogate fault memory => Page 7 .

If readings match specifications:

- Press =>key.
- Press keys 0 and 6 for "End output" function and confirm entry with Q key.
- Read out readiness code => Page 23 .

5 - Basic setting

5.1 - Basic setting

With "engine stopped and ignition off", the following operation can be performed with basic setting "function 04":

- ◆ Adaption of throttle valve control part to engine control unit
=>Page 107
- ◆ Adaption of exhaust gas recirculation valve to engine control unit
=>Display group 074 =>Page 100 .

With "engine running", basic setting "function 04" can be used to perform the following operations:

- ◆ Lambda control adaption =>Page 74
- ◆ Fault-finding by way of specific activation and deactivation of lambda control =>Page 73
- ◆ Diagnosis of secondary air system =>Page 101
- ◆ Vehicles with automatic gearbox: Adaption of kickdown function of accelerator pedal position sender to engine control unit =>Display group 063 (=>Page 116).

Test conditions for operations with engine running

- No faults stored in fault memory
- Coolant temperature at least 85 °C
- If fault memory has been erased or engine control unit disconnected from permanent positive supply, readiness code must be regenerated => Page 24 .
- Electrical consumers off (radiator fan must not be running during test)
- Air conditioner off
- Selector lever set to P or N
- Wheels straightahead
- Connect fault reader V.A.G 1551 (V.A.G 1552). Then start engine and select engine control unit with "Address word" 01.
(Connecting fault reader and selecting engine control unit=>Page 5)
- Interrogating and erasing fault memory
=> Page 7 . There must not be any faults stored (if necessary, eliminate fault, erase fault memory, switch off and restart engine, perform test drive and re-interrogate fault memory as a check).
- Leave engine idling.

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

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

-> Indicated on display:

Rapid data transfer HELP
 Select function XX

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

-> Indicated on display:

Rapid data transfer HELP
 Select function XX

6 - Encoding engine control unit

6.1 - Encoding engine control unit

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Notes:

- ◆ Control unit must be encoded if code displayed does not correspond to vehicle or if control unit has been replaced.
 - ◆ Encoding is checked with fault reader V.A.G 1551.
 - ◆ A 5-position code must always be displayed during control unit identification.
 - ◆ Incorrect encoding can lead to poorer emission values and greater strain on the automatic gearbox due to gearshift jolts.
- Connect fault reader V.A.G 1551 (V.A.G 1552). Then start engine and select engine control unit with "Address word" 01.
 (Connecting fault reader and selecting engine control unit=>Page 5)

-> Indicated on display:

Rapid data transfer HELP
 Select function XX

- Press keys 0 and 7 for "Encode control unit" function and confirm entry with Q key.

-> Indicated on display:

Encode control unit Q
 Enter code number xxxxx (0-32000)

- Enter appropriate vehicle code number and confirm with Q key.

Example of code number composition:

EUIII (emission standard)	10
Front-wheel drive with TCS/ESP	5
Manual gearbox	0
Audi A3	0
Code number	10 5 0 0

-> Fault reader V.A.G 1551 displays control unit identification, e.g.:

8D1906032.. 1.8l R4S/5V MOTR HS
 D..□
 Code 10500 WSC 06388

- Press =>key.

-> Indicated on display:

Rapid data transfer HELP
 Select function XX



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

Note:

Code entered is activated when ignition is next switched on.

Encoding options for engine control unit

Country/Emission standard	Drive/Additional functions	Gearbox	Vehicle model
10 = EUIII	0	0 = 5-speed manual gearbox	0 = Audi A3
	1	1 = -----	1 = -----
	2	2 = -----	2 = -----
03 = -----	3 = -----	3 = Automatic gearbox	3 = -----
	4 = Front-wheel drive without TCS ----- Front-wheel drive without ESP -----	4 = -----	4 = -----
	5 = Front-wheel drive with TCS ----- Front-wheel drive with ESP	5 = -----	5 = -----
	6 = -----	6 = -----	6 = -----
	7	7 = -----	7 = -----

Note:

"TCS" = Traction Control System

"ESP" = Electronic Stability Program (ESP always includes TCS)

Vehicles with "TCS" or "ESP" feature a pushbutton switch marked "TCS" or "ESP" in the centre console.

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7 - Reading measured value block**7.1 - Reading measured value block****Test requirements**

- Coolant temperature at least 80°C
 - Electrical consumers off (radiator fan must not be running during test)
 - Air conditioner off
 - Set selector lever to P or N
 - No faults stored in fault memory
- Connect fault reader V.A.G 1551 (V.A.G 1552). Then start engine and select engine control unit with "Address word" 01.
(Connecting fault reader and selecting engine control unit=>Page 5)

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

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

-> Indicated on display:

Read measured value block
 Enter display group number XXX

- Enter desired display group number and confirm entry with Q key.

Note:

The display group to be selected can be seen from the respective functional tests and component checks.

-> Indicated on display, e.g.:

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

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Note:

Proceed as follows to switch to a different display group:

Display group	V.A.G 1551
Up	Press key 3
Down	Press key 1
Skip	Press C key



24 - Mixture preparation, Injection

1 - Servicing Motronic injection system

1.1 - Servicing Motronic injection system

1.2 - Safety precautions

Pay attention to the following if testers and measuring instruments have to be used in the course of a test drive:

Attention:

- ♦ **Always attach testers and measuring instruments to back seat and have them operated from there by a second person.**
- ♦ **If testers and measuring instruments were to be operated from front passenger's seat, person sitting there could suffer injury in the event of an accident due to triggering of front passenger's airbag.**

Heed the following so as to avoid possible injury and/or the destruction of the injection and ignition system:

- ♦ Always switch off ignition before disconnecting and connecting injection and ignition system wires (also applies to measuring instrument leads).
- ♦ If engine is to be operated at cranking speed without it starting (e.g. compression test), unplug connectors from output stages for ignition coils and from injectors.
- ♦ Certain tests may lead to a fault being detected by the control unit and stored. The fault memory is therefore to be interrogated and if necessary erased on completion of all tests and repair work.
- ♦ Always switch off ignition before washing engine.
- ♦ Always switch off ignition before disconnecting and connecting battery so as not to damage engine control unit.
- ♦ If fault memory has been erased or engine control unit disconnected from permanent positive supply, readiness code must be regenerated => Page 24 .

Attention:

Fuel system is pressurised. Wrap cloth around joint before disconnecting hoses or opening test connection (to measure fuel pressure). Then dissipate pressure by carefully unfastening hose connection.

1.3 - Rules for cleanliness

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

- ♦ Carefully clean all joints and adjacent areas before disconnecting.
- ♦ Place parts removed on a clean surface and cover them over. Do not use fluffy cloths.
- ♦ Carefully cover or seal opened components if repairs are not to be performed immediately.
- ♦ Only install clean components:
Do not remove replacement parts from wrapping until immediately prior to installation.
Do not use parts that have been stored loose (e.g. in tool boxes).
- ♦ When system is open:
Do not work with compressed air if at all possible.
Do not move vehicle unless absolutely necessary.
- ♦ Unplugged connectors:
Protect against dirt and damp.

Only connect when dry.

1.4 - Technical data

Engine codes		APG (1.8 l / 5V / 92 kW engine)
Idling speed Speed cannot be adjusted; regulated by idling speed stabilisation		660 ... 860 rpm
Speed governing by closing of throttle valve		6800 rpm
Fuel pressure at idling speed	Vacuum hose connected	approx. 3.5 bar
	Vacuum hose disconnected	approx. 4.0 bar
Holding pressure after 10 minutes		min. 2.5 bar
Injectors	Spray pattern	Two-hole nozzle/same for all injectors
	Injection quantity (30 seconds)	85...105 ml
	Resistance (ambient temperature) ¹⁾	12 ... 13 ω

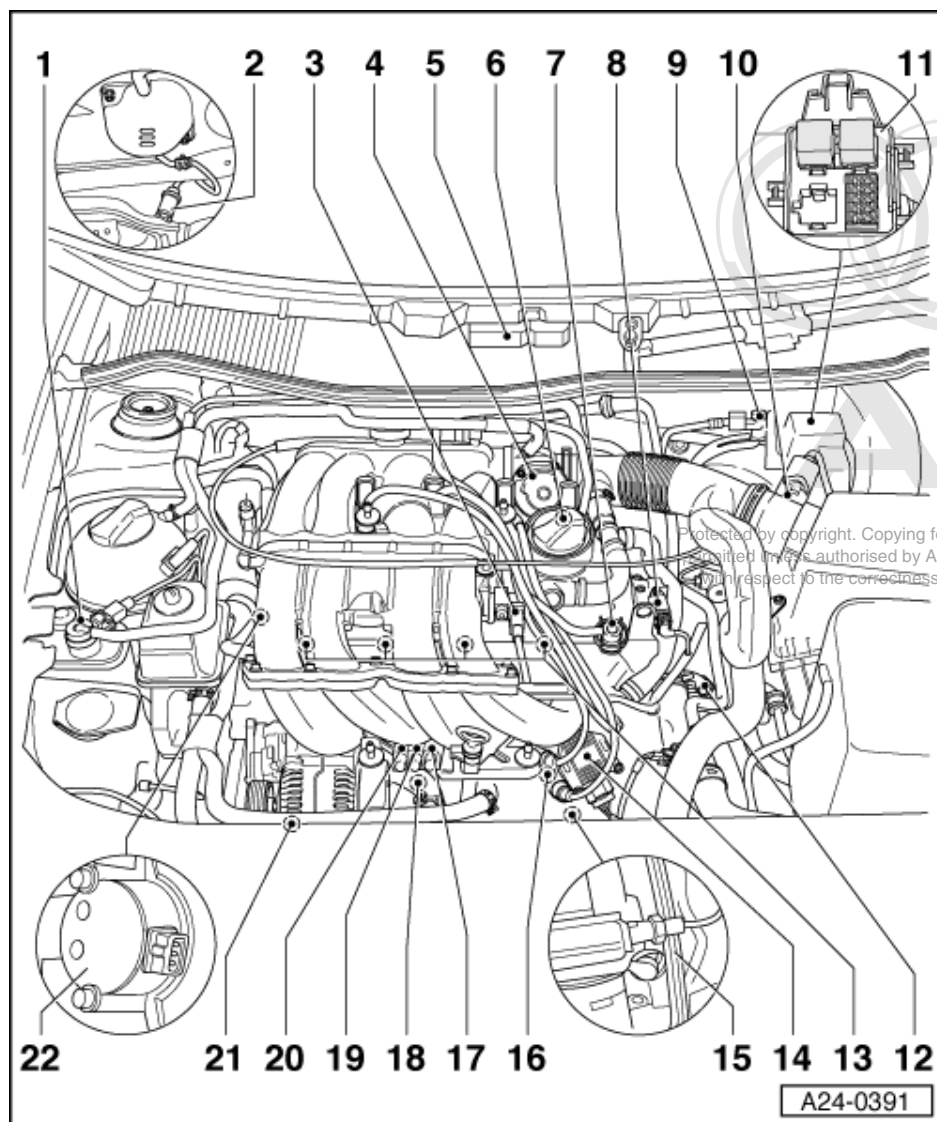
1) With warm engine, injector resistance increases by approx. 4...6 ω .



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1.5 - Exploded view of fitting locations



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Accelerator pedal position sender 1 and 2 (-G79 and -G185)

- ◆ Fitting location => Fig. 40
- ◆ Checking =>Page 113
- ◆ Learning kickdown function
=>Page 116

Brake light switch -F and brake pedal switch -F47

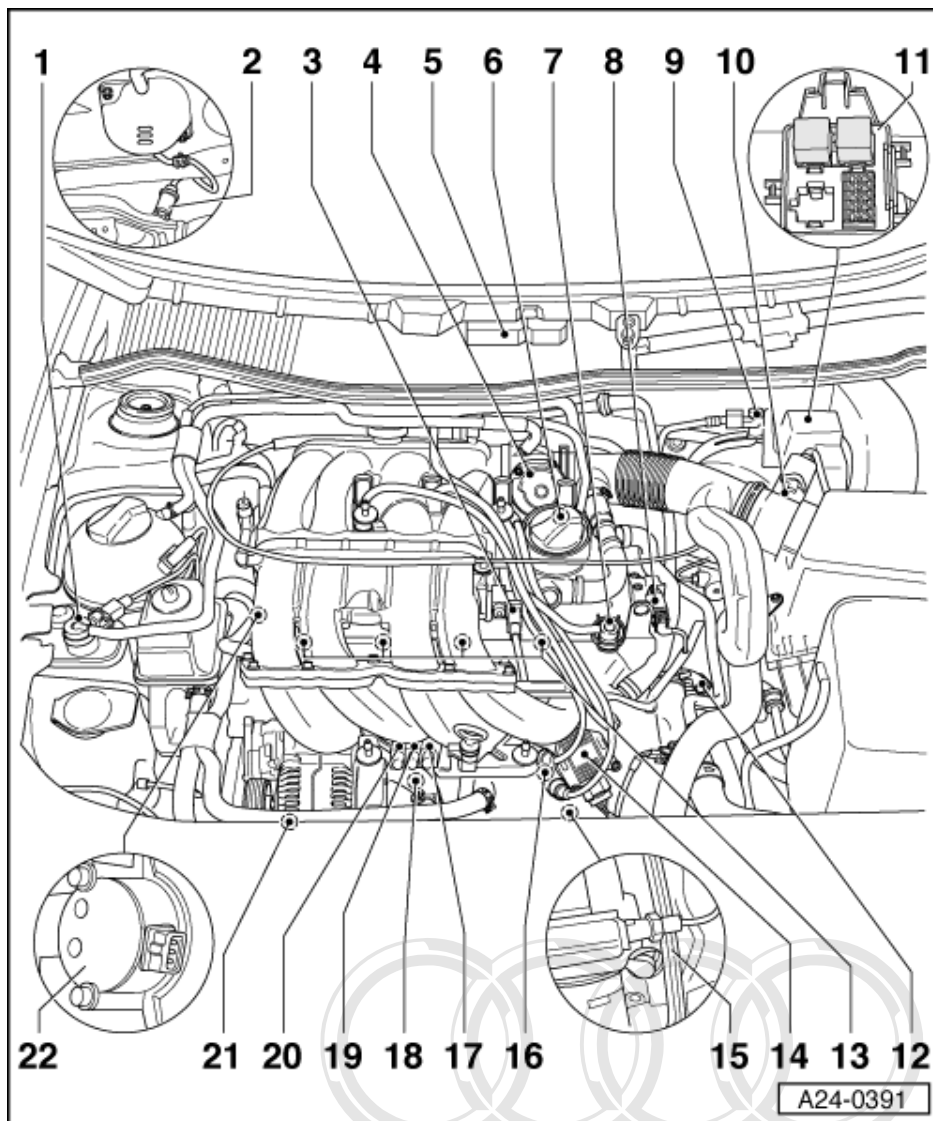
- ◆ Fitting location => Fig. 41

Clutch pedal switch -F36

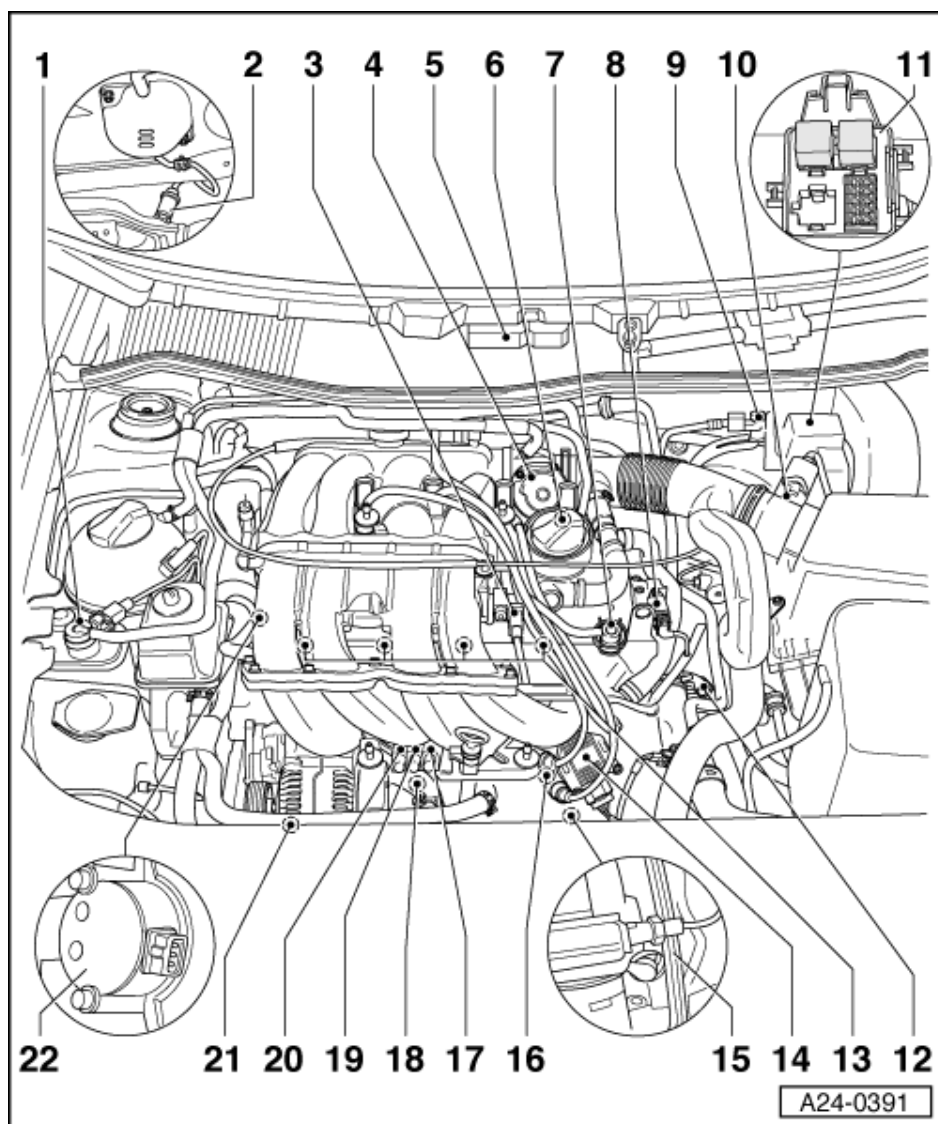
- ◆ Fitting location => Fig. 42

Electric throttle control fault lamp -K132

- ◆ "EPC" warning lamp
- ◆ Fitting location => Fig. 41



- 1 Activated charcoal filter solenoid valve 1 -N80
 - 2 4-pin connector
 - ♦ For lambda probe and lambda probe heating
 - ♦ On underside of vehicle on right
 - 3 Intake-manifold changeover valve -N156
 - 4 Throttle valve control part -J338
 - 5 Motronic control unit -J220
 - 6 Exhaust gas recirculation valve -N18** with exhaust gas recirculation potentiometer -G 212* and combination valve for secondary air system
 - 7 Fuel pressure regulator
- => Repair Group 26; EGR System; Servicing EGR System Components EGR System Servicing EGR System Components



8 Camshaft adjustment valve 2 -N208

9 Secondary air valve

10 Air-mass meter -G70

- ♦ With intake-air temperature sender -G42
- ♦ 5-pin connector

11 Protective enclosure for relays

- ♦ Fitting location for:
- ♦ Secondary air pump relay -J299
- ♦ Motronic current supply relay -J271

12 Coolant temperature sender (G62)

13 Injectors -N30...-N33

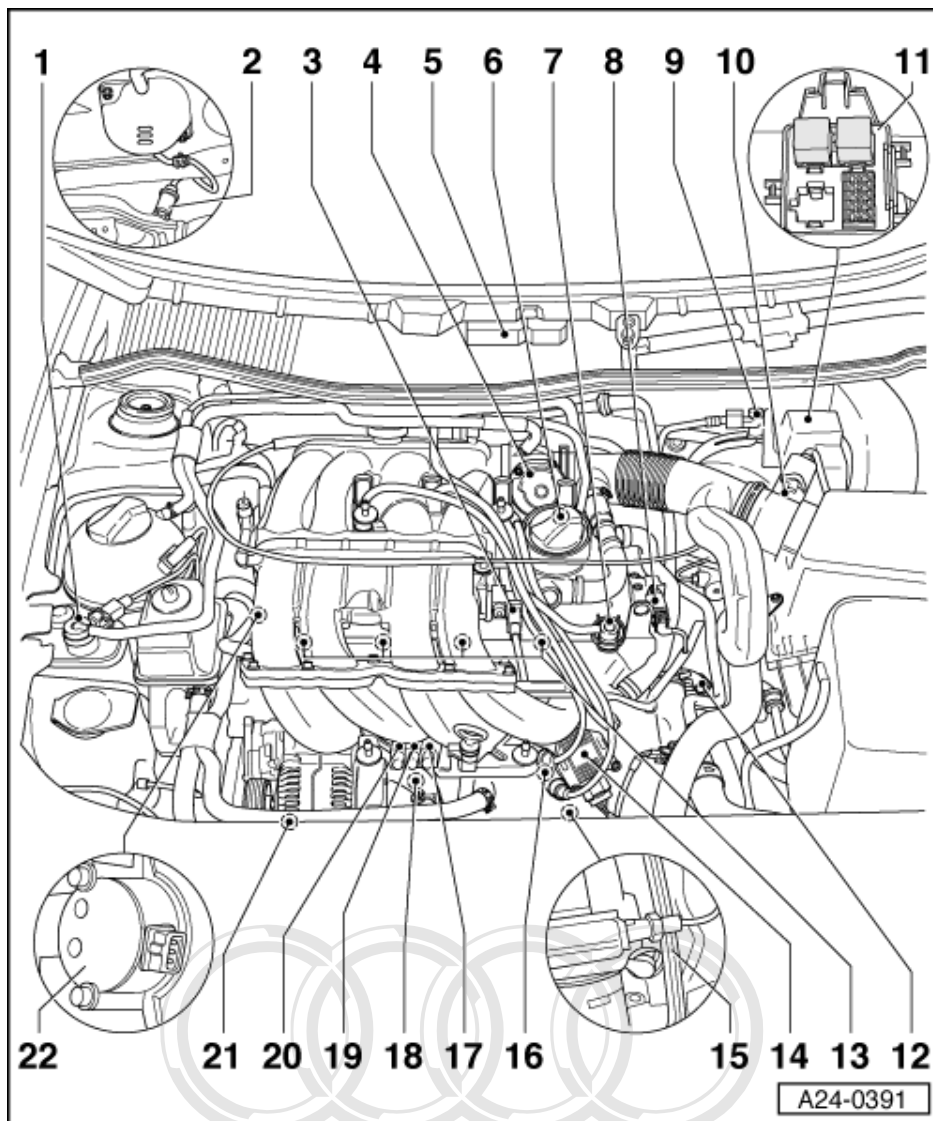
14 Ignition coils -N and -N128 with final output stage -N122

15 Engine speed sender (G28)

16 Knock sensor 2 -G66

17 3-pin connector

- ♦ For knock sensor 2



18 Knock sensor 1 -G61

19 3-pin connector

- ♦ For engine speed sender

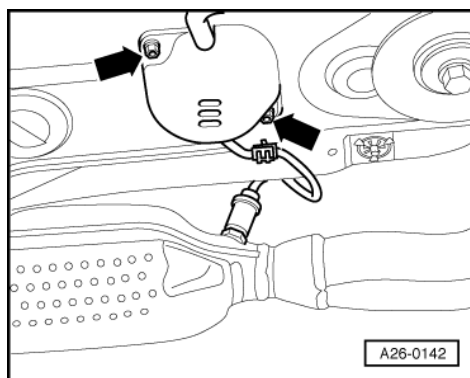
20 3-pin connector

- ♦ For knock sensor 1

21 Secondary air pump motor -V101

22 Hall sender -G40

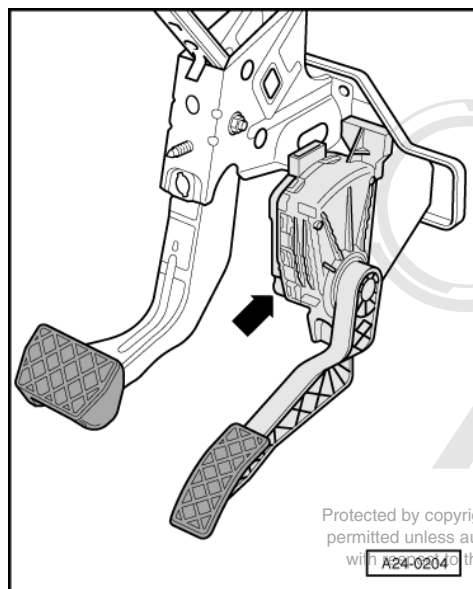
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-> Fig.1 Fitting location of connectors

The following connectors are accessible after unscrewing protective cover -arrows- on underside of vehicle.

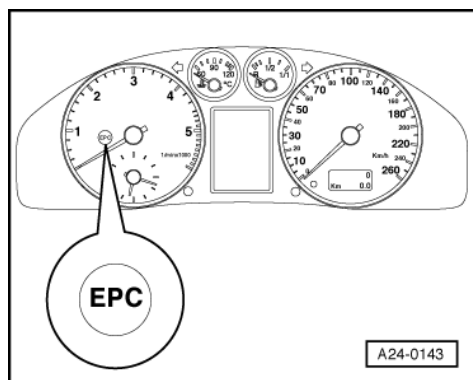
- ♦ Connector for lambda probe 1 upstream of catalytic converter and heater (black)
- ♦ Connector for lambda probe 2 downstream of catalytic converter and heater (brown)



-> Fig. 2 Fitting location of accelerator pedal position sender 1 and 2 (-G79 and -G185)

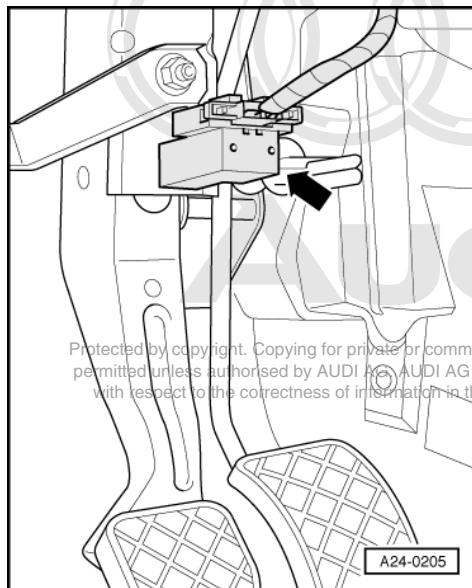
Note:

Diagram shows left-hand drive set-up.



-> Fig.3 Fitting location of electric throttle control fault lamp

-K132



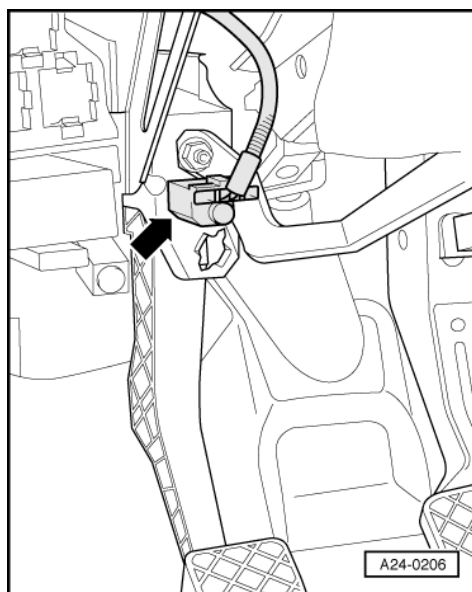
-> Fig.4 Fitting location of brake light switch -F and brake pedal switch -F47

Note:

Switches are only to be fitted once so as to ensure a firm fit.

Switch adjustment:

=> Running Gear, Front-wheel Drive and Four-wheel Drive; Repair Group 46



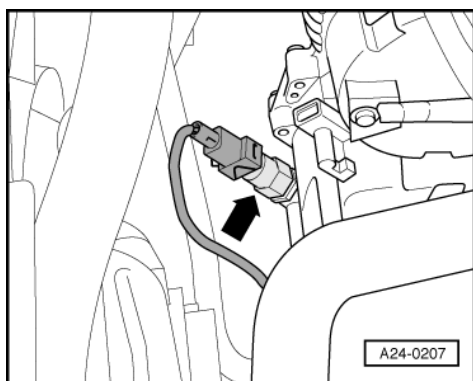
-> Fig.5 Fitting location of clutch pedal switch -F36

Note:

Switch is only to be fitted once so as to ensure a firm fit.

Switch adjustment:

=> Running Gear, Front-wheel Drive and Four-wheel Drive; Repair Group 46



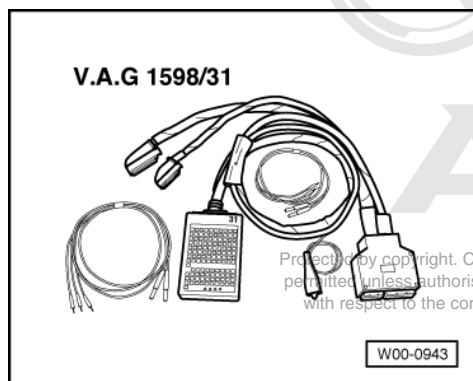
-> Fig.6 Fitting location of power-assisted steering pressure switch -F88

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

The following procedure applies to engine control units which are not bolted to a sheet-metal housing (to prevent theft). For procedure for engine control units with sheet-metal housing, refer to =>Page **45** .

Notes:

- ♦ The test box V.A.G 1598/31 is designed for simultaneous connection to the engine control unit wiring harness and the actual engine control unit.
- ♦ This has the advantage that the electronic engine management system remains fully operational with the test box connected (e.g. measurement of signals with engine running).
- ♦ Whether or not the engine control unit is additionally to be connected to the test box is indicated in the appropriate test sequences.
- ♦ For connection of measuring instruments (e.g. voltage tester V.A.G 1527 B, portable multimeter V.A.G 1526 A), always make use of adapter set V.A.G 1594 A.
- ♦ If fault memory has been erased or engine control unit disconnected from permanent positive supply, readiness code must be regenerated => Page **24** .



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Special tools and workshop equipment required

- ♦ V.A.G 1598/31

Sequence of operations

- Switch off ignition.
- Unscrew windscreen wiper arms.
- Pull off plenum chamber cover and place it towards windscreen.

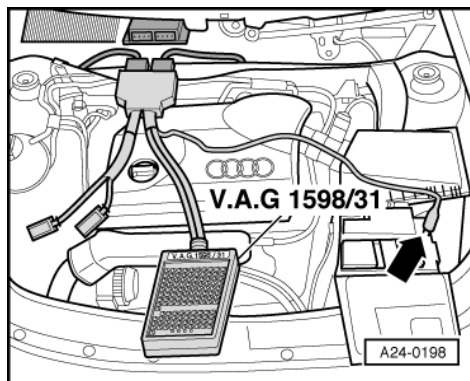
Note:

Always switch off ignition before disconnecting or connecting control unit connectors.

- Release catches and unplug control unit connectors.

Attention:

So as not to destroy electronic components, select required measuring range before connecting test leads and observe test conditions.



- -> Connect test box V.A.G 1598/31 to wiring harness connector. Connect earth clip -arrow- on test box to battery negative terminal. Whether or not the engine control unit is additionally to be connected to the test box is indicated in the appropriate test sequences.
- Perform testing as described in appropriate repair operations.

After reconnecting the engine control unit carry out the following steps:

- Adapt exhaust gas recirculation valve => Page 100 .
- Regenerate readiness code => Page 24 .

Note:

Somewhat rough idling and slight jolting when driving may be encountered in the initial learning phase during engine basic setting.

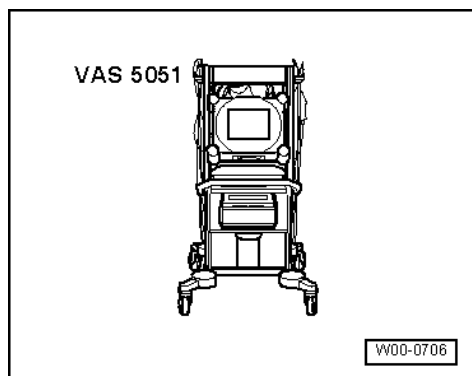
1.7 - Procedure following interruption of power supply

Note:

Somewhat rough idling and slight jolting when driving may be encountered in the initial learning phase during engine basic setting.



Special tools and workshop equipment required



- ♦ VAS 5051 with VAS 5051/1

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

Sequence of operations

Perform the following after interruption of power supply:

- Adapt exhaust gas recirculation valve => Page 100 .
- Regenerate readiness code => Page 24 .

1.8 - Replacing Motronic control unit -J220

The following procedure applies to engine control units which are not bolted to a catch (to prevent theft). For procedure for engine control units with catch, refer to=>Page 45 .

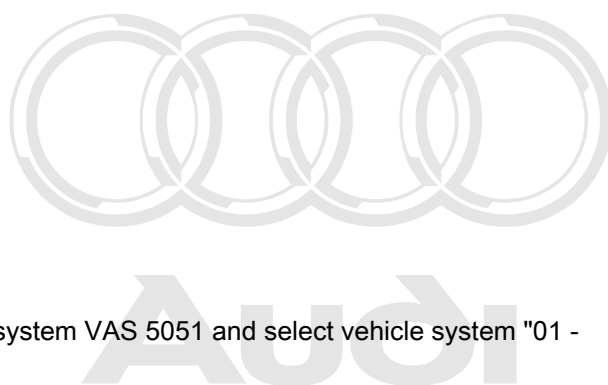
Removing



- Connect up vehicle diagnostic, testing and information system VAS 5051 and select vehicle system "01 - Engine electronics" from list. Ignition must be on.

-> Control unit identification and code -2- appear on display of vehicle diagnostic, testing and information system VAS 5051.

- Always start by displaying control unit identification and printing it out.
- Switch off ignition.
- Unscrew windscreen wiper arms.
- Pull off plenum chamber cover and place it towards windscreen.

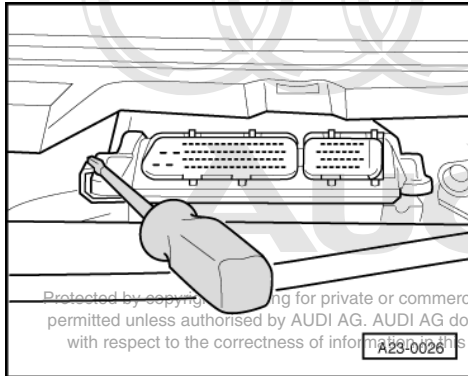


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Note:

Always switch off ignition before disconnecting or connecting control unit connectors.

- Release catches and unplug control unit connectors.



- -> Use screwdriver to press aside retainer tab of mount and pull out engine control unit to front.

Installing

Install in reverse order, paying attention to the following:

- -> Bend back retainer tab of mount.

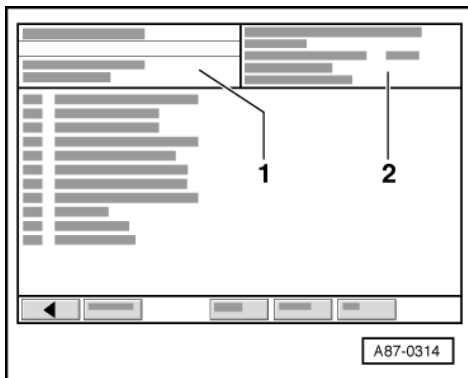
The following steps must be performed after connecting new engine control unit:

- Activate engine control unit in "Assisted fault-finding" under diagnosis item "Replacing engine control unit".

Use is to be made for this purpose of vehicle diagnostic, testing and information system VAS 5051.

Procedure for replacing engine control unit versions which are bolted to a sheet-metal housing (to prevent theft)

Removing



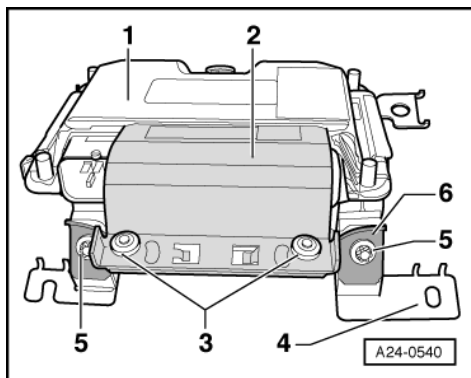
- Connect up vehicle diagnostic, testing and information system VAS 5051 and select vehicle system "01 - Engine electronics" from list. Ignition must be on.

-> Control unit identification and code -2- appear on display of vehicle diagnostic, testing and information system VAS 5051.

- Always start by displaying control unit identification and printing it out.
- Switch off ignition.
- Unscrew windscreen wiper arms.

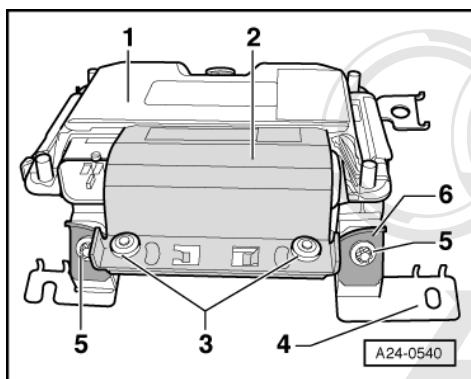


- Pull off plenum chamber cover and place it towards windscreen.



Note:

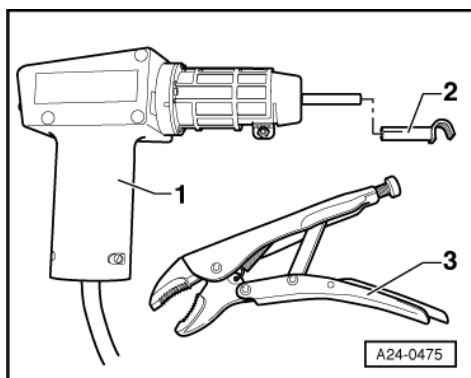
Item -1- in illustration shows engine control unit with anti-theft housing.



-> To render access to connectors at engine control unit more difficult (anti-theft protection), engine control unit -1- is bolted by way of a catch -2- and shear bolts -3- to a sheet-metal housing -4-.

Locking fluid is applied to thread of shear bolts to make bolts more difficult to screw out.

Catch -2- must be separated from sheet-metal housing to unplug connectors from engine control unit (e.g. when connecting up test box or replacing engine control unit). This procedure is described in the following.



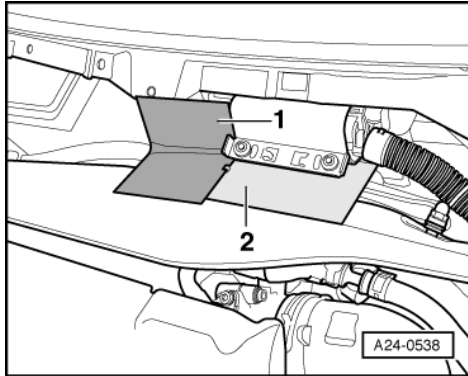
Tools required:

- ♦ -> Hot-air blower -1- (from wiring-harness repair set VAS 1978)
- ♦ Commercially available gripping pliers

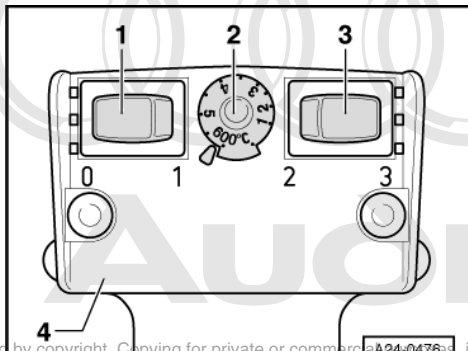
Procedure:

Attention:

To avoid damaging (scorching) wires, connectors, insulation and control units, always adhere exactly to the following operations and heed operating instructions for hot-air blower.



-> To avoid damaging wires and connectors, always attach a screen made of sheet-metal panels (item -1- and -2-). This will prevent connector housing and cable harness from heating up.



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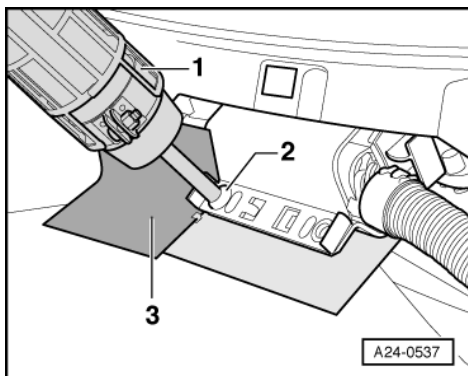
-> Make settings on hot-air blower as shown in illustration, i.e. set temperature potentiometer -2- to max. heat output and two-stage air flow switch -3- to position 3.

Note:

Bolt of catch must then be heated using hot-air blower. This operation is designed to reduce the inhibiting action of the locking fluid on the shear bolt thread to make it easier to screw out the shear bolts afterwards.

Attention:

Warming the thread of the catch also greatly increases the temperature of the shear bolts and sheet-metal housing components. Take care to avoid burns. It is also important to ensure that only the thread is heated and none of the surrounding components if at all possible (these should be covered if necessary).



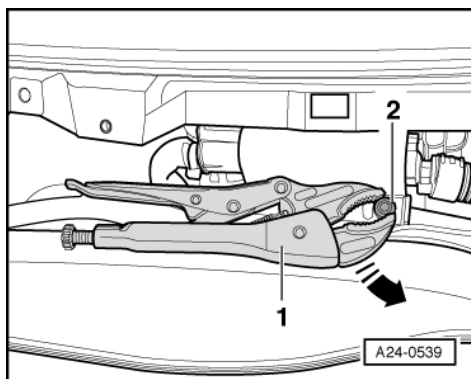


- -> Direct nozzle -1- of hot-air blower at bolt -2- of catch.

Note:

Take particular care to avoid the control-unit connectors in the immediate vicinity.

- Switch on hot-air blower and heat thread for roughly 20 to 25 seconds.
- -> Then grasp head of bolt -2- with gripping pliers -1- and screw out shear bolt in direction of arrow.

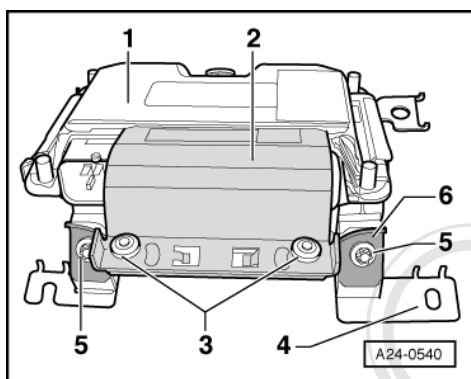


- To increase anti-theft protection, the catch has been attached in such a way that a complete revolution is not possible with the gripping pliers.

Employ exactly the same procedure for the second shear bolt, taking particular care to avoid the control-unit connectors in the immediate vicinity.

- After removing the second bolt, you must remove the windscreen wiper system.

=> Electrical System; Repair Group 92; Windscreen wiper system; Removing and installing windscreen wiper system
Windscreen wiper system Removing and installing windscreen wiper system



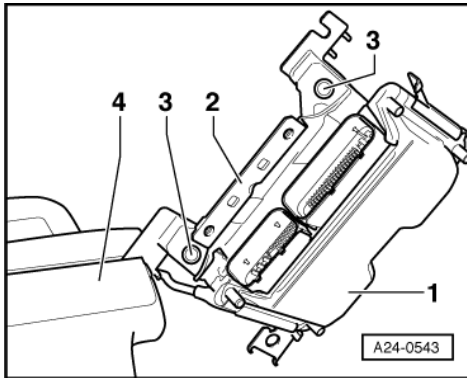
Attention:

Do not pull the control unit by the catch -6-, otherwise the control unit will be placed under mechanical stress and may be damaged as a result.

- Now pull out engine control unit using handle.

After removing, unbolt catch from handle. Do not pull out control unit until catch has been removed.

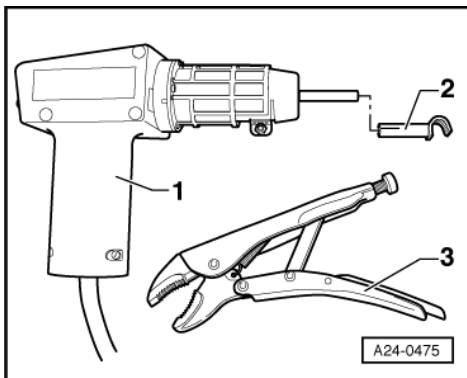
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-> To make it more difficult to pull out engine control unit -1- (anti-theft protection), catch -2- is bolted to sheet-metal housing by way of shear bolts -3-.

Locking fluid is applied to thread of shear bolts to make bolts more difficult to screw out.

- Clamp control unit in a vice.



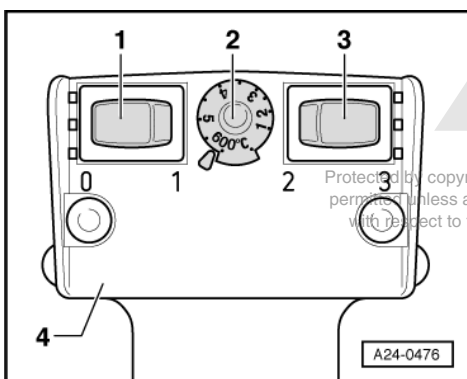
Tools required:

- ◆ -> Hot-air blower -1- (from wiring-harness repair set VAS 1978)
- ◆ Commercially available gripping pliers

Procedure:

Attention:

To avoid damaging (scorching) wires, connectors, insulation and control units, always adhere exactly to the following operations and heed operating instructions for hot-air blower.



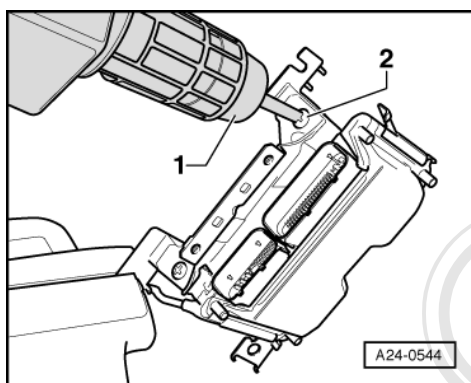
- -> Make settings on hot-air blower as shown in illustration, i.e. set temperature potentiometer -2- to max. heat output and two-stage air flow switch -3- to position 3.

Note:

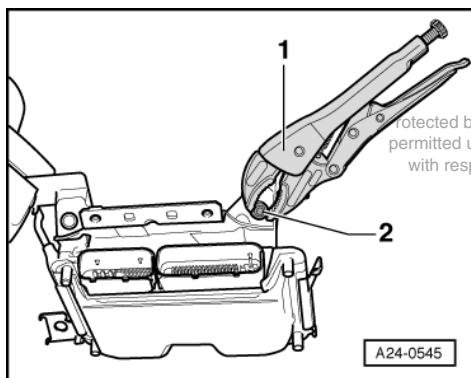
Bolt of catch must then be heated using hot-air blower. This operation is designed to reduce the inhibiting action of the locking fluid on the shear bolt thread to make it easier to screw out the shear bolts afterwards.

Attention:

Warming the thread of the catch also greatly increases the temperature of the shear bolts and sheet-metal housing components. Take care to avoid burns. It is also important to ensure that only the thread is heated and none of the surrounding components if at all possible (these should be covered if necessary).



- -> Direct nozzle -1- of hot-air blower at bolt -2- of catch.
- Switch on hot-air blower and heat thread for roughly 20 to 25 seconds.



- -> Then grasp head of bolt -2- with gripping pliers -1- and screw out shear bolt in direction of arrow.
- To increase anti-theft protection, the catch has been attached in such a way that a complete revolution is not possible with the gripping pliers.

Employ exactly the same procedure for the second shear bolt, taking particular care to avoid the control-unit connectors in the immediate vicinity.

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

- Take out old engine control unit and insert new one.

Installing

Install in reverse order, paying attention to the following:

The following steps must be performed after connecting new engine control unit:

- Activate engine control unit in "Assisted fault-finding" under diagnosis item "Replacing engine control unit".

Use is to be made for this purpose of vehicle diagnostic, testing and information system VAS 5051.

1.9 - Checking idling speed

Test requirements

- No leaks in exhaust system
- Coolant temperature at least 80°C
- Electrical consumers off (radiator fan must not be running during test)
- Air conditioner off
- Pressure gauge not connected
- Selector lever set to P or N (on vehicles with automatic gearbox)

Notes:

- ◆ Idling speed cannot be adjusted.
- ◆ Idling speed is checked during basic setting of engine.
- ◆ Air conditioner compressor is automatically switched off and activated charcoal filter system solenoid valve closed during basic setting of engine.

Checking idling speed

- Interrogate fault memory => Page 7 . There must not be any faults stored. If necessary, eliminate fault, erase fault memory, switch off and restart engine, perform test drive and re-interrogate fault memory as a check.
- Leave engine idling.
- Switch off air conditioner.
- Switch off heated rear window.
- Set selector lever to P or N (vehicles with automatic gearbox).

Attention:
Electric radiator fan must not run.

-> Indicated on display:

Rapid data transfer HELP
Select function XX

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

-> Indicated on display:

Basic setting HELP
Enter display group number xxx

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

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

Basic setting 56
1 2 3 4

- Check whether engine speed in display zone 1 (actual engine speed) is within permitted tolerance range (660 rpm...860 rpm).

	Display zones			
	1	2	3	4
Display group 56: Idling speed stabilisation at operating temperature				
Display	xxx rpm	xxx rpm	x.x %	X X X X X



Readout	Display zones			
	Engine speed (actual)	Engine speed (specified)	Idling speed control Torque change	Operating states
Operating range	min.: 660 rpm max.: 6800 rpm	min.: 660 rpm max.: 6800 rpm	min.: -5 % max.: 10 %	
Specification	660 rpm...860 rpm	820 rpm	x.x %	0 0 0 0
Note	If reading does not match specification => Page 52			Significance of figures => Page 52

Note:

- ♦ The engine speed in display zone 1 (actual engine speed) is the actual engine speed.
- ♦ The engine speed in display zone 2 (specified engine speed) is a theoretical engine speed calculated by the engine control unit.
- ♦ At idle, the engine control unit always attempts to adjust the actual engine speed to the specified engine speed.
- ♦ This means that at idle the actual engine speed must always roughly correspond to the specified engine speed.
- ♦ Display zones three and four are for information purposes and are of no relevance to checking idling speed.
- Press =>key.
- Press keys 0 and 6 for "End output" function and confirm entry with Q key.
- Interrogate fault memory again if reading does not match specification.

Perform the following tests marked with a dot if idling speed is too high/too low and no faults have been stored in the fault memory:

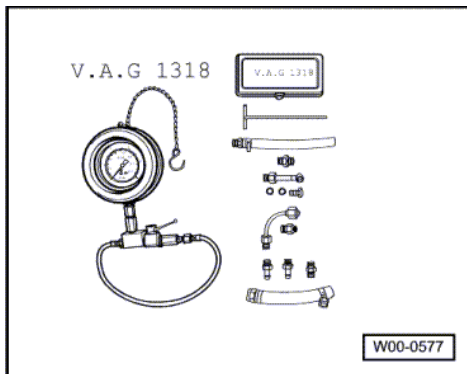
- Check throttle valve control part =>Page 106 .
- Activated charcoal filter solenoid valve permanently open; checking =>Page 97 .
- Adaption of throttle valve control part =>Page 107 .

Significance of 5-digit display in display group 56

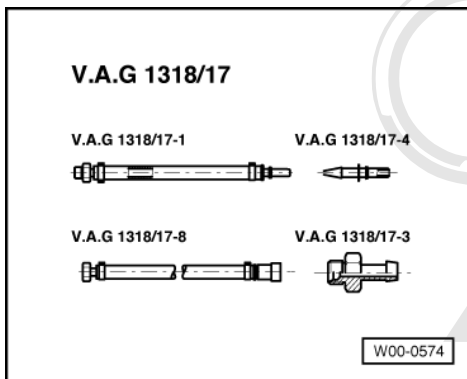
x	x	x	x	x	Display zone 4
				X	Air conditioner compressor off/on 0 = Air conditioner compressor off 1 = Air conditioner compressor on
			X		Selector lever set to P or N 0 = Selector lever set to P or N 1 = Selector lever set to 2/3/4/R/D
		X			Air conditioner requirement 0 = Min. heating/ cooling 1 = Max. heating/ cooling
					Not used
					Not used

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

Special tools and workshop equipment required



- ♦ V.A.G 1318
- ♦ V.A.G 1318/9



- ♦ V.A.G 1318/17 (2x)

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Note:

The fuel pressure regulator controls the fuel pressure as a function of intake manifold pressure. As a consequence, the pressure drop at the injectors remains the same in all engine speed and load ranges.

Test requirements:

- Fuel pump relay OK; checking => Page 59
- Fuel pump OK; checking

=> Fuel Supply System - Petrol Engines; Repair Group 20; Fuel supply - Front-wheel drive Fuel supply - Front-wheel drive

- Fuel filter OK
- Battery voltage at least 11 V

Attention:

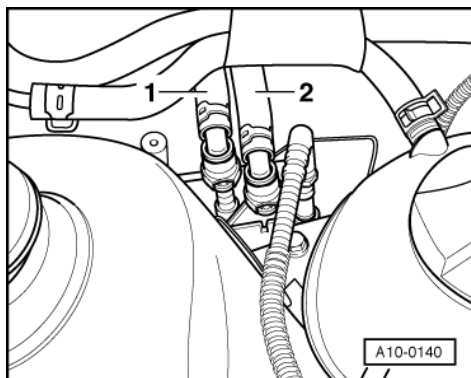
Fuel system is pressurised. Wrap cloth around joint before opening system. Then dissipate pressure by carefully unfastening joint.

Checking system pressure

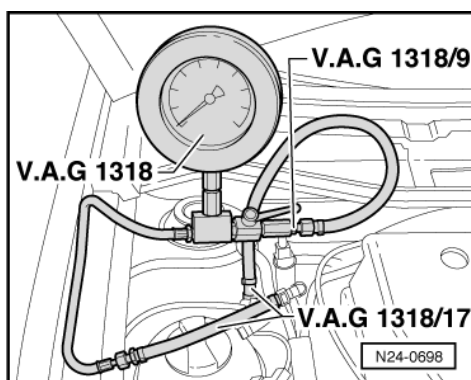
- Briefly open tank cap (pressure dissipation).



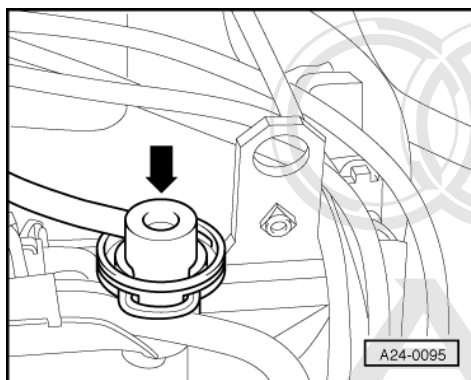
- Remove engine cover.



- -> Press release button and pull fuel supply hose -1- (with white mark) off supply pipe.



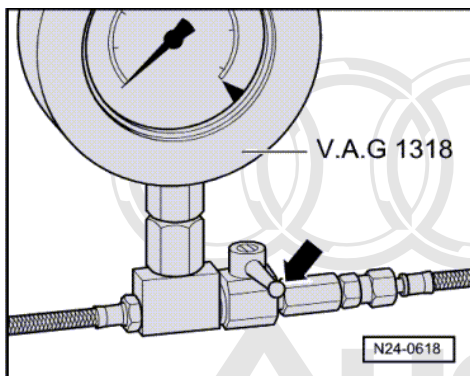
- -> Connect pressure gauge V.A.G 1318 with adapters 1318/9 and 1318/17 to supply pipe and fuel rail hose.
- Open pressure gauge cut-off valve. Lever points in direction of flow.
- Start engine and let it idle.
- Measure fuel pressure.
 - Specification: approx. 2.5 bar



- -> Pull off vacuum hose at fuel pressure regulator.
- **Fuel pressure must increase to approx. 3.0 bar**
- Switch off ignition.
- Check freedom from leaks and holding pressure by observing pressure drop on gauge.
 - After 10 minutes pressure must still be at least 2 bar

If holding pressure drops below 2 bar:

- Start engine and let it idle.



- -> Switch off ignition once pressure has built up. At the same time, close cut-off valve of pressure gauge V.A.G 1318 (lever at right angles to direction of flow -arrow-).
- Observe pressure drop on gauge.

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If pressure does not now decrease:

- Check fuel pump non-return valve.

If pressure does decrease again:

- Open pressure gauge cut-off valve. Lever points in direction of flow.
- Start engine and let it idle.
- Switch off ignition once pressure has built up. At the same time, pinch off return hose (with blue mark).

If pressure does not now decrease:

- Replace fuel pressure regulator.

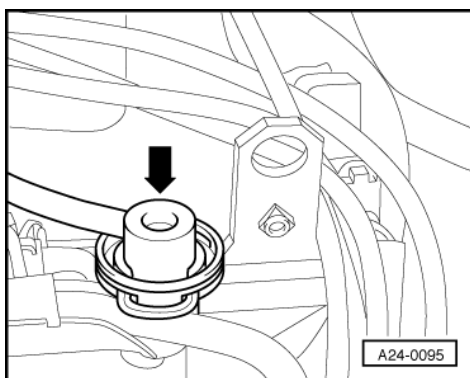
If pressure does decrease again:

- Check pipe connections, O-rings at fuel rail and injectors for leaks.
- Check pressure gauge for leaks.

Note:

Before detaching pressure gauge, dissipate fuel pressure by opening cut-off valve. When doing so, hold vessel in front of connection.

1.11 - Checking injection quantity, freedom from leaks and spray pattern of injectors



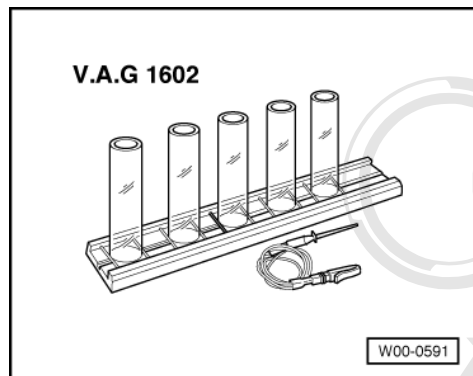
Test requirement

- Fuel pressure OK; checking => Page 53



Checking injectors for leaks

- -> Pull vacuum hose -arrow- off fuel pressure regulator.
- Unplug connectors from injectors and Hall sender.
- Unscrew fuel rail from intake manifold and detach from intake manifold with injectors upwards.



- -> Hold injector to be tested over graduated beaker of injection quantity tester V.A.G 1602.
- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page 42 .
- Use wires from adapter set V.A.G 1594 A to jumper contacts 1 and 65 at test box (this step connects earth to one end of fuel pump relay coil).
- Switch on ignition.

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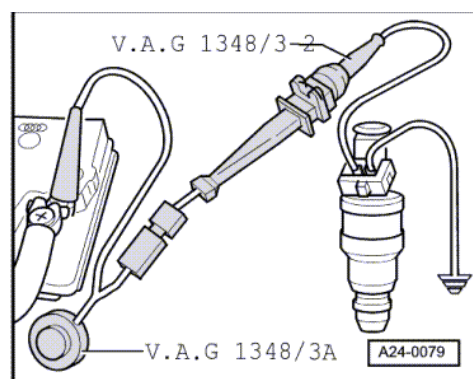
Note:

After switching on ignition, fuel pump runs continuously, even if engine is not running. Reason: The fuel pump relay receives positive supply via central electrics unit after switching on ignition. Negative is supplied to fuel pump relay via cable link in test box.

- Check injectors for leaks (visual inspection). With fuel pump running, only 1...2 drops per minute per injector may emerge.
- In the event of greater fuel loss, shut off fuel pump (switch off ignition) and replace defective injector.

Checking injection quantity

- Hold injector to be tested over graduated beaker of injection quantity tester V.A.G. 1602.



- -> Connect one contact of injector to engine earth using test lead and crocodile clamp from V.A.G 1594 A.
- Connect second contact of injector to positive with remote control V.A.G 1348/3A, adapter lead V.A.G 1348/3-2 and test lead.
- Switch on ignition.
 - Fuel pump must run
- Operate remote control V.A.G 1348/3A for 30 seconds.
- Perform measurement with all injectors.

- Once all four injectors have been actuated, place graduated beakers on a flat surface.

Specification for each injector: 85...105 ml

If reading does not match specification for all injectors:

- Check fuel pressure => Page 53 .

If reading does not match specification for one injector:

- Replace appropriate injector.

Note:

Spray pattern is also to be checked when checking injection quantity. It must be the same for all injectors.

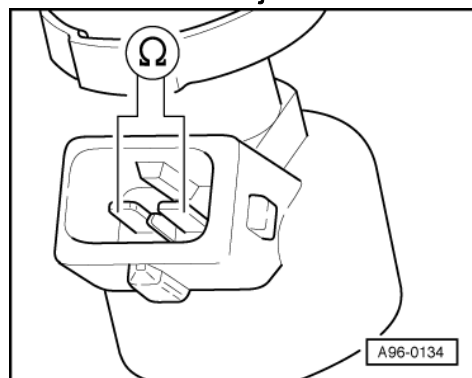
Fuel rail with injectors is to be installed appropriately in reverse order of removal paying attention to the following:

- Replace O-rings at all joints opened. (To replace front O-ring, never pull plastic cap off valve head - lift O-ring over plastic cap).
- Moisten O-rings with fresh engine oil.
- Make sure clips are properly connected.

1.12 - Checking injectors

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Electrical check on injectors



- Unplug connector at injector to be checked.
- -> Connect portable multimeter to injector for resistance measurement.

Specification: 11...18 Ω

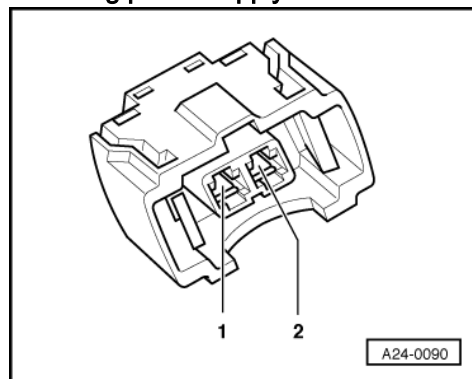
If reading does not match specification:

- Replace injector.

If reading matches specification:

- Check power supply => Page 57 .

Checking power supply





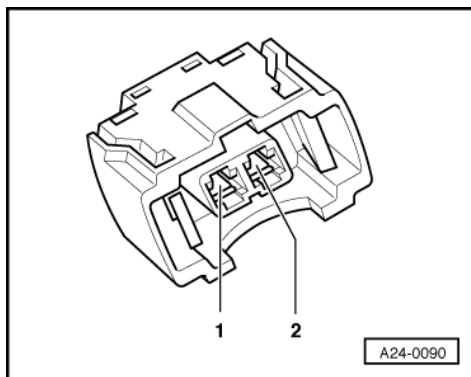
- Unplug connector at injector to be checked.
- -> Connect diode test lamp for voltage measurement to socket 1 of connector and earth.
- Operate starter for several seconds (engine may start).

Specification: Diode test lamp must light.

If diode test lamp lights:

- Check wiring => Page 58 .

If diode test lamp does not light:



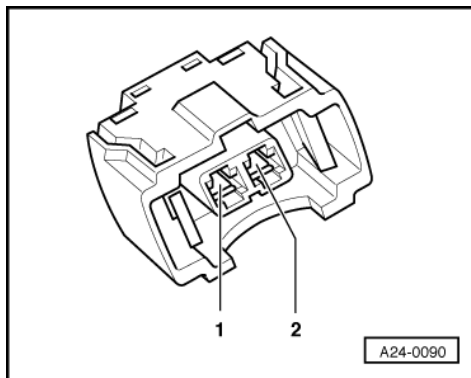
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- -> Check for continuity in wiring from socket 1 via fuse for injectors to fuel pump relay and eliminate open circuit if necessary.

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

Checking wiring

- Switch off ignition.
- Unplug connector at injector to be checked.



- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page 42 .
- -> Check for open circuit and short to earth/positive in the following wiring:

Cylinder	2-pin connector at wiring harness, Bush	Test box V.A.G 1598/31, socket
1	2	96
2	2	89
3	2	97

Cylinder	2-pin connector at wiring harness, Bush	Test box V.A.G 1598/31, socket
4	2	88

- If necessary, eliminate open circuit in wiring/short circuit.

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

- If wiring is OK, replace engine control unit => Page 44 .

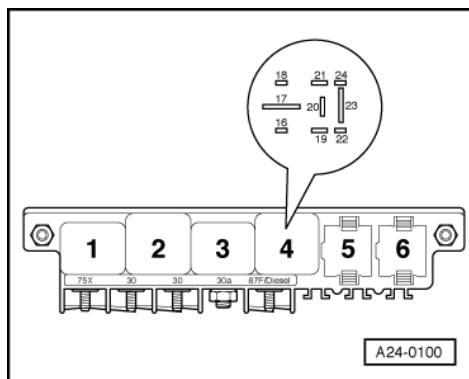
1.13 - Checking fuel pump relay -J17 and actuation

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

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A prerequisite for energisation of the fuel pump relay -J17 is that the engine is running. In other words, earth is not applied to the relay (via the engine control unit) until engine speed pulses are detected in the engine control unit.

Test requirement

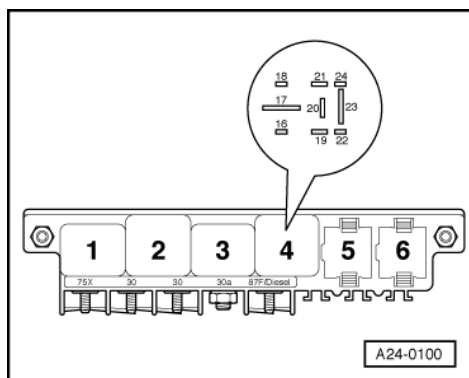


- Battery voltage OK

Checking operation of fuel pump relay

-> Fitting location of fuel pump relay: Micro central electrics behind driver's storage compartment, relay position 4

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 5 .
Engine must be idling.





- Start final control diagnosis => Page 19 . Fuel pump must run.

-> Fuel pump relay must be energised and fuel pump must run.

If relay does not pick up:

- Check actuation of fuel pump relay =>Page 60 .

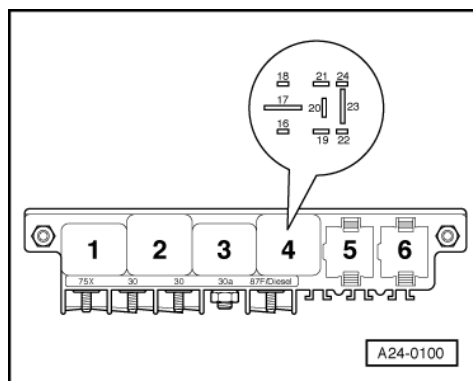
If fuel pump does not run:

- Check fuel pump and component actuation =>Page 61 .

Checking actuation of fuel pump relay

- Switch off ignition.
- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page 42 .
- Use test lead from V.A.G 1594 to connect sockets 65 and 2 of test box.
- Switch on ignition.

Specification: Fuel pump relay (relay position 4) must be energised

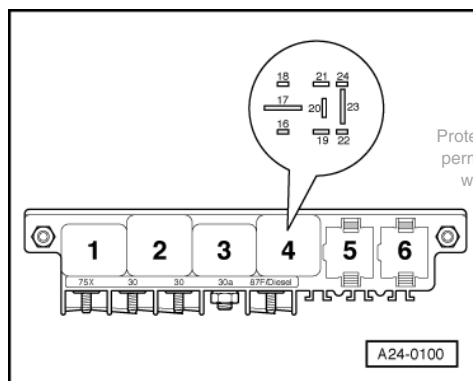


If relay now picks up, but not during final control diagnosis:

- Replace engine control unit => Page 44 .

If relay does not pick up:

- Switch off ignition.
- -> Pull fuel pump relay out of relay socket (relay position 4).



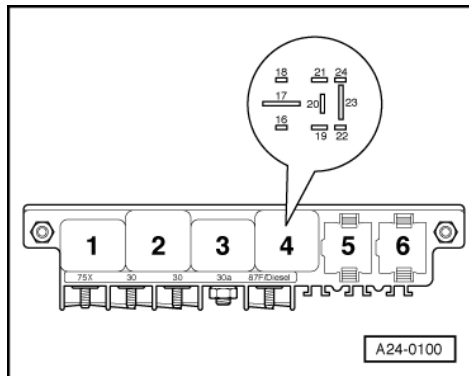
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- -> Connect portable multimeter for voltage measurement to contact 19 of relay socket and earth.

- Switch on ignition.

Specification: approx. battery voltage

If reading does not match specification:



- Check wiring.

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

If reading matches specification:

- Switch off ignition.
- -> Check for open circuit and short to earth/positive in the following wiring:

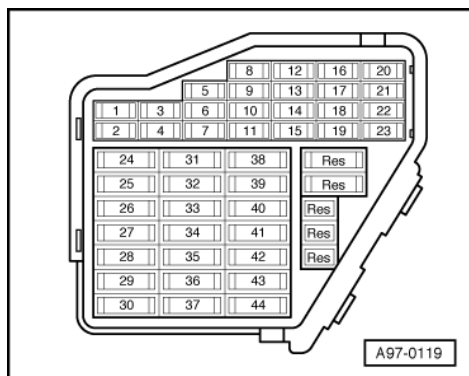
Micro central electrics on left in driver's footwell, position 4, contact	Test box V.A.G 1598/31, socket
16	65

- If necessary, eliminate open circuit in wiring/short circuit.

If no fault is found in wiring:

- Replace fuel pump relay -J17.

Checking fuel pump and component actuation

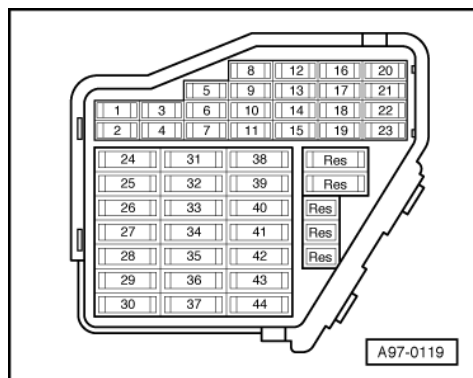


- -> Pull out fuses for fuel pump relay.

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

- Start final control diagnosis => Page 19 .

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- -> Connect portable multimeter for voltage measurement to earth and to left/right contact of fuses (voltage is only applied to one fuse contact).

Specifications: approx. battery voltage

If readings do not match specifications:

- Check wiring.

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

If no fault is found in wiring:

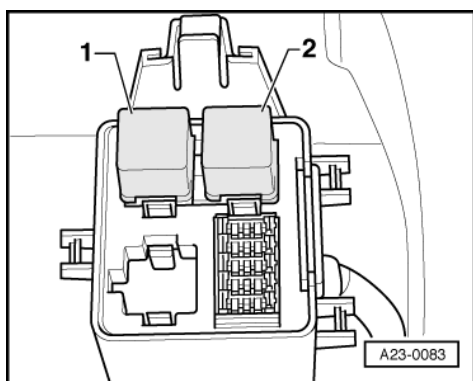
- Replace fuel pump relay -J17.

1.14 - Checking Motronic current supply relay -J271

Fitting location: Exploded view of fitting locations =>Page 36

Checking actuation of current supply relay

- Switch off ignition.
- Remove box cover.



- -> Pull current supply relay -2- out of relay carrier.
- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page 42 .
- Check for open circuit/short circuit in following wiring:

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Test box V.A.G 1598/31, socket	Current supply relay, contact
21	5 => Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

Resistance: max. 1.5 ohms

- If necessary, eliminate open circuit in wiring/short circuit.

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

If no fault is found in wiring:

- Check power supply for current supply relay.

Check power supply

- Switch off ignition.
- Connect portable multimeter for voltage measurement to contacts 1 and 3 of relay socket and earth.

Specification: approx. battery voltage

If reading does not match specification, use current flow diagram to check power supply.

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

If reading matches specification, check wiring between current supply relay and engine control unit.

Checking wiring between current supply relay and engine control unit

- Check fuse (see current flow diagram).

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

If no fault is found in fuse:

- Check for open circuit/short circuit in following wiring.

Test box V.A.G 1598/31, socket	Current supply relay, contact
121	2 => Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

Resistance: max. 1.5 ohms

- If necessary, eliminate open circuit in wiring/short circuit.

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

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If none of the checks reveals a fault, replace Motronic current supply relay -J271.

1.15 - Checking control unit power supply

Test requirement:

- Fuse for engine control unit OK



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

- Battery voltage at least 11 V
- Alternator OK
- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 5 .
Engine must be idling.

-> Indicated on display:

Rapid data transfer HELP
Select function XX

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

-> Indicated on display:

Read measured value block
Enter display group number XXX

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

-> Indicated on display:

Read measured value block 4
1 2 3 4

- Check specification for battery voltage in display zone 2.

	Display zones			
	1	2	3	4
Display group 4: Battery voltage with engine idling				
Display	xxxx rpm	xx.xxx V	xxx.x °C	xxx.x °C
Readout	Engine speed	Battery voltage	Coolant temperature	Intake air temperature
Operating range	min.: 750 rpm max.: 6800 rpm	min.: 0.000 V max.: 15.000 V	min.: -40.0 °C max.: 120.0 °C	min.: -40.0 °C max.: 120.0 °C
Specification	xxxx rpm	10.000...14.500 Volts	80.0...105.0 °C	From ambient temperature up to 90 °C
Note		If reading does not match specification =>Page 64 Evaluation of display zone 2		

Evaluation of display group 4

Display zone 2	Possible cause of trouble	Fault remedy
Fluctuation in value displayed between 10.000...14.500 V	- Loose contact	- Check power supply, terminals 15 and 30 => Page 64
0.000...10.000 Volts	- Battery flat/defective - Voltage regulator defective	- Check battery Check voltage regulator Check alternator
14.500...16.500 Volts	- Voltage regulator defective - Alternator defective	- Check voltage regulator Check alternator

Checking power supply, terminals 15 and 30

- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page 42 .

- Connect portable multimeter V.A.G 1526 for voltage measurement to the following test box sockets.

Power supply, terminal 15,

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

Power supply, terminal 30

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

If readings do not match specifications:

- Check wiring.

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1.16 - Checking air-mass meter -G70

Test requirement

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

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

Checking operation

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 5 .
Engine must be idling.

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

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

Note:

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

-> Indicated on display:

Basic setting	Q
Enter display group number	xxx

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

-> Indicated on display:



System in basic setting 2
1 2 3 4

- Check load sensing specifications.

	Display zones			
	1	2	3	4
Display group 2: Intake air mass at idle at operating temperature				
Display	xxx rpm	xx.x %	x.x ms	xxx.x g/s
Readout	Engine speed (in increments of 40)	Load	Mean injection period	Air mass
Operating range	min.: 660 rpm max.: 6800 rpm	min.: 0 % max.: 120.0 %	min.: 0 ms max.: 100 ms	min.: 0 g/s max.: 360.0 g/s
Specification	660...860 rpm	15.0...30.0 %	1.5...3.5 ms	1.5...4.0 g/s
Note	---	---	If reading does not match specification: Evaluation of display zone 3 => Page 66	If reading does not match specification: Evaluation of display zone 4 => Page 66

If reading matches specification:

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

Evaluation of display group 002

Display zone: 3	Possible cause of trouble	Fault remedy
Less than 1.5 ms	- Lower values can only occur in over-run mode	
Greater than 3.5 ms	- Load on engine from ancillaries	- Eliminate load (air conditioner/power steering/alternator)
	- Rough idling (not running on all cylinders)	- Check spark plugs Check injectors=>Page 57
	- Throttle valve control part -J338 defective	- Check throttle valve control part => Page 106

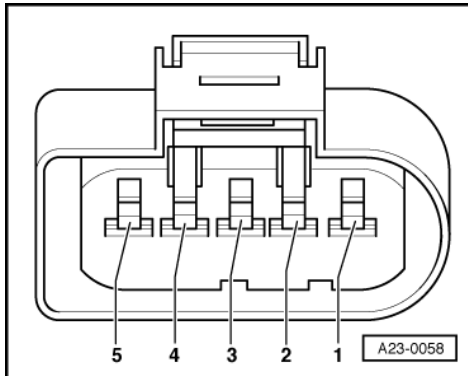
Evaluation of display group 002

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Display zone: 4	Possible cause of trouble	Fault remedy
Less than 1.5 g/s	- Large volume of unmetered air between intake manifold and air-mass meter - Power supply of air-mass meter/wiring to engine control unit	- Check power supply/wiring => Page 67 Eliminate leak in intake system (unmetered air)
Greater than 4.0 g/s	- Load on engine from ancillaries	- Eliminate load (air conditioner/power steering/alternator)
	- Power supply of air-mass meter/wiring to engine control unit	- Check power supply/wiring => Page 67

Checking power supply for air-mass meter

Fitting location: Exploded view of fitting locations =>Page 36



- Unplug connector from air-mass meter.
- -> Connect portable multimeter for voltage measurement to socket 2 of connector and engine earth.
- Briefly operate starter.

Specification: approx. battery voltage

Note:

Air-mass meter is supplied with power by fuel pump relay.

If there is no battery voltage:

- Check for open circuit/short to earth in wiring from socket 2 of connector via fuse to fuel pump relay and repair if necessary.

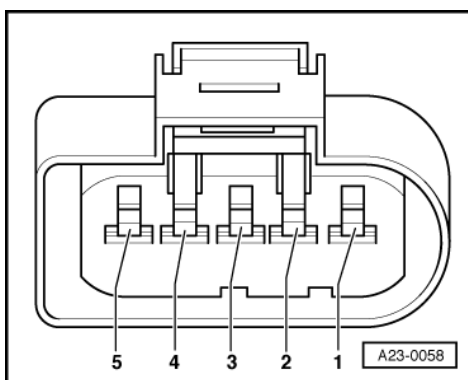
=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

If reading matches specification:

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- Check engine control unit earth supply => Page 67 .

Checking earth supply



- -> Connect up portable multimeter for voltage measurement to sockets 2 and 3 of connector.
- Briefly operate starter.

Specification: approx. battery voltage

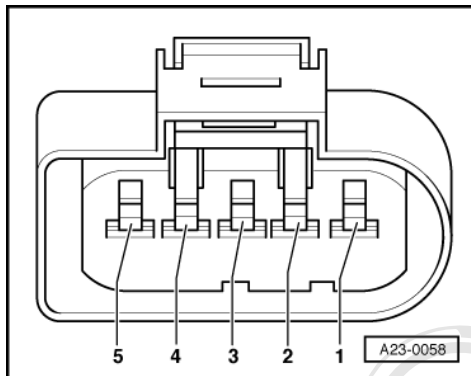


Note:

Engine control unit earth is applied to socket 3 of connector.

If reading does not match specification:

- Check wiring => Page 68 .



- -> Connect up portable multimeter for voltage measurement to sockets 3 and 4 of connector.
- Switch on ignition.

Specification: approx. 5 V

If reading does not match specification:

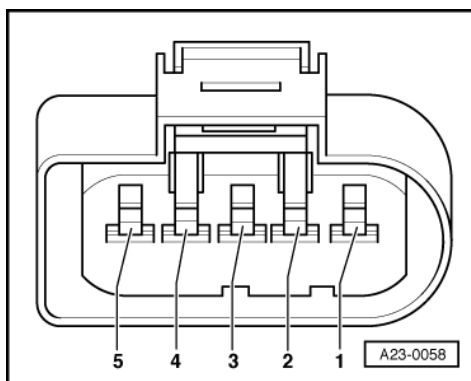
- Check wiring => Page 68 .

Checking wiring for air-mass meter

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Signal wire is also checked as part of wiring test.



- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page 42 .
- -> Check for open circuit and short to earth/positive in the following wiring.

Connector for air-mass meter -G70, socket	Test box V.A.G 1598/31, socket
3	27
4	53

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

- If necessary, eliminate open circuit in wiring/short circuit.

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

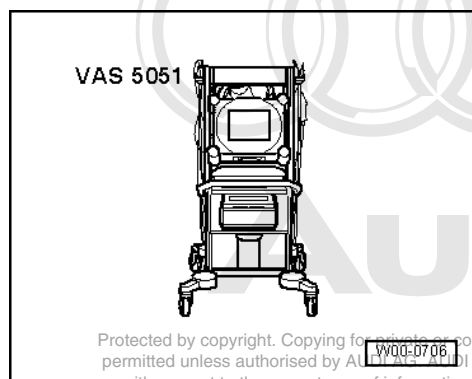
- Also check all wires for mutual short circuit.

Specification: infinity ohms (no continuity)

- If power supply and wiring are OK, replace air-mass meter -G70.

1.17 - Checking intake system for leaks (unmetered air)

Special tools, workshop equipment and other items required



- ♦ VAS 5051 with VAS 5051/1

or

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

Notes:

- ♦ Due to the vacuum in the intake system, the leak detector spray is drawn in with the unmetered air. The spray reduces the ignition performance of the mixture, thus causing a drop in engine speed and a sharp increase in CO content.
- ♦ Always heed the safety instructions on the can.

Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 5 .
Engine must be idling.

-> Display readout:

Rapid data transfer	HELP
Select function XX	

- Enter "08" for "Read measured value block" function and confirm with Q key.

-> Display readout:



Read measured value block Q
Enter display group number XXX

- Enter "001" for "Display group number 001" and confirm 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 apply engine leak detector spray to intake system components.

If engine speed does not change:

- Press =>key.

-> Indicated on display (function selection):

Rapid data transfer HELP
Select function XX

If engine speed decreases:

- Press =>key.
- Enter "06" for "End output" function and confirm entry with Q key.
- Switch off ignition.
- Check sprayed section of intake system for leaks and rectify fault.

Checking vacuum reserve in intake manifold for leaks (used e.g. for intake manifold changeover)

- Allow engine to idle for several minutes. Make sure pipes and connections to -N156 (intake manifold changeover valve) are OK (no leaks, complete).
- Perform intake manifold changeover test, as this enables checking of vacuum reserve in intake manifold for leakage =>Page 91 .

1.18 - Checking intake-air temperature sender -G42

Special tools and workshop equipment required

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

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or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

Note:

Intake-air temperature sender -G42 is integrated in air-mass meter and is thus not a separate component on the engine.

Fitting location: Exploded view of fitting locations =>Page 36

Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 5 .

Ignition must be on.

-> Display readout:

Rapid data transfer HELP
Select function XX

- Enter "08" for "Read measured value block" function and confirm with Q key.

-> Display readout:

Read measured value block Q
Enter display group number XXX

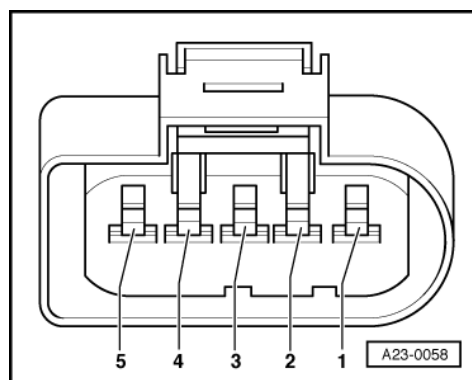
- Enter "004" for "Display group number 004" and confirm with Q key.
- Check specification for intake-air temperature sender in display zone 4.

	Display zones			
	1	2	3	4
Display group 004: Intake-air temperature with engine idling				
Display	xxxx rpm	xx.x V	xxx.x °C	xxx.x °C
Readout	Engine speed	Battery voltage	Coolant temperature	Intake air temperature
Specification	xxxx rpm	10.0...14.5 V	85.0...105.0 °C	From ambient temperature up to 80 °C
Note				If temperature displayed deviates greatly from ambient temperature, check sender => Page 71

Checking wiring

Fitting location: Exploded view of fitting locations =>Page 36

- Unplug 5-pin connector from air-mass meter.
- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page 42 .



- -> Check for open circuit and short to earth/positive in the following wiring.

Connector, contact	Test box V.A.G 1598/31, socket
1	26
3	27

- Check both wires for mutual short circuit.
- If necessary, eliminate open circuit in wiring/short circuit.
- Replace air-mass meter if wiring is OK, but value obtained is nevertheless not realistic.



1.19 - Checking coolant temperature sender -G62

Fitting location of coolant temperature sender => Page 36 .

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 5 .
Ignition must be on.

-> Indicated on display:

Rapid data transfer HELP
Select function XX

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

-> Indicated on display:

Read measured value block
Enter display group number xxx

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

-> Indicated on display:

Read measured value block 4
1 2 3 4

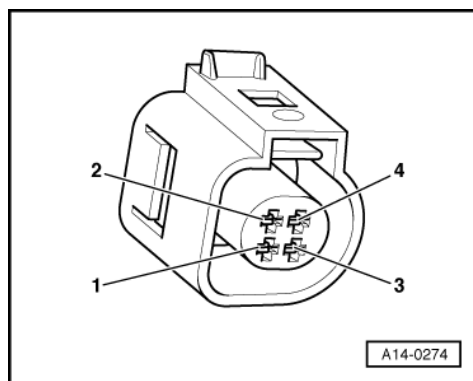
- Check specification for coolant temperature sender in display zone 3.

	Display zones			
	1	2	3	4
Display group 4: Coolant temperature with engine idling				
Display	xxx rpm	xx.xxx V	xx.x °C	xxx.x °C
Readout	Engine speed	Battery voltage	Coolant temperature	
Operating range	min.: 660 rpm max.: 6800 rpm	min.: 0.000 V max.: 15.000 V	min.: -40.0 °C max.: 120.0 °C	min.: -40.0 °C max.: 120.0 °C
Specification	660 ... 860 rpm	10.000...14.500 Volts	85.0...105.0 °C	Outside temperature
Note	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. - Temperature value must increase steadily - If reading does not match specification, check sender/wiring => Page 72			

Checking wiring

Fitting location of sender and connector => Page 36 .

- Switch off ignition.
- Unplug connector at sender.



- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page 42 .
- -> Check for open circuit and short to earth/positive in the following wiring.

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

Resistance: max. 1.5 ohms

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- If necessary, eliminate open circuit in wiring/short circuit.

If no fault is found in wiring:

- Replace coolant temperature sender -G62.

2 - Checking lambda control

2.1 - Checking lambda control

2.2 - Checking lambda probe and lambda control upstream of catalytic converter

Special tools and workshop equipment required

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

or

- ◆ V.A.G 1551 with V.A.G 1551/3 A

Test requirements:

- No faults stored in fault memory
- No leaks in exhaust system
- Coolant temperature at least 80 °C=>Display group 004, display zone 3

Checking operation

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 5.

Engine must be idling.

-> Display readout:

Rapid data transfer	HELP
Select function XX	

- Enter "04" for "Start basic setting" function and confirm with Q key.

Checking lambda probe status

-> Display readout:



Basic setting Q
Enter display group number XXX

- Enter "030" for "Display group number 030" and confirm with Q key.
- Check lambda probe status in display zone 1.

Note:

"Lambda probe status" indicates status of lambda control and lambda probe.

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Display zones			
	1	2	3 4
Display group 030: Lambda probe status			
Display	X X X	X X X	
Readout	Lambda probe status bank 1, probe 1	Lambda probe status bank 1, probe 2	
Operating range	0 = off 1 = on	0 = off 1 = on	
Specification	1 1 1	1 1 1/0	
Note	If reading does not match specification => Page 74		

Significance of 3-digit display in display group 030

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

Notes:

- ♦ First zone of 3-digit display (heating) fluctuates between 0 and 1.
- ♦ "0" may also be displayed at idle (no load) for lambda control bank 1 probe 2.

Checking lambda probe learned values and control

- Press C key.

-> Display readout:

Start basic setting Q
Enter display group number XXX

- Enter "032" for "Display group number 032" and confirm with Q key.
- Check lambda probe learned values and control in display zones 1 and 2:

Display zones			
	1	2	3 4
Display group 032: Lambda learned values			
Display	xx.x %	xx.x %	
Readout	Lambda learned value bank 1 at idle (additive)	Lambda learned value bank 1 at part throttle (multiplicative)	
Specification	-10.0...10.0 % May fluctuate slightly	-10.0...10.0 % May fluctuate slightly	

Display zones		
Note	If reading does not match specification =>Evaluation of display group 032, Page 75	

Evaluation of display group 032

Display zone: 1 / 2	Possible cause of trouble	Fault remedy
Lambda learned values (mul.) less than -10.0 %	- Leakage in intake area	- Check intake system for leaks and eliminate unmetered air => Page 69
Lambda learned values (add.) less than -10.0 %	- Oil dilution	- Change oil or drive across country at good speed
	- High oil consumption level	
	- Air-mass meter defective	- Check air-mass meter => Page 65
	- Activated charcoal filter solenoid valve sticking open	- Check activated charcoal filter solenoid valve => Page 97
	- Fuel pressure too high	- Check fuel pressure regulator => Page 53
	- Injector leaking	- Check injectors=>Page 57
	- Lambda probe heating defective	- Check lambda probe heating => Page 80
	- Lambda probe dirty	

Evaluation of display group 032

Display zone: 1 / 2	Possible cause of trouble	Fault remedy
Lambda learned values (mul.) greater than 10.0 %	- Unmetered air in intake system	- Check intake system for leaks and eliminate unmetered air => Page 69
Lambda learned values (add.) greater than 10.0 %	- Fuel pressure too low	- Check fuel pressure regulator => Page 53
	- Lambda probe heating defective	- Check lambda probe heating => Page 80
	- Injector does not open or only partially	- Check injectors=>Page 57
	- Activated charcoal filter solenoid valve sticking	- Check activated charcoal filter solenoid valve => Page 97

- Press C key.

-> Display readout:

Start basic setting Q
Enter display group number xxx

- Enter "033" for "Display group number 033" and confirm with Q key.
- Check 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	
Readout	Lambda control bank 1, probe 1	Lambda probe voltage bank 1, probe 1	
Specification	Value must fluctuate slightly in -20.0...20.0 % range	Voltage must fluctuate in 1.0...2.0 V range	



Note	Display zones		
	If reading does not match specification => Continued on Page 76	If reading does not match specification => Evaluation of display group 033, Page 76	

Note on display zone 1:

Display must fluctuate around 0. If display is always 0, lambda control has switched from closed loop to open loop mode on account of a fault in the lambda control. Interrogate fault memory => Page 7.

Notes on display zone 2:

- ♦ Voltage signal "Rich mixture (low residual oxygen level)" is less than 1.5 V.
- ♦ Voltage signal "Lean mixture (high residual oxygen level)" is greater than 1.5 V.

Evaluation of display group 033

Display zone: 2	Possible cause of trouble	Fault remedy
Constant 1.5 V	- Open circuit in wire 1 between lambda probe and control unit - Open circuit in wire 5 between lambda probe and control unit	- Check basic voltage => Page 76 - Check wiring of lambda probe upstream of catalytic converter => Page 77
Constant 4.9 V	- Short to positive in wire 1 between lambda probe and control unit	
Constant 0.0 V	- Short to earth in wire 1 between lambda probe and control unit	

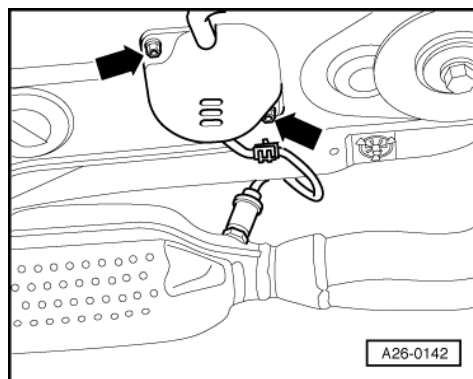
Continued

If reading in display zone 1 does not match specification or if value does not fluctuate slightly:

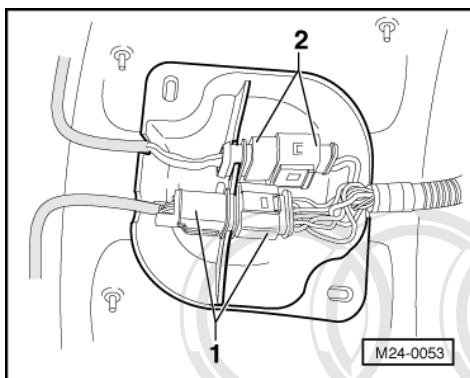
- Perform test drive to remove any residue from lambda probe and repeat test.

If reading in display zone 1 does not match specification even after a test drive or if value does not fluctuate:

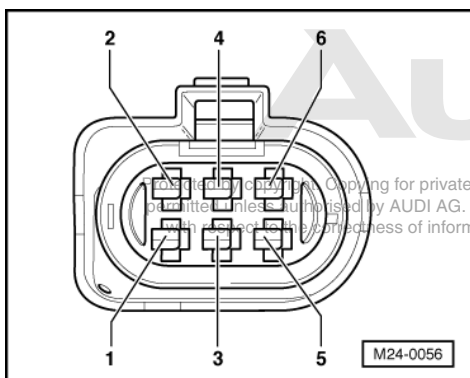
- Check basic voltage => Page 76.
- Check lambda probe heating => Page 80.
- Check for ageing of lambda probe upstream of catalytic converter => Page 79.

Checking basic voltage

- -> Unscrew protective cover -arrows- on underside of vehicle.



- -> Unplug 6-pin connector -1- (black) for lambda probe upstream of catalytic converter -G39.

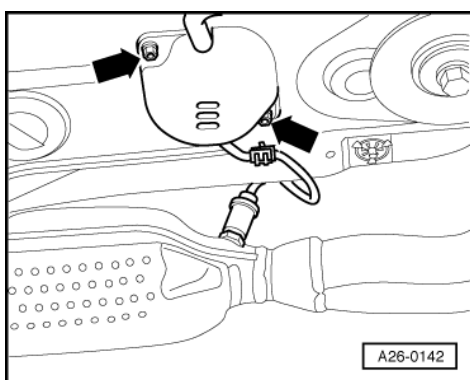


- -> Connect up multimeter for voltage measurement between contacts 1 and 5.
- Switch on ignition.
 - Specification: 0.400 ... 0.500 V
- Switch off ignition.

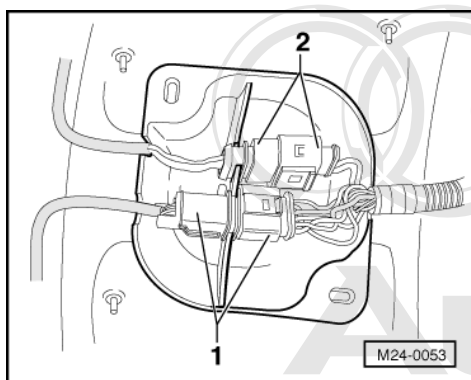
If reading does not match specification:

- Check lambda probe wiring => Page 77 .

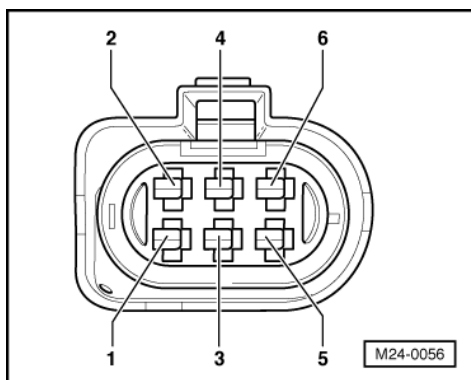
Checking lambda probe wiring



- -> Unscrew protective cover -arrows- on underside of vehicle.



- -> Unplug 6-pin connector -1- (black) for lambda probe upstream of catalytic converter -G39.
- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page 42 .



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

Connector, contact	Test box V.A.G 1598/31, socket
1	70
2	71
5	51
6	52

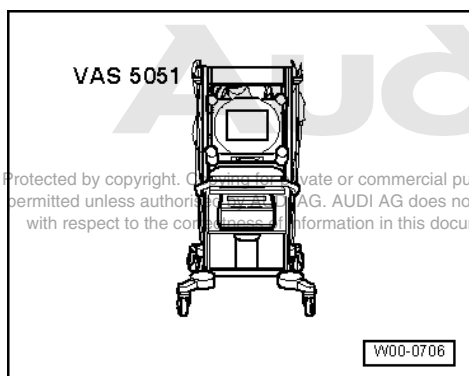
- Eliminate open circuit in wiring if necessary.
- Check wiring for mutual short circuit.

If no fault is found in wiring:

- Replace engine control unit => Page 44 .

2.3 - Checking ageing of lambda probe upstream of catalytic converter

Special tools and workshop equipment required



- ♦ VAS 5051 with VAS 5051/1

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

Test requirement:

- Coolant temperature at least 80 °C=>Display group 004, display zone 3

Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 5 .
Engine must be idling.

-> Display readout:

Rapid data transfer HELP
Select function XX

- Enter "04" for "Start basic setting" function and confirm with Q key.

-> Display readout:

Start basic setting Q
Enter display group number XXX

- Enter "034" for "Display group number 034" and confirm with Q key.
- Press and hold brake pedal until display in zone 4 switches from "Test OFF" to "Test ON".
- Keep pressing brake pedal until result of diagnosis is displayed in zone 4.

	Display zones			
	1	2	3	4
Display group 034: Diagnosis of ageing of lambda probe upstream of catalytic converter				
Display	xxxx rpm	xxx °C	x.x s	---
Readout	Engine speed	Exhaust gas temperature	Dynamic factor	Diagnosis status
Operating range				Test OFF Test ON B1-S1 OK B1-S1 not OK
Specification	660...860 rpm	200...400 °C	1.20...1.99	B1-S1 OK



Note	Display zones	
		If reading does not match specification => Continued onPage 80

Note on display zone 2:

Value calculated from engine speed and engine load.

Note on display zones 3 and 4:

The dynamic factor is a measure of the Lambda probe ageing. The control unit compares the control frequency of the lambda probe evaluation circuit to a specification stipulated in the control unit. If this value is not reached, display zone 4 shows: "B1-S1 not OK"

Continued

If reading does not match specification in display zone 4:

- Perform test drive to remove any residue from lambda probe and repeat test.

If reading in display zone 4 does not match specification even after a test drive:

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

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2.4 - Checking lambda probe heater -Z19 for lambda probe upstream of catalytic converter

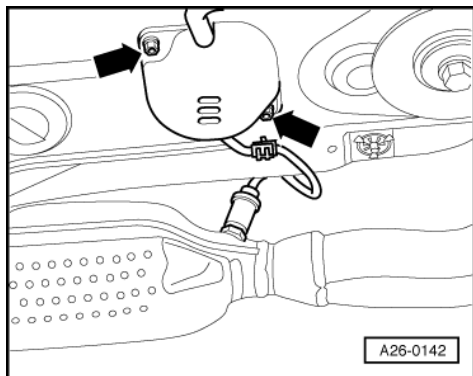
Special tools and workshop equipment required

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

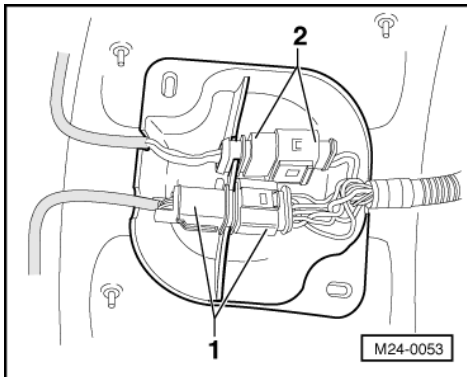
Test requirements:

- Coolant temperature at least 80 °C=>Display group 004, display zone 3
- Fuse for lambda probe heating OK

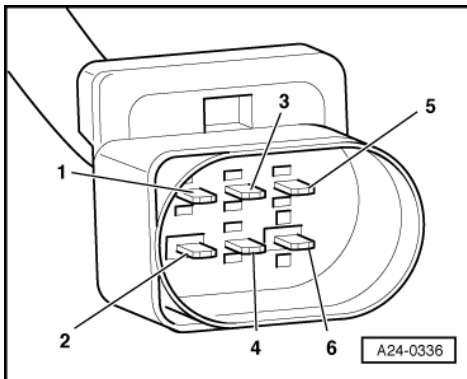
=> "Current Flow Diagrams, Electrical Fault-finding and Fitting Locations" binder

**Test sequence**

- -> Unscrew protective cover -arrows- on underside of vehicle.



- -> Unplug 6-pin connector -1- (black) for lambda probe upstream of catalytic converter -G39.



- -> Connect up multimeter for resistance measurement between contacts 3 and 4.
- Specification at ambient temperature: 2.5 ... 10 Ω

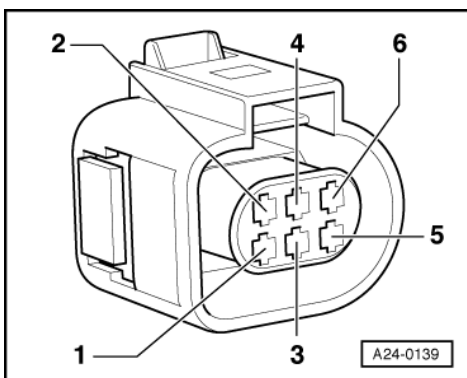
If reading does not match specification:

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

If reading matches specification:

- Check power supply for lambda probe heating.

Checking power supply for lambda probe heating



- -> Connect up multimeter for voltage measurement between contacts 3 and 4.
- Start engine.
- Specification: approx. battery voltage

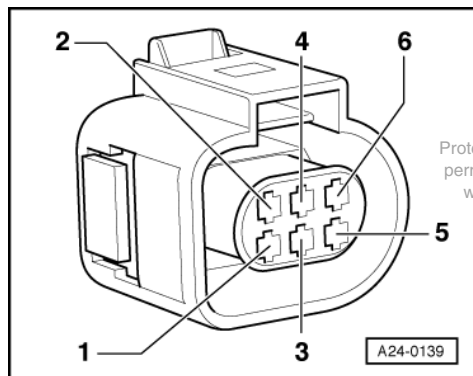
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Note:

Activation and deactivation of lambda probe heating by engine control unit can be observed if necessary in function "Read measured value block", display group number 041, display zone 2.

If there is no voltage:



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- -> Connect up multimeter for voltage measurement as follows.

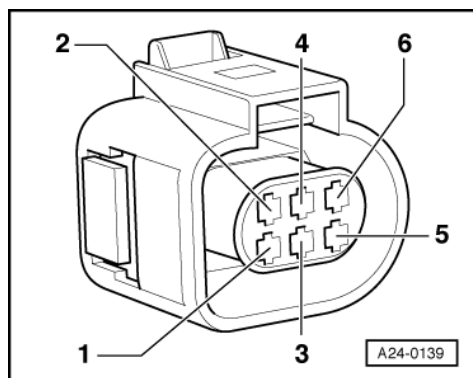
Connector, contact	Measure to
3 (positive)	Vehicle earth

- Briefly operate starter.
 - Specification: approx. battery voltage

If there is still no voltage:

- Check for open circuit in wiring from contact 3 of connector via fuse to fuel pump relay.

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



If power supply is OK:

- -> Connect up multimeter for voltage measurement as follows.

Connector, contact	Measure to
4 (engine control unit switched earth connection)	Battery positive

- Start engine.
 - Specification: approx. battery voltage

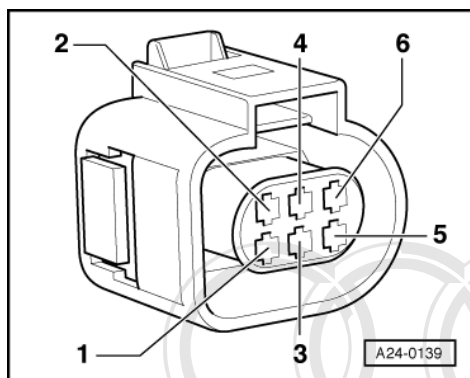
Note:

Activation and deactivation of lambda probe heating by engine control unit can be observed if necessary in function "Read measured value block", display group number 041, display zone 2.

- Switch off ignition.

If there is no voltage:

- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page 42 .



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

Connector, contact	Test box V.A.G 1598/31, socket
4	5

- Eliminate open circuit in wiring if necessary.

If wiring is OK, but there is no earth supply for lambda probe heating:

- Replace engine control unit => Page 44!

2.5 - Checking lambda probe and lambda control downstream of catalytic converter

Note:

Lambda control downstream of catalytic converter is on a higher level than lambda control upstream of catalytic converter and provides corrective action.

The lambda probe downstream of the catalytic converter also corrects slight shifts in the mixture (e.g towards rich) by causing lambda control upstream of catalytic converter to dwell at its upper/lower point for a certain period.

Special tools and workshop equipment required

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

or

- ◆ V.A.G 1551 with V.A.G 1551/3 A

**Test requirements:**

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

Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 5 .
Engine must be idling.

-> Display readout:

Rapid data transfer	HELP
Select function XX	

- Enter "04" for "Start basic setting" function and confirm with Q key.

Note:

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

-> Display readout:

Start basic setting	Q
Enter display group number XXX	

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

-> Display readout:

System in basic setting 43
1 2 3 4

- By pressing accelerator, increase engine speed to approx. 3000 rpm until display zone 2 shows a temperature well in excess of 350 °C. Then release accelerator pedal so that engine runs at idling speed.
- Set engine speed with engine-speed setting tool V.A.G 1788/10 to 1800...2200 rpm.
- Press and hold brake pedal until display in zone 4 switches from "Test OFF" to "Test ON"
- Continue to maintain engine speed at 1800...2200 rpm and keep brake pedal pressed until result of diagnosis appears in display zone 4.

	Display zones			
	1	2	3	4
Display group 043: Diagnosis of ageing of lambda probe downstream of catalytic converter				
Display	xxxx rpm	xxx °C	x.x V	---
Readout	Engine speed	Exhaust gas temperature	Lambda probe voltage bank 2, probe 1	Diagnosis status
Operating range	0...6500	70...850 °C	0...1.0 V	Test OFF Test ON B1-S2 OK B1-S2 not OK
Specification	1800...2200 rpm	Greater than 350 °C	0.5...0.7 V	B1-S2 OK
Note			If reading does not match specification => Continued onPage 85 .	

Note on display zone 2:

Value calculated from engine speed and engine load.

Continued

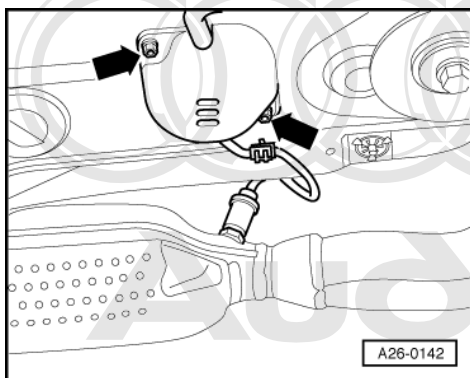
If reading does not match specification in display zone 4:

- Perform test drive to remove any residue from lambda probe and repeat test.

If reading in display zone 4 does not match specification even after a test drive:

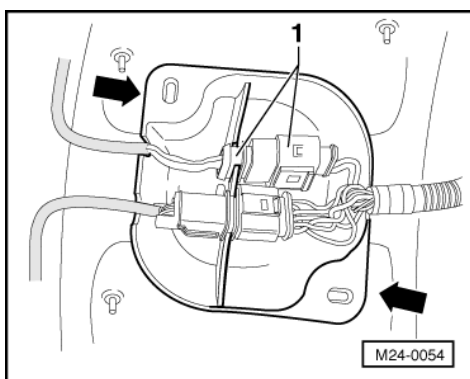
- Check basic voltage => Page 85
- Check wiring of lambda probe downstream of catalytic converter
=> Page 86

Checking basic voltage

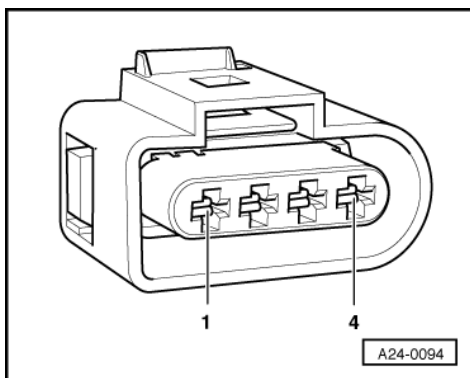


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-> Unscrew protective cover -arrows- on underside of vehicle.



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



- -> Connect up multimeter for voltage measurement between contacts 3 and 4.
- Switch on ignition.
- Specification: 0.400 ... 0.500 V



- Switch off ignition.

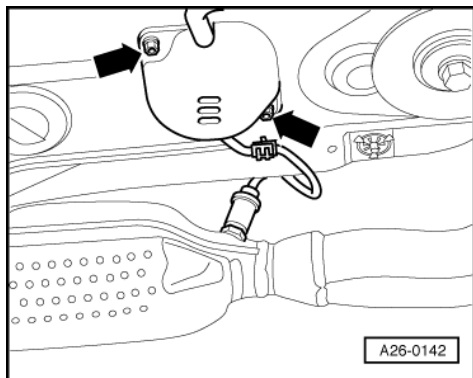
If reading does not match specification:

- Check lambda probe wiring => Page 86 .

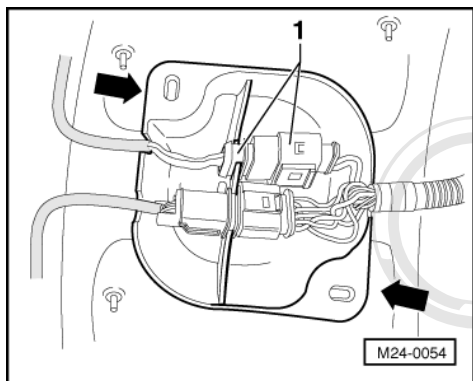
If reading matches specification:

- Replace lambda probe downstream of catalytic converter -G130.

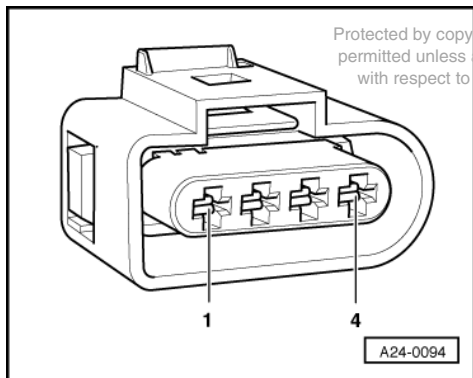
Checking lambda probe wiring



- -> Unscrew protective cover -arrows- on underside of vehicle.



- -> Unplug 4-pin connector -1- (brown) for lambda probe downstream of catalytic converter -G130.
- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page 42 .



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

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Connector, contact	Test box V.A.G 1598/31, socket
3	68
4	69

- Eliminate open circuit in wiring if necessary.
- Check wiring for mutual short circuit.

If wiring is OK:

- Replace engine control unit => Page 44 .

2.6 - Checking lambda probe heater -Z29 for lambda probe downstream of catalytic converter

Special tools and workshop equipment required

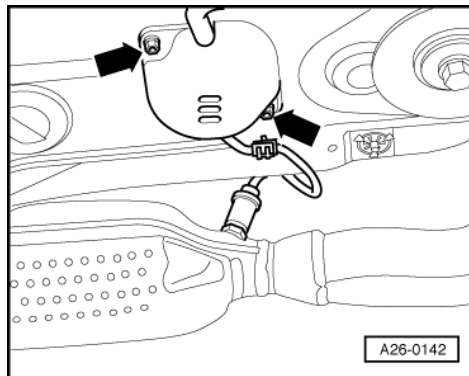
- ◆ V.A.G 1526 A
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/31

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Test requirements:

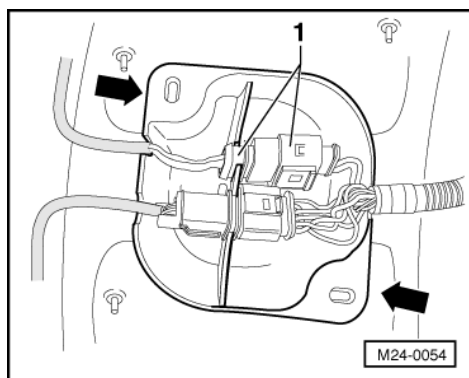
- Coolant temperature at least 80 °C=>Display group 004, display zone 3
- Fuse for lambda probe heating OK

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



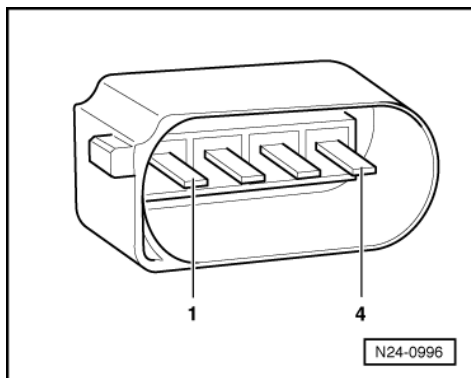
Test sequence

- -> Unscrew protective cover -arrows- on underside of vehicle.





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



- -> Connect up multimeter for resistance measurement between contacts 1 and 2.
- Specification at ambient temperature: 6.4 ... 47.5 Ω

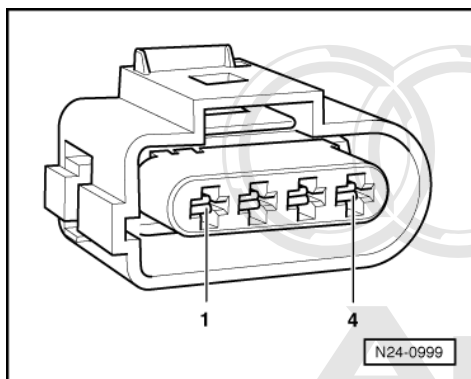
If reading does not match specification:

- Replace lambda probe downstream of catalytic converter -G130.

If reading matches specification:

- Check power supply for lambda probe heating.

Checking power supply for lambda probe heating

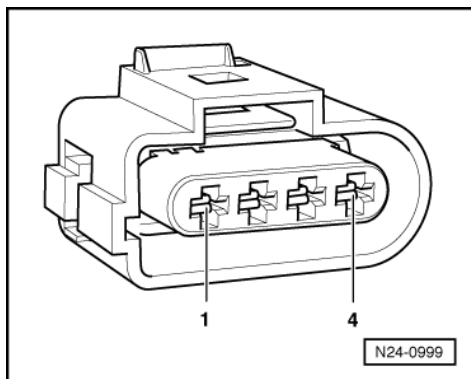


- -> Connect up multimeter for voltage measurement between contacts 1 (positive) and 2 (earth).
- Start engine.
- Specification: approx. battery voltage

Note:

Activation and deactivation of lambda probe heating by engine control unit can be observed if necessary in function "Read measured value block", display group number 041, display zone 4.

If there is no voltage:



- -> Connect up multimeter for voltage measurement as follows.

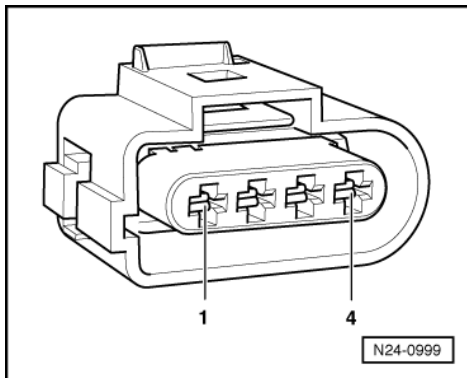
Connector, contact	Measure to
1 (positive)	Vehicle earth

- Briefly operate starter.
 - Specification: approx. battery voltage

If there is still no voltage:

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

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



If power supply is OK:

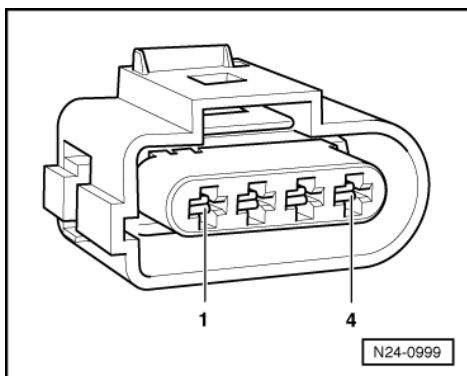
- -> Connect up multimeter for voltage measurement as follows.

Connector, contact	Measure to
2 (engine control unit switched earth connection)	Battery positive

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

If there is no voltage:

- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page 42 .



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



Connector, contact	Test box V.A.G 1598/31, socket
2	5

- Eliminate open circuit in wiring if necessary.

If wiring is OK, but there is no earth supply for lambda probe heating:

- Replace engine control unit => Page 44 .

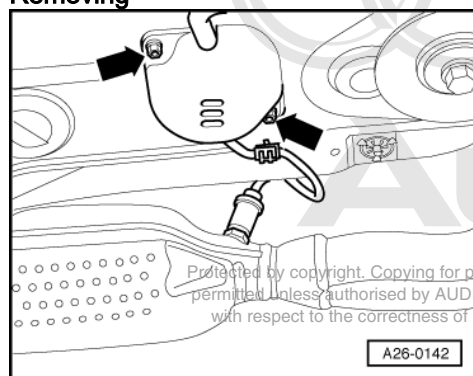
2.7 - Removing and installing lambda probe

Special tools, workshop equipment and other items required

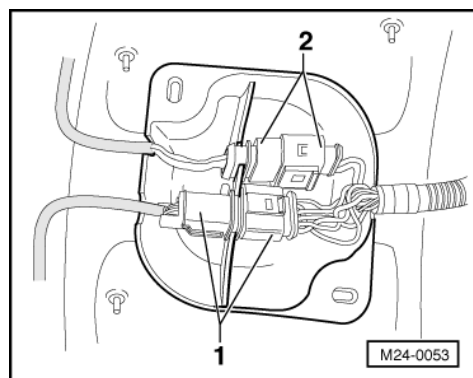


- ♦ Ring spanner set 3337
- ♦ Hot bolt paste G 052 112 A3

Removing



- -> Unscrew protective cover -arrows- on underside of vehicle.
- Unplug connector of appropriate lambda probe and move wire clear.



- (black) to lambda probe upstream of catalytic converter -G39
- (brown) to lambda probe downstream of catalytic converter -G130
- Use special tool 3337 to screw out lambda probe.

Installing

Pay attention to the following on installation:

Notes:

- ◆ The thread of the lambda probe is coated with an assembly paste, which must not be allowed to ingress into the openings in the probe.
- ◆ Tightening torque 55 Nm
- ◆ On installation, lambda probe cable must always be reattached at the same locations to prevent probe wire coming into contact with exhaust pipe.

3 - Checking intake manifold changeover

3.1 - Checking intake manifold changeover

Check is only to be performed in the event of loss of power or if a fault has been stored.

Intake manifold is switched from long to short tract at an engine speed of approx. 4500 rpm.

3.2 - Checking operation

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 5 .
Engine must be idling.

-> Indicated on display:

Rapid data transfer HELP
Select function XX

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

-> Indicated on display:

Read measured value block
Enter display group number XXX

- Press keys 0, 9 and 5 for "Display group number 95" and confirm entry with Q key.

-> Indicated on display:

Read measured value block 95
1 2 3 4

- Check intake manifold changeover specifications.

	Display zones			
	1	2	3	4
Display group 95: Intake manifold changeover at idle				
Display	xxx rpm	x.xx ms	xxx.x °C	SU-V OFF
Readout	Engine speed (in increments of 40)	Load	Coolant temperature	Intake manifold changeover



	Display zones			
Operating range	min.: 660 rpm max.: 6800 rpm	min.: 0.00 ms max.: 120.00 ms		SU-V OFF SU-V ON
Specification	660...860 rpm	15.0...30.0 ms	85.0...105.0 °C	SU-V OFF
Note				

- Check readout in display zone 4.

Specification: "SU-V OFF"

- Increase engine speed to approx. 4500 rpm (display zone 1) and observe display in zone 4.
- Intake manifold changeover must take place (display zone 4).

	Display zones			
	1	2	3	4
Display group 95: Intake manifold changeover whilst driving				
Display	xxxx rpm	x.xx ms	xxx.x °C	SU-V ON
Readout	Engine speed (in increments of 40)	Load	Coolant temperature	Intake manifold changeover
Operating range	min.: 660 rpm max.: 6800 rpm	min.: 0.00 ms max.: 120.00 ms		SU-V OFF SU-V ON
Specification	4500...6800 rpm	15.0...120.00 ms	80.0...105.0 °C	SU-V ON
Note				

- If "SU-V ON" is displayed but vacuum unit for intake manifold changeover is not energised (fitting location: at intake manifold, front left):
 - Check intake manifold changeover solenoid valve => Page 92 .
 - Checking vacuum system for leaks => Page 94 .

3.3 - Checking intake manifold changeover solenoid valve -N156

Fitting location => Page 36

Checking intake manifold changeover solenoid valve -N156

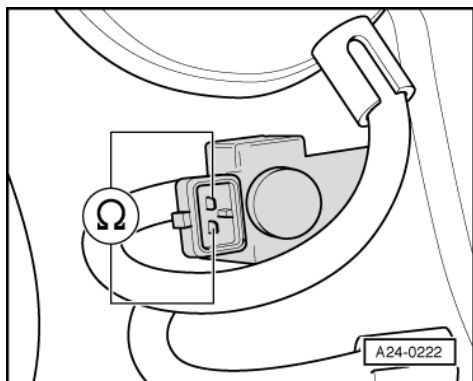
- Allow engine to idle for 2 to 3 minutes to build up vacuum.
- Switch off engine.
- Switch on ignition.

-> Perform final control diagnosis and actuate intake manifold changeover solenoid valve => Page 19 .

Final control diagnosis
Intake manif. changeover valve -N156

Solenoid valve must be felt and heard to click. Final control diagnosis is terminated after one minute.

- Switch off ignition if solenoid valve does not click.

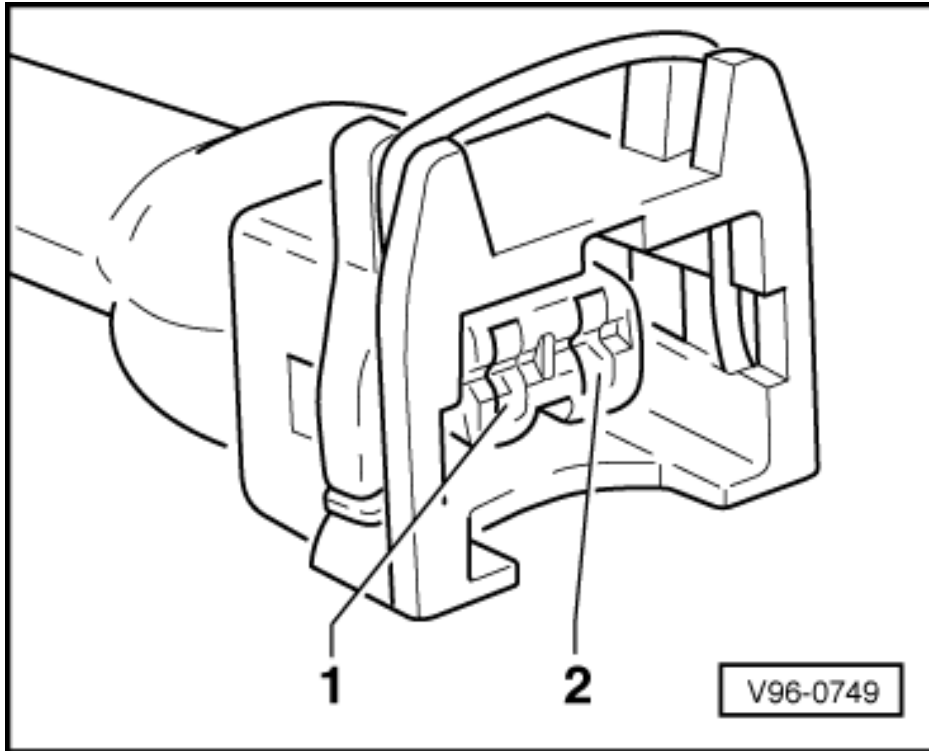


- Unplug connector from intake manifold changeover solenoid valve -N156.
- -> Measure resistance with V.A.G 1526 between solenoid valve contacts.

Specification: 25...35 ohms

- If reading does not match specification, replace intake manifold changeover solenoid valve -N156.

If reading matches specification, check power supply => Page **93** .



Checking power supply of intake manifold changeover solenoid valve -N156

- -> Connect diode test lamp V.A.G 1527 with leads from adapter set V.A.G 1594 to socket 1 of connector and engine earth.
- Briefly operate starter.

Diode test lamp must light.

- If diode test lamp does not light:
- Check fuse for intake manifold changeover solenoid valve:

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

If fuse is OK:

- Check for open circuit/short circuit in wiring from socket 1 of connector via fuse for intake manifold changeover solenoid valve to fuel pump relay.

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

If power supply is OK, check actuation => Page **93** .

Checking actuation of intake manifold changeover solenoid valve

- Connect diode test lamp V.A.G 1527 with leads from adapter set V.A.G 1594 to sockets 1 (positive) and 2 of connector at intake manifold changeover solenoid valve.

-> Perform final control diagnosis and actuate intake manifold changeover solenoid valve => Page **19** .

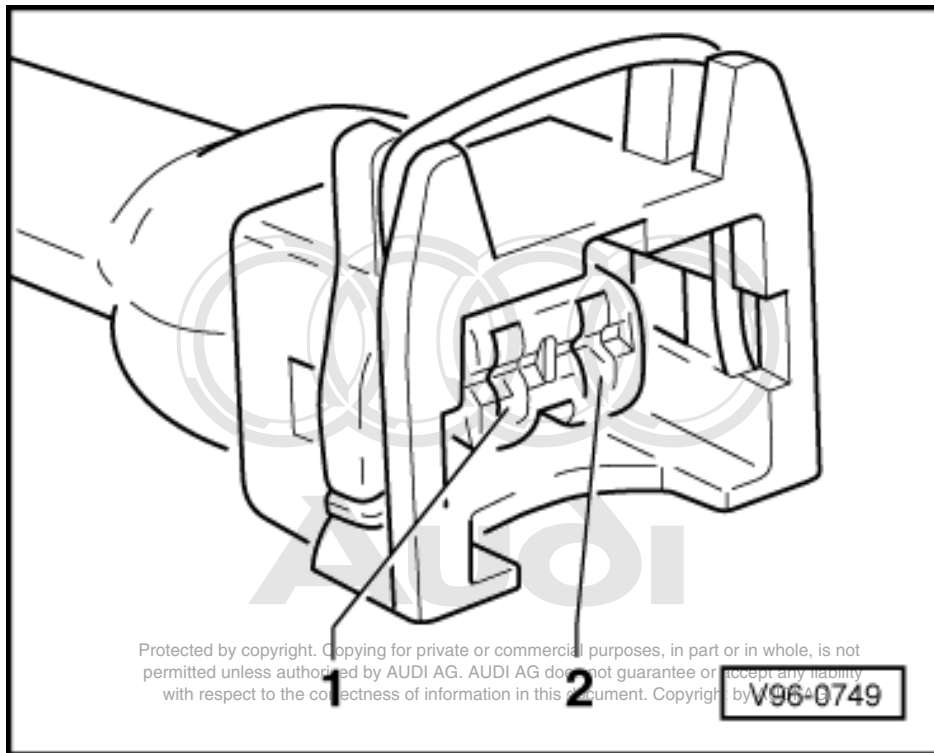


Final control diagnosis
Intake manif. changeover valve -N156

If diode test lamp does not flash or if it is permanently lit: Check wiring.

Checking wiring

- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page 42 .



Check for short to positive/earth and open circuit in the following wiring.

Intake manifold change-over connector, socket	Test box V.A.G 1598/31, socket
2	104

Resistance: max. 1.5 ohms

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

- If wiring is OK, replace engine control unit =>Page 44 .
- Check operation of intake manifold changeover -N156 again
=>Page 91 .

3.4 - Checking vacuum system

Checking solenoid valve for blockage and leakage

- Remove intake manifold changeover solenoid valve.
- Reconnect removed solenoid valve to wiring harness connector.

-> Perform final control diagnosis and actuate intake manifold changeover solenoid valve => Page 19 .

Final control diagnosis
 Intake manif. changeover valve -N156

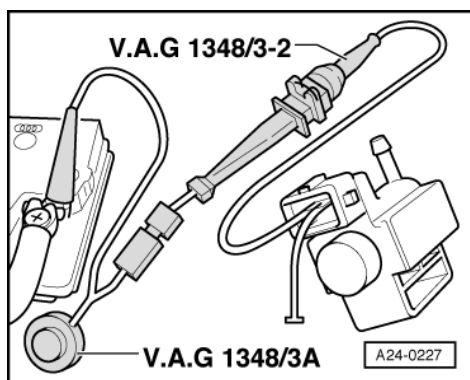
- By blowing in at long connection during final control diagnosis, check whether solenoid valve opens and closes properly.

If solenoid valve does not open and close:

- Replace intake manifold changeover solenoid valve.

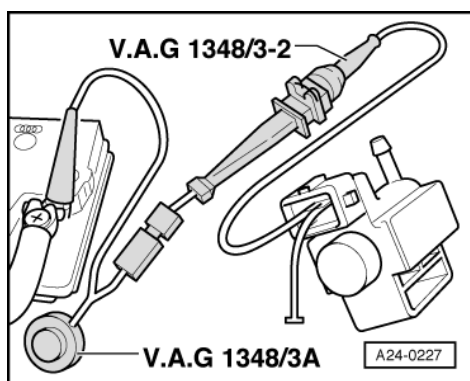
If no faults were found in any of the preceding checks:

- Reinstall intake manifold changeover solenoid valve.
- Check vacuum system for leaks => Page 95 .



Checking vacuum system for leaks

- Allow engine to idle for 2 to 3 minutes to build up vacuum.
- Switch off ignition.
- Unplug connector from intake manifold changeover solenoid valve -N156.
- -> Use test leads and crocodile clamp from V.A.G 1594 to connect one contact of solenoid valve to engine earth.



- -> Connect second contact of solenoid valve with remote control V.A.G 1348/3A, adapter lead V.A.G 1348/3-2 and test lead to positive.
- -> Actuate remote control V.A.G 1348/3A for approx. 2 to 3 minutes, during which period vacuum unit must remain energised.

If vacuum unit does not remain energised, check unit as follows:

- Pull vacuum pipe off vacuum unit for intake manifold changeover.
- Connect vacuum hand pump V.A.G 1390 to vacuum unit.
- Actuate vacuum hand pump and observe changeover.

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- Check vacuum unit for leaks (vacuum unit must not return to initial position until hand pump is vented).

If reading does not match specification:

- Replace vacuum unit.

4 - Checking fuel tank breather system

4.1 - Checking fuel tank breather system

4.2 - Diagnosis of fuel tank breather system

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 5 .
Engine must be idling.

- Engine idling

Note:

After starting engine, it may be necessary to reselect engine control unit with "Address word" 01 and "Start basic setting" with function "04".

-> Display readout:

Basic setting Q
Enter display group number XXX

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

-> Display readout:

System in basic setting 70
1 2 3 4
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- Check specification in display zone 4.

Note:

If test is not started or display switches from "Test ON" to "Test OFF", give brief burst of throttle to repeat test.

	Display zones			
	1	2	3	4
Display group 070: Diagnosis of fuel tank breather valve				
Display	xx %	xx.x %	xx %	---
Readout	Degree of opening of fuel tank breather valve	Lambda control deviation		Diagnosis status
Operating range	0...99 %	-25.0...25.0 %		Test OFF Test ON TEV OK TEV not OK
Specification	0...99 %	-20.0...20.0 %		TEV OK
Note				If "TEV not OK" is displayed: Interrogate fault memory => Page 97

If specification "TEV OK" is obtained:

- Press C key.

If reading does not match "TEV OK" specification: Check activated charcoal filter solenoid valve 1 -N80 => Page 97 .

4.3 - Checking activated charcoal filter solenoid valve 1 -N80

Leak test

Solenoid valve is closed when de-energised.

- Pull hoses off activated charcoal filter solenoid valve 1 -N80.
- Connect test hose to one connection of ACF valve.
- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 5 .
 Engine must be idling.
- Start final control diagnosis and select activated charcoal filter solenoid valve -N80 (fuel tank breather valve) =>Page 19 .

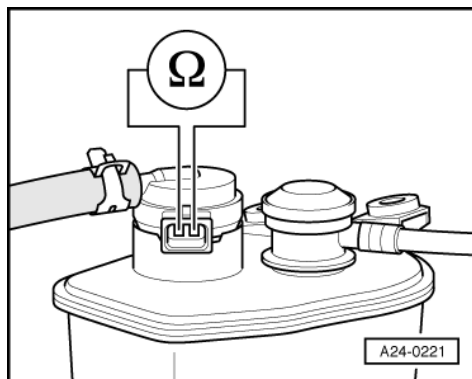
-> Indicated on display:

Final control diagnosis
 Fuel tank breather valve -N80

Solenoid valve must click...

...and must open and close (can be checked by blowing into test hose).

- If valve does not click, perform electrical check on activated charcoal filter solenoid valve 1 => Page 97 .
- If valve does not open and close properly, replace activated charcoal filter solenoid valve 1.



Electrical check on activated charcoal filter solenoid valve -N80

- Unplug connector from activated charcoal filter solenoid valve -N80.
- -> Measure resistance with portable multimeter V.A.G 1526 between contacts of solenoid valve.

Specification: 22...30 ohms

If reading does not match specification:

- Replace activated charcoal filter solenoid valve -N80.

If reading matches specification:

- Check power supply => Page 98 .

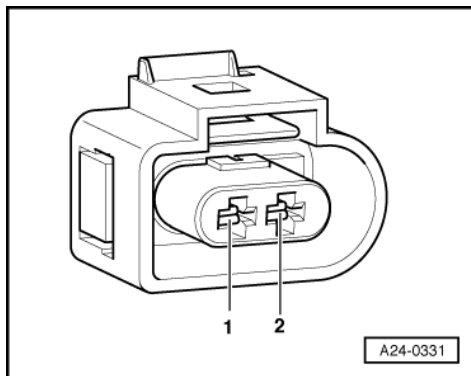
Checking solenoid valve power supply

Note:

Activated charcoal filter solenoid valve is supplied with power by way of fuel pump relay.

Test requirement

- Fuse for activated charcoal filter solenoid valve OK



- Unplug connector from activated charcoal filter solenoid valve -N80.
- -> Connect diode test lamp V.A.G 1527 between socket 1 of connector and engine earth.
- Operate starter.

Diode test lamp must light.

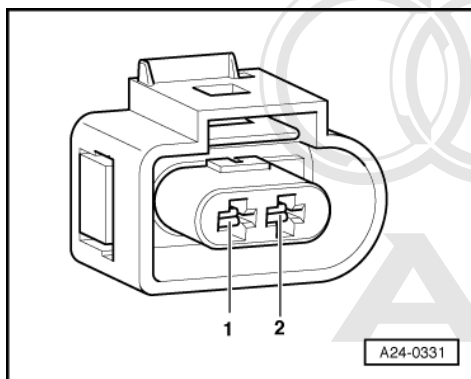
If diode test lamp does not light:

- Check for continuity in wiring from socket 1 via fuse to fuel pump relay and repair if necessary.

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

- If wiring is OK, check fuel pump relay => Page 59 .

If diode test lamp lights, check actuation => Page 98 .



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Checking actuation of activated charcoal filter solenoid valve

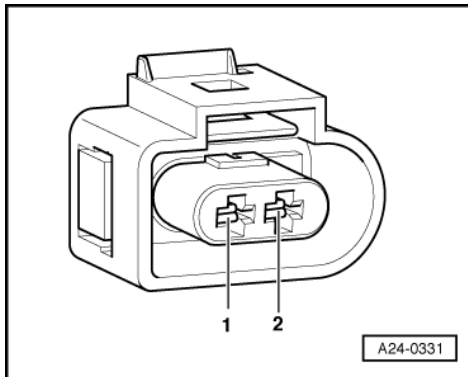
- -> Connect diode test lamp V.A.G 1527 between sockets 1 (positive) and 2 of connector.
- Start final control diagnosis and select activated charcoal filter solenoid valve -N80 =>Page 19 .

Diode test lamp must flash.

If diode test lamp does not flash or if it is permanently lit:

- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page **42** .

If diode test lamp is permanently lit:



- Check for short to earth in following wiring.

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

If diode test lamp does not flash:

- Check for short to positive/open circuit in the following wiring.

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

Resistance: max. 1.5 ohms

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

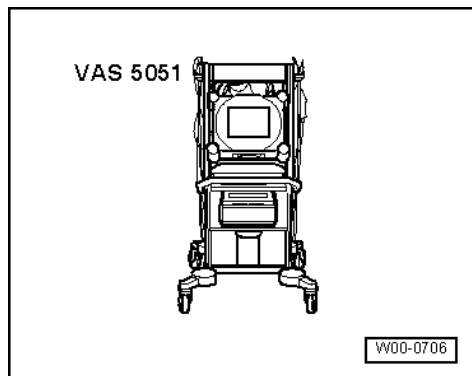
- If necessary, eliminate earth connection/open circuit in wiring.
- If there is neither an open circuit in the wiring nor a short circuit:
- Replace Motronic control unit -J220 => Page **44** .



5 - Checking exhaust gas recirculation system

5.1 - Checking exhaust gas recirculation system

5.2 - Adaption of exhaust gas recirculation valve



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Special tools and workshop equipment required

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

Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 5 .
Ignition must be on.

-> Display readout:

Rapid data transfer HELP
Select function XX

- Enter "04" for "Start basic setting" function and confirm with Q key.

-> Display readout:

Basic setting Q
Enter display group number XXX

- Enter "074" for "Display group number 074" and confirm with Q key.
- Check specification for exhaust gas recirculation valve in display zone 4.

	Display zones			
	1	2	3	4
Display group 074: Adaption of exhaust gas recirculation valve				
Display	x.x V	x.x V	xxx %	---
Readout	Zero position	Max. stop	Duty cycle	Adaption status
Operating range			0...100 %	ADP in progress ADP OK ADP ERROR

Specification	Display zones			
	0...2 V	3.0...5 V	0...100 %	ADP OK
Note	If reading does not match specification, check exhaust gas recirculation valve for dirt and foreign matter			If reading does not match specification: Check exhaust gas recirculation valve => 4-cyl. Engine (5-valve), Mechanics; Repair Group 26

Note on display zone 4:

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

6 - Checking secondary air inlet valve -N112

6.1 - Checking secondary air inlet valve -N112

6.2 - Diagnosis of secondary air system

Sequence of operations

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 5.

-> Display readout:

Rapid data transfer	HELP
Select function XX	

- Enter "04" for "Start basic setting" function and confirm with Q key.
- Lambda control must be active (check in Measured value block 099; Display zone 4; Display "on").

-> Display readout:

Basic setting	Q
Enter display group number XXX	

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

-> Display readout:

System in basic setting 77
1 2 3 4

- Press and hold brake pedal until display in zone 4 switches from "Test OFF" to "Test ON".
- Keep pressing brake pedal until result of diagnosis is displayed in zone 4.

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	Display zones			
	1	2	3	4
Display group 077: Diagnosis of secondary air system				
Display	xxxx rpm	xxx °C		---
Readout	Engine speed	Engine air mass		Diagnosis status
Operating range	0...6500 rpm			Test OFF Test ON SYST. OK SYST. not OK



	Display zones		
Specification	approx. 1400 rpm	1.5...4.0	SYST. OK
Note			If "SYST. not OK" is displayed: Interrogate fault memory => Page 7.

Note:

The test takes approx. 30 seconds. If test cannot be implemented, switch off engine and restart. Secondary air pump must run during test.

If reading matches "SYST. OK" specification:

- Press =>key.

-> Indicated on display (function selection):

Rapid data transfer HELP
Select function XX

If reading does not match "SYST. OK" specification: Check secondary air inlet valve -N112 =>Page 102

6.3 - Checking secondary air inlet valve -N112

Fitting location: Exploded view of fitting locations =>Page 36

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 5.
- Start final control diagnosis and actuate secondary air inlet valve
=> Page 19.

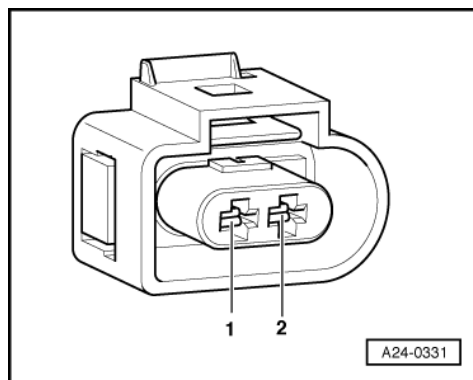
-> Indicated on display:

Final control diagnosis
Secondary air inlet valve -N112

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Secondary air inlet valve must click.

If secondary air inlet valve does not click:



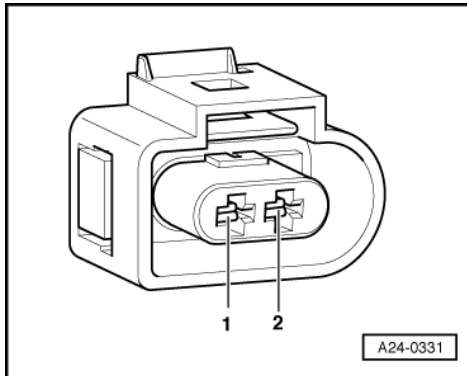
- -> Unplug 2-pin connector from solenoid valve.
- Connect diode test lamp V.A.G 1527 with test leads from V.A.G 1594 to unplugged connector.
- Repeat final control diagnosis again.

If diode test lamp now flashes during final control diagnosis:

- Replace secondary air inlet valve.

If diode test lamp still does not flash:

- Switch off ignition.
- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page 42 .



- Check for open circuit in the following wiring.

2-pin connector at wiring harness, socket	Test box V.A.G 1598/31, socket
2	105

Resistance: max. 1.5 ohms

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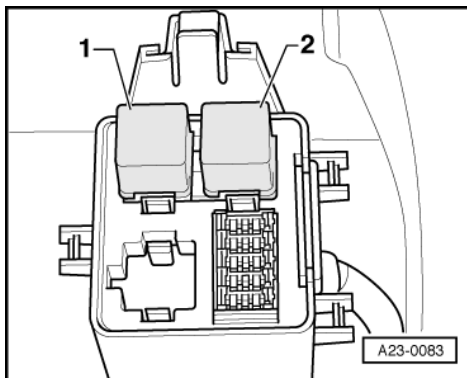
=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

If no fault is found in wiring:

- Use current flow diagram to check power supply for secondary air inlet valve

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

6.4 - Checking secondary air pump relay -J299



-> Fitting location of secondary air pump relay is relay position 1.

Fitting location of secondary air pump motor -V101 is at right longitudinal member.

- Start final control diagnosis and actuate secondary air pump relay -J299 => Page 19 .
 - -> Secondary air pump relay must be energised and secondary air pump motor -V101 must run intermittently

A - If relay does not pick up:

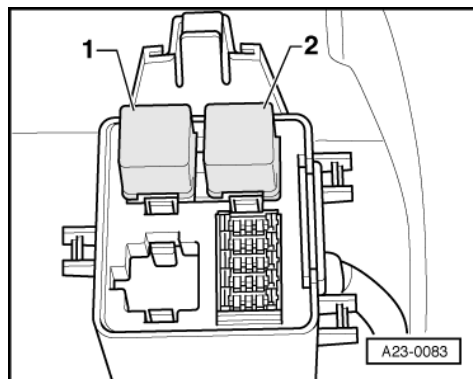
- Check power supply of secondary air pump relay => Page 104 .
- Check actuation of secondary air pump relay => Page 105 .

B - If relay is energised but secondary air pump motor does not run:

- Check power supply for secondary air pump motor => Page 105 .

Checking power supply of secondary air pump relay

- -> Disconnect secondary air pump relay -1-.



- -> Connect up portable multimeter for voltage measurement as follows.

Relay carrier, position 1, contact	Measure to
1	Engine earth

- Specification: approx. battery voltage

If reading does not match specification:

- Perform the following checks marked with a dot.
- Fuses must be OK.
- Check for open circuit in wiring from battery + (terminal 30) to fuse of secondary air pump relay -J299.

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

- -> Connect up portable multimeter for voltage measurement as follows.

Relay carrier, position 1, contact	Measure to
3	Engine earth

- Briefly operate starter.
- Specification: approx. battery voltage

If reading does not match specification:

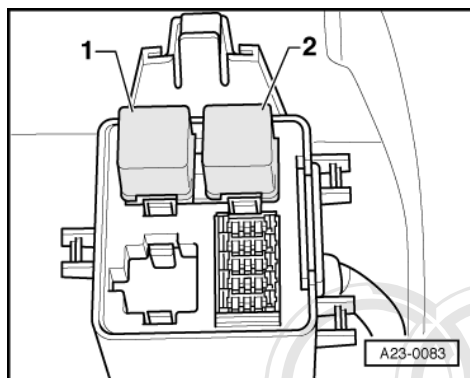
- Perform the following checks marked with a dot.
- Check for open circuit in wiring from secondary air pump relay -J299 via fuse to fuel pump relay.

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Checking actuation of secondary air pump relay

- Switch off ignition.
- -> Disconnect secondary air pump relay -J299.



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

Relay carrier, position 1, contact	Measure to
4	Battery (positive)

- Start final control diagnosis and actuate secondary air pump relay
 -J299 => Page 19 .
- LED must flash

If LED does not flash:

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- Switch off ignition.
- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page 42 .
- -> Check for open circuit and short to earth/positive in the following wiring:

Relay carrier, position 1, contact	Test box V.A.G 1598/31, socket
4	9

- If necessary, eliminate open circuit in wiring/short circuit.

If no fault is found:

- Replace secondary air pump relay -J299.

Checking power supply for secondary air pump motor

- Unplug connector from secondary air pump motor -V101.
- Connect up voltage tester V.A.G 1527 B between contacts 1 and 2.
- Start final control diagnosis and actuate secondary air pump relay
 -J299 => Page 19 .
- LED must light

If LED does not light:

- Perform the following checks marked with a dot.
- Check for open circuit in wiring from connector at motor -V101 to secondary air pump relay -J299.

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



- Check for open circuit in wiring from connector at motor -V101 to earth connection 1 in engine compartment wiring harness.

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

If no fault is found:

- Replace secondary air pump motor -V101.

7 - Checking electronic engine output control (electronic throttle)

7.1 - Checking electronic engine output control (electronic throttle)

7.2 - Function of electronic throttle system

With the electronic throttle system, the throttle valve is not actuated by way of a cable in response to the position of the accelerator pedal. There is no mechanical link between accelerator pedal and throttle valve.

The position of the accelerator pedal is signalled to the engine control unit by two accelerator pedal position senders (variable resistors in a joint housing) which are connected to the accelerator pedal.

The accelerator pedal position (driver input) is one of the main input variables for the engine control unit.

The throttle valve is operated by means of an electric motor (throttle valve actuator) in the throttle valve control part over the entire engine speed and load range.

The throttle valve is operated by the throttle valve actuator as specified by the engine control unit.

With the engine stopped and the ignition switched on, the engine control unit regulates the throttle valve actuator precisely in line with the specifications of the accelerator pedal position sender. In other words, when the accelerator pedal is depressed halfway the throttle valve actuator opens the throttle valve to the same extent and the throttle valve is then roughly half open.

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

It is thus possible, for example, for the throttle valve to be fully open although the accelerator pedal has only been depressed halfway. This has the advantage of avoiding throttling losses at the throttle valve.

Under certain load conditions, this system also results in considerable improvements as regards pollutant emissions and fuel consumption.

It would, however, be inappropriate to think of the electronic throttle system in terms of one or two components. On the contrary, it includes all the units needed to help determine, control and monitor the position of the throttle valve (e.g. accelerator pedal position sender, throttle valve control part, EPC warning lamp, engine control unit...).

7.3 - Checking throttle valve control part -J338

The following components are accommodated in the throttle valve control part housing.
(Housing is not to be opened)

- Throttle valve drive -G186 (this is an electric motor actuated by the engine control unit which opens the throttle valve by overcoming a spring force).
- Throttle valve drive angle sender 1 -G187

- Throttle valve drive angle sender 2 -G188

Note:

The angle senders take the form of potentiometers (variable resistors). They both provide the engine control unit with an independent indication of the throttle valve position (redundant feature).

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

7.4 - Adaption of throttle valve control part

In the adaption process, the engine control unit learns various throttle valve positions with the ignition switched on and the engine stopped. These positions are stored in the control unit. Feedback on the position of the throttle valve is provided by the two throttle valve drive angle senders.

Adaption must always be performed if the throttle valve control part -J338 or engine control unit is removed and installed/replaced or if the engine control unit power supply is interrupted.

Adaption is implemented:

- ◆ By initiating basic setting function (04), display group 60 with ignition on.
- ◆ Automatically if ignition is switched on for at least approx. 6 seconds without actuating starter and accelerator pedal and engine control unit recognises that "learning is required" (it is however not possible to see whether or not adaption has been performed successfully). "Learning required" is recognised if stored voltage values from the angle senders do not coincide with currently measured voltage values within a certain tolerance range.

Test requirements

- No faults stored in fault memory => Page 7 , Interrogating fault memory
- Accelerator pedal not pressed
- Coolant temperature greater than 5°C but less than 100°C
- Intake-air temperature greater than 5°C
- Supply voltage for engine control unit greater than 11 V; checking
=>Page 63
- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 5 .

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

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

-> Indicated on display:

Basic setting	Q	
Enter display group number		xxx

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

-> Indicated on display:

System in basic setting 60			
1	2	3	4

After pressing Q key, throttle valve actuator is initially de-energised.

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



The throttle valve is then opened a certain amount. Once this value is attained, the throttle valve actuator is de-energised again. The mechanical spring then has to close the throttle valve within a certain period to the previously learnt emergency running position (spring test).

The throttle valve is then closed by the throttle valve actuator; the values provided by the angle senders in the throttle valve control part are stored in the engine control unit.

De-energisation of the throttle valve actuator by the engine control unit whilst driving becomes apparent in the form of a higher uneven idling speed. Acceleration is only transmitted to the engine after a long delay.

- Check specification for throttle valve control part (display zone 3).

	Display zones			
	1	2	3	4
Display group 60: Adaption of throttle valve control part with ignition on				
Display	x.x %	x.x %	---	---
Readout	Throttle valve angle (angle sender 1)	Throttle valve angle (angle sender 2)	Adaption step counter	Adaption status
Operating range	min.: 0 % max.: 100 %	min.: 0 % max.: 100 %	0 to 8	ADP in progress ADP OK ADP ERROR
Specification	xxx %	xxx %	During adaption, step counter must be incremented from 0 to 8 (figures may also be omitted)	ADP in progress
Note			If reading does not match specification: Notes => Page 108 .	

- Check specification for throttle valve control part (display zone 4).

	Display zones			
	1	2	3	4
Display group 60: Adaption of throttle valve control part with ignition on				
Display	x.x %	x.x %	---	---
Readout	Throttle valve angle (angle sender 1)	Throttle valve angle (angle sender 2)	Adaption step counter	Adaption status
Operating range	min.: 0 % max.: 100 %	min.: 0 % max.: 100 %	0 to 8	ADP in progress ADP OK ADP ERROR
Specification	xxx %	xxx %	8	ADP OK
Note			If reading does not match specification: Notes => Page 108	

Note:

Termination of adaption process by control unit may be due to the following:

- ♦ Throttle valve cannot be completely closed (e.g. dirty)
- ♦ Battery voltage too low
- ♦ Fault in throttle valve control part or wiring
- ♦ Engine started during adaption process or accelerator pedal pressed
- ♦ Throttle valve housing strained (check bolted joint)

Following termination, tester displays "Function unknown or cannot be implemented at present". Adaption is restarted automatically when ignition is next switched on (several seconds).

- Conclude basic setting of engine by pressing⇒ key.
- Press keys 0 and 6 for "End data transfer" function and confirm entry with Q key.

7.5 - Checking throttle valve drive angle senders 1 and 2 -G187 and -G188

The throttle valve drive angle senders 1 and 2 -G187 and -G188 provide the engine control unit with information on the position of the throttle valve. Both angle senders are located in the throttle valve control part.

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 5.

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

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

-> Indicated on display:

Read measured value block	Q
Enter display group number	xxx

- Press keys 0, 6 and 2 for "Display group number 62" and confirm entry with Q key.

-> Indicated on display:

Read measured value block 62
1 2 3 4

- Check specifications for electronic throttle system potentiometer voltages.

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	Display zones			
	1	2	3	4
Display group 62: Electronic throttle system potentiometer voltages with ignition on				
Display	xx %	xx %	xx %	xx %
Readout	Throttle valve angle (angle sender 1)	Throttle valve angle (angle sender 2)	Accelerator pedal position sender	Accelerator pedal position sender 2
Operating range	min.: 0 % max.: 100 %	min.: 0 % max.: 100 %	min.: 0 % max.: 100 %	min.: 0 % max.: 100 %
Specification	3...93 %	97...3 %	12...97 %	4...94 %

Note:

The engine control unit converts the angle sender voltage values into percentages referenced to 5 V and displays the percentage values (5 V supply voltage corresponds to 100 %).

- Observe display zones 1 and 2.
- Slowly floor accelerator pedal.

The percentage value displayed in zone 1 must increase steadily. The tolerance range 3...93 % is not fully utilised.

The percentage value displayed in zone 2 must decrease steadily. The tolerance range 97...3 % is not fully utilised.



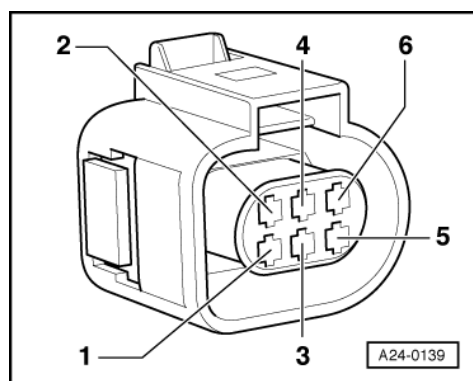
If displays are not as described:

- Check power supply and wiring of throttle valve control part =>Page 110 . Pay particular attention to the possibility of connectors being unplugged or corroded.
- Check accelerator pedal position senders =>Page 113 .

Notes:

- ♦ The reason for the display in zone 1 increasing, whereas the display in zone 2 decreases, is that the potentiometers (angle senders) in the throttle valve control part operate in opposite directions.
- ♦ In other words, the voltage tap value of angle sender 1 moves towards 5 V (the further the throttle valve is opened, the greater the voltage becomes; the percentage reading increases).
- ♦ The voltage tap value of angle sender 2 moves away from 5 V towards 0 V (the further the throttle valve is opened, the lower the voltage becomes; the percentage reading decreases).

Checking power supply of throttle valve control part



- Unplug connector of throttle valve control part.
- Switch on ignition.
- -> Connect portable multimeter for voltage measurement to the following connector sockets:

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

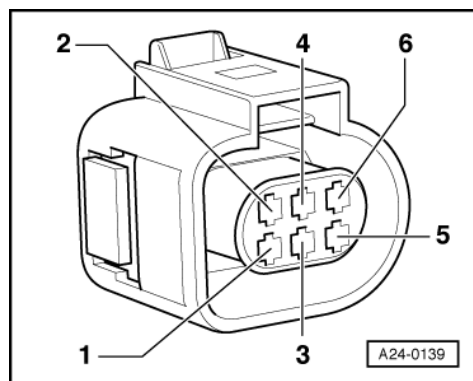
If readings do not match specifications, check wiring between engine control unit and throttle valve control part
=> Page 110 .

If readings match specifications, additionally check signal wires and actuation wires of throttle valve actuator
=> Page 110 .

Checking power, signal and actuation wiring

- Unplug connector of throttle valve control part.
- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page 42 .

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Check for short to positive/earth and open circuit in the following wiring.

6-pin connector at wiring harness, socket	Test box V.A.G 1598/31, socket
1	92
2	83
3	117
4	84
5	118
6	91

Resistance: max. 1.5 ohms

- If necessary, eliminate open circuit in wiring/short circuit.

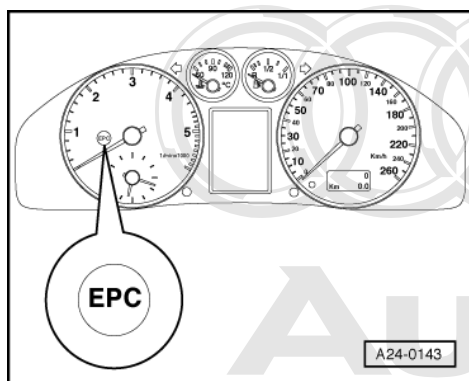
=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

If no fault is found in wiring:

- Replace throttle valve control part.

7.6 - Significance of EPC warning lamp (electric throttle control fault lamp -K132)

"EPC" is the abbreviation for Electronic Power Control, in other words electronic engine output control (electronic throttle).



-> Fitting location of EPC warning lamp

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After starting engine, engine control unit checks all components of relevance to operation of electronic throttle system.

During this component check, the engine control unit switches on the EPC lamp for approx. 3 seconds. The lamp lights continuously if a fault is already established in the course of this check.

If faults in the electronic throttle system are detected during engine operation, the engine control unit activates the EPC lamp (these faults are marked in the fault table). At the same time, an entry is made in the engine control unit fault memory.

Checking operation of warning lamp

- Start engine.



Specification: EPC warning lamp must light for approx. 3 seconds after starting engine if there is no fault relating to the electronic throttle system stored in the fault memory.

If EPC warning lamp does not light:

- Check wiring between engine control unit and EPC warning lamp in dash panel insert.

If EPC warning lamp lights for more than 3 seconds (or if it is permanently lit), check for short to earth in wiring =>Page **112** .

Checking wiring between engine control unit and EPC warning lamp in dash panel insert

- Switch off ignition.
- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page **42** .
- Jumper sockets 1 and 48 at test box with test leads from V.A.G 1594.
- Switch on ignition.

EPC warning lamp must light.

If EPC warning lamp does not light:

- Check EPC warning lamp in dash panel insert (fused?)/use current flow diagram to check warning lamp power supply.

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

If warning lamp and warning lamp power supply are OK, use current flow diagram to check wiring to dash panel insert.

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

If no fault is found in wiring:

- Replace engine control unit => Page **44** .

Checking for short to earth in wiring

- Start engine and let it idle.

Specification: **EPC warning lamp must go out**
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If EPC warning lamp does not go out:

- Interrogate engine control unit fault memory.

If there is no fault stored:

- Switch off ignition.
- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page **42** .

Check for short to earth in the following wiring.

Test box V.A.G 1598/31, socket	Dash panel insert, contact
48	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

Specification: infinity ohms (no continuity)

If reading does not match specification:

- Use current flow diagram to eliminate short to earth in wiring between engine control unit and EPC warning lamp.

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

If no fault is found in wiring:

- Replace engine control unit => Page 44 .

8 - Checking accelerator pedal position sender -G79 and -G185

8.1 - Checking accelerator pedal position sender -G79 and -G185

The two senders -G79 and -G185 are located at the accelerator pedal and each sender relays the driver input separately to the engine control unit. Both senders are accommodated in a joint housing.

- Connect vehicle diagnostic testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 5 .
Ignition must be on.

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

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

-> Indicated on display:

Read measured value block	Q
Enter display group number	xxx

- Press keys 0, 6 and 2 for "Display group number 62" and confirm entry with Q key.

-> Indicated on display:

Read measured value block 62			
1	2	3	4

- Check specifications for electronic throttle system potentiometer voltages.

	Display zones			
	1	2	3	4
Display group 62: Electronic throttle system potentiometer voltages with ignition on				
Display	xx %	xx %	xx %	xx %
Readout	Throttle valve angle (angle sender 1)	Throttle valve angle (angle sender 2)	Accelerator pedal position sender	Accelerator pedal position sender 2
Operating range	min.: 0 % max.: 100 %	min.: 0 % max.: 100 %	min.: 0 % max.: 100 %	min.: 0 % max.: 100 %
Specification	3...93 %	97...3 %	12...97 %	4...49 %

Note:

The engine control unit converts the angle sender voltage values into percentages referenced to 5 V and displays the percentage values (5 V supply voltage corresponds to 100 %).

- Observe display zones 3 and 4.



- Slowly floor accelerator pedal.

The percentage value displayed in zone 3 must increase steadily. The tolerance range 12...97 % is not fully utilised.

The percentage value displayed in zone 4 must likewise increase steadily. The tolerance range 4...49 % is not fully utilised.

Note:

The value displayed in zone 3 must always be roughly twice that in display zone 4.

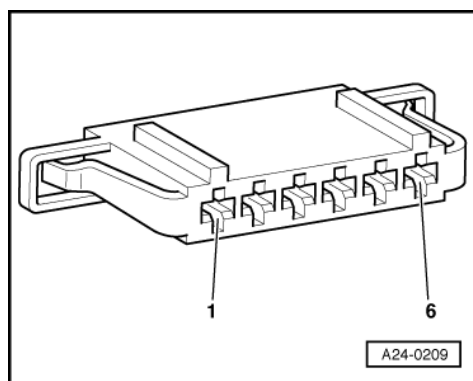
If displays are not as described:

- Check power supply and wiring of accelerator pedal position senders =>Page 114 .

Checking power supply of accelerator pedal position senders

- Unplug accelerator pedal position sender connector.

Note:



Connector is clipped in at pedal bracket next to brake light switch.

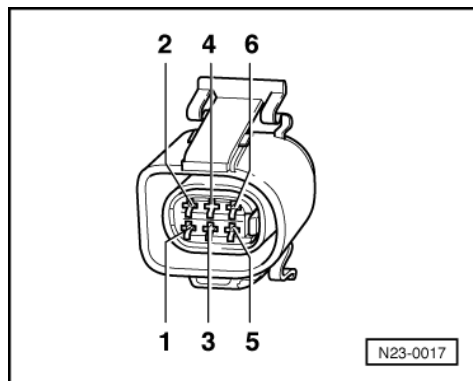
Left-hand drive vehicles:

- Switch on ignition.
- -> Connect portable multimeter for voltage measurement to the following connector sockets:

6-pin connector at wiring harness, socket	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:

- Switch on ignition.



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- -> Connect portable multimeter for voltage measurement to the following connector sockets:

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

All models:

If readings match specifications:

- Additionally check signal wires => Page 115 .

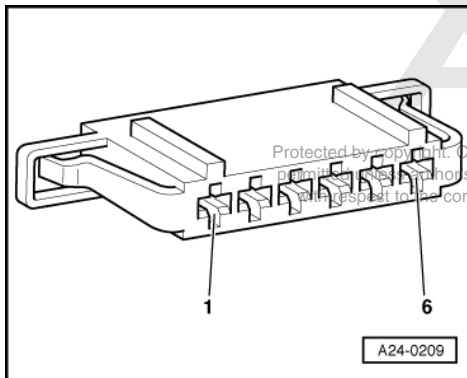
If readings do not match specifications:

- Check wiring between engine control unit and accelerator pedal position senders => Page 115 .

Checking signal wires and wiring between accelerator pedal position senders and engine control unit

- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page 42 .

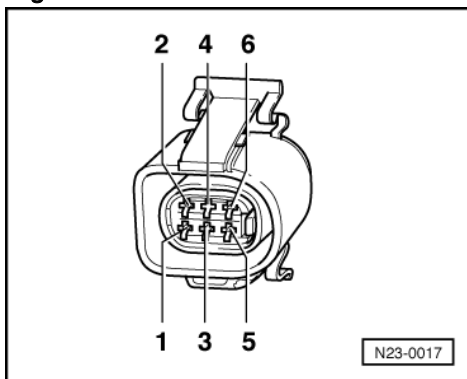
Left-hand drive vehicles:



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

Connector, socket	Test box V.A.G 1598/31, socket
1	72
2	73
3	36
4 (signal wire)	35
5	33
6 (signal wire)	34

Right-hand drive vehicles:



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

Connector, socket	Test box V.A.G 1598/31, socket
1 (signal wire)	35
2	73
3	36
4	33
5	72
6 (signal wire)	34

All models:

- If necessary, eliminate open circuit in wiring/short circuit.

If no fault is found in wiring:

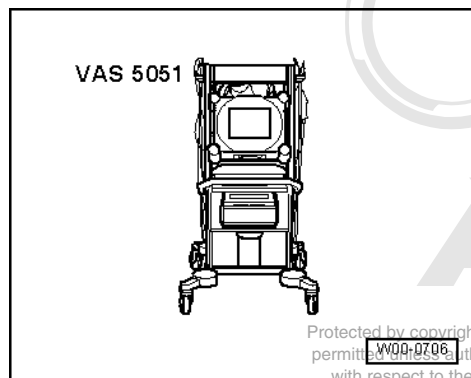
- Replace accelerator pedal position senders.

=> Fuel Supply System - Petrol Engines; Repair Group 20; Servicing Accelerator Mechanism - Right-hand drive vehicles
Servicing Accelerator Mechanism - Right-hand drive vehicles

8.2 - Learning kickdown function

If accelerator pedal position sender or engine control unit is replaced, kickdown function must be learnt on vehicles with automatic gearbox.

Special tools and workshop equipment required



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

Requirements:

- No fault stored in fault memory; Interrogating fault memory
=> Page 7
- Engine stopped, ignition on

Sequence of operations

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 5.

Ignition must be on.

-> Display readout:

Rapid data transfer HELP
Select function XX

- Enter "04" for "Start basic setting" function and confirm with Q key.

-> Display readout:

Basic setting Q
Enter display group number XXX

- Enter "063" for "Display group number 063" and confirm with Q key.

-> Display readout:

System in basic setting 63
1 2 3 4

Note:

Tester now displays prompt e.g. "Press and hold pedal".

- Floor accelerator pedal beyond kickdown point and keep it pressed.

Tester displays "ADP in progress" during learning phase.

Note:

The abbreviation "ADP" stands for Adaption.

Once kick-down point has been successfully learnt, tester displays "ADP OK" and accelerator pedal can be released.

If specification "ADP OK" is obtained:

- Press =>key.

-> Indicated on display (function selection):

Rapid data transfer HELP
Select function XX

If "ERROR" is displayed:

- Interrogate fault memory =>Page 7.

"ERROR" may be displayed, for example, if - following tester prompt - accelerator pedal is not floored immediately or if accelerator pedal is released with adaption already in progress but not yet completed. In both cases exit from "Basic setting" mode and restart adaption function => Page 116.

8.3 - Check brake light switch -F and brake pedal switch -F47

As the injection system operates with an accelerator pedal sender (potentiometer), which could be defective, engine-speed regulation is effected for safety reasons when brake is pressed. The control unit requires the brake-light switch and brake-pedal switch signals for this purpose. In other words, if the brake is actuated with the accelerator pedal constantly pressed, the engine speed is immediately regulated to idling speed. Inaccurate switch settings can lead to unintentional speed regulation.

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 5.



Ignition must be on.

-> Indicated on display:

Rapid data transfer HELP
Select function XX

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

-> Indicated on display:

Read measured value block
Enter display group number XXX

- Press keys 0, 6 and 6 for "Display group number 66" and confirm entry with Q key.

-> Indicated on display:

Read measured value block 66
1 2 3 4

- Observe readout in display zone 2.

	Display zones			
	1	2	3	4
Display group 66: Signals to engine control unit				
Display	xxx km/h	0 0 0 0	xxx km/h	0 0 0 0
Readout	Vehicle speed (ACTUAL)	Switch positions	Vehicle speed (SPECIFIED)	Switch positions for cruise control system
Operating range		Off = 0 On = 1		Off = 0 On = 1
Specification		0 0 0 0		
Note		Significance of digits => Page 118		

- Press brake pedal.

Significance of 4-digit display in zone 2:

x	x	x	x	Display zone 2
			X	Brake light switch 0 = Brake pedal not pressed 1 = Brake pedal pressed
		X		Brake pedal switch 0 = Brake pedal not pressed 1 = Brake pedal pressed
	X			Clutch pedal switch 0 = Clutch pedal not pressed 1 = Clutch pedal pressed
X				Cruise control system (CCS) 0 = CCS disabled 1 = CCS released

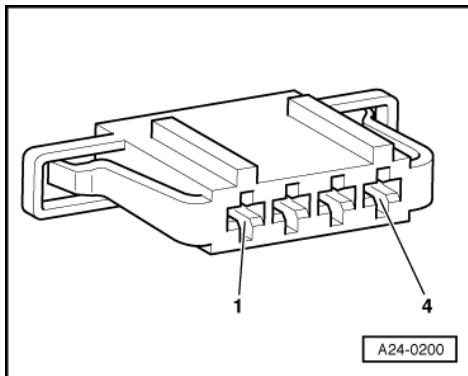
	Display zones			
	1	2	3	4
Display group 66: Signals to engine control unit				
Display	xxx km/h	0 0 1 1	xxx km/h	0 0 0 0

Readout	Display zones			
	Vehicle speed (ACTUAL)	Switch positions	Vehicle speed (SPECIFIED)	Switch positions for cruise control system
Operating range		Off = 0 On = 1		Off = 0 On = 1
Specification		0 0 1 1		
Note		Both displays must switch from 0 to 1		

- Allow brake pedal to slowly return to rest position.
- Both displays must switch back from 1 to 0.

If one or both of the displays does/do not switch from 0 to 1, check power supply => Page 119 .

Checking power supply



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- -> Connect portable multimeter for voltage measurement to the following connector sockets:
- Switch off ignition.

4-pin connector at wiring harness, socket	Specification
1 + earth	Battery voltage

- Switch on ignition.

4-pin connector at wiring harness, socket	Specification
2 + earth	Battery voltage

If readings match specifications:

- Check wiring => Page 119 .

If readings do not match specifications:

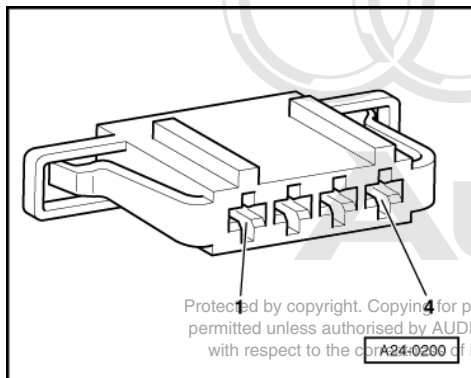
- Check for open circuit/short to earth in wiring from sockets 1 and 2 of connector.

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

- If necessary, eliminate open circuit in wiring/short circuit.

Checking wiring

- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page 42 .



Check for short to positive/earth and open circuit in the following wiring.

4-pin connector at wiring harness, socket	Test box V.A.G 1598/31, socket
4	56
3	55

Resistance: max. 1.5 ohms

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

- If necessary, eliminate open circuit in wiring/short circuit.

If no open circuit is found in wiring:

- Replace brake light switch/brake pedal switch.

8.4 - Checking clutch pedal switch -F36

This signal prevents engine speed overshoots and load change jolts on disengaging clutch and is required for the cruise control system.

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 5 .
Ignition must be on.

-> Indicated on display:

Rapid data transfer HELP
Select function XX

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

-> Indicated on display:

Read measured value block
Enter display group number XXX

- Press keys 0, 6 and 6 for "Display group number 66" and confirm entry with Q key.

-> Indicated on display:

Read measured value block 66
1 2 3 4

- Observe readout in display zone 2.

	Display zones			
	1	2	3	4
Display group 66: Signals to engine control unit				
Display	xxx km/h	0 0 0 0	xxx km/h	0 0 0 0
Readout	Vehicle speed (ACTUAL)	Switch positions	Vehicle speed (SPECIFIED)	Switch positions for cruise control system
Operating range		Off = 0 On = 1		Off = 0 On = 1
Specification		0 0 0 0		
Note		Significance of digits => Page 121		

- Press clutch pedal.

Significance of 4-digit display in zone 2:

x	x	x	x	Display zone 2
			X	Brake light switch 0 = Brake pedal not pressed 1 = Brake pedal pressed
		X		Brake pedal switch 0 = Brake pedal not pressed 1 = Brake pedal pressed
	X			Clutch pedal switch 0 = Clutch pedal not pressed 1 = Clutch pedal pressed
X				Cruise control system (CCS) 0 = CCS disabled 1 = CCS released

	Display zones			
	1	2	3	4
Display group 66: Signals to engine control unit				
Display	xxx rpm	0 1 0 0	xxx km/h	0 0 0 0
Readout	Engine speed - ACTUAL (actual engine speed)	Switch positions		Switch positions for cruise control system
Operating range		Off = 0 On = 1		Off = 0 On = 1
Specification		0 1 0 0		
Note		Display must switch from 0 to 1		

- Allow clutch pedal to slowly return to rest position.
- Display must switch back from 1 to 0.

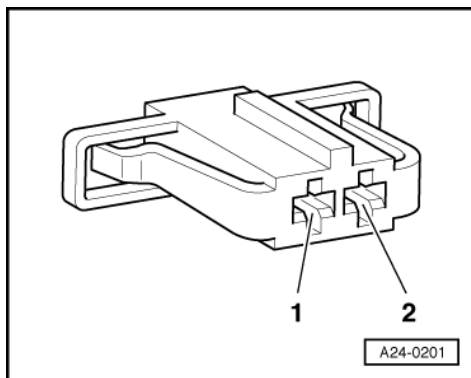
If display does not switch from 0 to 1:

- Check power supply => Page 122

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Checking power supply



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

2-pin connector at wiring harness, socket	Measure to
1	Body earth

- Switch on ignition.
- LED must light

If LED does not light:

- Check for open circuit/short to earth in wiring from contact 1 of connector via fuse to fuel pump relay.

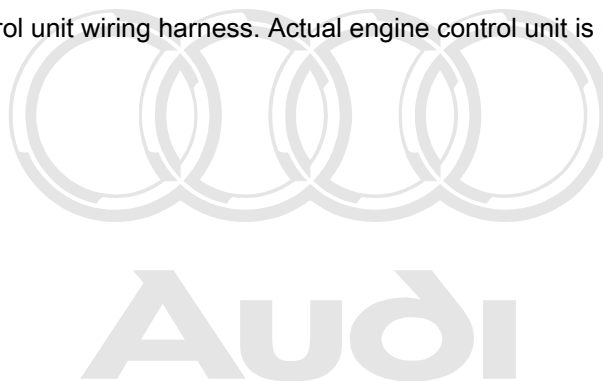
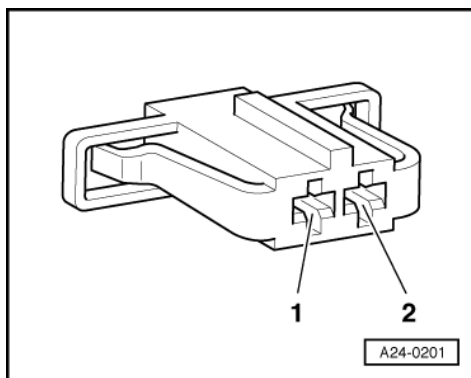
=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

If LED lights:

- Check wiring => Page 122 .

Checking wiring

- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page 42 .



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Check for short to positive/earth and open circuit in the following wiring.

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

Resistance: max. 1.5 ohms

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

- If necessary, eliminate open circuit in wiring/short circuit.

If no open circuit is found in wiring:

- Replace clutch pedal switch.

9 - Checking additional signals

9.1 - Checking additional signals

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9.2 - Checking engine-speed signal

Note:

The signal is generated by the engine-speed sender -G28, conditioned in the engine control unit and relayed from contact 37 of the engine control unit to various electronic systems (e.g. control unit for air conditioner, automatic gearbox and ABS / EDL). The engine-speed signal and the wiring are monitored by these systems.

Determine engine speed as follows:

- Use "Automatic test sequence" to check all control units for absence of engine-speed signal.
- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 5 .
Ignition must be on.
- Press key 1 for "Rapid data transfer".

-> Indicated on display:

Rapid data transfer	HELP
Enter address word XX	

- Press 0 key twice for "Automatic test sequence" function and confirm entry with Q key.

There must not be any "absence of engine-speed signal" fault stored in the control unit.

If any of the control units displays a fault:

- Determine open circuit/short circuit in wiring between engine control unit and corresponding control unit.

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

9.3 - Checking fuel consumption signal

This signal is required for the fuel consumption indicator in the dash panel insert.

If incorrect fuel consumption is displayed in dash panel insert:

- Adapt fuel consumption indicator to actual consumption.

=> Electrical System; Repair Group 01; Self-diagnosis of dash panel insert; Adaption Self-diagnosis of dash panel insert Adaption



If no fuel consumption is displayed in dash panel insert:

- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page 42 .

Check for short to positive/earth and open circuit in the following wiring.

Test box V.A.G 1598/31, socket	Dash panel insert, contact
81	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

Resistance: max. 1.5 ohms

- If necessary, eliminate open circuit in wiring/short circuit.

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

9.4 - Checking vehicle speed signal

Notes:

- ♦ The vehicle speed signal is generated by the road speed sender -G68 (at the gearbox) and conditioned in the dash panel insert.
- ♦ The conditioned signal is received at contact 54 of the engine control unit, where it is used for idling speed stabilisation and damping of load change jolts on shifting gear.
- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 5 .
Ignition must be on.

-> Indicated on display:

Rapid data transfer HELP
Select function XX

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

-> Indicated on display:

Read measured value block
Enter display group number XXX

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

-> Indicated on display:

Read measured value block 5
1 2 3 4

- Run a test drive.

Attention:

Attach fault reader to rear seat and operate it from there. Pay attention to safety precautions => Page 34 .

- Check vehicle speed specification.

	Display zones			
	1	2	3	4
Display group 5: Vehicle speed				

	Display zones			
Display	xxxx rpm	x.xx %	xxx km/h	Text
Readout	Engine speed - AC-TUAL (in increments of 40)	Engine load	Vehicle speed	Operating status
Operating range	min.: 660 rpm max.: 6800 rpm	min.: 0 % max.: 120 %	min.: 0 km/h max.: 250 km/h	Idle, part throttle, full throttle, overrun shut-off, acceleration enrichment
Specification	xxxx rpm	xxx %	Current vehicle speed	---
Note			Roughly the current vehicle speed must be displayed (approx. comparison with speedometer). If reading does not match specification, check wiring=>Page 125	

If vehicle speed is not displayed:

- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page 42 .

Check for short to positive/earth and open circuit in the following wiring.

Test box V.A.G 1598/31, socket	Dash panel insert, contact
54	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

Resistance: max. 1.5 ohms

- If necessary, eliminate open circuit in wiring/short circuit.

If no fault is found in wiring:

- Identify all components making use of vehicle speed signal (e.g. radio, automatic gearbox, air conditioner), consecutively disconnect them from dash panel insert and repeat test until cause has been established.

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9.5 - Checking crash signal

In the event of an accident (crash) resulting in triggering of the belt tensioners/airbag, the engine control unit deactivates the fuel pump relay, thus preventing excessive fuel spillage should the fuel system be damaged.

As long as the fault "Crash deactivation triggered" is stored in the engine control unit/has not been erased, fuel pump supply is disabled with ignition ON (no supply pressure is generated in the fuel system). This may result in delayed starting of the engine.

- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page 42 .

Check for short to positive/earth and open circuit in the following wiring.

Test box V.A.G 1598/31, socket	Airbag control unit, contact
67	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder



Resistance: max. 1.5 ohms

- If necessary, eliminate open circuit in wiring/short circuit.

If no fault is found in wiring:

- Interrogate fault memory of airbag control unit.

9.6 - Checking air conditioner compressor shutoff

Notes:

- ♦ The air conditioner compressor signal provides the engine control unit with the information that the compressor is to be switched on in 140 ms.
- ♦ The engine control unit can use the same wire to shut off the air conditioner compressor.
- ♦ The air conditioner compressor is shut off by the engine control unit:
 - On accelerating rapidly (full throttle in 1st gear)
 - In emergency running mode (limp-home)
 - If coolant temperature exceeds 120°C
 - In conjunction with gearbox control unit (kickdown switch)
 - After starting basic setting (function 04)

Test requirements

- Air conditioner operation OK
- No faults stored in engine control unit fault memory
- Passenger compartment temperature greater than +15 °C

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 5 .

-> Indicated on display:

Rapid data transfer HELP
Select function XX

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

-> Indicated on display:

Read measured value block
Enter display group number XXX

- Press keys 0, 5 and 0 for "Display group number 50" and confirm entry with Q key.

-> Indicated on display:

Read measured value block 50
1 2 3 4

- Check compressor shutoff in display zone 4.

	Display zones			
	1	2	3	4
Display group 50: Signals to engine control unit				
Display	xxx rpm	xxx rpm	A/C Low	Compr. OFF
Readout	Engine speed - ACTUAL (actual engine speed)	Engine speed - SPECIFIED (theoretical engine speed)	Air conditioner requirement	Air conditioner compressor status

	Display zones			
Operating range			A/C Low A/C High	Compr. OFF Compr. ON
Specification			A/C Low	Compr. OFF Compressor OFF

- Switch on air conditioner with "Auto" button. Compressor must run (display zone 4).
- Set air conditioner to maximum cooling/ heating (display zone 3).

	Display zones			
	1	2	3	4
Display group 50: Signals to engine control unit				
Display	xxx rpm	xxx rpm	A/C High	Compr. ON
Readout	Engine speed - ACTUAL (actual engine speed)	Engine speed - SPECIFIED (theoretical engine speed)	Air conditioner requirement	Air conditioner compressor status
Operating range			A/C Low A/C High	Compr. OFF Compr. ON
Specification			A/C High	Compr. ON Compressor ON

- Abruptly floor accelerator pedal and release it again (brief burst of throttle).
- Specification in display zone 4: Display switches for several seconds from "Compr. ON" to "Compr. OFF" (compressor shut-off on vehicle acceleration)

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If display in zone 4 is not as described

- Switch off ignition.
- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page 42 .

Check for short to positive/earth and open circuit in the following wiring.

Test box V.A.G 1598/31, socket	Air conditioner, contact
41	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

Resistance: max. 1.5 ohms

- If necessary, eliminate open circuit in wiring/short circuit.
- If there is no fault in the wiring, check operation of air conditioner.

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

9.7 - Checking data exchange between engine, ABS, EDL and gearbox control units

Notes:

- ◆ Data is exchanged between the individual control units by means of a bus system.
- ◆ Bus is the term used to describe a data transfer and distribution system.
- ◆ The wires between the control units along which data is transmitted are referred to as signal wires.
- ◆ Data is transmitted serially along these signal wires to the connected control units (e.g. engine speed, accelerator pedal position).



Checking data wire between engine and gearbox control units

- Interrogate fault memory of gearbox control unit.

=> Automatic Gearbox; Repair Group 01; Performing self-diagnosis Performing self-diagnosis

If a fault relating to "Data bus..." or "...communication" is displayed:

- Check whether vehicle has been fitted with correct engine/ gearbox control unit. If correct control units have been fitted:
- Connect up test box V.A.G. 1598/31 at wiring harness to engine control unit => Page 42 .

Check for short to positive/earth and open circuit in the following wiring.

Test box V.A.G 1598/31, socket	Automatic gearbox control unit, contact
58	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder
60	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

- If necessary, eliminate open circuit in wiring/short circuit.
- If wiring is OK, try replacing gearbox control unit or engine control unit.

9.8 - Checking wire for fuel tank level signal

Notes:

- ♦ The fuel tank level signal is supplied to the engine control unit by the dash panel insert.
- ♦ The conditioned signal is received at contact 30 of the engine control unit and used to establish the cause of certain faults detected (e.g. misfiring).
- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page 42 .
- Check for open circuit and short to earth/positive in the following wiring:

Test box V.A.G 1598/31, socket	Dash panel insert, contact
30	=> "Current Flow Diagrams, Electrical Fault-finding and Fitting Locations" binder

- If necessary, eliminate open circuit in wiring/short circuit.

9.9 - Checking power-assisted steering pressure switch -F88

Special tools and workshop equipment required

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- 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 power-assisted steering pressure switch is used for idling speed stabilisation on full left or right steering lock.

Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 5 .
Engine must be idling.

-> Display readout:

Rapid data transfer HELP
Select function XX

- Enter "08" for "Read measured value block" function and confirm with Q key.

-> Display readout:

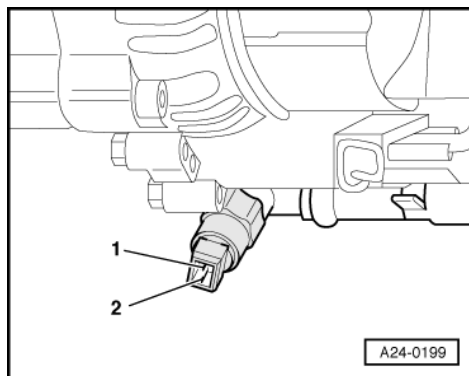
Read measured value block Q
Enter display group number XXX

- Enter "056" for "Display group number 056" and confirm with Q key.
- Check power-assisted steering pressure switch in display zone 4.

	Display zones			
	1	2	3	4
Display group 056: Idling speed stabilisation at operating temperature				
Display	xxx rpm	xxx rpm	x.x %	X X X X X
Readout	Engine speed (actual)	Engine speed (specified)	Idling speed control Torque change	Operating states
Operating range				0XXXX 1XXXX
Specification				0XXXX (with wheels straight ahead or slight steering angle)
				1XXXX (full steering lock or rapid movement of steering wheel)
Note				Value: X = No significance If display is not as described => Page 129

Checking switch

- Pull connector off power-assisted steering pressure switch -F88 at power steering pump.





- -> Connect multimeter to measure resistance on switch.
- Start engine.
 - Specification: $\infty \omega$ (no continuity)
- Apply full right/left steering lock.
 - Specification: approx. 0ω

If display does not change:

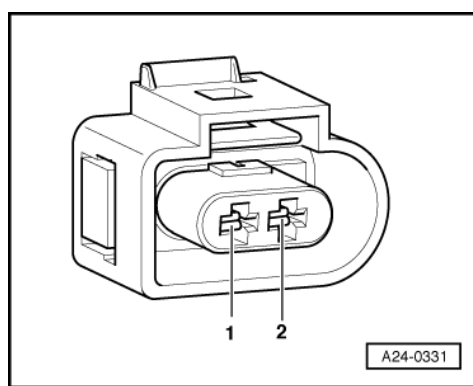
- Replace power-assisted steering pressure switch -F88.

If display changes:

- Check wiring => Page 130 .

Checking wiring

- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page 42 .



- -> Check for open circuit and short to earth/positive in the following wiring.

Connector, contact	Test box V.A.G 1598/31, socket
1	49
2	50

- If necessary, eliminate open circuit in wiring/short circuit.



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28 - Ignition system

1 - Checking ignition system

1.1 - Checking ignition system

1.2 - General notes on ignition system

- ◆ The engine control unit features self-diagnosis.
- ◆ A voltage of at least 11.5 V is required for proper operation of electrical components.
- ◆ Certain tests may lead to a fault being detected by the control unit and stored. The fault memory is therefore to be interrogated and if necessary erased on completion of all tests and repair work.
- ◆ If engine only starts briefly and then cuts out again after component fault-finding, repair or testing, this may be due to disabling of the engine control unit by the immobilizer. If this is the case, fault memory must be interrogated and control unit adapted if necessary.

1.3 - Safety precautions

Heed the following so as to avoid possible injury and/or the destruction of the injection and ignition system:

- ◆ Never touch/disconnect ignition cables with engine running or at cranking speed.
- ◆ Always switch off ignition before disconnecting and connecting battery so as not to damage engine control unit.
- ◆ Always switch off ignition before disconnecting and connecting injection and ignition system wires (also applies to measuring instrument leads).
- ◆ If engine is to be operated at cranking speed without it starting (e.g. compression test), unplug connectors from output stages for ignition coils and from injectors. Interrogate and erase fault memory on completion of work.
- ◆ Always switch off ignition before washing engine.

1.4 - Ignition system technical data

Engine codes		APG (1.8l / 5V / 92 kW)
Idling speed	Manual gearbox	660 ... 860 rpm 1)
Speed cannot be adjusted; regulated by idling speed stabilisation	Automatic gearbox	800 ... 860 rpm 1)
Speed governing By deactivation of injectors		approx. 6500 rpm
Ignition point is determined in control unit Ignition point cannot be adjusted		
Ignition system		Double-spark ignition system with two ignition coils
Spark plug connector		Resistance approx. 5 kW

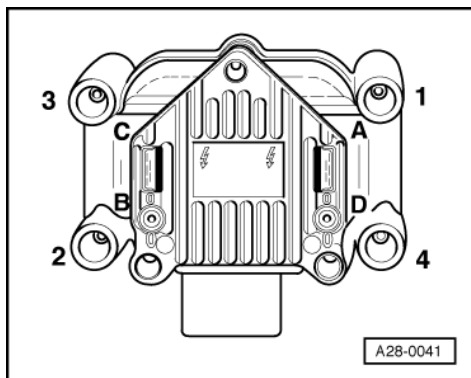


Firing order	1-3-4-2
--------------	---------

1) Current values:

=> "Exhaust Emission Test" binder

1.5 - Identification of ignition connections at ignition coil



- -> The illustration shows the ignition coil with the H.T. connections. It is designed to help check whether the ignition cables have been connected to the ignition coil in the proper order. It is also intended to prevent incorrect connection of new ignition cables following ignition cable replacement.

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Ignition output "A" at ignition coil =>Cylinder 1

Ignition output "B" at ignition coil =>Cylinder 2

Ignition output "C" at ignition coil =>Cylinder 3

Ignition output "D" at ignition coil =>Cylinder 4

1.6 - Checking ignition coils

Special tools and workshop equipment required

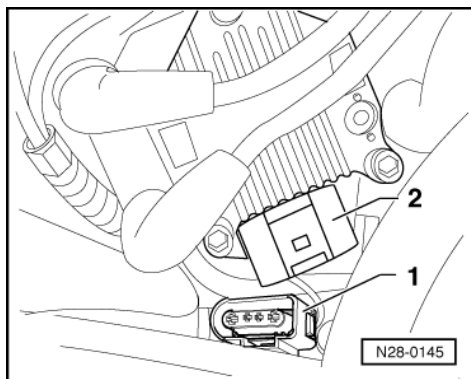
- ♦ V.A.G 1526 A
- ♦ V.A.G 1527 B
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/31

Checking power supply of ignition coils

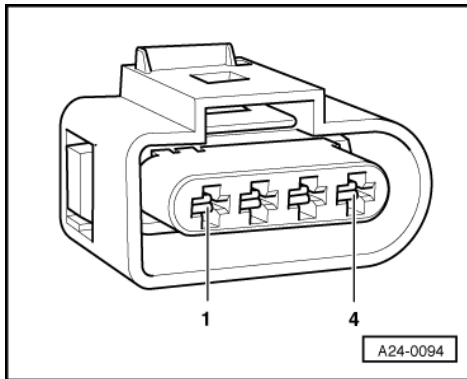
Test requirement:

- Fuse for ignition coils OK

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



- -> Unplug 4-pin connector -1- from output stage for ignition coils -2-.



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

Connector, contact	Measure to
2	Engine earth

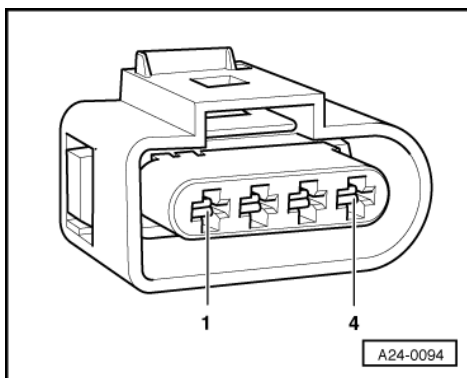
- Switch on ignition.
- LED must light

If LED does not light:

- Check wiring.

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

Checking earth supply of output stage



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

Connector, contact	Measure to
4	Battery positive

- LED must light

If LED does not light:

- Check for open circuit in wiring from contact 4 to earth.

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

- Eliminate open circuit in wiring if necessary.

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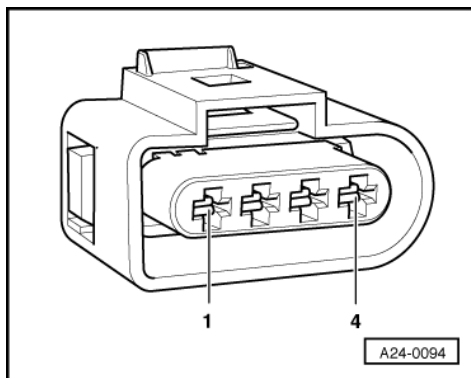
Checking actuation

Test requirements:

- Selector lever in neutral
- Connectors unplugged at all injectors

Note:

Fuel must not be injected during test so as to prevent catalytic converter damage. Connectors must therefore be unplugged from injectors.



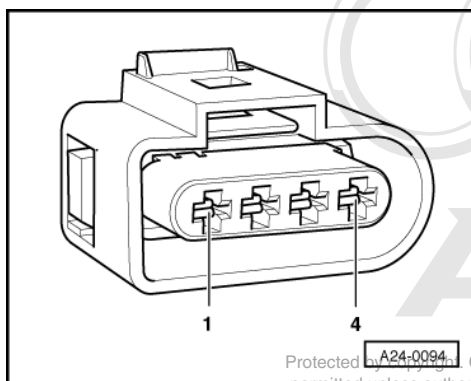
- -> Connect up voltage tester V.A.G 1527 B as follows.

Connector, contact	Measure to
1	Engine earth
3	Engine earth

- Briefly operate starter.
 - LED must flash in each case (brief flashing signal)

If reading does not match specification for one of the contacts:

- Switch off ignition.
- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page 42.



- -> Check for open circuit and short to earth/positive in the following wiring.

Connector, contact	Test box V.A.G 1598/31, socket
1	102

Connector, contact	Test box V.A.G 1598/31, socket
3	103

- If necessary, eliminate open circuit in wiring/short circuit.

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

If no fault is found:

- Replace ignition coils with output stage.

Note:

Ignition coils and output stage form a joint component and cannot be replaced separately.

1.7 - Checking engine speed sender -G28

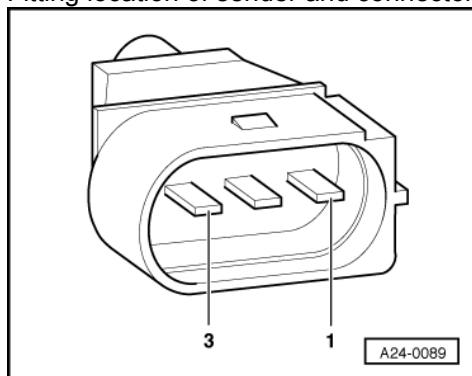
Notes:

- ♦ The engine speed sender is an engine-speed and reference-mark sender.
- ♦ Engine cannot be started without a signal from engine speed sender -G28.
- ♦ Engine stops immediately in the absence of a signal from engine speed sender -G28 when engine is running.

Checking engine speed sender

Fitting location of sender and connector => Page 36

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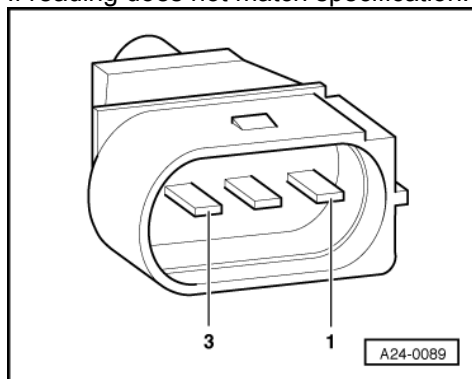
- Before checking, ensure proper installation and tight fit of sender.
- Unplug connector of engine speed sender (identification: grey connector).
- -> Connect up portable multimeter V.A.G 1526 A (resistance measurement) with test lead from V.A.G 1594 to contacts 2 and 3 of connector in connector holder.

Specification: approx. 450...1000 ω

Notes:

- ♦ Resistance of engine speed sender is referenced to a temperature of 20 °C.
- ♦ Resistance increases with increasing temperature.

If reading does not match specification:





- Replace engine speed sender.

If reading matches specification:

- -> Connect up portable multimeter V.A.G 1526 for resistance measurement between contacts 2 and 1 (earth) and to contacts 3 and 1 (earth).

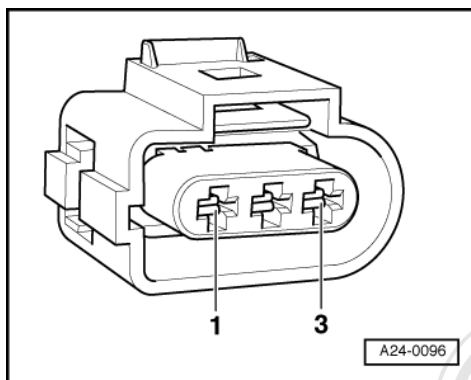
Specification: infinity ω in each case (no continuity)

If reading does not match specification:

- Replace engine speed sender.

If reading matches specification:

- Check wiring between sender connector and engine control unit as follows.
- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page 42 .



- -> Check wiring from 3-pin connector (sender connector)...
- ... to engine control unit for open circuit and short to positive/earth.

3-pin connector at wiring harness, socket	Test box V.A.G 1598/31, socket
1 (screen)	108
2 (earth wire)	90
3 (signal wire)	82

Resistance: max. 1.5 ohms

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

- If necessary, eliminate open circuit in wiring/short circuit.

1.8 - Checking knock control stop

Perform the following checks if a fault entry relating to "Knock control limit reached" has been stored.

	Possible cause of trouble	Fault remedy
Fault entry for all cylinders or Cylinder 1/2 and 3/4	- Poor fuel grade	- Change fuel grade (refer to Owner's Manual)
	- Knock sensor tightened to incorrect torque	- Slacken off knock sensor and tighten to 20 Nm

	Possible cause of trouble	Fault remedy
	- Knock sensor defective	- Check knock sensor => Page 137
	- Corrosion at connector	
	- Engine attachments loose	- Secure attachments
Fault entry for one cylinder	- Engine damage	- Check compression pressure
	- Engine attachments loose	- Secure attachments

1.9 - Checking knock sensors 1 and 2 -G61 and -G66

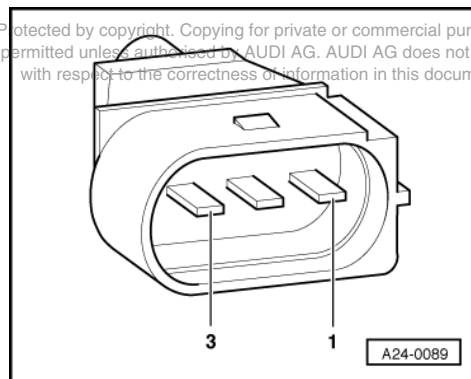
Notes:

- ◆ The actual knock sensors 1 and 2 -G61 and -G66 cannot be electrically checked (interrogate fault memory => Page 7).
- ◆ Exact compliance with tightening torque of 20 Nm is essential to proper knock sensor operation.
- ◆ Check connector for corrosion.
- ◆ Exclusive use is to be made of gold-plated contacts when repairing contacts in knock sensor connector.
- ◆ Check connector between knock sensor and wiring harness for corrosion.

Checking knock sensors

Fitting location of connectors => Page 36

- Unplug connector of appropriate knock sensor in engine compartment.

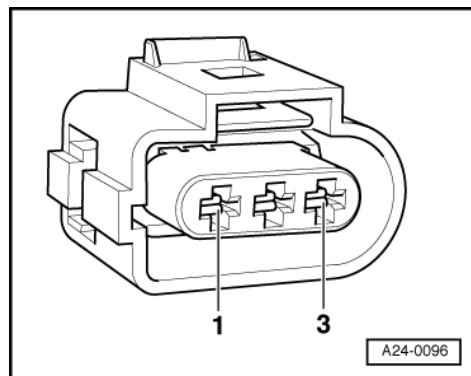


- -> Check all three contacts at knock sensor connector for mutual short circuit (contacts 1+2, 1+3, 2+3).

Specification: No mutual contact between wires (infinity ohms)

- Replace knock sensor if there is contact.
- Check knock sensor wiring if no short circuit is found.

Checking wiring between knock sensors and engine control unit





- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page **42**.
- -> Check wiring between respective sensor connector ...
- ... to engine control unit for open circuit and short to positive/earth.

Knock sensor 1 -G61 (cylinders 1 and 2)

3-pin connector at wiring harness, socket	Test box V.A.G 1598/31, socket
1 (signal)	106
2 (earth)	99
3 (screen)	108

Knock sensor 2 -G66 (cylinders 3 and 4)

3-pin connector at wiring harness, socket	Test box V.A.G 1598/31, socket
1 (signal)	107
2 (earth)	99
3 (screen)	108

Resistance: max. 1.5 ohms

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

- If necessary, eliminate open circuit in wiring/short circuit.

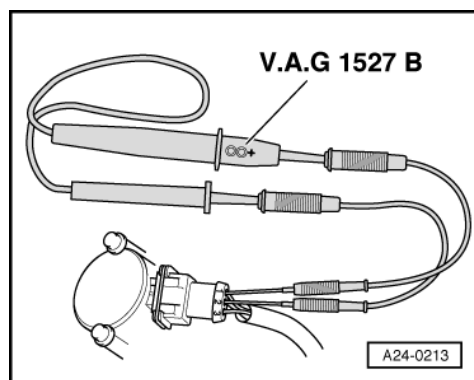
1.10 - Checking Hall sender -G40

The Hall sender supplies the ignition position for cylinder 1.

In the event of failure, knock control is deactivated and the ignition angle retarded slightly as cylinder assignment is no longer possible.

The engine continues to run without Hall sender signal and can also be restarted.

- ♦ If a fault is detected, the engine control unit triggers one spark per cylinder on each crankshaft revolution.
- ♦ The offset by one engine revolution has no noticeable effect on injection. Instead of injection taking place when the inlet valve is open, it is "advanced" to before closed inlet valve, which only slightly impairs the quality of mixture preparation.



Checking actuation of Hall sender

Use is to be made for the following tests of leads from the adapter set V.A.G 1594.

Fitting location of Hall sender-G40 =>Page **36**

- Push back rubber grommet at connector of Hall sender.
- -> Connect up diode test lamp V.A.G. 1527 from rear between contacts 1 and 2 to Hall sender connector (connector remains attached to Hall sender).

Note:

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

- Operate starter for several seconds.

Diode test lamp must flash briefly on every second engine revolution.

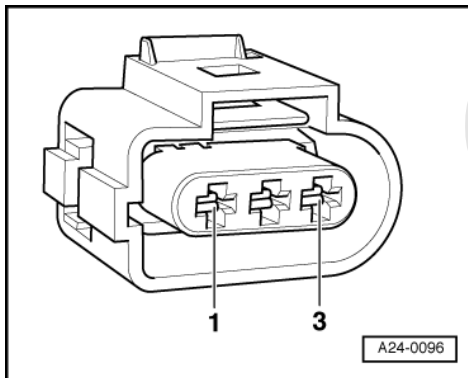
Note:

Diode test lamps with a low current input do not go out completely between actuation of engine control unit, but rather continue to glow slightly and become distinctly brighter on actuation.

Check power supply if diode test lamp does not flash.

Checking voltage supply for Hall sender

- Unplug connector at Hall sender.
- Switch on ignition.



- -> Connect portable multimeter V.A.G 1526 for voltage measurement to socket 1 of connector and engine earth.

Specification: approx. 5 V

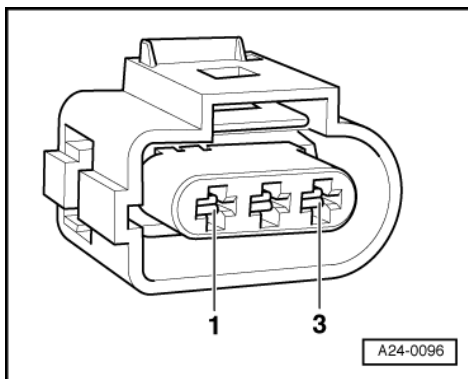
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Checking Hall sender signal wire

- Switch on ignition.
- -> Connect up portable multimeter V.A.G 1526 for voltage measurement between socket 2 of appropriate connector and engine earth.

Specification: approx. battery voltage

Checking Hall sender earth wire





- -> Connect up portable multimeter V.A.G 1526 for resistance measurement between socket 3 of connector and engine earth.

Specification: Continuity
Resistance: max. 1.5 ohms

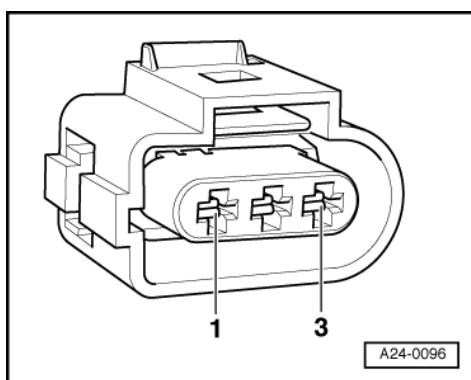
If all readings match specifications and diode test lamp does not flash (measured between contacts 1 and 2 with connector attached):

- Replace Hall sender.

Check wiring if readings do not match specifications.

Checking wiring between Hall sender and engine control unit

- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page 42 .



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

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

Resistance: max. 1.5 ohms

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

- If necessary, eliminate open circuit in wiring/short circuit.
- If after erasing fault memory on a trial basis, fault relating to camshaft sensor (Hall sender) is still displayed although all preceding checks were OK, the problem may be:
 - Twisting of Hall sender rotor ring; check phase position.

Checking phase position of Hall sender

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 5 .
Engine must be idling.

-> Indicated on display:

Rapid data transfer HELP
Select function XX

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

-> Indicated on display:

Read measured value block
Enter display group number XXX

- Press keys 0, 9 and 3 for "Display group number 93" and confirm entry with Q key.

-> Indicated on display:

Read measured value block 93
1 2 3 4

- Check Hall sender specifications

	Display zones			
	1	2	3	4
Display group 93: Phase position of Hall sender at idle				
Display	xxx rpm	xx %	0 ± 7 ° CA	
Readout	Engine speed	Engine load	Phase position, bank 1	Phase position, bank 2
Operating range	min.: 660 rpm max.: 6800 rpm	min.: 0 % max.: 120 %	min.: -20.3 ° CA max.: 14.8 ° CA	
Specification	660 ... 860 rpm	15...30 %	0 ± 6 ° CA	
Note	If readings do not match specifications, unscrew Hall sender and check whether rotor ring has been correctly installed at camshaft (incorrect installation causes retainer tab to be squashed on tightening bolt). Additionally check valve timing			

2 - Checking camshaft timing control

2.1 - Checking camshaft timing control

2.2 - Function of camshaft timing control

The inlet camshaft is adjusted as a function of load and engine speed. There is no adjustment of the exhaust camshaft.

The camshaft adjustment solenoid valve causes oil pressure to be applied to the camshaft adjuster (mechanical adjuster).

The camshaft adjuster then "advances" the inlet camshafts, i.e. the inlet valves open sooner.

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Checking operation of camshaft timing control

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 5 .
Engine must be idling.

-> Indicated on display:

Rapid data transfer HELP
Select function XX

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

-> Indicated on display:



Basic setting
Enter display group number XXX

- Press keys 0, 9 and 4 for "Display group number 94" and confirm entry with Q key.

-> Indicated on display:

Basic setting 94
1 2 3 4

- Check camshaft timing control specification.

	Display zones			
	1	2	3	4
Display group 94: Camshaft timing control				
Display	xxx rpm	Cam.TC.OFF	Test off	
Readout	Engine speed (in increments of 40)	Camshaft timing control off / on	Test result, bank 1	
Operating range	min.: 660 rpm max.: 6600 rpm	Cam.TC.OFF Cam.TC.ON	Test off Test on Syst. OK Syst. not OK	
Specification	Current engine speed	Cam.TC.OFF	Test off	
Note			Normal position	

- Increase engine speed until display zone 2 shows "Cam.TC.ON" and display zone 3 shows "Test on".

	Display zones			
	1	2	3	4
Display group 94: Camshaft timing control				
Display	xxx rpm	Cam.TC.ON	Test on	
Readout	Engine speed (in increments of 40)	Camshaft timing control off / on	Test result, bank 1	
Operating range	min.: 660 rpm max.: 6600 rpm	Cam.TC.OFF Cam.TC.ON	Test off Test on Syst. OK Syst. not OK	
Specification	Current engine speed	Cam.TC.ON	Test on	
Note				

- Maintain engine speed until display zone 3 shows Syst. OK.

	Display zones			
	1	2	3	4
Display group 94: Camshaft timing control				
Display	xxx rpm	Cam.TC.OFF	Syst. OK	
Readout	Engine speed (in increments of 40)	Camshaft timing control off / on	Test result, bank 1	
Operating range	min.: 660 rpm max.: 6600 rpm	Cam.TC.OFF Cam.TC.ON	Test off Test on Syst. OK Syst. not OK	
Specification	Current engine speed	Cam.TC.OFF	Syst. OK	

	Display zones		
Note			

If reading does not match specification in display zone 3, check camshaft adjustment solenoid valves => Page 144 .

Checking operation of camshaft timing control

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 5 .
Engine must be idling.

-> Indicated on display:

Rapid data transfer HELP
Select function XX

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

-> Indicated on display:

Read measured value block
Enter display group number XXX

- Press keys 0, 9 and 1 for "Display group number 91" and confirm entry with Q key.

-> Indicated on display:

Read measured value block 91
1 2 3 4

- Check camshaft timing control specification.

	Display zones			
	1	2	3	4
Display group 91: Camshaft timing control				
Display	xxx rpm	xx.x %	Cam.TC.OFF	xx.x °CA
Readout	Engine speed (in increments of 40)	Load	Camshaft timing control off / on	Adjustment feedback (via Hall sender -G40)
Operating range	min.: 660 rpm max.: 6800 rpm	min.: 0 % max.: 120 %	Cam.TC.OFF Cam.TC.ON	min.: -3.0 °CA max.: 25.0 °CA
Specification	Current engine speed		Cam.TC.OFF	-6.0...6.0 °CA
Note				Normal position

- Run a test drive.

Attention:

Attach fault reader to rear seat and operate it from there. Pay attention to safety precautions => Page 34 .

- Rapidly accelerate vehicle from a standstill in first gear (manual gearbox) or in selector lever position "2" (automatic gearbox) and in doing so check camshaft timing control specifications (display zones 3 and 4).

	Display zones			
	1	2	3	4
Display group 91: Camshaft timing control at 2000...3600 rpm				
Display	xxxx rpm	xx.x %	Cam.TC.ON	xx.x °CA



Readout	Display zones			
	Engine speed (in increments of 40)	Load	Camshaft timing control off / on	Adjustment feedback (via Hall sender -G40)
Operating range	min.: 750 rpm max.: 6920 rpm	min.: 0 % max.: 145 %	Cam.TC.OFF Cam.TC.ON	min.: -3.0 °CA max.: 25.0 °CA
Specification	2000...3600 rpm	greater than 140 %	Cam.TC.ON	17.0....25.0 °CA
Note				Switched position If reading does not match specification, check camshaft adjust- ment solenoid valve => Page 144

Notes:

- ♦ Display zone 3 shows whether or not camshaft timing control is being actuated by engine control unit.
 - "Cam.TC.OFF": Camshaft timing control actuation not active
 - "Cam.TC.ON": Camshaft timing control actuation active
- ♦ Display zone 4 shows whether camshaft timing control has actually been implemented (feedback via Hall sender).
 - Normal position: -6.0 °CA...6.0°CA
 - Switched position: 17.0 °CA...25.0°CA
- ♦ If, when performing test drive, display zone 3 shows "Cam.TC.ON" and display zone 4 indicates a value between 6.0 ° and 16.0 °CA: Camshaft adjustment solenoid valve is switching oil pressure in the proper manner to the mechanical camshaft adjuster, but the adjuster is not able to reach its end position (e.g. stiff).

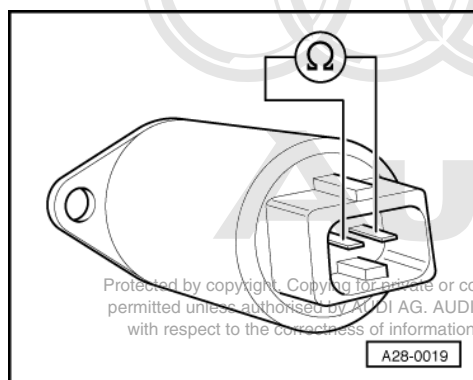
2.3 - Checking camshaft adjustment solenoid valve -N205

- Switch on ignition.
- Perform final control diagnosis and actuate camshaft timing control => Page 19 .

-> Indicated on display:

Final control diagnosis
Camshaft timing control 1

Solenoid valve must be heard to click distinctly on actuation of camshaft timing control.



Perform the following checks if reading does not match specification.

Electrical check on camshaft adjustment solenoid valve

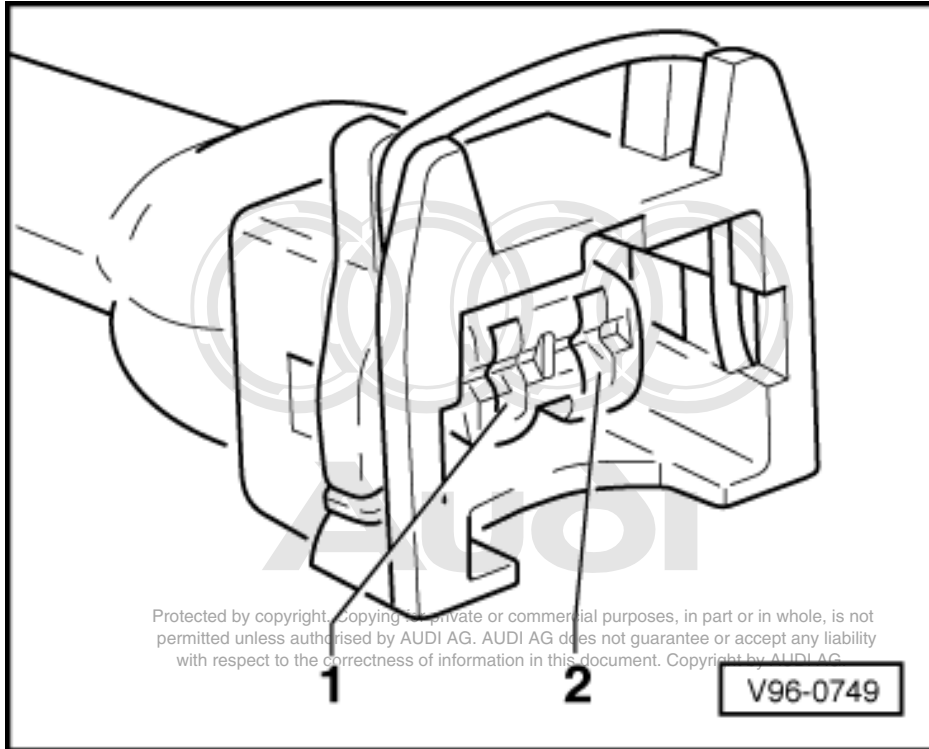
- Unplug connector from camshaft adjustment solenoid valve.

- -> Measure resistance with portable multimeter V.A.G 1526 between solenoid valve contacts.

Specification: 10 ... 18 Ω

If reading does not match specification:

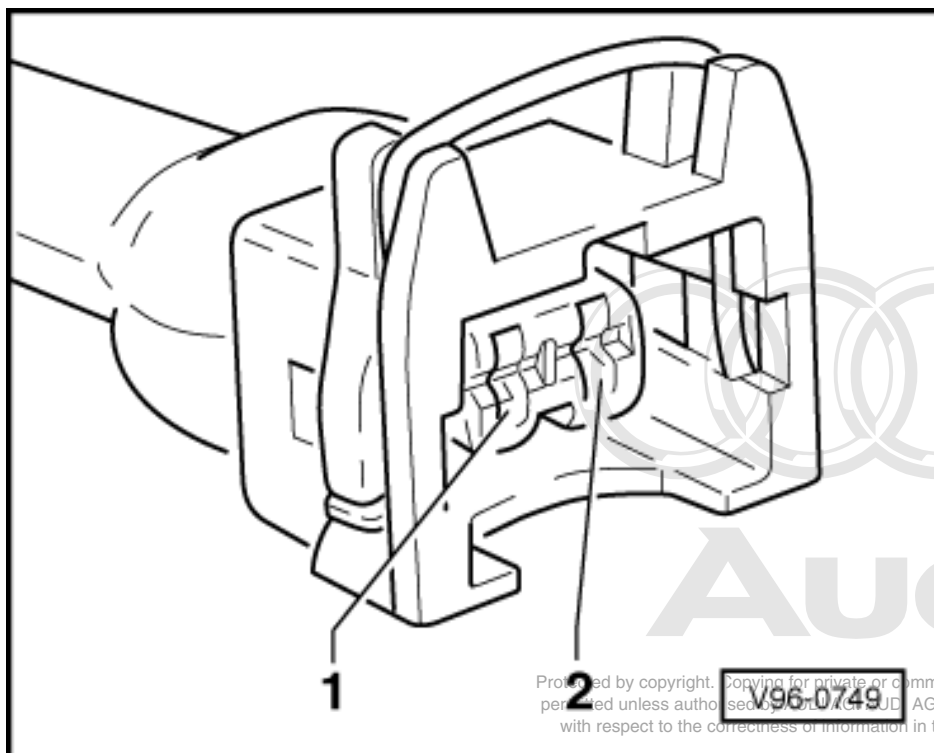
- Replace camshaft adjustment solenoid valve.



Checking power supply for camshaft adjustment solenoid valve

- Unplug connector at solenoid valve.
- -> Connect diode test lamp V.A.G 1527 with leads from adapter set V.A.G. 1594 to socket 1 of connector (positive) and engine earth.
- Operate starter for several seconds. Engine may also start.

Diode test lamp must light.



Perform the following checks if diode test lamp does not light.

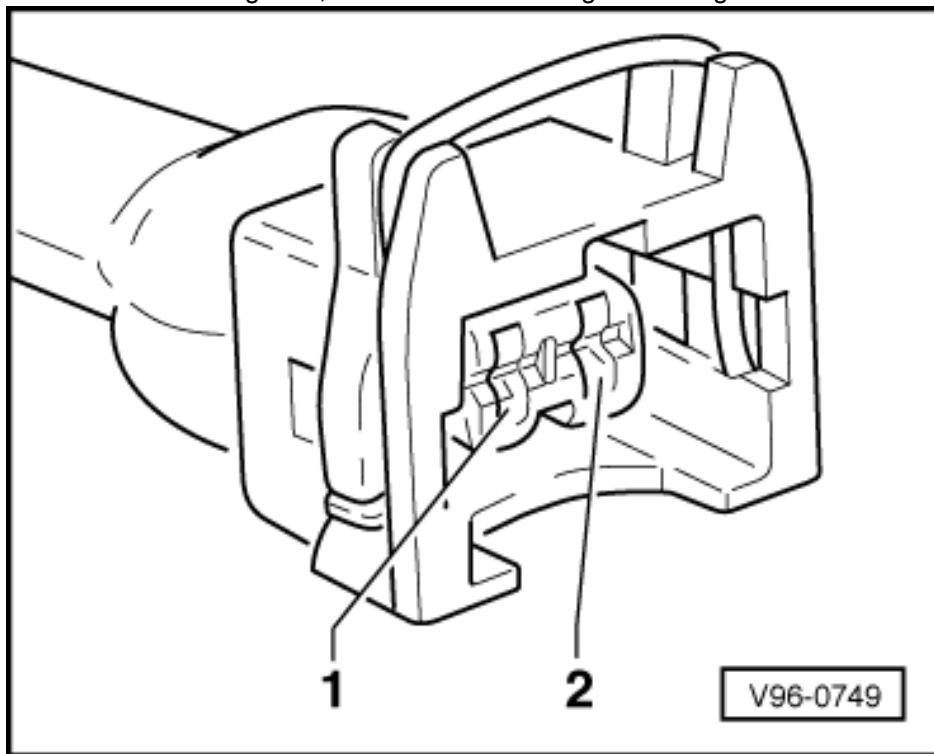
- Check fuse for camshaft adjustment solenoid valve.

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

If fuse is OK:

- -> Check for continuity in wiring from socket 1 of connector for camshaft adjustment solenoid valve via fuse to fuel pump relay.

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



Checking actuation of camshaft adjustment valve

- Unplug connector at solenoid valve.
- -> Connect diode test lamp V.A.G 1527 with leads from adapter set V.A.G 1594 to sockets 1 (positive) and 2 of connector at solenoid valve.
- Perform final control diagnosis and actuate camshaft timing control => Page 19 .

-> Indicated on display:

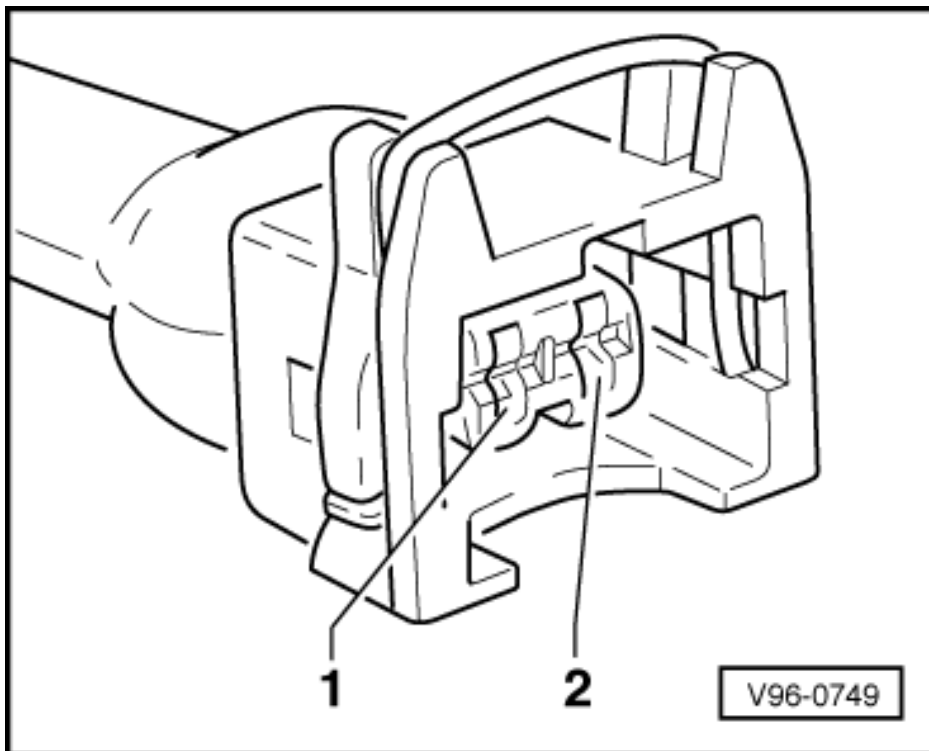
Final control diagnosis
Camshaft timing control 1

Diode test lamp must flash during actuation of camshaft timing control.

If diode test lamp does not flash or if it is permanently lit:

- Connect test box V.A.G 1598/31 to engine control unit wiring harness. Actual engine control unit is not to be connected=>Page 42 .

If diode test lamp is permanently lit:



- -> Check for short to earth in wiring from socket 2 of connector for camshaft adjustment solenoid valve.

If diode test lamp does not flash:

- -> Check for continuity and short to positive in wiring from socket 2 of connector for camshaft adjustment solenoid valve to socket 115 of test box.

Resistance: max. 1.5 ohms

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

- If necessary, eliminate short circuit/open circuit in wiring.

If there is neither an open circuit in the wiring nor a short circuit, replace engine control unit => Page 44 .

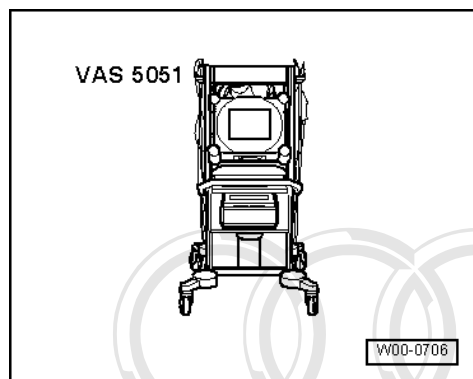


- If no faults were found in any of the preceding checks, replace mechanical camshaft adjuster.

=> 4-cyl. Engine, Mechanics; Repair Group 15; Cylinder Head, Valve Gear; Removing and installing camshafts and camshaft adjuster Cylinder Head, Valve Gear Removing and installing camshafts and camshaft adjuster

2.4 - Checking misfiring detection function

Special tools and workshop equipment required



- ♦ VAS 5051 with VAS 5051/1

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 5 .
Engine must be idling.

-> Display readout:

Rapid data transfer	HELP
Select function XX	

- Enter "08" for "Read measured value block" function and confirm with Q key.

-> Display readout:

Read measured value block	Q
Enter display group number xxx	

- Enter "014" for "Display group number 014" and confirm with Q key.
- Check misfiring detection in display zones 3 and 4.

	Display zones			
	1	2	3	4
Display group 014: Misfiring detection				
Display	xxx rpm	xxx %	xxx	---
Readout	Engine speed	Load	Misfiring total	Misfiring detection
Operating range	0...6500 rpm	15...100 %		Activated Not activated
Specification	660...860 rpm	15...30 %	0...5	Activated

	Display zones			
Note	---	---	If reading does not match specification (misfiring total greater than 5): evaluation of display zone 3 => Page 149	---

If reading matches specification:

- Press =>key.

-> Indicated on display (function selection):

Rapid data transfer	HELP
Select function XX	

Evaluation of display group 014

Display zone: 3	Possible cause of trouble	Fault remedy
Greater than 5	- Spark plug defective - Spark plug connector defective - Ignition coil defective - Ignition coil output stages defective	- Check spark plugs and ignition cables with connector Check ignition coils =>Page 132
	- Injector defective	- Check injectors => Page 57
	- Exhaust gas recirculation valve leaking	- Check exhaust gas recirculation valve => 4-Cylinder (2-Valve) Engine, Mechanics; Repair Group 13 100



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